

**PROJECT**

**COST 346**

**Emissions and Fuel Consumption from Heavy Duty Vehicles**

**Funding:** European  
**Duration:** Oct 1999 - Oct 2005  
**Status:** Complete with results

**Background & policy context:**

The greenhouse gas emission reduction targets agreed at Kyoto represent a first step to reduce emissions in the long term in order to stabilise the Earth’s climate. The European Union (EU) has made an important contribution to the Kyoto agreement and the European Commission (EC) intends to develop a strategy to reach the Union’s Kyoto target. This will require action in all sectors of the economy including the transport sector.

Of the six gases covered by the Kyoto protocol, carbon dioxide (CO2) is the most important as it accounts for about 80% of the total global warming potential of all six greenhouse gases. In the EU the share of transport CO2 emissions in total increased from 19% in 1985 to 26% in 1995. Road traffic is the most important source, and largely determines the trend in the transport sector; and road freight accounts for about 35% of transport CO2 emissions.

As well as CO2, road freight transport causes considerable amounts of other pollutant emissions. With a share of approximately 75% of combustion related particulate (PM) emissions and about 60% of oxides of nitrogen (NOx) emissions, road freight transport is the most important source of these pollutants within the total transport sector.

To forecast and monitor the development of heavy duty vehicle (HDV) emissions and the effect of emission reducing measures, calculation methods must be provided. COST 346 deals with the subject of estimation of air pollutant emissions caused by heavy duty vehicles. International research should be structured to today’s needs and a European data base of emission related information for heavy duty vehicles should be developed. Basic data for emission estimates, emission models and activity data shall be collected and mapped with the results from national research activities as well as those from the EU framework research programmes ARTEMIS and Particulates.

**Objectives:**

The main objective of the Action was to improve the knowledge of real world emission behaviour of the heavy duty vehicle fleet in Europe. This includes the enlargement of the emission data base, the activity figures and the development of an improved methodology for estimating pollutant emissions and fuel consumption. The methods should make it possible to estimate the emissions [g/km] from single vehicles as well as from vehicle fleets.

The activities are concentrated on improving the amount and quality of basic data on emissions and transport activity, as well as validating and improving existing models.

The main benefit of COST 346 will be the improvement of emission estimates for HDV’s. As a consequence the modelling of HDV emissions and the differentiation of vehicle types and driving conditions provides an effective tool for political decisions within the EU, as well as for traffic and transport engineering purposes. Furthermore, the database gives a comprehensive view of emissions under various driving conditions for HDV’s of different emission standards. The close co-operation between laboratories in different countries improves the harmonisation of European scientific knowledge and testing facilities. The focus is on the quality and extension of HDV emission and activity data.

**Methodology:**

To achieve the project's objectives, the following actions were set:
Establishment of a protocol for HDV emission and fuel consumption testing. The protocol includes provisions for ensuring comparability between measurements made in different laboratories (quality assurance procedures, etc.).

Production of engine maps for calculating emissions and fuel consumption from HDV’s. This covers both static and dynamic operating conditions and a representative range of engines.

Because of the lack of existing data on particulate matter (PM) emissions and their important impact on health, the Action includes measurements of PM size and number distributions.

Development of vehicle simulation models in order to calculate emissions for single vehicles. For this task existing, improved or totally new models are used and validated.

The use of aggregated emission models, aimed at the assessment of the overall emissions from a HDV fleet, requires detailed information on vehicles and vehicle operation (e.g. driving statistics) and more general traffic statistics (e.g. loading factors, fleet composition, mileage). COST 346 considers this aspect and makes recommendation on sources of information and methods of data acquisition.

**Parent Programmes:**
COST - Co-operation in science and technology

**Institute type:** Public institution

**Institute name:** Technical secretariat set in the European Commission

**Funding type:** Public (EU)

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**Key Results:**

COST 346 produced emission models which allow to calculate emission and fuel consumption indicators for a vehicle fleet as well as for individual vehicles taking into account the driving performances and conditions, vehicle age and other factors.

The work performed under the framework of the COST 346 action has improved the knowledge on emissions and fuel consumption of heavy duty vehicles under real world conditions. COST 346 led to a strong improvement in the data base on measured engines. Due to the commonly used test protocol and the co-operation with Artemis WP 400, most of the HGV related emission work within the participating countries could be utilised. In addition, a methodology for an emission factor database has been developed which can be adapted to each individual country on the basis of their own fleet distribution. A lack of data still exists in the description of the transmission losses and all other forces acting on the vehicle as well as in the description of the influence of auxiliaries.

**Technical Implications**

The following recommendations for further action have been made.

The measurements covered engines up to EURO 3 technology with some exceptions of EURO 4/5 prototypes. As EURO 4 enters at the end of 2005 the market and EURO 5 may come earlier than originally expected, the measurement programme has to be prolonged. EURO 4 and EURO 5 will have to utilise high end technology in order to achieve the required low emission levels. After treatment systems, controlled EGR combined with improved combustion processes will be required. The high technical standard will open the gap between type approval tests and real world emission behaviour. This fact calls for an extensive monitoring of the real world emission behaviour, which itself require improved field test possibilities.

The available fleet emission model provides the framework for an emission calculation. As the emission factors describe the emissions of the present vehicles in Europe, the basic data is generally usable for all vehicle categories from pre-EURO to EURO 3 emission standards. However, this is not the case for the fleet distribution and activity data. The data describing the fleet characteristics is available only for a few countries and serve as an example. In order to use the model on a nationally bases the local fleet characteristic has to be inputted into the model scheme.
There will be a big need for further work in estimating and checking emissions of road vehicles in general and heavy duty vehicles in special. The highly sophisticated engine and exhaust gas after treatment technique which is required to fulfil the EURO 4 and EURO 5 standards has to prove its effectiveness not only during the type approval, much more important it has to show the emission reduction capacity in real world. This calls for improved test procedures for on-road testing and effective short test in I/M procedures.

In addition it turned out, that in future engine measurements based on taking the engine out of the vehicle might not be a realistic solution based both on representative and economical reasons. Economical reasons of course also influence representativeness since there is a risk that the number of engines will be to small. This problem of course is most relevant both for future legislation and for emission factors to emission models.

Simultaneously it will be necessary improve the knowledge in to rolling resistance data on different road pavements and during different weather conditions, air resistance.

**Policy implications**

COST 346 offered a forum for dissemination of the results of national activities and research in the area of HDV and utilizing these results in a European wide initiative. Moreover, the results and conclusions from COST 346 could be used in the context of legislative proposals by national authorities or by the EC, such as:

- Consolidation of European measurement facilities and programmes for HDV or other vehicle categories.
- Regulations regarding PM size and number distributions.
- Future emission legislation for HDV.
- Inspection and maintenance and field inspection programmes for HDV.

Documents:
- [COST 346 Final Report - Part I (Final report)](#)

**STRIA Roadmaps:** Other specified

**Transport mode:** Road transport

**Transport sectors:** Freight transport

**Transport policies:** Environmental/Emissions aspects