

Appendix 4

Modelling of JCS study's CO₂ data

MODELLING OF JCS STUDY'S CO₂ DATA

Carbon dioxide

In Section 3.4 of the main report the fitting of the mathematical model developed in this research to data generated by the JCS study for NO_x, CO and hydrocarbons was described. In addition to these three regulated pollutants, the JCS study also presented data for CO₂. This too has been fitted to the mathematical model. However, because carbon dioxide is not one of the regulated pollutants, and therefore a description of its distribution function from vehicles in the parc is not central to this study, the modelling of this data is placed in this appendix so as not to detract from the main messages within the report.

Figure 1 shows a fit of the model to the JCS CO₂ data. It is interesting to note that for this atypical component of the exhaust emissions good agreement between the model and experimental data was obtained. The values of the mean and standard deviation parameters within the model are given in Table 1. Also included in the table is an indication of the error for the parameters, obtained semi-quantitatively by noting the range of value for the parameters before the fit deteriorated from good to moderate. The table also contains the data for the other species to save the reader from having to turn back to Table 3 of the main report.

It is noted from Figures 13 to 15 of the JCS report that the experimentally determined CO₂ distribution is virtually identical for both the "Total" and "Random" groups, and before and after maintenance. Hence it appears to be virtually independent of the state of maintenance of the vehicle.

Table 1 Parameters used in the log normal model to reproduce the JCS data

	mean	standard deviation
Carbon dioxide	183 ± 5 gm/km	0.30 ± 0.03
Oxides of nitrogen	0.192 ± 0.01 gm/km	1.05 ± 0.05
Hydrocarbons	0.22 ± 0.03 gm/km	1.0 ± 0.1
Carbon monoxide – "Total" sample	2.7 ± 0.2 gm/km	1.5 ± 0.2
Carbon monoxide – "Random" sample	2.7 ± 0.2 gm/km	0.95 ± 0.05

Figure 1a, Cumulative distribution of emissions for CO₂

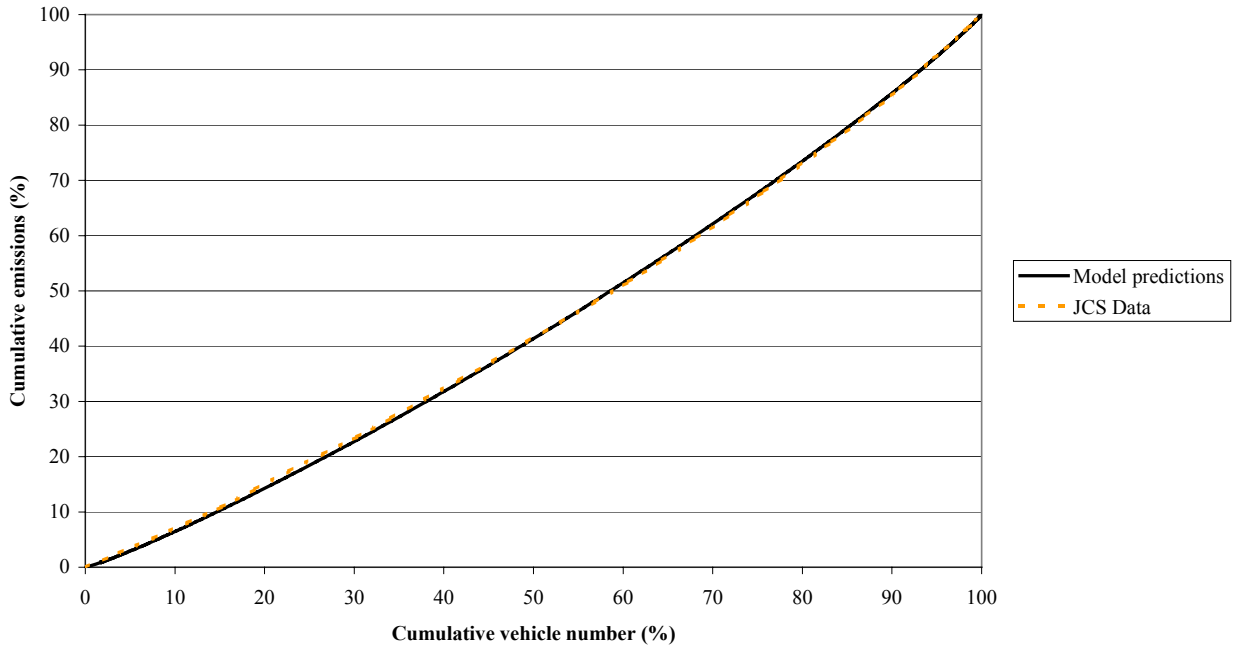


Figure 1b, Percentage of total CO₂ emissions against vehicular emission rate

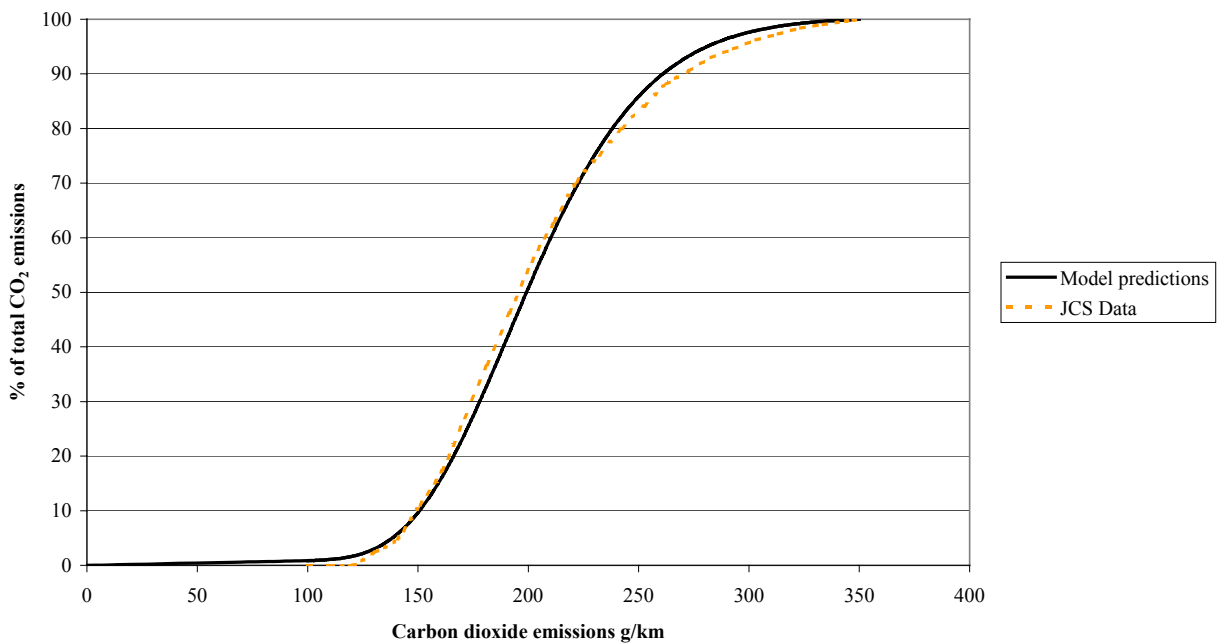


Figure 1 Fitting of the model to the JCS CO₂ data