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Interactive comment on "The use of tunnel concentration profile data to determine the ratio of NO_2/NO_x directly emitted from vehicles" *by* X. Yao et al.

Anonymous Referee #1

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This paper describes experiments undertaken in two road tunnels in Hong Kong that were aimed at determining the NO2/NOx ratio directly emitted from vehicles. Measurements were made using a mobile laboratory. There is currently increased interest in the ratio of NO2/NOx in vehicle exhausts because of the influence that modern pollution control technologies have e.g. use of oxidation catalysts on new diesel cars/vans and continuously regenerating traps on heavy vehicles such as buses or trucks. My major criticism of this paper is the limited nature of any new findings. Similar work in tunnels has already been reported e.g. Kurtenbach et al. (2001). On this basis, even though the paper is within the scope of ACP, I find the lack of any substantive conclusions an

important weakness and would therefore find it difficult to support its publication. I also have some more specific concerns with the work and these are outlined below.

Specific comments

A more detailed description of the road vehicle characteristics is required. For example, are the passenger cars gasoline-powered? How is a truck defined? What are the typical ages and technologies used in these vehicles? The charactertics of the speed of these vehicles is also important; we are only told that the speed limit is 70 kph.

On pg. 3 some of the advantages of the tunnel environment are considered. In the context of the current work some of the characteristics of the tunnel probably complicate the analysis. In particular, the forced input of “fresh” ambient air containing ozone ensures that O3-NO reaction remain important in this environment. A more balanced description of the advantages and complexities is required.

Pg. 4/5 Some information on the sampling technique is required. Did the mobile lab follow other traffic through the tunnel? If so, to what extent would the concentrations be affected by the vehicle in front of the lab e.g. a diesel truck or a gasoline car. A more thorough description of the sampling approach is required that supports the aims of the work. Are the samples representative of the entire vehicle fleet using the tunnel?

References have been made to the mobile lab used. It would be useful to have a brief description of the methods used to measure NO, NO2 and ozone.

By only considering the lowest NO2/NOx ratio as being that related to direct emissions of NO2 is inadequate. With measurements of O3, the total oxidant (OX = O3+NO2) would provide a more robust approach to calculating the faction of NOx that is in the form of NO2 (as applied by Clapp and Jenkin, 2001).

Pg. 10. The simple chemical model used is probably too simple. A consideration of OX would provide more insight. The model also implicitly assumes the NO2/NOx ratio from vehicle emissions is 2 %. The correlations shown in Fig. 5 suggest the ratio

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could be higher. This could be achieved by plotting NOx vs. OX and use the slope as the NO2/NOx emission ratio estimate. For NOx $>$ 300 ppb (with presumably little O3 availability) the slope in Fig 5a is approximately 13 % suggesting a ratio of 2 % is too low.

Section 4 (summary) should present the conclusions of the work. In this section one would expect to see something written on the new findings, their implications, how they compare with previous work etc.

References

Kurtenbach, R., K. H. Becker, J. A. G. Gomes, J. Kleffmann, J. C. Lorzer, M. Spittler, P. Wiesen, R. Ackermann, A. Geyer and U. Platt (2001). Investigations of Emissions and Heterogeneous Formation of HONO in a Road Traffic Tunnel. Atmospheric Environment 35(20): 3385-3394.

Interactive comment on Atmos. Chem. Phys. Discuss., 5, 12723, 2005.