INTERACTION BETWEEN ADHESIVE WEAR AND NOISE ON TIRE-CONCRETE PAVEMENT CONTACT AT DIFFERENT SPEEDS.

F. Gálvez-Avalos, K. Espinoza*, F.J. Aranda-García, C. Sedano-de la Rosa
*karlos.espinoza@academicos.udg.mx
Departamento de Ingenierías, Centro Universitario de la Costa Sur, Universidad de Guadalajara
Av. Independencia Nacional 151, Autlán de Navarro, Jalisco, CP 48900, Mexico

ABSTRACT

Tire wear and traffic noise are two phenomena that can be related. To relate noise and adhesive tire wear, a specific equation was applied to normalize the noise level at a given speed. Tools such as the ABAQUS software were used to simulate tire wear; while, a data logging sound level meter was employed to measure noise levels.

Additionally, a tire wear simulator and a scanning electron microscope were used to correlate wear patterns. The aim of the present work is to correlate tire wear with noise and speed, predicting and quantifying this phenomenon through experimental and simulated characterizations.

Experiments in tribology; Friction; Surface topography; noise- Speed;

INTRODUCTION

Traffic noise is the main source of environmental pollution, accounting for up to 70 % of noise. Furthermore, pavement noise constitutes around 80 % of traffic noise. Pollution is more severe during peak traffic hours than quieter times, due to increased speed and traffic volume [1]. Tire wear is an inevitable phenomenon, moreover accelerated tire wear affects the driving stability. In order to simulate tire wear, ABAQUS software was implemented for this work [2]. The aim of this analysis is to correlate the interaction between adhesive wear and noise in tire-concrete pavement contact at different speeds.

EXPERIMENTAL

A tire wear simulator instrumeted with a data logging sound level meter, model 407760, was implemented for the tests based on the ANSI and IEC 61672 Class 2 standards with an accuracy of 1.4 dB. The sound level meter was placed 12 cm away from the tire to capture sound more effectively. Wear test were conducted at three speeds as follows: 40 km/h, 60 km/h and 80 km/h.

To relate the interaction noise between the tire and the pavement at a specified speed, the following equation was used:

$$L_{norm} = L_{meas} + B \cdot \log\left(\frac{V_{ref}}{V}\right)$$

where L_{norm} is the normalized tire–pavement interaction noise level in dB, V_{ref} is the reference speed (km/h), L_{meas} is the measured level at actual speed V, and B is speed coefficient.

RESULTS

According to the results, it was observed that higher load resulted in higher noise levels. Similarly, higher speeds were associated with increased noise. Furthermore, it was observed that higher noise levels correspond to greater wear, indicating a positive correlation between noise and wear.

The average dB measured on the tests were 82 dB for 40 km/h, 86 dB of 40 km/h and 90 dB for 80 km/h (See fig.1).
At higher speeds, there is greater noise and frequency oscillation, which is related to greater wear on the tire.

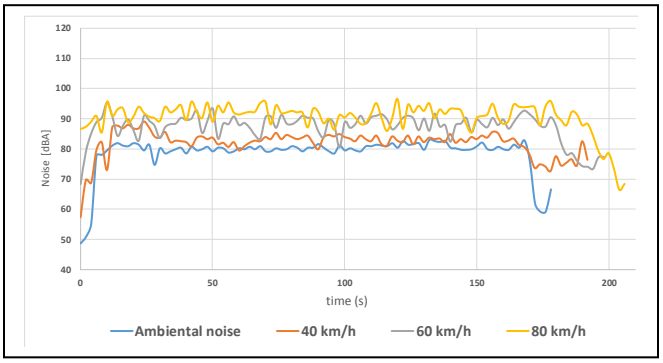

Fig.1 Noise Measurements Graph

REFERENCES

[1] Wang, Hui, Xun Zhang, and Shengchuan Jiang. "A laboratory and field universal estimation method for tire–pavement interaction noise (TPIN) based on 3D image technology." Sustainability 14.19 2022: 12066.

[2] Zhang, Shupei, et al. "Analysis of the Effect of Wear on Tire Cornering Characteristics Based on Grounding Characteristics." World Electric Vehicle Journal 14.7 (2023): 166.