FIELD INVESTIGATION ON TRAFFIC NOISE IN GREATER CAIRO •

1. Continuous Flow

BY

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ABSTRACT:

Noise is becoming a great problem in countries throughout the world. Traffic noise represents the greatest noise in towns. The main factors governing the resulting traffic noise level are the traffic density, nature of flow and the distance from the center of road. Field investigations on the two types of traffic noise, namely continuous & discontinuous flow were carried out in different location in greater Cairo.

This paper deals with the first type. The analysis of noise levels is given. A good correlation between the equivalent noise level and the traffic density was found.

INTRODUCTION:

The noise from road traffic is recognized as a major problem in urban communities throughout the world. The traffic noise problems in developing countries are expected to be different from those in advanced countries. Field investigations of road traffic noise, which were carried out at different locations in Greater Cairo, have two aims. First, is to evaluate the noise level regarding the recommended noise criteria. Second, to deduce a mathematical expression between the equivalent noise level and the traffic density which satisfies a good correlation. Such a mathematical expression can be used for prediction of the resulting traffic noise in the process of noise control in town planning.

Noise Criteria

The International Standard Organizations (I.S.O) recommendation R 1996 suggests that a basic outdoor noise criterion of 35-45 dB (A) can be applied to residential areas [1]. Some correction factors depending upon the type of residential area and the time of the day have been given in this recommendation.

FIELD INVESTIGATIONS

The A-weighted sound pressure level was measured by using the precision integrating sound level meter type 2218 (Bruel & Kjaer) which is equipped with a high sensitivity ½" diameter condenser microphone. The sound level meter was mounted on a

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portable floor stand at a height of 1.2m above the ground and at a distance of nearly 6m from the center of the road. The output of the sound level meter is fed to the noise level analyzer type 4426 which analyzes the noise level and computes the statistical level distribution. Here the following terms: L_1, L_{10}, L_{50}, L_{90}, L_{99}, and L_{eq} were given a special consideration (In general L_N: that level which is exceeded for N% of the measuring period, $1\% \leqslant N \leqslant 99\%$). The sampling period was taken as 5 minutes (300 samples and 0.1 Sec. period). The alphanumeric printer type 2312 was used to obtain a print out of all required results from the noise level analyzer.

As the traffic noise level depends mainly upon on the traffic density and type of vehicle, the numbers of private cars, heavy vehicles (lorries and buses) and motorbikes in both directions were counted individually every 5 minutes. The measurement periods were taken in such a manner as to cover the most noisy period.

RESULTS AND DISCUSSION

In the following discussion, the measured equivalent noise level and the statistical distribution of different noise levels at different locations combined with the traffic density of different types of vehicles were shown.

Figure 1 represents the traffic noise at Ramsis street in the period 10.00-14.00. The equivalent continuous noise level (Leq) lies in the range 81.6-84.6 dB(A). Which exceeds the corrected noise criteria (65 dB (A) during day-time) by an amount of 16.6-19.6 dB (A). Leq attains its peak value at the period 12.40-13.15.

Figure 2 shows the traffic noise at El-Haram street at the period 10.00-14.00. Leq lies in the range 78-82 dB(A) which exceeds the criteria by an amount of 13-17 dB(A). The max. value of Leq occurs at 12.45-13.15. A plot of the traffic noise at El-Haram street at the period 10.00-13.00 is given in Fig. 3. Leq lies in the range 79.0-81.0 dB(A) which is clearly unacceptable with 14-16 dB(A).

Figure 4 represents the traffic noise near the Italian hospital in Abbasia during the period 10.00-14.00. Leq lies in the range 74.0-81.6 dB(A) which exceeds the criteria by an amount of 29-36.6 dB(A).

The relation between the resulting equivalent noise level and the traffic density can be expressed as follows [2]:

$$L_{eq} = A + B \log (Q_1 + K_b Q_2 + K_m Q_3) \text{ dB(A)}$$

Where:

A, B: are constants

Q_1, Q_2, Q_3: are No of cars, buses and motorbikes respectively.
K_b, K_m: are No of Cars equivalent to one bus and one morotbike, respectively. They have the value 4 and 3 respectively [3].

All samples of the measured periods were taken, then the method of the least square method was applied to deduce the two constants. They were found to be equal to A = 65.9, B = 5.9.

Substituting these constants in the above equation and the different values of the traffic density, it was found that there is a good correlation between the calculated equivalent noise levels, and the measured values.

To check the correlation between the calculated and measured values, the correlation coefficient is calculated [4]. It was found to be 0.577, which means that there is 99% fittness between the traffic density and the equivalent noise level according to the given expression.

CONCLUSION

The traffic noise in Greater Cairo is very annoying. Some measures must be carried out to reduce the traffic noise. An empirical expression for the prediction of the equivalent noise level according to the traffic density of different types of vehicles is deduced. This expression can be applied in the process of noise control in town planning and also in the community noise problems in developed countries.

REFERENCES

1. International Standard Organization R, 1st, May 1971.
2. R.W.B. Stephens and H.G.Leventhall, Department of Physics, Chelsea College, London; chapman and Hall 1974; Acoustics and Vibration Progress Volume1.
3. W.Fasold and E.Sonntag - Bayphysikalische Entwurfslehre, Band 4: Bauakustik. VEB Verlag für Bauwesen, Berlin.
4. William Volk - McGraw - Hill Book Company, Inc, - Applied Statistics for Engineering.

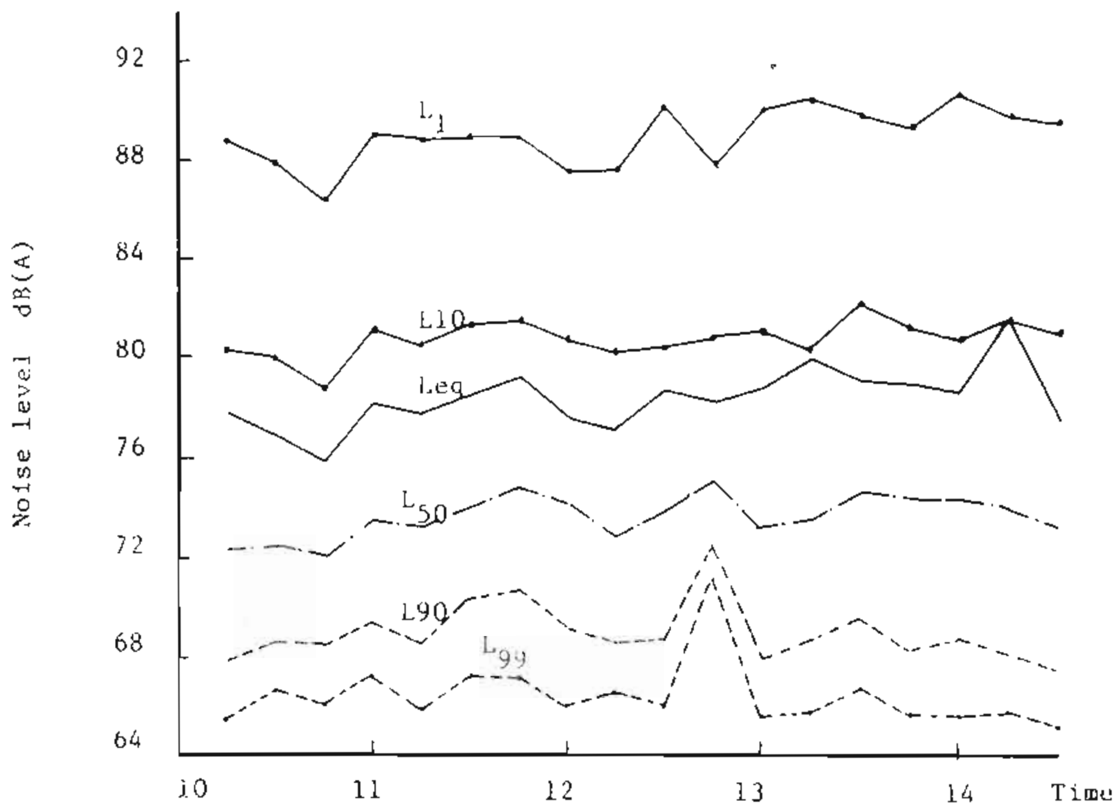

Fig. 1-a: Distribution analysis of noise levels.

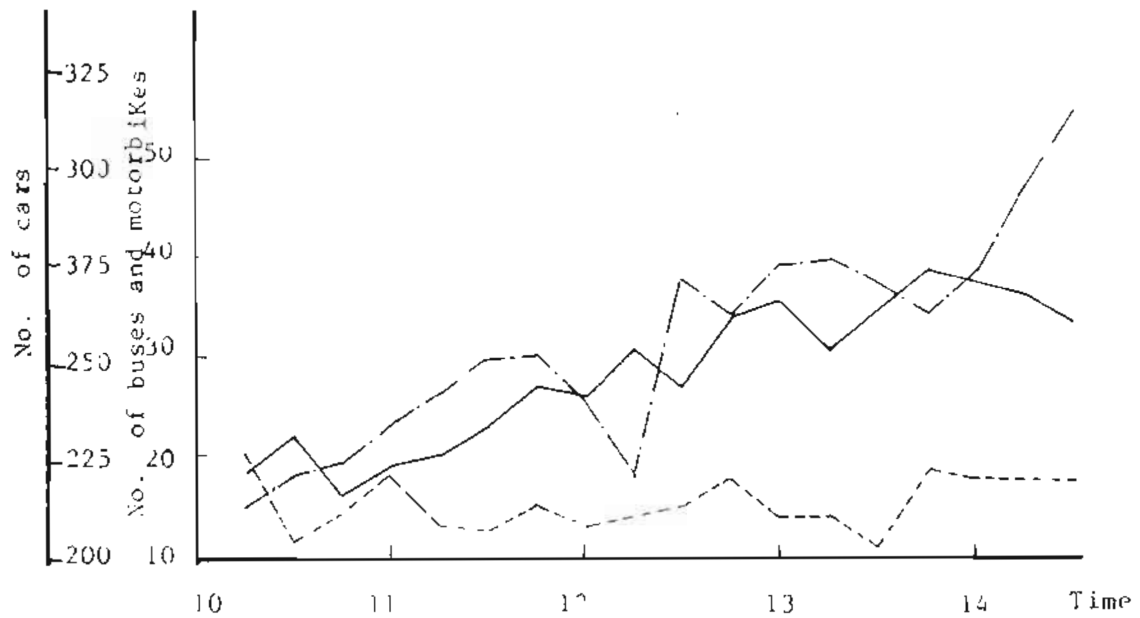

Fig. 1-b: Traffic density; ------ motorbikes; ———— buses; ——·—— cars.

Fig.(1): Traffic noise at Ramsis street in the period 10.0-14.15.

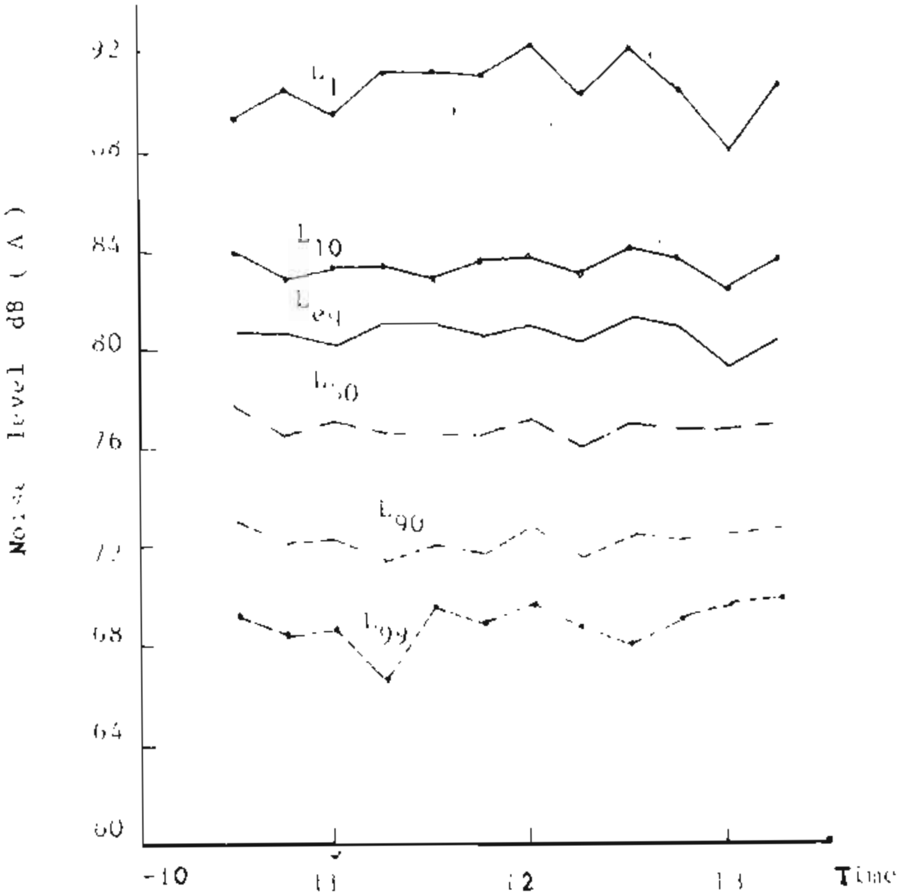

Fig. 2-a: Distribution analysis of noise levels.

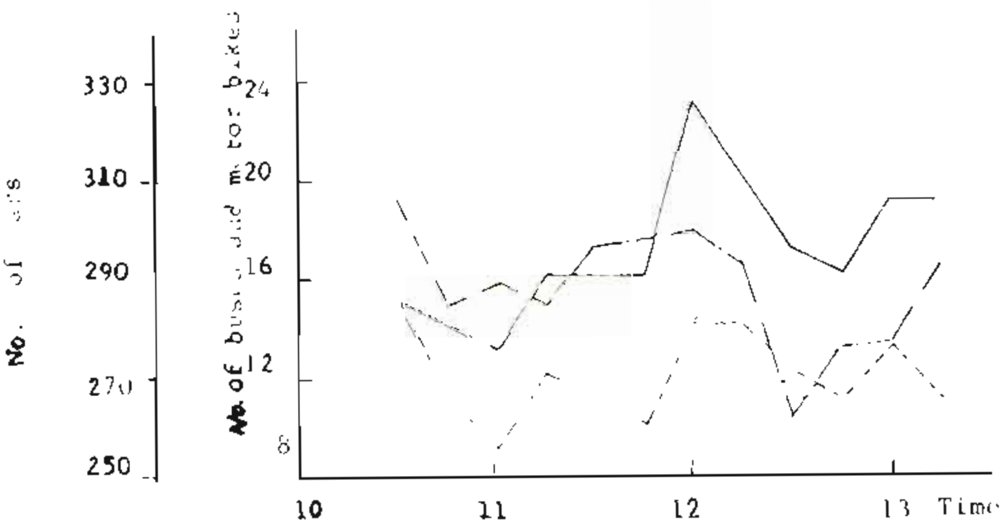

Fig.2-b: Traffic density;---- motorbikes; ——— buses, ——.—— cars.

Fig.(2): Traffic noise at El-Haram Street in the period 10.00-14.00.

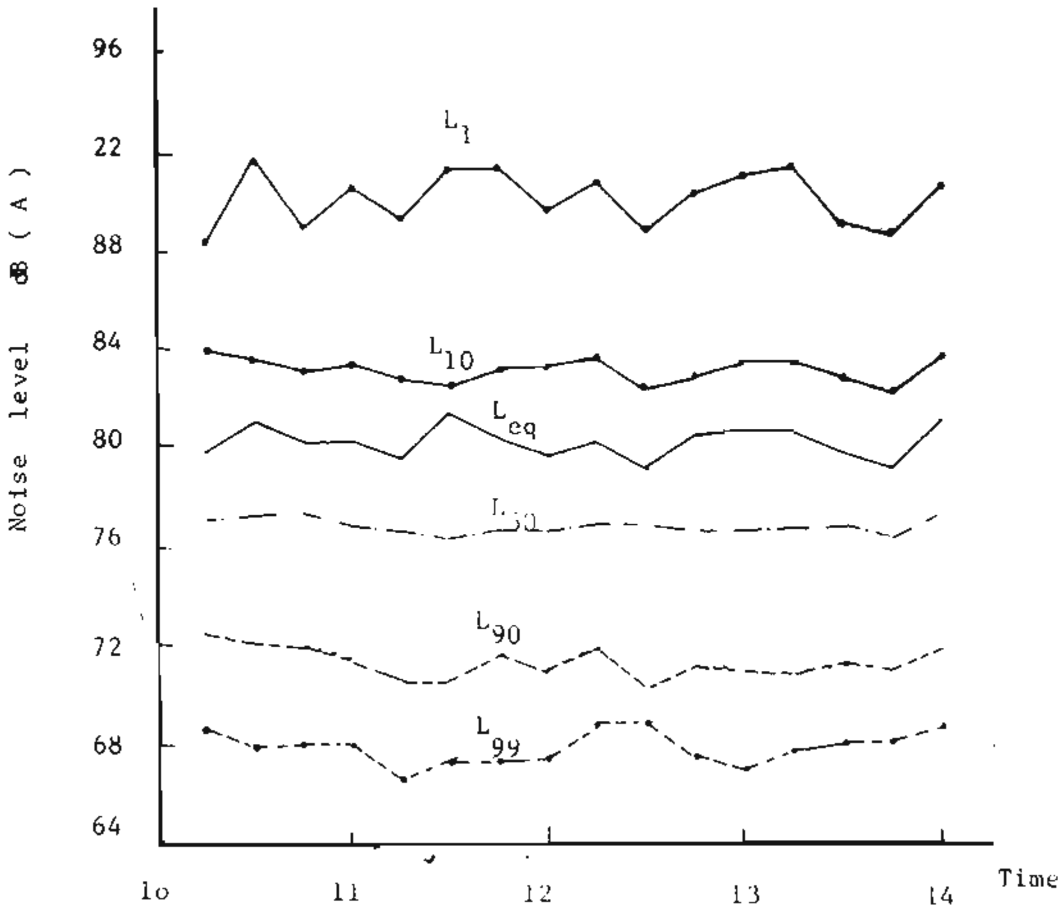

Fig.3-a: Distribution analysis of noise levels.

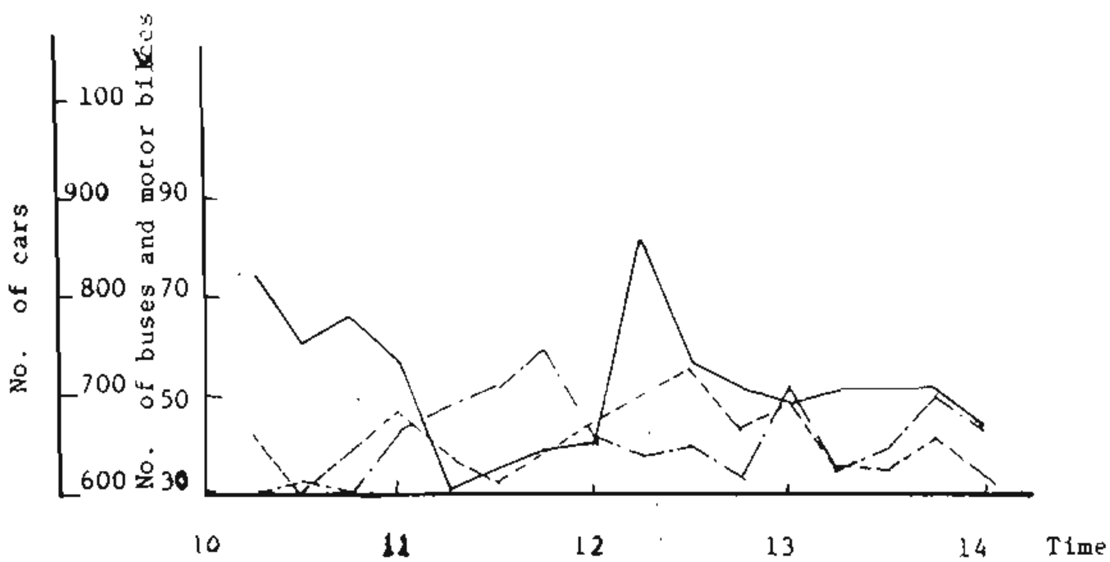

Fig.3-b: Traffic density; ----- motorbikes; ——— buses; ——·—— cars.

Fig.(3): Traffic noise at El-Haram street in the period 10.00-13.00.

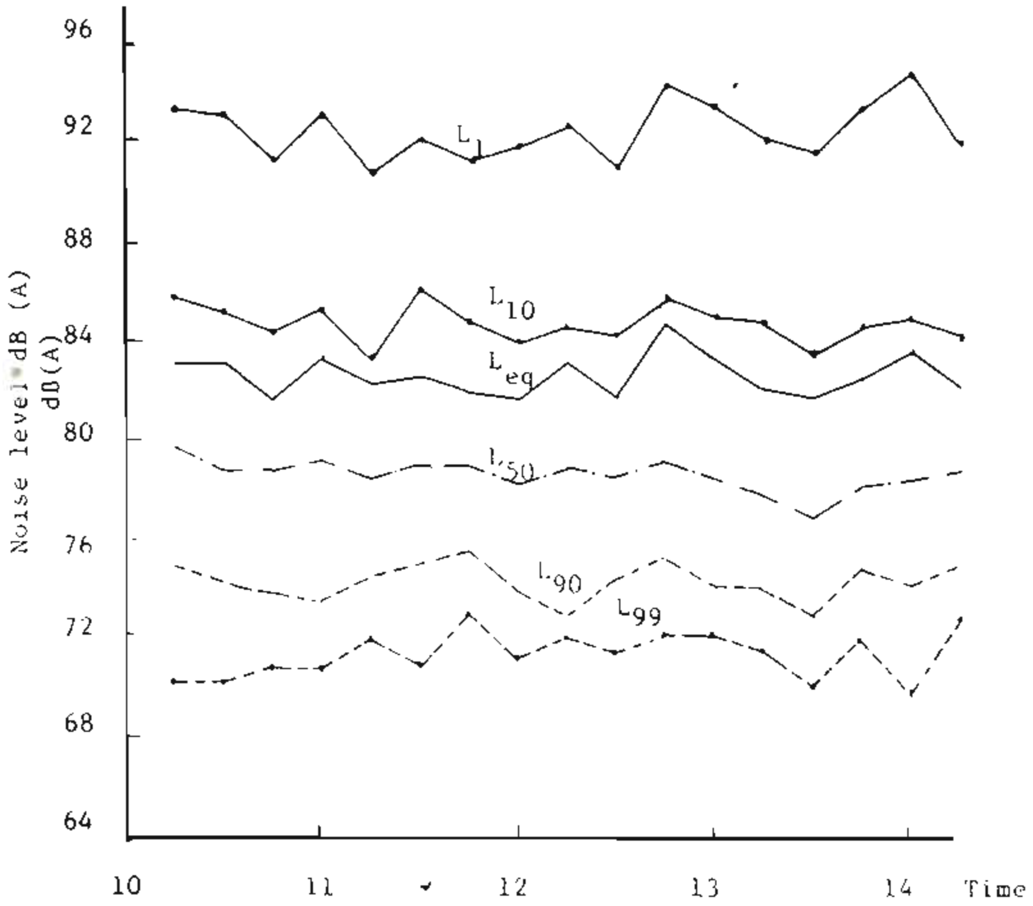

Fig.4-a: Distribution analysis of noise levels.

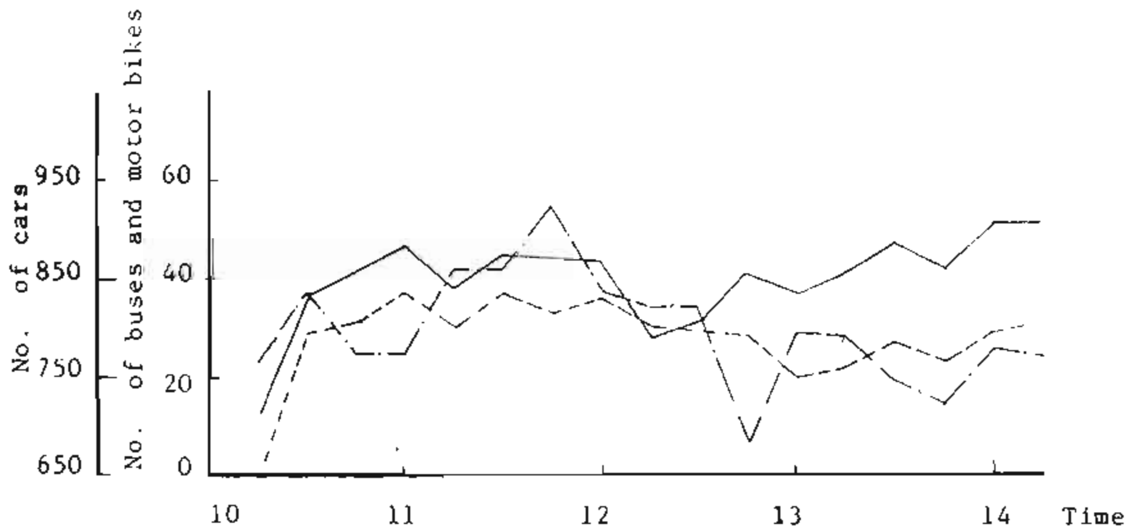

Fig.4-b: Traffic density; ----- motor bikes, ——— buses ——•—— cars.

Fig.(4): Traffic noise near Italian hospital in Cairo in the period. 10.00-14.30.