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Emission Characteristics for passenger cars

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Abstract--- In several extra-urban cities, motor vehicle emissions are a significant source of air pollution. The newly rapid procurement of private cars has enhanced the quality enhancement of the extra-urban air in many major cities. True life cycle measurements of remote emission sensors to test pollutant characteristics. The present study will provide policymakers with recommendations for further enhancing emission estimates for motor vehicles. Initially, the study aims to explain and process data collection and analysis of the emission characteristics used by private cars in the extra-urban climate, based on daily driving cycles. A dynamometer was included in the measures for the laboratory chassis. Nitrogen oxides (NOx), CO2 (CO), CO2 and hydrocarbon are known to be contaminants for pollution (HC). The measuring effects are observed

Keyword: Oxygen oxides (NOx); carbon monoxides (Co); CO2; hydrocarbons (HC), trail correction, external traffic.

1. INTRODUCTION

Light-duty gasoline vehicle (LDGV) emissions in-use were examined by remote sensing devices at five Beijing sites. Mass emission factors based on distance were extracted using real-world fuel consumption. The findings indicate that the latest aggressive control policies reduce emissions of on-road vehicles substantially. The cumulative emissions of older vehicles are significantly adding to the fleet. Earlier retrofitting projects for cars with three-way catalysts resulted in a minor reduction in emissions. The effect on average mass emission factors of model year and driving conditions show that vehicle emission monitoring's durability in Beijing may be insufficient [1].

The primary cause of air pollution in modern towns has been investigated for vehicle emissions. The rising number of passenger vehicles has led to composite traffic problems with severe consequences for pollution and fuel consumption, in particular during last decade. The goal of the study was to investigate the effects of driving patterns on fuel consumption and exhaust emission of automobiles in the Athens Basin at NTUA's Fuel Technology and Lubricants lab. The standard driving profile involves a complicated collection of accelerations and periodic stops and is simulated by driving cycles on a dynamometer of the laboratory frame. Application for EU laboratory test approvals was the latest European Driving Cycle (NEDC) based on European capital traffic info, Paris and Rome. In the creation of NEDC, traffic data from Athens was not included. The driving loop FTP 75 and the modal cycling Japan 10-15 have been used.

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Current uses in the United States and Japan include the FTP 75 driving cycle and the Japan 10-15 modality cycle. The Athens Driving Cycle (ADC) needs to be established in conjunction with the different conditions of traffic in Athens, the increased transport network and problems of air pollution than the other European cities. Onboard electronic equipment (GPS, OBD II reader, speed indicator etc) have been used and traffic data for "real world" have been collected that cover nearly all the route networks of Athens over a span of two years. Dedicated software was developed to analyze the parameters reported and therefore the first ADC was modeled with the following features: ADC was 1160 seconds, the total length was 6512 meters, the mean speed was 20.21 kilometers h-1 and the maximum speed was 70.86 kilometers h-1. To be compared, a lab dynamometer was tested on three passenger cars of various grades, implementing three distinctive driving systems: the Urban Driving Cycle (ECE-15), the NEDC and the newly built Athens Driving Cycle (ADC). Results have shown that ADC's NOX emissions are up to 2.5 times higher than ECE and EDC. During the ADC, higher CO emissions for the 1.6L and 2.0L cars was reported and for the 2.4L vehicle ECE-15 increased CO emissions. There was no major difference in total HC emissions. In all cases, fuel consumption in ADC mode was higher [2].

The on-road exhaust emissions model was developed with a view to estimating CO and HC emissions. The model was built on the basis of on-road emission data obtained from five road locations using a remote emissions sensor that calculates CO, HC, NOx and CO2 emission concentrations in the dispersing exhaust cloud. The model on-road estimate defined a relationship between the exhaust emission rates of the on-road vehicles and the immediate speed profile of the vehicle. As the instantaneous speed profile of a vehicle depends on various traffic demand and control scenarios, this emissions model can be used for estimating the emission consequences of alternative traffic management and control strategies.

Due to the aggregate existence of the road pollution model, a traffic simulation or an instantaneous traffic profile of a vehicle is easily integrated into a traffic assignment model. This model of emissions was therefore suitable for simulation of traffic, and study of optimization [3-5].

It has been emphasized continuous sampling that has represented real-time variation in gas level, with an uncertainty margin associated with the sensor response time and the rate of concentration fluctuations. Tumbling sampling allowed average gas concentration to be estimated over the entire sampling duration, thereby removing the uncertainties associated with the continuous process. The present activity has aimed to determine the suitability of the later system for this monitoring mission, as in-vehicle carbon monoxide (CO) exposure studies frequently show rapidly variations in the CO concentration and increasing use of the electrochemical sensing continuous method. In order to track the amount of CO in and outside of a vehicle moving in an urban region and analyze the quality of the concomitant collection samples, an electrochemical monitor of CO detection was used for these purposes. Trip-average CO levels have been calculated and compared using two test methods. The percentage difference between continuous and grab-based sample results ranged within a reasonable range (0.6–15.4%), while CO levels were higher than the instruments' detection limit (1 ppm). The regression of the continuous sample data against the data from a sample set revealed an average mistake of 6.9 percent which indicates that in-vehicle and external average CO concentration was adequate to track continued electrochemical processes in usually urban conditions [6–7].

The vehicle emissions research was outlined in selected areas in Nigeria. In each 8.0m away from the edge of the road in downwind direction, nine sampling points were considered. Parameters of priority were monitored: CO, NO2, SO2, PM10 and noise level. Other parameters that are tracked are air temperature, wind direction, wind speed and count of traffic. Compared to the AQI level (Air Quality index), all 5 air pollutants were monitored in the CO continuum – low to moderate to poor in some areas. SO2 – was very poor to poor, NO2 – very low to destitute, PM10 and noise level in all areas was destitute. The study found that the emissions associated with transport is also important and with possible serious health effects. The authors therefore suggest: adequate air quality control programmers; improvement of traffic flow and management involving effective urban networking; improvement of the fuel quality by reducing Sulphur. True legislative mechanism for controlling and tracking emissions of vehicles in the city; initiatives for reducing rush times for road and highway vehicles; and finally there was significant potential for pollution reductions and associated health dangers in the proper implementation of certain traffic control measures [8].

The primary cause of air pollution in contemporary cities is automotive emissions. The increased numbers of passenger cars have led to composite traffic difficulties and extreme pollution and fuel consumption, especially over the last decade. The influence of various operating parameters on the emission characteristics of the vehicle was nevertheless apparent. A newly registered gasoline/CGB bi-fuel in Egypt (Hyundai-star) was tested on-road and is evaluated from the European standard driving cycle (ECE-15). The EU driving cycle demonstrates vehicle operational characteristics for diverse speeds and accelerations, but has not shown a practical traffic speed background. Due to different driving conditions, the results of the driving cycle could not contribute to practical emissions and car fuel consumptions in pollution tests performed for the urban cycle. Two distinct fuel injection systems (i.e. sequential and closed loop venturi-continuous multi-point injection (MPI)) have been used. The vehicle was fitted with an infrarot gas analyser and a transducer to test the exhaust concentrations and the motor speed. Measuring at various speeds of the vehicle was carried out. The findings suggest a higher load and close idling levels for most emissions of carbon monoxide (CO), carbon dioxide (CO2), and unburned total hydrocarbon emissions (THC) [9-10].

It was beneficial to minimize pollutant emissions from ignition engines to reduce the broad effect of traffic release, e. g. trains, trucks, passenger vehicles and others on the green environment. Modern cars, however have catalytic converters. A bi-fuel vehicle that was converted to both fuel systems: natural gas compressed (CNG) and fuel base gasoline. An exhaust system is equipped with a locally developed three-way catalytic converter (TWC). The assessment of TWC's efficacy in reducing exhaust emissions from vehicles. Furthermore, the vehicles' emissions were measured and presented for each conversion efficiency. In the Egyptian market in Hyundai-star, operations were carried out using the idle state and on-road emission test procedures on a recently-registered gasoline/CNG bi-fuel vehicle, and evaluated against European urban driving standard cycle (ECE-15). There were two separate systems for the injection of fuel, namely a closed-loop multi-point (MPI) and venture-mixer system. The effects of emissions such as CO, CO2 and THC were calculated and compared between the two fuels listed above. The results show that the TWC and idle state service were

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very successful in reducing emissions of exhaust than they were in transient conditions. The research findings will also be utilized to establish TWC based on CNG emissions [11-12].

The aim of this study is to explain processing and data collection and to evaluate the emission characteristics for private vehicles in-use in situations outside the urban environment based on the European test driving cycle. The experiments are on a dynamometer and on road in the laboratory chassis. Moreover, it was designed and predicted to have a Road correction function (RCF).

2. ROAD CORRECTION FUNCTION

Road correction, RCF was proposed to estimate emission contaminants from vehicles, calculated in the road when measurement is known at the dynamometer of the laboratory chassis. Below is the basis of RCF:

A correction function is known as the output or level ratio of a system that is divided by the system input. It is a linear system if it is continuous independent of input changes or other conditions. If the vehicle's emission correction functions are linear, one measuring mean of emission which, given that changes in input are known, be predicted from measurements of another. The effects of input changes can be calculated by CF. Let measurement methods A and B be described as the corrections describing one vehicle's pollutant emission characteristics:

$$CF(t)_A = \frac{Out(t)_A}{In(t)_A} \quad (1)$$

$$CF(t)_B = \frac{Out(t)_B}{In(t)_B} \quad (2)$$

Where:
CF (t) = Correction function
OUT (t) = Output emission pollutants levels from measurement on mean (A or B)
IN (t) = Input emission pollutants levels from measurement on mean (A or B)
t = Time

If the vehicle emission pollutants characteristics are linear, then the correction functions are equal and a road transfer function, RCFBA, may be defined to describe the relationship between the measurements on means A and B,

$$RCF(t)_{AB} = \frac{In(t)_A}{In(t)_B} = \frac{Out(t)_A}{Out(t)_B} \quad (3)$$

The road correction feature can now be used to estimate the emission levels of another vehicle for average B emission measurement of a vehicle for a mean A emission levels. The projected level of the second mean, which is designated by ('), is:

$$Out(t)'_A = RCF_{BA}(t).Out(t)'_B \quad (4)$$

The RCF can be established such that emissions of any vehicle are estimated on the basis of a driving cycle. The determination of any RCF in operation of a control control pulse cycle will require initial measurement. A calculation on each average measurement will be necessary according to each driving period. Once the RCF is calculated, it will only be possible to estimate the emission level of new cars by calculating a single mean based on the period of control over another mean based on any driving cycle. However, vehicles can in practice not have linear or linear functions for road pollution correction over a limited range of inputs.

3. EXPERIMENTAL METHODOLOGY

3.1 Vehicles Used in the Present Work

Three trucks with slightly different, cumulative miles, weight, model and power reduction. The technical requirements for these vehicles selected in Table 1.

3.2 The European driving cycle

The European Test Cycle focused on Euro III. Two sections of the driving cycle, ECE15 and EUDC, are in this order compatible with the extra-urban, the urban and the road conditions. At 18.7 km/h average and 50 km/h at the top speed, the ECE15 test cycle simulates a 4.052 km. Extra-urban journey. It is 780 seconds in length. The same component is repeated four times during the ECE15 cycle in order to achieve a proper driving duration and temperature. In comparison, the EUDC cycle demonstrates the high-speed violent drive of 120 km/h. It takes around 400 seconds, at the average speed of 62.6 km/h it lasts 6.955 km. In this work, only one part of the cycle (ECE15) is considered for the period of the 250-second driving, Fig. 1.

3.3 Test Procedure.

The experimental work is performed with three passenger vehicles of various classifications, denoting vehicles 1 through 3, which are tested with an extra-urban driving cycle laboratory chassis dynamometers and on road tests (ECE-15). The car is provided with a gas analyzer infrared. During the test the exhaust gas, the speed and the time of the vehicle are registered.

The types of fuel injection systems used in the work in Table 1 are tabled. The vehicles selected are fitted with measuring instruments previously listed. In the passenger cabinet's back seats, the gas analyzer and its accessories are installed. The most critical connector for the analyzer is a rechargeable power supply laptop. Inserted inside a muffler gas sample probe of 3 m long. Your other terminal is connected via the rear door window to the gas analyzer. The photo. 2 gives a description of the research dynamometer laboratory chassis. The following precautions are taken into account before beginning measurements.

- the car motor is warm enough and works continuously in the normal idling configuration before beginning calculation.
- All the electrical equipment such as a radio and electric fan is off.
- The cabinet window is locked, except for a partially opened rear window (to permit the gas sampling connection). The drag effect is to remain within the standard value.

Three individuals would conduct the experimental work during the road test. The first is the driver, the second one, who starts gas analyzer record during his trip with a certain sequence. The third person was to assist the driver in the road. On a dynamometer, the test cycle was carried out. The research methods and conditions are standardized when a description of road testing is seen in the Figure. 3. Time records were made on the basis of the European cycle of mobility and laboratory chassis dynamometer for nitrogen oxide (NOx) hydrocarbon (CO), carbon dioxide (CO2), and total hydrocarbon (THC).

4. RESULTS AND DISCUSSION

4.1 Results (ECE-15) European driving cycle

The European cycle (ECE-15) extra-urban driving (trip) is illustrated in the figure. One where an extra-urban journey of 4,052 km simulates a mean speed of 18,7 km/h and a maximum velocity of 50 km/h. The cycle time is 250 seconds. The cycle involves idle, cruise, pace, and deceleration maneuvering.

4.2 Dynamometer test results on laboratory chassis

The NOx, CO, CO2 and HC emission pollutants were measured for the laboratory dynamometer of three vehicles. The outcomes of these steps are shown in Figs. 4 to 7, then. Data tests indicate emission pollutant levels measured for the vehicles and show a relative consistency with the driving cycle profile, in particular with NOx (Fig. 4), CO (Fig. 5) and HC (Fig. 6), although the CO2 profile (Fig. 7) is not consistent. Variation measured in the NOx, CO, CO2 and HC emission contaminants. With the exception of HC (Fig. 7), these findings show the profile of the driving cycle reasonably stable. The distributions of emission levels shown in the figures provide some useful insights into the emission characteristics of remote sensing. As NOx and CO2 emissions from vehicles both become major challenges for this vehicle, more focus should be given to enforcing co-benefit through synergetic control policies or measures of air pollutancies and CO emissions. The emission pollutants of vehicles number 2 are on the one hand, typically substantially greater than those of vehicles number 1 and no. 3; the emissions of the recorded pollutant emissions on the other hand, vary greatly. The difference in the recorded emission pollutants could be associated with the difference in vehicle conditions and the difference in vehicle combustion conditions. In all gas stations, most cars are fueled by standard gasoline because of its cheaper price and accessibility.

The result achieved for each vehicle of emission pollutants is then summed and shown in the figure. 8. Every vehicle's average concentrations of emission pollutants (NOx, CO, CO2 and HC) show almost similar effects among the fuel delivery system, model year, cumulative kilometers and reduced weight. These four parameters seem to play the leading role in rising vehicle emissions. Older cars are found to be higher emitters using standard fuel. The average pollutant emission levels of CO and HC are decreased generally and CO2 for newer vehicles is decreased. Older cars are also pollution violations which greatly lead to the failure of emissions tests.

4.3 Results of road tests

Measurements of emissions of road pollutants for the three vehicles shown in Figs. 9 to 12 provide road test information to determine the characteristics of emissions of contaminants. The four contaminants NOx, CO, CO2 and HC were tested separately. The results on the road shown in the figures for each of the three cars are compared. Comparisons show that the pollutants of nitrogen oxides (NOx), carbon monoxides (CO) (pm) and hydrocarbons (HC) emissions for a studied car are at the highest level, while carbon dioxide (co2) emissions pollutants (percent) are at the lowest in the vehicle no. 1, respectively. (ppm)

The results shown in Figs show that. 4 to 7 (the dynamometer for laboratory chassis) and the figs. In order to assess relationships between the above emission pollutants 9 - 12 (on the road) has been performed. In the test cases, statistically significant positive associations occur among all emission pollutants. Unburnt HC is the increase in exhaust and CO2 decrease for all types of vehicles as combustion efficiency decreases. In addition, the connection between parameters of vehicles and levels of emission pollutants is very significant. In terms of emission rates, engine size seemed less significant. Inspection and repair have a positive correlation with HC but are negatively connected with CO2.

The results obtained on each vehicle of emissions pollutants are then averaged and shown in Figure. 13. 12. For each car, the average concentration values (NOX, CO, CO2 and HC) of emissions indicate that the same effects between fuel supply systems, year model, cumulative miles and weight reduction have been observed. The most contributing to increased levels of automotive emissions are these four factors. The higher emitters are older vehicles using the standard fuel. Weak correlations between engine size, accumulated distance and emission concentrations were discovered. Results show that the concentrations of CO2 and HC are independent of vehicle requirements.

4.4 Results of Road Correction

The Road Correction Function (RCF) for extra-urban transport has been determined based on the equation (4) under the European driving cycle (ECE-15) and information is shown Figs. Each pollution pollutant contains between 14 and 17. The RCF was determined by taking into account the results of the laboratory chassis dynamometer (base). Nitrogen Oxides (NOx) (ppm), carbon monoxides (CO) (ppm), carbon dioxide (CO2) (percent) and hydrocarbons (HC) contaminants are the emission pollutants (ppm). The RCF values differ between vehicles. Each figure should theoretically overlay. Unknown statistics, such as driving conditions, weather variation, measuring or operator errors which be due to the variations between the results. Similar effects are illustrated by the average emission levels (NOx, CO, CO2, HC) for each vehicle. The findings show that concentrations of CO2 and HC are independent of the characteristics of the vehicle. Data shown in Fig, on the other hand. 18 offers a general indication of the average volumes and patterns in emissions measured on the dynamometer of laboratory chassis relative to model year of the vehicle. The average emission pollutant levels of NOx and CO are typically rising, and CO2 and HC for the newest vehicle are decreased.

4.5 Predicted Versus Measured Vehicle Emission Pollutants

The RCF values shown in Figs. 14 to 17 have been used in predicting vehicle no. 2 pollution pollutant emissions by using emission levels on the vehicle no. 1 laboratory chassis dynamometer. Figs. - Figs. 19 to 22 shows the time records expected and calculated for each pollution pollutant, in contrast to those measured for vehicle no. 2 for which the resulting vehicle emissions levels were well forecast. A strong relationship between what is forecast and what is measured. Unknown variables such as road conditions, weather variance, calculation and operator errors are suspected of the increased margin of error.

5. CONCLUSIONS

1. In this study three in-use vehicles with exhaust emission pollutants were examined using a remote sensing instrument on the road or laboratory chassis. Initiatives to improve the sustainability of the emission pollutant performance of in-use vehicles should be given more attention. In use vehicle regular checks are performed for the deterioration of the mileage. The most effective way of overcoming the environmental challenges generated by rising the purchasing of private vehicles is Egypt's new solution.

2. In view of the model year, four emission pollutants of vehicles have been measured for three car characteristics, including accumulation of kilometers, the motor motor displacement, engine power, the fuel delivery system. The driving cycle pattern is used for additional urban and laboratory dynamometers. The estimate (pm) of carbon emissions of monoxide (166,14 to 4471.17), carbon dioxide (CO2) emissions (15,22 to 30.52), and hydrocarbon (HC)(pm) measurements (ppm) was obtained on the basis of observations from (76,21 to 3403 (8)) nitrogen oxides produced (ppm) NOX (1.02 to 167.77).

3. The results showed that the results measured on the laboratory chassis' dynamometer varied from the results measuring on the actual road. An RCF was thus produced and awaited. That's why it can't be finished. This contributes to our own special time for developments in urban and external movement. In addition, the relationship between the prediction and the measured route is very good. The larger margin of error was suspected by unknown variables such as travel patterns, environmental fluencers, estimates and operator errors.

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Table 1 Test vehicles technical specifications selected

Model	Nissan 	Speranza 	Chevrolet Optra 
Fuel	Gasoline	Gasoline	Gasoline
accumulated mileage	153567 km	160486 km	120459 km
Unladen weight	1050 Kg	1040 Kg	1220 Kg
Cylinders	L4	L4	L4
Fuel system	Sequential multipoint fuel injection	Electronic Multipoint Injection	Electronic Multipoint Injection
Displaceme nt	1.5 L	1.3 L	1.5 L
Emission limits	European driving cycle	European driving cycle	European driving cycle

Fig. 3 Overview of the vehicle on road

Fig. 4 Overview of the vehicle with the measuring

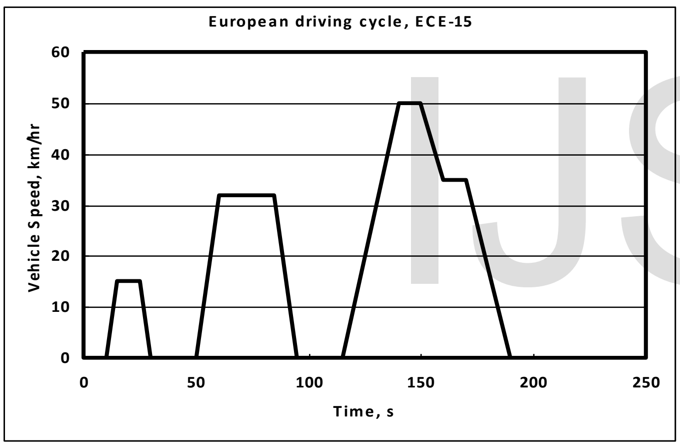

Fig. 1 European driving cycle, ECE-15

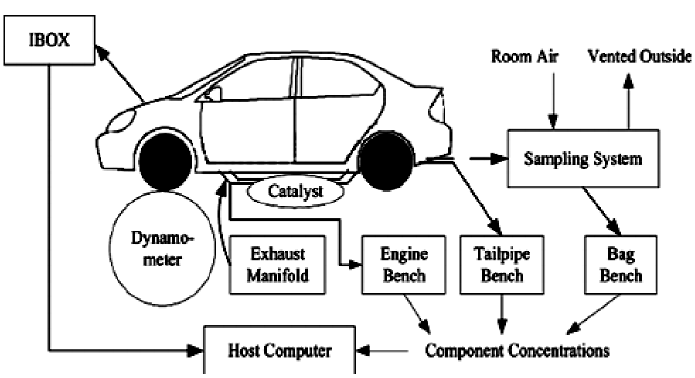

Fig. (2) Experimental setup for emission testing and engine calibration (Gullitti, 1999).

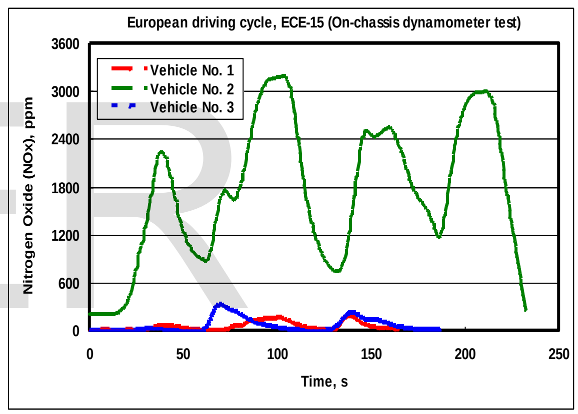

Fig. 5 Time history of emission pollutant for nitrogen oxide (NO_x) -chassis dynamomete

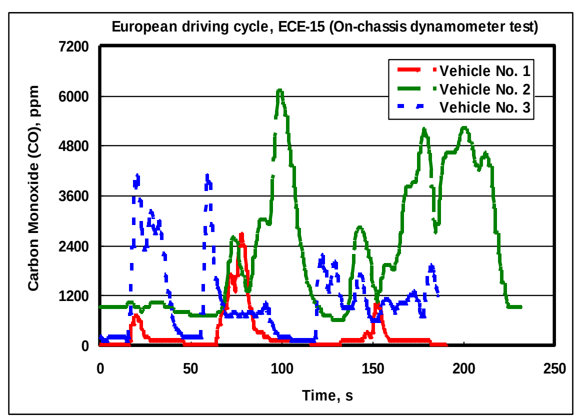

Fig. 6 Time history of emission pollutant for carbon monoxide (CO) –chassis dynamometer

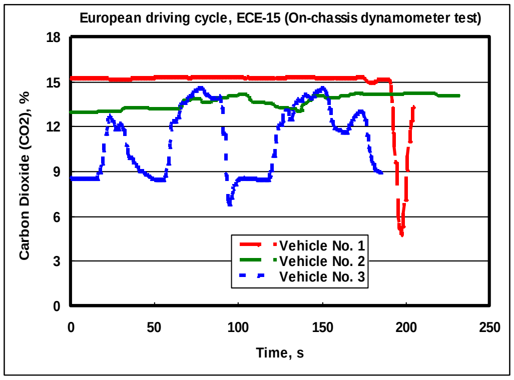

Fig. 7 Time history of emission pollutant for carbon dioxide (CO_2) - chassis dynamometer

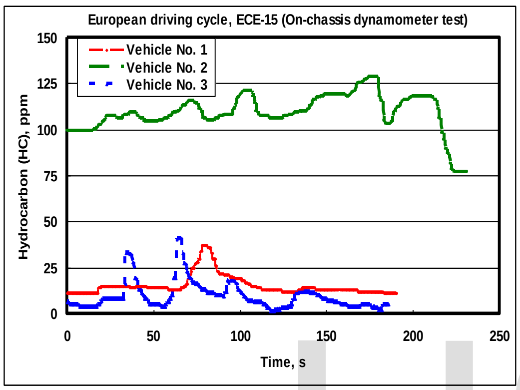

Fig. 8 Time history of emission pollutant for hydrocarbon (HC)chassis dynamometer

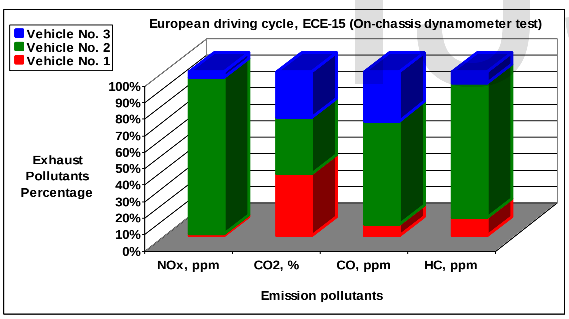

Fig. 9 Emission pollutants percentage averages-chassis dynamometer

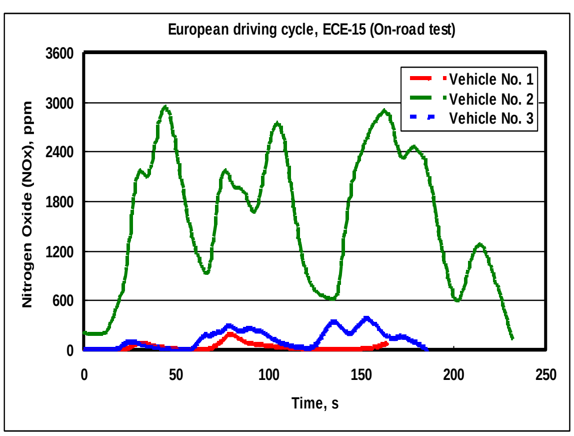

Fig. 10 Time history of emission pollutant for nitrogen oxide (NOx) - road test

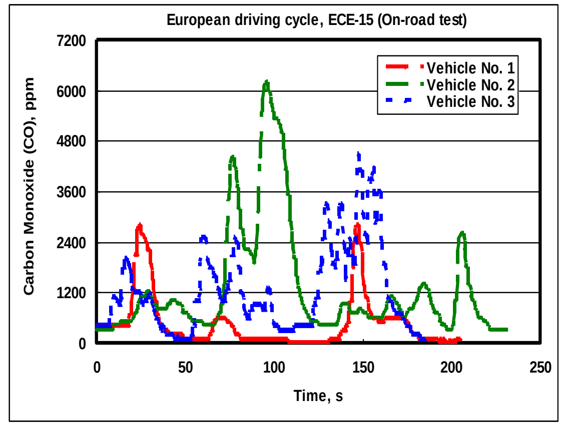

Fig. 11 Time history of emission pollutant for carbon monoxide (CO) – road test

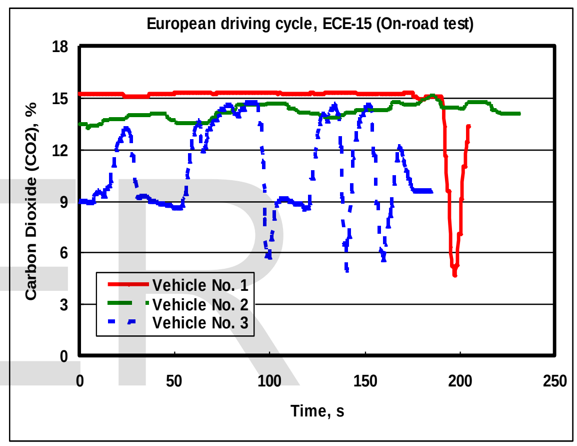

Fig. 12 Time history of emission pollutant for carbon dioxide (CO_2) - road test

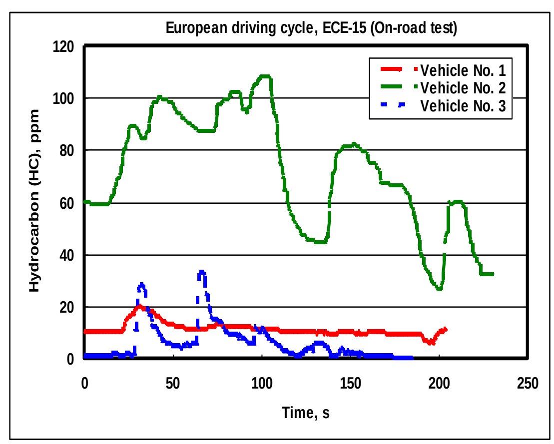

Fig. 13 Time history of emission pollutant for hydrocarbon (HC)- road test

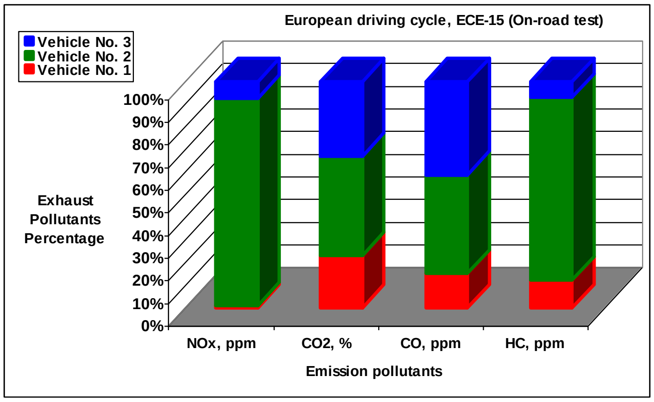

Fig. 14 Emission pollutants percentage averages-road test

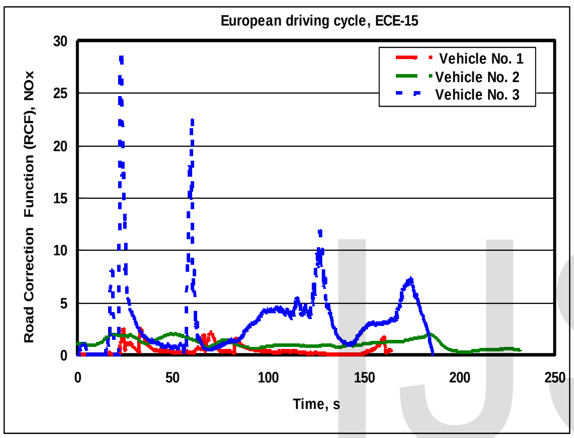

Fig. 15 Time history of road correction function (RCF)-nitrogen oxide (NO_x)

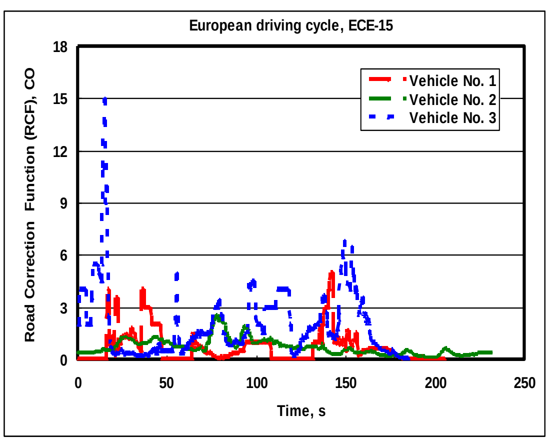

Fig. 16 Time history of road correction function (RCF)-carbon monoxide (CO)

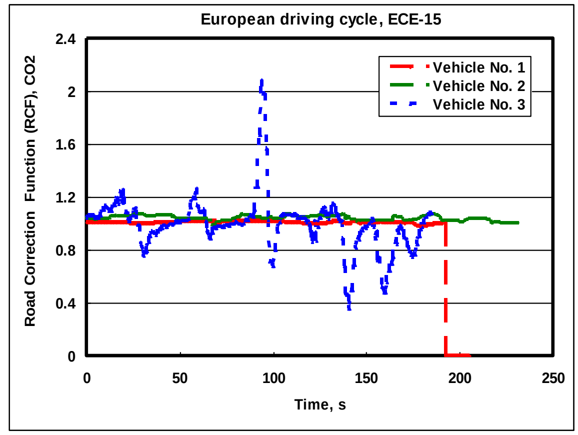

Fig. 17 Time history of road correction function (RCF)-carbon dioxide (CO_2

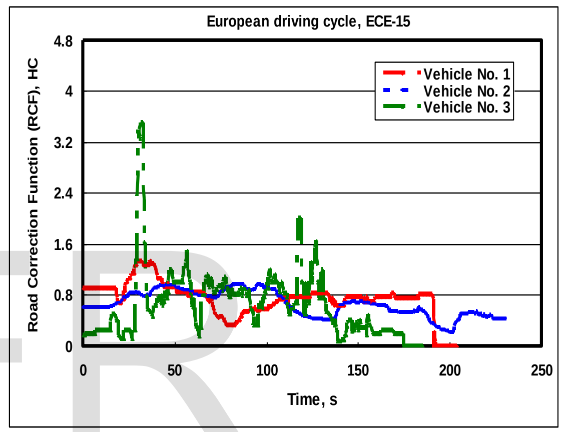

Fig. 18 Time history road correction function (RCF)-hydrocarbon (HC)

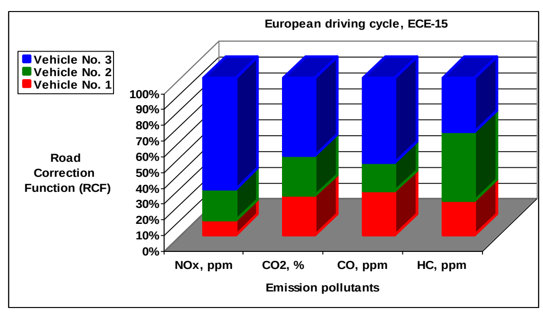

Fig. 19 Road correction function (RCF) percentage averages-road test

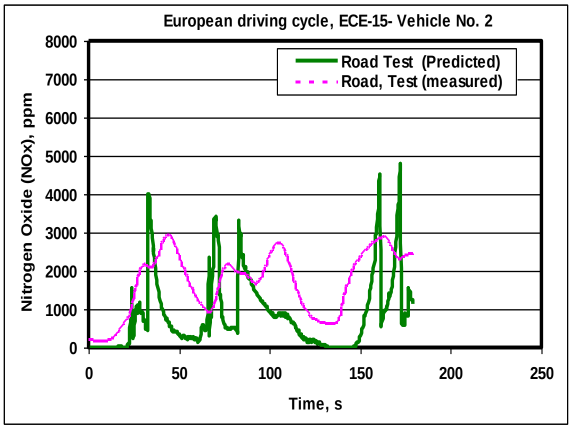

Fig. 20 Predicted versus measured vehicle emission pollutant of nitrogen oxide (NO_x)

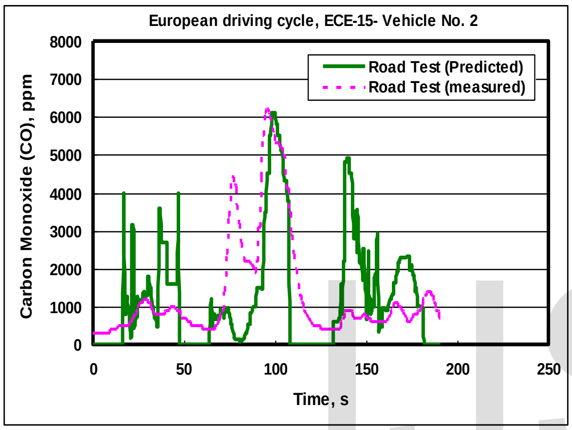

Fig. 21 Predicted versus measured vehicle emission pollutant of carbon monoxide (CO

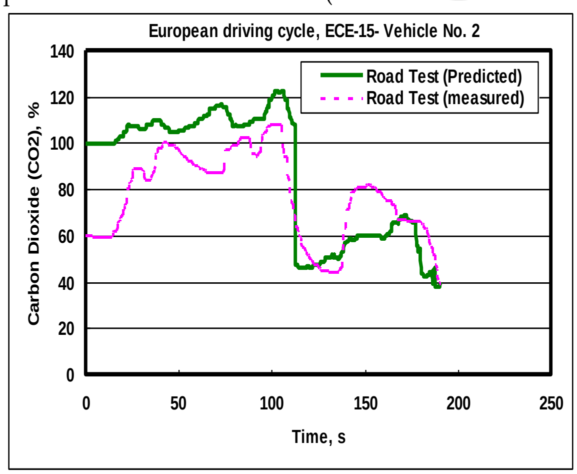

Fig. 22 Predicted versus measured vehicle emission pollutant of carbon dioxide (CO_2)

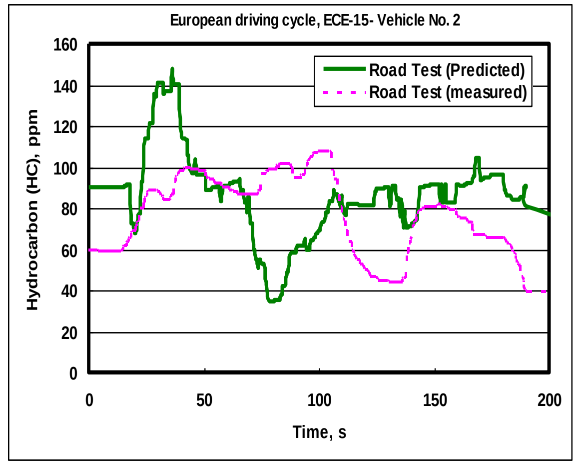

Fig. 23 Predicted versus measured vehicle emission pollutant of hydrocarbon (HC)

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