

EPMS and its Role in Preventing Global Warming

Takashi Yoshiura ; Universal Traffic Management Society of Japan *1
100 Maeda-cho Totsuka-ku, Yokohama Kanagawa 244-0804 JAPAN

Tel: +81-45-826-6789 Fax: +81-45-826-4591

Yasunori Ishii ;Shizuoka Prefectural Police Headquarters
2-4-13, Shintori Shizuoka-shi, Shizuoka 420-0065 JAPAN

Tel: +81-54-271-0110

Kohei Takeuchi ; Universal Traffic Management Society of Japan
Airman's Building 7th Floor No6, 2 Ichigaya-Tamachi Shinjuku-ku, Tokyo 162-0843
JAPAN

Tel: +81-3-3235-6520 Fax: +81-3-3235-6522

*1: KOITO INDUSTRIES,LTD.

PREFACE

The Environment Protection Management System, or EPMS, is one integral component in a seven-part, advanced traffic management scheme based on the Universal Traffic Management System (UTMS) proposed by the Japanese National Police Agency. The purpose of the EPMS is to reduce noise and air pollution along roadways, thereby improving the living environment for local residents. Toward this end, it will be necessary to establish effective quantitative measures to combat the pollution generated by road traffic (exhaust gas, noise, and vibration), to use this data to predict future pollution, and to use traffic control and other techniques to minimize pollution.

We have been actively addressing these issues since 1994, studying ways to reduce automobile exhaust gas through traffic controls. In fiscal 1996, we conducted field tests on nitrogen oxide compounds (NO_x) based on a new automobile exhaust gas collection method developed by this team, and obtained useful empirical data that supports many theoretical insights and ideas.

In fiscal 1997 we conducted experiments designed to reduce CO and SPM, both of which are equally toxic to human beings. We also conducted experiments to reduce CO₂ emissions, that are thought to cause global warming. These experiments offered further insights and empirical data.

This report discusses the findings of these experiments and future tasks.

DESCRIPTION AND RESULTS OF STUDIES **RESULTS OF STUDIES CONDUCTED IN FISCAL 1996**

Concepts of Traffic Pollution Control

(1) Control of air pollutants is affected by many related factors, including wind speed, wind direction, temperature, sunlight, and other weather conditions.

(2) Little can be understood about pollution control using only single traffic

parameters and general pollution data obtained from pollution measurement stations.

(3) Comprehensive control must be provided, taking into account both local pollution levels and the pollution level (background concentration) for the region as a whole.

(4) The concentration of air pollutants must be measured as close as possible to the side of the road in order to clearly identify the correlation with various traffic measures.

Results of experiments

During fiscal 1996, we conducted experiments on reducing nitrogen oxide compounds (NO_x), the air pollutants that have the most detrimental effect on human health. The findings are summarized below:

(1) We found a clear time series correlation between traffic volumes and the concentration of nitrogen oxide compounds (NO_x) measured at the roadside.

(2) We compared the relationship between vehicle speed and concentration of nitrogen oxide compounds (NO_x) with traffic volumes held constant and found a range of vehicle speeds in which the concentration of nitrogen oxide compounds (NO_x) was reduced. These observations match the theoretical values for vehicle speed and concentration of nitrogen oxide compounds (NO_x) per unit volume and time, thus verifying the theoretical values in the field.

(3) The concentration of nitrogen oxide compounds (Nox) measured at a point 30 meters perpendicular from the road side was generally about half that measured directly at the roadside. This observation is also consistent with theoretical values, thus verifying the concept of gas impact zones.

(4) We found that exhaust gas disperses and correlations between traffic volumes and the concentration of nitrogen oxide compounds (Nox) break down when average local wind speed exceeds 3-4 meters/second.

STUDIES CONDUCTED DURING FISCAL 1997

During fiscal 1997, we utilized the experimental data from the previous year to develop a theory of traffic pollution control and thus a workable system. We also continued conducting empirical studies of a variety of traffic pollution gases other than nitrogen oxide compounds (NO_x), namely CO, SPM, and CO₂. CO is second only to nitrogen oxide compounds (NO_x) in toxicity, while SPM is known to induce serious respiratory ailments. SPM is found mainly in the exhaust from diesel-powered vehicles and so is likely to be closely correlated with such traffic. We also studied methods for controlling CO₂-related traffic pollution since it is considered a serious threat to the ecology because it accelerates global warming. Indeed, governments around the world have been

discussing or implementing policies to control CO₂ emissions.

The 1997 experiments were conducted at the same locations in Shizuoka City as before and at the same times of the year in order to allow valid comparisons with the previous year's data. However, the 1997 experiments built on the findings from the previous year by adding temperature, humidity, and sunlight measurements, thereby increasing the number of variables.

The experimental methods were the same as the previous year. We measured the concentration at the roadside of exhaust gas for equivalent traffic volumes by giving different control data. "Different control data" refer to actual "cycle split offset" values which allow groups of cars to travel over a given section at a constant speed of between 30 and 50 kilometers per hour, depending on the total volume of traffic. Our goal was to seek correlations between speed and emission volume for each type of gas, thereby controlling traffic signals to reduce the total volume of automobile exhaust gas for different types of pollutants and in the long run, an EPMS can be developed to provide local control of exhaust gas pollution. Vehicle speed was set at 30-50 kilometers per hour because this produces the lowest volume of CO and SPM emissions per unit volume, while for CO₂, we wished to verify the range of speed to optimize fuel economy and collect samples to demonstrate exhaust reduction effects in the observed area.

RESULTS OF FISCAL 1997 EXPERIMENTS

This year, we measured CO₂, which is a gas with a different emission mechanism. For this reason, priority was placed on analyzing and studying the correlations between CO₂ and nitrogen oxide compounds (NO_x). Our findings were as follows:

- (1) There is a specific speed range that will reduce the concentration of CO₂ emissions.
- (2) There are differences in the speed ranges that will reduce the emission of nitrogen oxide compounds (NO_x) and CO₂. For CO₂, the range is about 10 kilometers per hour faster.
- (3) Therefore, for gases with different emission mechanisms, multiple control methods will have to be adopted.
- (4) Our analysis indicates that if multiple control methods and countermeasures are incorporated, the EPMS will be able to control emissions of CO₂, the emission mechanism of which differs from that of other gases.

TASKS FOR FISCAL 1998

During fiscal 1997 we demonstrated experimentally that the proposed system could be used to reduce emissions of gases with different emission mechanisms. In the future, we will need to study methane, another substance that increases global warming, and to expand our research to include vibration, noise, and other forms of pollution besides air pollution.

