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EMISSION FACTORS OF PASSENGER CARS IN ISRAEL

The motorization rate growth in Israel is one of the highest in the world. The number of vehicles in the country has risen about 20 times from 1960 and lead to serious problems of air pollution in the country, especially in heavly congested urban areas. The estimate of pollution inventories and establishment of appropriate standards are strongly related to accurate evaluation of vehicle emission factors. The results of such evaluations can serve, in addition, to air quality predictions, also for the development of new urban transportation systems, ventilation systems for closed parking areas, tunnels etc.

Main goal of the research work described in this paper was to estimate emission factors of gasoline passenger cars in Israel. The presentation here includes results and analysis of the experiments performed in this work: measurements of pollutants emission at idle, at constant speeds typical of suburban and interurban driving and tests at city-center driving. The measurements were carried out by using conventional methods of gas analysis and by remote sensing (see Figure 1(.

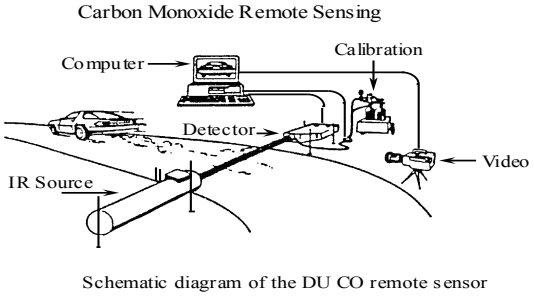

Figure 1. Schematic diagram of the remote sensing (RS) system

Main results that have been obtained in the work are briefly summarized below.

Factors of CO, HC, NO_X and CO_2 emissions from passenger cars were evaluated for three typical driving modes: interurban, residential and city center driving. Combined emission factors, representing in general vehicles' contribution to air pollution were also estimated.

Percentage of vehicles, that meet requirements of CO idling test standard, falls from 75% for newer vehicles (under 3 years old(to about 60% for older cars with ages above 10 years. Total results of the idling test show that about one third of the vehicles' fleet do not meet standard requirements.

About 10% of the vehicles which were tested contribute approximately 40% of the total CO emission and 50% of the total hydrocarbons – see Figure 2. This result correlates well with the published data, pointing out that 10% of the vehicles called big polluters are responsible for about a half of a total vehicles' emissions.

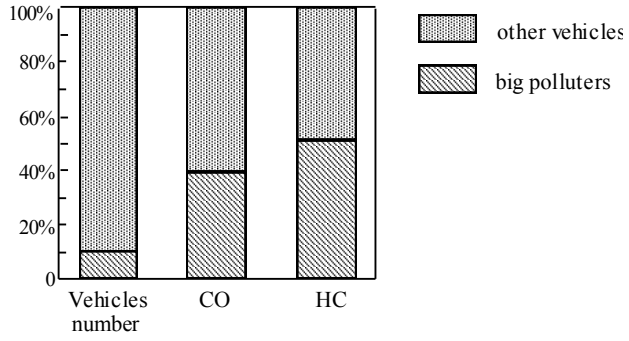

Figure 2. Contribution of big polluters to the total car emissions

The average speed of the current Israeli city center driving is about 15.4 km/h and it is 30% lower compared to that in the year 1980. During a work day average speed values change from a minimum of about 10 km/h to a maximum of about 20 km/h (see Figure 3).

Based on the results of the experiments which were performed, it may be estimated that the fuel economy penalties caused by the 30% reduction of the average speed amount to

approximately 15%.

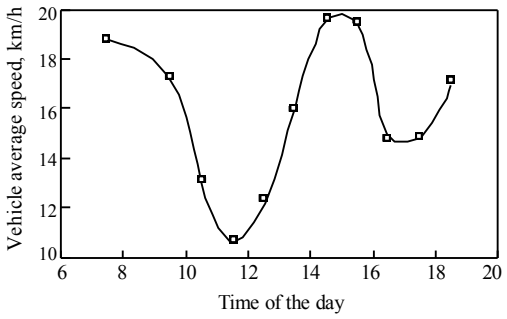

Figure 3. Car average speed distribution within a day

Use of air conditioning (AC) during city center driving leads to 13 - 28% increase in vehicle fuel consumption and generally the penalty is higher for lower speeds. CO_2 emission changes are generally similar to those of fuel consumption. AC switching-on leads to rise of CO_2 mass emissions by 15 - 34%. Operation of the AC system puts an additional load on the vehicle's engine and therefore leads to a corresponding rise in NO_X emissions. An increase by a factor of up to two in NO_X mass emissions has been found with AC system operation.

No significant differences were observed between catalyst-equipped and non-catalyst vehicle responses to average speed change and AC operation. CO, HC and NO_X emissions of catalyst-equipped vehicles were much lower than those of a carburettor non-catalyst car. The observed reductions of pollutants mass emissions were about 80% for CO and NO_X, and 85% for HC.

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