

WEST VIRGINIA DIVISION OF TRANSPORTATION  
DIVISION OF HIGHWAYS  
MATERIALS CONTROL, SOIL & TESTING DIVISION

MATERIALS PROCEDURE

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DETERMINATION CRITERIA FOR MONITORING GROUND VIBRATIONS IN  
RESIDENTIAL AREAS

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- 1.0 PURPOSE
- 1.1 To establish a procedure for event inspection, recording, and determination of possible damaging vibrations in structures caused by highway traffic.
- 2.0 SCOPE
- 2.1 This procedure shall apply to property or areas that have been requested to be instrumented to assist in the determination of possible vibration damage. The Division may elect to use other control procedures if special conditions dictate.
- 3.0 APPLICABLE DOCUMENTS
- 3.1 Bureau of Mines Report of Investigations #8507 Structure Response and Damage Produced by Ground Vibration from Surface Mine Blasting by D.E. Siskind, M.S. Stagg, J.W. Kopp, and C.H. Dowding.
- 3.2 Federal Highway Administration Report, Vibrations Induced by Construction Traffic, a historic case study by Henwood and Khamis Y. Haramy.
- 3.3 1996 Report on Estimated Airblast and Blast-Related Vibration at the Lincoln Project, Placer County, California. Green Valley, Arizona by W. L. Bender.
- 4.0 APPARATUS AND EQUIPMENT
- 4.1 One electronic recording seismograph capable of operation for at least three days of continuous monitoring. This device may be all self contained or have separate transducer sensors.

- 4.2 A power source such as a battery, or AC power outlet suitable to operate seismograph for approximately one week of continuous monitoring, if required.
- 4.3 A water resistant, vented protective covering to prevent moisture build-up if seismograph is used in an outside environment.
- 4.4 Two small sandbags weighing approximately 15 lbs each, to maintain stability in mounting seismograph when monitoring inside a structure.
- 4.5 A power transfer cable capable of transferring power from auxiliary battery to seismograph device.
- 4.6 A leveling plate to attach to the seismograph when used indoors to provide better coupling and leveling to structure.
- 4.7 If recording seismograph is used outside for monitoring, ground spikes may be used as per manufactures recommendations.

## 5.0 MONITORING PROCEDURES

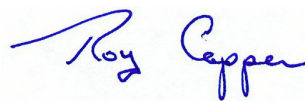
- 5.1 Adjust seismograph to manufacturer's recommendations for monitoring ground vibrations, with emphasis on setting Geo trigger minimum level at 0.5 inches per second, and Geo trigger maximum range at 10.00 inches per second. Additionally, when monitoring device is active it must be placed as level as possible.
- 5.2 When locating seismographic device inside or outside a structure, the most preferable method for measuring vibration is to direct couple the geophone transducer device to a structure. This may not be possible due to physical or property owner considerations.
- 5.3 For monitoring inside a structure or residence, place seismograph recording sensors in a non-obtrusive location away from pets or other possible interference. Place preferably on a hard surface such as a hardwood floor, using small sandbags to stabilize device if a direct coupling with structure is not possible.
- 5.4 If device is used for outside monitoring, use ground spikes attached to geophone sensors and firmly place in level soil, making a tight firm fit between the sensor and ground then place a 30lb sand bag on sensor to secure it, or bury geophone sensor completely, taking notice to place seismograph in area not to be disturbed by

interference such as lawn mowing or children's play areas. Additionally locate in a manner not to attract attention and to discourage theft.

- 5.5 Once a location has been chosen to place geophone transducer sensors, make sure sensor transducer is oriented as per manufacturer's specifications to possible source of vibrations.
- 5.6 Once geophone transducers are properly seated and power supply is sufficient, activate recording device as per manufactures specifications and begin recording data for a minimum of 24 hours, unless otherwise directed.
- 6.0 REPORT
- 6.1 Vibration strength determination shall be defined by the maximum rate of velocity of particle movement, and referred to as Peak Particle Velocity (PPV) measured in inches per second (in/sec).
- 6.2 After all data is collected and evaluated, determination of the severity of vibration will be documented as listed in the table below.

<u>Response</u>	Ground Vibration, PPV <u>(in/sec)</u>
Barely to distinctly perceptible	.02 - .10
Distinctly perceptible to strongly perceptible	.10 - .50
Strongly perceptible to mildly unpleasant	.50 - 1.0
Mildly unpleasant to distinctly unpleasant	1.0 - 2.0
Distinctly unpleasant to intolerable	2.0 - 10.0

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