VELOCITY AND MASS DISTRIBUTION OF PASSING VEHICLES ON A HIGHWAY BRIDGE FROM STRAIN RECORDS

Niko Manopulo[1]

INTRODUCTION

Methods for revealing vehicle speeds on highways, used today are quite expensive. Therefore they cannot be used everywhere. The project aims to propose a solution based on converting strain information obtained by a simple and inexpensive strain gage into meaning ful velocity distribution information. As a primary step qualitative information is tried to be obtained due to a number of inevitable assumptions. However more work on the field would result in quantitative data also.

METHODOLOGY

The main point of the methodology is the construction of an analogy between linear superposition of water waves and linear superposition of strain values caused by the passing vehicles. In fact fitting a sinusoidal curve to the Influence Line for moment at midspan of the bridge the strain equation can be transformed into a Fourier Series and consequently Fourier analysis for Amplitude Spectrum is to be run. For this purpose a data set has been generated according to the mechanical equations of the problem, considering three vehicles on the bridge with different weights and velocities.

RESULTS

The Fourier Analysis run on the synthetically generated data set gave interesting results but also some points which need deeper interpretation. As it can be seen from figure 1.a There is an big initial peak which has no numerical meaning as the velocity is too low and DFT is too high. However concentrating on the next three peaks they correspond to 5m/s 7.5m/s and 12m/s which are approx. the velocities of the three vehicles proposed in the data.

CONCLUSION

Obtaining meaningful information about the velocity distribution on a bridge using a strain gage is quite chalanging. However the theoretical derivation and the numerical calculations developed in this project show that Spectral Analysis of "Strain Waves" could ultimately reach some information about the velocities of the vehicles.
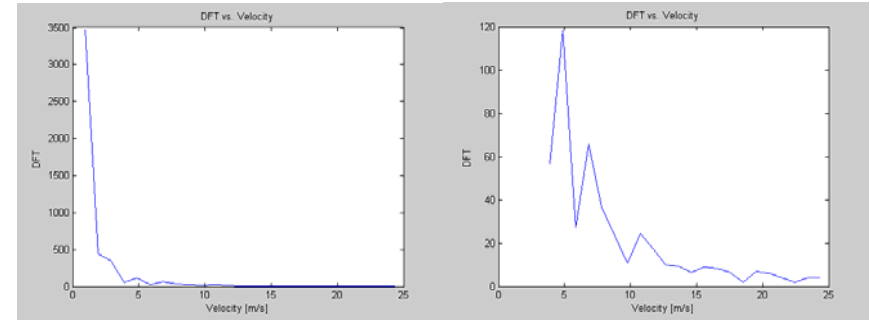

Figure 1.a   Figure 1.b

REFERENCES

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[1] B.S., Boğaziçi Univ, Civ. Engg., Bebek 80815 Istanbul, Turkey. manopulo@isbank.net.tr