Executive Summary
Lee County Blasting Study

By

Terra Dinamica LLC

This study completed under contract number 2983,
CN 04-17 for Lee County, Florida

December 1, 2004 – June 30, 2005

Researchers:

Frank J. Lucca
Andrew Williams

Report Date: June 2005

Terra Dinamica LLC
5 Meadow Brook Road
Granby, CT 06035
Tel: (860) 844-0506, Fax: (860) 844-0507
explosives@terradinamica.com, www.terradinamica.com

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June, 2005

Introduction

This project involved research, testing and scientific analysis of land development blasting in unincorporated Lee County. The purpose was to determine if land development blasting can be done without damage or other detrimental impacts to residences, other structures, public utilities or groundwater resources given the local geology of the County. Also, the purpose was to apply science to the Lee County regulations concerning blasting and to determine if they are too stringent or can be further restricted.

Terra Dinamica LLC was contracted by Lee County Florida to undertake this study. The study also investigated how rock blasting from development blasting affects structures in relationship to other environmental and manmade influences. The study included research on alternate technologies to blasting, state-of-the-art blasting techniques and technologies, and a literature search of other blasting and vibration studies.

The study was started on January 1, 2005 and proceeded through June of 2005. The study is unique in that it used a set of Test Houses, which were near blasting projects and Control Houses, which were not near any blasting.

Wireless micro-accelerometers and weather stations manufactured by Crossbow Technologies, Inc and Blasting type commercial seismographs manufactured by White Industrial Seismology, Inc, were the instrumentations used to wire the houses.

Two control houses in the county were used in different geographical locations. One control house was located on Fort Myers Beach and the other in the Winkler Road Extension, where a moratorium on blasting had been imposed.

One test house was located near a blasting project in a development north of Fort Myers. This development, Herons Glen, had to use blasting in construction of the water retention facilities for water management in an adjacent development.

Due to the unavailability of multiple development blasting projects, two other test houses were located in Estero area of Lee County. The houses were located on Wildcat Run near multiple quarry operations. The closest quarry cooperated fully and shared all of its records.

The regulations in Lee County are based solely on Peak Particle Velocity. Therefore, the blasting study is based solely on the effects of Peak Particle Velocities generated from blasting, equipment, other manmade induced vibrations, and environmental effects. The regulation peak particle velocity limit of 0.3 inches/second was the vibration limit imposed on the contractors during this study.

The study was performed to ascertain appropriate blasting limits. Due to the Lee County Blasting Regulation, the use of test houses and control houses facilitated the tracking of the effects of blasting verses environmental and other manmade influences on structures.

The use of the wireless micro-seismographs and the chosen commercial seismographs made it easier for blast monitoring in areas where higher blast peak particle velocities could be obtained and the comparison to other influences on the structures.

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www.delorme.com

TN
MN (4.5°W)

Scale 1 : 175,000

0 1 2 3 4 5 mi
0 1 2 3 4 5 km

1" = 2.76 mi Data Zoom 10-0

Findings

Vibration limit

From the results of this study, the current blast vibration limit of 0.3 inches/second (ips) is extremely conservative. The 0.3 ips limit falls well within the range of environmental effects and other manmade induced vibration; or in other words, is within the ambient vibrations levels of the county. The probability is low to nonexistent that blast vibration, if maintained below the limit, will cause any damage to neighboring residential and commercial properties.

A good rule of thumb for calculating vibration intensities follows: Under normal or typical conditions, the vibration intensity dies (attenuates or decays) to about 1/3 of its intensity every time the distance traveled doubles. In other words, if the Peak Particle Velocity at 600 feet from a blast is 0.3 inches/second, the intensity at 600 feet directly behind this monitoring point (1200 feet from blast) would roughly be equivalent to 0.1 inches/second.

Displacement is the damaging factor in vibration. Displacement can be defined as the amount of deviation or distance of any particle or point from its rest position. The change in displacement over a unit of time is called strain. In other words, a particle moves and stays at the position it moved to instead of returning to its normal position. Large displacements cause damage. These displacements are caused by high peak particle velocities with relatively low frequencies.

A simple formula to convert to displacement is to use the known measurement of Peak Particle Velocity (PPV) and Frequency (f). Many blasting seismographs will also report displacement. The formula follows:

Displacement = PPV/(2π) x (f)

For example, using 0.3 inches per second and a frequency of 30 hertz, the displacement would equal 0.00159 inches. A graph follows displaying displacement at different frequencies utilizing a 0.3 inches/second peak particle velocity. As can be seen, displacements are extremely low. None of which can cause damage. This is the reason by utilizing 0.3 ips as the Peak Particle Velocity limit that frequency can be ignored.

PPV = 0.3 inches/second

Freq	Displacement
5	0.00955
10	0.00477
15	0.00318
20	0.00239
25	0.00191
30	0.00159

35	0.00136
40	0.00119
45	0.00106
50	0.00095
70	0.00068
80	0.00060
90	0.00053

100	0.00048
150	0.00032
200	0.00024
250	0.00019
300	0.00016
1000	0.00005

In comparison, here is the same table using 2.0 inches/second and the third table utilizes 5.0 inches/second.

PPV = 2.0 inches/second

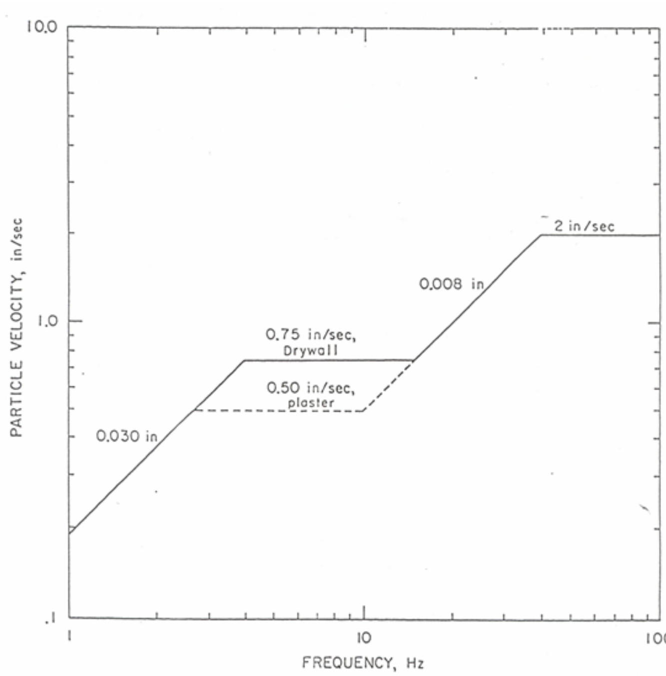
Freq	Displacement
5	0.06366
10	0.03183
15	0.02122
20	0.01592
25	0.01273
30	0.01061
35	0.00909
40	0.00796
45	0.00707
50	0.00637
70	0.00455
80	0.00398
90	0.00354
100	0.00318
150	0.00212
200	0.00159
250	0.00127
300	0.00106
1000	0.00032

PPV = 5.0 inches/second

Freq	Displacement
5	0.15916
10	0.07958
15	0.05305
20	0.03979
25	0.03183
30	0.02653
35	0.02274
40	0.01989
45	0.01768
50	0.01592
70	0.01137
80	0.00995
90	0.00884
100	0.00796
150	0.00531
200	0.00398
250	0.00318
300	0.00265
1000	0.00080

There have been multiple studies on blast induced vibration damage. During the literature search, the following was found and verified for construction and quarry blasting. 2.0 inches/second is still a good limit to prevent damage if the USBM "Z" curve is followed in regards to frequency.

"Z" Curve: Line shows zero probability of damage.

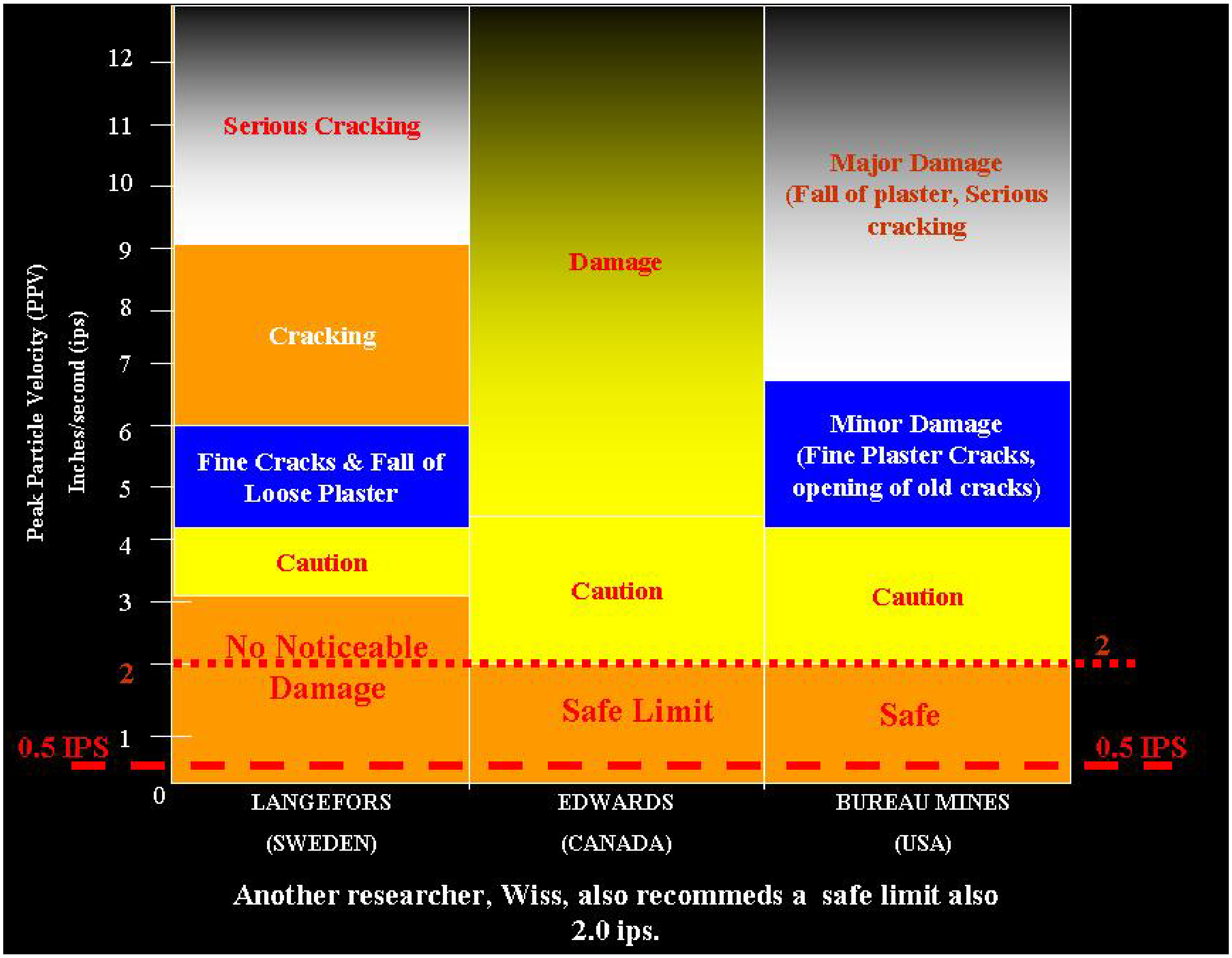


In actuality, since the USBM "Z" curve was developed for large scale mining operations, it could be followed as the limit for vibration without causing damage. But, humans are extremely receptive to vibration, and if this curve were followed, there would likely be many more complaints.

This curve represents the zero line of probability of damage in large scale and long-term blasting operations, such as coal. When used in construction blasting, as done in Lee County, the curve becomes even more conservative.

Here are results from multiple research projects:

Vibration Levels: 4 researchers in 4 different studies developed the same results.



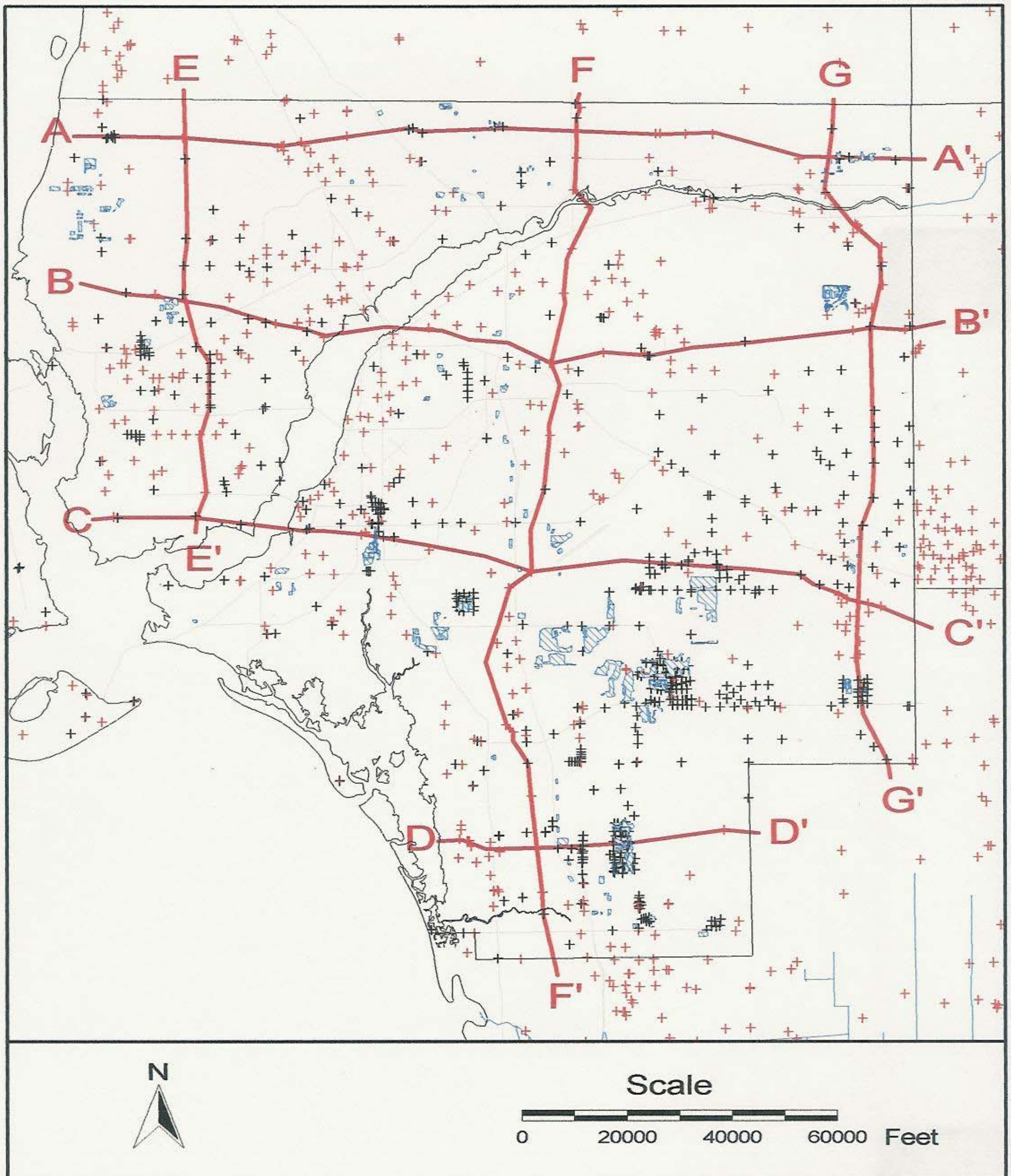
From the results of the Lee County Blasting Study and the literature search, it can be concluded that the 0.3 inches/second limit is extremely safe.

Geology
Rock blasting for development takes place in the upper layers.

The findings in regards to the geology of the area include the fact that nothing is atypical or special about the area. The geology is typical of that found within the Caribbean basin. There is a high presence of ground water and unconsolidated sediment and manmade fill in the area. These 2 influences will cause the frequency component of the blast induced vibration to be relatively low. Humans are very perceptive to low vibration frequencies. But, due to the low peak particle velocity limits (0.3 inches/second), frequency can be basically ignored in regards to damage potential in this type of blasting.

The following data was provided by geologist Greg Rawl, who was performing a ground water study for Lee County. This data was verified and supplemented from a literature search performed by Terra Dinamica LLC.

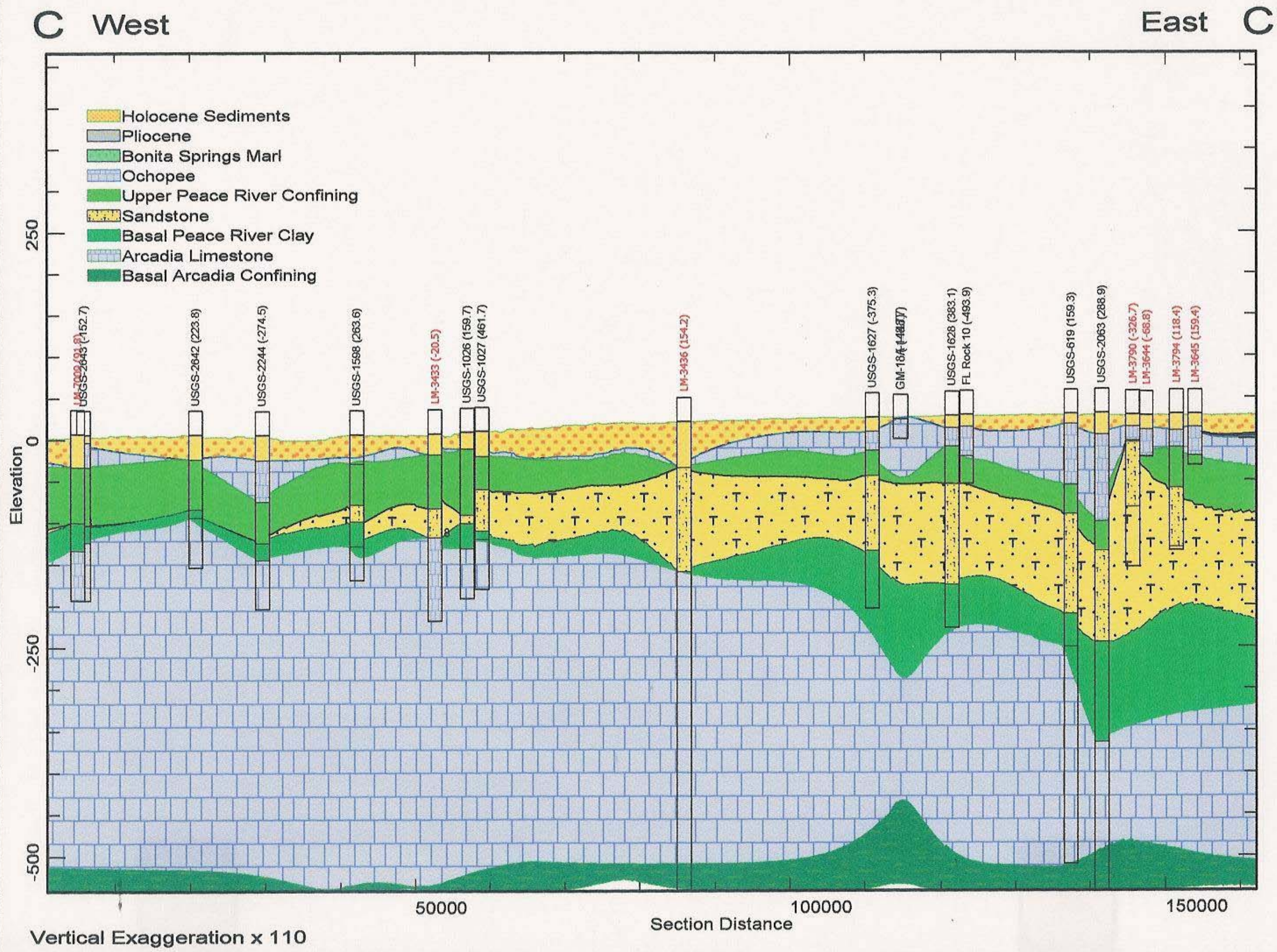
SERIES	GEOLOGIC UNIT		HYDROGEOLOGIC UNIT		VIEWLOG GEOLOGIC UNITS
HOLOCENE PLEISTOCENE	UNDIFFERENTIATED		SURFICIAL AQUIFER SYSTEM	SURFICIAL SEDIMENTS	HOLOCENE
PLIOCENE	TAMIAMI FORMATION			PINECREST LIMESTONE	PLIOCENE
				BONITA SPRINGS MARL CONFINING BED	BONITA SPRINGS MARL
				LOWER TAMIAMI AQUIFER	OCHOPEE
MIOCENE	HAWTHORN GROUP	PEACE RIVER FORMATION	INTERMEDIATE AQUIFER SYSTEM	UPPER PEACE RIVER CONFINING BED	UPPER PEACE RIVER CONFINING
				SANDSTONE AQUIFER	SANDSTONE
				BASAL PEACE RIVER CONFINING BED	BASAL PEACE RIVER CONFINING
		ARCADIA FORMATION		MID-HAWTHORN AQUIFER	ARCADIA
				BASAL MID-HAWTHORN CONFINING BED	BASAL MID-HAWTHORN CONFINING
OLIGOCENE			FLORIDAN AQUIFER SYSTEM	LOWER HAWTHORN AQUIFER	LOWER HAWTHORN
	SUWANNEE LIMESTONE			UPPER FLORIDAN AQUIFER	SUWANNEE



Lee County Groundwater Resource & Mining Study

Greg F. Rawl, P.G.
Professional Geologist
Specializing in Hydrogeology and Water Resources

Figure __ - Geologic Cross Section Location Map



Lee County Groundwater Resource & Mining Study

Figure __ - Geologic Cross Section C - C'

Environmental Effects

There was a high degree of change in humidity and temperature inside and outside of the houses. These high degrees of change will cause expansion, shrinkage, and settling of houses and other structures.

The following was found during the literature search and falls closely to the Lee County Study Results.

Typical Environmental Stresses, other Forces, and Equivalent Ground Vibrations from a study by Lewis Oriard turned out close to the Lee County Study.

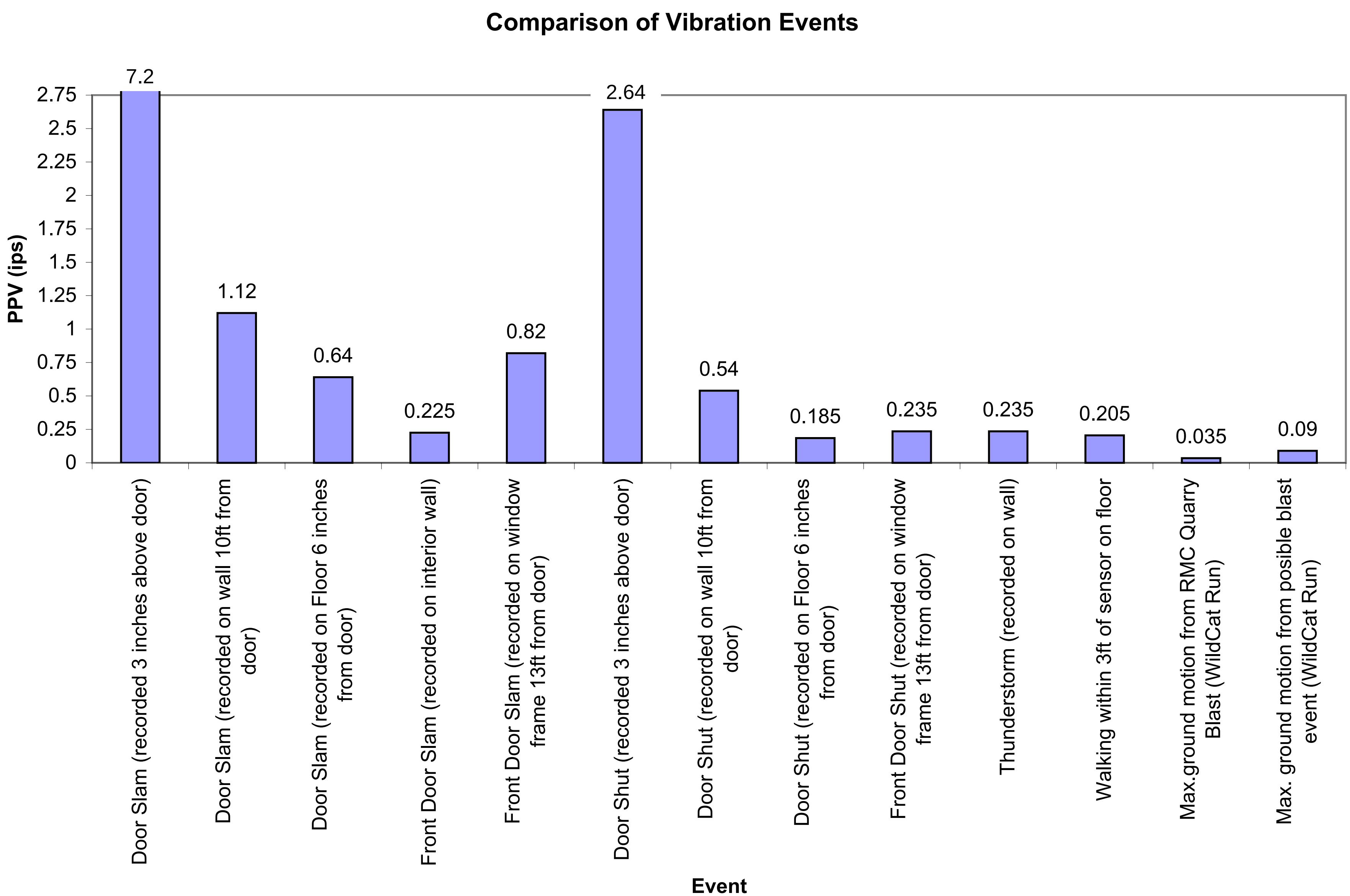
Force	Peak Particle Velocity	Note
Inside Humidity	3	19% Change
Outside Humidity	5	35% Change
Inside Temp	3.6	12 Degree Far. Change
Outside Temp	8.2	27 Degree Far. Change
Wind	3.5	23 MPH
Walking	0.3	Measured at Wall Corner
Jumping	1	Midwall in Same room
Door Slam	0.5	Wall in next room
Sliding Door Slam	1.5	Wall above door
Picture nails	2	Midwall Nearby
Blast Limits	**2**	

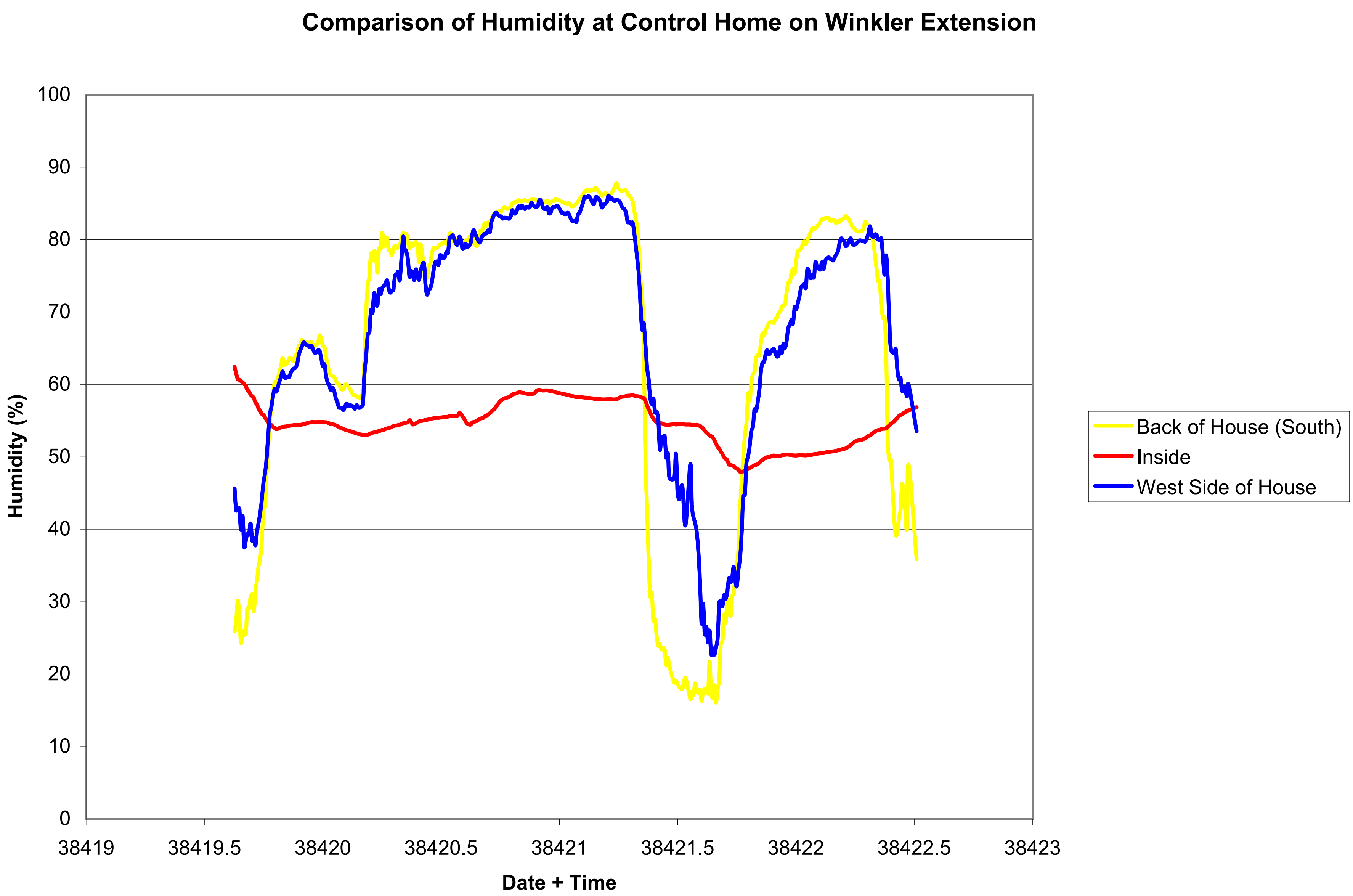
"The Effects of Vibrations and Environmental Forces"- By Lewis Oriard

The 3 test houses (near blasting) and the 2 control houses (not near blasting) had instrumentation installed to monitor vibration, humidity change, and temperature change. The test houses near the blasting did not show any signs of damage from blasting nor environmental changes since the instruments were installed. The control house on Winkler Road Extension also did not show any damage. The control house on Fort Myers Beach did show cracking (not near blasting).

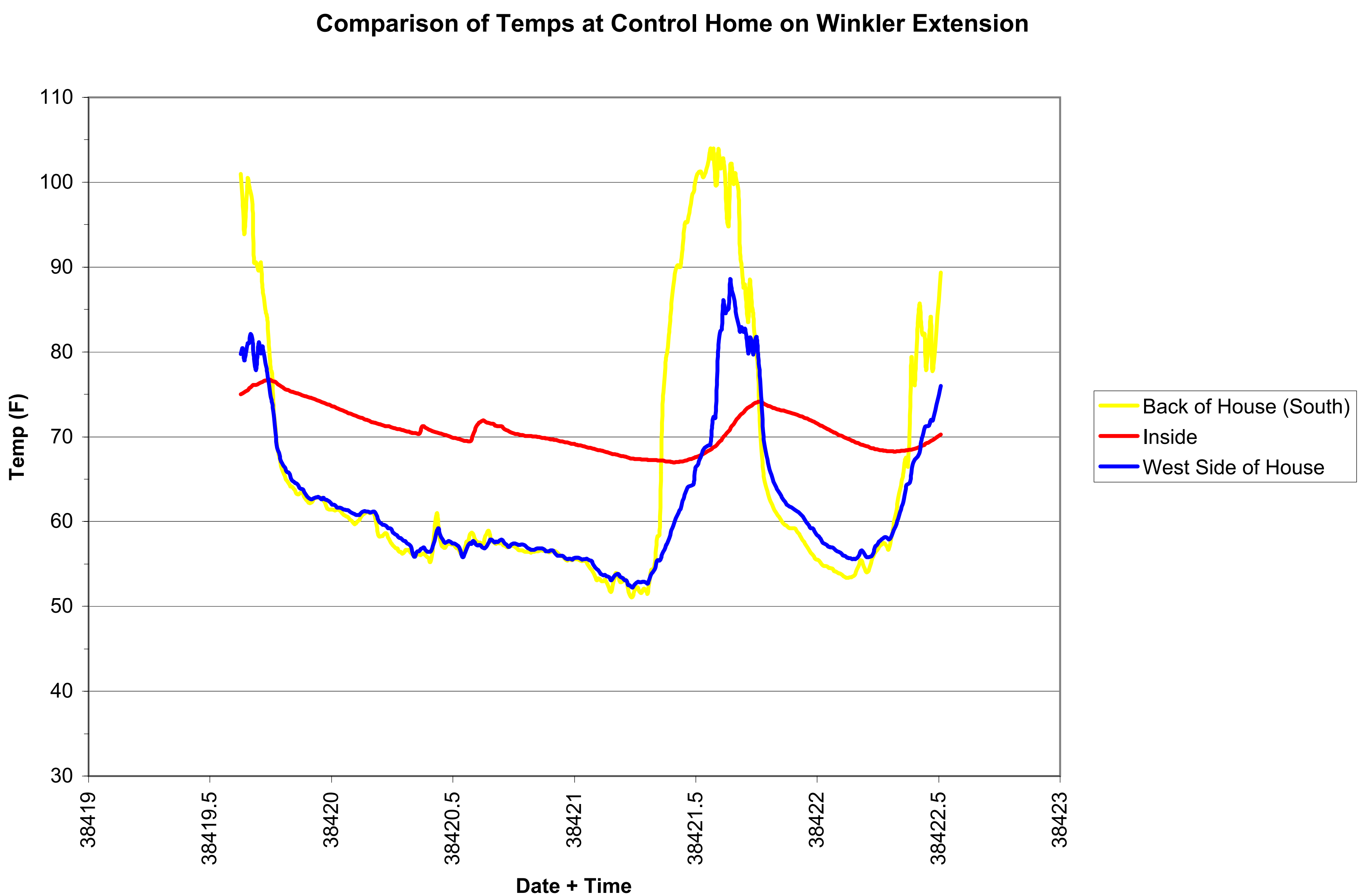
The vibrations caused by normal daily activities are in the range from 0.001 inches/second up to over 2 inches/second. The peak particle velocity limit for development blasting in Lee County is 0.3 inches/second. This limit falls in the range of ambient vibration experienced by structures.

An example of data follows:


Comparison of Vibration Events
PPV (ips)
2.75
2.5
2.25
2
1.75
1.5
1.25
1
0.75
0.5
0.25
0
7.2
1.12
0.64
0.225
0.82
2.64
0.54
0.185
0.235
0.235
0.205
0.035
0.09
Door Slam (recorded 3 inches above door)
Door Slam (recorded on wall 10ft from door)
Door Slam (recorded on Floor 6 inches from door)
Front Door Slam (recorded on interior wall)
Front Door Slam (recorded on window frame 13ft from door)
Door Shut (recorded 3 inches above door)
Door Shut (recorded on wall 10ft from door)
Door Shut (recorded on Floor 6 inches from door)
Front Door Shut (recorded on window frame 13ft from door)
Thunderstorm (recorded on wall)
Walking within 3ft of sensor on floor
Max.ground motion from RMC Quarry Blast (WildCat Run)
Max. ground motion from posible blast event (WildCat Run)
Event



Comparison of Humidity at Control Home on Winkler Extension
Humidity (%)
100
90
80
70
60
50
40
30
20
10
0
38419
38419.5
38420
38420.5
38421
38421.5
38422
38422.5
38423
Date + Time
Back of House (South)
Inside
West Side of House


Comparison of Temps at Control Home on Winkler Extension
Temp (F)
110
100
90
80
70
60
50
40
30
38419
38419.5
38420
38420.5
38421
38421.5
38422
38422.5
38423
Date + Time
Back of House (South)
Inside
West Side of House

Recommendations

The study has shown that the probability of damage from blasting with the 0.3 ips limit is low to nonexistent and this level is more or less equal to ambient levels found in the county. Since the blasting contractors have shown that they can blast without undue hardship to the current level of 0.3 ips at an inhabited structure (residence or business), the level should not be altered.

Recommendations include multiple code changes and can be found in the included presentation in section 9, Findings, but are repeated here.

Recommendations are totally related to changes in the Lee County Blasting Code and can be found in Section 11. Stated here are code changes in bullet format as presented to the Lee County Blasting Committee.

- Code:
  - Sec. 3-4. Local user and blaster registration
    - Require 8 hours of continuing education/year.
      - Blasting courses: Private, Explosives Manufacturers and distributors MSHA, OSHA, Conferences, etc.
  - Sec. 3-8. Limitations on blasting intensity.
    - 4 Compass directions: But put in a location where a reading can be obtained and used. Extrapolate to structure of concern.

(b) Blast intensity may not exceed any of the following limits:

- Peak Particle Velocity (PPV): Not peak vector sum (Resultant). It has been noted that the code enforcement officers for Lee County are using the correct PPV, but the seismic monitoring companies and blasting company has been known to use the PVS.

  - Peak Vector Sum is the Sum of the 3 Peaks in the vibration wave. This gives a higher number but is not a true representation.
  - The code says PPV, but everyone has been working with PVS.

(b) Blast intensity may not exceed any of the following limits:
Peak Particle Velocity (PPV):
Occupied Structure (Residence or business): 0.30 inches per second
Utilities: 5.0 inches/second
Roads: PPV of 10 inches/second. Roadway outside of fracture zone of blast. May need a test blast to determine extent of fracture zone.
Bridges: 5.0 inches/second.

Airblast overpressure:
134 dB (linear) at Residence or business
Not applicable at other structures

C: Delete the 80% rule:

Sec. 3-9. Limitation on blasting activity.

- Eliminate "No Blast" zone. 600 foot rule is not necessary. 0.3 ips is the limit. Doesn't matter at what distance.
- When close to residences or businesses, cover should be used. Rubber tire blasting mats should be used for distances 300 feet or less to a structure of concern. Between 600 feet to 301 feet, in place overburden or additional cover (sand or dirt) of at least 3 feet should be used. If blasting mats are used, additional cover is not needed.

Sec. 3-10. Blasting permit issuance; standard permit conditions.
Should not be a board issue. Should be issued or denied by the director if all conditions are met.

Sec. 3-13. Record keeping.
Add a standard blast report or blaster uses equivalent for the county that includes the following as a minimum:

- Date and time of blast
- Number of holes
- Depth
- Blast Pattern diagram and firing times
- Number of wet holes, water depth
- Hole diameter
- Burden & Spacing
- Amount of explosives
- Number of primers
- Type of detonators (i.e., electric or nonelectric);
- Number of detonators
- Stemming feet & type used
- Maximum pounds delay
- Maximum hole delay
- Weather
- Wind direction
- Type and make of blasting machine
- Global positioning system direction and distance in feet to the nearest building
- Decking feet
- Location of each seismograph
- Peak particle velocity inches per second & frequency
- Sound decibels
- Name, address, and license number of user of explosives; and
- Name, address, and permit number of blaster.

Sec. 3-15. Blast vibration monitoring.

- Printout not needed in the field. Just need the readings to be verified by enforcement officer in 24 hours, but reported right after the blast in writing.
- Calibration: 6 months is excessive. Should be by manufacturer's recommendation. Usually 1 year, but some newer ones do not need to be calibrated.

Pre-blast Surveys

- 1500 foot radius is excessive. 3000' offered is current.
- Normal Industry practice is 250 feet.
- Recommendation: 500 foot radius or closest habitable structure in four compass directions.
- Offer out to 1500 feet.

- This goes back to 0.3ips limit at closest residence.

One Strike Rule

- Field Blaster needs some relief on this.
  - Following company blast plan.
  - 3 strikes? With a fine for every strike?
  - Project halted until everything is resubmitted? Maybe a minimum of 10 days?
  - Lose license for 30 days, 60 days, then 1 year. Plus $15,000 fine paid by the blasting contractor for each occurrence.

Winkler Road Extension

- Remove the moratorium on blasting.

LEE COUNTY BLASTING STUDY

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TABLE OF CONTENTS

LEE COUNTY

PROJECT UNDERSTANDING & SCOPE

This project involves research, testing and scientific analysis of land development blasting in unincorporated Lee County. The purpose is to determine if land development blasting can be done without damage or other detrimental impacts to residences, other structures, public utilities or groundwater resources given the local geology of the County. Also, the purpose is to apply science to the Lee County regulations concerning blasting and to determine if they are too stringent or can be further restricted.

Blasting has become problematic in certain areas of the county where it is believed that some adverse impacts have occurred. The Board of County Commissioners has directed that a scientific study be done to analyze blasting impacts in relation to the local geology of the county.

The study should determine what impacts that blasting is causing to structures. Also, it should be determined and compared to the impacts caused by environmental forces. These forces include the changes to the inside and outside of structures and include humidity, barometric pressure, temperature, wind, and natural seismic events. The study will also include the impact of vibrations caused from other events besides blasting. All data will be compared in relation to blasting intensity measured in peak particle velocity, acceleration, frequency, displacement, and strain. The results will be correlated to damage of any kind. These results will try to be correlated to the annoyance factor or human response.

Other items to be addressed in the study are an evaluation of alternative methods to blasting, and state of the art techniques and options to reduce or eliminate blasting impacts. An array of proposed options and recommendations will be provided as part of the study. In addition, the county has adopted a blasting ordinance and review of the provisions of this ordinance will also be included in the scope of work with recommended changes.

Components of the study will include but not be limited to the following:

Review of blasting and blasting impacts:

- Geologic composition of unincorporated Lee County and how geologic conditions and composition affect existing residential structures/infrastructure in relation to development blasting activity. Geology of unincorporated Lee County as it relates to appropriateness of blasting activities.
- Relationship blasting affects to property damage (structural and cosmetic), and quiet enjoyment of property (nuisance or annoyance impacts).
- Effects of repetitive blasting on structures
- Effects of blasting on infrastructure such as utility lines, roadways, groundwater resources such as well fields, etc, both below and above ground.

- Review of existing blasting practices in Lee County and how they relate to state of the art technique and technology.
- Methods to reduce the impact of blasting: Trials of state of the art technologies and techniques not currently utilized in Lee County.
- Survey of state of the art ordinances and techniques utilized in other counties in Florida and worldwide.
- Effects of environmental forces inside and outside of structures and how they correlate and relate to damage and blasting intensity levels. Environmental effects include the following: Humidity changes, barometric pressure changes, temperature changes, wind, and natural seismic events.
- Compare blasting vs. environmental impacts.
- Research and test alternate technologies to blasting. These include but are not limited to the following: Pneumatic rock hammers, expandable chemicals, new technologies.
- Economic impact related to blasting/no blasting options, reduced levels of blasting, or alternative methods in lieu of blasting such as trenching or other non-blasting techniques. Economic impact should evaluate impacts on development community as well as residential homeowners.
- Review of Lee County's existing blasting ordinance
- Recommendations and options
- Limitations on blasting intensity
- Frequency
- Peak particle velocity
- Air blast overpressure/vibration
- Deliverables will include a written report addressing the items above. Recommendations and options will be presented to the Board of County Commissioners. There will be a committee established to review study progress and issues. The consultant(s) will present findings to various Board-appointed committees and the County Commission.

1. Introduction & Methodology

Rock excavation utilizing explosives energy or rock blasting in other terms, is used in Unincorporated Lee County primarily to create the surface water management systems for residential developments and to obtain the necessary fill to construct the development. When a new community or development is built, that is not in close proximity to neighbors, the rock blasting does not affect the neighbors. Afterwards, when a second community is planned and built nearby, blasting is utilized again for the new water management systems. The neighbors can now feel the vibration generated from blasting and hear the shockwave or airblast.

Lee County instituted extremely stringent blasting regulations during 2003 and 2004 to help ameliorate blasting complaints. In one area of the county, Winkler Road Extension, a moratorium was applied to blasting projects.

Due to multiple residential complaints generated from blasting activities, the Lee County Board of County commissioners directed that a scientific study be conducted to determine if land development blasting can be done without damage or other detrimental impacts to residences, other structures, public utilities or groundwater resources given the local geology of the County. Also, the purpose was to apply science to the Lee County regulations concerning blasting and to determine if they are too stringent or can be further restricted.

The study also investigated how rock blasting from development blasting affects structures in relationship to other environmental and manmade influences. The study included research on alternate technologies to blasting, state-of-the-art blasting techniques and technologies, and a literature search of other blasting and vibration studies.

Methodology

The regulations in Lee County are based solely on Peak Particle Velocity. Therefore, the blasting study is based solely on the effects of Peak Particle Velocities generated from blasting, equipment, other manmade induced vibrations, and environmental effects. Due to the regulation of 0.3 inches/second, this study was run backwards from the normal way to find a resultant. In other words, the resultant of 0.3 inches/second was given. The study was performed to understand and investigate if this limit could be obtained without undo hardship by the blasting contractors and whether this limit was safe for the protection of property owners.

Instrumentation was installed on the inside and outside of residences. These instruments measure vibration and environmental changes. 5 residences were used in the study. 3 of the residences were near blasting projects (test homes), 2 of the residences were used as “controls” (control homes) or they were not located near any blasting, but were in the same geographical area, therefore they were exposed to the same environmental effects.

An additional study was also conducted where a trench was sawed in the rock along one side of a rock excavation to see if vibration was mitigated.

The first part of the study started the first week of January, 2005. A blasting project was conducted in Herons Glen. The first test house was wired at 3510 Odyssea Ct, Herons Glenn Development. At the same time, the first control house was wired at 219 Ohio Ave, Fort Myers Beach. The test house on Herons Glen had the instrumentation installed until the end of February, 2005. The instrumentation in the control house on 219 Ohio Ave. was installed until mid-June, 2005.

In March of 2005, the control home on Winkler Road Extension had the instrumentation installed and was present until the end of June, 2005. Two test houses had instrumentation installed in the Wildcat Run Development off of Corkscrew Road (20683 & 20471). The houses in Wildcat Run experience effects from multiple quarries near the properties.

TN
MN (4.5°W)

Scale 1 : 175,000
0 1 2 3 4 5 mi
0 1 2 3 4 5 km
1" = 2.76 mi
Data Zoom 10-0


20471 WildCat Run
20683 WildCat Run
RMC Quarry

Send To Printer Back To TerraServer Change to 11x17 Print Size Show Grid Lines Change to Portrait

USGS **12 km NE of Bonita Springs, Florida, United States** 06 Jan 1999

Image courtesy of the U.S. Geological Survey

2. Research Equipment

The research instruments used for the monitoring of vibration, airblast, and environmental effects were supplied by two companies.

MiniSeis seismographs manufactured by White Industrial Seismology, Inc. were used on the outside and inside of structures to correlate the data collected from other instruments to blast induced vibration and to determine the peak particle velocity values generated by other influences, such as storms, door slams, etc.

Micro accelerometers and weather stations manufactured by Crossbow Technology Inc. were utilized to monitor vibration and environmental effects.

Data sheets on all equipment follow:

New

Crossbow

MTS

ENVIRONMENTAL SENSOR BOARD

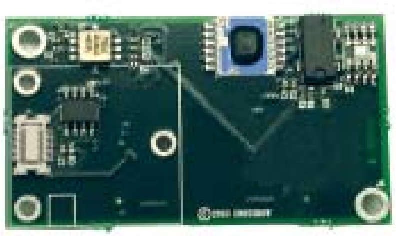
- Compatible with MICA2 Processor/ Radio Boards
- On-Board Temperature & Humidity, Barometric Pressure, and Ambient Light Sensors
- Dual-Axis Accelerometer
- 2K EEPROM for user configuration data
- Optional GPS Module

Applications

- Agricultural Monitoring
- Art Preservation
- Environmental Monitoring
- Sensor Location Mapping*

(*GPS Equipped)

MTS400CA



MTS400CA, MTS420CA

Developed in conjunction with UC Berkeley and Intel Research Labs, the MTS400CA and MTS420CA are two new additions to Crossbow's expanding family of low-cost sensor boards. These boards offer five basic environmental sensing parameters and an optional GPS module (MTS420CA).

The MTS400CA and MTS420CA sensor boards utilize the latest generation of IC-based surface mount sensors. These energy-efficient digital devices in turn provide extended battery life and performance wherever low maintenance field-deployed sensor nodes are required.

These versatile sensor boards are intended for a wide variety of applications ranging from a simple wireless weather station to a full mesh network of environmental monitoring nodes. Applicable industries include Agricultural, Industrial, Forestry, HVAC, and more.

Specifications:

DUAL-AXIS ACCELEROMETER
- Analog Devices ADXL202JE
- Acceleration range; resolution: ±2 *g*; 2 m*g* at 60 Hz
- Nonlinearity: 0.2% of full scale
- Zero *g* bias level: 2.0 m*g*/°C from 25°C

BAROMETRIC PRESSURE SENSOR
- Intersema MS5534AM
- Pressure range; resolution: 300-1100 mbar; 0.1 mbar
- Accuracy: ± 1.5% at 25°C
- Operating temp. range: -10°C to +60°C

AMBIENT LIGHT SENSOR
- TAOS TSL2550D
- Spectral responsivity: 400-1000 nm, similar to human eye

RELATIVE HUMIDITY & TEMPERATURE SENSOR
- Sensirion SHT11
- Humidity range; resolution: 0-100% RH; 0.03% RH
- Absolute RH accuracy: ± 3.5% RH
- Temp. range; resolution: -40°C to 123.8°C; 0.01°C
- Temp. accuracy: ± 0.5°C @ 25°C

GPS MODULE (MTS420CA Only)
- Leadtek GPS-9546
- SiRFstar IIe/LP chipset
- Tracking channels: 12
- L1 frequency: 1575.42 MHz C/A code
- Position accuracy: 10 m, 2D
- Reacquisition time: 0.1 sec. (typ.); (<30 sec. max. blockage)

Ordering Information

Model	Description
MTS400CA	MICA2 Weather Sensor Board
MTS420CA	MICA2 GPS/Weather Sensor Board

wireless sensor networks

Document Part Number: 6020-0053-01 Rev C

MTS

MICA2DOT SENSOR BOARD

- Compatible with Quarter-Sized MICA2DOT Processor/Radio Boards
- Dual-Axis ± 2 g Accelerometer
- Digitally Controlled Acoustic/Microphone Sensor
- Photosensitive Light Sensor
- Power Control for Accel, Light & Microphone Sensors

Applications

- Acoustic Tracking
- Robotics
- Seismic Monitoring
- Event Detection
- Ubiquitous Computing

MTS510CA

The MTS510CA is an accelerometer, light, and microphone/acoustic sensor board designed specifically to mate with the MICA2DOT Processor/Radio Board. The ultra-small size of this sensor board makes it ideal for use in applications like robotics, human-computer interaction experiments, and acoustic detection systems.

The MTS510CA features a dual-axis ± 2g MEMS accelerometer. This IC- based surface-mount sensor is low-power (<1mA) and has a DC response making it ideal for seismic, tilt, and shock/event detection applications. The MTS510CA also features a digitally controlled microphone circuit and a photocell light sensor. The analog output of all three sensors connects to a standard MICA2DOT's onboard analog to digital converter (ADC).

The accelerometer, microphone and light sensor circuits are all processor-controlled and can be switched on or off via user-defined programs. The gain of the microphone circuit is also digitally controlled. This circuit is useful for acoustic noise detection as well as basic audio sampling.

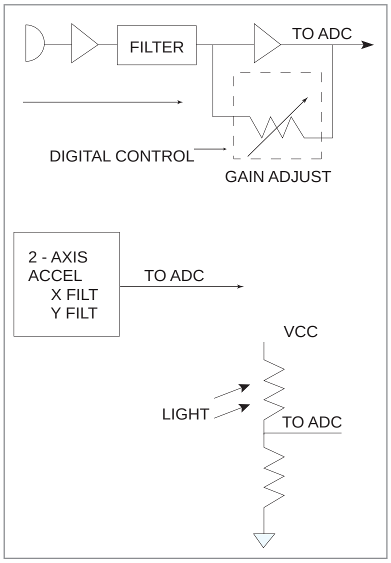
Specifications:

ACOUSTIC SENSOR
- Analog output
- Range: 100 Hz - 10 KHz
- 35 - 70 dB gain

DUAL-AXIS ACCELEROMETER
- Analog Devices ADXL202JE
- Analog Output
- Range: ±2 g
- Sensitivity: 2mg at 60 Hz

PHOTOSENSITIVE LIGHT SENSOR

ULTRA-COMPACT SIZE
- 25mm (1.0 inch) diameter footprint



MTS510CA Block Diagram

Model	Description
MTS510CA	Light, Acoustic, 2-Axis Accel Sensor Board for MICA2DOT

wireless sensor networks

Document Part Number: 6020-0058-02 Rev B

Mini–Seis I and II Seismographs

"The World's Most Powerful, Rugged and Economical Mini–Seismographs"

Features and Capabilities

- **Four Memory Models to Address Short and Long Term Monitoring Needs**

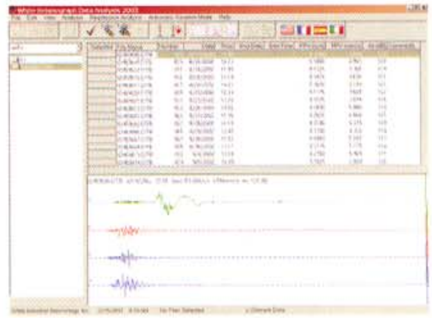
Mini–Seis I 1.0M – 1.0 megabyte of memory.	Up to 341 blast events.
Mini–Seis II 1/2M – 1/2 megabyte of memory.	Approximately 150 to 250 blast events.
Mini–Seis II 1/4M – 1/4 megabyte of memory.	Approximately 50 to 100 blast events.
Mini–Seis II 1/8M – 1/8 megabyte of memory.	Approximately 10 to 20 blast events.

- **Low Cost, Lightweight and Easy to Use**
- **Two Line, 40 Character Display and Six Key Keypad**
- **External Ground Motion Sensing Package and Acoustic Microphone**
- **Complimentary, Full–Featured Data Analysis Software For Windows (see inside for details)**
- **Major Features and Capabilities***
  - Data access by direct serial connection or remote modem.
  - Wave form and bar graph recording modes.
  - Optional transducer gains for recording very low and very high vibration levels.
  - Review event summary history for the last 341 events regardless of memory size.
  - Long lasting, rechargeable internal battery.
  - Sturdy case resistant to RF interference and convenient carrying case.
  - Auto–Report feature by direct connection or modem.
  - Print records on–site with many commercial, portable field printers.

Meets or exceeds ISEE performance and calibration standards.

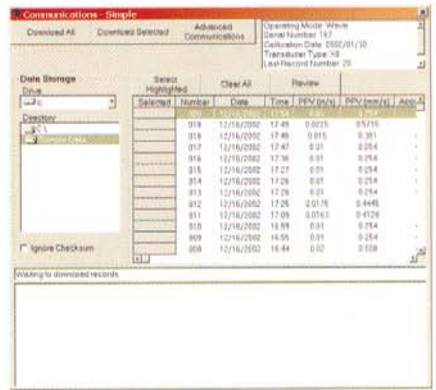
SEISMOGRAPH DATA ANALYSIS SOFTWARE FEATURES*

USER INTERFACE



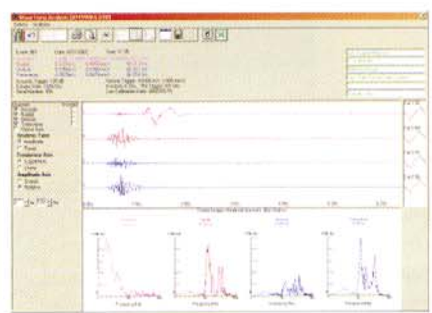
- Easy to use menus and toolbar.
- View records in a list, in a list with graphics, or as thumbnails.
- Combine or separate wave form and bar graph records.
- Context sensitive on–line help system.
- English, French, Spanish and Italian language capability.

COMMUNICATIONS



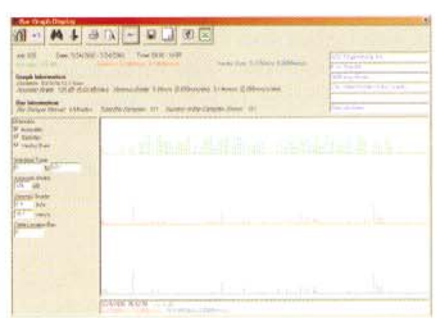
- Download any White seismograph by serial connection or modem.
- Simple communications and downloading.
- Advanced communications for more downloading control, modem access, gain and eprom modifications, seismograph setup and special functions.
- Enable automatic reporting of data by direct connection or modem.

WAVE FORM ANALYSES



- Standard presentation with time and amplitude scaling controls.
- Fourier frequency analysis (FFT) amplitude or power spectrum (velocity, displacement and acceleration wave forms).
- Velocity versus frequency curves (velocity, displacement and acceleration wave forms).
- Compare characteristics and frequencies of two distinct wave forms.
- Band pass filter acoustic and seismic channels.
- Displacement and acceleration wave form conversion.
- Pseudo response spectra (frequency based and wave form).
- Power spectrum transfer function (for determining natural frequency).
- French ponderation function.

BAR GRAPH ANALYSES



- Graphics presentation with time and amplitude scaling controls.
- Numerical list of data.

OTHER FEATURES

- Create custom velocity versus frequency criteria.
- Send reports to Microsoft Word or Excel.
- Process multiple wave form or bar graph records automatically.
- Create data summaries and multi–record transcriptions on a single page.
- Save records and analyses as text files.
- Regression analysis.
- File management functions – create directories, copy, move and delete files.

*Features listed apply to **Seismograph Data Analysis 2003** and higher versions. The software is available as a complimentary download from our web page at **http://www.whiteseis.com**, subject to the terms of the license agreement.

3. Geology of Lee County

The following geologic explanation was provided to this study from a concurrent study being conducted in Lee County concerning the hydrogeology of the county.

Greg Rawl, a professional geologist provided this information. The information was checked by Terra Dinamica LLC in the field and through a literature. Mr. Rawl has done a superb job of explaining the geology.

A. Geologic Units

The geology of southwestern Florida is comprised of sedimentary rocks of the Cenozoic age. In geologic time, these rocks are of a relatively young age, 58 million years old to present, as shown in the Geologic Time Scale below.

Geologic Time Scale

Era	Period	Epoch	Approximate duration (millions of years)	Approximate number of years ago (millions of years)
Cenozoic	Quaternary	Holocene	10,000 years ago to the present	
		Pleistocene	2	.01
	Tertiary	Pliocene	11	2
		Miocene	12	13
		Oligocene	11	25
		Eocene	22	36
		Paleocene	71	58

The exposed landmass of Southwest Florida was formed during the Pleistocene Epoch with the advances and declines in sea level 1.8 million to 8,000 years ago. The underlying limerock formations are also of more recent Cenozoic age, with the Suwannee Limestone formed in the Oligiocene, 36 to 25 million years ago.

These rocks are primarily carbonates (limestones) in the lower portion with clastics (sand and clay) in the upper part. The movement of groundwater from inland areas to the Gulf occurs primarily through the carbonate rocks (Meyer, 1989). As applicable to the Study, this section of the report describes the geology and the hydrogeology including the existing lithology, the general stratigraphy of the area, the hydrogeology of the area and the hydraulic characteristics of the area.

Geologic units in southwestern Florida generally consist, in ascending order, of the Suwannee Limestone of Oligocene age, Hawthorn Group (Arcadia and Peace River

Formations) of Oligocene to Pliocene age, Tamiami Formation of Pliocene age, and undifferentiated sediments of Holocene to Pleistocene age. These formations are shown in **Figure 3a Generalized Geologic and Hydrogeologic Units in the Study Area.**

The Suwannee Limestone is composed of fossiliferous, calcarenitic limestone with minor amounts of quartz sand. The thickness of the limestone varies widely, but commonly is greater than 100 m in Lee and Collier Counties. The basal Suwannee Limestone generally contains fine-grained, phosphatic, clastic material with interbeds of micrite and clay (Reese, 2000).

SERIES	GEOLOGIC UNIT		HYDROGEOLOGIC UNIT		VIEWLOG GEOLOGIC UNITS
HOLOCENE PLEISTOCENE	UNDIFFERENTIATED		SURFICIAL AQUIFER SYSTEM	SURFICIAL SEDIMENTS	HOLOCENE
PLIOCENE	TAMIAMI FORMATION			PINECREST LIMESTONE	PLIOCENE
				BONITA SPRINGS MARL CONFINING BED	BONITA SPRINGS MARL
				LOWER TAMIAMI AQUIFER	OCHOPEE
MIOCENE	HAWTHORN GROUP	PEACE RIVER FORMATION	INTERMEDIATE AQUIFER SYSTEM	UPPER PEACE RIVER CONFINING BED	UPPER PEACE RIVER CONFINING
				SANDSTONE AQUIFER	SANDSTONE
				BASAL PEACE RIVER CONFINING BED	BASAL PEACE RIVER CONFINING
		ARCADIA FORMATION		MID-HAWTHORN AQUIFER	ARCADIA
				BASAL MID-HAWTHORN CONFINING BED	BASAL MID-HAWTHORN CONFINING
OLIGOCENE			FLORIDAN AQUIFER SYSTEM	LOWER HAWTHORN AQUIFER	LOWER HAWTHORN
	SUWANNEE LIMESTONE			UPPER FLORIDAN AQUIFER	SUWANNEE

Figure 3a Generalized Geologic and Hydrogeologic Units in the Study Area

The Hawthorn Group is divided into the Arcadia Formation and the Peace River Formation. The Arcadia Formation, which unconformably overlies the Suwannee Limestone, consists of fine-grained carbonate sediments as well as sandy limestone, shell beds, dolomite, phosphatic sand and carbonate, sand, silt, and clay. The predominantly clastic Peace River Formation has a highly irregular erosional and karstic surface. The contact with the overlying Tamiami Formation appears to be unconformable in some areas but indistinct in other areas. The sediments of the Peace River Formation consist of interbedded, fine- to coarse-grained quartz sand, quartz silt, gravel, clay, carbonate, and phosphatic sand (Reese, 2000).

The Tamiami Formation overlies the Peace River Formation and consists of varying amounts of silt, sandy clay, micritic limestone, sandy and shelly limestone, calcareous sandstone, and quartz sand. The lithology of the Tamiami Formation varies greatly because of the complex nature of the depositional environment. The limestone is well indurated to unindurated, slightly phosphatic, variably sandy, and fossiliferous. The sand facies varies from well sorted, clean sand with abundant shells and traces of silt-size phosphate, to clayey sand with sand-size phosphate, clay-size carbonate in the matrix, and abundant well-preserved mollusk shells (Knapp and others, 1986; Reese, 2000).

The undifferentiated sediments of Holocene to Pleistocene age overlie the Tamiami Formation at land surface (Reese, 2000). These deposits mainly consist of quartz sand with minor amounts of shell and clay, and contain limestones, sandstones, and shell beds. With increasing elevation inland, the sand becomes thicker and less calcareous. The sand facies varies from fine to coarse grained, nonindurated to poorly indurated, and nonclayey to slightly clayey. Included in this group are marine terrace sediments, aeolian sand dunes, fluvial deposits, freshwater carbonates, peats, and clay beds.

B. Viewlog 3-D Geologic Model

The regional geology of the Study Area has been mapped analyzed three-dimensionally using a geologic database software called Viewlog. Viewlog has also been utilized to analyze groundwater level data and aquifer coefficients for the study area. This software was developed by and recently applied by EARTH*fx* for the Southwest Florida Feasibility Study (SWFFS). It is currently being utilized by SFWMD and will be basis for upcoming SFWMD models. It is the only hydrogeologic data base model encompassing all of Lee and surrounding counties. Viewlog works in concert with Microsoft's Access Database Program, which serves as the Database engine for the model.

The database contains information on lithologic units, hydrogeologic parameters and groundwater level data. Each aspect of the database is discussed in this section in detail. Output from Viewlog was exported directly to groundwater model.

<u>Lithologic Database</u>

The lithologic information stored in the Database is interpretative information pertaining to the elevations of the top and bottom of the various hydrogeologic units described in the previous section for each well location from which data has been obtained. The lithologic database initially consisted of 1,080 wells from a Water Resource Solutions (WRS) report prepared for South Florida Water Management District (SFWMD). Earth*fx* then took the WRS data and reformatted it into an Access Database format to be compatible with Viewlog to be utilized in the South West Florida Feasibility Study.

The domain of the lithologic information used for this study, as well as the Aquifer Coefficients and Water Level information contained in the database, was extended well into the adjacent Counties in order to take into account regional trends and provide well defined lithologic conditions for the boundary of the groundwater flow model. In all approximately 2,650 square miles were included from the original database in our geologic model study area. All of Lee County's 804 square miles of area was included in the model, along with 554 square miles in Charlotte County, 244 square miles in Glades County, 320 square miles in Hendry County, and 734 square miles in Collier County.

As part of this study, Lithologic logs of 629 wells in and adjacent to Lee County were received from a variety of sources, including Bonita Springs Utilities, Lee County Utilities South Florida Water Management District (SFWMD), the United States Geologic Survey (USGS) and various consultants' reports submitted to various agencies as part of zoning / land use issues. Most of the additional lithologic well logs that were added to the database within the study area are either from utilities, the USGS, Lee County Division of Natural Resources, Mining operations and various Geotechnical Borings.

All of the wells from which lithologic information were obtained for the database are shown in plan view in **Figure 3b – Location Map of Wells with Lithologic Data.** The wells from the original WRS database have the prefix LM in figure __ and are shown in red. The 629 wells that were added to the database as part of this project are shown in black.

When dealing with randomly distributed data, such as lithologic unit information, Viewlog works by referencing specific queries in the Access Database to then spatial distribute data point in Viewlog model domain. It then interpolates the information from the given data point to the entire model domain. Typically kriging algorithms are utilized to take into account trends in the data to calculate values in area were not site specific data is available. The results of the kriging essentially generate a numeric surface of the top and bottom of the various geologic units that are represented it the model.

The thickness of each unit is determined by Viewlog by subtracting the tops of each unit from the bottom for the entire model domain. To calculate the thickness of the upper unit, which in this study was the Holocene sediments, the model uses the numerically generated top of the underlying Pliocene and the Digital Elevation Model (DEM) Grid for the model domain. In the case of the Pliocene Unit, the model uses the numerically generated surface top of the Pliocene and the numerically generated top of the Bonita Springs Marl.

Attached are F**igures 3c through 3i** of the tops and thickness of some of the units represented in the model. It should be noted that the Pliocene and Bonita Springs Units are only present in the southern portion of Lee County.

Using the Viewlog, geologic cross sections can be generated upon need for specific areas. It is able to generate cross sections from the numerically generated surfaces of each unit for any desired orientation within the model domain.

For this report seven representative Cross Sections of the study area were created. Three of which are oriented in a north-south direction and four are oriented from east-west to show the area geology. Cross sections were generated beyond the Lee County to show regional trends.

The North-South Regional Cross Sections runs through the study area. The Regional Geologic Cross section A-A' in **Figure 3b.** Regional Geologic Cross Section B-B' as shown in **Figure 3b.**

One East-West Regional Cross Sections was run along the northern boundary of the project from Charlotte Harbor to the Lee-Hendry County line as shown in Regional Cross Section C-C' **(Figure 3b).** Another East-West Regional Cross Section was run along the southern project boundary from Estero Bay along the Imperial River to the Hendry County line, shown as D-D' (Figure 3b).

In addition, specific sections were run within the project area to show details within the study area. The locations of the Sections are shown in **Figure 3b – Location of Geologic Sections in Study Area.**

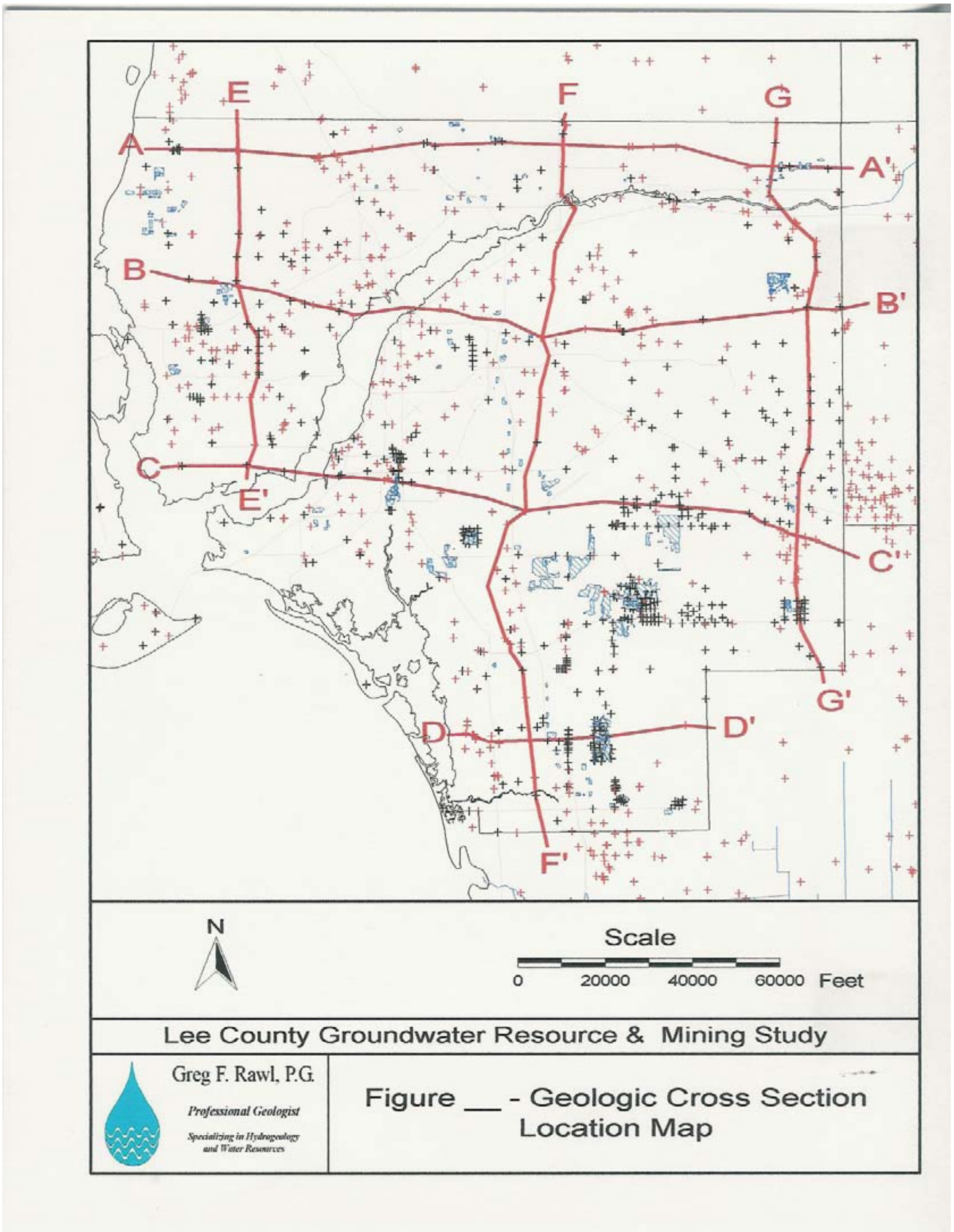

A
A'
B
B'
C
C'
D
D'
E
E'
F
F'
G
G'
N
Scale
0
20000
40000
60000 Feet
Lee County Groundwater Resource & Mining Study
Greg F. Rawl, P.G.
Professional Geologist
Specializing in Hydrogeology and Water Resources
Figure __ - Geologic Cross Section
Location Map

Figure 3b

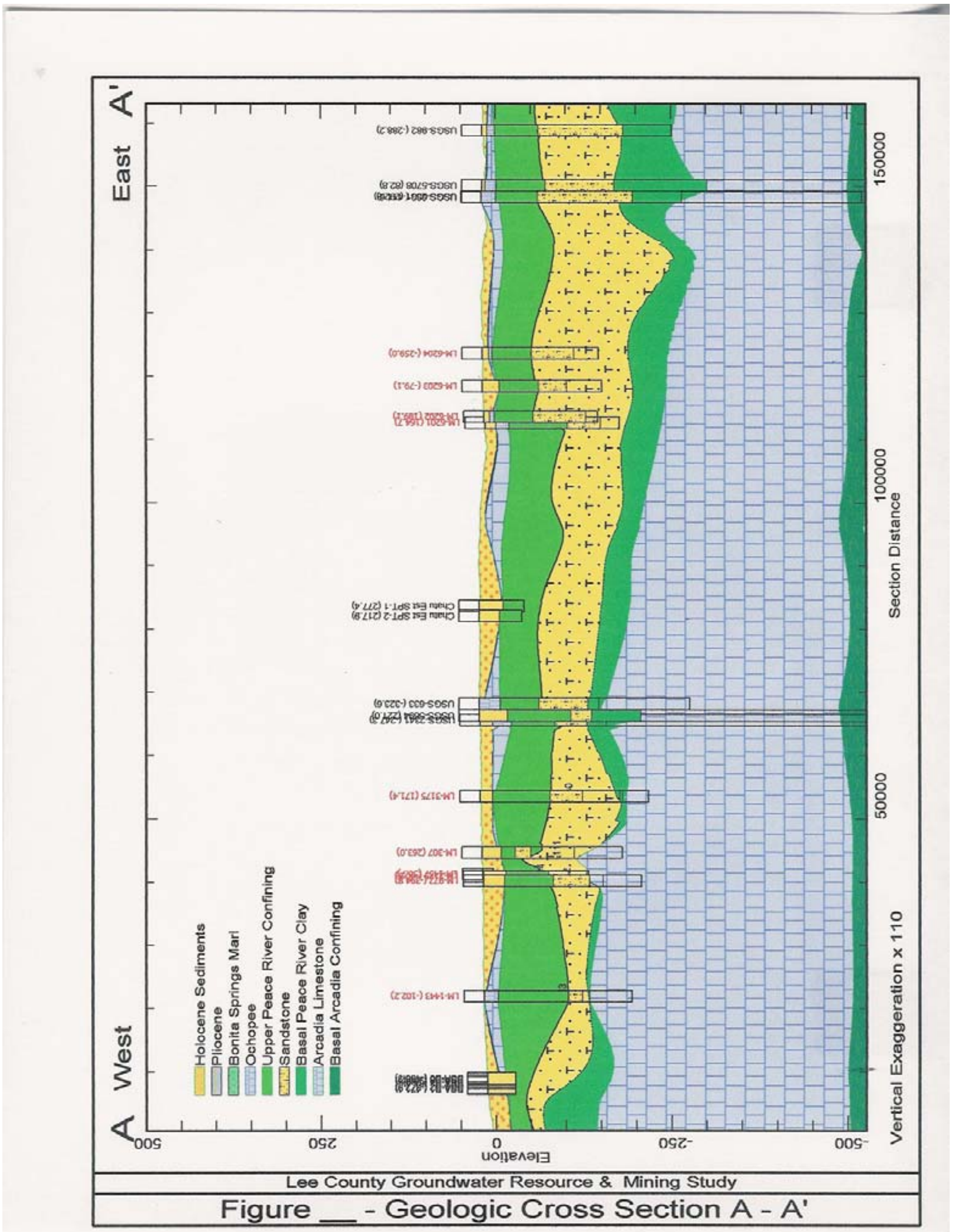


Figure __ - Geologic Cross Section A - A'
Lee County Groundwater Resource & Mining Study
A
West
East
A'
Holocene Sediments
Pliocene
Bonita Springs Marl
Ochopee
Upper Peace River Confining
Sandstone
Basal Peace River Clay
Arcadia Limestone
Basal Arcadia Confining
Elevation
500
250
0
-250
-500
Section Distance
50000
100000
150000
Vertical Exaggeration x 110

Figure 3c

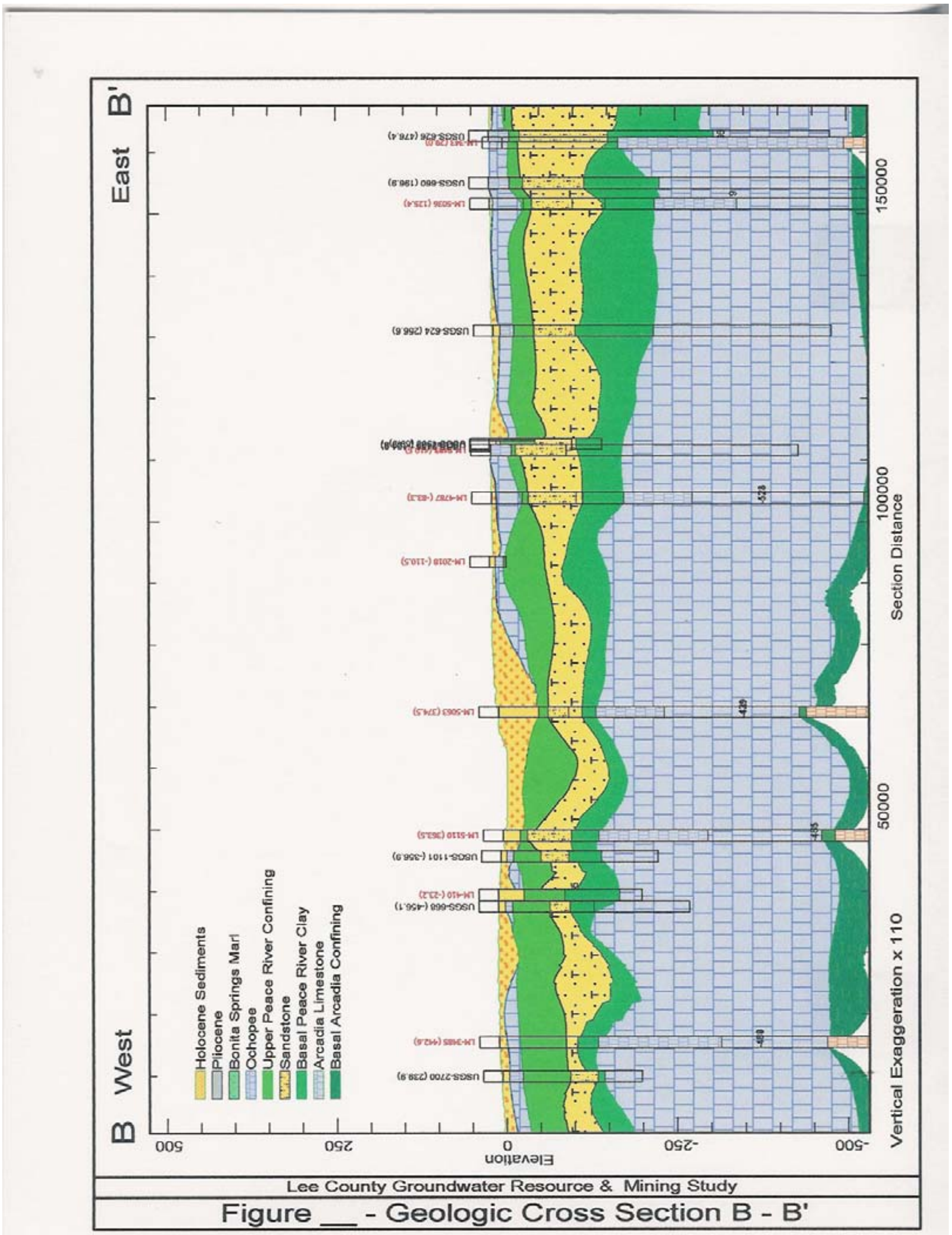


Figure __ - Geologic Cross Section B - B'
Lee County Groundwater Resource & Mining Study
B West
East B'
Holocene Sediments
Pliocene
Bonita Springs Marl
Ochopee
Upper Peace River Confining
Sandstone
Basal Peace River Clay
Arcadia Limestone
Basal Arcadia Confining
Elevation
500
250
0
-250
-500
Vertical Exaggeration x 110
Section Distance
50000
100000
150000

Figure 3d

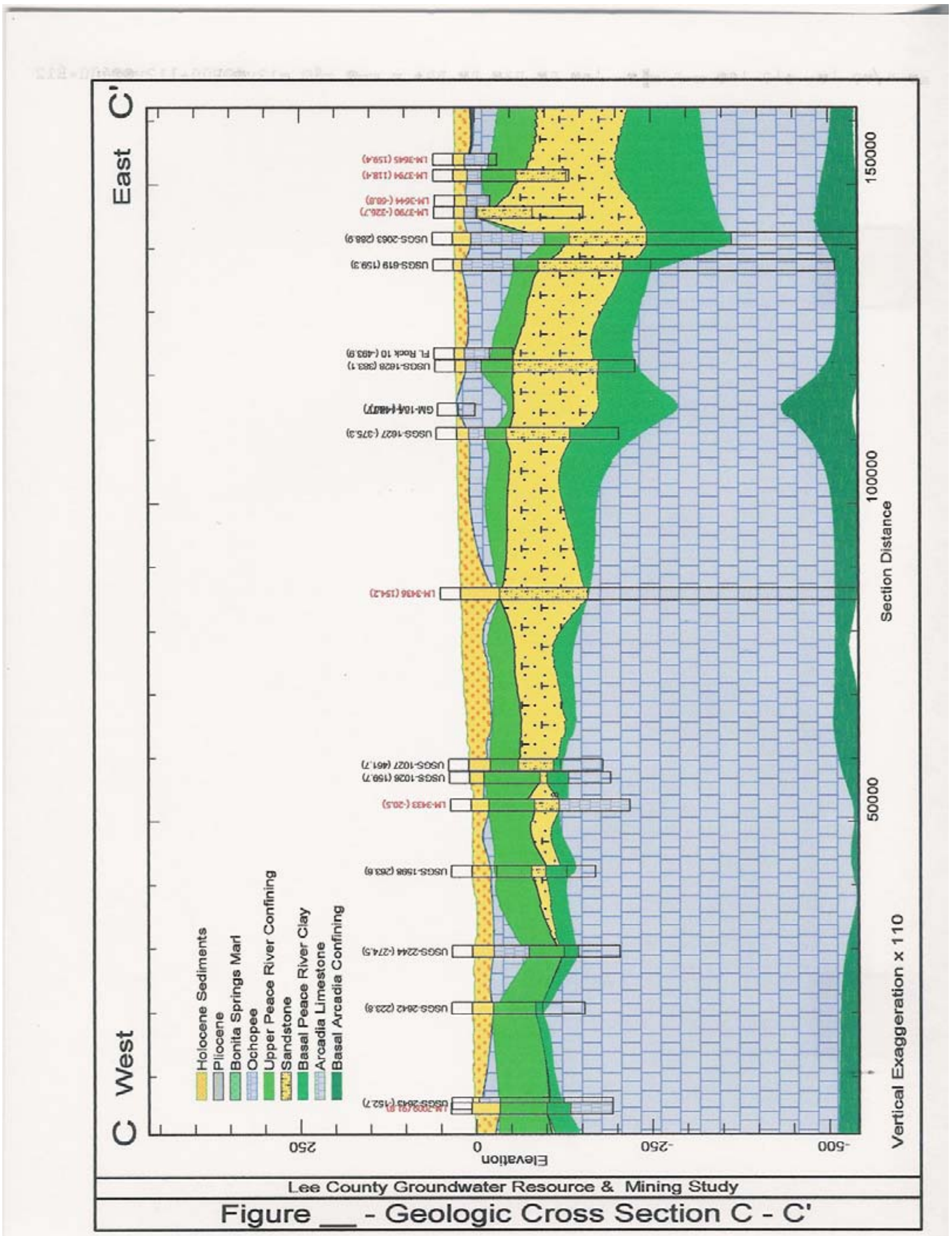

C West
East C'
Holocene Sediments
Pliocene
Bonita Springs Marl
Ochopee
Upper Peace River Confining
Sandstone
Basal Peace River Clay
Arcadia Limestone
Basal Arcadia Confining
Elevation
Section Distance
Vertical Exaggeration x 110
Lee County Groundwater Resource & Mining Study
Figure __ - Geologic Cross Section C - C'

Figure 3e

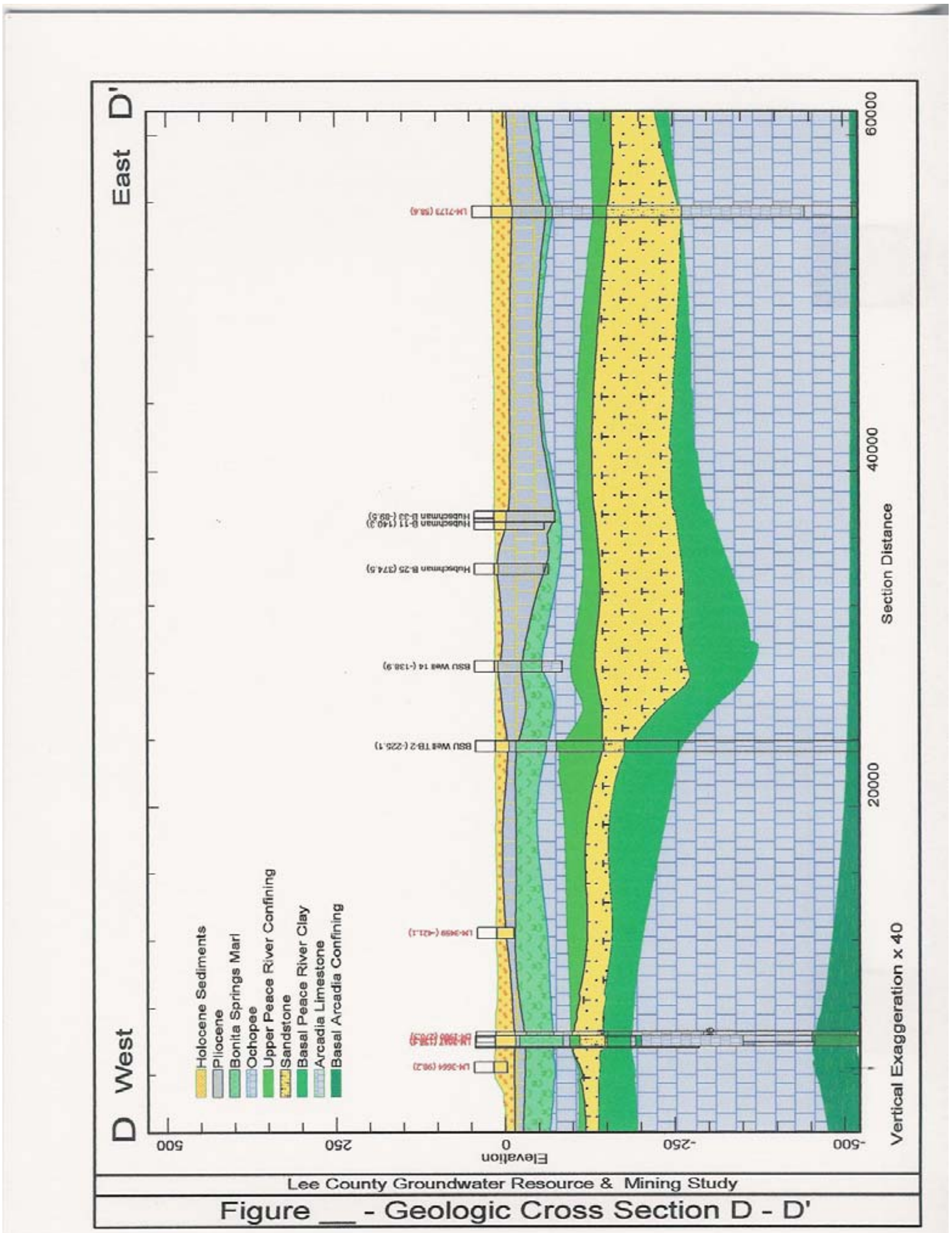

D West
East D'
Holocene Sediments
Pliocene
Bonita Springs Marl
Ochopee
Upper Peace River Confining
Sandstone
Basal Peace River Clay
Arcadia Limestone
Basal Arcadia Confining
Elevation
500
250
0
-250
-500
Section Distance
20000
40000
60000
Vertical Exaggeration x 40
Lee County Groundwater Resource & Mining Study
Figure __ - Geologic Cross Section D - D'

Figure 3f

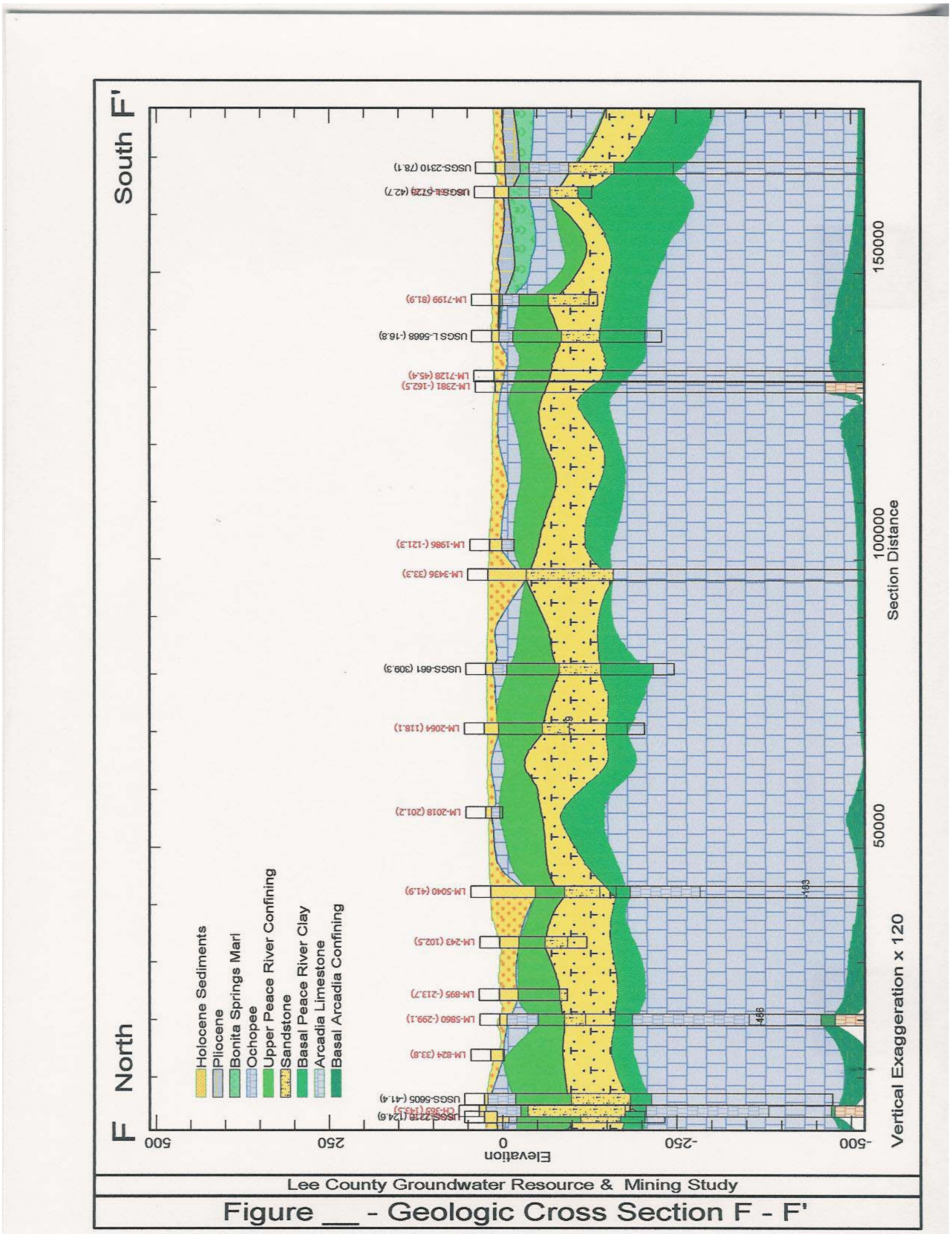

F North
South F'
Holocene Sediments
Pliocene
Bonita Springs Marl
Ochopee
Upper Peace River Confining
Sandstone
Basal Peace River Clay
Arcadia Limestone
Basal Arcadia Confining
Elevation
500
250
0
-250
-500
50000
100000
150000
Section Distance
Vertical Exaggeration x 120
Lee County Groundwater Resource & Mining Study
Figure __ - Geologic Cross Section F - F'

Figure 3g

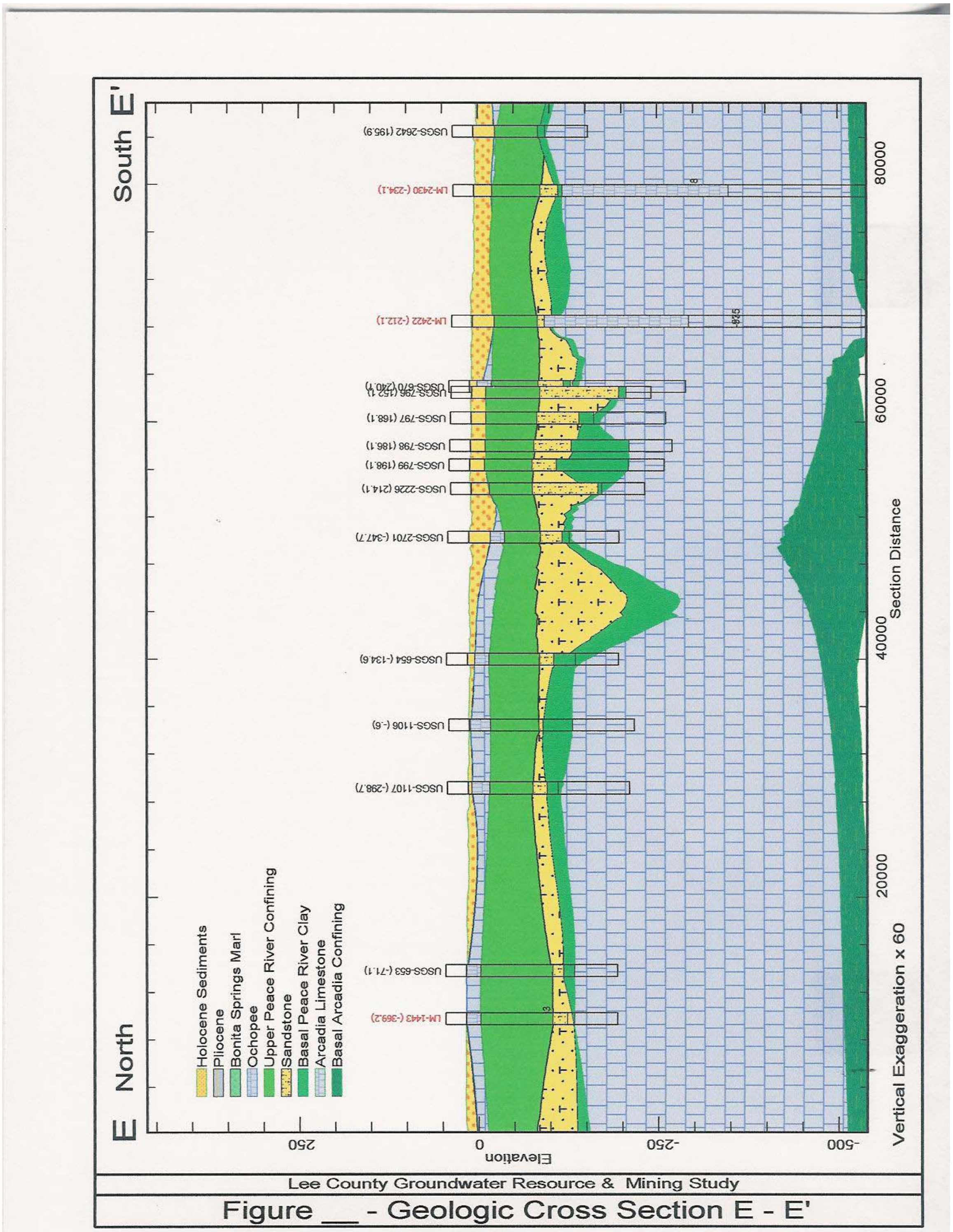

E North
South E'
Holocene Sediments
Pliocene
Bonita Springs Marl
Ochopee
Upper Peace River Confining
Sandstone
Basal Peace River Clay
Arcadia Limestone
Basal Arcadia Confining
LM-1443 (-369.2)
USGS-653 (-71.1)
USGS-1107 (-298.7)
USGS-1106 (-.6)
USGS-654 (-134.6)
USGS-2701 (-347.7)
USGS-2226 (214.1)
USGS-799 (198.1)
USGS-798 (186.1)
USGS-797 (168.1)
USGS-796 (152.1)
USGS-670 (240.1)
LM-2422 (-212.1)
LM-2430 (-234.1)
USGS-2642 (195.9)
250
0
-250
-500
Elevation
20000
40000
60000
80000
Section Distance
Vertical Exaggeration x 60
Lee County Groundwater Resource & Mining Study
Figure __ - Geologic Cross Section E - E'

Figure 3h

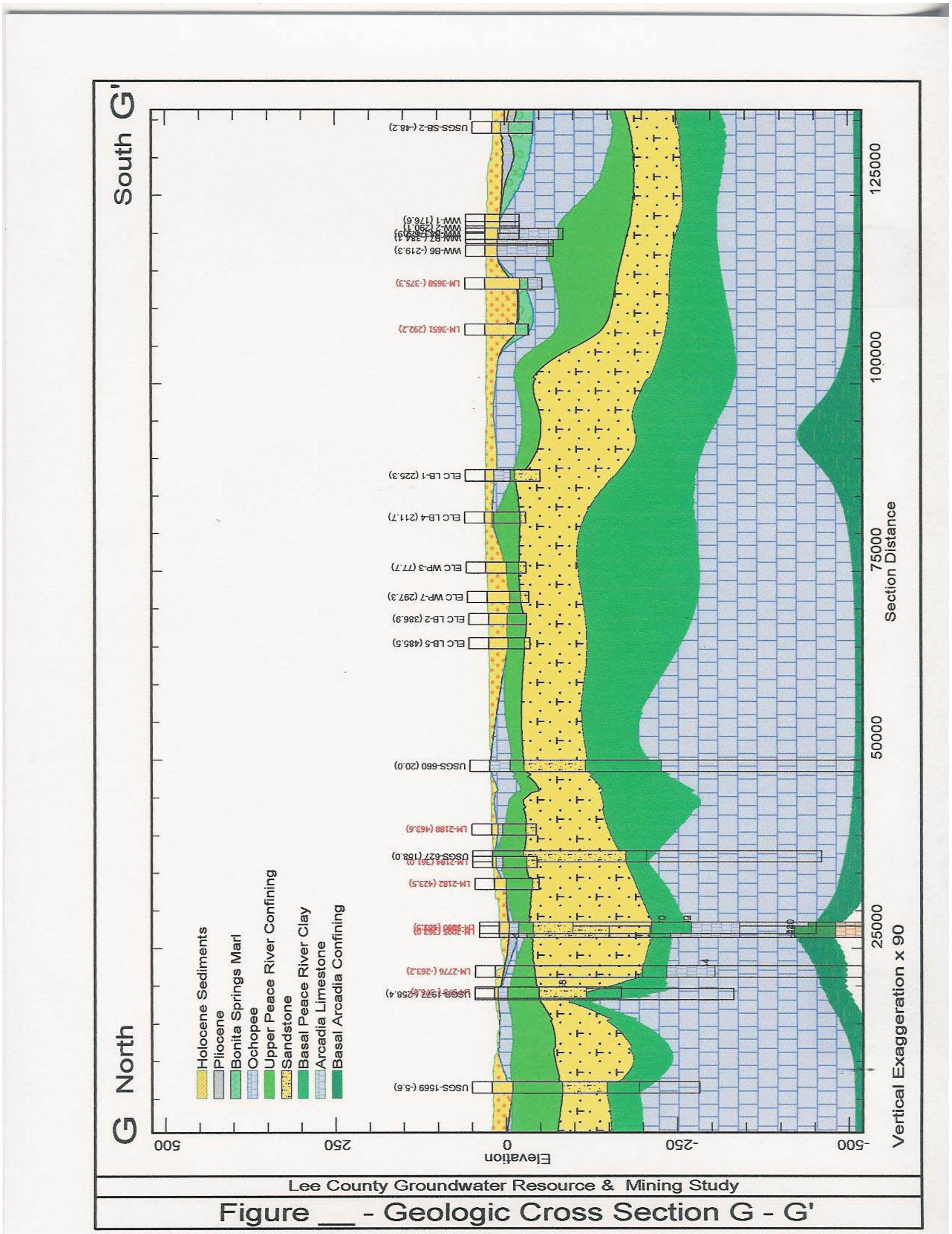

G North
South G'
Holocene Sediments
Pliocene
Bonita Springs Marl
Ochopee
Upper Peace River Confining
Sandstone
Basal Peace River Clay
Arcadia Limestone
Basal Arcadia Confining
500
250
0
-250
-500
Elevation
25000
50000
75000
100000
125000
Section Distance
Vertical Exaggeration x 90
Lee County Groundwater Resource & Mining Study
Figure __ - Geologic Cross Section G - G'

Figure 3i

3.1 Relationship of Geology to Blasting (General)

Geology is the biggest variable and has the greatest effect on blasting and blast induced ground vibration.

The rock structure, rock type, rock harness, overburden type and thickness, and the presence of water effects greatly vibration attenuation. Large amounts of overburden (soil, etc covering rock), soft rock, and water act as filters to the high frequencies of vibration waves. By filtering out the high frequencies, the vibration wave is extended in duration and humans can readily perceive the vibration.

There are 3 basic classifications of rock: Sedimentary, igneous, and metamorphic. The definitions follow:

- <u>Sedimentary Rocks</u>- are the result of the consolidation of sediments produced by the transformation of preexisting rocks by gravity, organisms, and erosion.
  - Examples: Argillite, Gypsum, Limestone, Dolomite, Coal, Shale, and Sandstone.

- <u>Igneous Rocks</u>- are the product of the consolidation and cooling of magma.
  - 2 types
    - Intrusive- example: Granite- cooled in the earth's interior.
    - Extrusive- example: Basalt- volcanic or cool on the earth's surface.

- <u>Metamorphic Rocks</u>- are the result of rock changing composition from extreme heat, pressure, and chemically active fluids.
  - Examples: Quartzite, Schist, Gneiss, Marble, Slate.

Rock Properties

A. <u>Compressive Strength</u>- Maximum compression that can be applied to rock before failure.
B. <u>Tensile Strength</u>- Maximum tension that can be applied to rock before failure.
   ** It's easier to pull(tensile) a rock apart than to smash(compressive) it.
C. <u>Specific Gravity</u>- Rock Density in grams/cubic centimeter (g/cc). Ratio of the mass of given volume of rock to the mass of an equal volume of water.
D. <u>Longitudinal Wave Velocity</u>- the velocity compression waves travel through rock.
   Theory: Explosive velocity should be higher than rock velocity to break it.
E. <u>Young's Modulus-</u> measurement of the rocks ability to withstand deformation.
F. Internal Friction and attenuation coefficients

For the blaster in the field, Specific Gravity/Rock Density is the rock property commonly used for blast design calculations.

ROCK STRUCTURE
The features that are created in rock formations from rock movement. This movement can occur during and after rock formation.

Rock fragmentation is controlled primarily by rock structure.

ROCK STRUCTURES

1. Bedding- the layering of or bedding planes dividing sedimentary rock.
   - ♦ If bedding planes are tight and do not vent gases, and in layers that fall within the fragmentation desired, bedding can be used in conjunction with the blast design to achieve the desired floor or wall profile.
2. Schistosity- layering in metamorphic rocks. Associated with minerals such as mica. Mica is weakly bonded, and can effect fragmentation positively. The rock formation will break along the cleavage planes of the mica.
3. Jointing- joints are fractures in the rock without displacement.

♦ If a rock mass is highly jointed, a loss of explosive energy will occur due to gas venting. This will reduce fragmentation and may increase airblast and vibration.

4. Faults- faults are fractures with rock movement. Movement of rock can occur on one or both sides of the fracture zone.
5. Contacts- the zone where different rock types make contact. An example would be a layer of sedimentary rock on top of an igneous rock.
   - ♦ If a contact occurs between 2 radically different rock types, drilling and blasting can be adversely affected.
6. Massive Rock- Rock lacking or having a small amount of bedding or jointing
7. Blast Cracks- from previous blasts or mechanical agent. These can have the same effect or worse as joints and fractures. Loss of energy.
8. Rock Hardness- Log hardness while drilling to assist in refinement to blast design.
   - ♦ Hard rock with a high density- Higher energy/powder factors.
9. Cavities and Mud seams
   - ♦ Cavities can cause overloading which can result in flyrock and venting.
   - ♦ Mud seams and cavities can vent explosive energy prematurely.

3.2 Relationship of Lee County Geology to Blasting

In blasting terms, there is nothing particular or different about neither the geology in the county nor the geology of the Winkler Road Extension area where there were numerous problems attributed to blasting.

There is a high presence of water and unconsolidated sediment or fill in much of the county. Unconsolidated sediment and water act as filters to vibrations waves. These filters remove the high frequency component of the vibration wave. Humans are extremely sensitive to low frequency vibration (1 – 30 hertz). Also, all structures have a frequency signature or resonant frequency. In a residential house, this resonant frequency is normally between 5 to 15 hertz. If the blast vibration frequency is equal to the resonant frequency, then the house shaking seems more intense and longer then if the frequencies were higher.

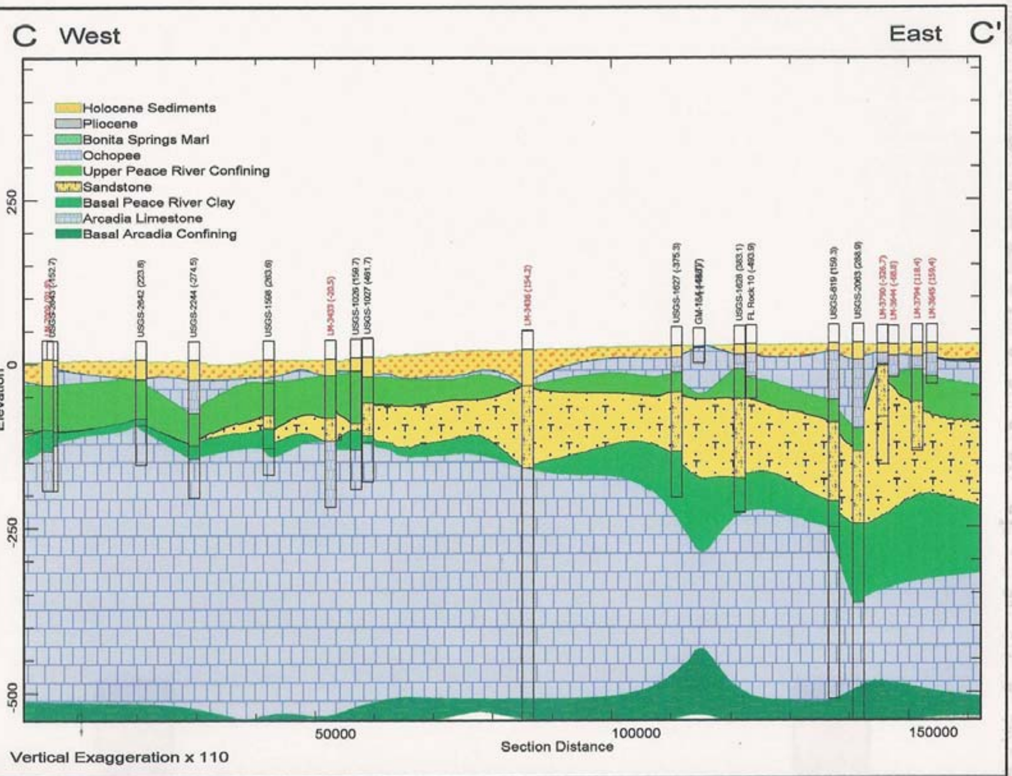
The peak particle velocity limit in Lee County for development blasting is 0.3 inches/second. This limit is well below the normal limits that are associated with damage at these low frequencies. Since the peak particle velocity limit is low, the low frequencies created by the geology are basically taken out of the equation. Although, damage is unlikely to occur, residents will feel the vibration and it will seem more intense then actual, especially if the vibration frequency is equal to the resonant frequency.

Winkler Road Extension

The following cross section C'-C' is close to the Winkler Road Extension. As can be seen when compared to the other cross section B' –B' there is no real difference in the geology of the area that would attribute to different responses to blast affects.

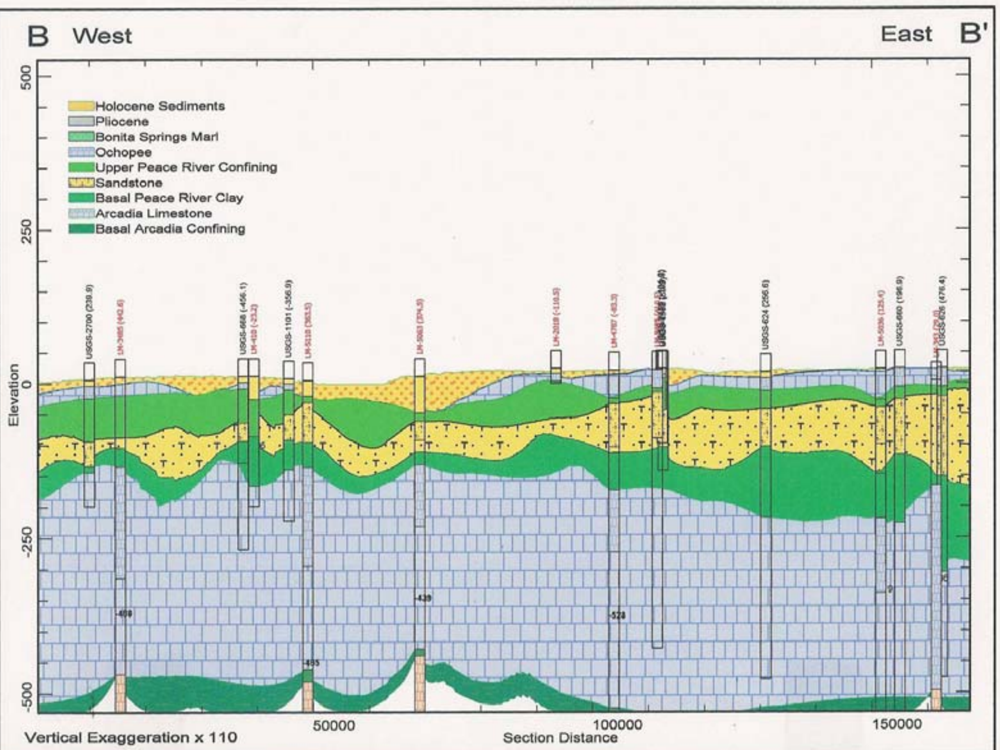
Lee County Groundwater Resource & Mining Study

Figure __ - Geologic Cross Section C - C'



Lee County Groundwater Resource & Mining Study

Figure __ - Geologic Cross Section B - B'



4. Environmental Forces

All houses crack from environmental forces. These forces include temperature change, humidity change, and settling. Other forces interact with structures and also cause damage. It is extremely difficult to distinguish between blast-induced damage and normal aging effects.

4.1 Effects of Environmental Forces on Structures

ENVIRONMENTAL FORCES

All structures are extremely dynamic. Daily environmental forces are causing change to structures 24 hours a day/7 days a week. Environmental forces affect all structures. No structure or dwelling can escape them. Environmental stresses occur inside and outside of the home or building. A partial list follows:

- Gravity
- Changes in humidity.
- Changes in temperature.
- Drying, warping, and shrinking of lumber.
- Curing and drying of mortar, concrete, plaster, joint compound.

During periods of extreme changes in temperature/humidity, a lot of changes can affect a structure. Cracking may occur, settlement, and a host of other changes, many damaging may seem to appear overnight. This is especially true in the spring and fall.

Typical Environmental Stresses, other Forces, and Equivalent Ground Vibrations from a study by Lewis Oriard turned out close to the Lee County Study.

Force	Peak Particle Velocity	Note
Inside Humidity	3	19% Change
Outside Humidity	5	35% Change
Inside Temp	3.6	12 Degree Far. Change
Outside Temp	8.2	27 Degree Far. Change
Wind	3.5	23 MPH
Walking	0.3	Measured at Wall Corner
Jumping	1	Midwall in Same room
Door Slam	0.5	Wall in next room
Sliding Door Slam	1.5	Wall above door
Picture nails	2	Midwall Nearby
Blast Limits	**2**	

"The Effects of Vibrations and Environmental Forces"- By Lewis Oriard

4.2 Lee County Study Results

There was a high degree of change in humidity and temperature inside and outside of the houses. These high degrees of change will cause expansion, shrinkage, and settling of houses and other structures.

The following was found during the literature search and falls closely to the Lee County Study Results.

Typical Environmental Stresses, other Forces, and Equivalent Ground Vibrations from a study by Lewis Oriard turned out close to the Lee County Study.

Force	Peak Particle Velocity	Note
Inside Humidity	3	19% Change
Outside Humidity	5	35% Change
Inside Temp	3.6	12 Degree Far. Change
Outside Temp	8.2	27 Degree Far. Change
Wind	3.5	23 MPH
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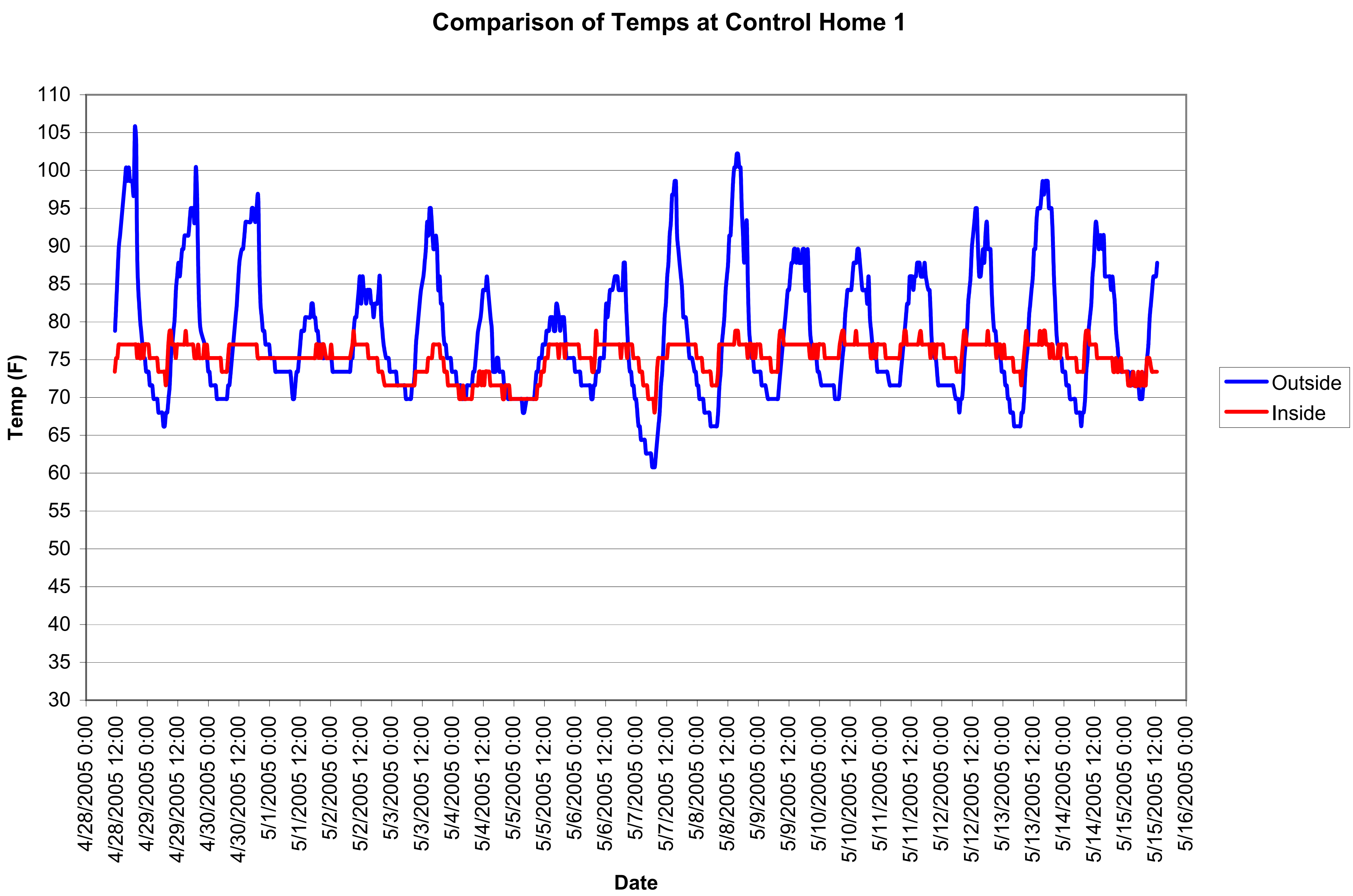
Picture nails	2	Midwall Nearby
Blast Limits	**2**	

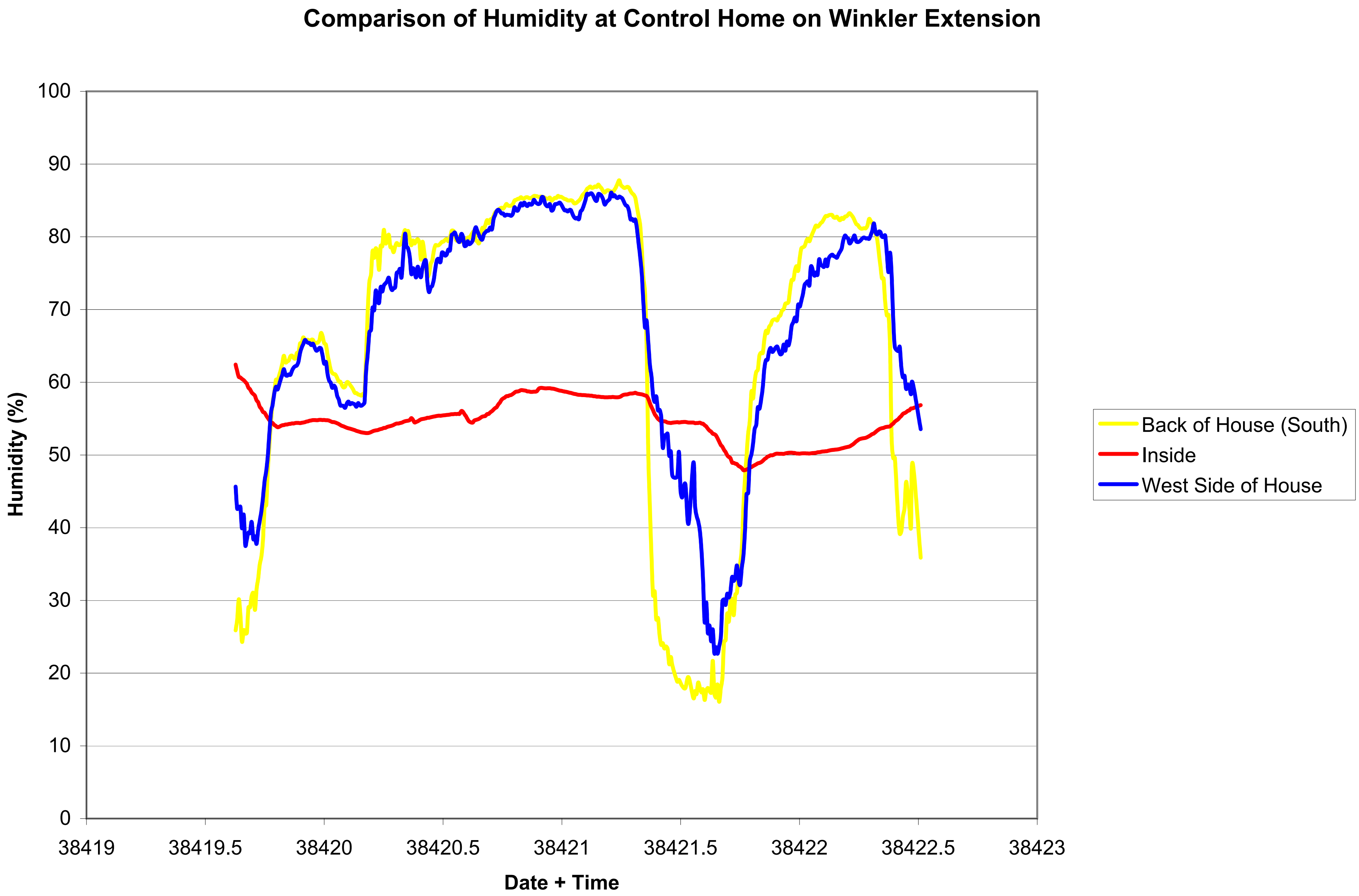
"The Effects of Vibrations and Environmental Forces"- By Lewis Oriard

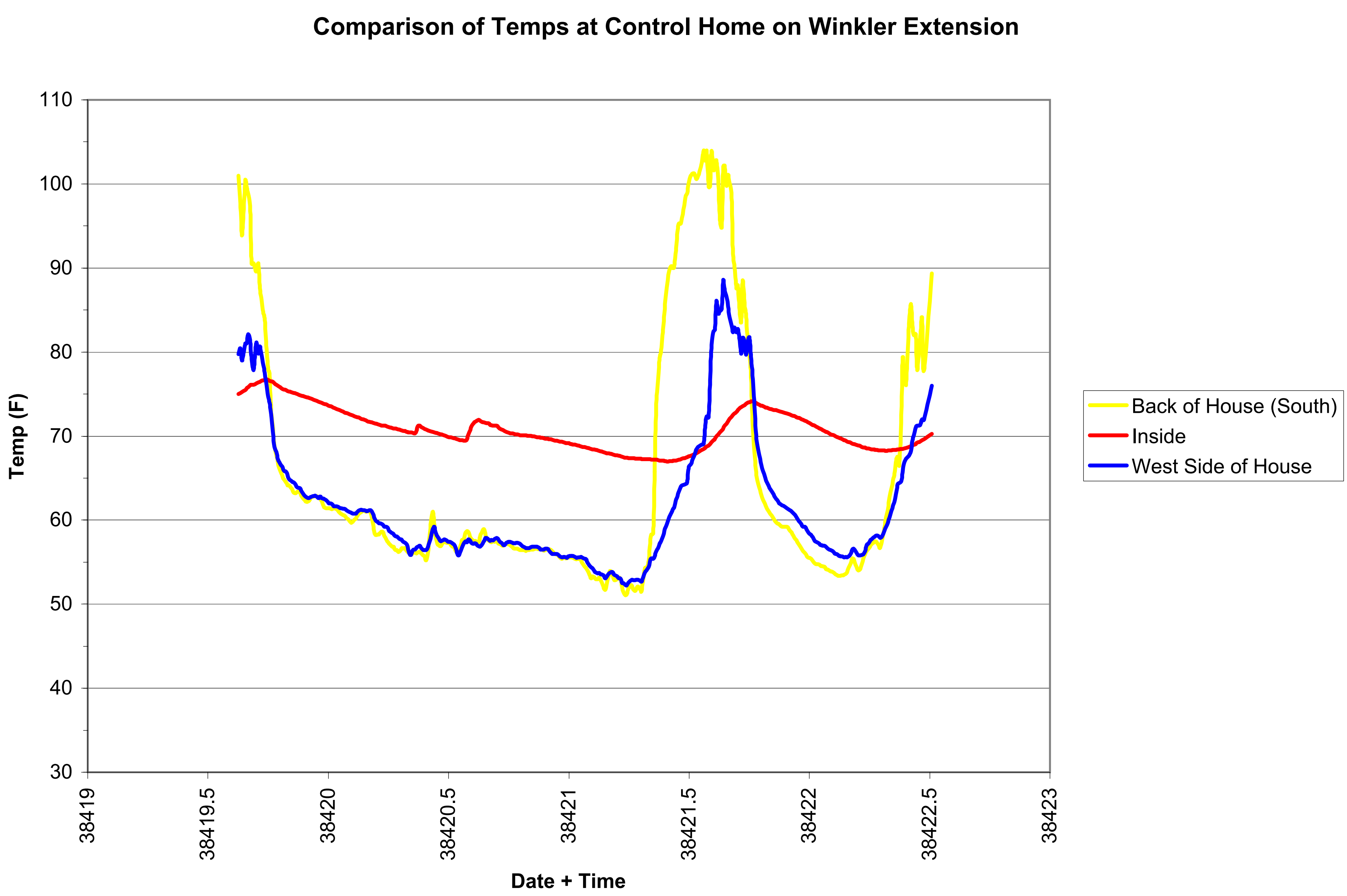
The 3 test houses (near blasting) and the 2 control houses (not near blasting) had instrumentation installed to monitor vibration, humidity change, and temperature change. The test houses near the blasting did not show any signs of damage from blasting nor environmental changes since the time the instruments were installed. The control house on Winkler Road Extension also did not show any damage. The control house on Fort Myers Beach did show cracking (not near blasting).

The vibrations caused by normal daily activities are in the range from 0.001 inches/second up to over 2 inches/second. The peak particle velocity limit for development blasting in Lee County is 0.3 inches/second. This limit falls in the range of ambient vibration experienced by structures.

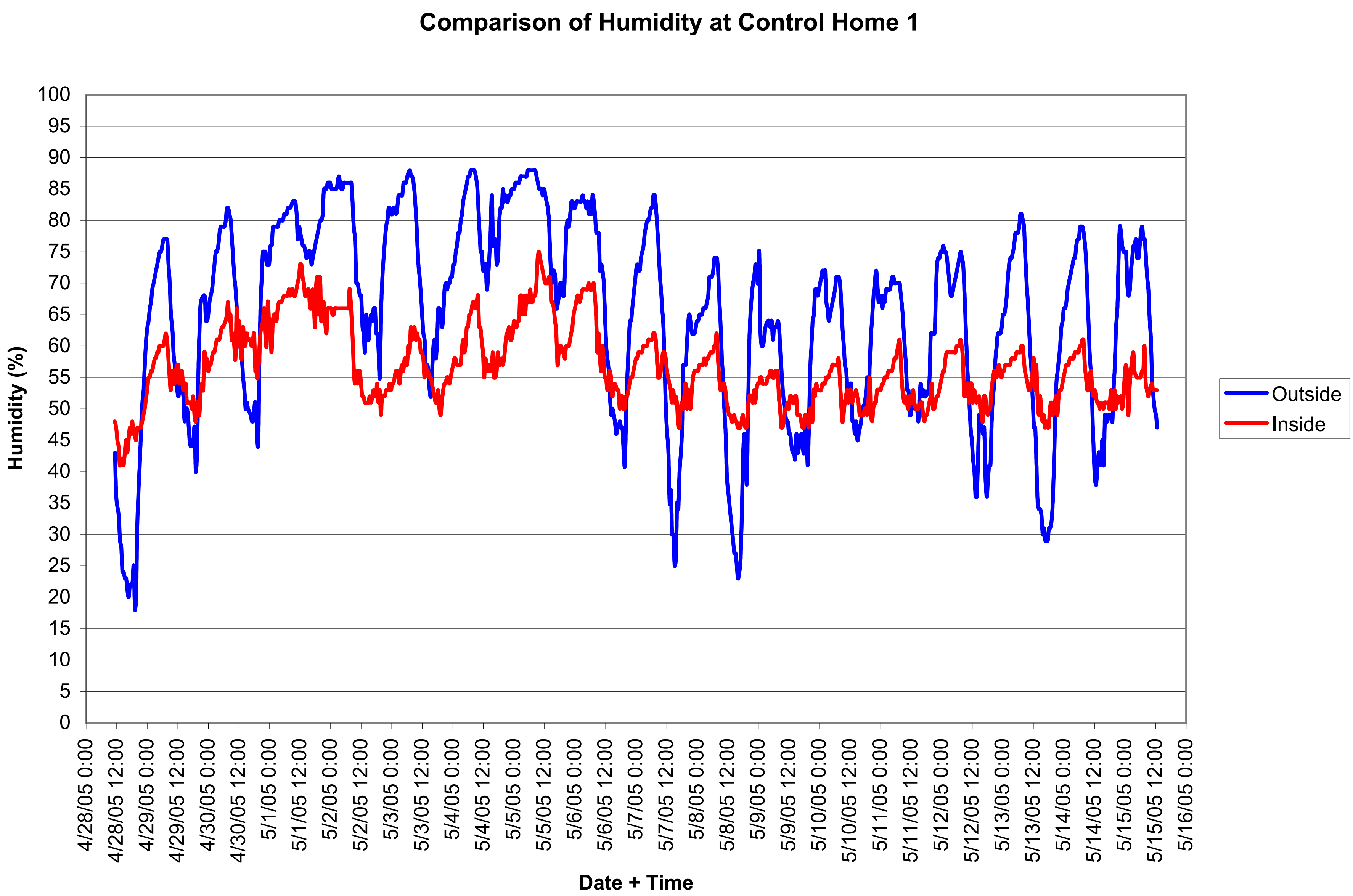
Samples of data and charts follow:

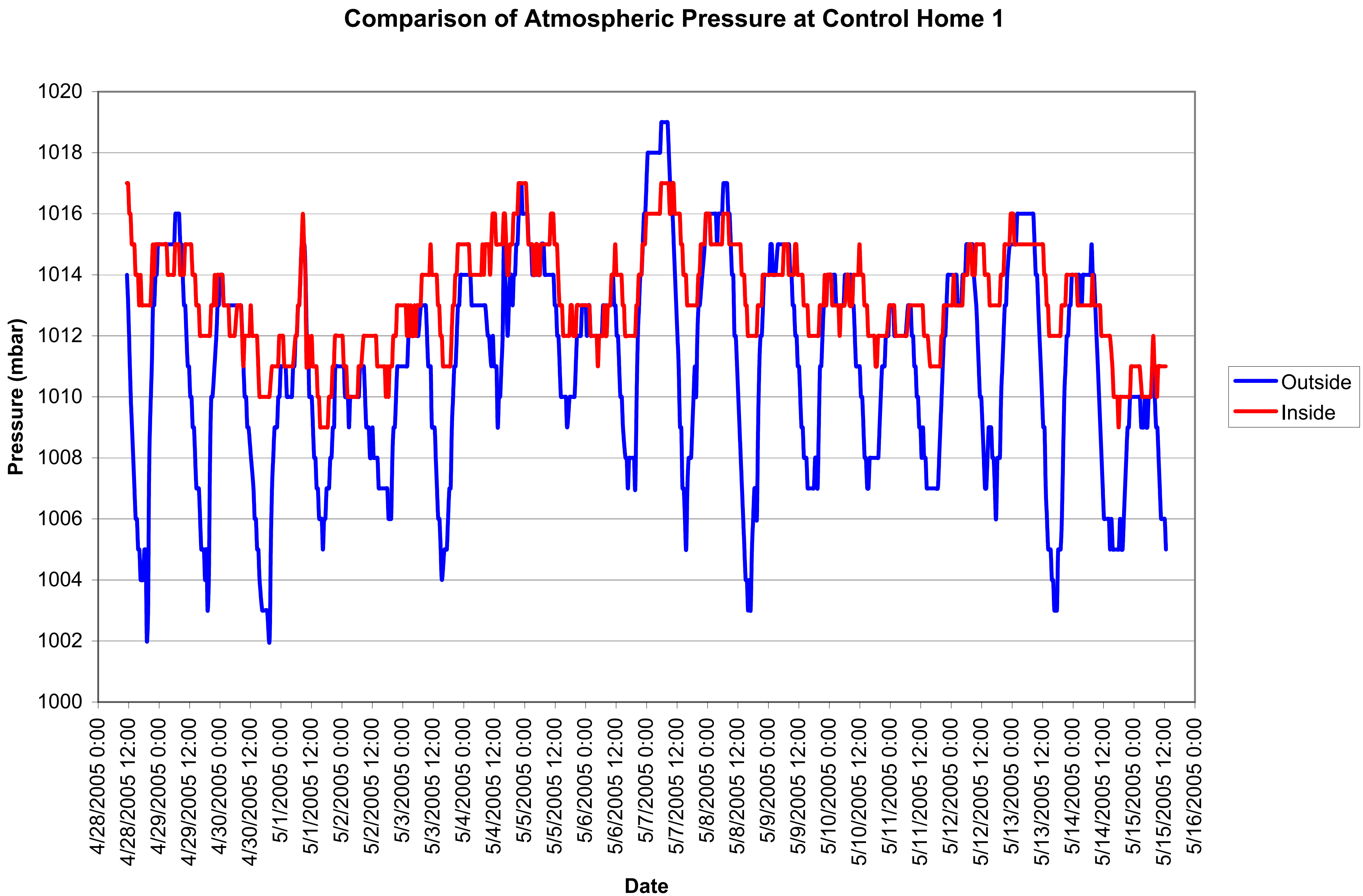

Comparison of Temps at Control Home 1
Temp (F)
110
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
4/28/2005 0:00
4/28/2005 12:00
4/29/2005 0:00
4/29/2005 12:00
4/30/2005 0:00
4/30/2005 12:00
5/1/2005 0:00
5/1/2005 12:00
5/2/2005 0:00
5/2/2005 12:00
5/3/2005 0:00
5/3/2005 12:00
5/4/2005 0:00
5/4/2005 12:00
5/5/2005 0:00
5/5/2005 12:00
5/6/2005 0:00
5/6/2005 12:00
5/7/2005 0:00
5/7/2005 12:00
5/8/2005 0:00
5/8/2005 12:00
5/9/2005 0:00
5/9/2005 12:00
5/10/2005 0:00
5/10/2005 12:00
5/11/2005 0:00
5/11/2005 12:00
5/12/2005 0:00
5/12/2005 12:00
5/13/2005 0:00
5/13/2005 12:00
5/14/2005 0:00
5/14/2005 12:00
5/15/2005 0:00
5/15/2005 12:00
5/16/2005 0:00
Date
Outside
Inside


Comparison of Humidity at Control Home on Winkler Extension
100
90
80
70
60
50
40
30
20
10
0
Humidity (%)
38419
38419.5
38420
38420.5
38421
38421.5
38422
38422.5
38423
Date + Time
Back of House (South)
Inside
West Side of House



Comparison of Temps at Control Home on Winkler Extension
110
100
90
80
70
60
50
40
30
Temp (F)
38419
38419.5
38420
38420.5
38421
38421.5
38422
38422.5
38423
Date + Time
Back of House (South)
Inside
West Side of House


Comparison of Humidity at Control Home 1
Humidity (%)
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
4/28/05 0:00
4/28/05 12:00
4/29/05 0:00
4/29/05 12:00
4/30/05 0:00
4/30/05 12:00
5/1/05 0:00
5/1/05 12:00
5/2/05 0:00
5/2/05 12:00
5/3/05 0:00
5/3/05 12:00
5/4/05 0:00
5/4/05 12:00
5/5/05 0:00
5/5/05 12:00
5/6/05 0:00
5/6/05 12:00
5/7/05 0:00
5/7/05 12:00
5/8/05 0:00
5/8/05 12:00
5/9/05 0:00
5/9/05 12:00
5/10/05 0:00
5/10/05 12:00
5/11/05 0:00
5/11/05 12:00
5/12/05 0:00
5/12/05 12:00
5/13/05 0:00
5/13/05 12:00
5/14/05 0:00
5/14/05 12:00
5/15/05 0:00
5/15/05 12:00
5/16/05 0:00
Date + Time
Outside
Inside


Comparison of Atmospheric Pressure at Control Home 1
Pressure (mbar)
1020
1018
1016
1014
1012
1010
1008
1006
1004
1002
1000
Date
4/28/2005 0:00
4/28/2005 12:00
4/29/2005 0:00
4/29/2005 12:00
4/30/2005 0:00
4/30/2005 12:00
5/1/2005 0:00
5/1/2005 12:00
5/2/2005 0:00
5/2/2005 12:00
5/3/2005 0:00
5/3/2005 12:00
5/4/2005 0:00
5/4/2005 12:00
5/5/2005 0:00
5/5/2005 12:00
5/6/2005 0:00
5/6/2005 12:00
5/7/2005 0:00
5/7/2005 12:00
5/8/2005 0:00
5/8/2005 12:00
5/9/2005 0:00
5/9/2005 12:00
5/10/2005 0:00
5/10/2005 12:00
5/11/2005 0:00
5/11/2005 12:00
5/12/2005 0:00
5/12/2005 12:00
5/13/2005 0:00
5/13/2005 12:00
5/14/2005 0:00
5/14/2005 12:00
5/15/2005 0:00
5/15/2005 12:00
5/16/2005 0:00
Outside
Inside

5. Vibration and Airblast

In a simplified version of what happens when explosives are detonated in a blasthole, the chemical reaction of the explosives produces a high pressure, high temperature gas. This gas pressure (***detonation pressure***) crushes the rock adjacent to the blasthole. The detonation pressure decays or dissipates quickly. The second phase, which immediately follows or is in conjunction with detonation phase, is the shock and stress wave propagation phase. When the wave front moves forward, it will encounter discontinuities and/or interfaces. At these points, some energy is transferred across and some is reflected back.

During and after the stress wave propagation, high pressure, high temperature gases extend radial cracks and any discontinuity, fracture, or joint. The explosive energy will always take the path of least resistance. Once the blasted rock is separated from the bedrock, no further fracturing occurs because the gas pressure escapes. This entire process occurs within a few milliseconds from detonation of the explosives.

In basic terms, the energy not utilized in the breakage process is wasted energy. This energy is dissipated in the form of vibration, airblast, and watershock (charges in open water).

Vibration is a wave motion created from an energy source, in the case of rock blasting; the source is explosive energy and rock movement. Vibration wave motion is normal and caused by many things including walking, running, cars, hammering, door slamming, and natural seismic events.

Primarily, blast induced ground vibrations are the result of the detonation pressure pushing the blasted rock away from the bedrock. This large force against the bedrock or unbroken portion causes the bedrock to vibrate. When the vibration is transmitted through the ground, this is called ***propagation***. The ***propagation velocity*** is the speed at which the vibration waves travel. As vibration waves travel away from the energy source the vibration is reduced or decays, this is called ***seismic attenuation***.

Properly designed blasts utilize the majority of explosive energy to break the rock. Poor designed blasts will have higher vibration levels due to wasted energy.

To understand blast-induced vibration, one must understand the following vibration components and terminology. A good example that is seen in many texts as an explanation of vibration is the following example.

The ground vibration caused from blasting is similar to the motion of a floating object placed in the water near the energy source. The distance between the wave crests that move the object is the ***wavelength***. The speed at which they travel outward from the energy source and moves past the object is the ***propagation velocity.*** The ***particle velocity*** is the speed at which the object bops up and down, and the ***frequency*** is the number of times the object bops up and down in one second.

In blasting, ground particles oscillate in response to a vibration wave. This oscillation is measured in ***particle velocity***. The maximum rate is the ***Peak Particle Velocity (PPV)***. In blasting this is measured in inches per second or millimeters per second.

Velocity is a measure of the distance that could be traveled by particles in 1 second, measured in inches/sec (ips) (also known as speed in layman's terms). e.g. 60mph means something will travel 60 miles in 1 hr, 1 ips means a particle would move 1 inch in 1 second. The actual time that particles are moving is much less than 1 second, so even if we measure 2 ips, the ground may only actually move 0.2 inches if ground movement only occurred for one 10th of a second.

Particle motion is defined as ground particles oscillating in response to the arrival of the vibration wave. There are basically 2 types of vibration waves, ***Body Waves*** and ***Surface Waves***.

Peak Particle Velocity is the maximum rate of particle movement; ***displacement*** is the distance the particle moves back and forth or the distance a particle or object moves from its position of rest. The change in displacement over a unit of distance is called ***strain***.

Besides Peak Particle Velocity, the ***frequency*** is one of the most important factors controlling the response of structures. ***Frequency*** is the number of times the particles move back and forth in one second. This back and forth motion can also be referred to as ***oscillations***. The number of oscillations/second or cycles/second that a particle makes under influence from the vibration wave is measured in ***Hertz (Hz).***

Frequency is dependent on site geology, distance to the blast, and delay sequencing (hole firing time).

When structures are excited by blast vibrations, that may be equal in all variables, except frequency, the structure in question will respond much differently to a ground motion with a principal frequency of 20 hertz as opposed to a ground motion with a principle frequency of 150 hertz.

Also, it is important for the explosives engineer to have a firm grasp of other methods to define vibration wave peak. During the monitoring of a blasting project, the term ***acceleration*** maybe used to define the vibration wave peak or intensity. Acceleration should always be examined in terms of the principal frequency and should not be used as a stand-alone limit.

Acceleration (a) ***is defined as the velocity per unit of time. As an example would be the car commercial that states "0-60 in 10 seconds". The car is accelerating to 60***

miles/hour in 10 seconds, which means there is a speed (velocity) that is calculated over time. The acceleration would be 6 mph/second.

The combination of vibration wave peak particle velocity (the peak speed the particle moves from rest to highest displacement and back down like the bobbing cork example stated earlier), and the frequency (number of movements in 1 second) are used to calculate acceleration. The gravitational acceleration on the earth's surface (constant of 386.4 inches/second^2 = 1 gravity (g)) is used to convert the acceleration measurement (which is measured in inches/second^2) to gravity.

The formula used is for approximate maximum acceleration is:

$$Accel. = \frac{2 * pi * V * f}{386.4}$$

Where: Units of acceleration = gravity, V= PPV (ips), f = frequency (Hz).

We can calculate acceleration or measure it with the seismograph. When acceleration is calculated instead of measured, the number is usually much lower then the actual result because the vibration wave is not a true sinusoidal curve. This is also the reason when using acceleration and frequency to convert to peak particle velocity in inches/second that it too is an approximation. But, this can give us a good approximation of what's happening.

High accelerations can make the perceived vibration seem more intense and can also make the seismic data unreliable.

To measure blast vibration, we use instruments called seismographs. The geophone is the part of the instrument that contains sensors. The geophone must be firmly attached to the material that is being monitored. If the geophone moves more than the material, it has decoupled. When monitoring close-in construction, this can readily occur especially if vibration wave acceleration is exceeding 1 g. When acceleration exceeds 1 g, it is much more likely that the seismograph sensor or geophone will experience decoupling.

As an example, if a board is sitting on top of a table, and the table experiences some type of force, the board will move much more than the table. In this example, the board is equivalent to the geophone. When a blast occurs, the rock is barely shaking or vibrating, but the geophone moves. The vibrations being recorded are actually the geophone moving, not what the rock is experiencing.

There are other problems that may occur to seismographs when used for close-in monitoring. These include exceeding the operational limits of the transducer and/or aliasing.

Inside of the geophone are the instruments that measure the vibration. In most commercial seismographs, these instruments are called Seismic Velocity Transducers. A coil moving through a magnetic field measures the output of the transducer.

In cases where the vibration frequency is high (over 250 Hz), the peak particle velocity approaches four inches/second, acceleration is over 1 g, or the geophone is placed in an area that will experience a multitude of different wave types at the same time, transducer decoupling may occur. This happens when the coil inside of the magnetic field moves enough to disrupt the magnetic field. This is exceeding the operational limits of the transducers.

Acceleration transducers or accelerometer seismograph units can be employed for close-in monitoring in the near field, but do not function well for midfield or far field monitoring. Again, if setup in the wrong location, it too can generate anomalous readings.

Using the same table and board example: If someone pounds on the table, the board will jump or bounce up. If a bag of sand is placed on the board, it will be held down. Although, a large enough force applied to the table will still move the board and sand bag. Because the instruments are being set up so close to the blast, no amount of cover will keep the geophone from moving more than the rock. Also, as first example demonstrates, even if the geophone is not decoupling, the transducer can be stressed beyond the operational limits.

Aliasing is a phenomenon, which can occur whenever a signal is not sampled at greater than twice the maximum frequency of the signal. This causes high frequency signals to appear at low frequencies. Also, to measure the amplitude correctly in high frequency situations, the sample rate must be at least 4-5 times of the actual frequency being monitored.

In other words, if an attempt is made to use normal commercial seismographs in the extreme near field to monitor blasting, the operational limits of the seismic transducers or data collectors will be exceeded in the particle velocity and frequency measurements, which will generate incorrect data.

Vibration Waves

To understand vibration control, the explosives engineer must understand vibration wave construction and phenomenon.

Blast induced vibration waves can be divided into three main categories: compressive, shear, and surface. To measure the motions, three perpendicular components of vibration motion must be measured. They are as follows:

<u>Ground vibration direction</u>

Transverse- horizontal motion at right angles to the blast.
Vertical – Up and down movement
Longitudinal (Radial)_- Horizontal movement along a line between the recorder and the blast.

The three main vibration wave types can be divided into ***body waves*** and ***surface waves.***

Body waves propagate through the body of the rock or soil. One type of body wave is known as ***P-Waves*** (Compression and Tension Waves). P-Waves are Push/Pull waves and they are the compression/dilatation in the direction of wave travel. They travel in the following mediums: solids, liquid, gas. The compression creates a change in volume of the medium. An example of these types of waves occurs when a rope or string is stretched and vibrates.

The other type of body wave is the ***S-Wave***. This is a transverse wave that moves at right angles to the direction of wave travel. These waves can only travel in a solid medium. S-Waves create a change in shape of the medium. An example would the flexing a rope. The rope moves up and down, but the wave travels to the other end.

At small distances as those seen in close-in blasting, blasts produce predominantly body waves. These body waves propagate outward somewhat spherically until they contact any boundary. These boundaries can include another layer of rock, free face, fracture, joint, surface, or soil. When body waves arrive at these intersections, surface and shear waves are produced.

Surface Waves travel along the outer surface layer of rock. They do not penetrate into the rock mass. The wave motion of surface waves decreases with depth. 1 wavelength in depth is equal to zero motion or no surface wave.

Surface waves are larger than body waves but travel slower (Frequency). These are the waves, which cause most of the vibration problems and complaints. These waves are the large energy carriers and produce the largest motions. There are two basic types of surface waves, the ***Love Wave*** and the ***Rayleigh Wave.*** Love Waves are transverse waves that propagate in a surface layer on top of another medium (Soil overlying rock). Rayleigh waves travel in the free surface and the particle motion is elliptical.

Normally when vibration waves interact with a free surface, the peak particle velocity is doubled.

If a seismograph is setup in an incorrect location such as near structures, etc, this doubling phenomenon will cause erroneous data.

Transmission and reflection of vibration waves also affect the peak particle velocities. In the case of two equal compression waves colliding, the stresses will add and double. Once they pass, they will resume their initial form and continue. In conditions where two opposite waves (compression and tension) collide, the stresses will cancel one another and then continue on and resume their initial form.

If a seismograph is setup in an area where there are a multitude of surfaces and structures, the interaction of the vibration waves with each other, surfaces, and structures may cause the seismograph readings to be erroneous and not representative of the actual peak particle velocities affecting the structure.

Seismographs should be setup outside of the structure of concern. If seismographs must be setup inside or on the structure of concern, an analysis should be completed that indicates the damping and/or the amplification effect of the structure.

When monitoring inside of a structure or extremely close to the blast, an array of seismographs should be used in various locations to insure that the proper readings are being recorded.

Using vibration prediction formulas and information from the seismograph array, a good approximation of the peak particle velocity can be calculated at the point or seismograph in question.

RESONANT FREQUENCY

Structural resonance of low level dwellings is normally in the range of 4-20Hz. This is a low frequency range.

If a structure is influenced by a vibration wave with the same frequency as the resonant frequency of the structure, this creates an amplification of the vibration wave.

- Geological effects- soil thickness, reflection, saturation, distance
- Blast induced- delay interval, constructive interference, destructive interference

Either effect or a combination of effects can cause blast vibrations that contain low frequency energy (below 15Hz).

Many regulations and studies incorporate the use of ***scaled distance*** for some basic vibration prediction and blast design starting points.

Scaled Distance

Scaled Distance (SD) is a scaling factor that relates similar blast effects from various charge weights of the same explosive at various distances. Scaled distance is calculated by dividing the distance to the structure of concern by a fractional power of the weight of the explosive material.

There are two excepted scaled distance formulas used in blasting, square root scaling and cube root scaling.

Square root scaling is the general formula used in most regulations and general blasting situations, where the charge can be considered linear. Cube root scaling is used for blasting in the extreme near field where the charge can be considered a point charge or in explosions involving very large quantities, such as those created by nuclear explosions. Ambraseys and Hendron first suggested cube root scaling for use in prediction of blast vibrations in the year 1968.

Square Root Scaling

Many times when construction-blasting specifications are encountered, designing to a certain square root scaled distance factor is required. This is useful as a beginning estimate for vibration control and provides a conservative and safe charge weight for the test blast program. Since explosives confinement is not taken into consideration, there can and usually is a large variation in results, especially in tight blasting situations. It should be noted that small charges generate vibrations with higher frequencies and smaller displacements.
A 1.5-lbs. (.68 kg) charge of explosive will USUALLY generate more vibration than 3 - 1/2-lbs. (.2 kg) charges even when detonated at the same time.

Square Root Scaled Distance Formula

$$\text{Scaled Distance (SD)} = \frac{\text{Distance Structure}}{\text{Weight}^{0.5}}$$

Or,

$$\text{Weight} = (D/SD)^2$$

Delay Sequencing

Blasting regulations usually state that only a certain amount of explosives may be detonated per delay; this has come to be known as the 8 millisecond delay window or 8 ms window. What this means is that amount of explosives being detonated at a given time not overlap with other blastholes being detonated within 8 ms. Years ago, researchers realized that charges needed to be separated to achieve optimum fragmentation and vibration response. At the time, the explosives initiation systems available could provide a separation of at least 8 ms on paper, so, 8 ms was recommended as the minimum time needed for separation of charges.

Separation of charges is extremely geology dependent. With the advent of modern electronic microsecond accurate initiation systems, this author believes that this be viewed on a case-by-case basis after analysis of the area to be blasted is completed.

Regression Analysis

Regression Analysis is the process of estimating peak particle velocity (dependent variable) statistically from the independent variables of explosive weight/delay and distance to the structure of concern (scaled distance).

Peak particle velocities tend to decrease with the increase of scaled distance. This means that the by plotting the data on a log-log graph will give the appearance of a linear relationship. From this data, an equation for the best fit or mean can be developed as:

PV = K x (SD)^s

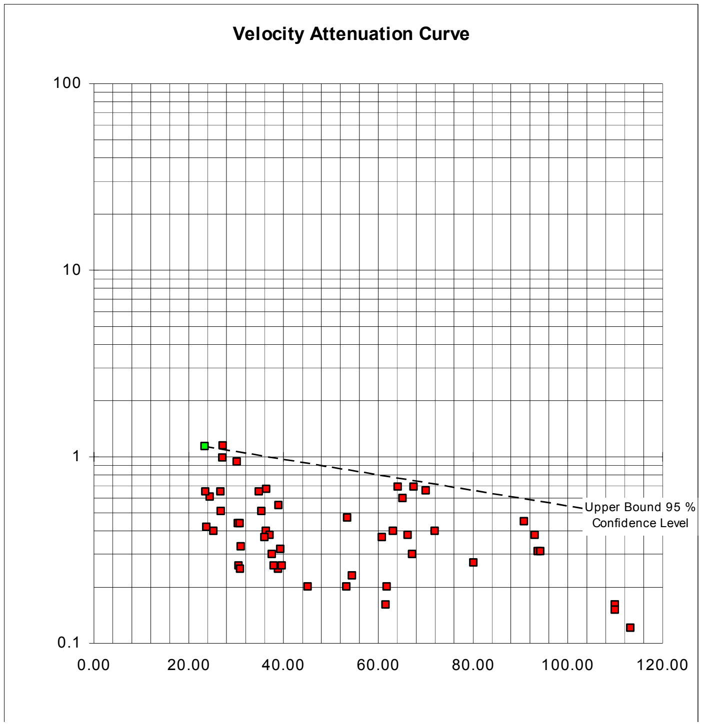
Where PV = the particle velocity and K is the y-intercept, it represents the value of the line when it intercepts the particle velocity axis at a scaled distance of 1. “S” is called the slope. The slope represents the decrease in particle velocity as the scaled distance increases.

From the standard deviation of the data, confidence intervals can be determined, which are based on an amount of explosives/delay that can be detonated at a certain distance. For example, a confidence range of 50% means that 50% of the data will fall below the 50% confidence line. If the analysis generates data that is interpreted based on a vibration limit of 1.0 inch/second, that 8 lbs/delay of explosives can be detonated at 20 feet and statistically, 50% of the peak particle velocities will be below 1 inch/second.

Normally, in blasting, a 95% confidence line is calculated. To develop a good analysis, a minimum of 30 – 35 data sets need to be analyzed. If done properly and enough seismographs are used, this can be accomplished and begun in the test blast program.

Regression analysis should be continued throughout the project and blast design should be adjusted accordingly.

A typical regression analysis graph using square root scaled distances follows as an example.



Utilizing the techniques of regression analysis and the vibration prediction formulas, blasts can be optimized and designed with confidence for close-in or tight blasting. The added benefit of high frequencies helps to reduce the potential of vibration effects and damage.

AIR BLAST

ATLAS Blasters Handbook Definition:
"THE AIRBORNE SHOCKWAVE OR ACOUSTIC TRANSIENT GENERATED BY AN EXPLOSION."

Basically vibration wave transmitted through air.

- Air Blast is a compression wave similar to the "P" wave observed in ground vibration**.**

Measured in DECIBELS (dB).

Can be a result of:

A. Insufficient explosives confinement
B. Inappropriate initiation system- Detonating cord.
C. Mud seams
D. Insufficient stemming
B. Inadequate burden

AIR BLAST FOCUSING

What is it?
Under certain conditions, air blast can be extremely high in a certain location some distance from the blast site.

Result of:

A. Temperature Inversions- if the air temp. increases as elevation or altitude increases, the air blast can bounce back towards the ground.

B. Wind Focusing- if the wind speed increases with altitude or elevation, the sound waves can be focused back toward the earth. Air blast effects are more intense down wind.

ATLAS HANDBOOK
Effect of Airblast

dB	
180	Structural damage
170	Most windows break
140- 160	Some windows break
130	USBM safe level
120	Threshold of pain for continuous sound
110- 120	Complaints likely OSHA max for 15 minutes
90	OSHA max for 8 hours

♦ Reduction:

A. Confine explosives.
B. Avoid Detonating Cord.
C. Avoid periods likely to cause focusing- inversions, etc.
D. Use delays to break up charge.
E. Cover blast with mats and/or sand, dirt, etc.

♦ AIR BLAST MONITORING

A. "PEAK ONLY" RECORDERS- will meet standards for recording. Available on most seismographs.
B. "Full Waveform" instruments can help determine the source of the air blast in relation to the first charge detonated. Only use in huge blasts.

5.1 Blast and Seismic Induced Damage Criteria

DEFINITIONS OF VIBRATION EFFECTS AND DAMAGE
All houses crack from environmental forces. These forces include temperature change, humidity change, and settling. Other forces interact with structures and also cause damage. It is extremely difficult to distinguish between blast-induced damage and normal aging effects.

1. Threshold effects- refer to hairline cracks that may or may not be seen by the naked eye (75 microns or less). Threshold effects do not damage the structural integrity of the structure.
2. Minor Damage- Cracks that are visible to the naked eye but do not effect the structural integrity of the structure. May or may not be repaired. It usually depends on the aesthetic appearance. Quarry and construction blasting with PPV as low as 2-3 ips (50.8 mm/s – 76 mm/s) has been known to damage houses, but in a normal house, it usually takes between 5.5-6.5 ips (137 mm/s – 165 mm/s) or higher.
3. Major Damage- Damage from blasting usually does not reach these levels. This type of damage is associated with earthquake levels of vibration. Usually involves structural damage.

Various government agencies have based regulations and blast limits on results of studies of large scale blasting operations.

Range of Common Residential Criteria and Effects

0.5 ips 12.5 mm/s	Bureau of Mines recommended guideline to prevent threshold damage in plaster-on-lath construction near long-term, large-scale surface mines with large scale blasting operations. (RI 8507)
0.75 ips 19.1 mm/s	Bureau of mines recommended guideline to prevent threshold damage in sheetrock construction near long-term, large-scale surface mines with large scale blasting operations. (RI 8507)
1.0 ips 25.4 mm/s	OSM regulatory limits for residences near long-term, large-scale surface mines with large scale blasting operations at distances of 300 – 5000 feet (9840 m – 16,400 meters).
2.0 ips 50.8 mm/s	Widely accepted limits for residences near construction blasting and quarry blasting. (BuMin Bull 656, RI 8507, various codes, specifications, and regulations). Also allowed by OSM for frequencies above 30 Hz.
5.4 ips 137 mm/s	Threshold effects to the average house subjected to quarry blasting vibrations. (BuMin Bull 656)
9 ips 229 mm/s	About 90% probability of Threshold damage from construction or quarry blasting vibrations. (BuMin Bull 656)
20 ips 508 mm/s	For close-in construction blasting, minor damage to nearly all houses, structural damage to some. For low-frequency vibrations, structural damage to most houses.
NOTE	**THE ABOVE CRITERIA APPLY ONLY TO RESIDENCES, NOT TO ANY OTHER FACILITIES OR MATERIALS**

Below are recommendations based on the author's experience for a starting point to develop acceptable levels or vibration limits for close-in blasting (under 20 feet).

Safe and Conservative Blasting Limits

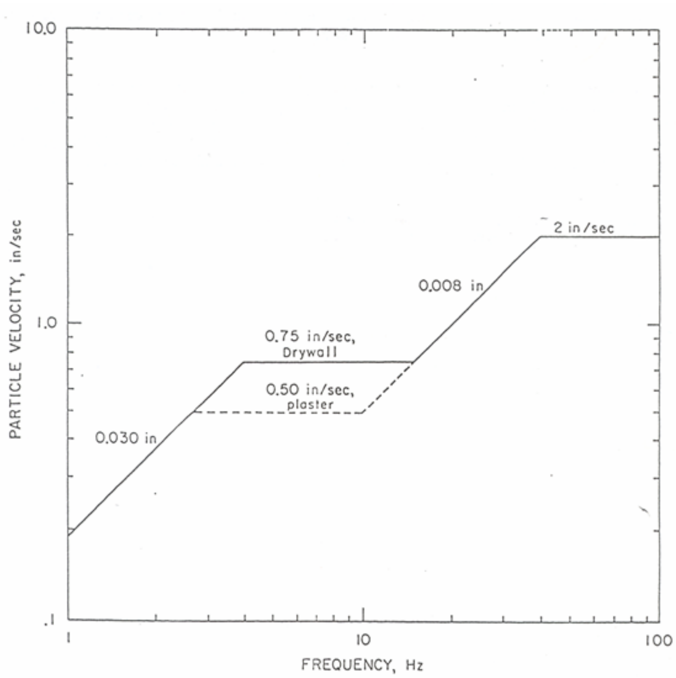
Peak Particle Velocity	Structure
2.0 ips – 51 mm/s	Residential Homes with plaster on lath construction
2.5 ips – 64 mm/s	Residential Homes with sheetrock construction
3.0 ips – 76 mm/s	Commercial Structures/buildings
3.0 ips – 76 mm/s	Wooden Bridge
5.0 ips – 127 mm/s	Well-cured concrete- can vary up to 375ips
5.0 ips – 127 mm/s	Steel/reinforced concrete bridge
5.0 ips – 127 mm/s	Buried pipelines- blast out of fracture zone.
15.0 ips – 381 mm/s	Cased drill holes

BLASTING COMPLAINTS

Peak Particle Velocity- ips, mm/s	% of Complaints
< 0.10, 2.54	1.0%
0.10, 2.54	1.5%
0.20, 5	5.0%
0.40, 10.2	10%
0.60, 15.2	15%
1.00, 25.4	20%
1.50, 38	40%
2.00, 50.8	50%
4.00, 101.6	70%

From: RI 8507

"Z" Curve: Line shows zero probability of damage.



CONCRETE SLABS, MASONRY, PLASTER, STUCCO, AND FOUNDATION WALLS

Foundation Walls: Foundation walls are similar to concrete slabs but are in a different plane. The same limits can apply.

Stucco: Stucco has many of the same characteristics of concrete but is more sensitive to environmental forces that cause shrinking. This is due to the application of stucco in thin layers.

Masonry: Blocks, bricks, tile, and the mortar used to hold them together can withstand levels of vibration almost as high as concrete. Most cracking in these materials occur from settling, shrinking due to curing, and environmental forces.

Plaster and Drywall: Cracks in Drywall or "sheetrock" are normally caused by structure settling, the drying of lumber to which it is attached, and the shrinking of the joint compound. Drywall can withstand high vibration levels because it is somewhat flexible.

Blasting Effects on Wells

Many studies have been conducted on the effect of blasting on wells. As with concrete, as long as the well is outside of the fracture zone of the blast, there should not be any problem.

A limit of 5 ips would be sufficient to avoid any problems. Studies have shown wells can withstand more than 25 ips.

A good rule of thumb to insure damage does not occur is to have a safe distance from the well to the blast of 2 times the blast hole depth.
Distance to SAFE ZONE = 2 times Blasthole depth.

5.2 Lee County Study Results

From the time of the study commencement in January 2005 to June 2005, blast induced damage was not observed in any of the test houses.

From the results of this study, the current blast vibration limit of 0.3 inches/second (ips) is extremely conservative. The 0.3 ips limit falls well within the range of environmental effects and other manmade induced vibration; or in other words, is within the ambient vibrations levels of the county. The probability is low that blast vibration, if maintained below the limit, will cause any damage to neighboring residential and commercial properties.

A good rule of thumb for calculating vibration intensities follows: Under normal or typical conditions, the vibration intensity dies (attenuates or decays) to about 1/3 of its intensity every time the distance traveled doubles. In other words, if the Peak Particle Velocity at 600 feet from a blast is 0.3 inches/second, the intensity at 600 feet directly behind this monitoring point (1200 feet from blast) would roughly be equivalent to 0.1 inches/second.

Displacement is the damaging factor in vibration. Displacement can be defined as the amount of deviation or distance of any particle or point from its rest position. The change in displacement of a unit of time is called strain. In other words, a particle moves and stays at the position it moved to instead of returning to its normal position. Large displacements cause damage. These displacements are caused by high peak particle velocities with relatively low frequencies.

A simple formula to convert to displacement is to use the known measurement of Peak Particle Velocity (PPV) and Frequency (f). Many blasting seismographs will also report displacement. The formula follows:

$$\text{Displacement} = \text{PPV}/(2\pi) \times (f)$$

For example, using 0.3 inches per second and a frequency of 30 hertz, the displacement would equal 0.00159 inches. A graph follows displaying displacement at different frequencies utilizing a 0.3 inches/second peak particle velocity. As can be seen, displacements are extremely low. None of which can cause damage. This is the reason by utilizing 0.3 ips as the Peak Particle Velocity limit that frequency can be ignored.

PPV = 0.3 inches/second

Freq	Displacement
5	0.00955
10	0.00477
15	0.00318
20	0.00239
25	0.00191
30	0.00159
35	0.00136
40	0.00119
45	0.00106
50	0.00095
70	0.00068
80	0.00060
90	0.00053
100	0.00048
150	0.00032
200	0.00024
250	0.00019
300	0.00016
1000	0.00005

In comparison, here is the same table using 2.0 inches/second and the third table utilizes 5.0 inches/second.

PPV = 2.0 inches/second

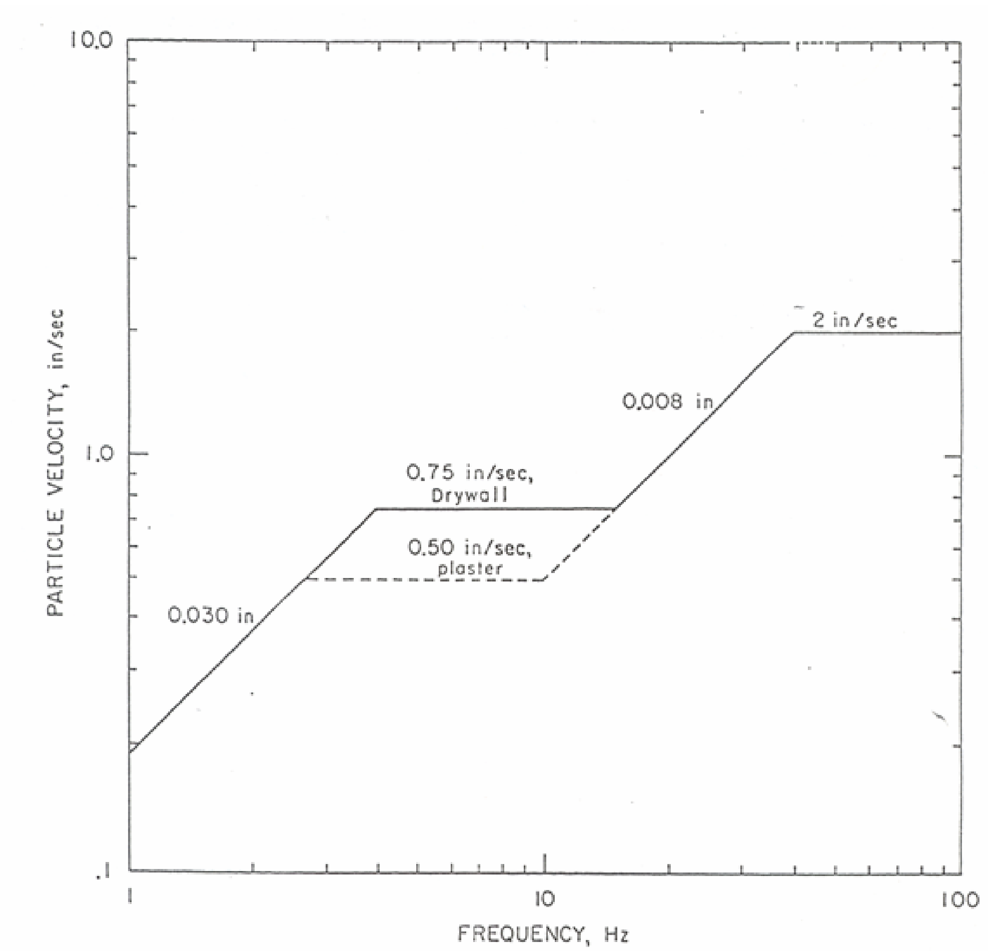
Freq	Displacement
5	0.06366
10	0.03183
15	0.02122
20	0.01592
25	0.01273
30	0.01061
35	0.00909
40	0.00796
45	0.00707
50	0.00637
70	0.00455
80	0.00398
90	0.00354
100	0.00318
150	0.00212
200	0.00159
250	0.00127
300	0.00106
1000	0.00032

PPV = 5.0 inches/second

Freq	Displacement
5	0.15916
10	0.07958
15	0.05305
20	0.03979
25	0.03183
30	0.02653
35	0.02274
40	0.01989
45	0.01768
50	0.01592
70	0.01137
80	0.00995
90	0.00884
100	0.00796
150	0.00531
200	0.00398
250	0.00318
300	0.00265
1000	0.00080

There have been multiple studies on blast induced vibration damage. During the literature search, the following was found and verified for construction and quarry blasting. 2.0 inches/second is still a good limit to prevent damage if the USBM "Z" curve is followed in regards to frequency.

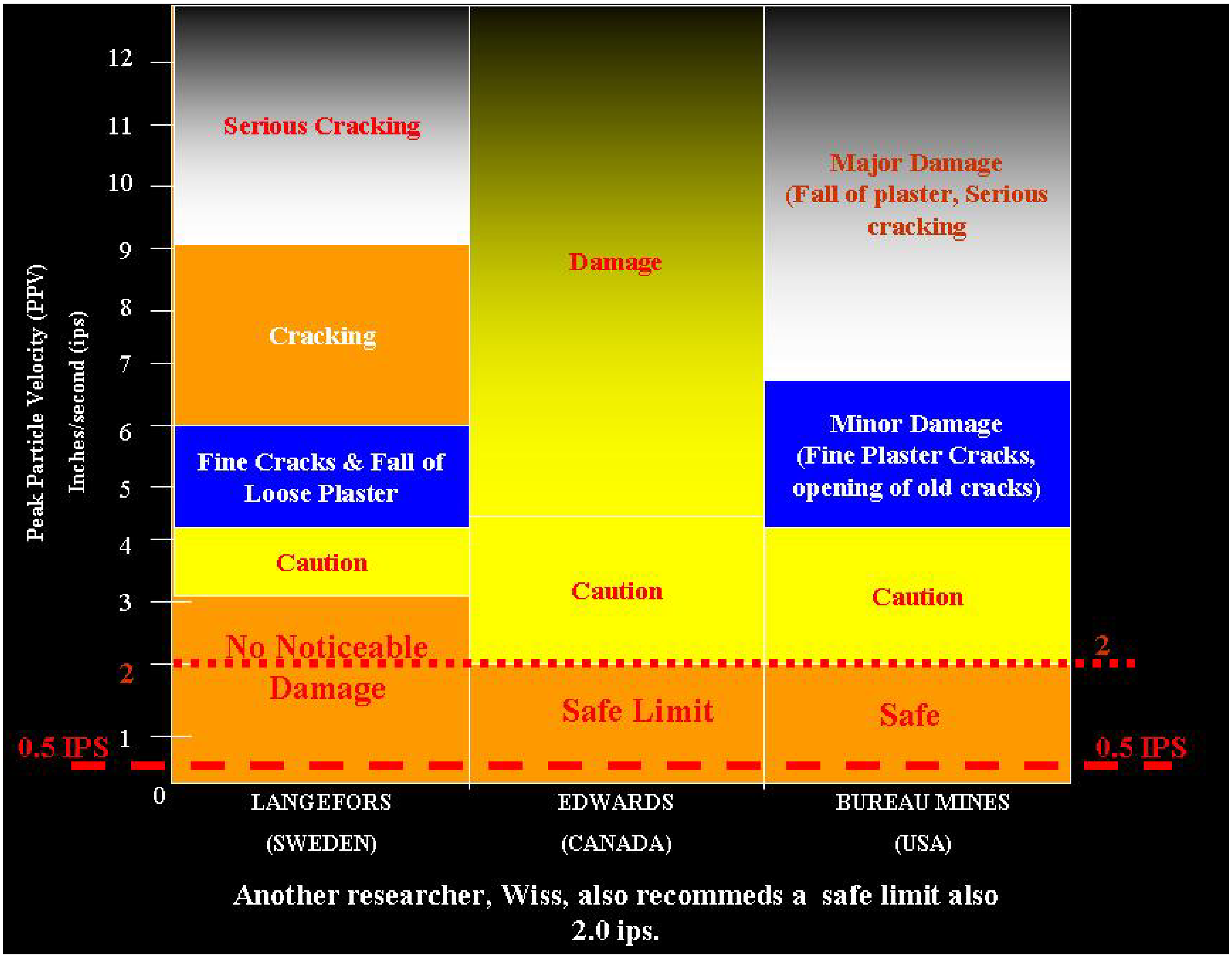
"Z" Curve: Line shows zero probability of damage.



This curve represents the zero line of probability of damage in large scale and long-term blasting operations, such as coal.

Here are results from multiple research projects:

Vibration Levels: 4 researchers in 4 different studies developed the same results.



From the results of the Lee County Blasting Study and the literature search, it can be concluded that the 0.3 inches/second limit is extremely safe.

In actuality, since the USBM "Z" curve was developed for large scale mining operations, it could be followed as the limit for vibration without causing damage. But, humans are extremely receptive to vibration, and if this curve were followed, there would likely be many more complaints.

A vibration regression analysis was completed and combined from the Herons Glen project and the data gathered from the RMC quarry near Wildcat Run.

The regression analysis data follows:

Terra Dinamica LLC

Linear Regression Analysis

Predictions from Combined Herons Glen and RMC Quarry Data

Distance from structure :	600	ft
Maximum desired PPV :	0.30	ips
Max. charge wt / 8ms :	19	lb

Theoretical Equation: PV = **8.8** *(SD)^ **-0.685**

Maximum Charge Weight Per Delay

(Desired PPV less than 0.30 ips)

Distance (ft)	Charge (lbs)
2	0
3	0
4	0
5	0
6	0
7	0
8	0
9	0
10	0
15	0
20	0
25	0
30	0
35	0
40	0
45	0
50	0
55	0
60	0
65	0
70	0
75	0
80	0
85	0
90	0
95	0
100	1
110	1
120	1
130	1
140	1
150	1
160	1
170	2

Distance (ft)	Charge (lbs)
180	2
190	2
200	2
225	3
250	3
275	4
300	5
325	5
350	6
375	7
400	8
425	9
450	11
475	12
500	13
525	14
550	16
575	17
600	19
625	20
650	22
675	24
700	25
725	27
750	29
800	33
850	38
900	42
950	47
1,000	52
1,050	57
1,100	63
1,150	69
1,200	75

Distance (ft)	Charge (lbs)
1,250	81
1,300	88
1,350	95
1,400	102
1,500	117
1,600	133
1,700	150
1,800	168
1,900	188
2,000	208
2,100	229
2,200	252
2,300	275
2,400	299
2,500	325
2,600	351
2,700	379
2,800	407
2,900	437
3,000	468
3,250	549
3,500	637
3,750	731
4,000	831
4,250	939
4,500	1,052
4,750	1,173
5,000	1,299
5,250	1,432
5,500	1,572
5,750	1,718
6,000	1,871
6,250	2,030
6,500	2,196
6,750	2,368

Terra Dinamica L.L.C.
Linear Regression Analysis Using SD = (D/(W)^(0.5))
Predictions from Combined Herons Glen and RMC Quarry Data
Theoretical Equation: PV = **8.8** *(SD)^ **-0.685**

Max. charge wt / 8ms : **20** lb

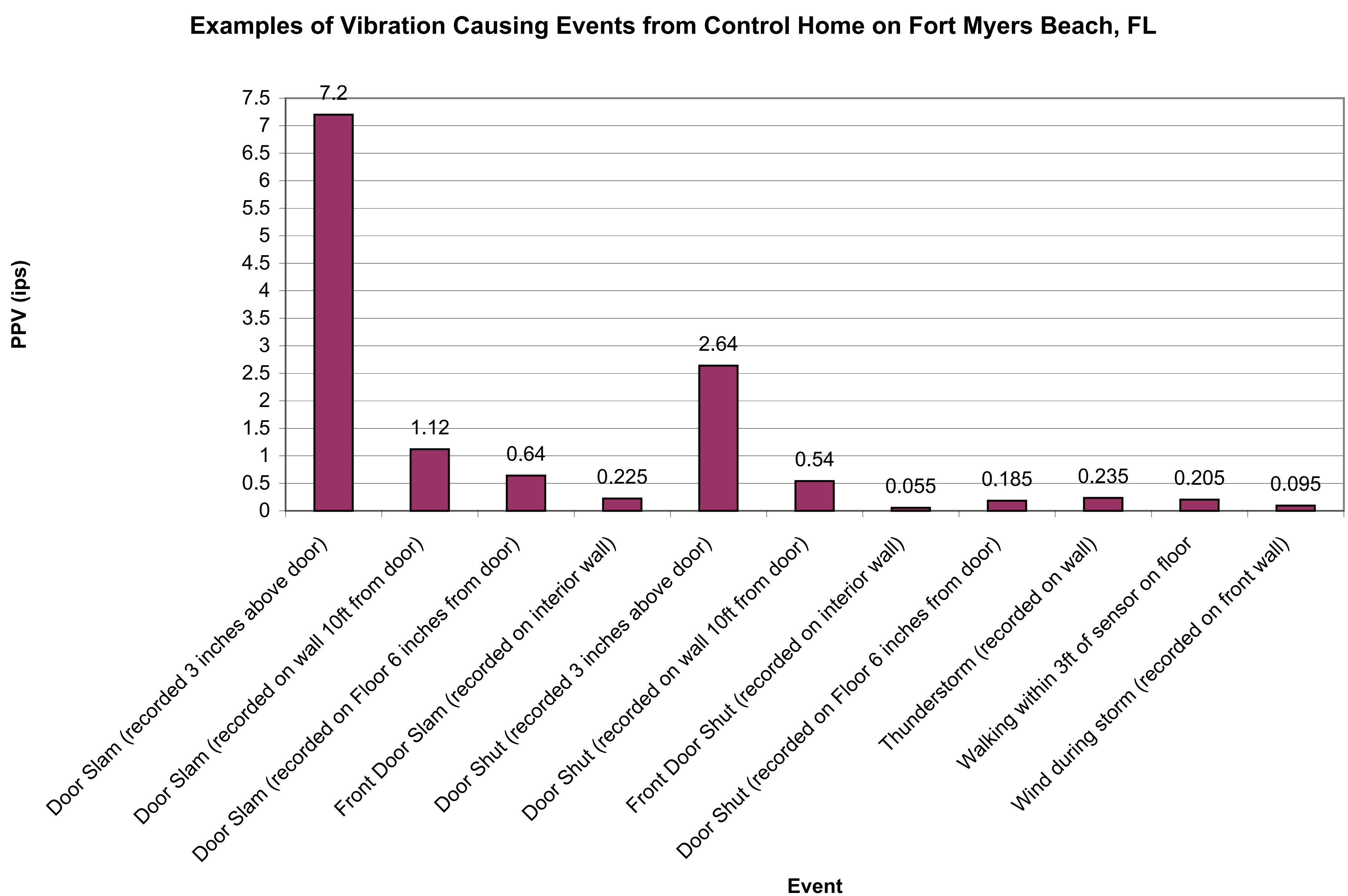
Theoretical Predicted PPV for Given Charge Weight

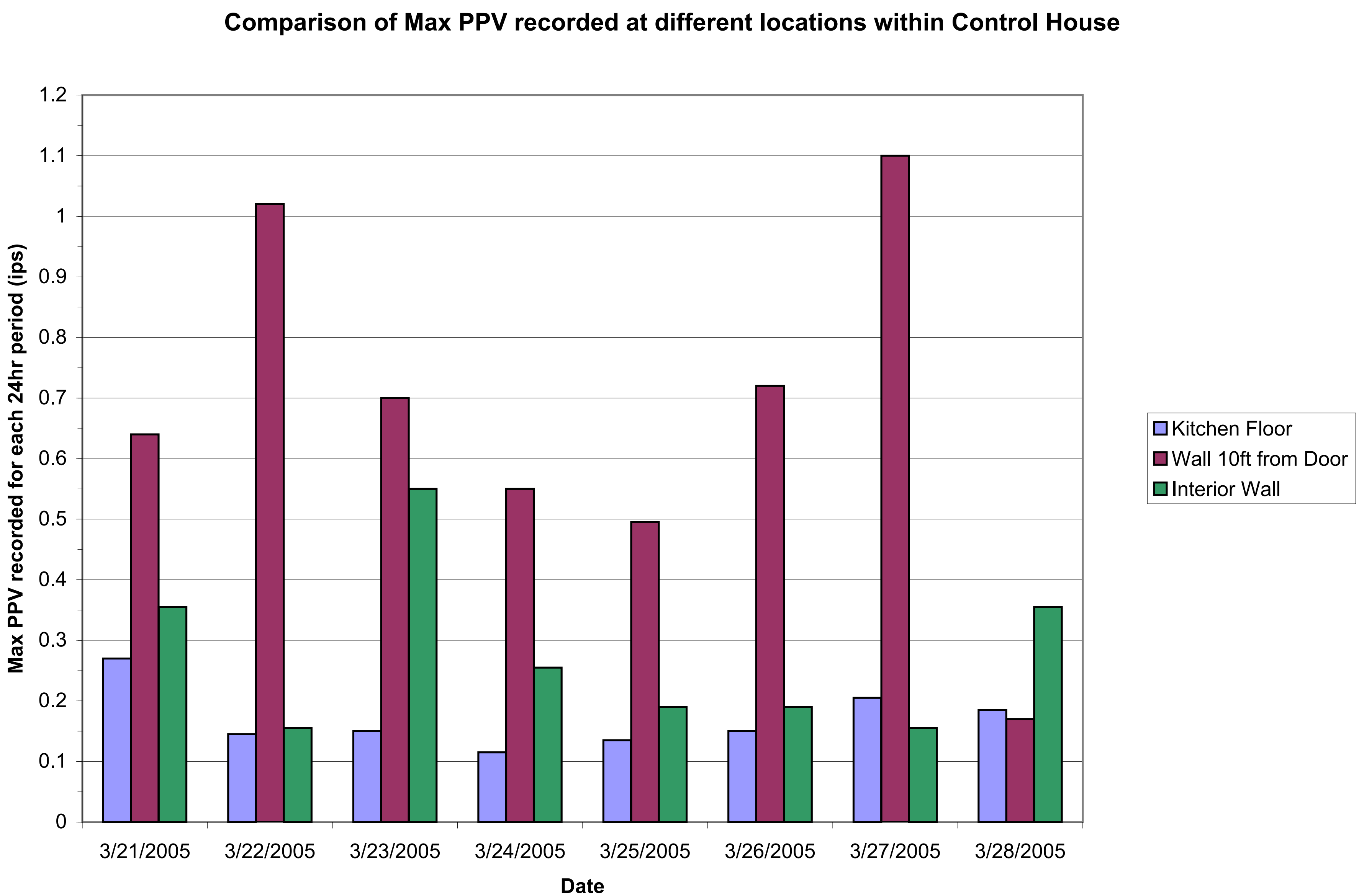
(Charge weight = 20.00 lb)

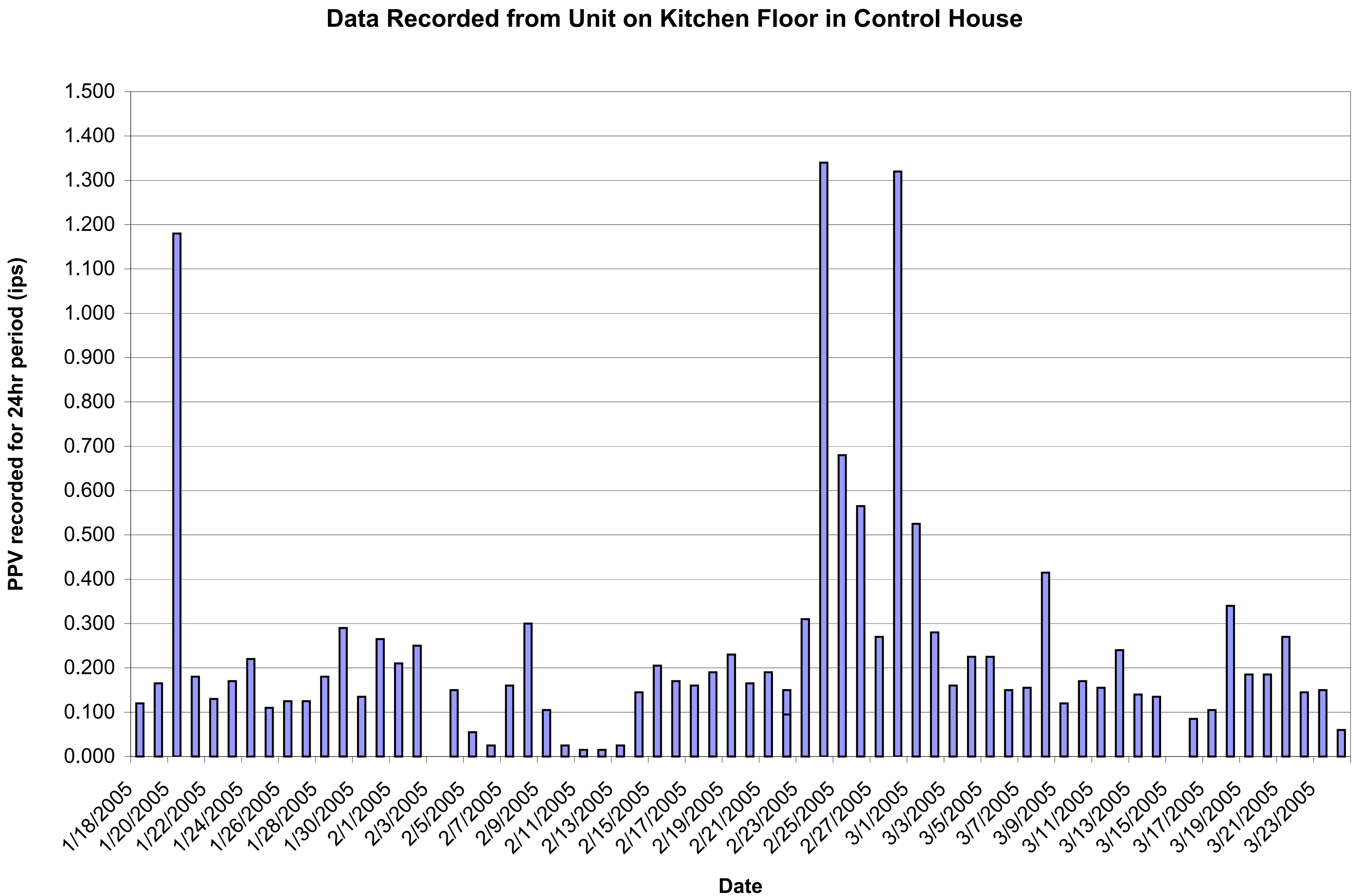
Distance (ft)	PPV (ips)
2	15.271
3	11.568
4	9.499
5	8.153
6	7.195
7	6.474
8	5.908
9	5.450
10	5.071
15	3.841
20	3.154
25	2.707
30	2.389
35	2.150
40	1.962
45	1.810
50	1.684
55	1.577
60	1.486
65	1.407
70	1.337
75	1.275
80	1.220
85	1.171
90	1.126
95	1.085
100	1.047
110	0.981
120	0.924
130	0.875
140	0.832
150	0.793
160	0.759
170	0.728

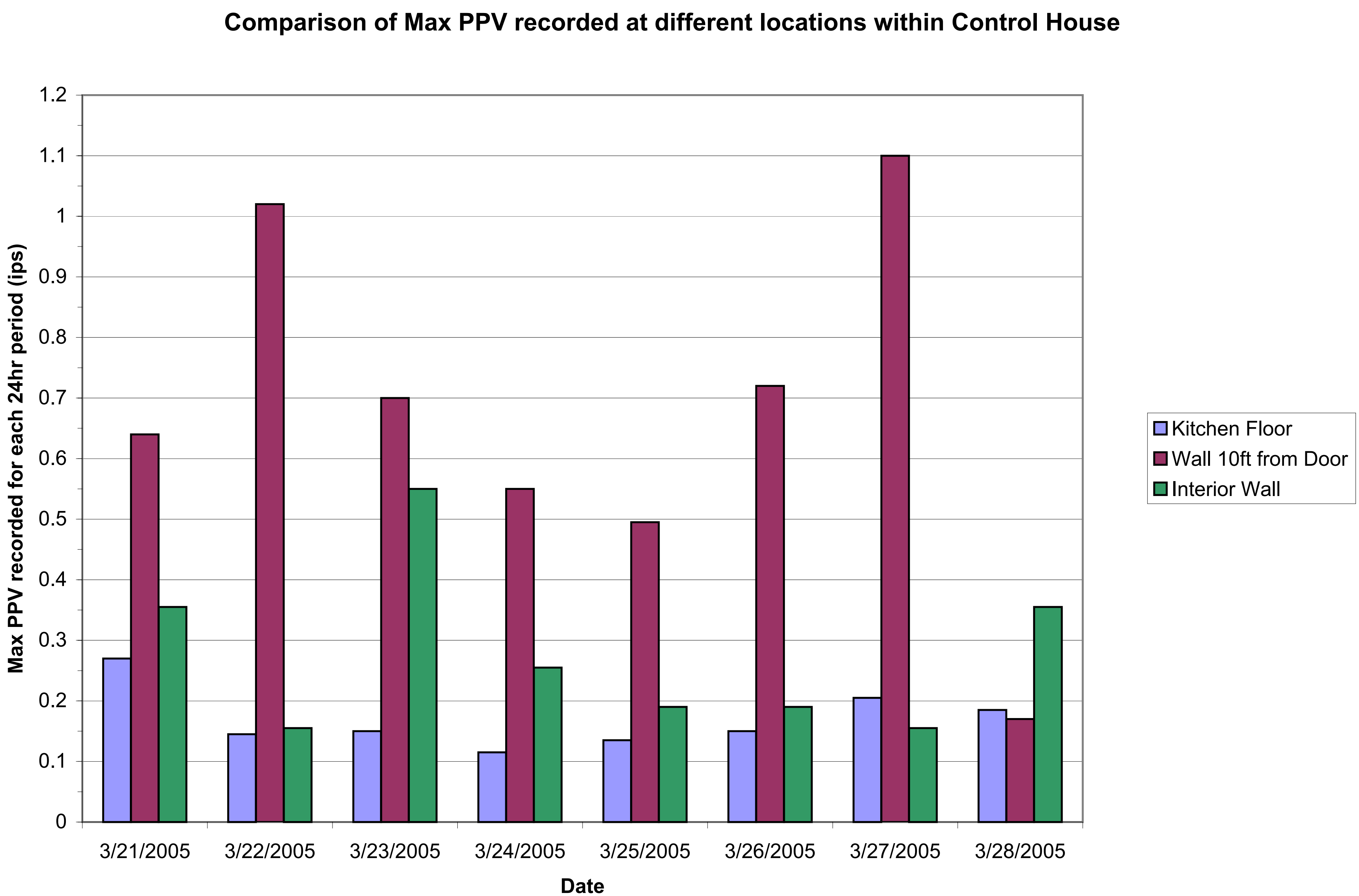
Distance (ft)	PPV (ips)
180	0.700
190	0.675
200	0.651
225	0.601
250	0.559
275	0.524
300	0.493
325	0.467
350	0.444
375	0.424
400	0.405
425	0.389
450	0.374
475	0.360
500	0.348
525	0.336
550	0.326
575	0.316
600	0.307
625	0.298
650	0.291
675	0.283
700	0.276
725	0.270
750	0.263
800	0.252
850	0.242
900	0.233
950	0.224
1,000	0.216
1,050	0.209
1,100	0.203
1,150	0.197
1,200	0.191

Distance (ft)	PPV (ips)
1,250	0.186
1,300	0.181
1,350	0.176
1,400	0.172
1,500	0.164
1,600	0.157
1,700	0.150
1,800	0.145
1,900	0.139
2,000	0.135
2,100	0.130
2,200	0.126
2,300	0.122
2,400	0.119
2,500	0.115
2,600	0.112
2,700	0.110
2,800	0.107
2,900	0.104
3,000	0.102
3,250	0.096
3,500	0.092
3,750	0.087
4,000	0.084
4,250	0.080
4,500	0.077
4,750	0.074
5,000	0.072
5,250	0.069
5,500	0.067
5,750	0.065
6,000	0.063
6,250	0.062
6,500	0.060
6,750	0.058


Examples of Vibration Causing Events from Control Home on Fort Myers Beach, FL
PPV (ips)
7.5
7
6.5
6
5.5
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
7.2
1.12
0.64
0.225
2.64
0.54
0.055
0.185
0.235
0.205
0.095
Door Slam (recorded 3 inches above door)
Door Slam (recorded on wall 10ft from door)
Door Slam (recorded on Floor 6 inches from door)
Front Door Slam (recorded on interior wall)
Door Shut (recorded 3 inches above door)
Door Shut (recorded on wall 10ft from door)
Front Door Shut (recorded on interior wall)
Door Shut (recorded on Floor 6 inches from door)
Thunderstorm (recorded on wall)
Walking within 3ft of sensor on floor
Wind during storm (recorded on front wall)
Event


Comparison of Max PPV recorded at different locations within Control House
Max PPV recorded for each 24hr period (ips)
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
3/21/2005
3/22/2005
3/23/2005
3/24/2005
3/25/2005
3/26/2005
3/27/2005
3/28/2005
Date
Kitchen Floor
Wall 10ft from Door
Interior Wall


Data Recorded from Unit on Kitchen Floor in Control House
PPV recorded for 24hr period (ips)
1.500
1.400
1.300
1.200
1.100
1.000
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
1/18/2005
1/20/2005
1/22/2005
1/24/2005
1/26/2005
1/28/2005
1/30/2005
2/1/2005
2/3/2005
2/5/2005
2/7/2005
2/9/2005
2/11/2005
2/13/2005
2/15/2005
2/17/2005
2/19/2005
2/21/2005
2/23/2005
2/25/2005
2/27/2005
3/1/2005
3/3/2005
3/5/2005
3/7/2005
3/9/2005
3/11/2005
3/13/2005
3/15/2005
3/17/2005
3/19/2005
3/21/2005
3/23/2005
Date

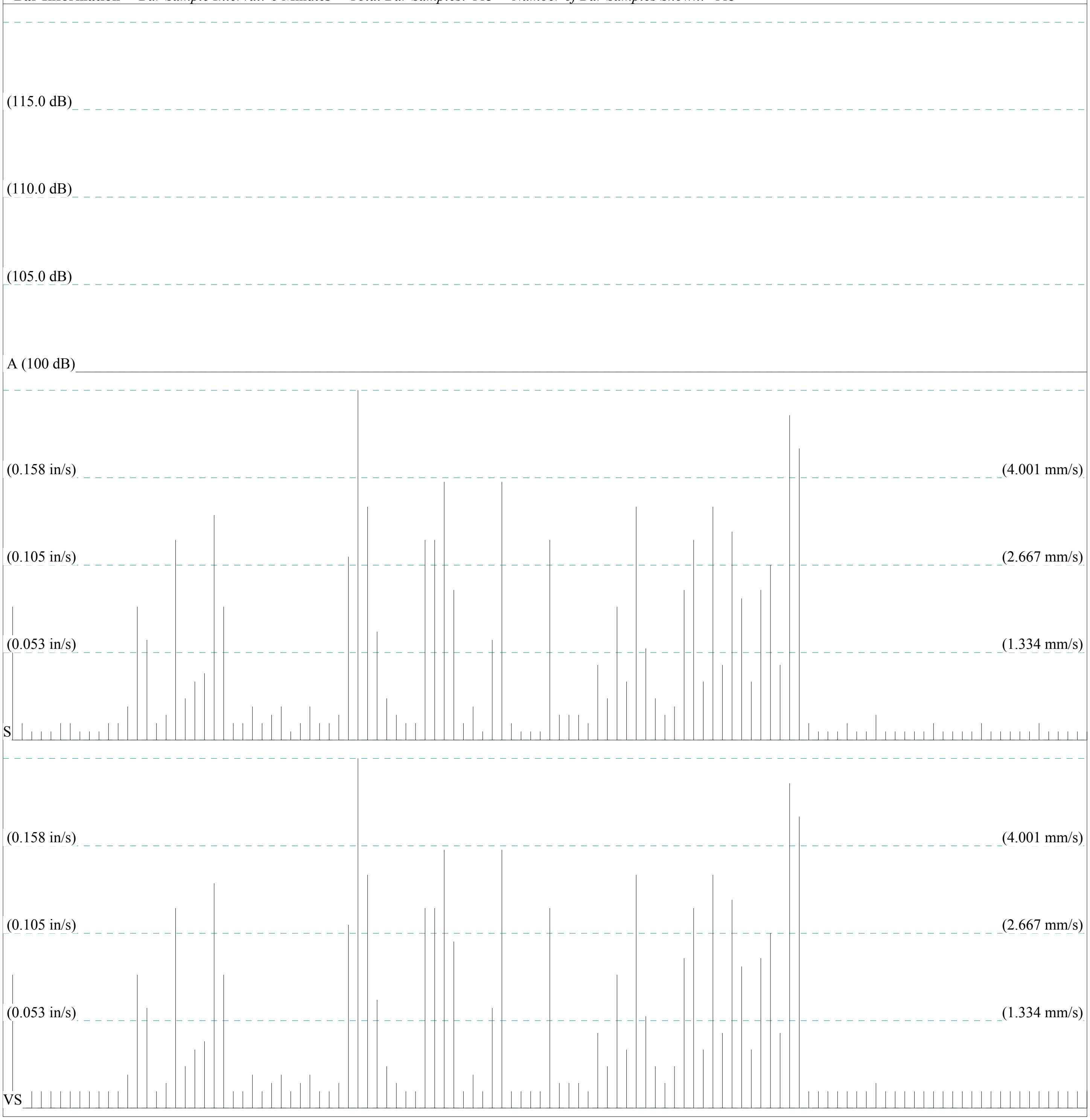

Comparison of Max PPV recorded at different locations within Control House
Max PPV recorded for each 24hr period (ips)
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
3/21/2005
3/22/2005
3/23/2005
3/24/2005
3/25/2005
3/26/2005
3/27/2005
3/28/2005
Date
Kitchen Floor
Wall 10ft from Door
Interior Wall

Herons Glen Data

Date	Charge (lbs)	Distance (ft)	Longitudinal Velocity (ips)	Longitudinal Frequency (Hz)	Longitudinal Peak Displacement (0.001 in)	Longitudinal Accel (G's)	Transverse Velocity (ips)	Transverse Frequency (Hz)	Transverse Peak Displacement (0.001 in)	Transverse Accel (G's)	Vertical Velocity (ips)	Vertical Frequency (Hz)	Vertical Peak Displacement (0.001 in)	Vertical Accel (G's)	Airblast (dB)	Recorded Peak Accel (G's)	PPV (ips)	Scaled Distance
12/3/2004	16	1,500	0.08	71.4		0.13	0.08	41.6		0.10	0.11	71.4		0.18	109	0.18	0.11	375.0
12/3/2004	16	1,500	0.07	6.4		0.05	0.06	4.5		0.02	0.07	25.0		0.07	109	0.07	0.07	375.0
12/6/2004	16	1,500	0.07	5.6		0.05	0.05	6.7		0.05	0.07	31.2		0.05	116	0.05	0.07	375.0
12/6/2004	16	1,500	0.13	14.7		0.15	0.12	45.4		0.13	0.18	71.4		0.23	112	0.23	0.18	375.0
12/7/2004	30	1,300	0.05	3.4		0.02	0.06	4.4		0.02	0.07	6.7		0.05	114	0.05	0.07	237.3
12/8/2004	24	3,200	0.03	2.2		0.02	0.05	2.8		0.02	0.02	3.0		0.02	106	0.02	0.05	653.2
12/8/2004	24	1,300	0.05	4.1		0.02	0.07	2.4		0.02	0.06	4.5		0.02	106	0.02	0.07	265.4
12/9/2004	30	2,900	0.05	5.3		0.02	0.05	1.6		0.02	0.03	3.5		0.02	106	0.02	0.05	529.5
12/9/2004	30	1,500	0.08	12.5		0.05	0.05	2.8		0.05	0.06	4.2		0.05	106	0.05	0.08	273.9
12/9/2004	30	2,200	0.06	6.7		0.02	0.07	2.7		0.02	0.07	23.8		0.05	109	0.05	0.07	401.7
12/9/2004	30	2,200	0.06	2.5		0.02	0.07	2.6		0.02	0.07	21.7		0.05	106	0.05	0.07	401.7
12/9/2004	16	750	0.06	8.6		0.02	0.10	11.1		0.05	0.07	6.7		0.05	114	0.05	0.10	187.5
12/10/2004	16	750	0.07	7.1		0.05	0.06	5.7		0.02	0.10	8.6		0.05	109	0.05	0.10	187.5
12/13/2004	16	1,200	0.05	10.6		0.02	0.02	12.5		0.02	0.04	3.6		0.02	100	0.02	0.05	300.0
12/13/2004	16	700	0.05	16.6		0.05	0.07	9.6		0.05	0.10	6.5		0.05	109	0.05	0.10	175.0
12/14/2004	30	2,100	0.06	9.6		0.05	0.04	10.0		0.05	0.06	25.0		0.05	106	0.05	0.06	383.4
12/14/2004	30	2,100	0.06	17.2		0.05	0.04	8.1		0.02	0.06	19.2		0.05	106	0.05	0.06	383.4
12/14/2004	30	1,450	0.10	11.9		0.07	0.06	9.4		0.05	0.09	62.5		0.13	106	0.13	0.10	264.7
12/15/2004	16	1,100	0.07	8.7		0.05	0.06	9.6		0.02	0.07	4.2		0.05	112	0.05	0.07	275.0
12/15/2004	16	1,100	0.07	9.4		0.05	0.04	3.4		0.02	0.07	4.3		0.05	109	0.05	0.07	275.0
12/15/2004	16	400	0.07	7.9		0.07	0.07	10.0		0.05	0.07	5.3		0.07	109	0.07	0.07	100.0
12/16/2004	16	1,100	0.05	9.4		0.05	0.04	62.5		0.05	0.05	31.2		0.05	106	0.05	0.05	275.0
12/16/2004	16	1,100	0.07	7.8		0.05	0.04	7.5		0.05	0.07	5.9		0.05	106	0.05	0.07	275.0
12/16/2004	16	400	0.06	11.6		0.07	0.06	7.4		0.05	0.07	4.5		0.10	109	0.10	0.07	100.0
12/16/2004	16	1,100	0.07	8.3		0.07	0.05	45.4		0.05	0.07	5.9		0.05	106	0.07	0.07	275.0
12/17/2004	16	1,100	0.06	7.4		0.02	0.04	10.6		0.02	0.05	4.8		0.02	106	0.02	0.06	275.0
12/17/2004	16	1,100	0.06	6.0		0.02	0.04	11.1		0.02	0.05	4.5		0.02	106	0.02	0.06	275.0
12/17/2004	16	400	0.06	10.8		0.05	0.06	9.8		0.02	0.08	4.4		0.05	114	0.05	0.08	100.0
12/20/2004	16	950	0.09	6.6		0.05	0.06	5.1		0.02	0.07	6.0		0.05	109	0.05	0.09	237.5
12/20/2004	16	950	0.09	8.4		0.05	0.07	4.3		0.02	0.07	5.7		0.05	106	0.05	0.09	237.5
12/20/2004	16	500	0.16	10.0		0.20	0.20	8.7		0.18	0.19	83.3		0.31	117	0.31	0.20	125.0
12/21/2004	12	950	0.08	7.8		0.07	0.06	4.5		0.05	0.07	26.3		0.05	112	0.07	0.08	274.2
12/21/2004	12	950	0.08	10.4		0.05	0.07	7.0		0.05	0.06	19.2		0.05	109	0.05	0.08	274.2
12/21/2004	12	500	0.24	8.1		0.13	0.23	10.4		0.13	0.29	16.0		0.30	118	0.30	0.29	144.3
12/22/2004	12	350	0.29	8.9		0.18	0.22	6.2		0.15	0.33	4.7		0.28	121	0.28	0.33	101.0
12/22/2004	12	850	0.09	6.8		0.05	0.08	6.6		0.05	0.11	4.2		0.05	114	0.05	0.11	245.4
12/22/2004	12	850	0.10	4.6		0.05	0.07	6.0		0.02	0.11	4.2		0.05	112	0.05	0.11	245.4
12/27/2004	12	350	0.30	7.2		0.20	0.29	8.9		0.15	0.31	6.1		0.26	118	0.26	0.31	101.0
12/27/2004	12	850	0.10	6.4		0.05	0.10	3.2		0.05	0.08	5.4		0.05	112	0.05	0.10	245.4
12/27/2004	12	850	0.10	6.4		0.07	0.09	3.2		0.05	0.08	5.2		0.05	109	0.07	0.10	245.4
12/27/2004	12	1,700	0.03	45.4		0.02	0.03	4.2		0.02	0.05	8.1		0.05	106	0.05	0.05	490.7
12/28/2004	12	350	0.22	10.6		0.18	0.28	9.6		0.13	0.22	11.6		0.20	118	0.20	0.28	101.0
12/28/2004	12	850	0.09	12.1		0.02	0.07	9.4		0.02	0.06	4.0		0.05	109	0.05	0.09	245.4
12/28/2004	12	850	0.11	11.9		0.05	0.06	2.2		0.02	0.05	3.9		0.02	106	0.05	0.11	245.4
12/29/2004	12	250	0.26	12.5		0.18	0.20	5.4		0.18	0.24	35.7		0.26	117	0.26	0.26	72.2
12/29/2004	12	750	0.10	10.8		0.07	0.06	10.0		0.02	0.06	4.3		0.05	109	0.07	0.10	216.5
12/29/2004	12	750	0.07	4.3		0.02	0.08	9.0		0.02	0.06	7.4		0.05	106	0.05	0.08	216.5
1/3/2005	20	250	0.16	12.1		0.15	0.19	11.6		0.13	0.20	11.3		0.13	120	0.15	0.20	55.9
1/3/2005	20	1,600	0.06	6.4		0.05	0.05	8.6		0.02	0.04	29.4		0.05	109	0.05	0.06	357.8
1/3/2005	20	1,600	0.05	8.9		0.05	0.06	8.9		0.02	0.04	50.0		0.02	106	0.05	0.06	357.8
1/3/2005	16	250	0.26	13.8		0.10	0.14	9.2		0.07	0.32	4.3		0.10	123	0.10	0.32	62.5
1/3/2005	16	1,600	0.08	9.2		0.05	0.07	10.0		0.02	0.04	6.9		0.02	114	0.05	0.08	400.0
1/3/2005	16	1,600	0.08	7.9		0.02	0.06	9.2		0.02	0.04	6.4		0.02	112	0.02	0.08	400.0
1/4/2005	9	250	0.25	8.1		0.18	0.22	8.7		0.15	0.34	8.6		0.26	120	0.26	0.34	83.3
1/4/2005	9	750	0.11	10.6		0.05	0.06	13.5		0.02	0.05	6.4		0.02	109	0.05	0.11	250.0
1/4/2005	9	750	0.09	10.8		0.02	0.09	7.2		0.02	0.05	6.0		0.02	109	0.02	0.09	250.0
1/4/2005	20	250	0.14	4.2		0.18	0.13	7.1		0.13	0.25	6.1		0.13	120	0.18	0.25	55.9
1/4/2005	20	1,200	0.05	5.1		0.05	0.08	7.1		0.05	0.07	38.4		0.05	114	0.05	0.08	268.3
1/4/2005	20	1,200	0.07	6.5		0.05	0.06	6.0		0.02	0.06	38.4		0.05	114	0.05	0.07	268.3
1/4/2005	20	2,200	0.07	41.6		0.05	0.04	62.5		0.02	0.07	50.0		0.07	106	0.07	0.07	491.9
1/5/2005	20	600	0.15	6.4		0.10	0.11	4.4		0.07	0.24	6.4		0.13	122	0.13	0.24	134.2
1/5/2005	20	1,100	0.07	5.1		0.02	0.06	3.4		0.05	0.07	4.3		0.05	114	0.05	0.07	246.0
1/5/2005	20	1,100	0.07	5.0		0.05	0.05	4.1		0.02	0.07	3.1		0.05	112	0.05	0.07	246.0
1/5/2005	20	2,000	0.05	45.4		0.05	0.04	4.7		0.05	0.06	23.8		0.05	106	0.05	0.06	447.2
1/5/2005	30	350	0.17	50.0		0.15	0.15	4.4		0.15	0.20	50.0		0.20	119	0.20	0.20	63.9
1/5/2005	30	2,300	0.04	2.1		0.02	0.06	27.7		0.05	0.06	16.6		0.05	109	0.05	0.06	419.9
1/5/2005	30	2,300	0.07	23.8		0.05	0.04	3.0		0.02	0.06	17.2		0.05	106	0.05	0.07	419.9
1/5/2005	30	3,000	0.05	4.0		0.02	0.04	2.9		0.02	0.03	4.3		0.02	100	0.02	0.05	547.7
1/6/2005	16	950	0.12	41.6		0.13	0.07	10.0		0.07	0.14	50.0		0.15	114	0.15	0.14	237.5
1/7/2005	16	950	0.07	41.6		0.07	0.07	2.1		0.07	0.09	29.4		0.10	114	0.10	0.09	237.5
1/10/2005	30	250	0.79	6.4		0.15	0.48	5.7		0.07	1.20	5.6		0.41	126	0.41	1.20	45.6
1/10/2005	30	2,300	0.07	2.4		0.02	0.07	2.7		0.05	0.06	17.8		0.05	109	0.05	0.07	419.9
1/10/2005	30	2,300	0.06	3.4		0.02	0.08	2.2		0.02	0.05	3.3		0.02	106	0.02	0.08	419.9
1/10/2005	30	3,000	0.07	2.3		0.02	0.06	2.6		0.05	0.06	17.8		0.05	106	0.05	0.07	547.7
1/12/2005	9	800	0.06	14.7		0.05	0.05	41.6		0.05	0.06	33.3		0.05	109	0.05	0.06	266.7
1/12/2005	9	850	0.06	12.5		0.05	0.07	9.0		0.05	0.07	7.1		0.05	117	0.05	0.07	283.3
1/12/2005	9	850	0.09	12.5		0.05	0.06	10.6		0.02	0.05	6.0		0.02	116	0.05	0.09	283.3
1/13/2005	9	800	0.06	8.6		0.05	0.05	10.6		0.05	0.05	5.1		0.05	109	0.05	0.06	266.7
1/13/2005	9	850	0.08	8.9		0.02	0.10	7.9		0.02	0.06	4.9		0.02	120	0.02	0.10	283.3
1/13/2005	9	850	0.08	6.0		0.05	0.10	7.4		0.02	0.06	5.0		0.02	119	0.05	0.10	283.3
1/14/2005	6	850	0.06	5.9		0.02	0.08	2.9		0.02	0.05	5.1		0.02	106	0.02	0.08	347.0
1/14/2005	6	850	0.06	6.0		0.05	0.07	2.9		0.02	0.05	25.0		0.07	106	0.07	0.07	347.0
1/14/2005	9	1,450	0.04	71.4		0.05	0.03	55.5		0.05	0.07	38.4		0.05	109	0.05	0.07	483.3
1/14/2005	9	900	0.07	2.7		0.02	0.05	5.8		0.02	0.08	4.7		0.02	112	0.02	0.08	300.0
1/14/2005	9	900	0.06	3.5		0.05	0.06	4.8		0.02	0.08	4.8		0.07	109	0.07	0.08	300.0
1/18/2005	9	900	0.19	6.9		0.05	0.11	6.6		0.05	0.15	5.6		0.05	114	0.05	0.19	300.0
1/18/2005	9	900	0.19	7.5		0.05	0.08	6.4		0.02	0.16	6.0		0.07	112	0.07	0.19	300.0
1/19/2005	9	1,950	0.08	55.5		0.07	0.10	33.3		0.10	0.07	45.4		0.07	106	0.10	0.10	650.0
1/19/2005	9	900	0.09	8.3		0.05	0.08	6.6		0.05	0.08	18.5		0.05	116	0.05	0.09	300.0
1/19/2005	9	900	0.08	9.4		0.02	0.08	5.0		0.02	0.08	15.6		0.05	114	0.05	0.08	300.0
1/20/2005	30	2,300	0.07	55.5		0.07	0.05	83.3		0.07	0.06	55.5		0.05	106	0.07	0.07	419.9
1/20/2005	30	250	0.09	83.3		0.13	0.12	100.0		0.18	0.16	71.4		0.20	117	0.20	0.16	45.6
1/21/2005	30	2,300	0.04	33.3		0.02	0.07	71.4		0.07	0.04	50.0		0.05	100	0.07	0.07	419.9
1/21/2005	30	250	0.19	27.7		0.13	0.31	33.3		0.20	0.32	38.4		0.31	122	0.31	0.32	45.6
1/24/2005	30	2,300	0.07	62.5		0.07	0.03	2.2		0.02	0.06	50.0		0.05	109	0.07	0.07	419.9
1/24/2005	30	4,000	0.02	5.3		0.02	0.05	3.3		0.02	0.02	2.9		0.02	100	0.02	0.05	730.3
1/24/2005	30	150	2.04	3.9		0.54	0.53	5.7		0.41	1.07	8.3		0.88	128	0.88	2.04	27.4
1/24/2005	9	900	0.10	6.7		0.05	0.08	3.7		0.02	0.11	8.4		0.05	112	0.05	0.11	300.0
1/24/2005	9	900	0.09	7.1		0.05	0.08	3.7		0.05	0.13	5.7		0.07	112	0.07	0.13	300.0
1/24/2005	9	1,950	0.06	55.5		0.07	0.08	50.0		0.07	0.07	45.4		0.07	112	0.07	0.08	650.0
1/24/2005	9	1,450	0.04	12.8		0.02	0.04	6.9		0.02	0.05	26.3		0.05	106	0.05	0.05	483.3
1/25/2005	9	900	0.12	6.4	2.90	0.05	0.10	6.6	2.41	0.05	0.13	4.8	4.30	0.05	116	0.05	0.13	300.0
1/25/2005	9	900	0.12	5.2	3.38	0.05	0.10	7.4	2.16	0.02	0.14	5.7	4.41	0.05	116	0.05	0.14	300.0
1/25/2005	9	1,950	0.07	6.6	1.28	0.05	0.06	7.5	1.58	0.05	0.06	6.0	1.46	0.05	106	0.05	0.07	650.0
1/25/2005	9	1,450	0.04	4.5	1.38	0.02	0.03	2.6	1.30	0.02	0.05	5.4	1.61	0.02	109	0.02	0.05	483.3
1/26/2005	12	900	0.10	9.6	1.87	0.05	0.09	6.9	2.03	0.05	0.08	5.7	2.15	0.05	114	0.05	0.10	259.8
1/26/2005	12	900	0.07	9.4	2.49	0.02	0.09	6.5	2.12	0.05	0.07	5.0	2.23	0.05	116	0.05	0.09	259.8
1/26/2005	12	1,950	0.08	5.0	2.58	0.07	0.07	20.0	1.60	0.07	0.06	5.1	2.06	0.07	109	0.07	0.08	562.9
1/26/2005	30	300	0.32	45.4	7.09	0.23	0.26	55.5	4.51	0.31	0.33	41.6	3.13	0.39	118	0.39	0.33	54.8
1/27/2005	30	300	0.24	50.0	5.08	0.18	0.15	4.1	6.09	0.10	0.21	50.0	2.55	0.23	119	0.23	0.24	54.8
1/28/2005	30	2,300	0.05	38.4	0.75	0.05	0.04	4.8	1.94	0.02	0.06	71.4	1.01	0.07	109	0.07	0.06	419.9
1/28/2005	30	2,300	0.05	35.7	1.32	0.05	0.03	10.2	2.00	0.02	0.05	50.0	1.13	0.07	109	0.07	0.05	419.9
1/28/2005	30	300	0.37	45.4	12.90	0.31	0.20	31.2	7.88	0.23	0.57	55.5	9.40	0.57	125	0.57	0.57	54.8
1/31/2005	30	300	0.27	12.5	9.76	0.20	0.26	8.6	6.62	0.10	0.32	6.2	7.49	0.28	127	0.28	0.32	54.8
1/31/2005	30	2,900	0.05	2.7	2.84	0.02	0.03	4.9	1.31	0.05	0.06	55.5	1.34	0.05	106	0.05	0.06	529.5
1/31/2005	30	300	1.20	4.6	38.09	0.52	0.50	4.4	20.72	0.26	1.44	4.8	40.88	2.00	130	2.00	1.44	54.8
2/1/2005	30	300	0.50	5.7	26.08	0.26	0.62	4.2	16.65	0.18	0.74	6.2	17.88	0.78	129	0.78	0.74	54.8
2/1/2005	30	3,150	0.05	3.1	2.15	0.05	0.08	2.3	5.62	0.02	0.04	35.7	1.08	0.02	109	0.05	0.08	575.1
2/1/2005	30	2,900	0.10	3.3	4.69	0.05	0.06	8.6	2.93	0.05	0.06	5.6	2.04	0.05	106	0.05	0.10	529.5
2/1/2005	30	3,150	0.07	2.4	4.84	0.02	0.05	3.0	2.43	0.02	0.04	33.3	1.00	0.02	109	0.02	0.07	575.1
2/2/2005	30	3,150	0.05	18.5	1.21	0.02	0.03	3.1	1.45	0.02	0.05	55.5	0.91	0.05	109	0.05	0.05	575.1
2/2/2005	30	300	0.51	7.8	10.23	0.18	0.41	5.6	9.40	0.18	0.65	4.6	13.28	0.46	126	0.46	0.65	54.8
2/3/2005	9	150	0.70	8.9	9.77	0.23	0.35	17.2	10.65	0.31	0.73	9.2	12.07	0.67	125	0.67	0.73	50.0
2/4/2005	12	150	0.26	12.5	5.11	0.13	0.26	13.1	7.59	0.13	0.36	6.1	6.85	0.36	129	0.36	0.36	43.3
2/7/2005	12	300	0.14	35.7	3.54	0.18	0.33	12.8	3.94	0.15	0.38	7.5	7.06	0.26	126	0.26	0.38	86.6
2/8/2005	30	150	0.58	0.9	21.14	0.20	0.45	3.1	19.60	0.18	0.50	4.5	12.70	0.65	128	0.65	0.58	27.4
2/9/2005	30	150	0.26	3.3	8.80	0.13	0.15	13.8	3.78	0.10	0.34	4.8	8.77	0.39	124	0.39	0.34	27.4
2/10/2005	30	80	0.16	4.3	5.34	0.10	0.14	3.2	9.26	0.13	0.23	4.7	7.90	0.23	119	0.23	0.23	14.6
2/10/2005	20	80	0.52	11.1	16.18	0.23	0.80	7.9	19.37	0.31	1.32	7.1	22.27	0.70	134	0.70	1.32	17.9
2/11/2005	20	500	0.14	38.4	4.87	0.13	0.16	6.0	4.56	0.13	0.30	11.9	5.05	0.26	124	0.26	0.30	111.8
2/11/2005	16	1,400	0.08	35.7	0.88	0.07	0.06	71.4	1.81	0.10	0.09	62.5	1.92	0.07	112	0.10	0.09	350.0
2/11/2005	16	1,350	0.05	6.0	1.62	0.05	0.04	2.4	1.91	0.02	0.07	27.7	1.41	0.07	106	0.07	0.07	337.5
2/11/2005	16	1,350	0.04	6.2	1.28	0.05	0.04	2.4	1.64	0.02	0.06	27.7	1.32	0.05	106	0.05	0.06	337.5
2/14/2005	20	250	0.23	29.4	8.22	0.15	0.12	14.7	3.59	0.15	0.41	38.4	13.92	0.49	123	0.49	0.41	55.9
2/14/2005	20	1,400	0.09	19.2	1.80	0.10	0.07	10.8	1.43	0.05	0.08	4.2	3.02	0.07	114	0.10	0.09	313.0
2/14/2005	20	1,350	0.10	6.9	2.37	0.05	0.07	8.4	2.61	0.05	0.09	13.5	2.24	0.05	116	0.05	0.10	301.9
2/14/2005	20	1,350	0.09	6.5	2.54	0.05	0.07	9.6	2.49	0.05	0.09	13.5	2.18	0.07	116	0.07	0.09	301.9
2/14/2005	20	2,250	0.07	62.5	1.13	0.07	0.06	31.2	1.81	0.05	0.06	50.0	1.06	0.07	106	0.07	0.07	503.1
2/15/2005	16	1,400	0.07	62.5	0.93	0.07	0.05	62.5	0.92	0.07	0.07	7.4	1.98	0.07	109	0.07	0.07	350.0
2/15/2005	16	2,250	0.05	55.5	0.62	0.05	0.04	3.2	1.70	0.05	0.05	62.5	0.97	0.05	100	0.05	0.05	562.5
2/15/2005	16	1,350	0.06	7.1	1.91	0.05	0.06	7.0	1.03	0.05	0.07	6.1	1.74	0.07	109	0.07	0.07	337.5
2/15/2005	16	1,350	0.05	7.9	1.31	0.05	0.05	7.8	1.67	0.05	0.06	6.0	1.74	0.07	109	0.07	0.06	337.5

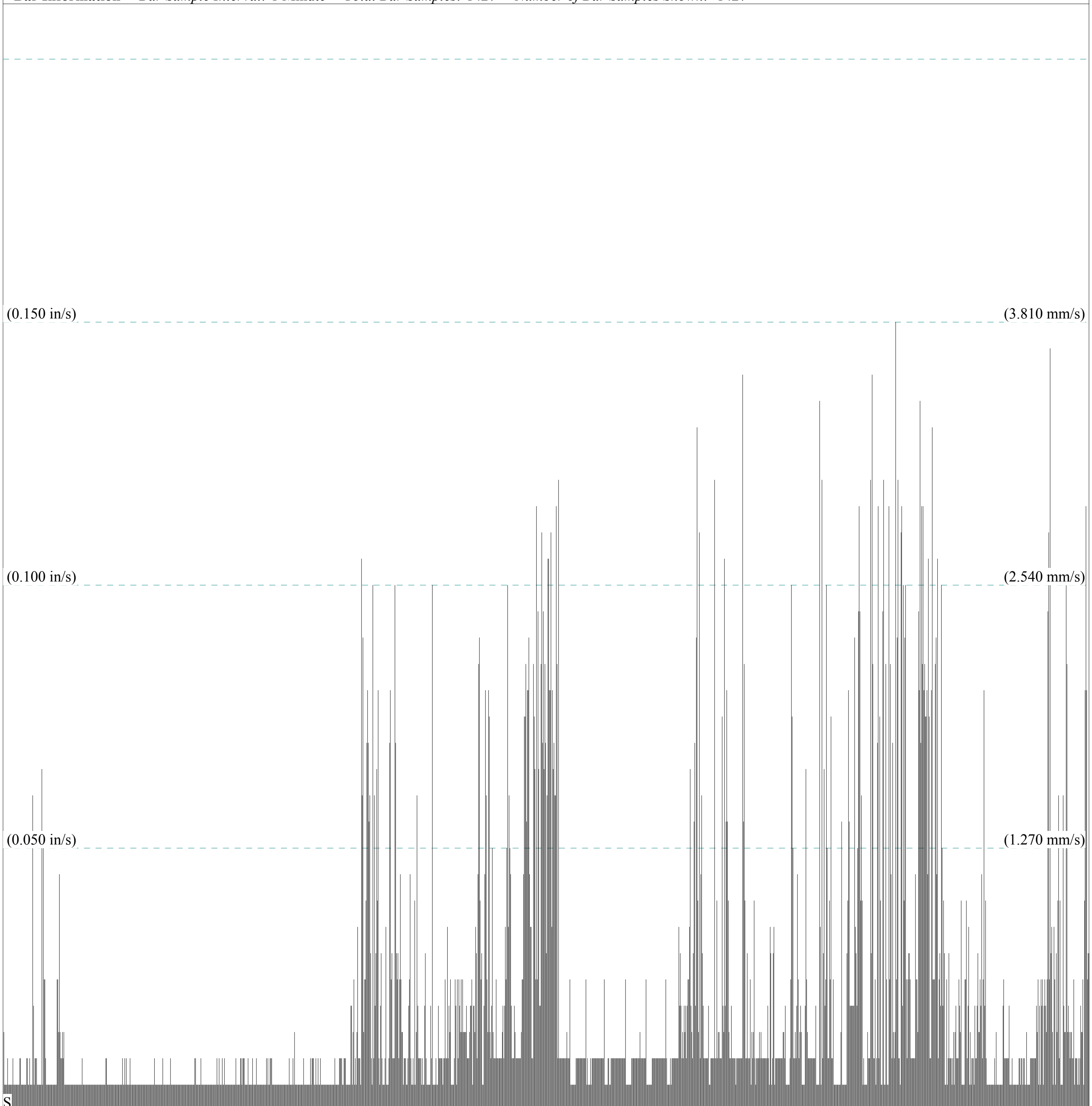
File: SN249719991202001.BAR Job Number: 001 Date Range: 1/31/2005 - 2/1/2005 Time Range: 12:47 - 00:05 Serial Number: 2497

Peak Amplitudes *Acoustic (A):* 100 dB *Seismic (S):* 0.2100in/s 5.334mm/s *Vector Sum (VS):* 0.2100in/s 5.334mm/s
Graph Information *Duration:* 0.0 hr to 11.3 hr *Acoustic Scale:* 120 dB *Seismic Scale:* 0.21 in/s 5.33 mm/s
Bar Information *Bar Sample Interval:* 6 Minutes *Total Bar Samples:* 113 *Number of Bar Samples Shown:* 113



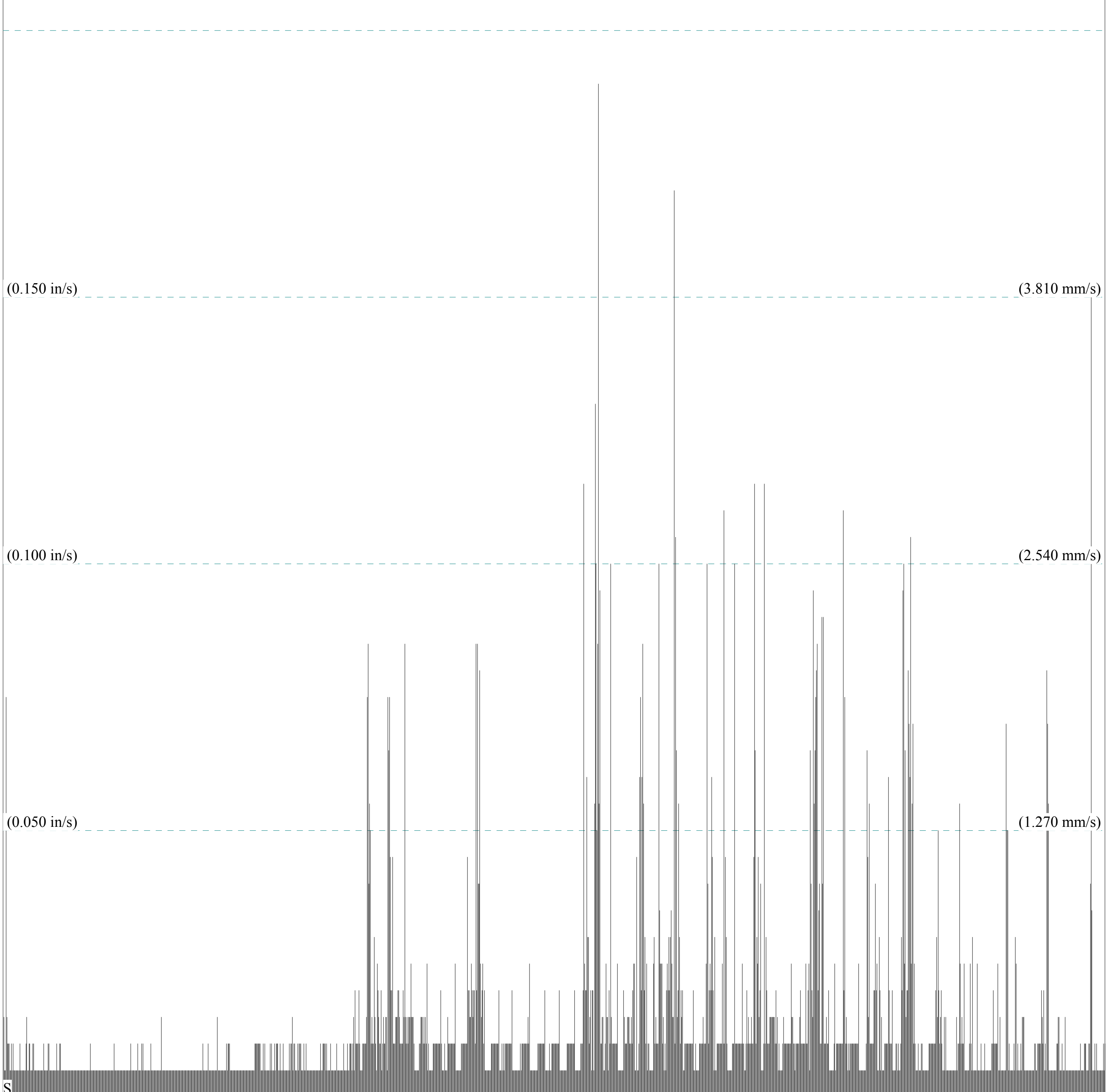
File: SN249720050222008.BAR Job Number: 008 Date Range: 2/22/2005 - 2/22/2005 Time Range: 00:00 - 23:46 Serial Number: 2497

Peak Amplitudes *Seismic (S):* 0.1500in/s 3.810mm/s
Graph Information *Duration:* 0.0 hr to 23.8 hr *Seismic Scale:* 0.20 in/s 5.08 mm/s
Bar Information *Bar Sample Interval:* 1 Minute *Total Bar Samples:* 1427 *Number of Bar Samples Shown:* 1427



File: SN249720050222007.BAR Job Number: 007 Date Range: 2/21/2005 - 2/22/2005 Time Range: 00:00 - 00:00 Serial Number: 2497

Peak Amplitudes *Seismic (S):* 0.1900in/s 4.826mm/s
Graph Information *Duration:* 0.0 day to 1.0 day *Seismic Scale:* 0.20 in/s 5.08 mm/s
Bar Information *Bar Sample Interval:* 1 Minute *Total Bar Samples:* 1440 *Number of Bar Samples Shown:* 1440

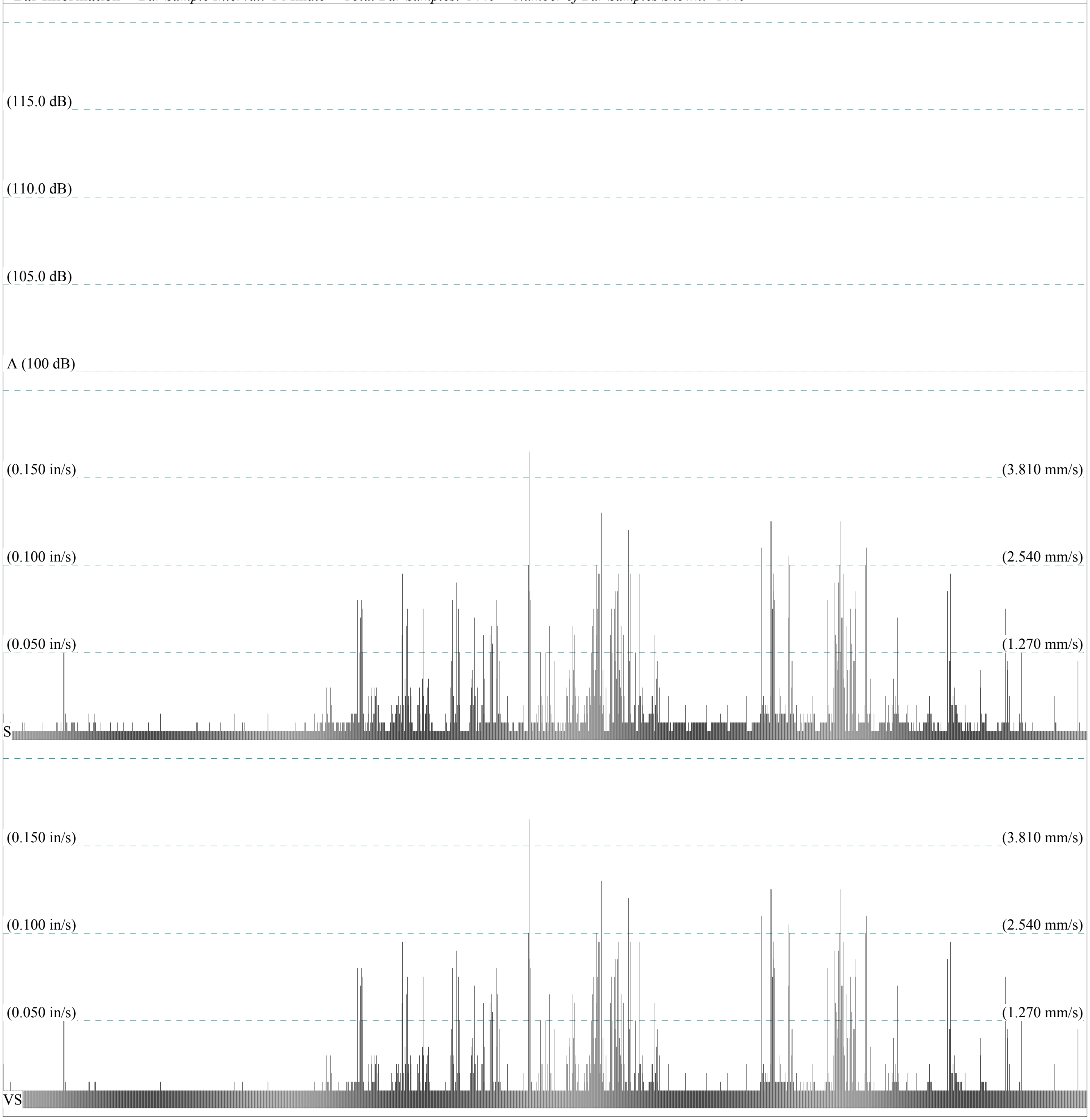


File: SN249720050222006.BAR   Job Number: 006   Date Range: 2/20/2005 - 2/21/2005   Time Range: 00:00 - 00:00   Serial Number: 2497

Peak Amplitudes *Acoustic (A):* 0 dB   *Seismic (S):* 0.1650in/s   4.191mm/s   *Vector Sum (VS):* 0.1650in/s   4.191mm/s

Graph Information *Duration:* 0.0 day to 1.0 day   *Acoustic Scale:* 120 dB   *Seismic Scale:* 0.20 in/s   5.08 mm/s

Bar Information *Bar Sample Interval:* 1 Minute   *Total Bar Samples:* 1440   *Number of Bar Samples Shown:* 1440

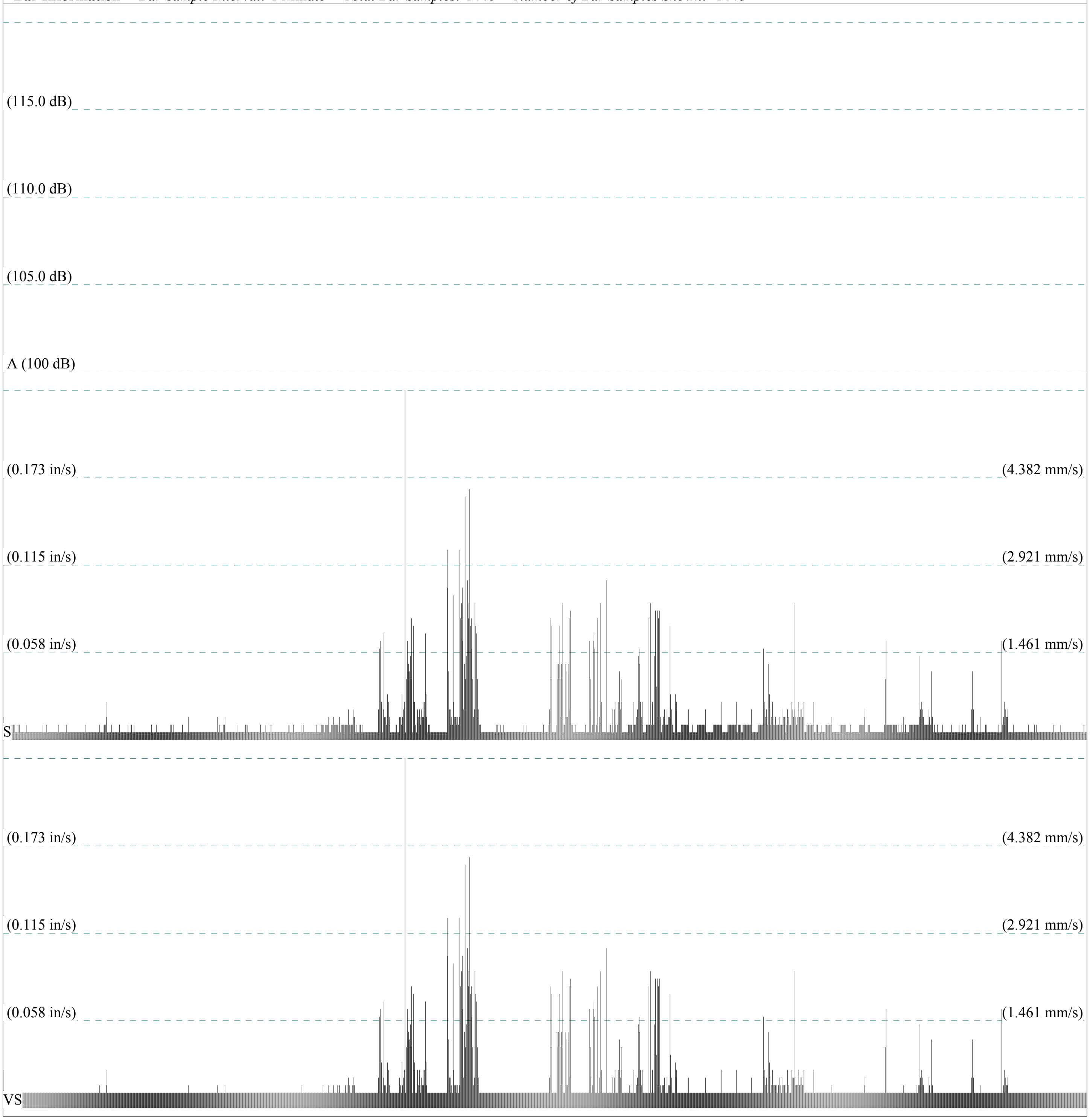


File: SN249720050222005.BAR Job Number: 005 Date Range: 2/19/2005 - 2/20/2005 Time Range: 00:00 - 00:00 Serial Number: 2497

Peak Amplitudes *Acoustic (A):* 0 dB *Seismic (S):* 0.2300in/s 5.842mm/s *Vector Sum (VS):* 0.2300in/s 5.842mm/s

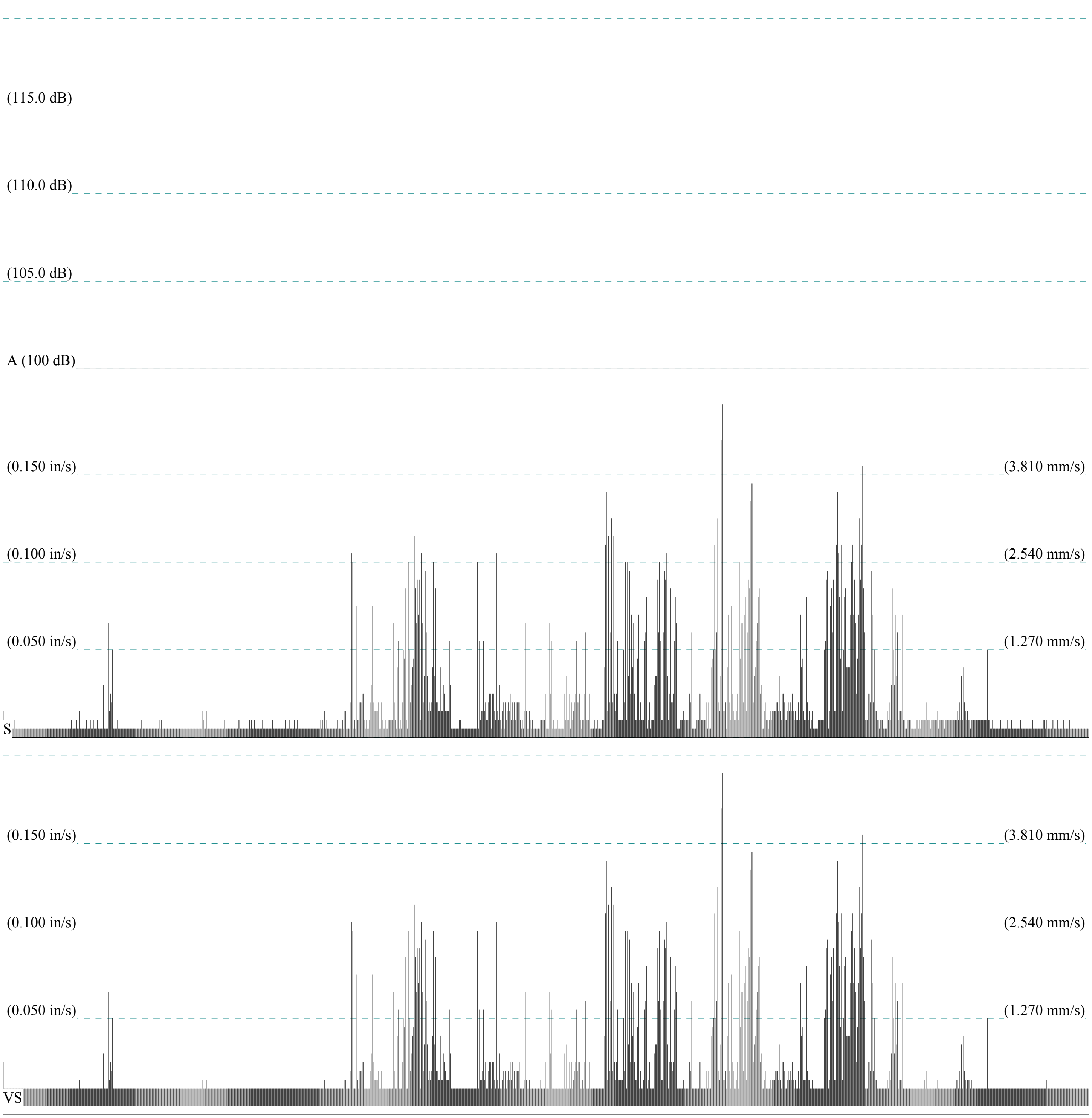
Graph Information *Duration:* 0.0 day to 1.0 day *Acoustic Scale:* 120 dB *Seismic Scale:* 0.23 in/s 5.84 mm/s

Bar Information *Bar Sample Interval:* 1 Minute *Total Bar Samples:* 1440 *Number of Bar Samples Shown:* 1440



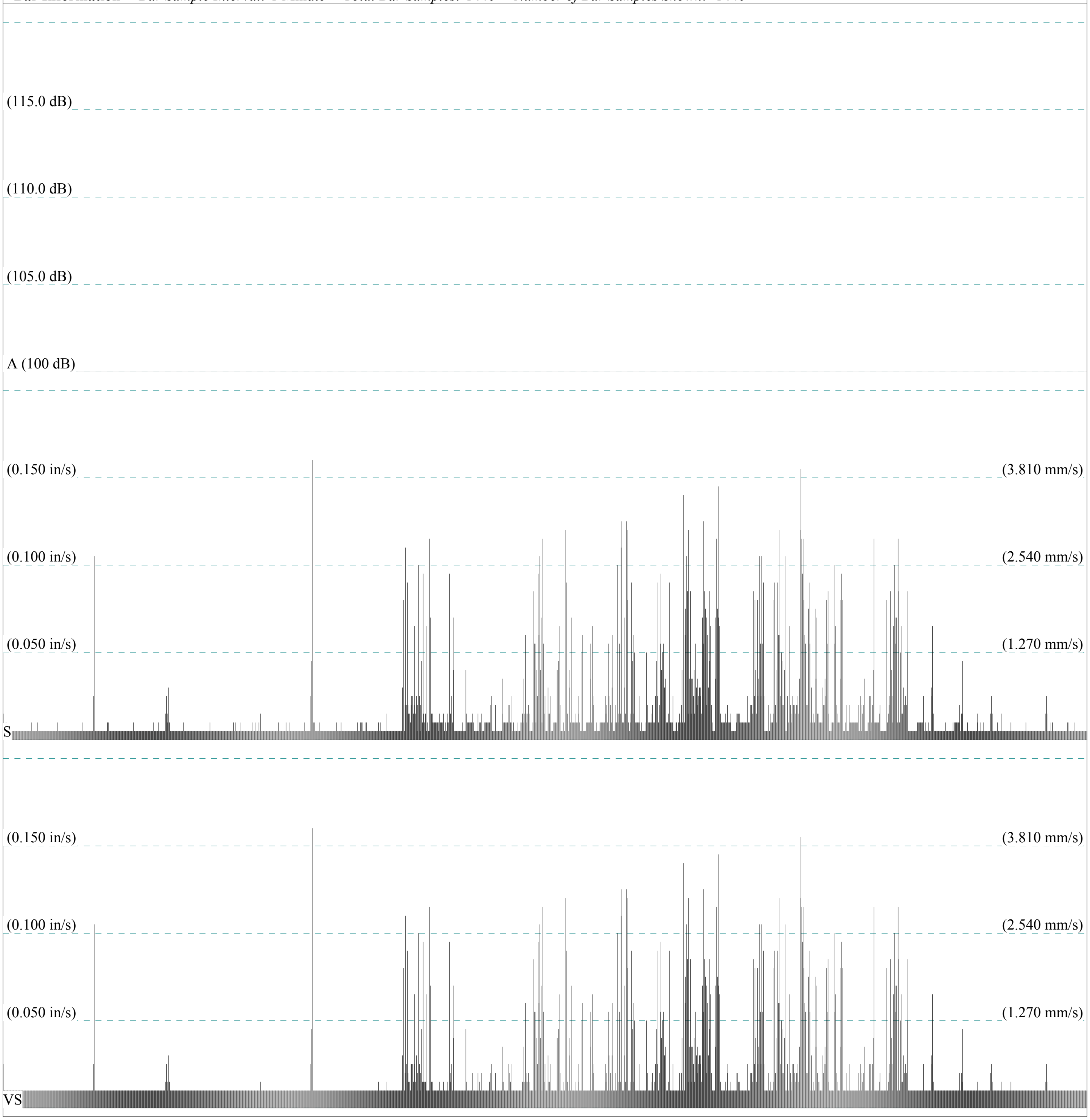
File: SN249720050222004.BAR Job Number: 004 Date Range: 2/18/2005 - 2/19/2005 Time Range: 00:00 - 00:00 Serial Number: 2497

Peak Amplitudes *Acoustic (A):* 0 dB *Seismic (S):* 0.1900in/s 4.826mm/s *Vector Sum (VS):* 0.1900in/s 4.826mm/s
Graph Information *Duration:* 0.0 day to 1.0 day *Acoustic Scale:* 120 dB *Seismic Scale:* 0.20 in/s 5.08 mm/s
Bar Information *Bar Sample Interval:* 1 Minute *Total Bar Samples:* 1440 *Number of Bar Samples Shown:* 1440



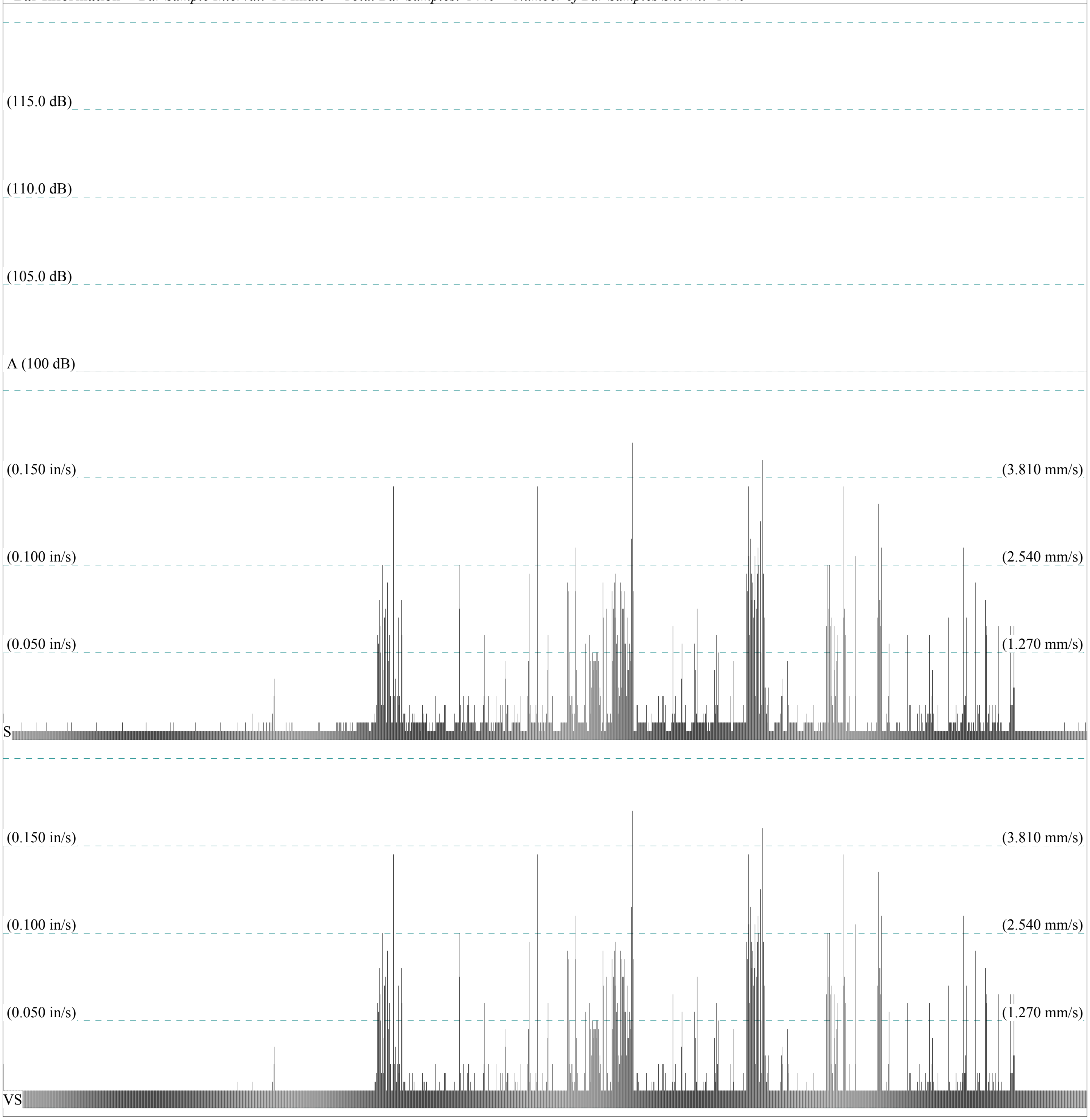
File: SN249720050222003.BAR Job Number: 003 Date Range: 2/17/2005 - 2/18/2005 Time Range: 00:00 - 00:00 Serial Number: 2497

Peak Amplitudes *Acoustic (A):* 0 dB *Seismic (S):* 0.1600in/s 4.064mm/s *Vector Sum (VS):* 0.1600in/s 4.064mm/s
Graph Information *Duration:* 0.0 day to 1.0 day *Acoustic Scale:* 120 dB *Seismic Scale:* 0.20 in/s 5.08 mm/s
Bar Information *Bar Sample Interval:* 1 Minute *Total Bar Samples:* 1440 *Number of Bar Samples Shown:* 1440



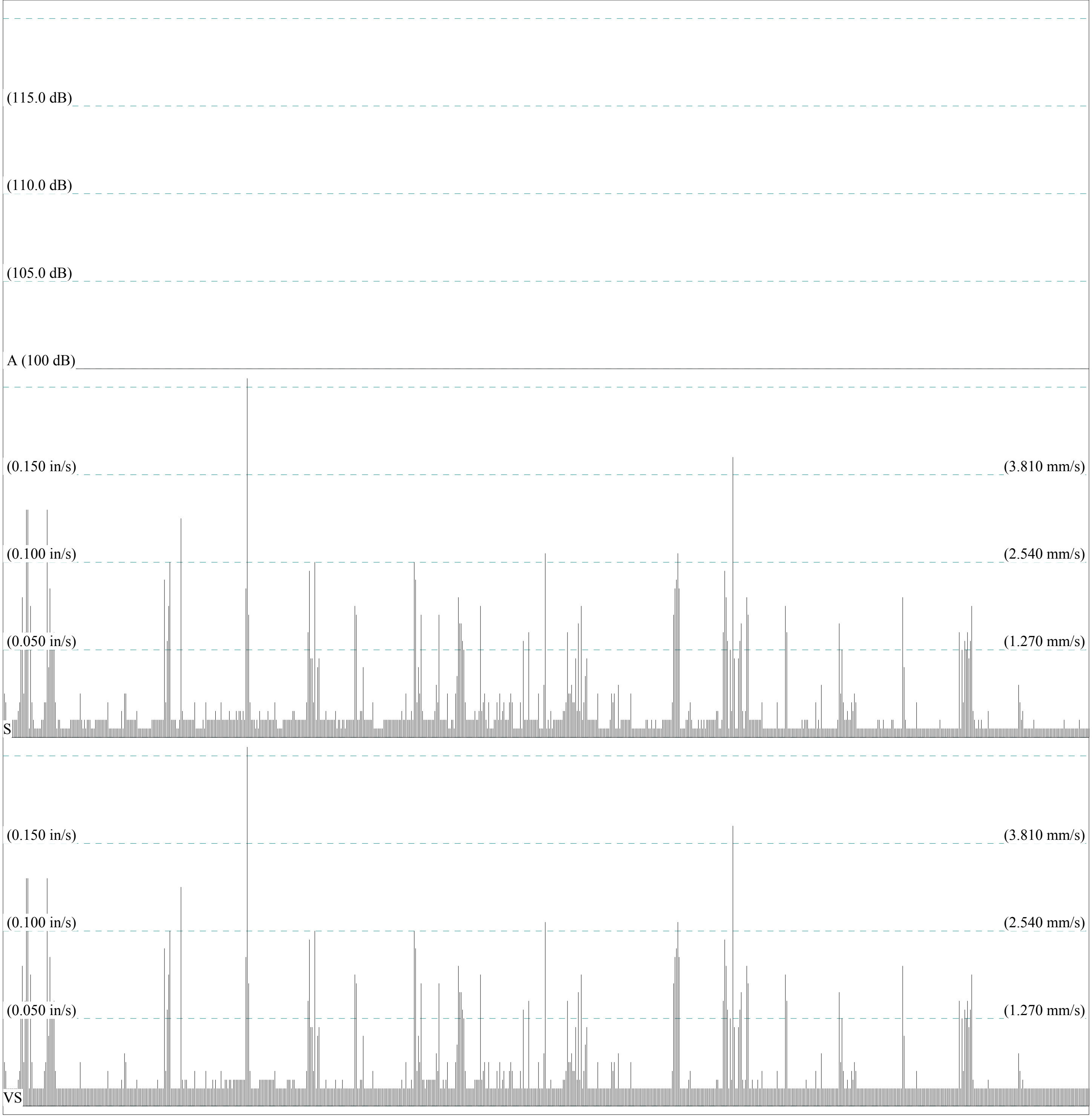
File: SN249720050222002.BAR Job Number: 002 Date Range: 2/16/2005 - 2/17/2005 Time Range: 00:00 - 00:00 Serial Number: 2497

Peak Amplitudes *Acoustic (A):* 0 dB *Seismic (S):* 0.1700in/s 4.318mm/s *Vector Sum (VS):* 0.1700in/s 4.318mm/s
Graph Information *Duration:* 0.0 day to 1.0 day *Acoustic Scale:* 120 dB *Seismic Scale:* 0.20 in/s 5.08 mm/s
Bar Information *Bar Sample Interval:* 1 Minute *Total Bar Samples:* 1440 *Number of Bar Samples Shown:* 1440



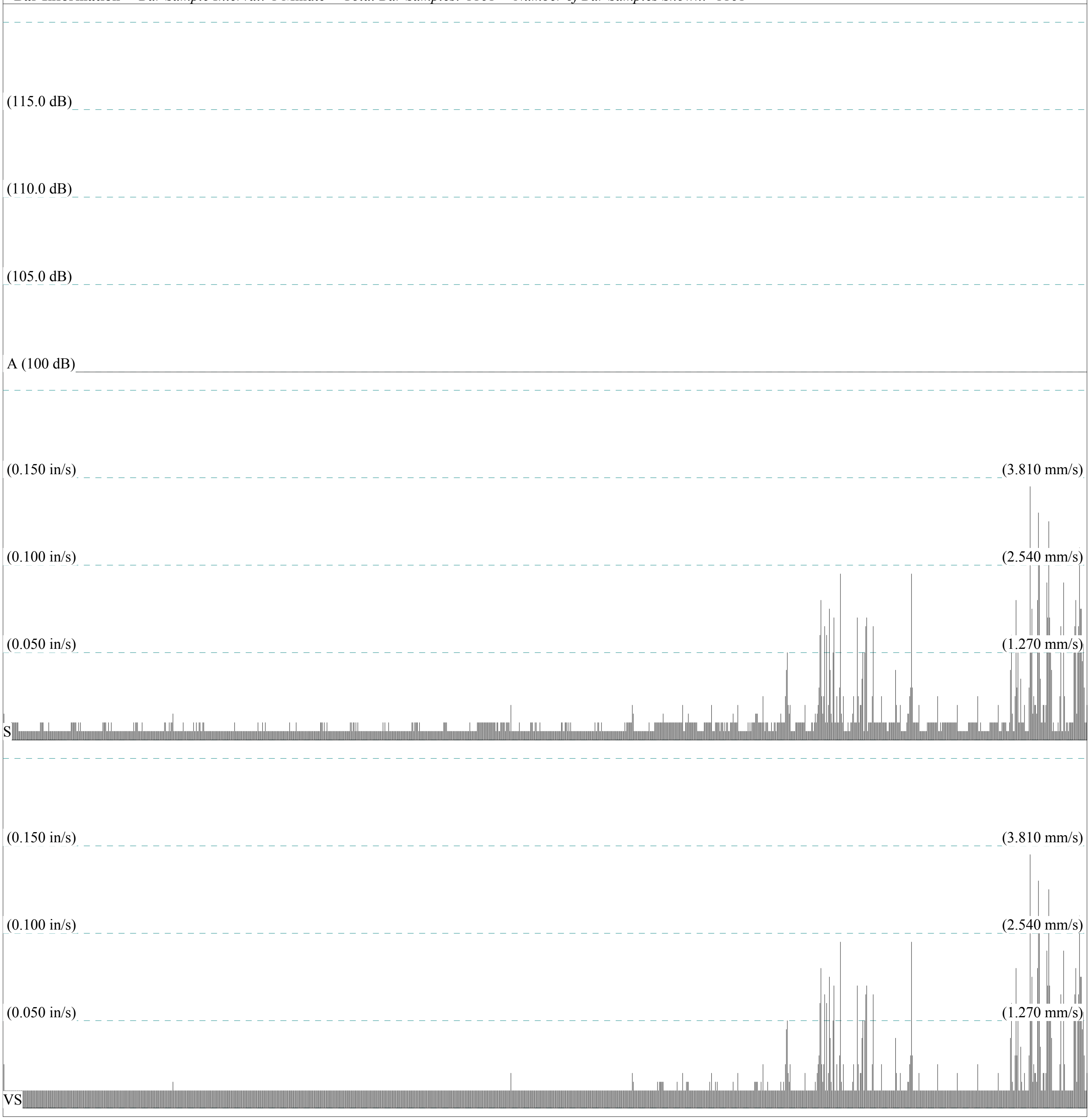
File: SN249720050222001.BAR Job Number: 001 Date Range: 2/15/2005 - 2/16/2005 Time Range: 10:53 - 00:00 Serial Number: 2497

Peak Amplitudes *Acoustic (A):* 100 dB *Seismic (S):* 0.2050in/s 5.207mm/s *Vector Sum (VS):* 0.2050in/s 5.207mm/s
Graph Information *Duration:* 0.0 hr to 13.1 hr *Acoustic Scale:* 120 dB *Seismic Scale:* 0.20 in/s 5.08 mm/s
Bar Information *Bar Sample Interval:* 1 Minute *Total Bar Samples:* 787 *Number of Bar Samples Shown:* 787



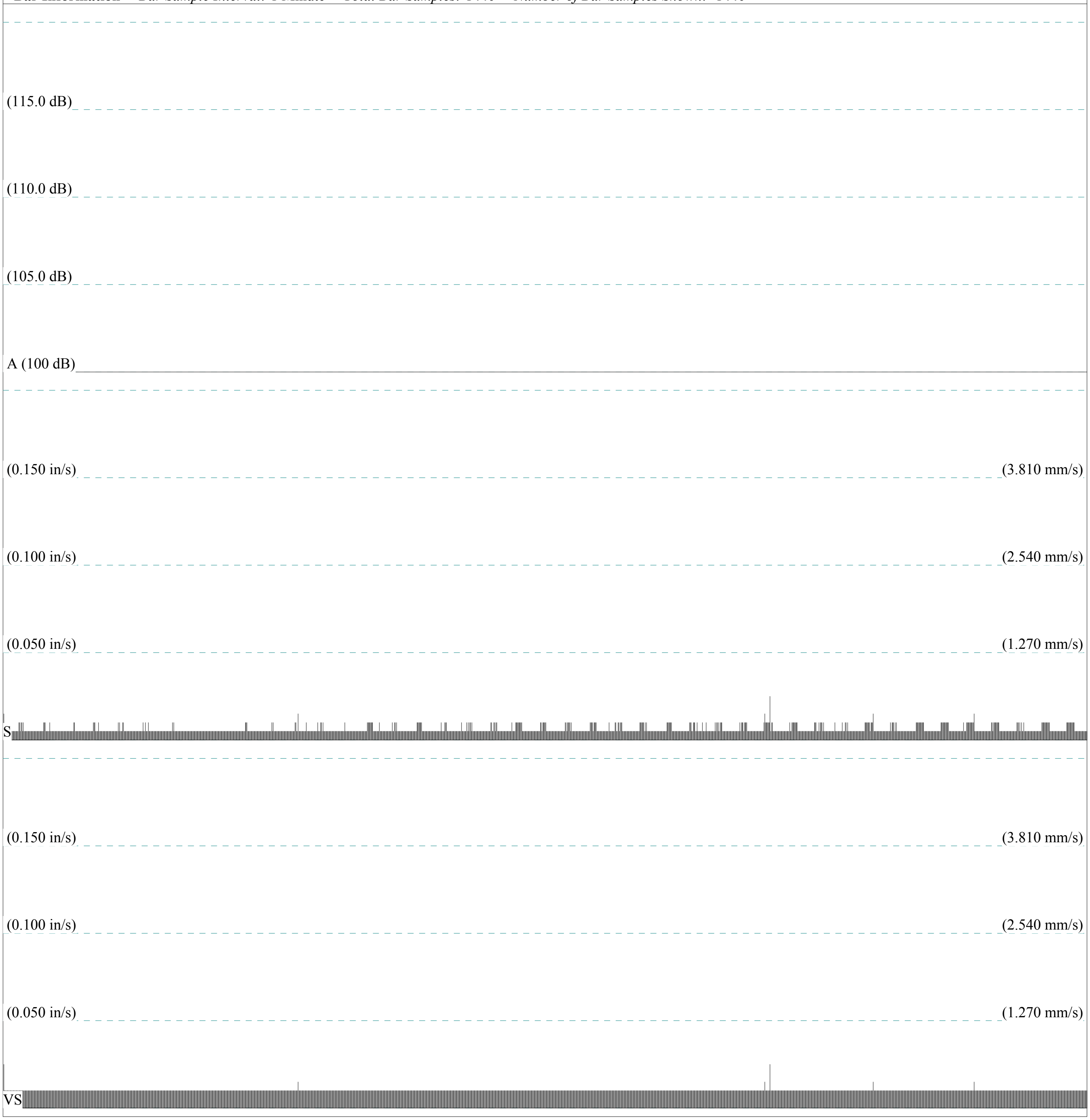
File: TDHOUSE007.BAR Job Number: 007 Date Range: 2/14/2005 - 2/14/2005 Time Range: 00:00 - 19:21 Serial Number: 2497

Peak Amplitudes *Acoustic (A):* 100 dB *Seismic (S):* 0.1450in/s 3.683mm/s *Vector Sum (VS):* 0.1450in/s 3.683mm/s
Graph Information *Duration:* 0.0 hr to 19.4 hr *Acoustic Scale:* 120 dB *Seismic Scale:* 0.20 in/s 5.08 mm/s
Bar Information *Bar Sample Interval:* 1 Minute *Total Bar Samples:* 1161 *Number of Bar Samples Shown:* 1161



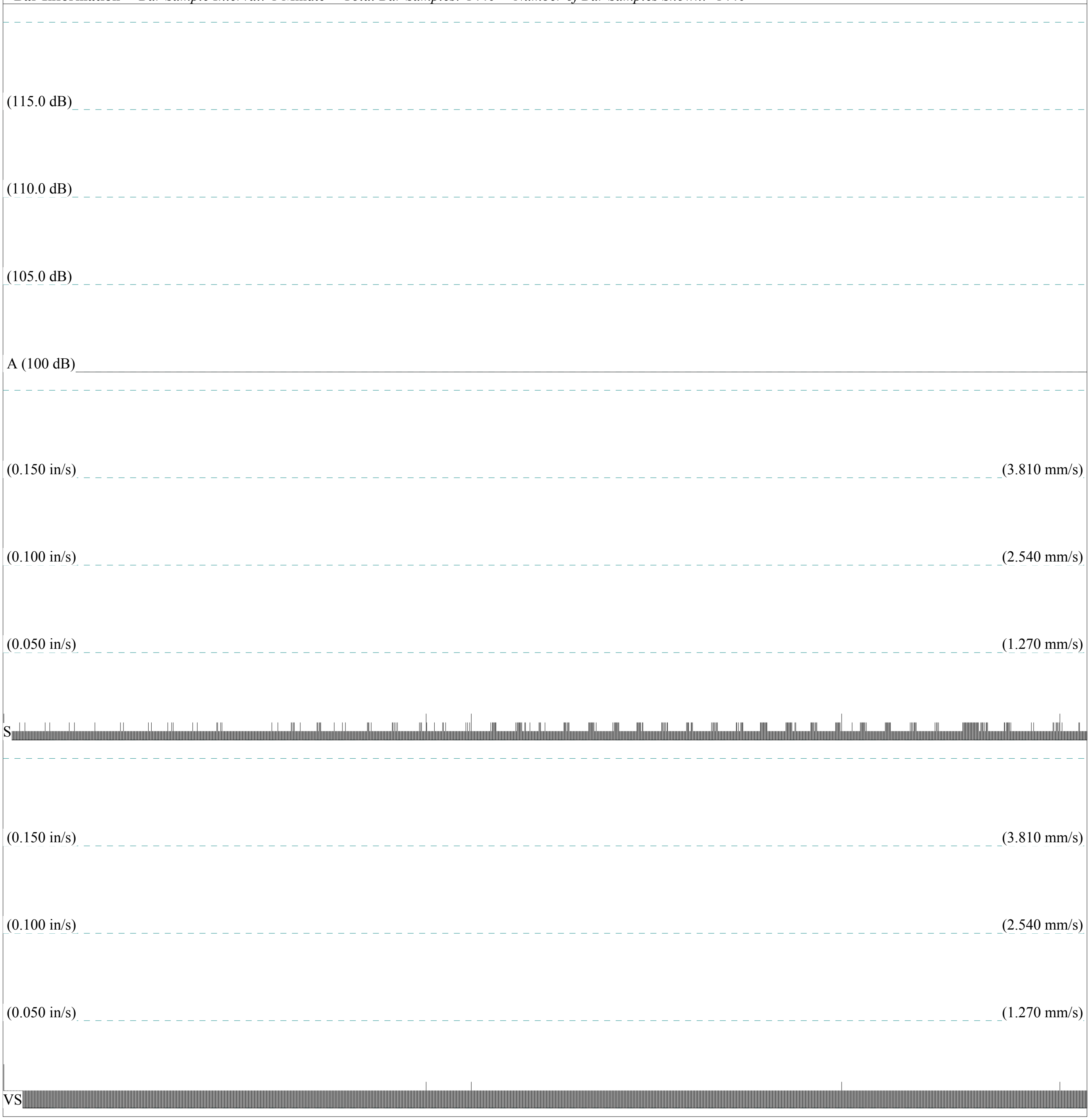
File: TDHOUSE006.BAR   Job Number: 006   Date Range: 2/13/2005 - 2/14/2005   Time Range: 00:00 - 00:00   Serial Number: 2497

Peak Amplitudes *Acoustic (A):* 0 dB   *Seismic (S):* 0.0250in/s   0.635mm/s   *Vector Sum (VS):* 0.0250in/s   0.635mm/s
Graph Information *Duration:* 0.0 day to 1.0 day   *Acoustic Scale:* 120 dB   *Seismic Scale:* 0.20 in/s   5.08 mm/s
Bar Information *Bar Sample Interval:* 1 Minute   *Total Bar Samples:* 1440   *Number of Bar Samples Shown:* 1440



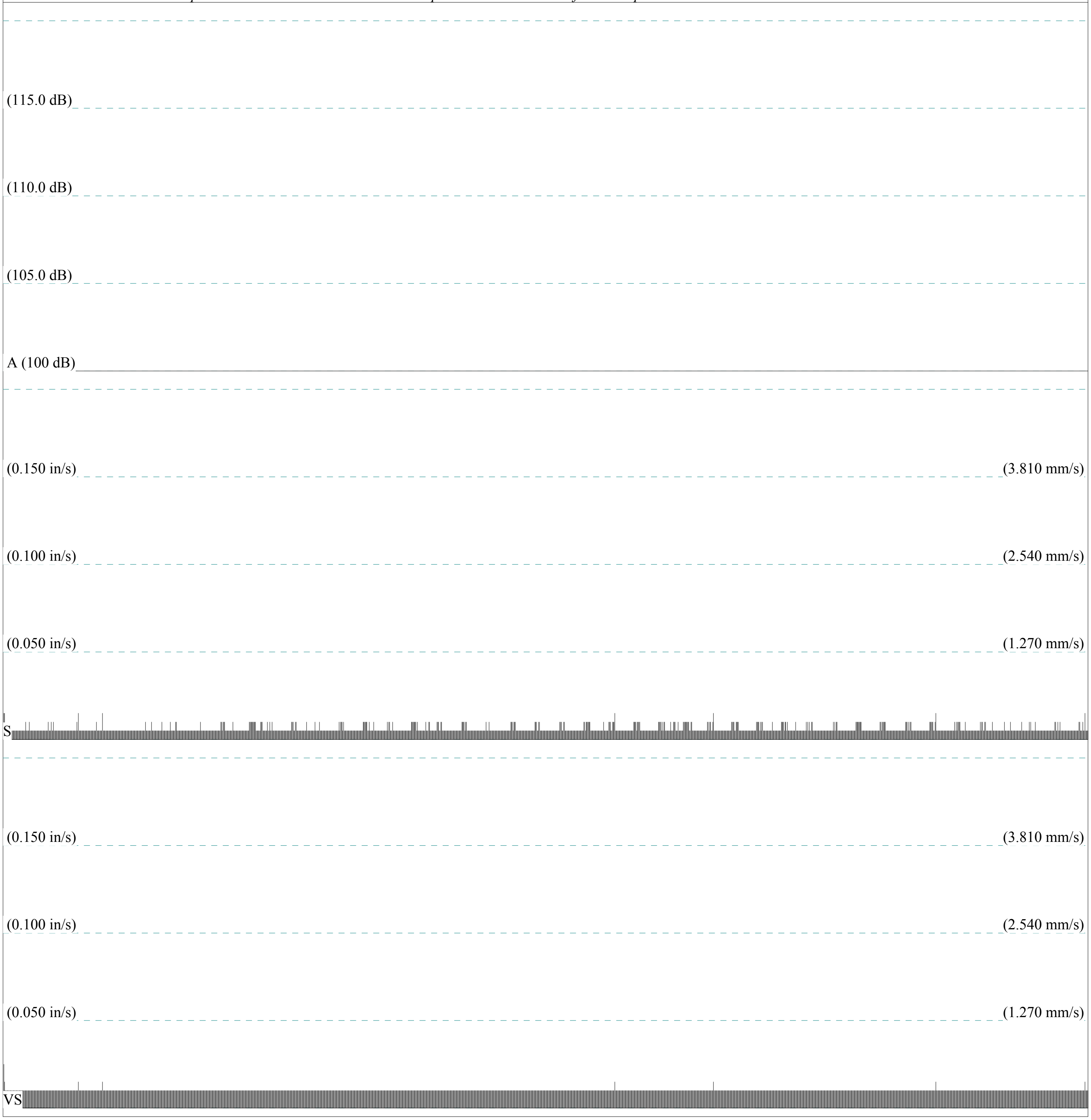
File: TDHOUSE005.BAR   Job Number: 005   Date Range: 2/12/2005 - 2/13/2005   Time Range: 00:00 - 00:00   Serial Number: 2497

Peak Amplitudes *Acoustic (A):* 0 dB *Seismic (S):* 0.0150in/s 0.381mm/s *Vector Sum (VS):* 0.0250in/s 0.635mm/s
Graph Information *Duration:* 0.0 day to 1.0 day *Acoustic Scale:* 120 dB *Seismic Scale:* 0.20 in/s 5.08 mm/s
Bar Information *Bar Sample Interval:* 1 Minute *Total Bar Samples:* 1440 *Number of Bar Samples Shown:* 1440



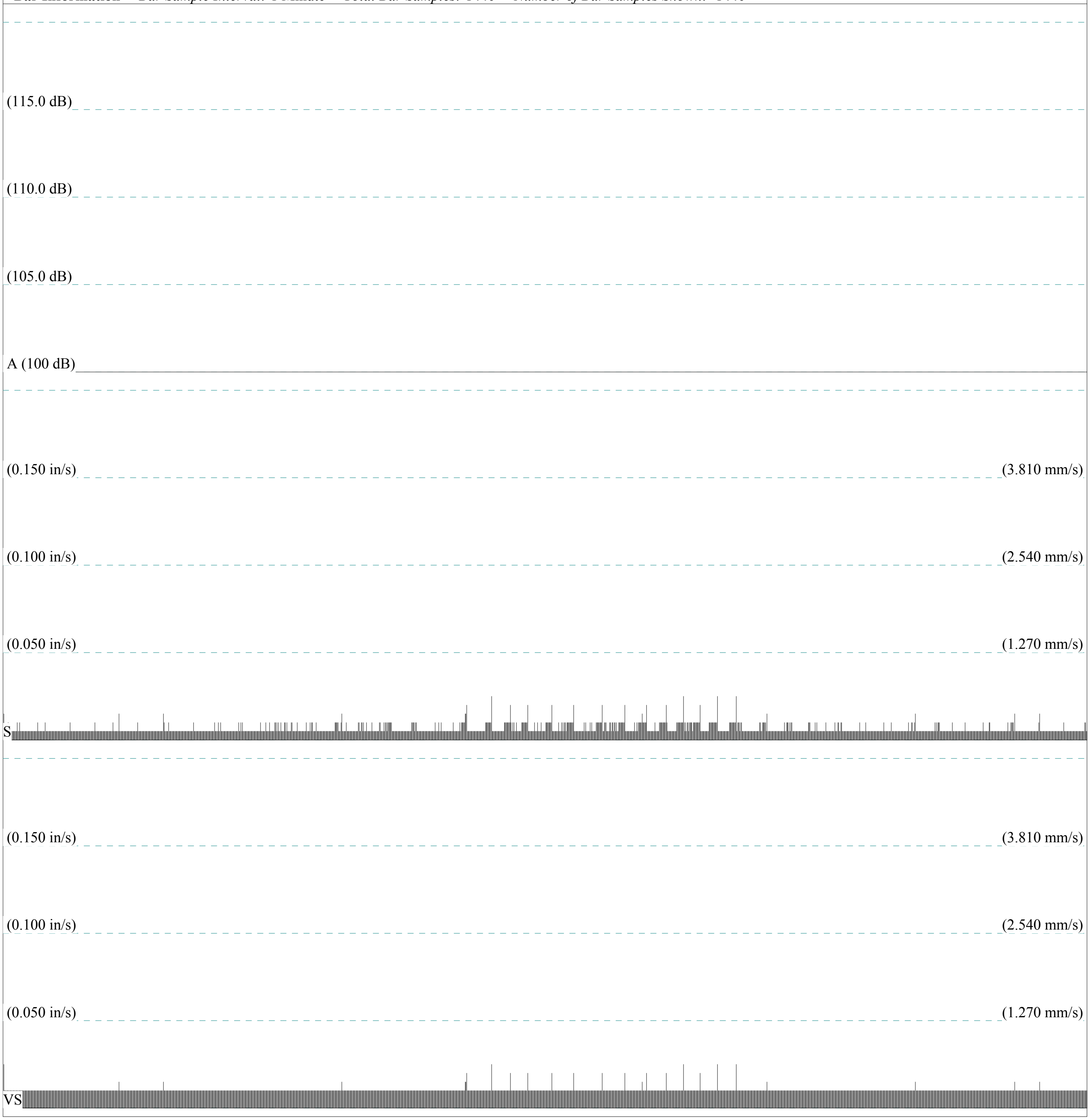
File: TDHOUSE004.BAR   Job Number: 004   Date Range: 2/11/2005 - 2/12/2005   Time Range: 00:00 - 00:00   Serial Number: 2497

Peak Amplitudes *Acoustic (A):* 0 dB   *Seismic (S):* 0.0150in/s   0.381mm/s   *Vector Sum (VS):* 0.0250in/s   0.635mm/s
Graph Information *Duration:* 0.0 day to 1.0 day   *Acoustic Scale:* 120 dB   *Seismic Scale:* 0.20 in/s   5.08 mm/s
Bar Information *Bar Sample Interval:* 1 Minute   *Total Bar Samples:* 1440   *Number of Bar Samples Shown:* 1440



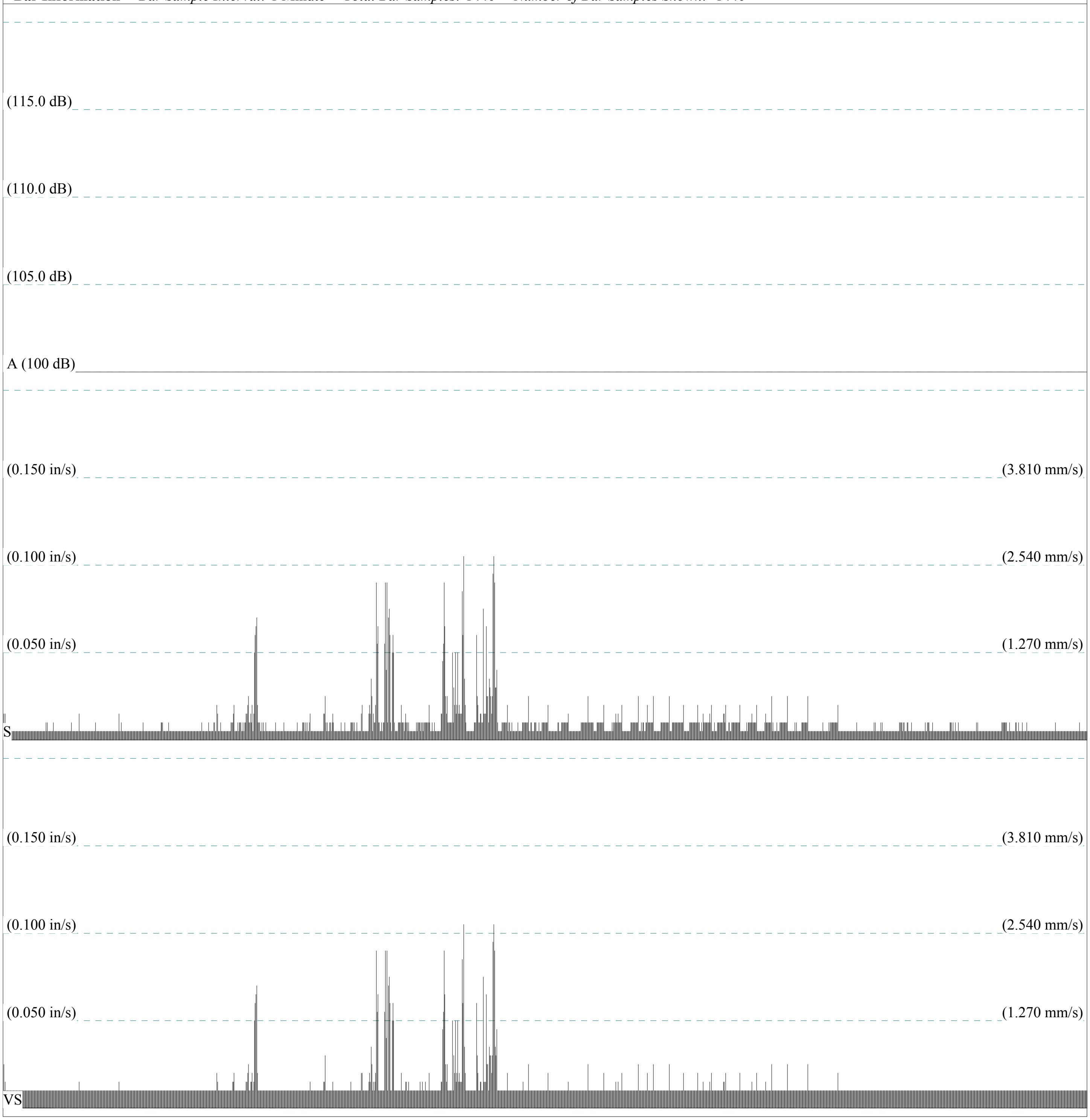
File: TDHOUSE003.BAR Job Number: 003 Date Range: 2/10/2005 - 2/11/2005 Time Range: 00:00 - 00:00 Serial Number: 2497

Peak Amplitudes *Acoustic (A):* 0 dB *Seismic (S):* 0.0250in/s 0.635mm/s *Vector Sum (VS):* 0.0250in/s 0.635mm/s
Graph Information *Duration:* 0.0 day to 1.0 day *Acoustic Scale:* 120 dB *Seismic Scale:* 0.20 in/s 5.08 mm/s
Bar Information *Bar Sample Interval:* 1 Minute *Total Bar Samples:* 1440 *Number of Bar Samples Shown:* 1440



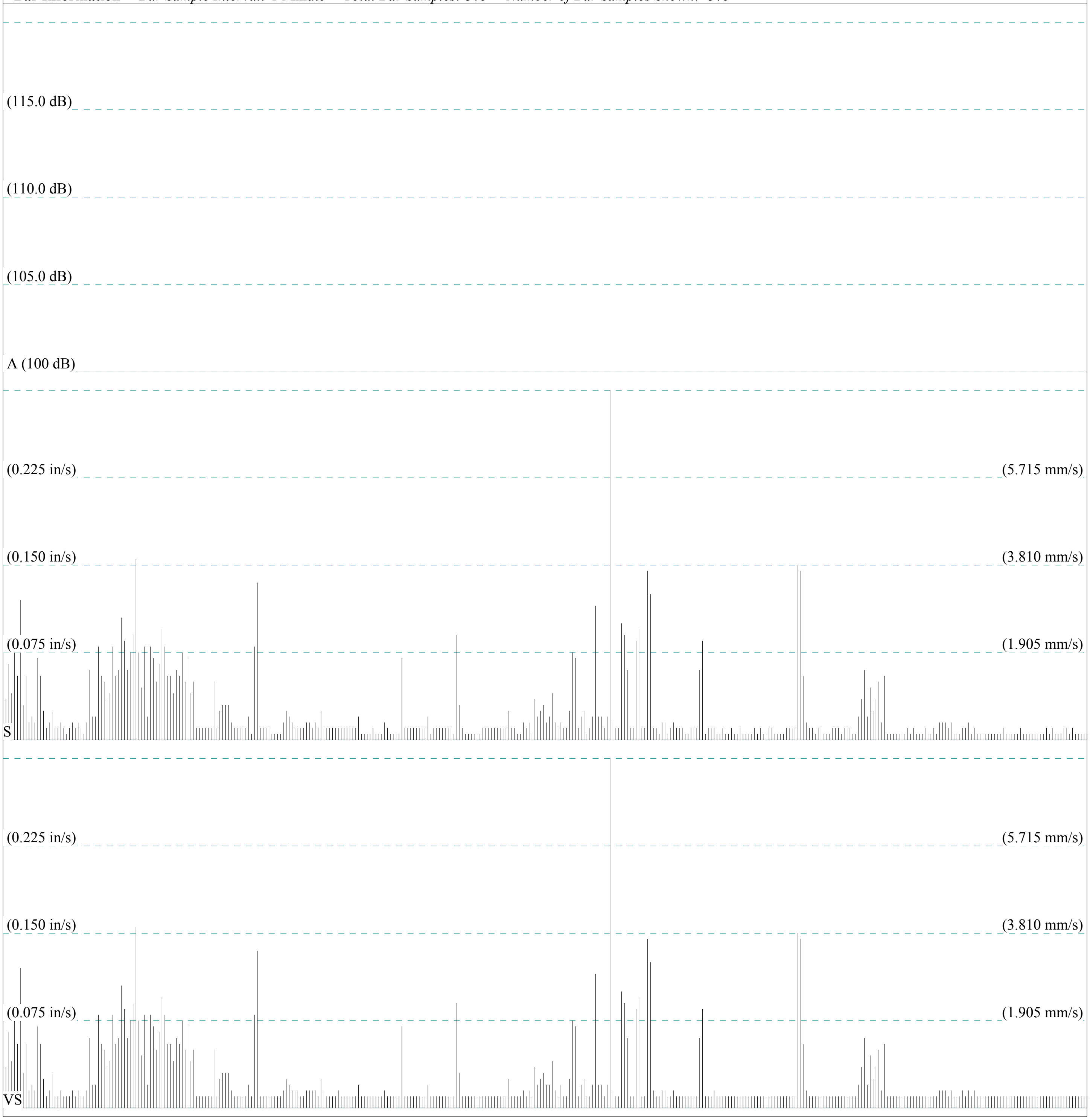
File: TDHOUSE002.BAR Job Number: 002 Date Range: 2/9/2005 - 2/10/2005 Time Range: 00:00 - 00:00 Serial Number: 2497

Peak Amplitudes *Acoustic (A):* 0 dB *Seismic (S):* 0.1050in/s 2.667mm/s *Vector Sum (VS):* 0.1050in/s 2.667mm/s
Graph Information *Duration:* 0.0 day to 1.0 day *Acoustic Scale:* 120 dB *Seismic Scale:* 0.20 in/s 5.08 mm/s
Bar Information *Bar Sample Interval:* 1 Minute *Total Bar Samples:* 1440 *Number of Bar Samples Shown:* 1440



File: TDHOUSE001.BAR   Job Number: 001   Date Range: 2/8/2005 - 2/9/2005   Time Range: 17:45 - 00:00   Serial Number: 2497

Peak Amplitudes *Acoustic (A):* 0 dB   *Seismic (S):* 0.3000in/s   7.620mm/s   *Vector Sum (VS):* 0.3000in/s   7.620mm/s
Graph Information *Duration:* 0.0 hr to 6.3 hr   *Acoustic Scale:* 120 dB   *Seismic Scale:* 0.30 in/s   7.62 mm/s
Bar Information *Bar Sample Interval:* 1 Minute   *Total Bar Samples:* 375   *Number of Bar Samples Shown:* 375

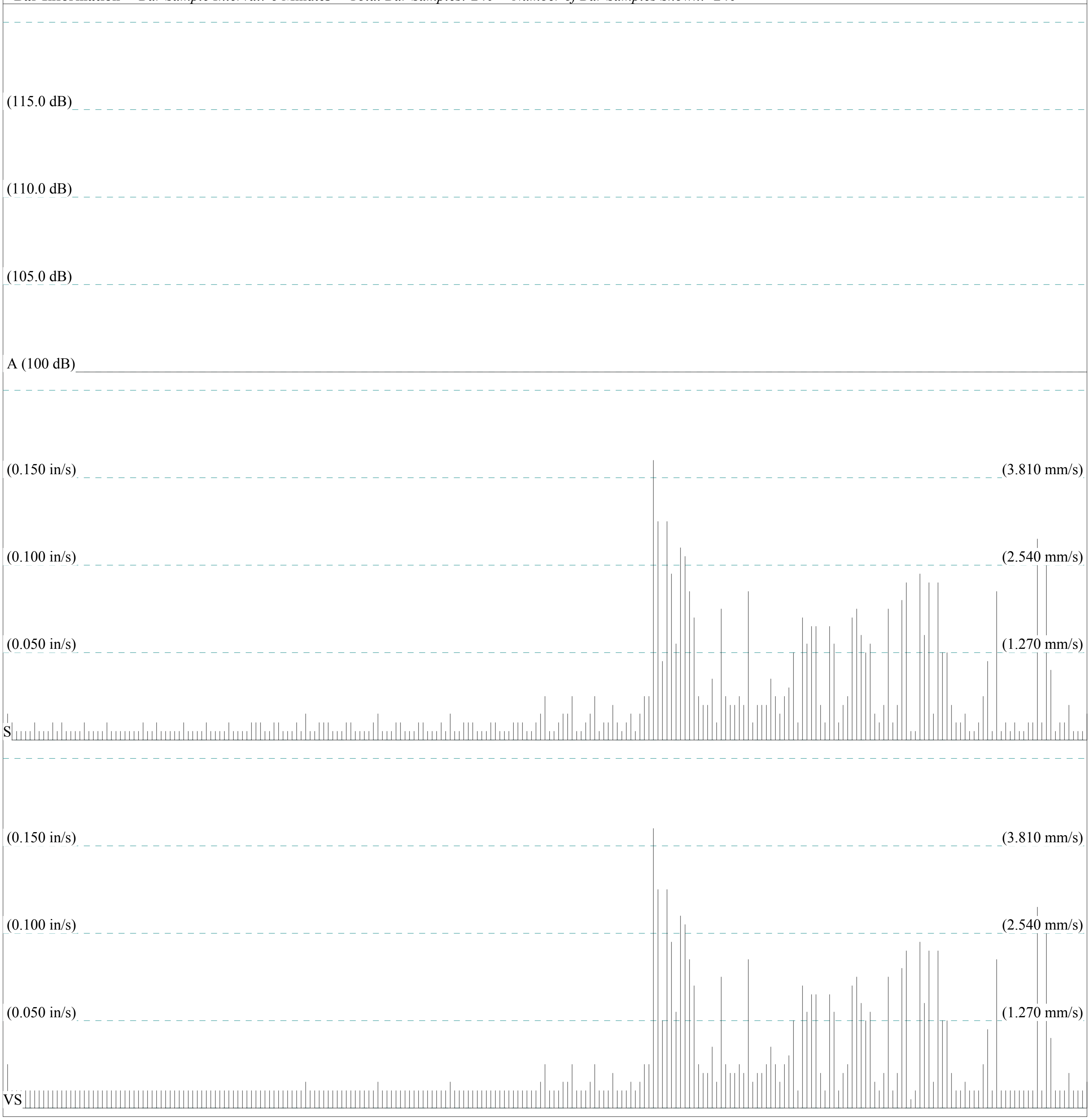


File: SN249720190531008.BAR Job Number: 008 Date Range: 2/7/2005 - 2/8/2005 Time Range: 00:05 - 00:05 Serial Number: 2497

Peak Amplitudes *Acoustic (A):* 0 dB *Seismic (S):* 0.1600in/s 4.064mm/s *Vector Sum (VS):* 0.1600in/s 4.064mm/s

Graph Information *Duration:* 0.0 day to 1.0 day *Acoustic Scale:* 120 dB *Seismic Scale:* 0.20 in/s 5.08 mm/s

Bar Information *Bar Sample Interval:* 6 Minutes *Total Bar Samples:* 240 *Number of Bar Samples Shown:* 240

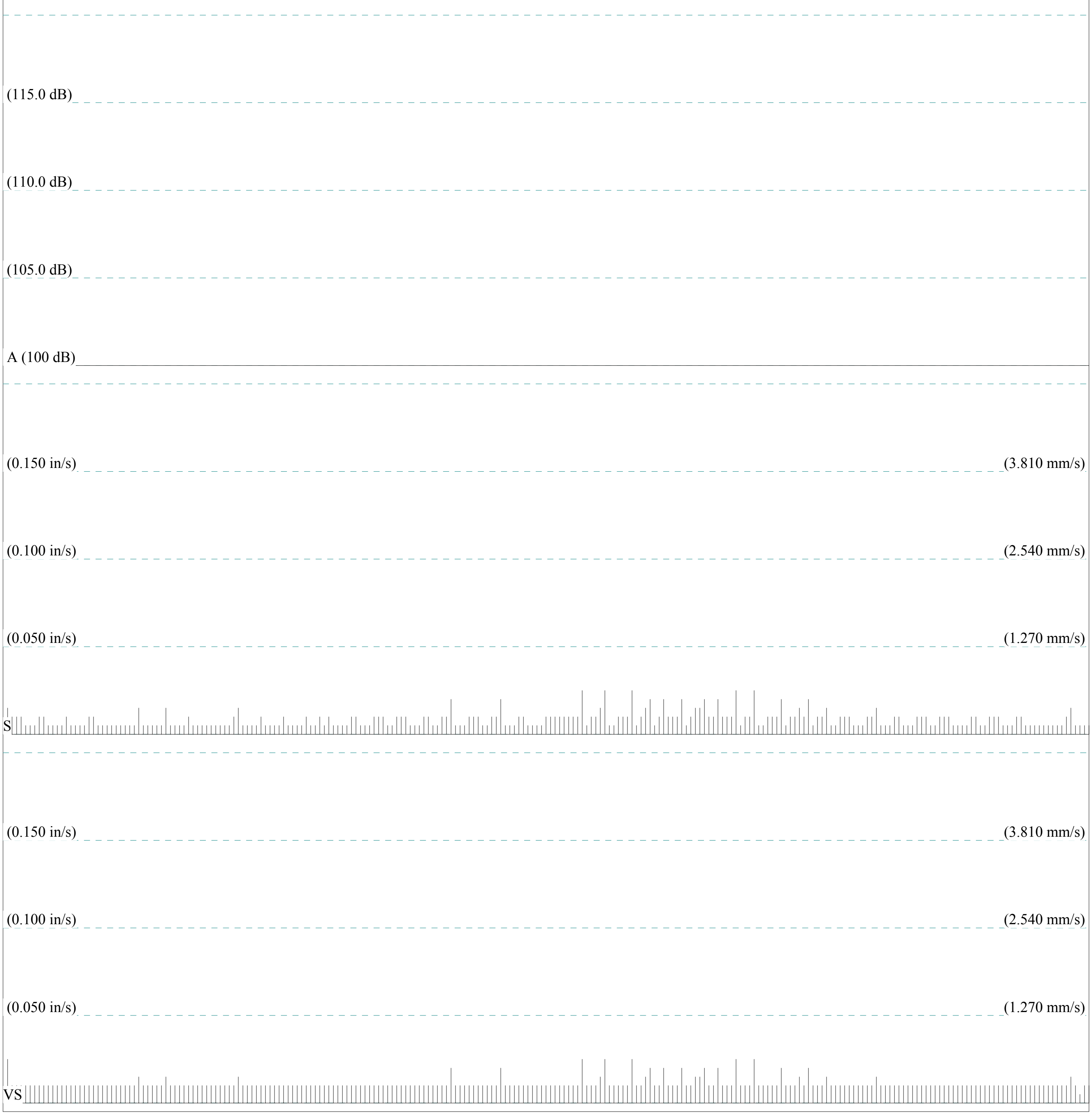


File: SN249720000229007.BAR Job Number: 007 Date Range: 2/6/2005 - 2/7/2005 Time Range: 00:05 - 00:05 Serial Number: 2497

Peak Amplitudes *Acoustic (A):* 0 dB *Seismic (S):* 0.0250in/s 0.635mm/s *Vector Sum (VS):* 0.0250in/s 0.635mm/s

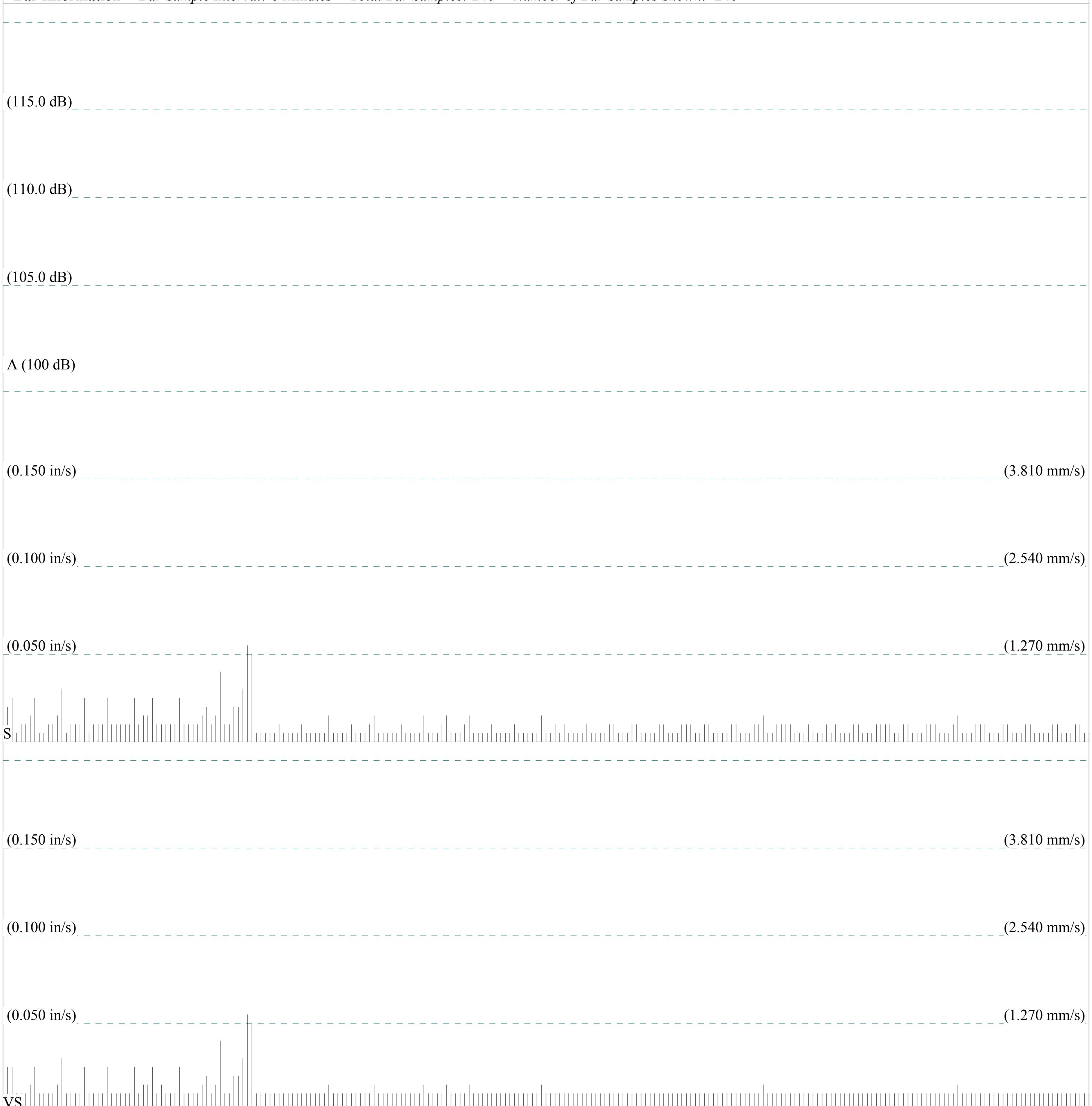
Graph Information *Duration:* 0.0 day to 1.0 day *Acoustic Scale:* 120 dB *Seismic Scale:* 0.20 in/s 5.08 mm/s

Bar Information *Bar Sample Interval:* 6 Minutes *Total Bar Samples:* 240 *Number of Bar Samples Shown:* 240



File: SN249719991203006.BAR Job Number: 006 Date Range: 2/5/2005 - 2/6/2005 Time Range: 00:05 - 00:05 Serial Number: 2497

Peak Amplitudes *Acoustic (A):* 0 dB *Seismic (S):* 0.0550in/s 1.397mm/s *Vector Sum (VS):* 0.0550in/s 1.397mm/s
Graph Information *Duration:* 0.0 day to 1.0 day *Acoustic Scale:* 120 dB *Seismic Scale:* 0.20 in/s 5.08 mm/s
Bar Information *Bar Sample Interval:* 6 Minutes *Total Bar Samples:* 240 *Number of Bar Samples Shown:* 240

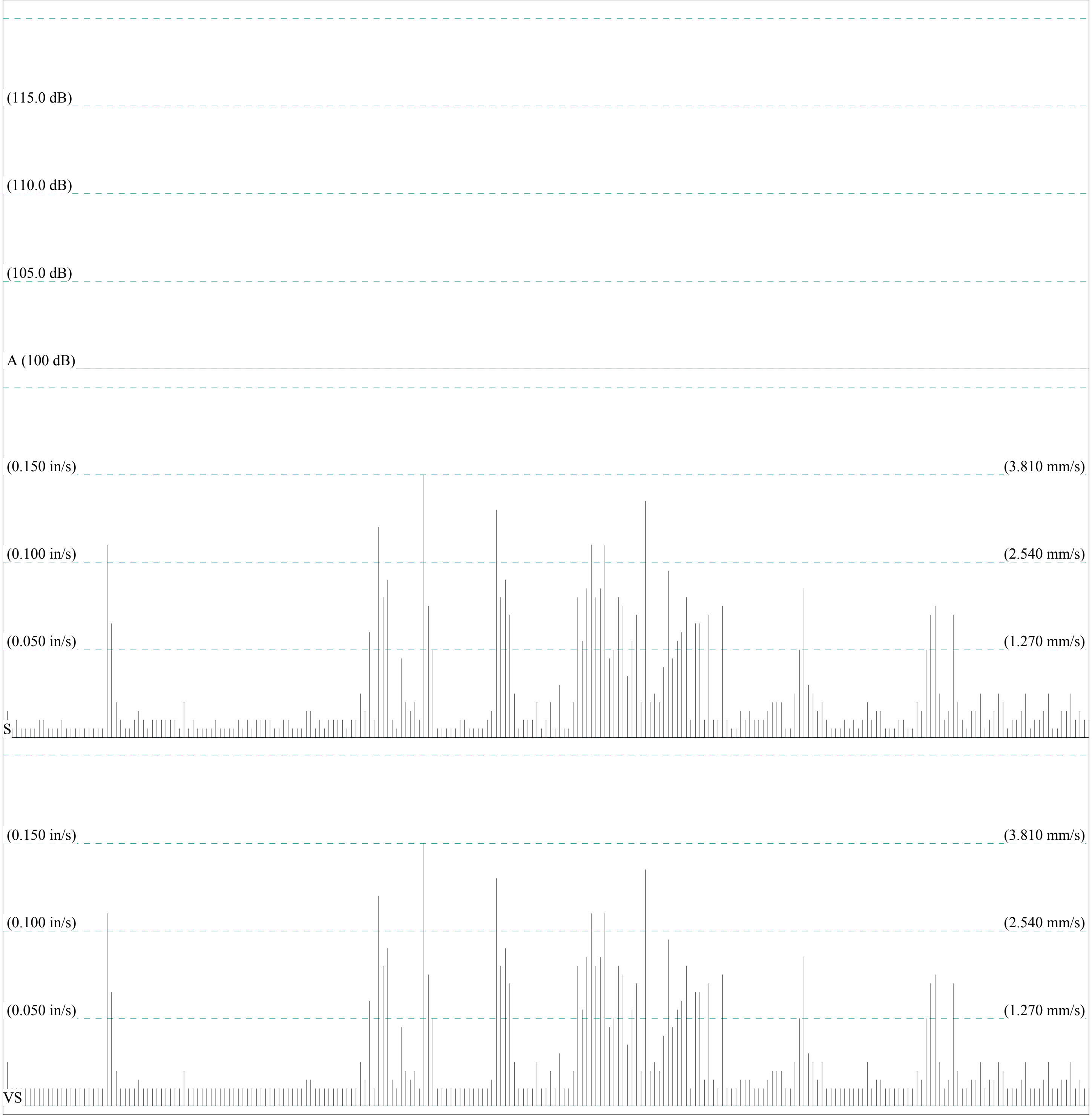


File: SN2497199912020005.BAR   Job Number: 005   Date Range: 2/4/2005 - 2/5/2005   Time Range: 00:05 - 00:05   Serial Number: 2497

Peak Amplitudes *Acoustic (A):* 0 dB   *Seismic (S):* 0.1500in/s 3.810mm/s   *Vector Sum (VS):* 0.1500in/s 3.810mm/s

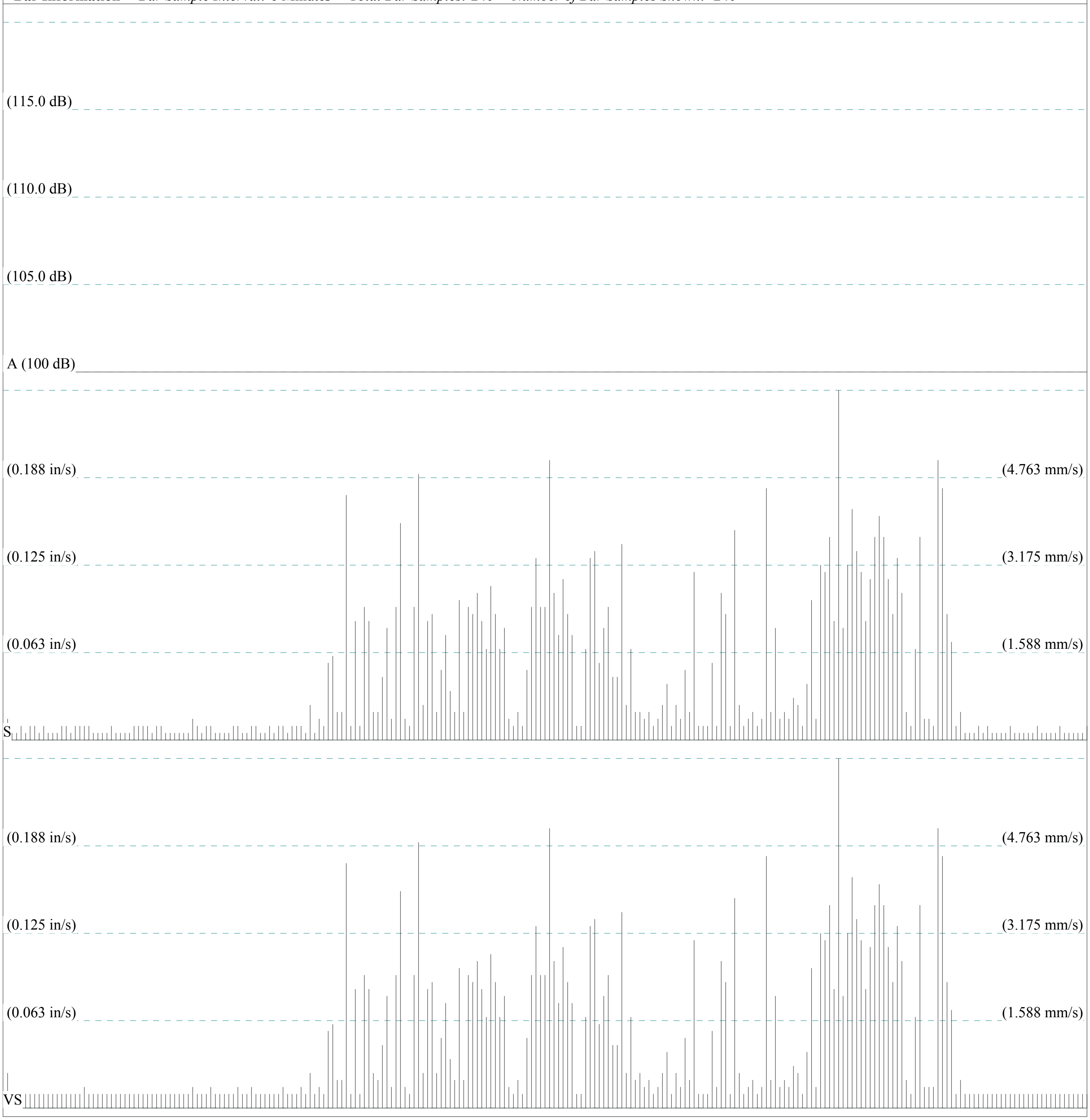
Graph Information *Duration:* 0.0 day to 1.0 day   *Acoustic Scale:* 120 dB *Seismic Scale:* 0.20 in/s 5.08 mm/s

Bar Information *Bar Sample Interval:* 6 Minutes   *Total Bar Samples:* 240   *Number of Bar Samples Shown:* 240



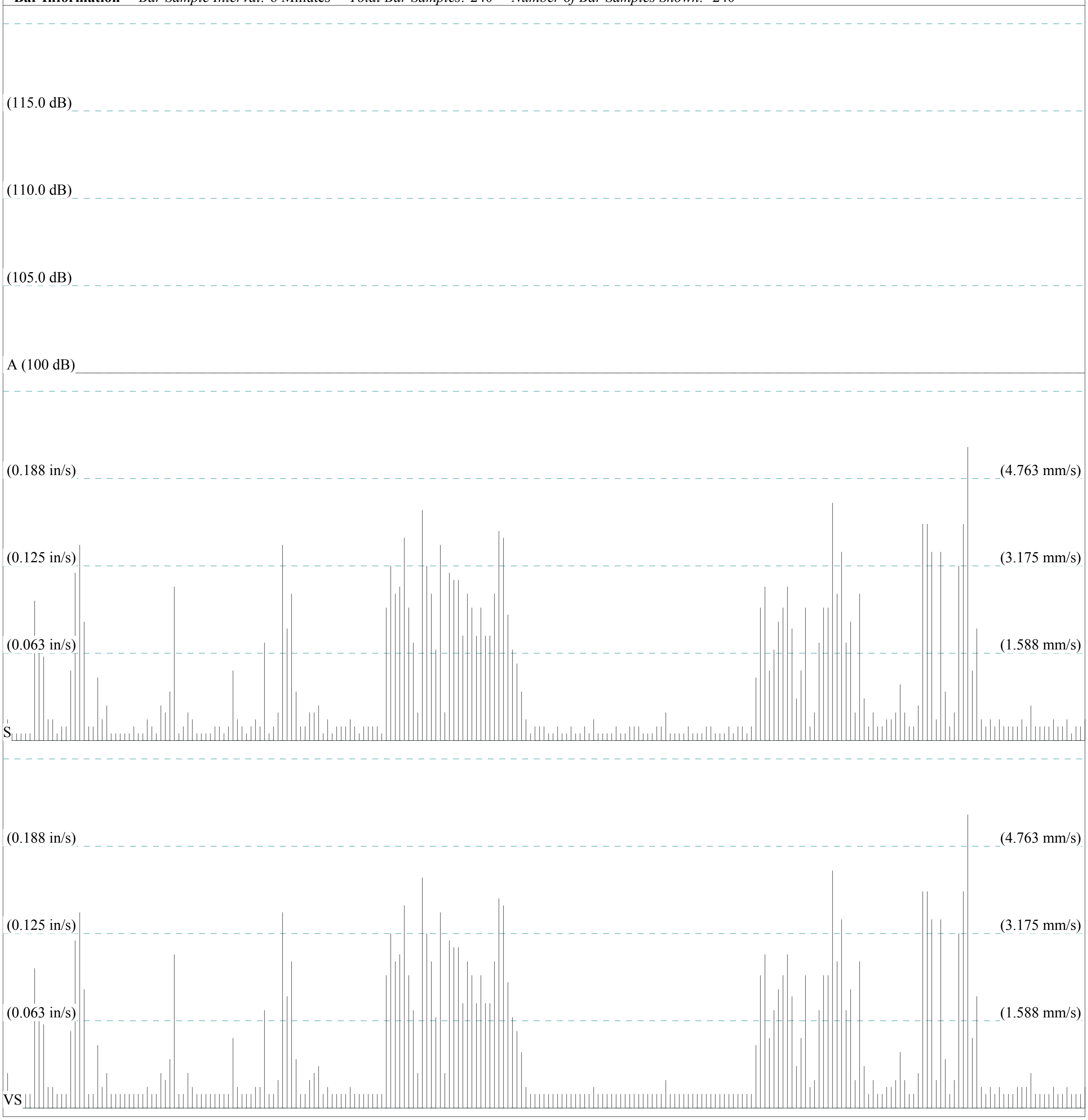
File: SN2497200301310003.BAR Job Number: 003 Date Range: 2/2/2005 - 2/3/2005 Time Range: 00:05 - 00:05 Serial Number: 2497

Peak Amplitudes *Acoustic (A):* 0 dB *Seismic (S):* 0.2500in/s 6.350mm/s *Vector Sum (VS):* 0.2500in/s 6.350mm/s
Graph Information *Duration:* 0.0 day to 1.0 day *Acoustic Scale:* 120 dB *Seismic Scale:* 0.25 in/s 6.35 mm/s
Bar Information *Bar Sample Interval:* 6 Minutes *Total Bar Samples:* 240 *Number of Bar Samples Shown:* 240



File: SN249720000731002.BAR Job Number: 002 Date Range: 2/1/2005 - 2/2/2005 Time Range: 00:05 - 00:05 Serial Number: 2497

Peak Amplitudes *Acoustic (A):* 0 dB *Seismic (S):* 0.2100in/s 5.334mm/s *Vector Sum (VS):* 0.2100in/s 5.334mm/s
Graph Information *Duration:* 0.0 day to 1.0 day *Acoustic Scale:* 120 dB *Seismic Scale:* 0.25 in/s 6.35 mm/s
Bar Information *Bar Sample Interval:* 6 Minutes *Total Bar Samples:* 240 *Number of Bar Samples Shown:* 240



Unit Located on Window Frame
Front Wall of House 13ft from Door
Vibration Caused By Front Door being Shut

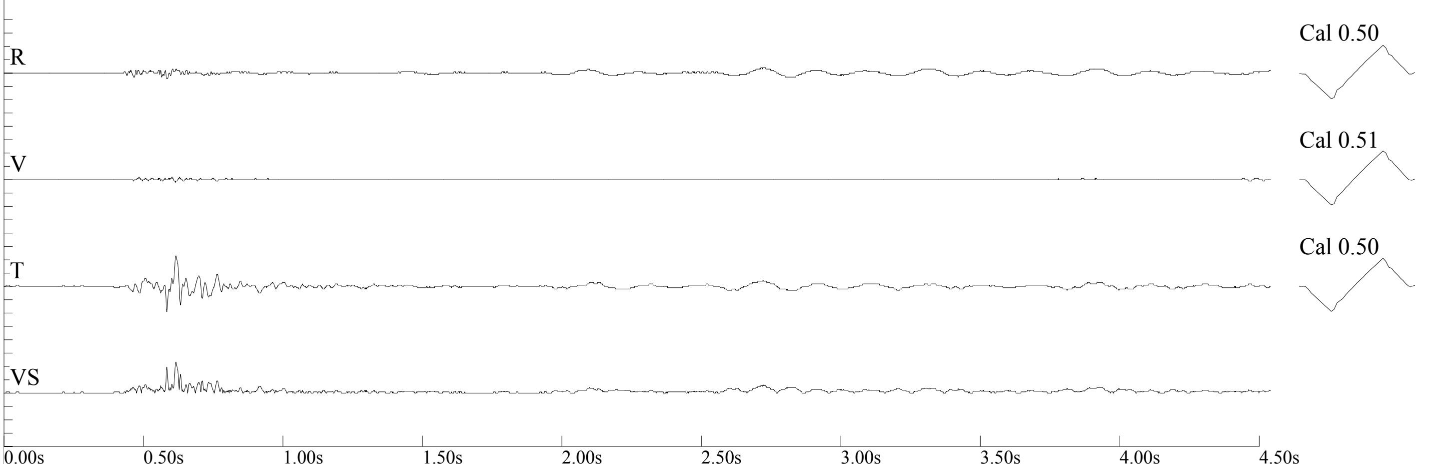
File Name: WINDOW DOOR SHUT000.DTB
Number: 000
Date: 3/28/2005
Time: 12:19
Serial Number: 1646
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 142 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.5

Amplitudes and Frequencies

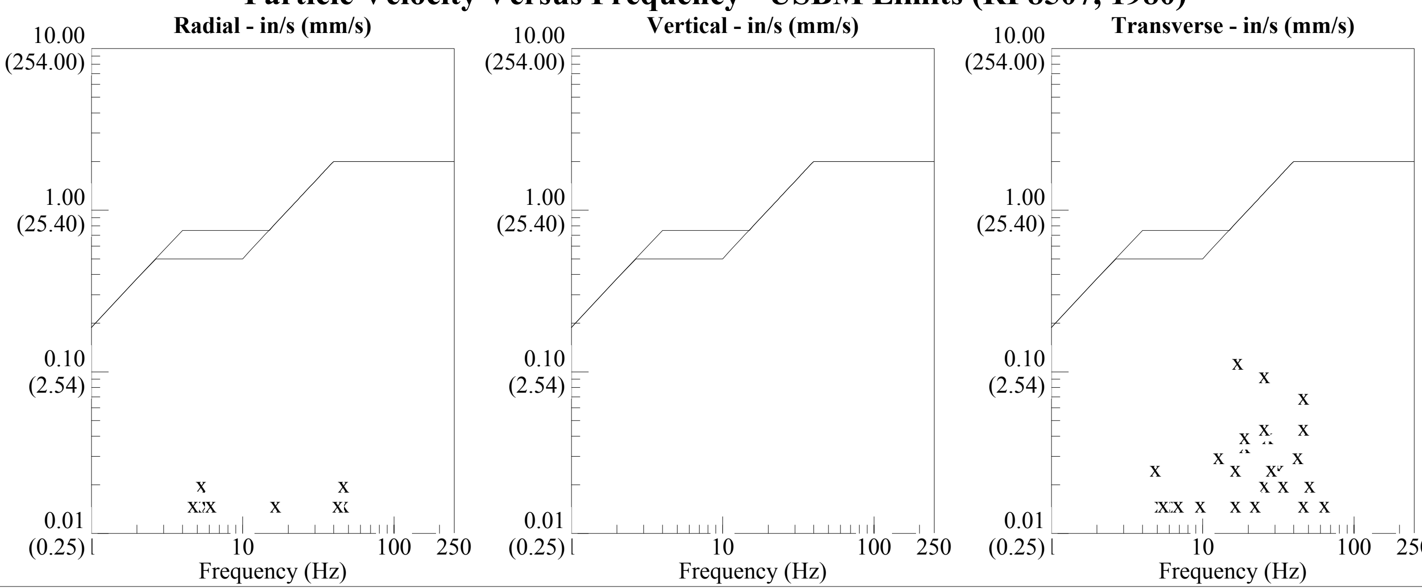
Radial: 0.02in/s 0.508mm/s @ 6.1Hz
Vertical: 0.01in/s 0.254mm/s @ 0.0Hz
***Transverse:* 0.115in/s 2.921mm/s @ 17.0Hz**
Vector Sum (VS): 0.115in/s 2.921mm/s
*Displacement:*0.000847in 0.021510mm
*Acceleration:*0.059627g's
*Calibration Date:*2/18/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
0.20in/s (0.050in/s/div) 5.08mm/s (1.270mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



TerraDinamica

Unit Located on Window Frame
Front Wall of House 13ft from Door
Vibration Caused By Front Door being Shut

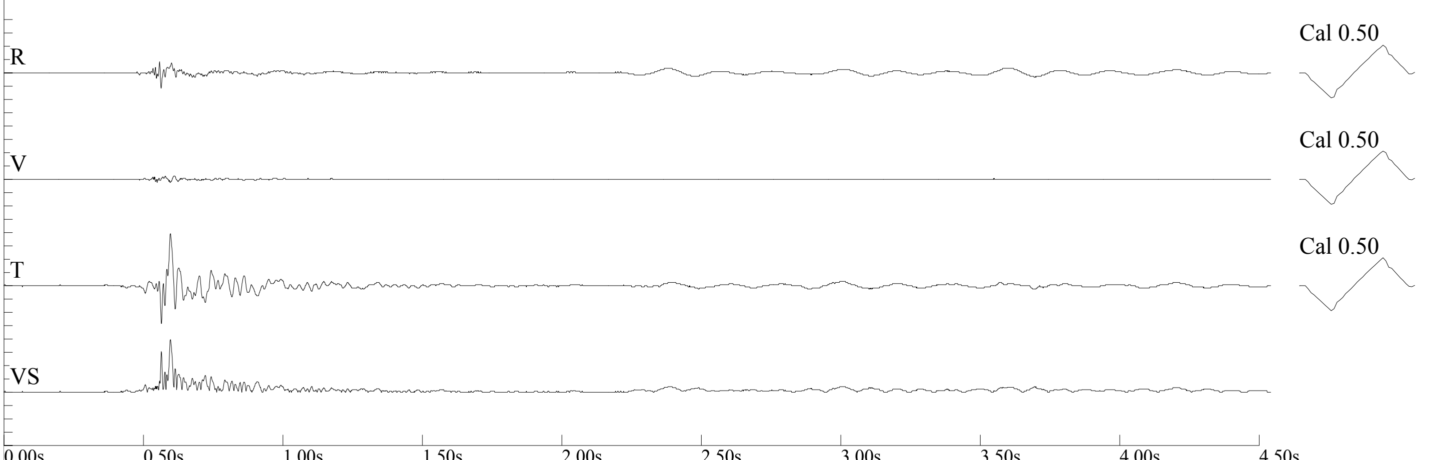
File Name: WINDOW DOOR SHUT002.DTB
Number: 002
Date: 3/28/2005
Time: 12:25
Serial Number: 1646
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 142 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.5

Amplitudes and Frequencies

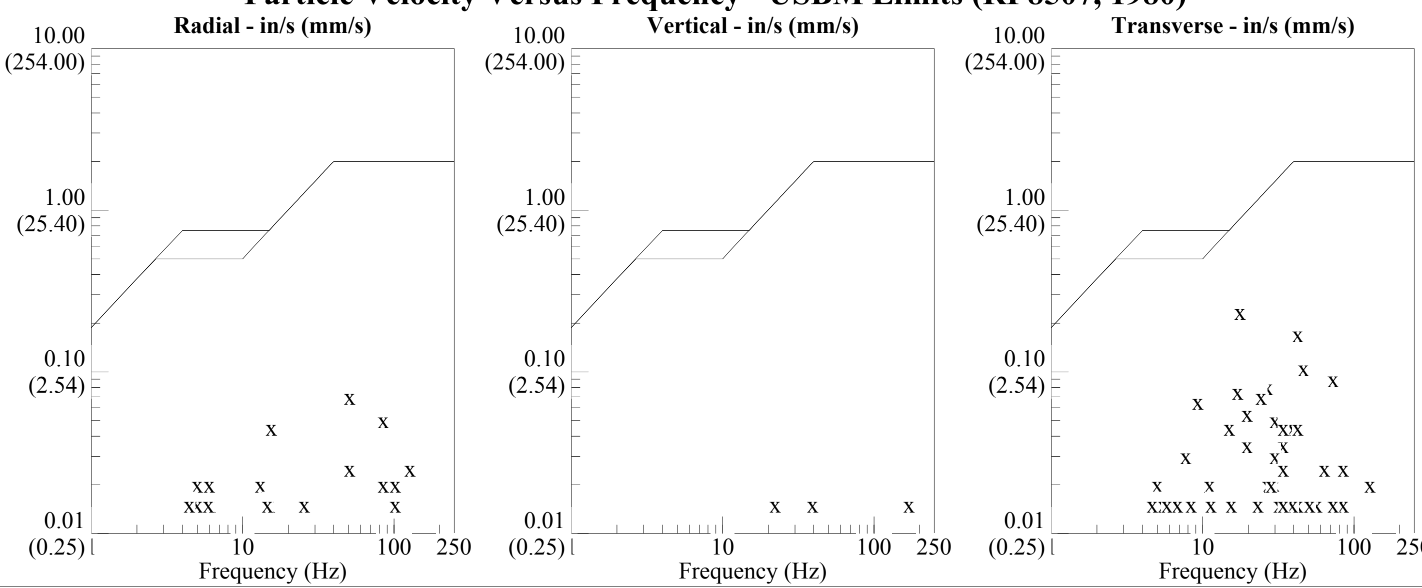
Radial: 0.07in/s 1.778mm/s @ 51.2Hz
Vertical: 0.015in/s 0.381mm/s @ 46.5Hz
***Transverse:* 0.235in/s 5.969mm/s @ 18.2Hz**
Vector Sum (VS): 0.235in/s 5.969mm/s
*Displacement:*0.001920in 0.048756mm
*Acceleration:*0.099379g's
*Calibration Date:*2/18/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
0.24in/s (0.060in/s/div) 6.10mm/s (1.524mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



TerraDinamica

Unit Located on Window Frame
Front Wall of House 13ft from Door
Vibration Caused By Front Door being Shut

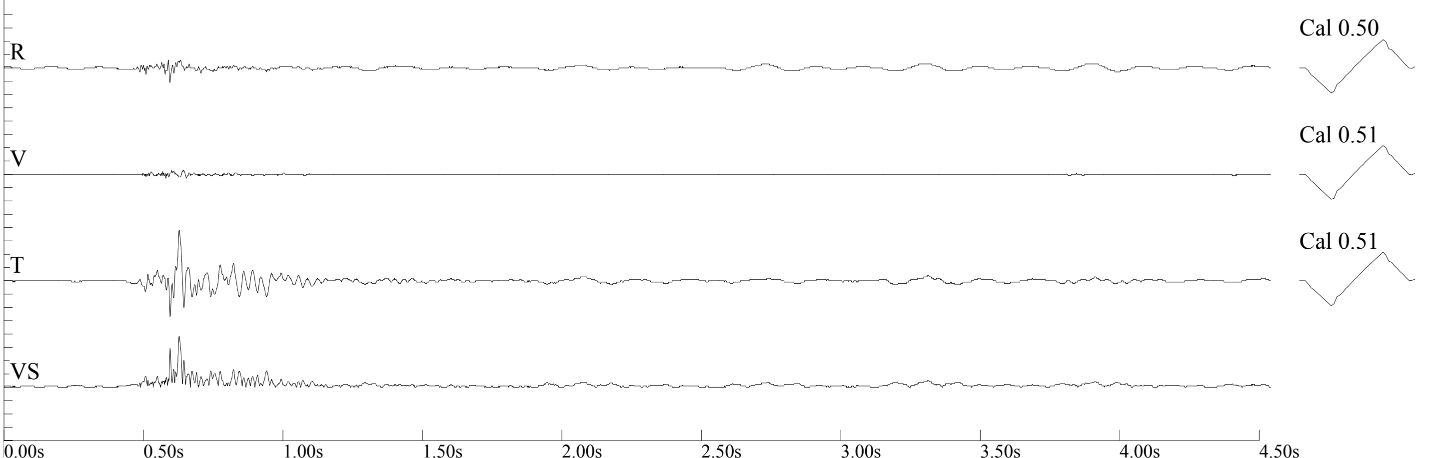
File Name: WINDOW DOOR SHUT001.DTB
Number: 001
Date: 3/28/2005
Time: 12:24
Serial Number: 1646
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 142 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.5

Amplitudes and Frequencies

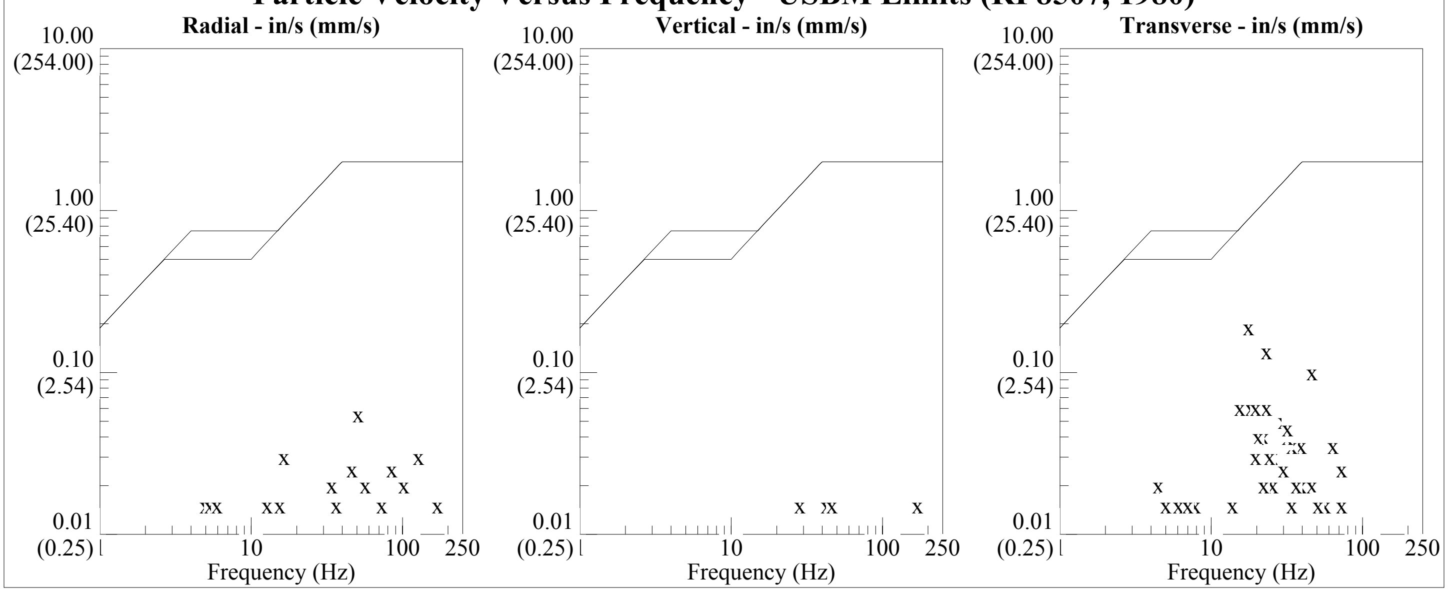
Radial: 0.055in/s 1.397mm/s @ 51.2Hz
Vertical: 0.015in/s 0.381mm/s @ 39.3Hz
***Transverse:* 0.19in/s 4.826mm/s @ 17.6Hz**
Vector Sum (VS): 0.19in/s 4.826mm/s
*Displacement:*0.001386in 0.035202mm
*Acceleration:*0.086128g's
*Calibration Date:*2/18/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
0.20in/s (0.050in/s/div) 5.08mm/s (1.270mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located on Window Frame
Front Wall of House 13ft from Door
Vibration Caused By Front Door being Shut

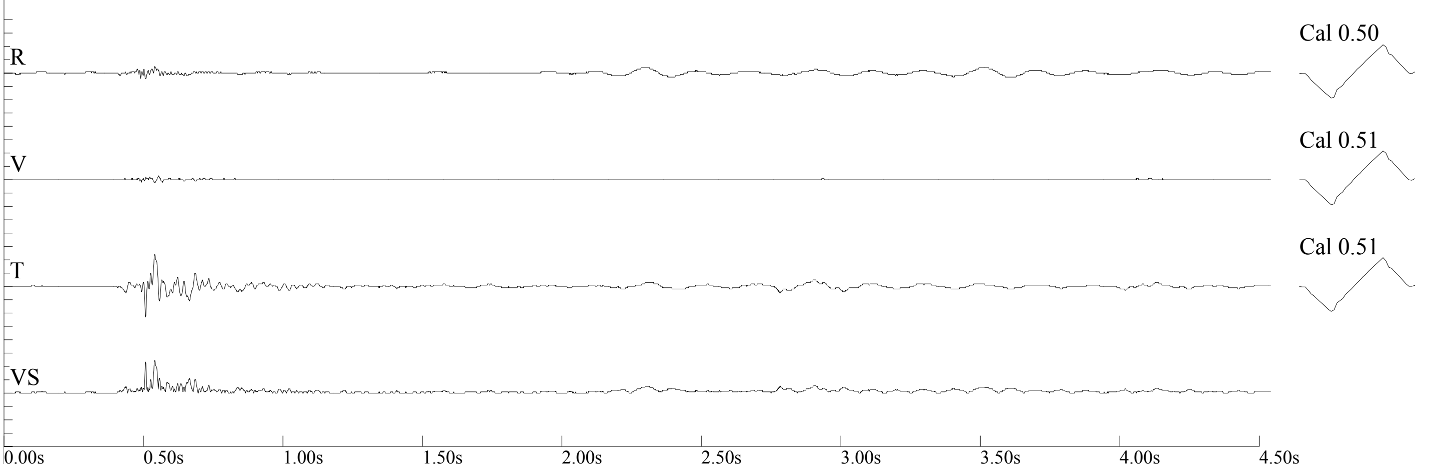
File Name: WINDOW DOOR SHUT004.DTB
Number: 004
Date: 3/28/2005
Time: 12:25
Serial Number: 1646
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 142 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.5

Amplitudes and Frequencies

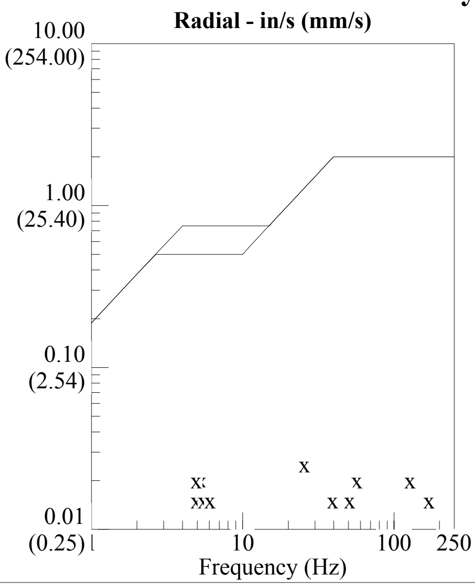
Radial: 0.025in/s 0.635mm/s @ 26.9Hz
Vertical: 0.015in/s 0.381mm/s @ 42.6Hz
***Transverse:* 0.12in/s 3.048mm/s @ 23.2Hz**
Vector Sum (VS): 0.125in/s 3.175mm/s
*Displacement:*0.000970in 0.024631mm
*Acceleration:*0.079503g's
*Calibration Date:*2/18/2005

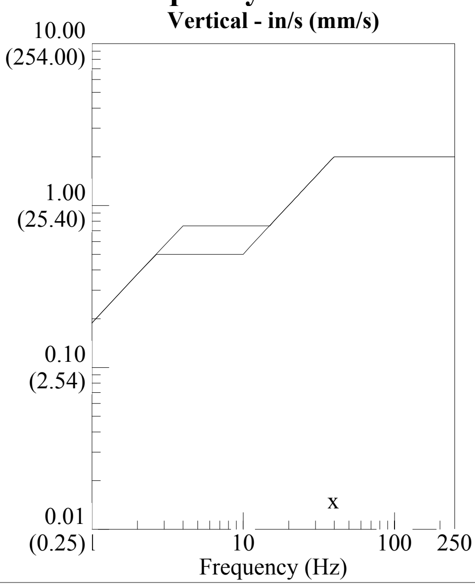
Graph Information

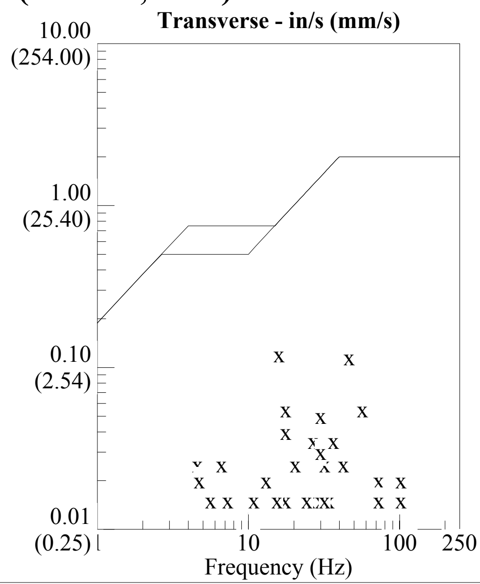
*Duration:*0.000s To: 4.500s
Seismic Scale:
0.20in/s (0.050in/s/div) 5.08mm/s (1.270mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)

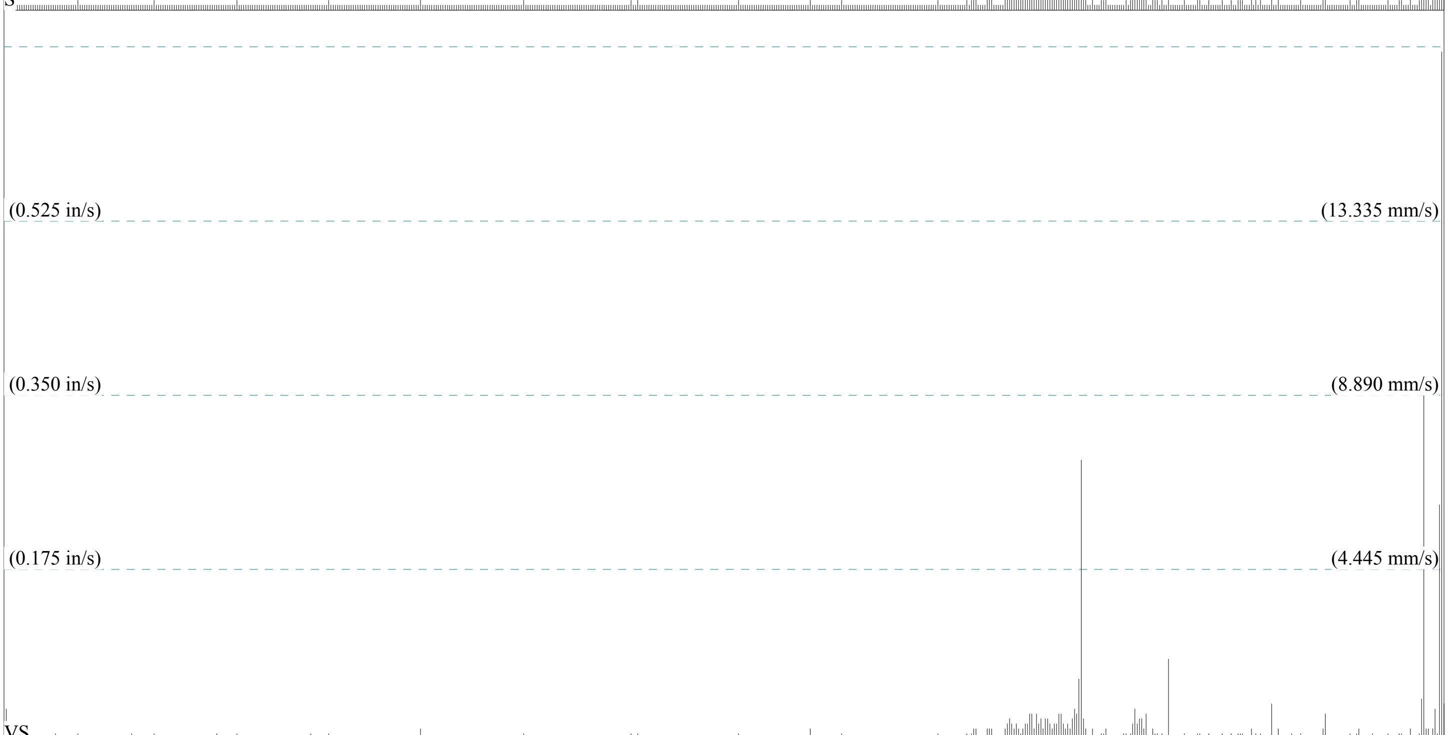






File: WALL 10FT FROM FRONT DOOR003.BAR Job Number: 003 Date Range: 3/22/2005 - 3/22/2005 Time Range: 00:00 - 10:43 Serial Number: 1646

Peak Amplitudes *Seismic (S):* 0.6400in/s 16.256mm/s *Vector Sum (VS):* 0.6950in/s 17.653mm/s
Graph Information *Duration:* 0.0 hr to 10.7 hr *Seismic Scale:* 0.70 in/s 17.78 mm/s
Bar Information *Bar Sample Interval:* 1 Minute *Total Bar Samples:* 643 *Number of Bar Samples Shown:* 643



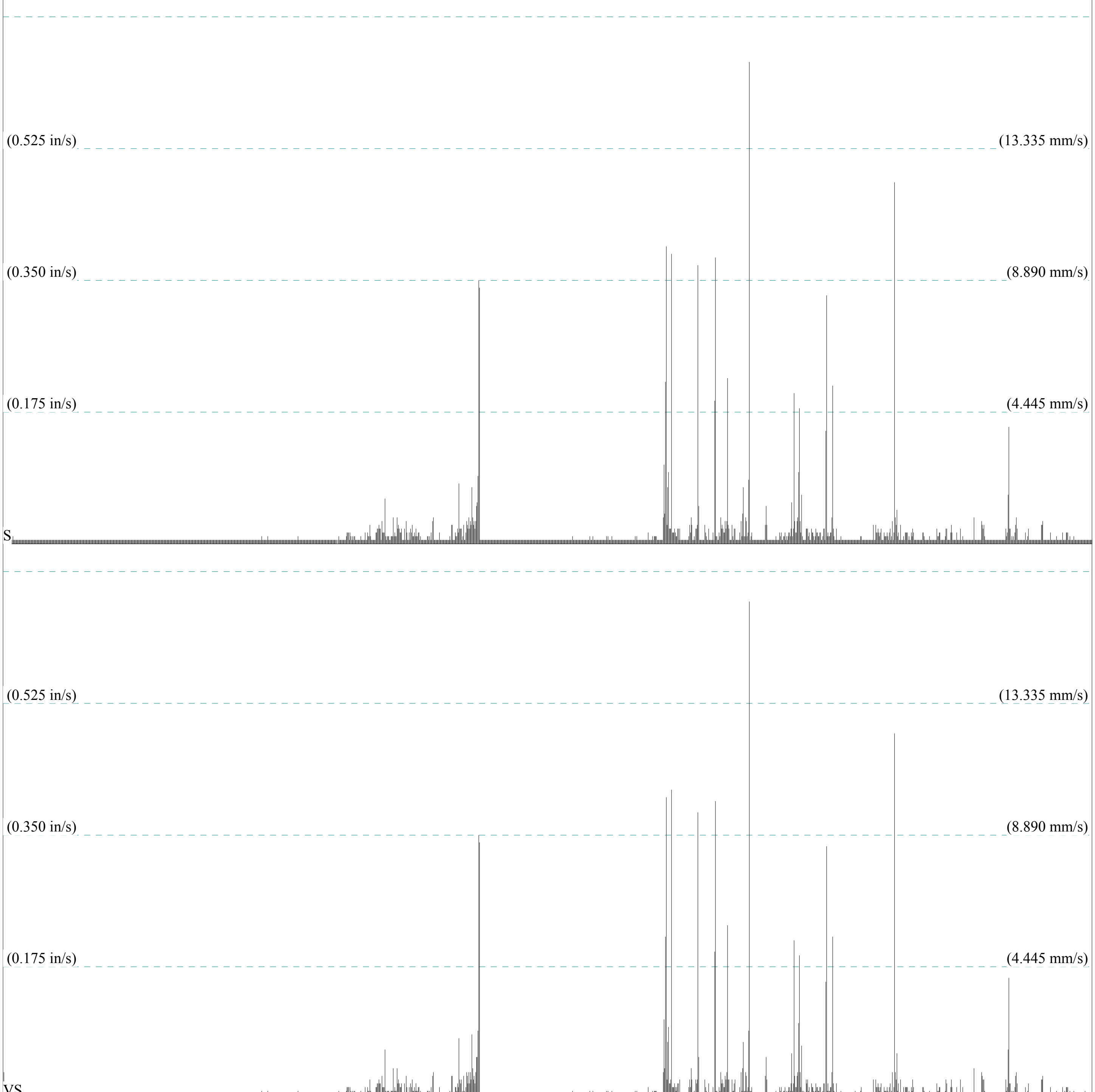
Last Calibration Date: 10/3/2003

File: WALL 10FT FROM FRONT DOOR002.BAR Job Number: 002 Date Range: 3/21/2005 - 3/22/2005 Time Range: 00:00 - 00:00 Serial Number: 1646

Peak Amplitudes *Seismic (S):* 0.6400in/s 16.256mm/s *Vector Sum (VS):* 0.6600in/s 16.764mm/s

Graph Information *Duration:* 0.0 day to 1.0 day *Seismic Scale:* 0.70 in/s 17.78 mm/s

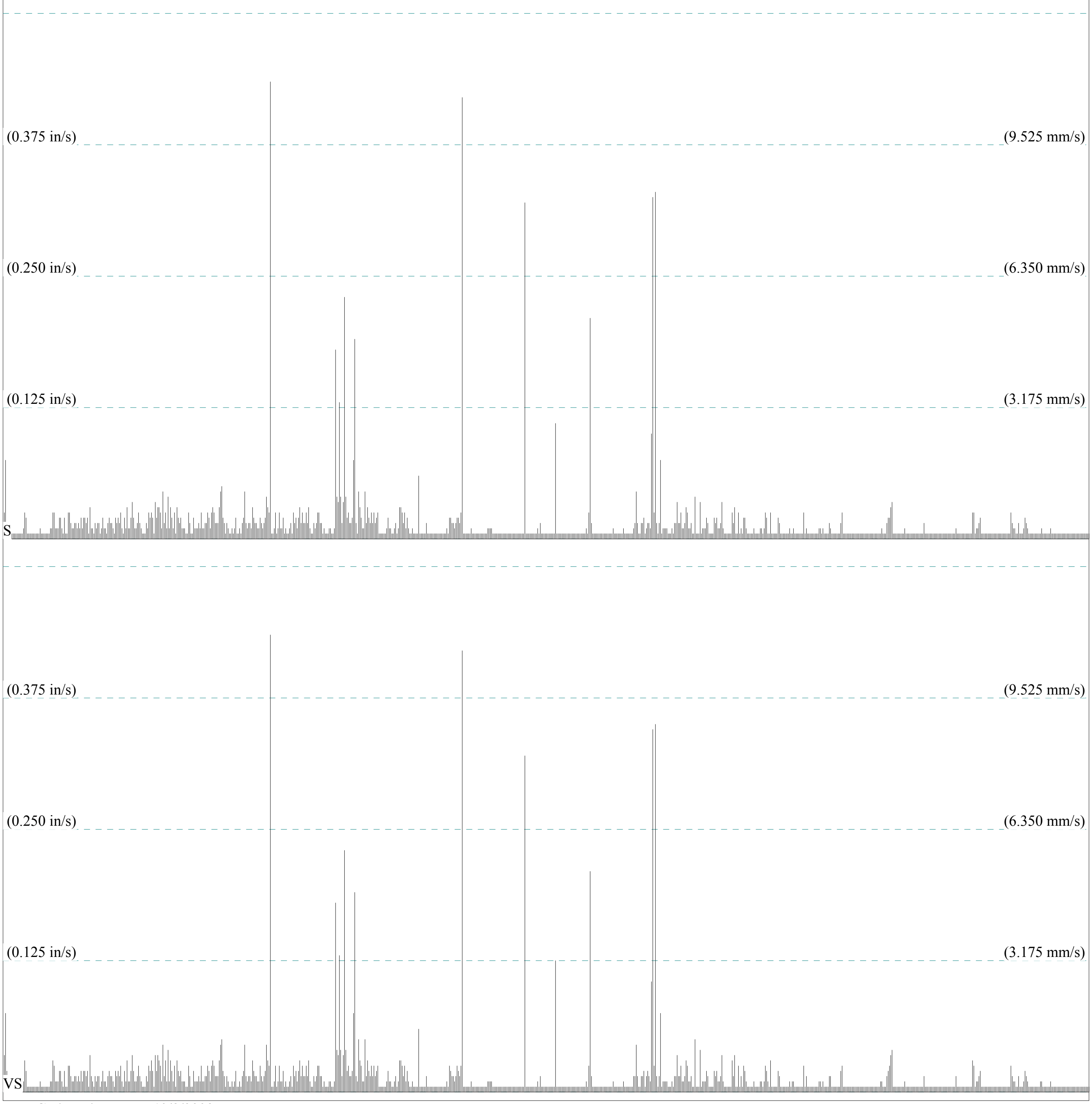
Bar Information *Bar Sample Interval:* 1 Minute *Total Bar Samples:* 1440 *Number of Bar Samples Shown:* 1440



Last Calibration Date: 10/3/2003

File: WALL 10FT FROM FRONT DOOR001.BAR Job Number: 001 Date Range: 3/20/2005 - 3/21/2005 Time Range: 09:51 - 00:00 Serial Number: 1646

Peak Amplitudes *Seismic (S):* 0.4350in/s 11.049mm/s *Vector Sum (VS):* 0.4350in/s 11.049mm/s
Graph Information *Duration:* 0.0 hr to 14.2 hr *Seismic Scale:* 0.50 in/s 12.70 mm/s
Bar Information *Bar Sample Interval:* 1 Minute *Total Bar Samples:* 849 *Number of Bar Samples Shown:* 849



Last Calibration Date: 10/3/2003

Unit Located on floor
Walking within 3ft of sensor

File Name: WALK_3FT010.DTB
Number: 010
Date: 3/19/2005
Time: 13:23
Serial Number: 1644
Seismic Trigger: 0.0100 in/s 0.2540 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

Radial: 0.01in/s 0.254mm/s @ 0.0Hz

***Vertical:* 0.205in/s 5.207mm/s @ 20.4Hz**

Transverse: 0.01in/s 0.254mm/s @ 0.0Hz

Vector Sum (VS): 0.205in/s 5.207mm/s

*Displacement:*0.002698in 0.068540mm

*Acceleration:*0.092754g's

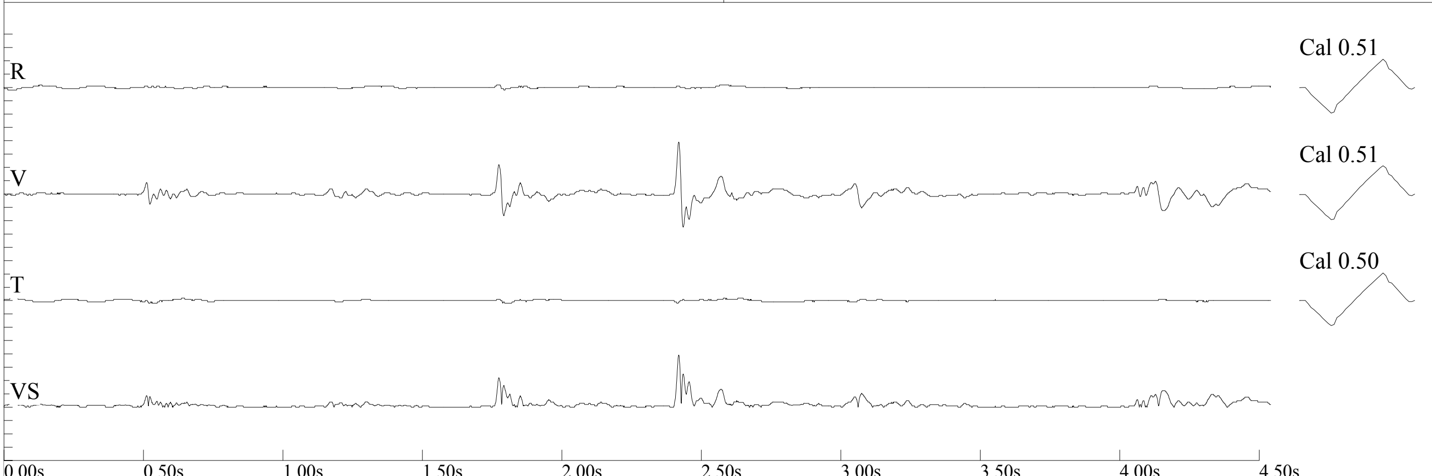
*Calibration Date:*2/16/2005

Graph Information

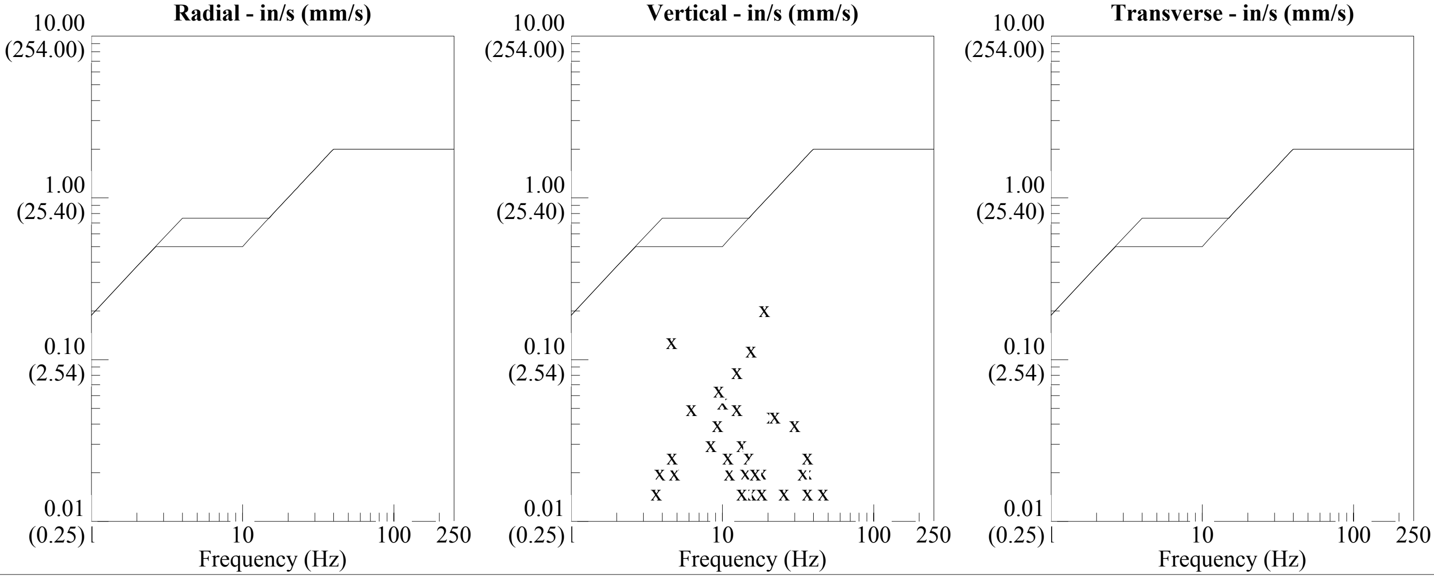
*Duration:*0.000s To: 4.500s

Seismic Scale:
0.21in/s (0.053in/s/div) 5.33mm/s (1.334mm/s/div)

*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located on floor
Walking within 3ft of sensor

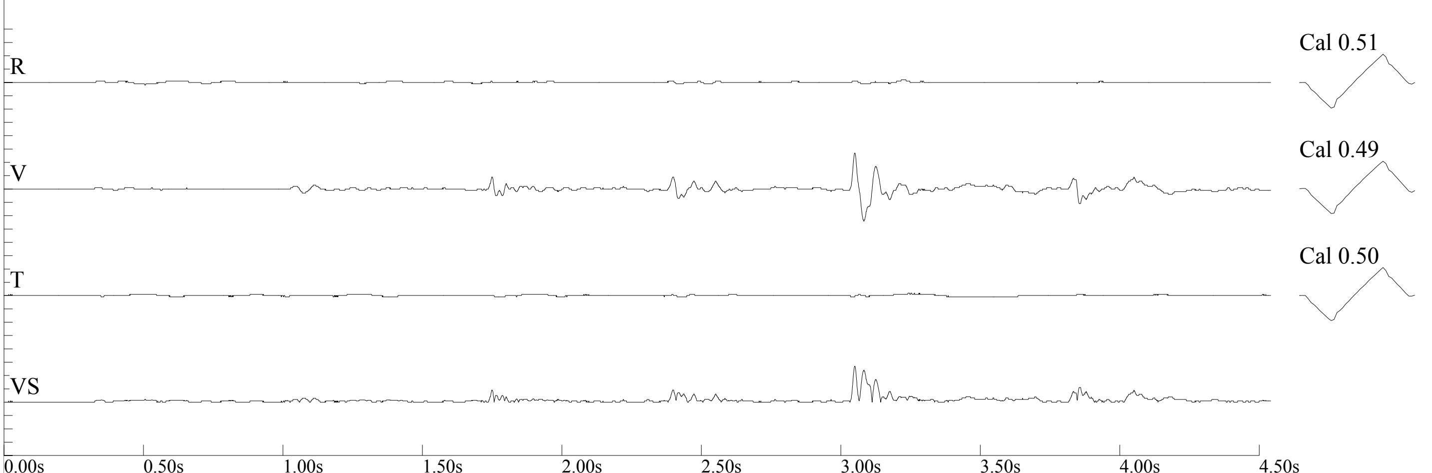
File Name: WALK_3FT013.DTB
Number: 013
Date: 3/19/2005
Time: 13:24
Serial Number: 1644
Seismic Trigger: 0.0100 in/s 0.2540 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

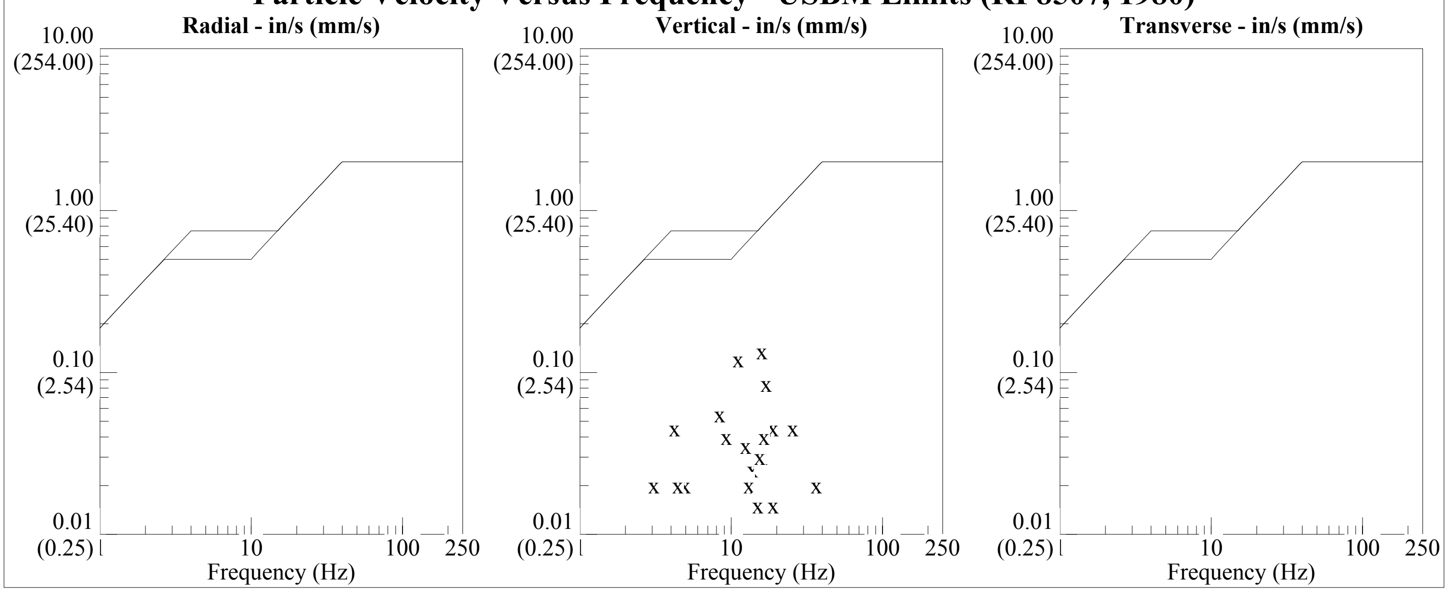
Radial: 0.01in/s 0.254mm/s @ 0.0Hz
***Vertical:* 0.135in/s 3.429mm/s @ 17.0Hz**
Transverse: 0.01in/s 0.254mm/s @ 0.0Hz
Vector Sum (VS): 0.135in/s 3.429mm/s
*Displacement:*0.001785in 0.045332mm
*Acceleration:*0.033126g's
*Calibration Date:*2/16/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
0.20in/s (0.050in/s/div) 5.08mm/s (1.270mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



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Unit Located on floor
Walking within 3ft of sensor

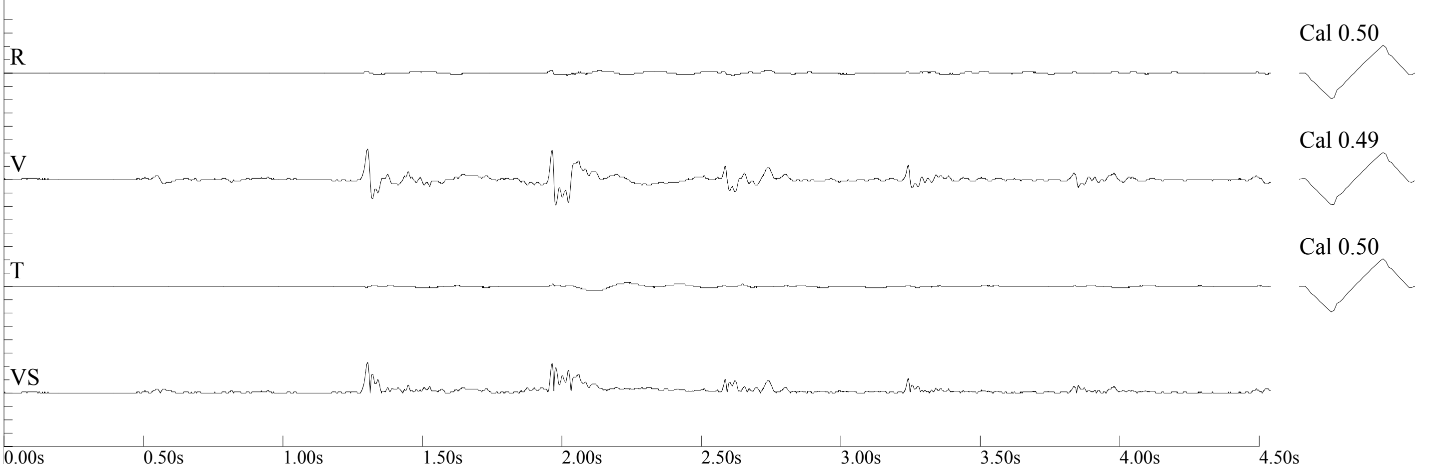
File Name: WALK_3FT014.DTB
Number: 014
Date: 3/19/2005
Time: 13:24
Serial Number: 1644
Seismic Trigger: 0.0100 in/s 0.2540 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

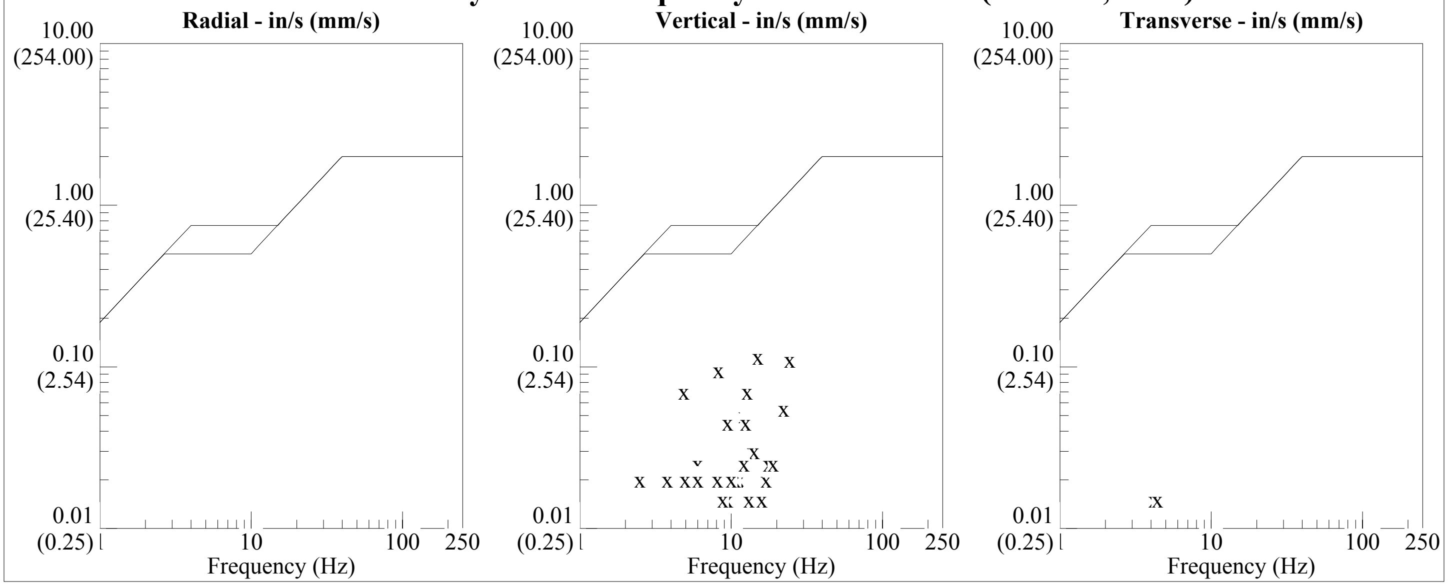
Radial: 0.01in/s 0.254mm/s @ 0.0Hz
***Vertical:* 0.115in/s 2.921mm/s @ 16.5Hz**
Transverse: 0.015in/s 0.381mm/s @ 5.0Hz
Vector Sum (VS): 0.115in/s 2.921mm/s
*Displacement:*0.002667in 0.067745mm
*Acceleration:*0.072878g's
*Calibration Date:*2/16/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
0.20in/s (0.050in/s/div) 5.08mm/s (1.270mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located Above Door
Door Slammed

File Name: ABOVE-DOOR_SLAM011.DTB
Number: 011
Date: 3/19/2005
Time: 14:00
Serial Number: 1644
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

Radial: 1.02in/s 25.908mm/s @ 7.6Hz

***Vertical:* 2.56in/s 65.024mm/s @ 170.6Hz**

***Transverse:* 2.56in/s 65.024mm/s @ 85.3Hz**

Vector Sum (VS): 3.635in/s 92.329mm/s

*Displacement:*0.022368in 0.568137mm

*Acceleration:*6.333747g's

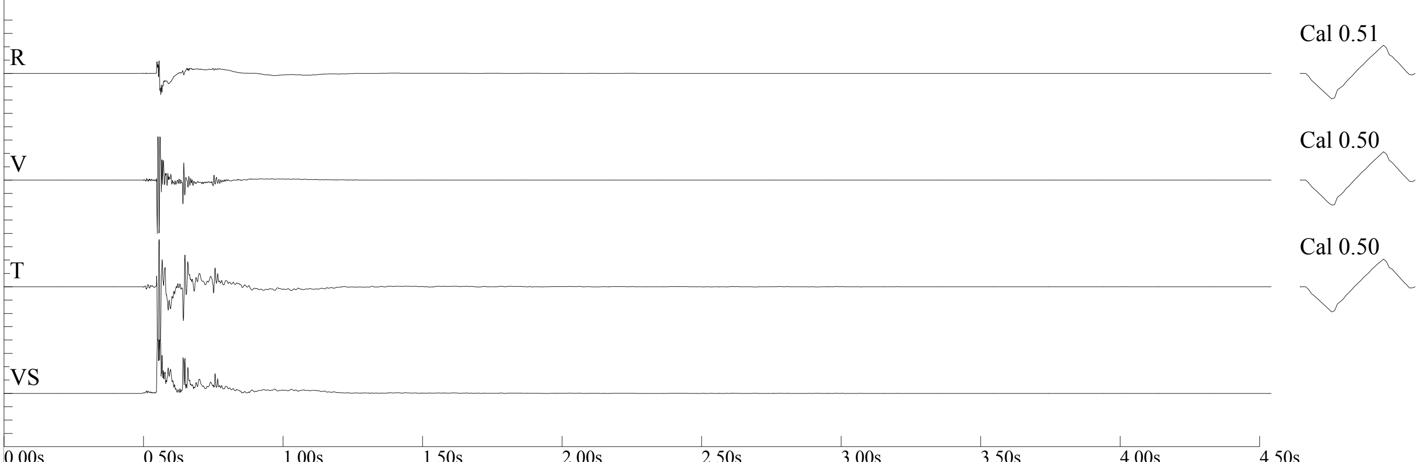
*Calibration Date:*2/16/2005

Graph Information

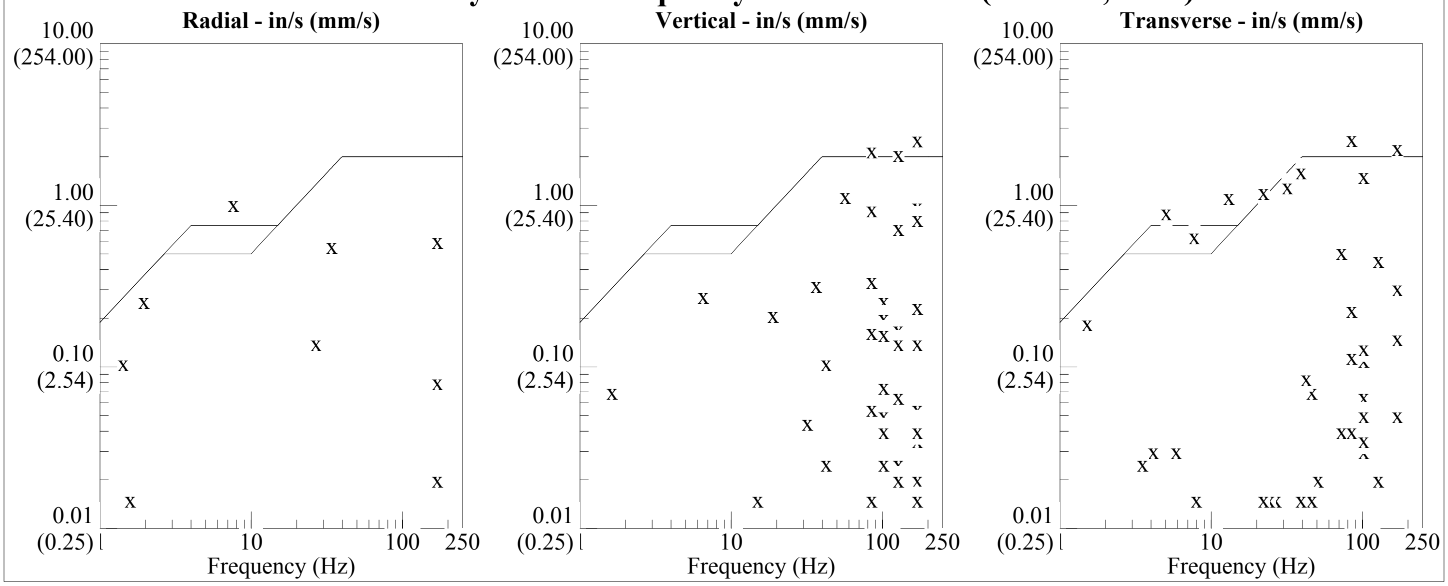
*Duration:*0.000s To: 4.500s

Seismic Scale:
2.56in/s (0.640in/s/div) 65.02mm/s (16.256mm/s/div)

*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



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Unit Located Above Door
Door Slammed

File Name: ABOVE-DOOR_SLAM012.DTB
Number: 012
Date: 3/19/2005
Time: 14:00
Serial Number: 1644
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

Radial: 0.92in/s 23.368mm/s @ 32.0Hz

***Vertical:* 2.56in/s 65.024mm/s @ 128.0Hz**

***Transverse:* 2.56in/s 65.024mm/s @ 73.1Hz**

Vector Sum (VS): 3.65in/s 92.71mm/s

*Displacement:*0.022755in 0.577969mm

*Acceleration:*6.307246g's

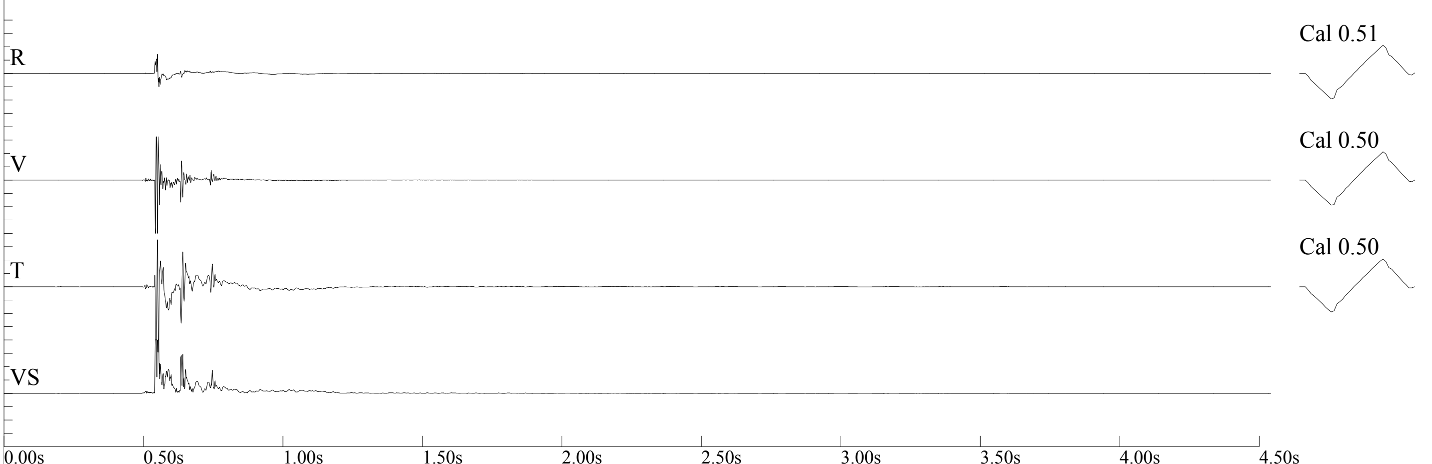
*Calibration Date:*2/16/2005

Graph Information

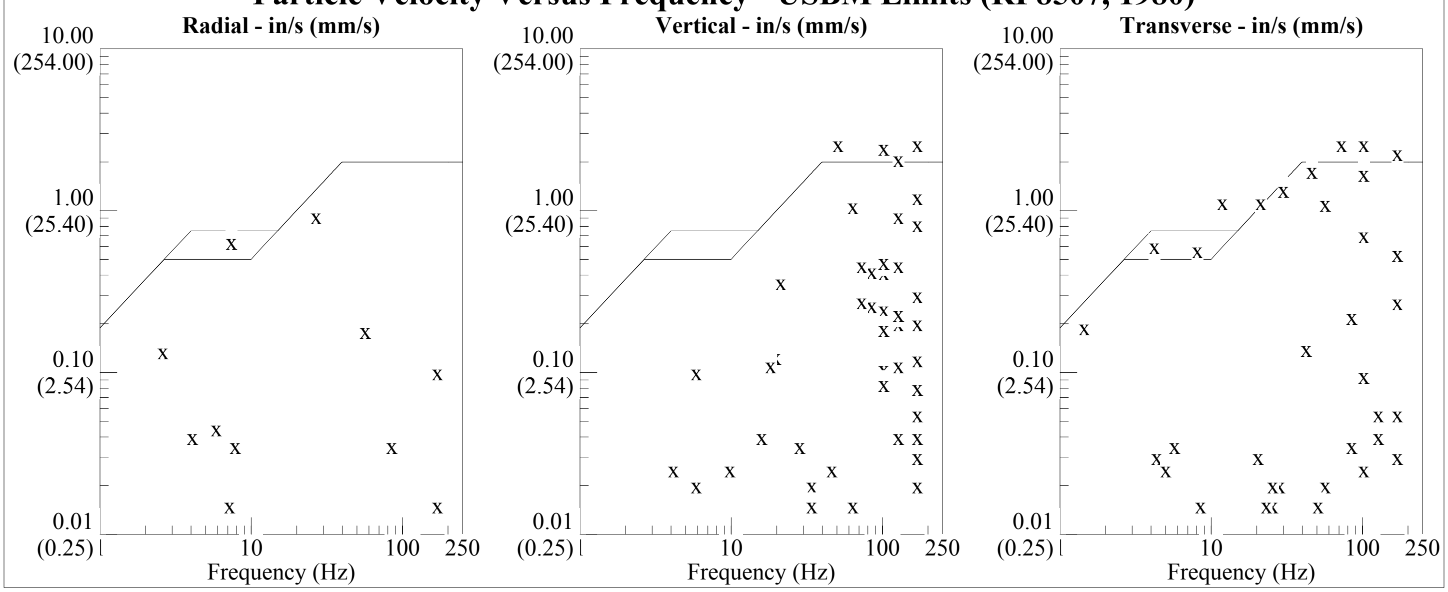
*Duration:*0.000s To: 4.500s

Seismic Scale:
2.56in/s (0.640in/s/div) 65.02mm/s (16.256mm/s/div)

*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located Above Door
Door Slammed

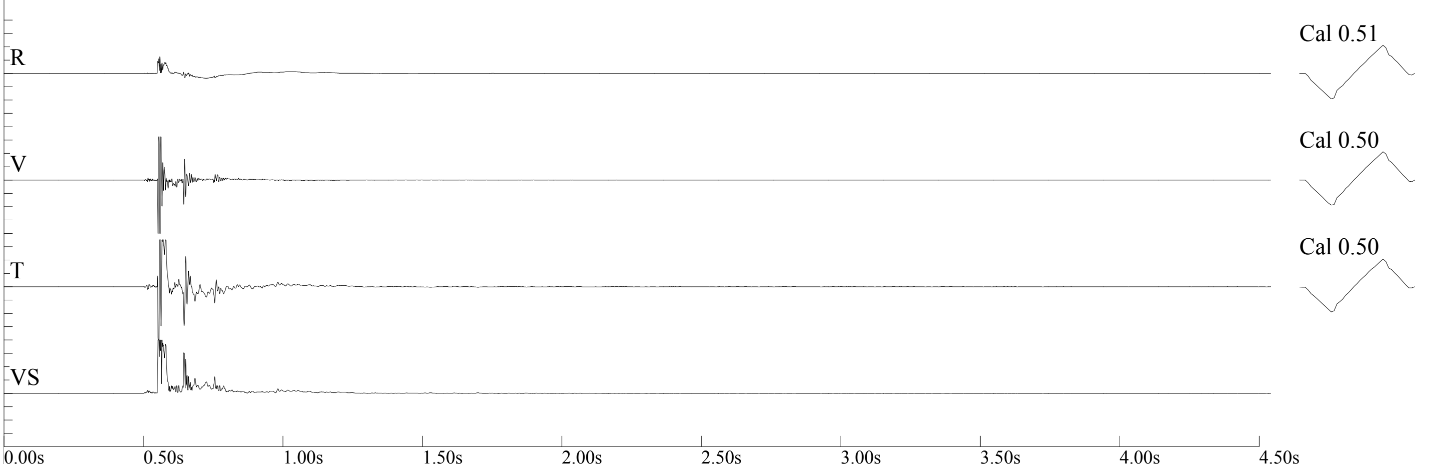
File Name: ABOVE-DOOR_SLAM013.DTB
Number: 013
Date: 3/19/2005
Time: 14:00
Serial Number: 1644
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

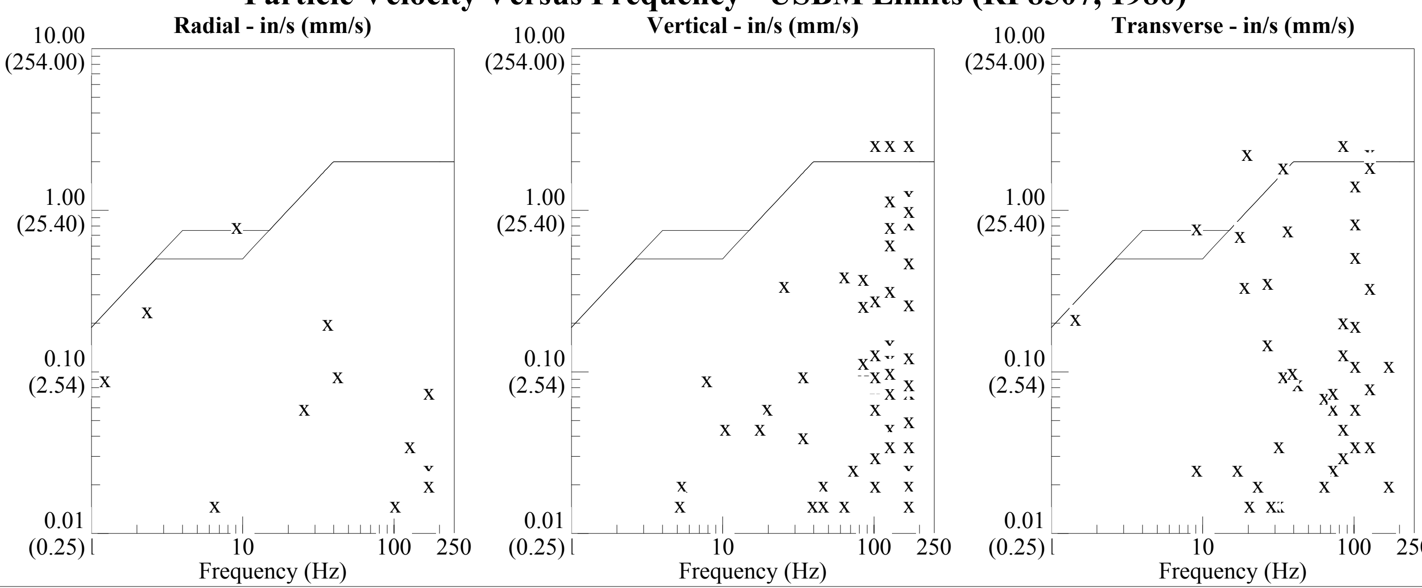
Radial: 0.80in/s 20.32mm/s @ 10.2Hz
***Vertical:* 2.56in/s 65.024mm/s @ 170.6Hz**
***Transverse:* 2.56in/s 65.024mm/s @ 85.3Hz**
Vector Sum (VS): 3.655in/s 92.837mm/s
*Displacement:*0.021725in 0.551821mm
*Acceleration:*6.333747g's
*Calibration Date:*2/16/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
2.56in/s (0.640in/s/div) 65.02mm/s (16.256mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located Above Door
Door Slammed

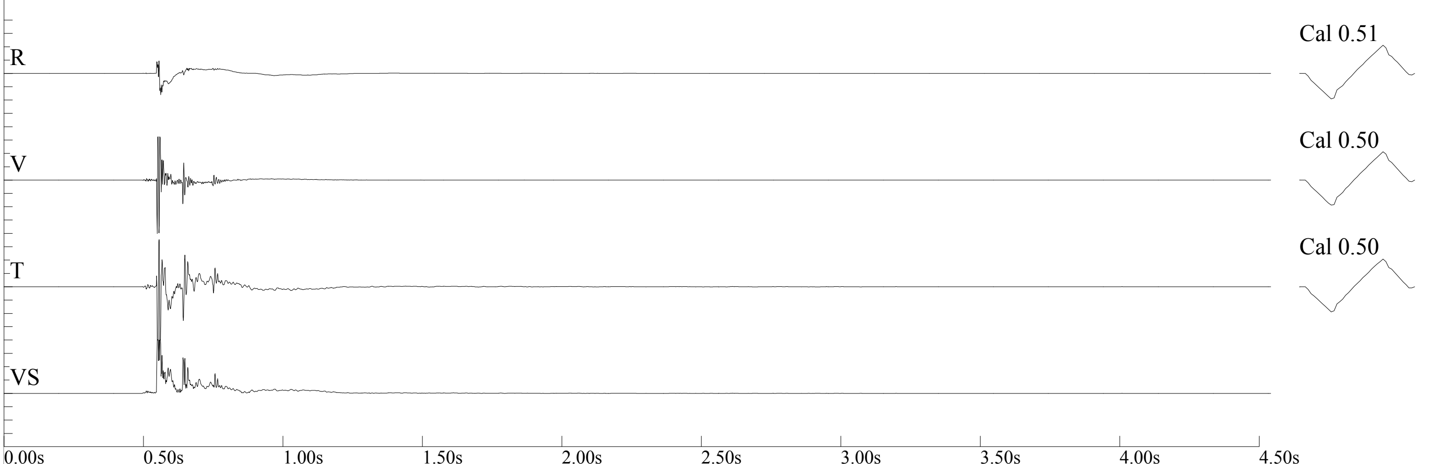
File Name: ABOVE-DOOR_SLAM011.DTB
Number: 011
Date: 3/19/2005
Time: 14:00
Serial Number: 1644
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

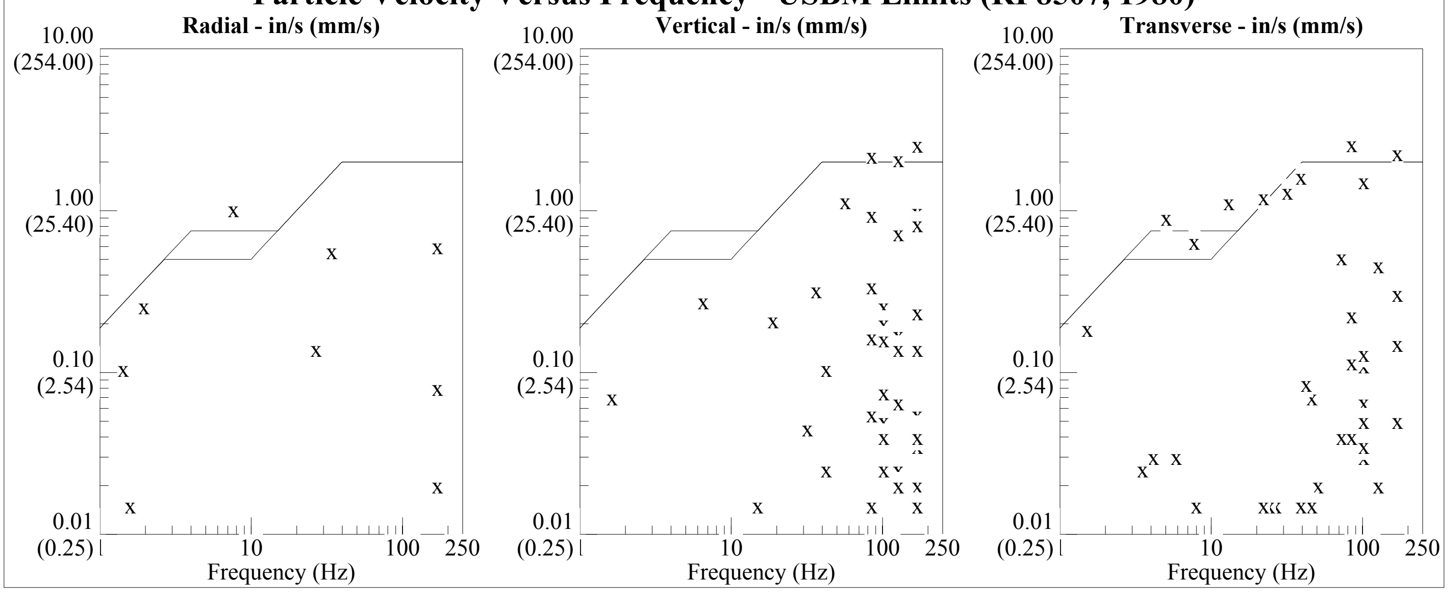
Radial: 1.02in/s 25.908mm/s @ 7.6Hz
***Vertical:* 2.56in/s 65.024mm/s @ 170.6Hz**
***Transverse:* 2.56in/s 65.024mm/s @ 85.3Hz**
Vector Sum (VS): 3.635in/s 92.329mm/s
*Displacement:*0.022368in 0.568137mm
*Acceleration:*6.333747g's
*Calibration Date:*2/16/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
2.56in/s (0.640in/s/div) 65.02mm/s (16.256mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located Above Door
Door Slammed

File Name: ABOVE-DOOR_SLAM012.DTB
Number: 012
Date: 3/19/2005
Time: 14:00
Serial Number: 1644
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

Radial: 0.92in/s 23.368mm/s @ 32.0Hz

***Vertical:* 2.56in/s 65.024mm/s @ 128.0Hz**

***Transverse:* 2.56in/s 65.024mm/s @ 73.1Hz**

Vector Sum (VS): 3.65in/s 92.71mm/s

*Displacement:*0.022755in 0.577969mm

*Acceleration:*6.307246g's

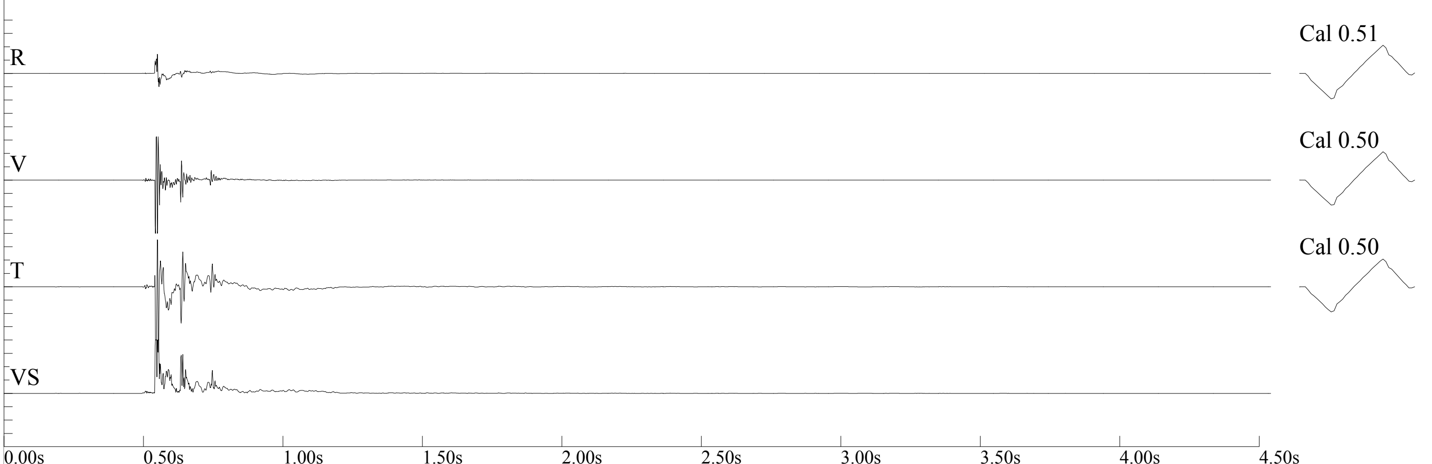
*Calibration Date:*2/16/2005

Graph Information

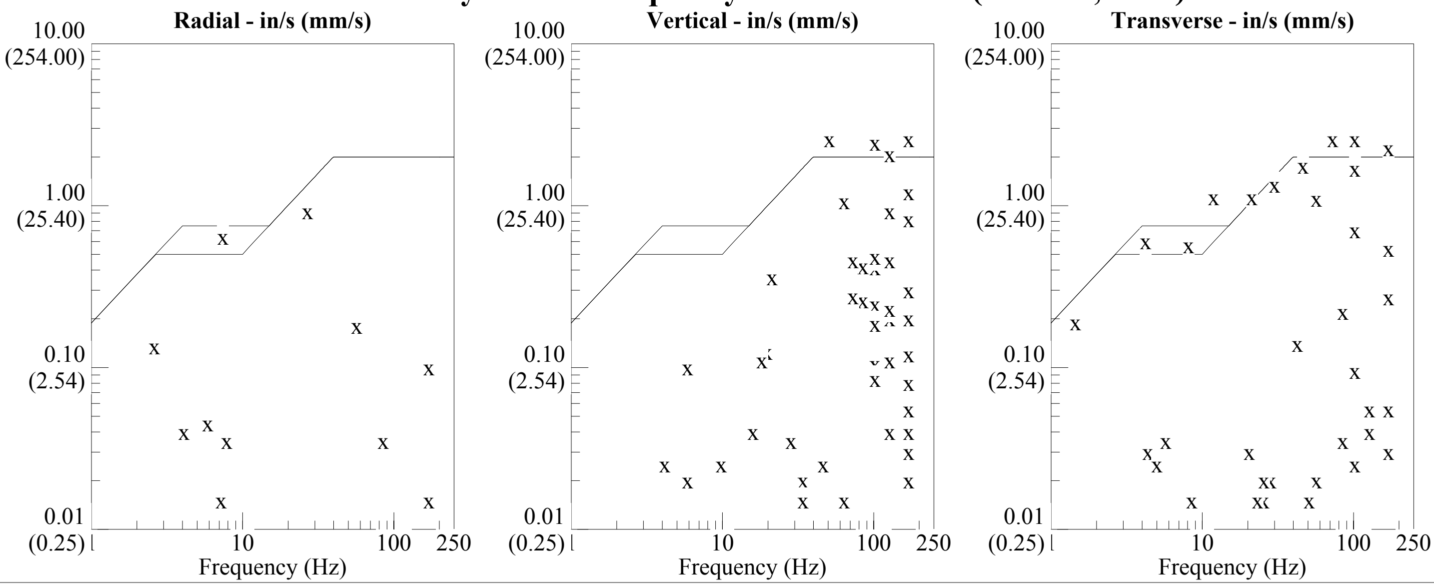
*Duration:*0.000s To: 4.500s

Seismic Scale:
2.56in/s (0.640in/s/div) 65.02mm/s (16.256mm/s/div)

*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located Above Door
Door Slammed

File Name: ABOVE-DOOR_SLAM013.DTB
Number: 013
Date: 3/19/2005
Time: 14:00
Serial Number: 1644
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

Radial: 0.80in/s 20.32mm/s @ 10.2Hz

***Vertical:* 2.56in/s 65.024mm/s @ 170.6Hz**

***Transverse:* 2.56in/s 65.024mm/s @ 85.3Hz**

Vector Sum (VS): 3.655in/s 92.837mm/s

*Displacement:*0.021725in 0.551821mm

*Acceleration:*6.333747g's

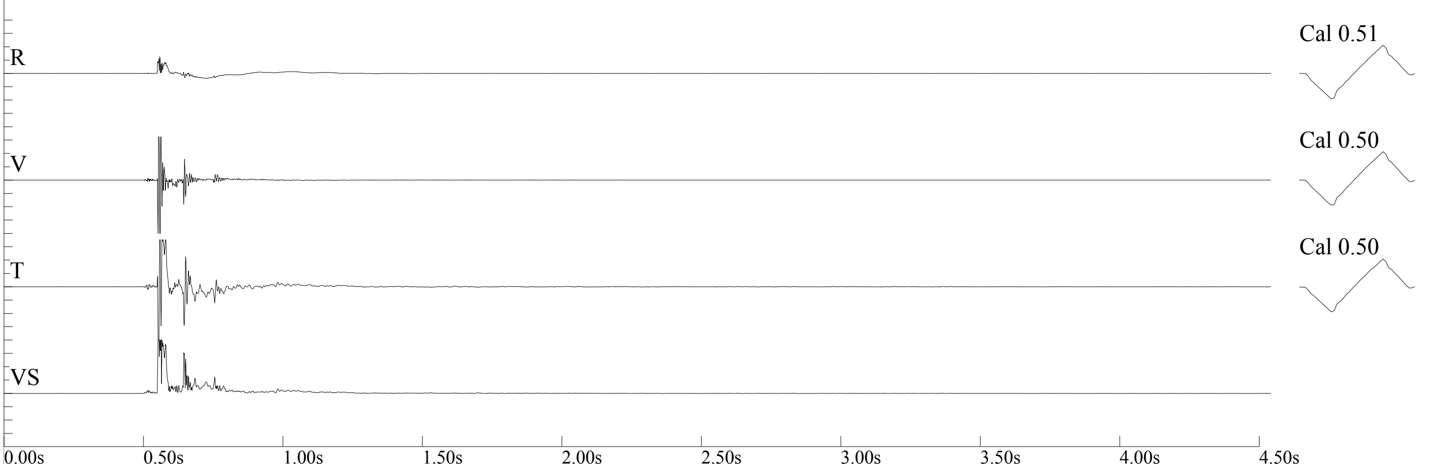
*Calibration Date:*2/16/2005

Graph Information

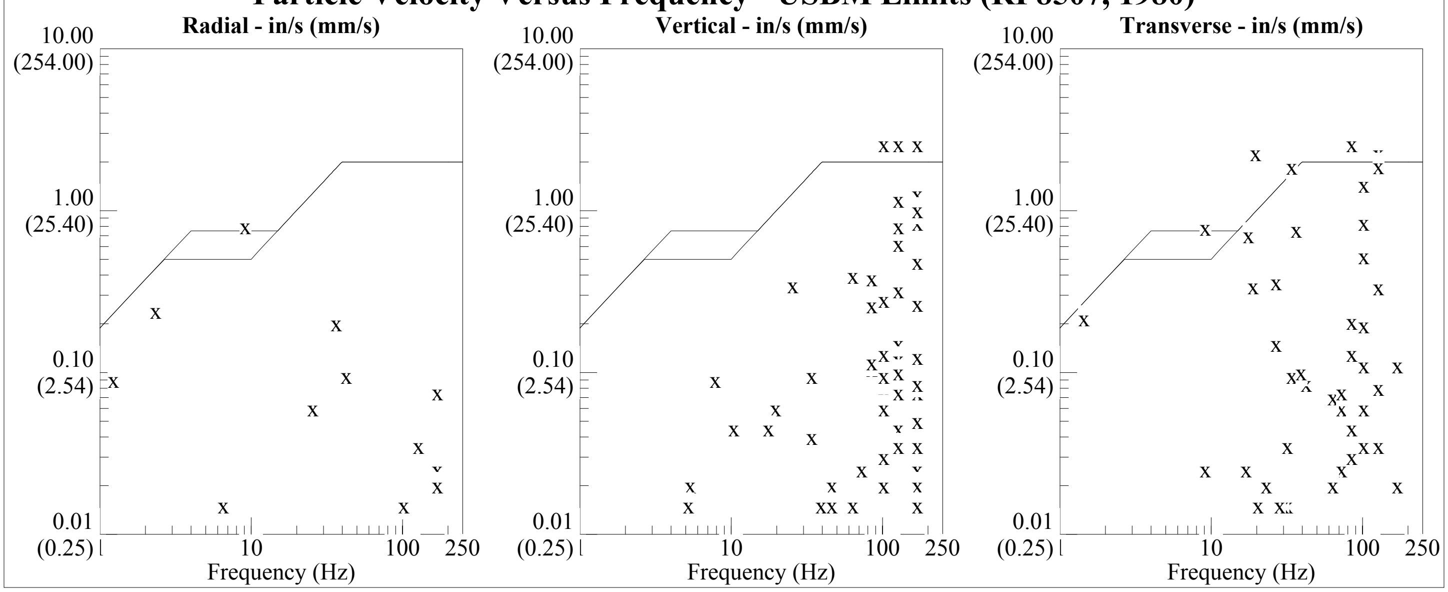
*Duration:*0.000s To: 4.500s

Seismic Scale:
2.56in/s (0.640in/s/div) 65.02mm/s (16.256mm/s/div)

*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located on Floor 6 inches from Door
Door Slammed

File Name: DOOR_SLAM003.DTB
Number: 003
Date: 3/19/2005
Time: 13:18
Serial Number: 1644
Seismic Trigger: 0.0250 in/s 0.6350 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

Radial: 0.115in/s 2.921mm/s @ 85.3Hz

***Vertical:* 0.265in/s 6.731mm/s @ 64.0Hz**

Transverse: 0.04in/s 1.016mm/s @ 10.8Hz

Vector Sum (VS): 0.27in/s 6.858mm/s

*Displacement:*0.001066in 0.027082mm

*Acceleration:*0.430642g's

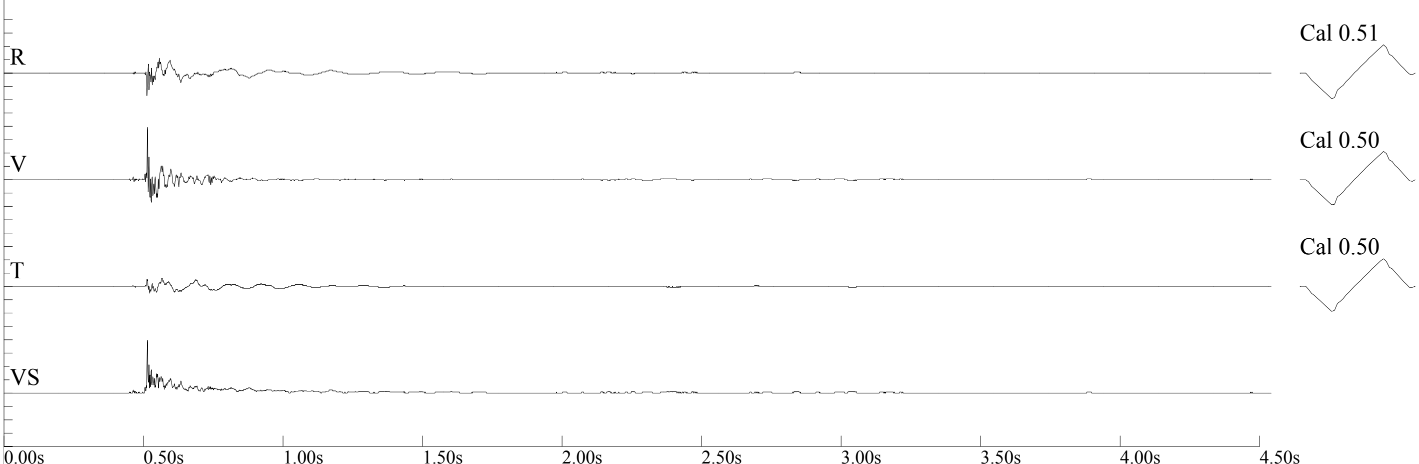
*Calibration Date:*2/16/2005

Graph Information

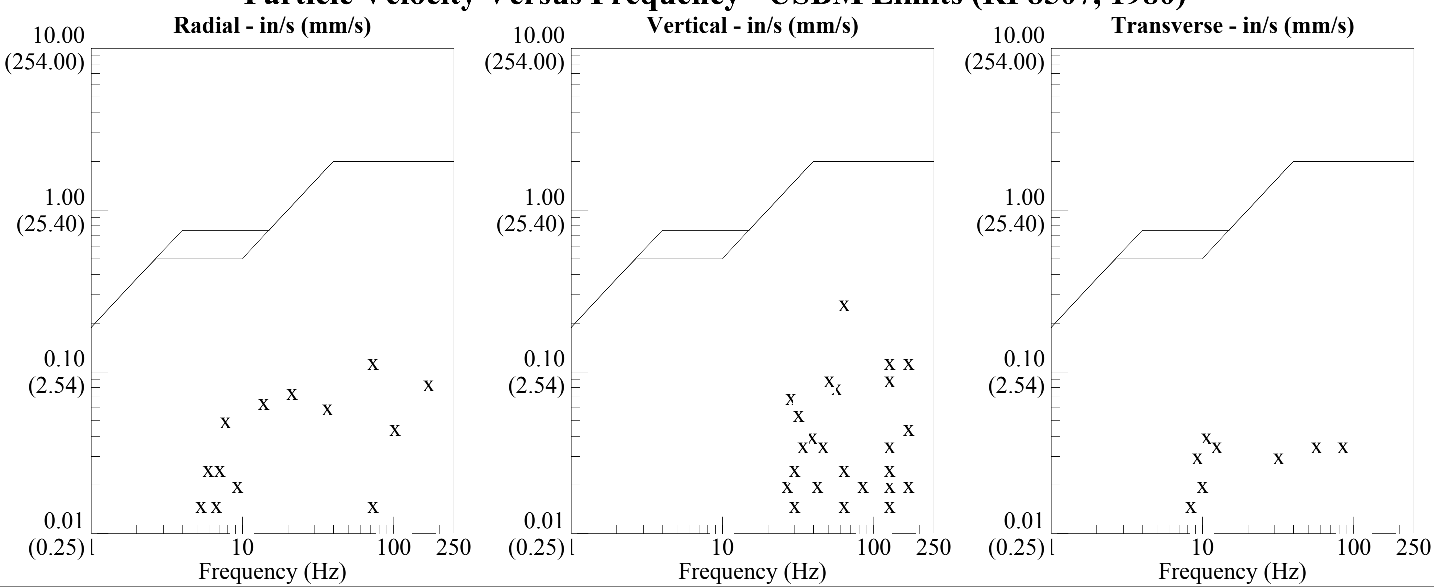
*Duration:*0.000s To: 4.500s

Seismic Scale:
0.27in/s (0.068in/s/div) 6.86mm/s (1.715mm/s/div)

*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located on Floor 6 inches from Door
Door Slammed

File Name: DOOR_SLAM006.DTB
Number: 006
Date: 3/19/2005
Time: 13:19
Serial Number: 1644
Seismic Trigger: 0.0250 in/s 0.6350 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

Radial: 0.145in/s 3.683mm/s @ 102.4Hz

***Vertical:* 0.315in/s 8.001mm/s @ 85.3Hz**

Transverse: 0.04in/s 1.016mm/s @ 256.0Hz

Vector Sum (VS): 0.32in/s 8.128mm/s

*Displacement:*0.000976in 0.024778mm

*Acceleration:*0.457143g's

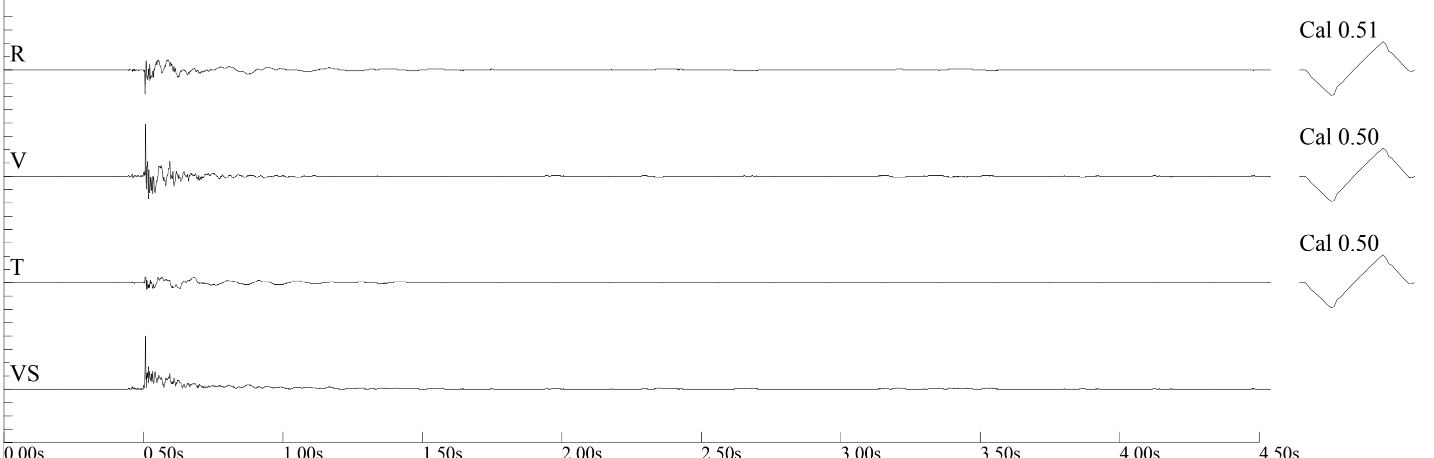
*Calibration Date:*2/16/2005

Graph Information

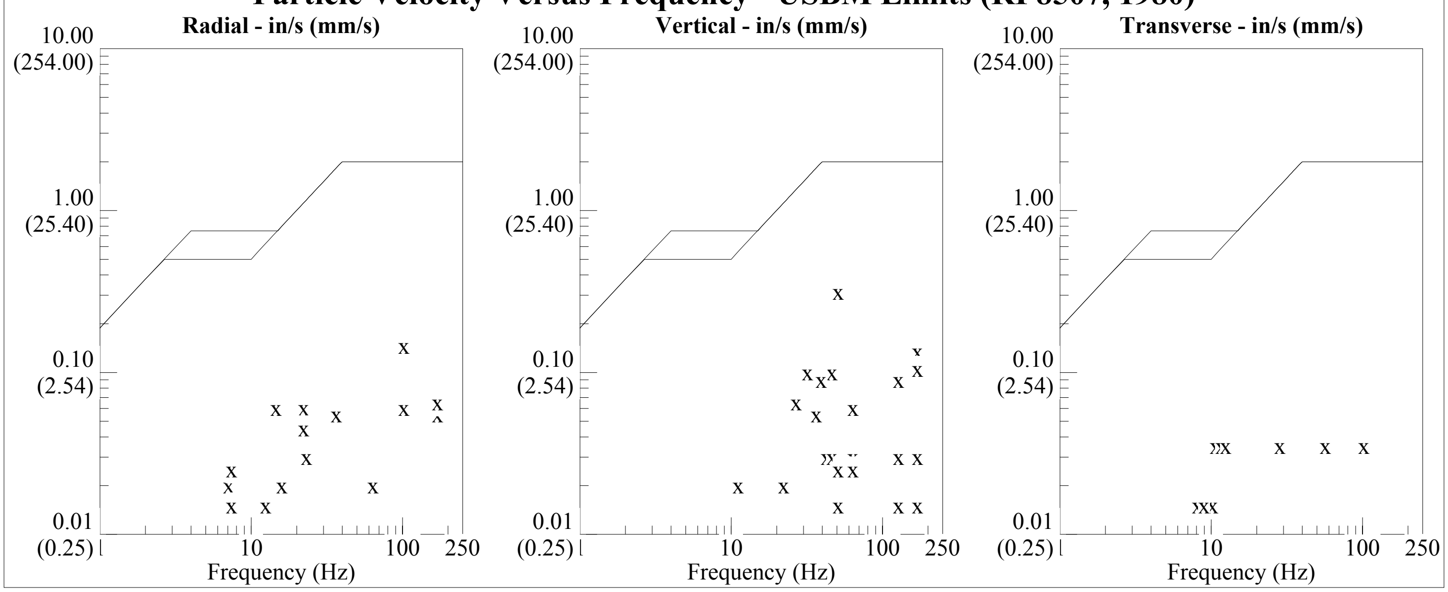
*Duration:*0.000s To: 4.500s

Seismic Scale:
0.32in/s (0.080in/s/div) 8.13mm/s (2.032mm/s/div)

*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



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Unit Located on Floor 6 inches from Door
Door Slammed

File Name: DOOR_SLAM005.DTB
Number: 005
Date: 3/19/2005
Time: 13:18
Serial Number: 1644
Seismic Trigger: 0.0250 in/s 0.6350 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

Radial: 0.155in/s 3.937mm/s @ 170.6Hz

***Vertical:* 0.355in/s 9.017mm/s @ 85.3Hz**

Transverse: 0.055in/s 1.397mm/s @ 128.0Hz

Vector Sum (VS): 0.36in/s 9.144mm/s

*Displacement:*0.001225in 0.031111mm

*Acceleration:*0.463768g's

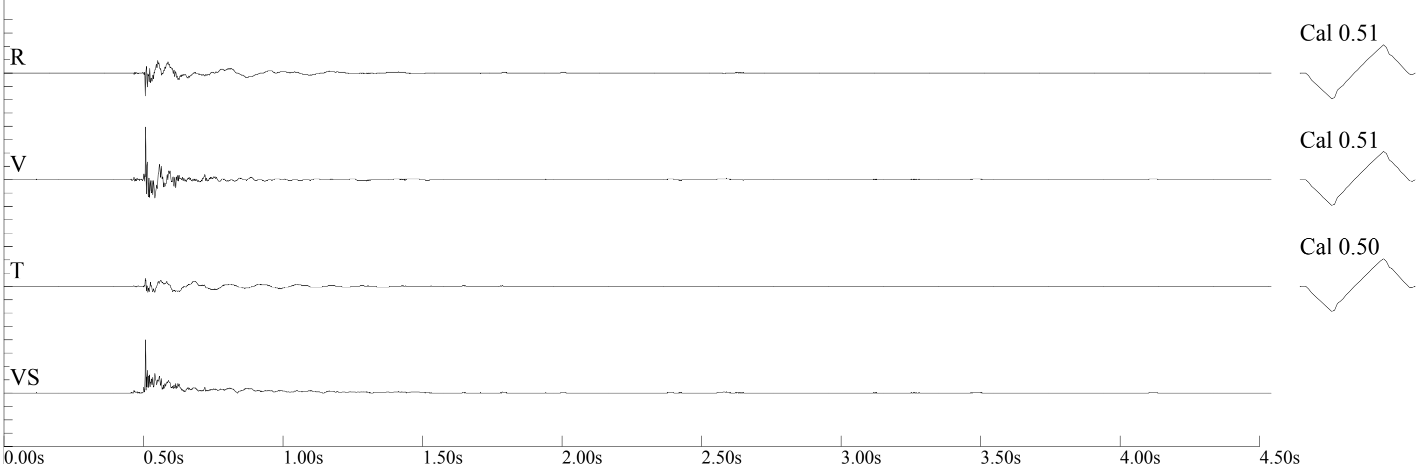
*Calibration Date:*2/16/2005

Graph Information

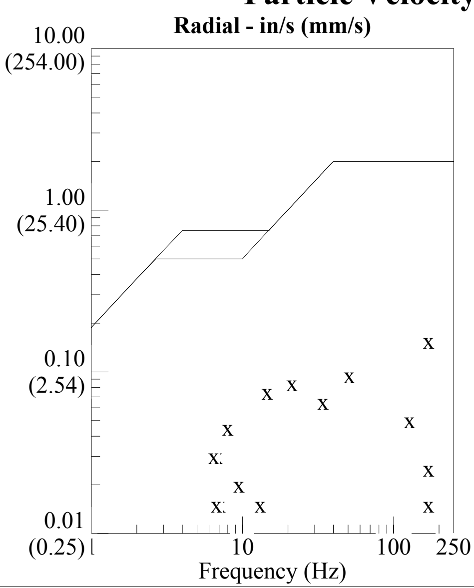
*Duration:*0.000s To: 4.500s

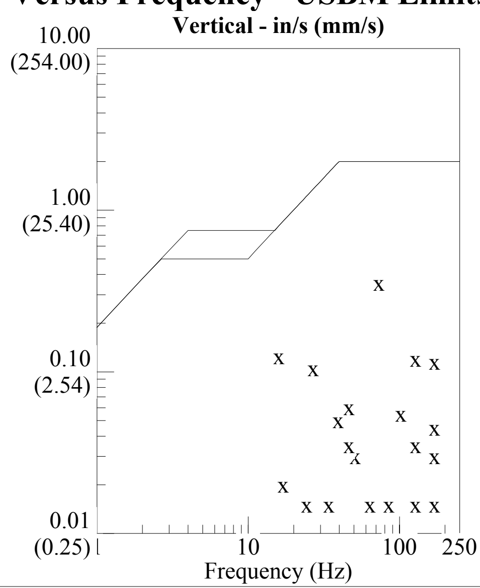
Seismic Scale:
0.36in/s (0.090in/s/div) 9.14mm/s (2.286mm/s/div)

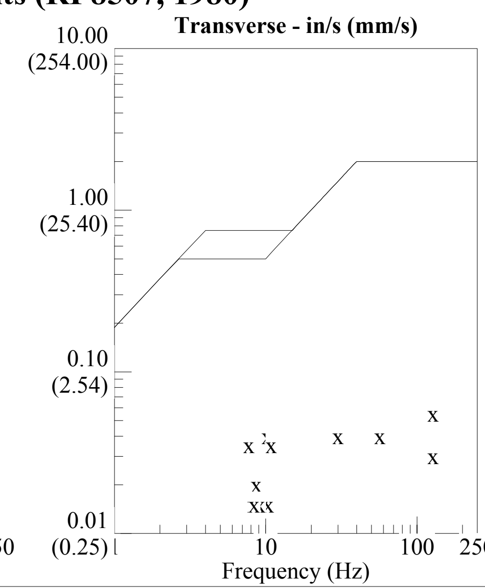
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)







TerraDinamica

Unit Located on Floor 6 inches from Door
Door Slammed

File Name: DOOR_SLAM004.DTB
Number: 004
Date: 3/19/2005
Time: 13:18
Serial Number: 1644
Seismic Trigger: 0.0250 in/s 0.6350 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

Radial: 0.18in/s 4.572mm/s @ 128.0Hz

***Vertical:* 0.355in/s 9.017mm/s @ 85.3Hz**

Transverse: 0.055in/s 1.397mm/s @ 102.4Hz

Vector Sum (VS): 0.37in/s 9.398mm/s

*Displacement:*0.001222in 0.031047mm

*Acceleration:*0.530021g's

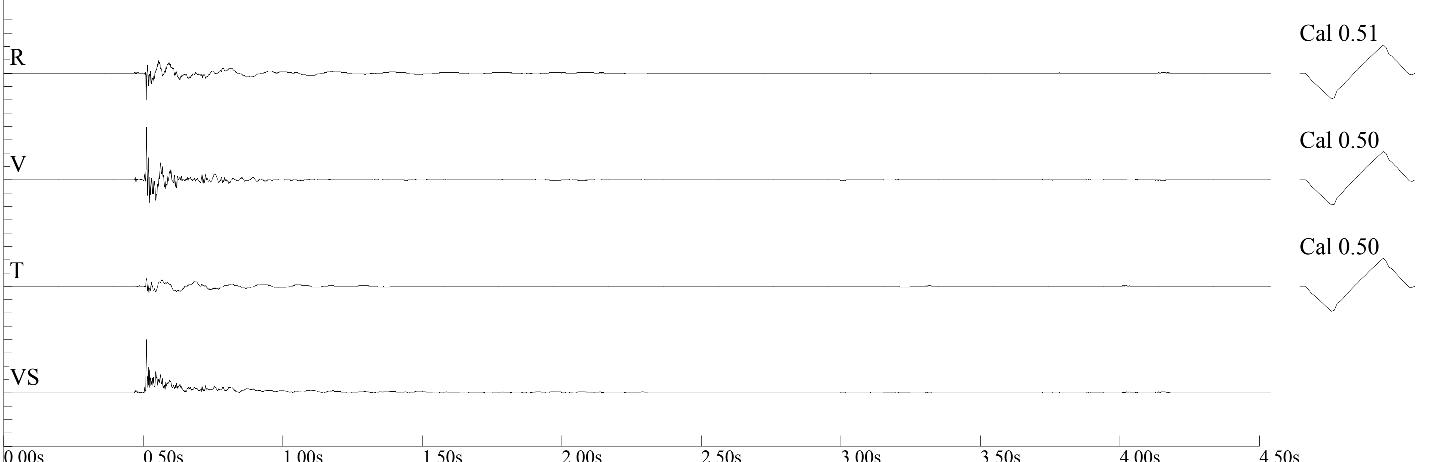
*Calibration Date:*2/16/2005

Graph Information

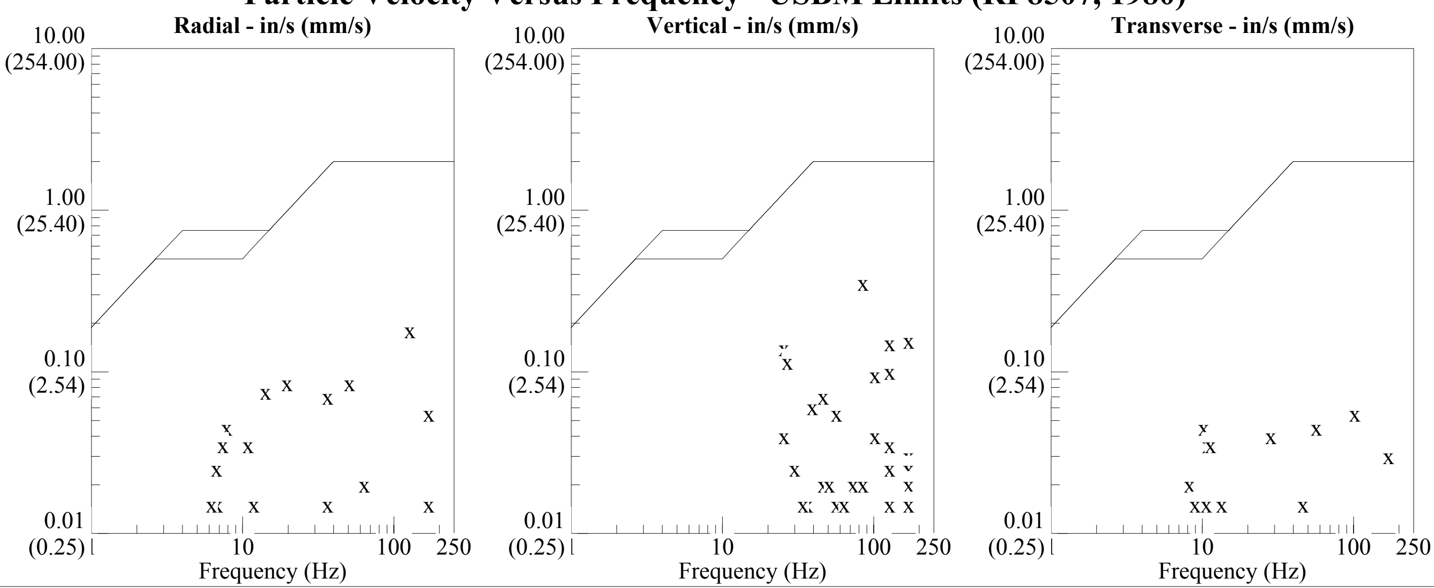
*Duration:*0.000s To: 4.500s

Seismic Scale:
0.36in/s (0.090in/s/div) 9.14mm/s (2.286mm/s/div)

*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located on Floor 6 inches from Door
Door Slammed

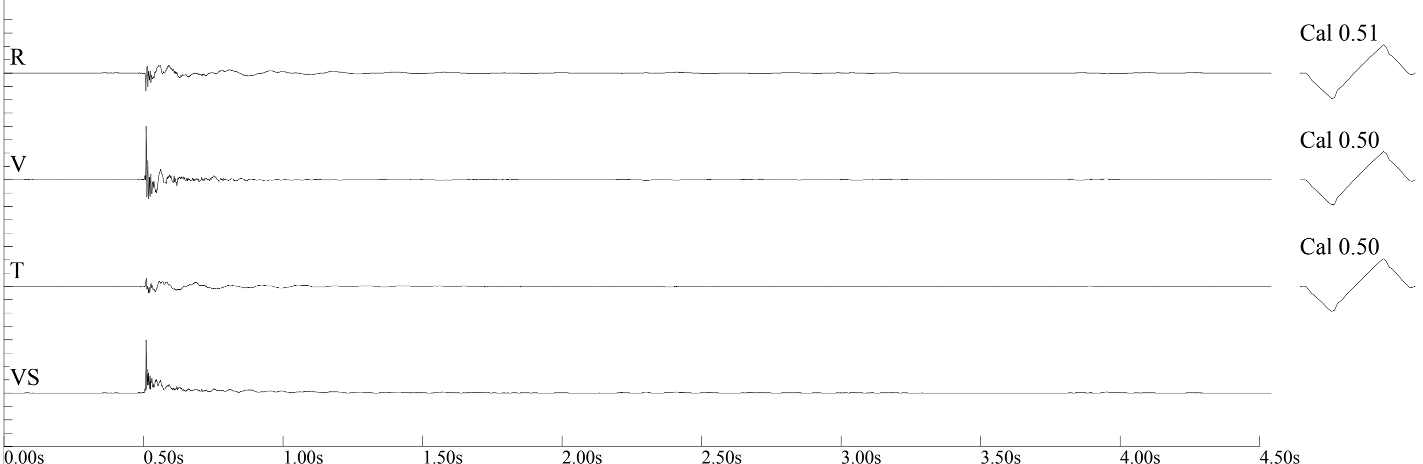
File Name: DOOR_SLAM007.DTB
Number: 007
Date: 3/19/2005
Time: 13:19
Serial Number: 1644
Seismic Trigger: 0.0250 in/s 0.6350 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

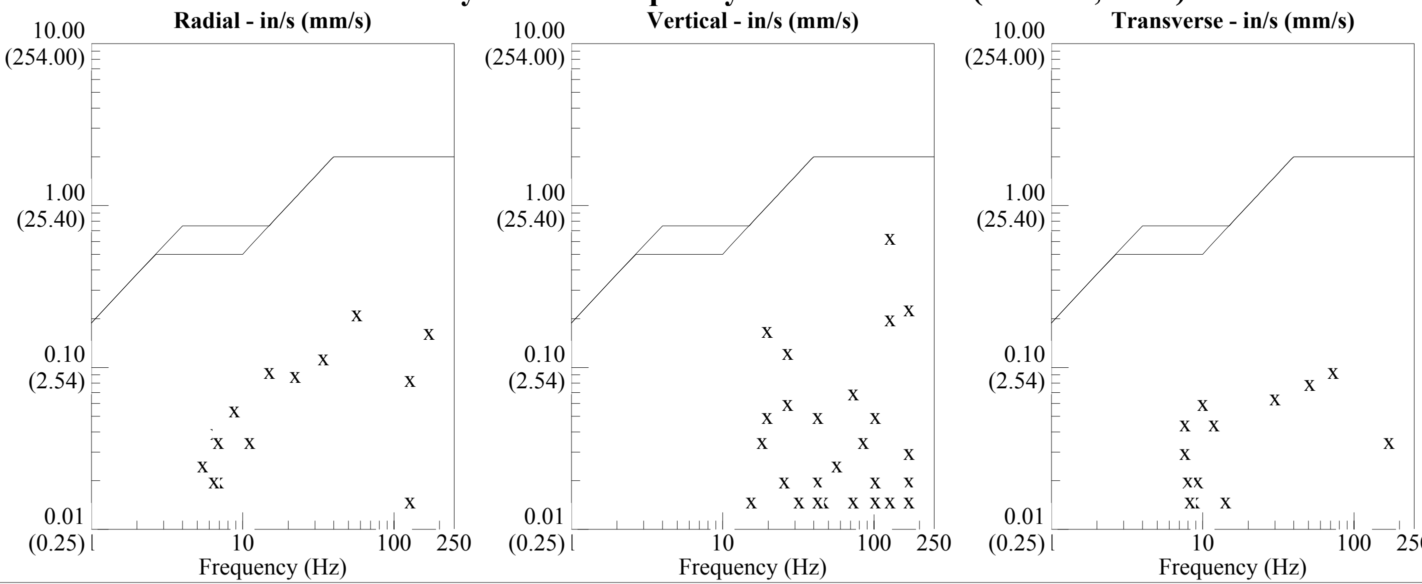
Radial: 0.215in/s 5.461mm/s @ 73.1Hz
***Vertical:* 0.64in/s 16.256mm/s @ 128.0Hz**
Transverse: 0.095in/s 2.413mm/s @ 85.3Hz
Vector Sum (VS): 0.65in/s 16.51mm/s
*Displacement:*0.001705in 0.043314mm
*Acceleration:*0.881159g's
*Calibration Date:*2/16/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
0.64in/s (0.160in/s/div) 16.26mm/s (4.064mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



TerraDinamica

Unit Located on Floor 6 inches from Door
Door Slammed

File Name: DOOR_SLAM003.DTB
Number: 003
Date: 3/19/2005
Time: 13:18
Serial Number: 1644
Seismic Trigger: 0.0250 in/s 0.6350 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

Radial: 0.115in/s 2.921mm/s @ 85.3Hz

***Vertical:* 0.265in/s 6.731mm/s @ 64.0Hz**

Transverse: 0.04in/s 1.016mm/s @ 10.8Hz

Vector Sum (VS): 0.27in/s 6.858mm/s

*Displacement:*0.001066in 0.027082mm

*Acceleration:*0.430642g's

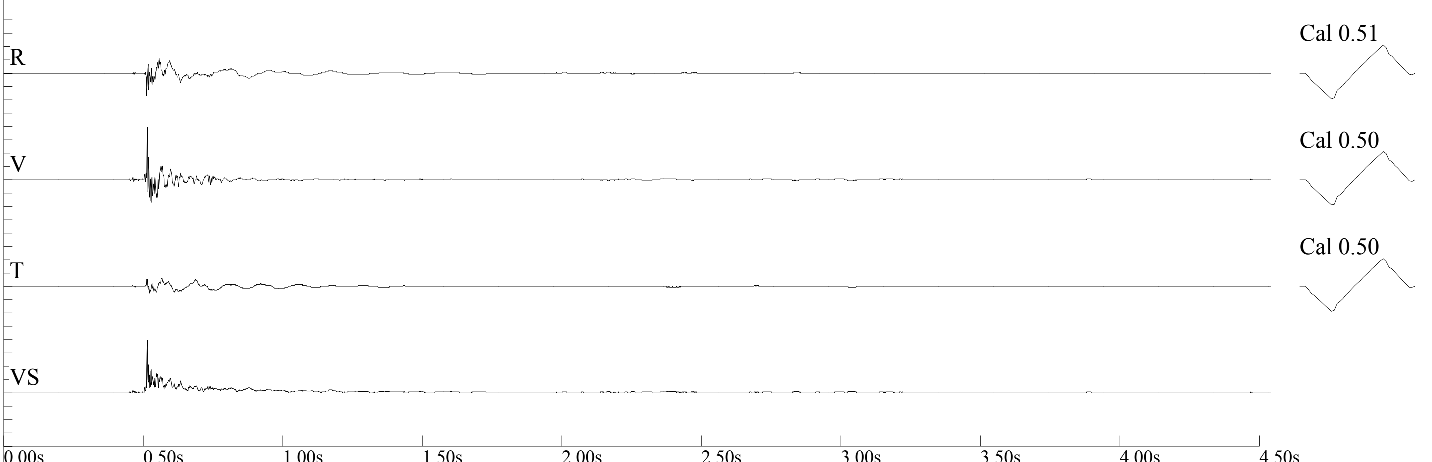
*Calibration Date:*2/16/2005

Graph Information

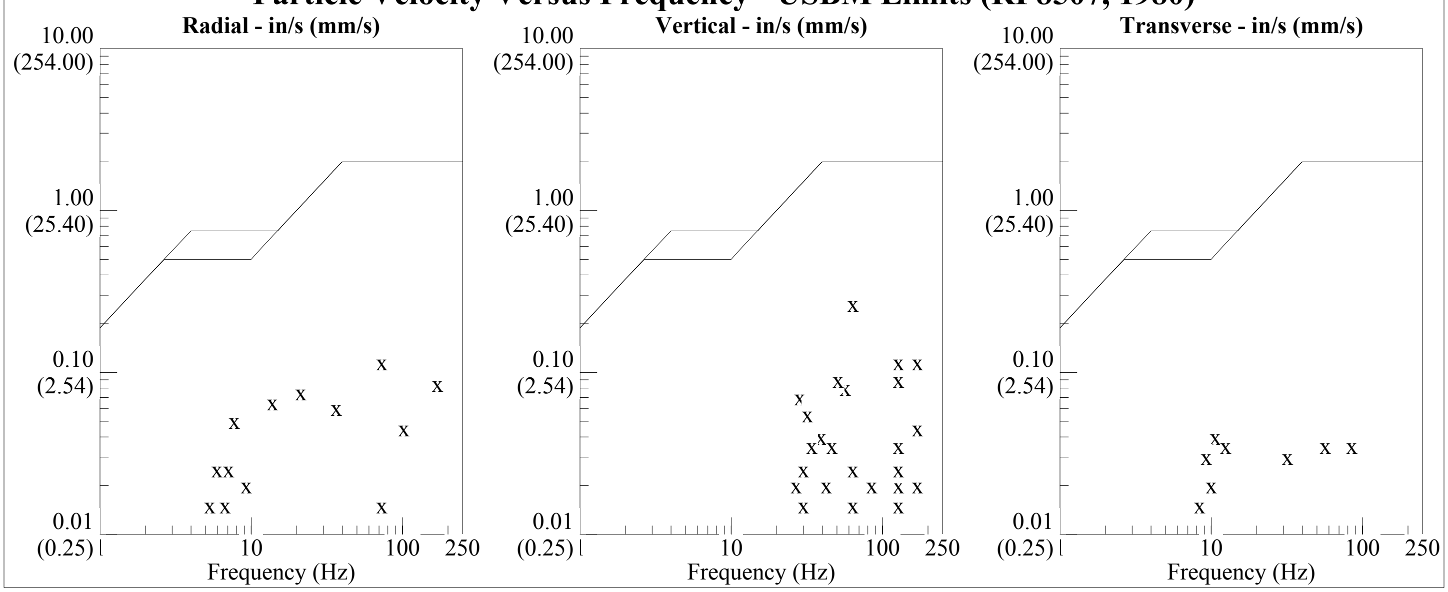
*Duration:*0.000s To: 4.500s

Seismic Scale:
0.27in/s (0.068in/s/div) 6.86mm/s (1.715mm/s/div)

*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located on Floor 6 inches from Door
Door Slammed

File Name: DOOR_SLAM006.DTB
Number: 006
Date: 3/19/2005
Time: 13:19
Serial Number: 1644
Seismic Trigger: 0.0250 in/s 0.6350 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

Radial: 0.145in/s 3.683mm/s @ 102.4Hz

***Vertical:* 0.315in/s 8.001mm/s @ 85.3Hz**

Transverse: 0.04in/s 1.016mm/s @ 256.0Hz

Vector Sum (VS): 0.32in/s 8.128mm/s

*Displacement:*0.000976in 0.024778mm

*Acceleration:*0.457143g's

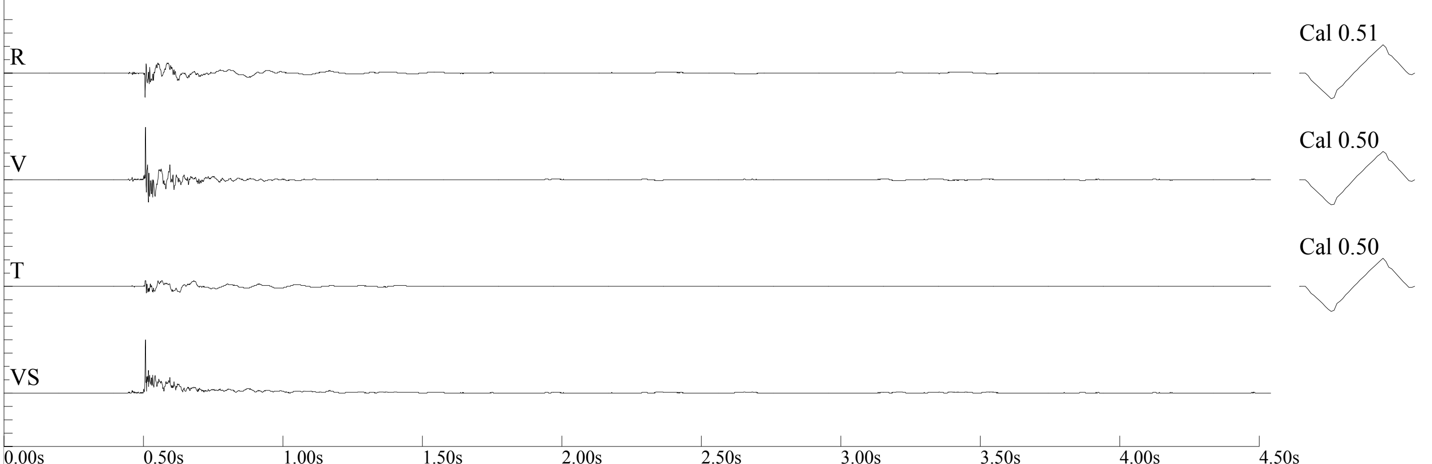
*Calibration Date:*2/16/2005

Graph Information

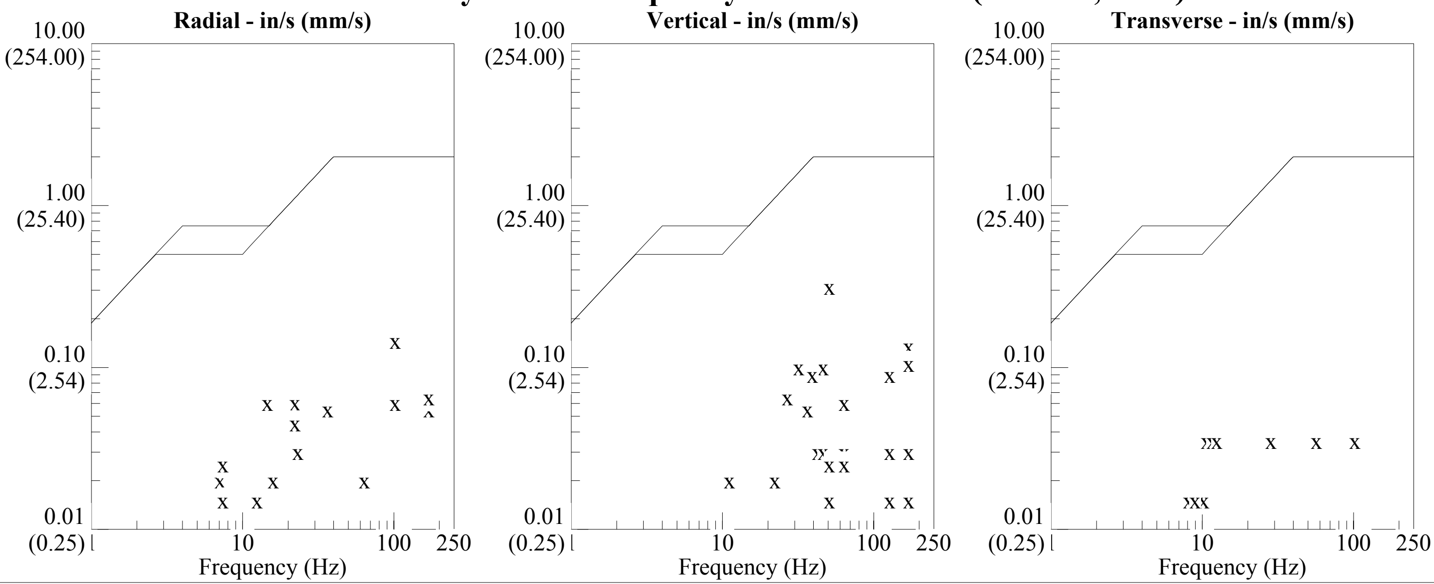
*Duration:*0.000s To: 4.500s

Seismic Scale:
0.32in/s (0.080in/s/div) 8.13mm/s (2.032mm/s/div)

*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



TerraDinamica

Unit Located on Floor 6 inches from Door
Door Slammed

File Name: DOOR_SLAM005.DTB
Number: 005
Date: 3/19/2005
Time: 13:18
Serial Number: 1644
Seismic Trigger: 0.0250 in/s 0.6350 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

Radial: 0.155in/s 3.937mm/s @ 170.6Hz

***Vertical:* 0.355in/s 9.017mm/s @ 85.3Hz**

Transverse: 0.055in/s 1.397mm/s @ 128.0Hz

Vector Sum (VS): 0.36in/s 9.144mm/s

*Displacement:*0.001225in 0.031111mm

*Acceleration:*0.463768g's

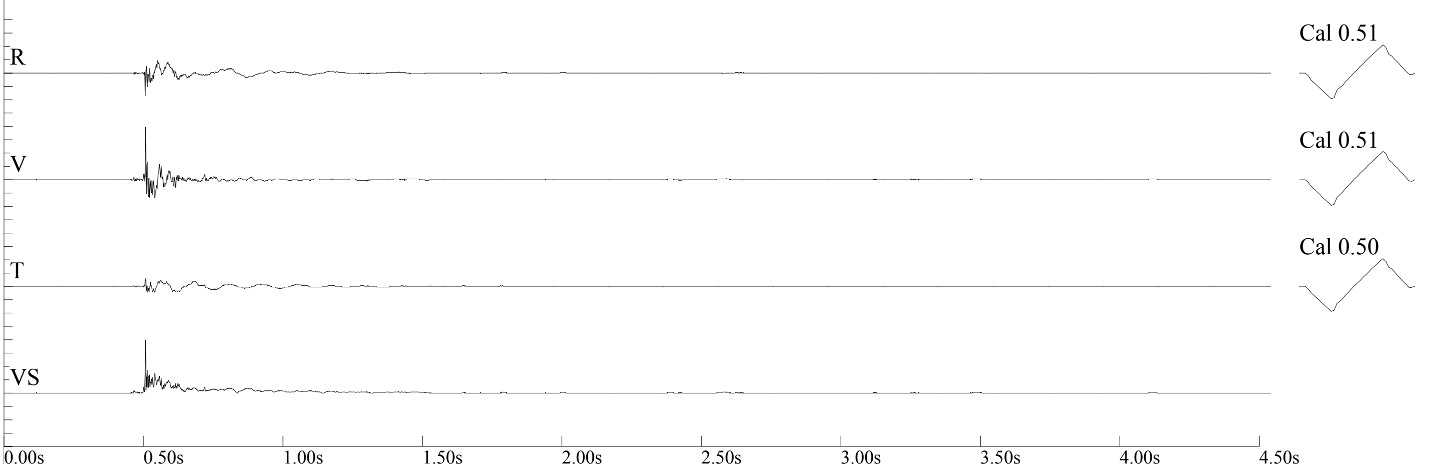
*Calibration Date:*2/16/2005

Graph Information

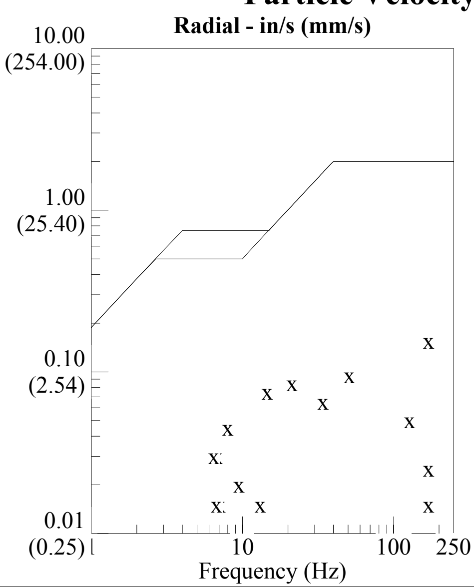
*Duration:*0.000s To: 4.500s

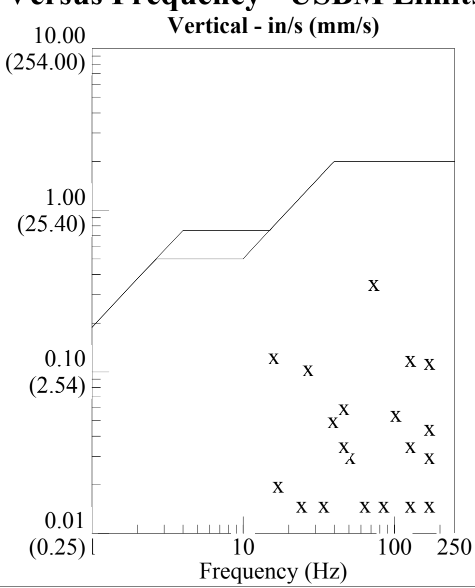
Seismic Scale:
0.36in/s (0.090in/s/div) 9.14mm/s (2.286mm/s/div)

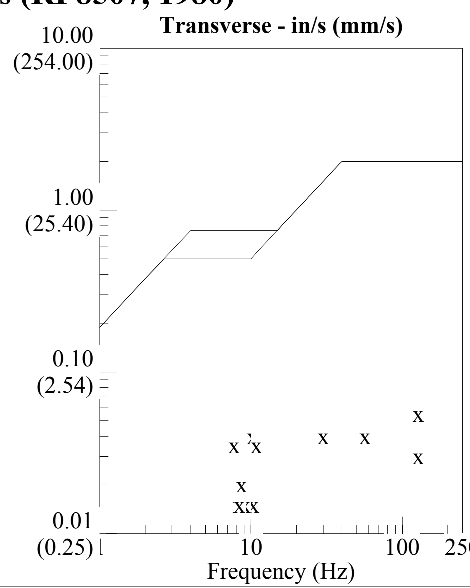
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)







Unit Located on Floor 6 inches from Door
Door Slammed

File Name: DOOR_SLAM004.DTB
Number: 004
Date: 3/19/2005
Time: 13:18
Serial Number: 1644
Seismic Trigger: 0.0250 in/s 0.6350 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

Radial: 0.18in/s 4.572mm/s @ 128.0Hz

***Vertical:* 0.355in/s 9.017mm/s @ 85.3Hz**

Transverse: 0.055in/s 1.397mm/s @ 102.4Hz

Vector Sum (VS): 0.37in/s 9.398mm/s

*Displacement:*0.001222in 0.031047mm

*Acceleration:*0.530021g's

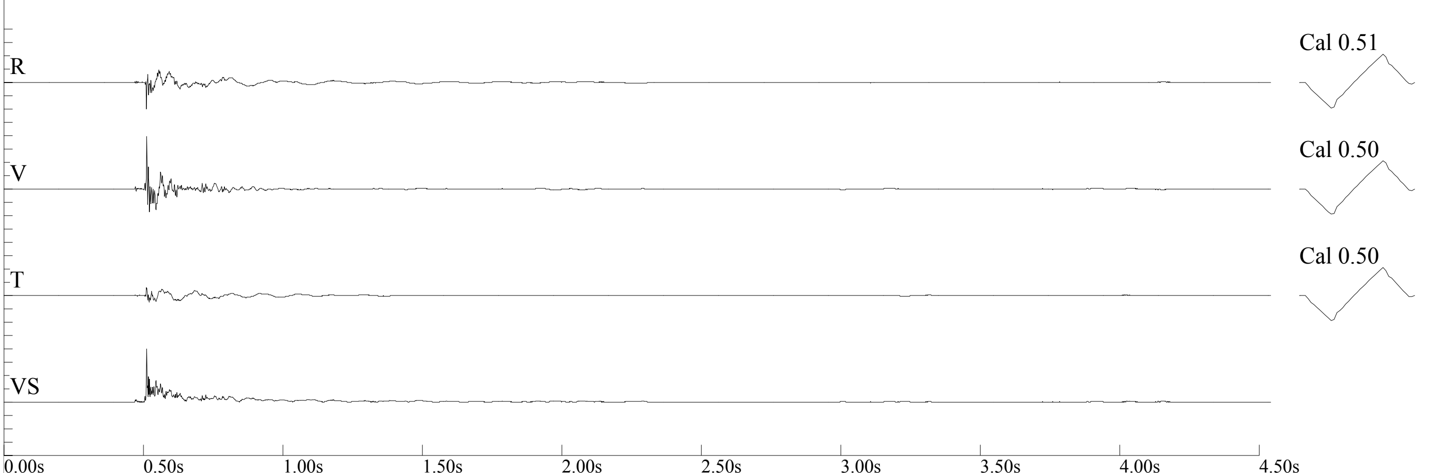
*Calibration Date:*2/16/2005

Graph Information

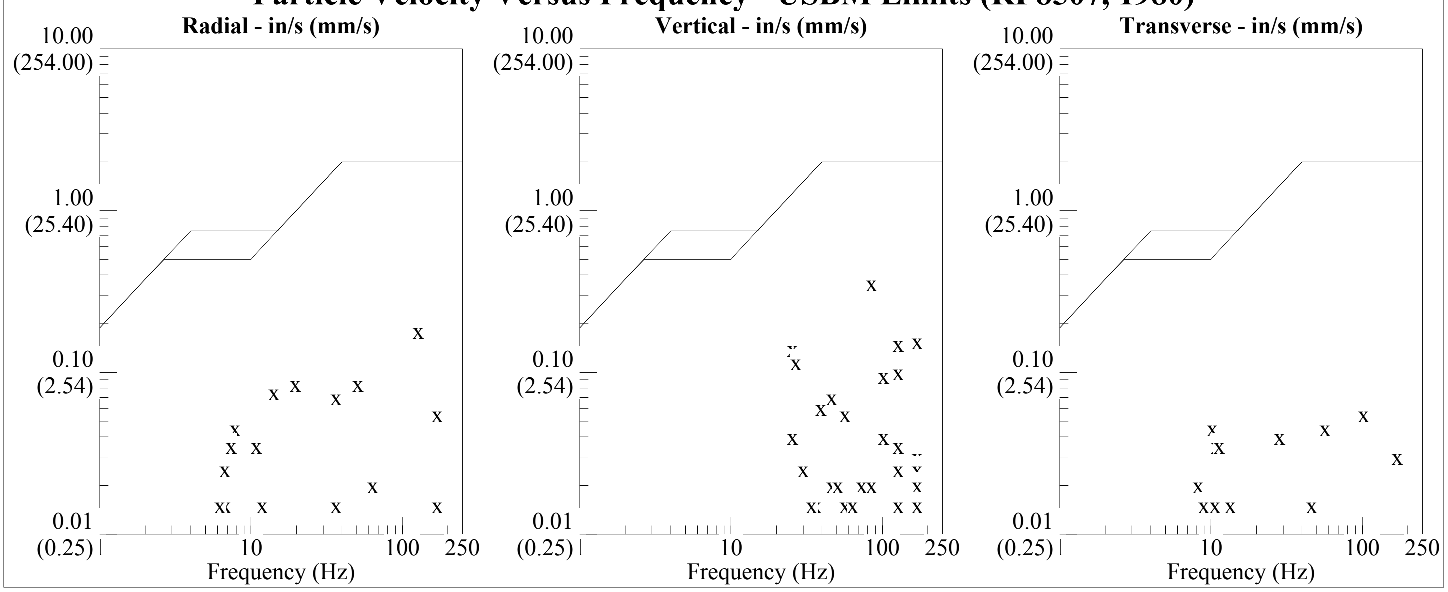
*Duration:*0.000s To: 4.500s

Seismic Scale:
0.36in/s (0.090in/s/div) 9.14mm/s (2.286mm/s/div)

*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



TerraDinamica

Unit Located on Floor 6 inches from Door
Door Slammed

File Name: DOOR_SLAM007.DTB
Number: 007
Date: 3/19/2005
Time: 13:19
Serial Number: 1644
Seismic Trigger: 0.0250 in/s 0.6350 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

Radial: 0.215in/s 5.461mm/s @ 73.1Hz

***Vertical:* 0.64in/s 16.256mm/s @ 128.0Hz**

Transverse: 0.095in/s 2.413mm/s @ 85.3Hz

Vector Sum (VS): 0.65in/s 16.51mm/s

*Displacement:*0.001705in 0.043314mm

*Acceleration:*0.881159g's

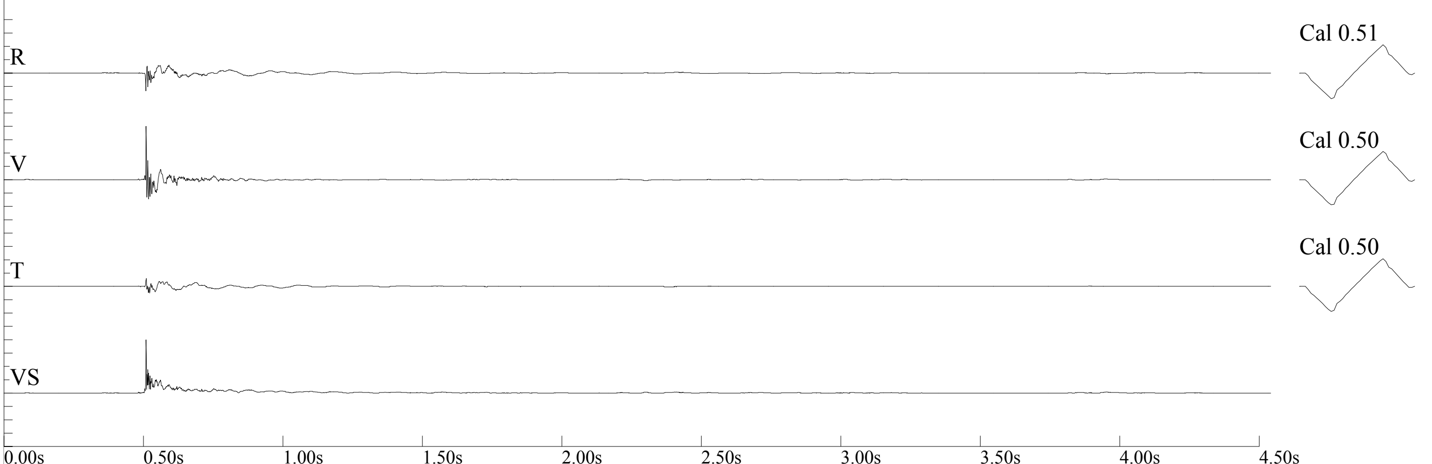
*Calibration Date:*2/16/2005

Graph Information

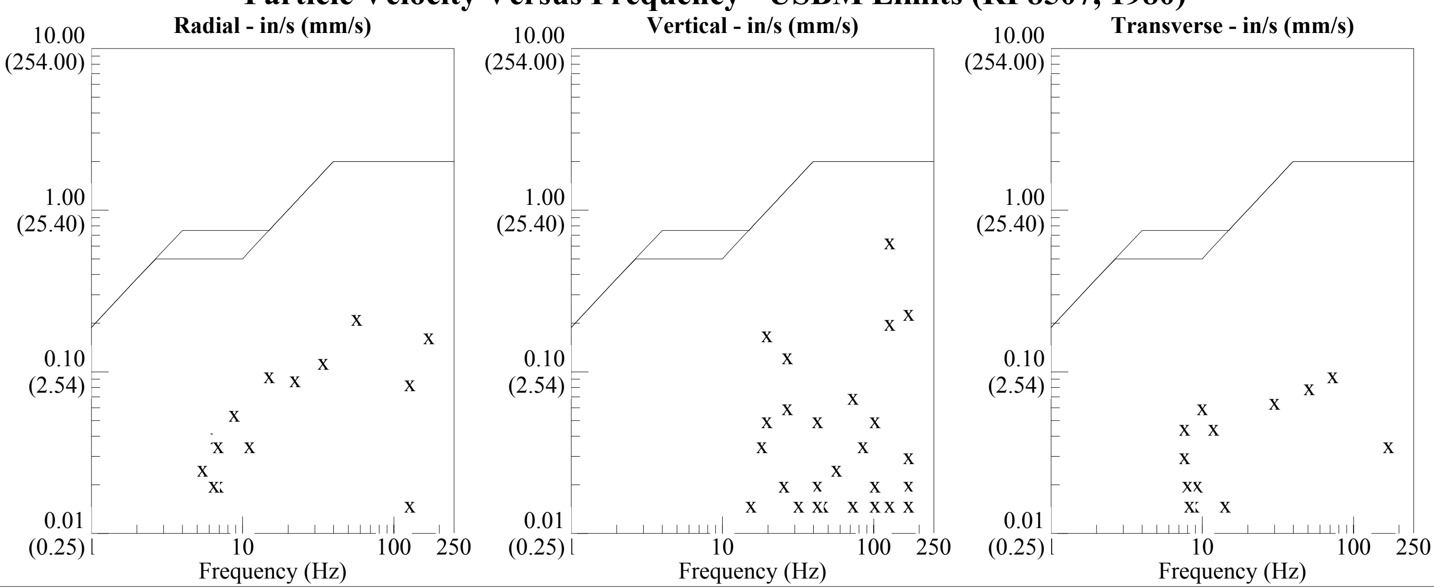
*Duration:*0.000s To: 4.500s

Seismic Scale:
0.64in/s (0.160in/s/div) 16.26mm/s (4.064mm/s/div)

*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located Above Door
Door Slam

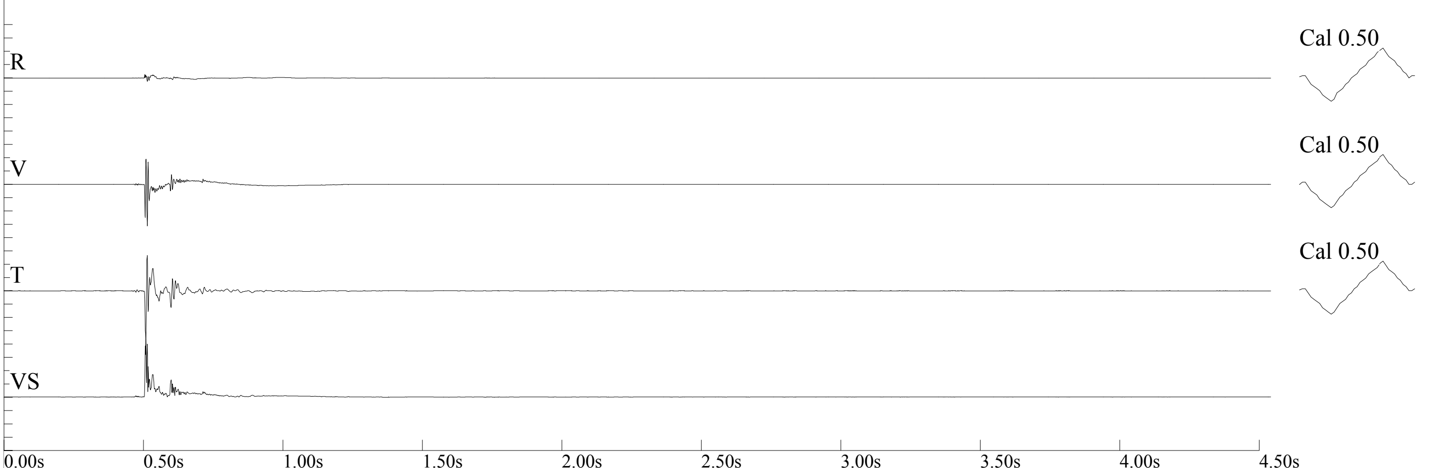
File Name: DOOR_SLAM_ABOVE_DOOR003.DTB
Number: 003
Date: 3/20/2005
Time: 18:16
Serial Number: 2474
Seismic Trigger: 0.2000 in/s 5.0800 mm/s
Acoustic Trigger: 130 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

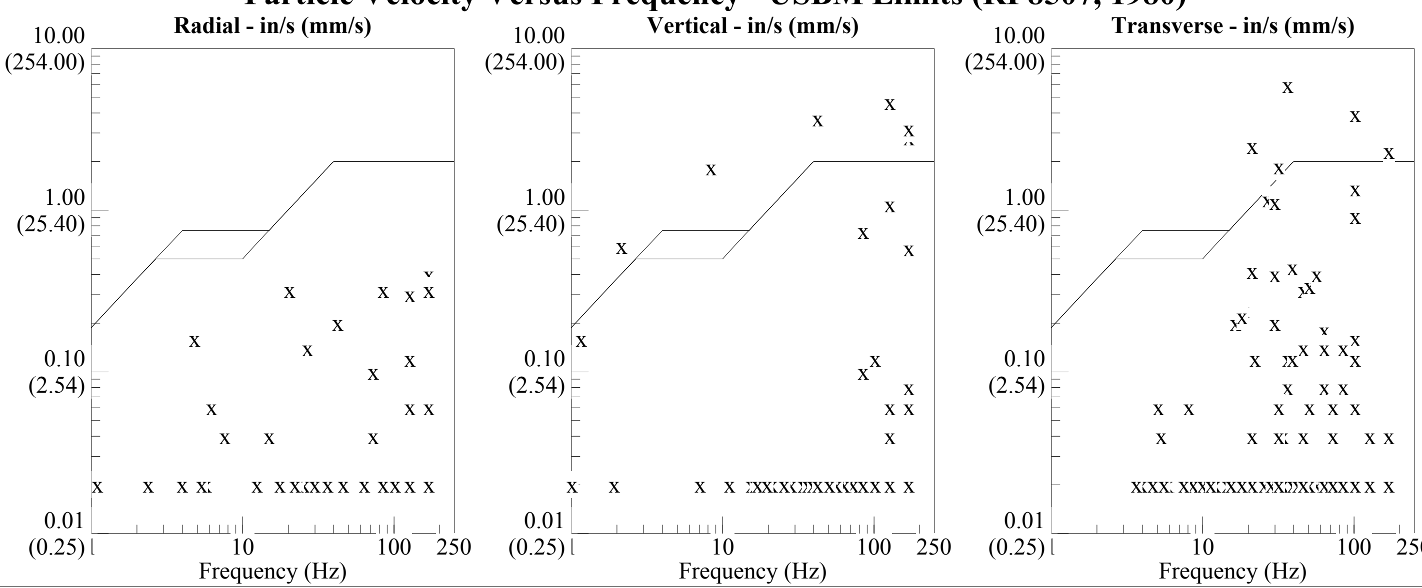
Radial: 0.40in/s 10.16mm/s @ 170.6Hz
Vertical: 4.64in/s 117.856mm/s @ 128.0Hz
***Transverse:* 5.92in/s 150.368mm/s @ 39.3Hz**
Vector Sum (VS): 6.455in/s 163.957mm/s
*Displacement:*0.022489in 0.571227mm
*Acceleration:*8.268323g's
*Calibration Date:*2/18/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
5.92in/s (1.480in/s/div) 150.37mm/s (37.592mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located Above Door
Door Slam

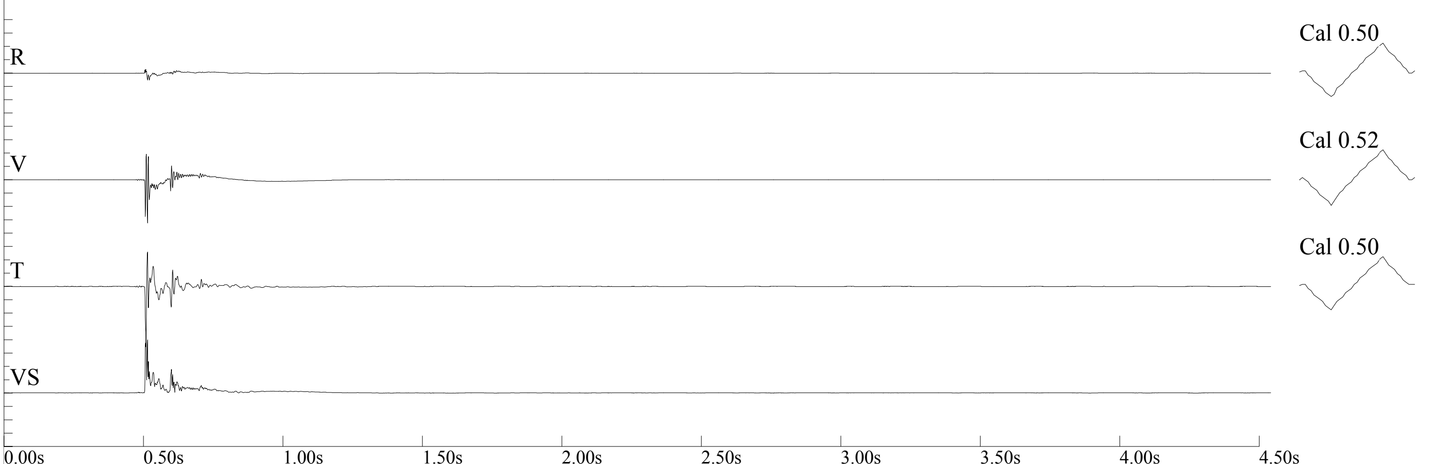
File Name: DOOR_SLAM_ABOVE_DOOR005.DTB
Number: 005
Date: 3/20/2005
Time: 18:16
Serial Number: 2474
Seismic Trigger: 0.2000 in/s 5.0800 mm/s
Acoustic Trigger: 130 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

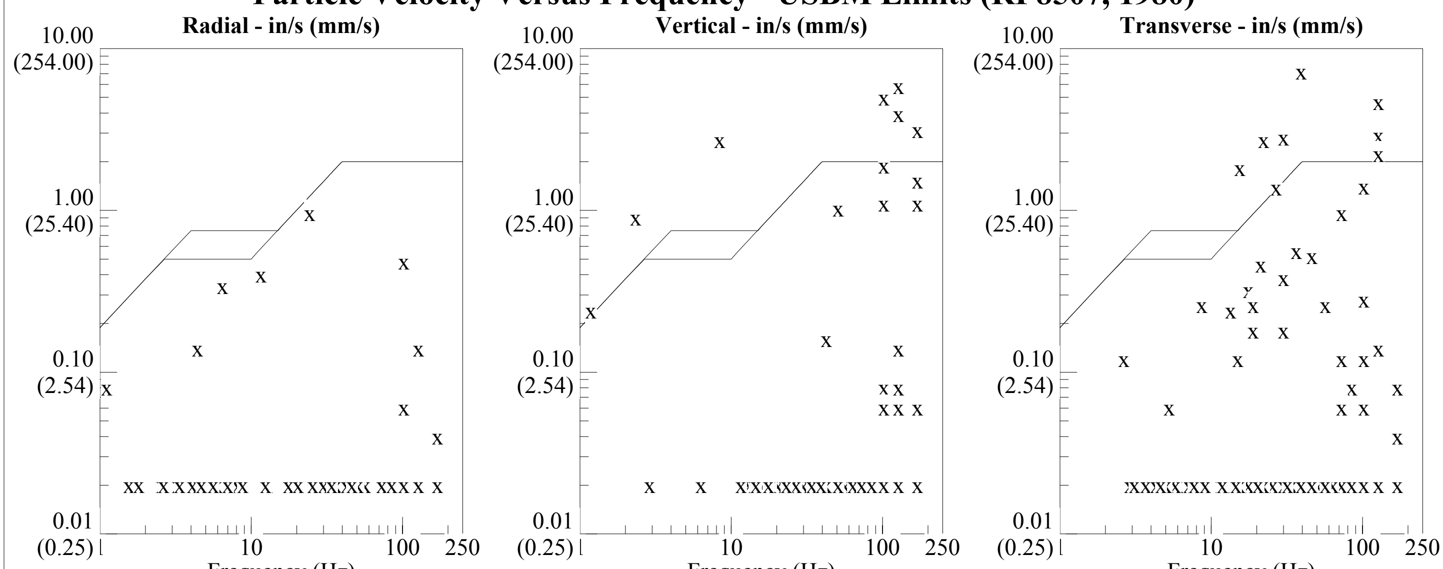
Radial: 0.96in/s 24.384mm/s @ 24.3Hz
Vertical: 5.84in/s 148.336mm/s @ 128.0Hz
***Transverse:* 7.20in/s 182.88mm/s @ 51.2Hz**
Vector Sum (VS): 7.85in/s 199.39mm/s
*Displacement:*0.033410in 0.848614mm
*Acceleration:*10.388410g's
*Calibration Date:*2/18/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
7.20in/s (1.800in/s/div) 182.88mm/s (45.720mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located Above Door
Door Slam

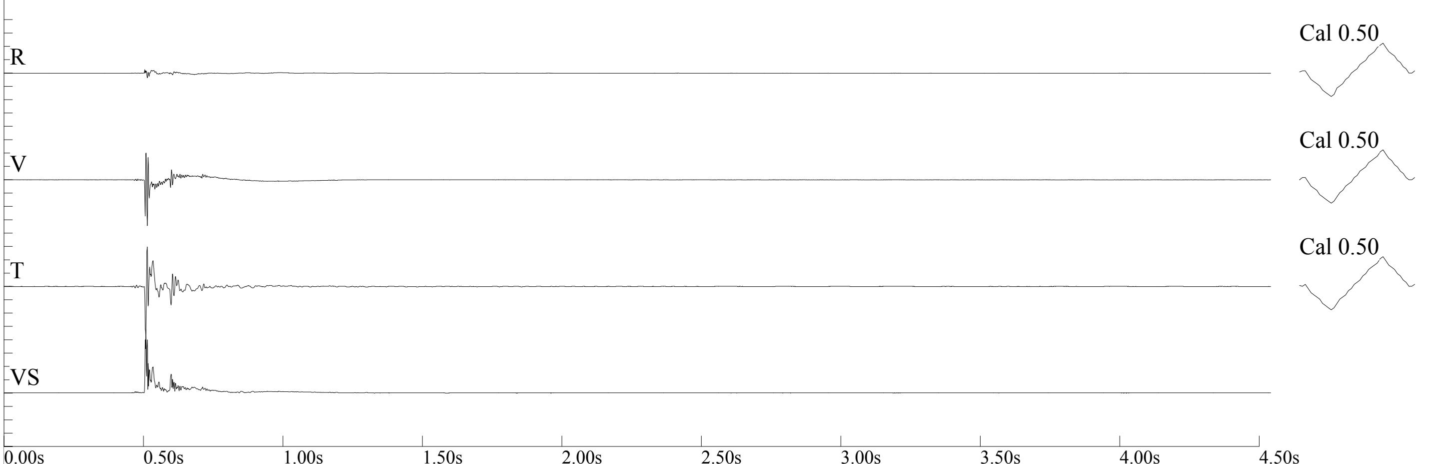
File Name: DOOR_SLAM_ABOVE_DOOR004.DTB
Number: 004
Date: 3/20/2005
Time: 18:16
Serial Number: 2474
Seismic Trigger: 0.2000 in/s 5.0800 mm/s
Acoustic Trigger: 130 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

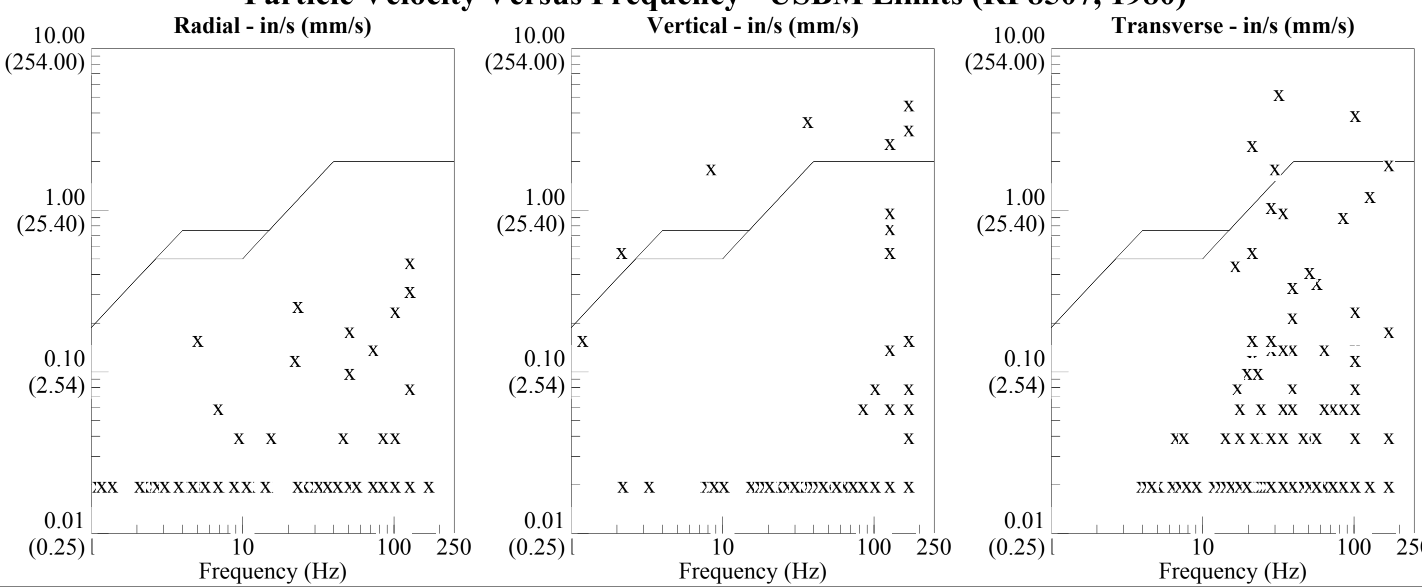
Radial: 0.48in/s 12.192mm/s @ 128.0Hz
Vertical: 4.56in/s 115.824mm/s @ 170.6Hz
***Transverse:* 5.28in/s 134.112mm/s @ 64.0Hz**
Vector Sum (VS): 6.03in/s 153.162mm/s
*Displacement:*0.022969in 0.583417mm
*Acceleration:*8.056314g's
*Calibration Date:*2/18/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
5.28in/s (1.320in/s/div) 134.11mm/s (33.528mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located Above Door
Door Slam

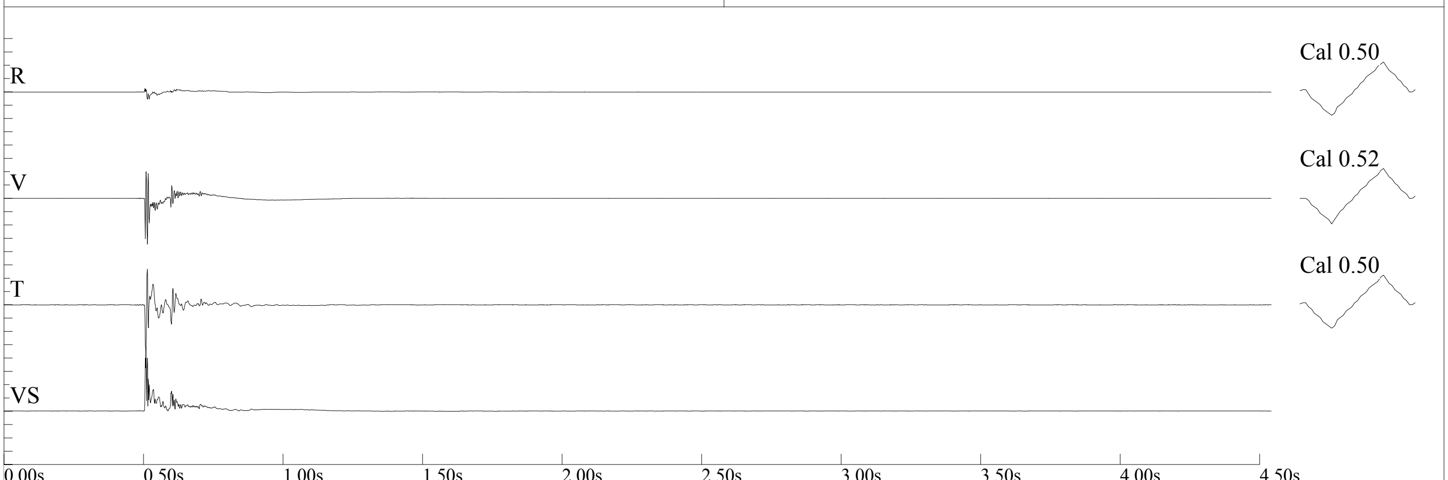
File Name: DOOR_SLAM_ABOVE_DOOR006.DTB
Number: 006
Date: 3/20/2005
Time: 18:18
Serial Number: 2474
Seismic Trigger: 0.2000 in/s 5.0800 mm/s
Acoustic Trigger: 130 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

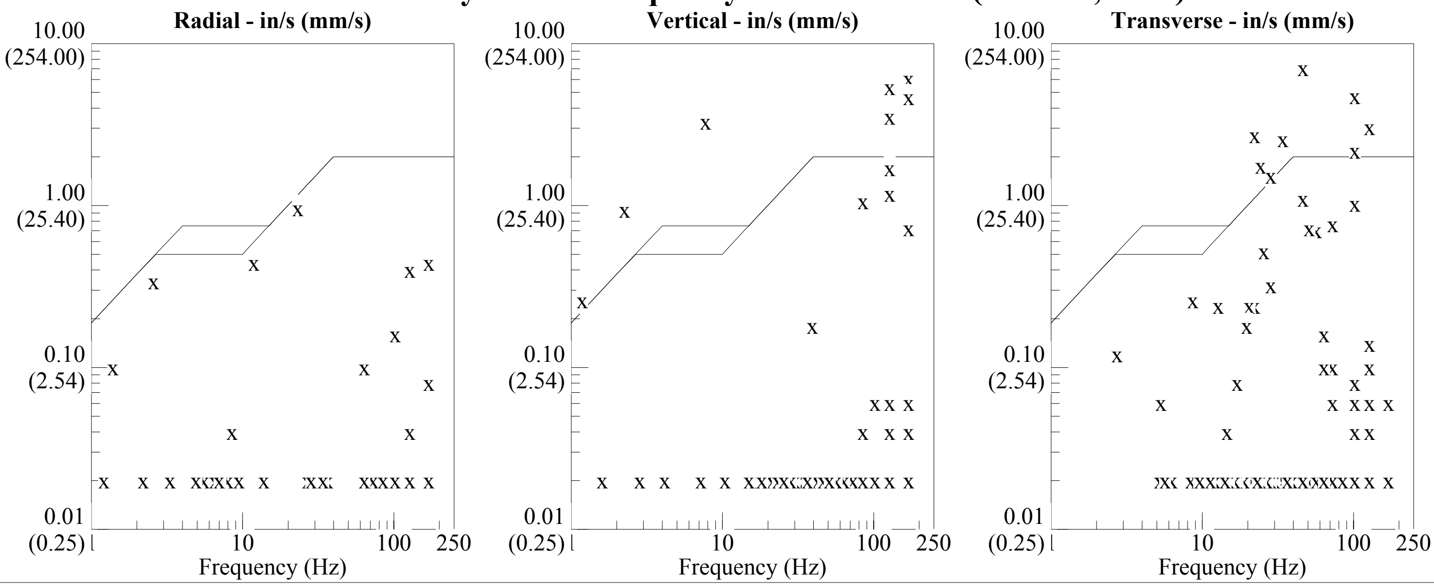
Radial: 0.96in/s 24.384mm/s @ 23.2Hz
Vertical: 6.08in/s 154.432mm/s @ 170.6Hz
***Transverse:* 7.04in/s 178.816mm/s @ 73.1Hz**
Vector Sum (VS): 7.755in/s 196.977mm/s
*Displacement:*0.035559in 0.903206mm
*Acceleration:*10.600410g's
*Calibration Date:*2/18/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
7.04in/s (1.760in/s/div) 178.82mm/s (44.704mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located on Floor 6 inches from Door
Door Shut with normal amount of force

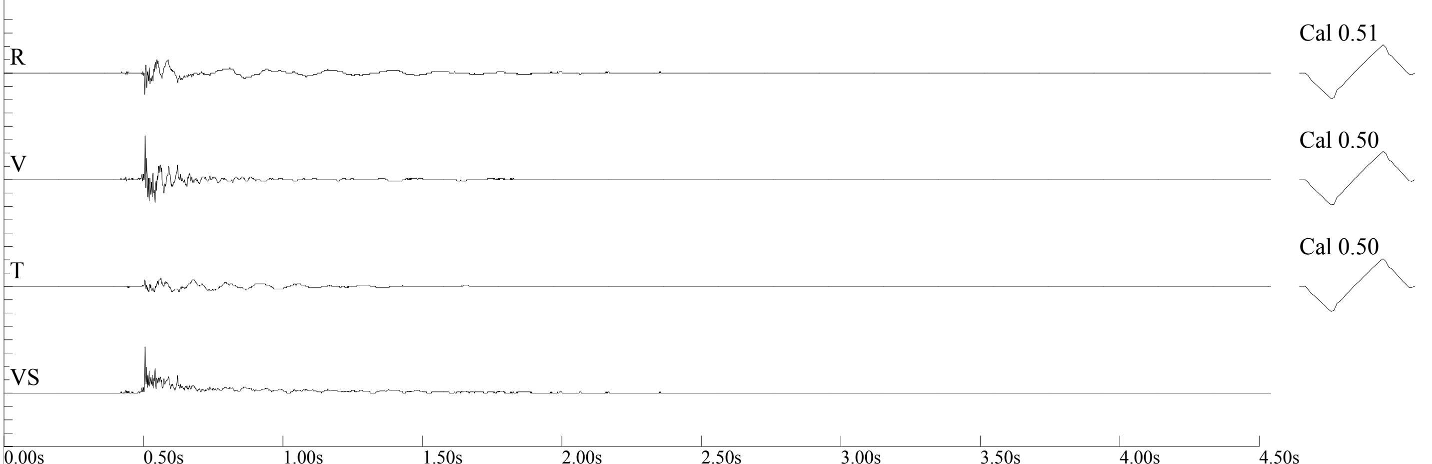
File Name: DOOR_SHUT000.DTB
Number: 000
Date: 3/19/2005
Time: 13:16
Serial Number: 1644
Seismic Trigger: 0.0250 in/s 0.6350 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

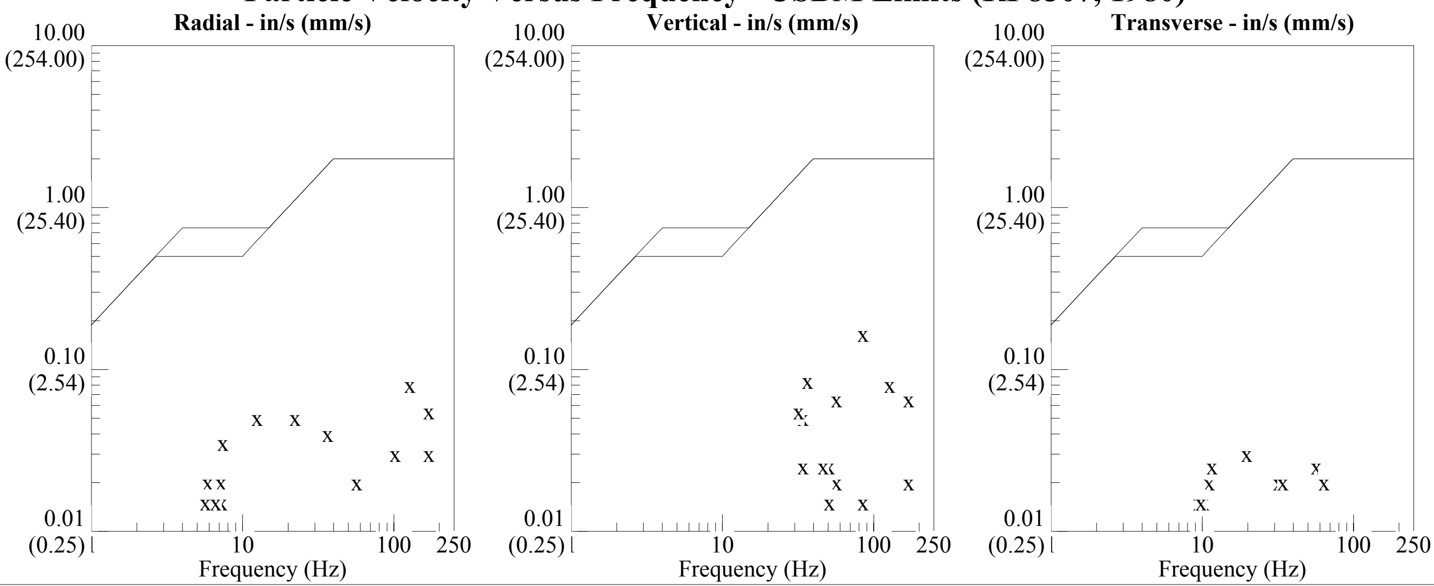
Radial: 0.055in/s 1.397mm/s @ 170.6Hz
***Vertical:* 0.165in/s 4.191mm/s @ 128.0Hz**
Transverse: 0.03in/s 0.762mm/s @ 26.9Hz
Vector Sum (VS): 0.175in/s 4.445mm/s
*Displacement:*0.000788in 0.020008mm
*Acceleration:*0.251760g's
*Calibration Date:*2/16/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
0.20in/s (0.050in/s/div) 5.08mm/s (1.270mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



TerraDinamica

Unit Located on Floor 6 inches from Door
Door Shut with normal amount of force

File Name: DOOR_SHUT001.DTB
Number: 001
Date: 3/19/2005
Time: 13:17
Serial Number: 1644
Seismic Trigger: 0.0250 in/s 0.6350 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

Radial: 0.04in/s 1.016mm/s @ 25.6Hz

***Vertical:* 0.185in/s 4.699mm/s @ 102.4Hz**

Transverse: 0.03in/s 0.762mm/s @ 46.5Hz

Vector Sum (VS): 0.185in/s 4.699mm/s

*Displacement:*0.000654in 0.016610mm

*Acceleration:*0.245135g's

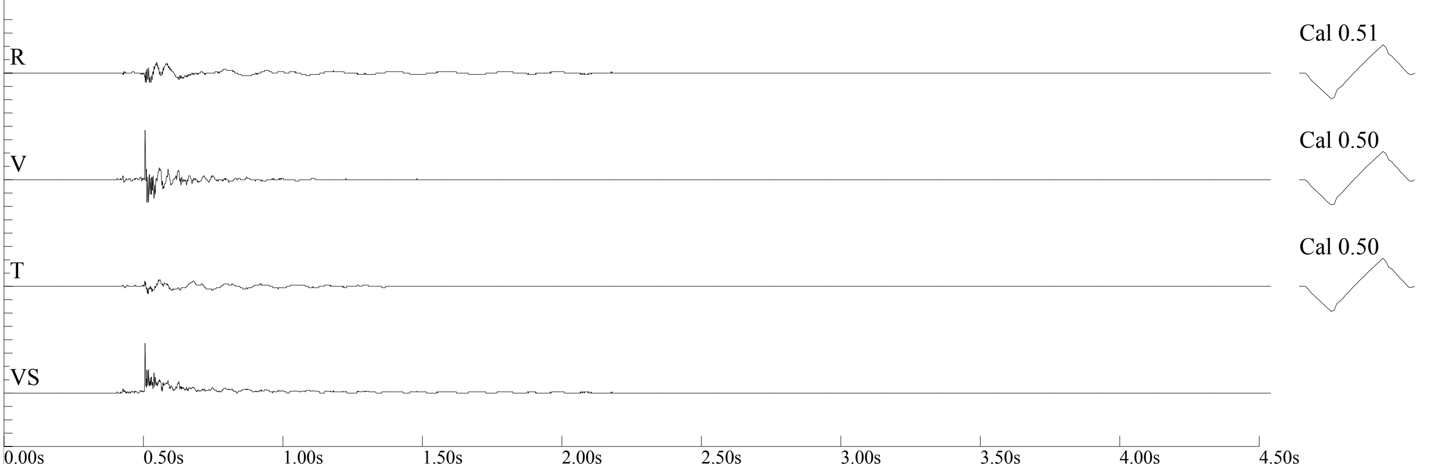
*Calibration Date:*2/16/2005

Graph Information

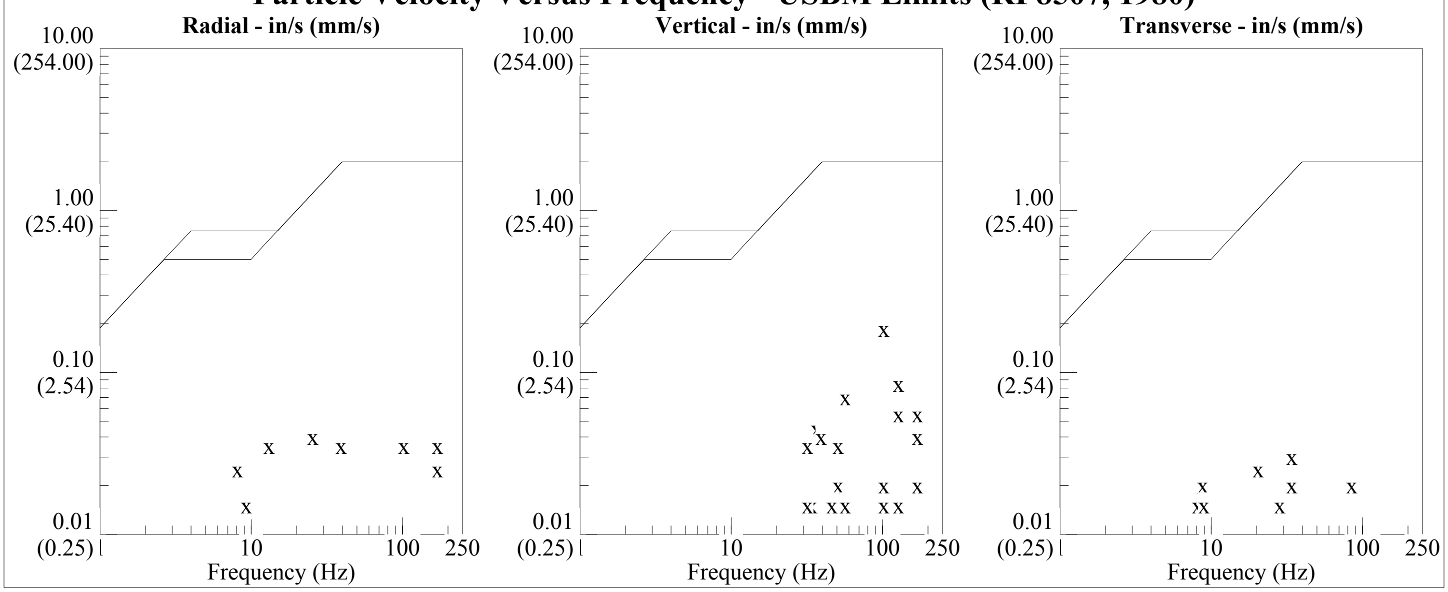
*Duration:*0.000s To: 4.500s

Seismic Scale:
0.20in/s (0.050in/s/div) 5.08mm/s (1.270mm/s/div)

*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



TerraDinamica

Unit Located on Floor 6 inches from Door
Door Shut with normal amount of force

File Name: DOOR_SHUT000.DTB
Number: 000
Date: 3/19/2005
Time: 13:16
Serial Number: 1644
Seismic Trigger: 0.0250 in/s 0.6350 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

Radial: 0.055in/s 1.397mm/s @ 170.6Hz

***Vertical:* 0.165in/s 4.191mm/s @ 128.0Hz**

Transverse: 0.03in/s 0.762mm/s @ 26.9Hz

Vector Sum (VS): 0.175in/s 4.445mm/s

*Displacement:*0.000788in 0.020008mm

*Acceleration:*0.251760g's

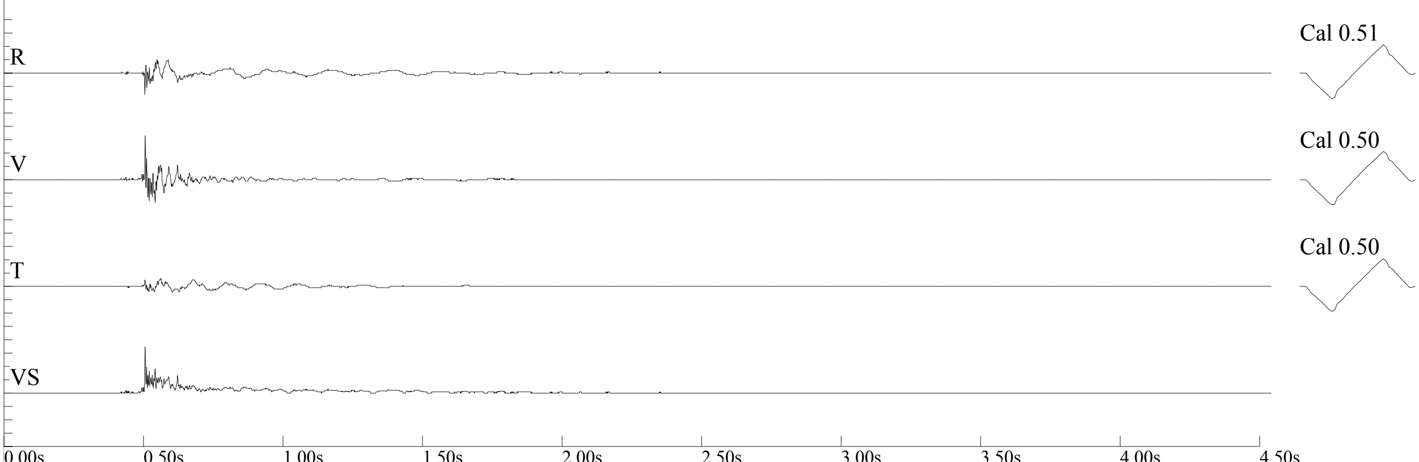
*Calibration Date:*2/16/2005

Graph Information

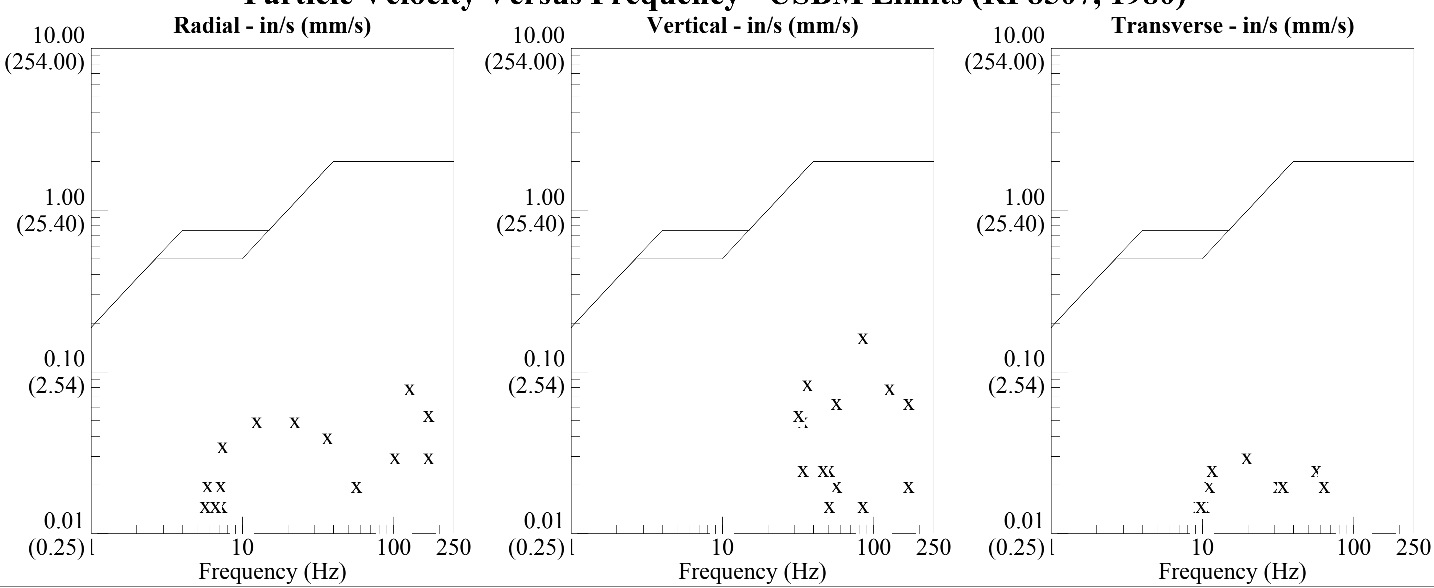
*Duration:*0.000s To: 4.500s

Seismic Scale:
0.20in/s (0.050in/s/div) 5.08mm/s (1.270mm/s/div)

*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located on Floor 6 inches from Door
Door Shut with normal amount of force

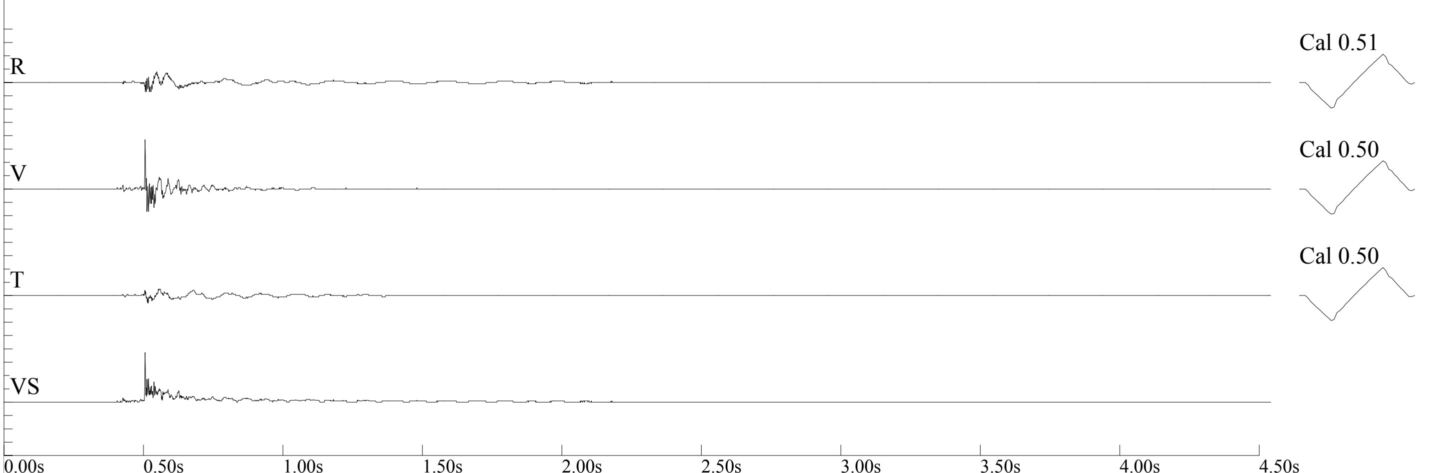
File Name: DOOR_SHUT001.DTB
Number: 001
Date: 3/19/2005
Time: 13:17
Serial Number: 1644
Seismic Trigger: 0.0250 in/s 0.6350 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

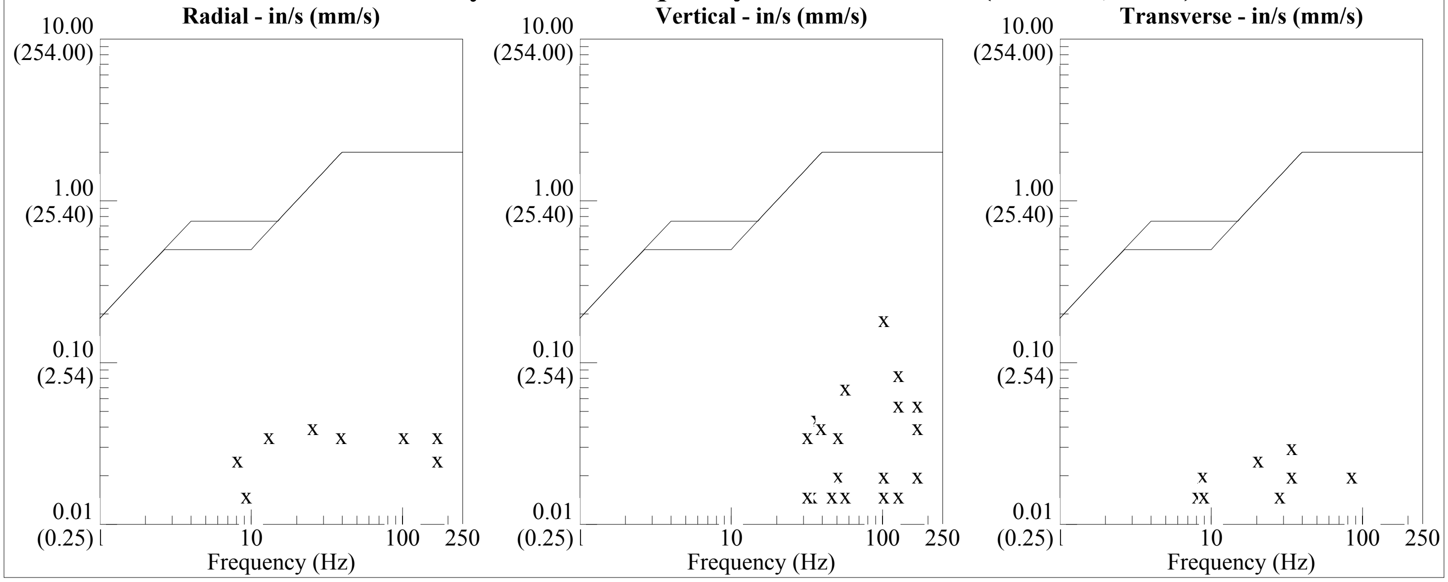
Radial: 0.04in/s 1.016mm/s @ 25.6Hz
***Vertical:* 0.185in/s 4.699mm/s @ 102.4Hz**
Transverse: 0.03in/s 0.762mm/s @ 46.5Hz
Vector Sum (VS): 0.185in/s 4.699mm/s
*Displacement:*0.000654in 0.016610mm
*Acceleration:*0.245135g's
*Calibration Date:*2/16/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
0.20in/s (0.050in/s/div) 5.08mm/s (1.270mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



TerraDinamica

Unit Located Above Door
Door Shut with normal amount of force

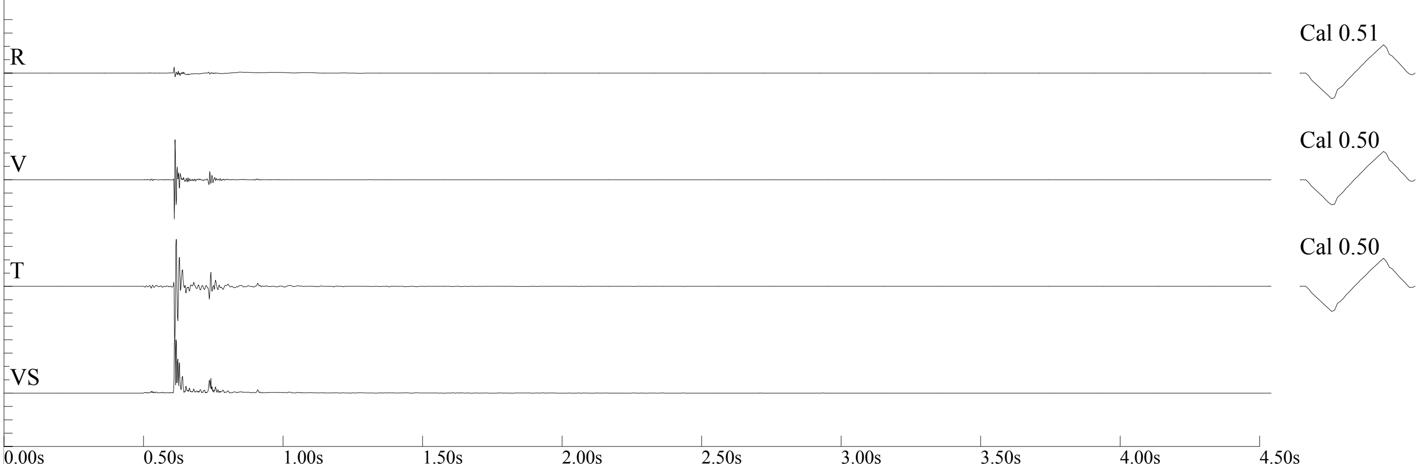
File Name: ABOVE-DOOR_SHUT008.DTB
Number: 008
Date: 3/19/2005
Time: 13:58
Serial Number: 1644
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

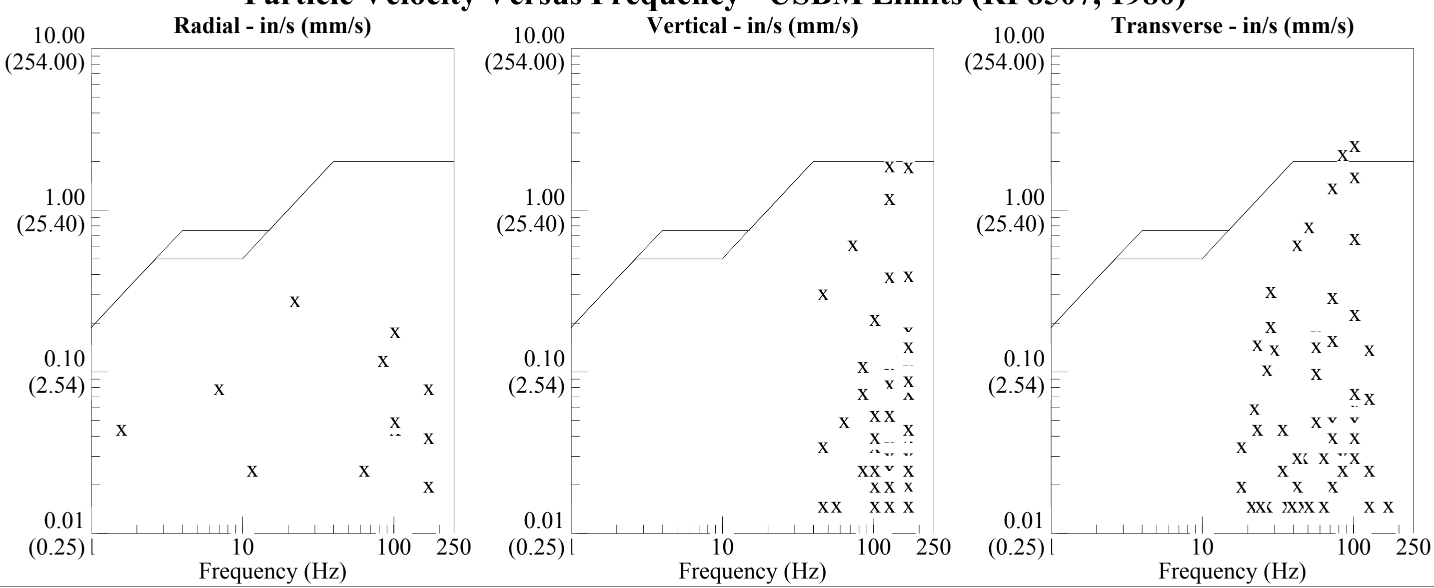
Radial: 0.28in/s 7.112mm/s @ 128.0Hz
Vertical: 1.92in/s 48.768mm/s @ 128.0Hz
***Transverse:* 2.56in/s 65.024mm/s @ 102.4Hz**
Vector Sum (VS): 2.925in/s 74.295mm/s
*Displacement:*0.007616in 0.193435mm
*Acceleration:*4.452174g's
*Calibration Date:*2/16/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
2.56in/s (0.640in/s/div) 65.02mm/s (16.256mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located Above Door
Door Shut with normal amount of force

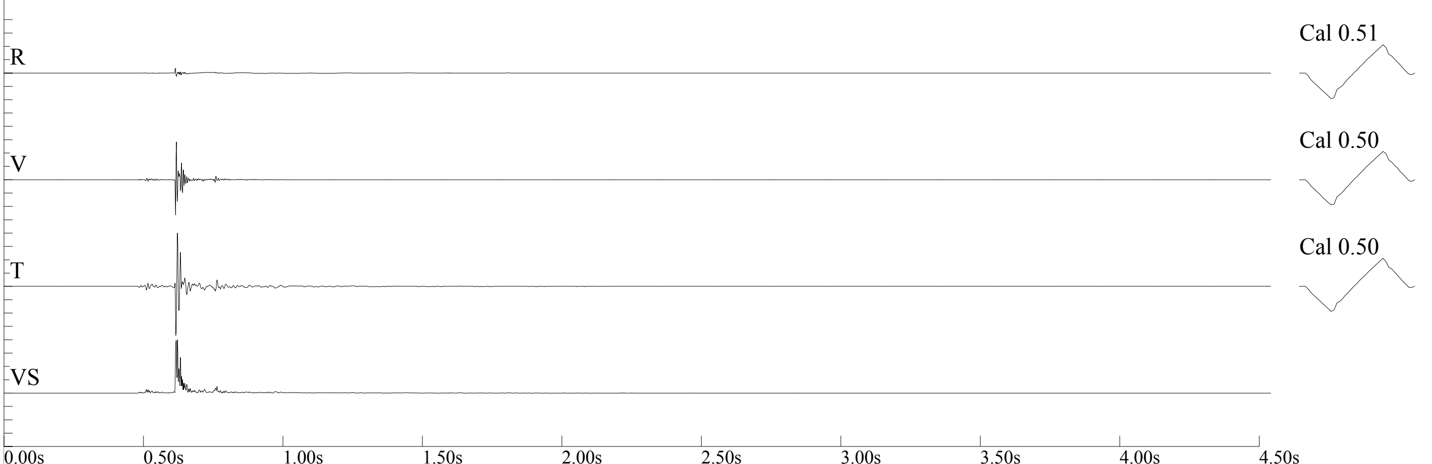
File Name: ABOVE-DOOR_SHUT009.DTB
Number: 009
Date: 3/19/2005
Time: 13:59
Serial Number: 1644
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

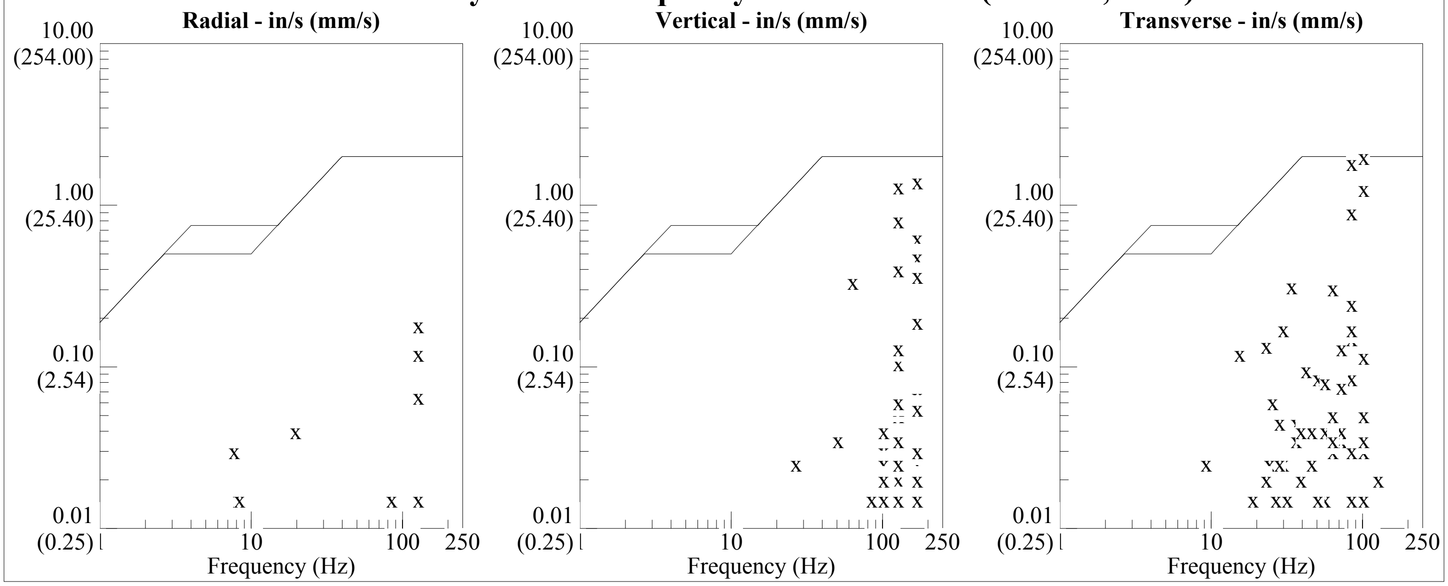
Radial: 0.18in/s 4.572mm/s @ 128.0Hz
Vertical: 1.40in/s 35.56mm/s @ 170.6Hz
***Transverse:* 1.98in/s 50.292mm/s @ 102.4Hz**
Vector Sum (VS): 2.12in/s 53.848mm/s
*Displacement:*0.005948in 0.151083mm
*Acceleration:*2.994617g's
*Calibration Date:*2/16/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
1.98in/s (0.495in/s/div) 50.29mm/s (12.573mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located Above Door
Door Shut with normal amount of force

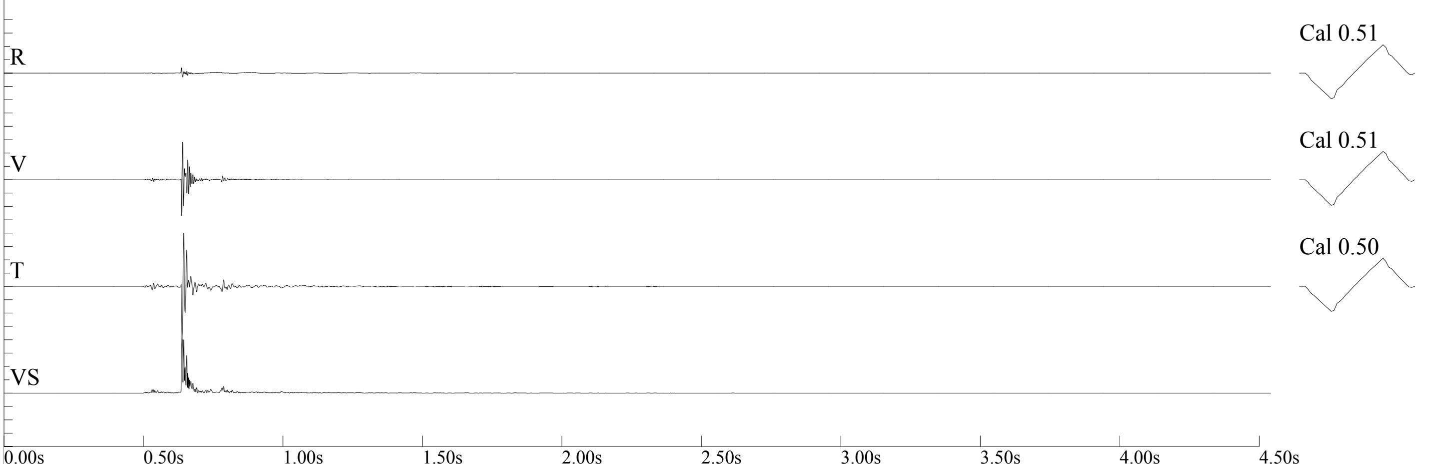
File Name: ABOVE-DOOR_SHUT010.DTB
Number: 010
Date: 3/19/2005
Time: 13:59
Serial Number: 1644
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

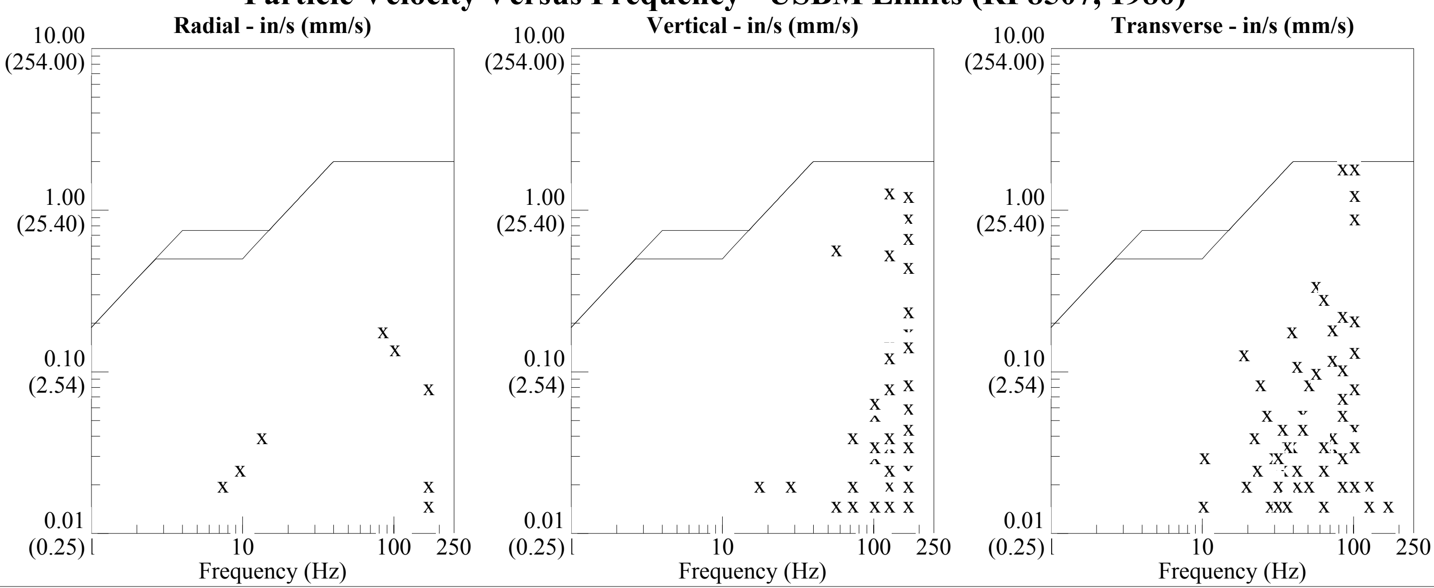
Radial: 0.18in/s 4.572mm/s @ 128.0Hz
Vertical: 1.30in/s 33.02mm/s @ 128.0Hz
***Transverse:* 1.84in/s 46.736mm/s @ 85.3Hz**
Vector Sum (VS): 2.05in/s 52.07mm/s
*Displacement:*0.005658in 0.143725mm
*Acceleration:*3.153623g's
*Calibration Date:*2/16/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
1.84in/s (0.460in/s/div) 46.74mm/s (11.684mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located Above Door
Door Shut with Normal amount of force

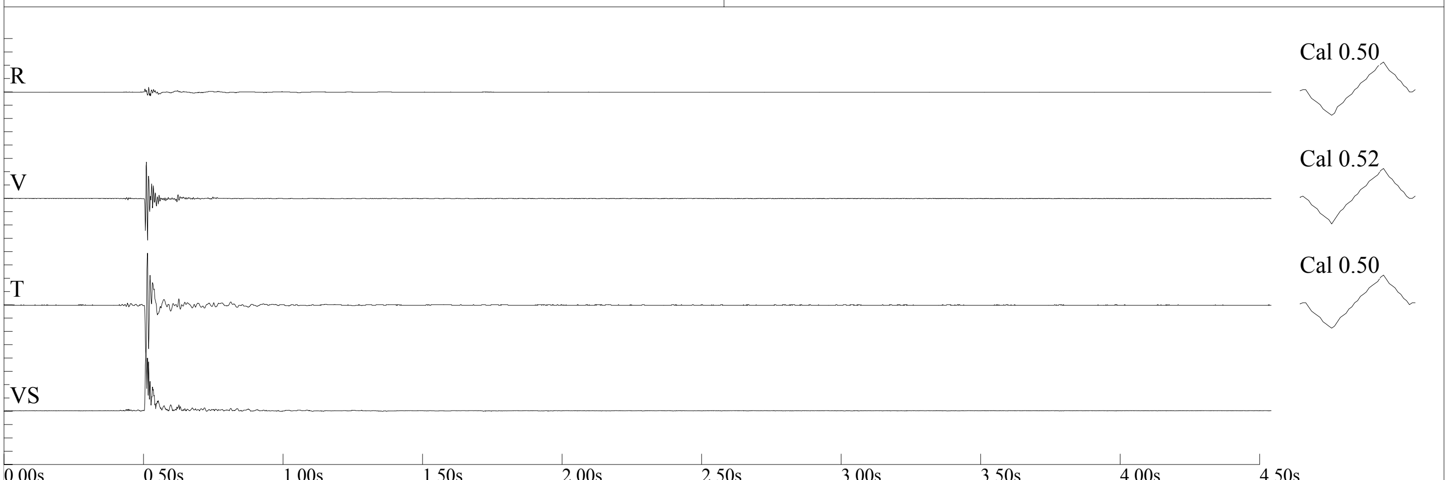
File Name: DOOR_SHUT_ABOVE_DOOR000.DTB
Number: 000
Date: 3/20/2005
Time: 18:15
Serial Number: 2474
Seismic Trigger: 0.2000 in/s 5.0800 mm/s
Acoustic Trigger: 130 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

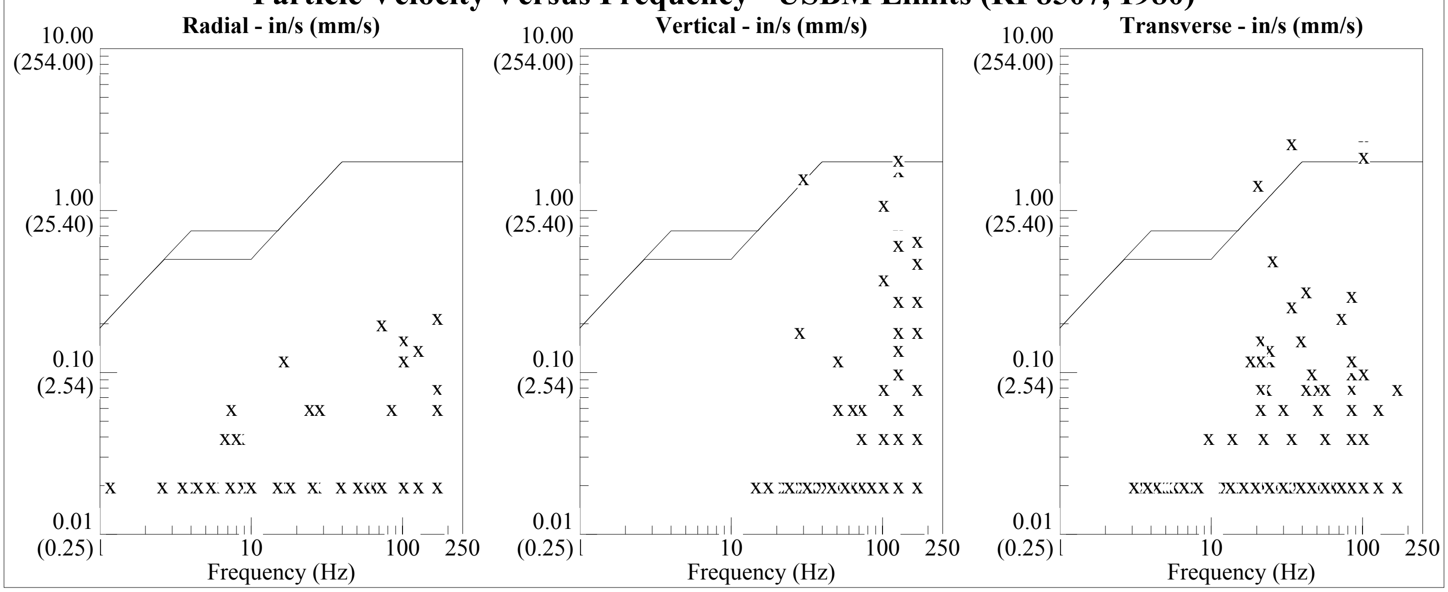
Radial: 0.22in/s 5.588mm/s @ 170.6Hz
Vertical: 2.08in/s 52.832mm/s @ 128.0Hz
***Transverse:* 2.64in/s 67.056mm/s @ 56.8Hz**
Vector Sum (VS): 3.30in/s 83.82mm/s
*Displacement:*0.009743in 0.247470mm
*Acceleration:*4.452174g's
*Calibration Date:*2/18/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
2.64in/s (0.660in/s/div) 67.06mm/s (16.764mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



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Unit Located Above Door
Door Shut with Normal amount of force

File Name: DOOR_SHUT_ABOVE_DOOR001.DTB
Number: 001
Date: 3/20/2005
Time: 18:16
Serial Number: 2474
Seismic Trigger: 0.2000 in/s 5.0800 mm/s
Acoustic Trigger: 130 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

Radial: 0.12in/s 3.048mm/s @ 128.0Hz

Vertical: 0.86in/s 21.844mm/s @ 128.0Hz

***Transverse:* 1.48in/s 37.592mm/s @ 85.3Hz**

Vector Sum (VS): 1.54in/s 39.116mm/s

*Displacement:*0.005752in 0.146093mm

*Acceleration:*2.120083g's

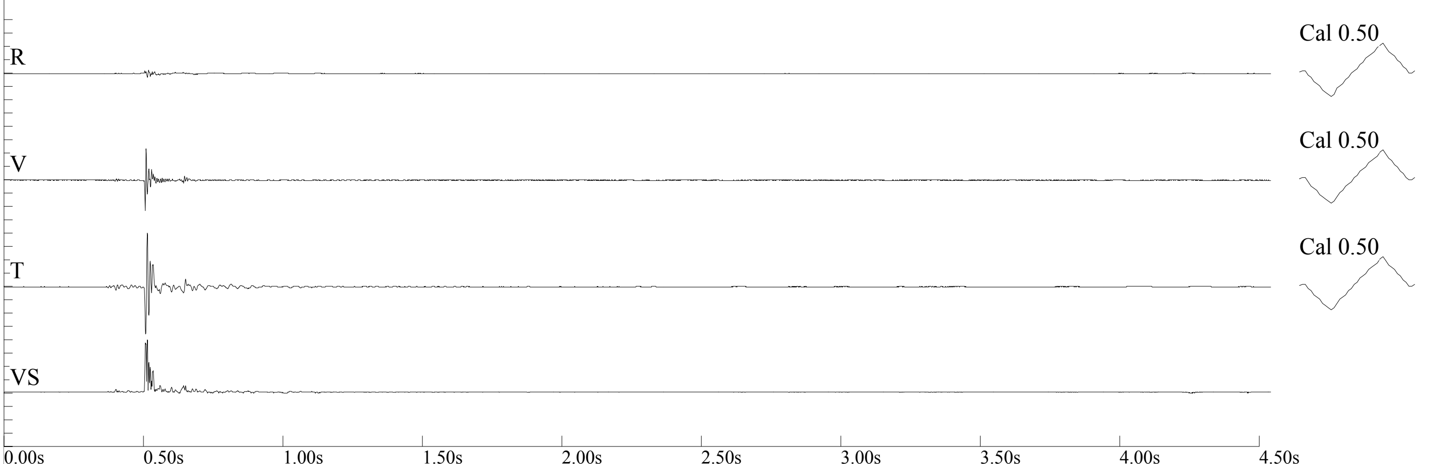
*Calibration Date:*2/18/2005

Graph Information

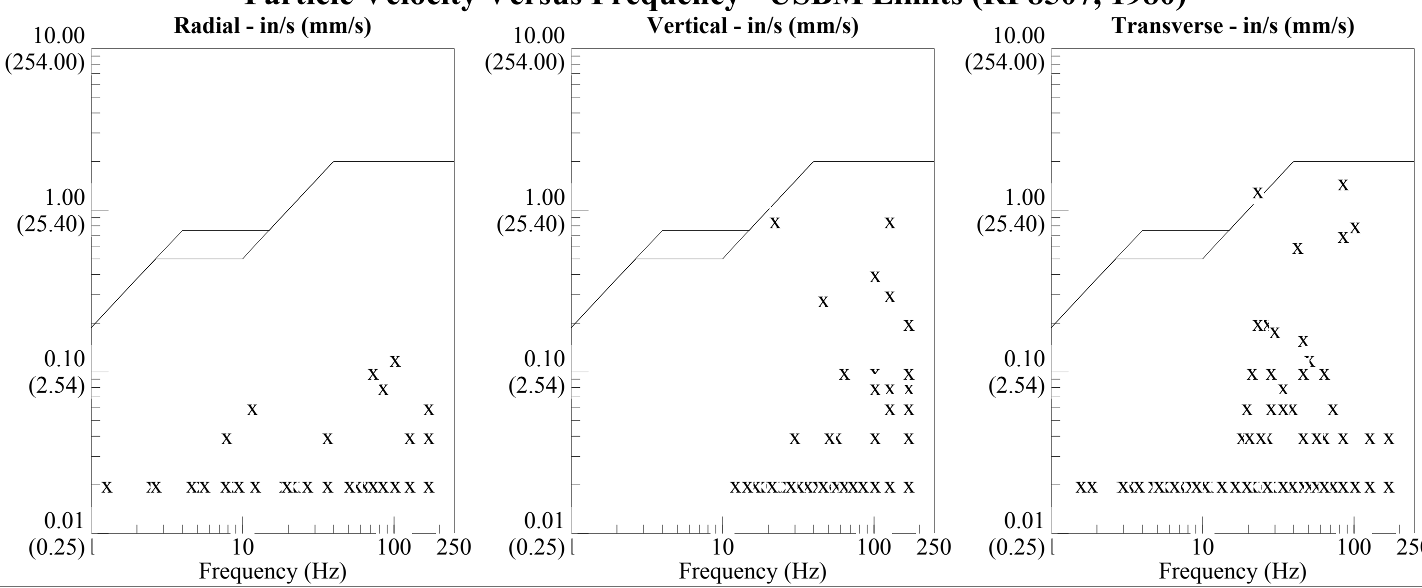
*Duration:*0.000s To: 4.500s

Seismic Scale:
1.48in/s (0.370in/s/div) 37.59mm/s (9.398mm/s/div)

*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located Above Door
Door Shut with Normal amount of force

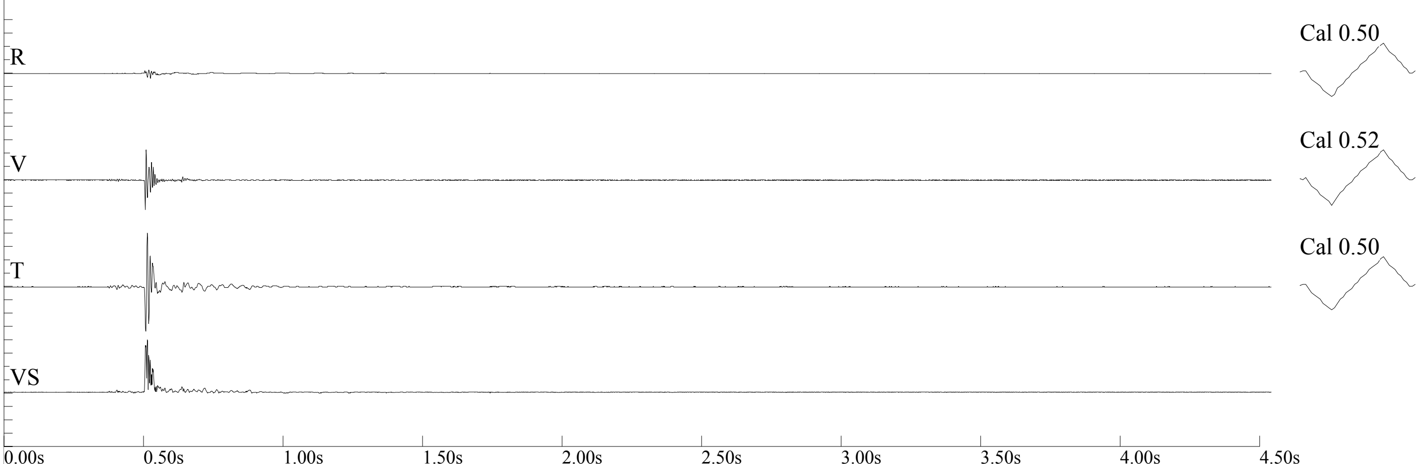
File Name: DOOR_SHUT_ABOVE_DOOR002.DTB
Number: 002
Date: 3/20/2005
Time: 18:16
Serial Number: 2474
Seismic Trigger: 0.2000 in/s 5.0800 mm/s
Acoustic Trigger: 130 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

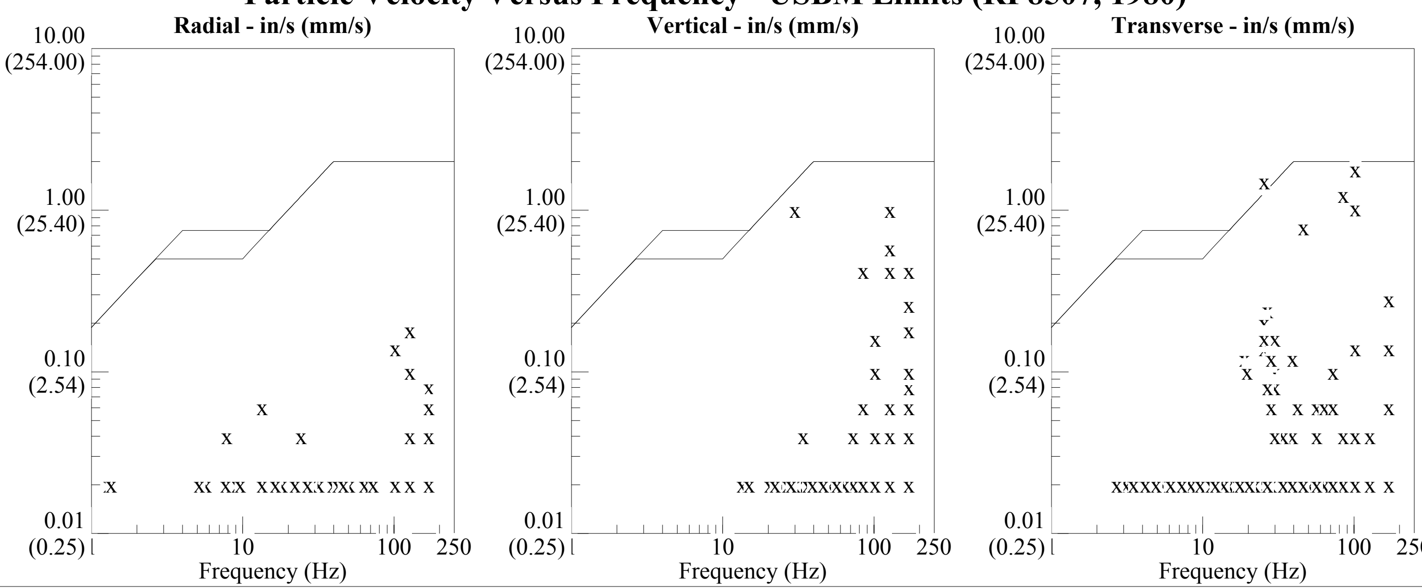
Radial: 0.18in/s 4.572mm/s @ 128.0Hz
Vertical: 1.00in/s 25.40mm/s @ 128.0Hz
***Transverse:* 1.78in/s 45.212mm/s @ 102.4Hz**
Vector Sum (VS): 1.885in/s 47.879mm/s
*Displacement:*0.006401in 0.162575mm
*Acceleration:*2.517598g's
*Calibration Date:*2/18/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
1.78in/s (0.445in/s/div) 45.21mm/s (11.303mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located 10 ft from Door on same wall
Door Slam

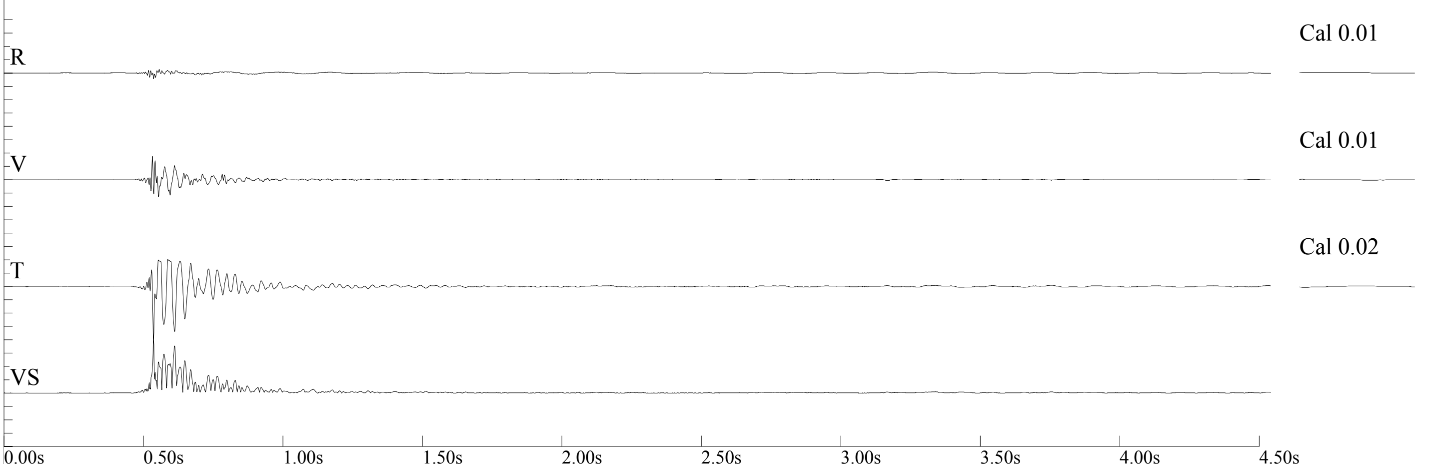
File Name: DOOR_SLAM_10FT_SAME_WALL004.DTB
Number: 004
Date: 3/19/2005
Time: 15:04
Serial Number: 1646
Seismic Trigger: 0.0500 in/s 1.2700 mm/s
Acoustic Trigger: 116 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 7.1

Amplitudes and Frequencies

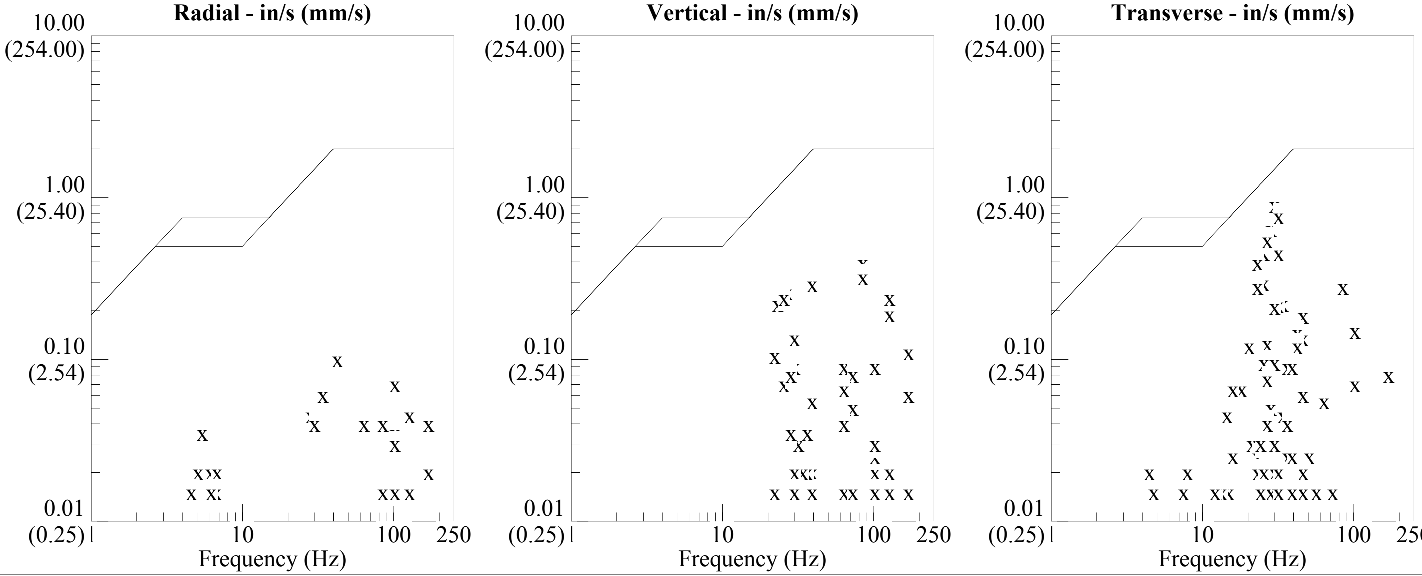
Radial: 0.10in/s 2.54mm/s @ 46.5Hz
Vertical: 0.395in/s 10.033mm/s @ 85.3Hz
***Transverse:* 0.90in/s 22.86mm/s @ 30.1Hz**
Vector Sum (VS): 0.93in/s 23.622mm/s
*Displacement:*0.004501in 0.114330mm
*Acceleration:*0.662526g's
*Calibration Date:*2/18/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
0.90in/s (0.225in/s/div) 22.86mm/s (5.715mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located 10 ft from Door on same wall
Door Slam

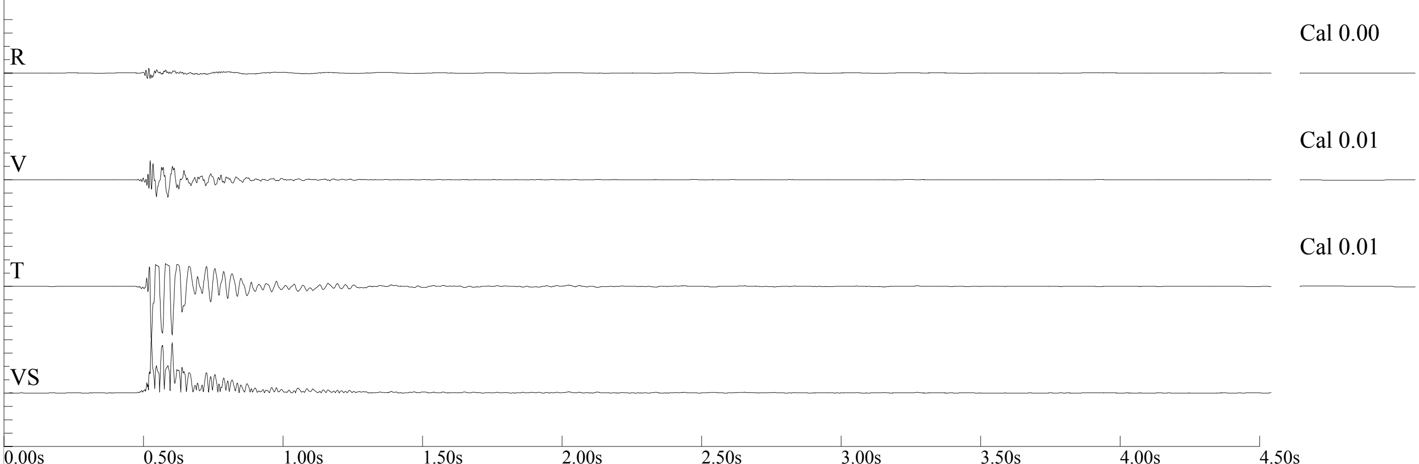
File Name: DOOR_SLAM_10FT_SAME_WALL006.DTB
Number: 006
Date: 3/19/2005
Time: 15:05
Serial Number: 1646
Seismic Trigger: 0.0500 in/s 1.2700 mm/s
Acoustic Trigger: 116 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 7.1

Amplitudes and Frequencies

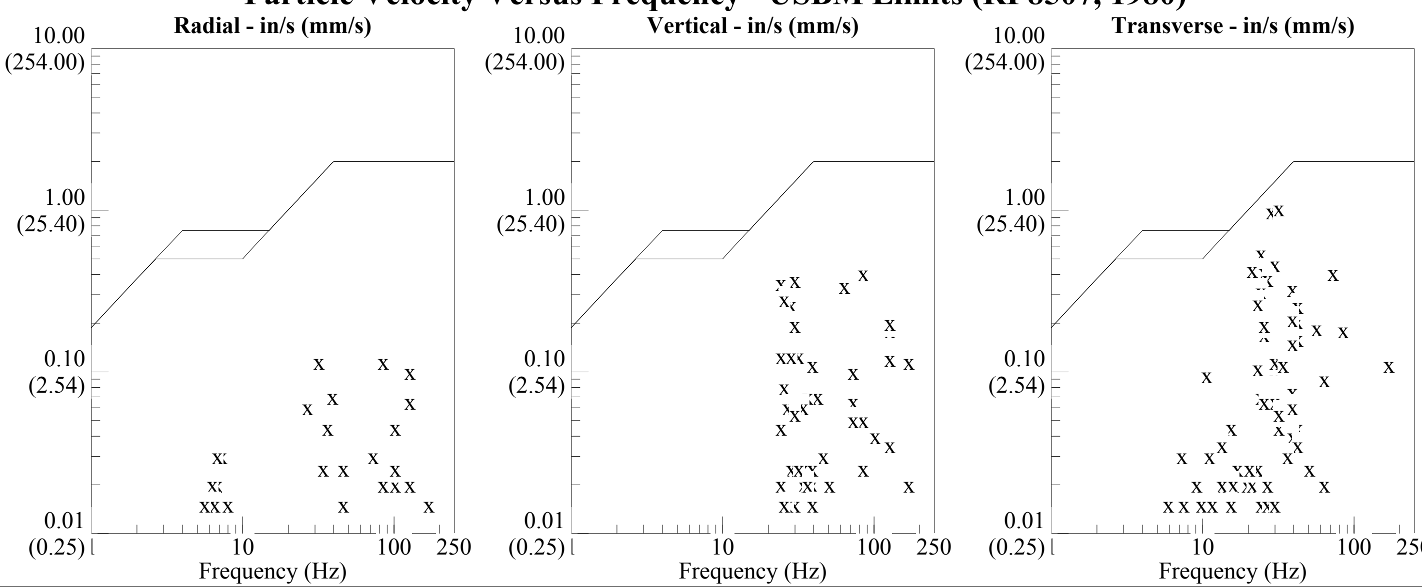
Radial: 0.115in/s 2.921mm/s @ 85.3Hz
Vertical: 0.405in/s 10.287mm/s @ 85.3Hz
***Transverse:* 1.12in/s 28.448mm/s @ 30.1Hz**
Vector Sum (VS): 1.14in/s 28.956mm/s
*Displacement:*0.007553in 0.191855mm
*Acceleration:*0.960663g's
*Calibration Date:*2/18/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
1.12in/s (0.280in/s/div) 28.45mm/s (7.112mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located 10 ft from Door on same wall
Door Slam

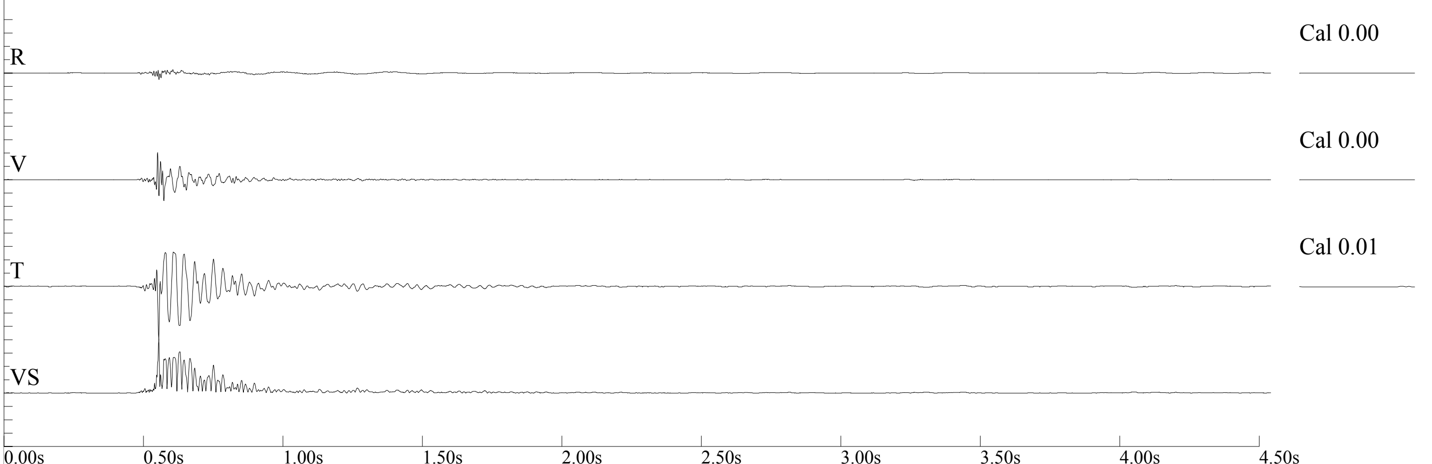
File Name: DOOR_SLAM_10FT_SAME_WALL005.DTB
Number: 005
Date: 3/19/2005
Time: 15:04
Serial Number: 1646
Seismic Trigger: 0.0500 in/s 1.2700 mm/s
Acoustic Trigger: 116 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 7.1

Amplitudes and Frequencies

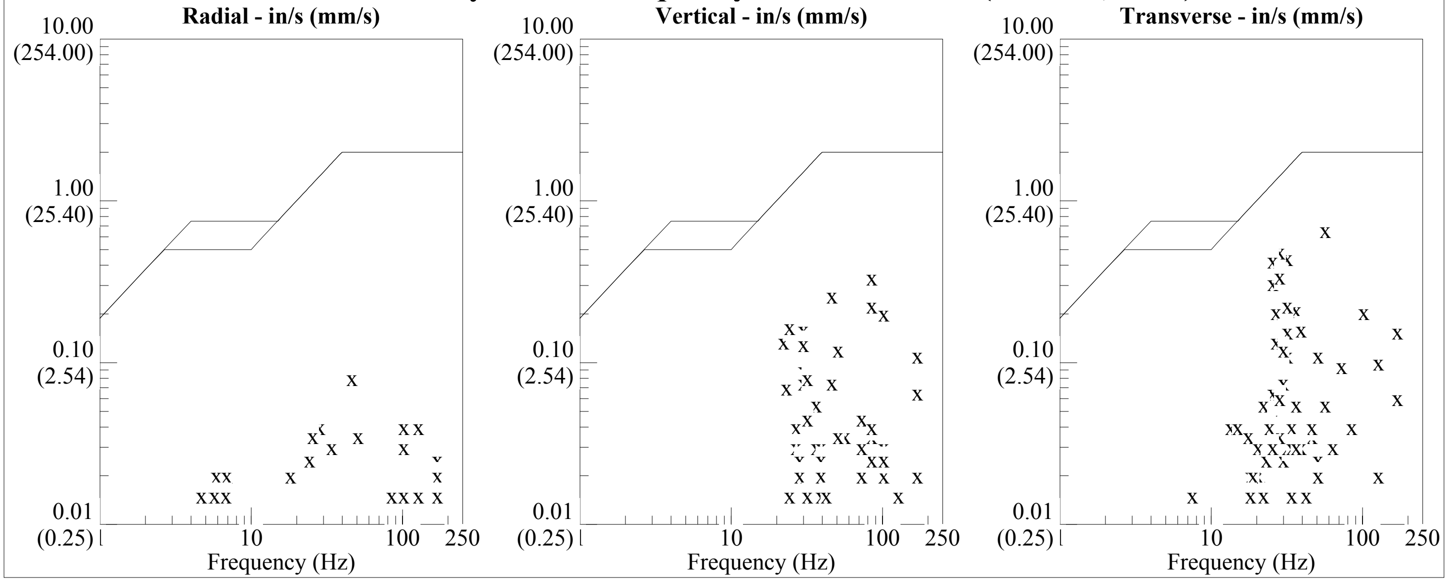
Radial: 0.08in/s 2.032mm/s @ 46.5Hz
Vertical: 0.335in/s 8.509mm/s @ 85.3Hz
***Transverse:* 0.66in/s 16.764mm/s @ 56.8Hz**
Vector Sum (VS): 0.685in/s 17.399mm/s
*Displacement:*0.003813in 0.096846mm
*Acceleration:*0.563147g's
*Calibration Date:*2/18/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
0.66in/s (0.165in/s/div) 16.76mm/s (4.191mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located 10 ft from Door on same wall
Door Slam

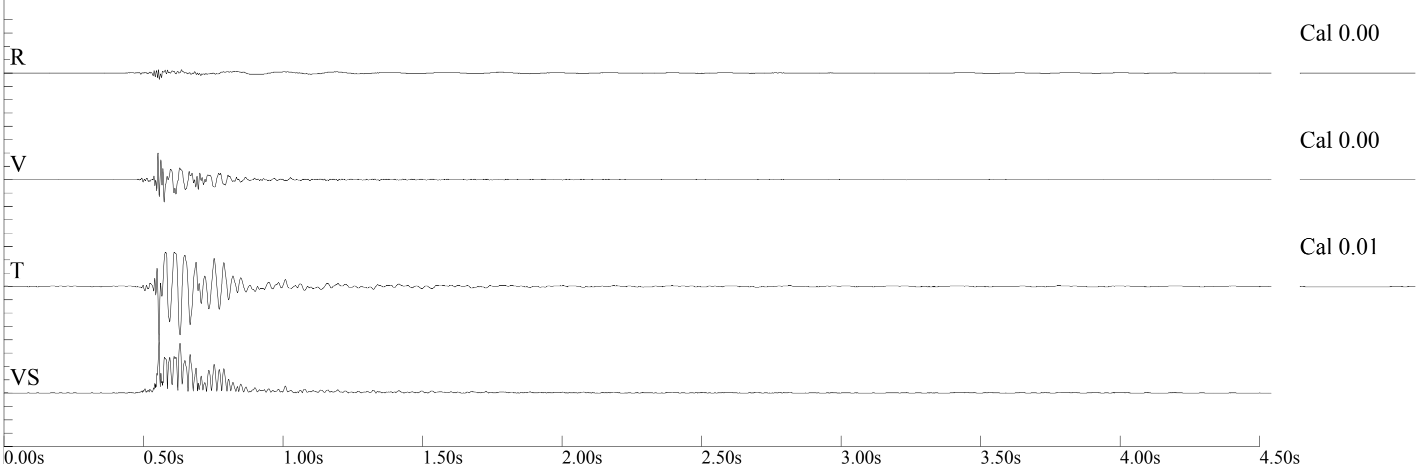
File Name: DOOR_SLAM_10FT_SAME_WALL007.DTB
Number: 007
Date: 3/19/2005
Time: 15:06
Serial Number: 1646
Seismic Trigger: 0.0500 in/s 1.2700 mm/s
Acoustic Trigger: 116 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 7.1

Amplitudes and Frequencies

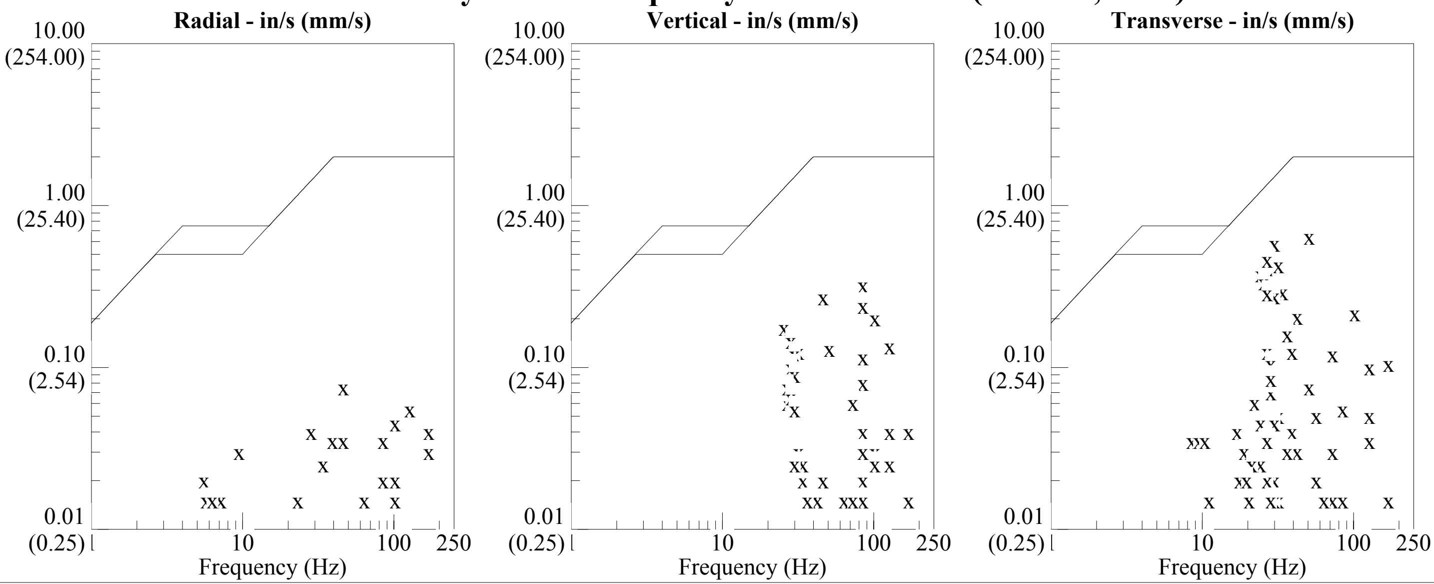
Radial: 0.075in/s 1.905mm/s @ 46.5Hz
Vertical: 0.32in/s 8.128mm/s @ 85.3Hz
***Transverse:* 0.64in/s 16.256mm/s @ 56.8Hz**
Vector Sum (VS): 0.67in/s 17.018mm/s
*Displacement:*0.003666in 0.093110mm
*Acceleration:*0.536646g's
*Calibration Date:*2/18/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
0.64in/s (0.160in/s/div) 16.26mm/s (4.064mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



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Unit Located 10 ft from Door on same wall
Door Shut

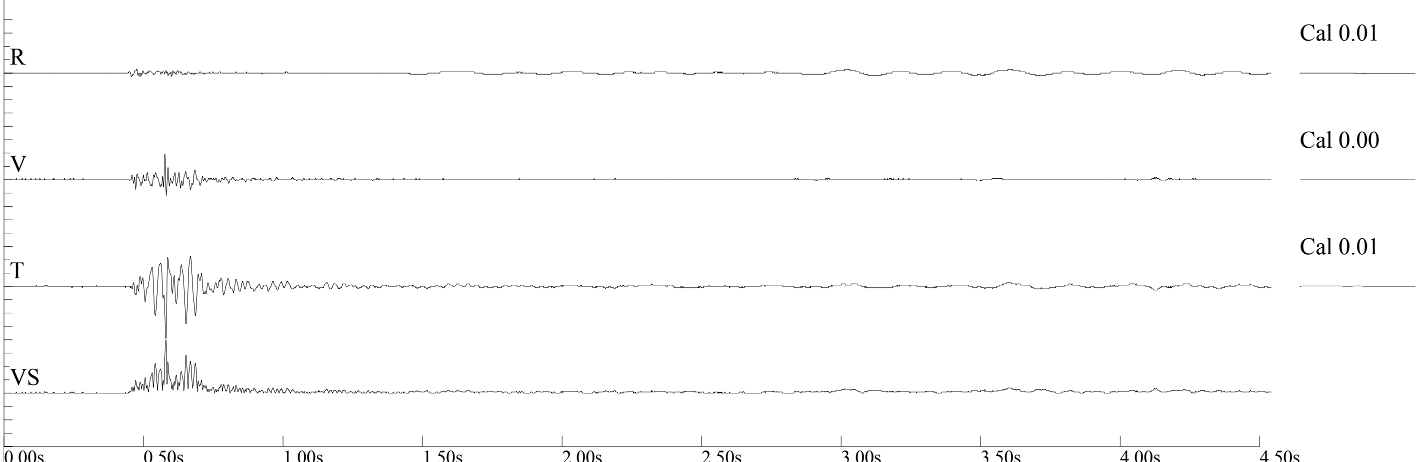
File Name: DOOR_SHUT_10FT_SAME_WALL001.DTB
Number: 001
Date: 3/19/2005
Time: 15:02
Serial Number: 1646
Seismic Trigger: 0.0500 in/s 1.2700 mm/s
Acoustic Trigger: 116 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 7.1

Amplitudes and Frequencies

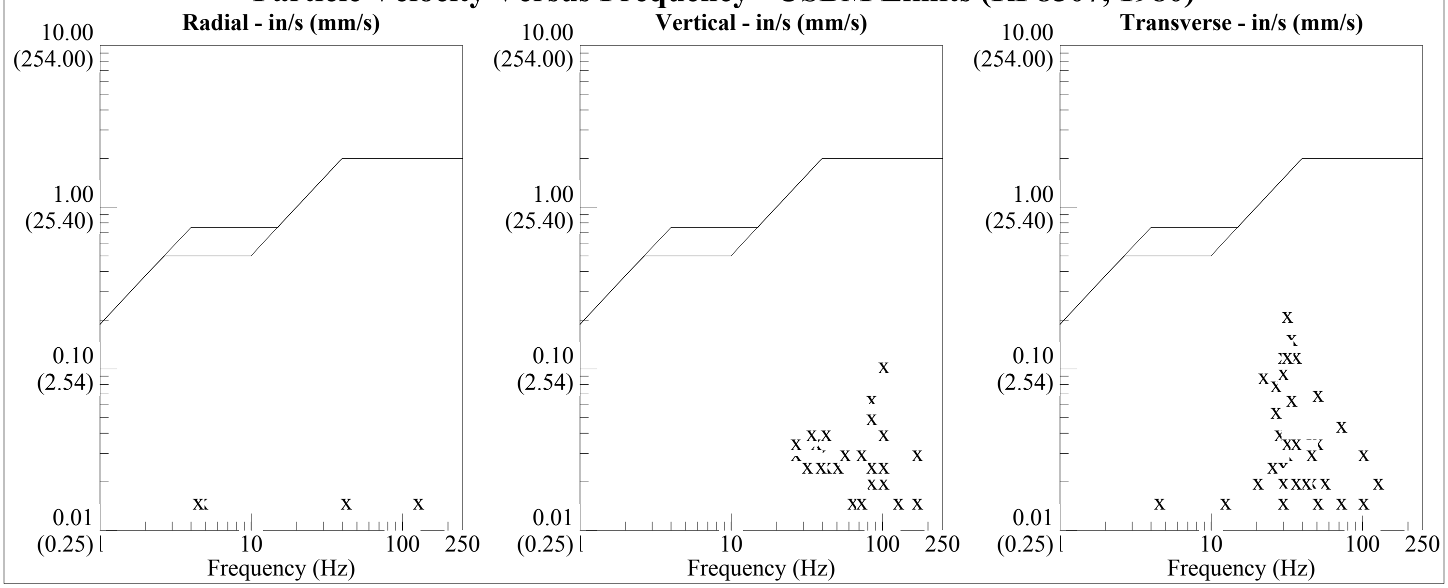
Radial: 0.015in/s 0.381mm/s @ 5.8Hz
Vertical: 0.105in/s 2.667mm/s @ 102.4Hz
***Transverse:* 0.215in/s 5.461mm/s @ 32.0Hz**
Vector Sum (VS): 0.22in/s 5.588mm/s
*Displacement:*0.000926in 0.023523mm
*Acceleration:*0.218634g's
*Calibration Date:*2/18/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
0.22in/s (0.055in/s/div) 5.59mm/s (1.397mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located 10 ft from Door on same wall
Door Shut

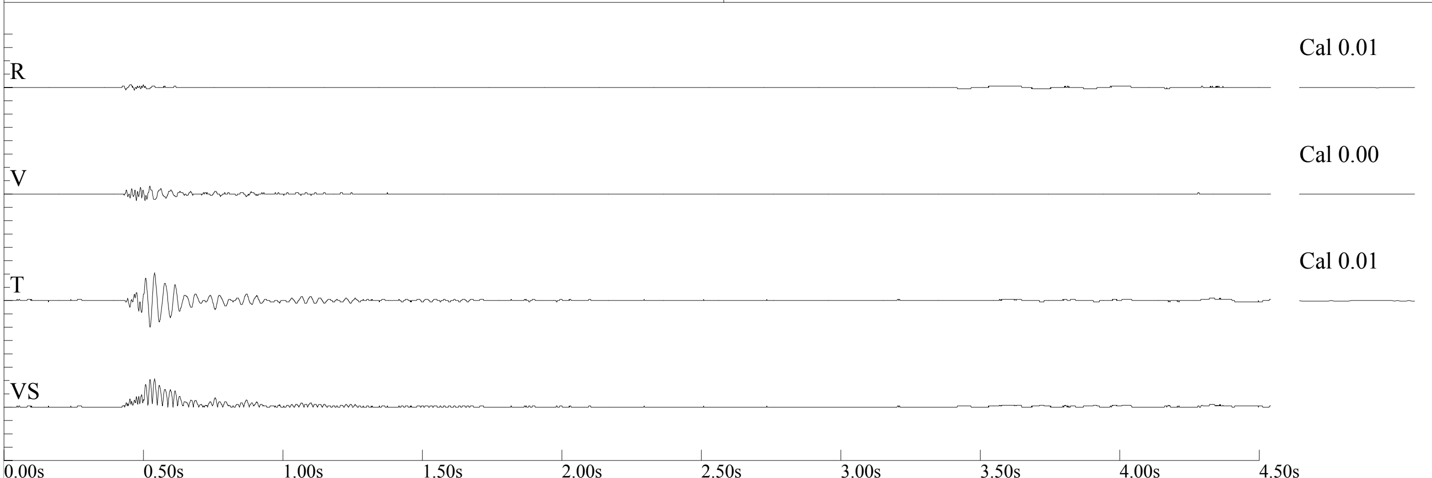
File Name: DOOR_SHUT_10FT_SAME_WALL002.DTB
Number: 002
Date: 3/19/2005
Time: 15:03
Serial Number: 1646
Seismic Trigger: 0.0500 in/s 1.2700 mm/s
Acoustic Trigger: 116 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 7.1

Amplitudes and Frequencies

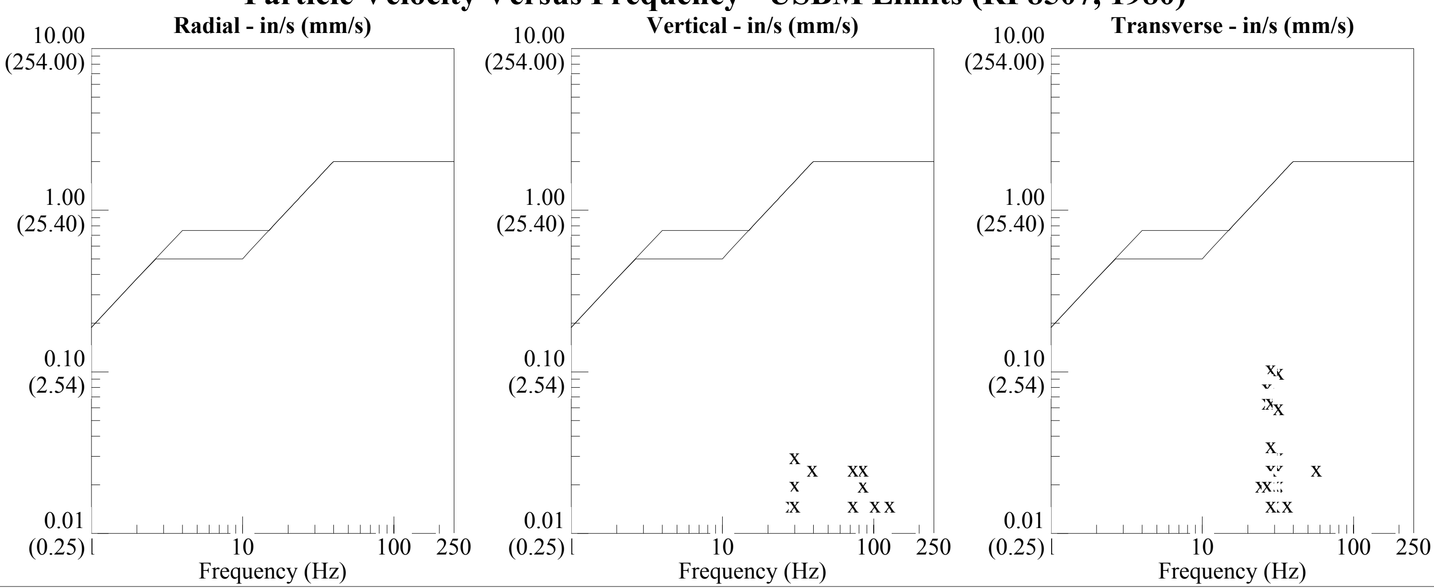
Radial: 0.005in/s 0.127mm/s @ 0.0Hz
Vertical: 0.03in/s 0.762mm/s @ 36.5Hz
***Transverse:* 0.105in/s 2.667mm/s @ 28.4Hz**
Vector Sum (VS): 0.105in/s 2.667mm/s
*Displacement:*0.000585in 0.014859mm
*Acceleration:*0.046377g's
*Calibration Date:*2/18/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
0.20in/s (0.050in/s/div) 5.08mm/s (1.270mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located 10 ft from Door on same wall
Door Shut

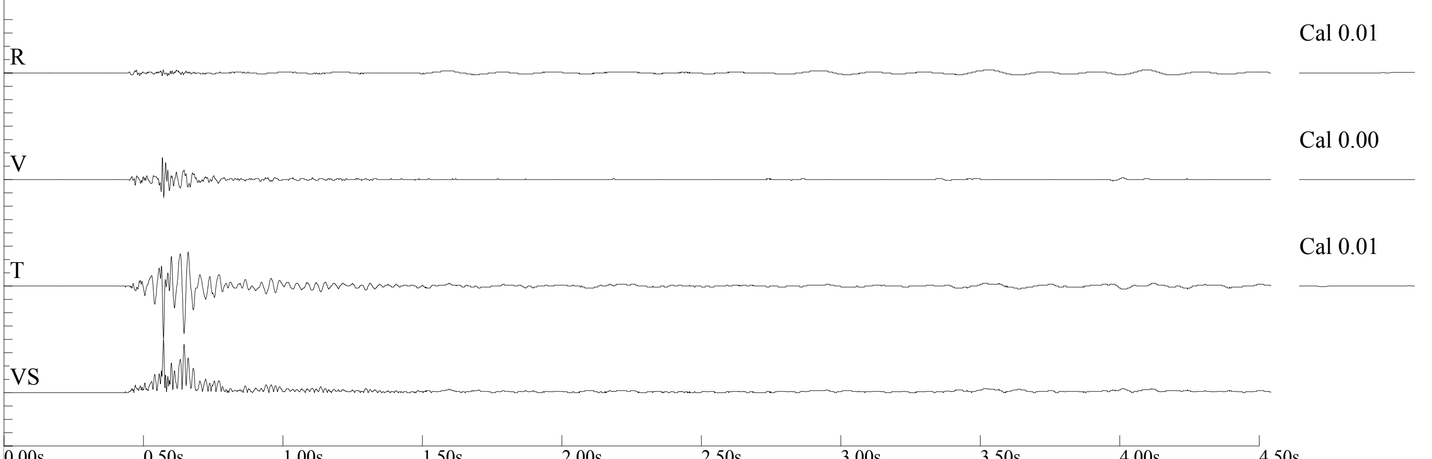
File Name: DOOR_SHUT_10FT_SAME_WALL003.DTB
Number: 003
Date: 3/19/2005
Time: 15:03
Serial Number: 1646
Seismic Trigger: 0.0500 in/s 1.2700 mm/s
Acoustic Trigger: 116 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 7.1

Amplitudes and Frequencies

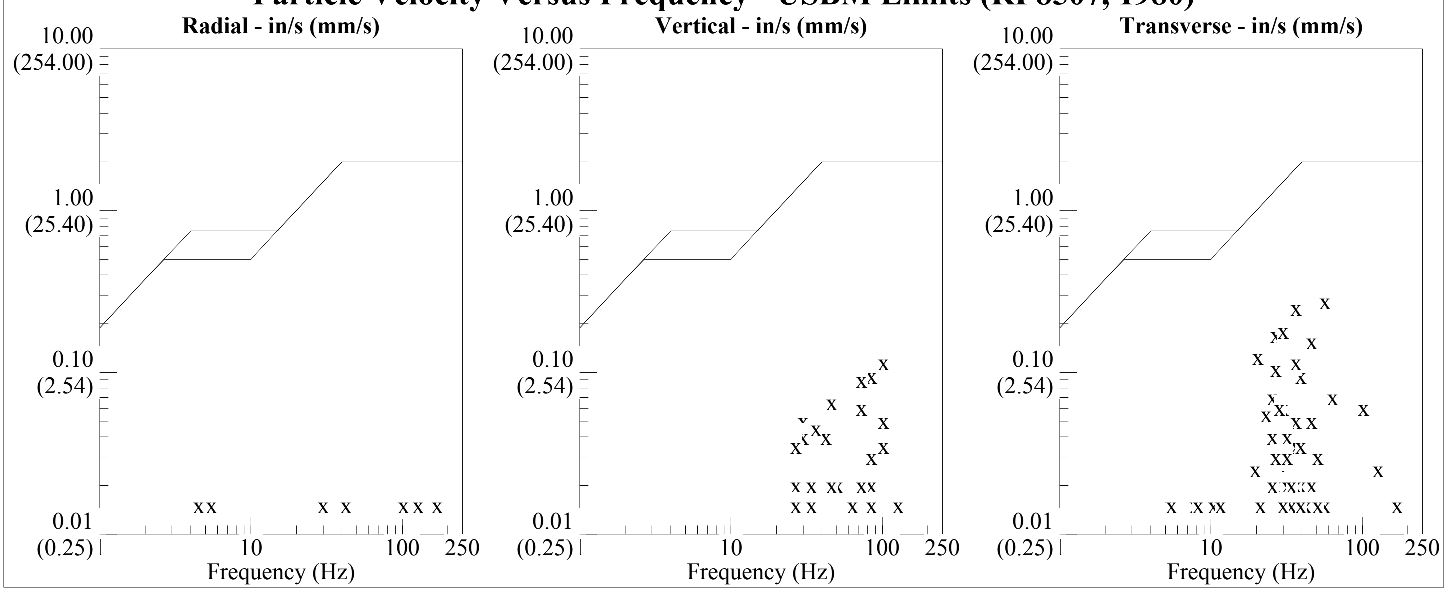
Radial: 0.015in/s 0.381mm/s @ 128.0Hz
Vertical: 0.115in/s 2.921mm/s @ 102.4Hz
***Transverse:* 0.275in/s 6.985mm/s @ 56.8Hz**
Vector Sum (VS): 0.29in/s 7.366mm/s
*Displacement:*0.001548in 0.039320mm
*Acceleration:*0.218634g's
*Calibration Date:*2/18/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
0.28in/s (0.070in/s/div) 7.11mm/s (1.778mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located on Window Frame
Front Wall of House 13ft from Door
Vibration Caused By Front Door Slam

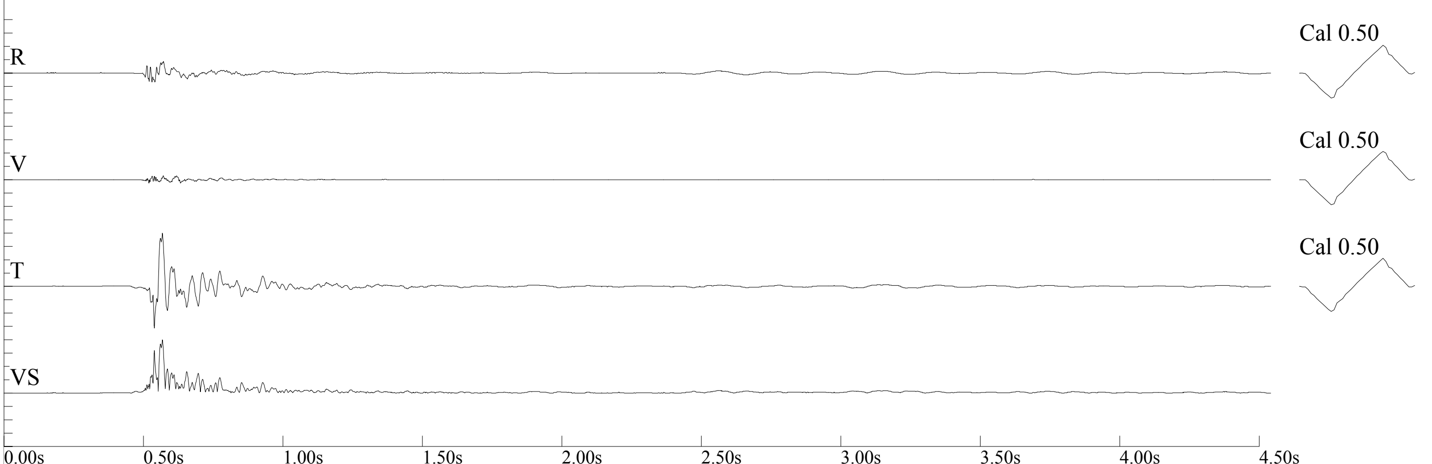
File Name: WINDOW DOOR SLAM005.DTB
Number: 005
Date: 3/28/2005
Time: 12:26
Serial Number: 1646
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 142 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.5

Amplitudes and Frequencies

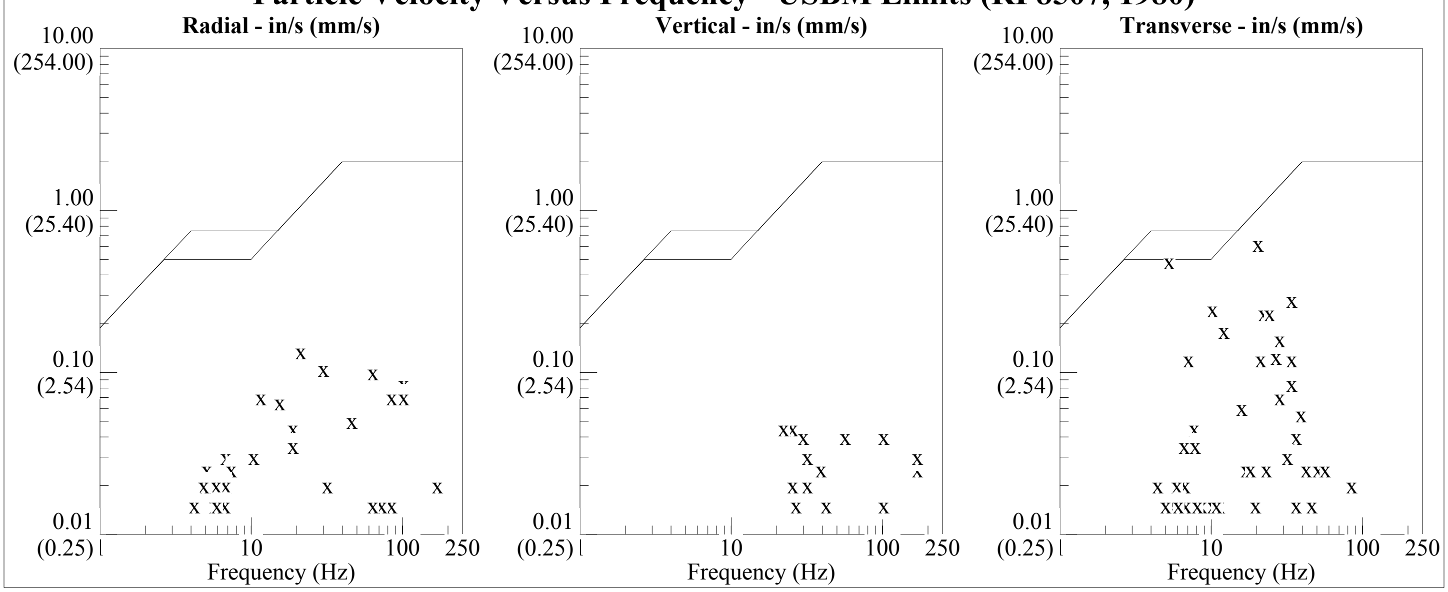
Radial: 0.135in/s 3.429mm/s @ 21.3Hz
Vertical: 0.045in/s 1.143mm/s @ 36.5Hz
***Transverse:* 0.62in/s 15.748mm/s @ 20.4Hz**
Vector Sum (VS): 0.63in/s 16.002mm/s
*Displacement:*0.006985in 0.177413mm
*Acceleration:*0.311387g's
*Calibration Date:*2/18/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
0.62in/s (0.155in/s/div) 15.75mm/s (3.937mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located on Window Frame
Front Wall of House 13ft from Door
Vibration Caused By Front Door Slam

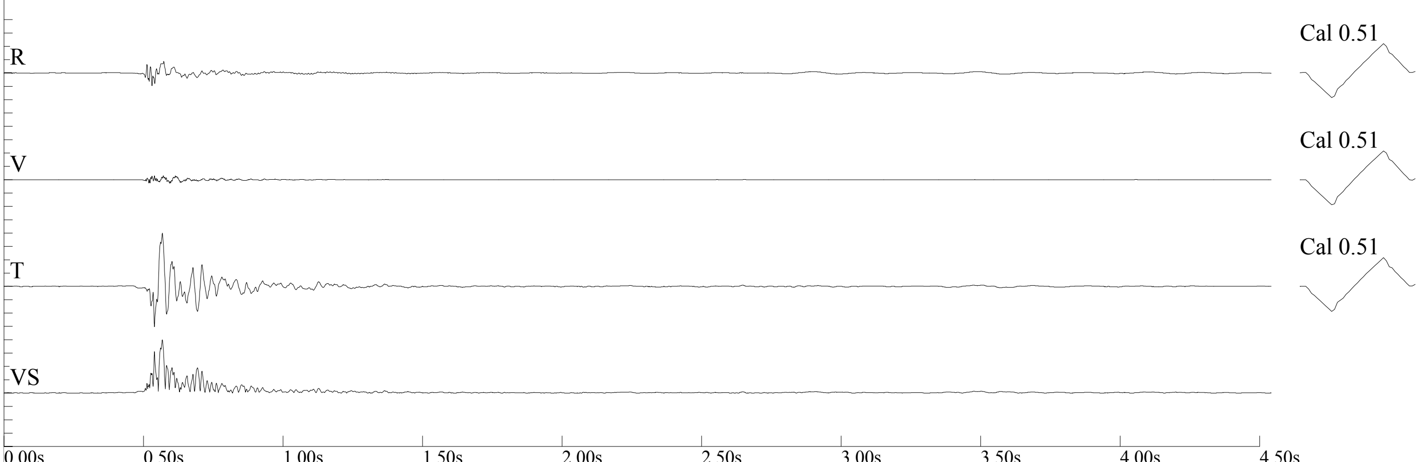
File Name: WINDOW DOOR SLAM008.DTB
Number: 008
Date: 3/28/2005
Time: 12:27
Serial Number: 1646
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 142 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.5

Amplitudes and Frequencies

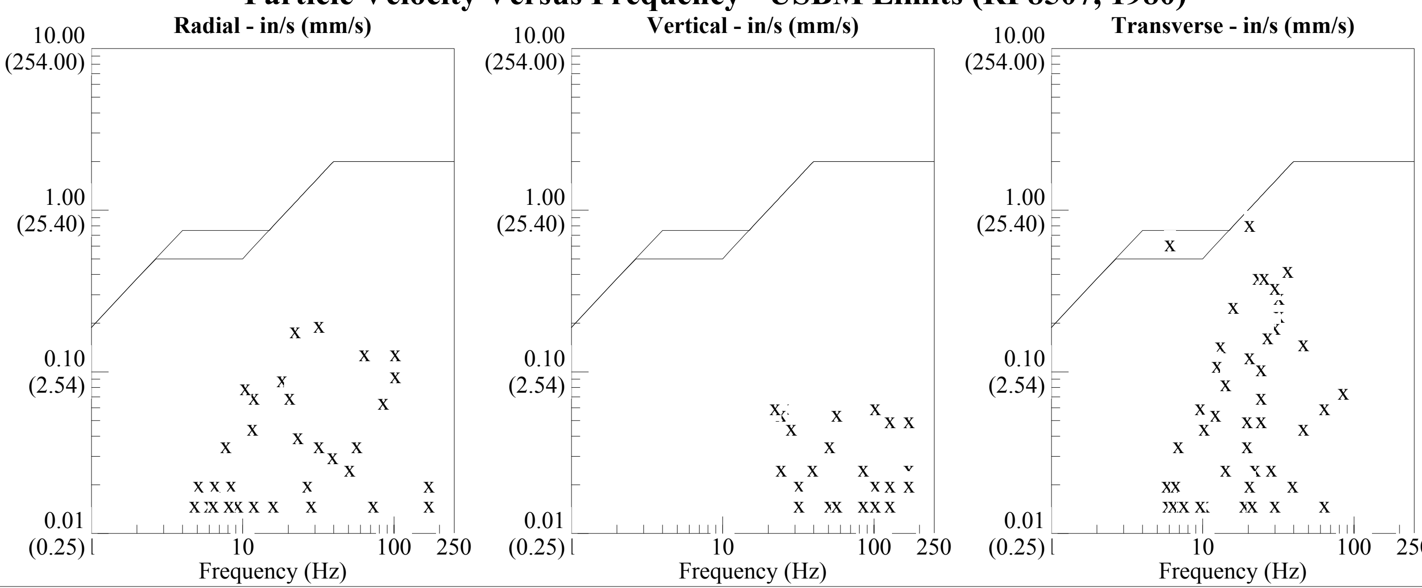
Radial: 0.195in/s 4.953mm/s @ 32.0Hz
Vertical: 0.06in/s 1.524mm/s @ 102.4Hz
***Transverse:* 0.82in/s 20.828mm/s @ 20.4Hz**
Vector Sum (VS): 0.83in/s 21.082mm/s
*Displacement:*0.008990in 0.228341mm
*Acceleration:*0.437267g's
*Calibration Date:*2/18/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
0.82in/s (0.205in/s/div) 20.83mm/s (5.207mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



TerraDinamica

Unit Located on Window Frame
Front Wall of House 13ft from Door
Vibration Caused By Front Door Slam

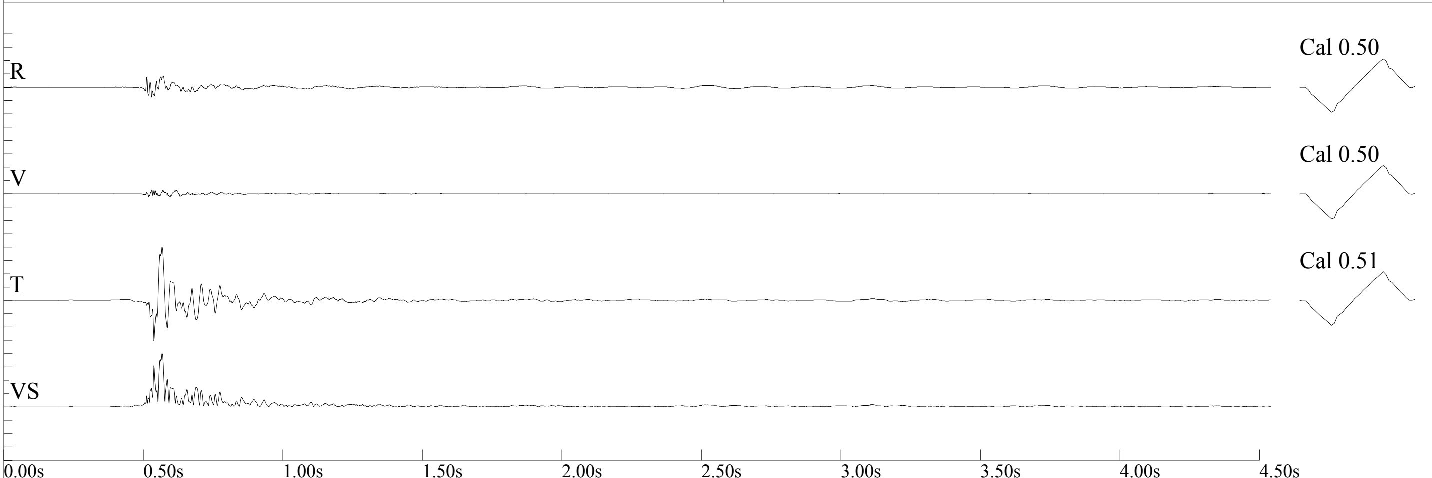
File Name: WINDOW DOOR SLAM006.DTB
Number: 006
Date: 3/28/2005
Time: 12:27
Serial Number: 1646
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 142 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.5

Amplitudes and Frequencies

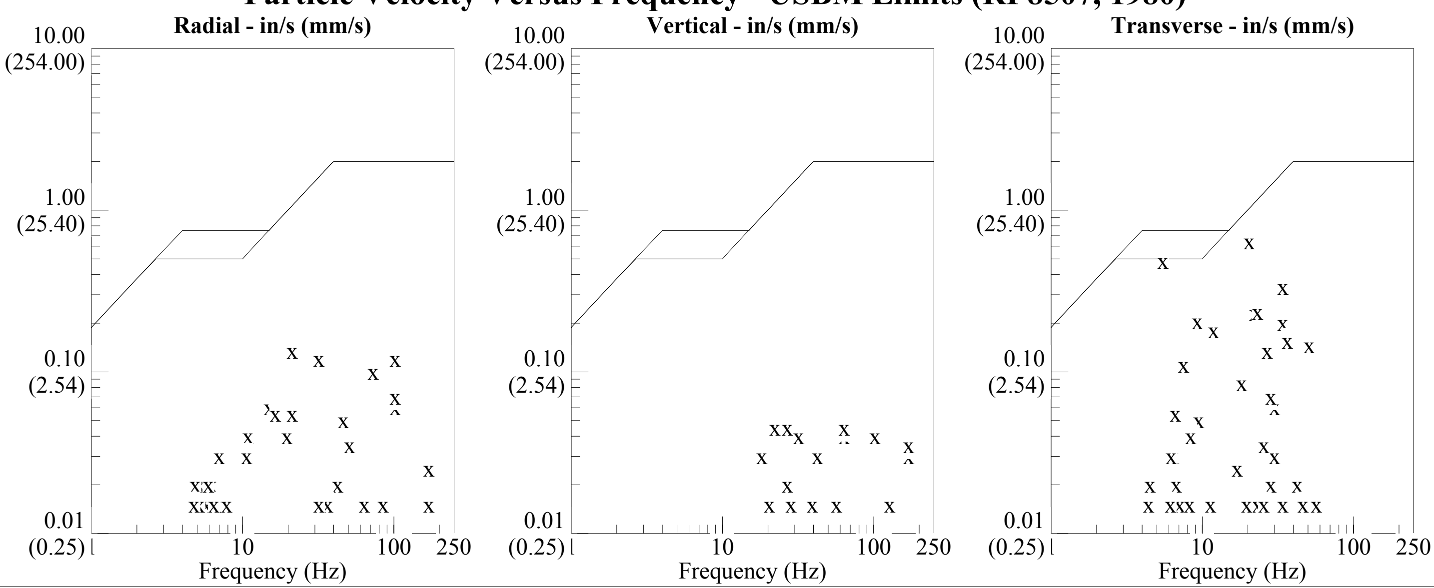
Radial: 0.135in/s 3.429mm/s @ 21.3Hz
Vertical: 0.045in/s 1.143mm/s @ 64.0Hz
***Transverse:* 0.64in/s 16.256mm/s @ 20.4Hz**
Vector Sum (VS): 0.65in/s 16.51mm/s
*Displacement:*0.007271in 0.184673mm
*Acceleration:*0.318012g's
*Calibration Date:*2/18/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
0.64in/s (0.160in/s/div) 16.26mm/s (4.064mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located on Window Frame
Front Wall of House 13ft from Door
Vibration Caused By Front Door Slam

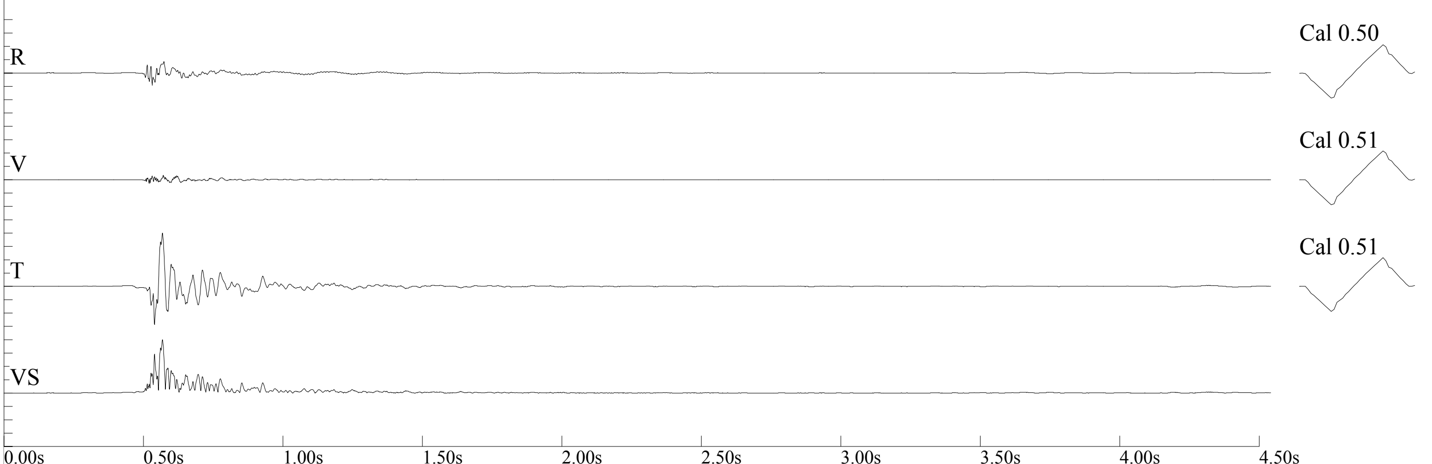
File Name: WINDOW DOOR SLAM010.DTB
Number: 010
Date: 3/28/2005
Time: 12:28
Serial Number: 1646
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 142 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.5

Amplitudes and Frequencies

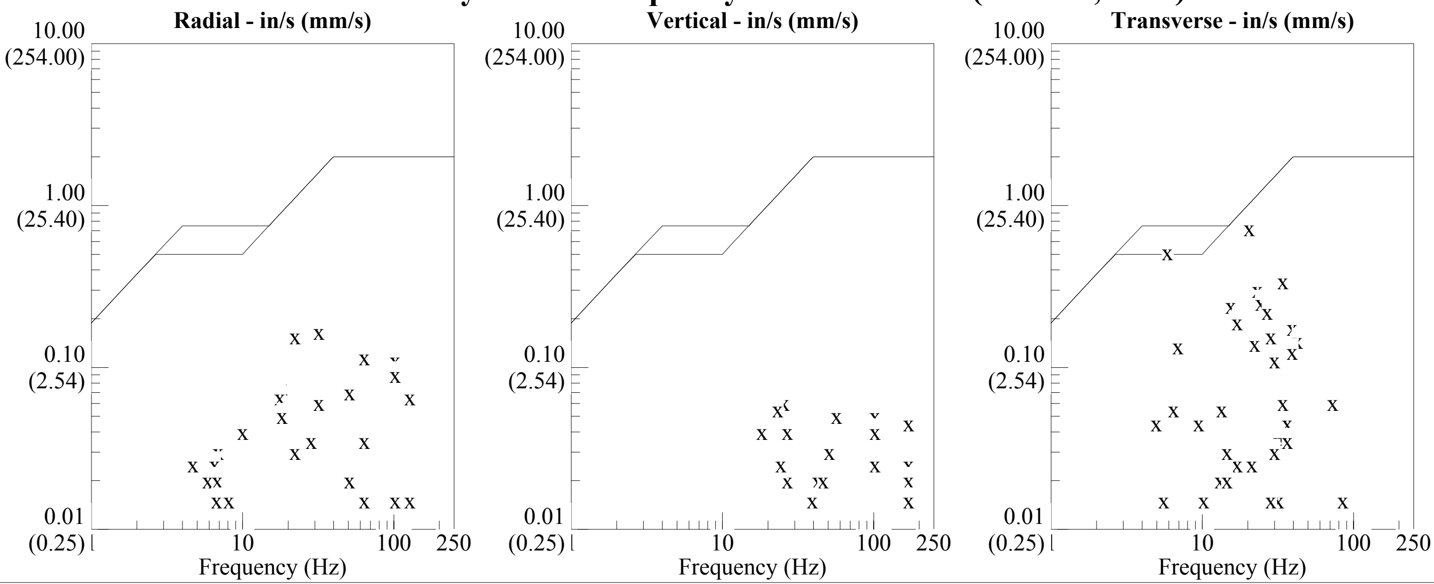
Radial: 0.165in/s 4.191mm/s @ 32.0Hz
Vertical: 0.06in/s 1.524mm/s @ 34.1Hz
***Transverse:* 0.72in/s 18.288mm/s @ 20.4Hz**
Vector Sum (VS): 0.73in/s 18.542mm/s
*Displacement:*0.007814in 0.198483mm
*Acceleration:*0.351139g's
*Calibration Date:*2/18/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
0.72in/s (0.180in/s/div) 18.29mm/s (4.572mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



TerraDinamica

Unit Located on Window Frame **Front Wall of House 13ft from Door** **Vibration Caused By Front Door being Shut**	File Name: WINDOW DOOR SHUT000.DTB Number: 000 Date: 3/28/2005 Time: 12:19 Serial Number: 1646 Seismic Trigger: 0.0300 in/s 0.7620 mm/s Acoustic Trigger: 142 dB Sample Rate: 1024 Record Duration: 4.0 Seconds Pre-Trigger: 0.50 Seconds Sensor Gain: 2x Battery: 6.5

Amplitudes and Frequencies

Radial: 0.02in/s 0.508mm/s @ 6.1Hz

Vertical: 0.01in/s 0.254mm/s @ 0.0Hz

***Transverse:* 0.115in/s 2.921mm/s @ 17.0Hz**

Vector Sum (VS): 0.115in/s 2.921mm/s

*Displacement:*0.000847in 0.021510mm

*Acceleration:*0.059627g's

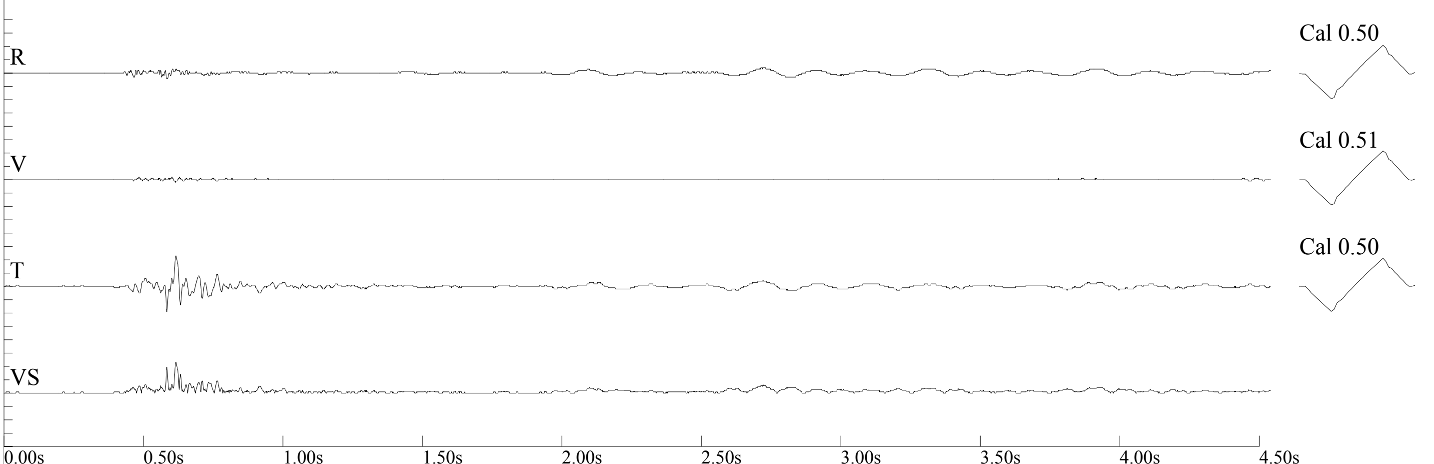
*Calibration Date:*2/18/2005

Graph Information

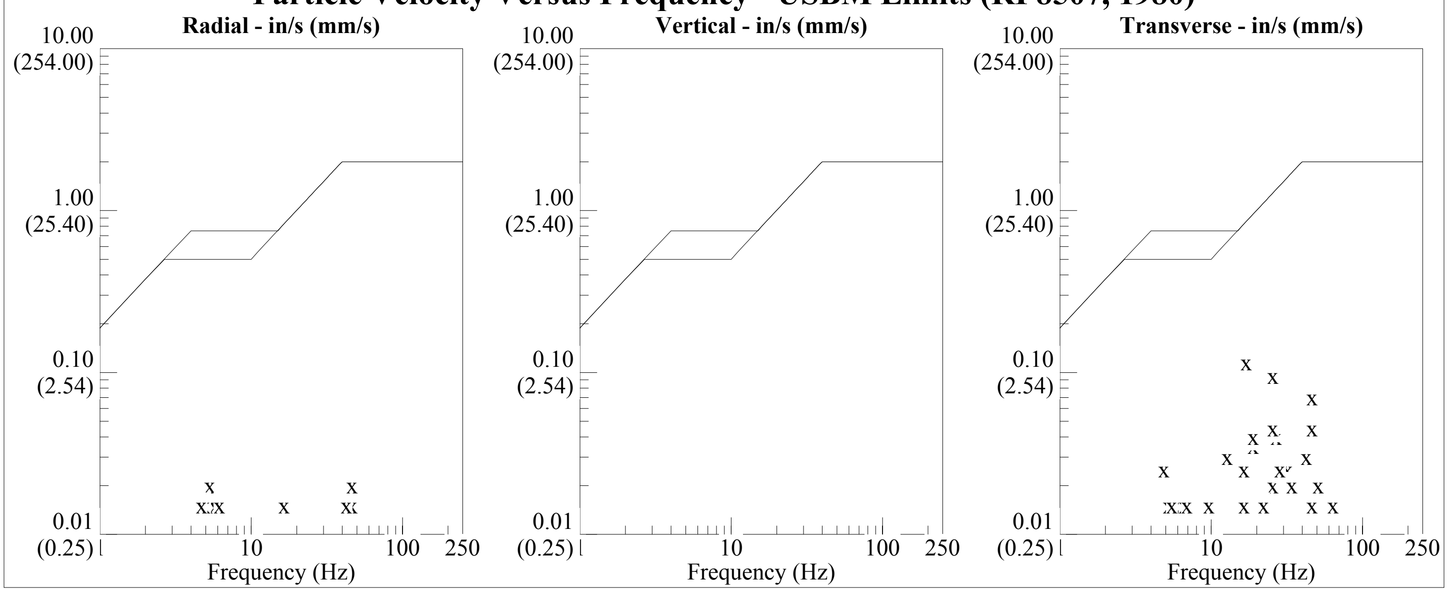
*Duration:*0.000s To: 4.500s

Seismic Scale:
0.20in/s (0.050in/s/div) 5.08mm/s (1.270mm/s/div)

*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



TerraDinamica

Unit Located on Window Frame **Front Wall of House 13ft from Door** **Vibration Caused By Front Door being Shut**	File Name: WINDOW DOOR SHUT002.DTB Number: 002 Date: 3/28/2005 Time: 12:25 Serial Number: 1646 Seismic Trigger: 0.0300 in/s 0.7620 mm/s Acoustic Trigger: 142 dB Sample Rate: 1024 Record Duration: 4.0 Seconds Pre-Trigger: 0.50 Seconds Sensor Gain: 2x Battery: 6.5

Amplitudes and Frequencies

Radial: 0.07in/s 1.778mm/s @ 51.2Hz

Vertical: 0.015in/s 0.381mm/s @ 46.5Hz

***Transverse:* 0.235in/s 5.969mm/s @ 18.2Hz**

Vector Sum (VS): 0.235in/s 5.969mm/s

*Displacement:*0.001920in 0.048756mm

*Acceleration:*0.099379g's

*Calibration Date:*2/18/2005

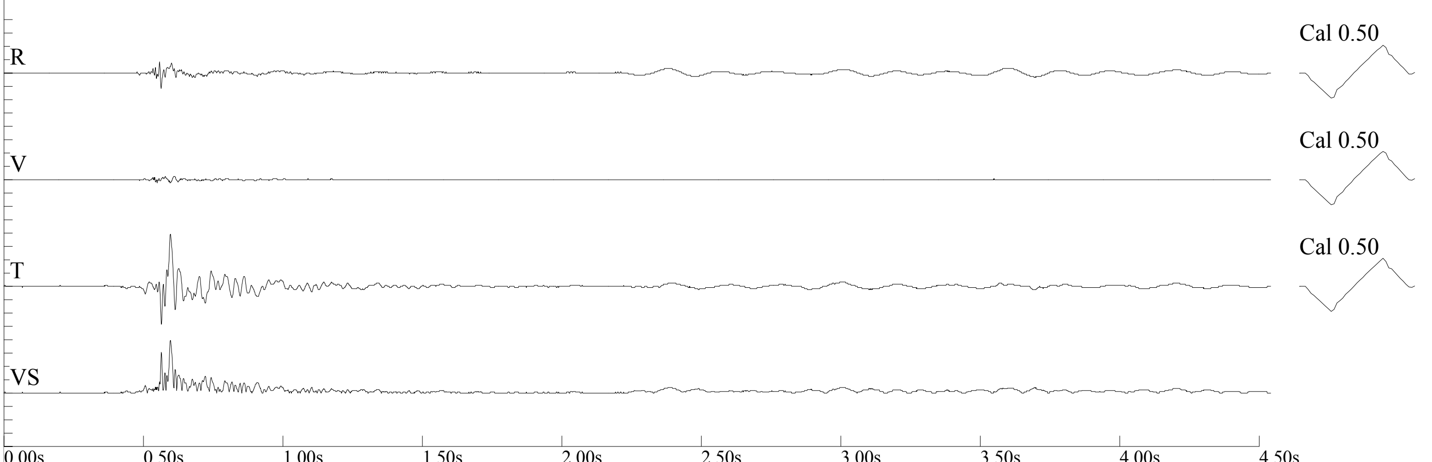
Graph Information

*Duration:*0.000s To: 4.500s

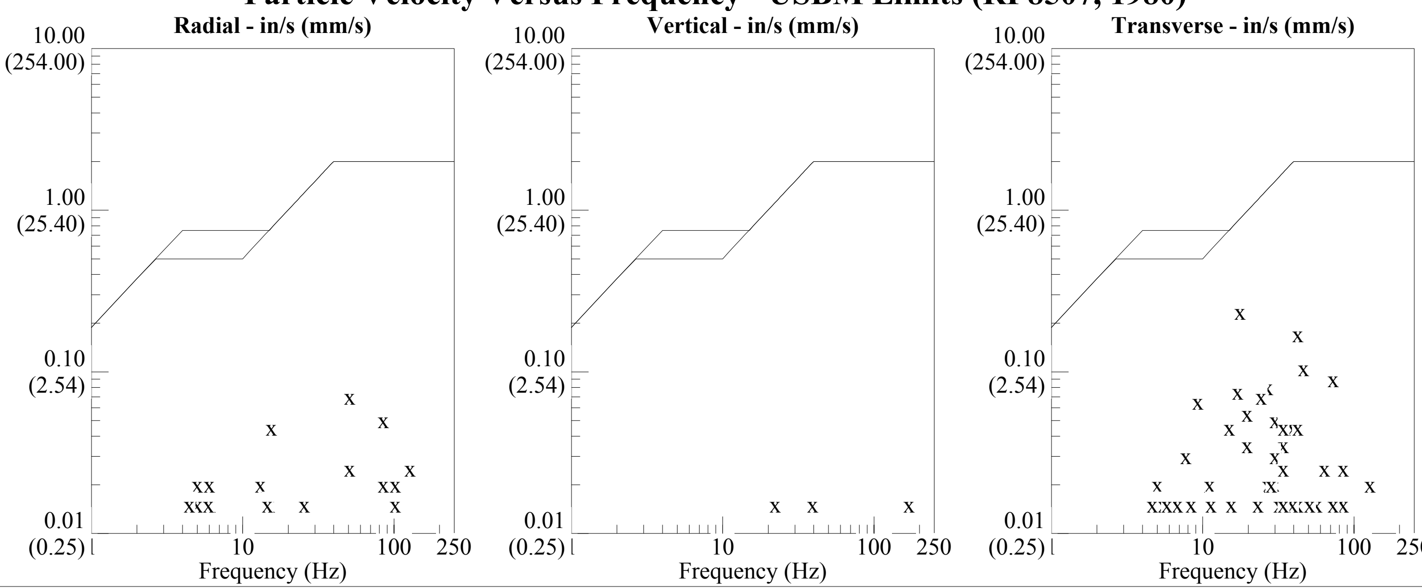
Seismic Scale:

0.24in/s (0.060in/s/div) 6.10mm/s (1.524mm/s/div)

*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located on Window Frame
Front Wall of House 13ft from Door
Vibration Caused By Front Door being Shut

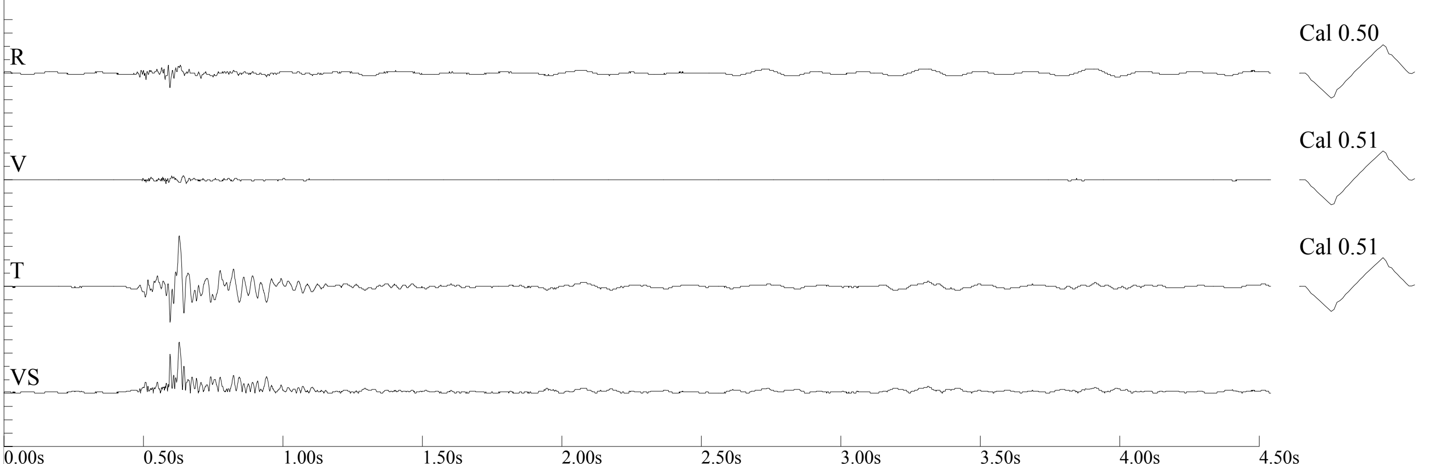
File Name: WINDOW DOOR SHUT001.DTB
Number: 001
Date: 3/28/2005
Time: 12:24
Serial Number: 1646
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 142 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.5

Amplitudes and Frequencies

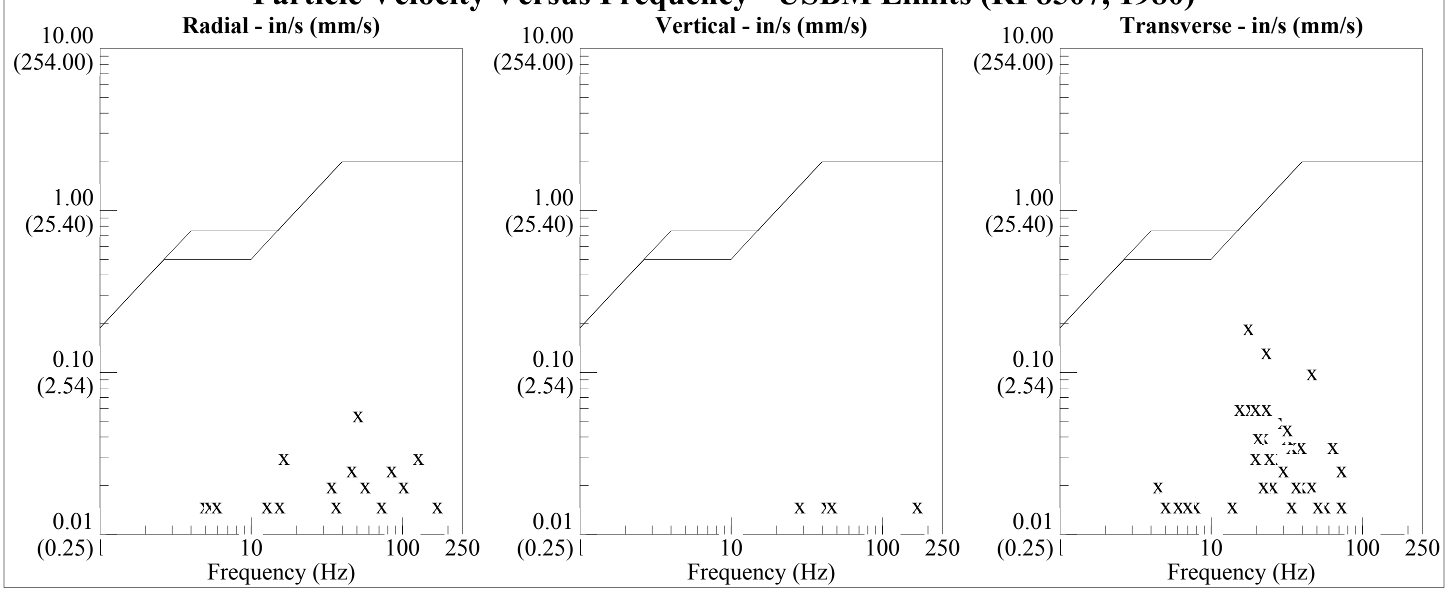
Radial: 0.055in/s 1.397mm/s @ 51.2Hz
Vertical: 0.015in/s 0.381mm/s @ 39.3Hz
***Transverse:* 0.19in/s 4.826mm/s @ 17.6Hz**
Vector Sum (VS): 0.19in/s 4.826mm/s
*Displacement:*0.001386in 0.035202mm
*Acceleration:*0.086128g's
*Calibration Date:*2/18/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
0.20in/s (0.050in/s/div) 5.08mm/s (1.270mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



TerraDinamica

Unit Located on Window Frame
Front Wall of House 13ft from Door
Vibration Caused By Front Door being Shut

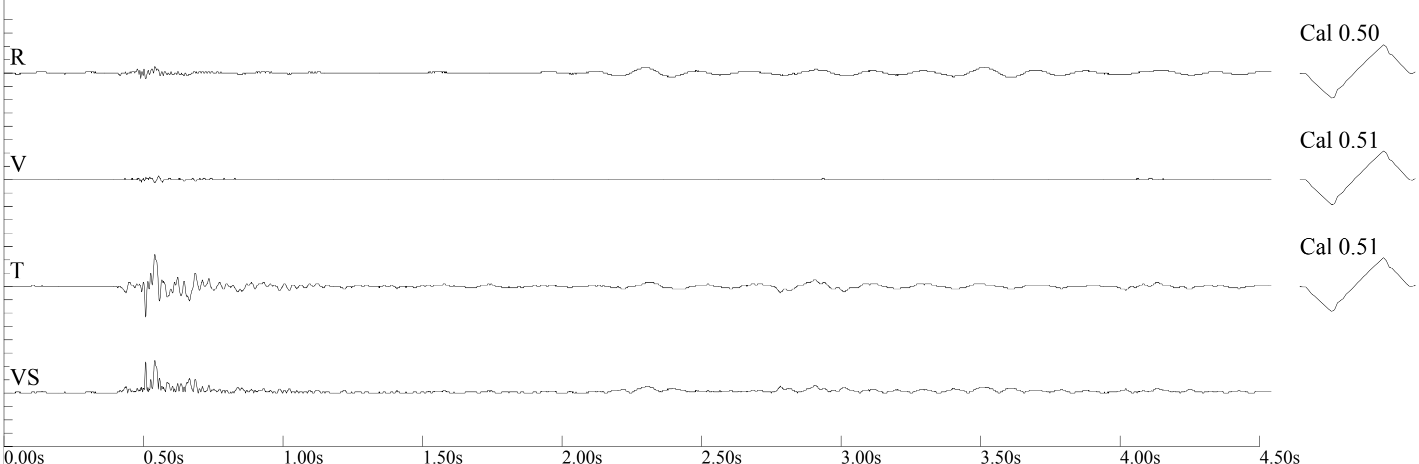
File Name: WINDOW DOOR SHUT004.DTB
Number: 004
Date: 3/28/2005
Time: 12:25
Serial Number: 1646
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 142 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.5

Amplitudes and Frequencies

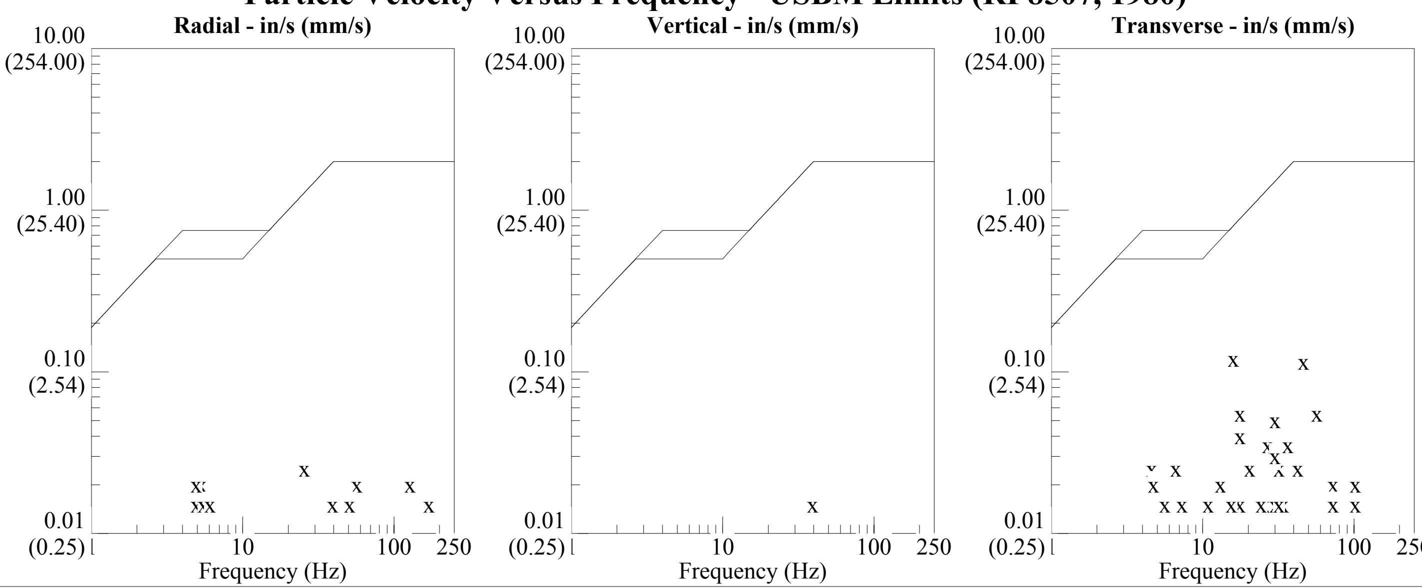
Radial: 0.025in/s 0.635mm/s @ 26.9Hz
Vertical: 0.015in/s 0.381mm/s @ 42.6Hz
***Transverse:* 0.12in/s 3.048mm/s @ 23.2Hz**
Vector Sum (VS): 0.125in/s 3.175mm/s
*Displacement:*0.000970in 0.024631mm
*Acceleration:*0.079503g's
*Calibration Date:*2/18/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
0.20in/s (0.050in/s/div) 5.08mm/s (1.270mm/s/div)
*Time Line Intervals at:*0.50 s

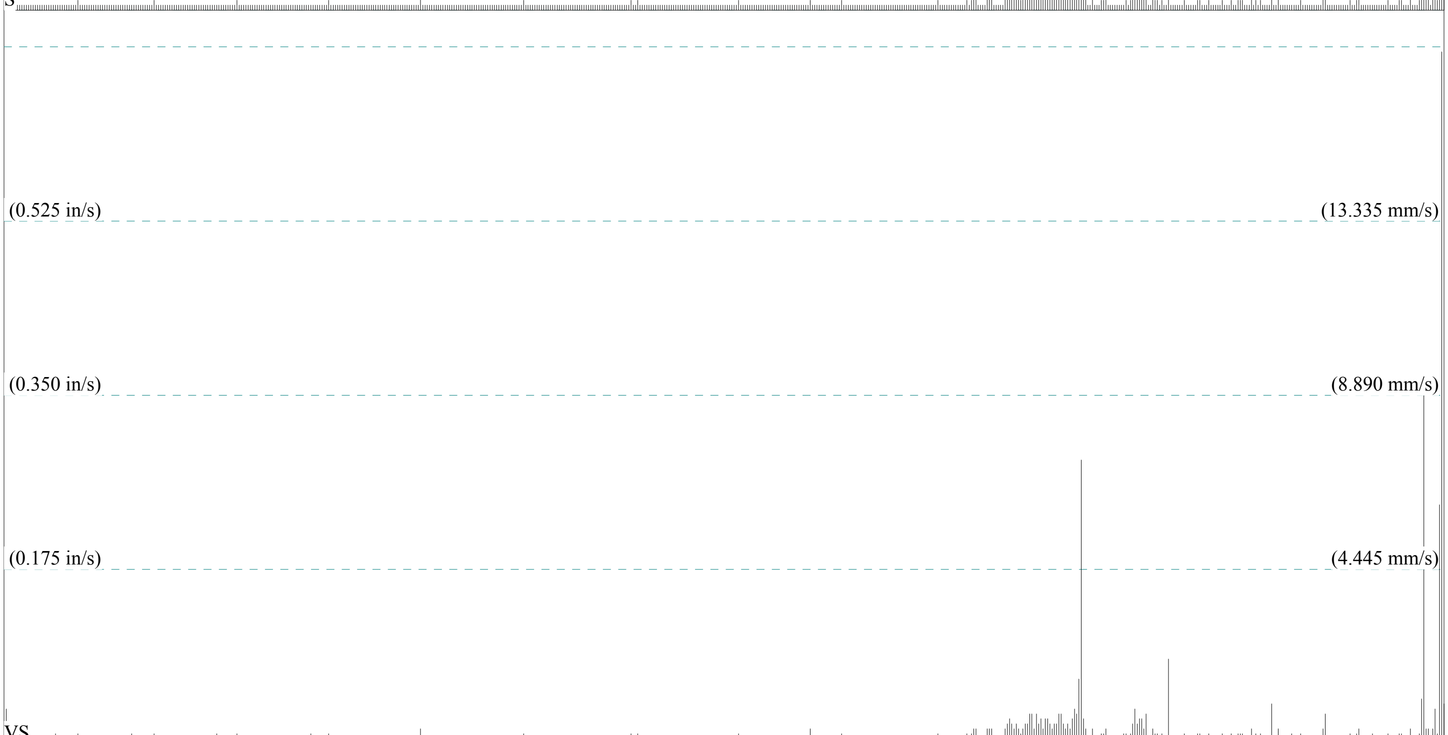


Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



File: WALL 10FT FROM FRONT DOOR003.BAR   Job Number: 003   Date Range: 3/22/2005 - 3/22/2005   Time Range: 00:00 - 10:43   Serial Number: 1646

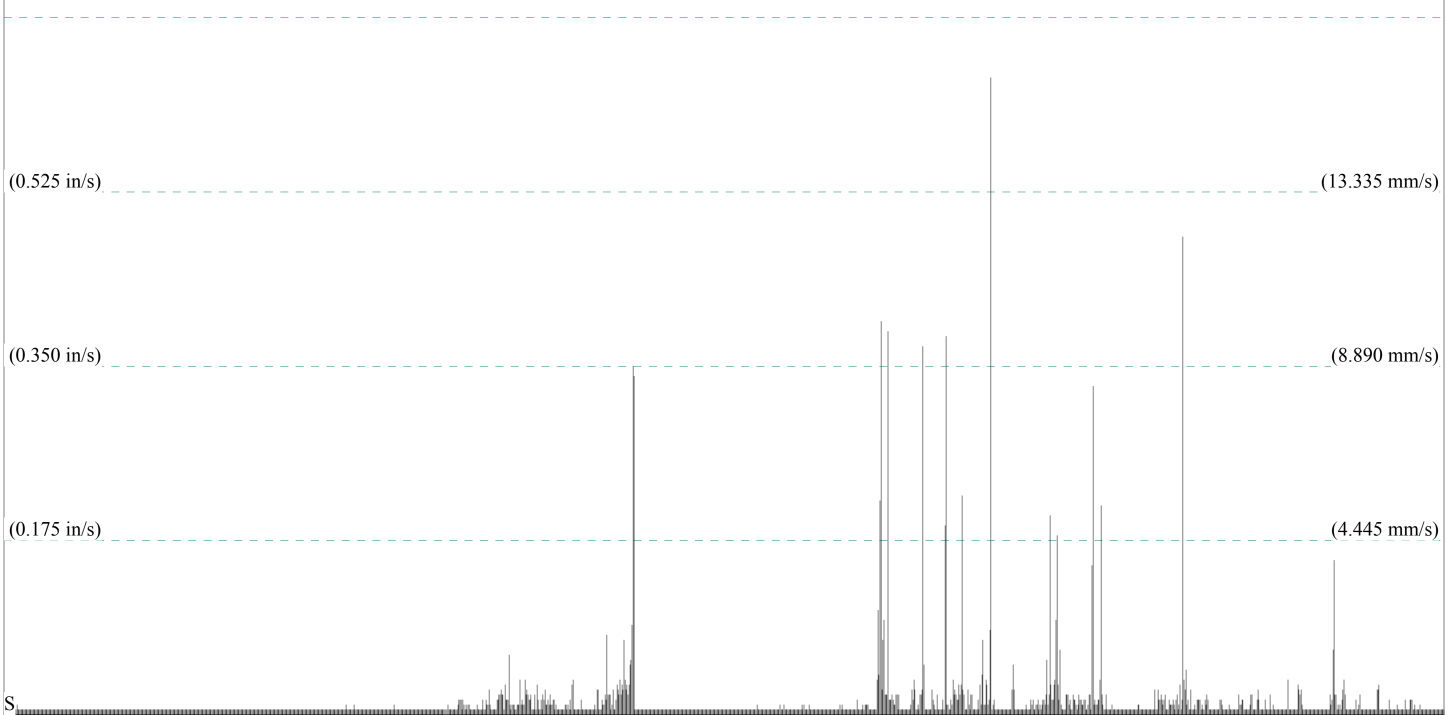
Peak Amplitudes *Seismic (S):* 0.6400in/s 16.256mm/s *Vector Sum (VS):* 0.6950in/s 17.653mm/s
Graph Information *Duration:* 0.0 hr to 10.7 hr *Seismic Scale:* 0.70 in/s 17.78 mm/s
Bar Information *Bar Sample Interval:* 1 Minute *Total Bar Samples:* 643 *Number of Bar Samples Shown:* 643

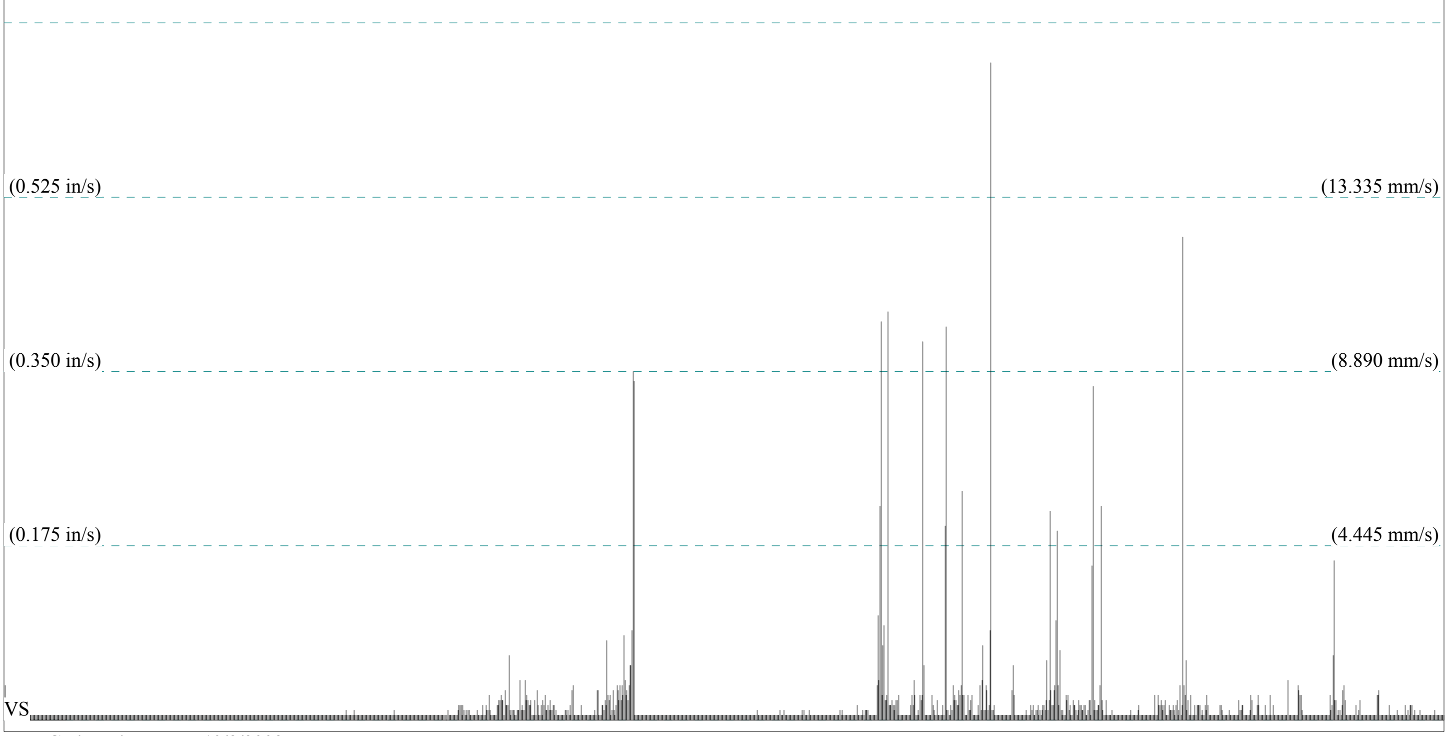


Last Calibration Date: 10/3/2003

File: WALL 10FT FROM FRONT DOOR002.BAR   Job Number: 002   Date Range: 3/21/2005 - 3/22/2005   Time Range: 00:00 - 00:00   Serial Number: 1646

Peak Amplitudes *Seismic (S):* 0.6400in/s 16.256mm/s *Vector Sum (VS):* 0.6600in/s 16.764mm/s
Graph Information *Duration:* 0.0 day to 1.0 day *Seismic Scale:* 0.70 in/s 17.78 mm/s
Bar Information *Bar Sample Interval:* 1 Minute *Total Bar Samples:* 1440 *Number of Bar Samples Shown:* 1440

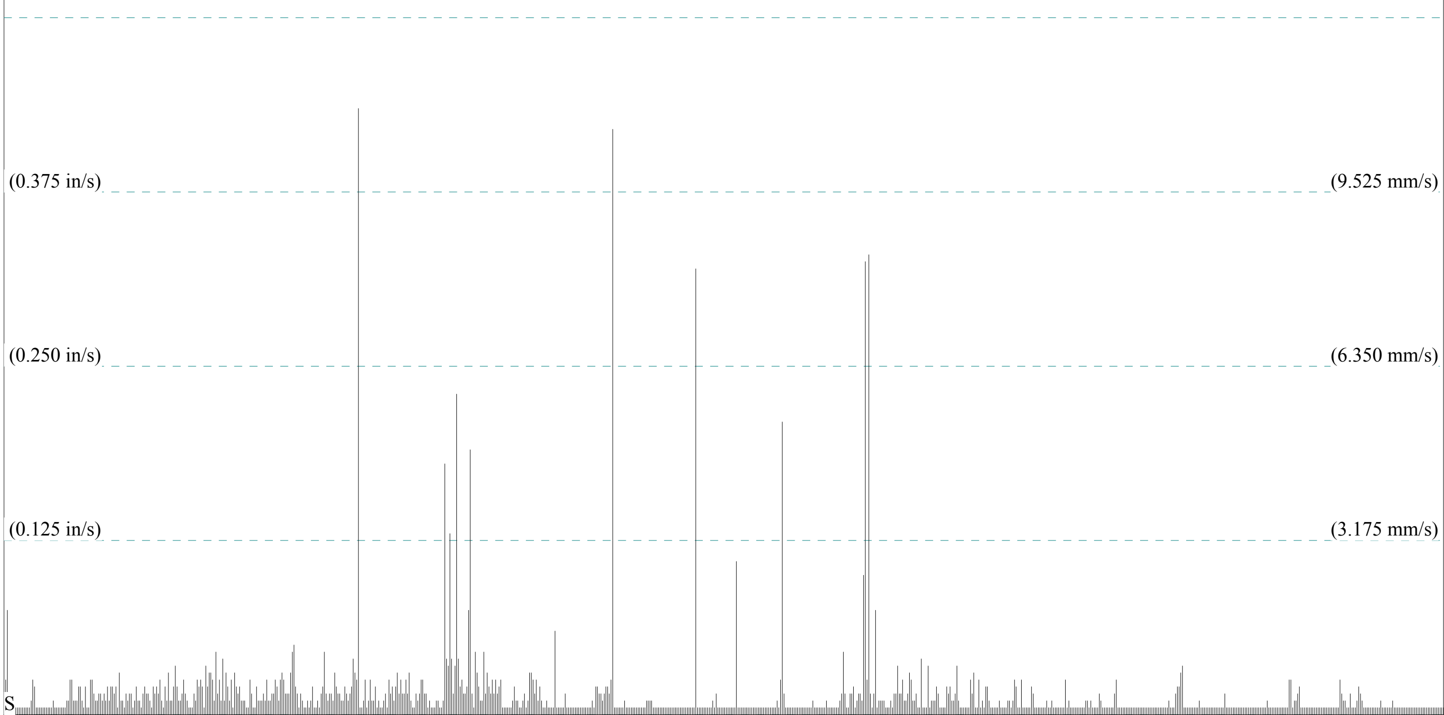


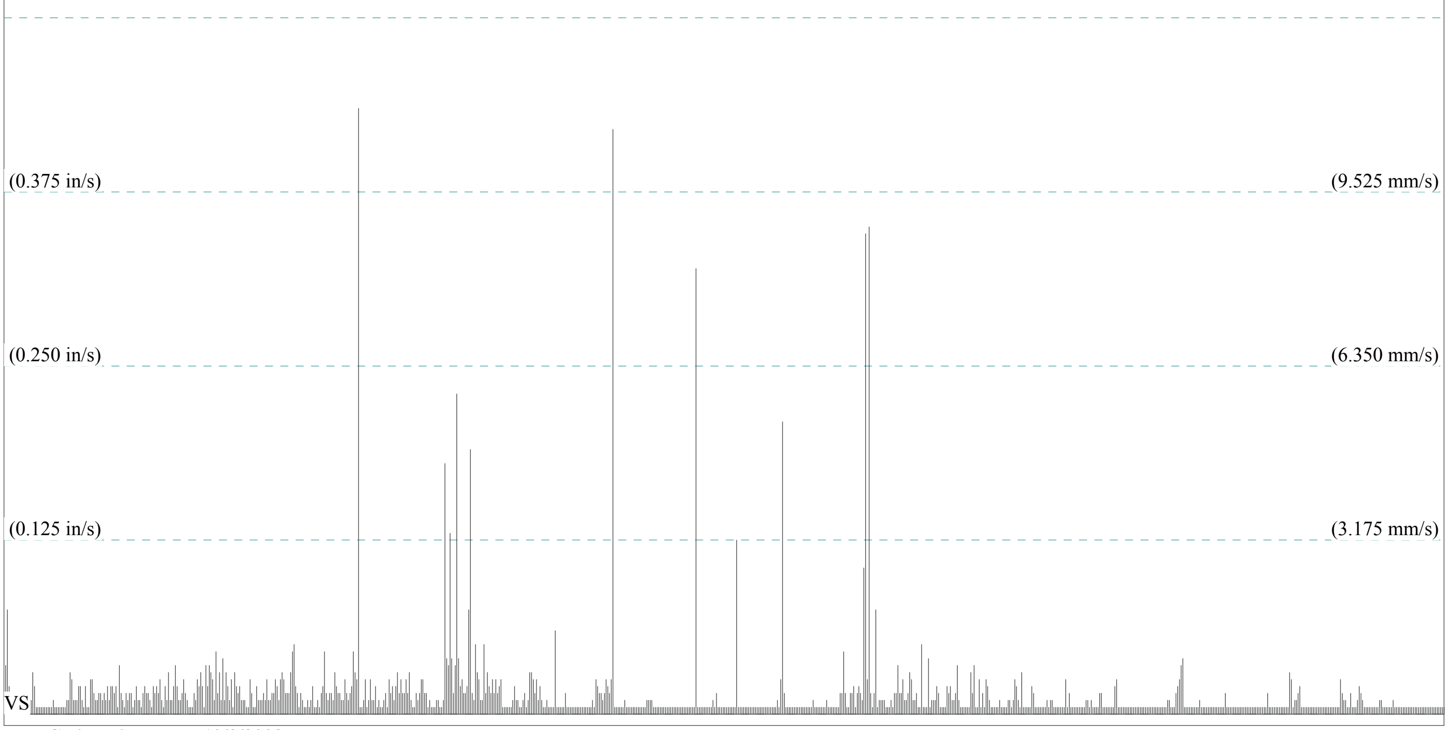


Last Calibration Date: 10/3/2003

File: WALL 10FT FROM FRONT DOOR001.BAR Job Number: 001 Date Range: 3/20/2005 - 3/21/2005 Time Range: 09:51 - 00:00 Serial Number: 1646

Peak Amplitudes *Seismic (S):* 0.4350in/s 11.049mm/s *Vector Sum (VS):* 0.4350in/s 11.049mm/s
Graph Information *Duration:* 0.0 hr to 14.2 hr *Seismic Scale:* 0.50 in/s 12.70 mm/s
Bar Information *Bar Sample Interval:* 1 Minute *Total Bar Samples:* 849 *Number of Bar Samples Shown:* 849





Last Calibration Date: 10/3/2003

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Unit Located on floor
Walking within 3ft of sensor

File Name: WALK_3FT010.DTB
Number: 010
Date: 3/19/2005
Time: 13:23
Serial Number: 1644
Seismic Trigger: 0.0100 in/s 0.2540 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

Radial: 0.01in/s 0.254mm/s @ 0.0Hz

***Vertical:* 0.205in/s 5.207mm/s @ 20.4Hz**

Transverse: 0.01in/s 0.254mm/s @ 0.0Hz

Vector Sum (VS): 0.205in/s 5.207mm/s

*Displacement:*0.002698in 0.068540mm

*Acceleration:*0.092754g's

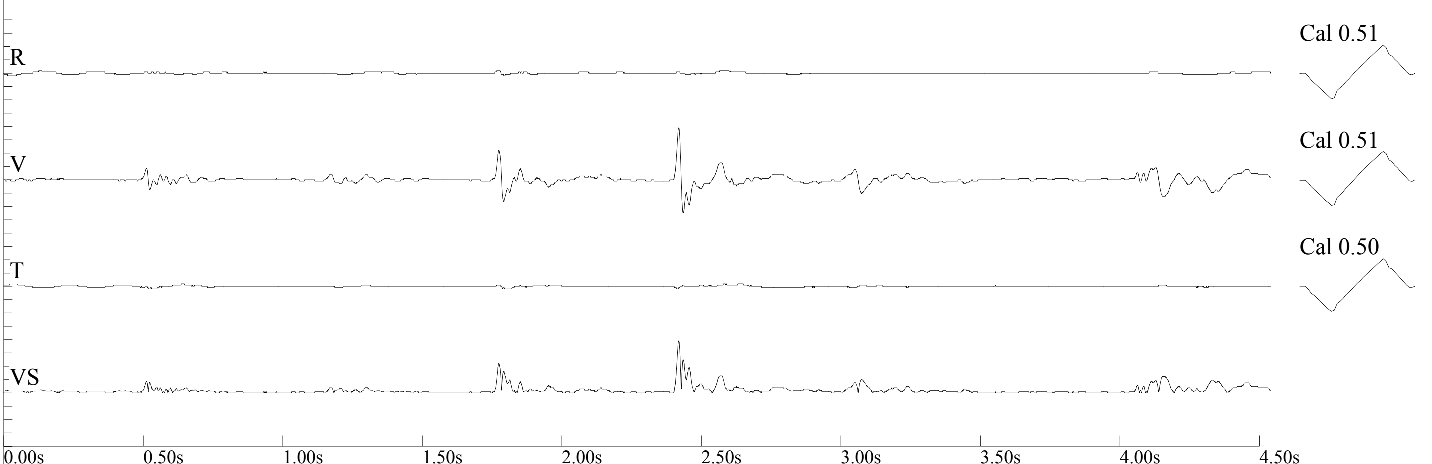
*Calibration Date:*2/16/2005

Graph Information

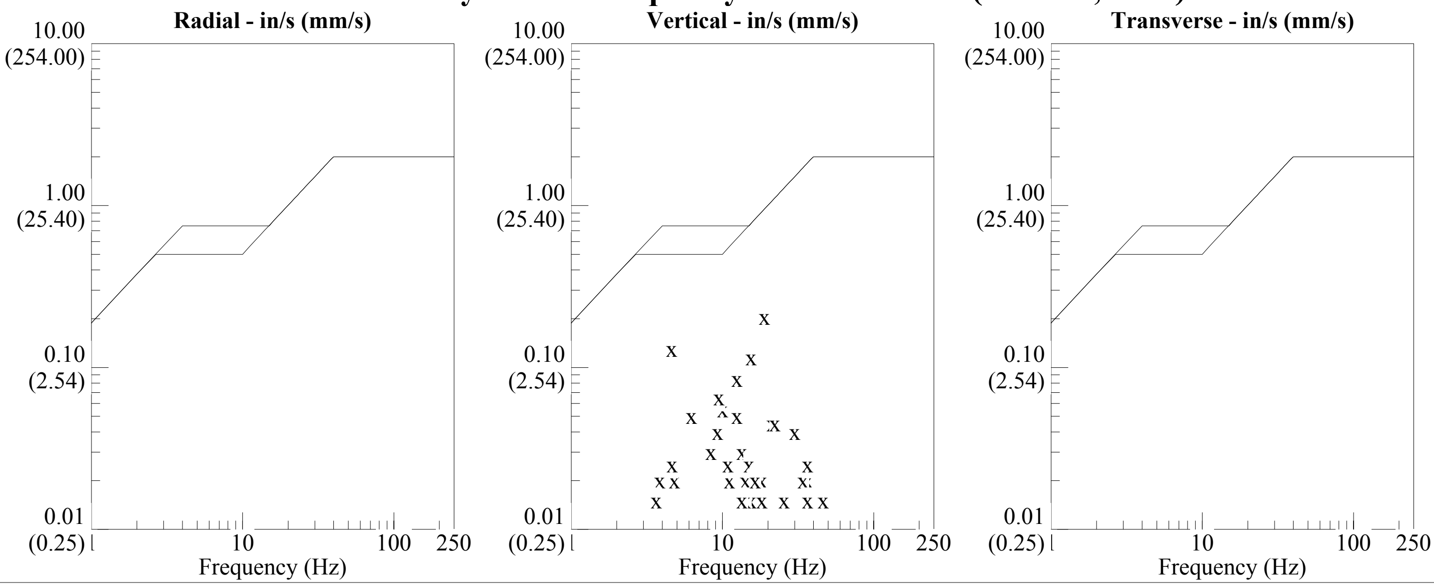
*Duration:*0.000s To: 4.500s

Seismic Scale:
0.21in/s (0.053in/s/div) 5.33mm/s (1.334mm/s/div)

*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located on floor
Walking within 3ft of sensor

File Name: WALK_3FT013.DTB
Number: 013
Date: 3/19/2005
Time: 13:24
Serial Number: 1644
Seismic Trigger: 0.0100 in/s 0.2540 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

Radial: 0.01in/s 0.254mm/s @ 0.0Hz

***Vertical:* 0.135in/s 3.429mm/s @ 17.0Hz**

Transverse: 0.01in/s 0.254mm/s @ 0.0Hz

Vector Sum (VS): 0.135in/s 3.429mm/s

*Displacement:*0.001785in 0.045332mm

*Acceleration:*0.033126g's

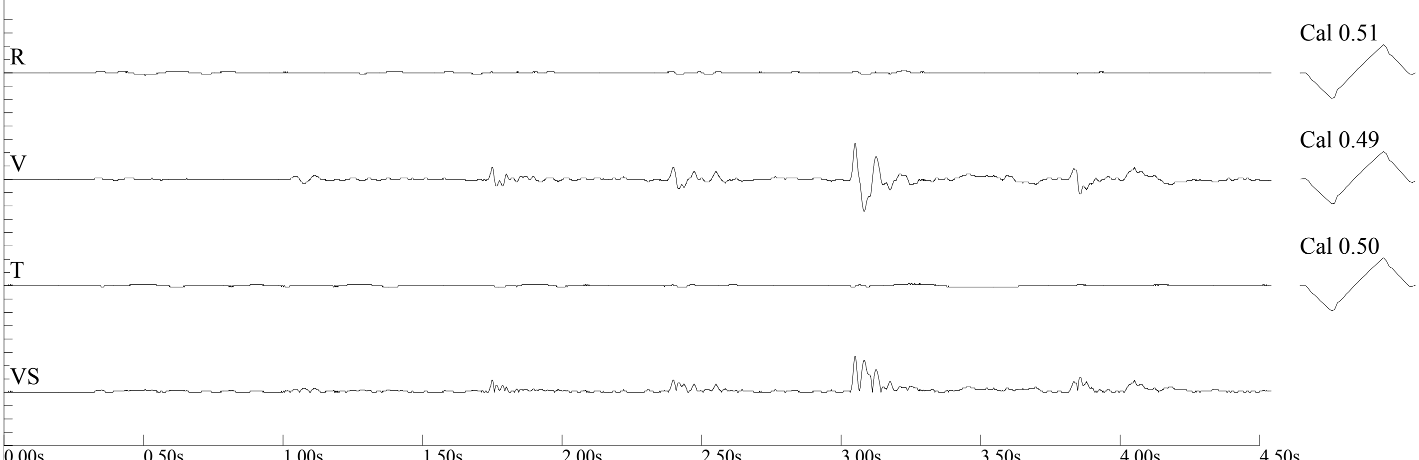
*Calibration Date:*2/16/2005

Graph Information

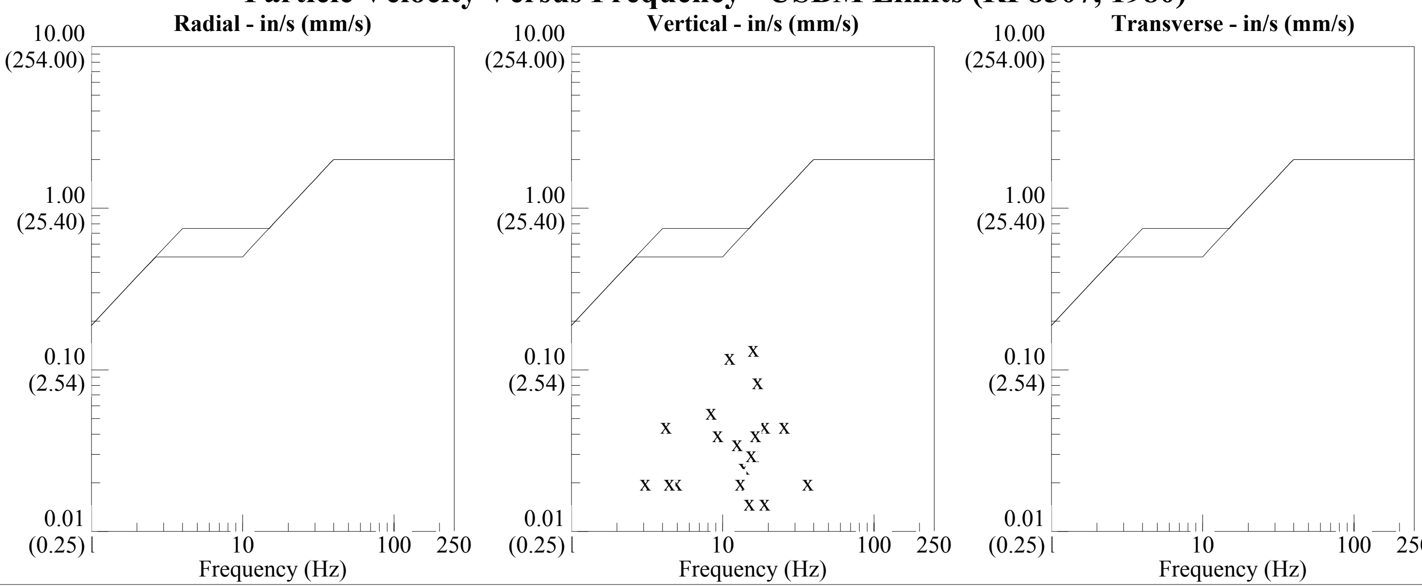
*Duration:*0.000s To: 4.500s

Seismic Scale:
0.20in/s (0.050in/s/div) 5.08mm/s (1.270mm/s/div)

*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



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Unit Located on floor
Walking within 3ft of sensor

File Name: WALK_3FT014.DTB
Number: 014
Date: 3/19/2005
Time: 13:24
Serial Number: 1644
Seismic Trigger: 0.0100 in/s 0.2540 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

Radial: 0.01in/s 0.254mm/s @ 0.0Hz

***Vertical:* 0.115in/s 2.921mm/s @ 16.5Hz**

Transverse: 0.015in/s 0.381mm/s @ 5.0Hz

Vector Sum (VS): 0.115in/s 2.921mm/s

*Displacement:*0.002667in 0.067745mm

*Acceleration:*0.072878g's

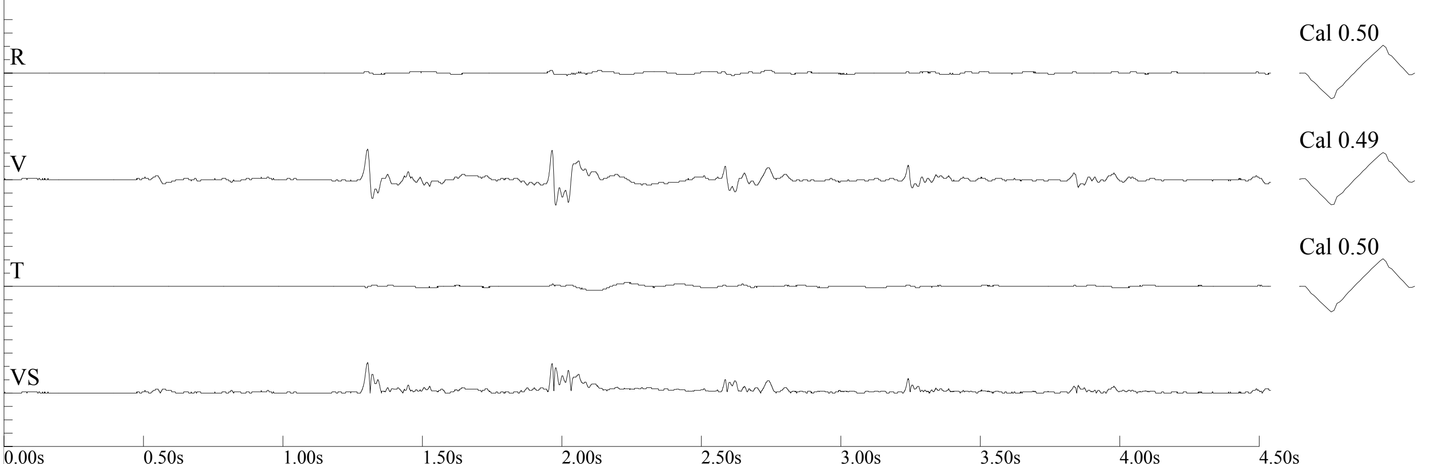
*Calibration Date:*2/16/2005

Graph Information

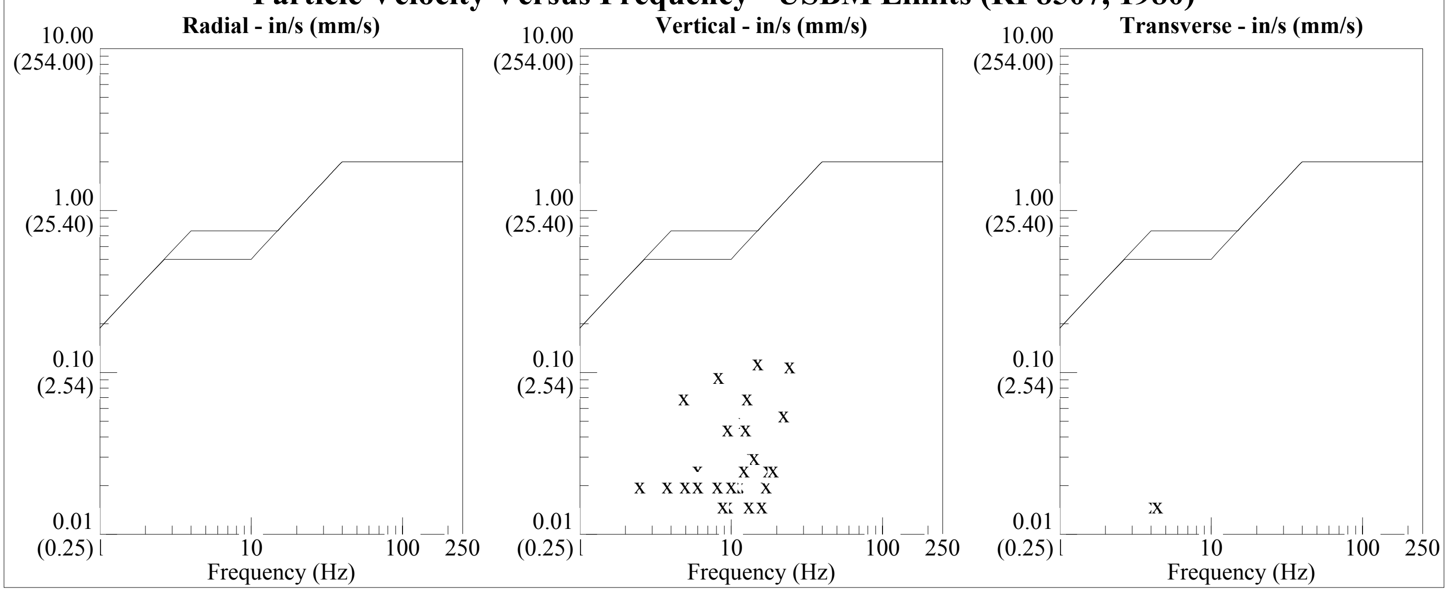
*Duration:*0.000s To: 4.500s

Seismic Scale:
0.20in/s (0.050in/s/div) 5.08mm/s (1.270mm/s/div)

*Time Line Intervals at:*0.50 s

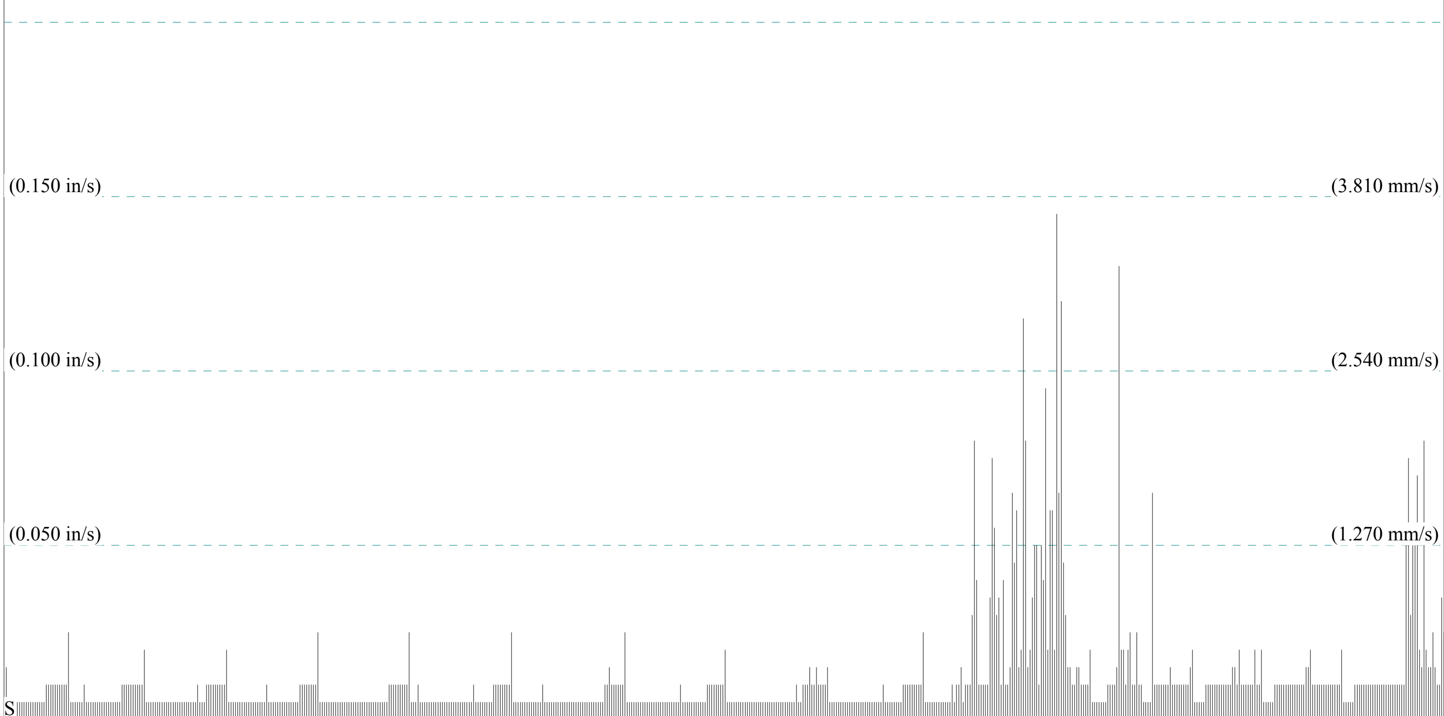


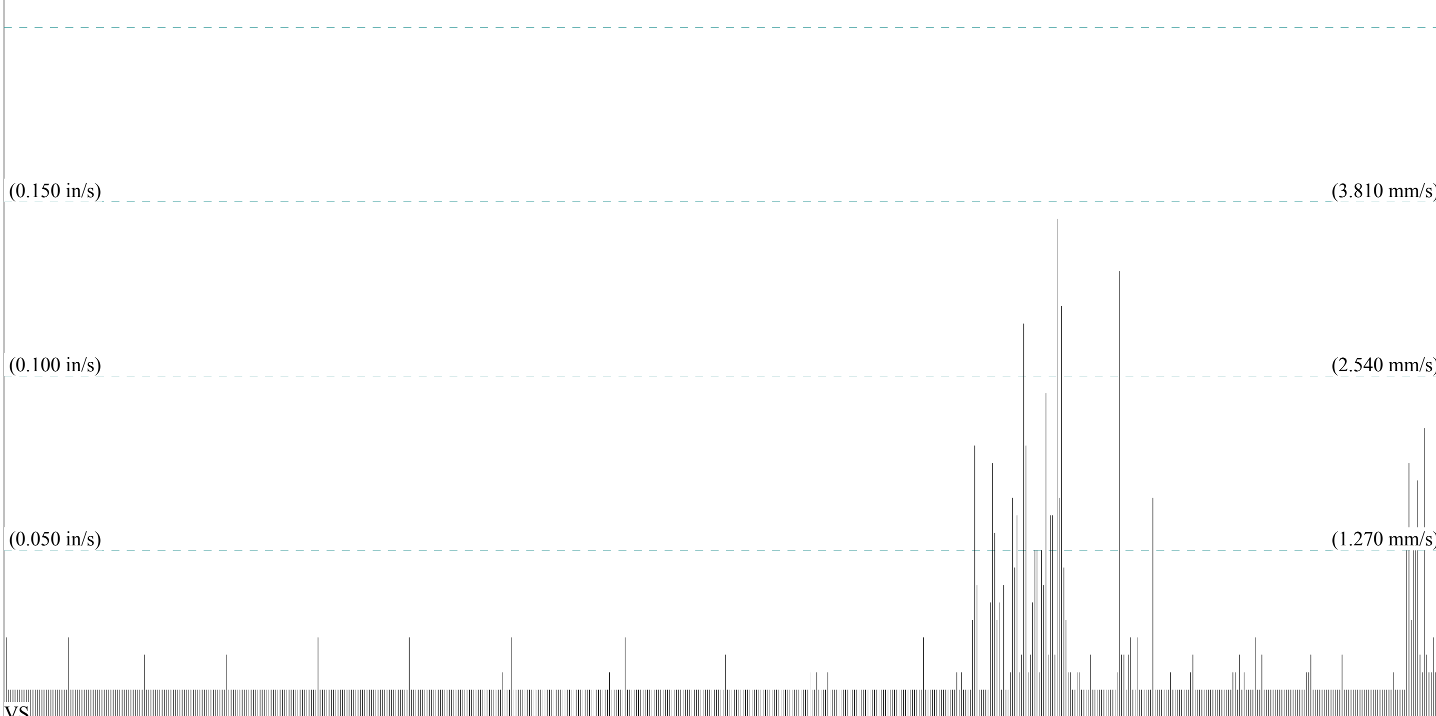
Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



File: KIRCHEN FLOOR004.BAR   Job Number: 004   Date Range: 3/22/2005 - 3/22/2005   Time Range: 00:00 - 10:47   Serial Number: 2497

Peak Amplitudes *Seismic (S):* 0.1450in/s 3.683mm/s *Vector Sum (VS):* 0.1450in/s 3.683mm/s
Graph Information *Duration:* 0.0 hr to 10.8 hr *Seismic Scale:* 0.20 in/s 5.08 mm/s
Bar Information *Bar Sample Interval:* 1 Minute *Total Bar Samples:* 647 *Number of Bar Samples Shown:* 647

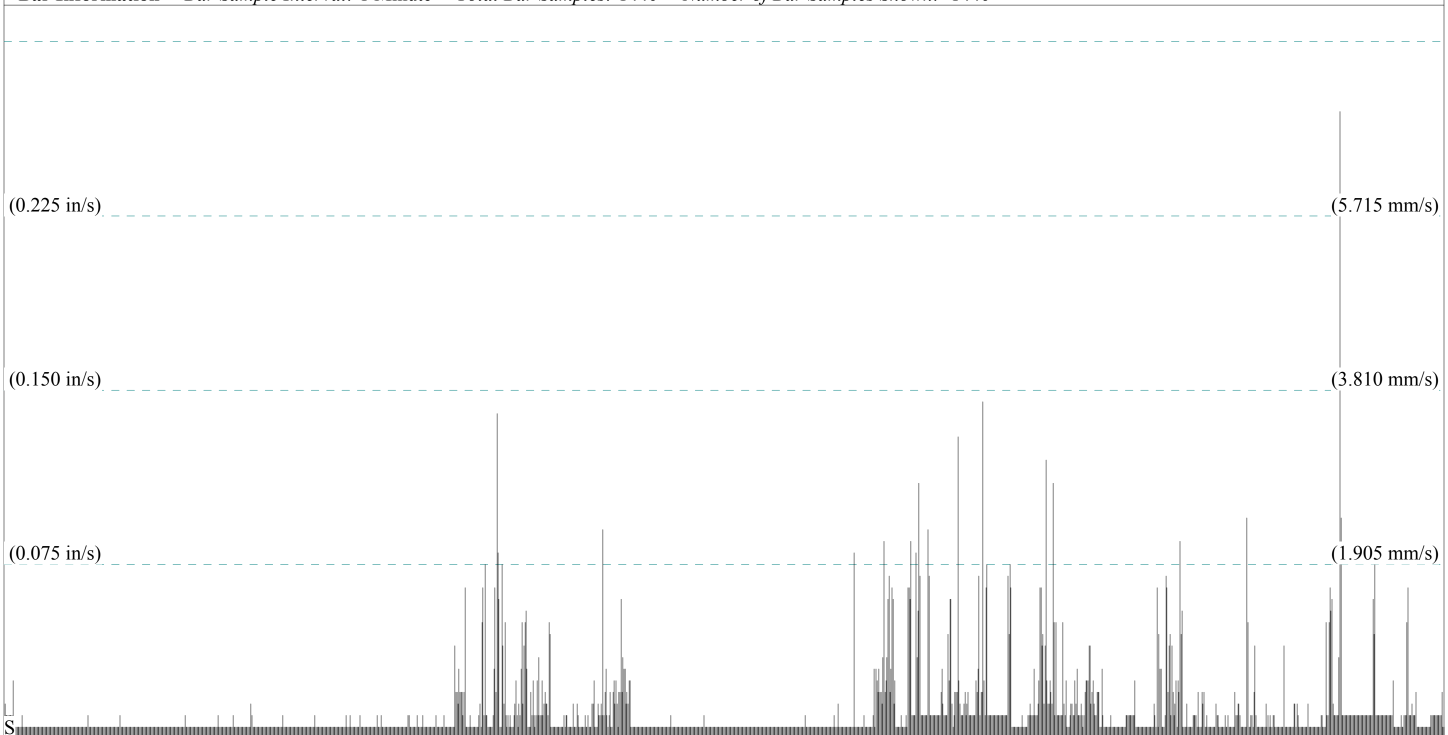


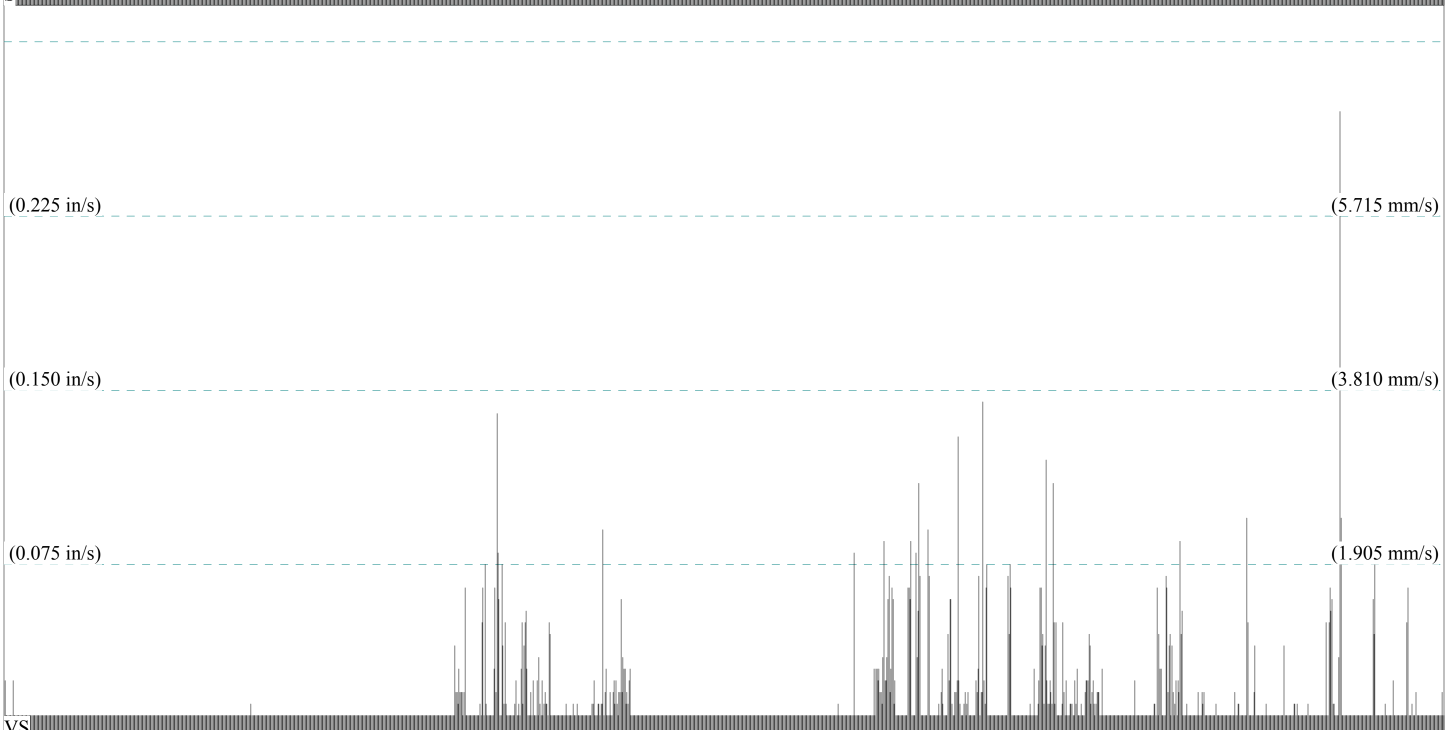


Last Calibration Date: 10/3/2003

File: KIRCHEN FLOOR003.BAR Job Number: 003 Date Range: 3/21/2005 - 3/22/2005 Time Range: 00:00 - 00:00 Serial Number: 2497

Peak Amplitudes *Seismic (S):* 0.2700in/s 6.858mm/s *Vector Sum (VS):* 0.2700in/s 6.858mm/s
Graph Information *Duration:* 0.0 day to 1.0 day *Seismic Scale:* 0.30 in/s 7.62 mm/s
Bar Information *Bar Sample Interval:* 1 Minute *Total Bar Samples:* 1440 *Number of Bar Samples Shown:* 1440

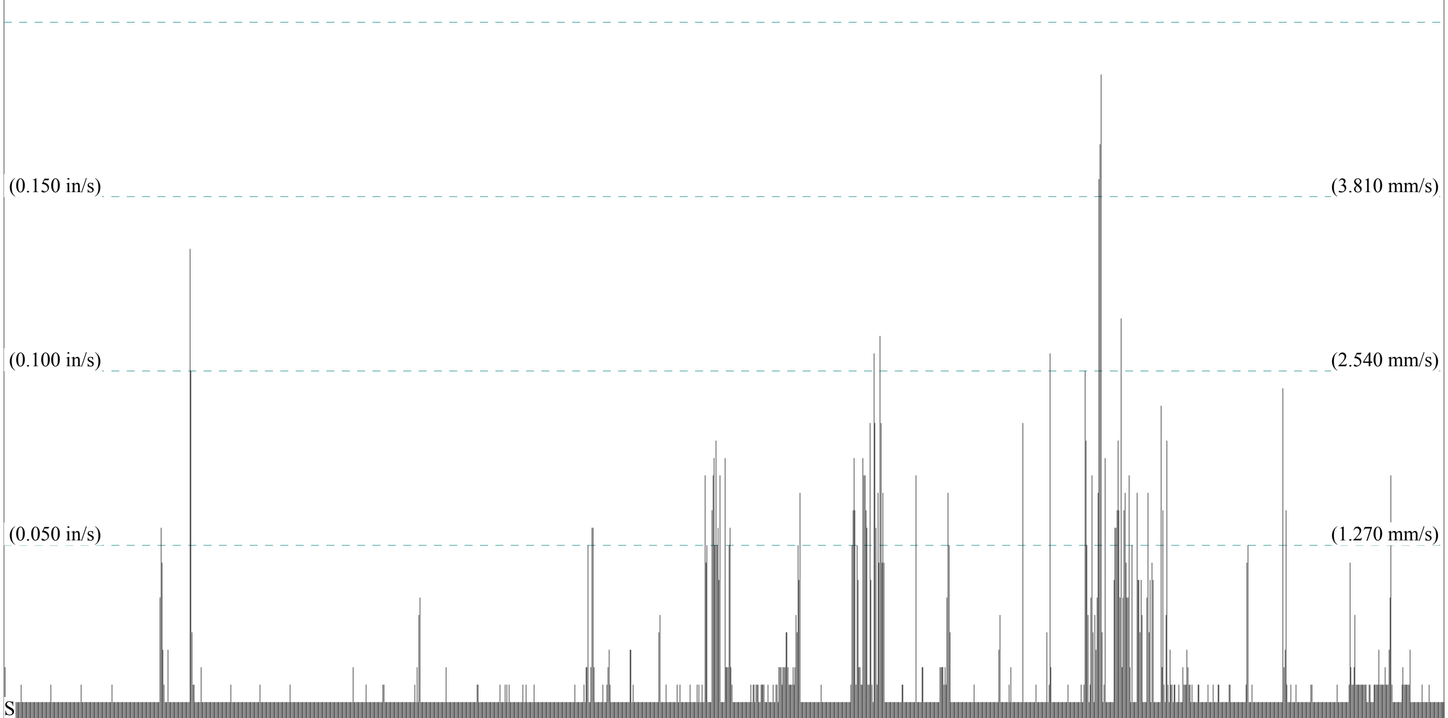


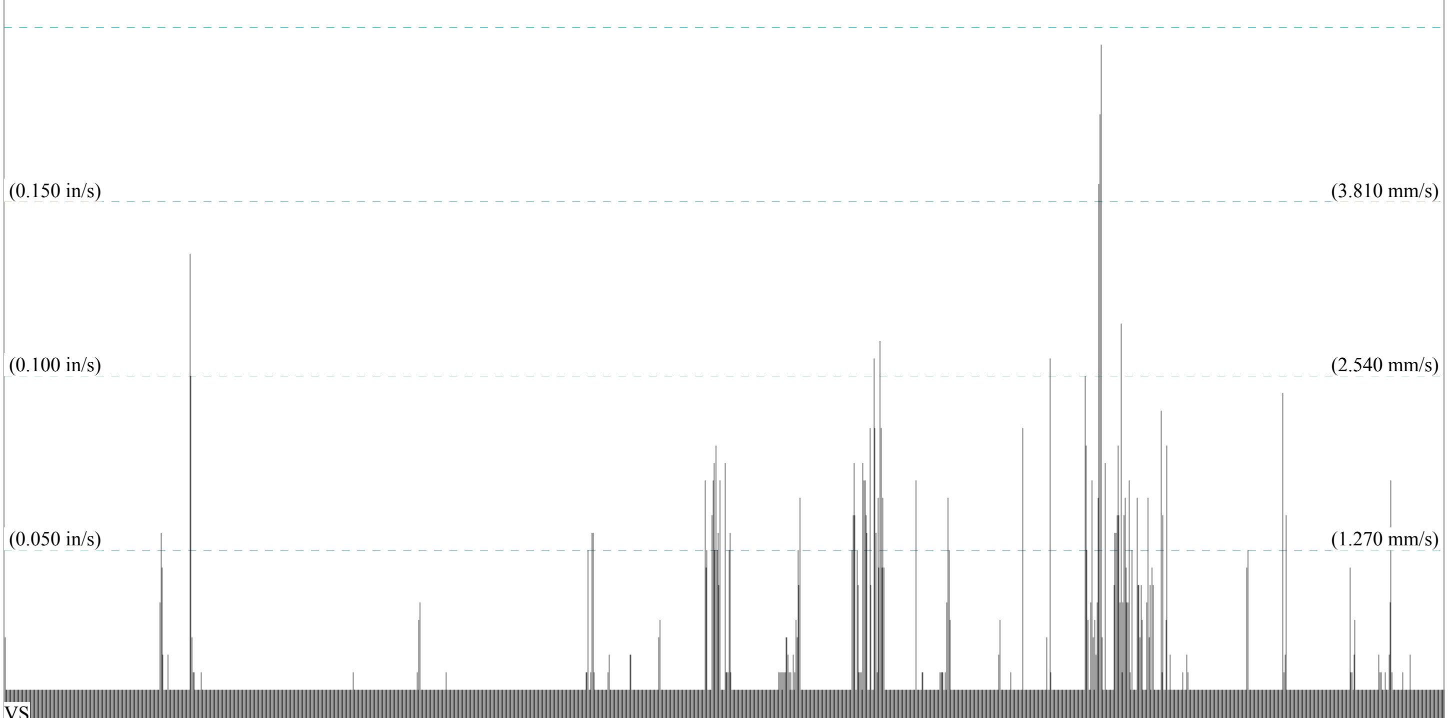


Last Calibration Date: 10/3/2003

File: KIRCHEN FLOOR002.BAR Job Number: 002 Date Range: 3/20/2005 - 3/21/2005 Time Range: 00:00 - 00:00 Serial Number: 2497

Peak Amplitudes *Seismic (S):* 0.1850in/s 4.699mm/s *Vector Sum (VS):* 0.1950in/s 4.953mm/s
Graph Information *Duration:* 0.0 day to 1.0 day *Seismic Scale:* 0.20 in/s 5.08 mm/s
Bar Information *Bar Sample Interval:* 1 Minute *Total Bar Samples:* 1440 *Number of Bar Samples Shown:* 1440

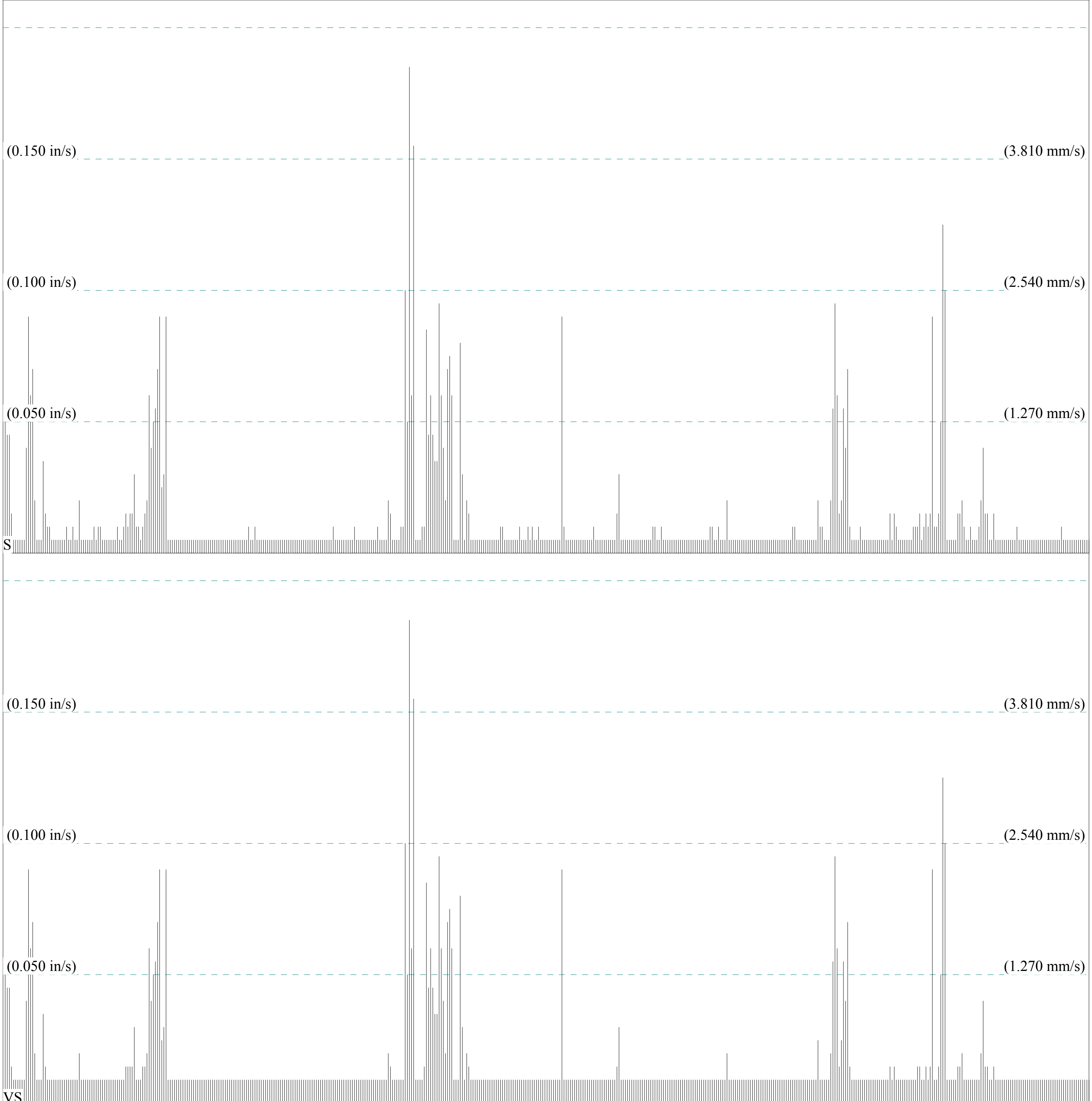




Last Calibration Date: 10/3/2003

File: KIRCHEN FLOOR001.BAR Job Number: 001 Date Range: 3/19/2005 - 3/20/2005 Time Range: 15:27 - 00:00 Serial Number: 2497

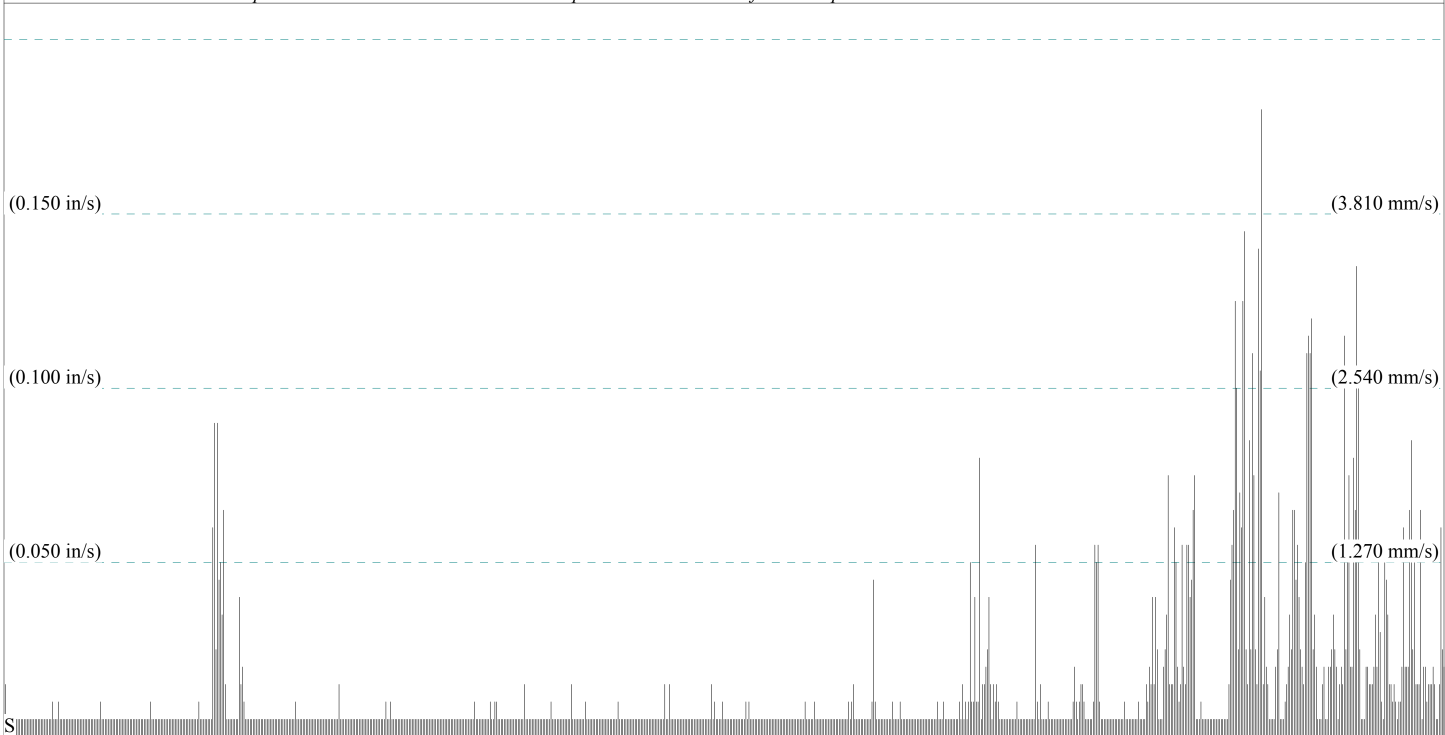
Peak Amplitudes *Seismic (S):* 0.1850in/s 4.699mm/s *Vector Sum (VS):* 0.1850in/s 4.699mm/s
Graph Information *Duration:* 0.0 hr to 8.6 hr *Seismic Scale:* 0.20 in/s 5.08 mm/s
Bar Information *Bar Sample Interval:* 1 Minute *Total Bar Samples:* 513 *Number of Bar Samples Shown:* 513

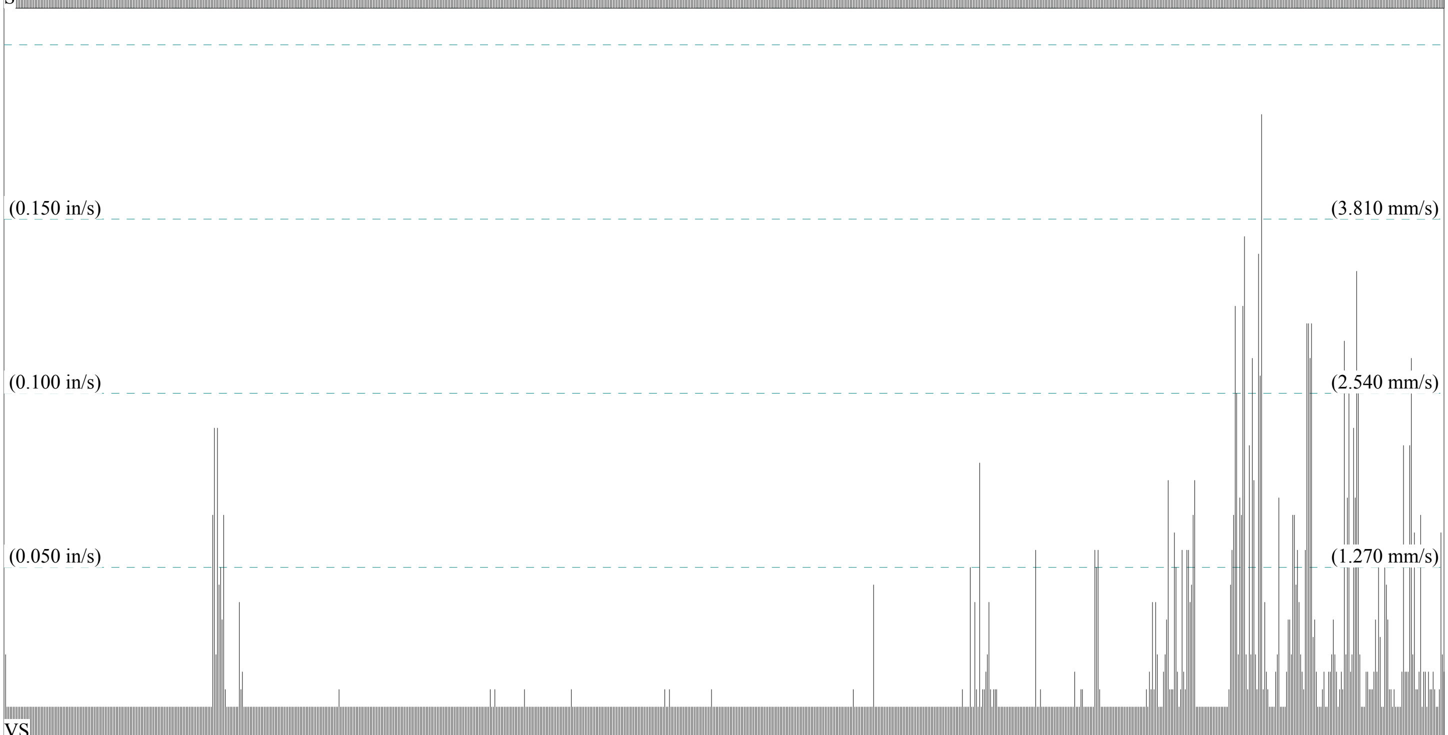


Last Calibration Date: 10/3/2003

File: KITCHEN_FLOOR004.BAR Job Number: 004 Date Range: 3/19/2005 - 3/19/2005 Time Range: 00:00 - 15:23 Serial Number: 2497

Peak Amplitudes *Seismic (S):* 0.1800in/s 4.572mm/s *Vector Sum (VS):* 0.1800in/s 4.572mm/s
Graph Information *Duration:* 0.0 hr to 15.4 hr *Seismic Scale:* 0.20 in/s 5.08 mm/s
Bar Information *Bar Sample Interval:* 1 Minute *Total Bar Samples:* 924 *Number of Bar Samples Shown:* 924

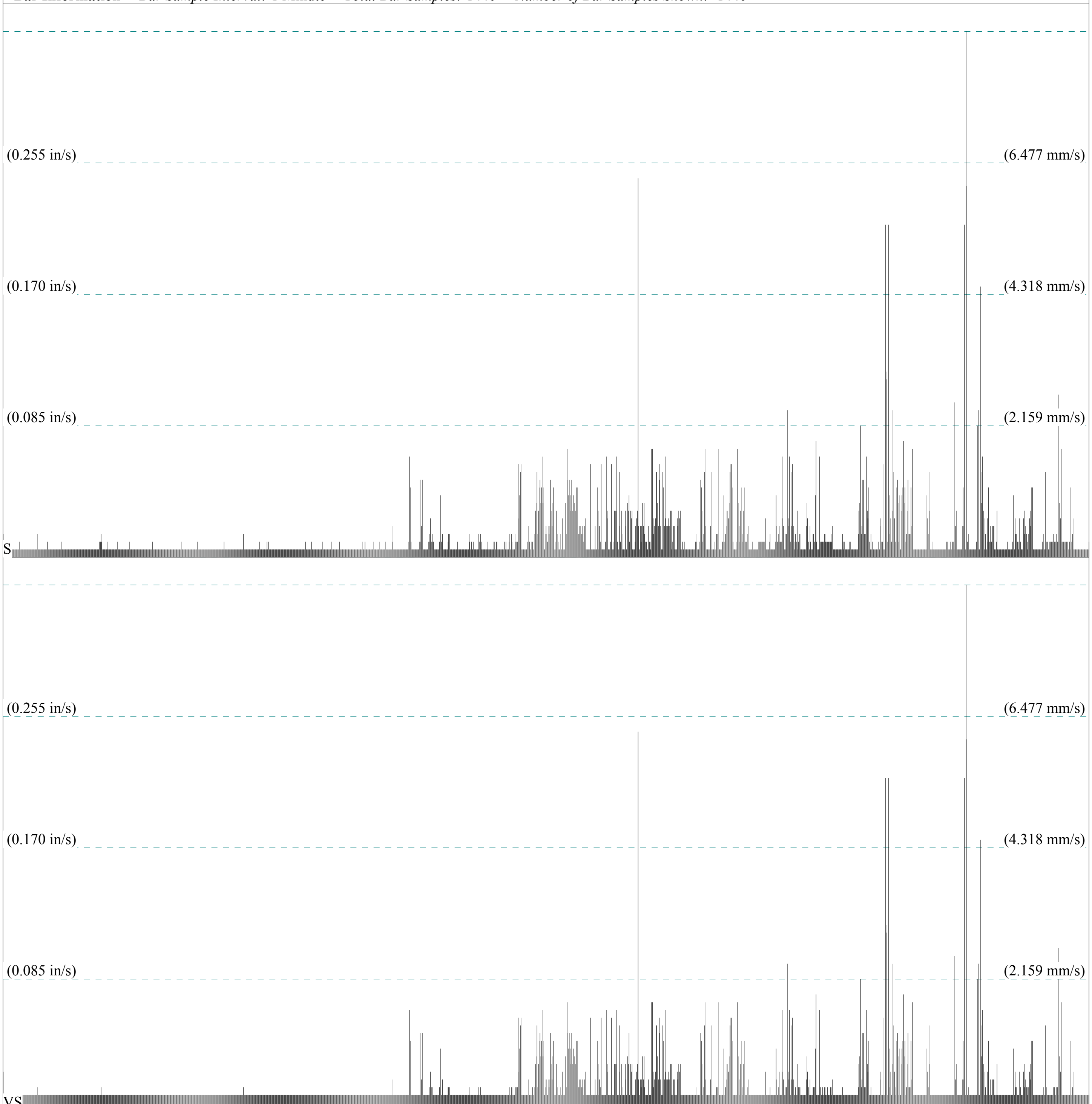




Last Calibration Date: 10/3/2003

File: KITCHEN_FLOOR003.BAR Job Number: 003 Date Range: 3/18/2005 - 3/19/2005 Time Range: 00:00 - 00:00 Serial Number: 2497

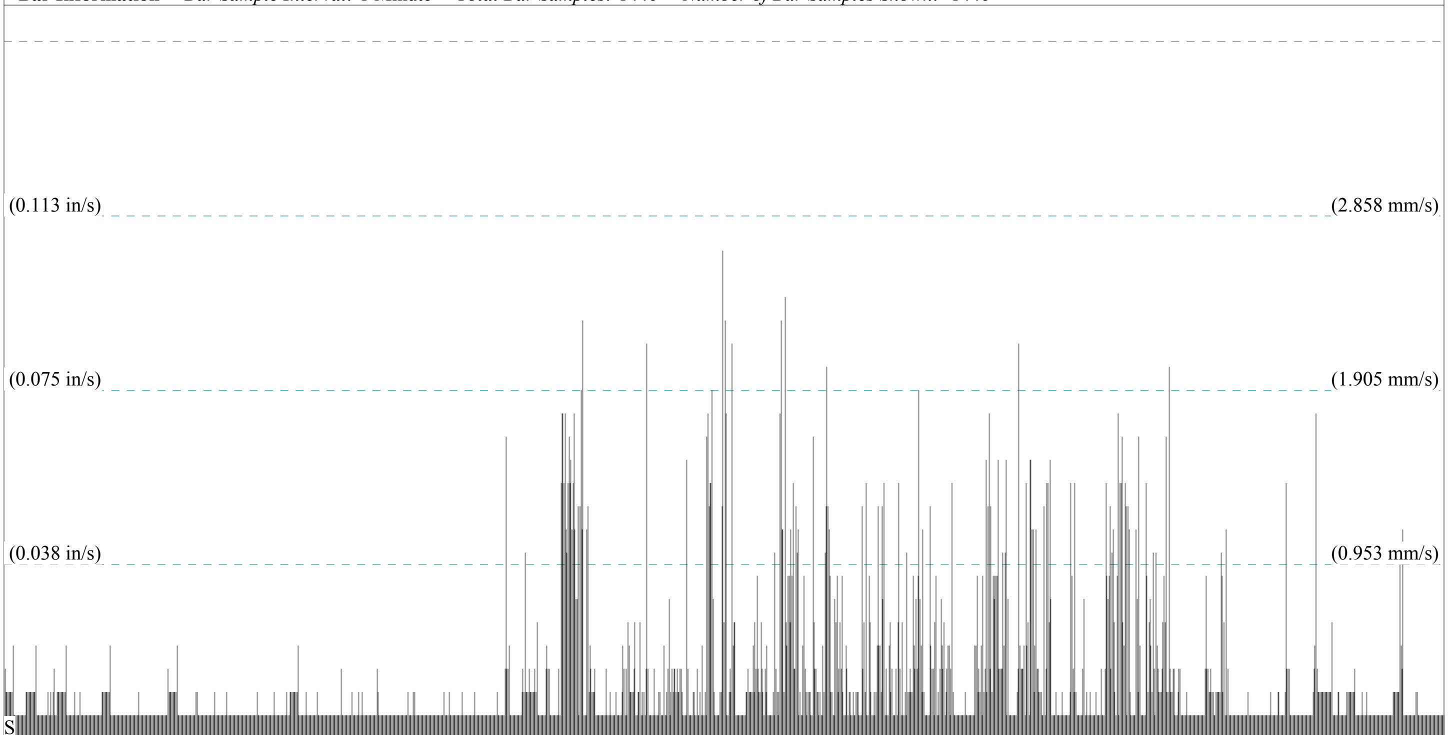
Peak Amplitudes *Seismic (S):* 0.3400in/s 8.636mm/s *Vector Sum (VS):* 0.3400in/s 8.636mm/s
Graph Information *Duration:* 0.0 day to 1.0 day *Seismic Scale:* 0.34 in/s 8.64 mm/s
Bar Information *Bar Sample Interval:* 1 Minute *Total Bar Samples:* 1440 *Number of Bar Samples Shown:* 1440

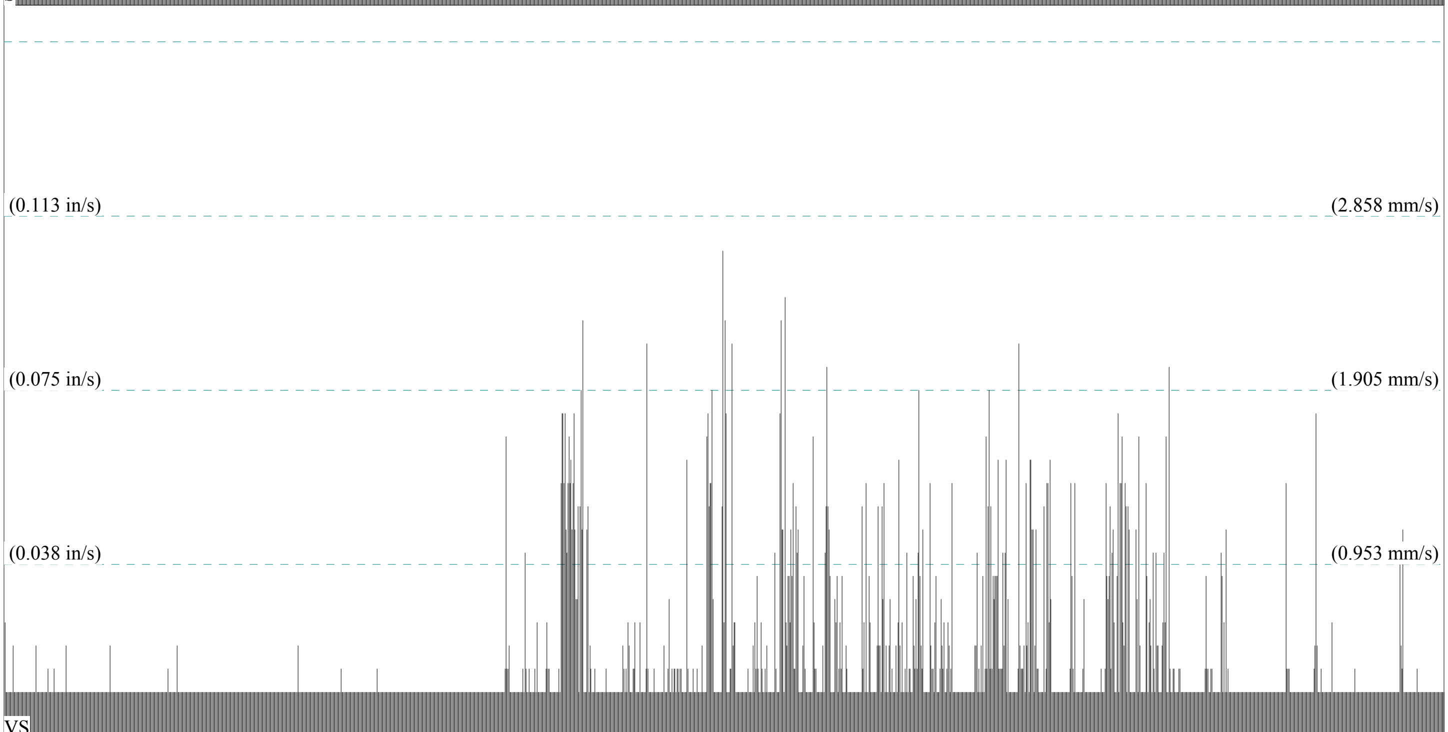


Last Calibration Date: 10/3/2003

File: KITCHEN_FLOOR002.BAR Job Number: 002 Date Range: 3/17/2005 - 3/18/2005 Time Range: 00:00 - 00:00 Serial Number: 2497

Peak Amplitudes *Seismic (S):* 0.1050in/s 2.667mm/s *Vector Sum (VS):* 0.1050in/s 2.667mm/s
Graph Information *Duration:* 0.0 day to 1.0 day *Seismic Scale:* 0.15 in/s 3.81 mm/s
Bar Information *Bar Sample Interval:* 1 Minute *Total Bar Samples:* 1440 *Number of Bar Samples Shown:* 1440

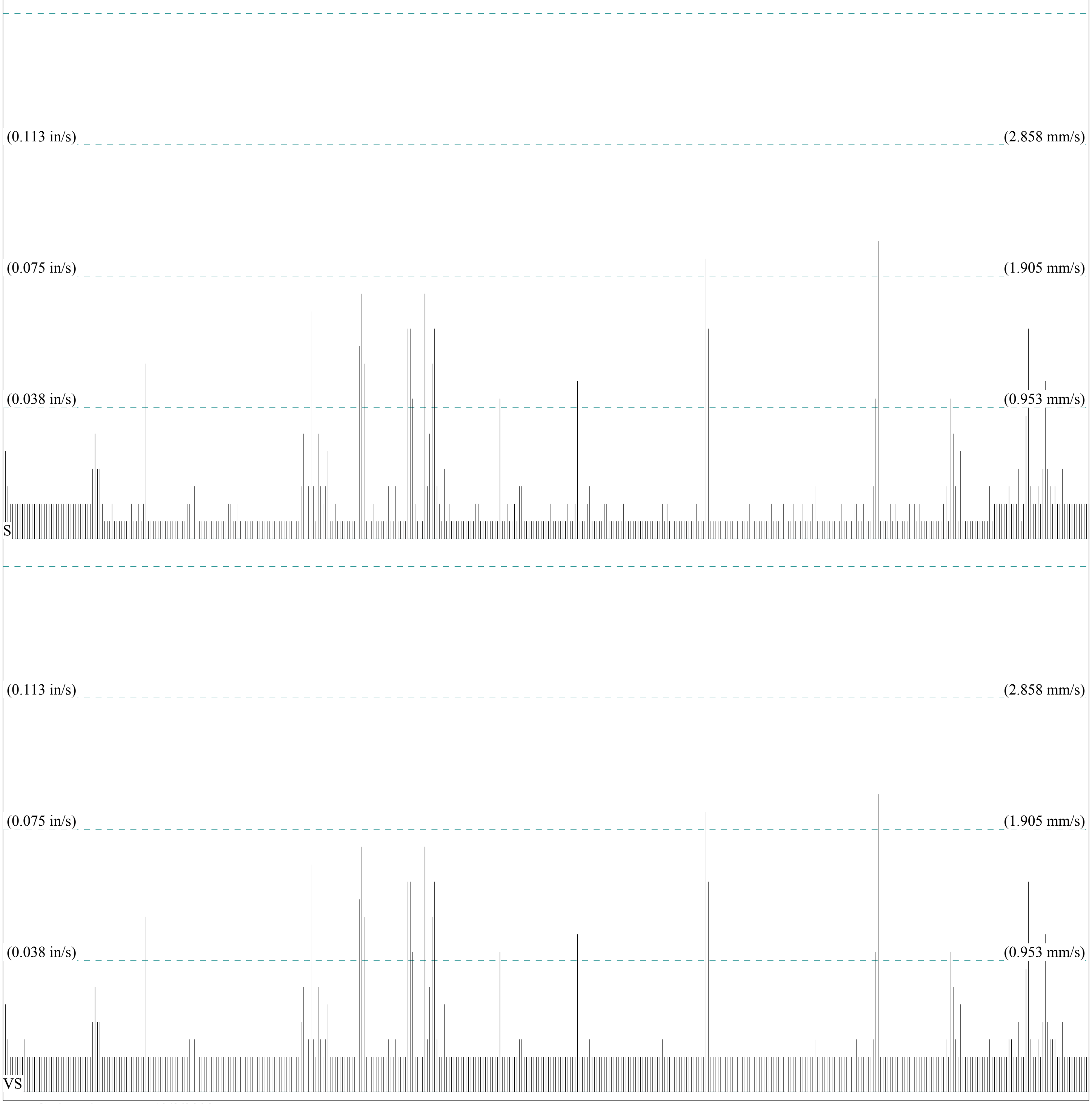




Last Calibration Date: 10/3/2003

File: KITCHEN_FLOOR001.BAR Job Number: 001 Date Range: 3/16/2005 - 3/17/2005 Time Range: 16:32 - 00:00 Serial Number: 2497

Peak Amplitudes *Seismic (S):* 0.0850in/s 2.159mm/s *Vector Sum (VS):* 0.0850in/s 2.159mm/s
Graph Information *Duration:* 0.0 hr to 7.5 hr *Seismic Scale:* 0.15 in/s 3.81 mm/s
Bar Information *Bar Sample Interval:* 1 Minute *Total Bar Samples:* 448 *Number of Bar Samples Shown:* 448



Last Calibration Date: 10/3/2003

TerraDinamica

Unit Located On Interior Wall
Wall is not connected to wall with door
Front Door Slammed

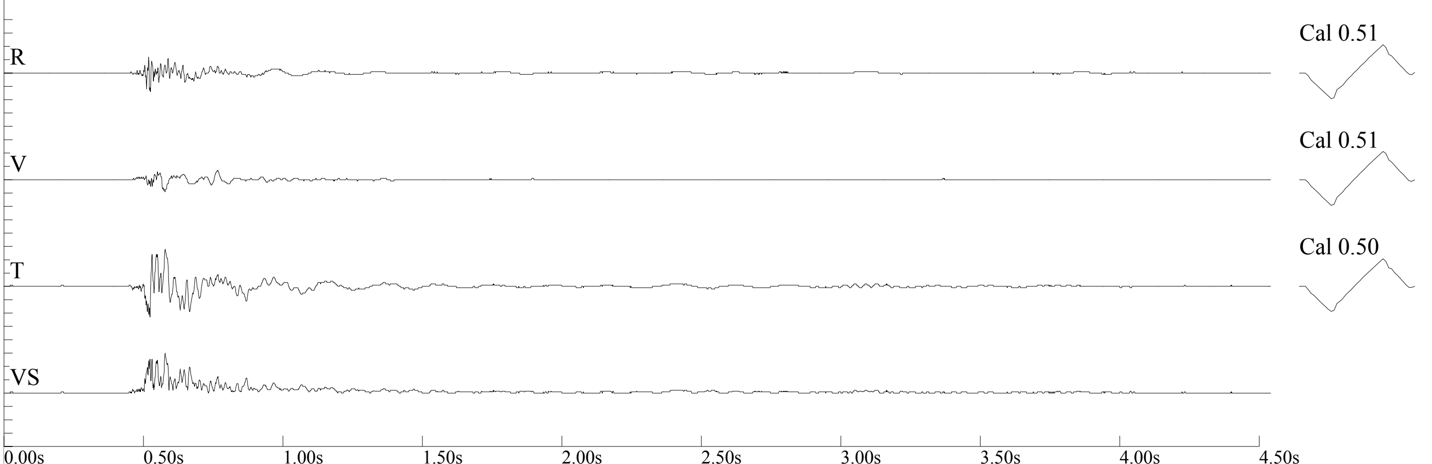
File Name: INTERIOR_WALL_FRONT_SLAM008.DTB
Number: 008
Date: 3/19/2005
Time: 14:24
Serial Number: 1644
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

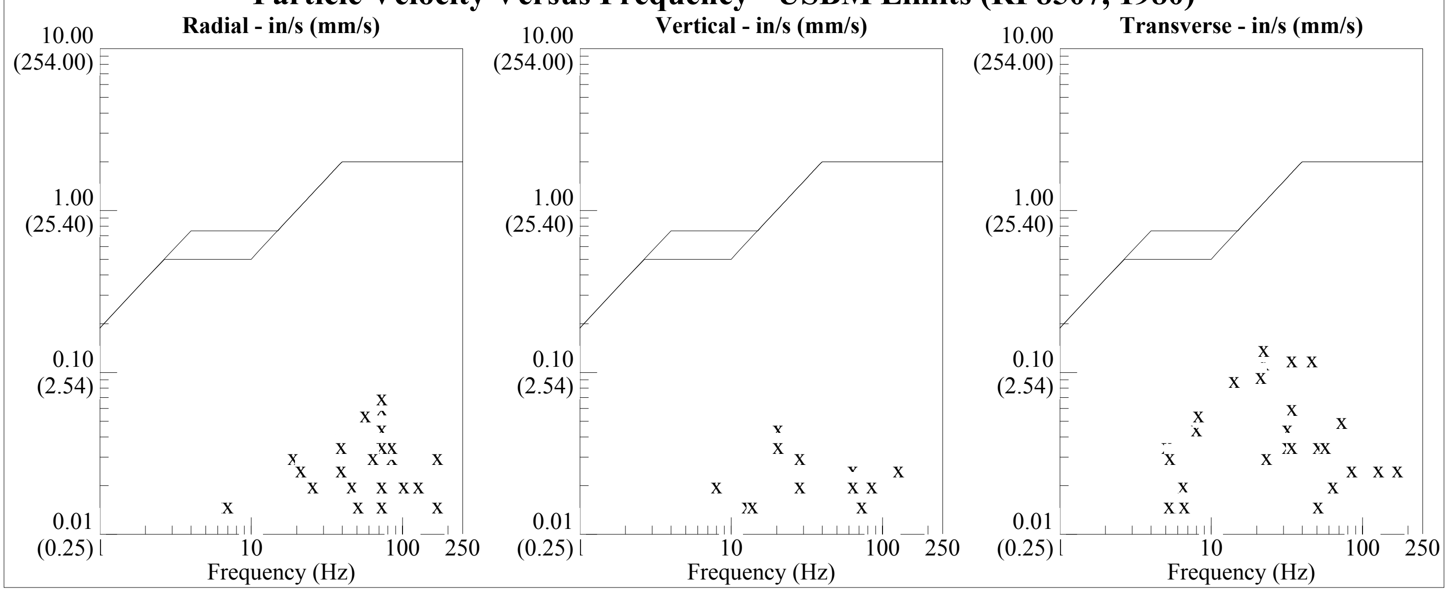
Radial: 0.07in/s 1.778mm/s @ 73.1Hz
Vertical: 0.045in/s 1.143mm/s @ 20.4Hz
***Transverse:* 0.14in/s 3.556mm/s @ 23.2Hz**
Vector Sum (VS): 0.15in/s 3.81mm/s
*Displacement:*0.002035in 0.051695mm
*Acceleration:*0.139130g's
*Calibration Date:*2/16/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
0.20in/s (0.050in/s/div) 5.08mm/s (1.270mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located On Interior Wall
Wall is not connected to wall with door
Front Door Slammed

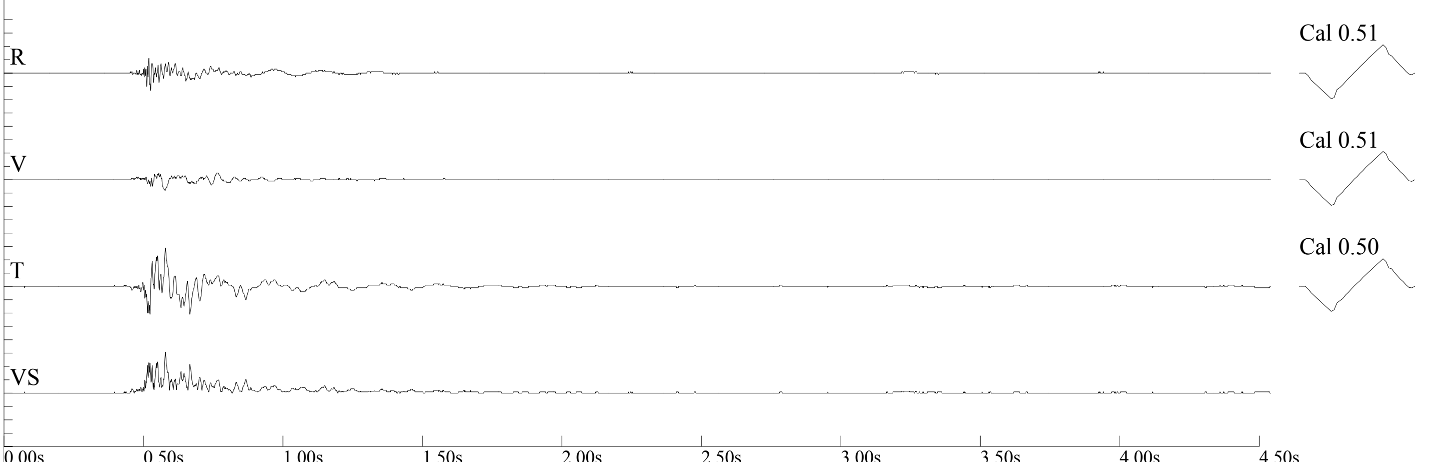
File Name: INTERIOR_WALL_FRONT_SLAM009.DTB
Number: 009
Date: 3/19/2005
Time: 14:25
Serial Number: 1644
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

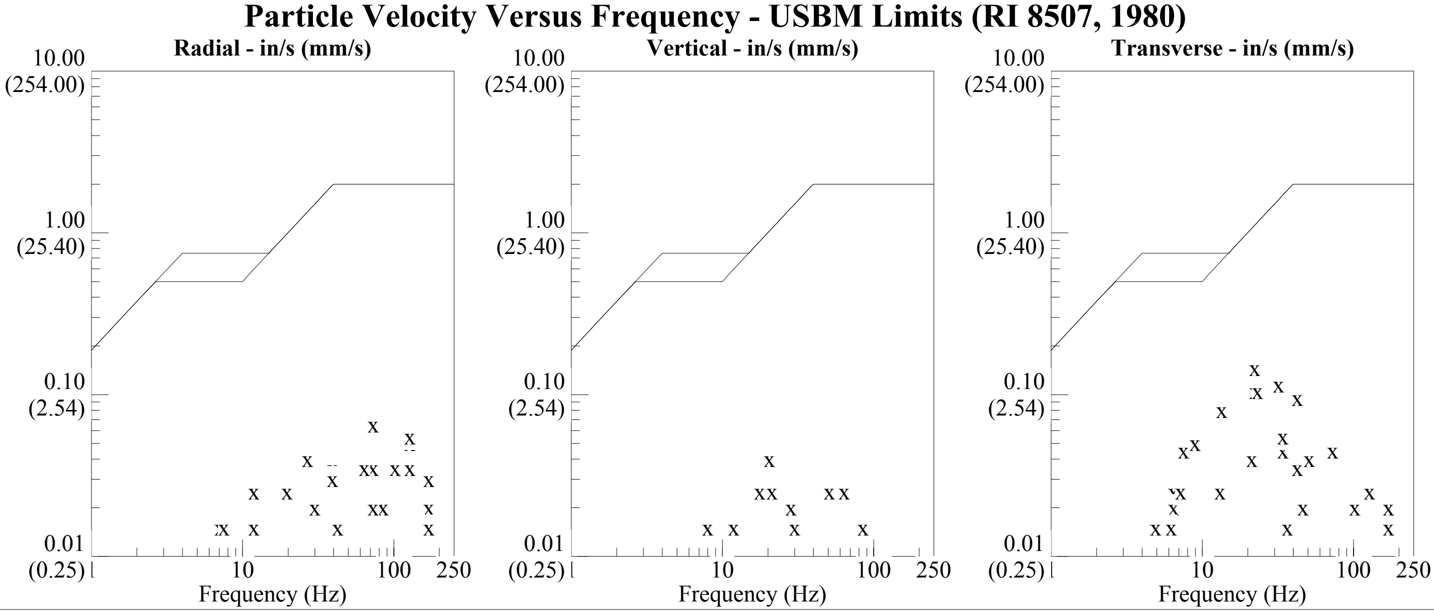
Radial: 0.065in/s 1.651mm/s @ 73.1Hz
Vertical: 0.04in/s 1.016mm/s @ 21.3Hz
***Transverse:* 0.145in/s 3.683mm/s @ 22.2Hz**
Vector Sum (VS): 0.155in/s 3.937mm/s
*Displacement:*0.001822in 0.046287mm
*Acceleration:*0.132505g's
*Calibration Date:*2/16/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
0.20in/s (0.050in/s/div) 5.08mm/s (1.270mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located On Interior Wall
Wall is not connected to wall with door
Front Door Slammed

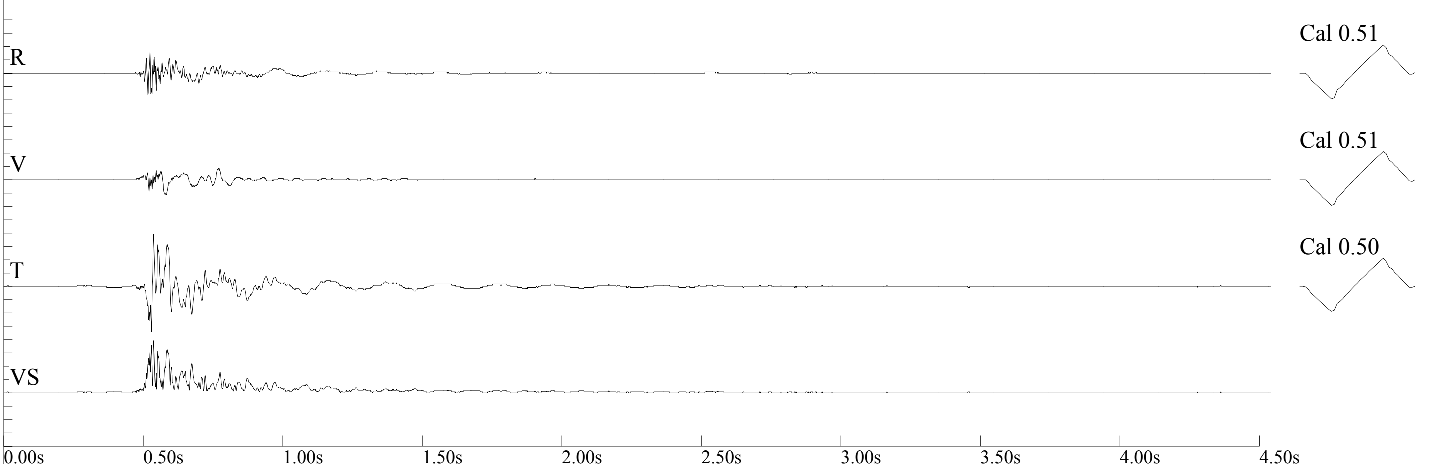
File Name: INTERIOR_WALL_FRONT_SLAM010.DTB
Number: 010
Date: 3/19/2005
Time: 14:25
Serial Number: 1644
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

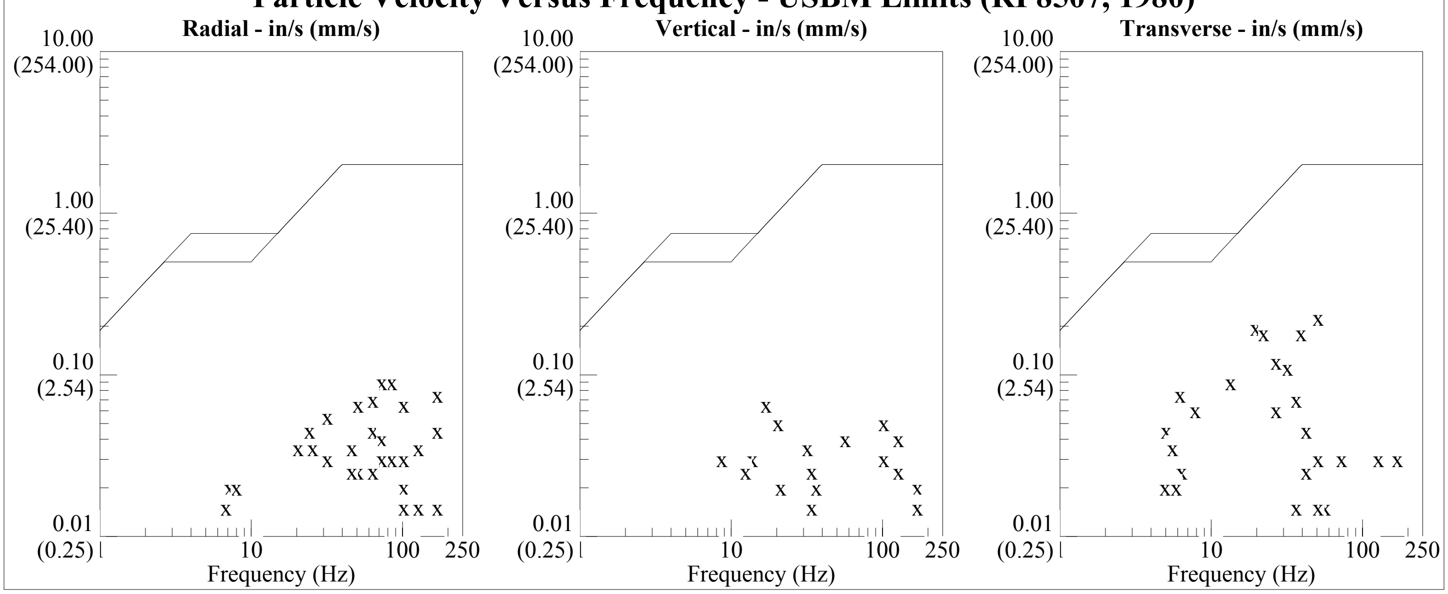
Radial: 0.095in/s 2.413mm/s @ 102.4Hz
Vertical: 0.065in/s 1.651mm/s @ 17.0Hz
***Transverse:* 0.225in/s 5.715mm/s @ 51.2Hz**
Vector Sum (VS): 0.225in/s 5.715mm/s
*Displacement:*0.002655in 0.067445mm
*Acceleration:*0.192133g's
*Calibration Date:*2/16/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
0.23in/s (0.058in/s/div) 5.84mm/s (1.461mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located On Interior Wall
Wall is not connected to wall with door
Front Door Slammed

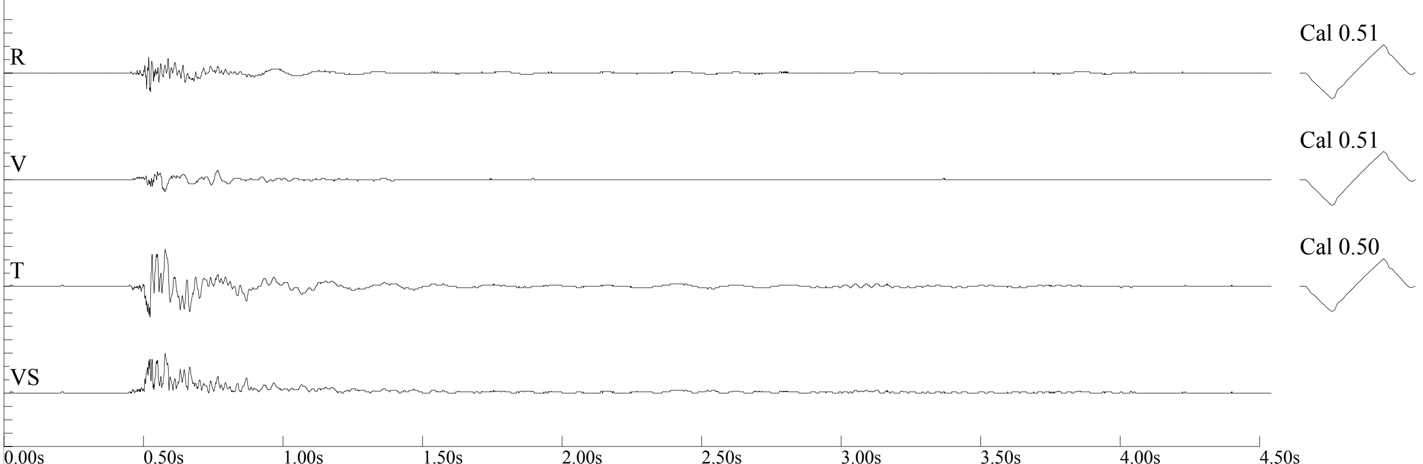
File Name: INTERIOR_WALL_FRONT_SLAM008.DTB
Number: 008
Date: 3/19/2005
Time: 14:24
Serial Number: 1644
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

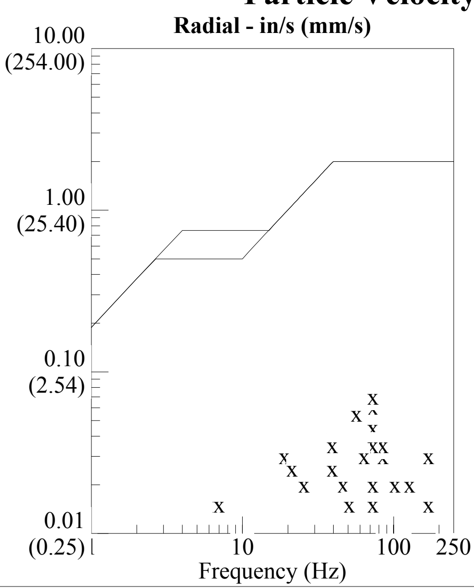
Radial: 0.07in/s 1.778mm/s @ 73.1Hz
Vertical: 0.045in/s 1.143mm/s @ 20.4Hz
***Transverse:* 0.14in/s 3.556mm/s @ 23.2Hz**
Vector Sum (VS): 0.15in/s 3.81mm/s
*Displacement:*0.002035in 0.051695mm
*Acceleration:*0.139130g's
*Calibration Date:*2/16/2005

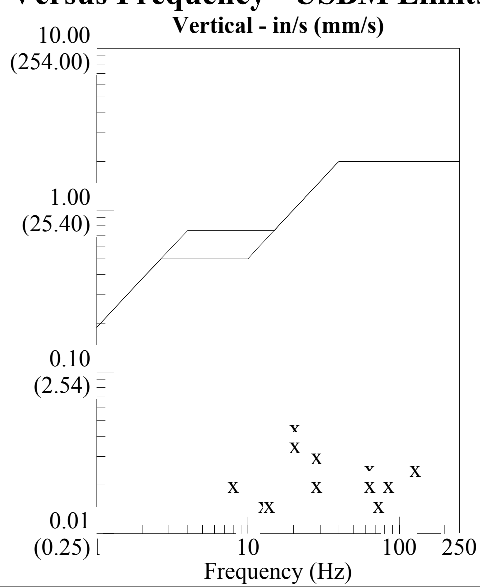
Graph Information

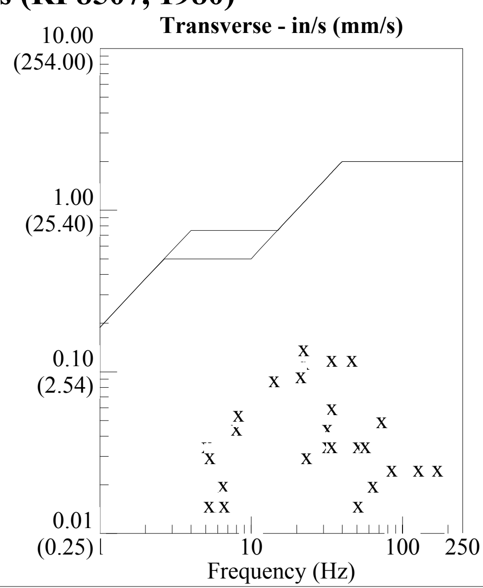
*Duration:*0.000s To: 4.500s
Seismic Scale:
0.20in/s (0.050in/s/div) 5.08mm/s (1.270mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)







Unit Located On Interior Wall
Wall is not connected to wall with door
Front Door Slammed

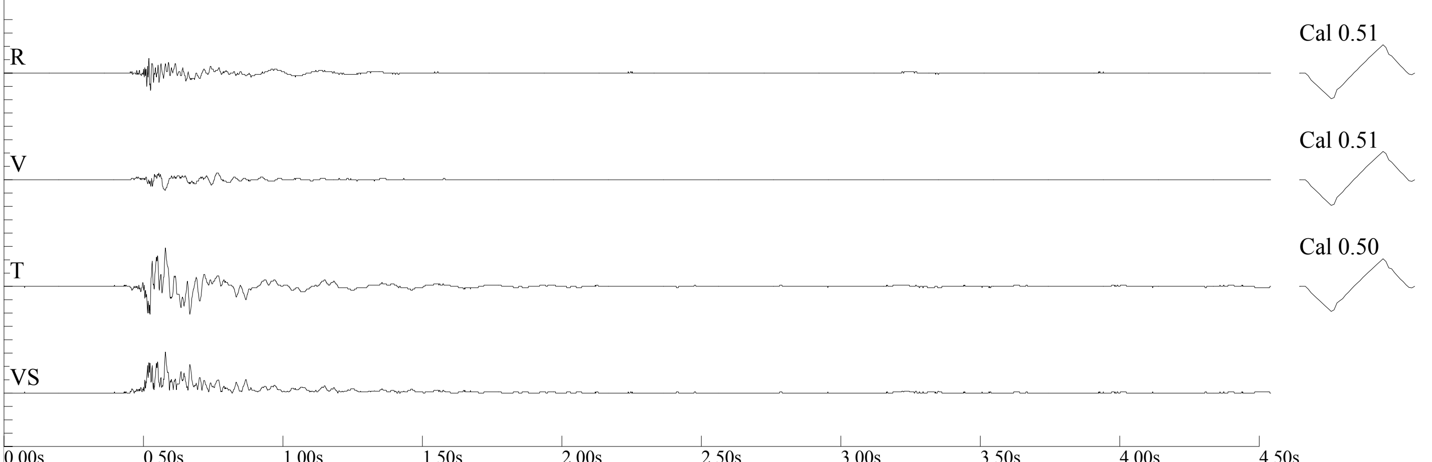
File Name: INTERIOR_WALL_FRONT_SLAM009.DTB
Number: 009
Date: 3/19/2005
Time: 14:25
Serial Number: 1644
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

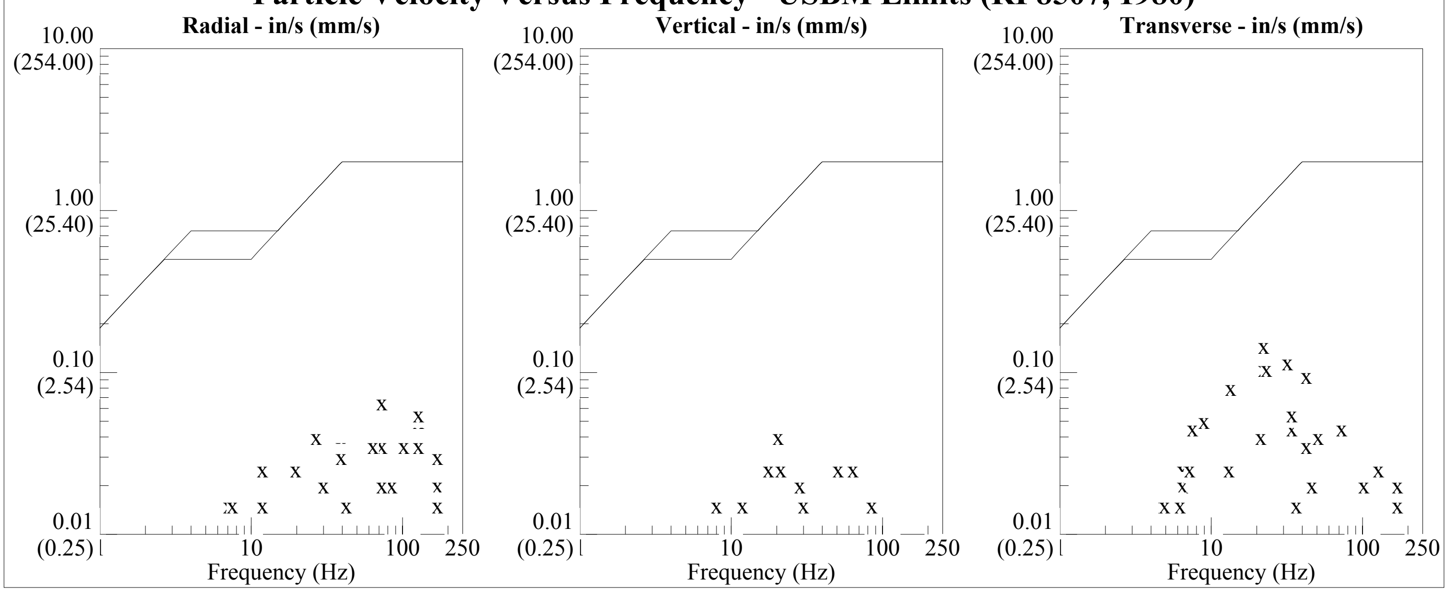
Radial: 0.065in/s 1.651mm/s @ 73.1Hz
Vertical: 0.04in/s 1.016mm/s @ 21.3Hz
***Transverse:* 0.145in/s 3.683mm/s @ 22.2Hz**
Vector Sum (VS): 0.155in/s 3.937mm/s
Displacement: 0.001822in 0.046287mm
Acceleration: 0.132505g's
Calibration Date: 2/16/2005

Graph Information

Duration: 0.000s To: 4.500s
Seismic Scale:
0.20in/s (0.050in/s/div) 5.08mm/s (1.270mm/s/div)
Time Line Intervals at: 0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



TerraDinamica

Unit Located On Interior Wall
Wall is not connected to wall with door
Front Door Slammed

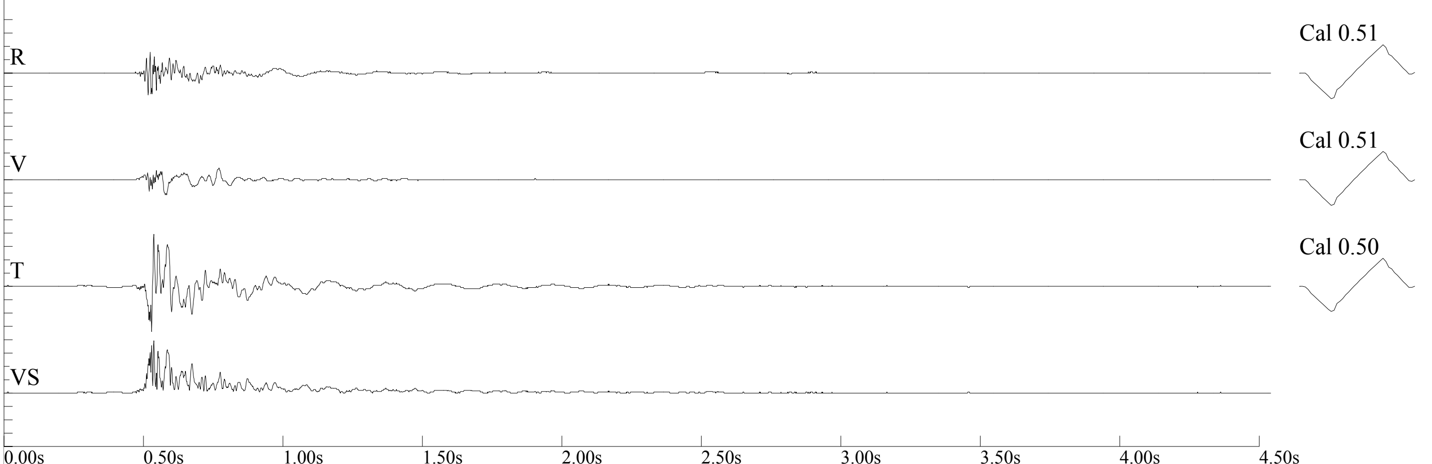
File Name: INTERIOR_WALL_FRONT_SLAM010.DTB
Number: 010
Date: 3/19/2005
Time: 14:25
Serial Number: 1644
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

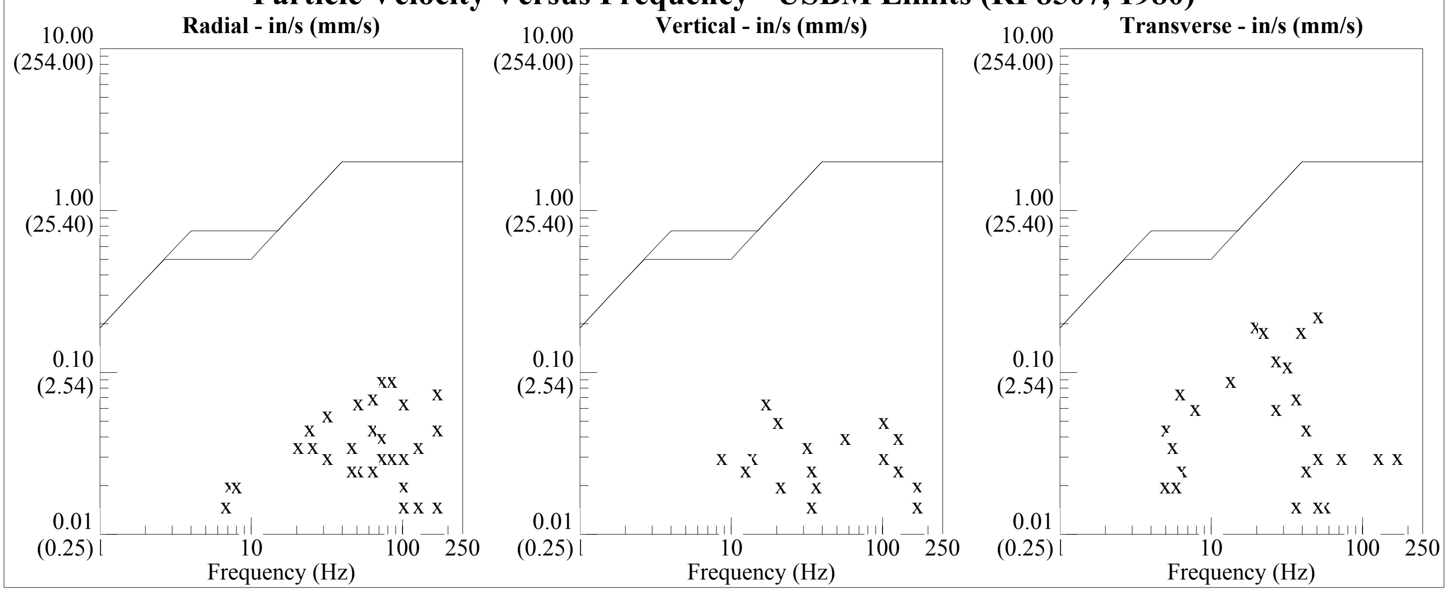
Radial: 0.095in/s 2.413mm/s @ 102.4Hz
Vertical: 0.065in/s 1.651mm/s @ 17.0Hz
***Transverse:* 0.225in/s 5.715mm/s @ 51.2Hz**
Vector Sum (VS): 0.225in/s 5.715mm/s
*Displacement:*0.002655in 0.067445mm
*Acceleration:*0.192133g's
*Calibration Date:*2/16/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
0.23in/s (0.058in/s/div) 5.84mm/s (1.461mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located On Interior Wall
Wall is not connected to wall with door
Front Door Shut with normal amount of force

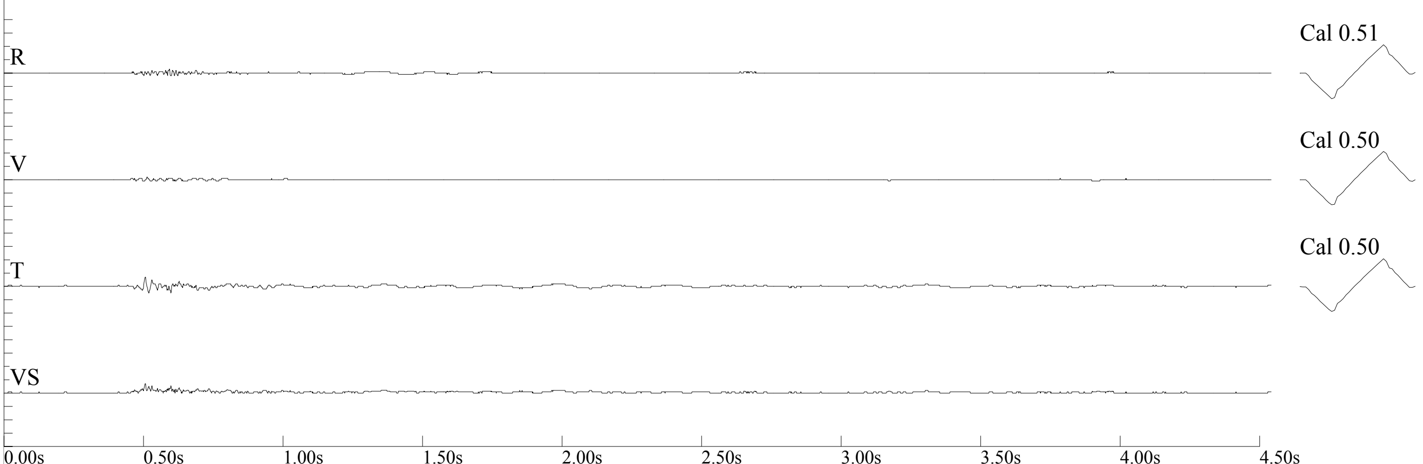
File Name: INTERIOR_WALL_FRONT_SHUT011.DTB
Number: 011
Date: 3/19/2005
Time: 14:27
Serial Number: 1644
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

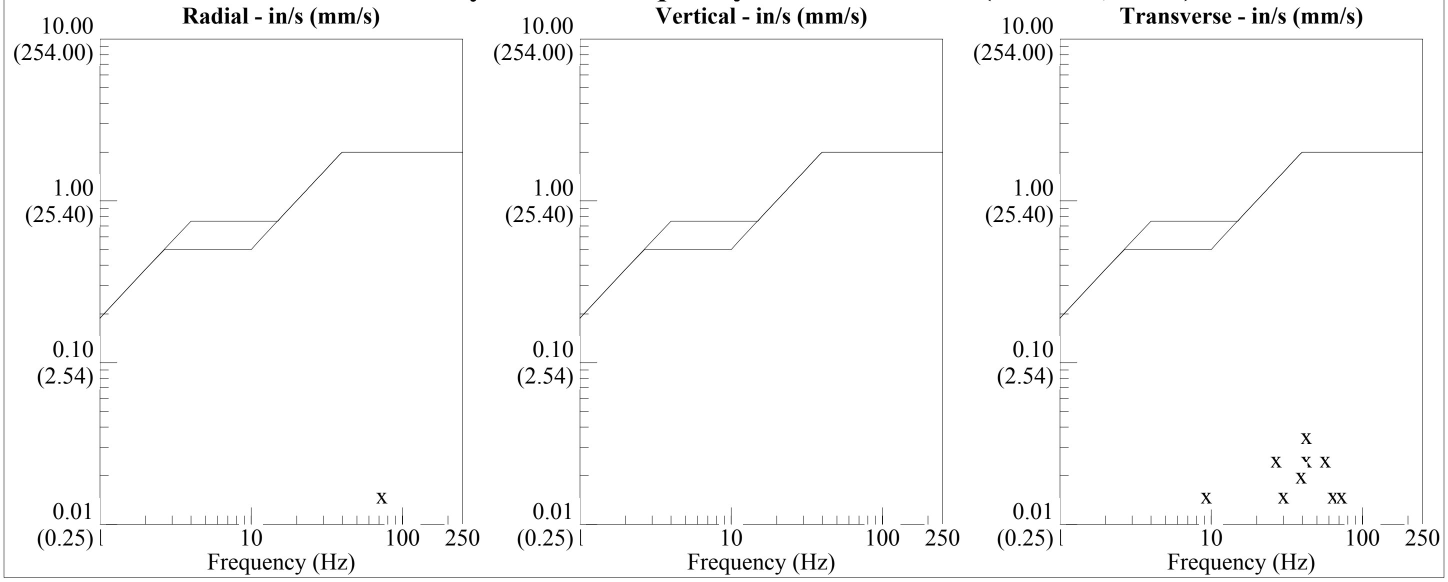
Radial: 0.015in/s 0.381mm/s @ 73.1Hz
Vertical: 0.01in/s 0.254mm/s @ 0.0Hz
***Transverse:* 0.035in/s 0.889mm/s @ 46.5Hz**
Vector Sum (VS): 0.035in/s 0.889mm/s
*Displacement:*0.000364in 0.009241mm
*Acceleration:*0.026501g's
*Calibration Date:*2/16/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
0.20in/s (0.050in/s/div) 5.08mm/s (1.270mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located On Interior Wall
Wall is not connected to wall with door
Front Door Shut with normal amount of force

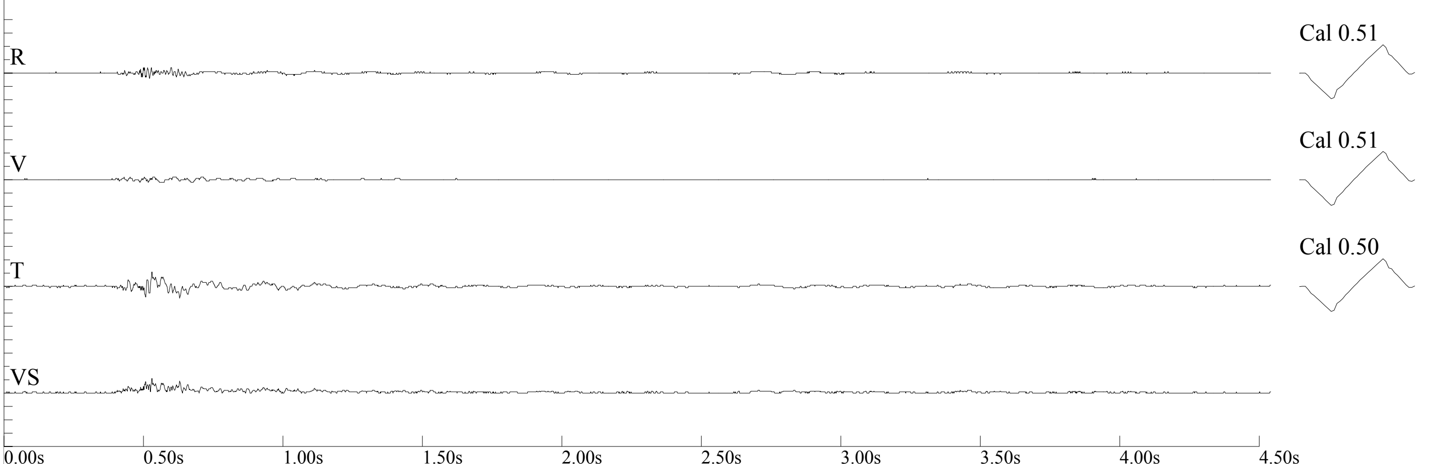
File Name: INTERIOR_WALL_FRONT_SHUT012.DTB
Number: 012
Date: 3/19/2005
Time: 14:27
Serial Number: 1644
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

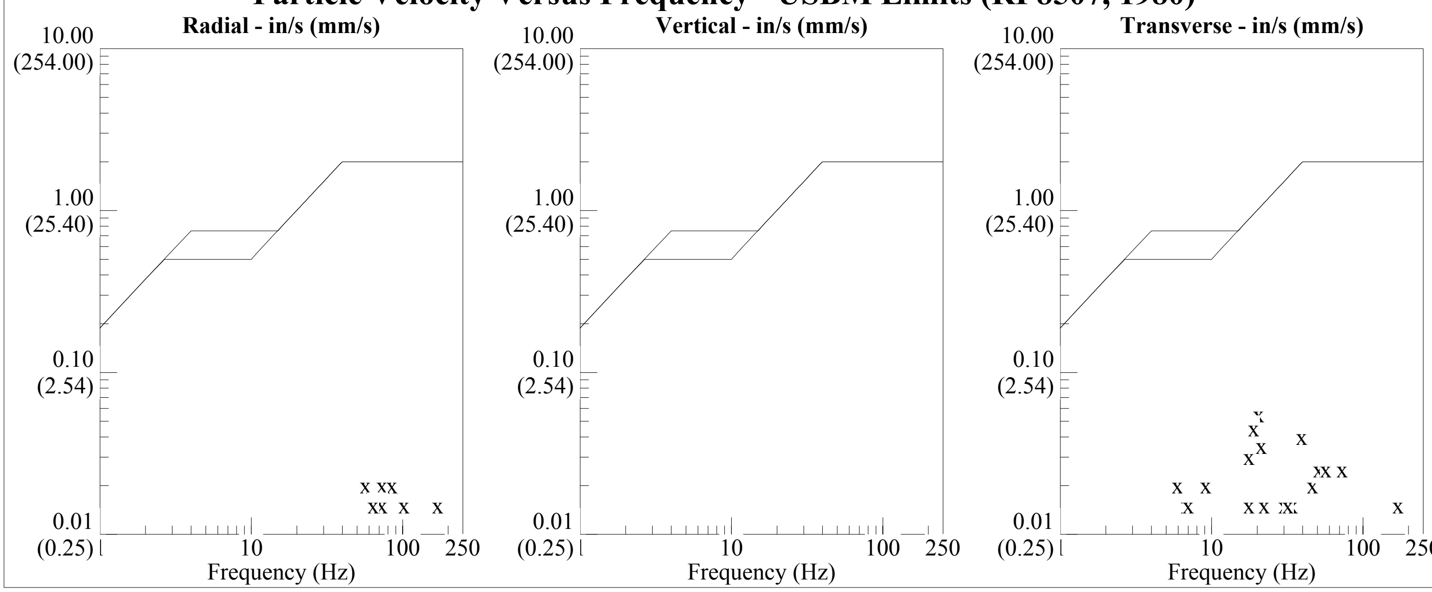
Radial: 0.02in/s 0.508mm/s @ 85.3Hz
Vertical: 0.01in/s 0.254mm/s @ 0.0Hz
***Transverse:* 0.055in/s 1.397mm/s @ 21.3Hz**
Vector Sum (VS): 0.055in/s 1.397mm/s
*Displacement:*0.000764in 0.019400mm
*Acceleration:*0.053002g's
*Calibration Date:*2/16/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
0.20in/s (0.050in/s/div) 5.08mm/s (1.270mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



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Unit Located On Interior Wall
Wall is not connected to wall with door
Front Door Shut with normal amount of force

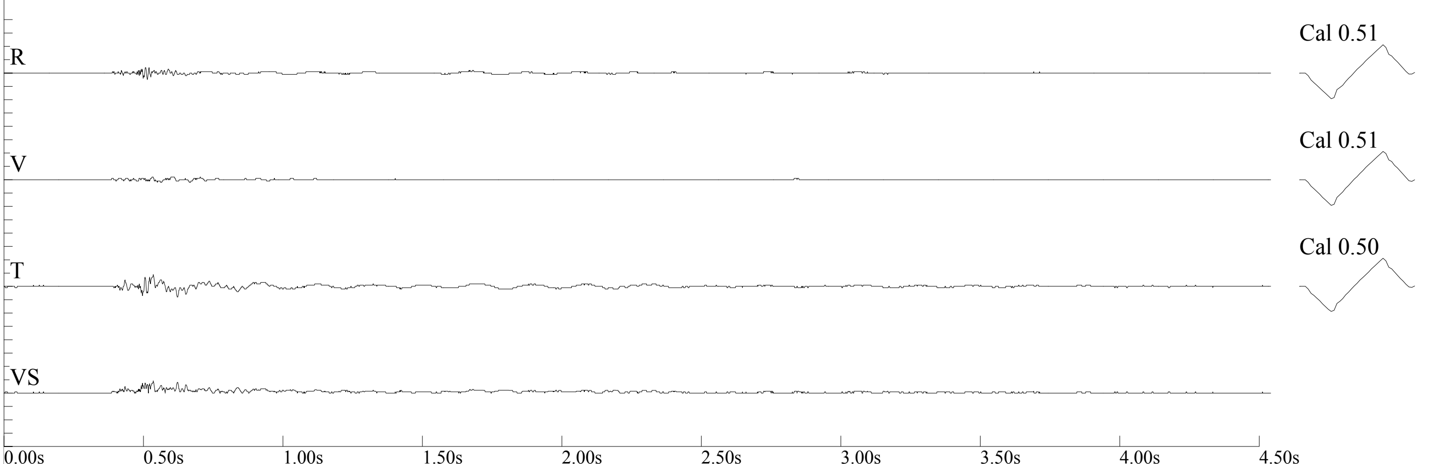
File Name: INTERIOR_WALL_FRONT_SHUT013.DTB
Number: 013
Date: 3/19/2005
Time: 14:28
Serial Number: 1644
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

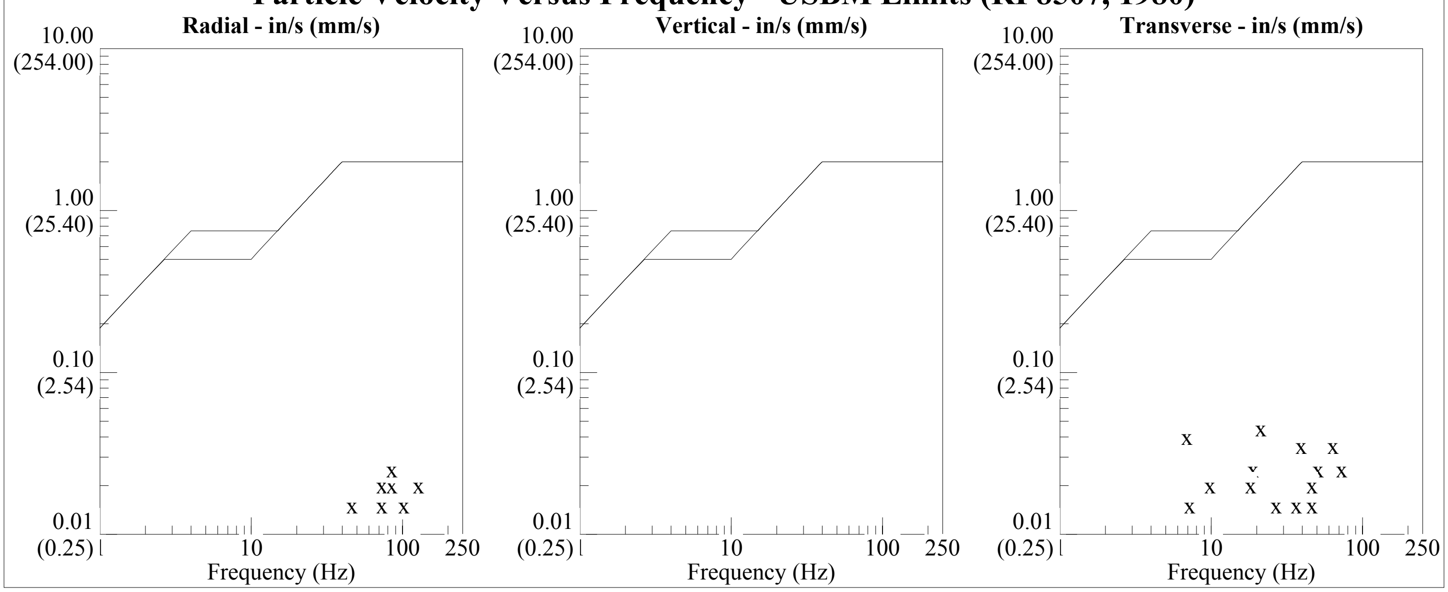
Radial: 0.025in/s 0.635mm/s @ 102.4Hz
Vertical: 0.01in/s 0.254mm/s @ 0.0Hz
***Transverse:* 0.045in/s 1.143mm/s @ 21.3Hz**
Vector Sum (VS): 0.045in/s 1.143mm/s
*Displacement:*0.000708in 0.017992mm
*Acceleration:*0.046377g's
*Calibration Date:*2/16/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
0.20in/s (0.050in/s/div) 5.08mm/s (1.270mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located On Interior Wall **Wall is not connected to wall with door** **Front Door Shut with normal amount of force**	File Name: INTERIOR_WALL_FRONT_SHUT011.DTB Number: 011 Date: 3/19/2005 Time: 14:27 Serial Number: 1644 Seismic Trigger: 0.0300 in/s 0.7620 mm/s Acoustic Trigger: 123 dB Sample Rate: 1024 Record Duration: 4.0 Seconds Pre-Trigger: 0.50 Seconds Sensor Gain: 2x Battery: 6.4

Amplitudes and Frequencies

Radial: 0.015in/s 0.381mm/s @ 73.1Hz

Vertical: 0.01in/s 0.254mm/s @ 0.0Hz

***Transverse:* 0.035in/s 0.889mm/s @ 46.5Hz**

Vector Sum (VS): 0.035in/s 0.889mm/s

*Displacement:*0.000364in 0.009241mm

*Acceleration:*0.026501g's

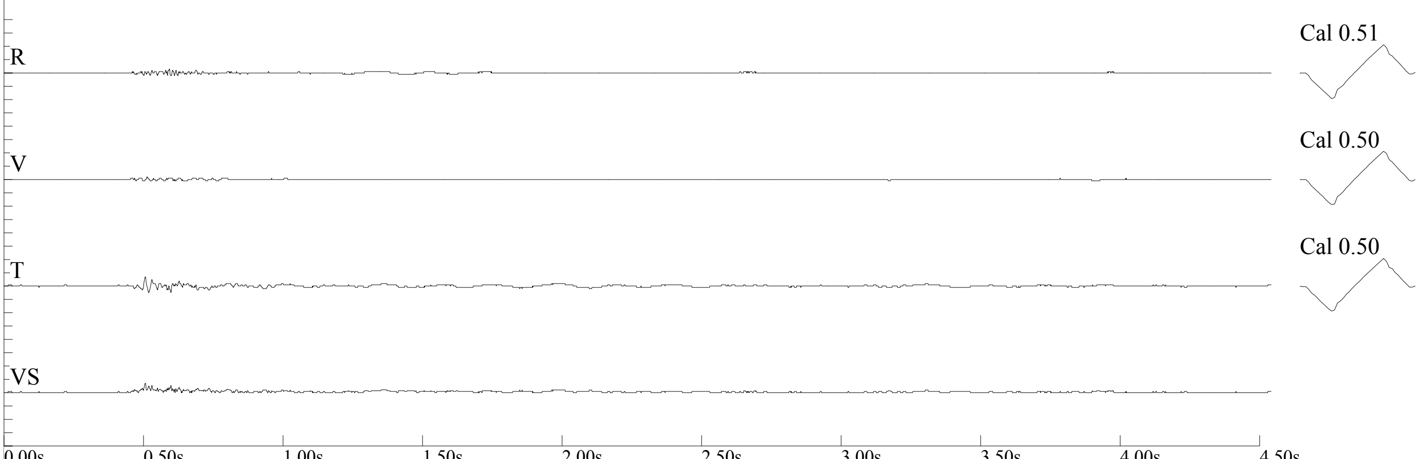
*Calibration Date:*2/16/2005

Graph Information

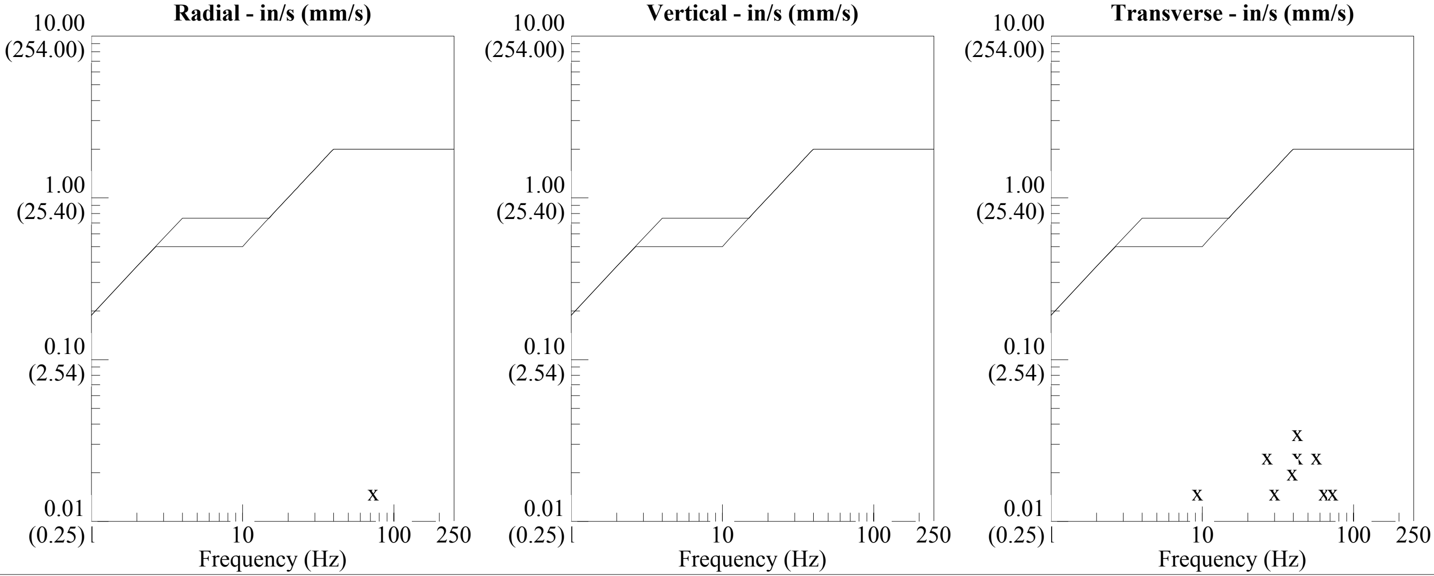
*Duration:*0.000s To: 4.500s

Seismic Scale:
0.20in/s (0.050in/s/div) 5.08mm/s (1.270mm/s/div)

*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



TerraDinamica

Unit Located On Interior Wall
Wall is not connected to wall with door
Front Door Shut with normal amount of force

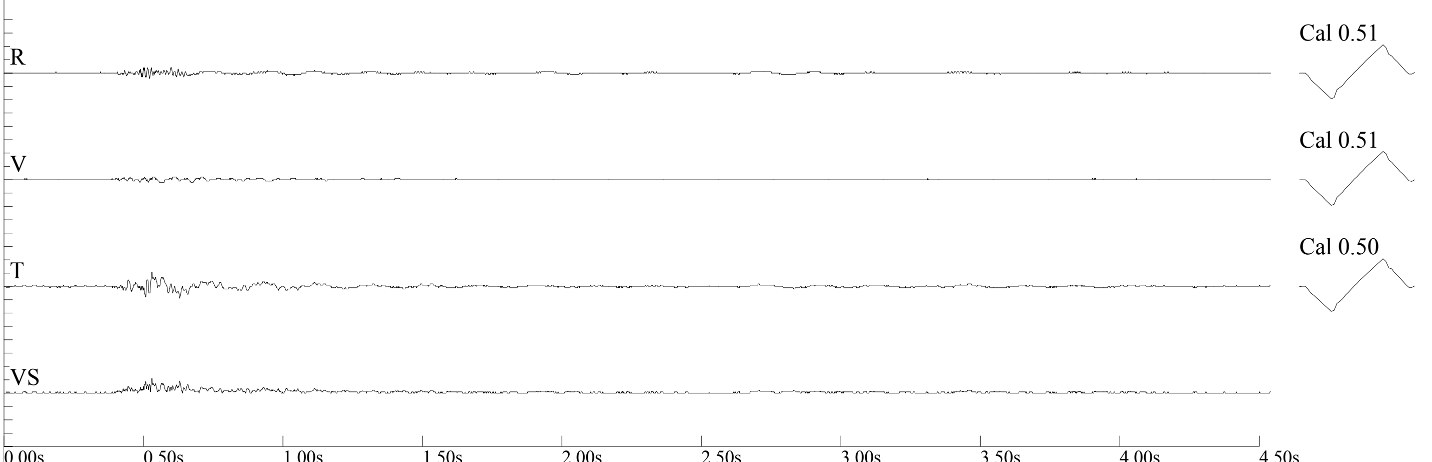
File Name: INTERIOR_WALL_FRONT_SHUT012.DTB
Number: 012
Date: 3/19/2005
Time: 14:27
Serial Number: 1644
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

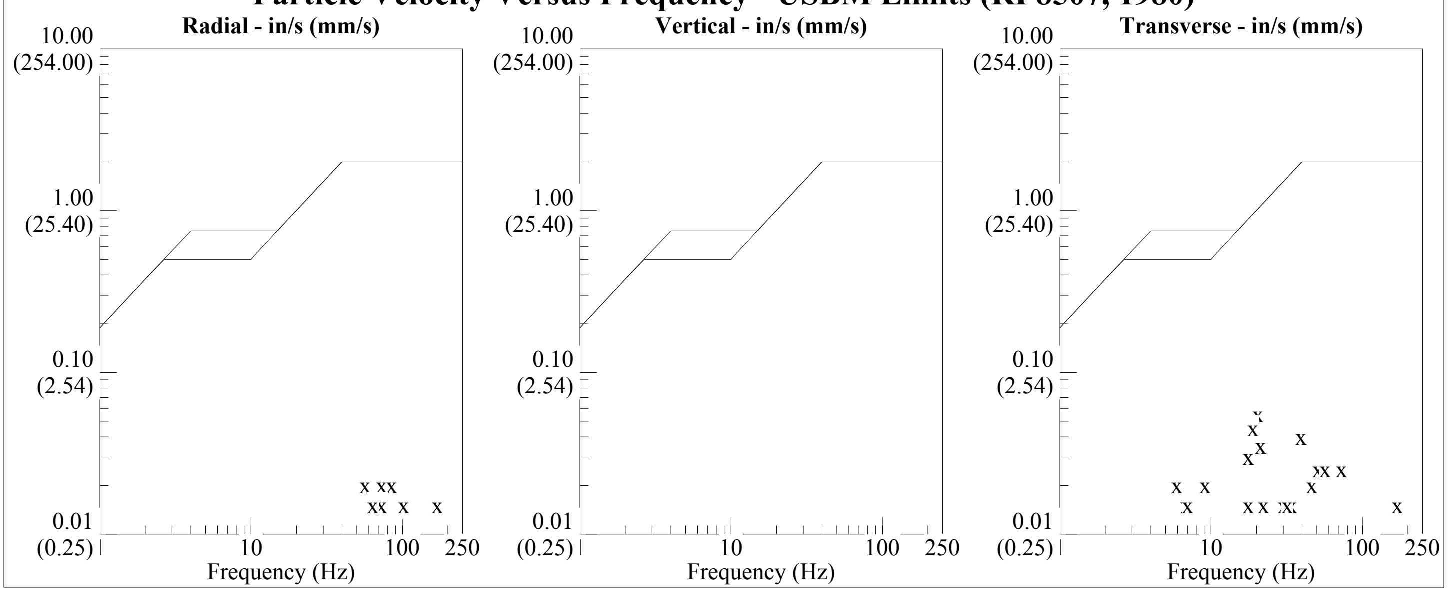
Radial: 0.02in/s 0.508mm/s @ 85.3Hz
Vertical: 0.01in/s 0.254mm/s @ 0.0Hz
Transverse: **0.055in/s 1.397mm/s @ 21.3Hz**
Vector Sum (VS): 0.055in/s 1.397mm/s
*Displacement:*0.000764in 0.019400mm
*Acceleration:*0.053002g's
*Calibration Date:*2/16/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
0.20in/s (0.050in/s/div) 5.08mm/s (1.270mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located On Interior Wall
Wall is not connected to wall with door
Front Door Shut with normal amount of force

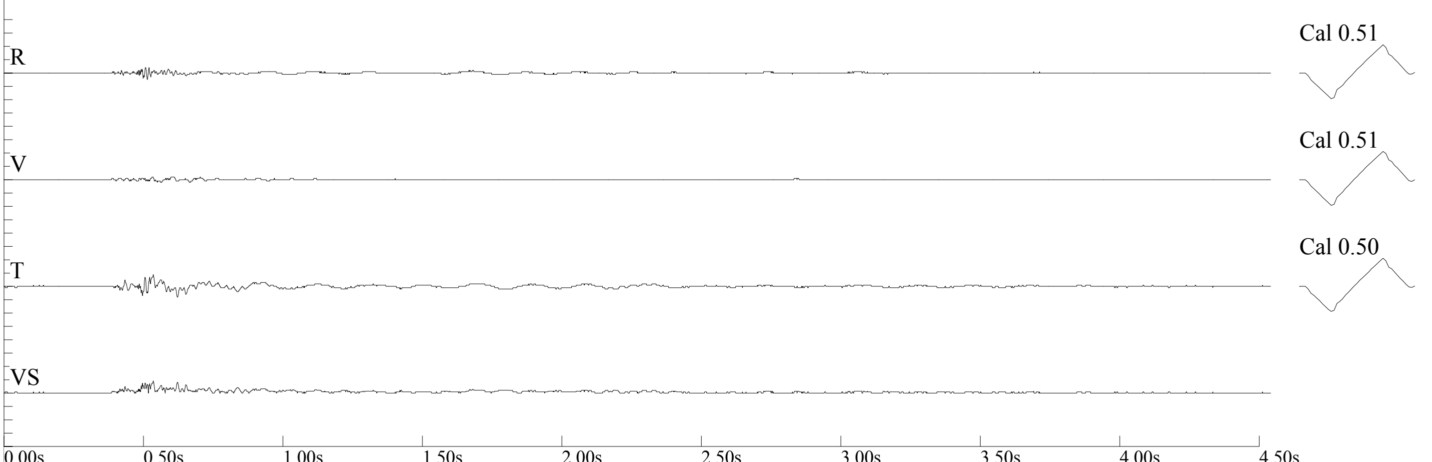
File Name: INTERIOR_WALL_FRONT_SHUT013.DTB
Number: 013
Date: 3/19/2005
Time: 14:28
Serial Number: 1644
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

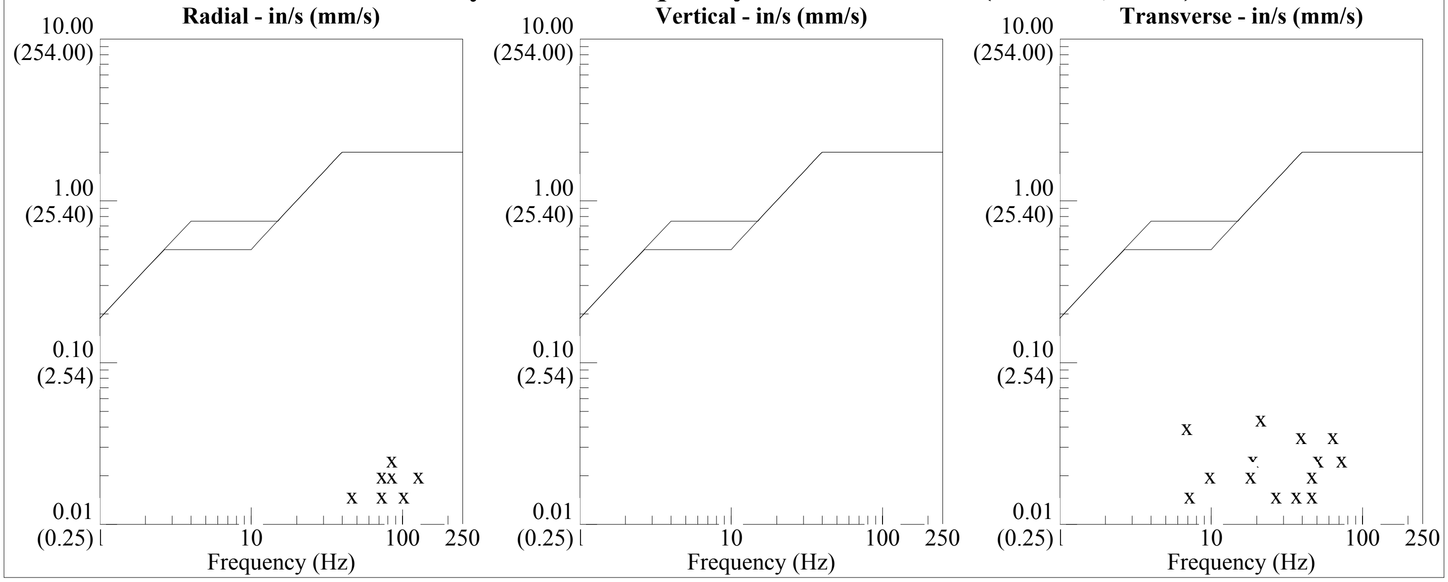
Radial: 0.025in/s 0.635mm/s @ 102.4Hz
Vertical: 0.01in/s 0.254mm/s @ 0.0Hz
***Transverse:* 0.045in/s 1.143mm/s @ 21.3Hz**
Vector Sum (VS): 0.045in/s 1.143mm/s
*Displacement:*0.000708in 0.017992mm
*Acceleration:*0.046377g's
*Calibration Date:*2/16/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
0.20in/s (0.050in/s/div) 5.08mm/s (1.270mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located On Interior Wall
Wall is not connected to wall with door
Back Door Slam

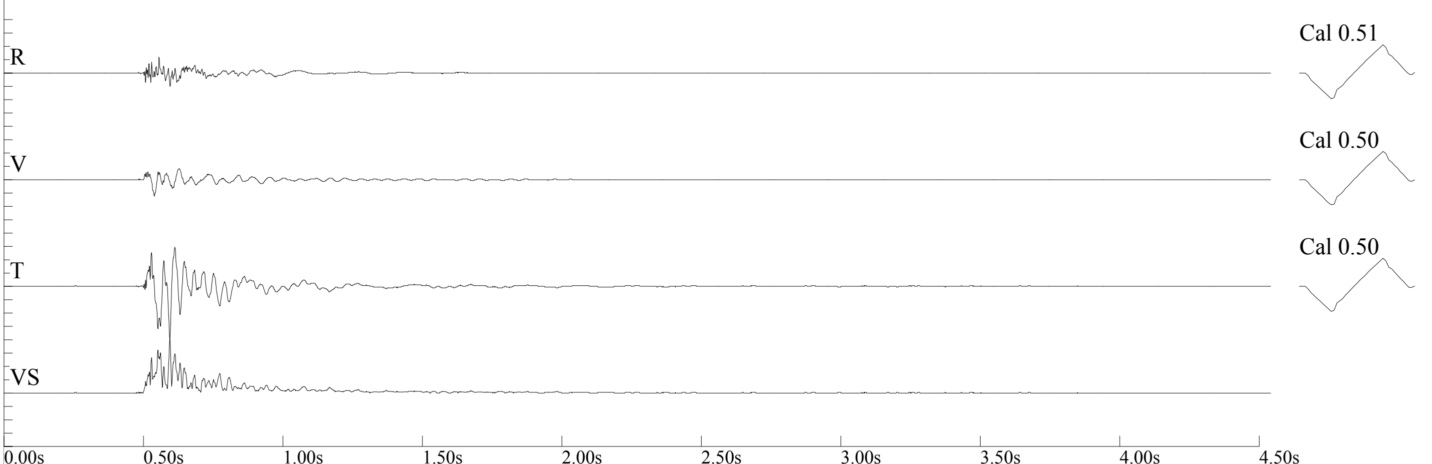
File Name: INTERIOR_WALL_BACK_SLAM017.DTB
Number: 017
Date: 3/19/2005
Time: 14:30
Serial Number: 1644
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

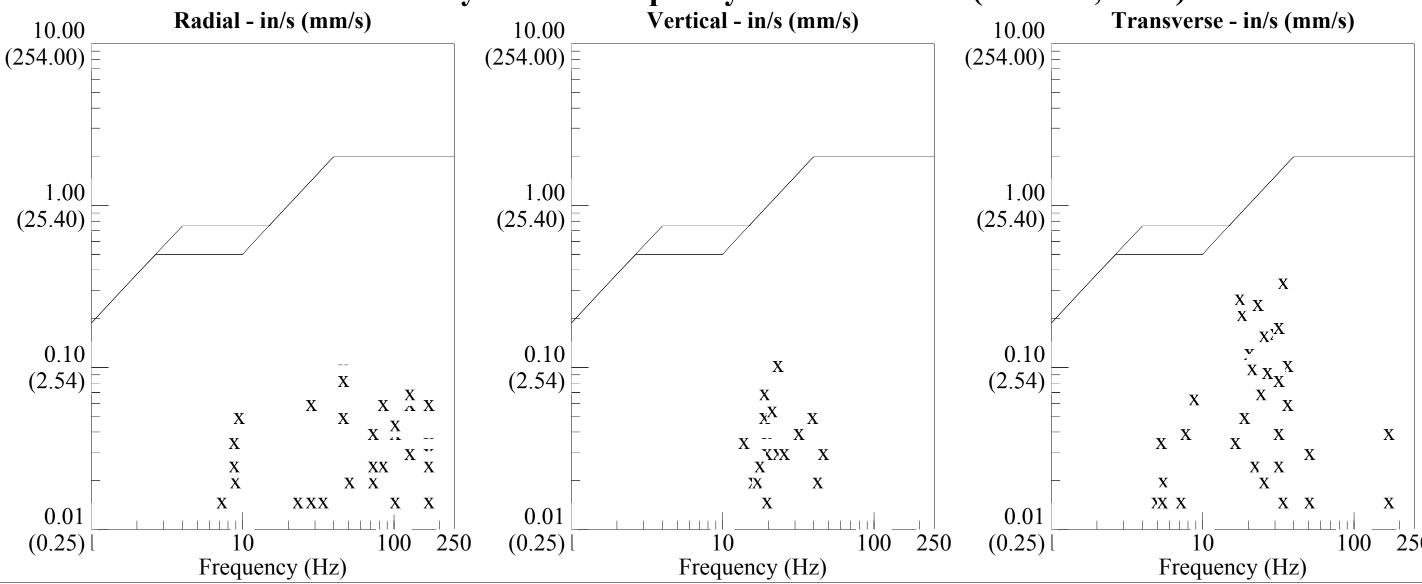
Radial: 0.10in/s 2.54mm/s @ 46.5Hz
Vertical: 0.105in/s 2.667mm/s @ 23.2Hz
***Transverse:* 0.34in/s 8.636mm/s @ 34.1Hz**
Vector Sum (VS): 0.35in/s 8.89mm/s
*Displacement:*0.003470in 0.088130mm
*Acceleration:*0.172257g's
*Calibration Date:*2/16/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
0.34in/s (0.085in/s/div) 8.64mm/s (2.159mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located On Interior Wall
Wall is not connected to wall with door
Back Door Slam

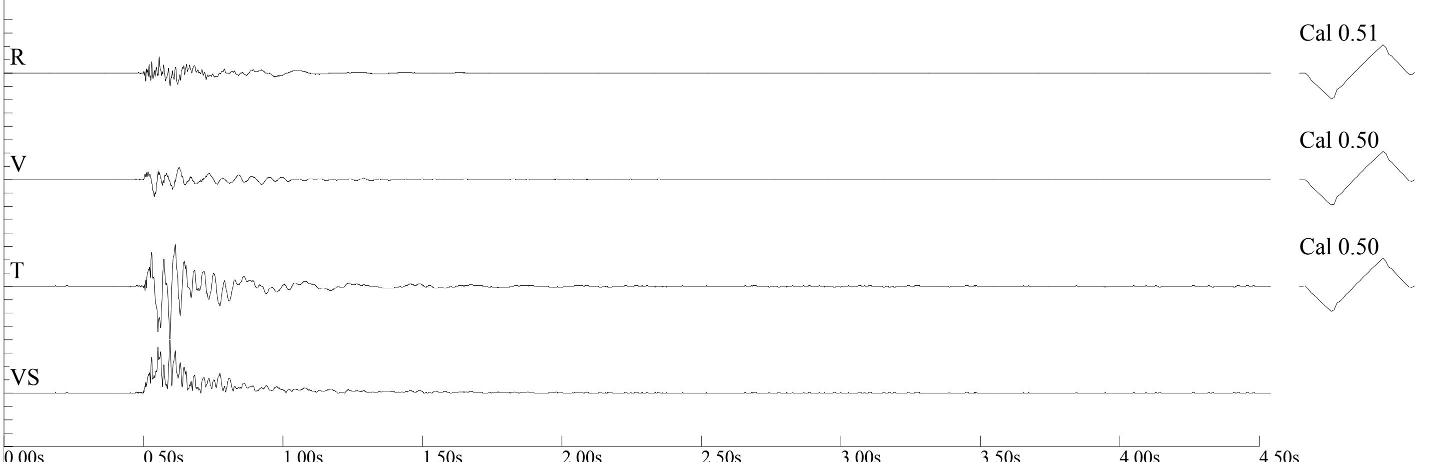
File Name: INTERIOR_WALL_BACK_SLAM018.DTB
Number: 018
Date: 3/19/2005
Time: 14:31
Serial Number: 1644
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

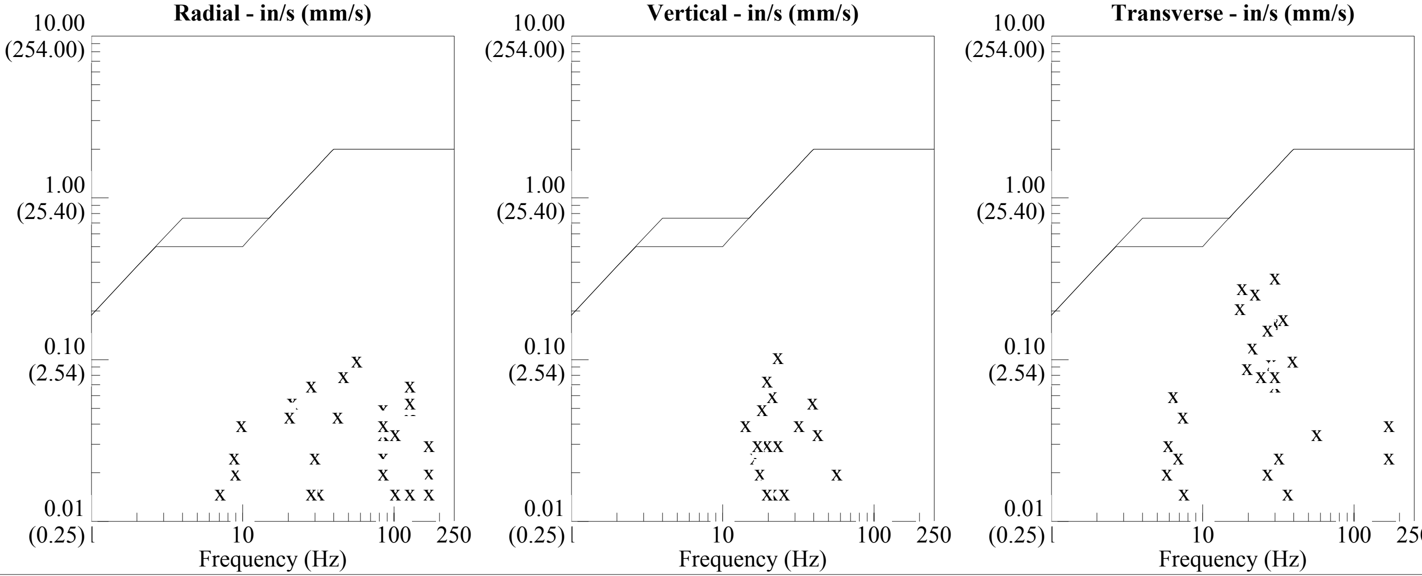
Radial: 0.10in/s 2.54mm/s @ 56.8Hz
Vertical: 0.105in/s 2.667mm/s @ 24.3Hz
***Transverse:* 0.325in/s 8.255mm/s @ 32.0Hz**
Vector Sum (VS): 0.335in/s 8.509mm/s
*Displacement:*0.003434in 0.087228mm
*Acceleration:*0.165632g's
*Calibration Date:*2/16/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
0.33in/s (0.083in/s/div) 8.38mm/s (2.096mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located On Interior Wall
Wall is not connected to wall with door
Back Door Slam

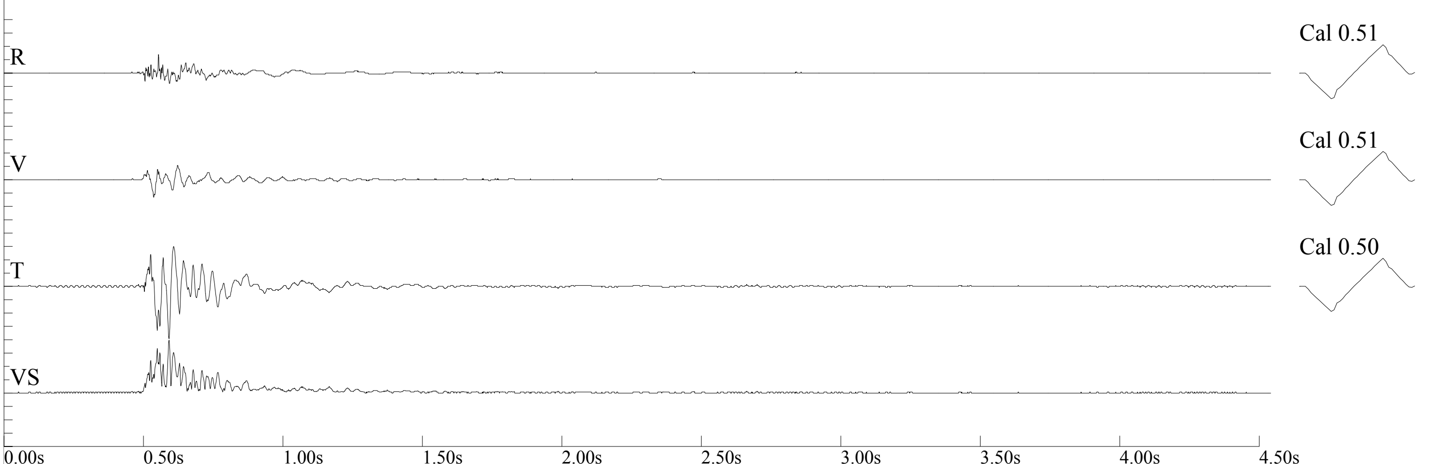
File Name: INTERIOR_WALL_BACK_SLAM019.DTB
Number: 019
Date: 3/19/2005
Time: 14:31
Serial Number: 1644
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

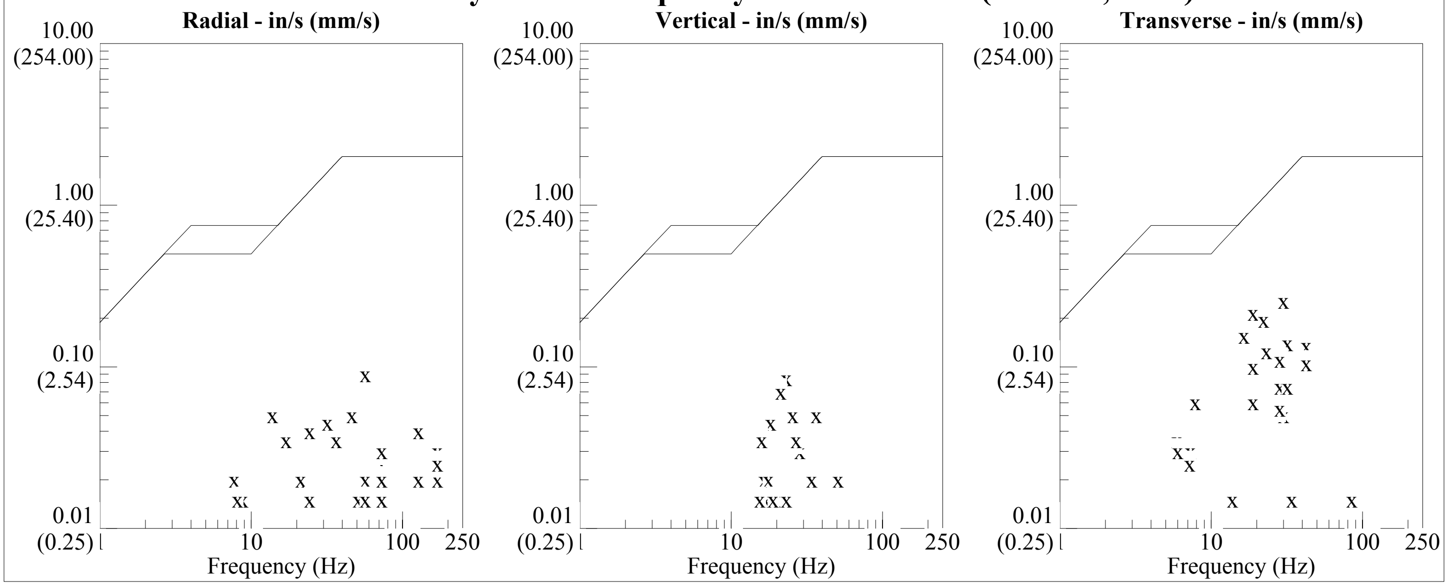
Radial: 0.09in/s 2.286mm/s @ 56.8Hz
Vertical: 0.085in/s 2.159mm/s @ 23.2Hz
***Transverse:* 0.255in/s 6.477mm/s @ 30.1Hz**
Vector Sum (VS): 0.26in/s 6.604mm/s
*Displacement:*0.002814in 0.071476mm
*Acceleration:*0.152381g's
*Calibration Date:*2/16/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
0.26in/s (0.065in/s/div) 6.60mm/s (1.651mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



TerraDinamica

Unit Located On Interior Wall
Wall is not connected to wall with door
Back Door Slam

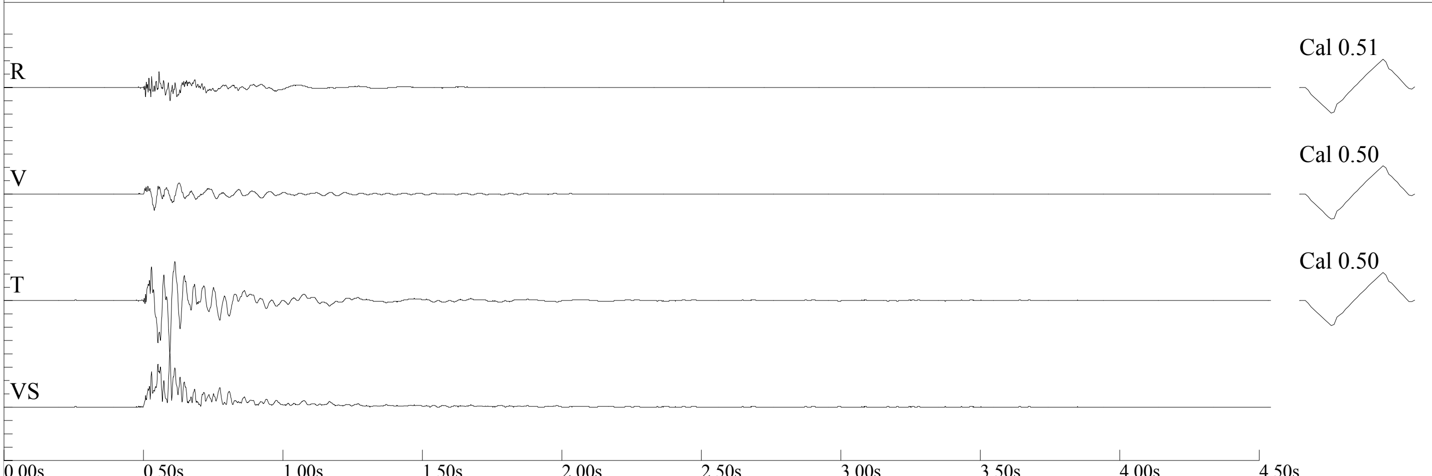
File Name: INTERIOR_WALL_BACK_SLAM017.DTB
Number: 017
Date: 3/19/2005
Time: 14:30
Serial Number: 1644
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

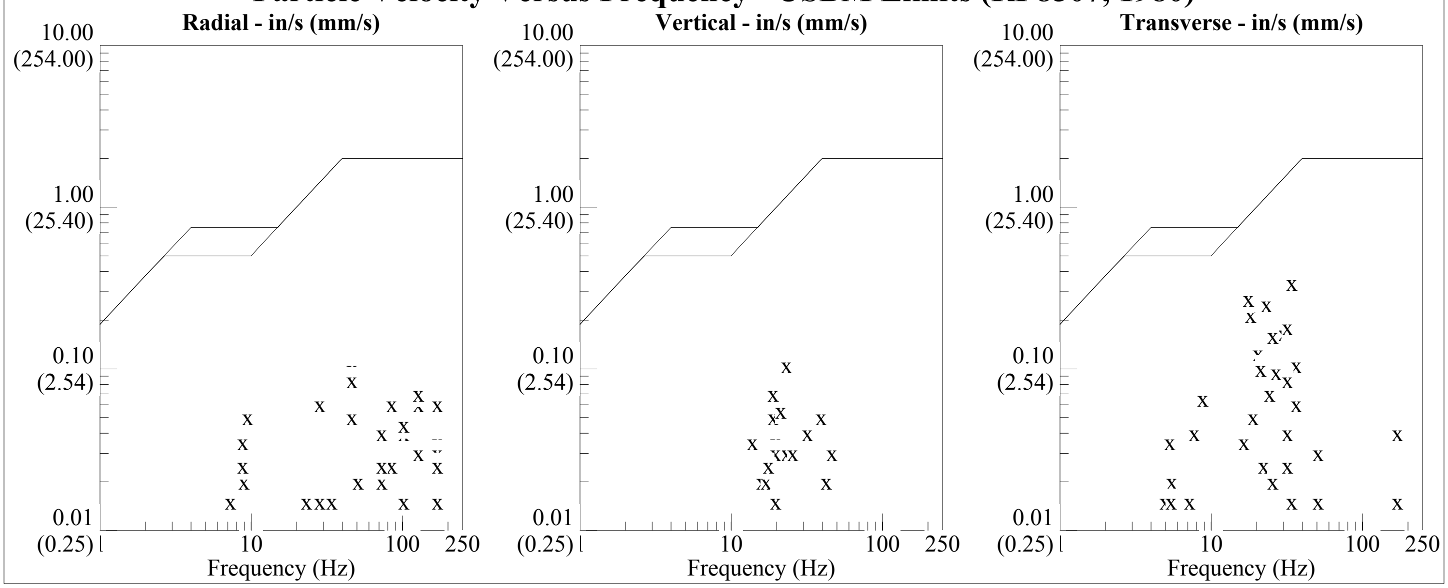
Radial: 0.10in/s 2.54mm/s @ 46.5Hz
Vertical: 0.105in/s 2.667mm/s @ 23.2Hz
***Transverse:* 0.34in/s 8.636mm/s @ 34.1Hz**
Vector Sum (VS): 0.35in/s 8.89mm/s
*Displacement:*0.003470in 0.088130mm
*Acceleration:*0.172257g's
*Calibration Date:*2/16/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
0.34in/s (0.085in/s/div) 8.64mm/s (2.159mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



TerraDinamica

Unit Located On Interior Wall
Wall is not connected to wall with door
Back Door Slam

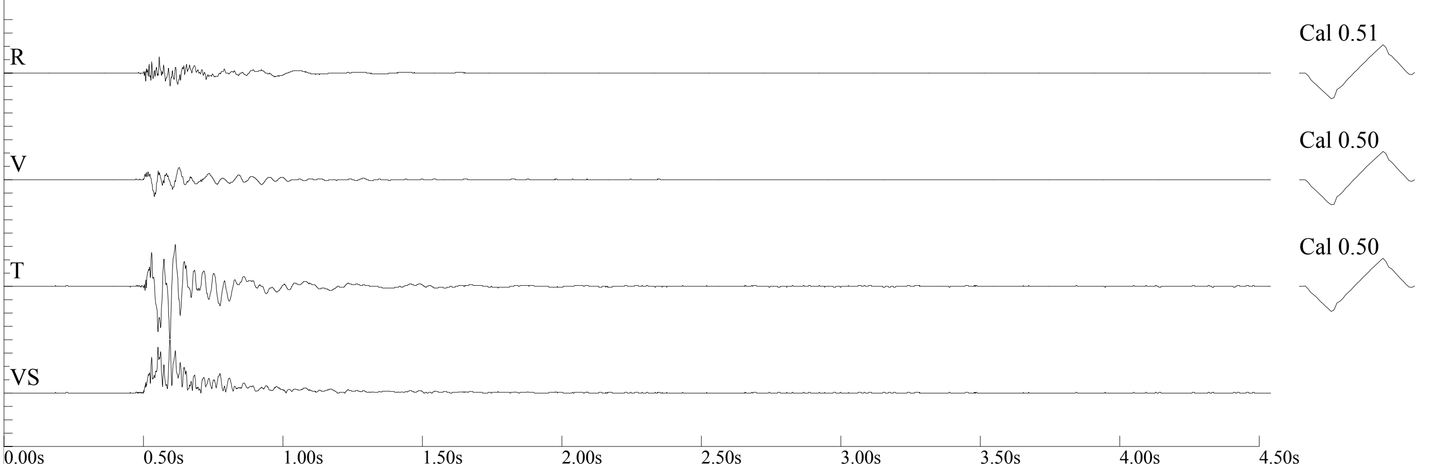
File Name: INTERIOR_WALL_BACK_SLAM018.DTB
Number: 018
Date: 3/19/2005
Time: 14:31
Serial Number: 1644
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

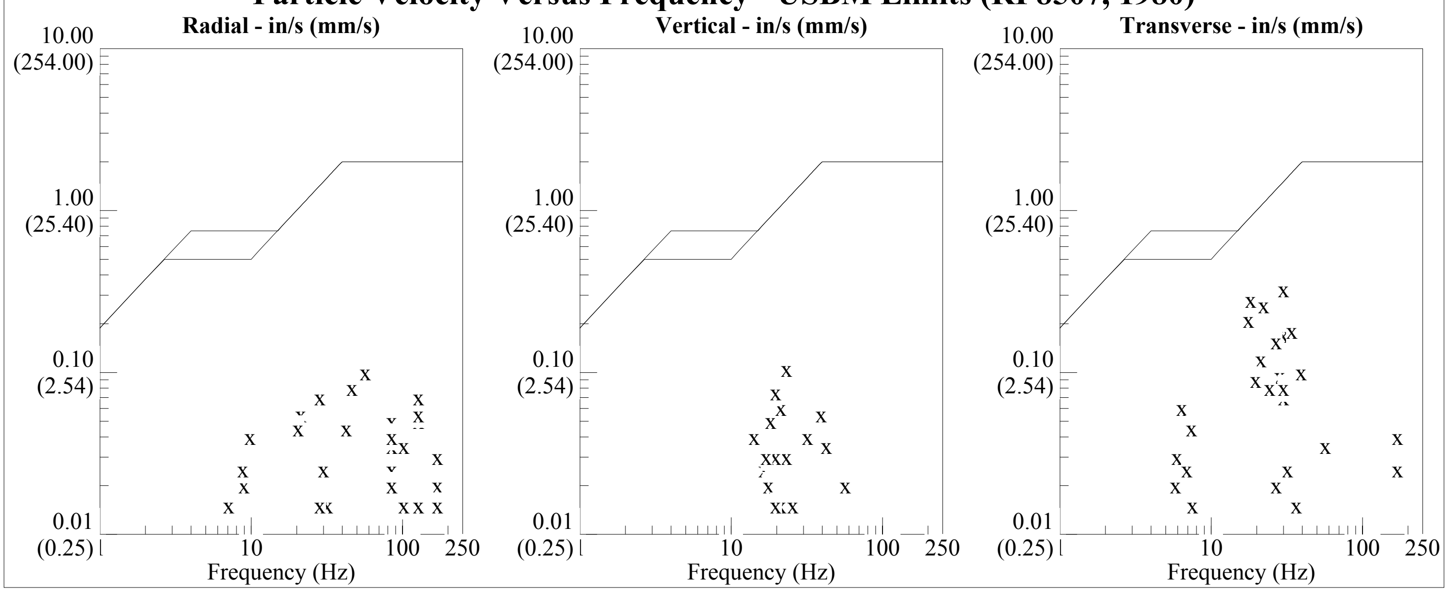
Radial: 0.10in/s 2.54mm/s @ 56.8Hz
Vertical: 0.105in/s 2.667mm/s @ 24.3Hz
***Transverse:* 0.325in/s 8.255mm/s @ 32.0Hz**
Vector Sum (VS): 0.335in/s 8.509mm/s
Displacement: 0.003434in 0.087228mm
Acceleration: 0.165632g's
Calibration Date: 2/16/2005

Graph Information

Duration: 0.000s To: 4.500s
Seismic Scale:
0.33in/s (0.083in/s/div) 8.38mm/s (2.096mm/s/div)
Time Line Intervals at: 0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located On Interior Wall
Wall is not connected to wall with door
Back Door Slam

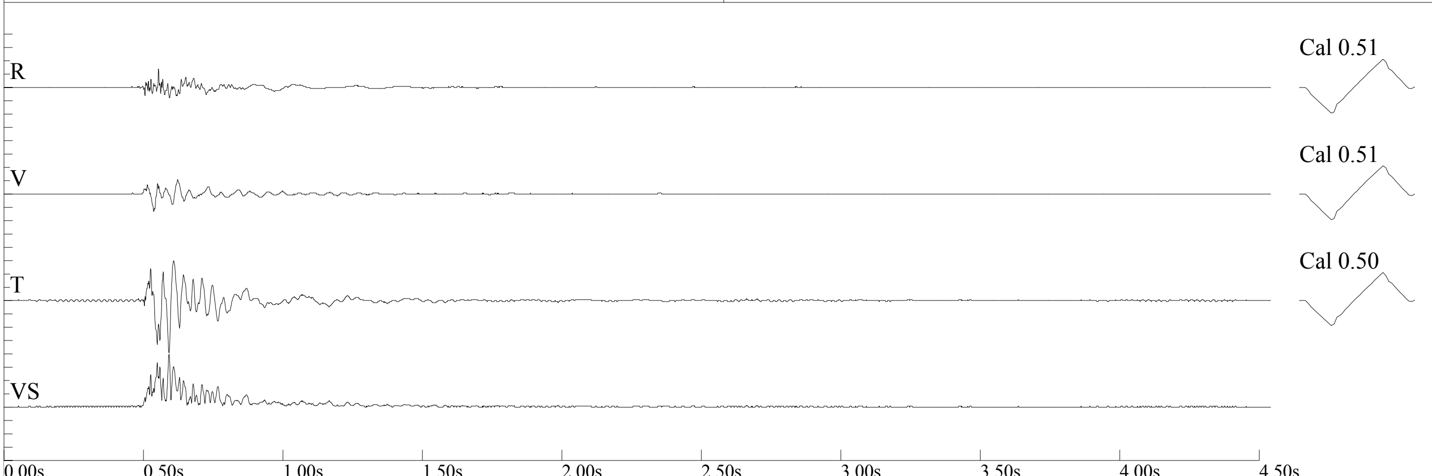
File Name: INTERIOR_WALL_BACK_SLAM019.DTB
Number: 019
Date: 3/19/2005
Time: 14:31
Serial Number: 1644
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

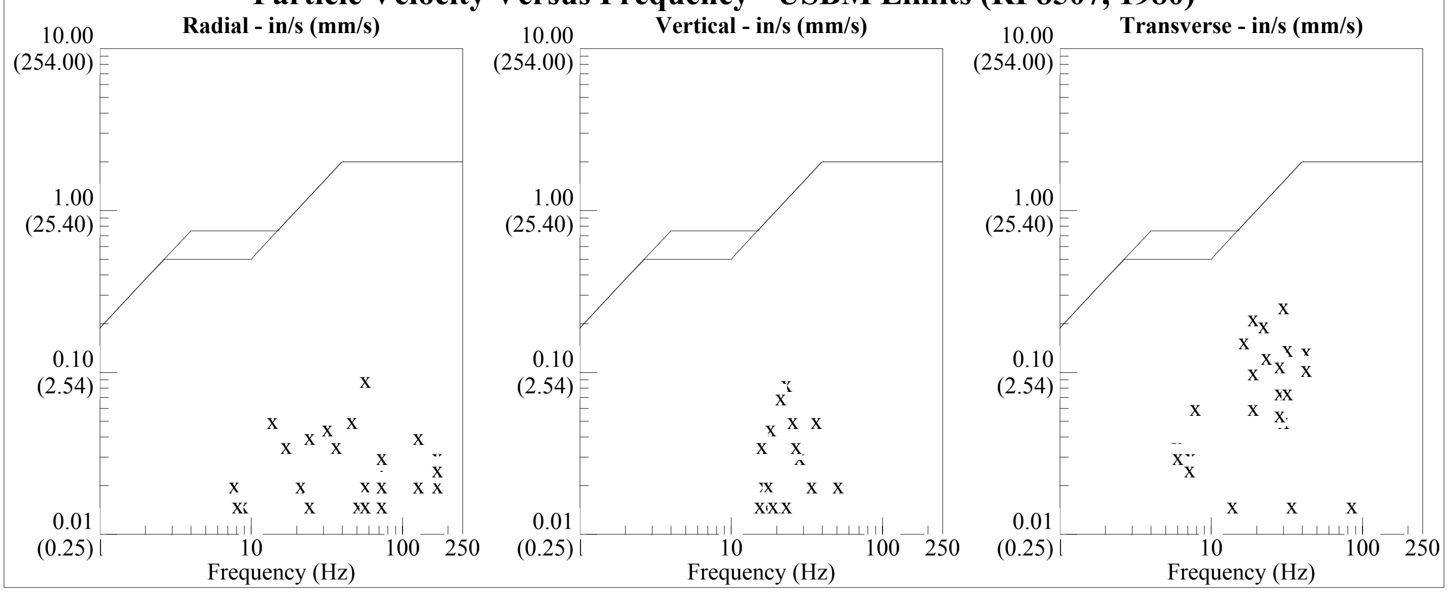
Radial: 0.09in/s 2.286mm/s @ 56.8Hz
Vertical: 0.085in/s 2.159mm/s @ 23.2Hz
***Transverse:* 0.255in/s 6.477mm/s @ 30.1Hz**
Vector Sum (VS): 0.26in/s 6.604mm/s
*Displacement:*0.002814in 0.071476mm
*Acceleration:*0.152381g's
*Calibration Date:*2/16/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
0.26in/s (0.065in/s/div) 6.60mm/s (1.651mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located On Interior Wall
Wall is not connected to wall with door
Back Door Shut with normal amount of force

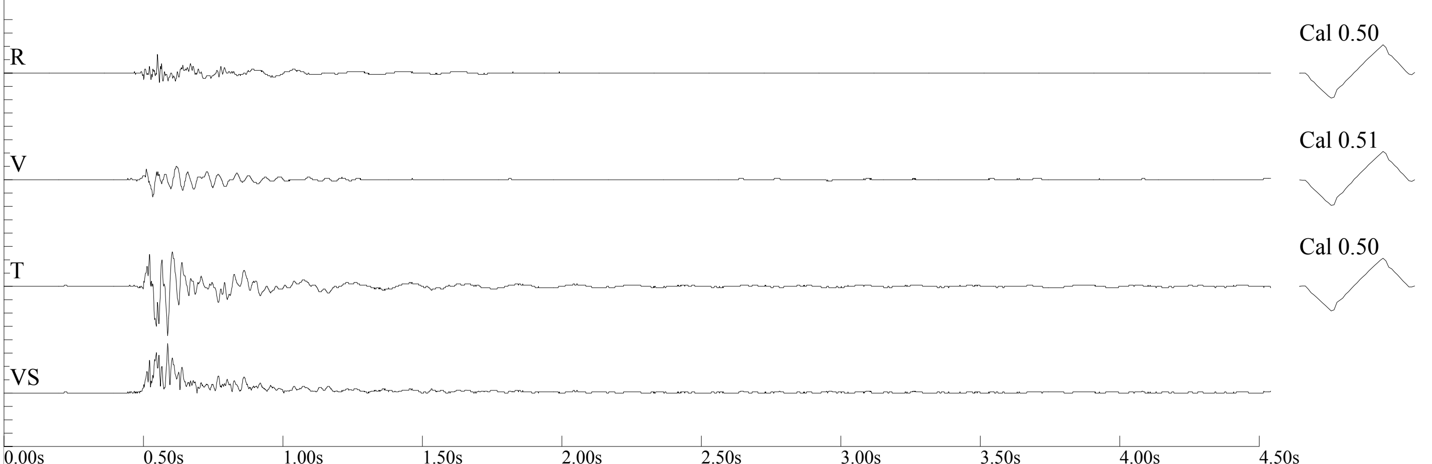
File Name: INTERIOR_WALL_BACK_SHUT014.DTB
Number: 014
Date: 3/19/2005
Time: 14:28
Serial Number: 1644
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

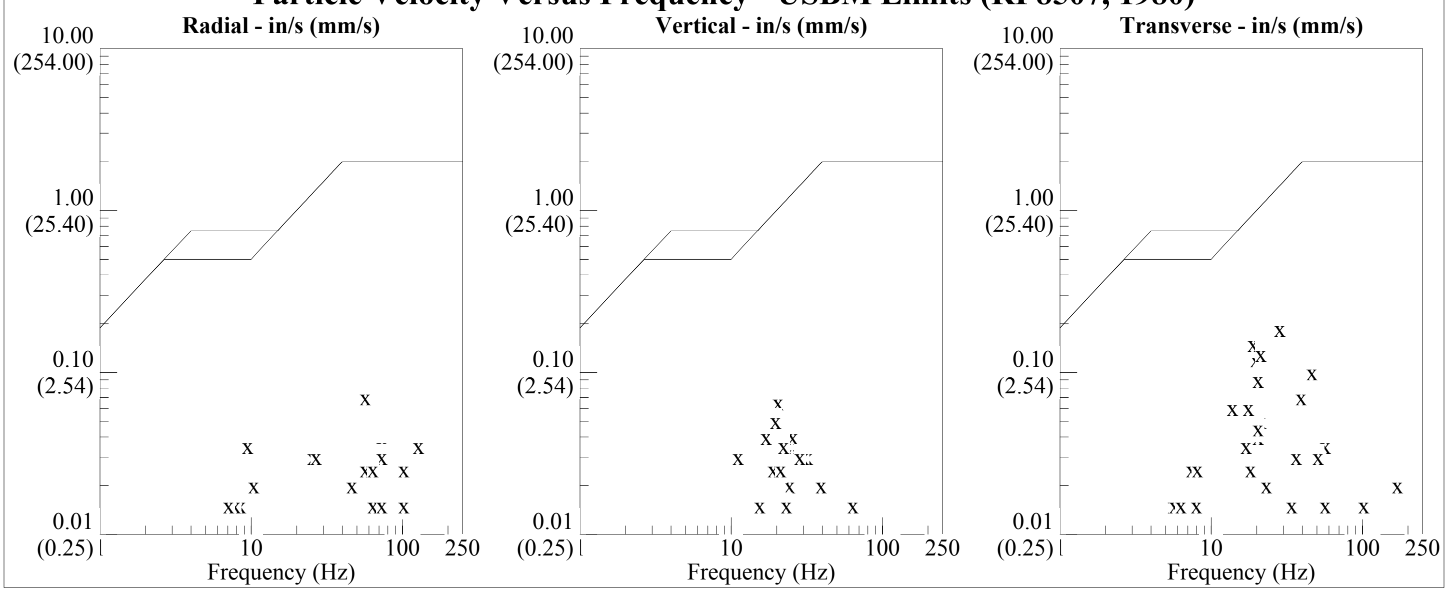
Radial: 0.07in/s 1.778mm/s @ 64.0Hz
Vertical: 0.065in/s 1.651mm/s @ 23.2Hz
***Transverse:* 0.185in/s 4.699mm/s @ 28.4Hz**
Vector Sum (VS): 0.185in/s 4.699mm/s
*Displacement:*0.002078in 0.052790mm
*Acceleration:*0.112629g's
*Calibration Date:*2/16/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
0.20in/s (0.050in/s/div) 5.08mm/s (1.270mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



TerraDinamica

Unit Located On Interior Wall
Wall is not connected to wall with door
Back Door Shut with normal amount of force

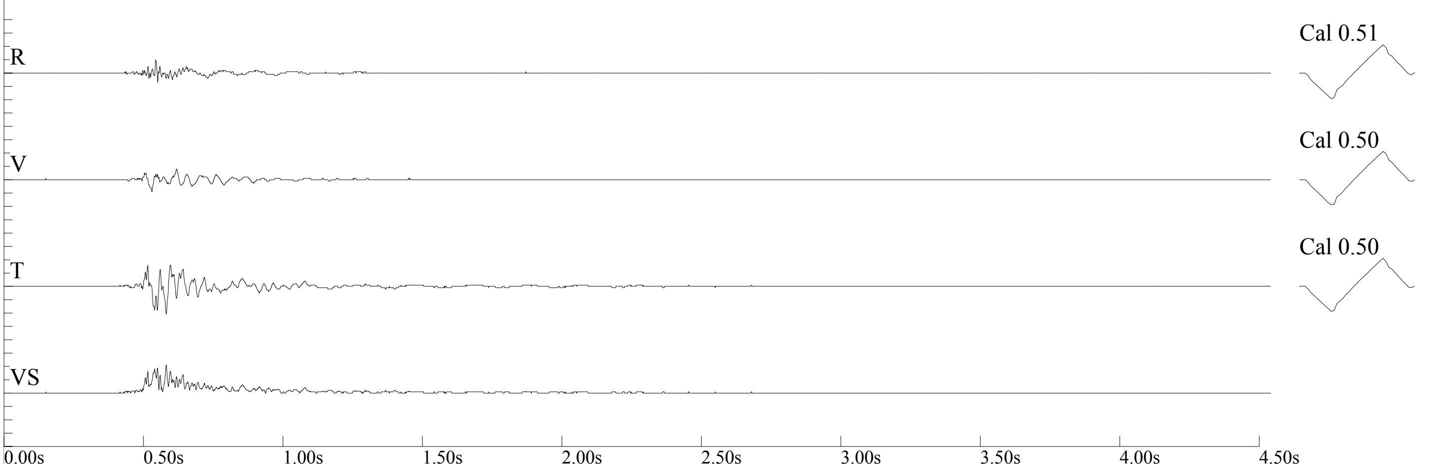
File Name: INTERIOR_WALL_BACK_SHUT015.DTB
Number: 015
Date: 3/19/2005
Time: 14:29
Serial Number: 1644
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

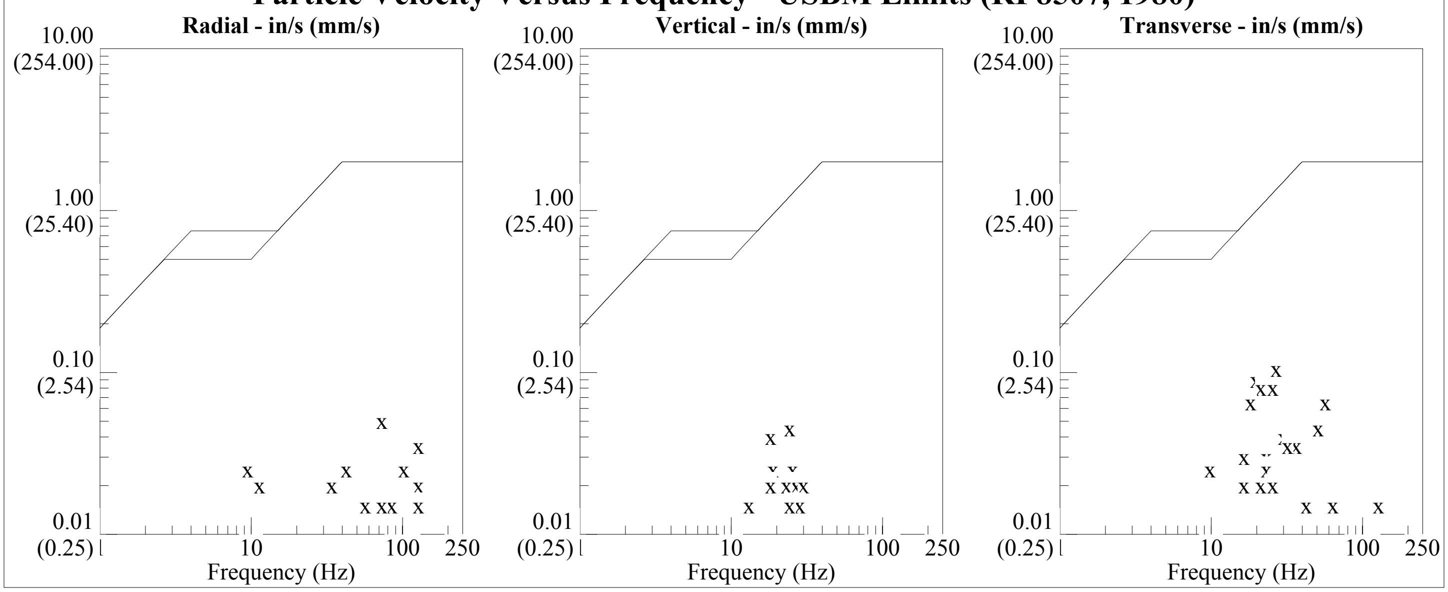
Radial: 0.05in/s 1.27mm/s @ 73.1Hz
Vertical: 0.045in/s 1.143mm/s @ 25.6Hz
Transverse: **0.105in/s 2.667mm/s @ 26.9Hz**
Vector Sum (VS): 0.105in/s 2.667mm/s
*Displacement:*0.001324in 0.033642mm
*Acceleration:*0.066253g's
*Calibration Date:*2/16/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
0.20in/s (0.050in/s/div) 5.08mm/s (1.270mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



TerraDinamica

Unit Located On Interior Wall
Wall is not connected to wall with door
Back Door Shut with normal amount of force

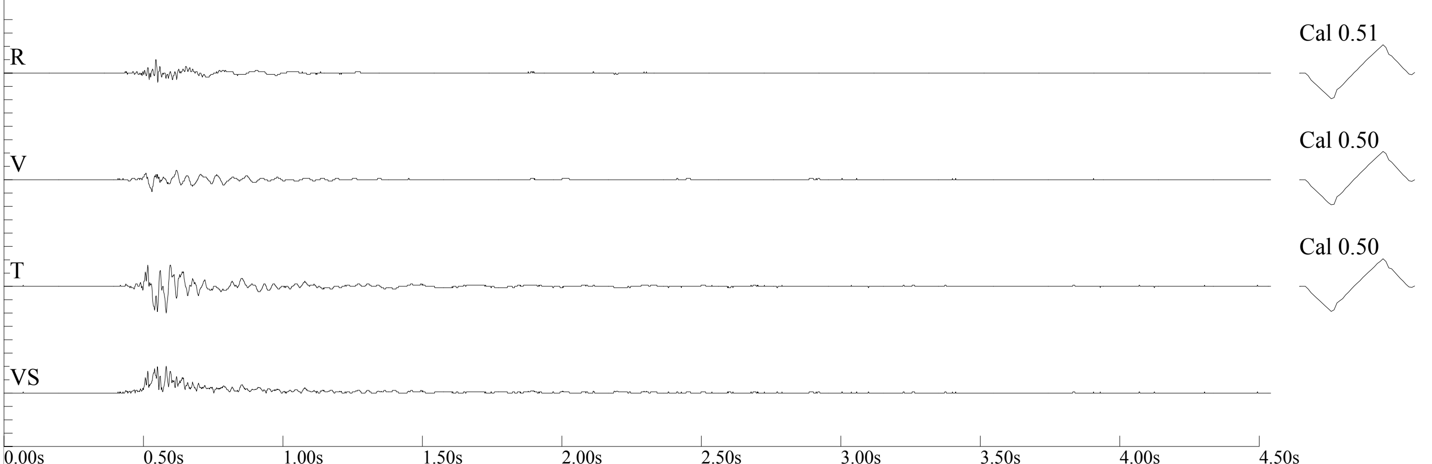
File Name: INTERIOR_WALL_BACK_SHUT016.DTB
Number: 016
Date: 3/19/2005
Time: 14:30
Serial Number: 1644
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

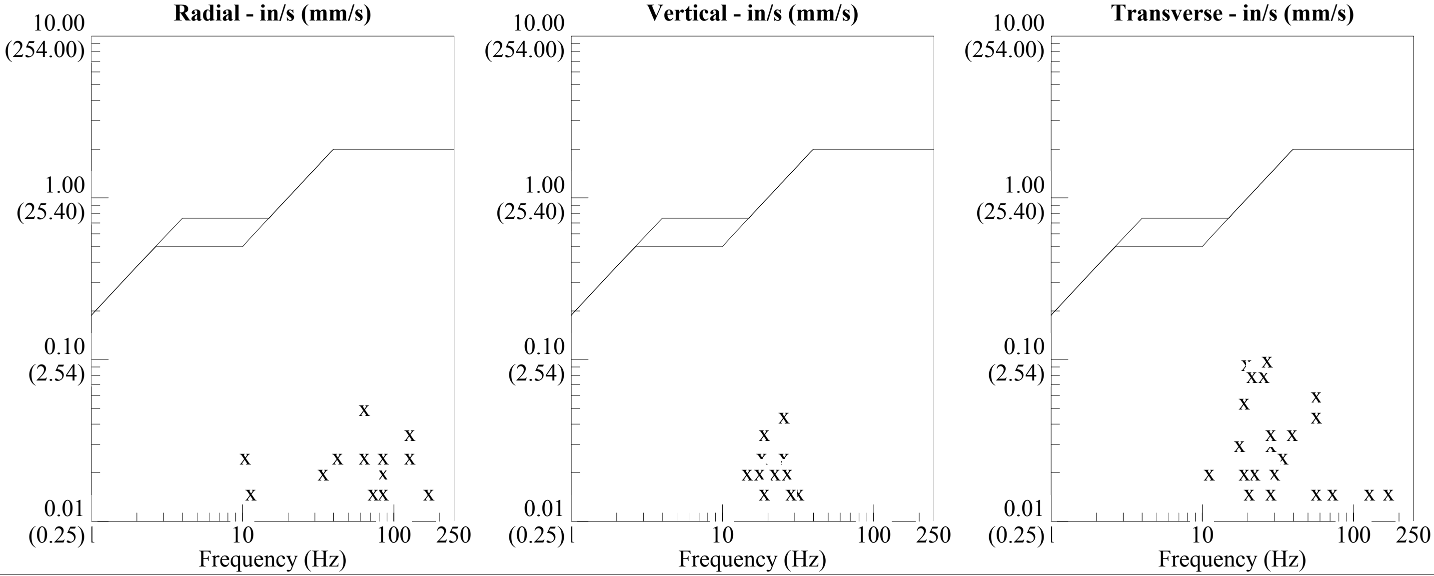
Radial: 0.05in/s 1.27mm/s @ 64.0Hz
Vertical: 0.045in/s 1.143mm/s @ 25.6Hz
***Transverse:* 0.10in/s 2.54mm/s @ 26.9Hz**
Vector Sum (VS): 0.10in/s 2.54mm/s
*Displacement:*0.001307in 0.033207mm
*Acceleration:*0.072878g's
*Calibration Date:*2/16/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
0.20in/s (0.050in/s/div) 5.08mm/s (1.270mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located On Interior Wall
Wall is not connected to wall with door
Back Door Shut with normal amount of force

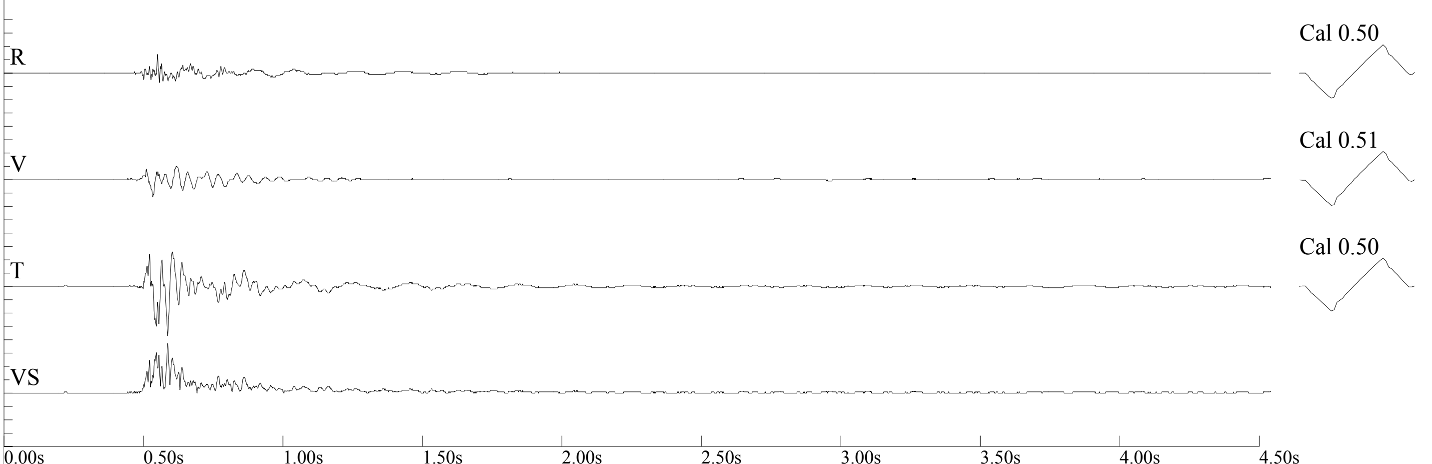
File Name: INTERIOR_WALL_BACK_SHUT014.DTB
Number: 014
Date: 3/19/2005
Time: 14:28
Serial Number: 1644
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

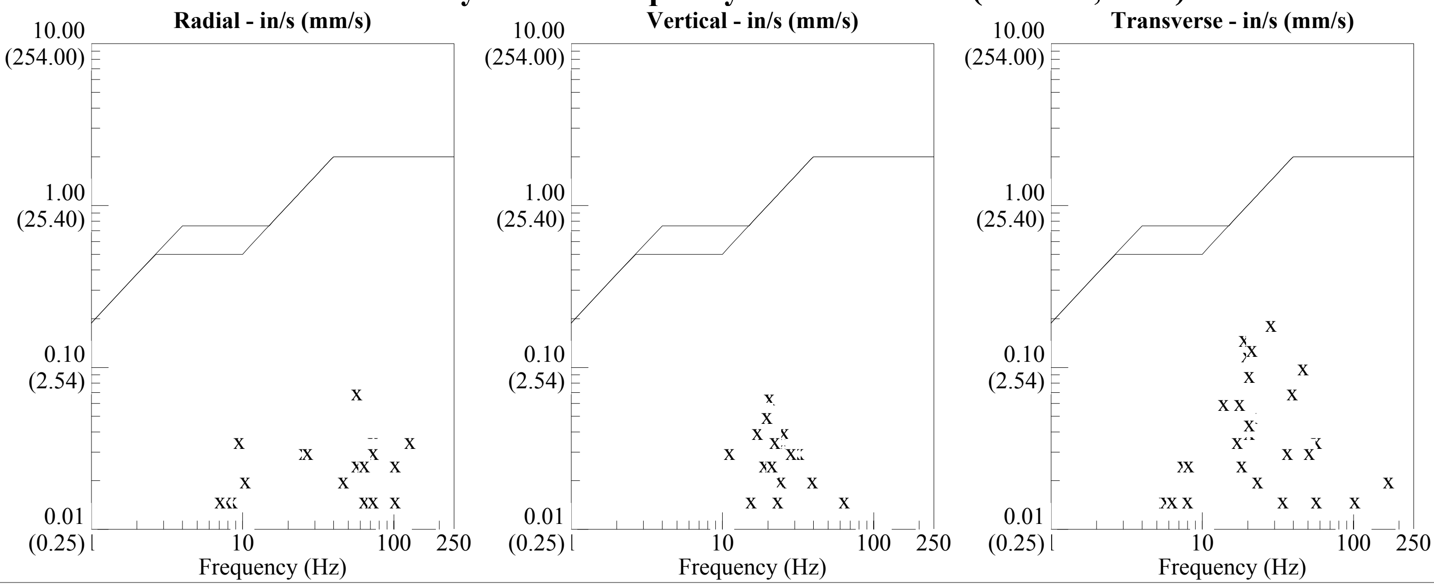
Radial: 0.07in/s 1.778mm/s @ 64.0Hz
Vertical: 0.065in/s 1.651mm/s @ 23.2Hz
***Transverse:* 0.185in/s 4.699mm/s @ 28.4Hz**
Vector Sum (VS): 0.185in/s 4.699mm/s
*Displacement:*0.002078in 0.052790mm
*Acceleration:*0.112629g's
*Calibration Date:*2/16/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
0.20in/s (0.050in/s/div) 5.08mm/s (1.270mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located On Interior Wall
Wall is not connected to wall with door
Back Door Shut with normal amount of force

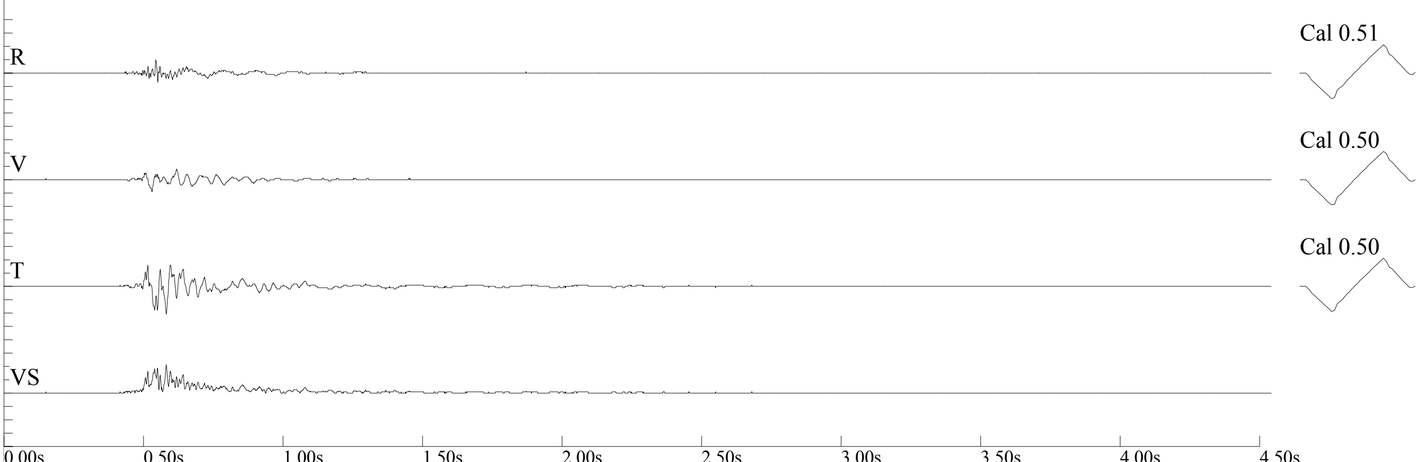
File Name: INTERIOR_WALL_BACK_SHUT015.DTB
Number: 015
Date: 3/19/2005
Time: 14:29
Serial Number: 1644
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

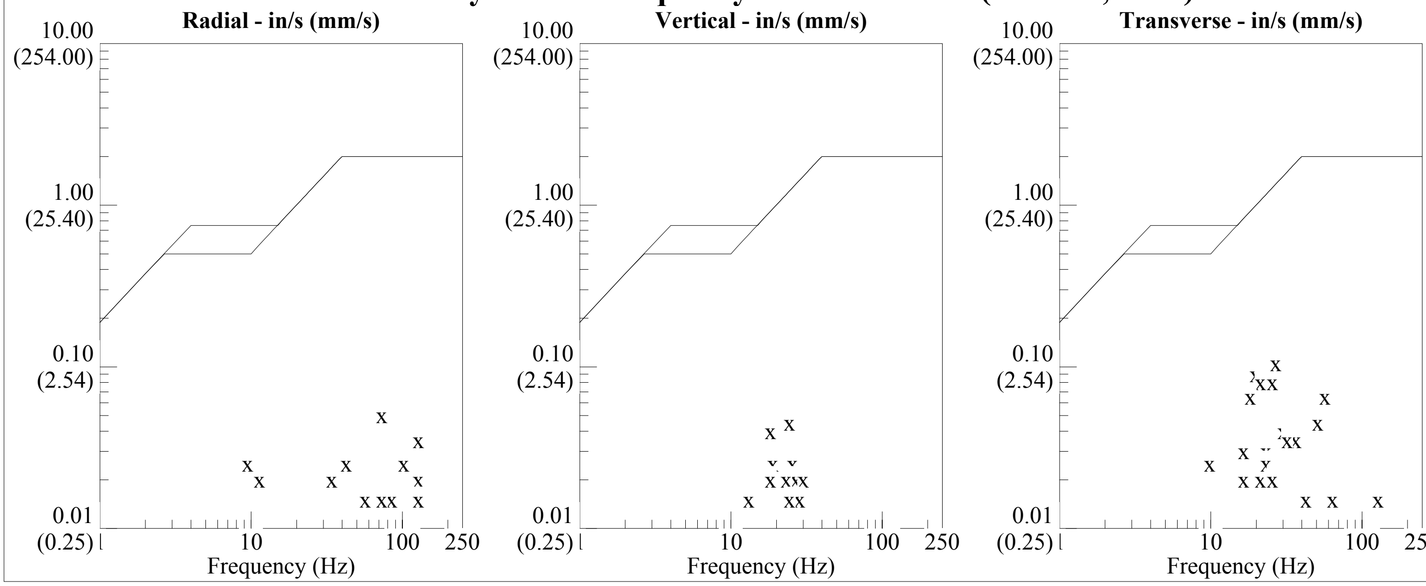
Radial: 0.05in/s 1.27mm/s @ 73.1Hz
Vertical: 0.045in/s 1.143mm/s @ 25.6Hz
***Transverse:* 0.105in/s 2.667mm/s @ 26.9Hz**
Vector Sum (VS): 0.105in/s 2.667mm/s
*Displacement:*0.001324in 0.033642mm
*Acceleration:*0.066253g's
*Calibration Date:*2/16/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
0.20in/s (0.050in/s/div) 5.08mm/s (1.270mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located On Interior Wall
Wall is not connected to wall with door
Back Door Shut with normal amount of force

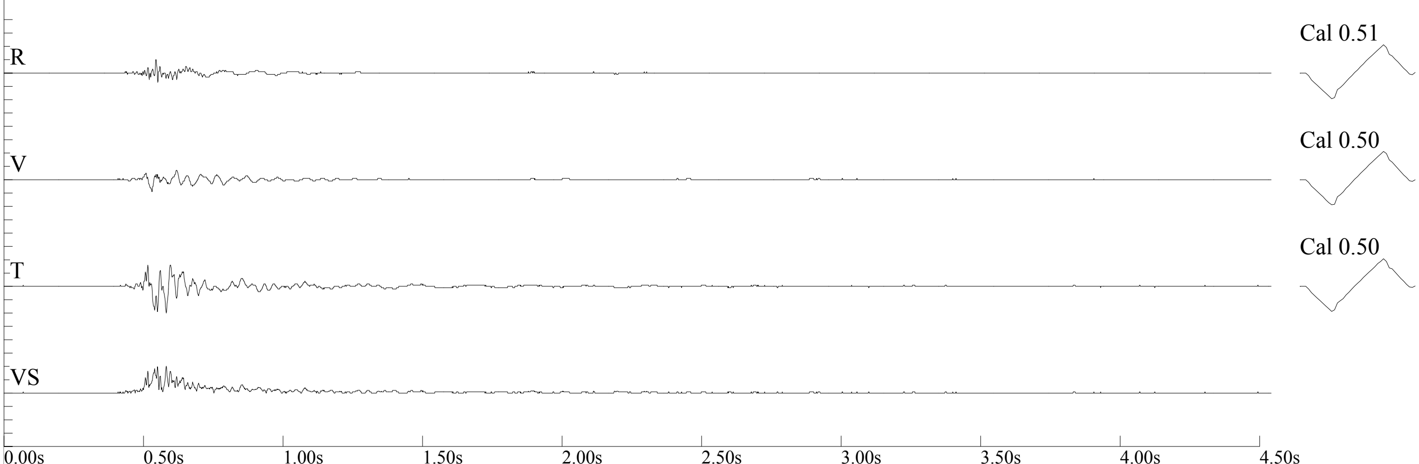
File Name: INTERIOR_WALL_BACK_SHUT016.DTB
Number: 016
Date: 3/19/2005
Time: 14:30
Serial Number: 1644
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

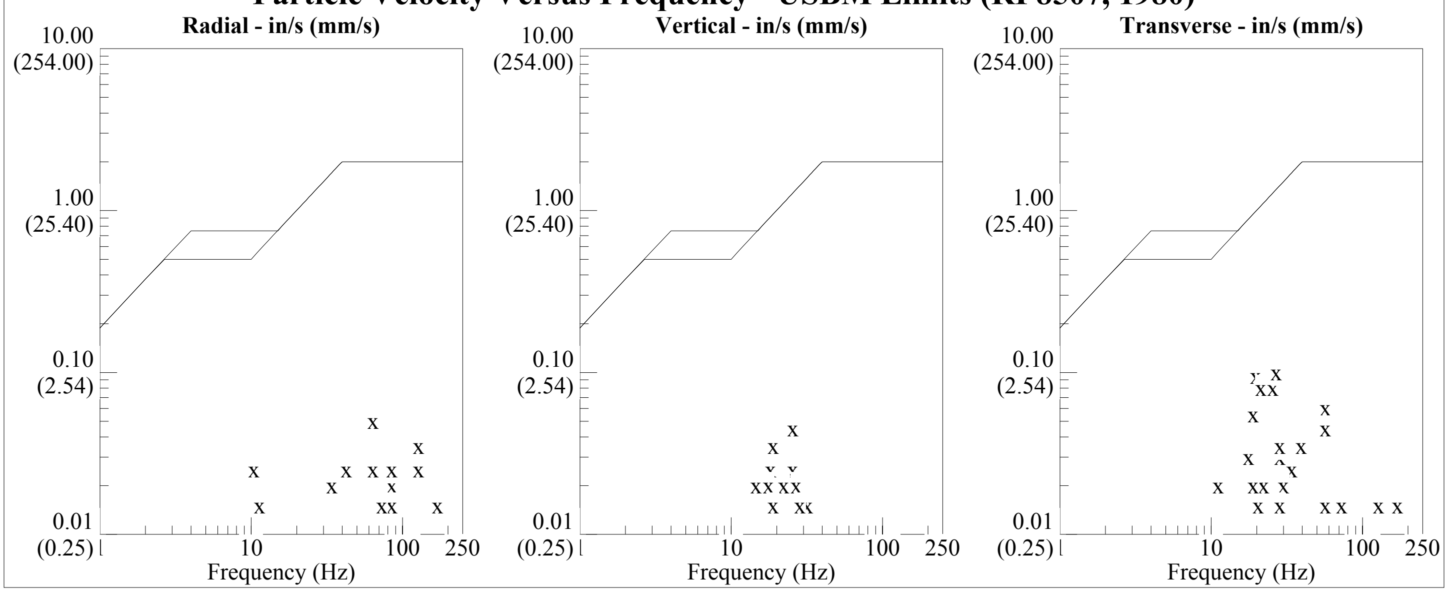
Radial: 0.05in/s 1.27mm/s @ 64.0Hz
Vertical: 0.045in/s 1.143mm/s @ 25.6Hz
***Transverse:* 0.10in/s 2.54mm/s @ 26.9Hz**
Vector Sum (VS): 0.10in/s 2.54mm/s
*Displacement:*0.001307in 0.033207mm
*Acceleration:*0.072878g's
*Calibration Date:*2/16/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
0.20in/s (0.050in/s/div) 5.08mm/s (1.270mm/s/div)
*Time Line Intervals at:*0.50 s

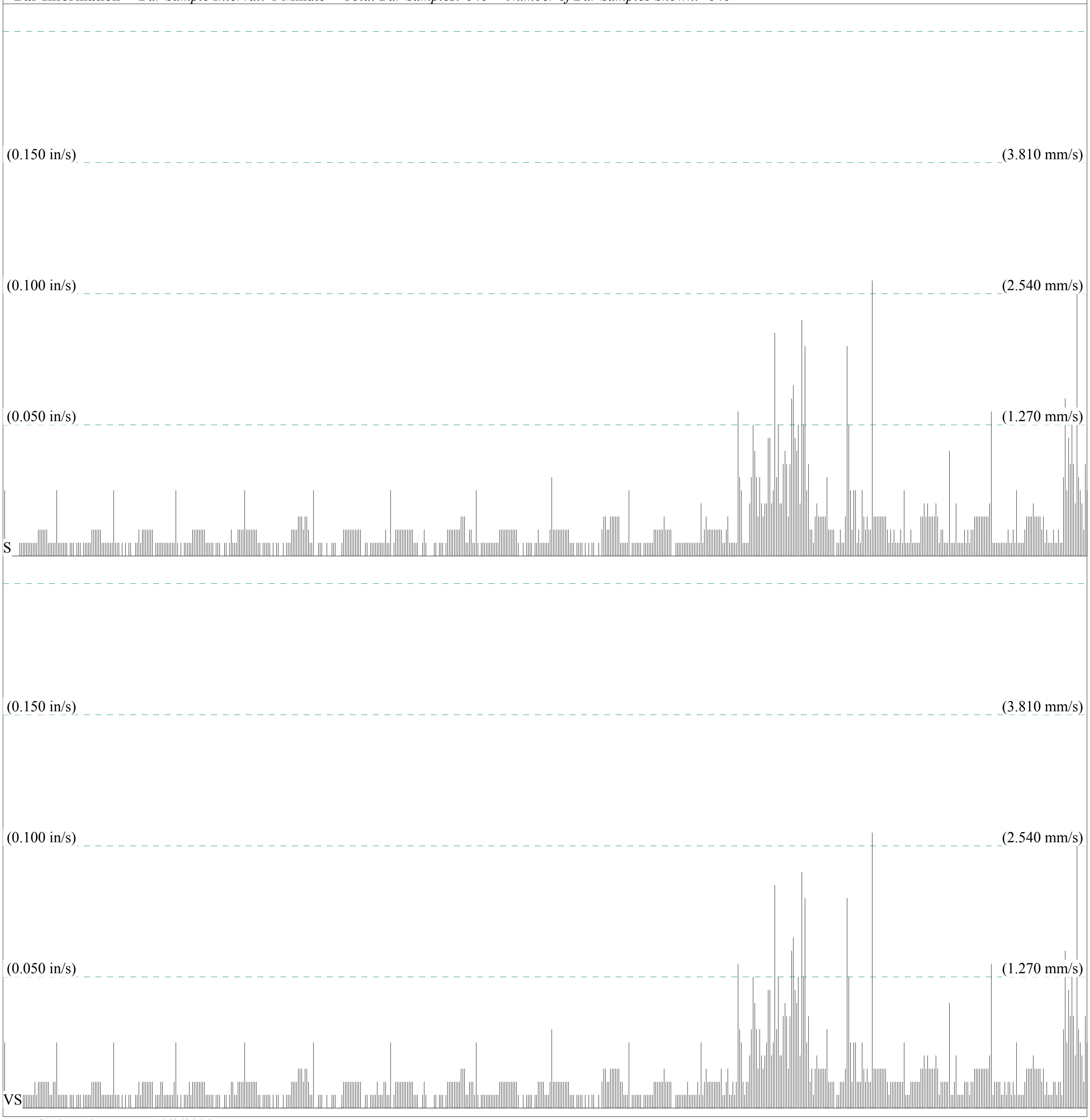


Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



File: INTERIOR WALL002.BAR   Job Number: 002   Date Range: 3/22/2005 - 3/22/2005   Time Range: 00:00 - 10:46   Serial Number: 1644

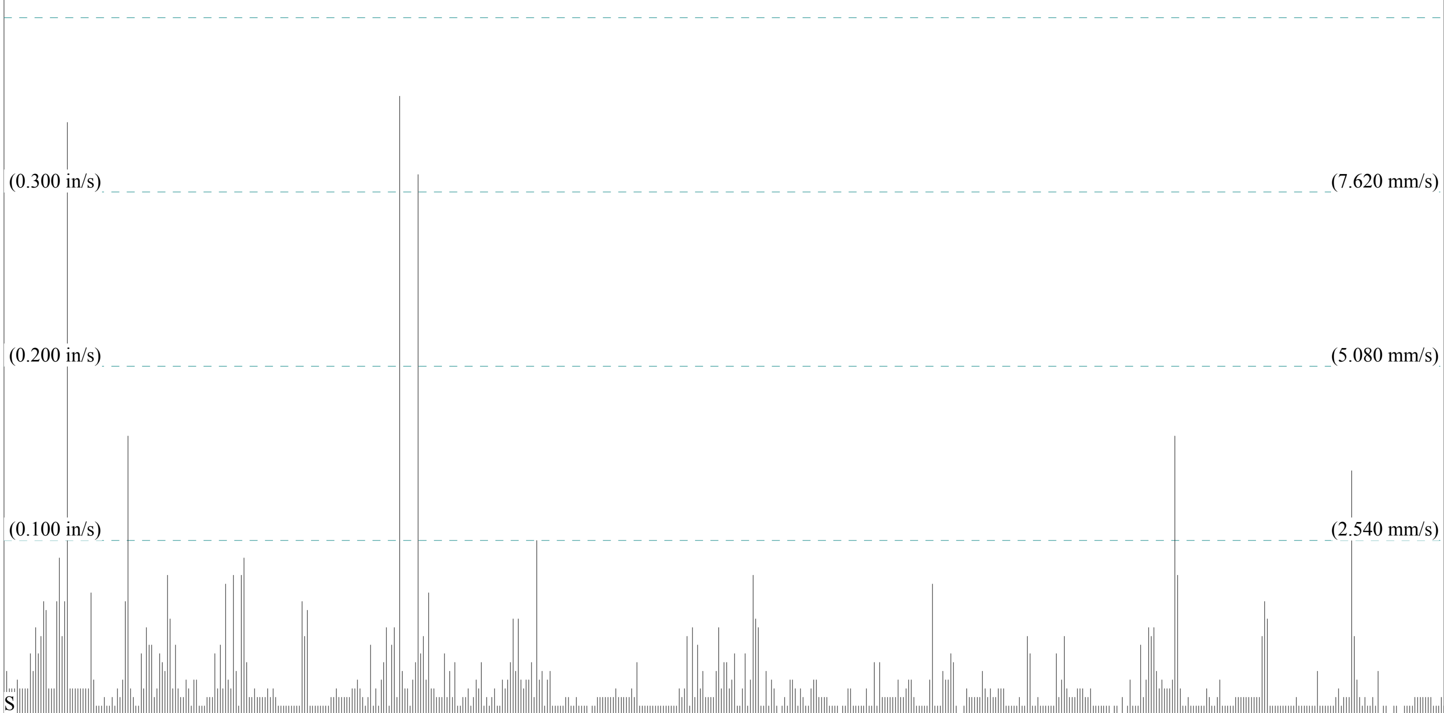
Peak Amplitudes *Seismic (S):* 0.1050in/s 2.667mm/s *Vector Sum (VS):* 0.1050in/s 2.667mm/s
Graph Information *Duration:* 0.0 hr to 10.8 hr *Seismic Scale:* 0.20 in/s 5.08 mm/s
Bar Information *Bar Sample Interval:* 1 Minute *Total Bar Samples:* 646 *Number of Bar Samples Shown:* 646

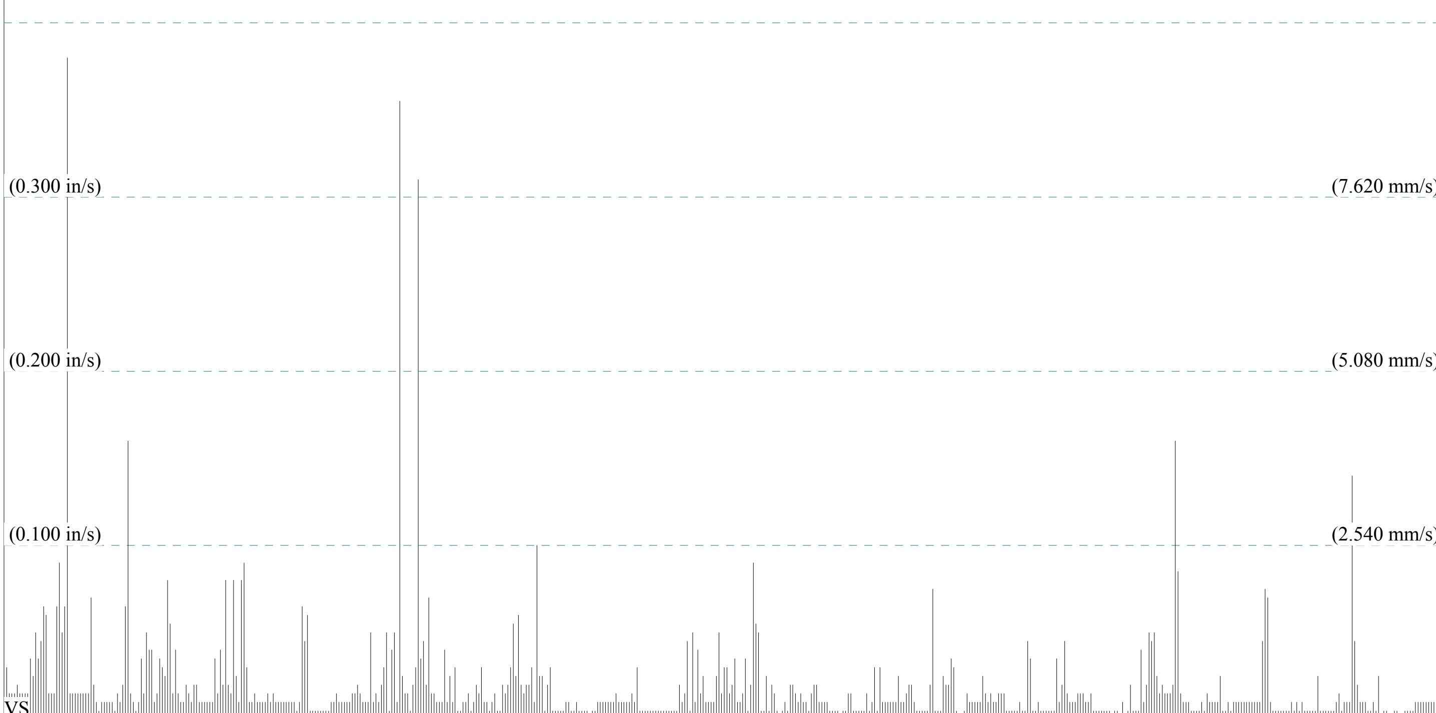


Last Calibration Date: 10/3/2003

File: INTERIOR WALL001.BAR Job Number: 001 Date Range: 3/21/2005 - 3/22/2005 Time Range: 14:55 - 00:00 Serial Number: 1644

Peak Amplitudes *Seismic (S):* 0.3550in/s 9.017mm/s *Vector Sum (VS):* 0.3800in/s 9.652mm/s
Graph Information *Duration:* 0.0 hr to 9.1 hr *Seismic Scale:* 0.40 in/s 10.16 mm/s
Bar Information *Bar Sample Interval:* 1 Minute *Total Bar Samples:* 546 *Number of Bar Samples Shown:* 546

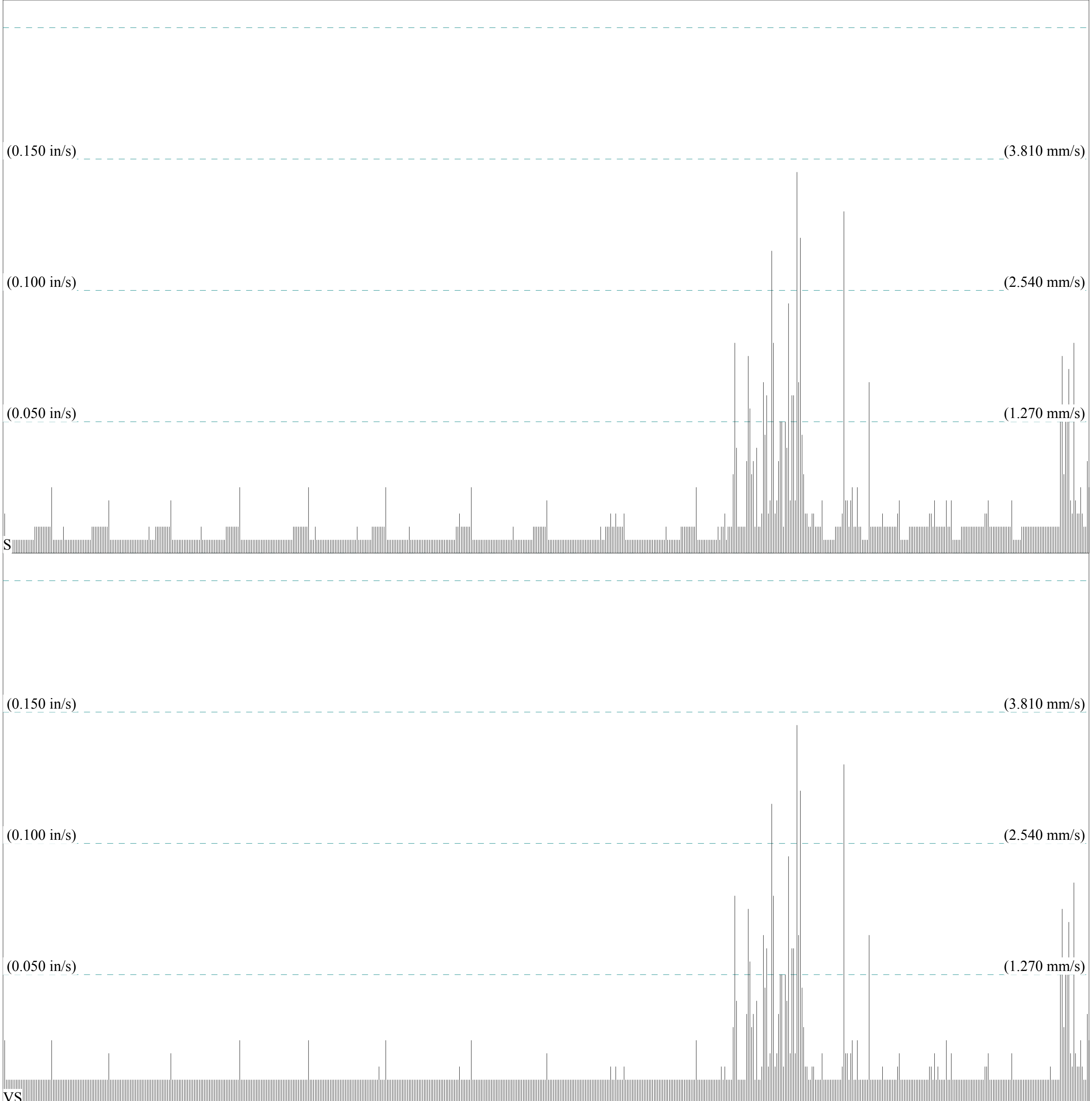




Last Calibration Date: 10/3/2003

File: KIRCHEN FLOOR004.BAR   Job Number: 004   Date Range: 3/22/2005 - 3/22/2005   Time Range: 00:00 - 10:47   Serial Number: 2497

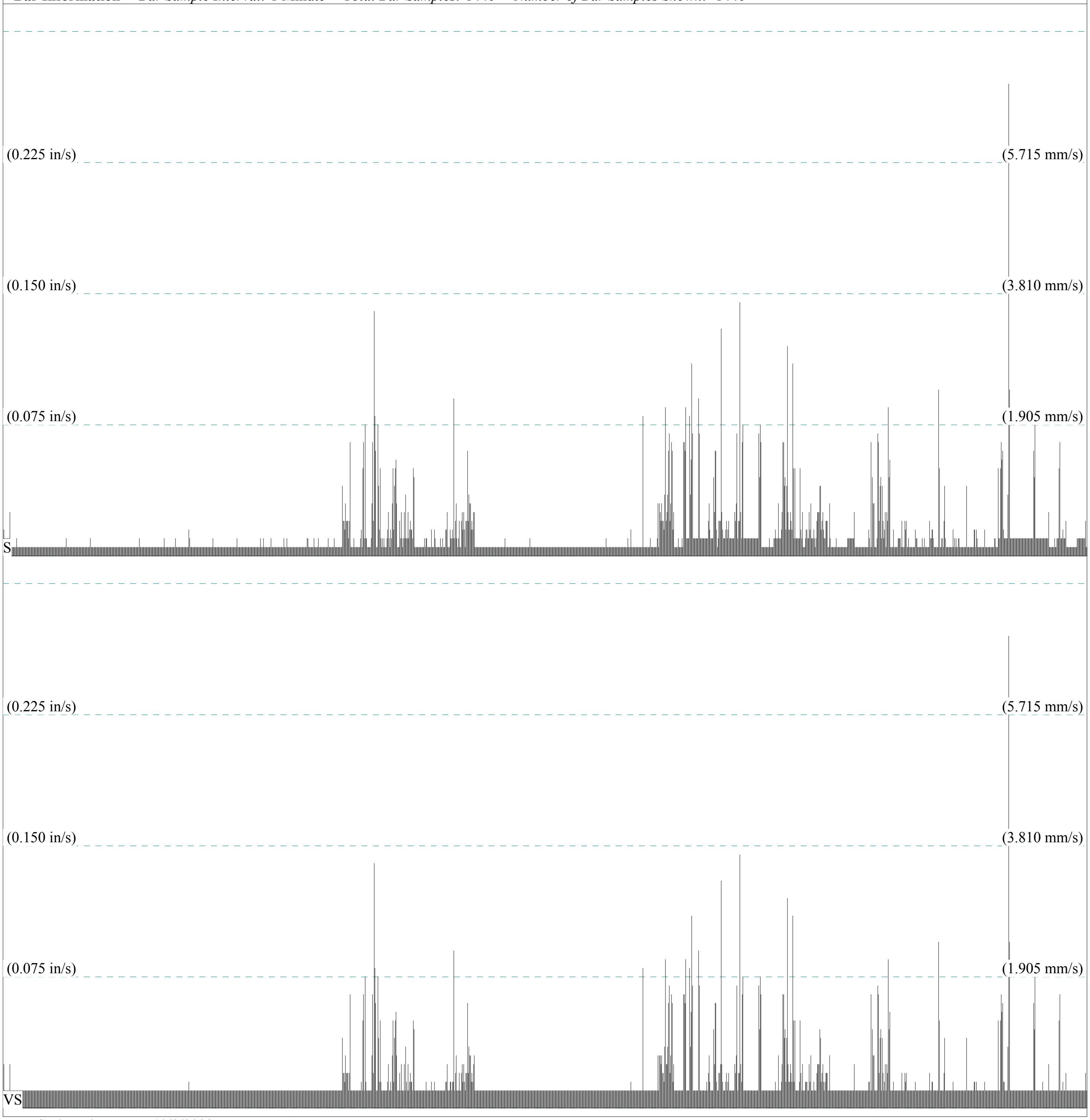
Peak Amplitudes *Seismic (S):* 0.1450in/s 3.683mm/s *Vector Sum (VS):* 0.1450in/s 3.683mm/s
Graph Information *Duration:* 0.0 hr to 10.8 hr *Seismic Scale:* 0.20 in/s 5.08 mm/s
Bar Information *Bar Sample Interval:* 1 Minute *Total Bar Samples:* 647 *Number of Bar Samples Shown:* 647



Last Calibration Date: 10/3/2003

File: KIRCHEN FLOOR003.BAR   Job Number: 003   Date Range: 3/21/2005 - 3/22/2005   Time Range: 00:00 - 00:00   Serial Number: 2497

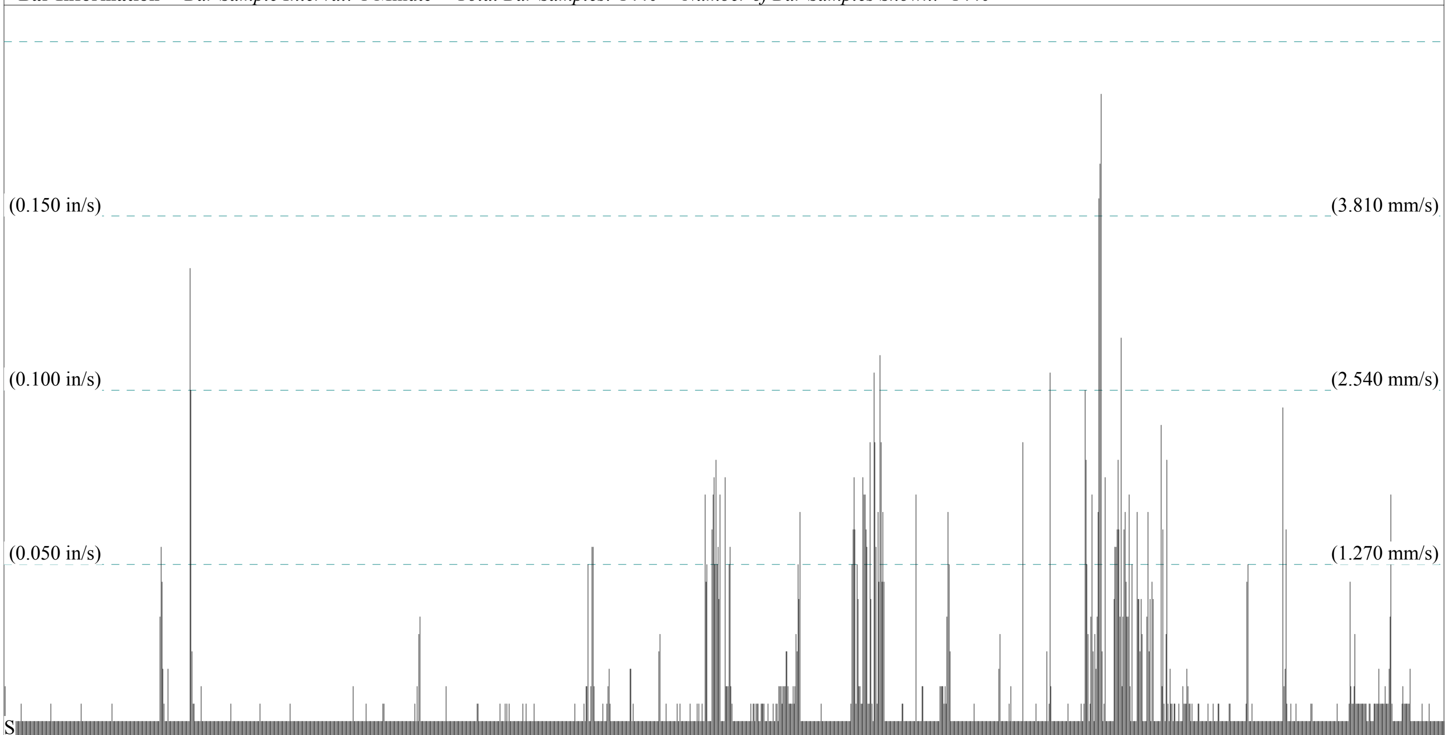
Peak Amplitudes *Seismic (S):* 0.2700in/s 6.858mm/s *Vector Sum (VS):* 0.2700in/s 6.858mm/s
Graph Information *Duration:* 0.0 day to 1.0 day *Seismic Scale:* 0.30 in/s 7.62 mm/s
Bar Information *Bar Sample Interval:* 1 Minute *Total Bar Samples:* 1440 *Number of Bar Samples Shown:* 1440

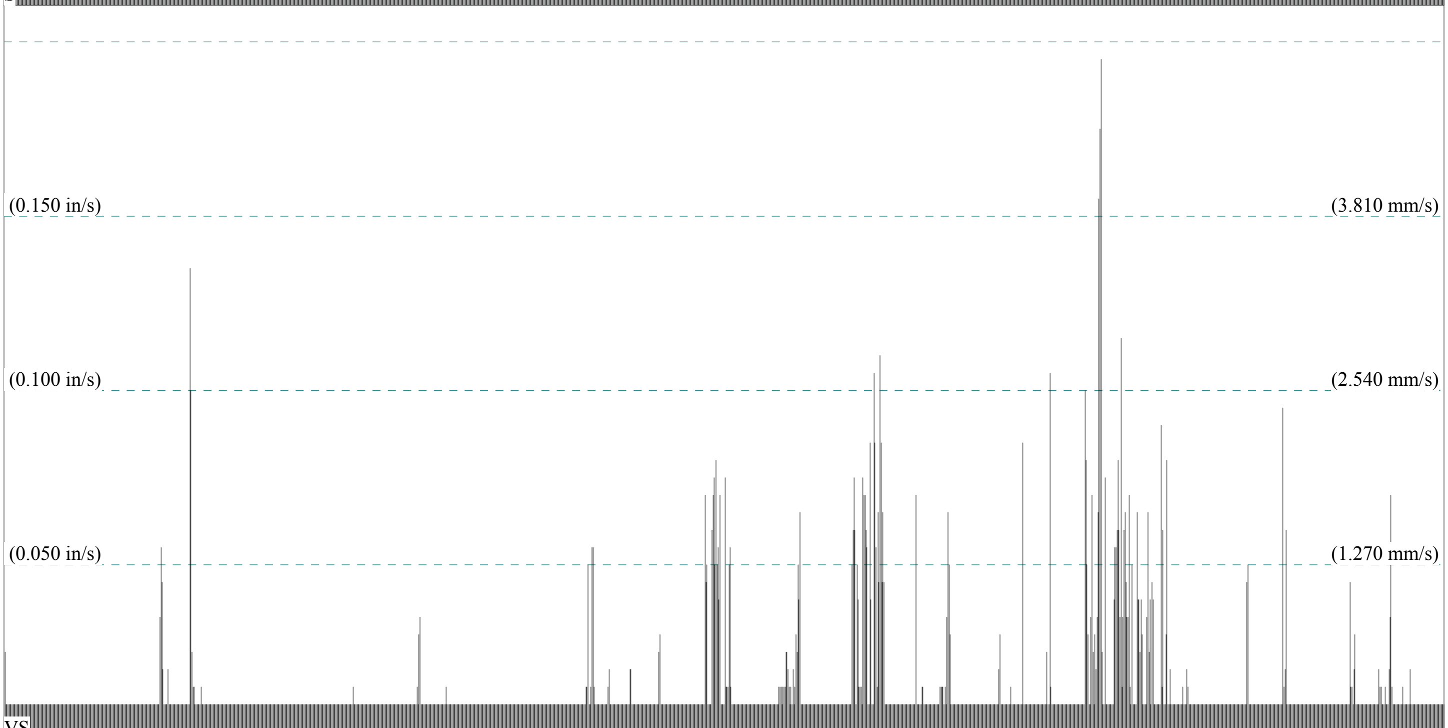


Last Calibration Date: 10/3/2003

File: KIRCHEN FLOOR002.BAR Job Number: 002 Date Range: 3/20/2005 - 3/21/2005 Time Range: 00:00 - 00:00 Serial Number: 2497

Peak Amplitudes *Seismic (S):* 0.1850in/s 4.699mm/s *Vector Sum (VS):* 0.1950in/s 4.953mm/s
Graph Information *Duration:* 0.0 day to 1.0 day *Seismic Scale:* 0.20 in/s 5.08 mm/s
Bar Information *Bar Sample Interval:* 1 Minute *Total Bar Samples:* 1440 *Number of Bar Samples Shown:* 1440

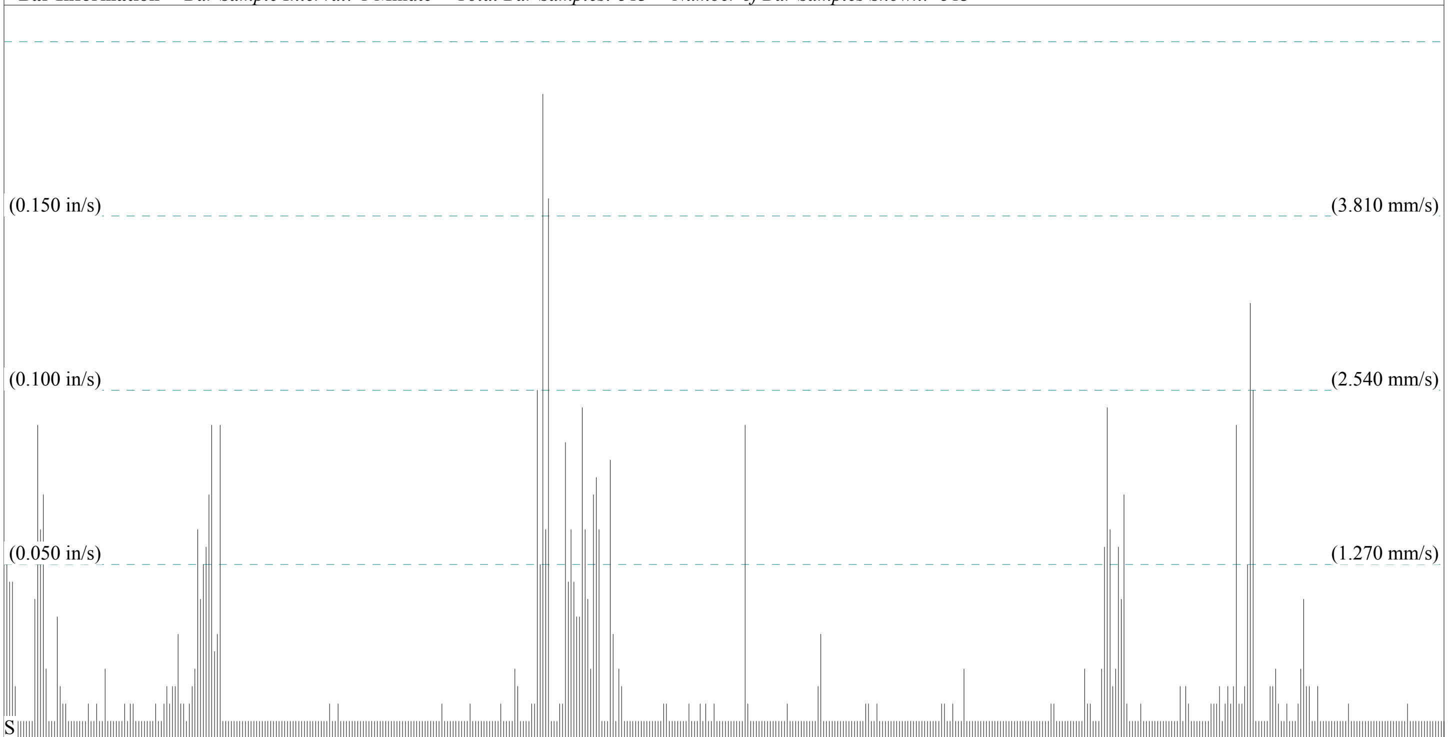


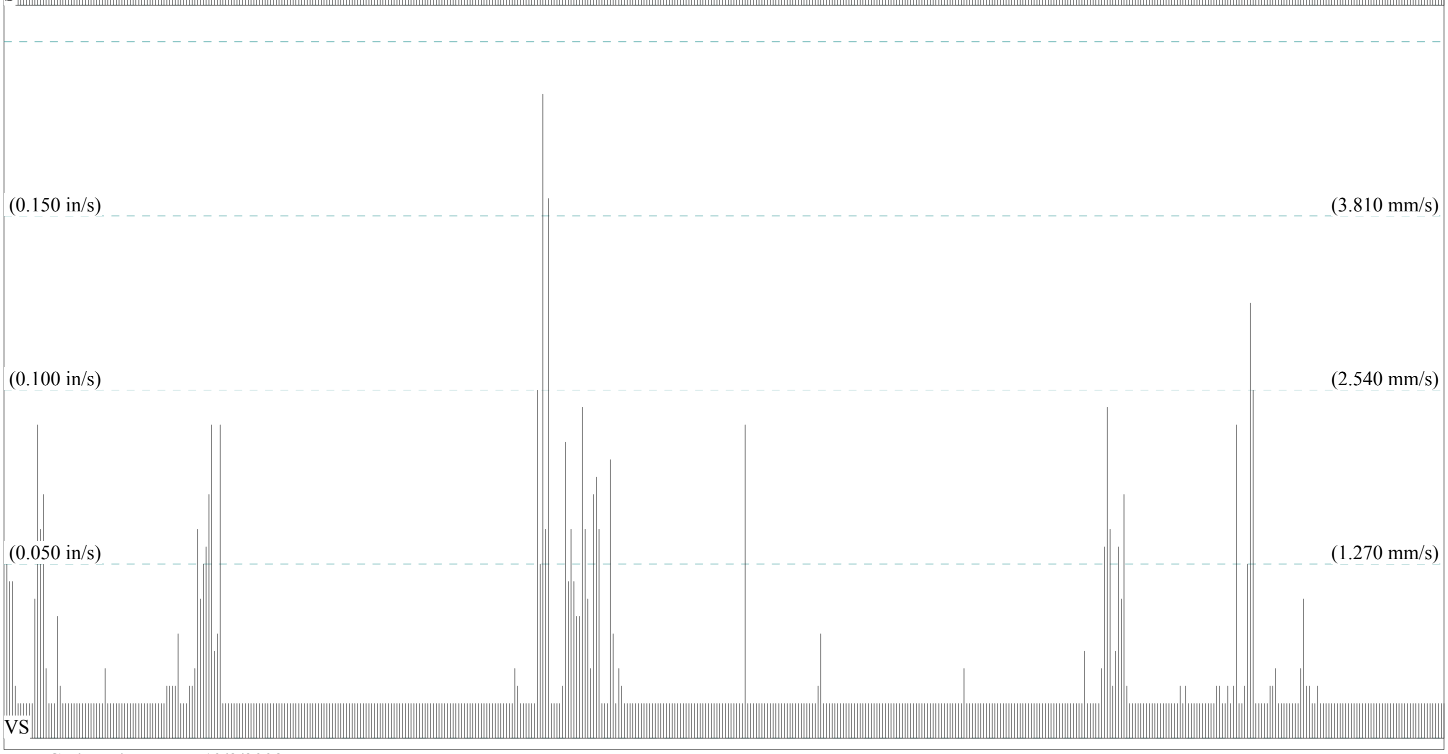


Last Calibration Date: 10/3/2003

File: KIRCHEN FLOOR001.BAR Job Number: 001 Date Range: 3/19/2005 - 3/20/2005 Time Range: 15:27 - 00:00 Serial Number: 2497

Peak Amplitudes *Seismic (S):* 0.1850in/s 4.699mm/s *Vector Sum (VS):* 0.1850in/s 4.699mm/s
Graph Information *Duration:* 0.0 hr to 8.6 hr *Seismic Scale:* 0.20 in/s 5.08 mm/s
Bar Information *Bar Sample Interval:* 1 Minute *Total Bar Samples:* 513 *Number of Bar Samples Shown:* 513

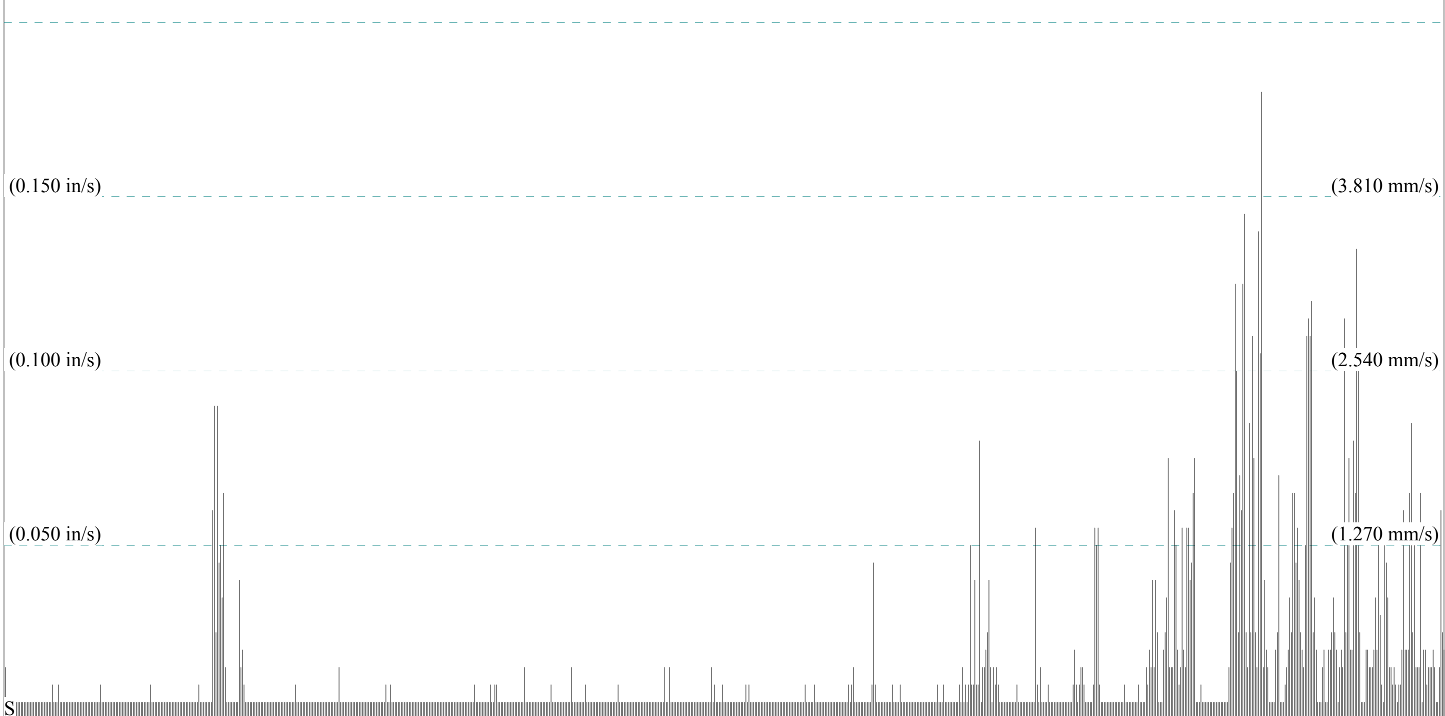


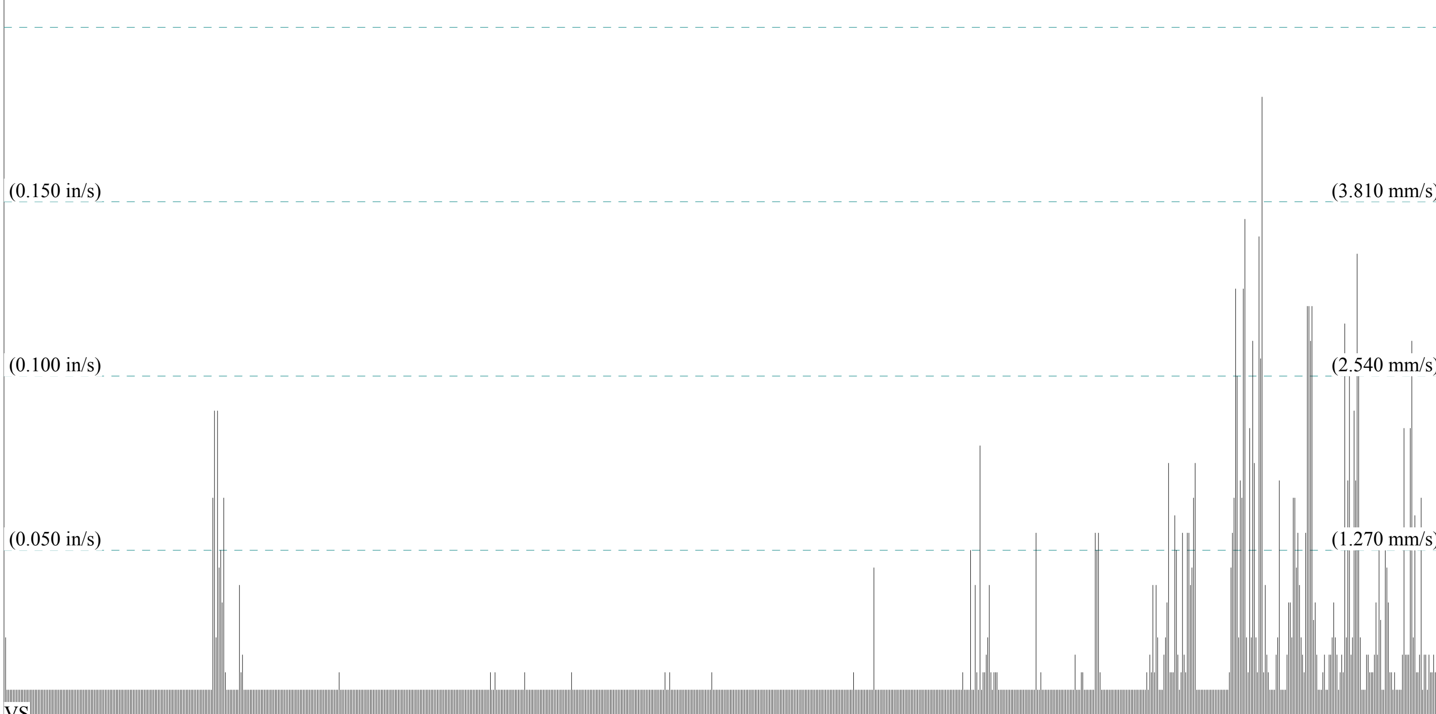


Last Calibration Date: 10/3/2003

File: KITCHEN_FLOOR004.BAR Job Number: 004 Date Range: 3/19/2005 - 3/19/2005 Time Range: 00:00 - 15:23 Serial Number: 2497

Peak Amplitudes *Seismic (S):* 0.1800in/s 4.572mm/s *Vector Sum (VS):* 0.1800in/s 4.572mm/s
Graph Information *Duration:* 0.0 hr to 15.4 hr *Seismic Scale:* 0.20 in/s 5.08 mm/s
Bar Information *Bar Sample Interval:* 1 Minute *Total Bar Samples:* 924 *Number of Bar Samples Shown:* 924

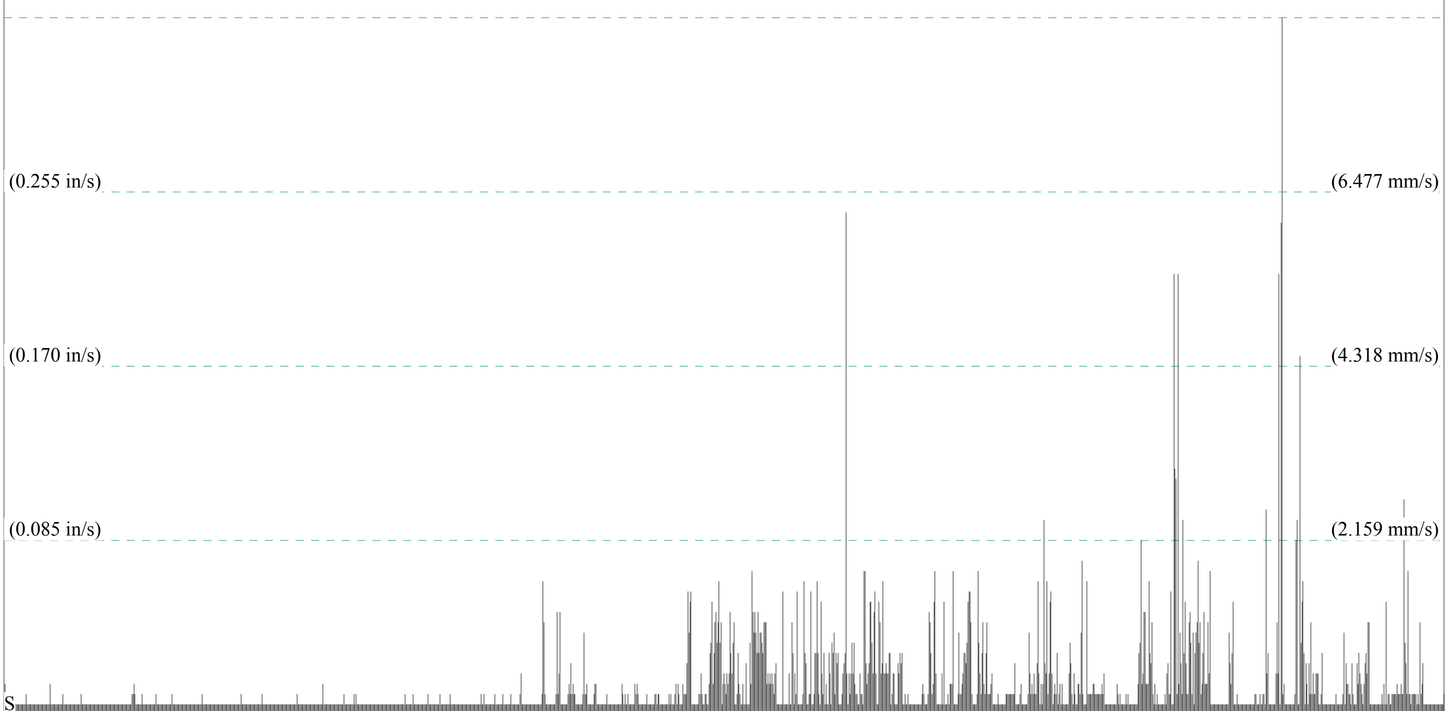


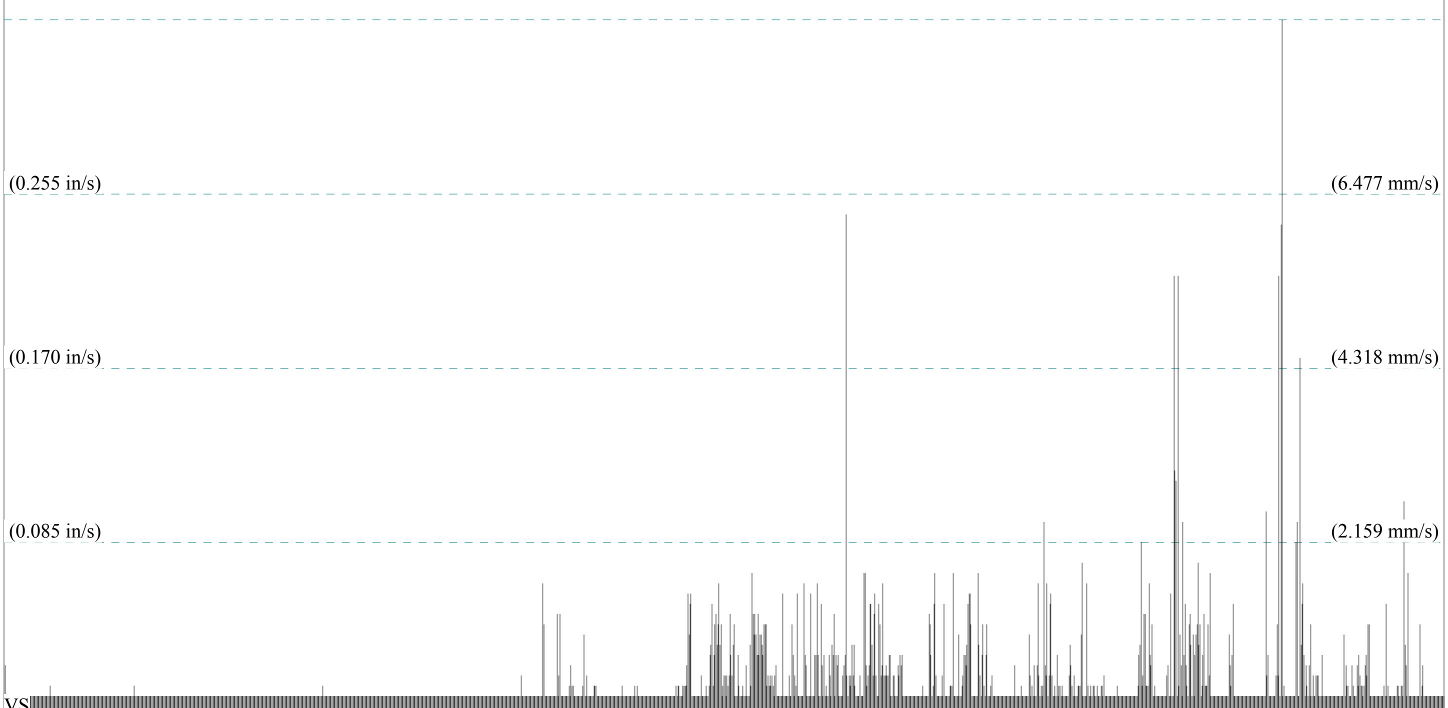


Last Calibration Date: 10/3/2003

File: KITCHEN_FLOOR003.BAR Job Number: 003 Date Range: 3/18/2005 - 3/19/2005 Time Range: 00:00 - 00:00 Serial Number: 2497

Peak Amplitudes *Seismic (S):* 0.3400in/s 8.636mm/s *Vector Sum (VS):* 0.3400in/s 8.636mm/s
Graph Information *Duration:* 0.0 day to 1.0 day *Seismic Scale:* 0.34 in/s 8.64 mm/s
Bar Information *Bar Sample Interval:* 1 Minute *Total Bar Samples:* 1440 *Number of Bar Samples Shown:* 1440

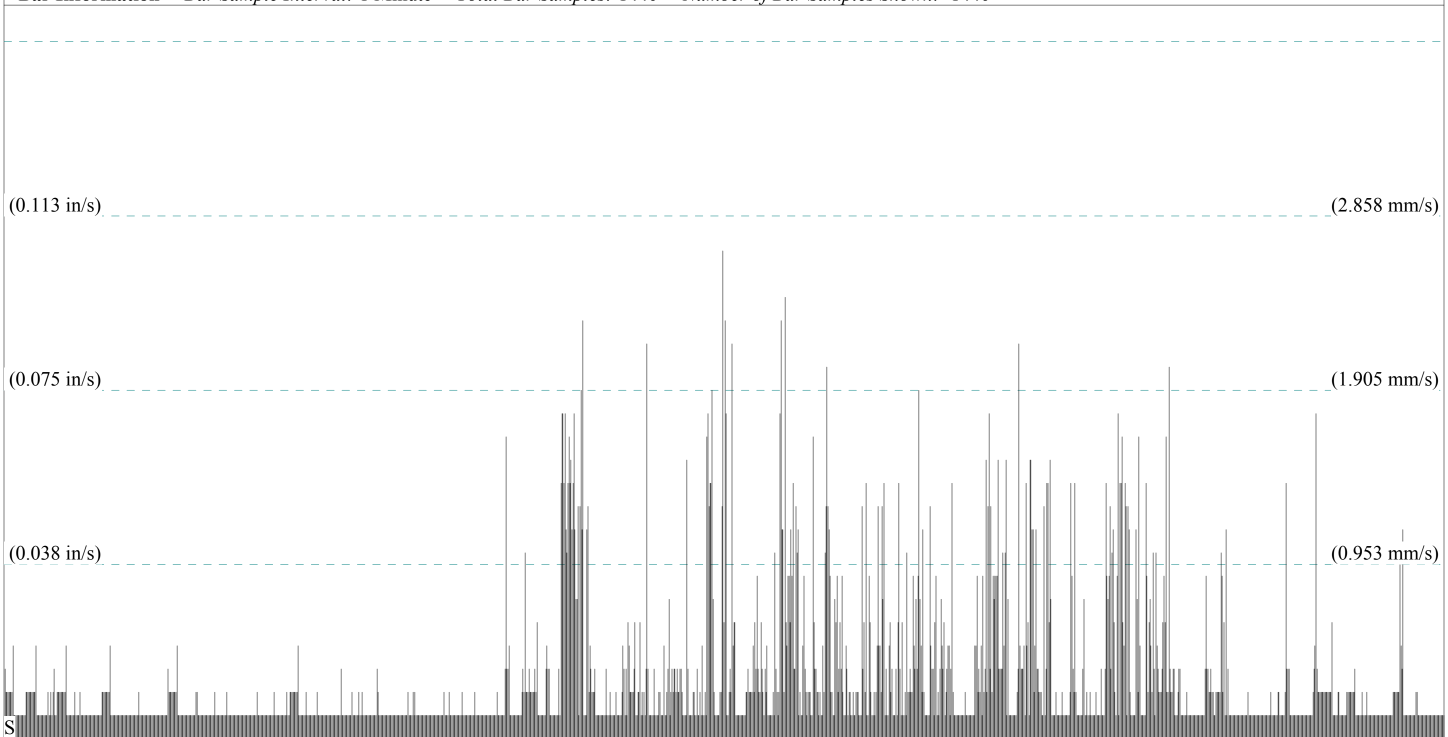


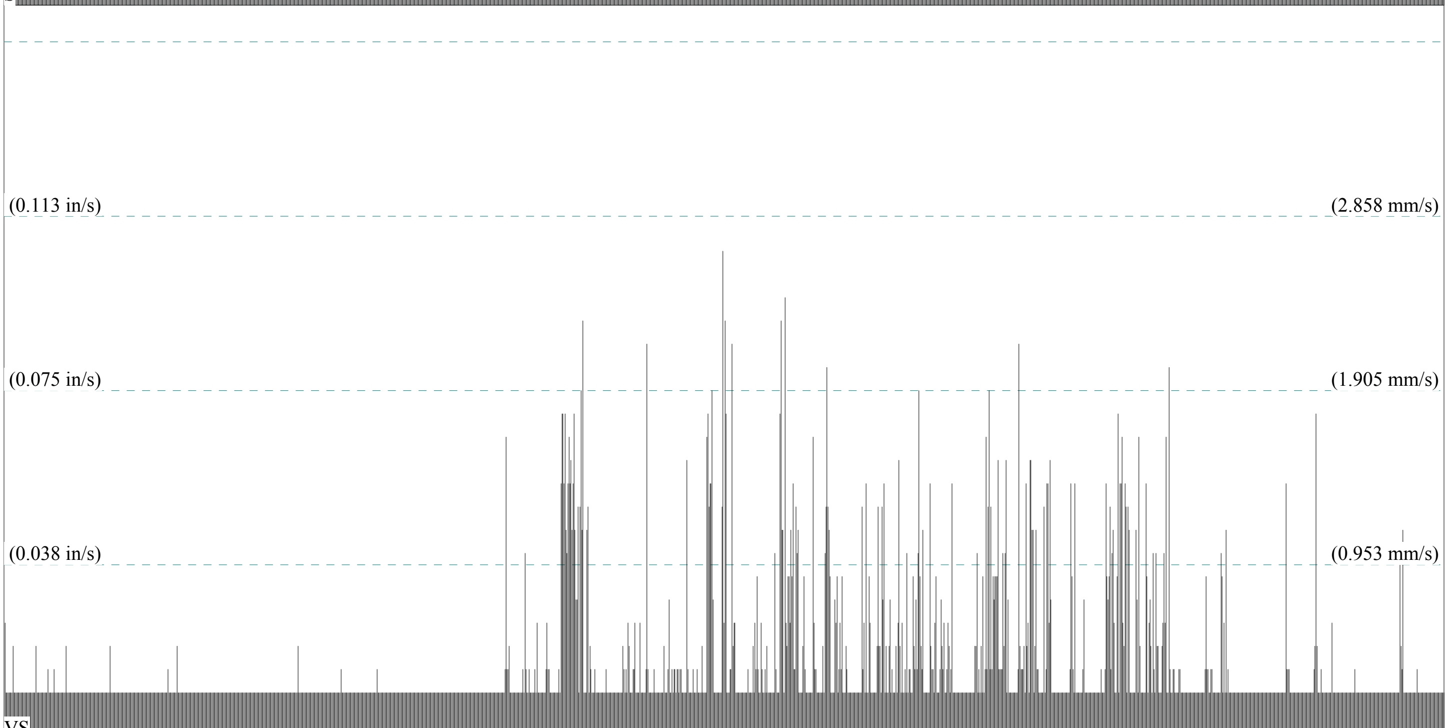


Last Calibration Date: 10/3/2003

File: KITCHEN_FLOOR002.BAR Job Number: 002 Date Range: 3/17/2005 - 3/18/2005 Time Range: 00:00 - 00:00 Serial Number: 2497

Peak Amplitudes *Seismic (S):* 0.1050in/s 2.667mm/s *Vector Sum (VS):* 0.1050in/s 2.667mm/s
Graph Information *Duration:* 0.0 day to 1.0 day *Seismic Scale:* 0.15 in/s 3.81 mm/s
Bar Information *Bar Sample Interval:* 1 Minute *Total Bar Samples:* 1440 *Number of Bar Samples Shown:* 1440

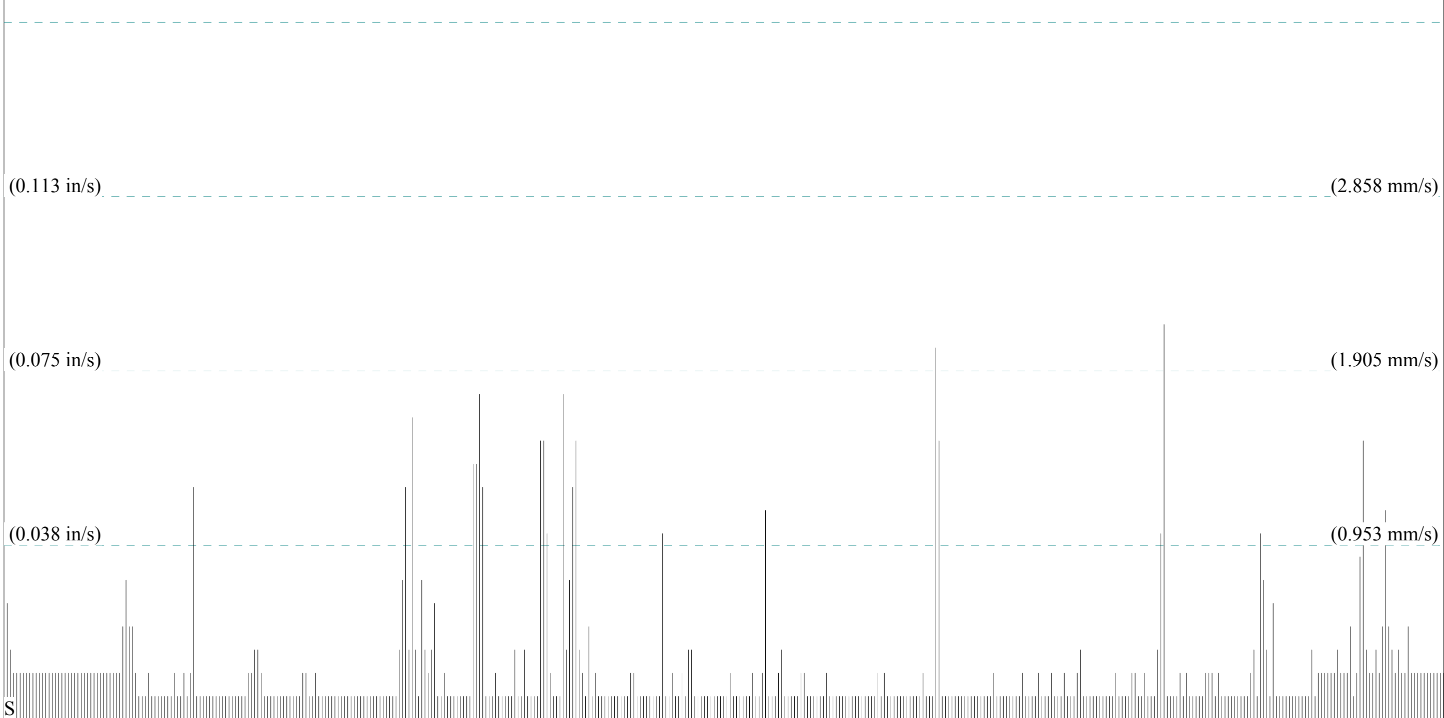


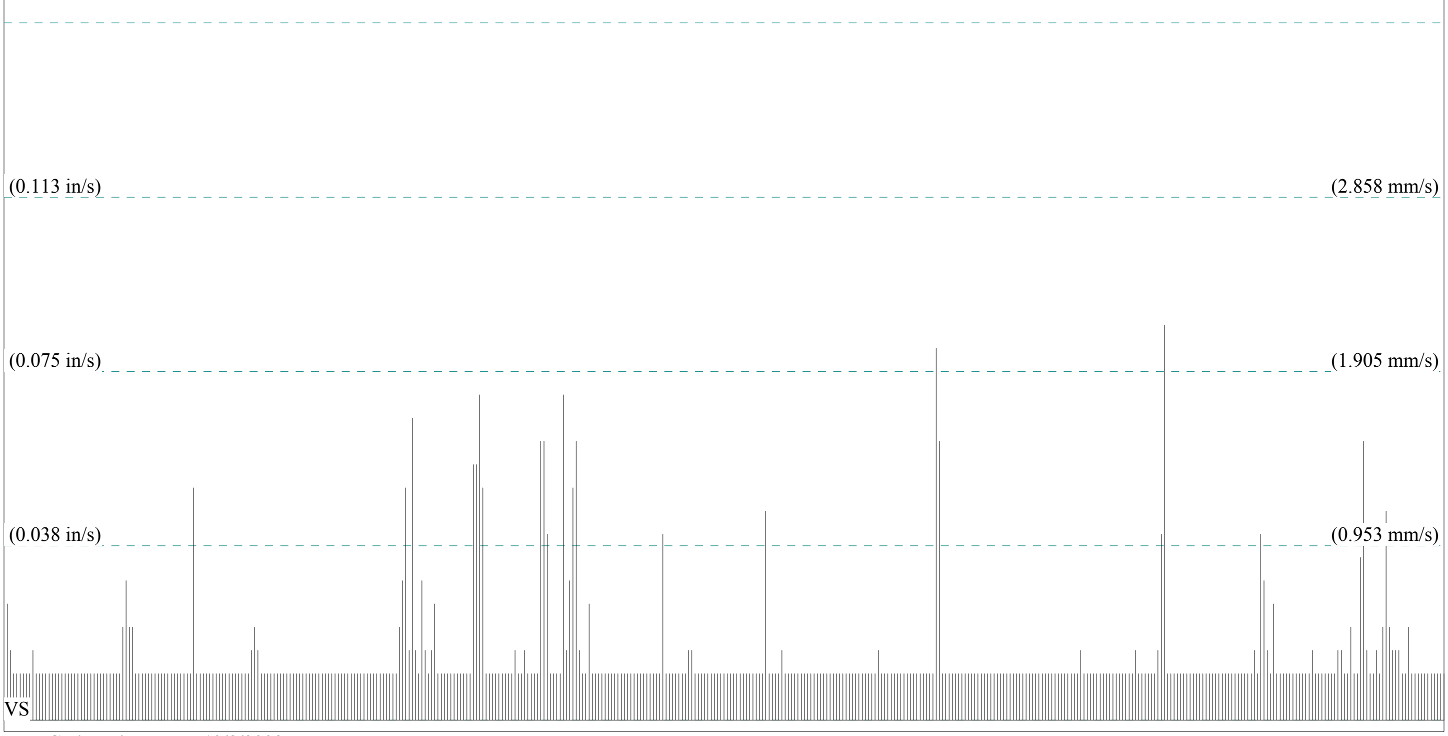


Last Calibration Date: 10/3/2003

File: KITCHEN_FLOOR001.BAR   Job Number: 001   Date Range: 3/16/2005 - 3/17/2005   Time Range: 16:32 - 00:00   Serial Number: 2497

Peak Amplitudes *Seismic (S):* 0.0850in/s 2.159mm/s *Vector Sum (VS):* 0.0850in/s 2.159mm/s
Graph Information *Duration:* 0.0 hr to 7.5 hr *Seismic Scale:* 0.15 in/s 3.81 mm/s
Bar Information *Bar Sample Interval:* 1 Minute *Total Bar Samples:* 448 *Number of Bar Samples Shown:* 448





Last Calibration Date: 10/3/2003

Unit Located On Interior Wall
Wall is not connected to wall with door
Front Door Slammed

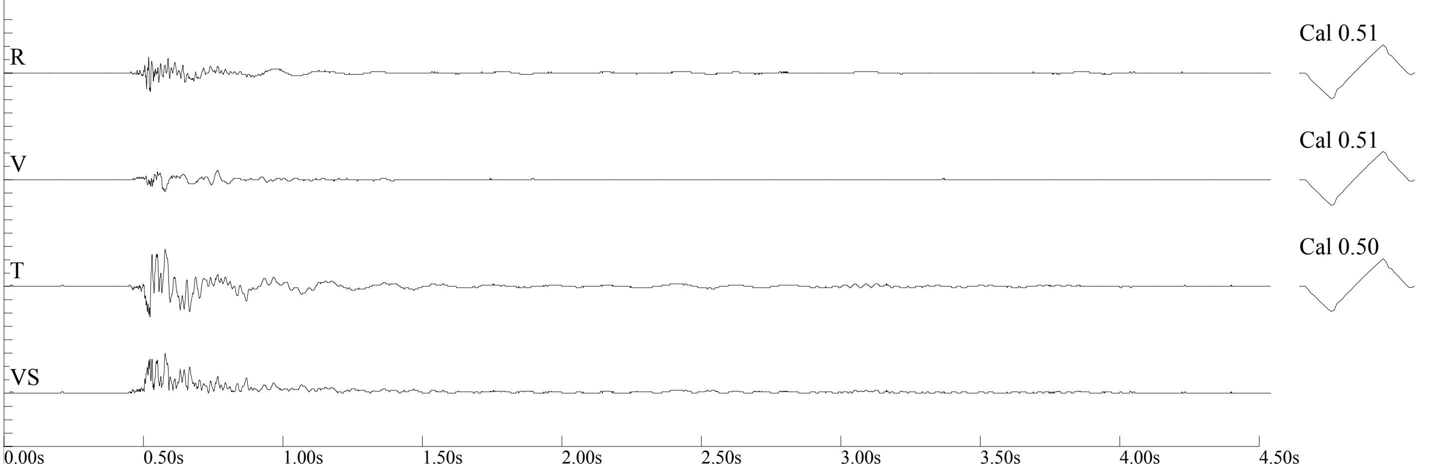
File Name: INTERIOR_WALL_FRONT_SLAM008.DTB
Number: 008
Date: 3/19/2005
Time: 14:24
Serial Number: 1644
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

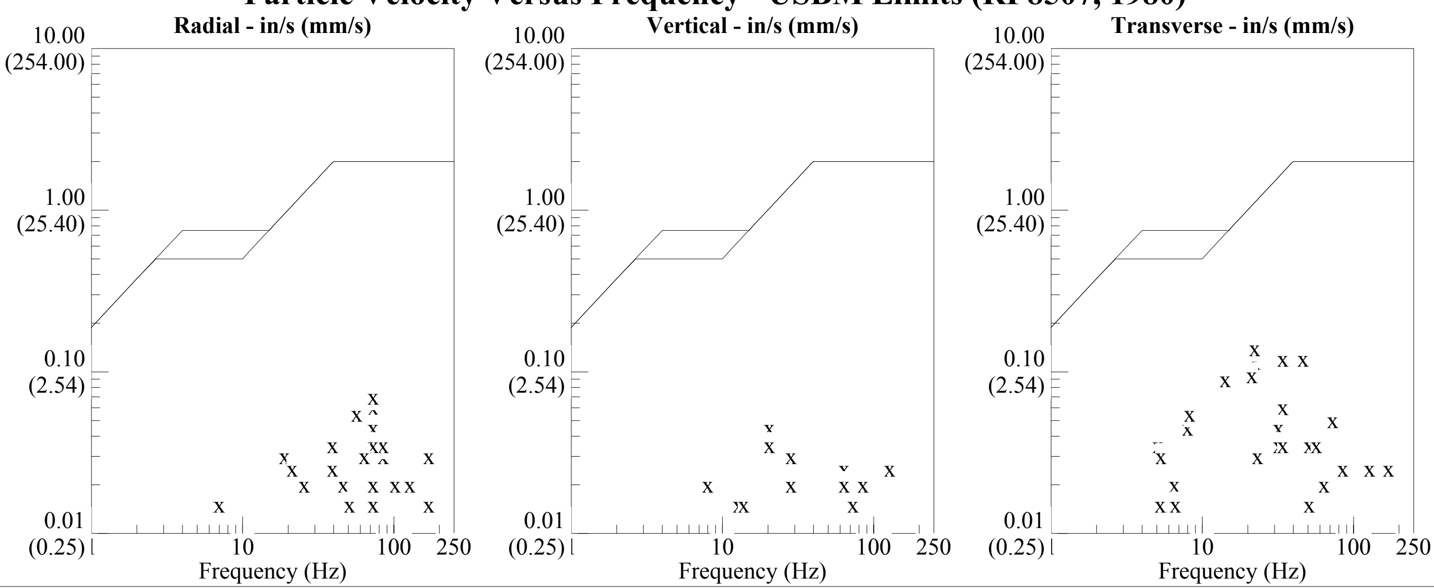
Radial: 0.07in/s 1.778mm/s @ 73.1Hz
Vertical: 0.045in/s 1.143mm/s @ 20.4Hz
***Transverse:* 0.14in/s 3.556mm/s @ 23.2Hz**
Vector Sum (VS): 0.15in/s 3.81mm/s
*Displacement:*0.002035in 0.051695mm
*Acceleration:*0.139130g's
*Calibration Date:*2/16/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
0.20in/s (0.050in/s/div) 5.08mm/s (1.270mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located On Interior Wall
Wall is not connected to wall with door
Front Door Slammed

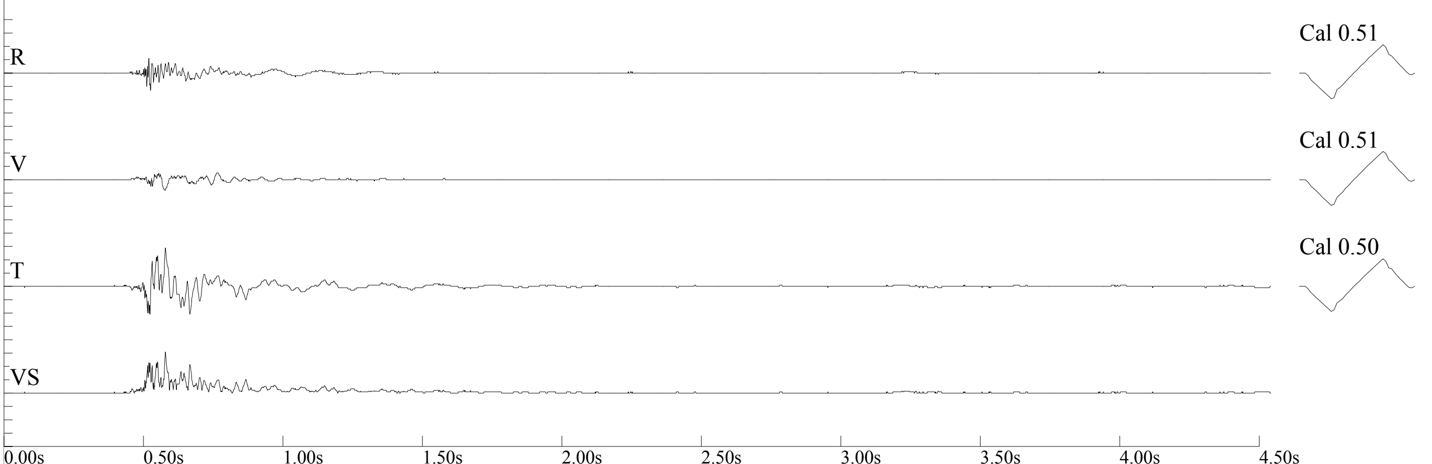
File Name: INTERIOR_WALL_FRONT_SLAM009.DTB
Number: 009
Date: 3/19/2005
Time: 14:25
Serial Number: 1644
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

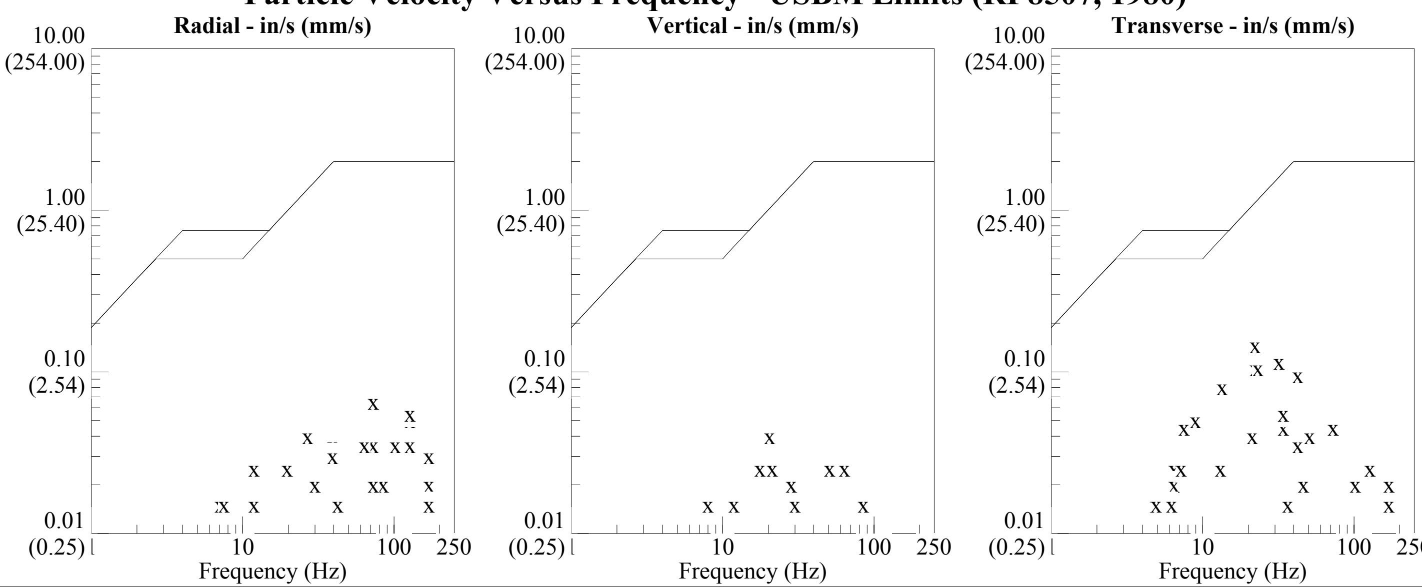
Radial: 0.065in/s 1.651mm/s @ 73.1Hz
Vertical: 0.04in/s 1.016mm/s @ 21.3Hz
***Transverse:* 0.145in/s 3.683mm/s @ 22.2Hz**
Vector Sum (VS): 0.155in/s 3.937mm/s
*Displacement:*0.001822in 0.046287mm
*Acceleration:*0.132505g's
*Calibration Date:*2/16/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
0.20in/s (0.050in/s/div) 5.08mm/s (1.270mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



TerraDinamica

Unit Located On Interior Wall
Wall is not connected to wall with door
Front Door Slammed

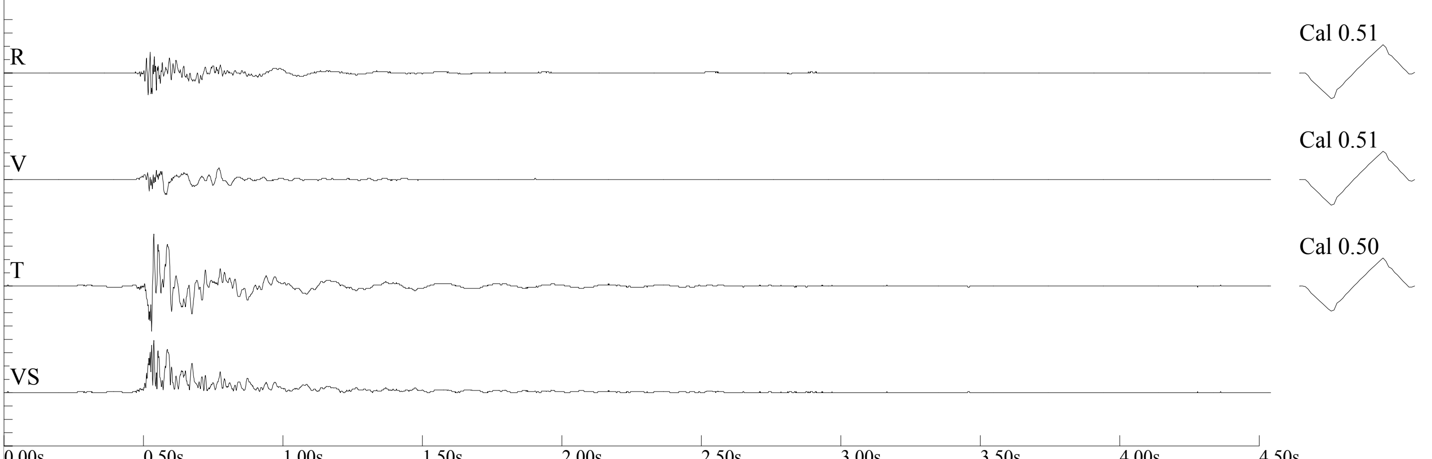
File Name: INTERIOR_WALL_FRONT_SLAM010.DTB
Number: 010
Date: 3/19/2005
Time: 14:25
Serial Number: 1644
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

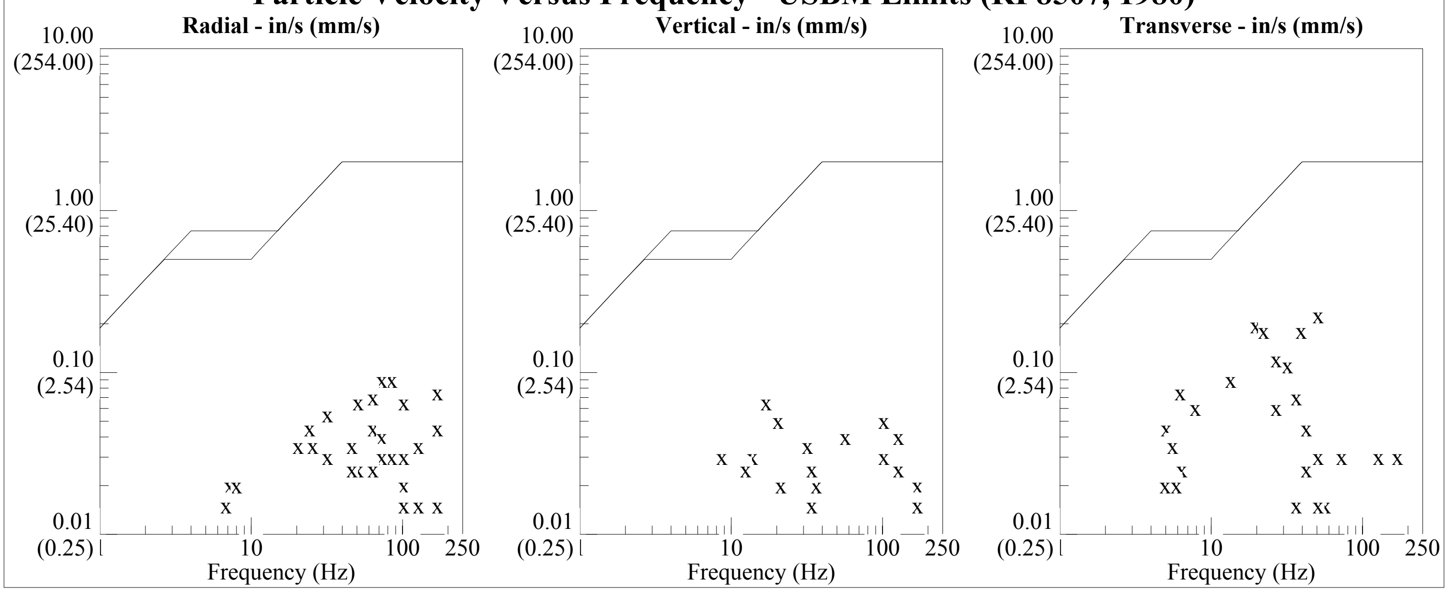
Radial: 0.095in/s 2.413mm/s @ 102.4Hz
Vertical: 0.065in/s 1.651mm/s @ 17.0Hz
***Transverse:* 0.225in/s 5.715mm/s @ 51.2Hz**
Vector Sum (VS): 0.225in/s 5.715mm/s
*Displacement:*0.002655in 0.067445mm
*Acceleration:*0.192133g's
*Calibration Date:*2/16/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
0.23in/s (0.058in/s/div) 5.84mm/s (1.461mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located On Interior Wall
Wall is not connected to wall with door
Front Door Slammed

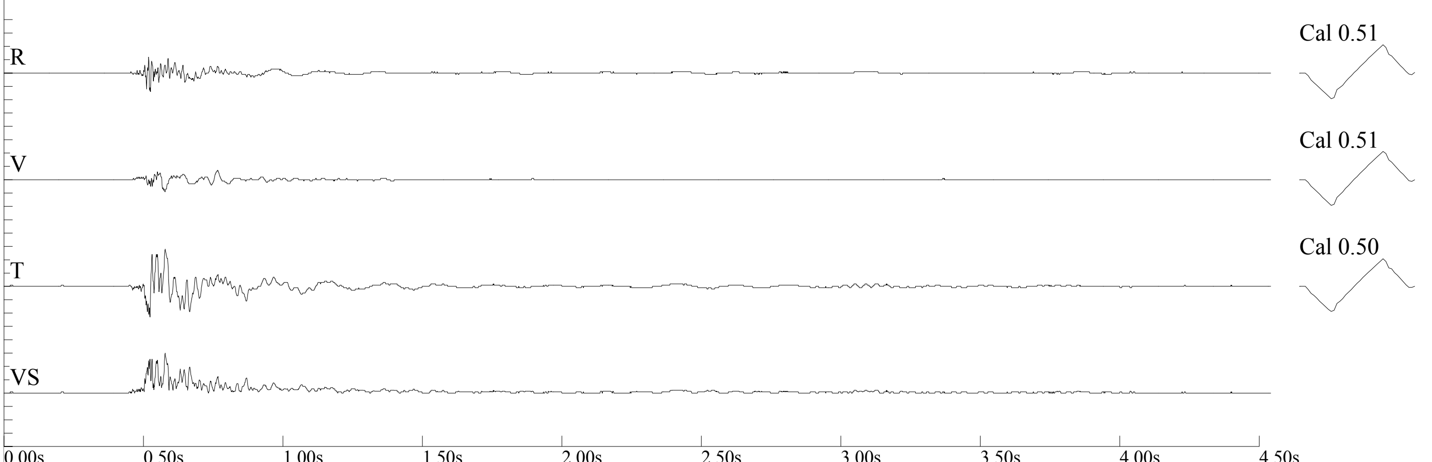
File Name: INTERIOR_WALL_FRONT_SLAM008.DTB
Number: 008
Date: 3/19/2005
Time: 14:24
Serial Number: 1644
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

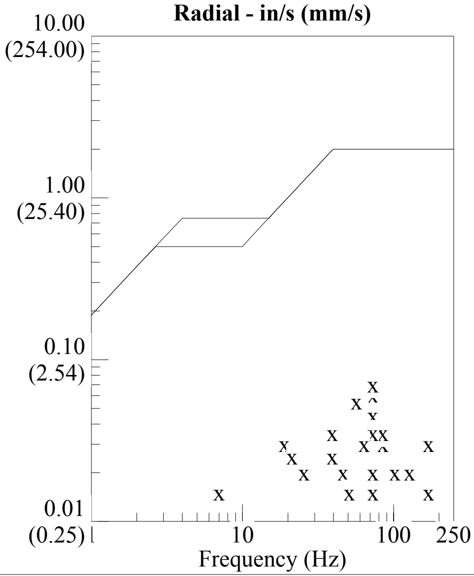
Radial: 0.07in/s 1.778mm/s @ 73.1Hz
Vertical: 0.045in/s 1.143mm/s @ 20.4Hz
***Transverse:* 0.14in/s 3.556mm/s @ 23.2Hz**
Vector Sum (VS): 0.15in/s 3.81mm/s
*Displacement:*0.002035in 0.051695mm
*Acceleration:*0.139130g's
*Calibration Date:*2/16/2005

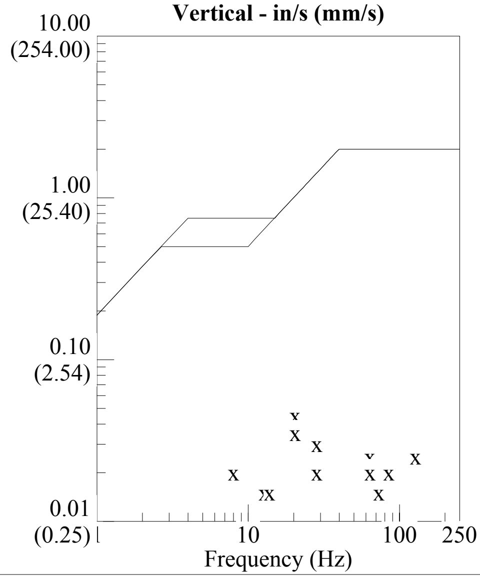
Graph Information

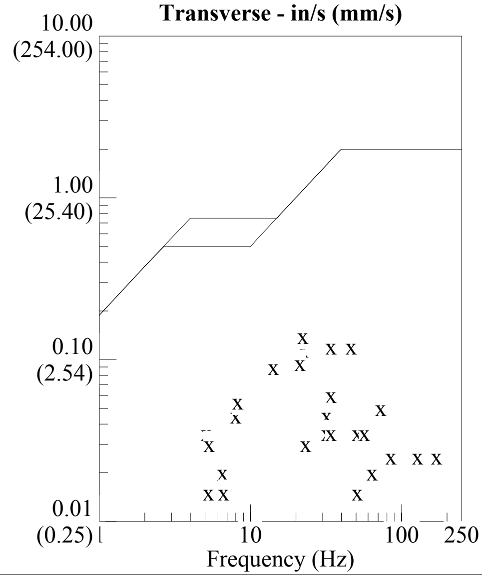
*Duration:*0.000s To: 4.500s
Seismic Scale:
0.20in/s (0.050in/s/div) 5.08mm/s (1.270mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)







Unit Located On Interior Wall
Wall is not connected to wall with door
Front Door Slammed

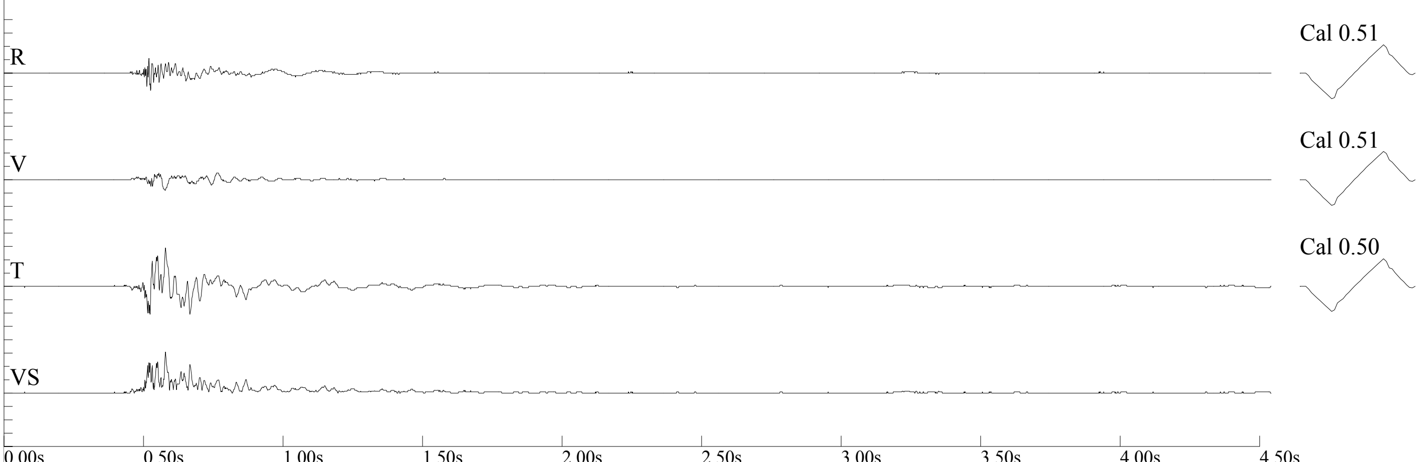
File Name: INTERIOR_WALL_FRONT_SLAM009.DTB
Number: 009
Date: 3/19/2005
Time: 14:25
Serial Number: 1644
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

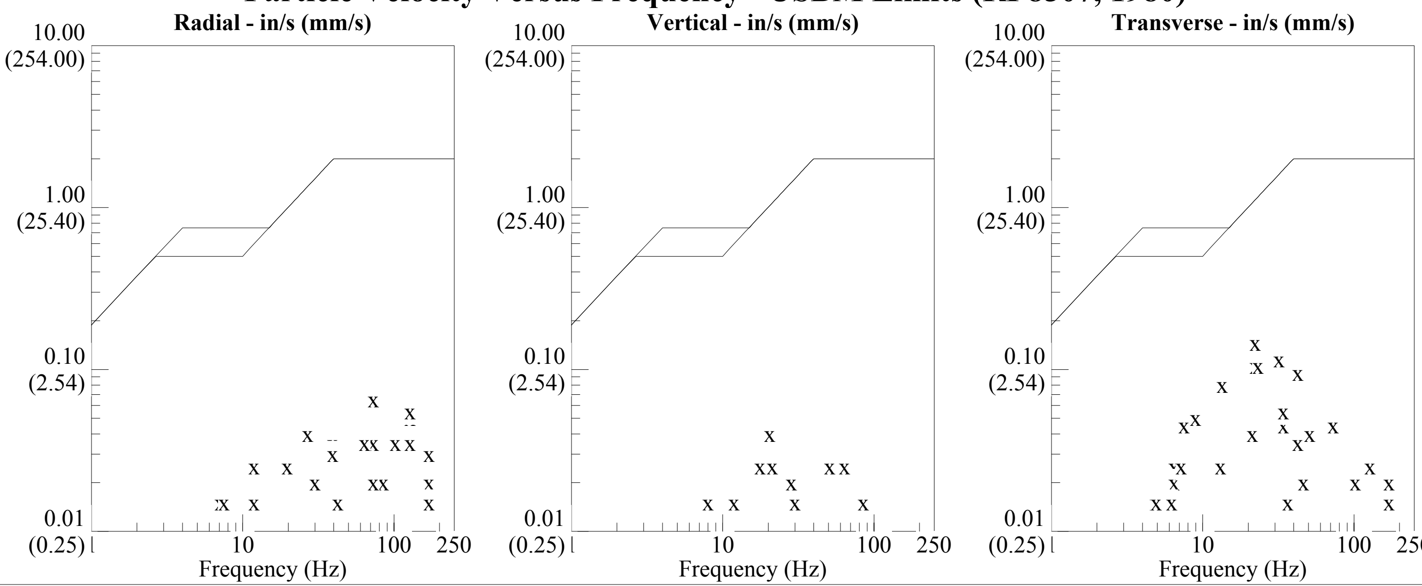
Radial: 0.065in/s 1.651mm/s @ 73.1Hz
Vertical: 0.04in/s 1.016mm/s @ 21.3Hz
***Transverse:* 0.145in/s 3.683mm/s @ 22.2Hz**
Vector Sum (VS): 0.155in/s 3.937mm/s
*Displacement:*0.001822in 0.046287mm
*Acceleration:*0.132505g's
*Calibration Date:*2/16/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
0.20in/s (0.050in/s/div) 5.08mm/s (1.270mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located On Interior Wall
Wall is not connected to wall with door
Front Door Slammed

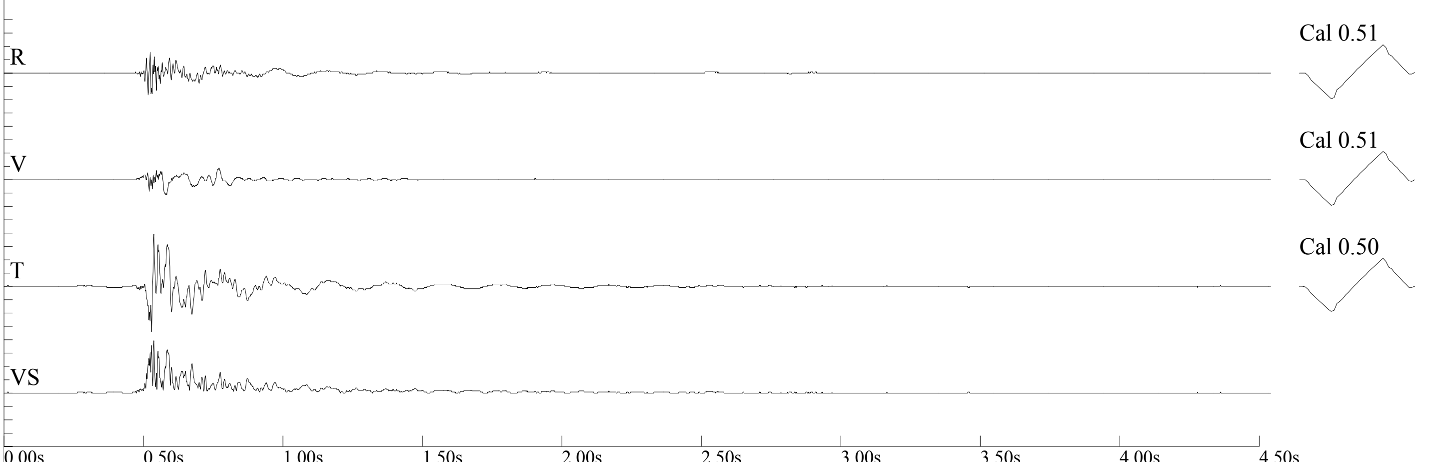
File Name: INTERIOR_WALL_FRONT_SLAM010.DTB
Number: 010
Date: 3/19/2005
Time: 14:25
Serial Number: 1644
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

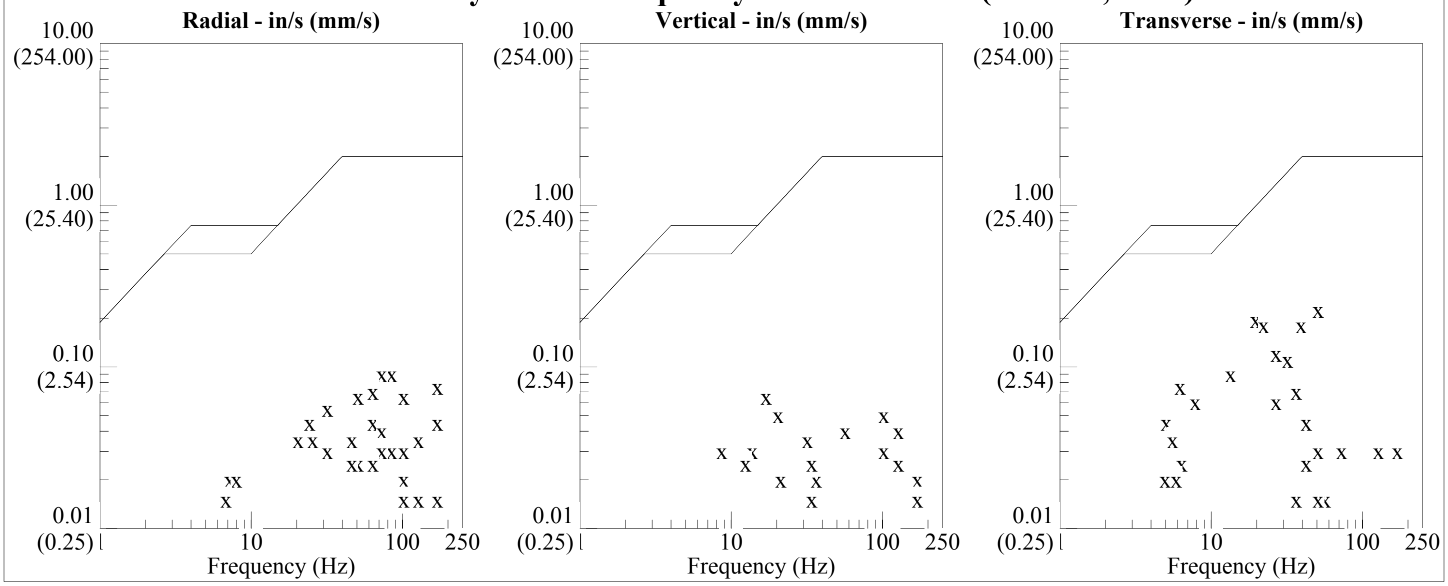
Radial: 0.095in/s 2.413mm/s @ 102.4Hz
Vertical: 0.065in/s 1.651mm/s @ 17.0Hz
***Transverse:* 0.225in/s 5.715mm/s @ 51.2Hz**
Vector Sum (VS): 0.225in/s 5.715mm/s
*Displacement:*0.002655in 0.067445mm
*Acceleration:*0.192133g's
*Calibration Date:*2/16/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
0.23in/s (0.058in/s/div) 5.84mm/s (1.461mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located On Interior Wall
Wall is not connected to wall with door
Front Door Shut with normal amount of force

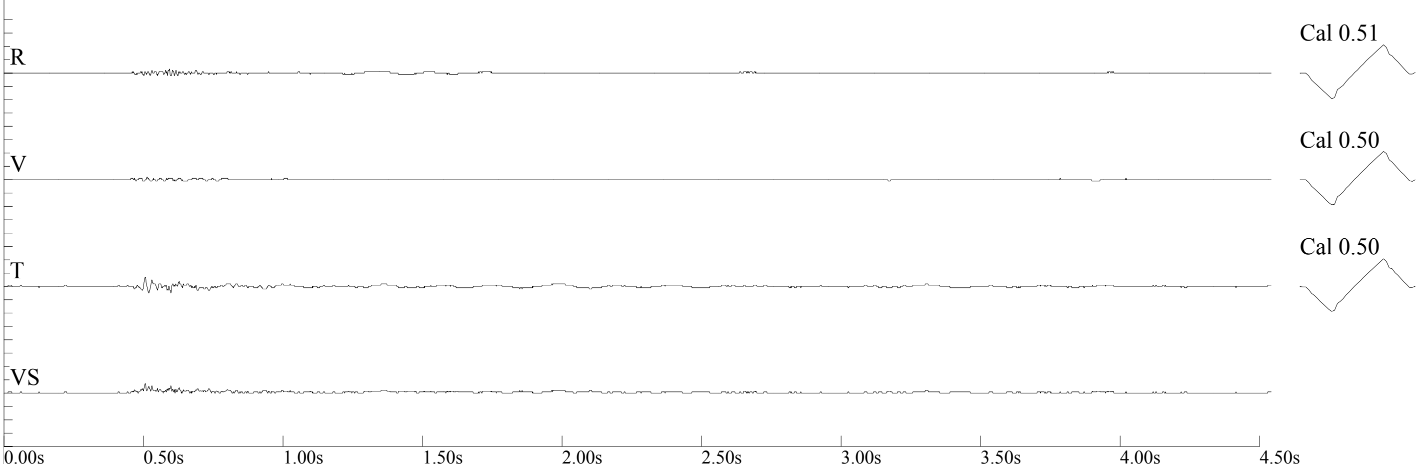
File Name: INTERIOR_WALL_FRONT_SHUT011.DTB
Number: 011
Date: 3/19/2005
Time: 14:27
Serial Number: 1644
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

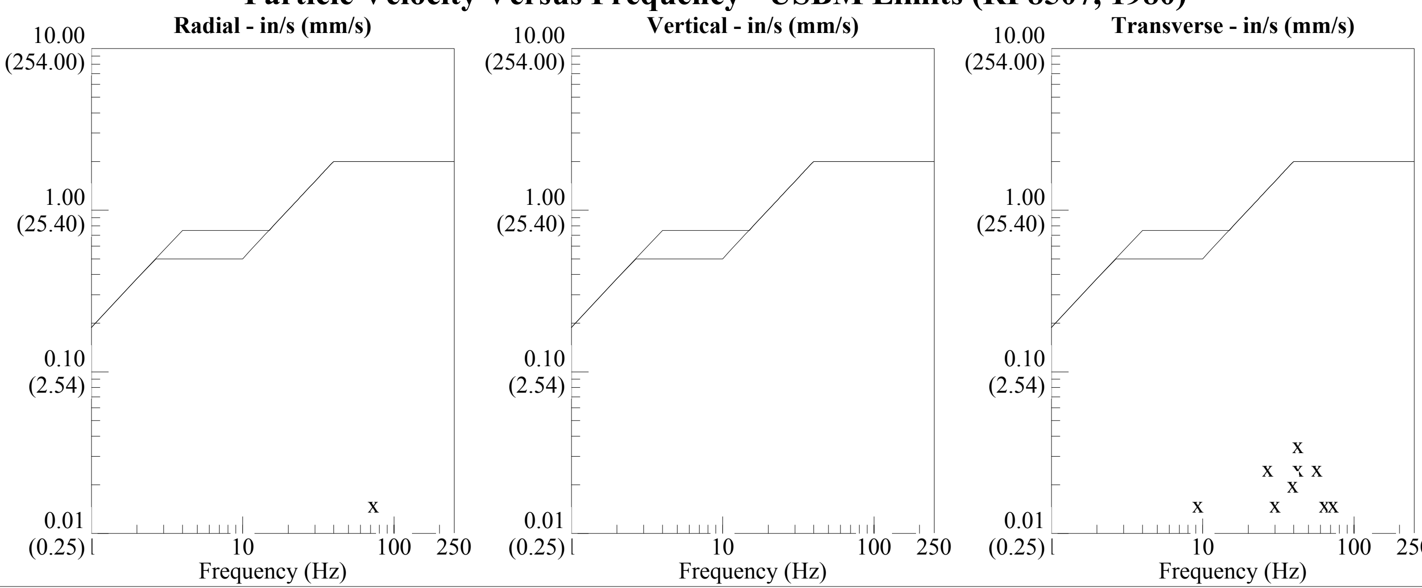
Radial: 0.015in/s 0.381mm/s @ 73.1Hz
Vertical: 0.01in/s 0.254mm/s @ 0.0Hz
***Transverse:* 0.035in/s 0.889mm/s @ 46.5Hz**
Vector Sum (VS): 0.035in/s 0.889mm/s
*Displacement:*0.000364in 0.009241mm
*Acceleration:*0.026501g's
*Calibration Date:*2/16/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
0.20in/s (0.050in/s/div) 5.08mm/s (1.270mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located On Interior Wall
Wall is not connected to wall with door
Front Door Shut with normal amount of force

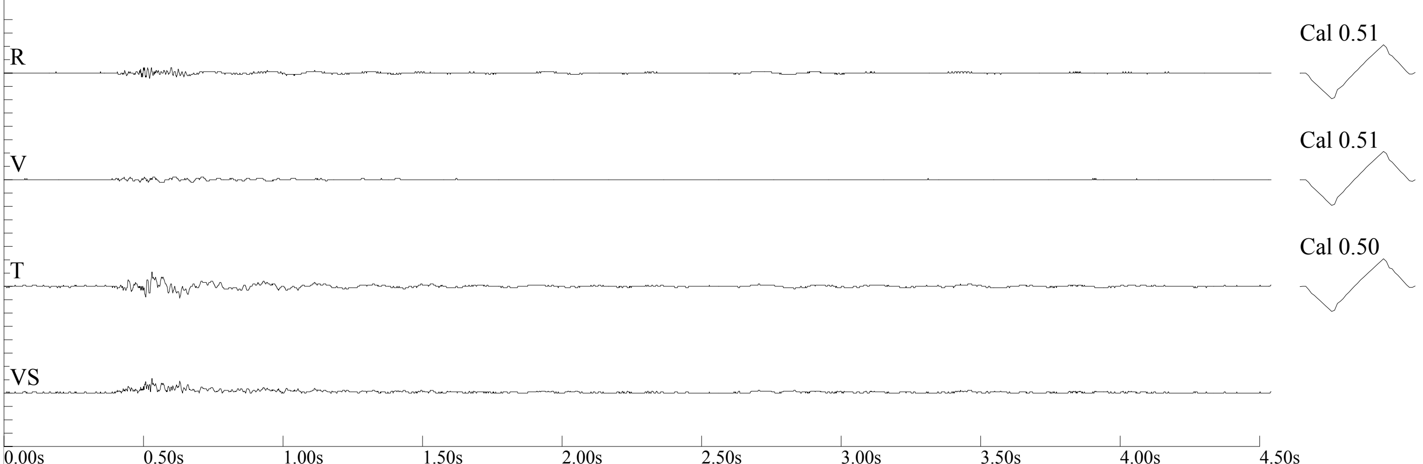
File Name: INTERIOR_WALL_FRONT_SHUT012.DTB
Number: 012
Date: 3/19/2005
Time: 14:27
Serial Number: 1644
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

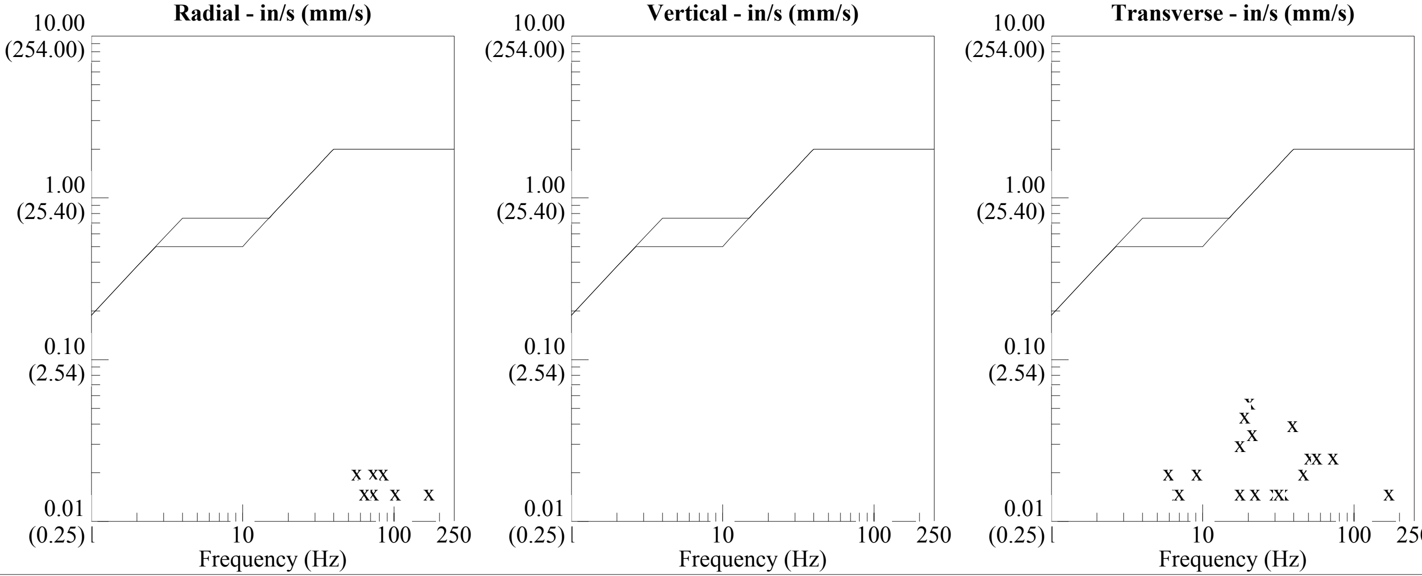
Radial: 0.02in/s 0.508mm/s @ 85.3Hz
Vertical: 0.01in/s 0.254mm/s @ 0.0Hz
***Transverse:* 0.055in/s 1.397mm/s @ 21.3Hz**
Vector Sum (VS): 0.055in/s 1.397mm/s
*Displacement:*0.000764in 0.019400mm
*Acceleration:*0.053002g's
*Calibration Date:*2/16/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
0.20in/s (0.050in/s/div) 5.08mm/s (1.270mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located On Interior Wall
Wall is not connected to wall with door
Front Door Shut with normal amount of force

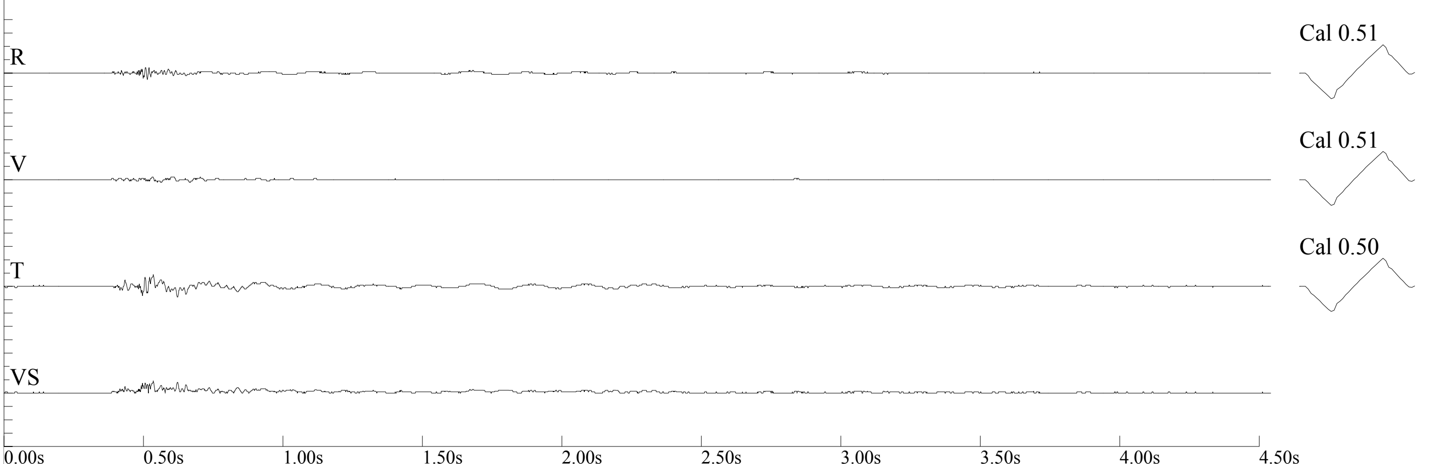
File Name: INTERIOR_WALL_FRONT_SHUT013.DTB
Number: 013
Date: 3/19/2005
Time: 14:28
Serial Number: 1644
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

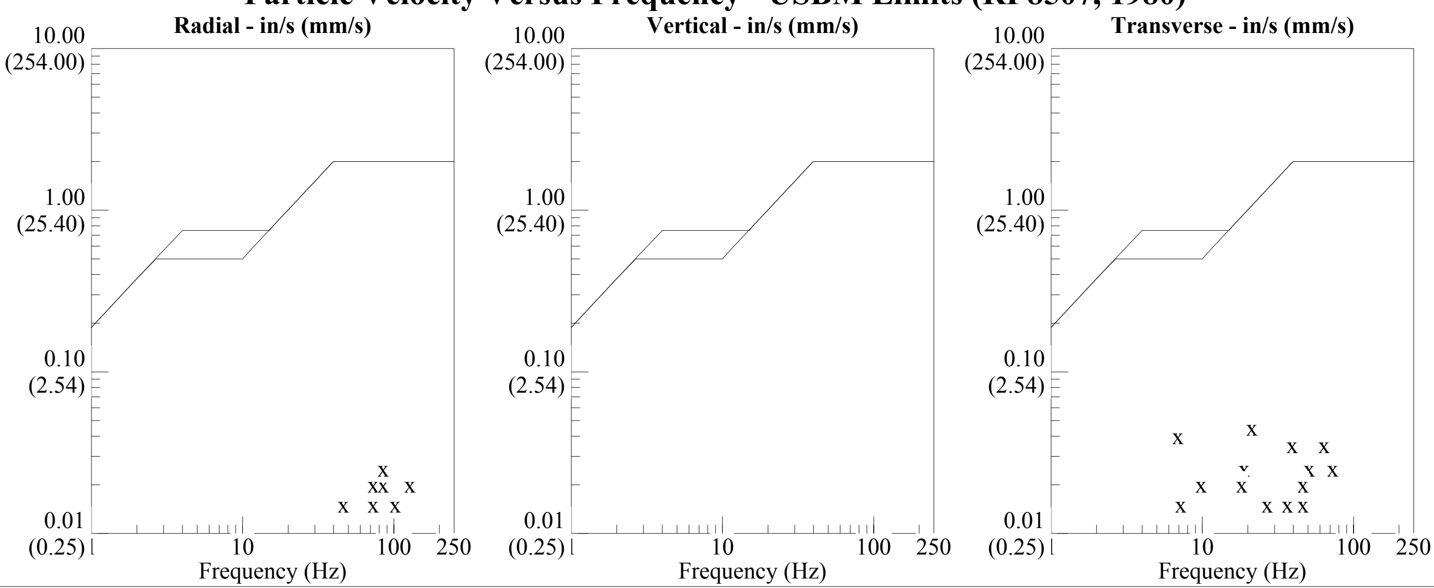
Radial: 0.025in/s 0.635mm/s @ 102.4Hz
Vertical: 0.01in/s 0.254mm/s @ 0.0Hz
***Transverse:* 0.045in/s 1.143mm/s @ 21.3Hz**
Vector Sum (VS): 0.045in/s 1.143mm/s
*Displacement:*0.000708in 0.017992mm
*Acceleration:*0.046377g's
*Calibration Date:*2/16/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
0.20in/s (0.050in/s/div) 5.08mm/s (1.270mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located On Interior Wall
Wall is not connected to wall with door
Front Door Shut with normal amount of force

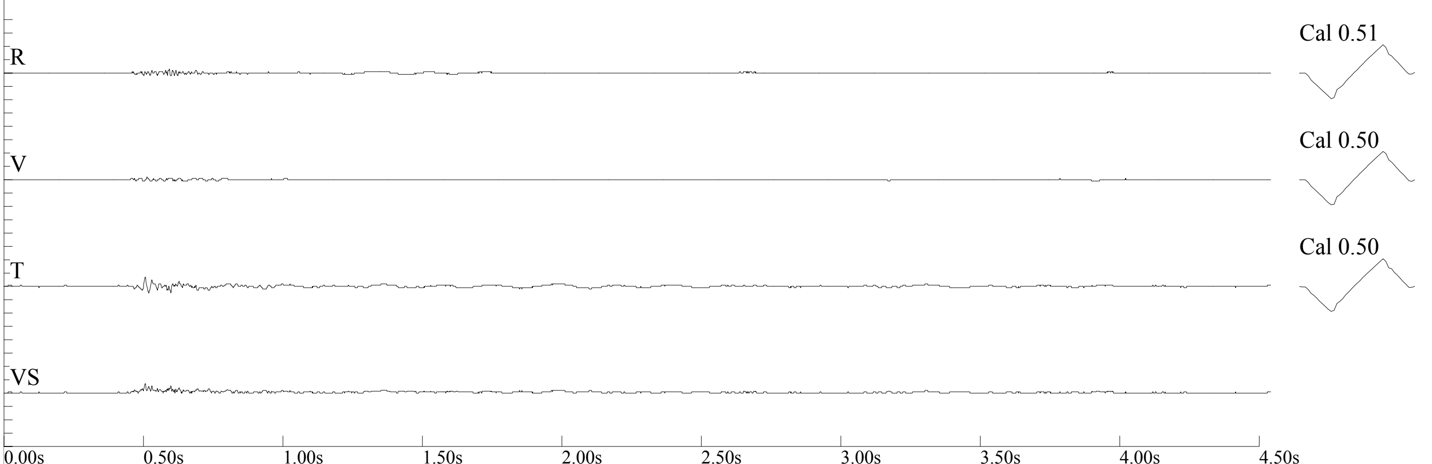
File Name: INTERIOR_WALL_FRONT_SHUT011.DTB
Number: 011
Date: 3/19/2005
Time: 14:27
Serial Number: 1644
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

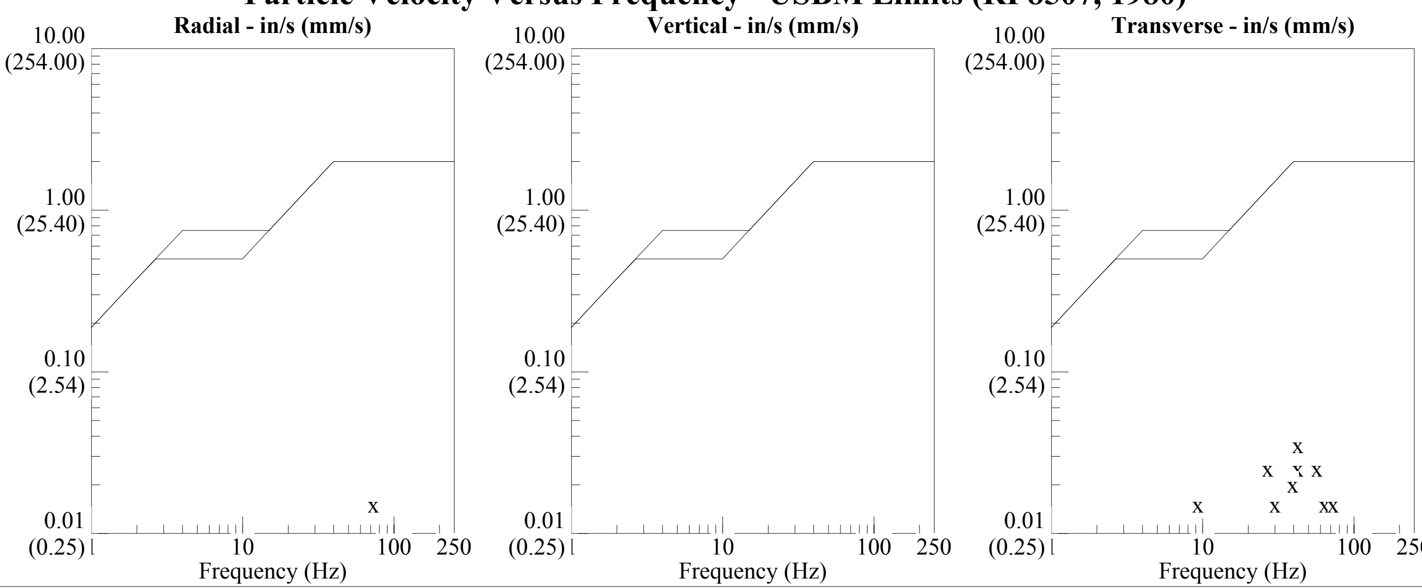
Radial: 0.015in/s 0.381mm/s @ 73.1Hz
Vertical: 0.01in/s 0.254mm/s @ 0.0Hz
***Transverse:* 0.035in/s 0.889mm/s @ 46.5Hz**
Vector Sum (VS): 0.035in/s 0.889mm/s
*Displacement:*0.000364in 0.009241mm
*Acceleration:*0.026501g's
*Calibration Date:*2/16/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
0.20in/s (0.050in/s/div) 5.08mm/s (1.270mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located On Interior Wall
Wall is not connected to wall with door
Front Door Shut with normal amount of force

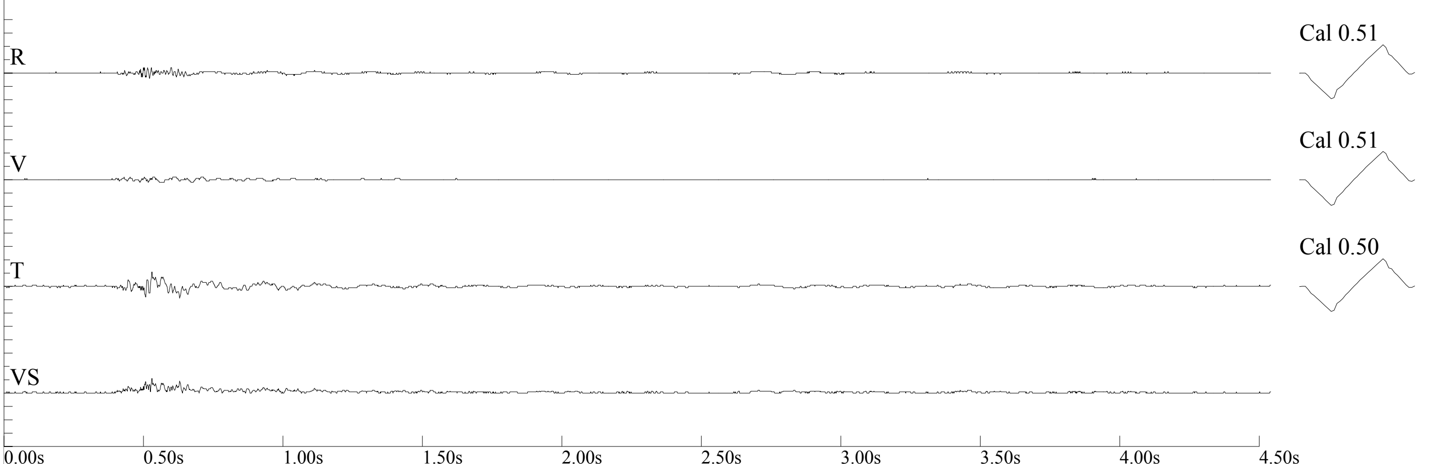
File Name: INTERIOR_WALL_FRONT_SHUT012.DTB
Number: 012
Date: 3/19/2005
Time: 14:27
Serial Number: 1644
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

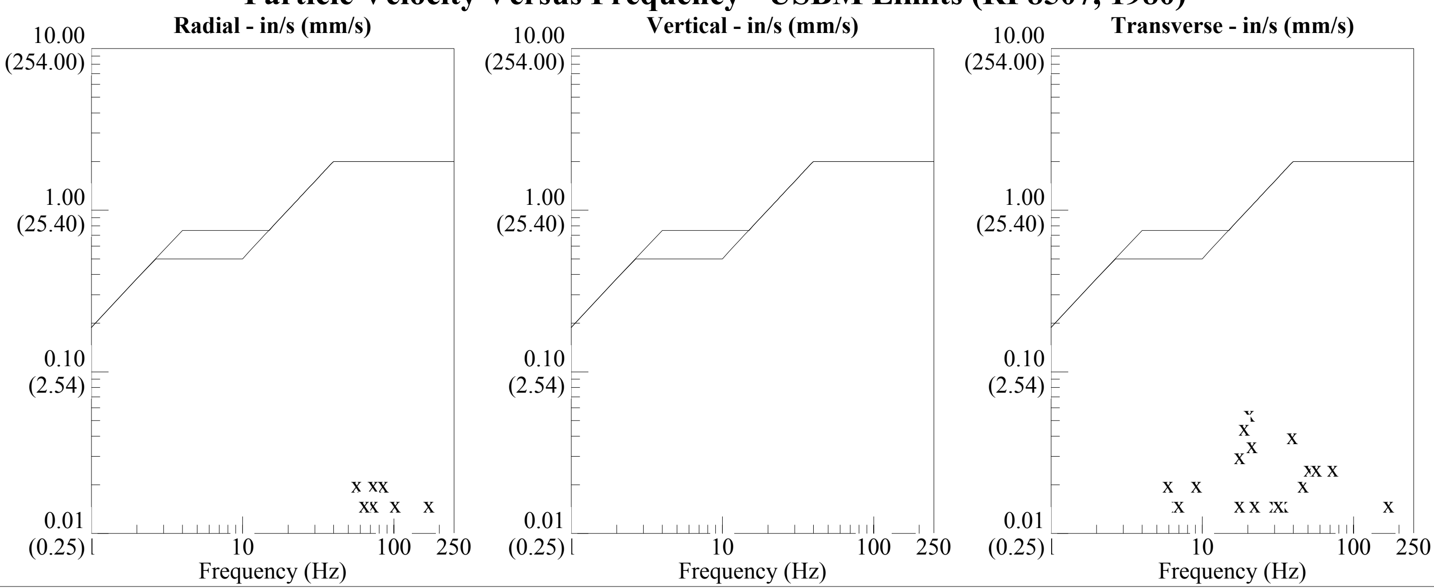
Radial: 0.02in/s 0.508mm/s @ 85.3Hz
Vertical: 0.01in/s 0.254mm/s @ 0.0Hz
***Transverse:* 0.055in/s 1.397mm/s @ 21.3Hz**
Vector Sum (VS): 0.055in/s 1.397mm/s
*Displacement:*0.000764in 0.019400mm
*Acceleration:*0.053002g's
*Calibration Date:*2/16/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
0.20in/s (0.050in/s/div) 5.08mm/s (1.270mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located On Interior Wall
Wall is not connected to wall with door
Front Door Shut with normal amount of force

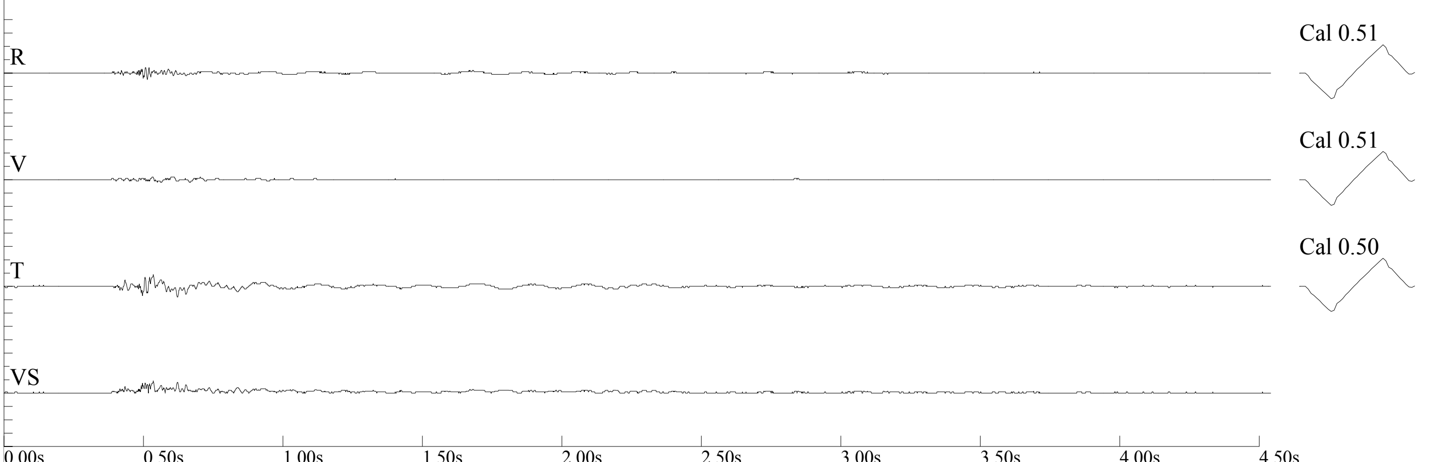
File Name: INTERIOR_WALL_FRONT_SHUT013.DTB
Number: 013
Date: 3/19/2005
Time: 14:28
Serial Number: 1644
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

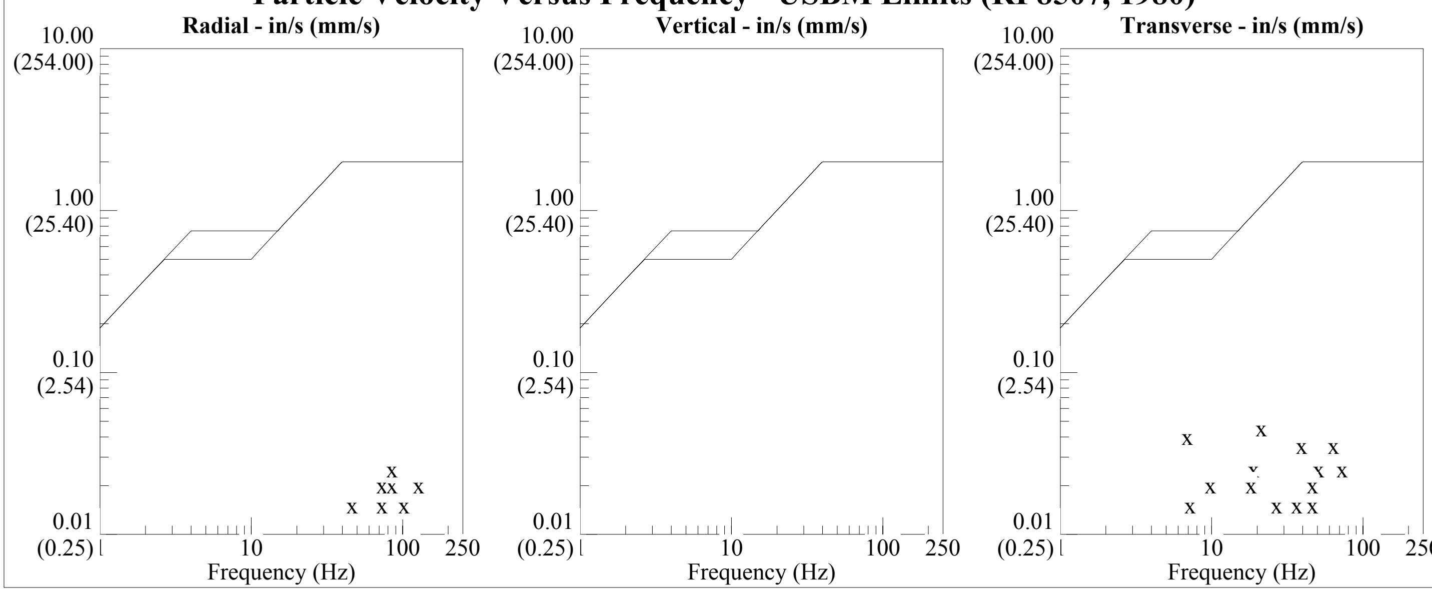
Radial: 0.025in/s 0.635mm/s @ 102.4Hz
Vertical: 0.01in/s 0.254mm/s @ 0.0Hz
***Transverse:* 0.045in/s 1.143mm/s @ 21.3Hz**
Vector Sum (VS): 0.045in/s 1.143mm/s
*Displacement:*0.000708in 0.017992mm
*Acceleration:*0.046377g's
*Calibration Date:*2/16/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
0.20in/s (0.050in/s/div) 5.08mm/s (1.270mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located On Interior Wall
Wall is not connected to wall with door
Back Door Slam

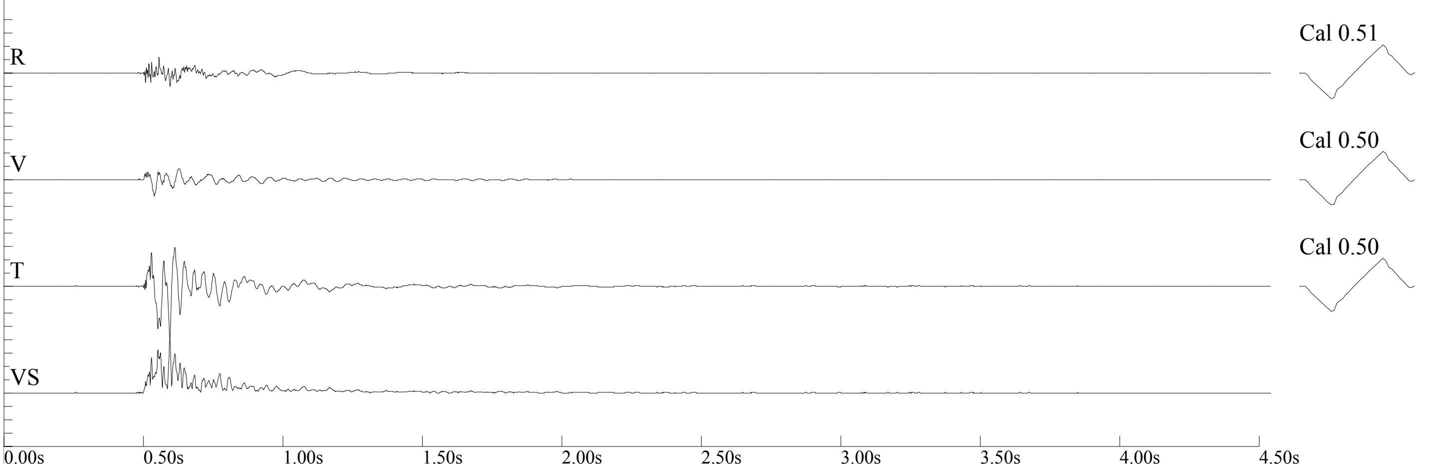
File Name: INTERIOR_WALL_BACK_SLAM017.DTB
Number: 017
Date: 3/19/2005
Time: 14:30
Serial Number: 1644
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

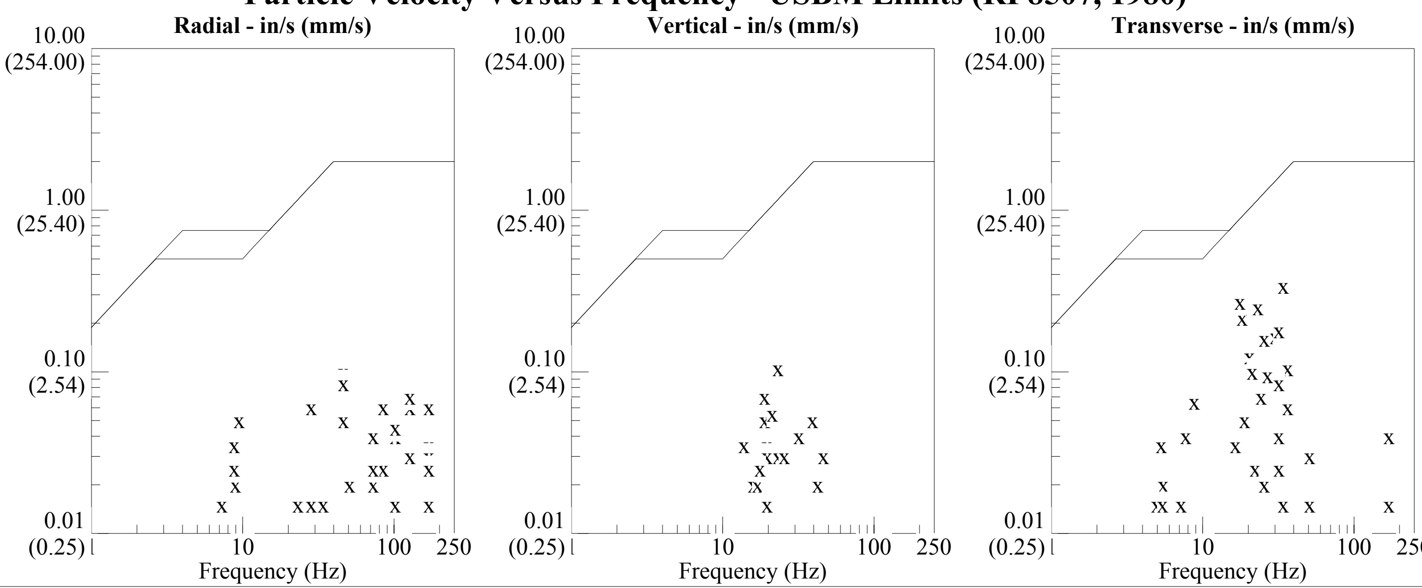
Radial: 0.10in/s 2.54mm/s @ 46.5Hz
Vertical: 0.105in/s 2.667mm/s @ 23.2Hz
***Transverse:* 0.34in/s 8.636mm/s @ 34.1Hz**
Vector Sum (VS): 0.35in/s 8.89mm/s
*Displacement:*0.003470in 0.088130mm
*Acceleration:*0.172257g's
*Calibration Date:*2/16/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
0.34in/s (0.085in/s/div) 8.64mm/s (2.159mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located On Interior Wall
Wall is not connected to wall with door
Back Door Slam

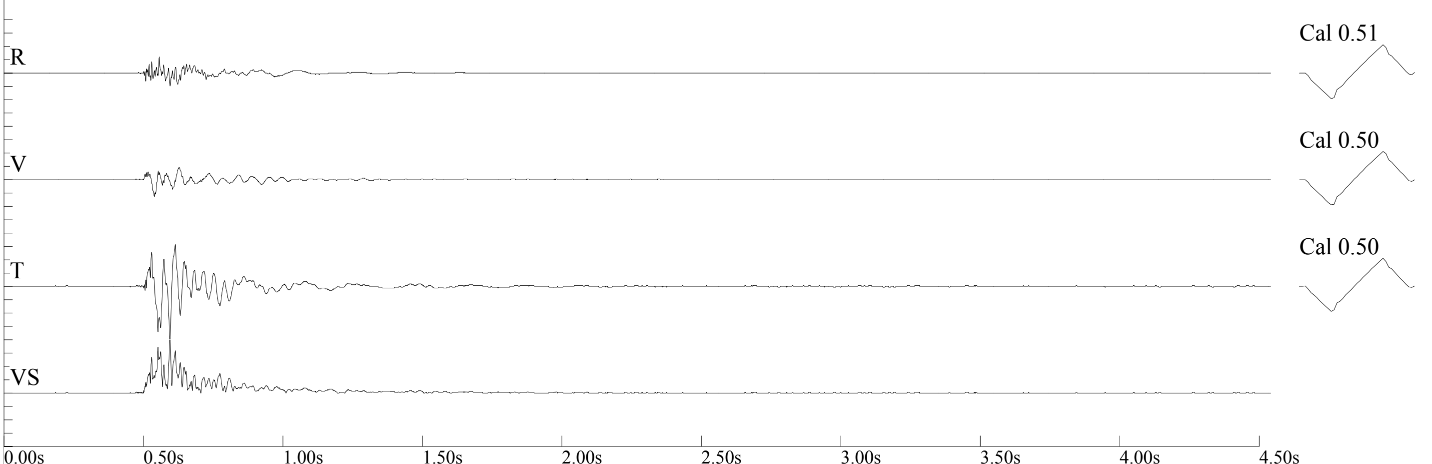
File Name: INTERIOR_WALL_BACK_SLAM018.DTB
Number: 018
Date: 3/19/2005
Time: 14:31
Serial Number: 1644
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

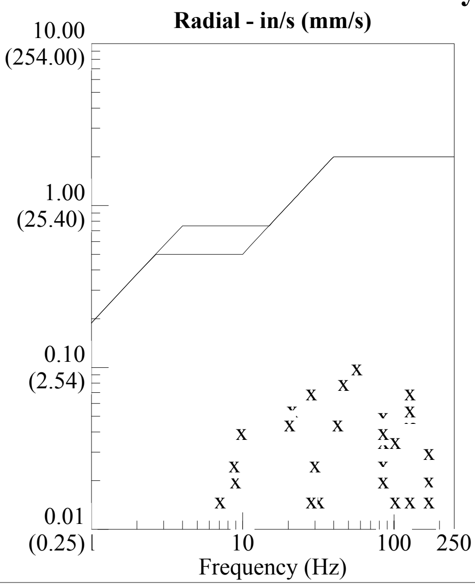
Radial: 0.10in/s 2.54mm/s @ 56.8Hz
Vertical: 0.105in/s 2.667mm/s @ 24.3Hz
***Transverse:* 0.325in/s 8.255mm/s @ 32.0Hz**
Vector Sum (VS): 0.335in/s 8.509mm/s
*Displacement:*0.003434in 0.087228mm
*Acceleration:*0.165632g's
*Calibration Date:*2/16/2005

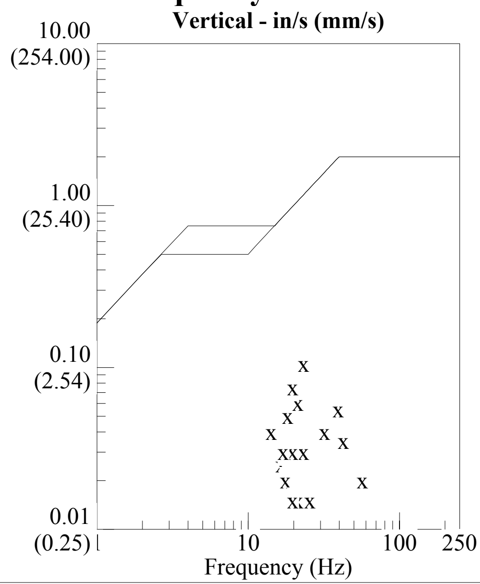
Graph Information

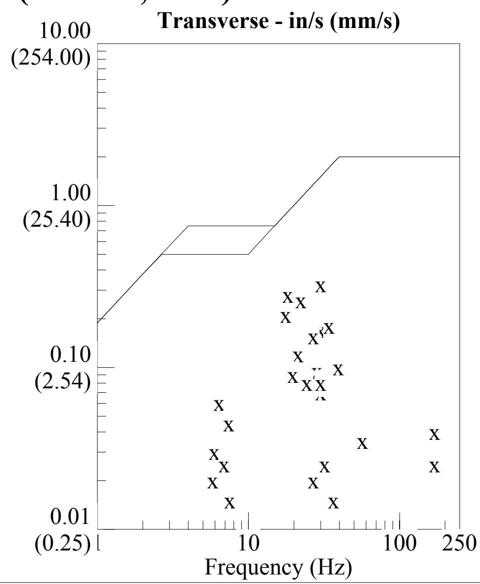
*Duration:*0.000s To: 4.500s
Seismic Scale:
0.33in/s (0.083in/s/div) 8.38mm/s (2.096mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)







TerraDinamica

Unit Located On Interior Wall **Wall is not connected to wall with door** **Back Door Slam**	File Name: INTERIOR_WALL_BACK_SLAM019.DTB Number: 019 Date: 3/19/2005 Time: 14:31 Serial Number: 1644 Seismic Trigger: 0.0300 in/s 0.7620 mm/s Acoustic Trigger: 123 dB Sample Rate: 1024 Record Duration: 4.0 Seconds Pre-Trigger: 0.50 Seconds Sensor Gain: 2x Battery: 6.4

Amplitudes and Frequencies

Radial: 0.09in/s 2.286mm/s @ 56.8Hz

Vertical: 0.085in/s 2.159mm/s @ 23.2Hz

***Transverse:* 0.255in/s 6.477mm/s @ 30.1Hz**

Vector Sum (VS): 0.26in/s 6.604mm/s

*Displacement:*0.002814in 0.071476mm

*Acceleration:*0.152381g's

*Calibration Date:*2/16/2005

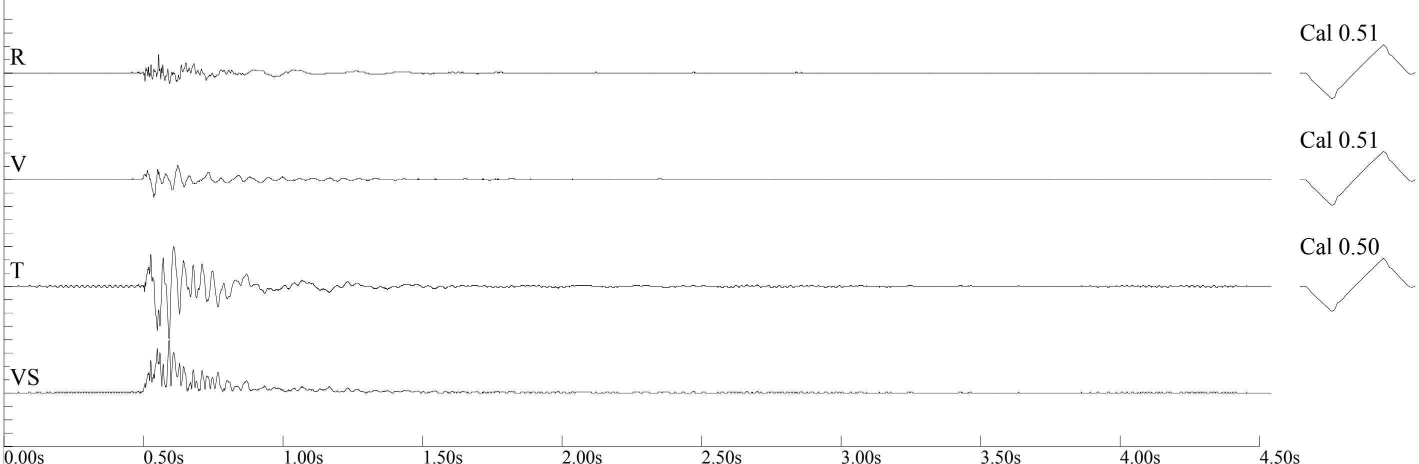
Graph Information

*Duration:*0.000s To: 4.500s

Seismic Scale:

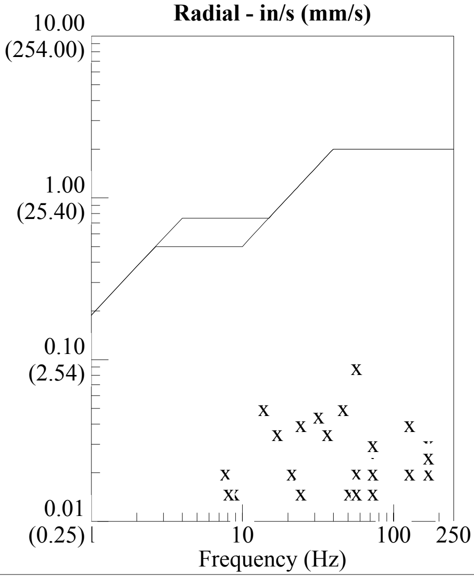
0.26in/s (0.065in/s/div) 6.60mm/s (1.651mm/s/div)

*Time Line Intervals at:*0.50 s

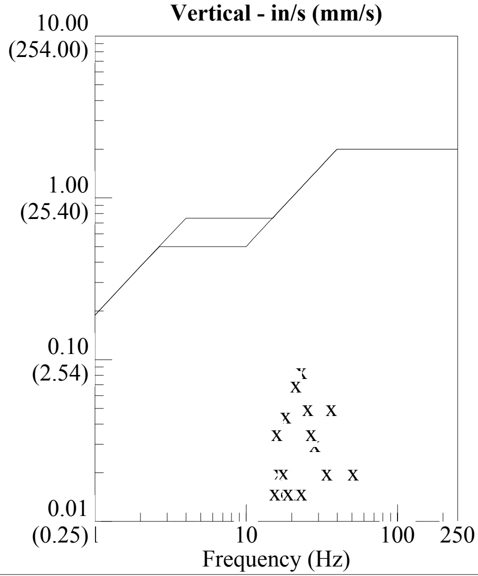


Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)

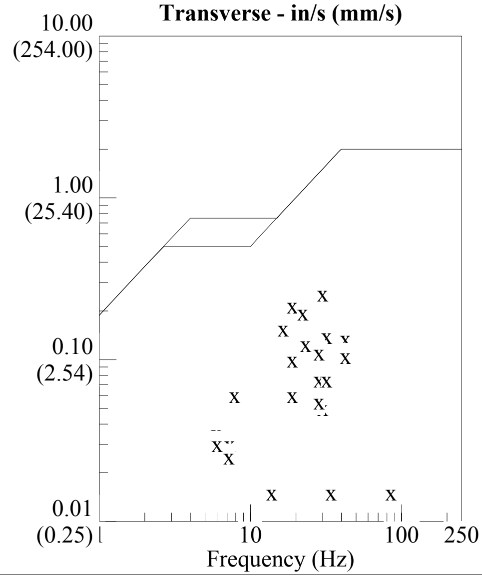
Radial - in/s (mm/s)



Vertical - in/s (mm/s)



Transverse - in/s (mm/s)



Unit Located On Interior Wall
Wall is not connected to wall with door
Back Door Slam

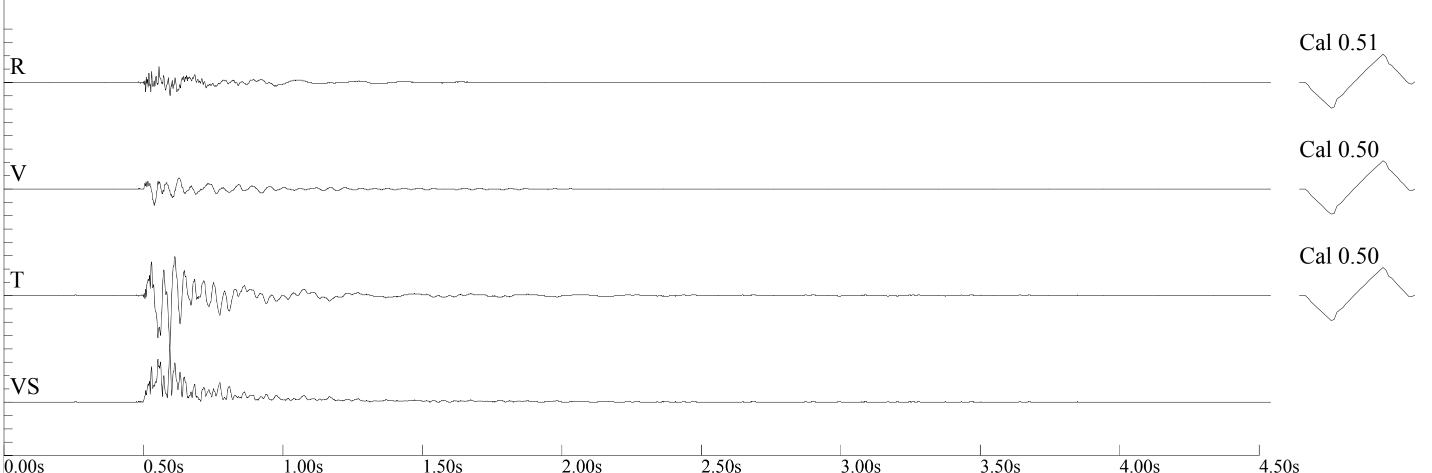
File Name: INTERIOR_WALL_BACK_SLAM017.DTB
Number: 017
Date: 3/19/2005
Time: 14:30
Serial Number: 1644
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

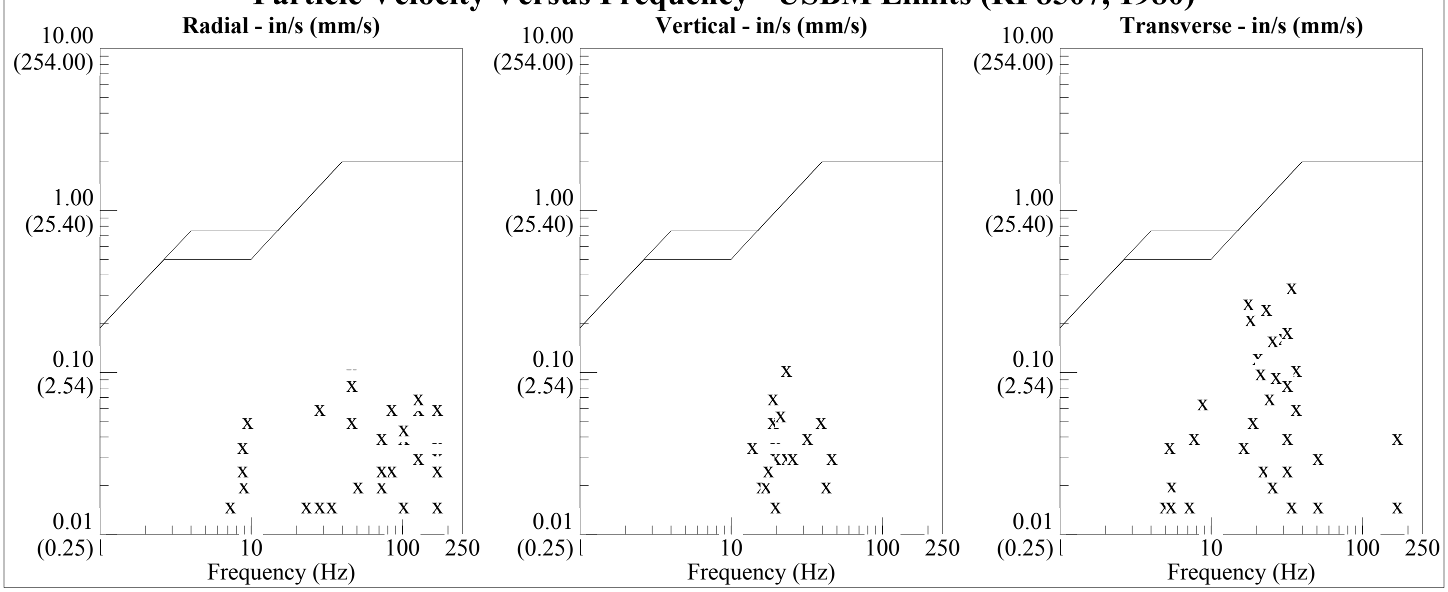
Radial: 0.10in/s 2.54mm/s @ 46.5Hz
Vertical: 0.105in/s 2.667mm/s @ 23.2Hz
***Transverse:* 0.34in/s 8.636mm/s @ 34.1Hz**
Vector Sum (VS): 0.35in/s 8.89mm/s
*Displacement:*0.003470in 0.088130mm
*Acceleration:*0.172257g's
*Calibration Date:*2/16/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
0.34in/s (0.085in/s/div) 8.64mm/s (2.159mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



TerraDinamica

Unit Located On Interior Wall
Wall is not connected to wall with door
Back Door Slam

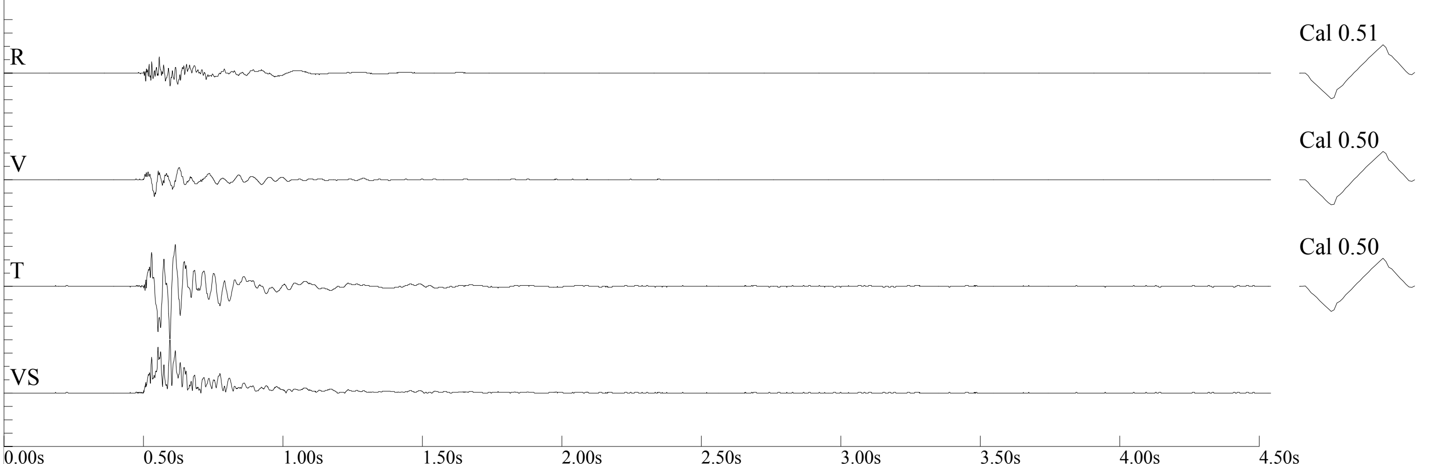
File Name: INTERIOR_WALL_BACK_SLAM018.DTB
Number: 018
Date: 3/19/2005
Time: 14:31
Serial Number: 1644
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

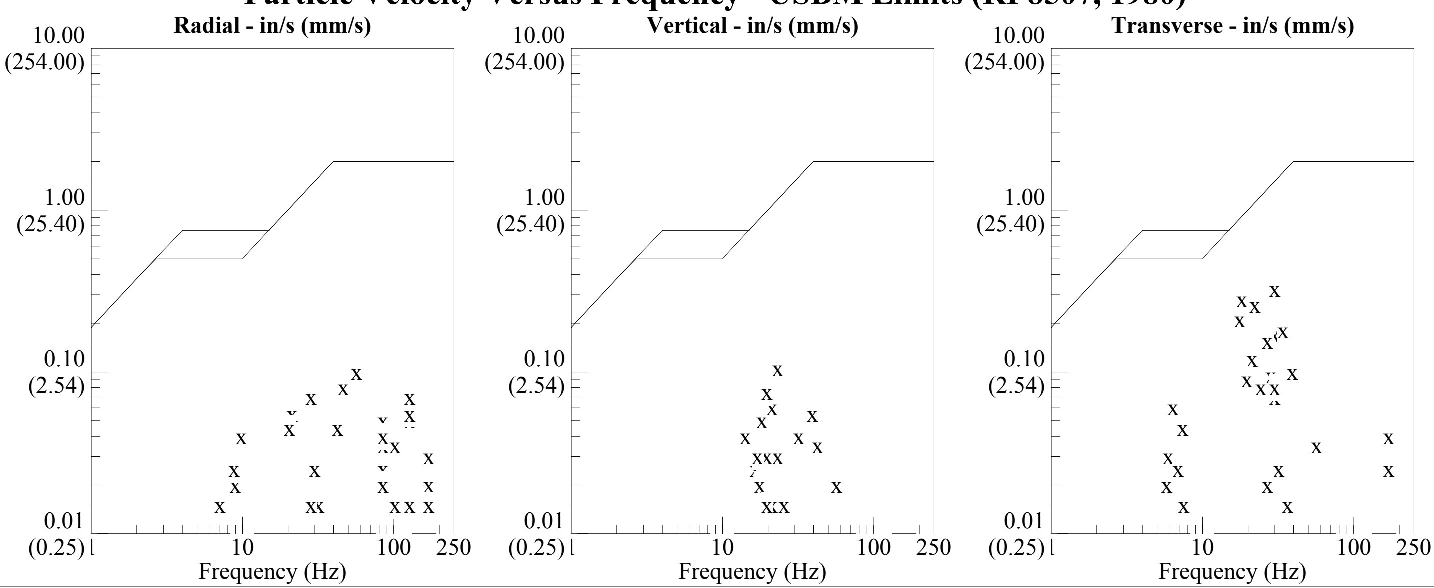
Radial: 0.10in/s 2.54mm/s @ 56.8Hz
Vertical: 0.105in/s 2.667mm/s @ 24.3Hz
***Transverse:* 0.325in/s 8.255mm/s @ 32.0Hz**
Vector Sum (VS): 0.335in/s 8.509mm/s
*Displacement:*0.003434in 0.087228mm
*Acceleration:*0.165632g's
*Calibration Date:*2/16/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
0.33in/s (0.083in/s/div) 8.38mm/s (2.096mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located On Interior Wall
Wall is not connected to wall with door
Back Door Slam

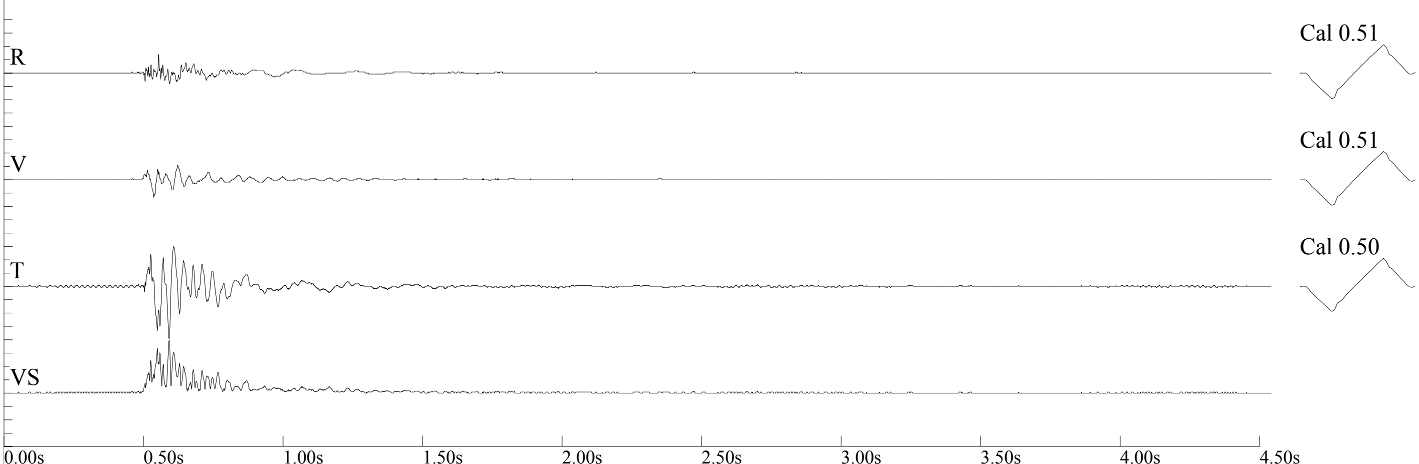
File Name: INTERIOR_WALL_BACK_SLAM019.DTB
Number: 019
Date: 3/19/2005
Time: 14:31
Serial Number: 1644
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

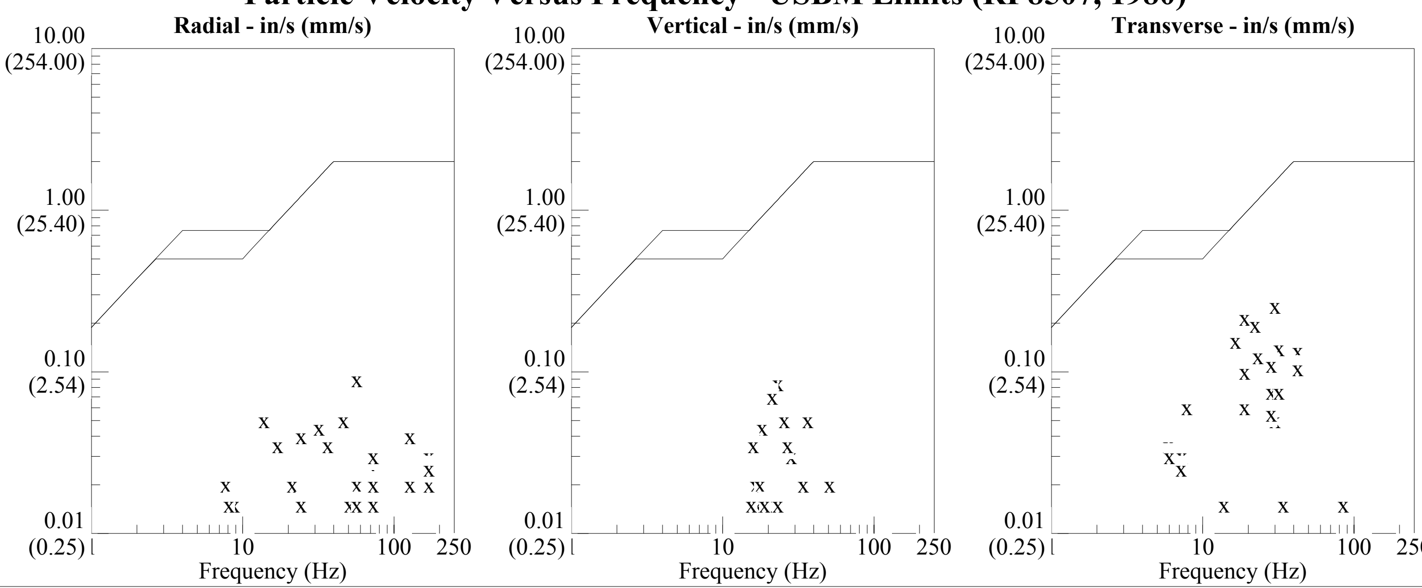
Radial: 0.09in/s 2.286mm/s @ 56.8Hz
Vertical: 0.085in/s 2.159mm/s @ 23.2Hz
***Transverse:* 0.255in/s 6.477mm/s @ 30.1Hz**
Vector Sum (VS): 0.26in/s 6.604mm/s
*Displacement:*0.002814in 0.071476mm
*Acceleration:*0.152381g's
*Calibration Date:*2/16/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
0.26in/s (0.065in/s/div) 6.60mm/s (1.651mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located On Interior Wall
Wall is not connected to wall with door
Back Door Shut with normal amount of force

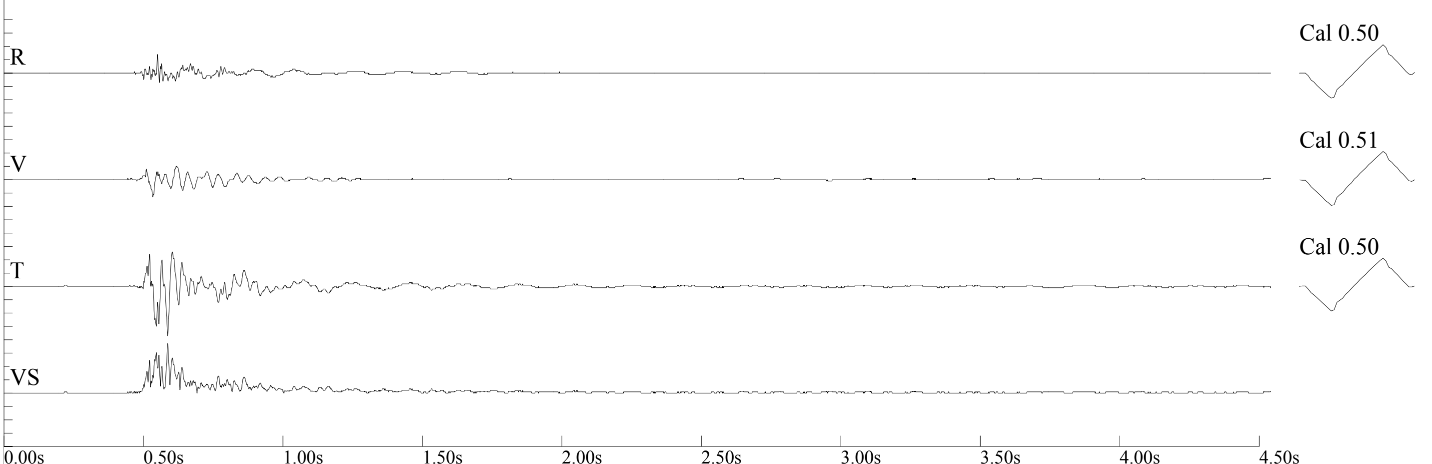
File Name: INTERIOR_WALL_BACK_SHUT014.DTB
Number: 014
Date: 3/19/2005
Time: 14:28
Serial Number: 1644
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

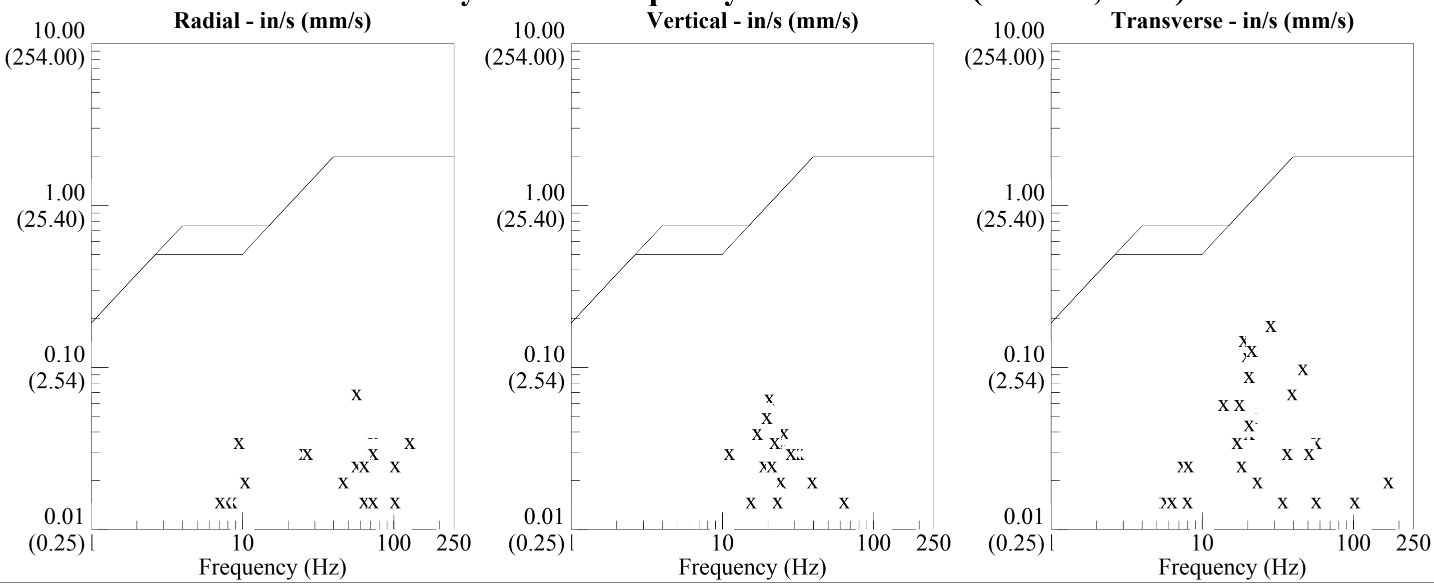
Radial: 0.07in/s 1.778mm/s @ 64.0Hz
Vertical: 0.065in/s 1.651mm/s @ 23.2Hz
***Transverse:* 0.185in/s 4.699mm/s @ 28.4Hz**
Vector Sum (VS): 0.185in/s 4.699mm/s
*Displacement:*0.002078in 0.052790mm
*Acceleration:*0.112629g's
*Calibration Date:*2/16/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
0.20in/s (0.050in/s/div) 5.08mm/s (1.270mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located On Interior Wall
Wall is not connected to wall with door
Back Door Shut with normal amount of force

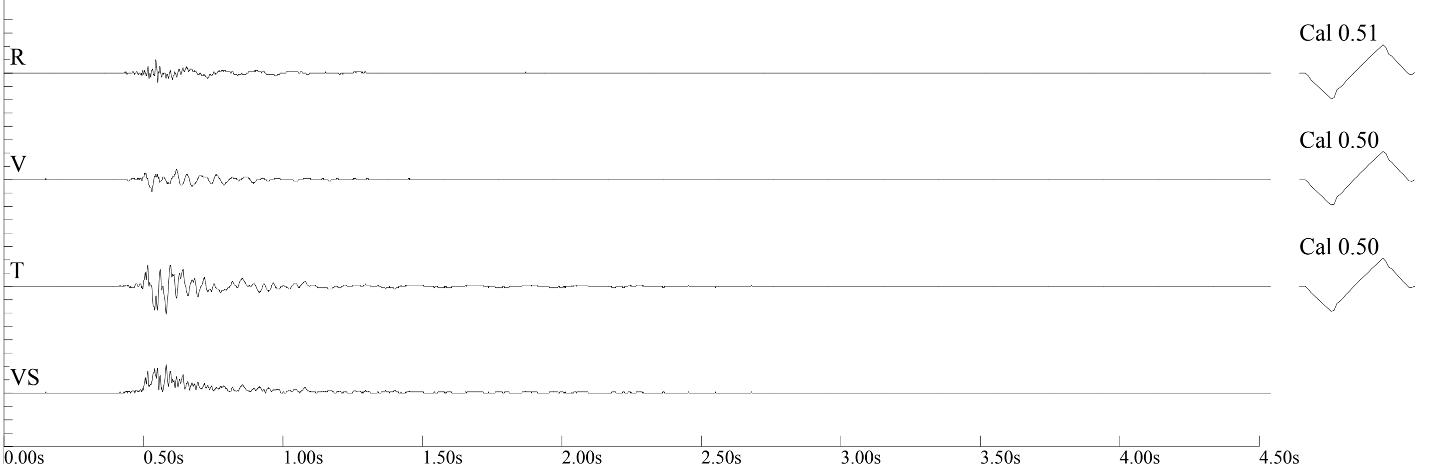
File Name: INTERIOR_WALL_BACK_SHUT015.DTB
Number: 015
Date: 3/19/2005
Time: 14:29
Serial Number: 1644
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

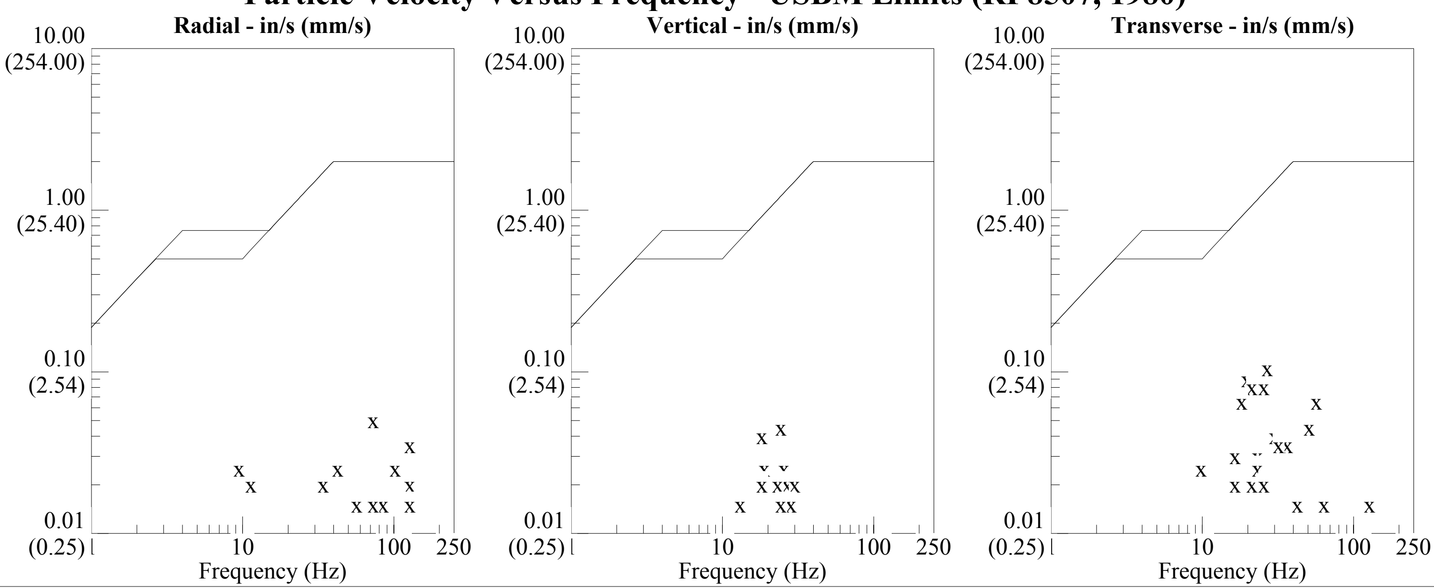
Radial: 0.05in/s 1.27mm/s @ 73.1Hz
Vertical: 0.045in/s 1.143mm/s @ 25.6Hz
***Transverse:* 0.105in/s 2.667mm/s @ 26.9Hz**
Vector Sum (VS): 0.105in/s 2.667mm/s
*Displacement:*0.001324in 0.033642mm
*Acceleration:*0.066253g's
*Calibration Date:*2/16/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
0.20in/s (0.050in/s/div) 5.08mm/s (1.270mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



TerraDinamica

Unit Located On Interior Wall **Wall is not connected to wall with door** **Back Door Shut with normal amount of force**	File Name: INTERIOR_WALL_BACK_SHUT016.DTB Number: 016 Date: 3/19/2005 Time: 14:30 Serial Number: 1644 Seismic Trigger: 0.0300 in/s 0.7620 mm/s Acoustic Trigger: 123 dB Sample Rate: 1024 Record Duration: 4.0 Seconds Pre-Trigger: 0.50 Seconds Sensor Gain: 2x Battery: 6.4

Amplitudes and Frequencies

Radial: 0.05in/s 1.27mm/s @ 64.0Hz

Vertical: 0.045in/s 1.143mm/s @ 25.6Hz

***Transverse:* 0.10in/s 2.54mm/s @ 26.9Hz**

Vector Sum (VS): 0.10in/s 2.54mm/s

*Displacement:*0.001307in 0.033207mm

*Acceleration:*0.072878g's

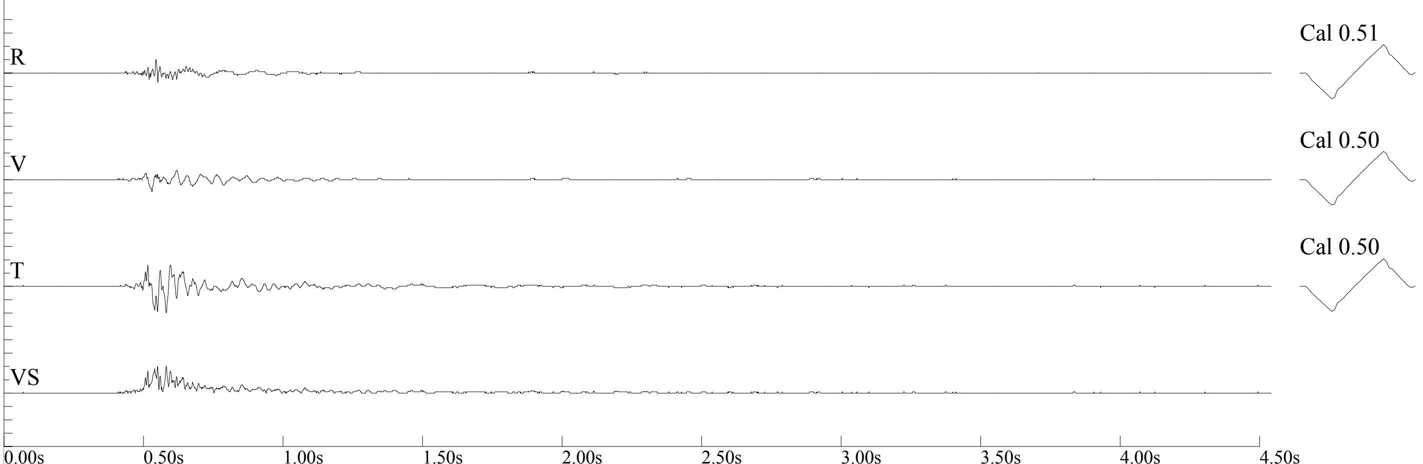
*Calibration Date:*2/16/2005

Graph Information

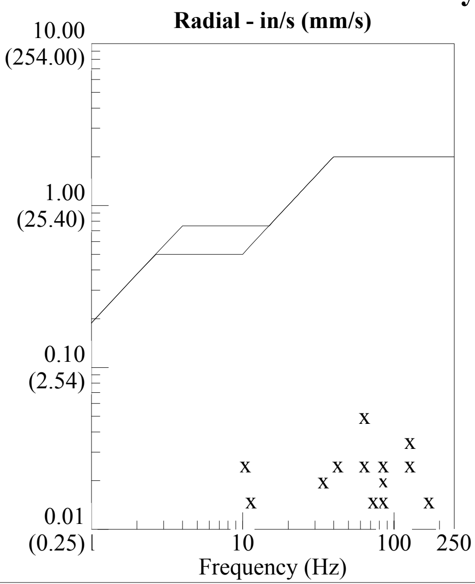
*Duration:*0.000s To: 4.500s

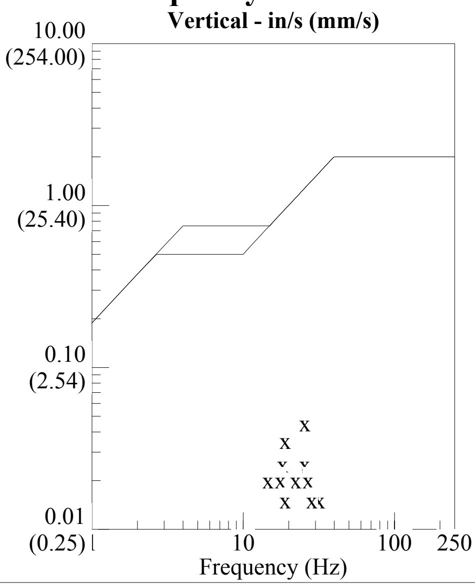
Seismic Scale:
0.20in/s (0.050in/s/div) 5.08mm/s (1.270mm/s/div)

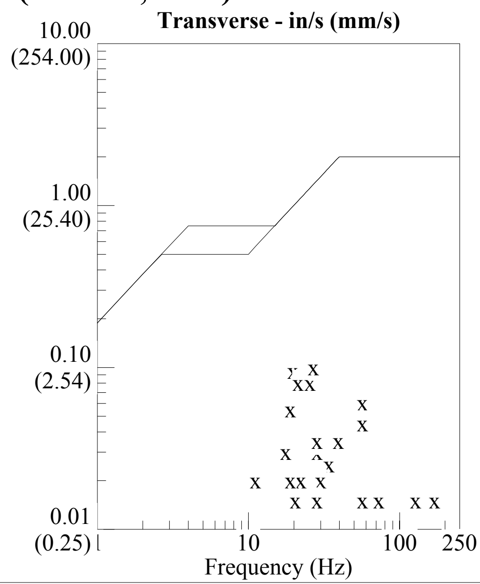
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)







Unit Located On Interior Wall
Wall is not connected to wall with door
Back Door Shut with normal amount of force

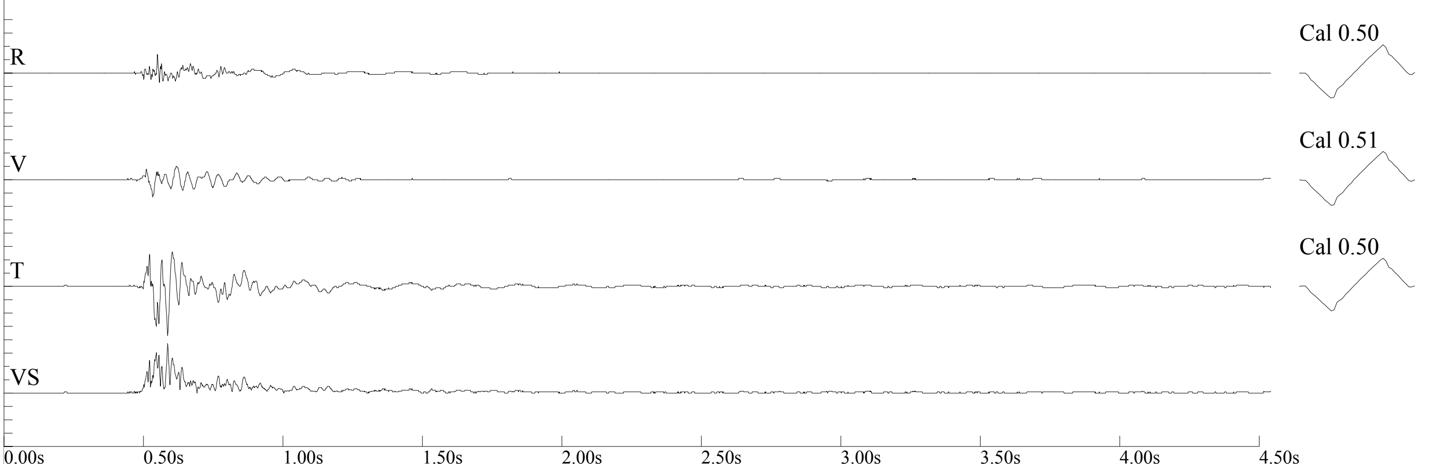
File Name: INTERIOR_WALL_BACK_SHUT014.DTB
Number: 014
Date: 3/19/2005
Time: 14:28
Serial Number: 1644
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

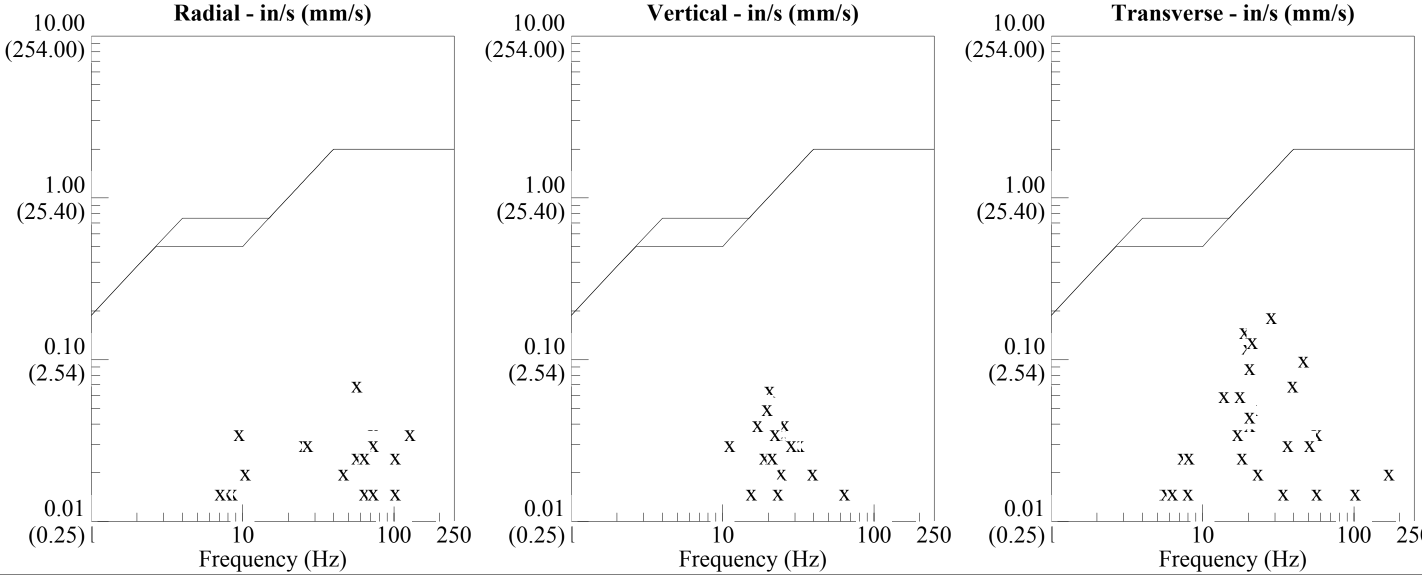
Radial: 0.07in/s 1.778mm/s @ 64.0Hz
Vertical: 0.065in/s 1.651mm/s @ 23.2Hz
***Transverse:* 0.185in/s 4.699mm/s @ 28.4Hz**
Vector Sum (VS): 0.185in/s 4.699mm/s
*Displacement:*0.002078in 0.052790mm
*Acceleration:*0.112629g's
*Calibration Date:*2/16/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
0.20in/s (0.050in/s/div) 5.08mm/s (1.270mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



TerraDinamica

Unit Located On Interior Wall
Wall is not connected to wall with door
Back Door Shut with normal amount of force

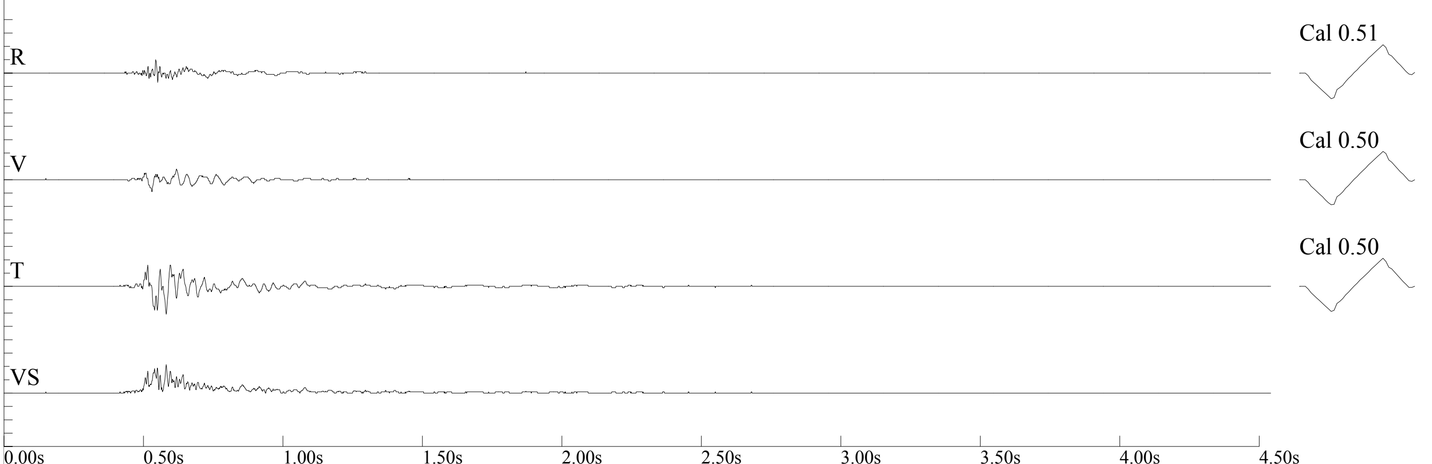
File Name: INTERIOR_WALL_BACK_SHUT015.DTB
Number: 015
Date: 3/19/2005
Time: 14:29
Serial Number: 1644
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

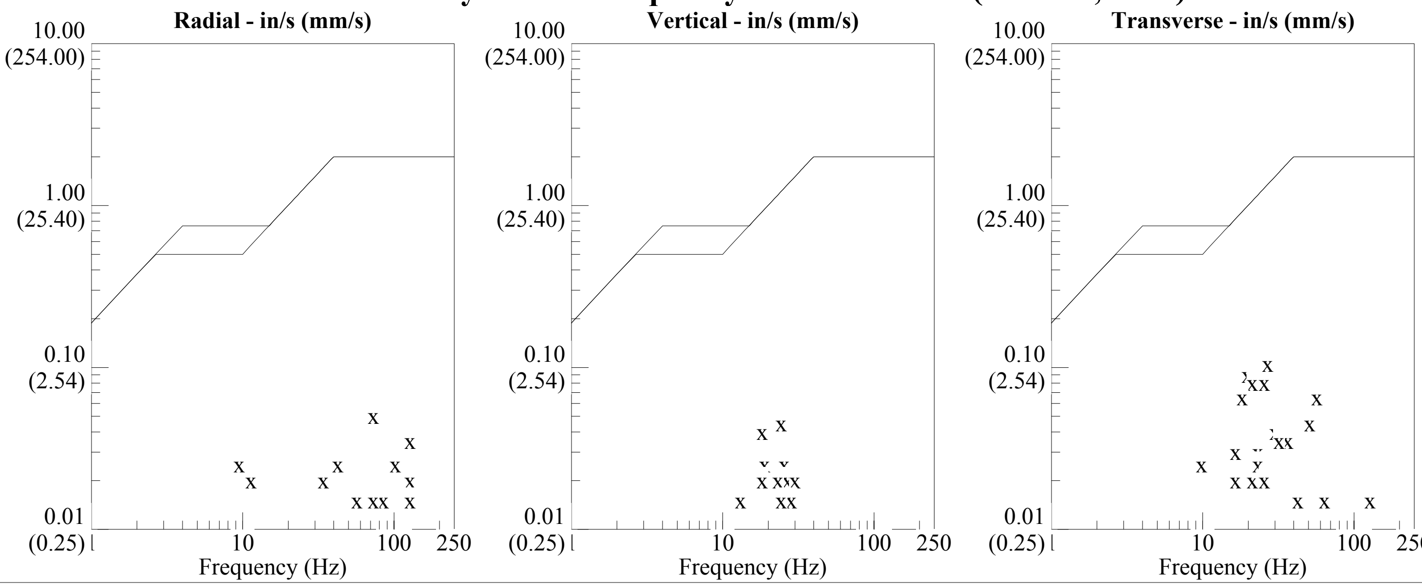
Radial: 0.05in/s 1.27mm/s @ 73.1Hz
Vertical: 0.045in/s 1.143mm/s @ 25.6Hz
Transverse: **0.105in/s 2.667mm/s @ 26.9Hz**
Vector Sum (VS): 0.105in/s 2.667mm/s
*Displacement:*0.001324in 0.033642mm
*Acceleration:*0.066253g's
*Calibration Date:*2/16/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
0.20in/s (0.050in/s/div) 5.08mm/s (1.270mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located On Interior Wall
Wall is not connected to wall with door
Back Door Shut with normal amount of force

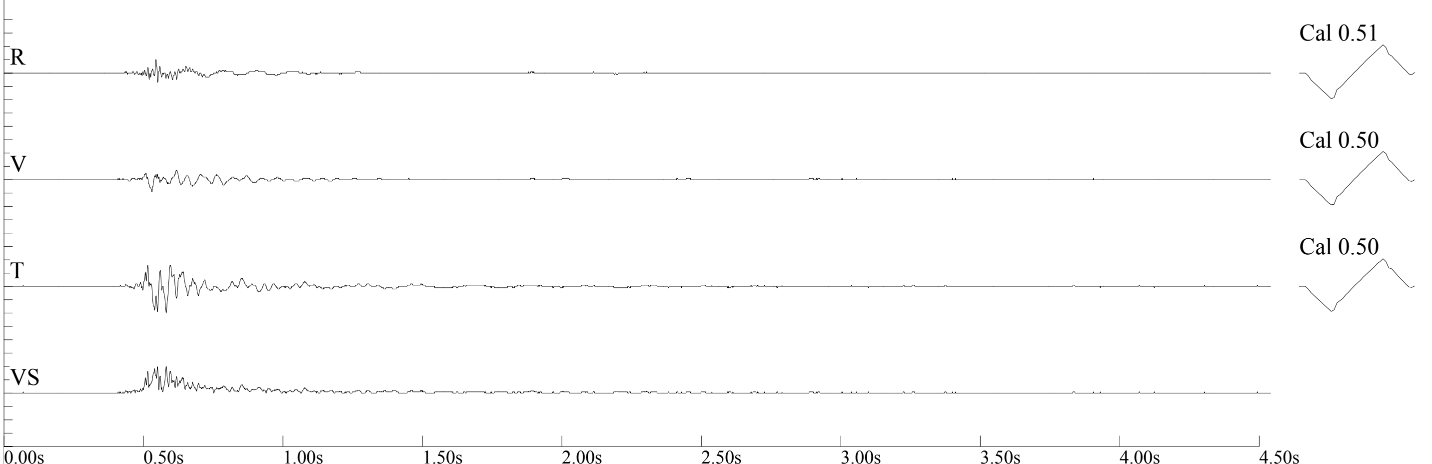
File Name: INTERIOR_WALL_BACK_SHUT016.DTB
Number: 016
Date: 3/19/2005
Time: 14:30
Serial Number: 1644
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

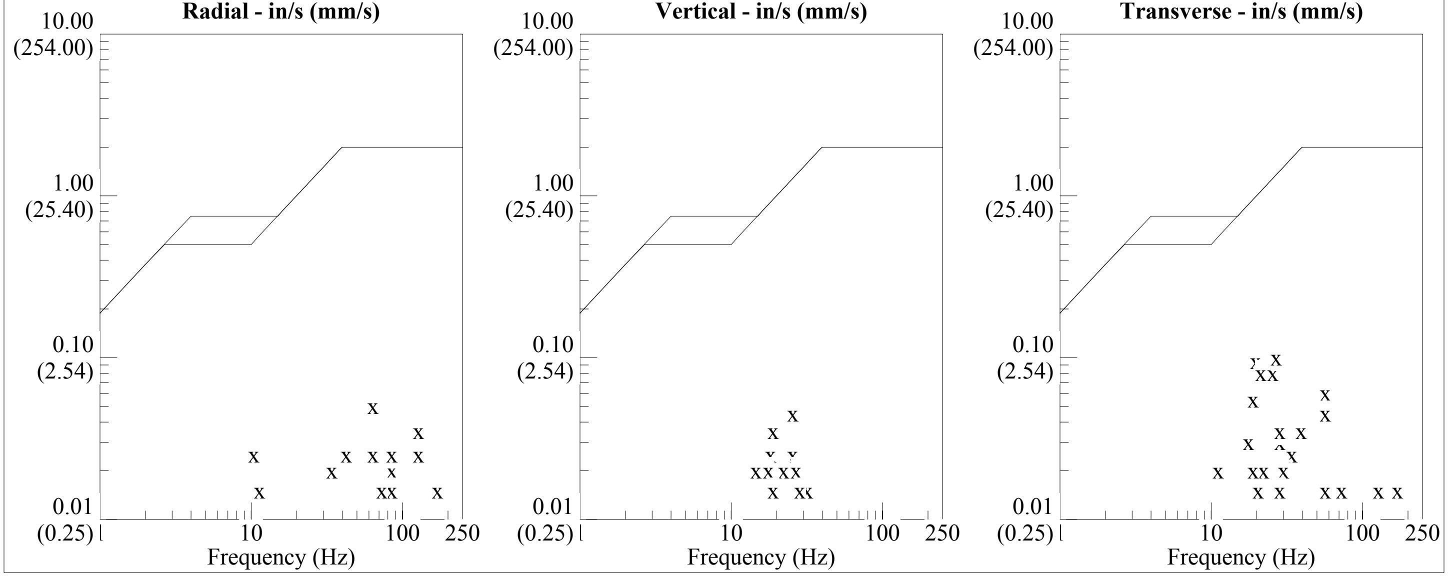
Radial: 0.05in/s 1.27mm/s @ 64.0Hz
Vertical: 0.045in/s 1.143mm/s @ 25.6Hz
***Transverse:* 0.10in/s 2.54mm/s @ 26.9Hz**
Vector Sum (VS): 0.10in/s 2.54mm/s
*Displacement:*0.001307in 0.033207mm
*Acceleration:*0.072878g's
*Calibration Date:*2/16/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
0.20in/s (0.050in/s/div) 5.08mm/s (1.270mm/s/div)
*Time Line Intervals at:*0.50 s

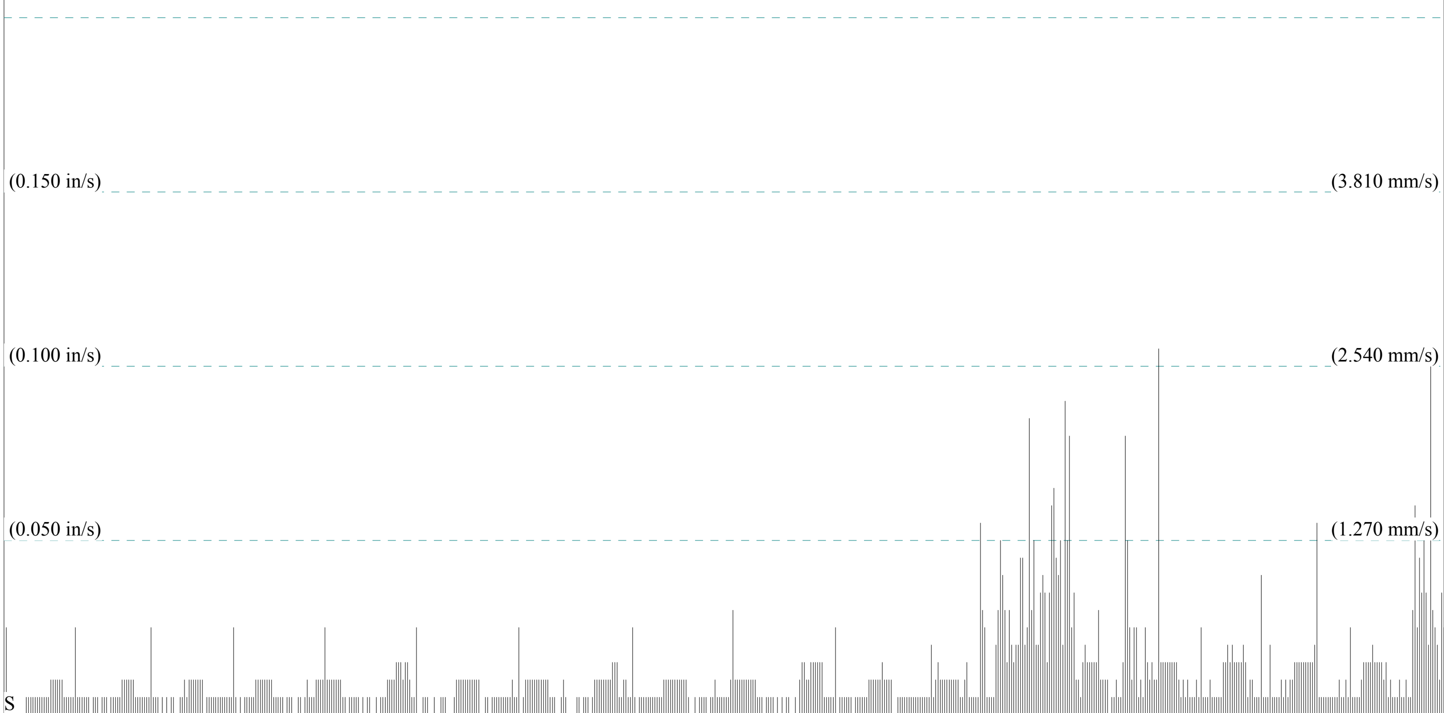


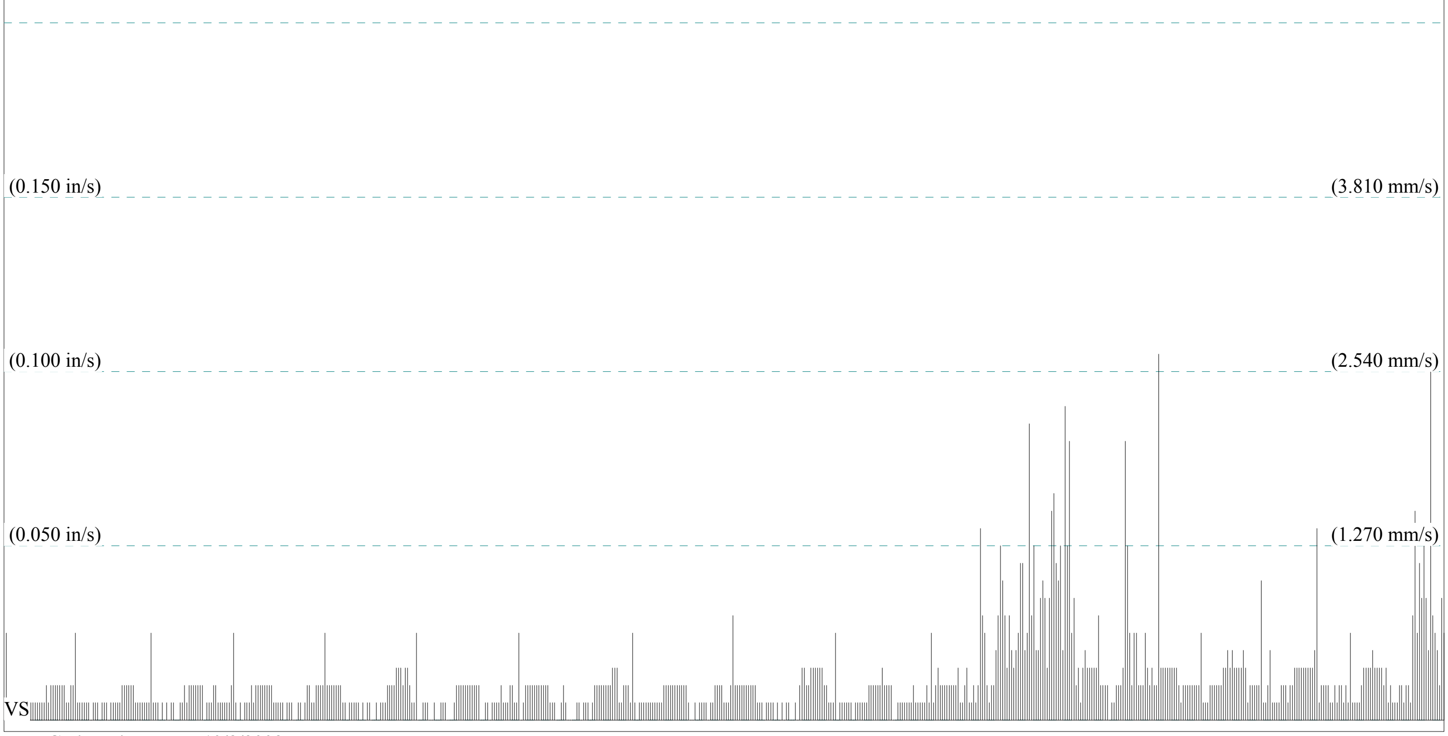
Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



File: INTERIOR WALL002.BAR   Job Number: 002   Date Range: 3/22/2005 - 3/22/2005   Time Range: 00:00 - 10:46   Serial Number: 1644

Peak Amplitudes *Seismic (S):* 0.1050in/s 2.667mm/s *Vector Sum (VS):* 0.1050in/s 2.667mm/s
Graph Information *Duration:* 0.0 hr to 10.8 hr *Seismic Scale:* 0.20 in/s 5.08 mm/s
Bar Information *Bar Sample Interval:* 1 Minute *Total Bar Samples:* 646 *Number of Bar Samples Shown:* 646

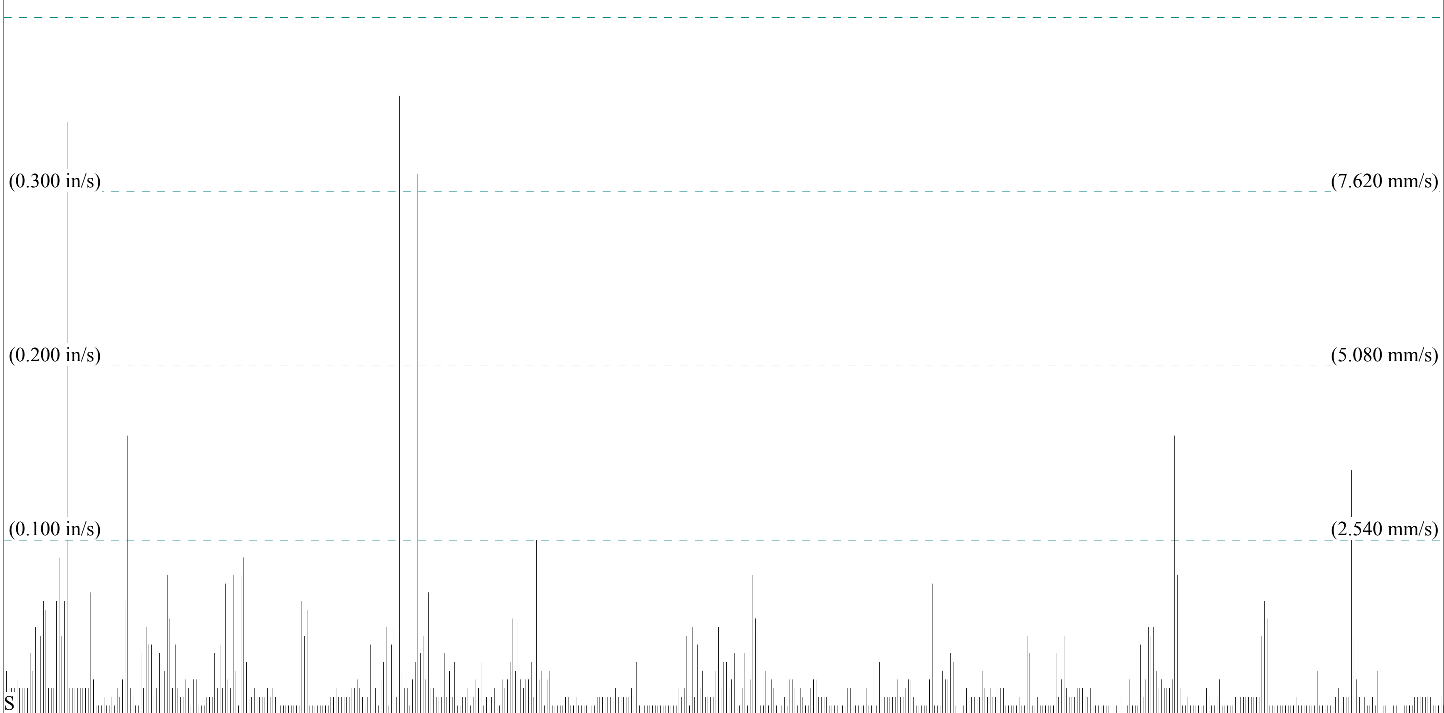


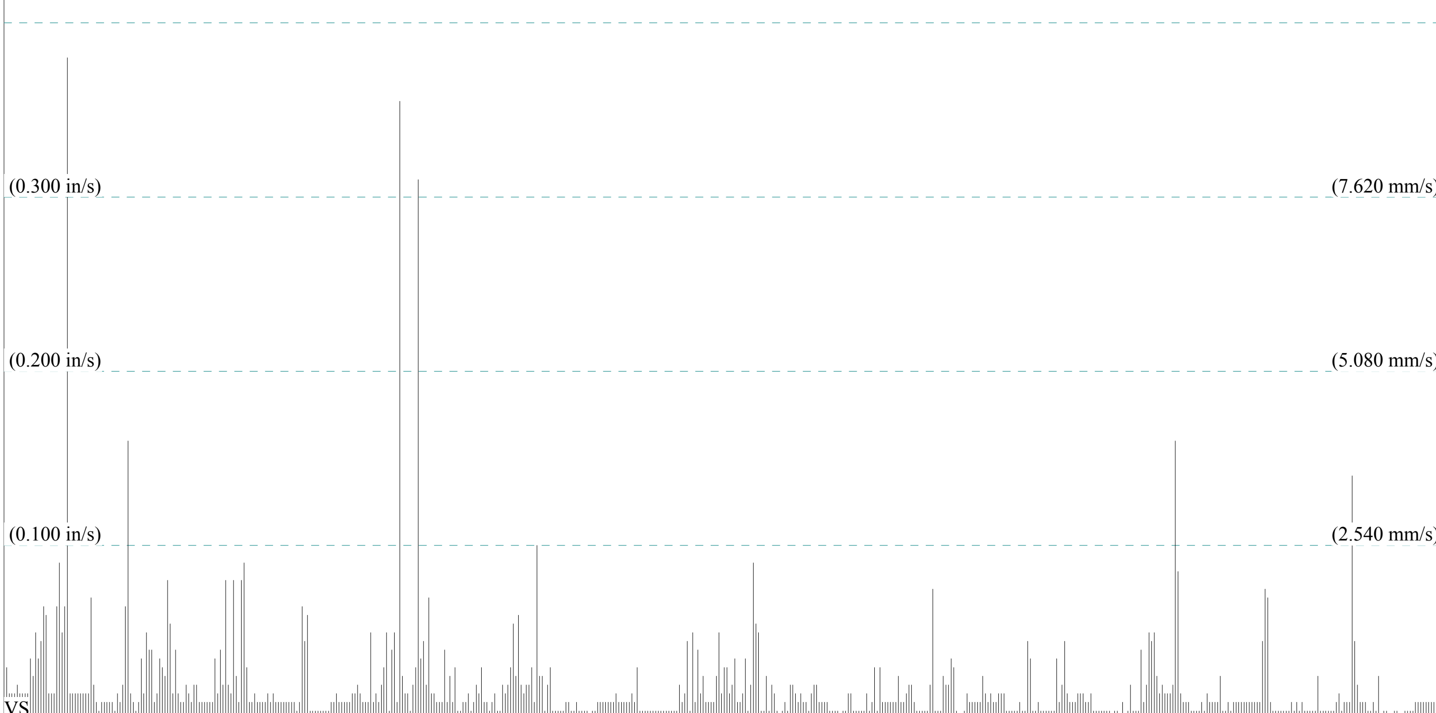


Last Calibration Date: 10/3/2003

File: INTERIOR WALL001.BAR Job Number: 001 Date Range: 3/21/2005 - 3/22/2005 Time Range: 14:55 - 00:00 Serial Number: 1644

Peak Amplitudes *Seismic (S):* 0.3550in/s 9.017mm/s *Vector Sum (VS):* 0.3800in/s 9.652mm/s
Graph Information *Duration:* 0.0 hr to 9.1 hr *Seismic Scale:* 0.40 in/s 10.16 mm/s
Bar Information *Bar Sample Interval:* 1 Minute *Total Bar Samples:* 546 *Number of Bar Samples Shown:* 546





Last Calibration Date: 10/3/2003

Unit Located Above Door
Door Slammed

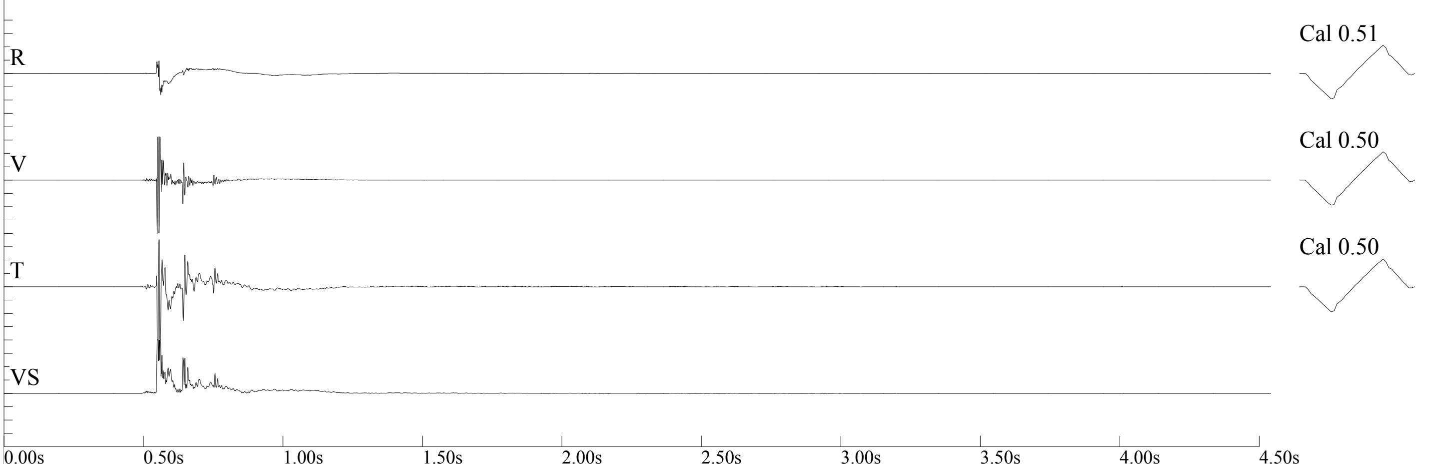
File Name: ABOVE-DOOR_SLAM011.DTB
Number: 011
Date: 3/19/2005
Time: 14:00
Serial Number: 1644
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

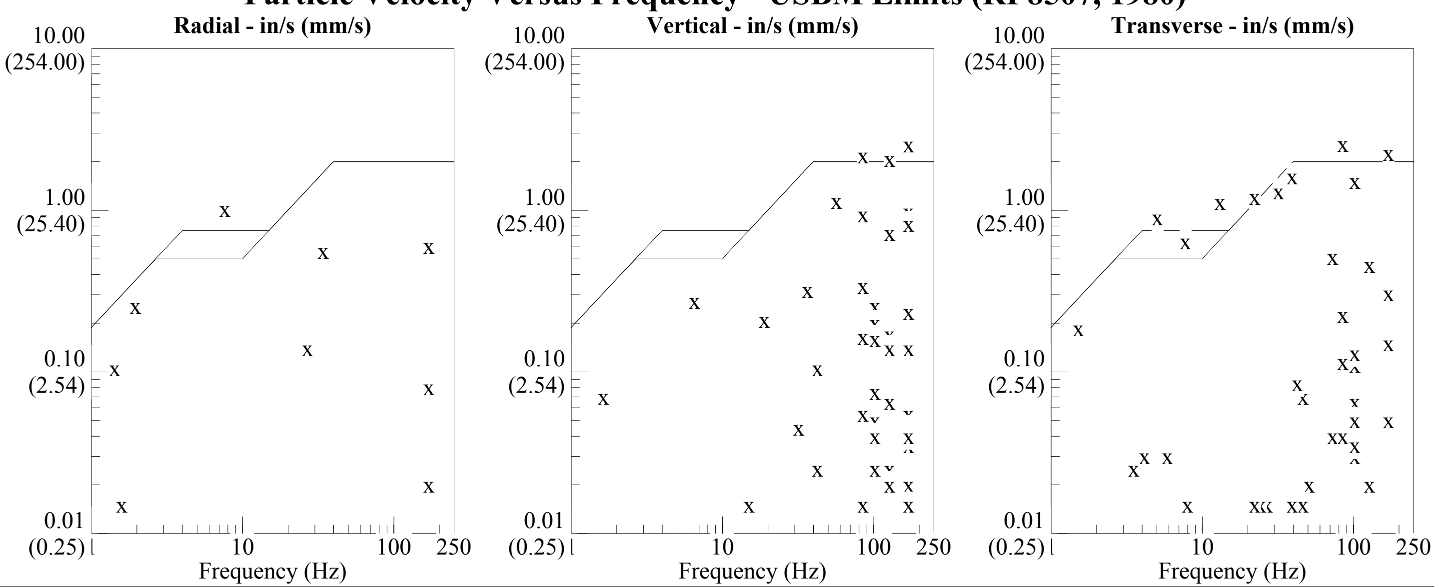
Radial: 1.02in/s 25.908mm/s @ 7.6Hz
***Vertical:* 2.56in/s 65.024mm/s @ 170.6Hz**
***Transverse:* 2.56in/s 65.024mm/s @ 85.3Hz**
Vector Sum (VS): 3.635in/s 92.329mm/s
Displacement: 0.022368in 0.568137mm
Acceleration: 6.333747g's
Calibration Date: 2/16/2005

Graph Information

Duration: 0.000s To: 4.500s
Seismic Scale:
2.56in/s (0.640in/s/div) 65.02mm/s (16.256mm/s/div)
Time Line Intervals at: 0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located Above Door
Door Slammed

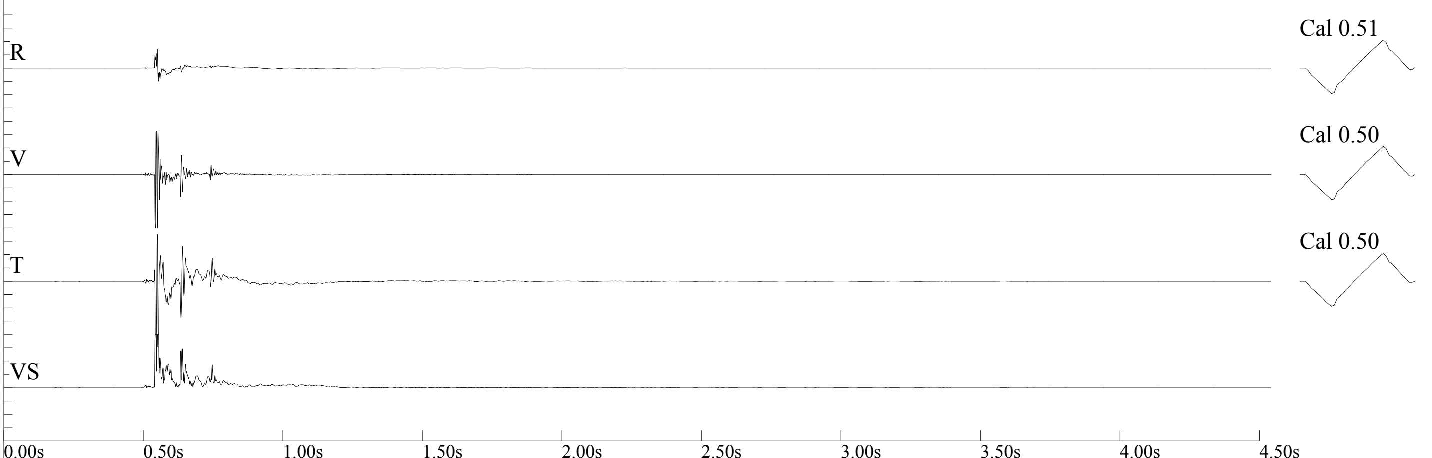
File Name: ABOVE-DOOR_SLAM012.DTB
Number: 012
Date: 3/19/2005
Time: 14:00
Serial Number: 1644
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

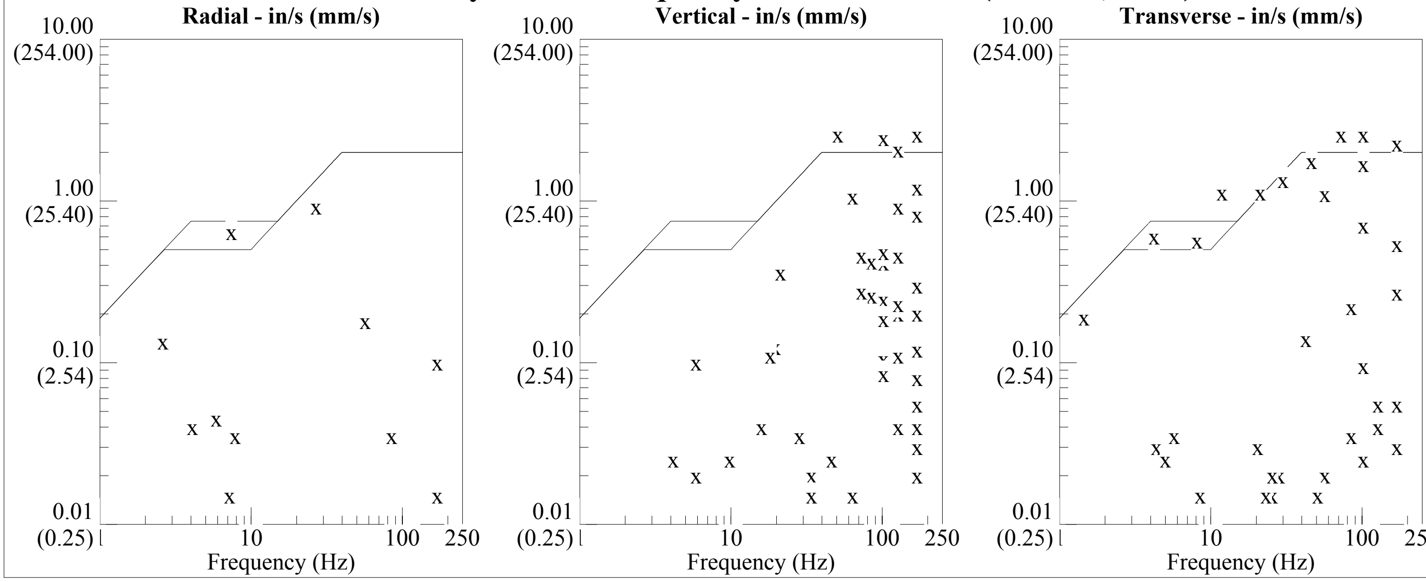
Radial: 0.92in/s 23.368mm/s @ 32.0Hz
***Vertical:* 2.56in/s 65.024mm/s @ 128.0Hz**
***Transverse:* 2.56in/s 65.024mm/s @ 73.1Hz**
Vector Sum (VS): 3.65in/s 92.71mm/s
*Displacement:*0.022755in 0.577969mm
*Acceleration:*6.307246g's
*Calibration Date:*2/16/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
2.56in/s (0.640in/s/div) 65.02mm/s (16.256mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located Above Door
Door Slammed

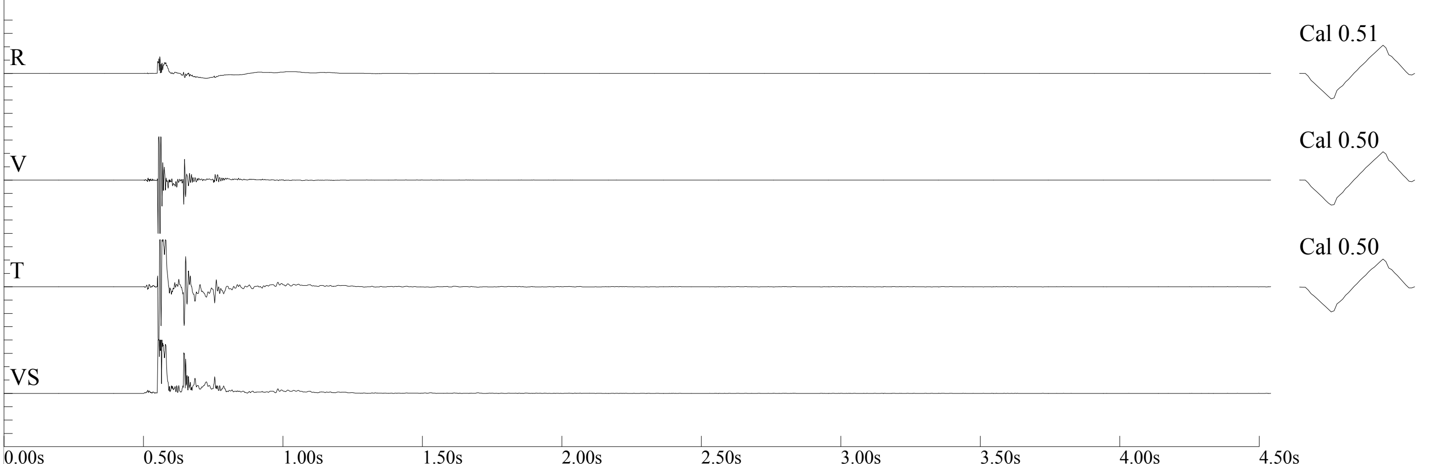
File Name: ABOVE-DOOR_SLAM013.DTB
Number: 013
Date: 3/19/2005
Time: 14:00
Serial Number: 1644
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

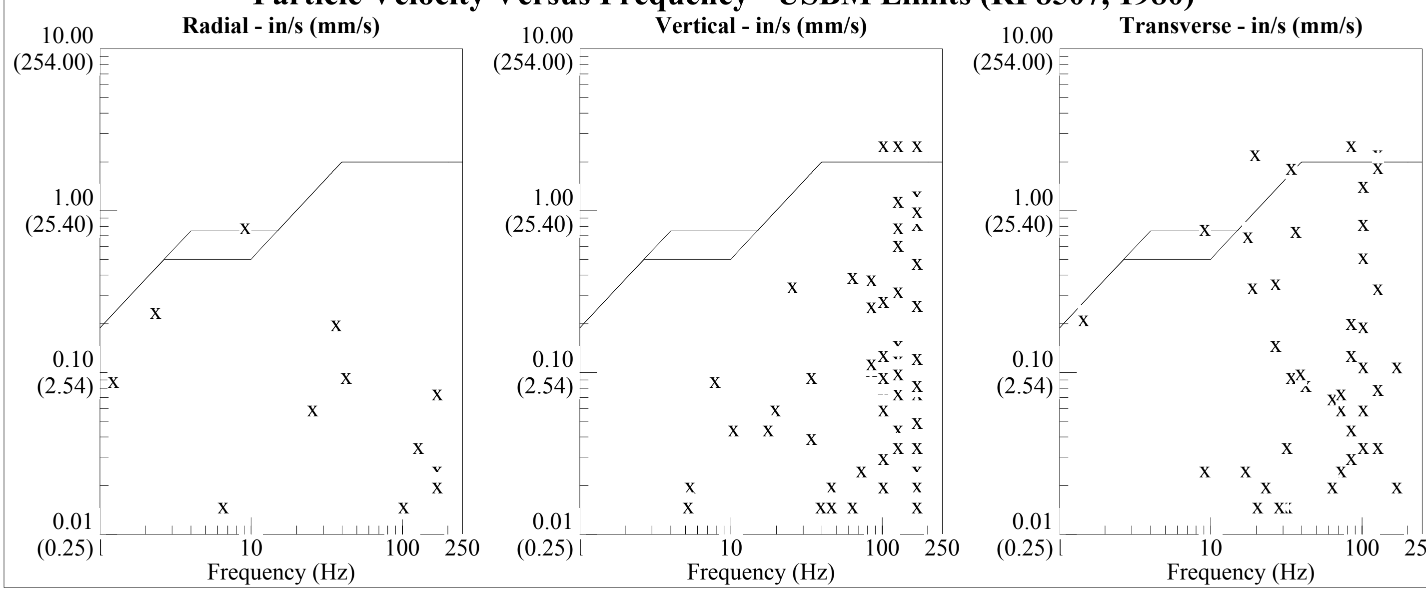
Radial: 0.80in/s 20.32mm/s @ 10.2Hz
***Vertical:* 2.56in/s 65.024mm/s @ 170.6Hz**
***Transverse:* 2.56in/s 65.024mm/s @ 85.3Hz**
Vector Sum (VS): 3.655in/s 92.837mm/s
*Displacement:*0.021725in 0.551821mm
*Acceleration:*6.333747g's
*Calibration Date:*2/16/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
2.56in/s (0.640in/s/div) 65.02mm/s (16.256mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



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Unit Located Above Door
Door Slammed

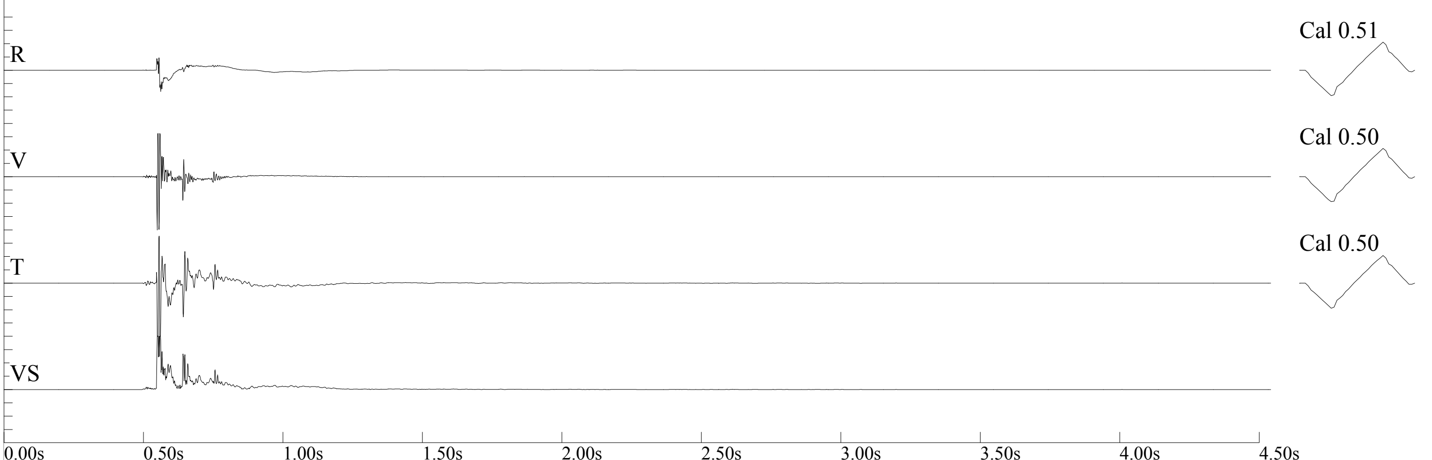
File Name: ABOVE-DOOR_SLAM011.DTB
Number: 011
Date: 3/19/2005
Time: 14:00
Serial Number: 1644
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

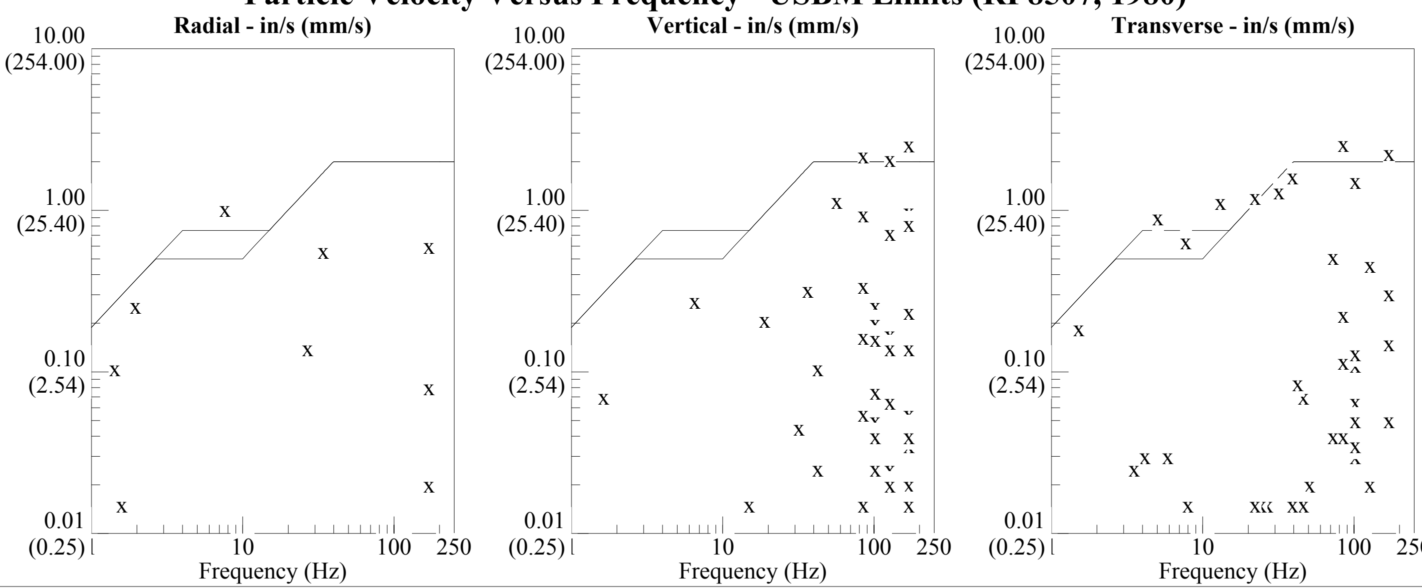
Radial: 1.02in/s 25.908mm/s @ 7.6Hz
***Vertical:* 2.56in/s 65.024mm/s @ 170.6Hz**
***Transverse:* 2.56in/s 65.024mm/s @ 85.3Hz**
Vector Sum (VS): 3.635in/s 92.329mm/s
*Displacement:*0.022368in 0.568137mm
*Acceleration:*6.333747g's
*Calibration Date:*2/16/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
2.56in/s (0.640in/s/div) 65.02mm/s (16.256mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located Above Door
Door Slammed

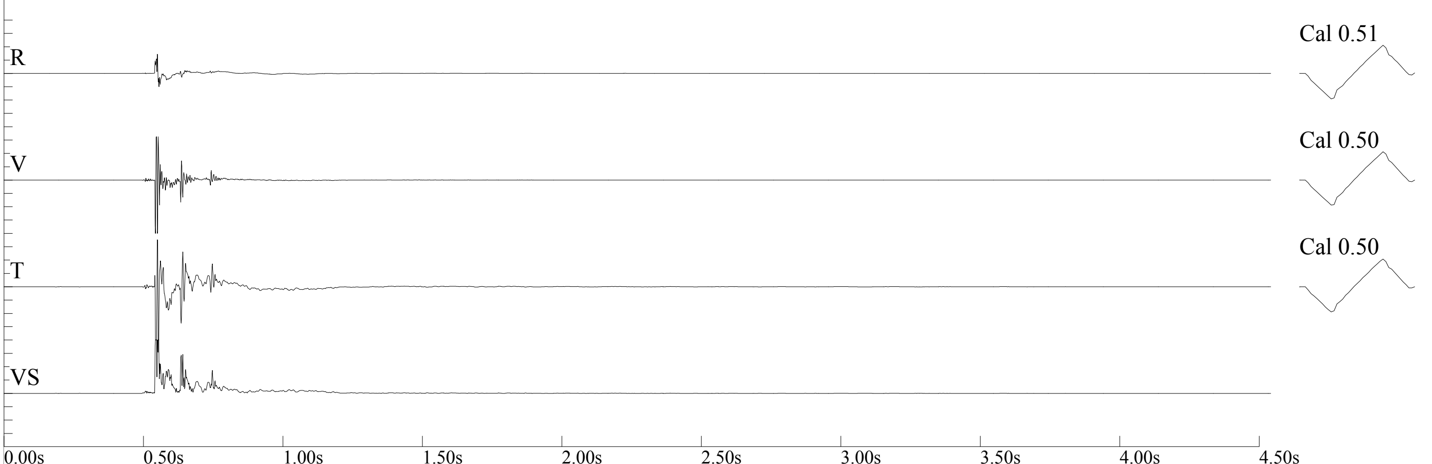
File Name: ABOVE-DOOR_SLAM012.DTB
Number: 012
Date: 3/19/2005
Time: 14:00
Serial Number: 1644
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

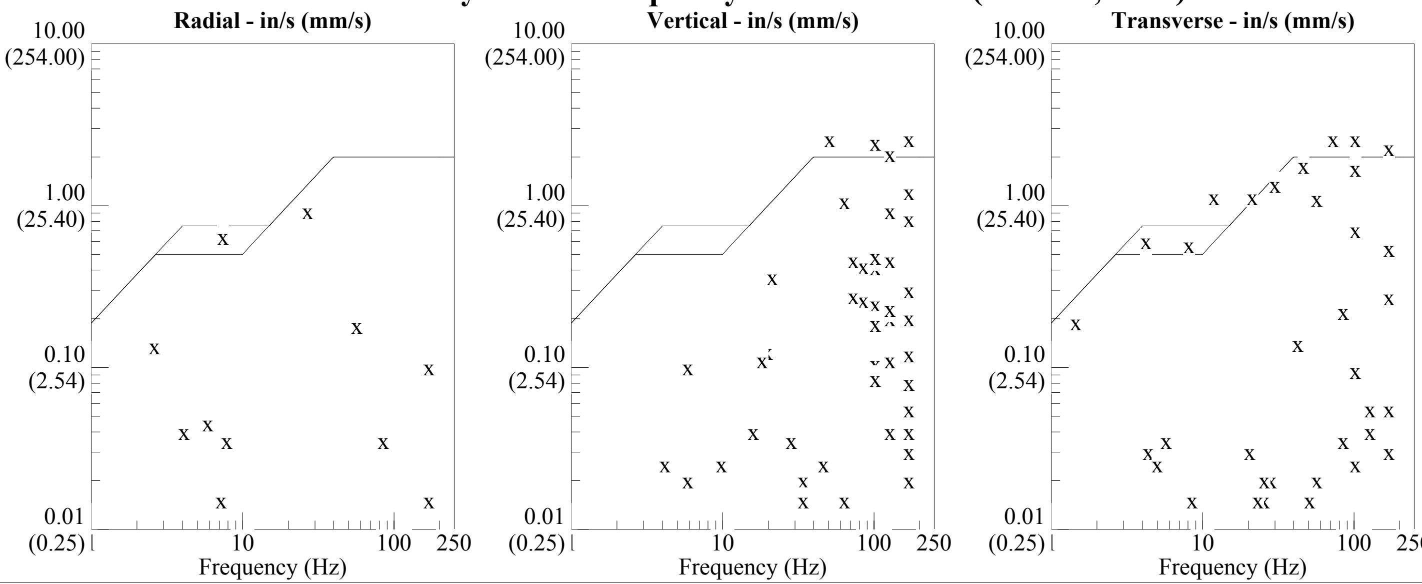
Radial: 0.92in/s 23.368mm/s @ 32.0Hz
***Vertical:* 2.56in/s 65.024mm/s @ 128.0Hz**
***Transverse:* 2.56in/s 65.024mm/s @ 73.1Hz**
Vector Sum (VS): 3.65in/s 92.71mm/s
*Displacement:*0.022755in 0.577969mm
*Acceleration:*6.307246g's
*Calibration Date:*2/16/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
2.56in/s (0.640in/s/div) 65.02mm/s (16.256mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located Above Door
Door Slammed

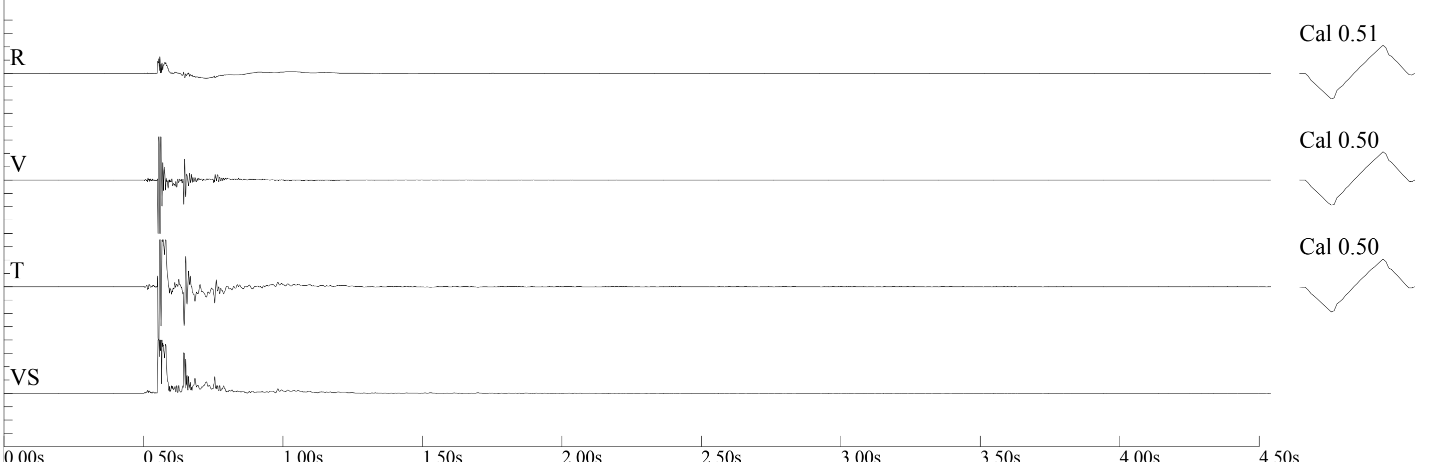
File Name: ABOVE-DOOR_SLAM013.DTB
Number: 013
Date: 3/19/2005
Time: 14:00
Serial Number: 1644
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

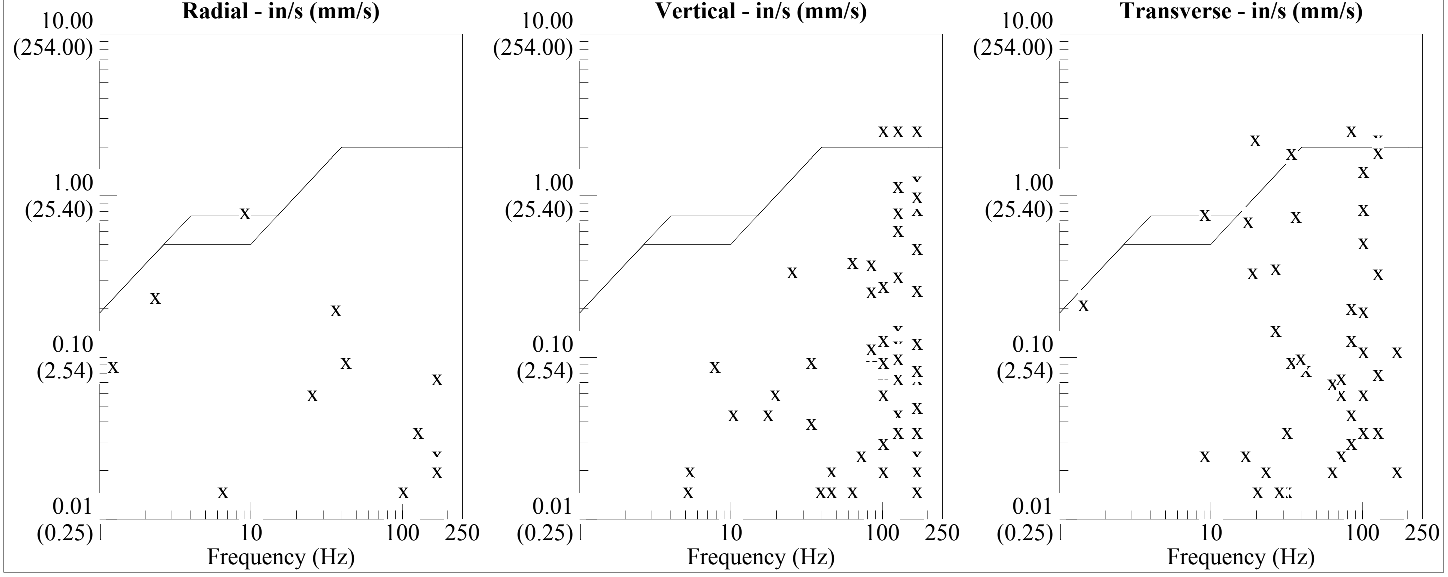
Radial: 0.80in/s 20.32mm/s @ 10.2Hz
***Vertical:* 2.56in/s 65.024mm/s @ 170.6Hz**
***Transverse:* 2.56in/s 65.024mm/s @ 85.3Hz**
Vector Sum (VS): 3.655in/s 92.837mm/s
*Displacement:*0.021725in 0.551821mm
*Acceleration:*6.333747g's
*Calibration Date:*2/16/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
2.56in/s (0.640in/s/div) 65.02mm/s (16.256mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



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Unit Located on Floor 6 inches from Door
Door Slammed

File Name: DOOR_SLAM003.DTB
Number: 003
Date: 3/19/2005
Time: 13:18
Serial Number: 1644
Seismic Trigger: 0.0250 in/s 0.6350 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

Radial: 0.115in/s 2.921mm/s @ 85.3Hz

***Vertical:* 0.265in/s 6.731mm/s @ 64.0Hz**

Transverse: 0.04in/s 1.016mm/s @ 10.8Hz

Vector Sum (VS): 0.27in/s 6.858mm/s

*Displacement:*0.001066in 0.027082mm

*Acceleration:*0.430642g's

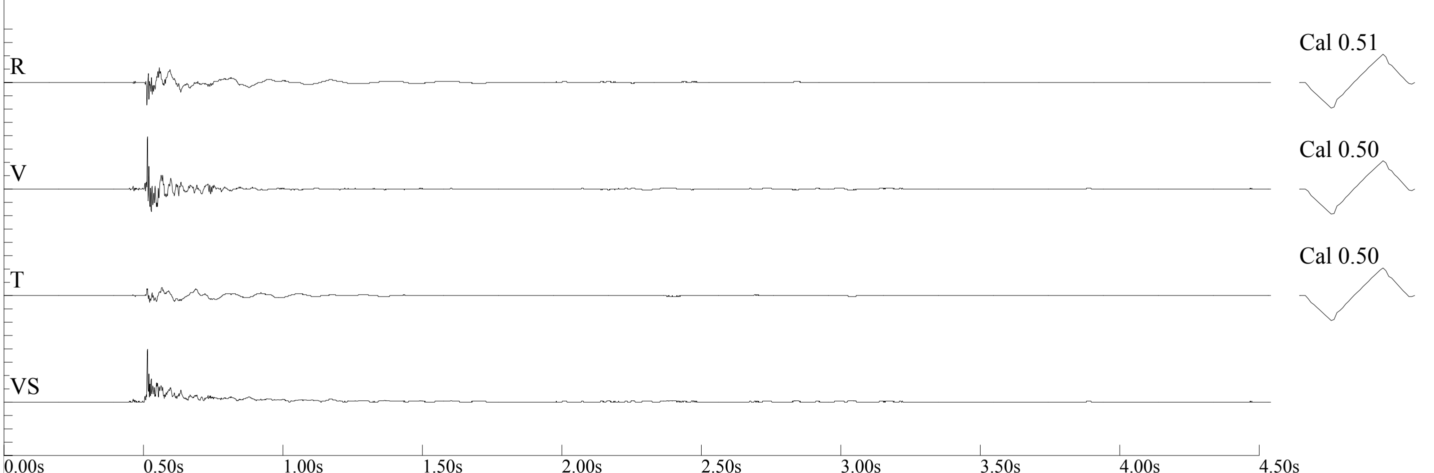
*Calibration Date:*2/16/2005

Graph Information

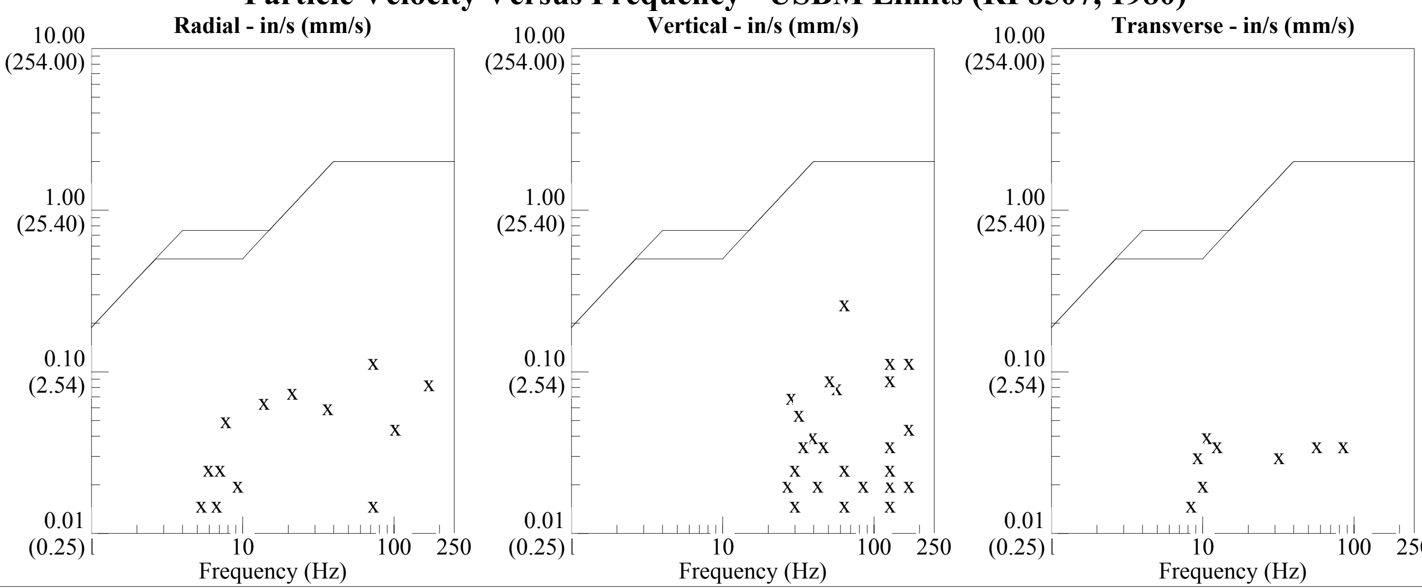
*Duration:*0.000s To: 4.500s

Seismic Scale:
0.27in/s (0.068in/s/div) 6.86mm/s (1.715mm/s/div)

*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located on Floor 6 inches from Door
Door Slammed

File Name: DOOR_SLAM006.DTB
Number: 006
Date: 3/19/2005
Time: 13:19
Serial Number: 1644
Seismic Trigger: 0.0250 in/s 0.6350 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

Radial: 0.145in/s 3.683mm/s @ 102.4Hz

***Vertical:* 0.315in/s 8.001mm/s @ 85.3Hz**

Transverse: 0.04in/s 1.016mm/s @ 256.0Hz

Vector Sum (VS): 0.32in/s 8.128mm/s

*Displacement:*0.000976in 0.024778mm

*Acceleration:*0.457143g's

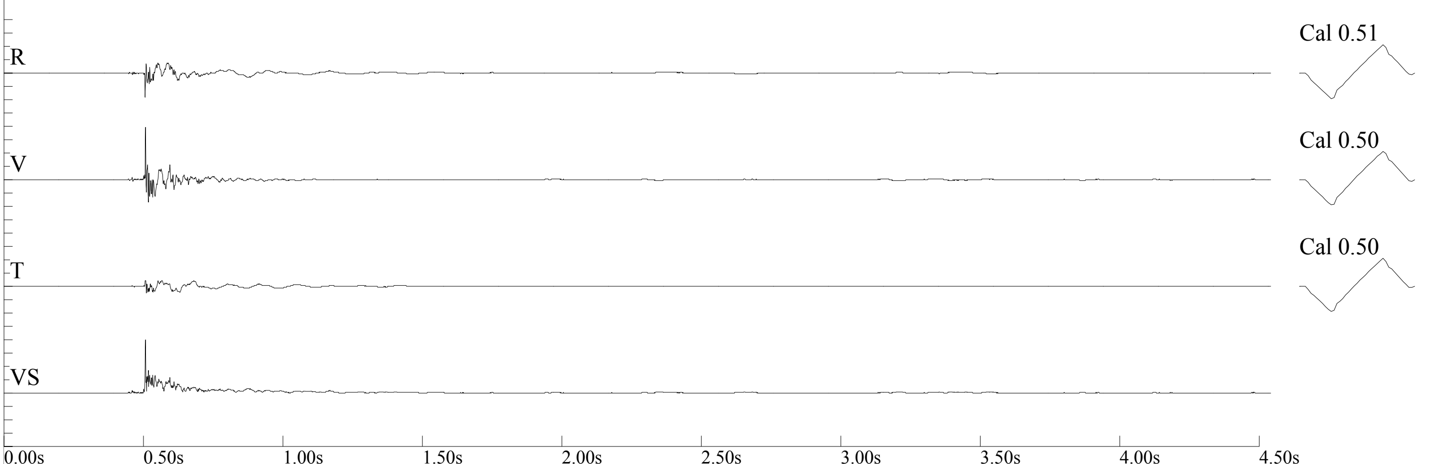
*Calibration Date:*2/16/2005

Graph Information

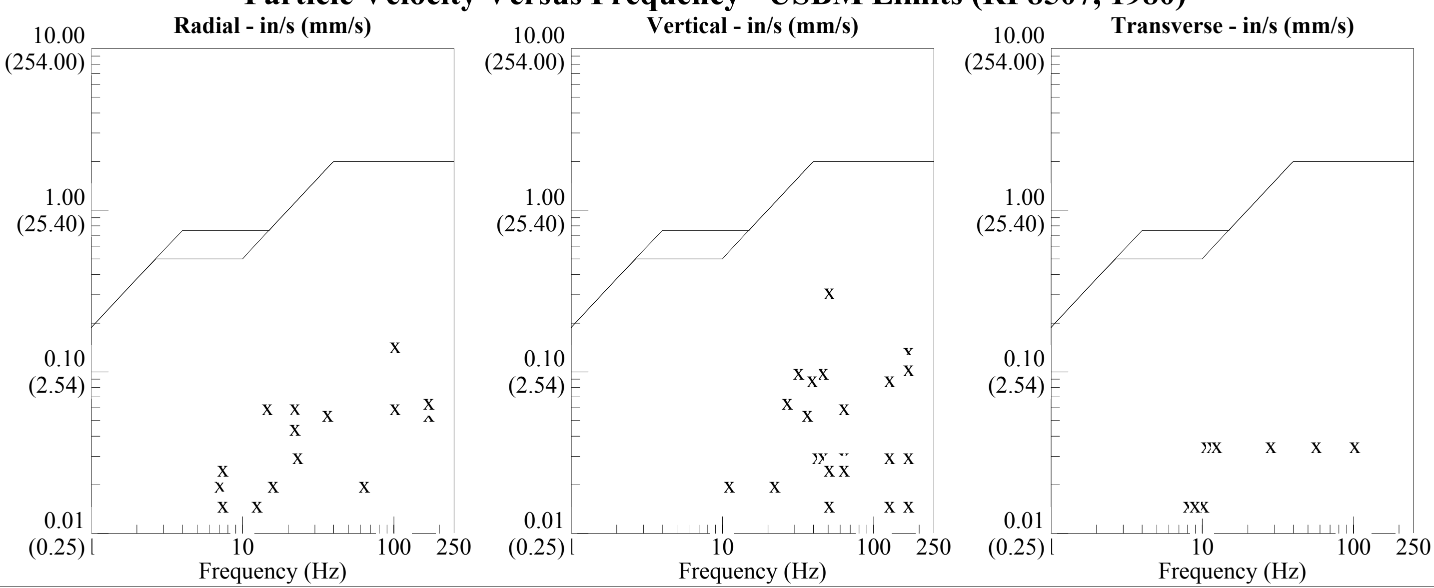
*Duration:*0.000s To: 4.500s

Seismic Scale:
0.32in/s (0.080in/s/div) 8.13mm/s (2.032mm/s/div)

*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located on Floor 6 inches from Door
Door Slammed

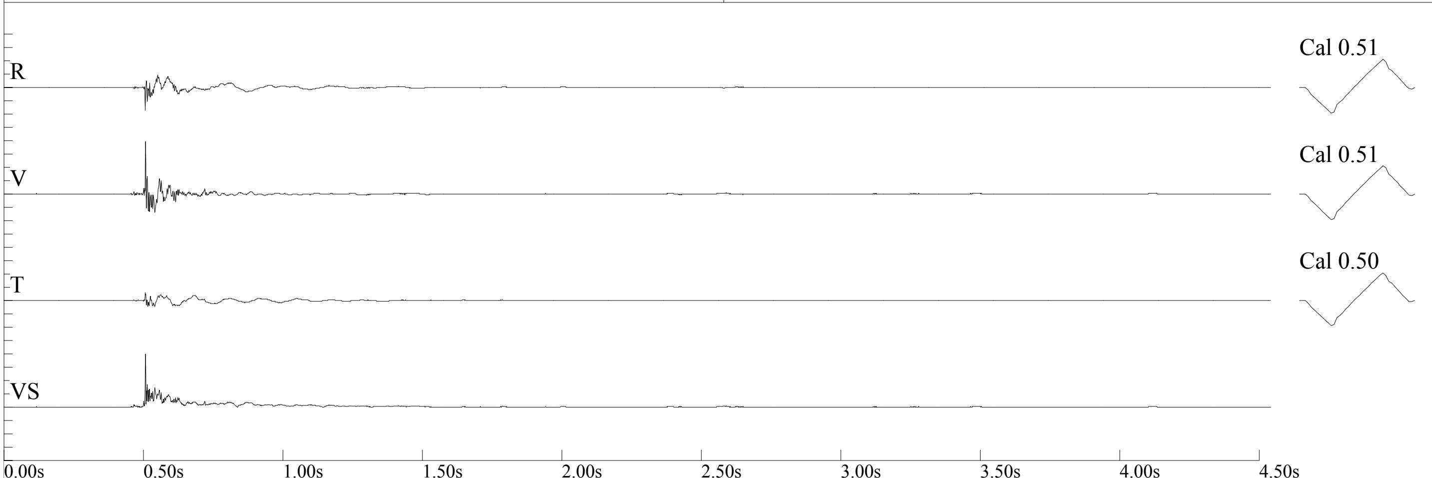
File Name: DOOR_SLAM005.DTB
Number: 005
Date: 3/19/2005
Time: 13:18
Serial Number: 1644
Seismic Trigger: 0.0250 in/s 0.6350 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

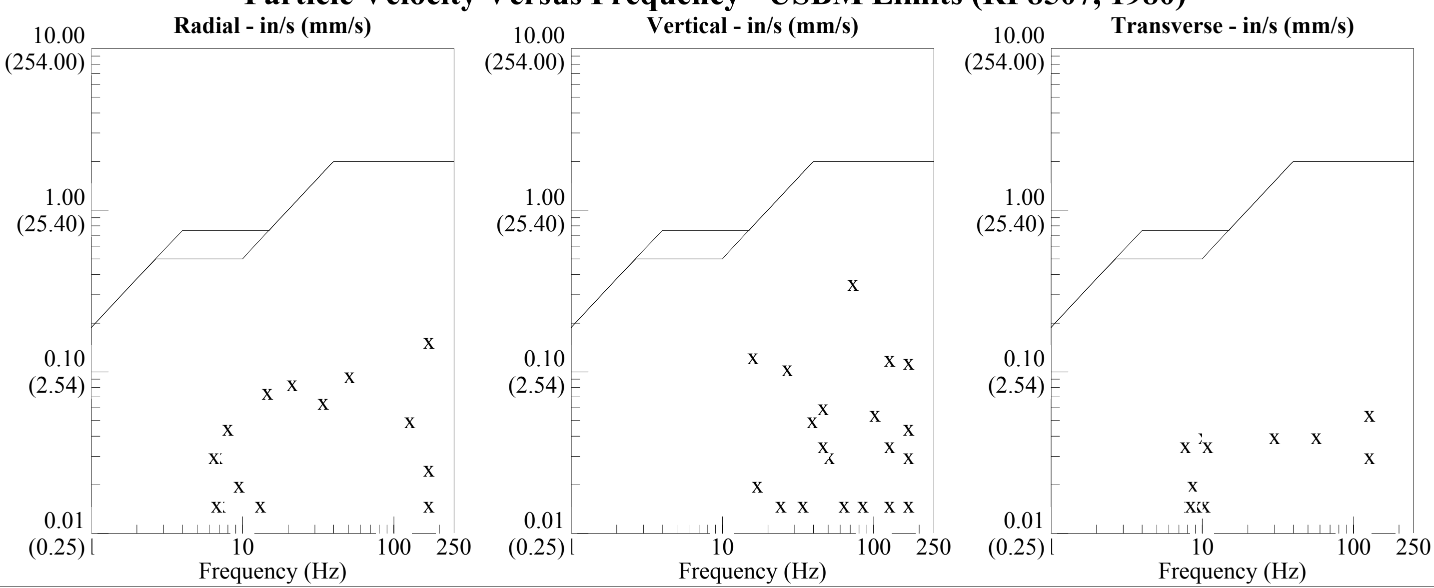
Radial: 0.155in/s 3.937mm/s @ 170.6Hz
***Vertical:* 0.355in/s 9.017mm/s @ 85.3Hz**
Transverse: 0.055in/s 1.397mm/s @ 128.0Hz
Vector Sum (VS): 0.36in/s 9.144mm/s
*Displacement:*0.001225in 0.031111mm
*Acceleration:*0.463768g's
*Calibration Date:*2/16/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
0.36in/s (0.090in/s/div) 9.14mm/s (2.286mm/s/div)
*Time Line Intervals at:*0.50 s

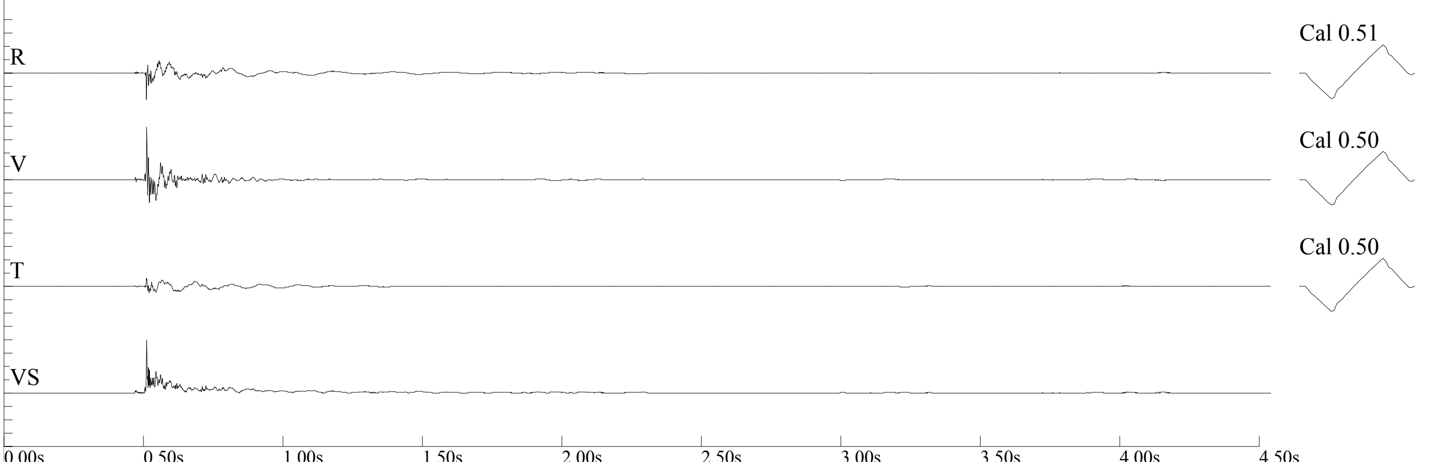


Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)

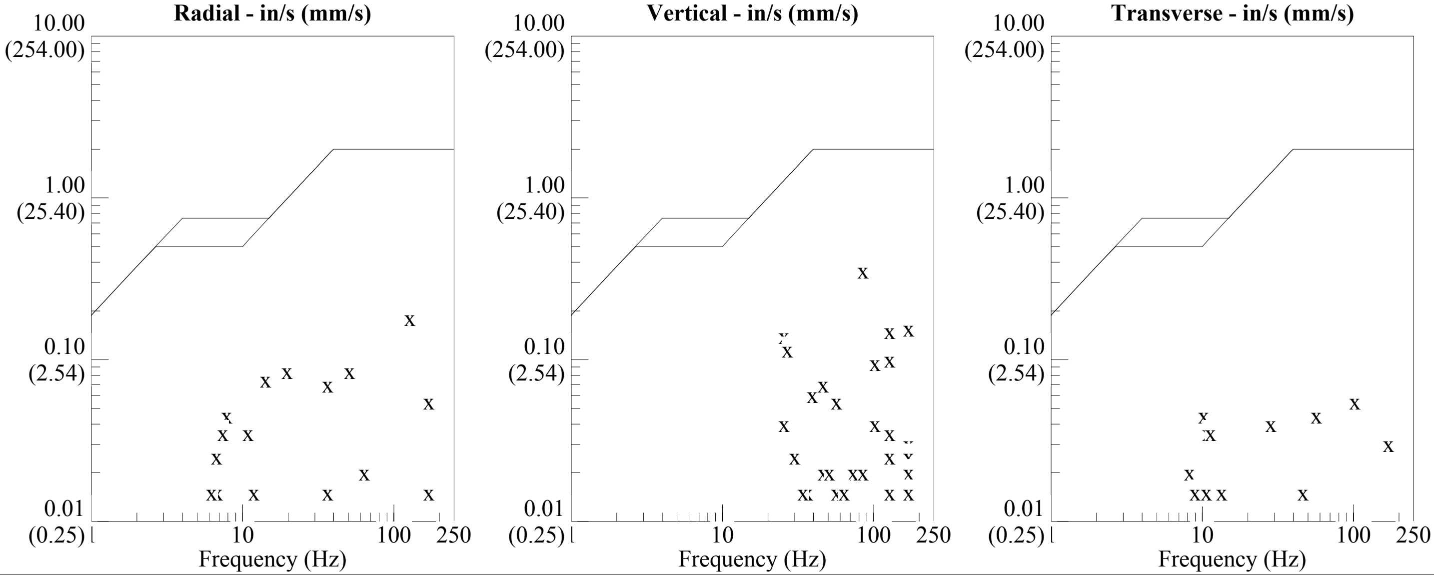


Unit Located on Floor 6 inches from Door **Door Slammed**	File Name: DOOR_SLAM004.DTB Number: 004 Date: 3/19/2005 Time: 13:18 Serial Number: 1644 Seismic Trigger: 0.0250 in/s 0.6350 mm/s Acoustic Trigger: 123 dB Sample Rate: 1024 Record Duration: 4.0 Seconds Pre-Trigger: 0.50 Seconds Sensor Gain: 2x Battery: 6.4

Amplitudes and Frequencies	Graph Information
Radial: 0.18in/s 4.572mm/s @ 128.0Hz ***Vertical:* 0.355in/s 9.017mm/s @ 85.3Hz** *Transverse:* 0.055in/s 1.397mm/s @ 102.4Hz *Vector Sum (VS):* 0.37in/s 9.398mm/s *Displacement:*0.001222in 0.031047mm *Acceleration:*0.530021g's *Calibration Date:*2/16/2005	*Duration:*0.000s To: 4.500s *Seismic Scale:* 0.36in/s (0.090in/s/div) 9.14mm/s (2.286mm/s/div) *Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



TerraDinamica

Unit Located on Floor 6 inches from Door
Door Slammed

File Name: DOOR_SLAM007.DTB
Number: 007
Date: 3/19/2005
Time: 13:19
Serial Number: 1644
Seismic Trigger: 0.0250 in/s 0.6350 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

Radial: 0.215in/s 5.461mm/s @ 73.1Hz

***Vertical:* 0.64in/s 16.256mm/s @ 128.0Hz**

Transverse: 0.095in/s 2.413mm/s @ 85.3Hz

Vector Sum (VS): 0.65in/s 16.51mm/s

*Displacement:*0.001705in 0.043314mm

*Acceleration:*0.881159g's

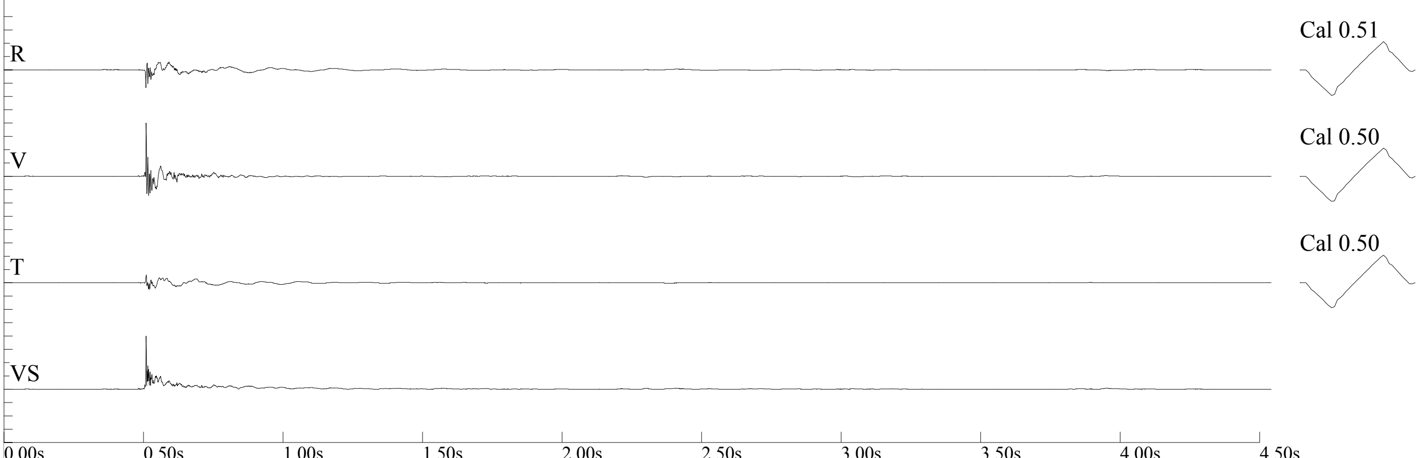
*Calibration Date:*2/16/2005

Graph Information

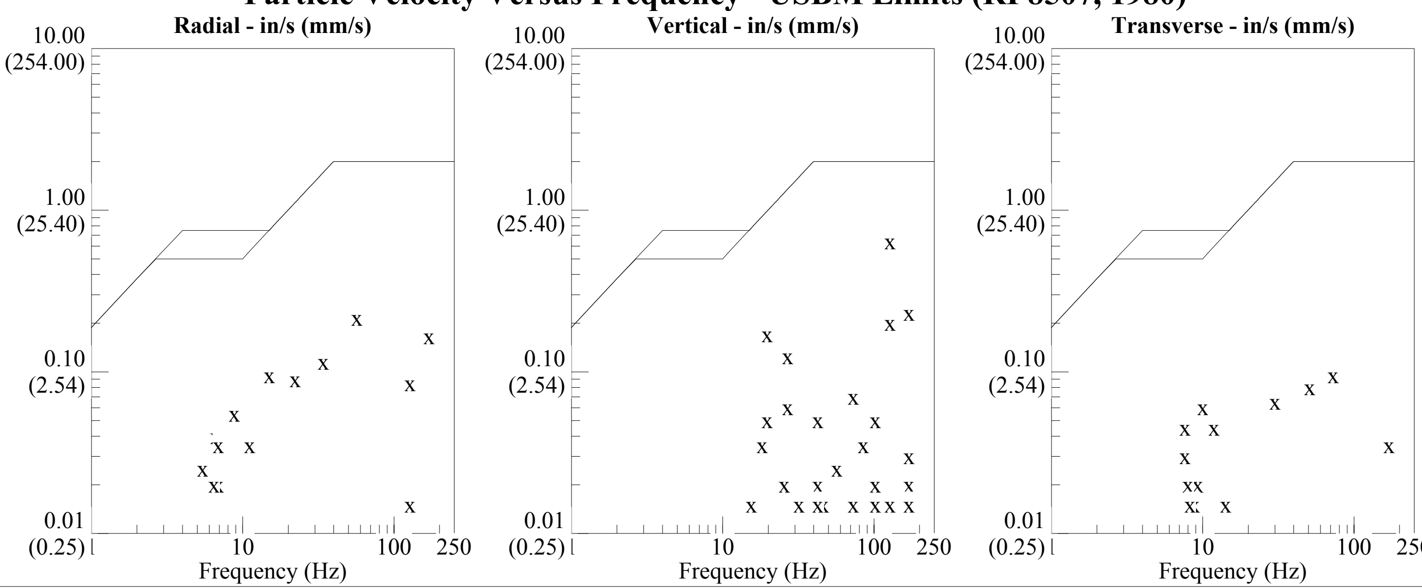
*Duration:*0.000s To: 4.500s

Seismic Scale:
0.64in/s (0.160in/s/div) 16.26mm/s (4.064mm/s/div)

*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



TerraDinamica

Unit Located on Floor 6 inches from Door
Door Slammed

File Name: DOOR_SLAM003.DTB
Number: 003
Date: 3/19/2005
Time: 13:18
Serial Number: 1644
Seismic Trigger: 0.0250 in/s 0.6350 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

Radial: 0.115in/s 2.921mm/s @ 85.3Hz

***Vertical:* 0.265in/s 6.731mm/s @ 64.0Hz**

Transverse: 0.04in/s 1.016mm/s @ 10.8Hz

Vector Sum (VS): 0.27in/s 6.858mm/s

*Displacement:*0.001066in 0.027082mm

*Acceleration:*0.430642g's

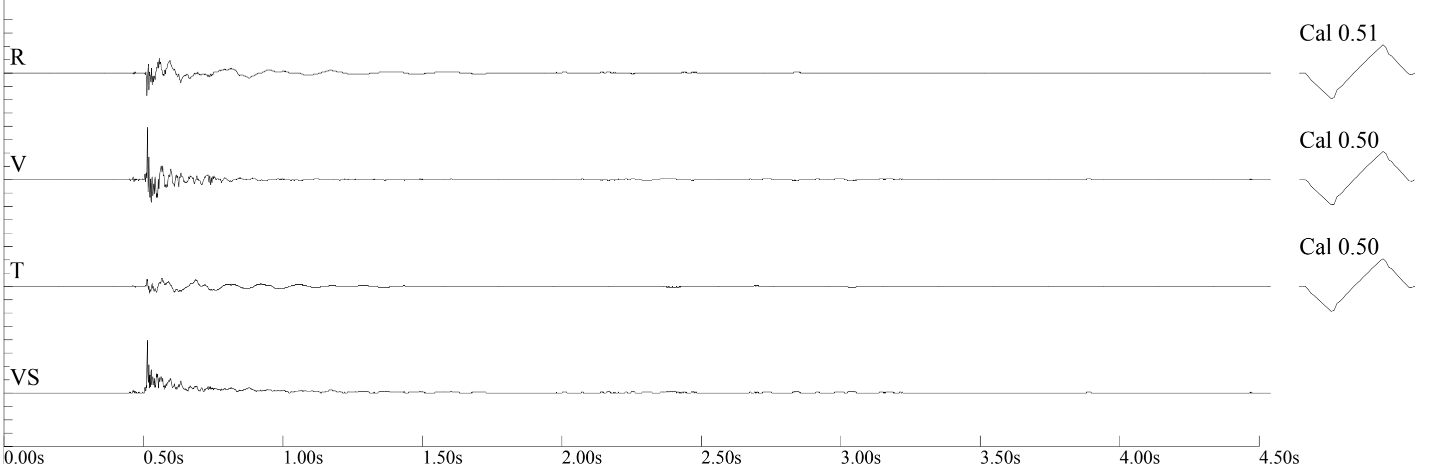
*Calibration Date:*2/16/2005

Graph Information

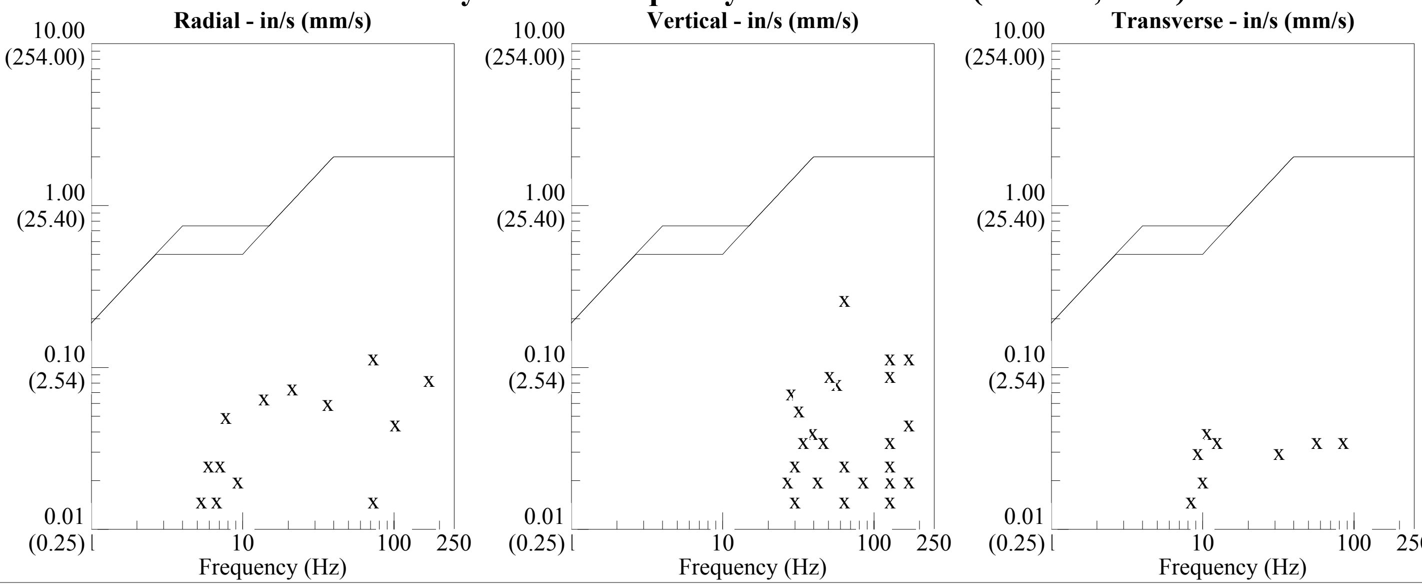
*Duration:*0.000s To: 4.500s

Seismic Scale:
0.27in/s (0.068in/s/div) 6.86mm/s (1.715mm/s/div)

*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located on Floor 6 inches from Door
Door Slammed

File Name: DOOR_SLAM006.DTB
Number: 006
Date: 3/19/2005
Time: 13:19
Serial Number: 1644
Seismic Trigger: 0.0250 in/s 0.6350 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

Radial: 0.145in/s 3.683mm/s @ 102.4Hz

***Vertical:* 0.315in/s 8.001mm/s @ 85.3Hz**

Transverse: 0.04in/s 1.016mm/s @ 256.0Hz

Vector Sum (VS): 0.32in/s 8.128mm/s

*Displacement:*0.000976in 0.024778mm

*Acceleration:*0.457143g's

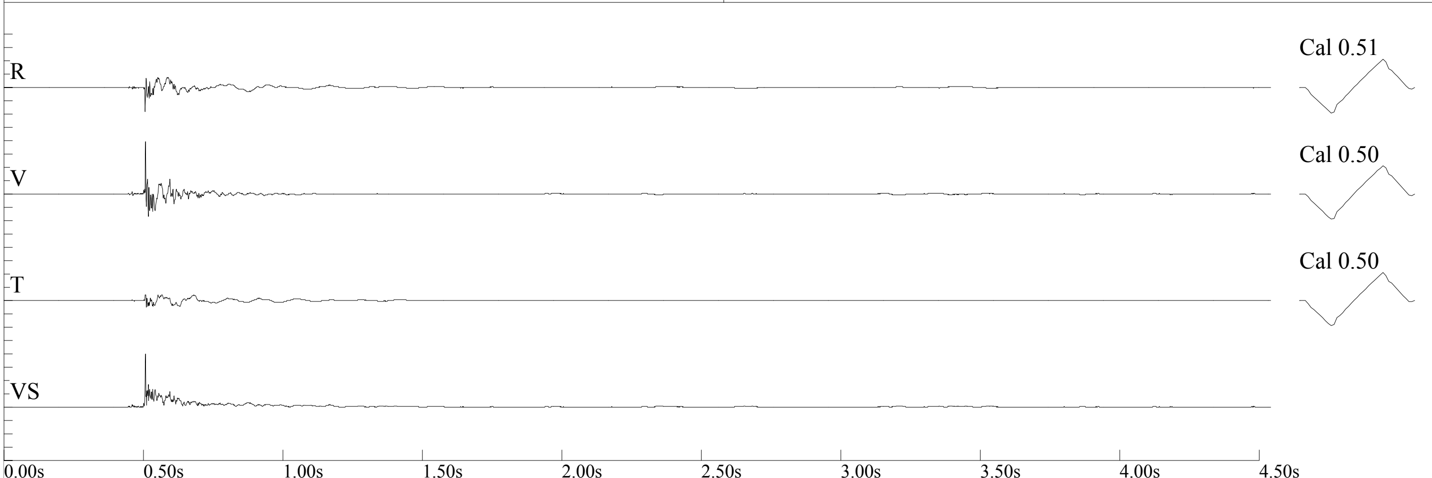
*Calibration Date:*2/16/2005

Graph Information

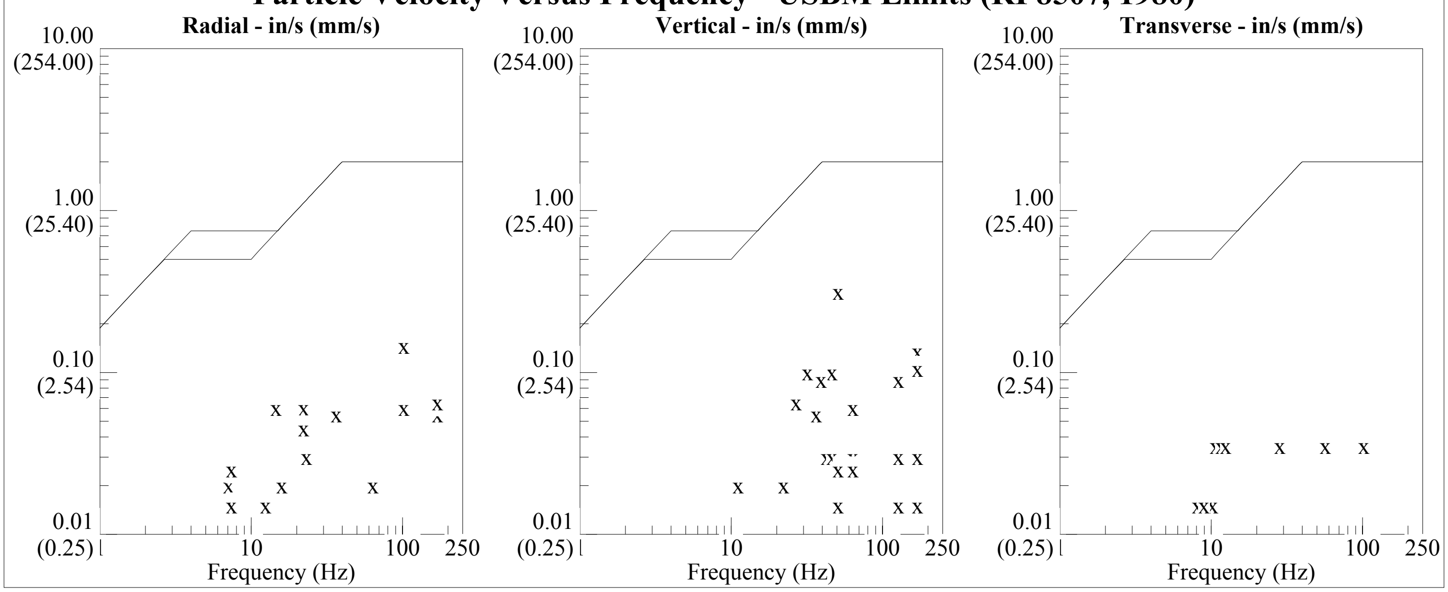
*Duration:*0.000s To: 4.500s

Seismic Scale:
0.32in/s (0.080in/s/div) 8.13mm/s (2.032mm/s/div)

*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located on Floor 6 inches from Door
Door Slammed

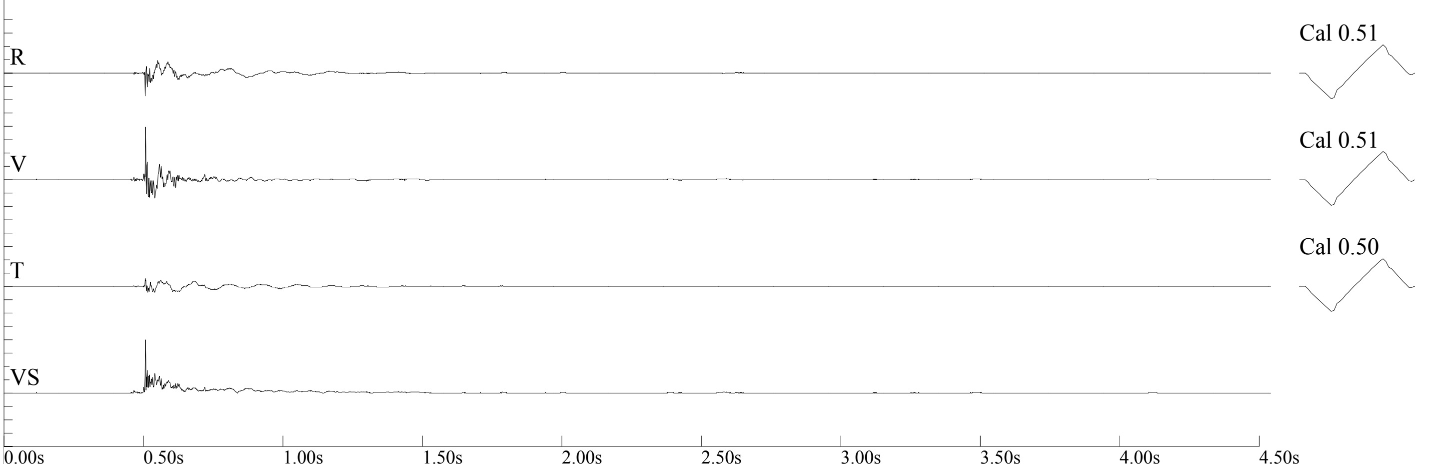
File Name: DOOR_SLAM005.DTB
Number: 005
Date: 3/19/2005
Time: 13:18
Serial Number: 1644
Seismic Trigger: 0.0250 in/s 0.6350 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

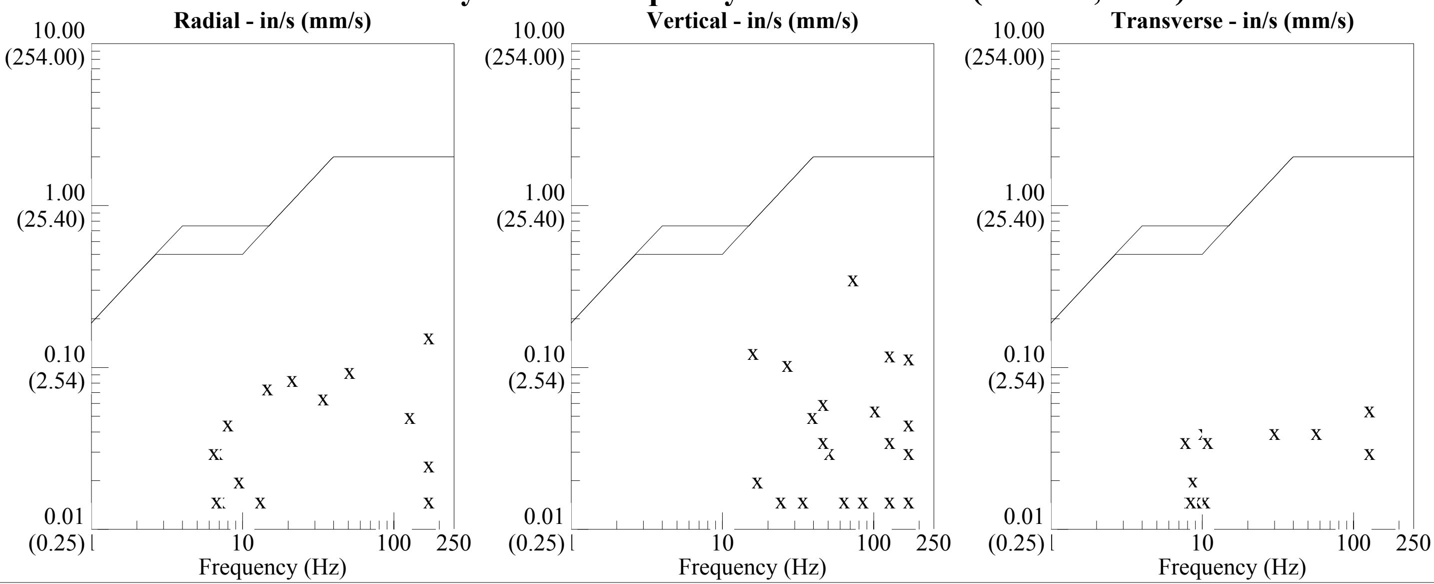
Radial: 0.155in/s 3.937mm/s @ 170.6Hz
***Vertical:* 0.355in/s 9.017mm/s @ 85.3Hz**
Transverse: 0.055in/s 1.397mm/s @ 128.0Hz
Vector Sum (VS): 0.36in/s 9.144mm/s
*Displacement:*0.001225in 0.031111mm
*Acceleration:*0.463768g's
*Calibration Date:*2/16/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
0.36in/s (0.090in/s/div) 9.14mm/s (2.286mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located on Floor 6 inches from Door
Door Slammed

File Name: DOOR_SLAM004.DTB
Number: 004
Date: 3/19/2005
Time: 13:18
Serial Number: 1644
Seismic Trigger: 0.0250 in/s 0.6350 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

Radial: 0.18in/s 4.572mm/s @ 128.0Hz

***Vertical:* 0.355in/s 9.017mm/s @ 85.3Hz**

Transverse: 0.055in/s 1.397mm/s @ 102.4Hz

Vector Sum (VS): 0.37in/s 9.398mm/s

*Displacement:*0.001222in 0.031047mm

*Acceleration:*0.530021g's

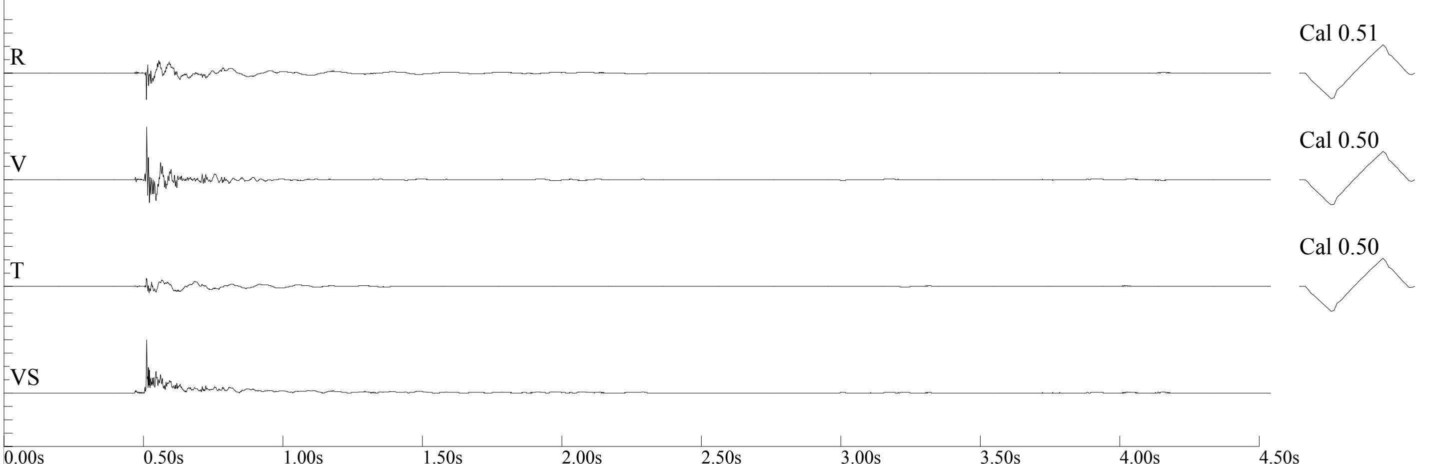
*Calibration Date:*2/16/2005

Graph Information

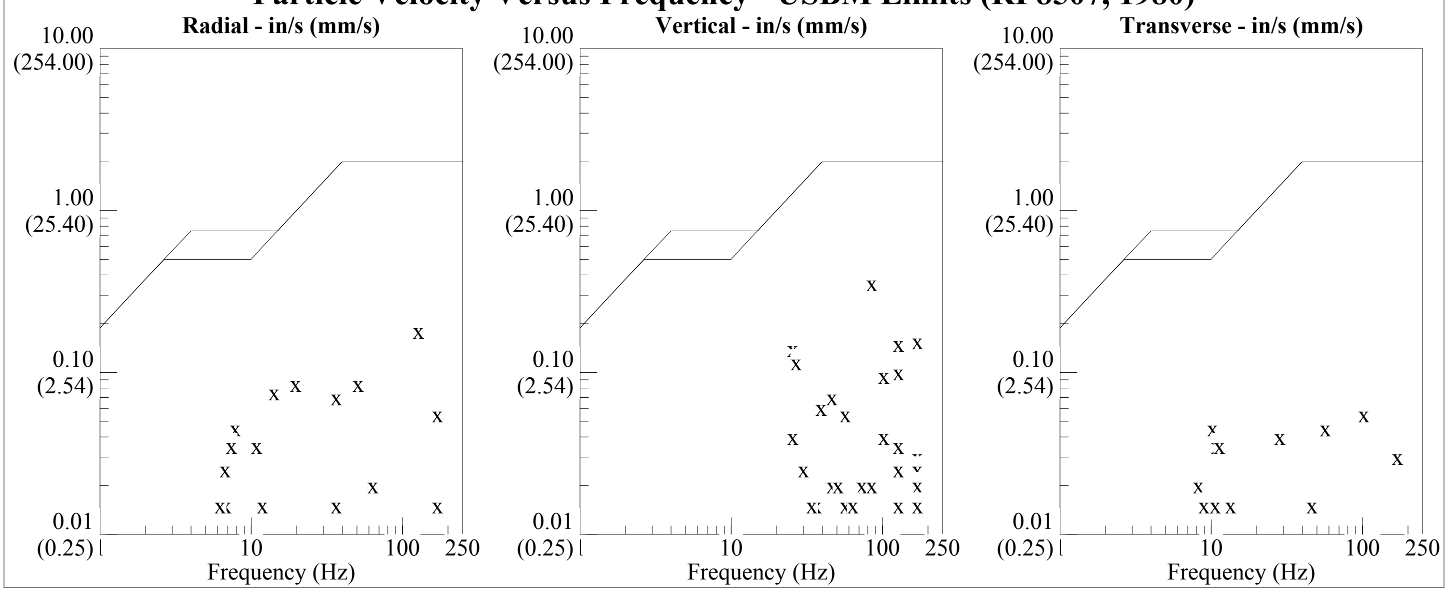
*Duration:*0.000s To: 4.500s

Seismic Scale:
0.36in/s (0.090in/s/div) 9.14mm/s (2.286mm/s/div)

*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



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Unit Located on Floor 6 inches from Door **Door Slammed**	File Name: DOOR_SLAM007.DTB Number: 007 Date: 3/19/2005 Time: 13:19 Serial Number: 1644 Seismic Trigger: 0.0250 in/s 0.6350 mm/s Acoustic Trigger: 123 dB Sample Rate: 1024 Record Duration: 4.0 Seconds Pre-Trigger: 0.50 Seconds Sensor Gain: 2x Battery: 6.4

Amplitudes and Frequencies

Radial: 0.215in/s 5.461mm/s @ 73.1Hz

***Vertical:* 0.64in/s 16.256mm/s @ 128.0Hz**

Transverse: 0.095in/s 2.413mm/s @ 85.3Hz

Vector Sum (VS): 0.65in/s 16.51mm/s

*Displacement:*0.001705in 0.043314mm

*Acceleration:*0.881159g's

*Calibration Date:*2/16/2005

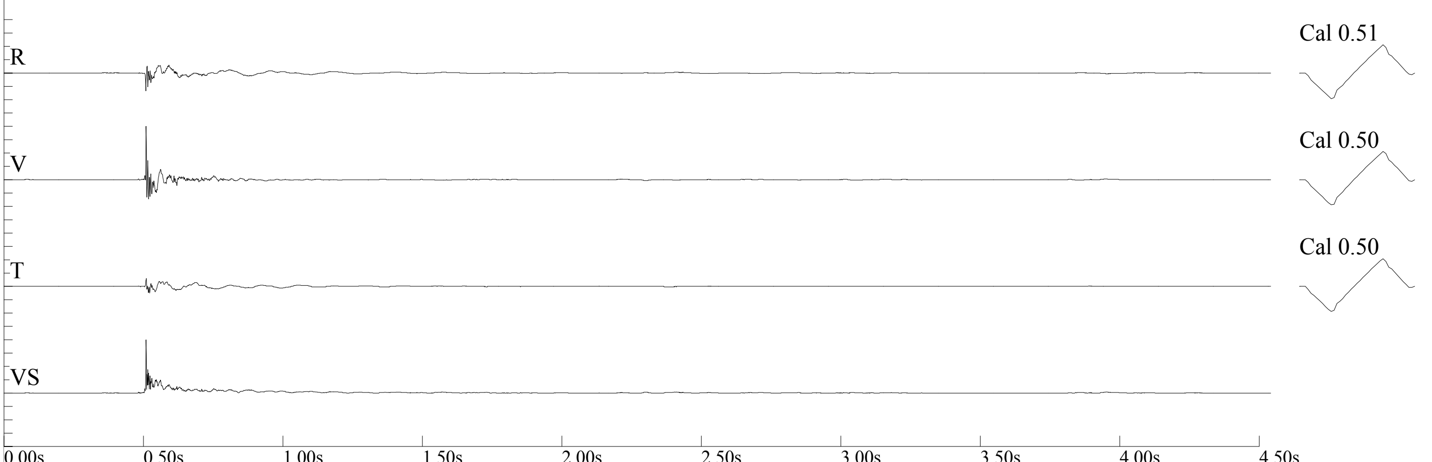
Graph Information

*Duration:*0.000s To: 4.500s

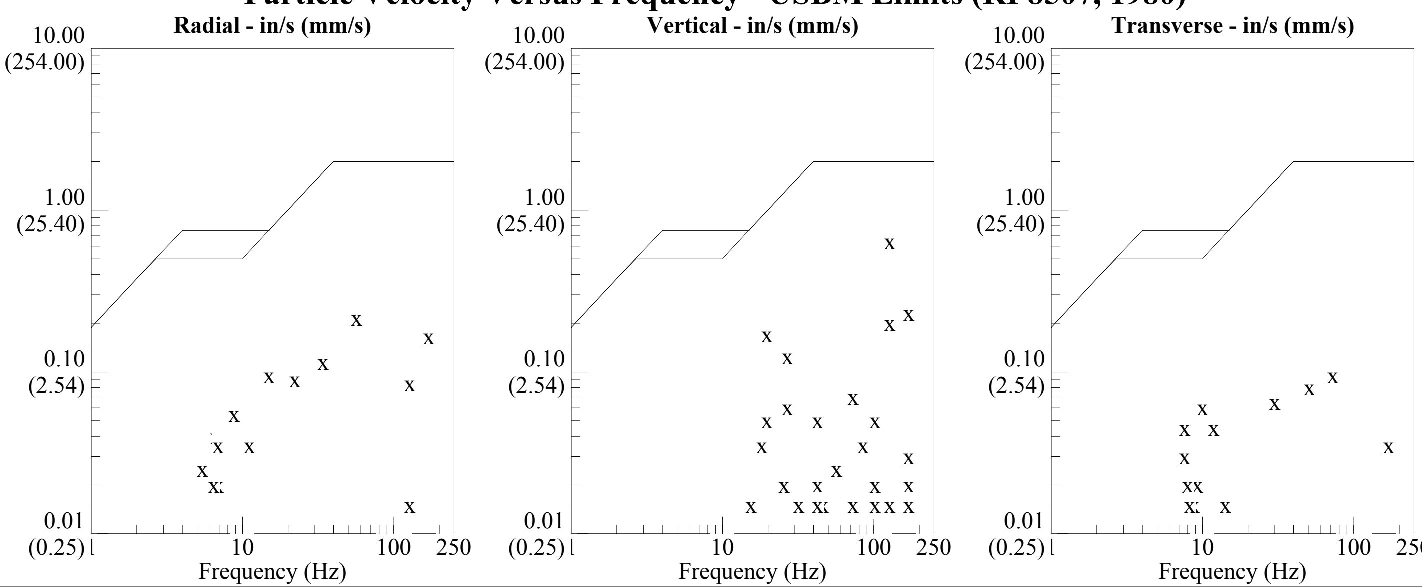
Seismic Scale:

0.64in/s (0.160in/s/div) 16.26mm/s (4.064mm/s/div)

*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



TerraDinamica

Unit Located Above Door
Door Slam

File Name: DOOR_SLAM_ABOVE_DOOR003.DTB
Number: 003
Date: 3/20/2005
Time: 18:16
Serial Number: 2474
Seismic Trigger: 0.2000 in/s 5.0800 mm/s
Acoustic Trigger: 130 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

Radial: 0.40in/s 10.16mm/s @ 170.6Hz

Vertical: 4.64in/s 117.856mm/s @ 128.0Hz

***Transverse:* 5.92in/s 150.368mm/s @ 39.3Hz**

Vector Sum (VS): 6.455in/s 163.957mm/s

*Displacement:*0.022489in 0.571227mm

*Acceleration:*8.268323g's

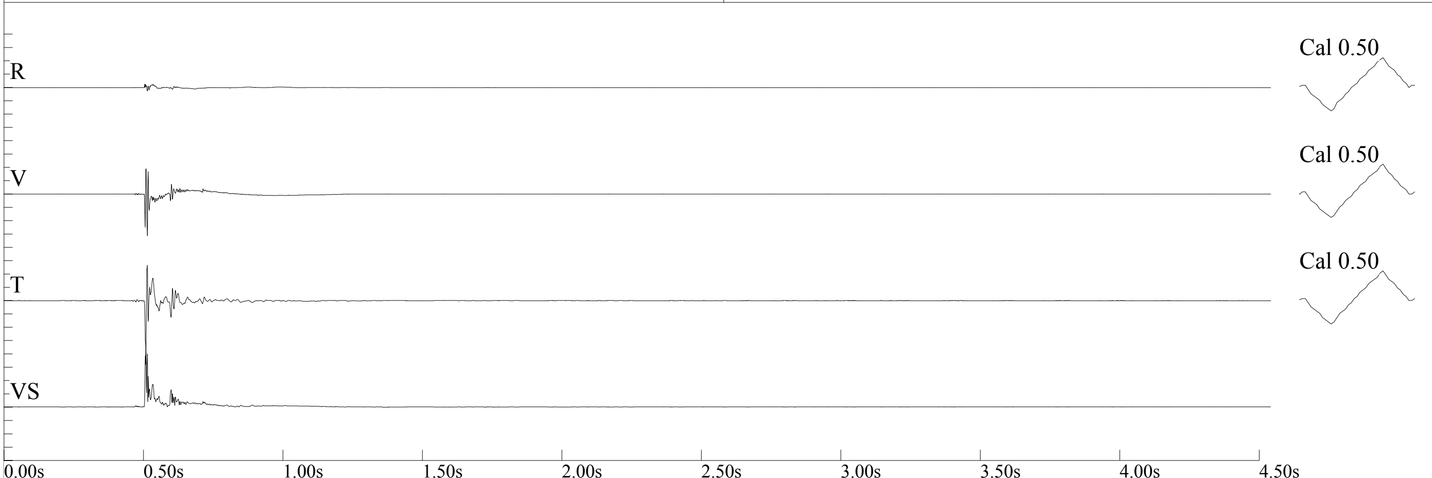
*Calibration Date:*2/18/2005

Graph Information

*Duration:*0.000s To: 4.500s

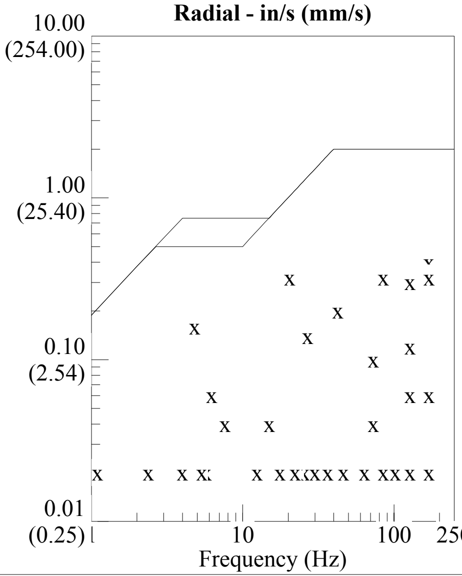
Seismic Scale:
5.92in/s (1.480in/s/div) 150.37mm/s (37.592mm/s/div)

*Time Line Intervals at:*0.50 s

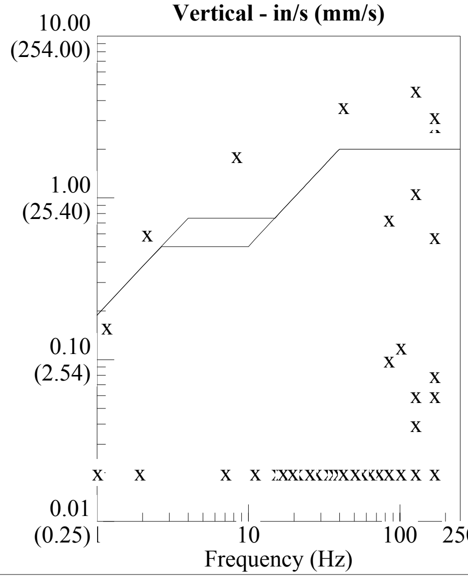


Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)

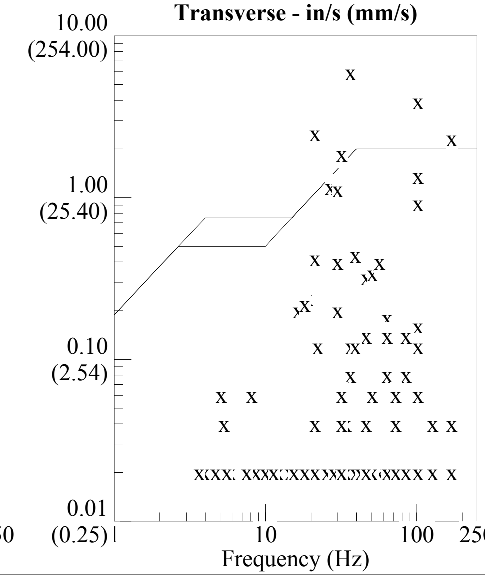
Radial - in/s (mm/s)



Vertical - in/s (mm/s)



Transverse - in/s (mm/s)



Unit Located Above Door
Door Slam

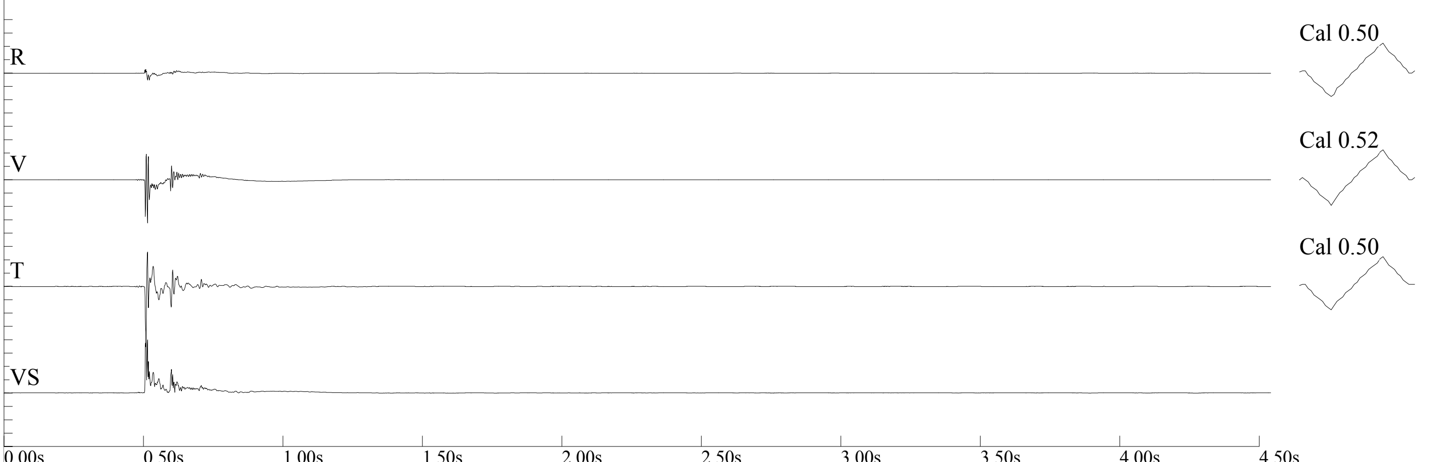
File Name: DOOR_SLAM_ABOVE_DOOR005.DTB
Number: 005
Date: 3/20/2005
Time: 18:16
Serial Number: 2474
Seismic Trigger: 0.2000 in/s 5.0800 mm/s
Acoustic Trigger: 130 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

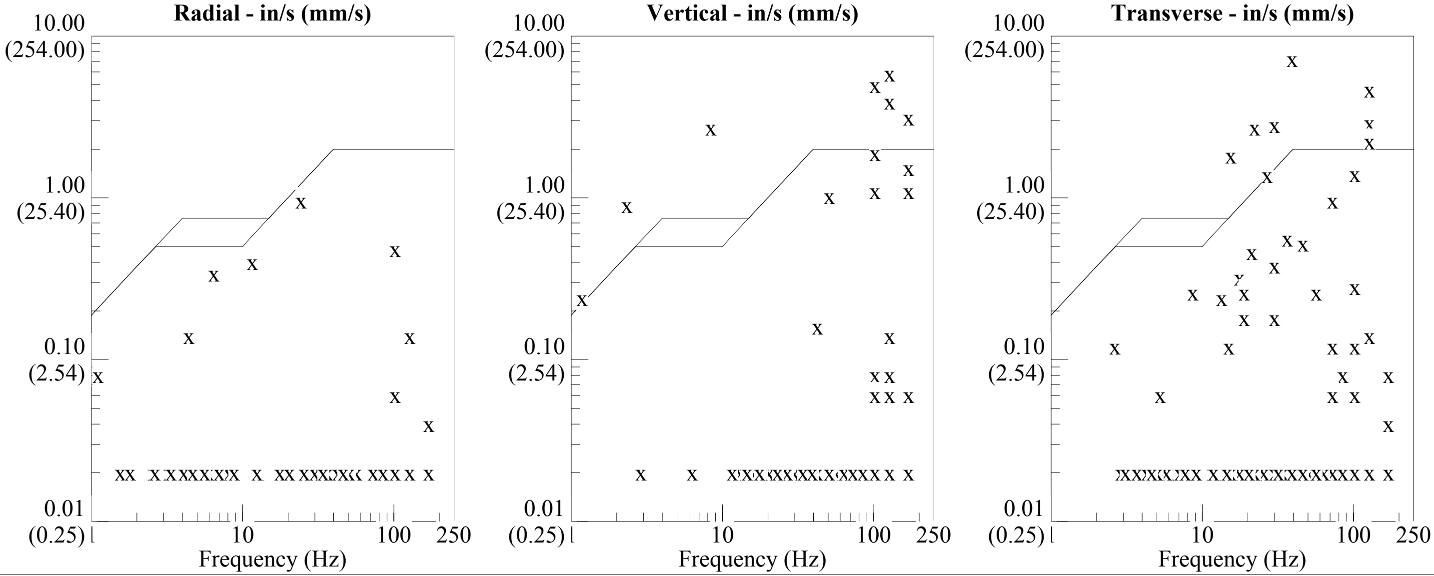
Radial: 0.96in/s 24.384mm/s @ 24.3Hz
Vertical: 5.84in/s 148.336mm/s @ 128.0Hz
***Transverse:* 7.20in/s 182.88mm/s @ 51.2Hz**
Vector Sum (VS): 7.85in/s 199.39mm/s
Displacement: 0.033410in 0.848614mm
Acceleration: 10.388410g's
Calibration Date: 2/18/2005

Graph Information

Duration: 0.000s To: 4.500s
Seismic Scale:
7.20in/s (1.800in/s/div) 182.88mm/s (45.720mm/s/div)
Time Line Intervals at: 0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located Above Door
Door Slam

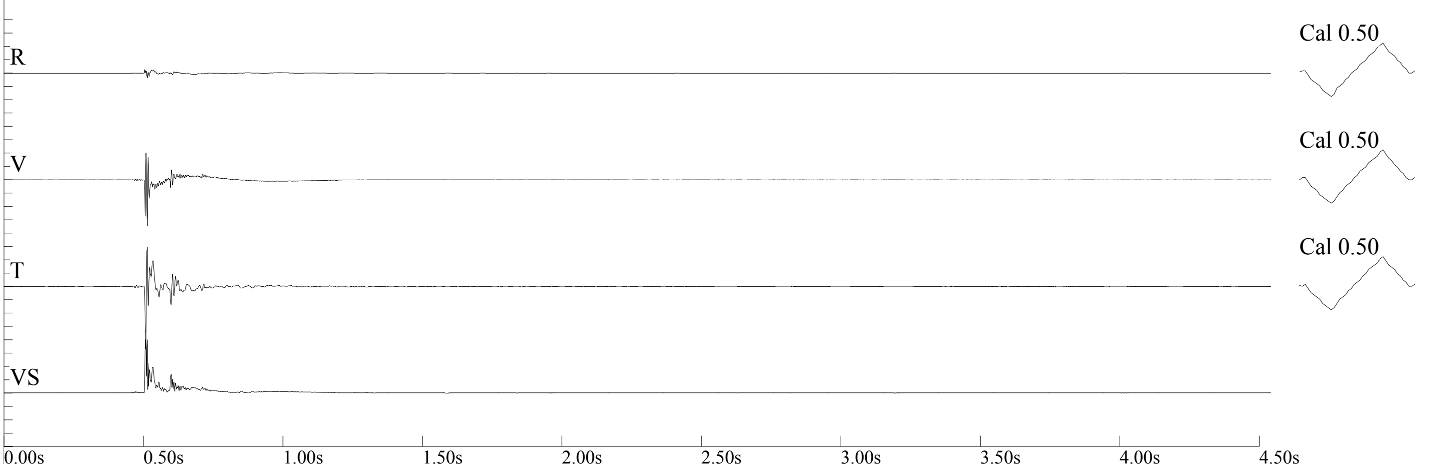
File Name: DOOR_SLAM_ABOVE_DOOR004.DTB
Number: 004
Date: 3/20/2005
Time: 18:16
Serial Number: 2474
Seismic Trigger: 0.2000 in/s 5.0800 mm/s
Acoustic Trigger: 130 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

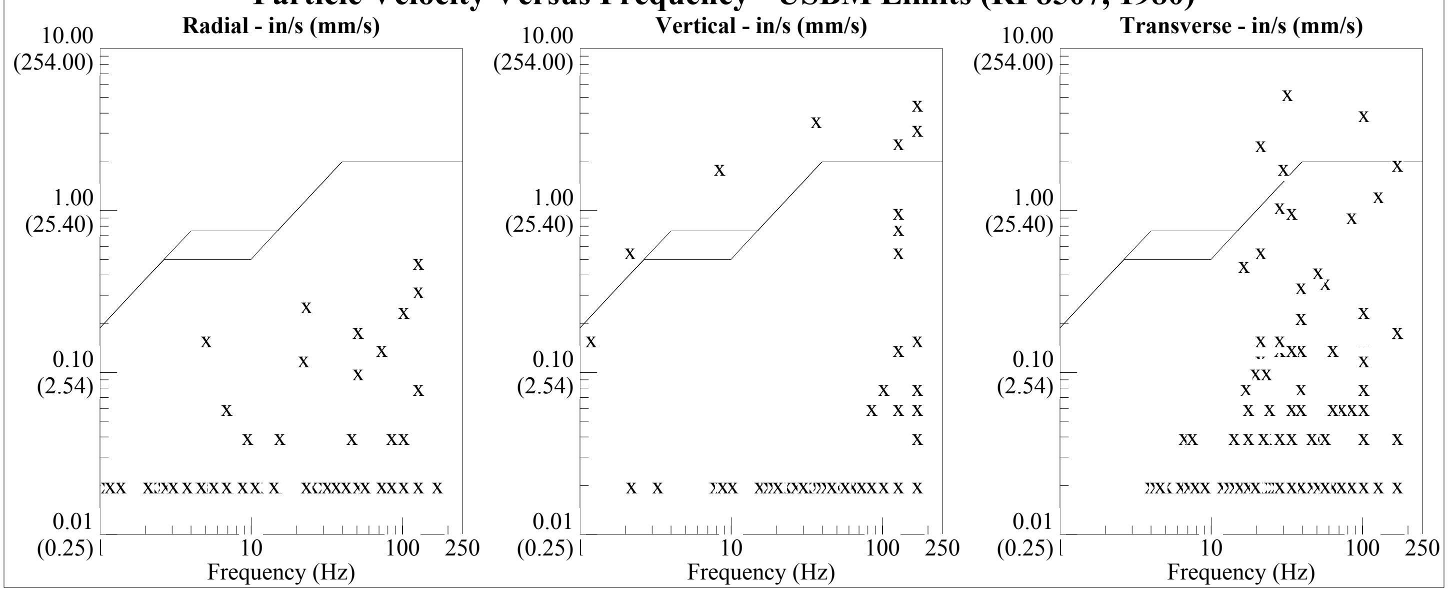
Radial: 0.48in/s 12.192mm/s @ 128.0Hz
Vertical: 4.56in/s 115.824mm/s @ 170.6Hz
***Transverse:* 5.28in/s 134.112mm/s @ 64.0Hz**
Vector Sum (VS): 6.03in/s 153.162mm/s
*Displacement:*0.022969in 0.583417mm
*Acceleration:*8.056314g's
*Calibration Date:*2/18/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
5.28in/s (1.320in/s/div) 134.11mm/s (33.528mm/s/div)
*Time Line Intervals at:*0.50 s

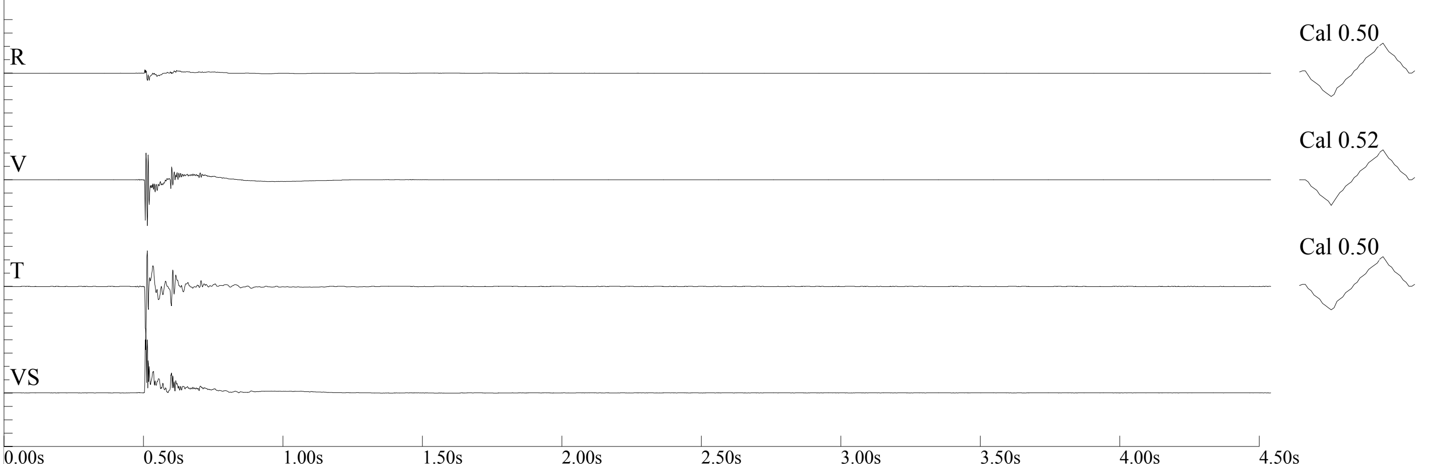


Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)

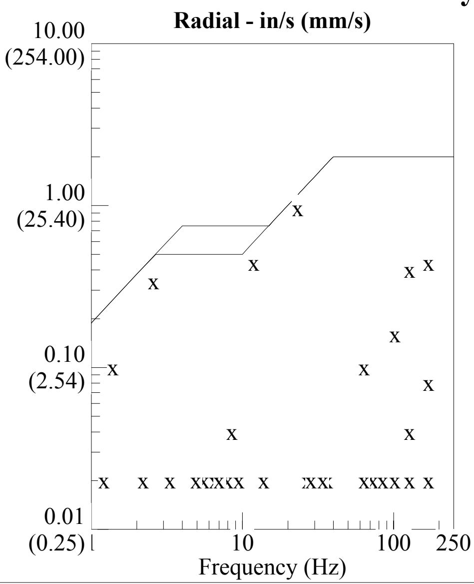


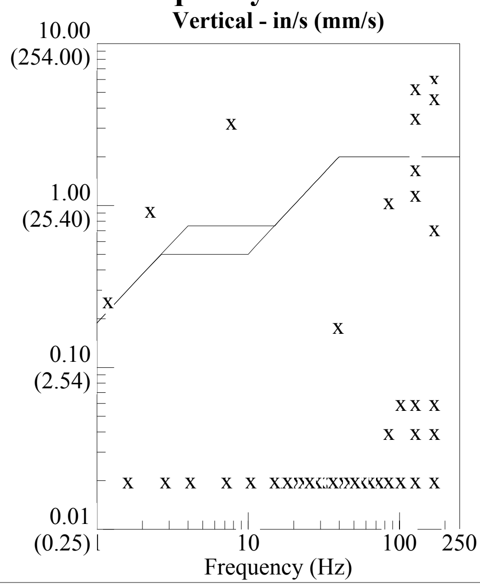
Unit Located Above Door **Door Slam**	File Name: DOOR_SLAM_ABOVE_DOOR006.DTB Number: 006 Date: 3/20/2005 Time: 18:18 Serial Number: 2474 Seismic Trigger: 0.2000 in/s 5.0800 mm/s Acoustic Trigger: 130 dB Sample Rate: 1024 Record Duration: 4.0 Seconds Pre-Trigger: 0.50 Seconds Sensor Gain: 2x Battery: 6.4

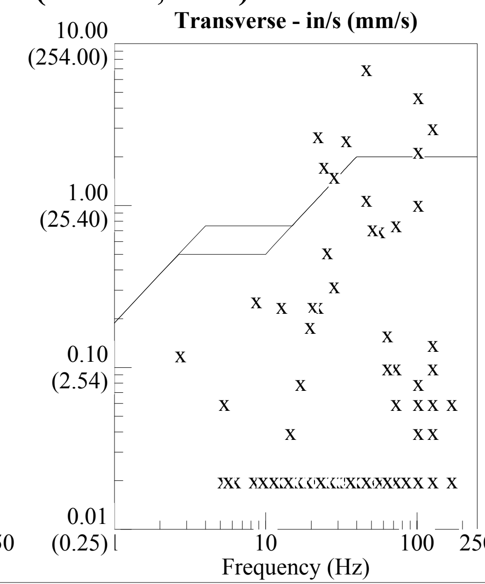
Amplitudes and Frequencies	Graph Information
Radial: 0.96in/s 24.384mm/s @ 23.2Hz *Vertical:* 6.08in/s 154.432mm/s @ 170.6Hz ***Transverse:* 7.04in/s 178.816mm/s @ 73.1Hz** *Vector Sum (VS):* 7.755in/s 196.977mm/s *Displacement:*0.035559in 0.903206mm *Acceleration:*10.600410g's *Calibration Date:*2/18/2005	*Duration:*0.000s To: 4.500s *Seismic Scale:* 7.04in/s (1.760in/s/div) 178.82mm/s (44.704mm/s/div) *Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)







Unit Located on Floor 6 inches from Door
Door Shut with normal amount of force

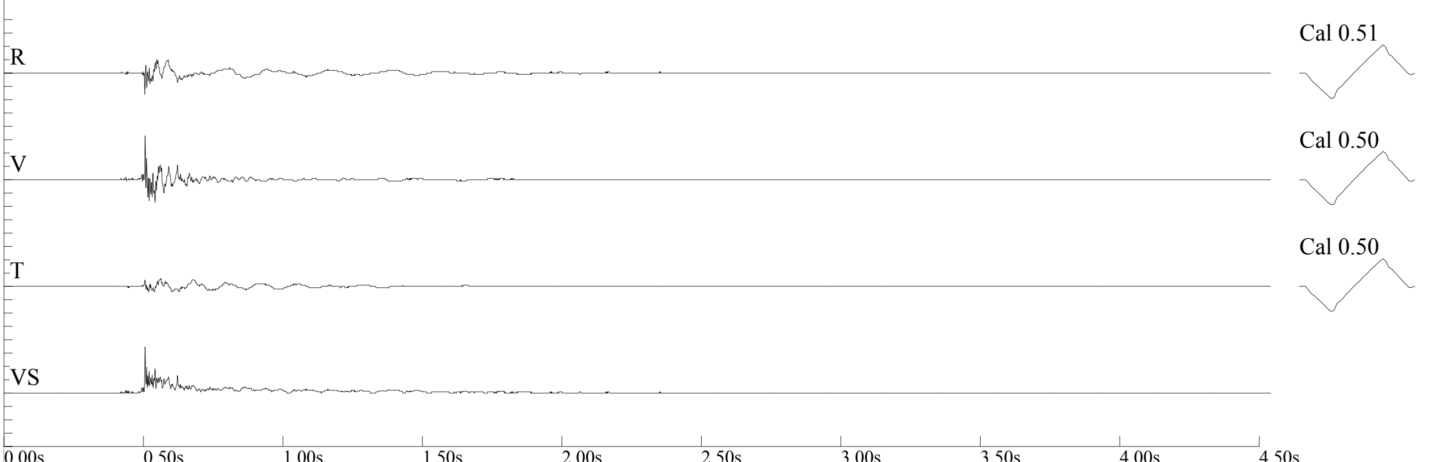
File Name: DOOR_SHUT000.DTB
Number: 000
Date: 3/19/2005
Time: 13:16
Serial Number: 1644
Seismic Trigger: 0.0250 in/s 0.6350 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

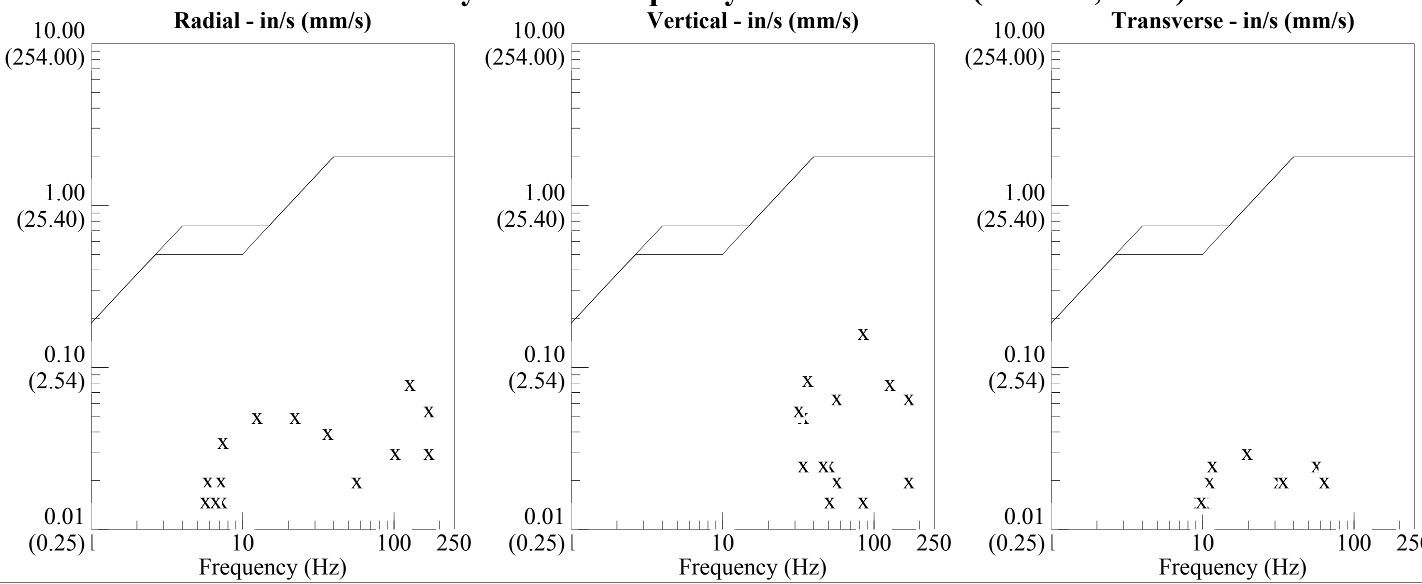
Radial: 0.055in/s 1.397mm/s @ 170.6Hz
***Vertical:* 0.165in/s 4.191mm/s @ 128.0Hz**
Transverse: 0.03in/s 0.762mm/s @ 26.9Hz
Vector Sum (VS): 0.175in/s 4.445mm/s
*Displacement:*0.000788in 0.020008mm
*Acceleration:*0.251760g's
*Calibration Date:*2/16/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
0.20in/s (0.050in/s/div) 5.08mm/s (1.270mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located on Floor 6 inches from Door
Door Shut with normal amount of force

File Name: DOOR_SHUT001.DTB
Number: 001
Date: 3/19/2005
Time: 13:17
Serial Number: 1644
Seismic Trigger: 0.0250 in/s 0.6350 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

Radial: 0.04in/s 1.016mm/s @ 25.6Hz

***Vertical:* 0.185in/s 4.699mm/s @ 102.4Hz**

Transverse: 0.03in/s 0.762mm/s @ 46.5Hz

Vector Sum (VS): 0.185in/s 4.699mm/s

Displacement: 0.000654in 0.016610mm

Acceleration: 0.245135g's

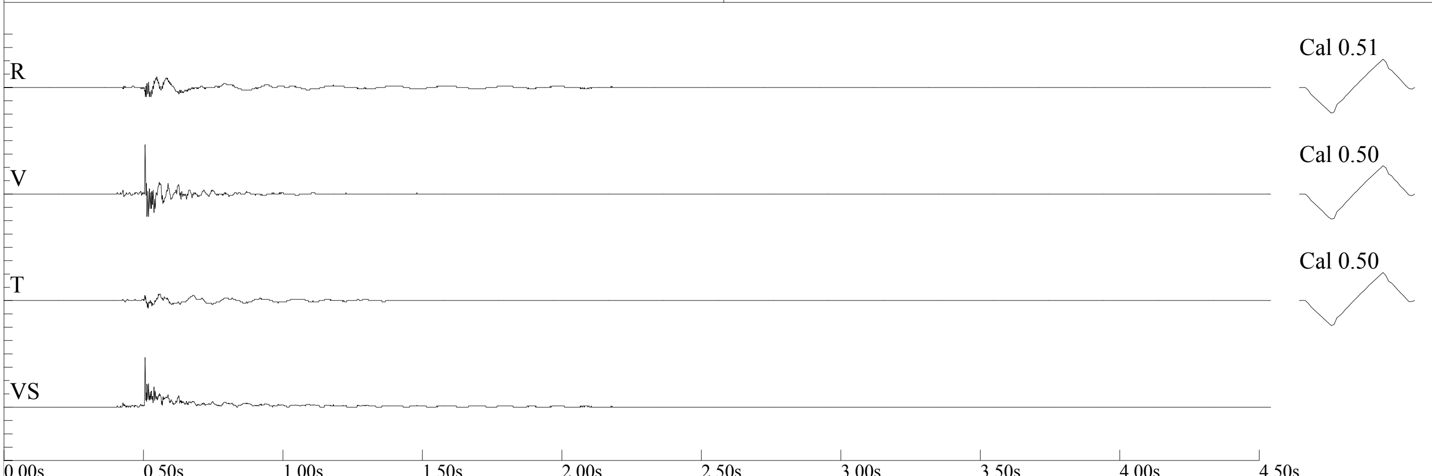
Calibration Date: 2/16/2005

Graph Information

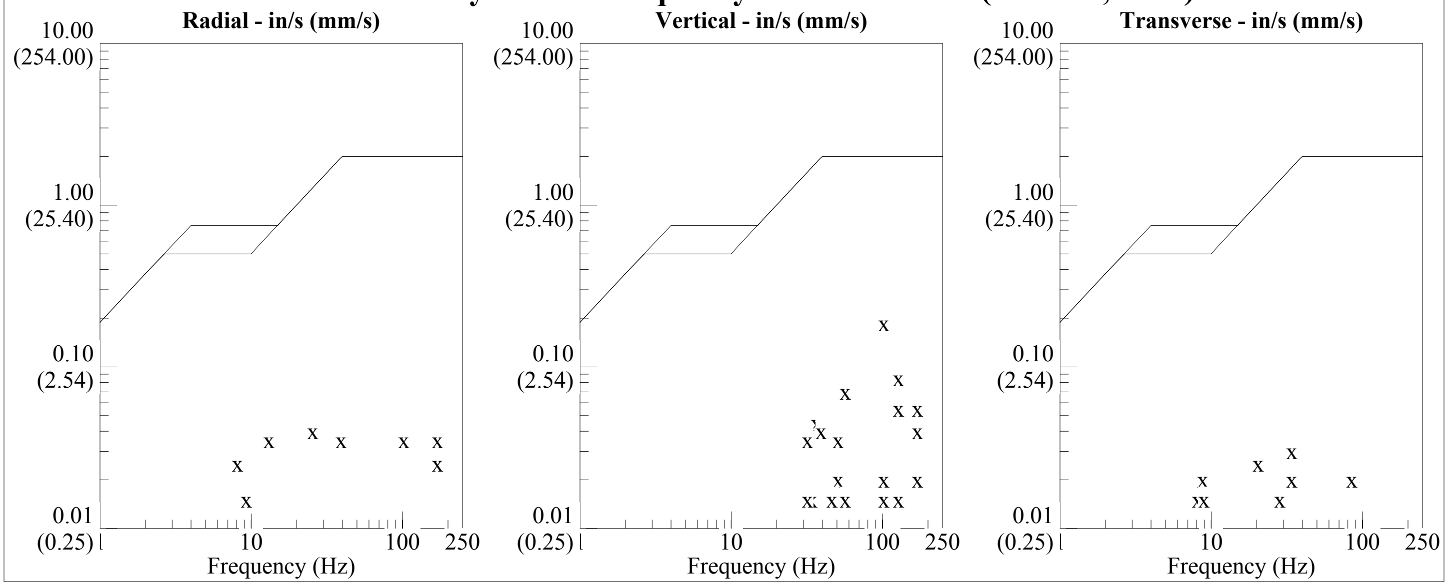
Duration: 0.000s To: 4.500s

Seismic Scale:
0.20in/s (0.050in/s/div) 5.08mm/s (1.270mm/s/div)

Time Line Intervals at: 0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



TerraDinamica

Unit Located on Floor 6 inches from Door
Door Shut with normal amount of force

File Name: DOOR_SHUT000.DTB
Number: 000
Date: 3/19/2005
Time: 13:16
Serial Number: 1644
Seismic Trigger: 0.0250 in/s 0.6350 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

Radial: 0.055in/s 1.397mm/s @ 170.6Hz

***Vertical:* 0.165in/s 4.191mm/s @ 128.0Hz**

Transverse: 0.03in/s 0.762mm/s @ 26.9Hz

Vector Sum (VS): 0.175in/s 4.445mm/s

*Displacement:*0.000788in 0.020008mm

*Acceleration:*0.251760g's

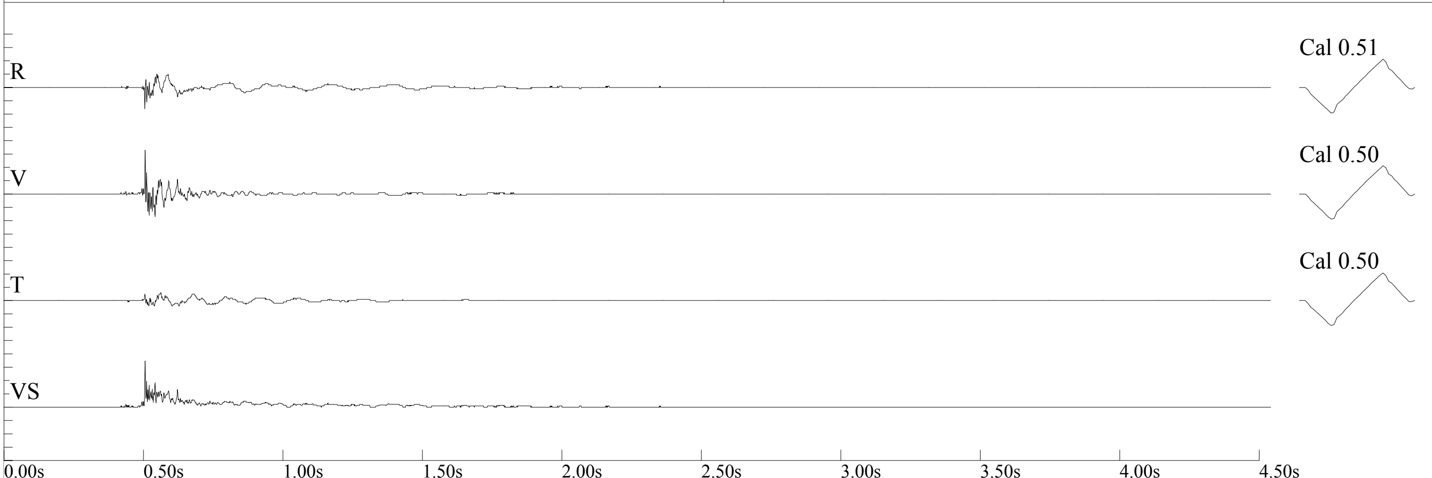
*Calibration Date:*2/16/2005

Graph Information

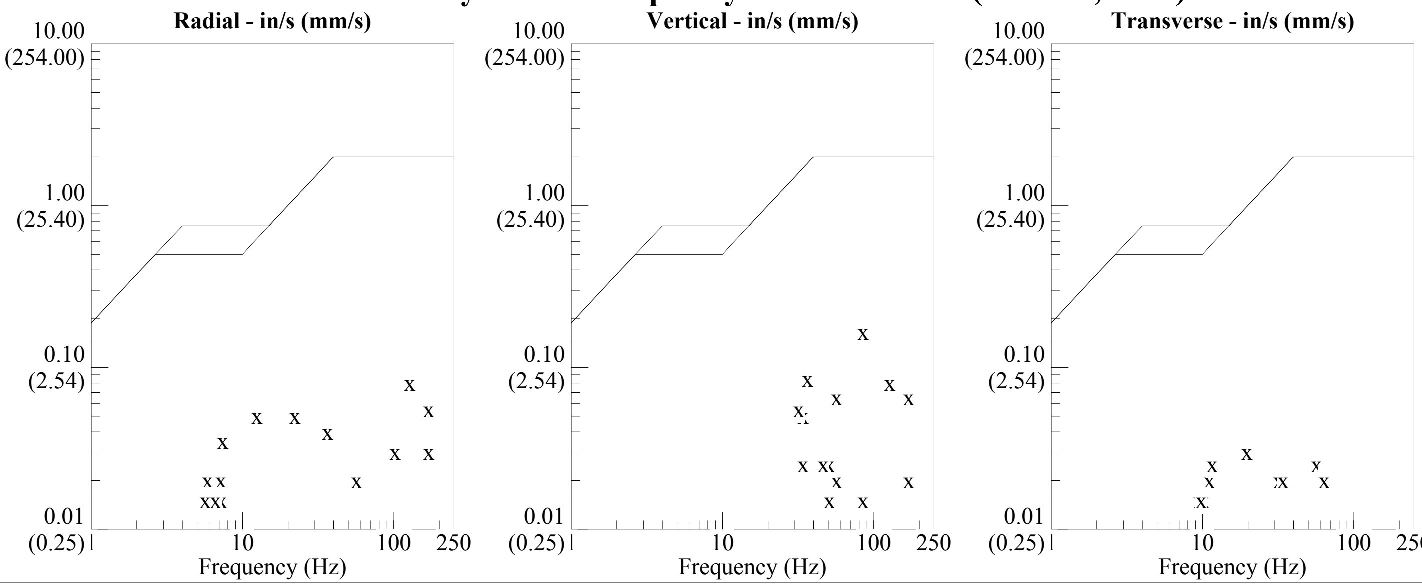
*Duration:*0.000s To: 4.500s

Seismic Scale:
0.20in/s (0.050in/s/div) 5.08mm/s (1.270mm/s/div)

*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located on Floor 6 inches from Door
Door Shut with normal amount of force

File Name: DOOR_SHUT001.DTB
Number: 001
Date: 3/19/2005
Time: 13:17
Serial Number: 1644
Seismic Trigger: 0.0250 in/s 0.6350 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

Radial: 0.04in/s 1.016mm/s @ 25.6Hz

***Vertical:* 0.185in/s 4.699mm/s @ 102.4Hz**

Transverse: 0.03in/s 0.762mm/s @ 46.5Hz

Vector Sum (VS): 0.185in/s 4.699mm/s

*Displacement:*0.000654in 0.016610mm

*Acceleration:*0.245135g's

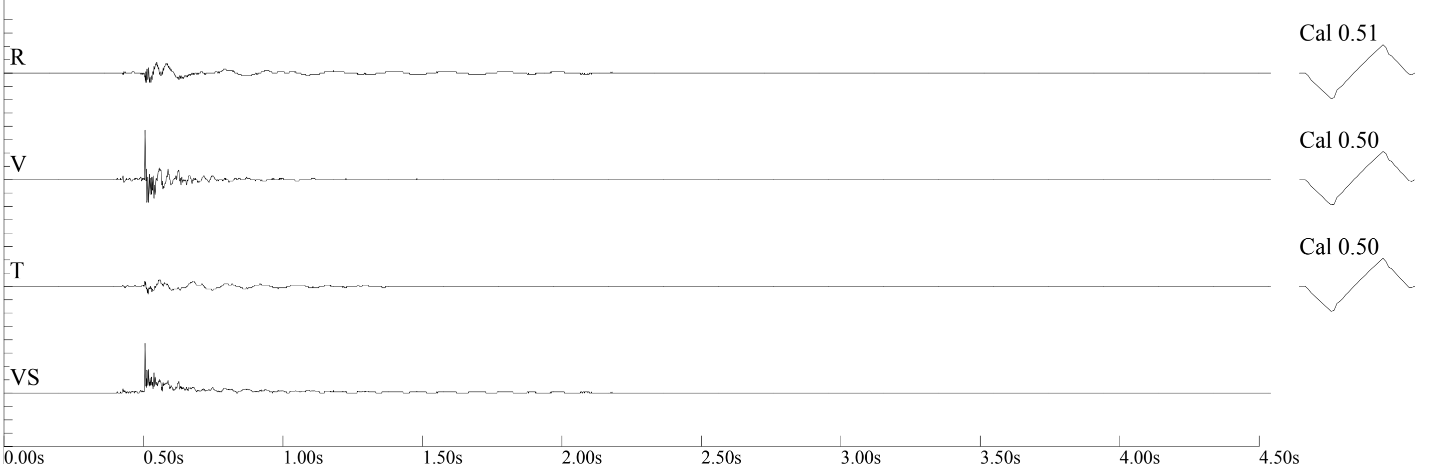
*Calibration Date:*2/16/2005

Graph Information

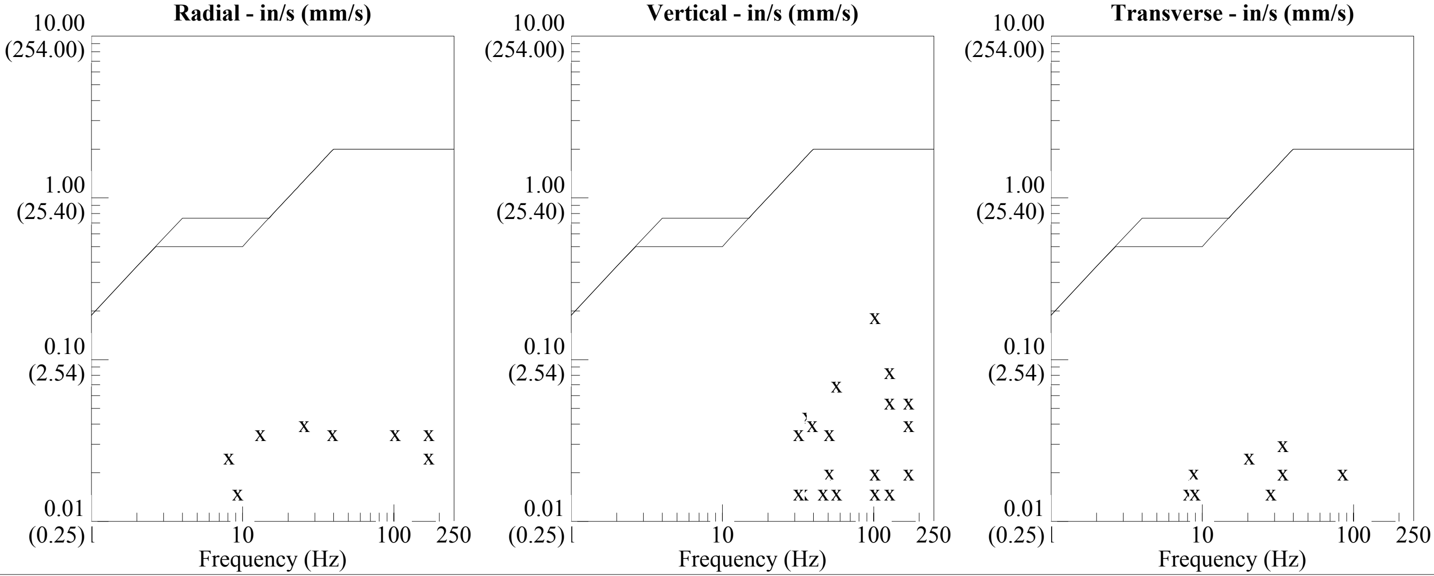
*Duration:*0.000s To: 4.500s

Seismic Scale:
0.20in/s (0.050in/s/div) 5.08mm/s (1.270mm/s/div)

*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located Above Door
Door Shut with normal amount of force

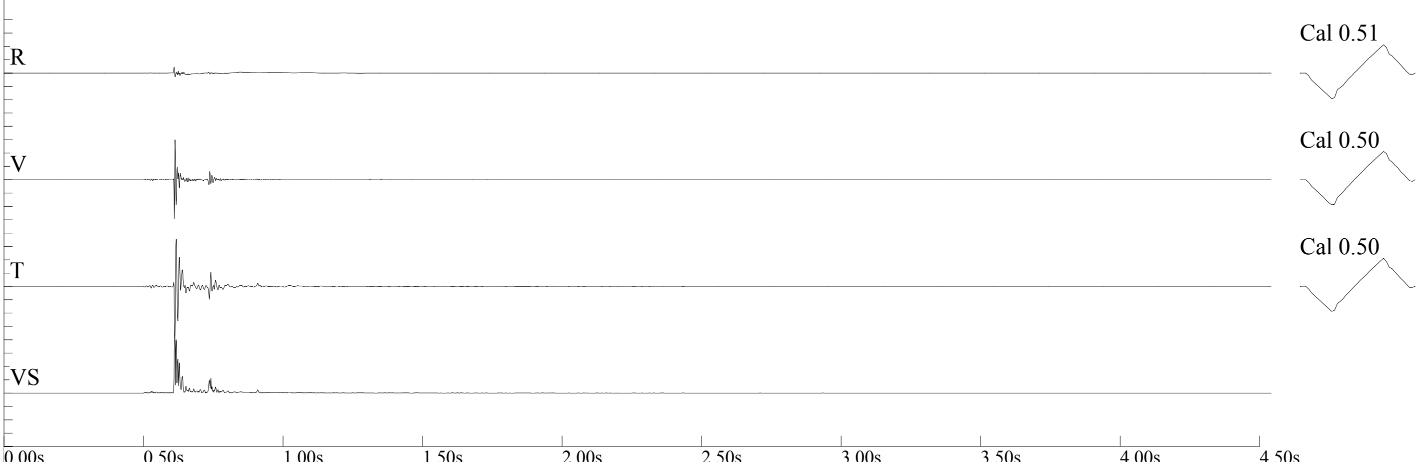
File Name: ABOVE-DOOR_SHUT008.DTB
Number: 008
Date: 3/19/2005
Time: 13:58
Serial Number: 1644
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

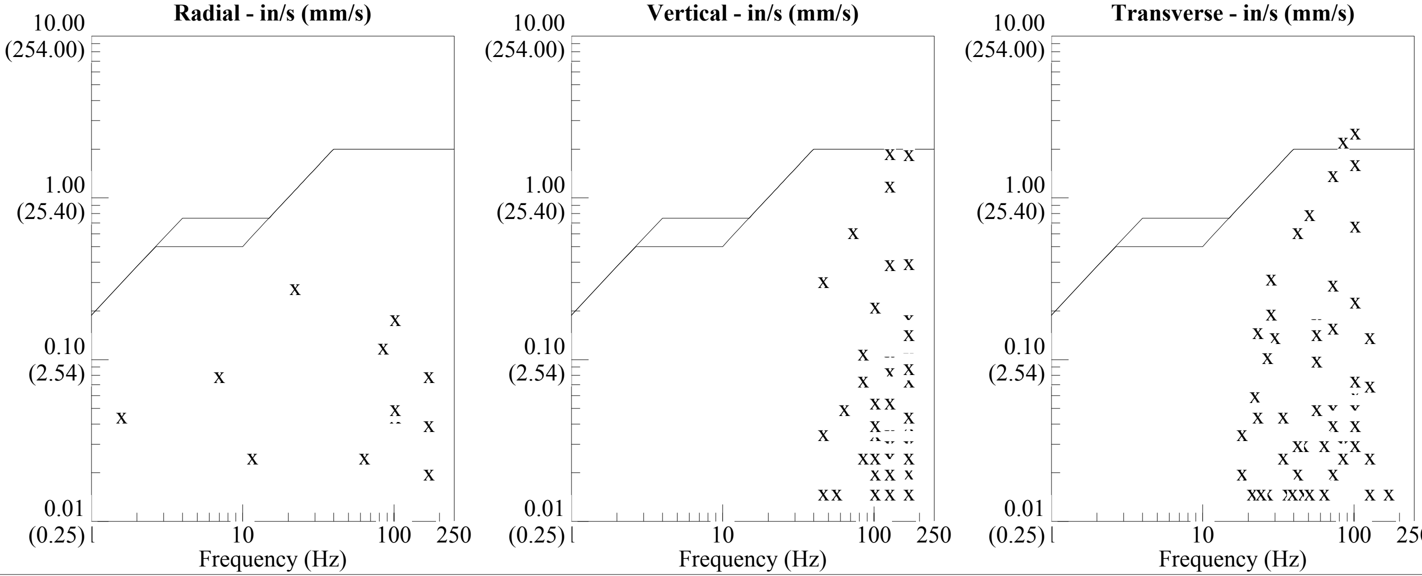
Radial: 0.28in/s 7.112mm/s @ 128.0Hz
Vertical: 1.92in/s 48.768mm/s @ 128.0Hz
***Transverse:* 2.56in/s 65.024mm/s @ 102.4Hz**
Vector Sum (VS): 2.925in/s 74.295mm/s
*Displacement:*0.007616in 0.193435mm
*Acceleration:*4.452174g's
*Calibration Date:*2/16/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
2.56in/s (0.640in/s/div) 65.02mm/s (16.256mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located Above Door
Door Shut with normal amount of force

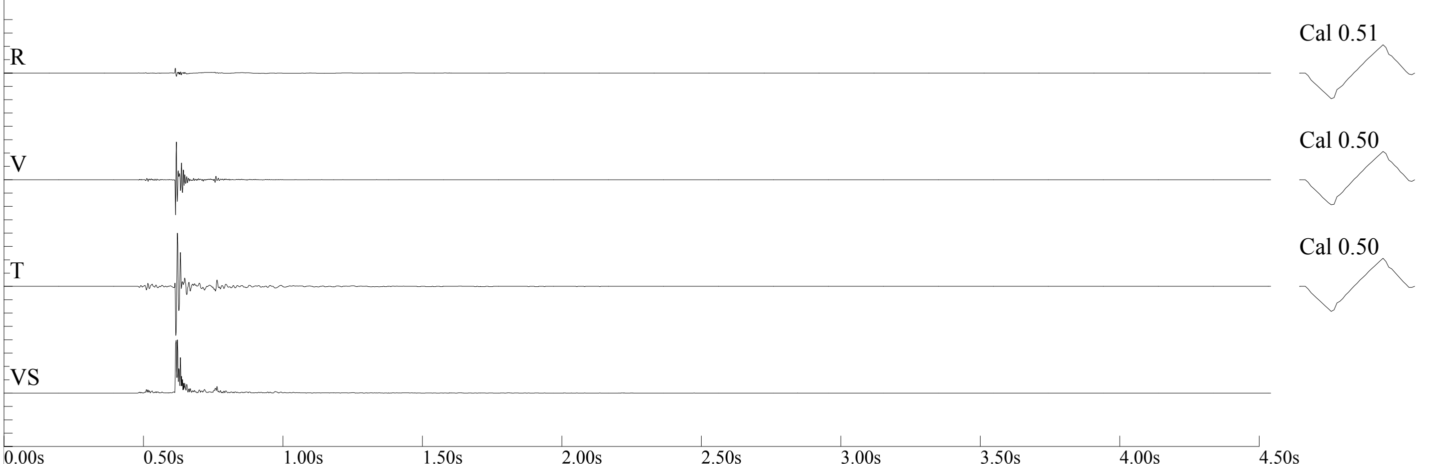
File Name: ABOVE-DOOR_SHUT009.DTB
Number: 009
Date: 3/19/2005
Time: 13:59
Serial Number: 1644
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

Radial: 0.18in/s 4.572mm/s @ 128.0Hz
Vertical: 1.40in/s 35.56mm/s @ 170.6Hz
***Transverse:* 1.98in/s 50.292mm/s @ 102.4Hz**
Vector Sum (VS): 2.12in/s 53.848mm/s
*Displacement:*0.005948in 0.151083mm
*Acceleration:*2.994617g's
*Calibration Date:*2/16/2005

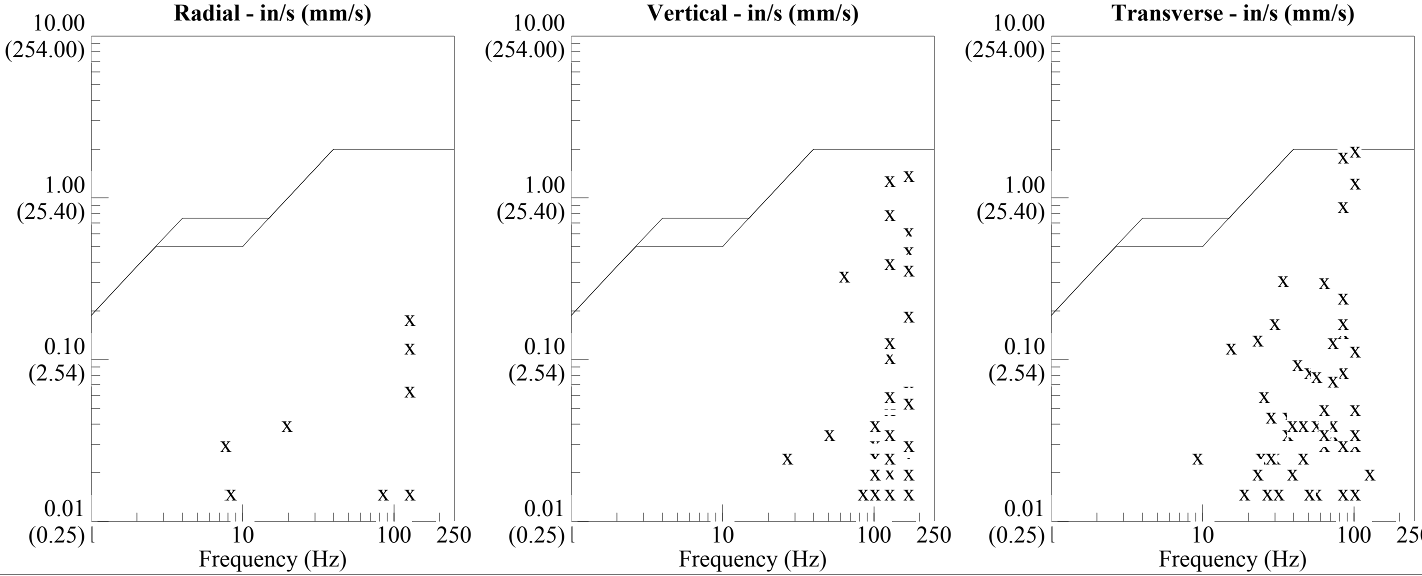
Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
1.98in/s (0.495in/s/div) 50.29mm/s (12.573mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)

Radial - in/s (mm/s) **Vertical - in/s (mm/s)** **Transverse - in/s (mm/s)**



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Unit Located Above Door
Door Shut with normal amount of force

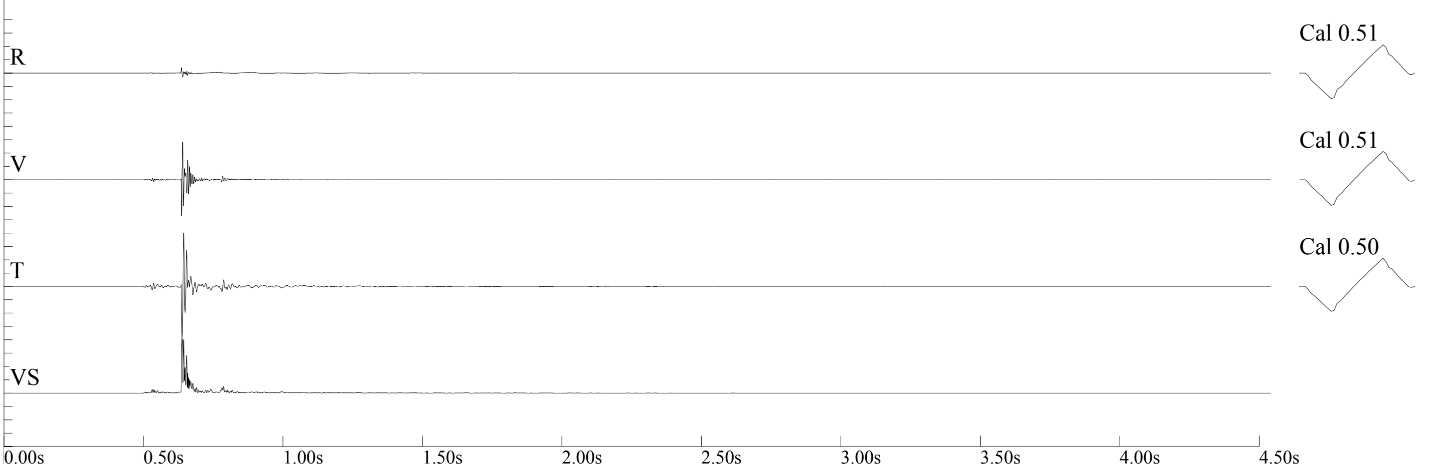
File Name: ABOVE-DOOR_SHUT010.DTB
Number: 010
Date: 3/19/2005
Time: 13:59
Serial Number: 1644
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 123 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

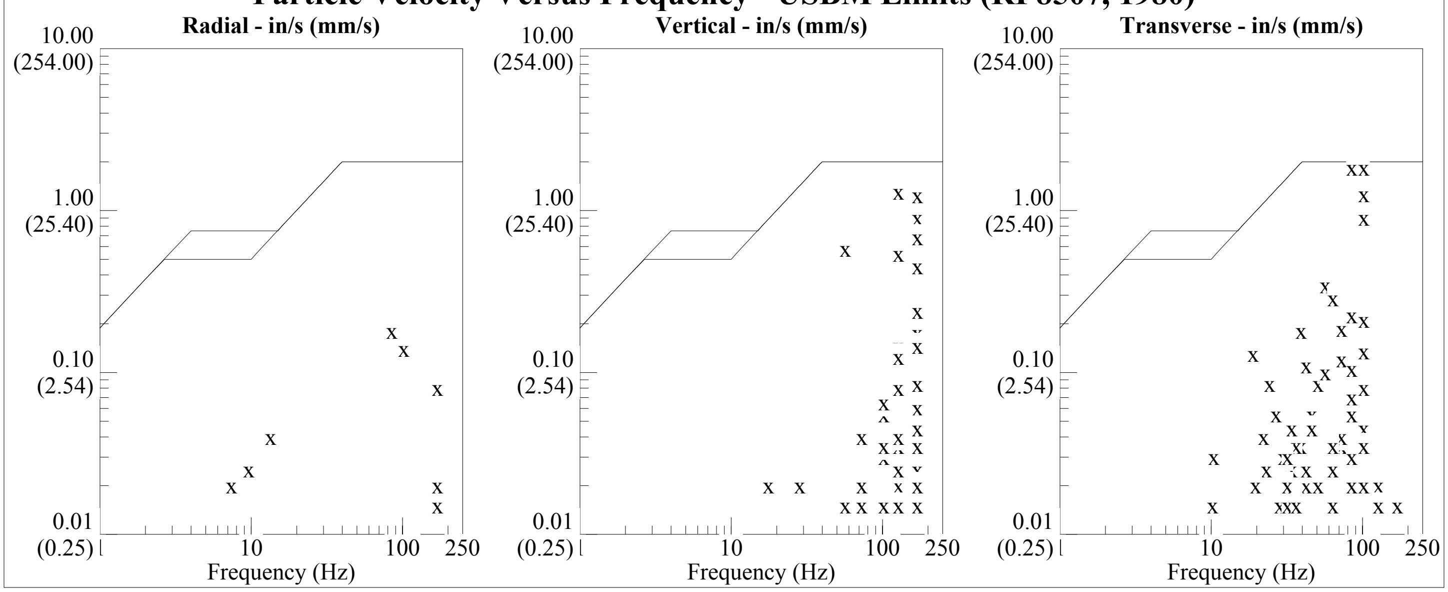
Radial: 0.18in/s 4.572mm/s @ 128.0Hz
Vertical: 1.30in/s 33.02mm/s @ 128.0Hz
***Transverse:* 1.84in/s 46.736mm/s @ 85.3Hz**
Vector Sum (VS): 2.05in/s 52.07mm/s
*Displacement:*0.005658in 0.143725mm
*Acceleration:*3.153623g's
*Calibration Date:*2/16/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
1.84in/s (0.460in/s/div) 46.74mm/s (11.684mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located Above Door
Door Shut with Normal amount of force

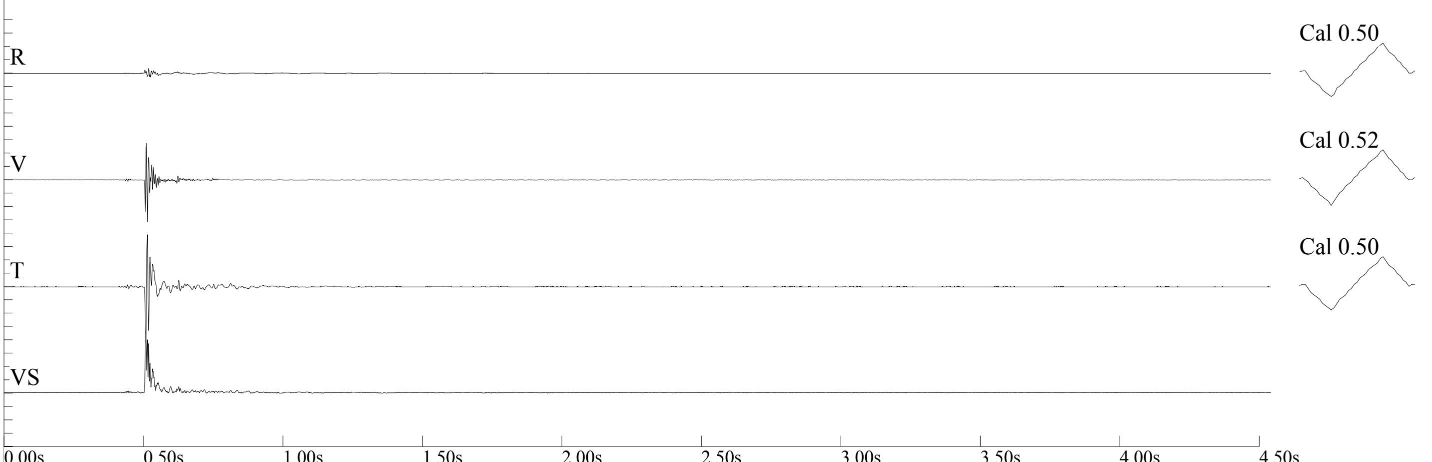
File Name: DOOR_SHUT_ABOVE_DOOR000.DTB
Number: 000
Date: 3/20/2005
Time: 18:15
Serial Number: 2474
Seismic Trigger: 0.2000 in/s 5.0800 mm/s
Acoustic Trigger: 130 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

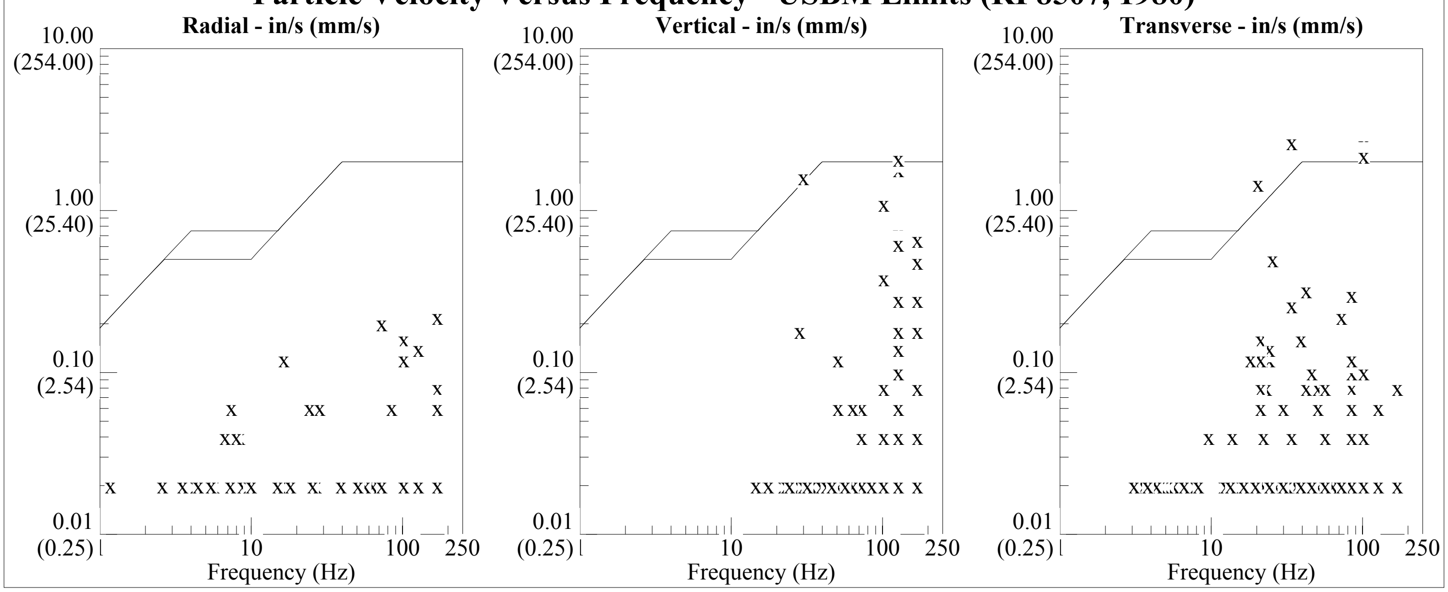
Radial: 0.22in/s 5.588mm/s @ 170.6Hz
Vertical: 2.08in/s 52.832mm/s @ 128.0Hz
***Transverse:* 2.64in/s 67.056mm/s @ 56.8Hz**
Vector Sum (VS): 3.30in/s 83.82mm/s
*Displacement:*0.009743in 0.247470mm
*Acceleration:*4.452174g's
*Calibration Date:*2/18/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
2.64in/s (0.660in/s/div) 67.06mm/s (16.764mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located Above Door
Door Shut with Normal amount of force

File Name: DOOR_SHUT_ABOVE_DOOR001.DTB
Number: 001
Date: 3/20/2005
Time: 18:16
Serial Number: 2474
Seismic Trigger: 0.2000 in/s 5.0800 mm/s
Acoustic Trigger: 130 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

Radial: 0.12in/s 3.048mm/s @ 128.0Hz

Vertical: 0.86in/s 21.844mm/s @ 128.0Hz

***Transverse:* 1.48in/s 37.592mm/s @ 85.3Hz**

Vector Sum (VS): 1.54in/s 39.116mm/s

*Displacement:*0.005752in 0.146093mm

*Acceleration:*2.120083g's

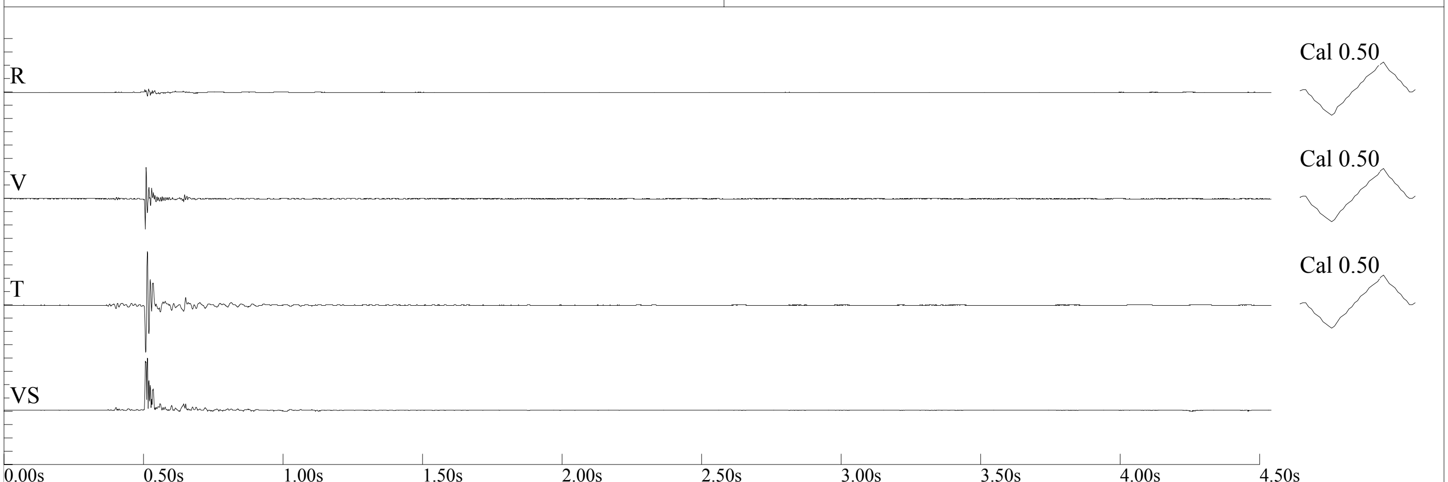
*Calibration Date:*2/18/2005

Graph Information

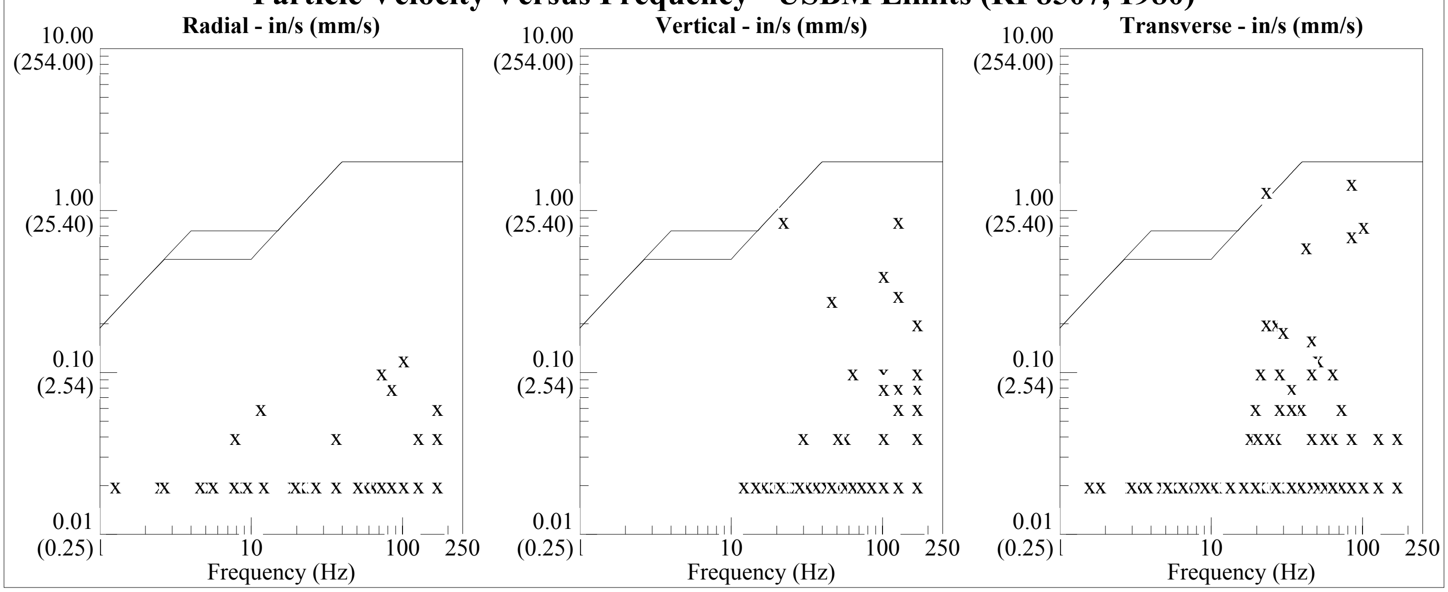
*Duration:*0.000s To: 4.500s

Seismic Scale:
1.48in/s (0.370in/s/div) 37.59mm/s (9.398mm/s/div)

*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located Above Door
Door Shut with Normal amount of force

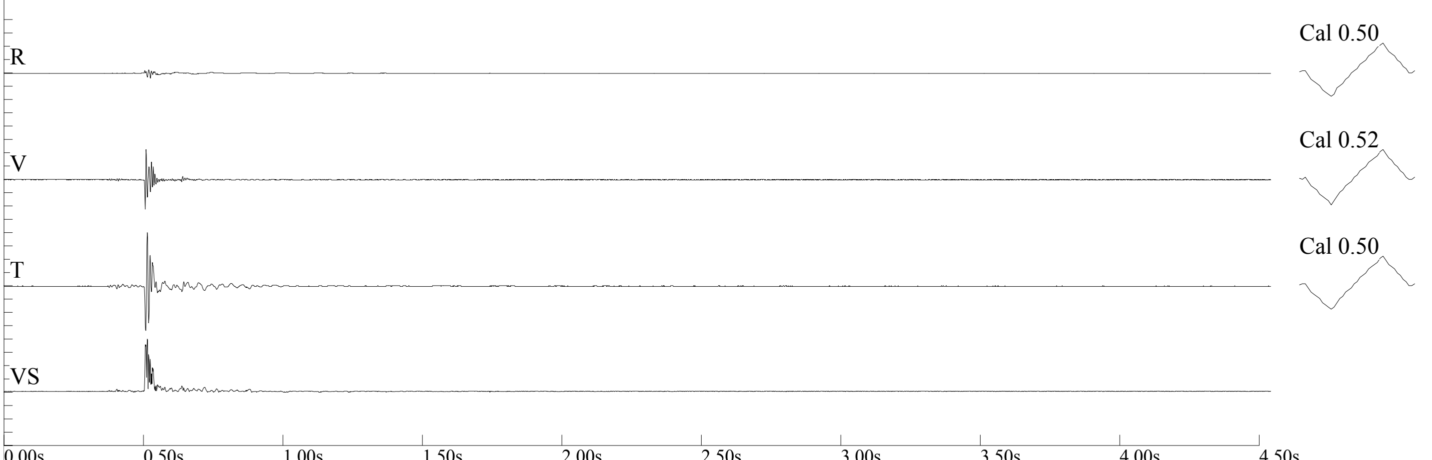
File Name: DOOR_SHUT_ABOVE_DOOR002.DTB
Number: 002
Date: 3/20/2005
Time: 18:16
Serial Number: 2474
Seismic Trigger: 0.2000 in/s 5.0800 mm/s
Acoustic Trigger: 130 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

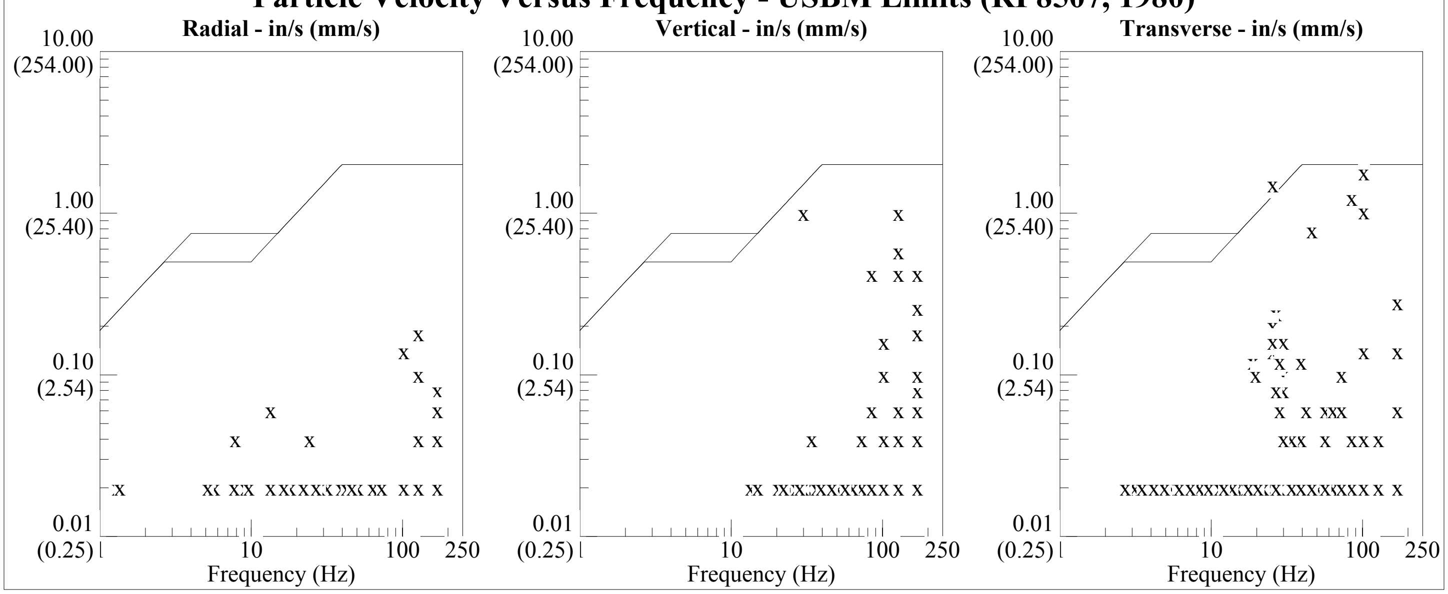
Radial: 0.18in/s 4.572mm/s @ 128.0Hz
Vertical: 1.00in/s 25.40mm/s @ 128.0Hz
***Transverse:* 1.78in/s 45.212mm/s @ 102.4Hz**
Vector Sum (VS): 1.885in/s 47.879mm/s
*Displacement:*0.006401in 0.162575mm
*Acceleration:*2.517598g's
*Calibration Date:*2/18/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
1.78in/s (0.445in/s/div) 45.21mm/s (11.303mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located 10 ft from Door on same wall
Door Slam

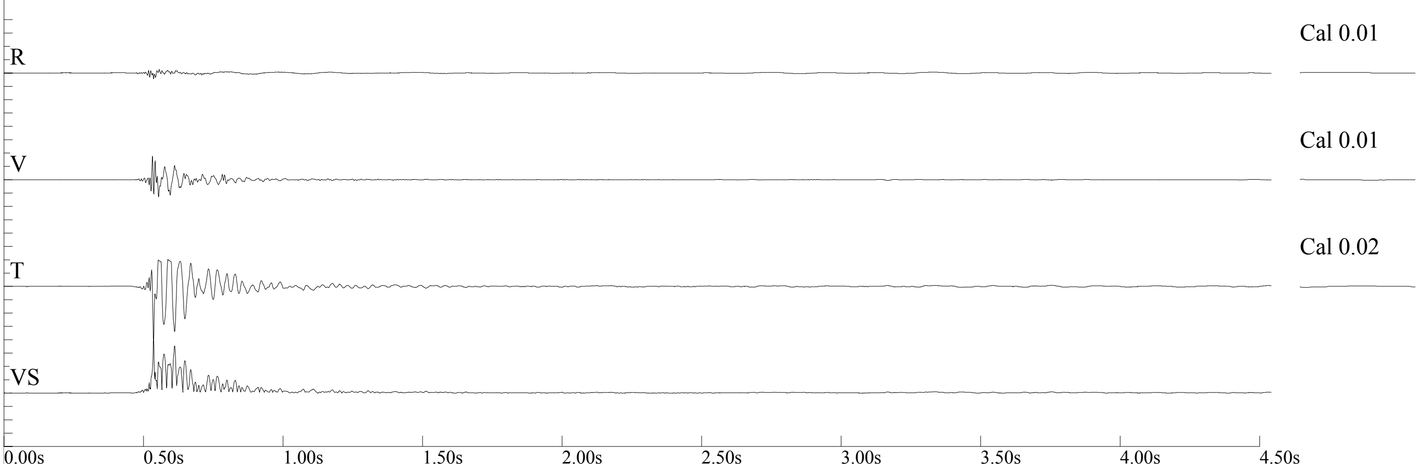
File Name: DOOR_SLAM_10FT_SAME_WALL004.DTB
Number: 004
Date: 3/19/2005
Time: 15:04
Serial Number: 1646
Seismic Trigger: 0.0500 in/s 1.2700 mm/s
Acoustic Trigger: 116 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 7.1

Amplitudes and Frequencies

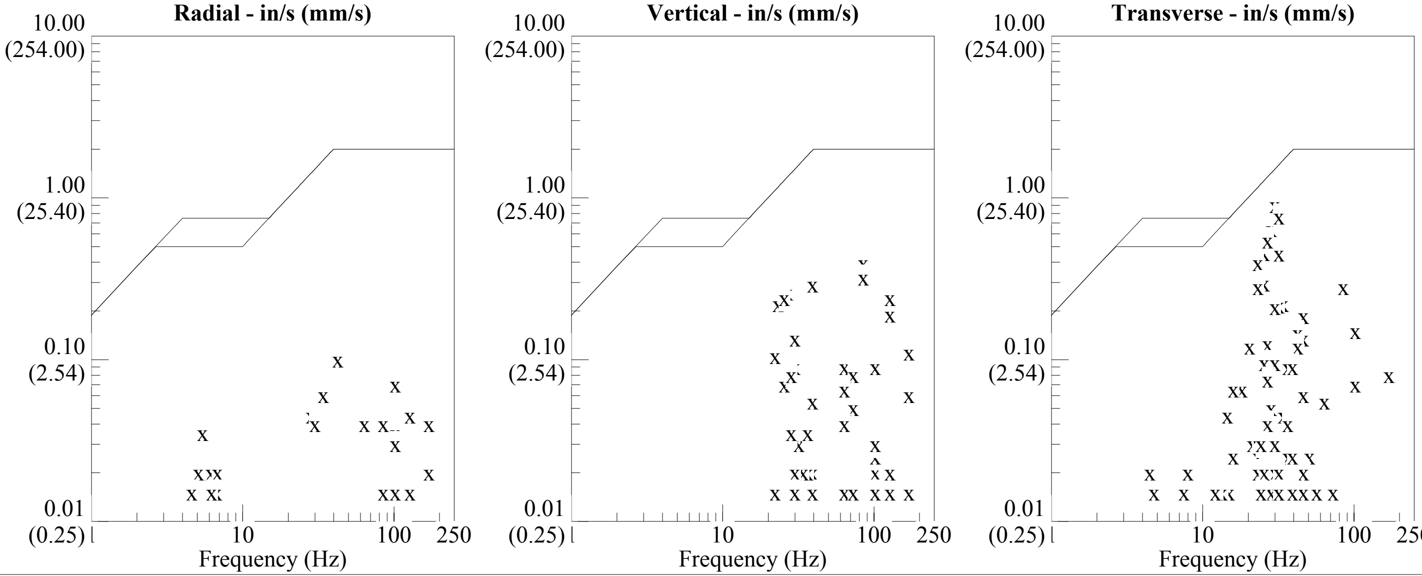
Radial: 0.10in/s 2.54mm/s @ 46.5Hz
Vertical: 0.395in/s 10.033mm/s @ 85.3Hz
***Transverse:* 0.90in/s 22.86mm/s @ 30.1Hz**
Vector Sum (VS): 0.93in/s 23.622mm/s
*Displacement:*0.004501in 0.114330mm
*Acceleration:*0.662526g's
*Calibration Date:*2/18/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
0.90in/s (0.225in/s/div) 22.86mm/s (5.715mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located 10 ft from Door on same wall
Door Slam

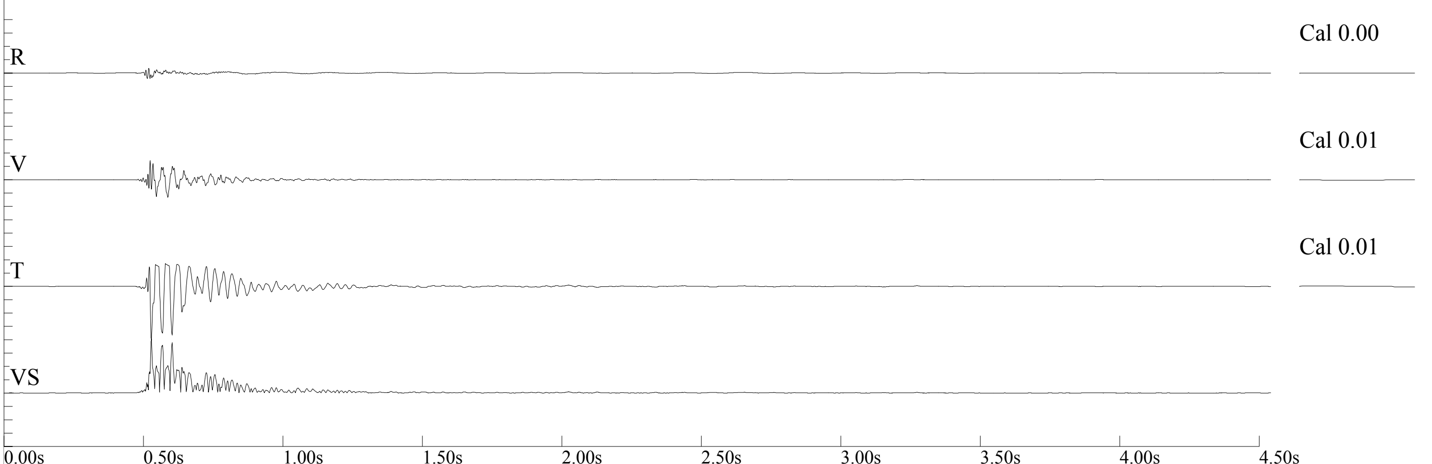
File Name: DOOR_SLAM_10FT_SAME_WALL006.DTB
Number: 006
Date: 3/19/2005
Time: 15:05
Serial Number: 1646
Seismic Trigger: 0.0500 in/s 1.2700 mm/s
Acoustic Trigger: 116 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 7.1

Amplitudes and Frequencies

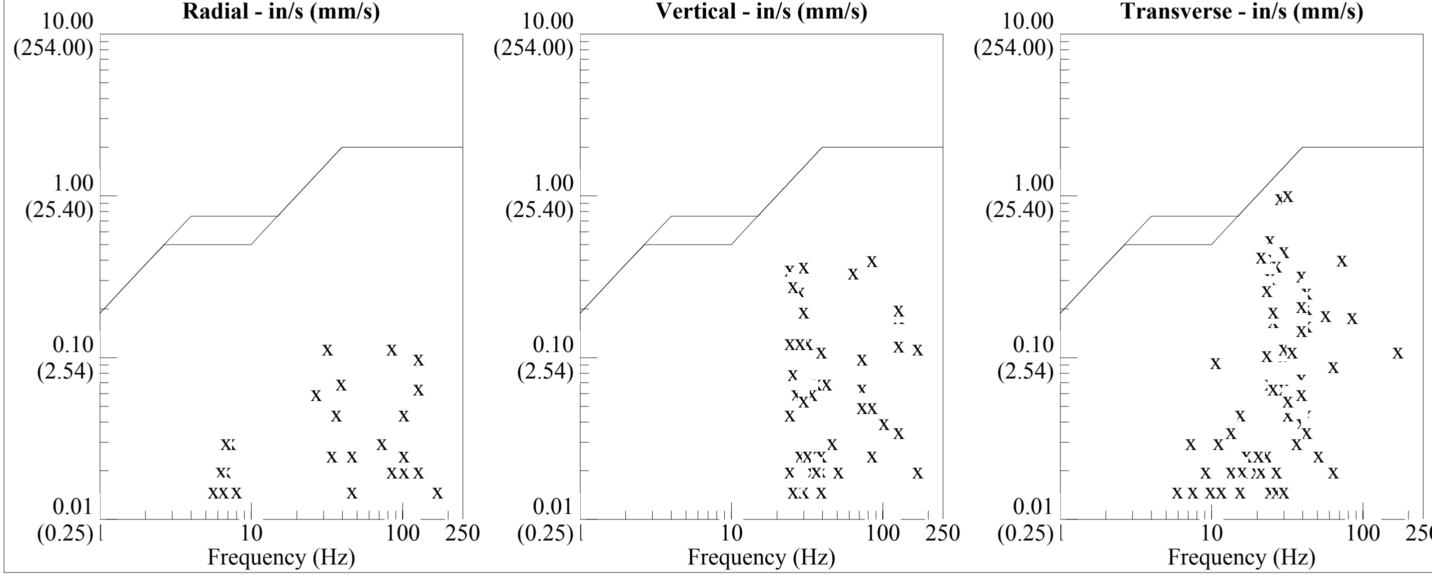
Radial: 0.115in/s 2.921mm/s @ 85.3Hz
Vertical: 0.405in/s 10.287mm/s @ 85.3Hz
***Transverse:* 1.12in/s 28.448mm/s @ 30.1Hz**
Vector Sum (VS): 1.14in/s 28.956mm/s
*Displacement:*0.007553in 0.191855mm
*Acceleration:*0.960663g's
*Calibration Date:*2/18/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
1.12in/s (0.280in/s/div) 28.45mm/s (7.112mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



TerraDinamica

Unit Located 10 ft from Door on same wall
Door Slam

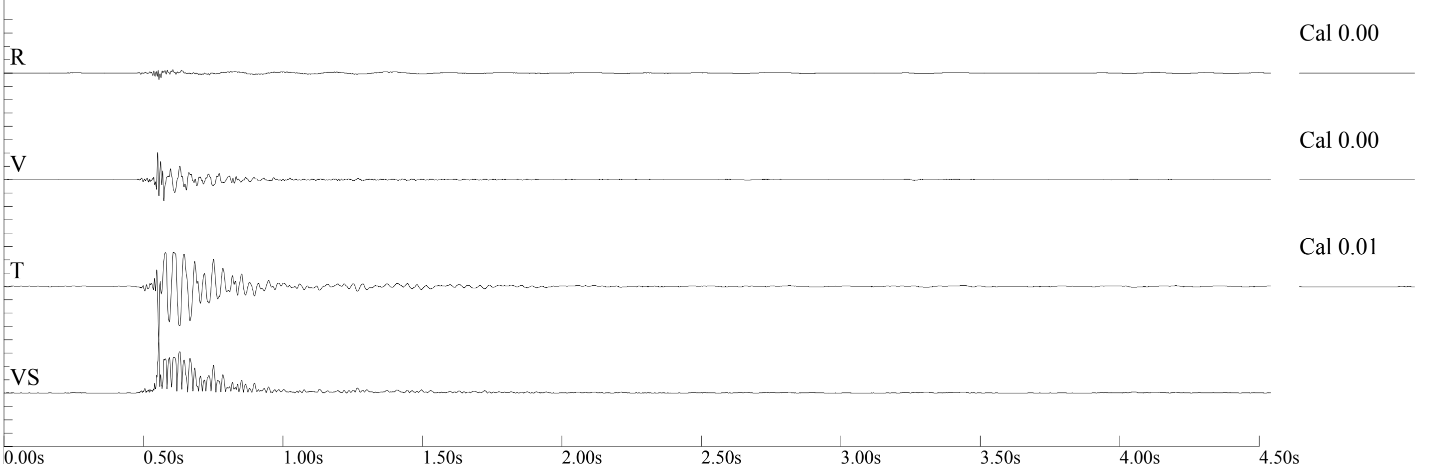
File Name: DOOR_SLAM_10FT_SAME_WALL005.DTB
Number: 005
Date: 3/19/2005
Time: 15:04
Serial Number: 1646
Seismic Trigger: 0.0500 in/s 1.2700 mm/s
Acoustic Trigger: 116 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 7.1

Amplitudes and Frequencies

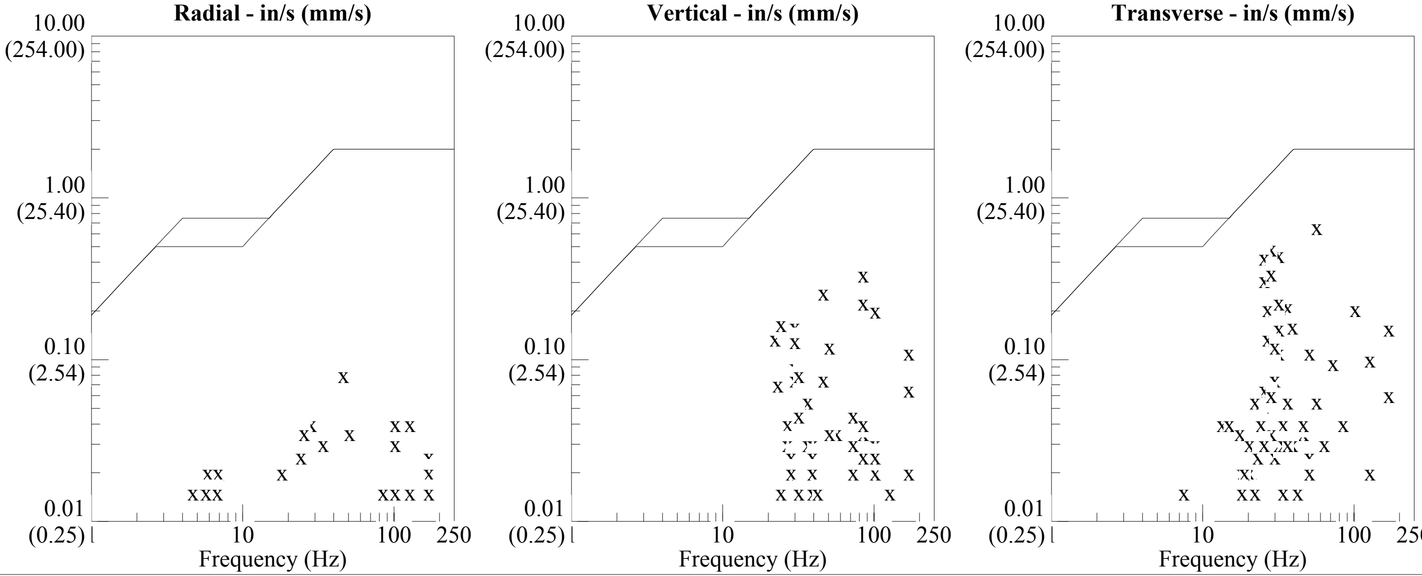
Radial: 0.08in/s 2.032mm/s @ 46.5Hz
Vertical: 0.335in/s 8.509mm/s @ 85.3Hz
Transverse: **0.66in/s 16.764mm/s @ 56.8Hz**
Vector Sum (VS): 0.685in/s 17.399mm/s
*Displacement:*0.003813in 0.096846mm
*Acceleration:*0.563147g's
*Calibration Date:*2/18/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
0.66in/s (0.165in/s/div) 16.76mm/s (4.191mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



TerraDinamica

Unit Located 10 ft from Door on same wall
Door Slam

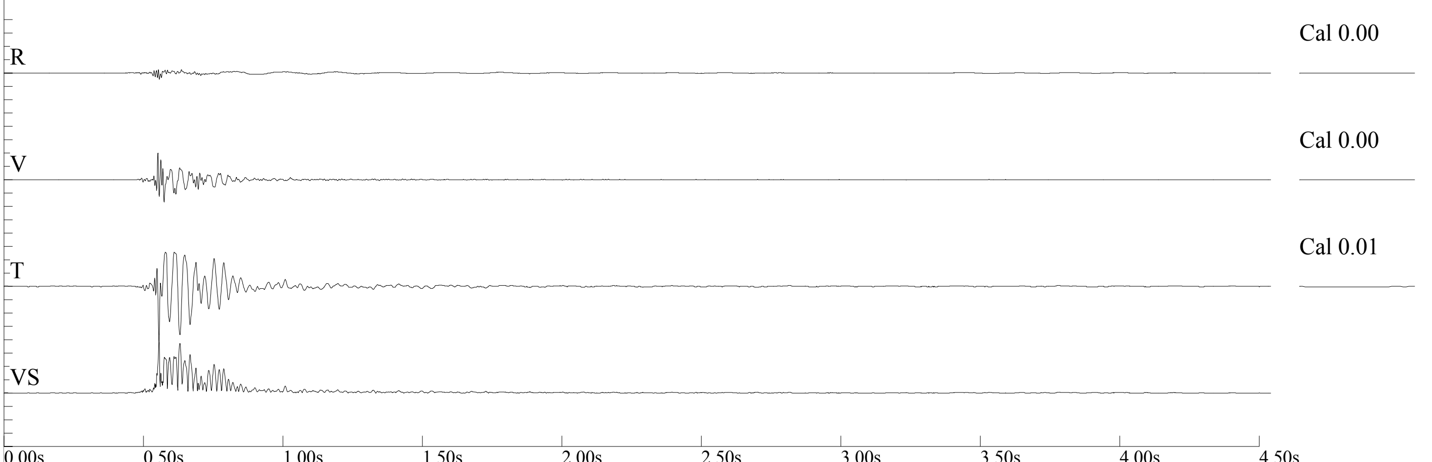
File Name: DOOR_SLAM_10FT_SAME_WALL007.DTB
Number: 007
Date: 3/19/2005
Time: 15:06
Serial Number: 1646
Seismic Trigger: 0.0500 in/s 1.2700 mm/s
Acoustic Trigger: 116 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 7.1

Amplitudes and Frequencies

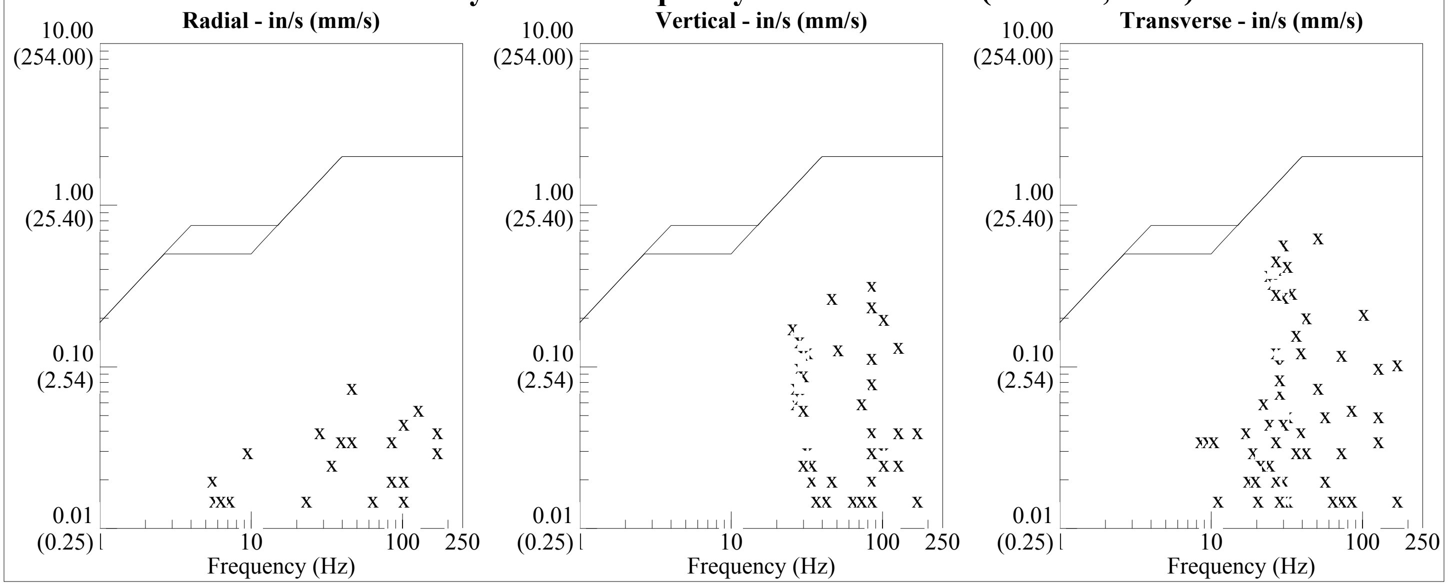
Radial: 0.075in/s 1.905mm/s @ 46.5Hz
Vertical: 0.32in/s 8.128mm/s @ 85.3Hz
***Transverse:* 0.64in/s 16.256mm/s @ 56.8Hz**
Vector Sum (VS): 0.67in/s 17.018mm/s
*Displacement:*0.003666in 0.093110mm
*Acceleration:*0.536646g's
*Calibration Date:*2/18/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
0.64in/s (0.160in/s/div) 16.26mm/s (4.064mm/s/div)
*Time Line Intervals at:*0.50 s



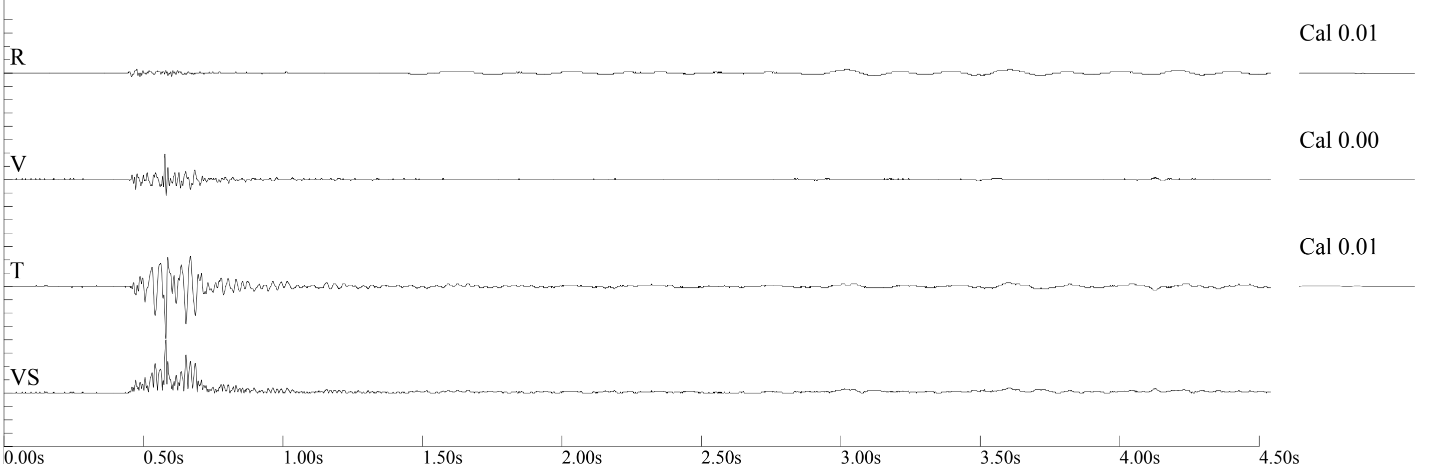
Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



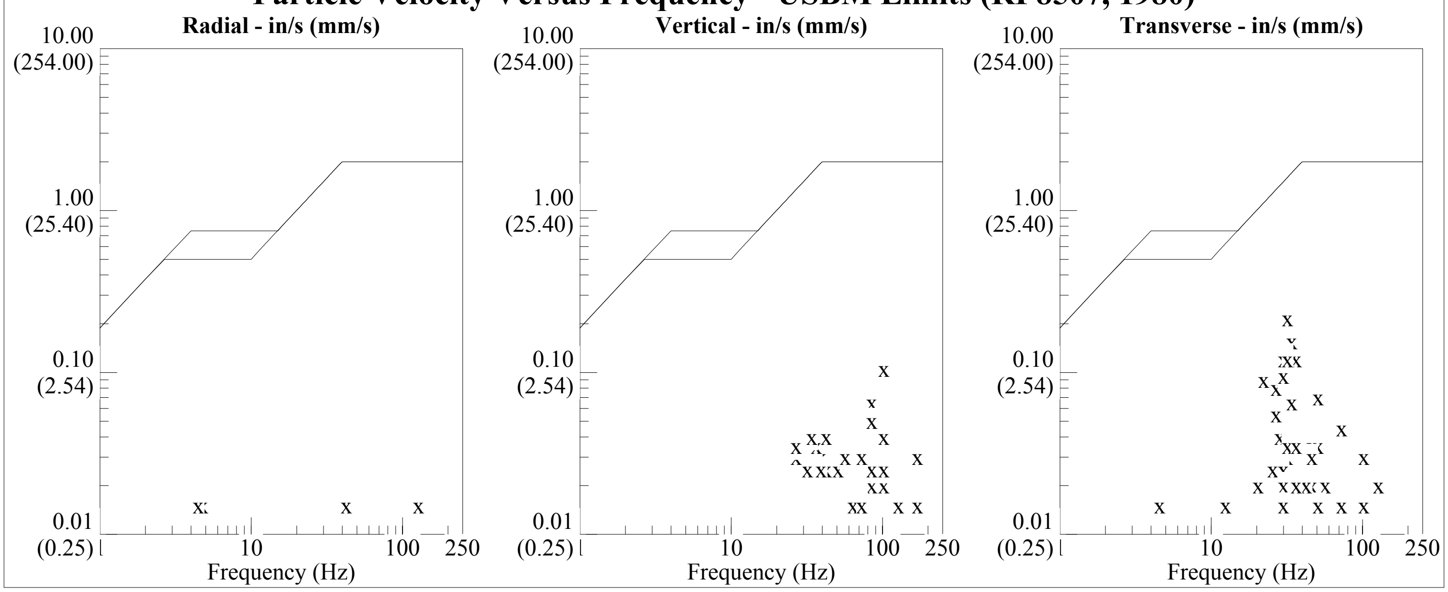
TerraDinamica

Unit Located 10 ft from Door on same wall **Door Shut**	File Name: DOOR_SHUT_10FT_SAME_WALL001.DTB Number: 001 Date: 3/19/2005 Time: 15:02 Serial Number: 1646 Seismic Trigger: 0.0500 in/s 1.2700 mm/s Acoustic Trigger: 116 dB Sample Rate: 1024 Record Duration: 4.0 Seconds Pre-Trigger: 0.50 Seconds Sensor Gain: 2x Battery: 7.1

Amplitudes and Frequencies	Graph Information
Radial: 0.015in/s 0.381mm/s @ 5.8Hz *Vertical:* 0.105in/s 2.667mm/s @ 102.4Hz ***Transverse:* 0.215in/s 5.461mm/s @ 32.0Hz** *Vector Sum (VS):* 0.22in/s 5.588mm/s *Displacement:*0.000926in 0.023523mm *Acceleration:*0.218634g's *Calibration Date:*2/18/2005	*Duration:*0.000s To: 4.500s *Seismic Scale:* 0.22in/s (0.055in/s/div) 5.59mm/s (1.397mm/s/div) *Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located 10 ft from Door on same wall
Door Shut

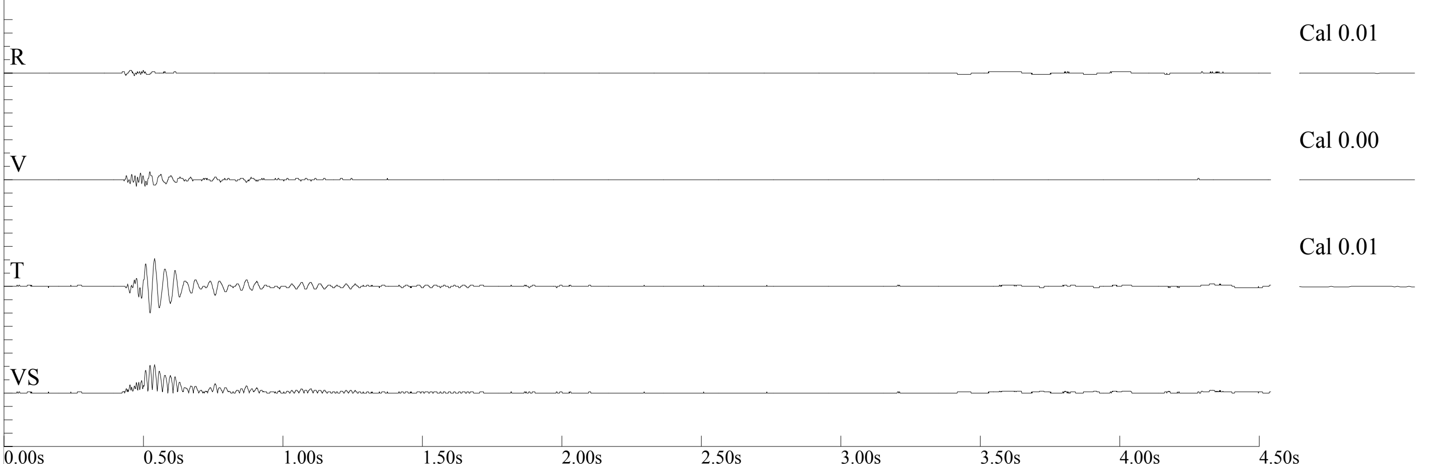
File Name: DOOR_SHUT_10FT_SAME_WALL002.DTB
Number: 002
Date: 3/19/2005
Time: 15:03
Serial Number: 1646
Seismic Trigger: 0.0500 in/s 1.2700 mm/s
Acoustic Trigger: 116 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 7.1

Amplitudes and Frequencies

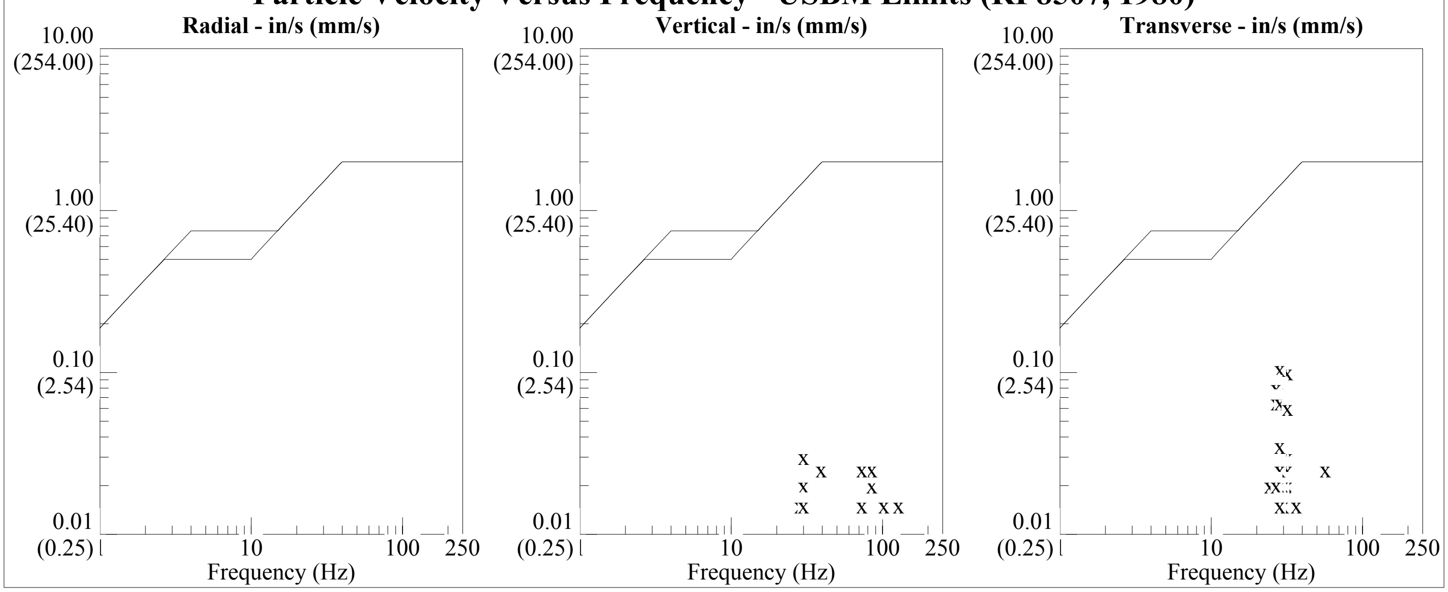
Radial: 0.005in/s 0.127mm/s @ 0.0Hz
Vertical: 0.03in/s 0.762mm/s @ 36.5Hz
***Transverse:* 0.105in/s 2.667mm/s @ 28.4Hz**
Vector Sum (VS): 0.105in/s 2.667mm/s
*Displacement:*0.000585in 0.014859mm
*Acceleration:*0.046377g's
*Calibration Date:*2/18/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
0.20in/s (0.050in/s/div) 5.08mm/s (1.270mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



TerraDinamica

Unit Located 10 ft from Door on same wall
Door Shut

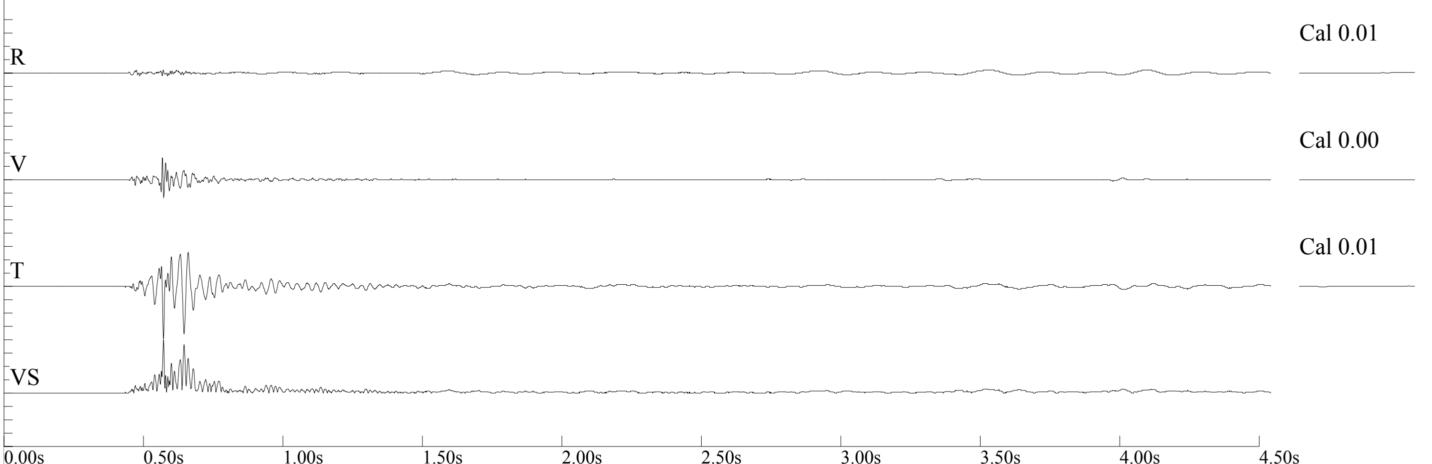
File Name: DOOR_SHUT_10FT_SAME_WALL003.DTB
Number: 003
Date: 3/19/2005
Time: 15:03
Serial Number: 1646
Seismic Trigger: 0.0500 in/s 1.2700 mm/s
Acoustic Trigger: 116 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 7.1

Amplitudes and Frequencies

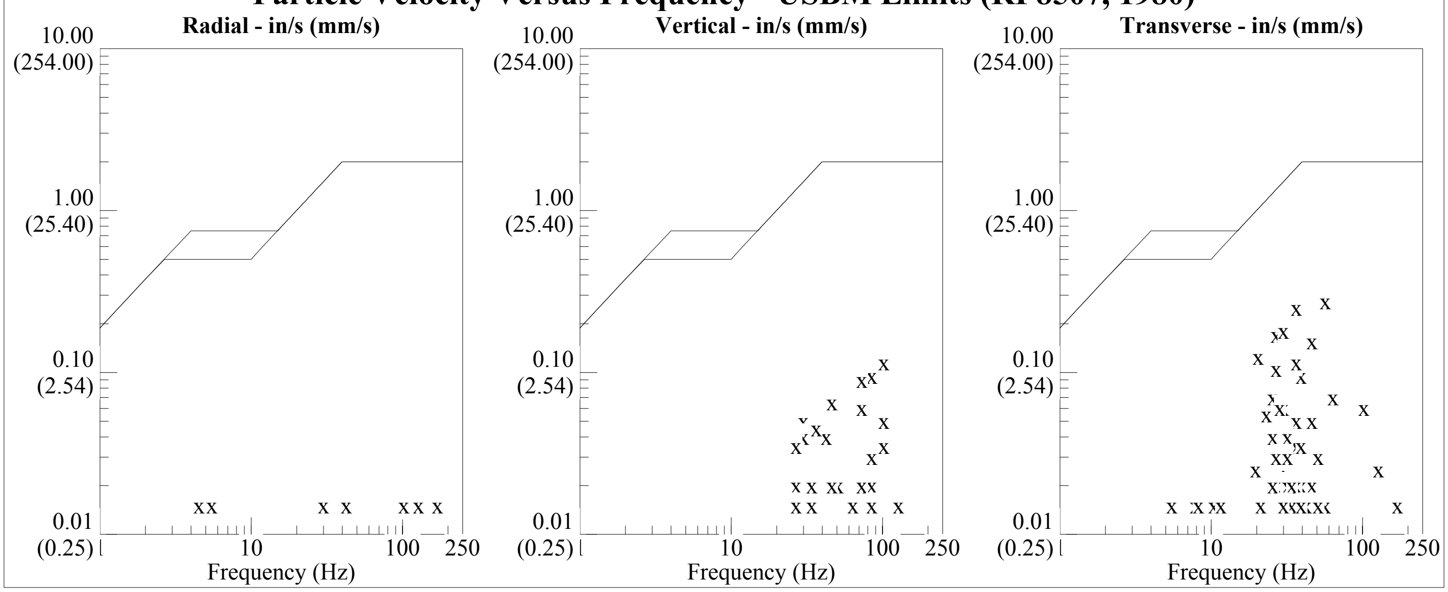
Radial: 0.015in/s 0.381mm/s @ 128.0Hz
Vertical: 0.115in/s 2.921mm/s @ 102.4Hz
***Transverse:* 0.275in/s 6.985mm/s @ 56.8Hz**
Vector Sum (VS): 0.29in/s 7.366mm/s
*Displacement:*0.001548in 0.039320mm
*Acceleration:*0.218634g's
*Calibration Date:*2/18/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
0.28in/s (0.070in/s/div) 7.11mm/s (1.778mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located on Window Frame
Front Wall of House 13ft from Door
Vibration Caused By Front Door Slam

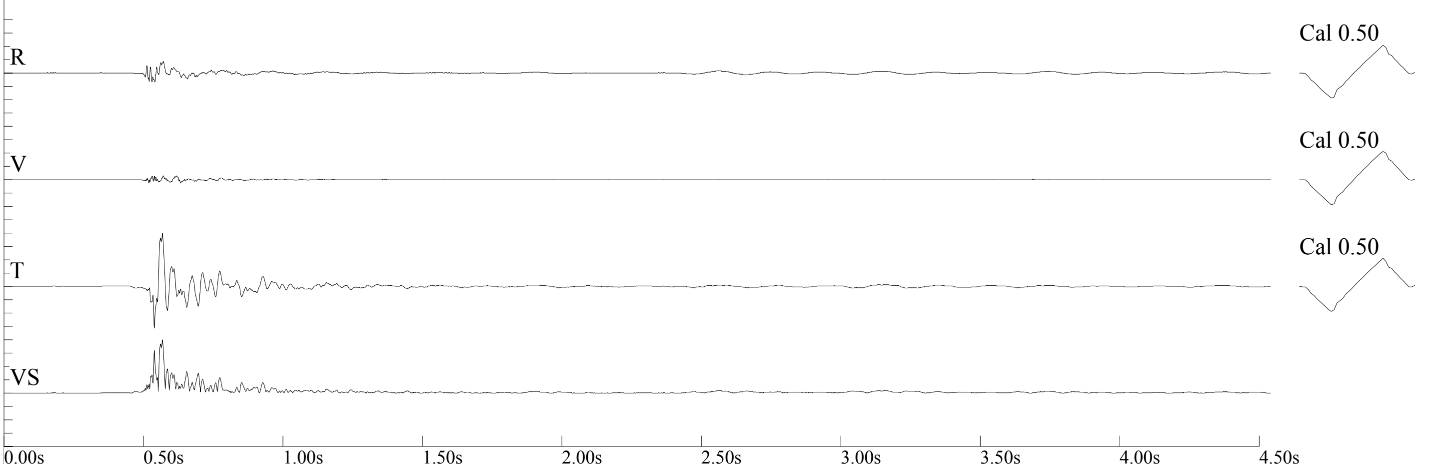
File Name: WINDOW DOOR SLAM005.DTB
Number: 005
Date: 3/28/2005
Time: 12:26
Serial Number: 1646
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 142 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.5

Amplitudes and Frequencies

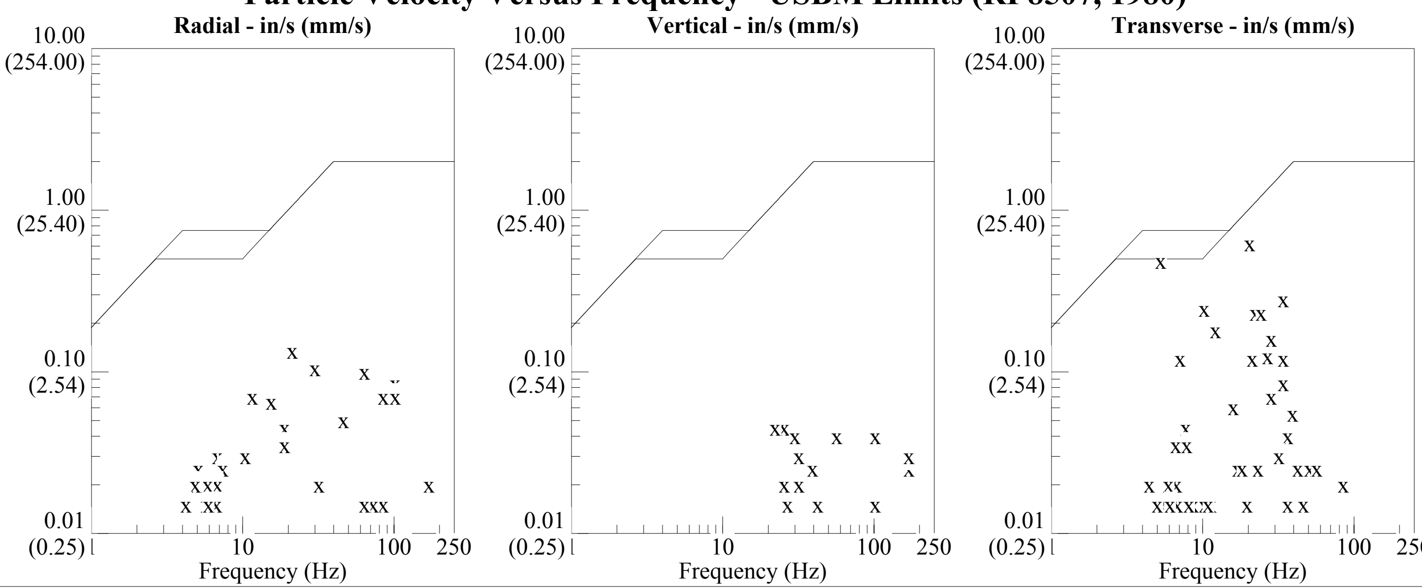
Radial: 0.135in/s 3.429mm/s @ 21.3Hz
Vertical: 0.045in/s 1.143mm/s @ 36.5Hz
***Transverse:* 0.62in/s 15.748mm/s @ 20.4Hz**
Vector Sum (VS): 0.63in/s 16.002mm/s
Displacement: 0.006985in 0.177413mm
Acceleration: 0.311387g's
Calibration Date: 2/18/2005

Graph Information

Duration: 0.000s To: 4.500s
Seismic Scale:
0.62in/s (0.155in/s/div) 15.75mm/s (3.937mm/s/div)
Time Line Intervals at: 0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located on Window Frame
Front Wall of House 13ft from Door
Vibration Caused By Front Door Slam

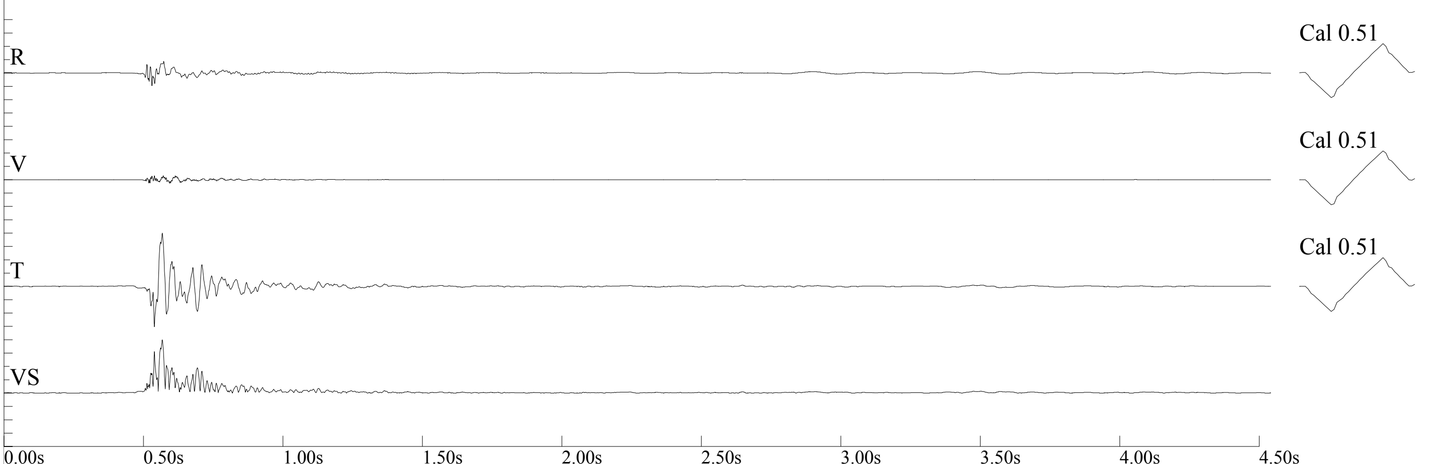
File Name: WINDOW DOOR SLAM008.DTB
Number: 008
Date: 3/28/2005
Time: 12:27
Serial Number: 1646
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 142 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.5

Amplitudes and Frequencies

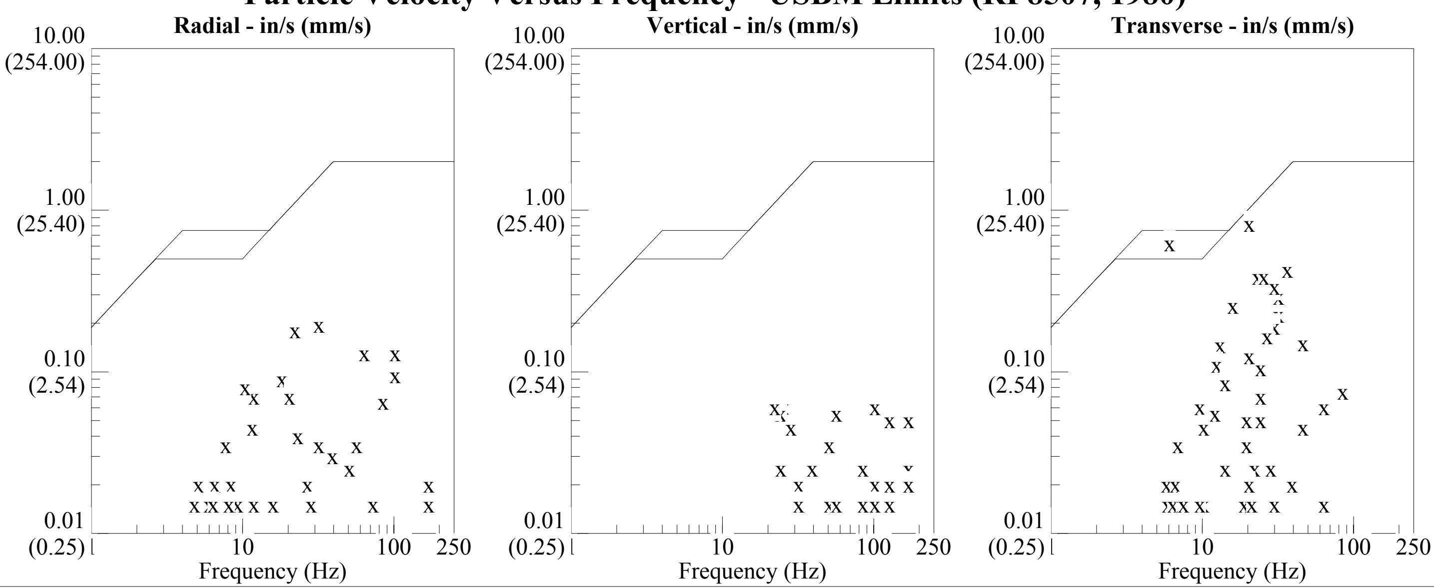
Radial: 0.195in/s 4.953mm/s @ 32.0Hz
Vertical: 0.06in/s 1.524mm/s @ 102.4Hz
***Transverse:* 0.82in/s 20.828mm/s @ 20.4Hz**
Vector Sum (VS): 0.83in/s 21.082mm/s
*Displacement:*0.008990in 0.228341mm
*Acceleration:*0.437267g's
*Calibration Date:*2/18/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
0.82in/s (0.205in/s/div) 20.83mm/s (5.207mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located on Window Frame
Front Wall of House 13ft from Door
Vibration Caused By Front Door Slam

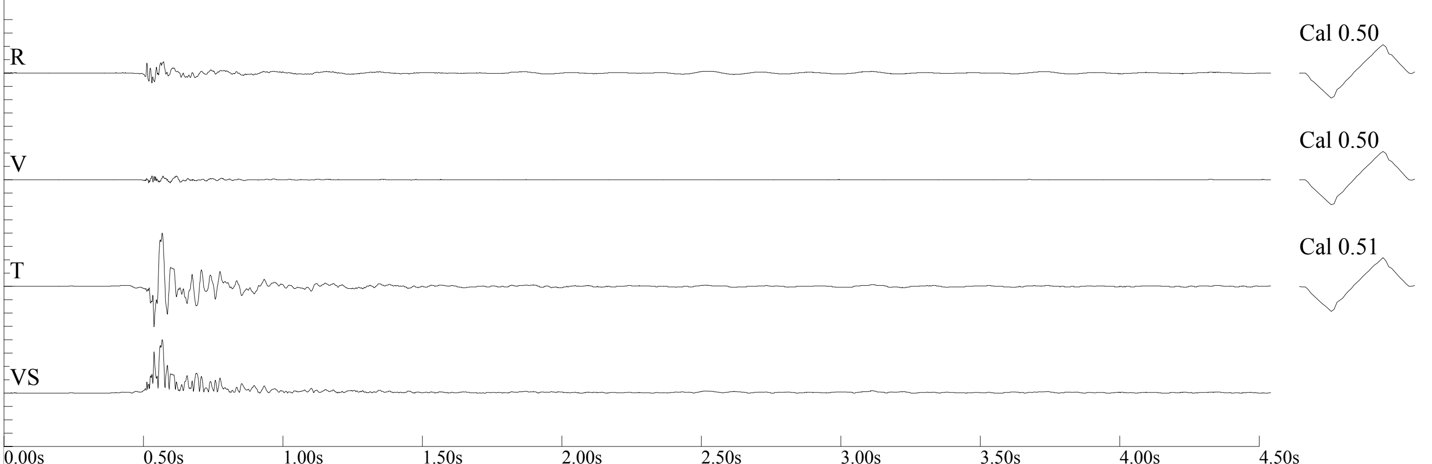
File Name: WINDOW DOOR SLAM006.DTB
Number: 006
Date: 3/28/2005
Time: 12:27
Serial Number: 1646
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 142 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.5

Amplitudes and Frequencies

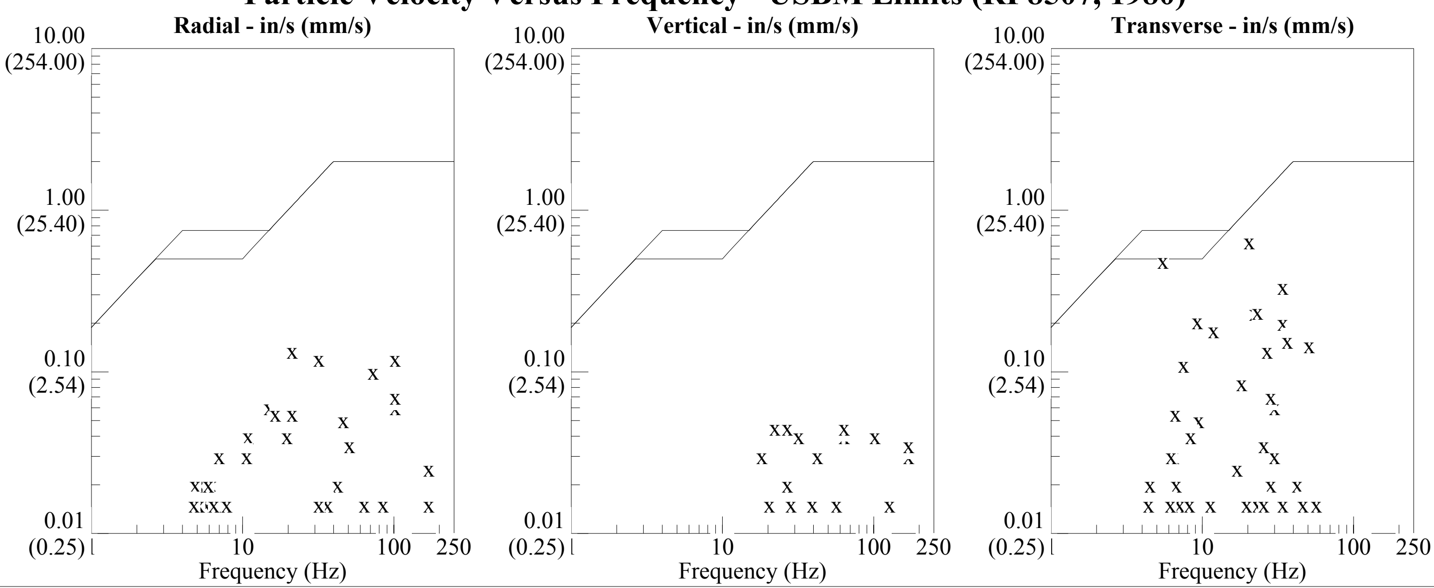
Radial: 0.135in/s 3.429mm/s @ 21.3Hz
Vertical: 0.045in/s 1.143mm/s @ 64.0Hz
***Transverse:* 0.64in/s 16.256mm/s @ 20.4Hz**
Vector Sum (VS): 0.65in/s 16.51mm/s
*Displacement:*0.007271in 0.184673mm
*Acceleration:*0.318012g's
*Calibration Date:*2/18/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
0.64in/s (0.160in/s/div) 16.26mm/s (4.064mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Unit Located on Window Frame
Front Wall of House 13ft from Door
Vibration Caused By Front Door Slam

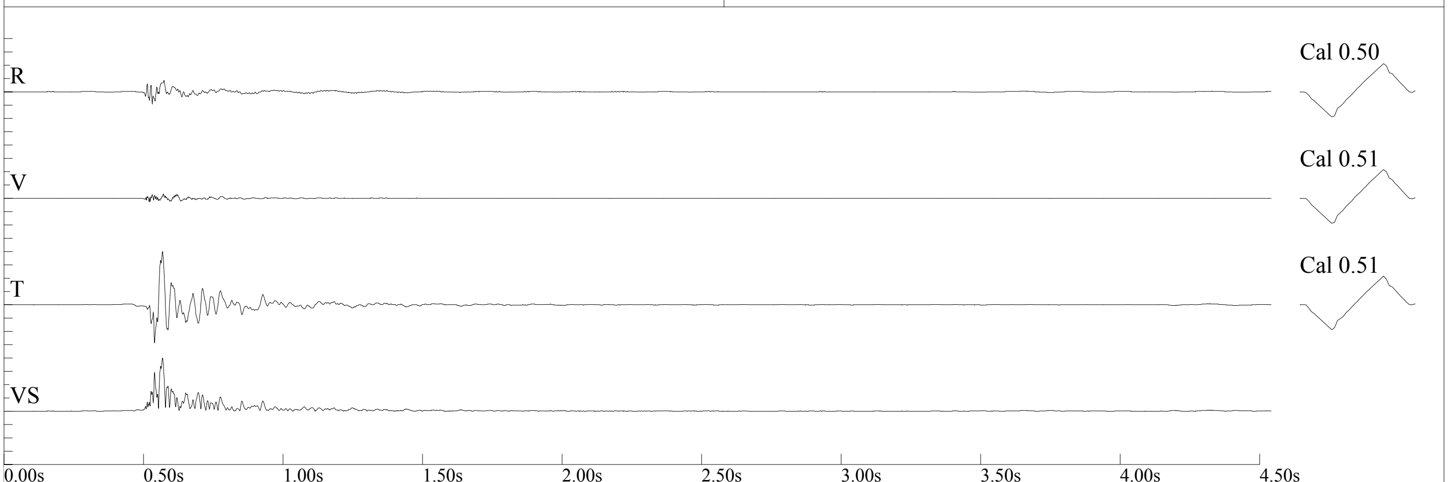
File Name: WINDOW DOOR SLAM010.DTB
Number: 010
Date: 3/28/2005
Time: 12:28
Serial Number: 1646
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 142 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.5

Amplitudes and Frequencies

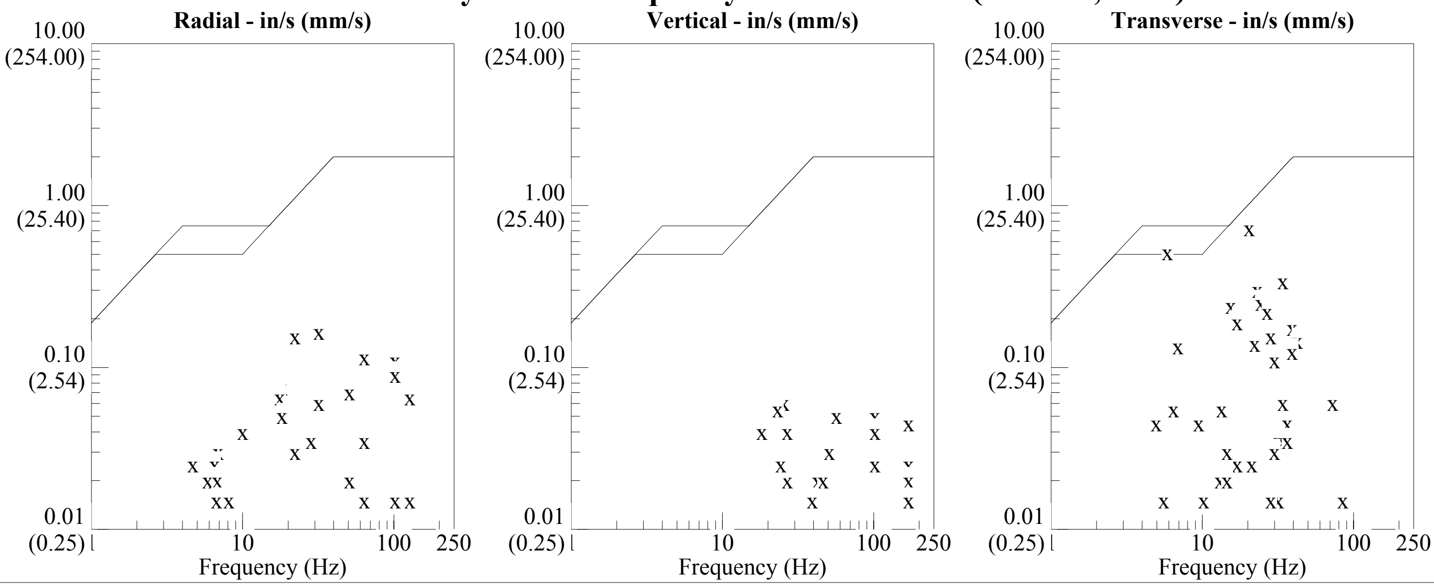
Radial: 0.165in/s 4.191mm/s @ 32.0Hz
Vertical: 0.06in/s 1.524mm/s @ 34.1Hz
***Transverse:* 0.72in/s 18.288mm/s @ 20.4Hz**
Vector Sum (VS): 0.73in/s 18.542mm/s
*Displacement:*0.007814in 0.198483mm
*Acceleration:*0.351139g's
*Calibration Date:*2/18/2005

Graph Information

*Duration:*0.000s To: 4.500s
Seismic Scale:
0.72in/s (0.180in/s/div) 18.29mm/s (4.572mm/s/div)
*Time Line Intervals at:*0.50 s



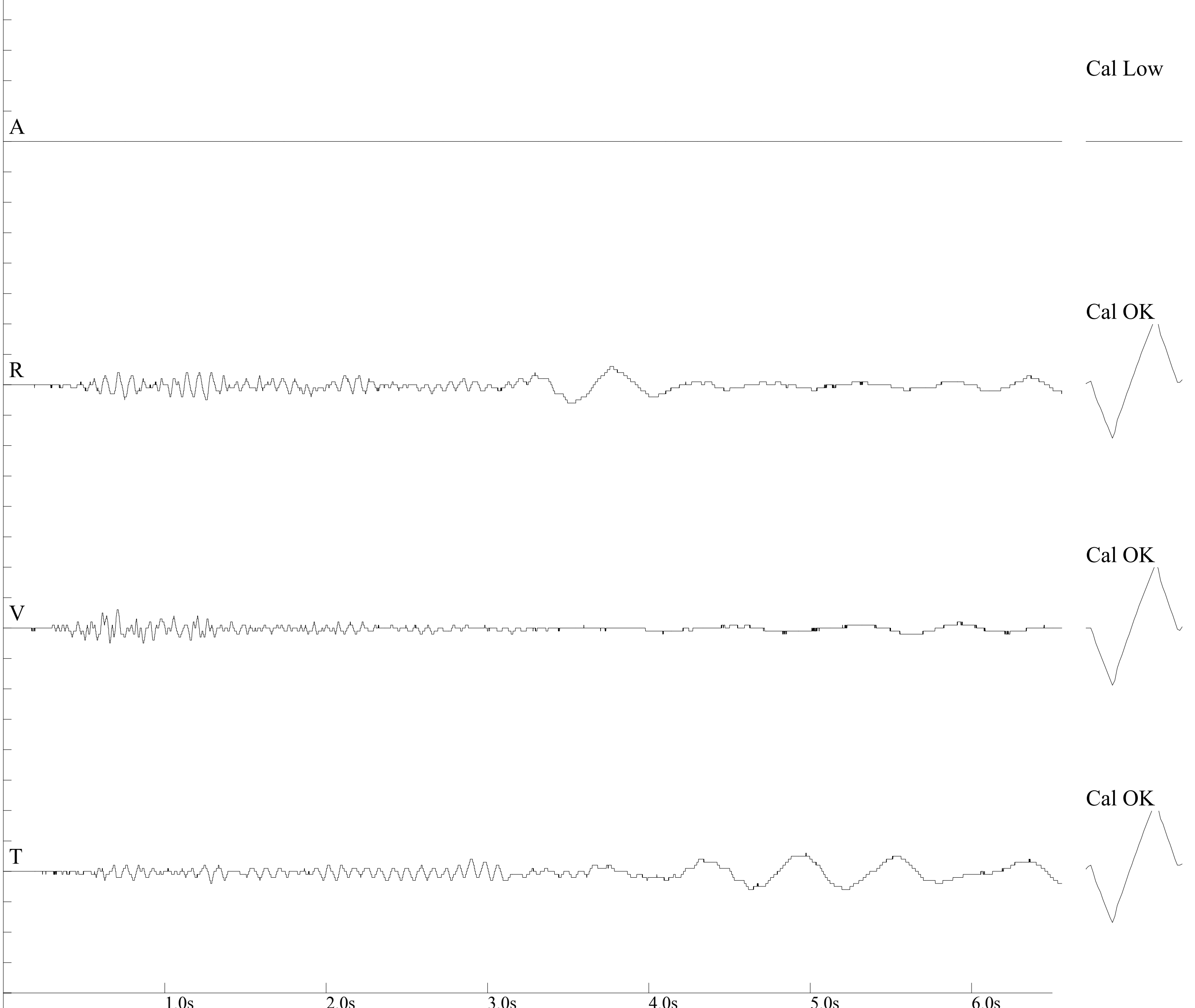
Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Wildcat Run
#20683

File Name: 2 LEE APRIL20050401006.DTB
Number: 006
Date: 4/1/2005
Time: 16:12
Serial Number: 2475
Seismic Trigger: 0.0200 in/sec
Acoustic Trigger: 142 dB
Sample Rate: 1024
Record Duration: 6.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.2

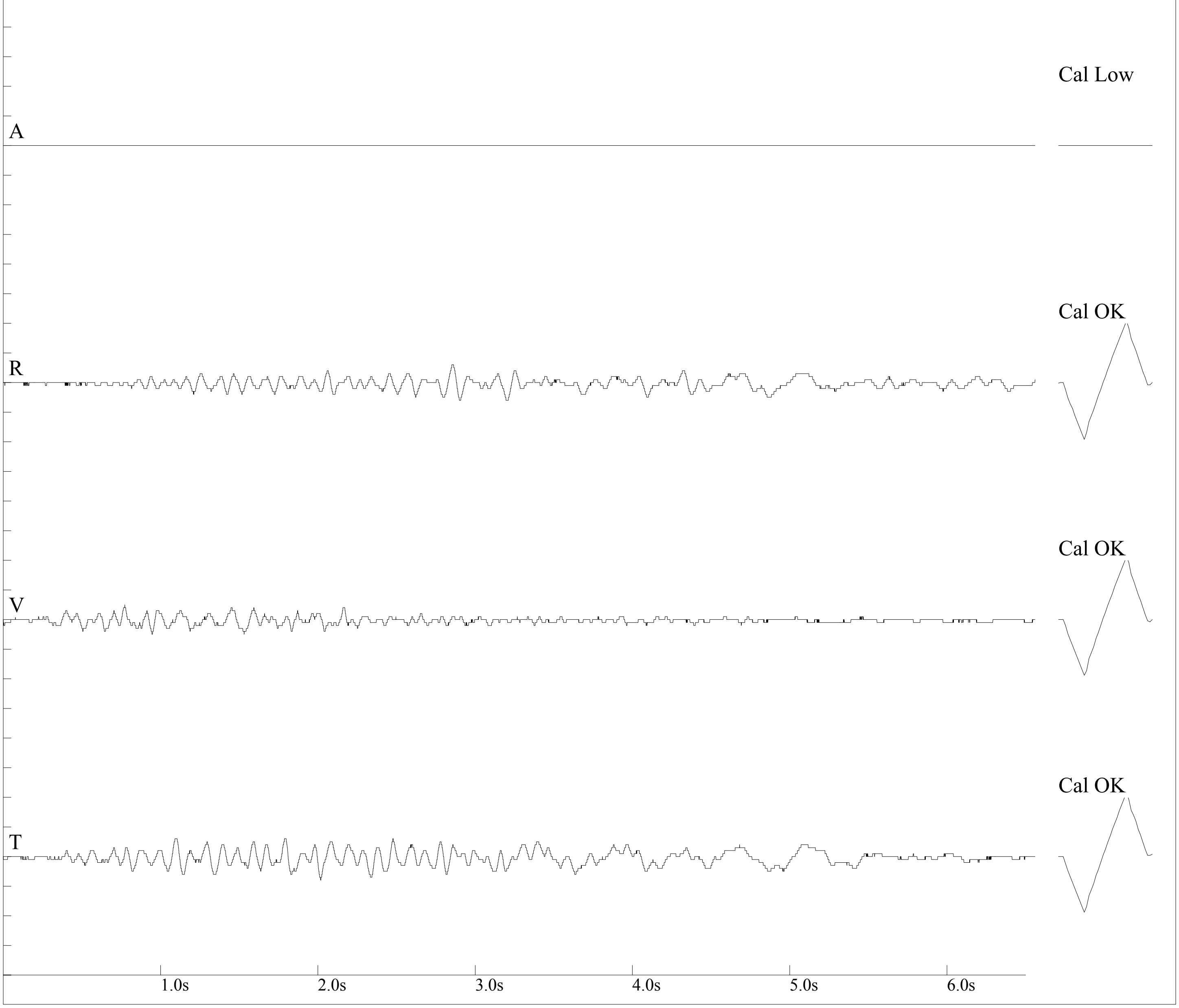
Amplitudes and Frequencies	**Graph Information**
Acoustic: <100 dB, <0.02 Mb, <0.0003 psi, <0.002 kPa	*Duration:* 0.000 s To: 6.500 s
***Radial:* 0.0300 in/sec @ 2.1Hz**	*Acoustic Scale:* 120 dB
***Vertical:* 0.0300 in/sec @ 18.2Hz**	*Seismic Scale:* 0.20 in/sec (0.050 in/sec/div)
***Transverse:* 0.0300 in/sec @ 2.0Hz**	*Time Line Intervals at:* 1.00 s



Wildcat Run
#20471

File Name: 2 LEE APRIL20050401004.DTB
Number: 004
Date: 4/1/2005
Time: 11:25
Serial Number: 2475
Seismic Trigger: 0.0200 in/sec
Acoustic Trigger: 142 dB
Sample Rate: 1024
Record Duration: 6.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.3

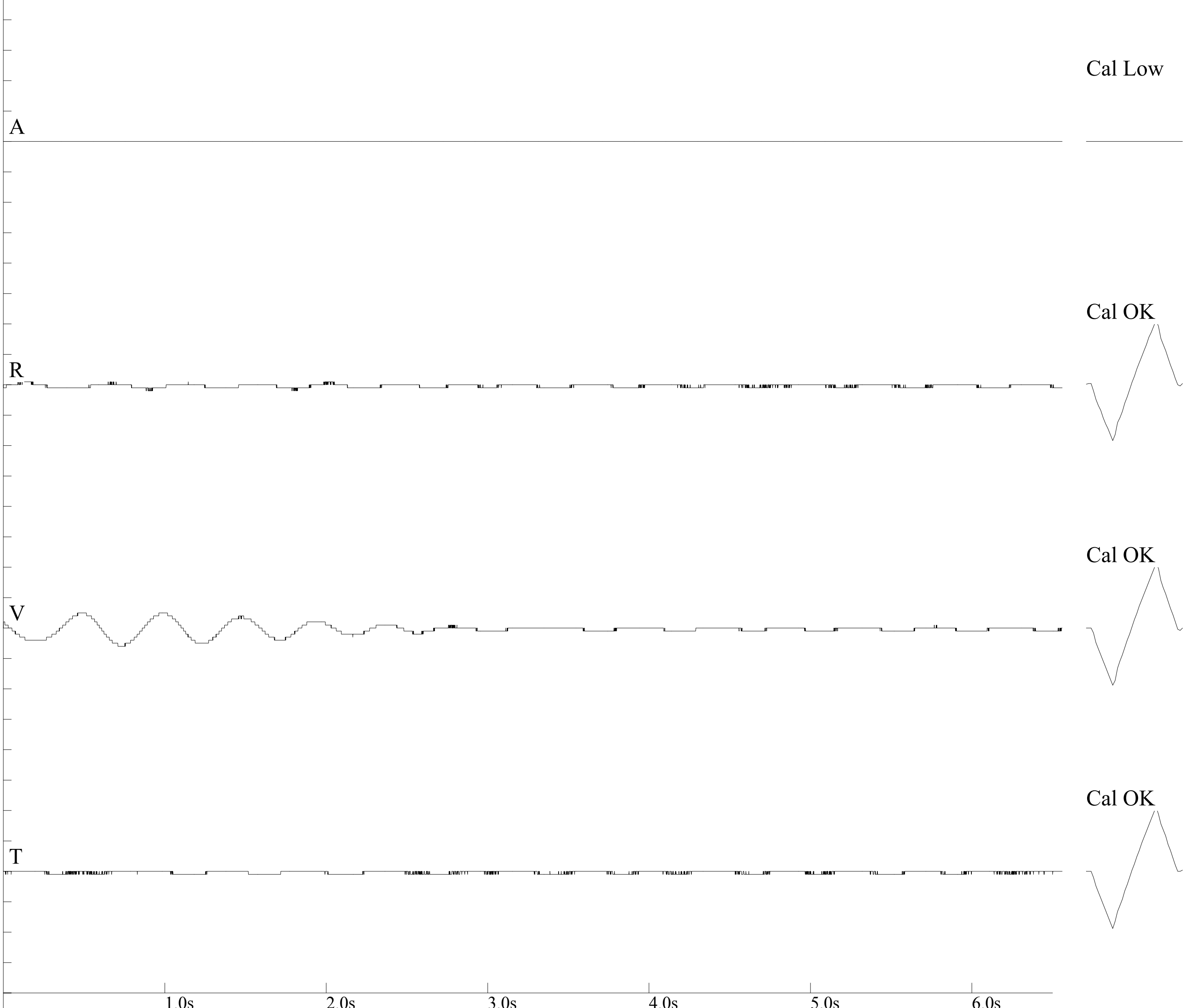
Amplitudes and Frequencies	Graph Information
Acoustic: <100 dB, <0.02 Mb, <0.0003 psi, <0.002 kPa	*Duration:* 0.000 s To: 6.500 s
Radial: 0.0300 in/sec @ 10.8Hz	*Acoustic Scale:* 120 dB
Vertical: 0.0250 in/sec @ 15.5Hz	*Seismic Scale:* 0.20 in/sec (0.050 in/sec/div)
***Transverse:* 0.0400 in/sec @ 9.6Hz**	*Time Line Intervals at:* 1.00 s



Wildcat Run
#20683

File Name: 2 LEE APRIL20050401005.DTB
Number: 005
Date: 4/1/2005
Time: 11:26
Serial Number: 2475
Seismic Trigger: 0.0200 in/sec
Acoustic Trigger: 142 dB
Sample Rate: 1024
Record Duration: 6.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.3

Amplitudes and Frequencies	Graph Information
Acoustic: <100 dB, <0.02 Mb, <0.0003 psi, <0.002 kPa	*Duration:* 0.000 s To: 6.500 s
Radial: 0.0100 in/sec @ 0.0Hz	*Acoustic Scale:* 120 dB
***Vertical:* 0.0300 in/sec @ 2.1Hz**	*Seismic Scale:* 0.20 in/sec (0.050 in/sec/div)
Transverse: 0.0050 in/sec @ 0.0Hz	*Time Line Intervals at:* 1.00 s



6. Blast Design Parameters (General)

RULES OF THUMB & BLAST PARAMETERS

- Bench Height- usually predetermined by the site plan.

  - If not predetermined, than it is equal to or greater than the charge diameter (inches) multiplied by 5. Answer in feet. When the bench is more than 4X the burden, drill deviation can be a problem.

  - Metric: Charge Diameter (mm)/15 = meters

- Blasthole Diameter- to create optimum energy distribution, use blasthole diameters (inches) equal to the bench height in feet divided by 10. Maximum diameter is divided by 5.

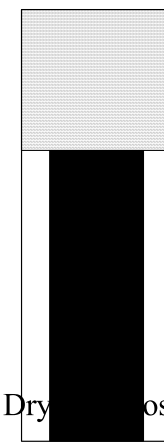
  Example: Bench height = 50ft, 50/10 = 5" diameter
  Metric: Bench height (m) x 15 = Charge diameter (mm)

- Decoupling Effect- when charge diameters are less than borehole diameters, energy and detonation pressure losses occur.
  - % reduction in wet blastholes

    (1 - (Explosive diameter/blasthole diameter)^1.8) x 100%
  - % reduction in dry blastholes

    (1 - (Explosive diameter/blasthole diameter)^2.6) x 100%
    - Example: 6.25" hole, 5" charge Metric: 160 mm hole, 127 mm charge

      Wet: 33% loss



Dry [illegible]oss

- Blasthole Diameter- Hole diameter verses bit diameter- the hole diameter will be slightly larger than the bit size.

- Size verses cost- as bit size goes up, cost will go down.

- Size verses explosive distribution- As blasthole diameters reduce, explosive distribution becomes more uniform, usually, fragmentation size decreases.

- <u>Burden</u>- Distance from the blasthole to nearest free face or planned free face.

    <u>3 rules of thumb</u>

    1. Relationship to charge diameter: **USE FOR ESTIMATION ONLY!**
        2-3 times the charge diameter in inches. Example: A 6.25" charge will have a burden range of 12.5ft to 18.75ft.

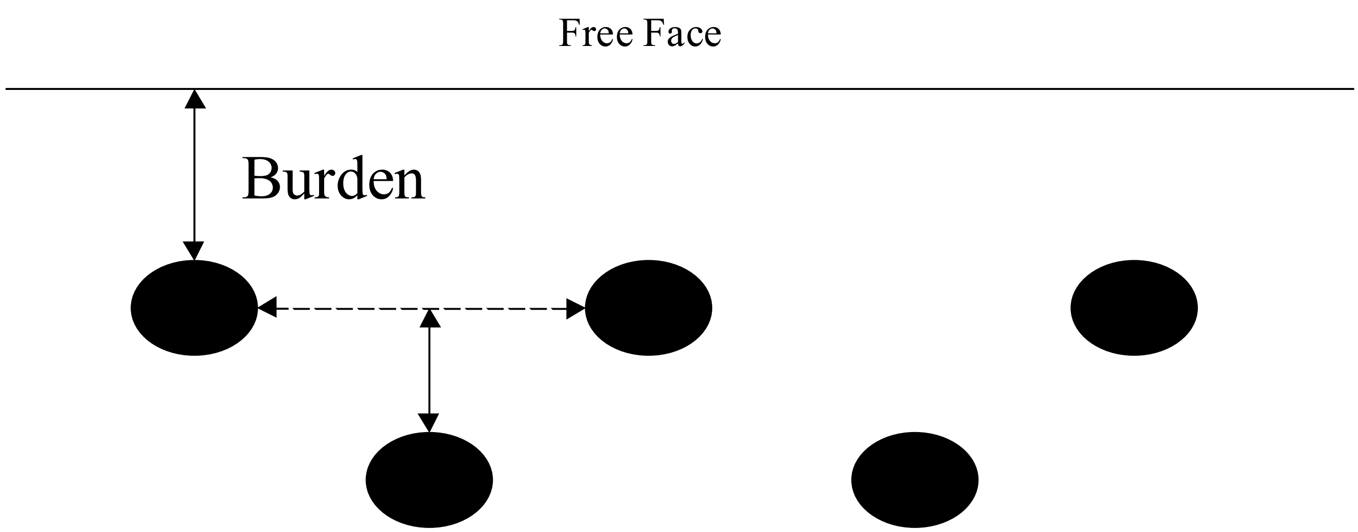
    2. **Relationship to charge diameter**

        $$\mathbf{\frac{(25\text{–}35) \times \text{charge diameter}''}{12''} = \text{burden}}$$

    3. Relationship to rock density, explosive density, and charge diameter
        Burden = ((Explosive density X 2)/rock density) +1.8) x CD

        Metric = ((Explosive density X 2)/rock density) +32) x CDm

This formula is used for the initial design only, it does not take into account bench height, explosive energy, velocity, rock type, or local geologic structure.



<u>Burden Stiffness Ratio</u>

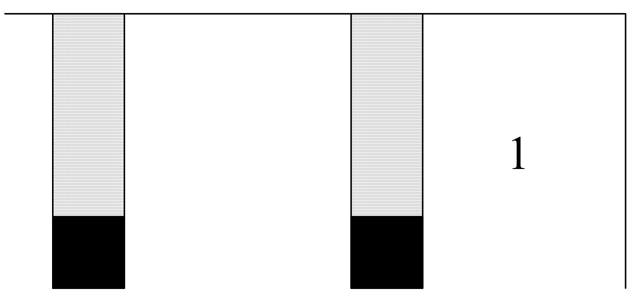
The Burden Stiffness Ratio is equal to the bench height divided by the burden. If the ratio is less than 2, the rockmass will be stiff and hard to fracture and move.

Example:

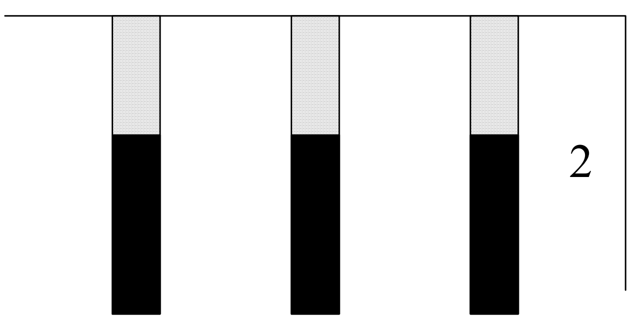
Bench height = 20ft	6 meters
Burden = 12ft	3.6
Ratio = 1.67 moderate to poor.	1.67 moderate to poor

Smaller charge diameters and tighter patterns can improve the stiffness ratio.

Low stiffness ratios require higher energy and powder factors to achieve uniform fragmentation and movement.



Ratio of 1, Poor energy distribution

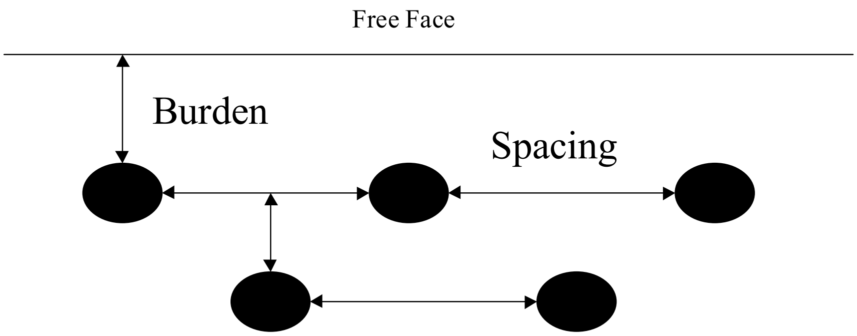


Ratio of 2, Fair energy distribution

Ratio of 3, Good energy distribution

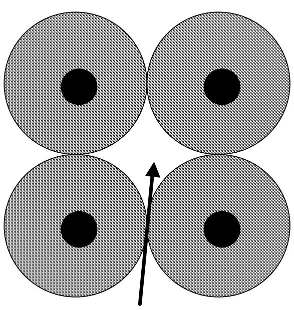
Spacing

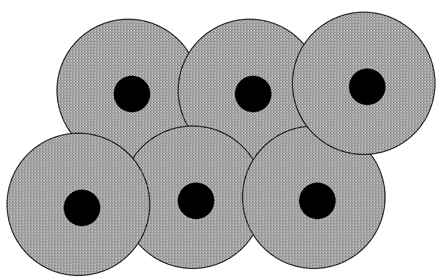
- The distance between blastholes. Spacing is perpendicular to the burden.



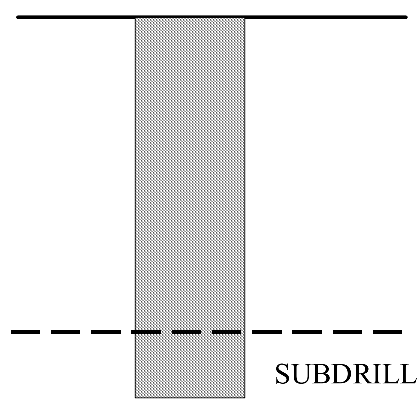
- Normally ranges from 1 - 1.8 times the burden.
- Staggered pattern with burden multiplied by 1.15 gives optimum energy distribution. This creates and equilateral triangle.
- Jointing parallel to free face can permit wider spacings.
- Staggered patterns with proper burdens and spacings that are setup in equilateral triangles create better fragmentation, muckpile profile, reduce vibration, reduce backbreak, etc.

The above improvements occur because the explosive energy is evenly distributed and not wasted.


Poor fracture zone


All zones fractures

- Subdrilling- The distance the blast hole is drilled below grade to help break the rock to the desired depth.
- Equal to the burden distance multiplied by .3 to .5.
- Minimum of 10 multiplied by the charge diameter.
- If half the burden distance leaves an excessive toe, than half the burden distance should be reduced.



- To improve fragmentation and floor control, the primer cartridge should be placed at grade.

- Stemming
    - Inert material- placed in the blasthole on top of the explosive to confine energy.
    - **Ratio to Charge diameter- Range = 20 - 60 times the charge diameter, average is 20 – 30 times the charge diameter.**
    - Flyrock and premature venting- if the stemming is less then 20 charge diameters, flyrock or premature gas venting can occur.
    - **Ratio to Burden- Range = .7 - 1.3 times the burden dimension. This formula will get you into trouble on tight patterns!**
    - Trench or site work with overburden, keep stemming into rock at least 2 feet.
    - Crushed rock confines explosive energy better than drill cuttings. The angles on the rock interlock. 1/10 x borehole diameter = stemming size
    - Wet blastholes require more stemming for confinement than dry blastholes.

  - Relative Confinement factor (RC)- Base stemming on confinement factor. Should be better than 1.4.

$$RC = \frac{(\text{Stem length} \times 600) + (\text{charge diameter} \times 140)}{(\text{Charge ABS} \times \text{Charge Diameter})}$$

METRIC

$$RC = \frac{(\text{Stem length} \times 210{,}000) + (\text{charge diameter} \times 600)}{((\text{Charge ABS} \times 4.18\ \text{cal/joule}) \times \text{Charge Diameter})}$$

  - Vertical energy distribution- Charge length ÷ bench height > 80%, will produce more uniform fragmentation.
  - Crest row- large toe burdens may require the blasthole close to the face. More stemming will need to be used.

- Decking
  - Reduce the charge weight by using sections of inert material in the explosive column.
  - Deck with inert material. The material can be drill cuttings, by crushed gravel is better.
  - Dry holes minimum length of the inert deck is equal to 6 times the charge diameter.
  - Wet holes minimum length of the inert deck is equal to 12 times the charge diameter.
  - Decking can be used to lower ground vibration amplitudes, decrease explosive use, obtain better energy distribution is large blastholes, used to break cap rock, decrease backbreak and endbreak, use in opening cuts, use in buffer blasting.
  - Care should be taken not to overconfine the explosive charge.

- Volume Calculations

  Bank cubic yards (bcys or yd^3) or Bank cubic meters (bcm) bcys = (burden x spacing x bench height) ÷ 27 or bcm = burden x spacing x bench height

Bank cubic yards to Tons
tons = bcys x rock density x 0.844

Bank cubic meters to Tons(MT) = bcm x rock density

- Charging Calculations
    - Loading Density- pounds of explosive per foot or Kilograms/meter of borehole
      Imperial = .3405 x (explosive density) x (explosive diameter")^2
      Metric = .000785 x (explosive density) x (explosive diameter-mm)^2

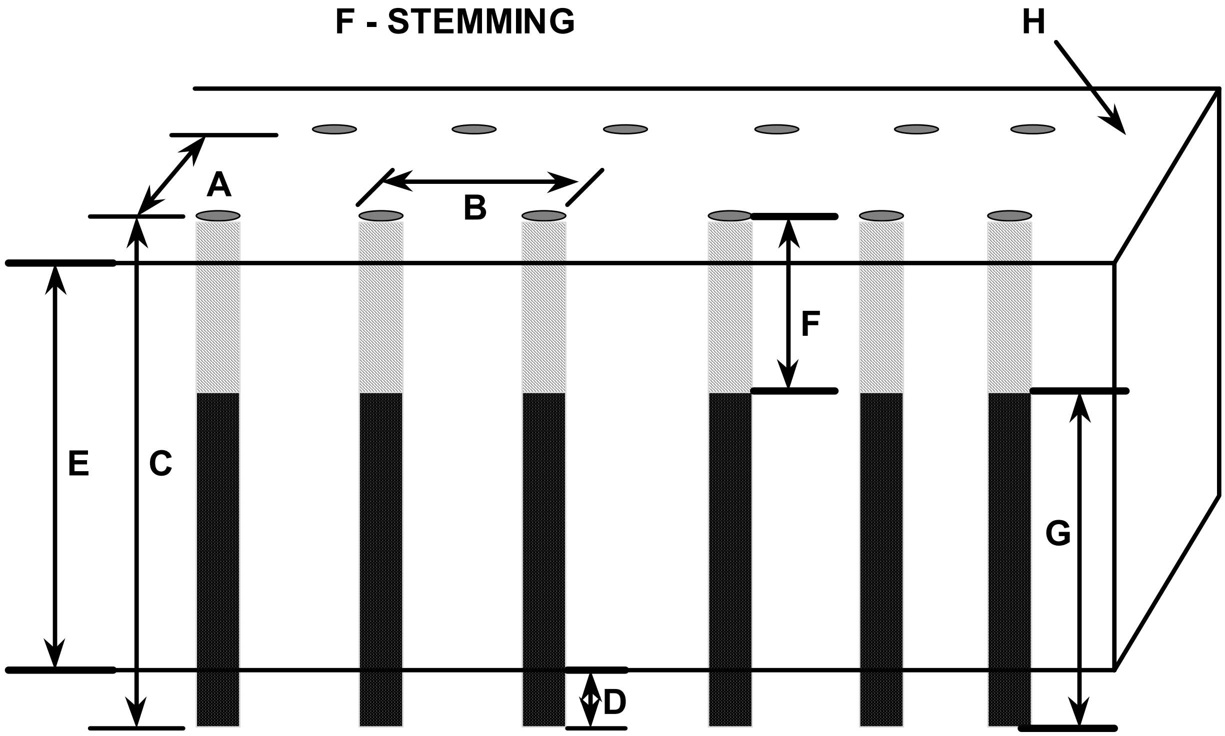
    - Explosive Energy- Kilocalories per pound of explosive
      Explosive AWS (cal/gm) x .454
      Metric= AWS (Cal/gm)

    - Loading Energy- Kilocalories of energy per foot or meter of blasthole.
    = (explosive energy per pound) x (loading density)
    Metric = **(**explosive energy- AWS cal/gm) x (loading density)

- Powder Factor Calculation
    - Pounds of explosive/bcys
      Lbs./yd^3 = (loading density) x (charge length)/yd^3 per hole
    - Kilograms/bcm = (loading density) x (charge length)/bcm per hole
    - Weight/ton = explosive weight/ton of rock
      Good way to track costs, poor way to compare explosive performance.

BASIC BLASTING TERMS

A - BURDEN
B - SPACING
C - HOLE DEPTH
D - SUBDRILL
E - BENCH HEIGHT
F - STEMMING
G - EXPLOSIVE COLUMN
H - BENCH



7. Lee County Blasting Practice

Blasting practices in Lee County for development follow basic and accepted industry practices. Because of the nature of the geometry of the site development and the high presence of water, there isn't much that can be done to change the practices without greatly increasing the costs.

Current general practice requires depths of cut to range from 10 feet to 20 feet below surface. Average blasthole depths are 15 feet with a blasthole diameter of 4 inches to 6 inches. This diameter allows explosives cartridges of 1-2 inches less in diameter to be safely loaded in blastholes. Normally, 30 lbs of explosives or less per blast delay are initiated in a blast.

Non-electric detonators and emulsion products are the products preferred and used in Lee County. Emulsion explosives are used due to their resistance to water.

Using the techniques currently employed, blasters in Lee County have not experienced any significant problems staying under the current vibration limits of 0.3 inches/second and 134 db for airblast.

One note, the stemming employed in most instances observed was sand and/or drill cuttings readily available on the ground. To insure that airblast at an absolute minimum, angular crushed rock should be used as stemming.

The following pictures were taken on the Heron Glen project.

Emulsion cartridge with detonator & primer charge

Blasters helper preparing charges for loading

Blasthole Drilling Rig

Charges ready to be loaded

Charges ready for loading in blastholes

Driller and Blaster-in-Charge

Non-electric detonator and primer cartridge

8. Alternate Technologies to Blasting and Alternate Blasting Techniques

Alternate technologies to blasting were investigated through contacting product manufacturers and doing literature searches. The authors/project investigators have also used alternate technologies in other areas.

The only alternate technologies to blasting in Lee County that will work in most instances are the use of rock hammers, chippers, and trenchers. These are time consuming and in many instances cost ineffective, but do work.

Expanding chemicals that break rock and other non-explosives systems were investigated. Two geologic items in Lee County make the use of these technologies not viable. This includes the high presence of water and the numerous voids, etc in the rock of the area.

The high water content will make the use of expanding chemicals ineffective. Also, when using these chemicals, holes must still be drilled and loaded with the chemical. The cost is much higher then blasting for the actual product and much more time consuming (it takes roughly 24-48 hours for the chemical to expand and crack the rock).

Even in dry areas, due to the presence of the many voids and mud seams in the rock, the expanding chemicals will not be confined enough to build up enough pressure to crack the rock.

Alternate and state of the art blasting techniques and products were also investigated. Currently, the latest explosives product on the market to control vibration is the use of digital or computerized detonators. But, due to the already low peak particle velocity limit, these products may make it easier for the contractor to stay below the level, but they are extremely expensive at this time and make them a non-viable product until the cost drops. Plus, with the low peak particle velocity level already in place and the actual results being obtained, it would be difficult to see any improvement.

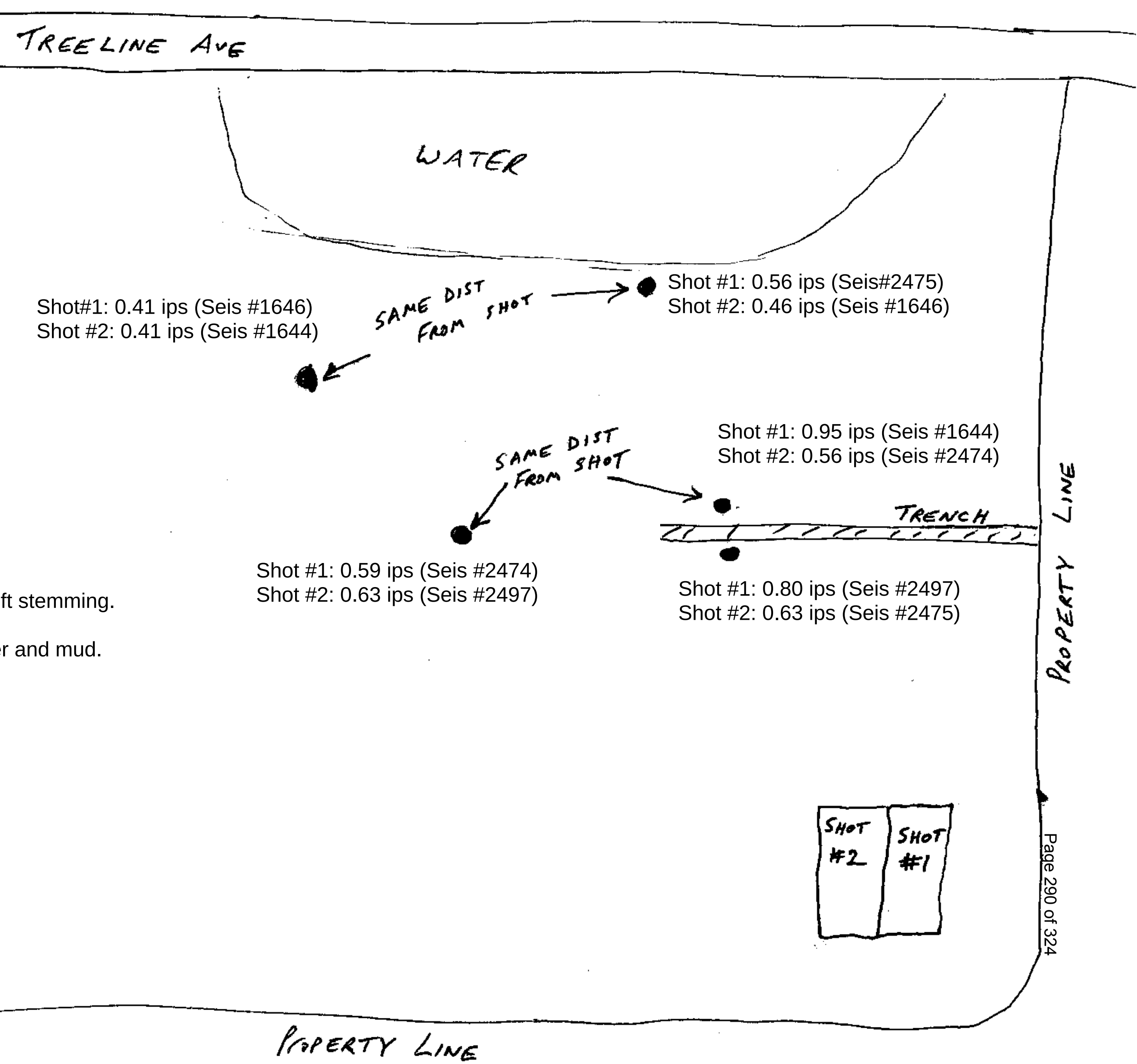
Due to the shallow nature of the rock excavations and the cost involved, the only way to reduce vibration farther would be to use much smaller explosives charge diameters with many more blastholes.

This technique would do multiple things. First, the project price would increase and the timeline would increase too. Also, with the current peak particle velocity limit of 0.3 inches/second and the low results being obtained, there would not be much improvement seen in the results, if any at all. This would increase blasting cost exponentially and although easier to maintain the 0.3 inches/second, it still would not be possible to lower the limit. The 0.3 inches/second limit is as low as can be set to insure that property owners due not suffer damage and to still be cost effective in blasting.

An attempt was made to use and alternate technique utilizing trencher technology in conjunction with blasting. The authors have drilled channels numerous times to mitigate vibration at structures by creating a break line between the blast and the structure of concern.

At a project at called the Airport Technology Center, a trench was cut by a local hydro-trenching company to test this hypothesis. Unfortunately, due to the extremely muddy and wet field conditions, the trench did not perform to expectations. The trench filled back in with mud and water and was rendered useless.

Ft Myers Airport Tech Center



Shot #1: 04/25/2005, 30lbs/delay

Shot #2: 04/26/2005, 20lbs/delay

Approx 10ft of overburden, 15ft holes, 12ft stemming.

Trench almost completely filled with water and mud.
Ground saturated.

All seismographs spiked and buried.

Ft Myers Airport Tech Center
Shot #1
30lbs/delay
Dist. to Shot = 299 ft (from GPS)
No Trench between Seis and Shot

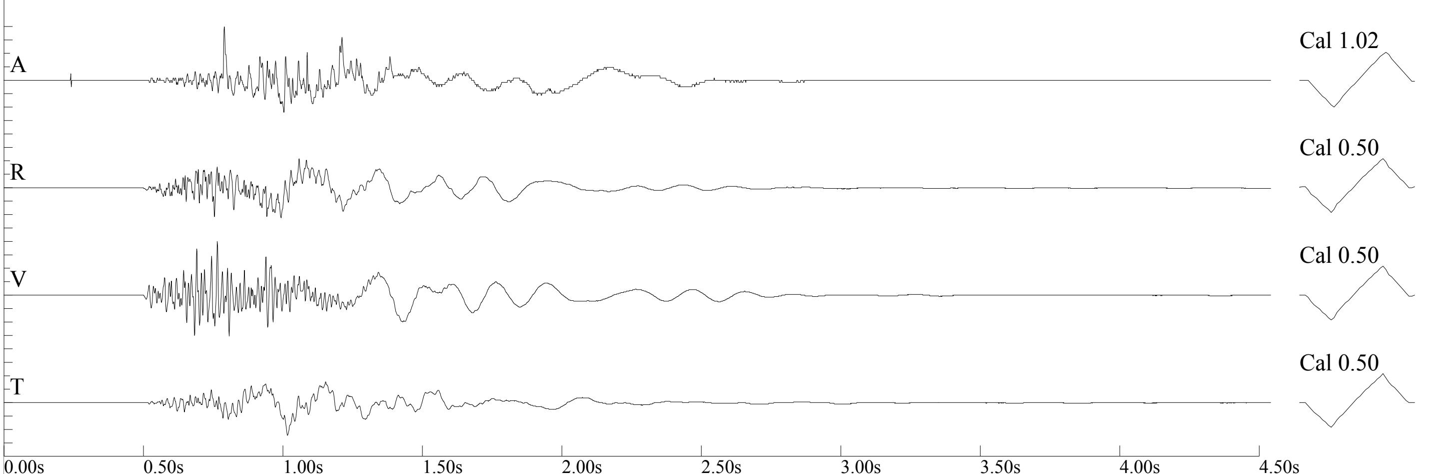
File Name: #2497001.DTB
Number: 001
Date: 4/25/2005
Time: 15:31
Serial Number: 2497
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 125 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.5

Amplitudes and Frequencies

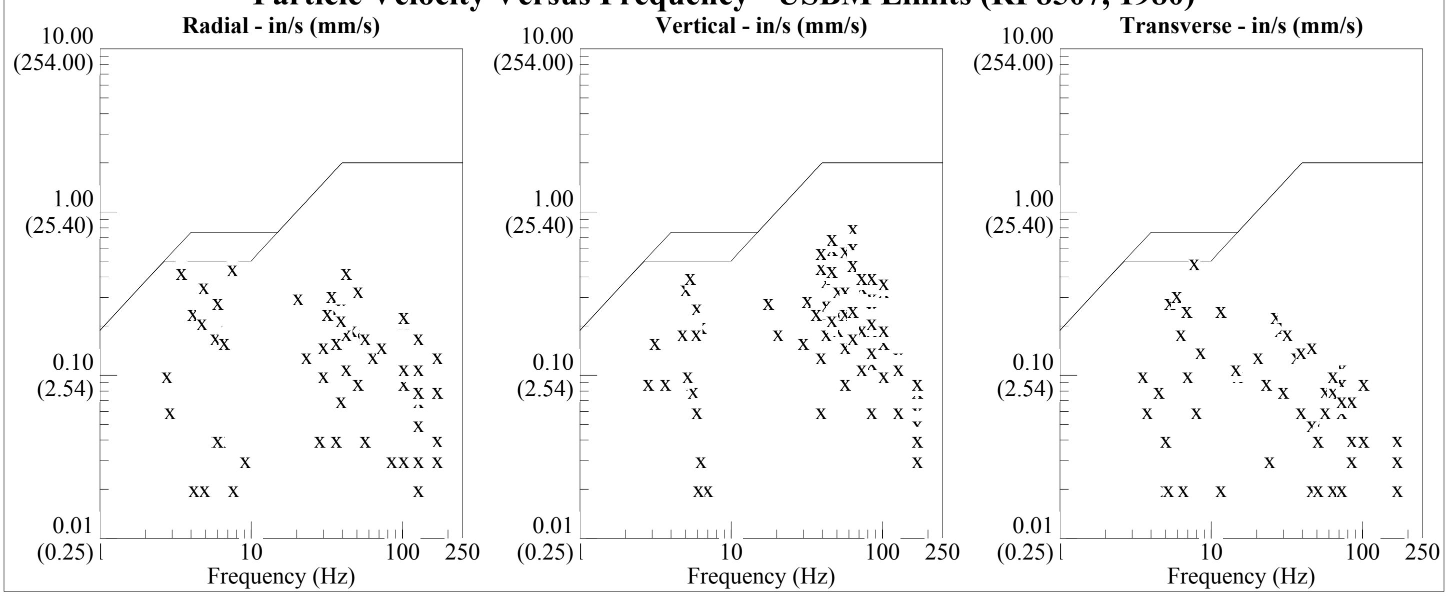
Acoustic: 128 dB @ 34.1 Hz
(0.50Mb 0.0073psi 0.0500kPa)
Radial: 0.45in/s 11.43mm/s @ 7.5Hz
***Vertical:* 0.80in/s 20.32mm/s @ 64.0Hz**
Transverse: 0.49in/s 12.446mm/s @ 7.7Hz
*Displacement:*0.013849in 0.351775mm
*Acceleration:*0.742029g's

Graph Information

*Duration:*0.000s To: 4.500s
Acoustic Scale:
128dB 0.50Mb (0.126Mb/div)
Seismic Scale:
0.80in/s (0.200in/s/div) 20.32mm/s (5.080mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Ft Myers Airport Tech Center
Shot #1
30lbs/delay
Dist. to Shot = 339 ft (from GPS)
No Trench between Seis and Shot

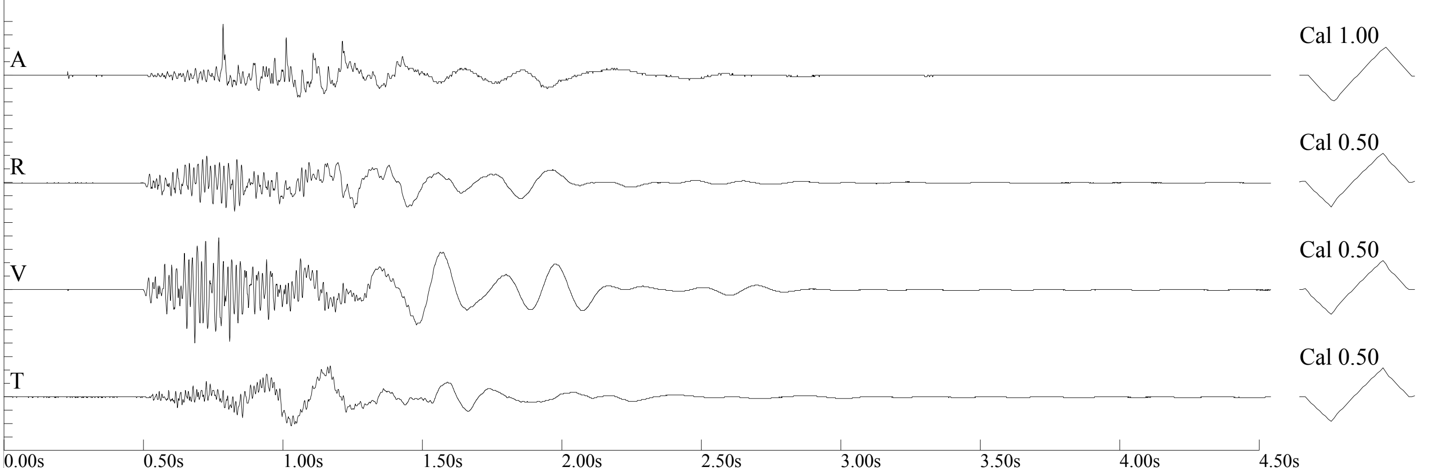
File Name: #2474001.DTB
Number: 001
Date: 4/25/2005
Time: 15:31
Serial Number: 2474
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 125 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

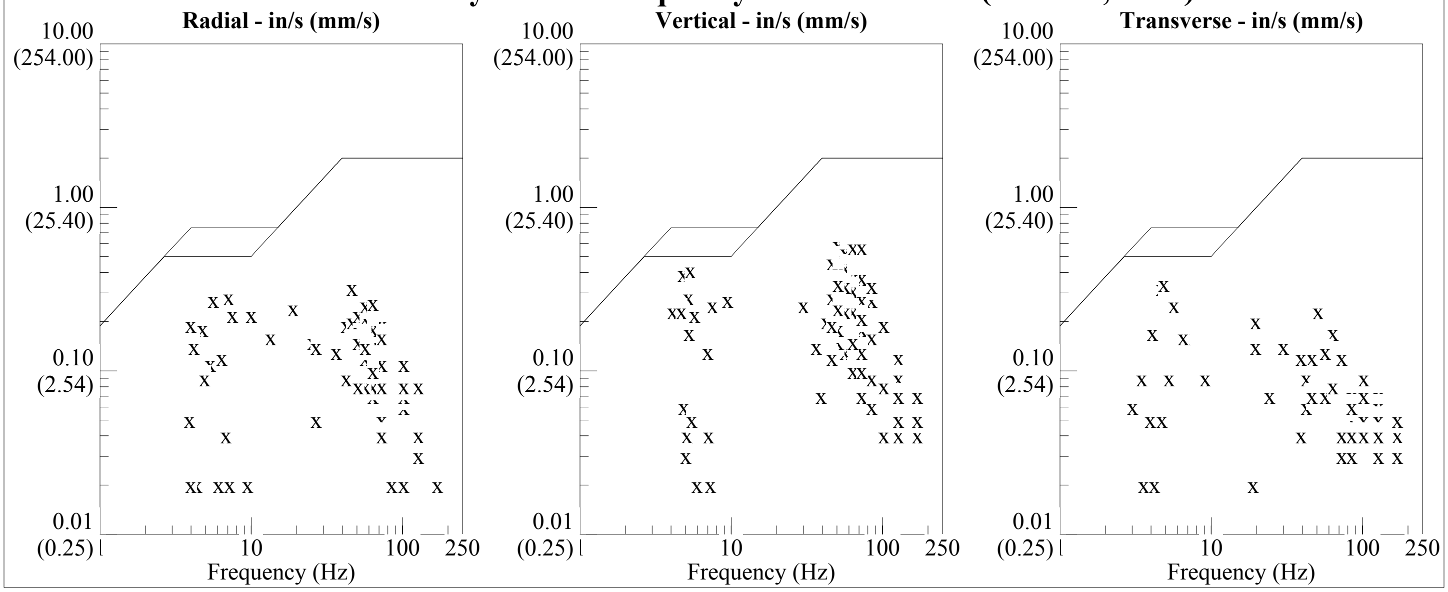
Acoustic: 130 dB @ 25.6 Hz
(0.60Mb 0.0087psi 0.0600kPa)
Radial: 0.32in/s 8.128mm/s @ 51.2Hz
***Vertical:* 0.59in/s 14.986mm/s @ 51.2Hz**
Transverse: 0.34in/s 8.636mm/s @ 4.9Hz
*Displacement:*0.013291in 0.337593mm
*Acceleration:*0.689027g's

Graph Information

*Duration:*0.000s To: 4.500s
Acoustic Scale:
130dB 0.63Mb (0.158Mb/div)
Seismic Scale:
0.59in/s (0.148in/s/div) 14.99mm/s (3.747mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Ft Myers Airport Tech Center
Shot #1
30lbs/delay
Dist. to Shot = 444 ft (from GPS)
No Trench between Seis and Shot

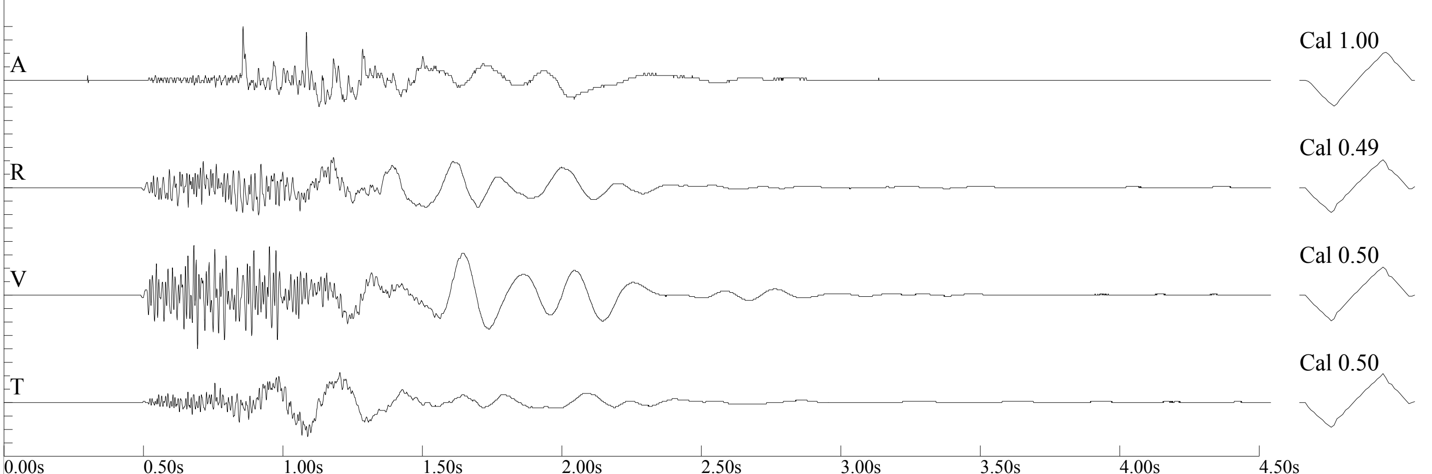
File Name: #1646001.DTB
Number: 001
Date: 4/25/2005
Time: 15:31
Serial Number: 1646
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 125 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.5

Amplitudes and Frequencies

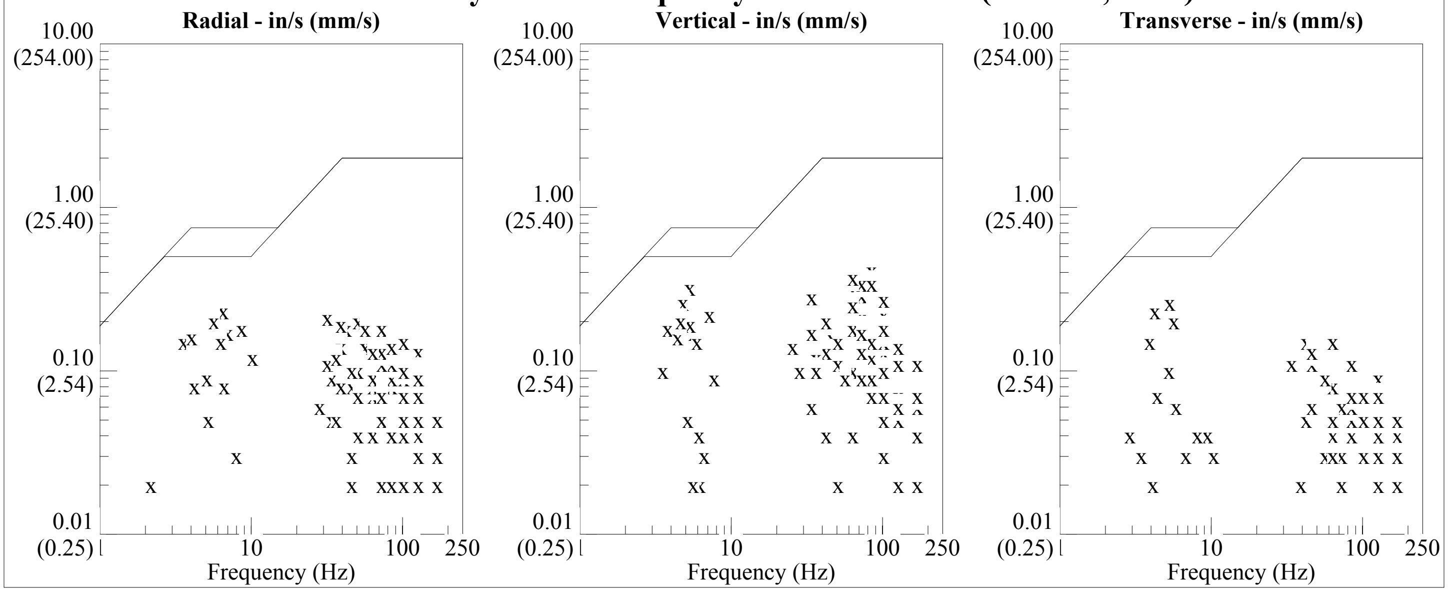
Acoustic: 127 dB @ 23.2 Hz
(0.46Mb 0.0067psi 0.0460kPa)
Radial: 0.23in/s 5.842mm/s @ 6.6Hz
***Vertical:* 0.41in/s 10.414mm/s @ 85.3Hz**
Transverse: 0.26in/s 6.604mm/s @ 5.3Hz
*Displacement:*0.010243in 0.260165mm
*Acceleration:*0.556522g's

Graph Information

*Duration:*0.000s To: 4.500s
Acoustic Scale:
127dB 0.45Mb (0.112Mb/div)
Seismic Scale:
0.41in/s (0.103in/s/div) 10.41mm/s (2.604mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



TerraDinamica

Ft Myers Airport Tech Center **Shot #1** **30lbs/delay** **Dist. to Shot = 341 ft (from GPS)** **Trench between Seis and Shot**	File Name: #1644001.DTB Number: 001 Date: 4/25/2005 Time: 15:31 Serial Number: 1644 Seismic Trigger: 0.0300 in/s 0.7620 mm/s Acoustic Trigger: 125 dB Sample Rate: 1024 Record Duration: 4.0 Seconds Pre-Trigger: 0.50 Seconds Sensor Gain: 2x Battery: 6.5

Amplitudes and Frequencies

Acoustic: 128 dB @ 32.0 Hz
(0.48Mb 0.0070psi 0.0480kPa)

Radial: 0.44in/s 11.176mm/s @ 51.2Hz

***Vertical:* 0.95in/s 24.13mm/s @ 56.8Hz**

Transverse: 0.32in/s 8.128mm/s @ 4.6Hz

Displacement: 0.011728in 0.297887mm

Acceleration: 1.073292g's

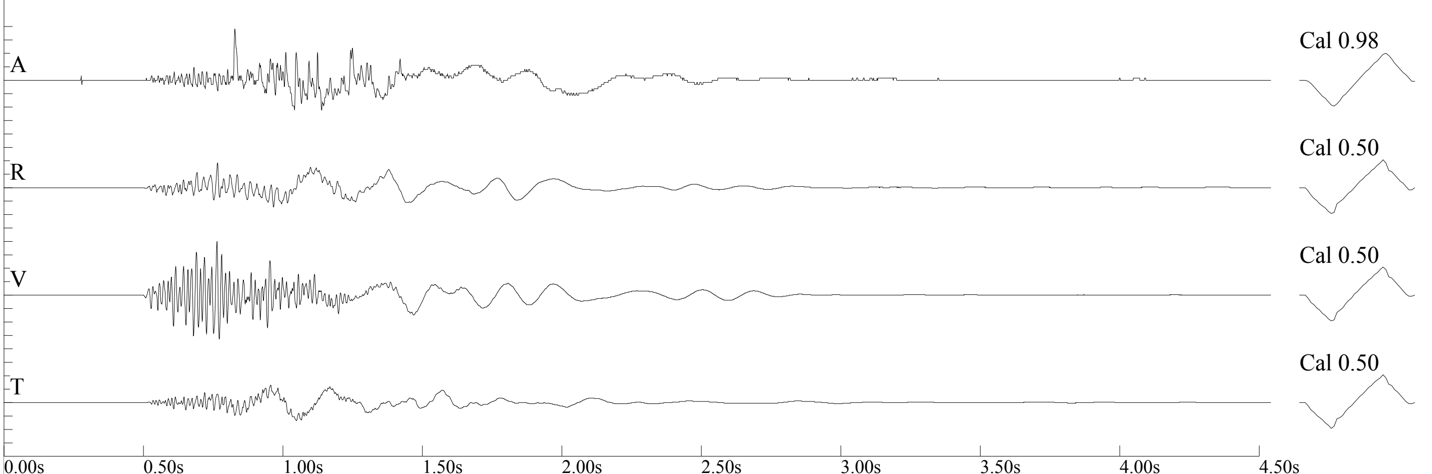
Graph Information

Duration: 0.000s To: 4.500s

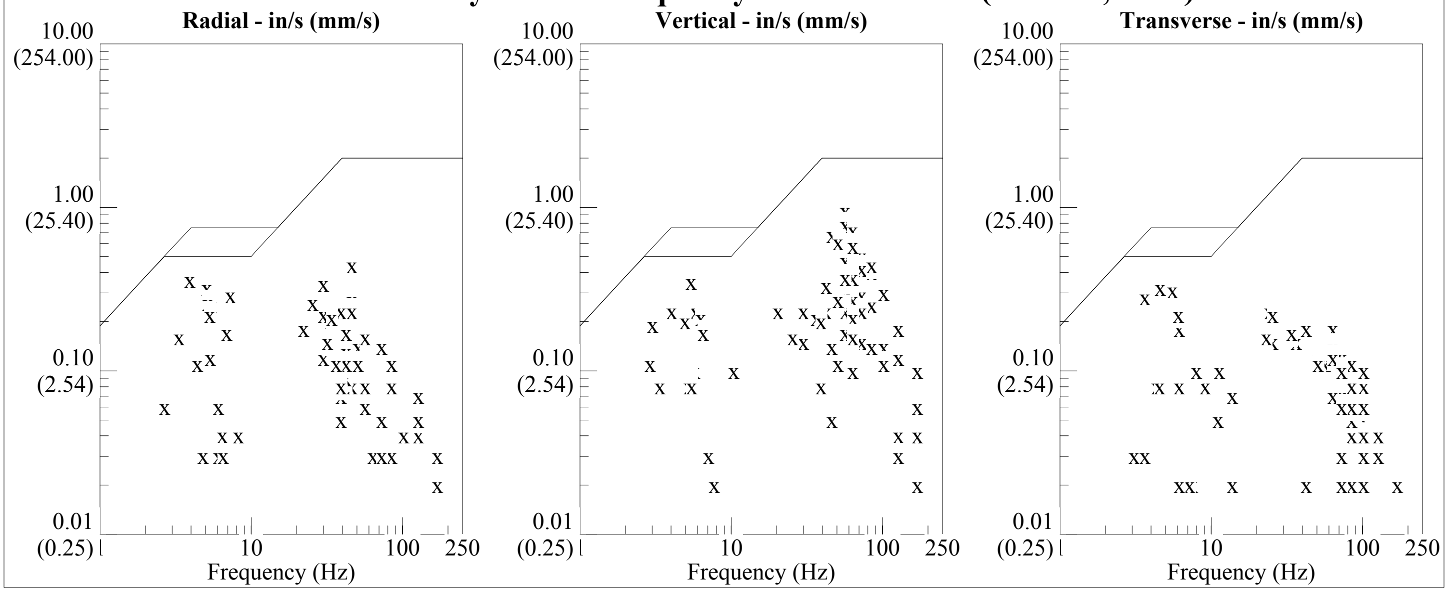
Acoustic Scale:
128dB 0.50Mb (0.126Mb/div)

Seismic Scale:
0.95in/s (0.238in/s/div) 24.13mm/s (6.033mm/s/div)

Time Line Intervals at: 0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Ft Myers Airport Tech Center
Shot #1
30lbs/delay
Dist. to Shot = 442 ft (from GPS)
Trench between Seis and Shot

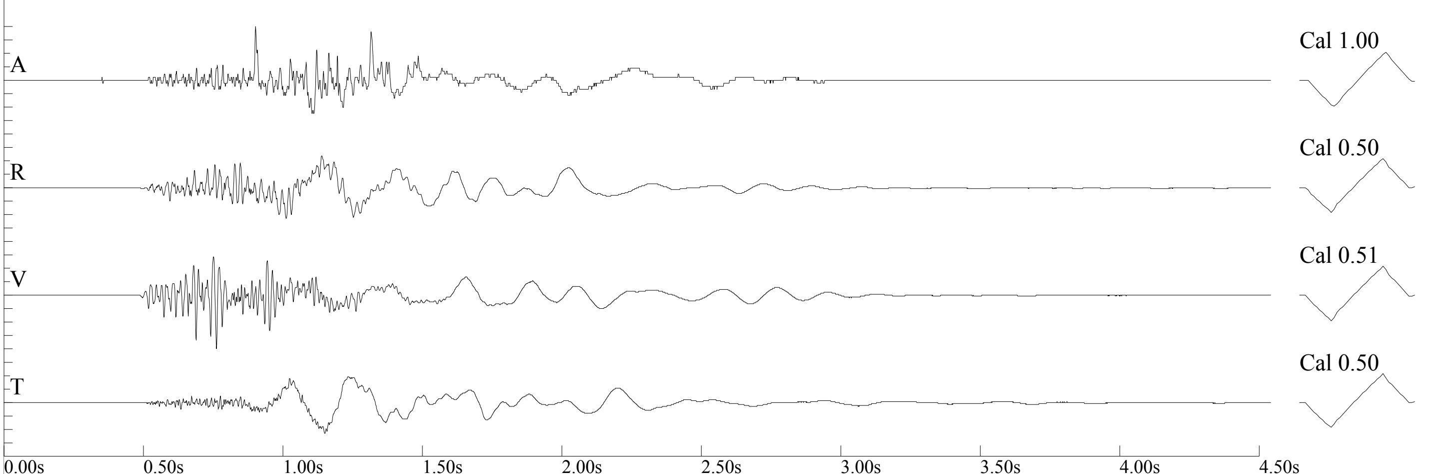
File Name: #2475000.DTB
Number: 000
Date: 4/25/2005
Time: 15:31
Serial Number: 2475
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 125 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

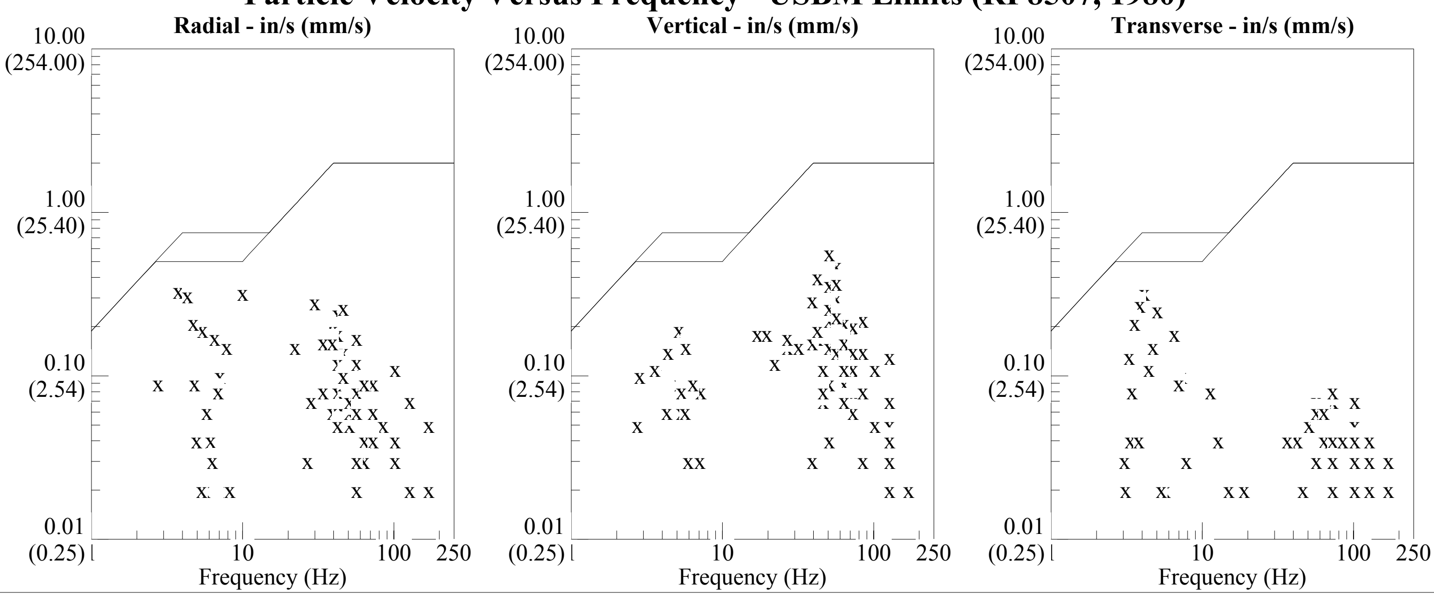
Acoustic: 125 dB @ 30.1 Hz
(0.36Mb 0.0052psi 0.0360kPa)
Radial: 0.33in/s 8.382mm/s @ 3.7Hz
***Vertical:* 0.56in/s 14.224mm/s @ 51.2Hz**
Transverse: 0.32in/s 8.128mm/s @ 4.1Hz
*Displacement:*0.012580in 0.319530mm
*Acceleration:*0.490269g's

Graph Information

*Duration:*0.000s To: 4.500s
Acoustic Scale:
125dB 0.36Mb (0.089Mb/div)
Seismic Scale:
0.56in/s (0.140in/s/div) 14.22mm/s (3.556mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Ft Myers Airport Tech Center
Shot #2
20 lbs/delay
Dist. to Shot = 319 ft (from GPS)
No Trench between Seis and Shot

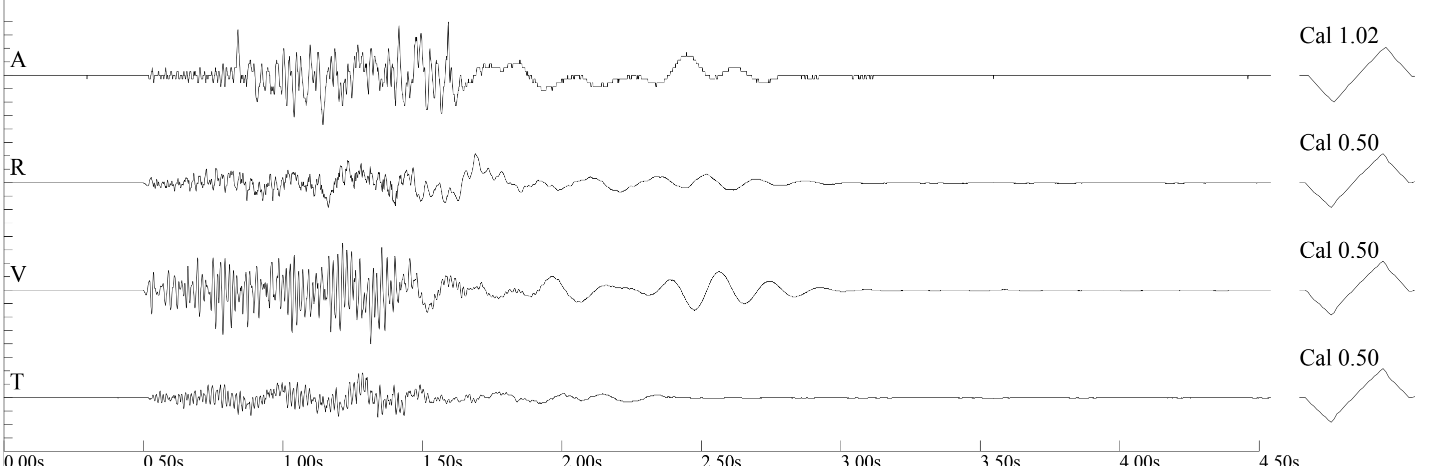
File Name: #2497002.DTB
Number: 002
Date: 4/26/2005
Time: 15:29
Serial Number: 2497
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 125 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

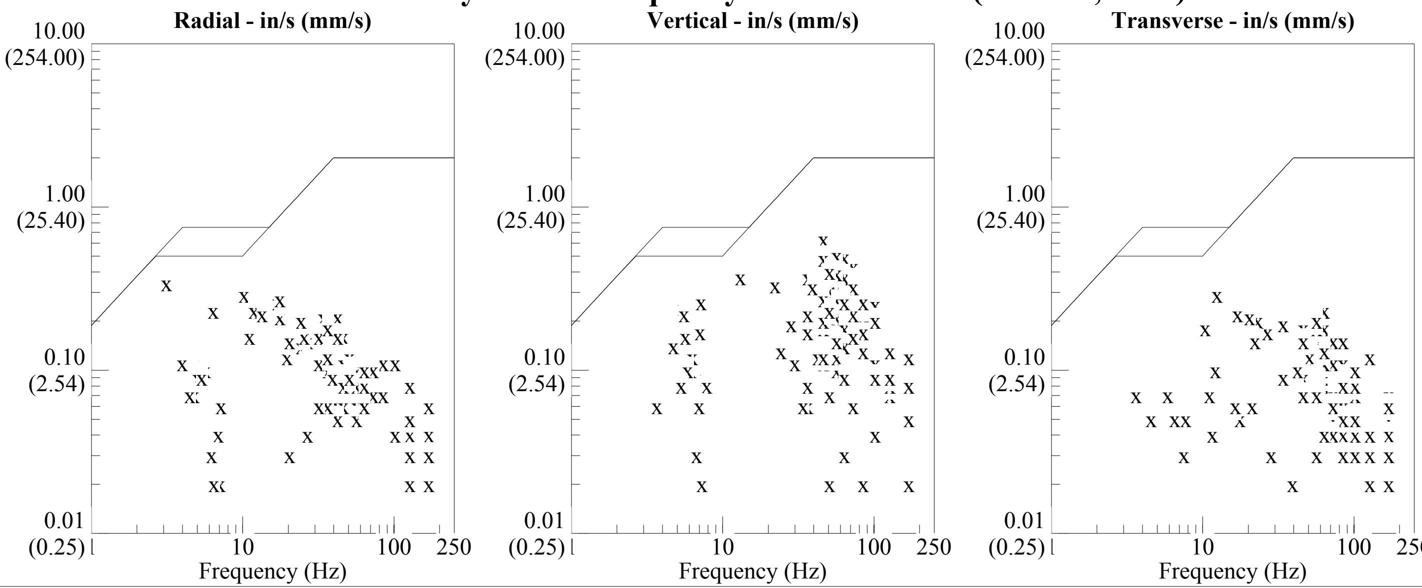
Acoustic: 123 dB @ 36.5 Hz
(0.28Mb 0.0041psi 0.0280kPa)
Radial: 0.34in/s 8.636mm/s @ 3.1Hz
***Vertical:* 0.63in/s 16.002mm/s @ 46.5Hz**
Transverse: 0.29in/s 7.366mm/s @ 12.4Hz
*Displacement:*0.009907in 0.251635mm
*Acceleration:*0.556522g's

Graph Information

*Duration:*0.000s To: 4.500s
Acoustic Scale:
123dB 0.28Mb (0.071Mb/div)
Seismic Scale:
0.63in/s (0.158in/s/div) 16.00mm/s (4.001mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Ft Myers Airport Tech Center **Shot #2** **20 lbs/delay** **Dist. to Shot = 278 ft (from GPS)** **No Trench between Seis and Shot**	File Name: #2475001.DTB Number: 001 Date: 4/26/2005 Time: 15:29 Serial Number: 2475 Seismic Trigger: 0.0300 in/s 0.7620 mm/s Acoustic Trigger: 125 dB Sample Rate: 1024 Record Duration: 4.0 Seconds Pre-Trigger: 0.50 Seconds Sensor Gain: 2x Battery: 6.4

Amplitudes and Frequencies

Acoustic: 126 dB @ 46.5 Hz
(0.40Mb 0.0058psi 0.0400kPa)

Radial: 0.44in/s 11.176mm/s @ 3.8Hz

***Vertical:* 0.63in/s 16.002mm/s @ 42.6Hz**

Transverse: 0.35in/s 8.89mm/s @ 7.5Hz

Displacement: 0.014981in 0.380530mm

Acceleration: 0.755280g's

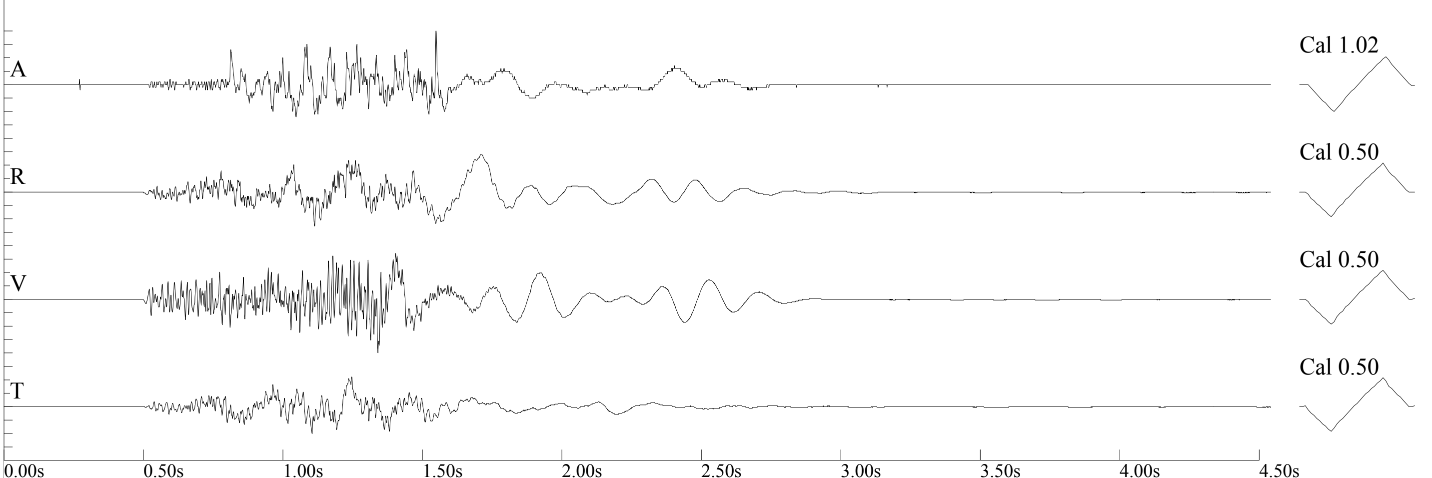
Graph Information

Duration: 0.000s To: 4.500s

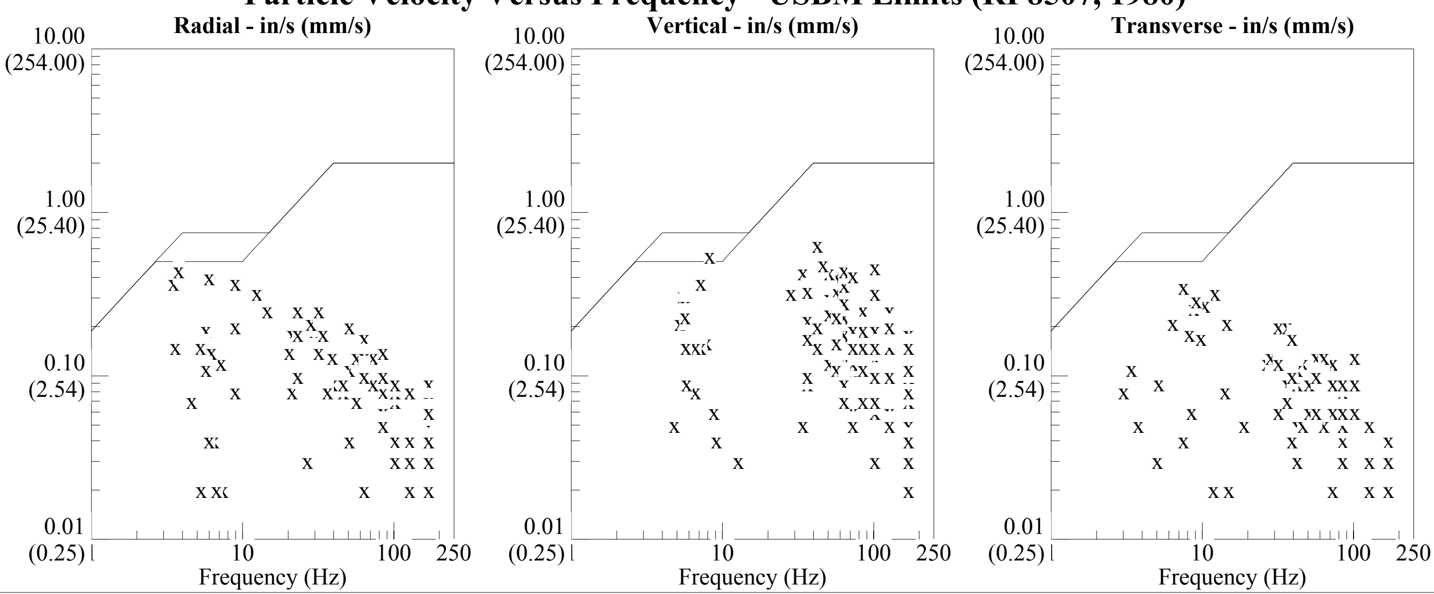
Acoustic Scale:
126dB 0.40Mb (0.100Mb/div)

Seismic Scale:
0.63in/s (0.158in/s/div) 16.00mm/s (4.001mm/s/div)

Time Line Intervals at: 0.50 s

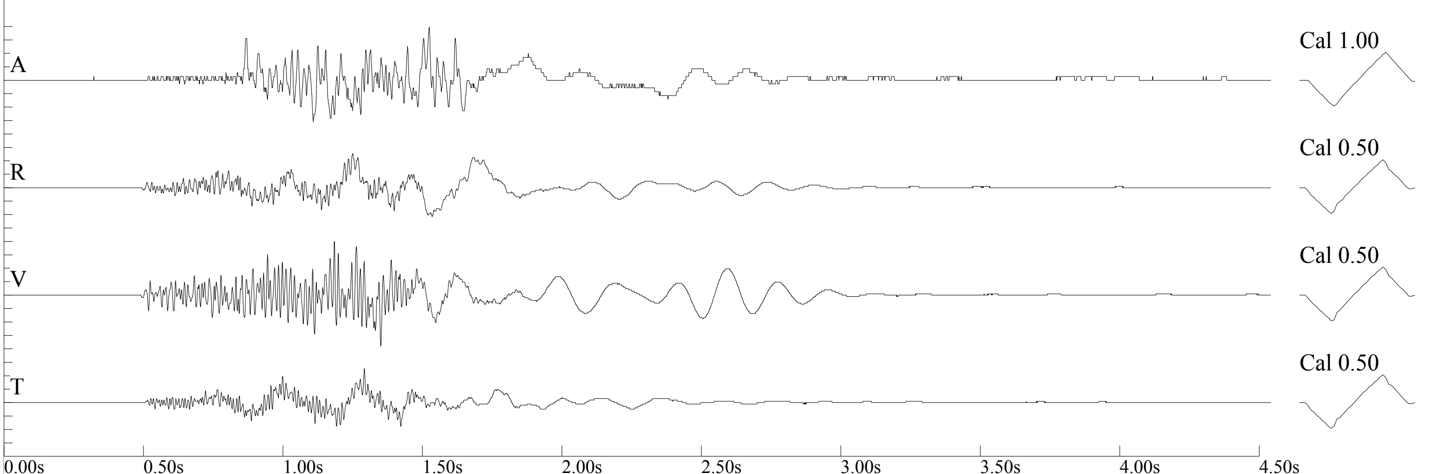


Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)

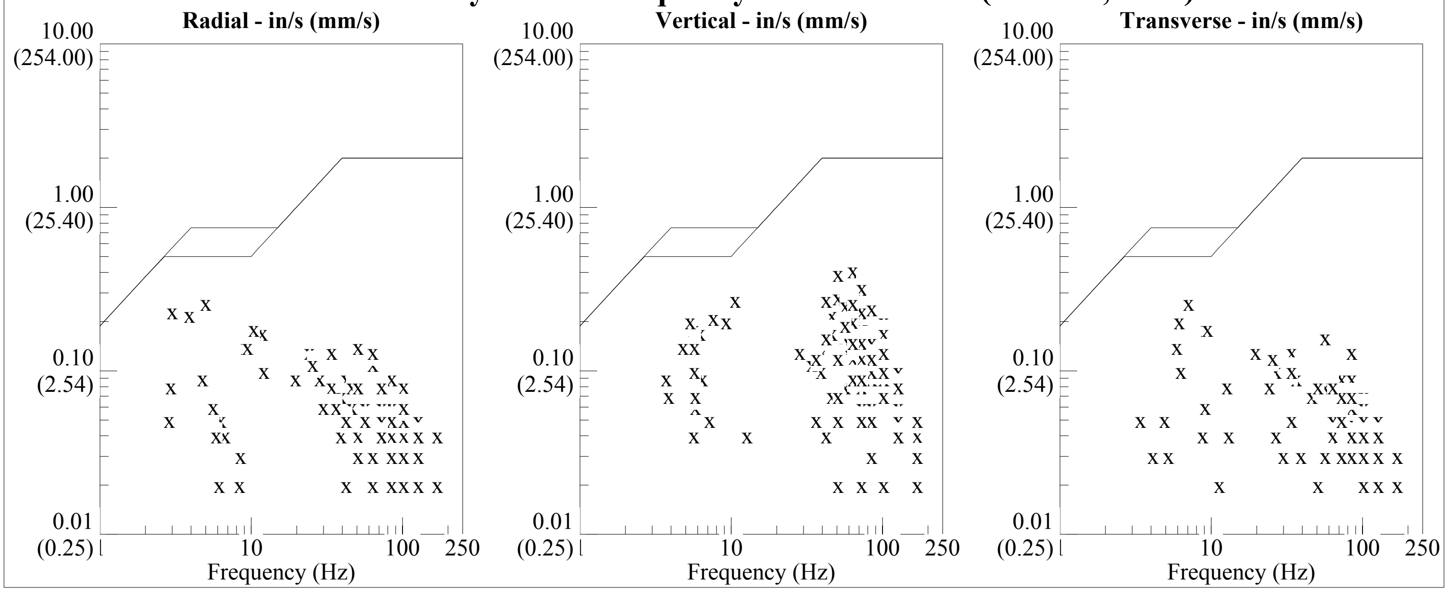


Ft Myers Airport Tech Center **Shot #2** **20 lbs/delay** **Dist. to Shot = 356 ft (from GPS)** **No Trench between Seis and Shot**	File Name: #1644002.DTB Number: 002 Date: 4/26/2005 Time: 15:30 Serial Number: 1644 Seismic Trigger: 0.0300 in/s 0.7620 mm/s Acoustic Trigger: 125 dB Sample Rate: 1024 Record Duration: 4.0 Seconds Pre-Trigger: 0.50 Seconds Sensor Gain: 2x Battery: 6.5

Amplitudes and Frequencies	**Graph Information**
Acoustic: 123 dB @ 12.4 Hz (0.28Mb 0.0041psi 0.0280kPa) *Radial:* 0.26in/s 6.604mm/s @ 5.0Hz ***Vertical:* 0.41in/s 10.414mm/s @ 64.0Hz** *Transverse:* 0.26in/s 6.604mm/s @ 7.1Hz *Displacement:*0.007789in 0.197851mm *Acceleration:*0.397516g's	*Duration:*0.000s To: 4.500s *Acoustic Scale:* 123dB 0.28Mb (0.071Mb/div) *Seismic Scale:* 0.41in/s (0.103in/s/div) 10.41mm/s (2.604mm/s/div) *Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Ft Myers Airport Tech Center
Shot #2
20 lbs/delay
Dist. to Shot = 325 ft (from GPS)
Trench between Seis and Shot

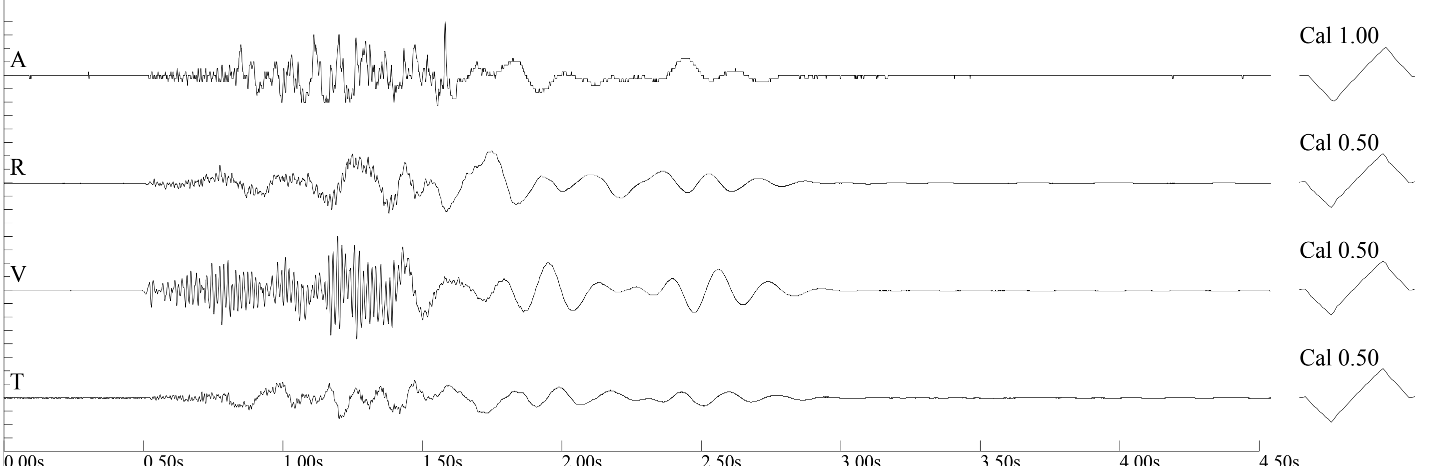
File Name: #2474002.DTB
Number: 002
Date: 4/26/2005
Time: 15:30
Serial Number: 2474
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 125 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.4

Amplitudes and Frequencies

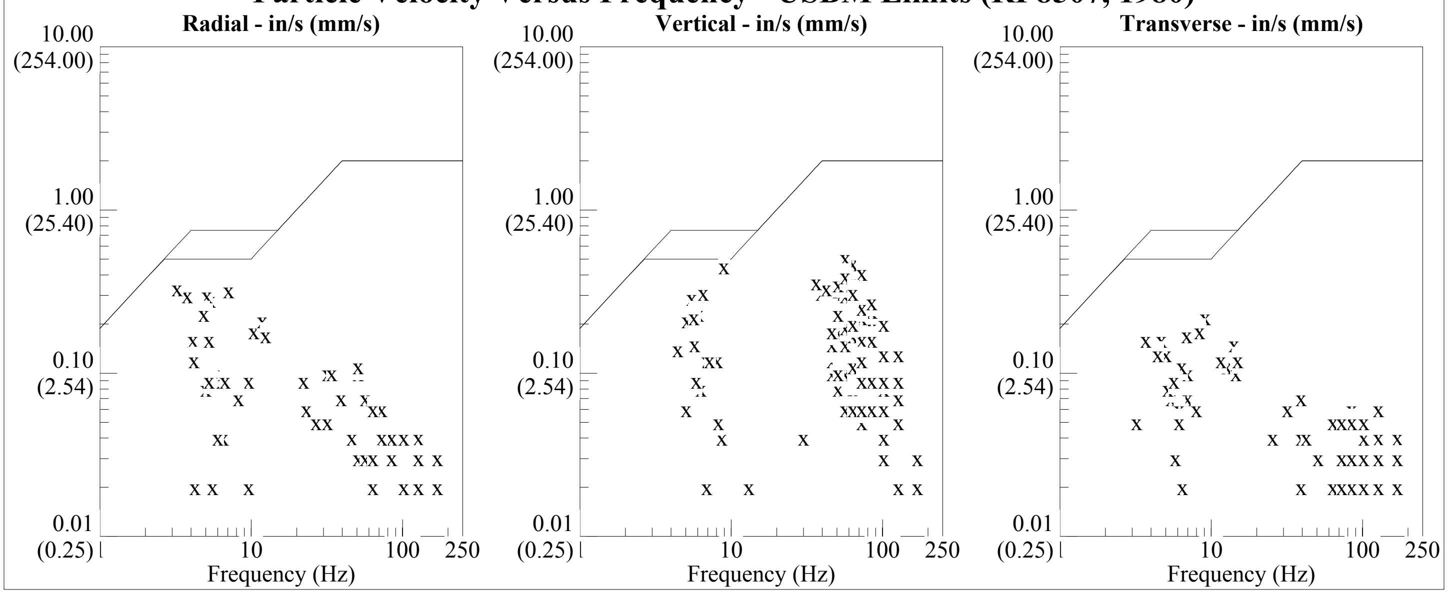
Acoustic: 124 dB @ 56.8 Hz
(0.32Mb 0.0046psi 0.0320kPa)
Radial: 0.33in/s 8.382mm/s @ 3.2Hz
***Vertical:* 0.56in/s 14.224mm/s @ 56.8Hz**
Transverse: 0.22in/s 5.588mm/s @ 9.3Hz
*Displacement:*0.013744in 0.349100mm
*Acceleration:*0.556522g's

Graph Information

*Duration:*0.000s To: 4.500s
Acoustic Scale:
124dB 0.32Mb (0.079Mb/div)
Seismic Scale:
0.56in/s (0.140in/s/div) 14.22mm/s (3.556mm/s/div)
*Time Line Intervals at:*0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)



Ft Myers Airport Tech Center
Shot #2
20 lbs/delay
Dist. to Shot = 359 ft (from GPS)
Trench between Seis and Shot

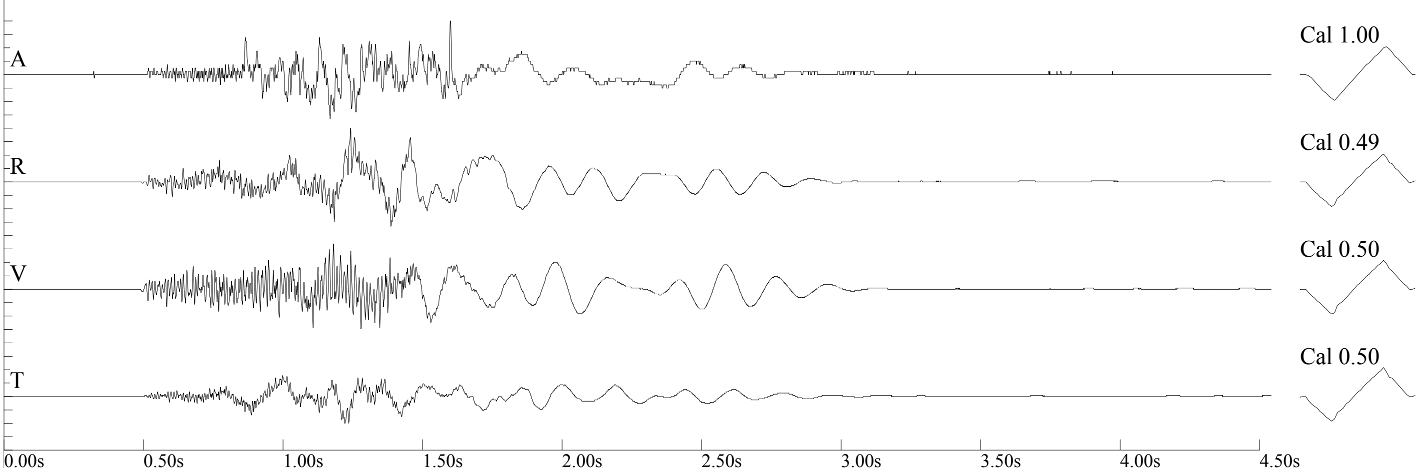
File Name: #1646002.DTB
Number: 002
Date: 4/26/2005
Time: 15:29
Serial Number: 1646
Seismic Trigger: 0.0300 in/s 0.7620 mm/s
Acoustic Trigger: 125 dB
Sample Rate: 1024
Record Duration: 4.0 Seconds
Pre-Trigger: 0.50 Seconds
Sensor Gain: 2x
Battery: 6.5

Amplitudes and Frequencies

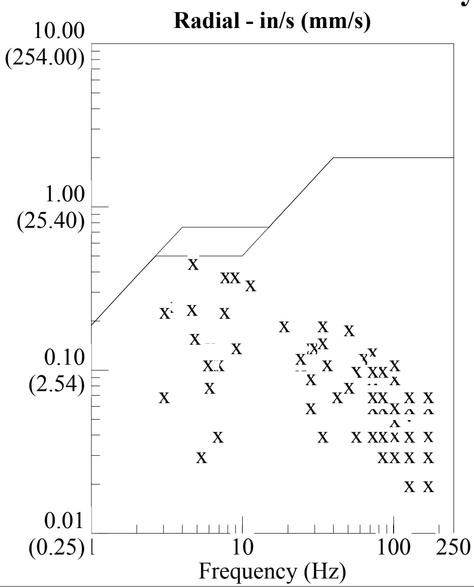
Acoustic: 124 dB @ 51.2 Hz
(0.32Mb 0.0046psi 0.0320kPa)
***Radial:* 0.46in/s 11.684mm/s @ 4.7Hz**
Vertical: 0.39in/s 9.906mm/s @ 73.1Hz
Transverse: 0.23in/s 5.842mm/s @ 8.8Hz
Displacement: 0.011487in 0.291774mm
Acceleration: 0.437267g's

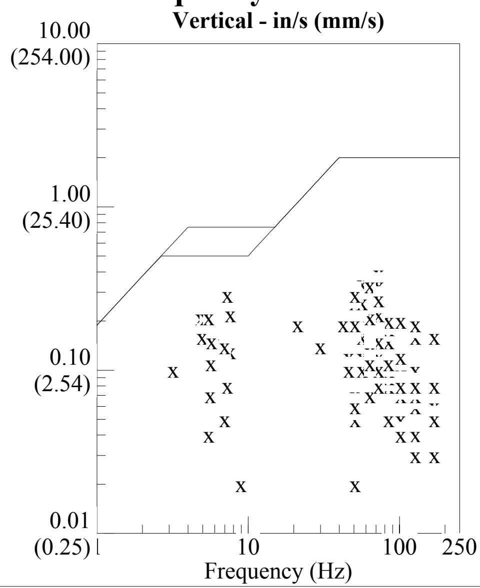
Graph Information

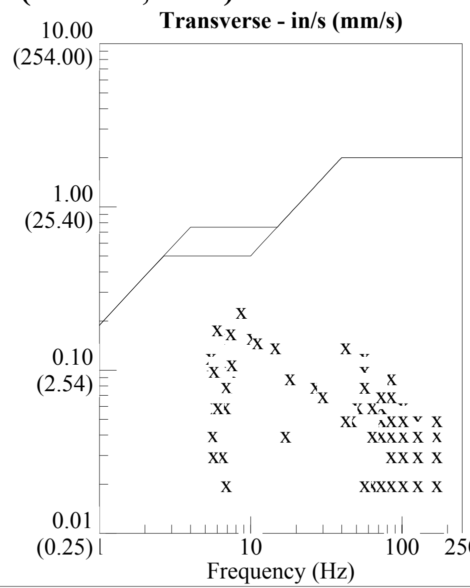
Duration: 0.000s To: 4.500s
Acoustic Scale:
124dB 0.32Mb (0.079Mb/div)
Seismic Scale:
0.46in/s (0.115in/s/div) 11.68mm/s (2.921mm/s/div)
Time Line Intervals at: 0.50 s



Particle Velocity Versus Frequency - USBM Limits (RI 8507, 1980)







9. Findings and Discussion

This study was unique for the following reasons:

1. Due to regulations, the resultant of 0.3 inches/second was given. The study had to prove whether this limit was viable.
2. The study utilized “Control Structures” and “Test Structures” in the same geographical area.

Normally, a study of this type runs a series of test to develop the resultant. Due to the regulatory constraints of Lee County, Fl, the resultant had to be proved or disproved. This required utilizing the “Control” and “Test” structures, to determine the affects of outside influences to a structure other then blasting.

9.1 Description of Findings

The peak particle velocity limit for development blasting in Lee County is 0.3 inches/second. This is one of the lowest limits that these authors have seen throughout the USA.

The researchers tracked peak particle velocities created by blast vibration, environmental influences, and other manmade influences.

The study indicates that environmental influences and settling are most likely the instruments of damage to most structures. During periods of extreme changes in temperature/humidity, a lot of changes can affect a structure. These include: cracking, settlement, and a host of other changes. Many of these changes may seem to appear overnight. This is especially true in the spring, fall, and during the storm seasons typical in Florida.

First, it was found that the environmental influences mimic those found in the study by Lewis Oriard. Mr. Oriard’s results are found earlier in this report, but are repeated below:

Typical Environmental Stresses, other Forces, and Equivalent Ground Vibrations from a study by Lewis Oriard turned out close to the Lee County Study.

Force	Peak Particle Velocity	Note
Inside Humidity	3	19% Change
Outside Humidity	5	35% Change
Inside Temp	3.6	12 Degree Far. Change
Outside Temp	8.2	27 Degree Far. Change
Wind	3.5	23 MPH
Walking	0.3	Measured at Wall Corner
Jumping	1	Midwall in Same room
Door Slam	0.5	Wall in next room
Sliding Door Slam	1.5	Wall above door
Picture nails	2	Midwall Nearby
Blast Limits	**2**	

"The Effects of Vibrations and Environmental Forces"- By Lewis Oriard

Second, it was found that daily activity or ambient vibration levels readily exceed the peak particle velocity blasting limit of 0.3 inches/second imposed in Lee County. These limits closely mimic the limits also stated in the preceding Oriard Chart. Charts created for actual data collected in Lee County can be found in the Vibration and Environmental sections of this report, but also follow this section.

Following is a list of findings from the monthly summary reports:

- February, 2005: Data from the test house in Herons Glen and the control home in Fort Myers Beach (not near any blasting) are relatively equal. The blasts are roughly equivalent or less in peak particle velocity to normal household activity and environmental effects, but the duration of the blasts are longer and in conjunction with the low frequency make human response a factor and will generate complaints. Minor cracks have appeared in the control home in Fort Myers Beach, which has not been subjected to any blasting. The house is newly painted and remodeled.
- March: Control Home Fort Myers Beach: When the house is unoccupied, the vibrations levels register from 0.015 ips to 0.025 ips. When the house is occupied, the range increases from 0.1 ips to 0.3 ips. The vibration blasting limit for Lee County is 0.3 ips. It should be noted that there have been readings higher then 0.3 ips at the control home (not near any blasting). Attached are actual readings from this control home.
- April: Not much difference, if any, can be seen from data gathered from the test houses near blasting to the data gathered from the control houses.
- May: The study is confirming that the limit of 0.3 inches/second as a peak particle velocity for blasting is a good limit. The study is showing that many daily occurrences are well above this level.

9.2 Recommendations

Recommendations are totally related to changes in the Lee County Blasting Code and can be found in Section 11. Stated here are code changes in bullet format as presented to the Lee County Blasting Committee.

- Code:
  - Sec. 3-4. Local user and blaster registration
    - Require 8 hours of continuing education/year.
      - Blasting courses: Private, Explosives Manufacturers and distributors MSHA, OSHA, Conferences, etc.
  - Sec. 3-8. Limitations on blasting intensity.
    - 4 Compass directions: But put in a location where a reading can be obtained and used. Extrapolate to structure of concern.

(b) Blast intensity may not exceed any of the following limits:

- Peak Particle Velocity (PPV): Not peak vector sum (Resultant). It has been noted that the code enforcement officers for Lee County are using the correct PPV, but the seismic monitoring companies and blasting company has been known to use the PVS.

  - Peak Vector Sum is the Sum of the 3 Peaks in the vibration wave. This gives a higher number but is not a true representation.
  - The code says PPV, but everyone has been working with PVS.

(b) Blast intensity may not exceed any of the following limits:
Peak Particle Velocity (PPV):
Occupied Structure (Residence or business): 0.30 inches per second
Utilities: 5.0 inches/second
Roads: PPV of 10 inches/second. Roadway outside of fracture zone of blast. May need a test blast to determine extent of fracture zone.
Bridges: 5.0 inches/second.

Airblast overpressure:
134 dB (linear) at Residence or business
Not applicable at other structures

C: Delete the 80% rule

Sec. 3-9. Limitation on blasting activity.

- Eliminate "No Blast" zone. 600 foot rule is not necessary. 0.3 ips is the limit. Doesn't matter at what distance.
- When close to residences or businesses, cover should be used. Rubber tire blasting mats should be used for distances 300 feet or less to a structure of concern. Between 600 feet to 301 feet, in place overburden or additional cover (sand or dirt) of at least 3 feet should be used. If blasting mats are used, additional cover is not needed.

Sec. 3-10. Blasting permit issuance; standard permit conditions.
Should not be a board issue. Should be issued or denied by the director if all conditions are met.

Sec. 3-13. Record keeping.
Add a standard blast report or blaster uses equivalent for the county that includes the following as a minimum:

- Date and time of blast
- Number of holes
- Depth
- Blast Pattern diagram and firing times
- Number of wet holes, water depth
- Hole diameter
- Burden & Spacing
- Amount of explosives
- Number of primers
- Type of detonators (i.e., electric or nonelectric);
- Number of detonators
- Stemming feet & type used
- Maximum pounds delay
- Maximum hole delay
- Weather
- Wind direction
- Type and make of blasting machine
- Global positioning system direction and distance in feet to the nearest building
- Decking feet
- Location of each seismograph
- Peak particle velocity inches per second & frequency
- Sound decibels
- Name, address, and license number of user of explosives; and
- Name, address, and permit number of blaster.

Sec. 3-15. Blast vibration monitoring.

- Printout not needed in the field. Just need the readings to be verified by enforcement officer in 24 hours, but reported right after the blast in writing.
- Calibration: 6 months is excessive. Should be by manufacturer's recommendation. Usually 1 year, but some newer ones do not need to be calibrated.

Pre-blast Surveys

- 1500 foot radius is excessive. 3000' offered is current.
- Normal Industry practice is 250 feet.
- Recommendation: 500 foot radius or closest habitable structure in four compass directions.
- Offer out to 1500 feet.

- This goes back to 0.3ips limit at closest residence.

One Strike Rule

- Field Blaster needs some relief on this.
  - Following company blast plan.
  - 3 strikes? With a fine for every strike?
  - Project halted until everything is resubmitted? Maybe a minimum of 10 days?
  - Lose license for 30 days, 60 days, then 1 year. Plus $15,000 fine paid by the blasting contractor for each occurrence.

Winkler Road Extension

- Remove the moratorium on blasting.

10. Literature Review

Hundreds of sources were researched and read during the literature review by the Terra Dinamica LLC team. Copies of the literature most prevalent for use in Lee County will be included with the final report submittal.

Sample list of Literature Review:

- Blast Vibration Analysis
- Blast Vibration Monitoring and Control
- ISEE Blasters Handbook
- Blasting Specifications for Construction Projects
- Construction Vibrations
- Diagnosing and Repairing House Structure Problems
- Effects of Vibrations and Environmental Forces: A Guide for the Investigation of Structures.
- Engineering Geology
- Response Spectrum Method
- Seismic Effects of Blasting in Rock
- Vibrations from Blasting
- Charles Dowding, Northwest University Autonomous Crack Measurement (on-line)
- US Bureau of Mines
    - RI-8484- Airblast Impact to Strucures
    - RI-8506- Blast Vibration Instrumentation
    - RI-8507- Impacts to Structures
    - RI-8896- Vibration from Repeated Blasting
    - RI-8969- Blast Vibration Measurements Near and on Structures
    - RI-9523- Vibration Effects on Transmission Pipelines

(o) Type of detonators used and delay periods used;
(p) Location of seismograph; set up procedure used;
(q) The PPV, airblast overpressure and frequency measurements for the blast; and
(r) Copy of strip tape from seismograph showing readings, marked with date, time and machine location, and signed by seismograph operator.
Use standard Lee County designed blast report or equivalent.
(Ord. No. 04-04, § 1, 4-27-04)

Sec. 3-14. Notice to county staff prior to blast.
A County inspector must be onsite prior to the detonation of a blast. The blaster or user must notify Lee County Code Enforcement that a blast is planned. This notice must be provided at least 24 hours prior to the blast and include the date, time and location of the blast. The County inspector is not required to wait more than 1/2 hour beyond the blast time specified in the notice from the blaster. The County inspector has the discretion to remain on the site or leave if the blast is delayed. If the inspector leaves the site, then the blaster or user will be required to notify Code Enforcement when the blast is ready. If the inspector remains on site, then additional inspection fees will be charged to the user. These additional inspection fees must be paid prior to any subsequent blast activity.
Notice must also be provided to the appropriate Fire District, by telephone and fax transmission, 24 hours prior to detonation of the blast.

(Ord. No. 04-04, § 1, 4-27-04)
Sec. 3-15. Blast vibration monitoring.
All blasts must be monitored using seismograph equipment that meets the criteria and requirements of this section. The purpose of the seismographic readings are to confirm compliance with the provisions of this article.
(a)Seismograph equipment. The instrumentation used must meet the following minimum criteria.
(1)Capable of measuring the three mutually perpendicular components of particle velocity in directions vertical, radial and perpendicular to the vibration source. The equipment must be capable of measuring a frequency response of 2 Hz to 200 Hz, with no greater than a 3 dB roll off, and PPV of up to at least 4 inches per second; and have an airblast channel frequency range of .1 to 200 Hz, 2 to 200 Hz, 5 or 6 to 200 Hz.
(2) Capable of recording the full waveform from a single blast as well as continuous monitoring.
~~(3) Capable of providing a contemporaneous printed hard copy (strip chart) of the full waveform and PPV data in the field as well as recording digital data as a permanent record. Instruments limited to recording seismic activity at a remote location for later retrieval and dissemination may not be used to meet LDC requirements, they will be considered supplemental only.~~
(4)Each piece of the monitoring equipment must be labeled with a serial number. This serial number must be cross referenced or otherwise identified on the field print out copy as well as the permanent digital record.
(5) Components of the monitoring equipment must be calibrated as a unit and remain together

11. Recommendations to Lee County Blasting Code and Regulations

Recommendation follow ordinance and are written in "bold & italic". These recommendations are meant to open up discussion and will be rewritten multiple times.

Chapter 3 EXPLOSIVES AND BLASTING REGULATIONS

ARTICLE I. DEVELOPMENT BLASTING

Sec. 3-1. Purpose and intent.

The Board of County Commissioners has determined that it is in the best interest of the public health, safety and welfare to enact regulations governing explosives used in the development of property in unincorporated Lee County. The purpose of this article is to set forth the provisions, conditions and requirements applicable to development blasting activity within the County.

(Ord. No. 04-04, § 1, 4-27-04)

~~Sec. 3-2. Applicability; Winkler Road extension blasting prohibition.~~

~~(a) The provisions of the article apply to existing and future development blasting activity within~~

~~**the unincorporated areas of Lee County. Bona fide construction materials mining activities, approved by the county and conducted in compliance with the provisions of F.S. Ch. 552, are not required to comply with the regulations set forth in this article.**~~
~~**(b) A permit is required prior to initiating development blasting activity. This includes test blasting.**~~
~~**(c) Development blasting activity is prohibited within the Winkler Road Extension area described as follows:**~~

~~**That land within the Suburban and Outlying Suburban Land Use Categories as defined in the Lee County Comprehensive Plan, lying south of Summerlin Road within Sections 34 and 35, Township 45 South, Range 24 East and Sections 2, 3, 4, 9, 10 and 11, Township 46 South, Range 24 East and west of Hendry Creek.**~~
~~**(Ord. No. 04-04, § 1, 4-27-04; Ord. No. 04-06, § 3, 4-11-04; Ord. No. 04-07, § 3, 5-25-04)**~~

Sec. 3-3. Definitions.
The following words, terms and phrases will have the meanings stated in this section.

Acceleration
The velocity per unit time.
Airblast overpressure means the impulsive sound or blast amplitude as measured in decibels.
Amplitude
A time varying or kinematic vibration quantity of displacement, velocity, or acceleration. These all have instantaneous values at any moment and also peak values at a specific moment for any vibration record.
Blaster means an individual that holds a valid state permit allowing the loading and detonation of explosives. A blaster must be employed by a user.
Blast site means the area identified in the blasting plan that will encompass the blasting activity. It may include the entire project site where appropriate.
Board means the Lee County Board of County Commissioners.
Development blasting activity means the detonation of explosives for the purpose of demolishing a structure or fragmenting rock, gravel, earth or trees for excavation or construction; and blasting not otherwise regulated by F.S. Ch. 552.
Director means the Director of the Department of Community Development or designee.
Displacement
Amount of deviation or distance of any particle or point from its rest position.
Frequency means the blast energy over time measured in hertz.
The number of cycles executed per unit time. In vibration analysis, unit time is a second. Frequency is the number of times the particles (See Peak Particle Velocity) move back and forth in one second. This back and forth motion can also be referred to as oscillations. The number of oscillations/second or cycles/second that a particle makes under influence from the vibration wave is measured in Hertz (Hz).

Peak particle velocity (PPV) means a measurement of ground vibration velocity in inches per second.
Particle velocity is the displacement per unit time in reference to the speed or excitation of the particles in the ground resulting from vibratory motion. In blasting, ground particles oscillate in response to a vibration wave. This oscillation is measured in particle velocity. The maximum rate is the Peak Particle Velocity (PPV). blasting this is measured in inches per second or millimeters per second.
Peak Particle Velocity is the maximum rate of particle movement.
Structure means a building or facility that is existing or under construction. It includes, but is not limited to, homes, mobile homes, buildings, roadways, utilities, foundations, pools, wells, drainage facilities, water management facilities, seawalls, docks, driveways, concrete slabs and similar improvements.
User means an individual that holds a valid state license allowing the purchase and detonation of explosives.
Velocity
Displacement per unit time. Rate of change of displacement, or how fast a particle moves from its rest position to its maximum displacement position and back.
Wavelength
The length of one complete cycle.
(Ord. No. 04-04, § 1, 4-27-04)

Sec. 3-4. Local user and blaster registration.
(a) Registration required. Users and blasters seeking to conduct development blasting activity must be locally registered. All blasting activity must be conducted by a blaster holding a valid state permit. A blaster must be employed by a user holding a valid State license. This provision allows the user and blaster to be the same person, as long as this person holds both the state user license and blaster permit.
(b) Application requirements for registration. In order to obtain a local registration, each user and blaster must file a separate application on the form prescribed by the Director. This application must include the following information:
(1) Name, address and contact number for the applicant (ie. user or blaster applying for registration).
(2) A physical description of the applicant, accompanied by valid photo identification. Acceptable forms of photo identification include a driver's license, state identification card or valid passport.
(3) A copy of the valid State user's license or blaster's permit, as appropriate.
(4) If the application is for a blaster's registration, the name, address and contact number for
the user employing the blaster. The user employing the blaster must also hold a valid local registration.
(5) If the application is for a user's registration, the Florida company associated with and/or

qualified by the user, along with the mailing address of the company, the address for the principal place of business, and a contact name and number.
(6) An original completed fingerprint information card for the applicant.
(7) Copy of declaration page identifying the applicant's insurance coverage for workers' compensation, and comprehensive general liability and property damage insurance in the amount of 1,000,000.00 per occurrence and aggregate.
(8) The application must be signed by the applicant and include a sworn, notarized statement that the information is true and correct.
(9) The application fee.
(c) Criteria for review and approval. Applications for a local user or blaster registration will be reviewed by the Director once the application is found complete. Registrations are issued at the discretion of the Director based upon the application and whether the applicant has violated any provisions of this article within the preceding five years.
(d) Renewal. The registration must be updated annually by providing:
(1) A copy of the state license or permit renewal, as appropriate;
(2) A copy of the insurance renewal information; and
(3) The renewal fee.
(e)Registration fees. The registration fees are set forth in the Lee County Administrative Code.

(Ord. No. 04-04, § 1, 4-27-04)
Sec. 3-5. Blasting permit application requirements.
(a) Application. Only a locally registered user may apply for a blasting permit.
The application must include the following:
(1) Name, address and contact information for the following individuals:
a. User (the permit applicant);
b. Blaster;
c. Developer;
d. Property owner;
e. Engineer creating or corroborating the blasting plan;
f. Seismograph operator; and
g. Person to conduct pre- and post-blast surveys.
(2) Local registrations for the user and blaster responsible for proposed activity.
(3) Location of proposed blasting activity. (Include strap number, physical address, metes and bounds legal description with accompanying sketch, and an aerial depicting project site.)
(4) A description of the project to be benefited by the blasting activity, including a copy of the approved local development order, and an explanation of why the blasting is necessary.
(5) A sketch of the proposed blasting site/project superimposed over an aerial, showing measured distances from all structures, buildings, streets, above and below ground utilities, wells and other facilities within 1,500 feet of the blasting site.

(6) A list of all property not under the ownership or control of the user, blaster or developer
within 3,000 feet of the blast site. This list must include the name and address of the property owner, whether the property is improved, and the type of structure and occupancy.
(7) A proposed blasting plan that includes:
a. Description of proposed blasting procedure;
b. An estimate of the total number of cubic yards to be removed as a result of the blasting;
c. An estimate of the number of blasts to be detonated;
d. The quantity and type of explosives to be used;
e. Maximum amount of explosives per delay;
f. Maximum number of holes per delay;
g. Proposed delay between holes and rows; and
h. Proposed placement of seismographic machines.
(8) Estimated starting date and completion date for blasting operations.
(9) Hours of intended blasting operations.
(10) Traffic control, barricading and sign plan.
(11) Warning notification plan.
(12) Letter of permission and authorization, signed by the property owner and acknowledged
before a notary, allowing the proposed blasting activity.
(13) Written approval, or letters of no objection, from the Lee County Department of Transportation, Lee County Port Authority, Lee County Utilities, and the utility entities holding franchise rights within 3,000 feet of the proposed blasting site. The approval letter may impose conditions on the blasting activity that are intended to preserve and protect structures for which the entity is responsible.
(14) Other information deemed necessary or appropriate by the Director or Board, which may include, but is not limited to:
a. Pre-blast assessment, prepared by a geotechnical engineer or other blasting professional, which assesses the geology of the blast site and surrounding area out to 3,000 feet and the potential for damage to structures and facilities within 3,000 feet of the blast site;
b. Pre-blast inspection of structures and facilities located near the proposed blast location. (Including video taping of structures);
c. Bond to protect County facilities;
d. Hydrological study;
e. Geological study; and
f. Test wells.
(b) Fees. The established fee for blasting permit applications and blasting inspections are set
forth in the Lee County Administrative Code.
(c) Escrow agreement. Prior to issuance of the blasting permit, the applicant must deliver an executed escrow agreement, acceptable to the County Attorney's office, and fully funded with cash in the amount of $ 50,000.

(Ord. No. 04-04, § 1, 4-27-04)

Sec. 3-6. Inspection fee accounts.
The permit applicant may create a blast inspection account with the County to cover the costs associated with the proposed number of blast inspections necessary to complete the permitted blast activity. This account may include authorization for the County to charge a credit account in the name of the user. The account will be adjusted or charged after each inspection. If additional inspections are required that are not funded by the account, the inspections will be delayed until sufficient funds are provided to the County.
(Ord. No. 04-04, § 1, 4-27-04)

Sec. 3-7. Bonds and escrow agreements.
Bonds required as a condition of permit approval must be in a form prescribed by the County and found legally sufficient by the County Attorney's office.
Escrow agreements must be executed on the form required by Lee County and funded with cash. Prior to issuance of a blasting permit, the escrow agreement must be reviewed and approved by the County Attorney's office. In all instances the County will act as the escrow agent. Funds will be disbursed from the escrow account in accord with the terms of the agreement and section 3-19.
(Ord. No. 04-04, § 1, 4-27-04)

Sec. 3-8. Limitations on blasting intensity.
(a)Blast intensity will be measured in all four compass directions at the nearest structure not owned by the developer, as measured from the boundary of the blast site. If no structure exists within one mile of the blast site, then the measurement will be taken at the one mile mark in the direction of the nearest structure. However, the director has the discretion to require monitoring of intensity levels at alternate locations not under the ownership or control of the developer, user or blaster. These alternate locations may be inside or outside the overall development project boundary.
Or, the seismograph will be set at a location agreed upon by the Lee County code enforcement officer. The peak particle velocity at the structure will be determine by accepted extrapolation practices.
(b) Blast intensity may not exceed any of the following limits:
Peak Particle Velocity (PPV): ***Not peak vector sum.***
Occupied Structure (Residence or business) 0.30 inches per second
Utilities: 5.0 inches/second
Roads: Roadway outside of fracture zone of blast. May need a test blast to determine.
Bridges: 5.0 inches/second.
Airblast overpressure:
134 peak dBL (linear) ~~- 0.1 Hz high-pass system~~
~~133 peak dBL (linear) - 2 Hz high-pass system~~
~~129 peak dBL (linear) 5 or 6Hz high-pass system~~

134 db at habitable structures. Other structures airblast is non-applicable.

~~***(c)80% Rule. If the user or blaster, based upon their expertise and experience, have reason to believe that a blast will exceed 80% of one or more of the intensity thresholds set forth above, then blasting activity must cease immediately. Blasting activity will be permitted to resume after the user obtains approval for a modification of the blasting permit that will ensure the blasting intensity does not exceed the intensity limitations set forth in subsection 3-8(b).***~~
~~***In addition to the above, if the daily shot records submitted for the blasting activity in accordance with this article indicate 80% of one or more intensity limitations set forth above have been exceeded, all blasting activity must cease. Blasting activity will be permitted to resume only after the user obtains approval for a modification of the blasting permit that will ensure the blasting intensity does not exceed the intensity limitations set forth in subsection 3-8(b).***~~
~~***(Ord. No. 04-04, § 1, 4-27-04; Ord. No. 04-06, § 3, 4-11-04)***~~
Delete this section.

Sec. 3-9. Limitation on blasting activity.
Blasting activity within 600 feet of a structure not under the ownership or control of the developer, user or blaster, is prohibited. The 600 feet will be measured from the boundary of the proposed blast site, in accordance with section 3-17.
Blasting activity may proceed within 600 feet of a structure with the approval of the Director, Community Development.
(Ord. No. 04-04, § 1, 4-27-04)

Sec. 3-10. Blasting permit issuance; standard permit conditions.
(a)Blasting permit required. It is unlawful to conduct development blasting activity, including test blasting, within the unincorporated area of Lee County without a valid blasting permit issued in accordance with this article.
(b)Right to permit approval. Issuance of a blasting permit is a privilege and not a right. Issuance of a permit constitutes a discretionary act of the Board based upon review of the permit application and relevant information available to the Board from County departments and files concerning the user, blaster, developer or owner of the subject project. Denial of a blasting permit application will include a written explanation for the denial.
Blasting permit applications will be reviewed by the Board as a public hearing agenda item. Public hearings will be scheduled for 9:30 a.m. or as soon there after as they may be heard. County staff will prepare a written recommendation, including proposed permit conditions, to accompany the permit application as part of the agenda item backup. The conditions set forth in this article will be considered the minimum conditions applicable to blasting permit approval.
As part of the permit review process, the Board will consider, at minimum, the compatibility of the proposed blasting activity with the surrounding community, and the

proximity of schools, churches, health care facilities and public infrastructure facilities to the blast site. Notwithstanding the above, a blasting permit will be denied if the Board determines approval of the proposed blasting activity is not in the best interest of the public health, safety and welfare of its citizens.

(c)Permit denial. The Department of Transportation, Lee County Port Authority, Lee County Utilities, or an entity holding a utility franchise within the area affected by the proposed blasting activity has the right to deny a blasting permit application in order to afford reasonable protection of public infrastructure or facilities. The reason for the denial must be specifically stated in writing.

(d)Standard conditions. The following provisions constitute the standard conditions applicable to development blasting permits.

(1) County staff has the right to enter upon the property and complete all necessary inspections related to the blasting activity or in response to complaints resulting from the blasting activity.

(2) Hours of blasting activity:

10:00 a.m. 4:00 p.m. Monday through Friday

No weekends

No State holidays

No Federal holidays

(3) The permit is issued to the user identified in the application and allows the blaster identified in the application to conduct the blasting activity. If the blaster identified in the application changes subsequent to the application submittal or after the permit is issued, then the user must notify the County as to the name, address, contact information and registration requirements of the replacement blaster prior to detonation of blasts by the replacement blaster.

(4) The responsible user, blaster and engineer, identified in the permit application, must be onsite during all phases of the physical blast preparation (drilling holes, etc.) and detonation activity.

(5)No detonation of explosives (blasting) may occur without appropriate County staff on site.

(6)Notice of the proposed blast time must be provided to Lee County Code Enforcement and the Fire District 24 hours prior to the blast in accordance with section 3-14. A Code Enforcement inspector must be on-site during the blast.

(7) A blasting permit is issued to the user and is not transferable.

(8) A record of each blast must be maintained in accordance with section 3-13.

(9) A permit is valid for 90 days from date of issuance, unless otherwise specifically stated on the face of the permit. Permit extensions are allowed in accordance with section 3-12.

(10)Issuance of the blasting permit does not relieve the applicant, the user, the blaster or the developer of responsibility for the results of the blasting activity, including the accuracy and adequacy of the blasting plan as implemented in the field.

(11)The developer is responsible for handling, discharging or settling all damage or annoyance claims resulting from the blasting activity.

(12)The developer must execute an escrow agreement and fund a cash escrow account prior

to issuance of the blasting permit. The sole purpose of this escrow agreement is to compensate property owners for damage (cosmetic or structural) to their property resulting from the blasting activity. Lee County will be the escrow agent. Disbursements from the escrow account will be made by the County based upon the decision of the arbiter as a result of binding arbitration proceedings. The developer is solely responsible for the costs associated with the arbitration proceedings.
(Ord. No. 04-04, § 1, 4-27-04)

Sec. 3-11. Duration of permit approval.
A permit is valid for a period of 90 days from the date of issuance, unless otherwise specifically stated on the face of the permit. However, no permit may be issued for a duration of more than six months.
(Ord. No. 04-04, § 1, 4-27-04)

Sec. 3-12. Permit extension.
The Board has the discretion to extend a permit approval for a period of up to 90 days, based upon the filing of the appropriate application and fee. Only one permit extension is permitted per base permit. Subsequent blasting activity within the same project or area will require the filing and approval of a new and complete permit application.
(Ord. No. 04-04, § 1, 4-27-04)

Sec. 3-13. Record keeping.
The permit applicant (user) is responsible to maintain a record of each blast. A copy of the record must be filed with Lee County Code Enforcement no later than 10:00 a.m. of the workday following the blast. All original blasting records must be retained by the user responsible for the blasting activity for at least three years following the conclusion of the blasting activity. The records must be available for inspection by the County upon request. The blasting records must include the following information:
(a) Name of the user responsible for the blasting activity;
(b) Name of the blaster conducting the blasting activity;
(c) Date, time and location of the blast;
(d) Type of material blasted;
(e) Number of holes, spacing, burden;
(f) Diameter and depth of holes;
(g) Type of explosives used per hole;
(h) Amount of explosives used;
(i) Maximum amount of explosives per delay;
(j) Maximum number of holes per delay;
(k) Method of firing and type of circuit;
(l) Weather conditions (including factors such as wind direction, temperature, cloud cover etc);
(m) Height or length of stemming;
(n) Whether mats or other types of protection were used;

as a unit for the duration of the permitted blasting activity. Mixing various pieces together that were not calibrated for use as a unit will not satisfy the requirements of this section.
(6) Monitoring equipment must be calibrated at least once every six months ***or by manufacturers recommendations.***. Written documentation as to the calibration, including identification of the unit parts, who performed the calibration and the standard used, must accompany the instruments and be available for immediate inspection upon request by the County.
(b) Set up of seismograph equipment.
(1) Set up of the equipment must be in accordance with accepted industry standards as identified by the International Society of Explosive Engineers or the US Department of Interior, Bureau of Mines Report RI 8508.
(2) Seismograph equipment must be set up at the locations approved as part of the blasting plan.
(3) Whenever possible, monitoring equipment must be placed in undisturbed soil. Placement on driveways, walkways or slabs must be avoided.
(4) The Board or their designee may require additional monitoring devices if, after a field inspection with the monitors in place, additional monitoring appears appropriate or necessary to establish compliance with the provisions of this article.
(c) Location of seismograph equipment. Blast intensity must be monitored in all four compass directions. Seismic monitoring equipment must be located at the nearest structure not owned by the Developer that is within one mile of the blast site boundary. If no structure exists within one mile of the blast site, then the measurement will be taken at the one mile mark in the direction of the nearest structure, or as otherwise determined by the board.
Or placed in a location agreed upon by the field code enforcement officer. Peak Particle velocity at the structure of concern will be determined by accepted extrapolation practices.
(d) Inspection of seismograph equipment. Code Enforcement is required to inspect all monitoring equipment prior to the blast. The user or developer must facilitate these inspections, including the provision of transportation over difficult terrain, if necessary.
(e) Contemporaneous reporting requirements. A copy of the paper read out (strip chart) from each unit recording the blast activity must be provided to the Code Enforcement inspector ***within 24 hours of the blast, but the results will be reported to the code enforcement inspector immediately after the blast.*** The strip chart must include a full waveform and specifically identify the exact monitoring location; the date, time and place of the blast activity, the PPV, frequency and airblast overpressure; and be signed by the seismograph operator.
(f) Followup reporting requirements. The user must submit the following written documents to Lee County Code Enforcement by 10:00 a.m. the workday following the blast.
(1) Copy of the daily shot report that includes all of the blast record keeping information identified in section 3-13.
(2)A copy of the digital data generated by each required seismograph unit, with a copy of the corresponding printed strip chart attached.
(Ord. No. 04-04, § 1, 4-27-04; Ord. No. 04-06, § 3, 4-11-04)

Sec. 3-16. Pre- and post-blast condition surveys.

- ***1500 foot radius is excessive. 3000' offered is current.***
- ***Normal Industry practice is 250 feet.***
- ***Recommendation: 500 foot radius or closest habitable structure in four compass directions.***
- ***Offer out to 1500 feet.***

Change following code as needed.

(a) Generally.
(1)All condition surveys must be conducted by a professional with the appropriate credentials and experience. A copy of the curriculum vitae or resume detailing the reviewer's credentials must be attached to each survey report.
(2) Condition surveys must be made available as follows:
a.Pre-blast condition survey: A copy, including color copies of all photos, must be provided to the owner of the structure or facility surveyed and Lee County Code Enforcement prior to the detonation of any blasts allowed under the permit.
b. Post-blast condition survey: A copy, including color copies of all photos, must be provided to the owner of the structure or facility surveyed and Lee County Code Enforcement upon completion, but no later than ten days after the physical survey date.
(3) Content of condition survey report. The survey must document the current interior and exterior condition of the structure, facility, pool, seawall, dock, driveway, foundation, well, utilities, drainage facility, water management facility, concrete slab or other improvements on the property that is the subject of the survey. The survey must include sufficient documentation to satisfy all typical insurance carrier requirements related to substantiating a claim for damage, including but not limited to, documenting the status of the structural engineering.
(4) Cost. The cost of condition surveys will be borne by the user, blaster and developer.
(b) Pre-blast condition survey.
(1) 1,500 foot radius around blast site.

Prior to conducting blasting activity, the user and developer must obtain a professional pre-blast condition survey for all structures and facilities within a 1,500-foot radius of the blast site. Structures and facilities touched by the 1,500-foot radius measurement, must be included in the survey requirement.

The professional conducting the survey must provide a written notice to the owner and tenants of the property. This notice must indicate the reason for the survey, the proposed date and time of the survey, and a local or toll free contact number for purposes of scheduling an alternative date or obtaining additional information. A copy of this notice must be provided to Code Enforcement.

If the owner of the structure or facility refuses to allow access to conduct the pre-blast survey, the professional attempting to survey the property must note this on the survey form. The property owner should sign the form to verify refusal. At least three attempts must be made to notify the owner of the need for the survey. The user and developer have the burden to prove the property owner refused the pre-blast survey. Sufficient proof of refusal will consist of either: (a) a written document signed by the property owner stating they understand the purpose of the blast survey and refuse to have it conducted; or (b) a sworn affidavit from the professional hired to conduct the survey setting forth the details related to the property owner's refusal, including a narrative about the attempts to obtain permission to conduct the survey, and the information provided to the property owner regarding condition surveys.

A copy of all pre-blast surveys, including documentation as to any property owner's refusal, must be submitted to Code Enforcement prior to conducting the permitted blasting activity.

(2) Area between 1,500 foot and 3,000 foot radius around blast site.
In addition to the surveys required under subsection (b)(1), the user and developer must provide a viable opportunity for a professional pre-blast condition survey to be conducted on all structures and facilities falling within a distance of 1,500 to 3,000 feet from the blast site. Structures and facilities touched by the 3,000 foot radius measurement must be included in the survey.

The professional conducting the survey must provide a written notice to the owner and tenants of the property. This notice must indicate where and when the blasting activity will occur, the reason for the survey, and a local or toll free contact number for purposes of scheduling a date and time for the survey or obtaining additional information. A copy of this notice must be provided to the County.

The notice offering a pre-blast survey must be sent at least 20 days prior to the start of blasting activity via regular and certified mail. Sufficient time must be provided to allow scheduling and completion of all pre-blast condition surveys requested before the blasting activity occurs. Prior to commencement of blasting activity, the user or developer must submit a sworn affidavit to Code Enforcement indicating the notice offering a pre-blast condition survey was sent to all property owners within the designated area and all pre-blast surveys requested are complete. The affidavit must include an attachment identifying the names and addresses used in sending the notices.

(c)Post-blast condition survey. Upon completion of the blasting allowed under the permit, the user and developer will obtain professional post-blast condition surveys for properties, structures or facilities that are the subject of damage complaints or claims made during the course of the blasting activity. A list of all property owners filing a compliant with the County will be compiled by Code Enforcement.

The professional conducting the survey will contact each property owner in writing, via certified mail, to schedule a mutually convenient date and time for the post-blast survey. The surveys must be completed within 15 days after cessation of the blasting activity. A copy of the condition survey report must be provided to the property owner and Code Enforcement upon completion, but no later than ten days after the physical survey date.

The Developer must submit a sworn affidavit within 30 days after the cessation of the blasting activity that identifies the location of the properties offered a post-blast condition survey; property owners' names and the mailing addresses used to extend the offer; and whether the survey was completed or refused. No further blasting permits will be issued within unincorporated Lee County for projects in which this developer is a principal, beneficiary, or subsidiary until this affidavit is filed.

(d) Content of condition survey. The condition survey must include a written description of the interior and exterior condition of each structure or facility examined. Existing cracks, damage or other defects must be specifically located and described with sufficient specificity to make it possible to determine the effect, if any, of the proposed blasting activity. If significant cracks or damage exist or if the defects are too complicated to describe in writing, photographs must be taken to supplement the survey. In lieu of the written survey report, a good quality videotape survey, with appropriate audio description of locations, conditions and defects may be substituted. A copy, in whatever form created, must be provided to the property owner and Code Enforcement prior to approval for subsequent blasting activity on projects within unincorporated Lee County.

The survey must be kept for a minimum of seven years and be available upon request.
(Ord. No. 04-04, § 1, 4-27-04)

Sec. 3-17. Measurement.
For purposes of this article, all distance measurements relative to the blast site will be measured from the outer boundary of the blast site as depicted on the approved development blasting permit.
(Ord. No. 04-04, § 1, 4-27-04)

Sec. 3-18. Notice of blasting activity.
(a) Written notice. Written notice to property owners within one mile of the proposed blast site must be provided by the user 10-20 calendar days prior to commencement of the blasting activity. The notice should be sent regular mail to the address for the property indicated in the property appraiser records on the date the notice is sent. The contents of the notice must address the following:
(1) Explanation of the blasting activity that will occur and what to expect, including the meaning of the audible warning system.

(2) The location of the blasting activity.
(3) Dates and times of the proposed blasting activity.
(4) Expected duration of the blasting activity.
(5) Contact information for complaints concerning the blasting activity.
(6) Availability of a pre-blast condition survey.
(b) Audible notice. Prior to detonation of a blast, a series of audible warning signals, using sirens or horns or both, must be sounded with sufficient intensity to be heard at a minimum distance of 1,000 feet from the blast site. An air horn, with a tone and sound different than that in use by the Police, Fire District and EMS vehicles, must be used. The warning signals must be sounded as follows:

One minute prior to the blast a series of three short (three seconds) signals.

Use of heavy construction equipment operating within 1,500 feet of the blast site must cease once the audible signal is sounded, until the detonation is complete.
(c) Signs. At least five days, but no more than ten days, prior to the commencement of the permitted blasting activity, warning signs must be erected by the user or blaster as follows:
(1) The sign must be at least 30 inches by 30 inches, but no greater than 48 inches square and at a height lower than eight feet from the ground.
(2) The sign must state, in five-inch block letters, "WARNING - Blasting". It must also include the date and times of the proposed blasting, the project name, the names of the user, blaster and developer along with a local contact number.
(3) No commercial advertising is permitted on the sign face.
(4) Signs must be placed adjacent to the right-of-way at 250 foot intervals around the perimeter of the development project and be clearly visible to the traveling public.
(5)All signs must be removed within one week of the completion of the development blasting activity or the expiration of the blasting permit, whichever occurs first.
(Ord. No. 04-04, § 1, 4-27-04)

Sec. 3-19. Complaints about blasting activity.
Lee County Code Enforcement will maintain a list of property owner complaints and damage claims for each active blasting permit. This list will include the name of the property owner, the location of the property and a synopsis of the complaint or claim for damage. Complaints received by the user, blaster or developer must be reported to Code Enforcement within 24 hours by the recipient of the complaint. All complaints or claims involving damage will be the subject of an interim post-blast condition survey, conducted within 48 hours of receiving the complaint, unless the survey is specifically refused or property owner agrees to a different time frame for conducting the survey.
The interim post-blast condition survey must meet the criteria for condition surveys set forth in section 3-16. However, the survey must be completed within the condensed time frame set forth above or blasting must cease until the interim condition survey requirement is met.

The developer is responsible for handling, discharging or settling all damage or annoyance claims resulting from the blasting activity. Monitoring or review of the blasting activity conducted by the County in accordance with this article will not relieve the user, blaster and developer of responsibility for compliance with this article.
Damage complaints will be resolved though binding arbitration. The developer will be solely responsible for the cost of the arbitration proceedings. The County will disburse funds from the developer's escrow account to property owners based upon the decision of the arbiter.
(Ord. No. 04-04, § 1, 4-27-04)

Sec. 3-20. Violations and penalties.
(a)Intensity violation. Blasting activity that: exceeds the limitations set forth in section 3-8 for PPV or airblast overpressure at the locations specified in section 3-8(a); ***~~or, the 80% rule~~***; or, fails to measure and record the blast intensity at the nearest structure not owned by the developer in accordance with sections 3-8 and 3-15 constitutes an "intensity violation" under this article. Intensity violations will precipitate the following action:
(1)A fine of $2,500 against the user~~, blaster, engineer~~ and developer, who will be jointly liable for the full amount of this fine. The fine is due and payable upon issuance of the county citation;

- ***Field Blaster needs some relief on this.***
  - ***Following company blast plan.***
  - ***3 strikes? With a fine for every strike?***
  - ***Project halted until everything is resubmitted? Maybe a minimum of 10 days?***
  - ***Lose license for 30 days, 60 days, then 1 year. Plus $15,000 fine paid by the blasting contractor for each occurrence.***

~~(2) Automatic revocation of the blasting permit~~***;***

~~(3)No further blasting permits will be issued for the development project, including all future phases of the project. Disputes as to the scope of the development project for purposes of this subsection will be decided by the Director; and,~~
~~(4) No further blasting permits will be issued to the user, blaster or the company or business entity qualified or associated with the user for a period of five years. The fact that a new user is obtained to qualify a company does not eliminate the sanction. The user will not be eligible to qualify any other companies or entities for purposes of blasting in unincorporated Lee County for a period of five years. The blaster will not be permitted to act as the responsible blaster for purposes of blasting in unincorporated Lee County for a period of five years.~~
(b) Non-intensity violation. Violation of the provisions of this article, other than those applicable to blast intensity, constitute a "non-intensity violation". Non-intensity violations will precipitate the following action:
(1) Imposition of a fine against the user, blaster and developer, individually or jointly. The fine

is due and payable based upon issuance of the County citation. Fine amounts are set forth in the Lee County Administrative Code.
(2) Automatic suspension of the current blasting permit. The permit may be reinstated at the discretion of the Director if:
a. The violation is abated to the Director's satisfaction; and
b.The information requested by the Director is submitted and found sufficient by the County.
(3) Potential revocation of the blasting permit based upon the nature of the violation and the history of violator's compliance.
(Ord. No. 04-04, § 1, 4-27-04; Ord. No. 04-06, § 3, 4-11-04)

Sec. 3-21. Deviations and variances.
No deviations or variances from the provisions of this article may be granted or approved.
(Ord. No. 04-04, § 1, 4-27-04)

Sec. 3-22. Appeal.
Appeals from the decisions under this article are only to the Circuit Court.
(Ord. No. 04-04, § 1, 4-27-04)

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