Abstract Volume

Fifth International Conference on

Recent Advances in Geotechnical Earthquake Engineering and Soil Dynamics

and Symposium in Honor of Professor I.M. Idriss

May 24-29, 2010 • San Diego, California

Edited by Shamsher Prakash

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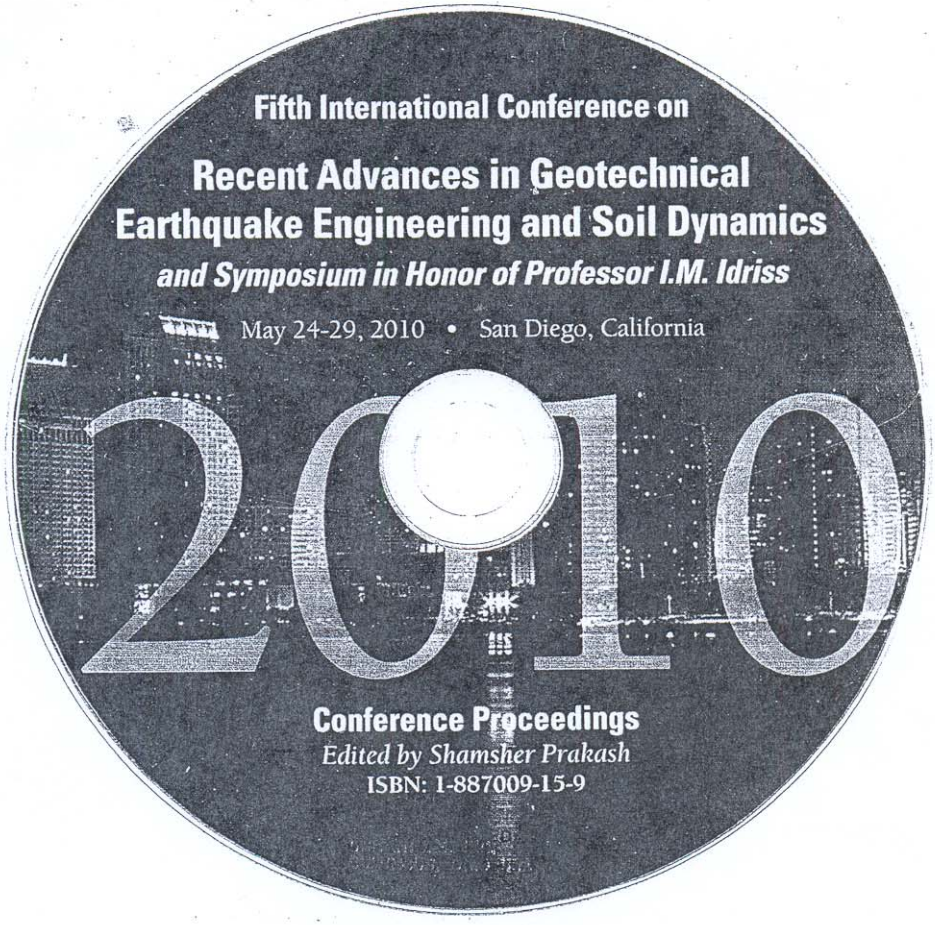
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INVESTIGATION OF VIBRATION CAUSED BY TRAFFIC AND RAILWAY LOAD

Paper No. 5.31a

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ABSTRACT

Two examples related to investigation of vibrations in civil engineering structures are presented in this paper. It is shown how dynamic analysis related to the vibrations caused by train and heavy traffic load can be performed and used in practical engineering problems.

In the first example it is shown how it is possible to decrease vibration in underground structures. These vibrations appear as the results of dynamic effect of the train loading over the rails. The most important factor for any dynamic analysis is to define dynamic load. Group of experts from University of Belgrade performed experimental testing. They used train "Beovoz", and the testing has been done at new railway station "Prokop" in Belgrade. The results of these experiments concerning dynamic loads are given in this paper. Presented diagram consists of 6615 data obtained during the 14.75 sec with time interval $\Delta t = 0.00233$ sec. Dynamic calculation was performed using the program SAP 2000, which is based on the finite element method. In this paper two kinds of dynamic analysis has been done. First analysis was performed without elastomer, and second one was with elastomer used as a carpet in railway ballast. As it is known, one of the most useful methods for reducing the negative effects of vibrations is installing the elastomer. Elastomer is composite material consists of rubber and synthetic materials, and it was placed between ballast and concrete plate of the metro superstructure. Firstly, dynamic analysis of free vibrations for both models was done. Forced vibrations by train cause significant vibrations of metro superstructure and soil. Displacement, velocity and acceleration of all nodes of finite elements are calculated and results are presented in this paper. This analysis shows that usage of elastomer makes transmission of vibrations to soil less than before, because the rigidity of structure was changed. In this case it was obtained that maximum vertical displacement is 2.15 time less than without elastomer.

Second example presents the foundation for special equipment - eletronic balances, which are very sensetive, even to small displacement. These balances had to be placed for Laboratory for Mass in "Institute for Measurements and Precious Metals" in Belgrade. Presented dynamic analysis is related to the vibrations caused by heavy traffic load in order to obtain optimum foundation solution. Based on the recorded vibrations provided in the "Results of Seismometric Analysis of Micro-tremors Report", prepared by the Faculty of Mining and Geology in Belgrade, value of maximum amplitude of vibrations that can be expected as well the dominant frequency of oscillations have been recorded. In order to assess whether the obtained measurements are within limits and if the foundations construction has been designed well, dynamic calculations of foundations have been done for such defined dynamic load. Presented dynamic analysis and results of the investigation show that applied type of foundations construction has been designed well, as maximum values of movement foundation acceleration obtained are lower than allowed.

Key words: **dynamic analysis, vibrations, heavy traffic and railway road, measurements**