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Effect of Plantation on Traffic Vibration

KEYWORDS: Vehicular Traffic, Filtration, Ground borne vibrationT

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ABSTRACT *Vibration is a through and forth motion of the particle. Vehicular movements on the road surface generate ground vibrations and generated vibrations propagate through soil. This paper discusses the effects of root system on traffic-induced ground vibrations. Field ground vibrations were measured at site adjacent to roadways. Measurements are taken on front and rear side of the trees and also taken from site where there is no interference of the roots of trees keeping same distance from the edge of the road for both data collection stapes. Vibration is measured with the use vibration analyzers and NVGate software is used for analysis. This analyzed data of without plantation and with plantation are compared. This discusses the effects of plant system on filtering the ground vibrations generated by vehicular movement on the roads. Numerical results of peak ground vibrations are presented and discussed with respect to the site and ground conditions.*

INTRODUCTION

Vibration is defined as an oscillation of particles of an equilibrium point. Vibration is one of the main factors for fatigue in buildings. There are many vibration sources around us. (like Earthquakes, Road vehicles, Railway, Wind, Blast, Pile driving etc.). Here discussions are based on only Traffic generated Vibrations. Vehicular traffic generates air borne and ground borne vibration. Air borne vibrations are law frequency vibration and excite upper part of the building while in case of ground borne vibration Caused by the dynamic impact forces of tires on the pavement surface. Due to this interactions, waves are generated which propagate through road pavement, road sub-base to soil and finally excite foundation of the building below ground this excited Foundation can induce vibration in other building components below or above ground. This could cause serious damage in industries producing micro and Nano scale equipments. Vibration could also produce error during experiment in high precision labs equipped with lasers, sensors or microscopes. Surgery could be hazardous in operation-theatres affected by vibrations. Long term contact to vibrations can cause damage in buildings, minor effect such as cracks, which in critical cases could results in collapse, especially in historical buildings, which could cause diseases such as mild –deafness, memory-loss, and aggressive-behaviour.

Normally roadway system usually consisting of pavement, natural drain or/and trees are believed having significant effects on attenuating traffic induced ground motions, especially the high frequency motion generated by wheel forces. So the waves generated by vehicular movements should pass through such topographical conditions. Here measurements are carried out to study the effect of plantation on traffic generated ground vibration. Vibrations generated due to vehicular movements are measured with help of oros-3 series analyzers. It contains transducers for measuring the data and computing system and NVGate software for real time or post analysis of data.

The filtering effects of the root system of the trees on ground motions are observed and discussed. The amount of filtering due to roots on ground motions will be calculated. This amount of filtering represents the effect of root systems on filtering the traffic-induced ground motions.

In those studies, ground is commonly assumed as a homogeneous or a layered elastic subjected to moving loads.

In this paper, field measurements of the ground vibrations generated with moving vehicle on road surface without plantation and with plantations are conducted. The measurement is performed on two sites with same pavement conditions and soil properties. Accelerometers are used to record ground accelerations in three directions the parallel to traffic, perpendicular to traffic and vertical directions at appropriate distances from the road. The peak values and attenuation of the recorded accelerations are generated from the moving forces on road surface with plantation and without plantations are compared.

METHODOLOGY OF DATA COLLECTION

There is a stander format for collection of data as per site conditions and nearby features of location.

1 Vibration measurements were carried out at selected sites where plantation easily available.

2 Vibration analyzer was used to carry out data at each location.

3 Measurements were made of vibration on the ground near the road surface. Area near the sensors would have needed to be vacated in order to control adverse effects from internal vibrations such as footfalls.

4 The measurement locations were chosen with consideration of both technical and practical issues. The vibration transducer needed to be placed in such way, that vibration path cut by a root of plants and without planted area.

5 Tri-axial uni-axial transducers were used to measure the vibrations. The transducer was fixed on metal plate having size of 10 cm × 30 cm × 0.5 cm with help of adhesive material.

6 The plate having the transducer was placed simply on the plane ground and plate was leveled using level tube.

CARE DURING TESTING

During testing with sensitive transducers we have to take certain care to handle the equipment.

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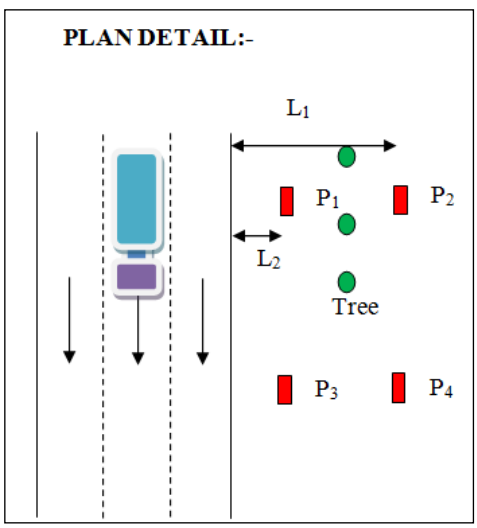
1 Area near the sensors would have needed to be vacated in order to control adverse effects from internal vibrations such as footfalls.

2 The transducers were protected from movement of any things near the transducers.

3 The analyzer and associated batteries were located in a weather-proof place.

SITE DESCRIPTION
Before selecting site for testing technical and practical issues to be taken care. So that can easy to collect the data and avoid the uncertainties on data.

SITE PLAN AND SENSOR POSITION
1) NARMADA CANAL TESTING
Name of Test site: NARMADA CANAL.
Name of the Plants: NEEM TREES

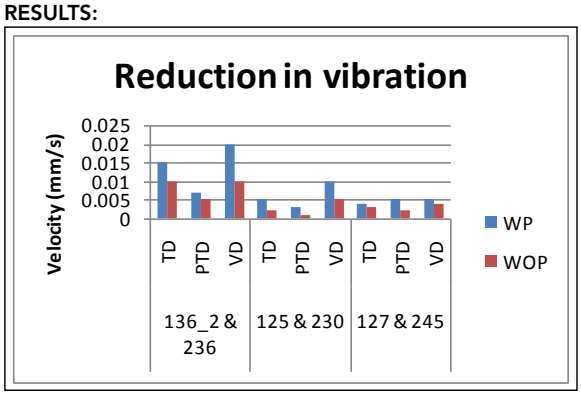


Type of data collection: Here the data are collected on Two Steps on first step data are collected on front and rear sides of the row of trees and reductions of vibrations are calculated and these reductions are compared with the data taken without plantations.

L1= 17 feet
L2= 7 feet

Avg. Dia of trees = 10 inches

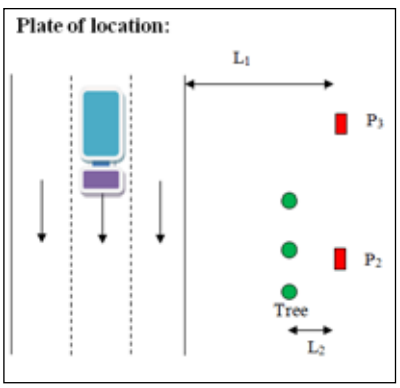
RESULTS:



The data are collected in three directions Traffic Direction (TD), Perpendicular to Traffic Direction (PTD) and Vertical Directions (VD). Here height of column shows the reductions on velocity of vibration. The values are compared considering with plantation (WP) and without plantations (WOP).

CONCLUSION:
- Reduction of vibration in traffic directions(TD) are 5 to 50%
- Reduction of vibration in perpendicular to traffic directions(PTD) are 10 to 50%
- Reduction of vibration in vertical directions(TD) are 0 to 50

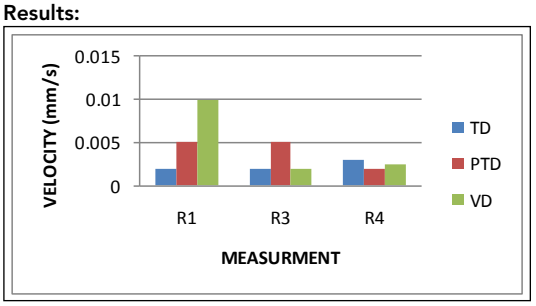
2) RADHASWAMI (NEAR TAPOVAN Cr.)
Name of Test site: Radhaswami.
Name of the Plants: NEEM TREES
Plate of location:



PLAN DETAIL:-
Type of data collection method: Simultaneous data collection.
L1= 17 feet
L2= 7 feet
D= 10 inches

Type of data collection: Here the data are collected simultaneously with and without plantations. The measurements are taken rear side of the row of trees and differences on vibrations are calculated.

Results:



The data are collected in three directions Traffic Direction (TD), Perpendicular to Traffic Direction (PTD) and Vertical Directions (VD). Here height of column shows the reductions on velocity of vibration. The values are compared considering with plantation (WP) and without plantations (WOP).

Conclusion:
- Avg. 10% to 50% Reduction is observed
- Reduction of vibration in traffic directions(TD) are up to 0.01 mm/s
- Reduction of vibration in perpendicular to traffic directions (PTD) is 0.005 mm/s.
- Reduction of vibration in vertical directions (VD) is 0.002 mm/s.

GENERAL CONCLUSION:
Although traffic-induced ground vibrations are usually not strong enough to cause any structural damage, it might cause some architectural damage to buildings, annoys people and impede normal operations of sensitive equipment.

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Much effort has been spent on modeling traffic-induced ground vibrations. Among various approaches, a few theoretical models had been developed.

Those theoretical models usually neglect the effects of the root system on filtering out the traffic forces, or model the roadway system in a very idealized and simplified way, thus they do not necessarily give reliable predictions of the traffic-induced ground vibrations.

In this study, field measurements were performed to investigate the effects of plantations on filtering the waves generated by vehicular movement on road surface. Measurements at two sites were performed. Measured ground vibration data are analysed in this study. It is found that the root of trees affect significantly to ground vibrations generated by forces on the road and the reductions on vibrations are observed up to 10 to 50%.

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