

Hong Kong: Vehicle Related Air Pollution

In Support of Action Blue Sky

A set of measures aimed at alleviating air pollution caused by road vehicles

Maintenance

1. All vehicles must be properly maintained, no matter what fuel they use. The manufacturers' recommended, preventive maintenance scheme and all related specifications should be closely adhered to. A properly maintained vehicle will burn less fuel, release less pollutants to the atmosphere and be safer. It is therefore important that ways and means be found to ensure that all vehicles receive regular, good quality maintenance. It is also important that an effective system be put in place which bans the use of poorly maintained vehicles. It is not just a legal requirement but also a moral duty incumbent on all vehicle owners to properly maintain their vehicles.

N.B. It should be noted that the HKSARG Construction & Maintenance Regulations (Cap 374) requires owners to properly maintain their vehicles.

Mechanics Licensing

2. One of the possible measures to ensure good quality vehicle maintenance, and hence enhanced consumer protection, would be to license motor mechanics / technicians. Through a well designed licensing scheme, mechanics / technicians should (i) be required to hold a relevant minimum qualification, (ii) be appropriately skilled and experienced, (iii) practice life-long learning and (iv) be continually kept up-to-date regarding the latest product technology / related workplace processes. Disciplinary procedures would also need to be included in order to ensure compliance. A compulsory licensing scheme would likely be more effective compared with a voluntary one.

N.B. It should be noted that the HKSARG EMSD is currently developing a Mechanic's Licensing Scheme, to be launched by the end of 2006.

Registration of Garages

3. Another possible measure aimed at protecting the public and vehicle owners alike would be to register vehicle repair enterprises (garages / workshops). The register would ensure that garages / workshops:

- (i) Employ properly qualified and skilled (licensed) mechanics / technicians.
- (ii) Have adequate levels of equipment & tools.
- (iii) Apply appropriate maintenance related data (Manufacturers Specifications) to suite the vehicle types under repair, at any given time.
- (iv) Provide regular upgrading courses for their mechanics and technicians.
- (v) Adhere to all health, safety and environment protection regulations.
- (vi) Maintain premises which are suitable for the purpose (space, location etc.)

Vehicle Related Emissions Data Collection / Management System

4. Once the Mechanics' Licensing and the Garage Registration Schemes are operating satisfactorily, nominated garages could be enlisted to join a scheme to upload service / emissions related data to a central (HKSARG) computer. The results of HKSARG Transport Department and Environmental Protection Department exhaust emission test data may also be uploaded to the same database.
5. At any given time this data could be analysed, using appropriately designed software, to produce a profile of the emissions created by the various types of vehicle used in Hong Kong. This system could therefore become an important tool for managing vehicle emissions and identified hotspots for appropriate corrective measures and to minimize the environmental footprint created by Hong Kong's mobility industry.
6. This system could be expanded to include roadworthiness data so that inadequately maintained vehicles may be banned from the roads perhaps when applications for relicensing are submitted to the Transport Department. This could easily be achieved by using the aforementioned service / emissions data (on individual vehicle basis) to flag-up vehicles which fail to meet requirements related to safety / roadworthiness and environmental aspects.

Enforcement of Existing Regulations & Tightening of Future Regulations

7. Effective enforcement of all vehicle-related regulations must be ensured. Hong Kong currently has good vehicle-related regulations, across most of the necessary domains. However, these regulations can only be as good as the enforcement mechanisms put in place. The relevant authorities must therefore explore ways of maximizing the enforcement of all current regulations. Furthermore, regulations should be considered to be 'living documents' in that they can be quickly updated so as to respond to rapid changes in technology and related processes and also to any unexpected change or deterioration in the environment or safety on the road.

Hong Kong Institution of Engineers: Automotive Engineering Group

8. The Hong Kong Institution of Engineers (HKIE) needs to create an Automotive Engineering Group (AEG) which would provide a forum for experts to identify and discuss areas of concern and to provide advice when called upon, so to do. It is anticipated that the AEG would comprise of representatives from HKSARG departments such as; Transport Department, Environmental Protection Department, Electrical & Mechanical Services Department, Hong Kong Police Force Traffic Section, non-governmental officers from the light and heavy vehicle industry and other interested parties, as thought fit by the Mechanical, Marine, Nautical & Chemical (MMNC) Divisional Committee. Members would normally be professional engineers in their respective specializations or of equivalent / similar status.
9. The AEG would also give much needed support to future aspiring Professional Automotive Engineers. Furthermore, AEG members would be expected to network themselves with experts around the World in order to help in prescribing solutions to quickly resolve vehicular-related concerns, as and when these arise.

N.B. The introduction of an AEG is currently being explored (by the undersigned) with the MMNC Division of the HKIE. The support of the HKIE President, the LegCo

Engineering Constituency Representative (The Hon. Ir Dr. Raymond Ho) and the MMNC Chairman have already been secured.

Jockey Club Large Vehicle Testing [R&D] and Emissions Centre (Pended)

10. The HK Jockey Club (JC) has donated the sum of HK\$16.61 million in order to build and equip the captioned new centre. A report on the donation awarding ceremony may be seen at <http://aedatabase.vtc.edu.hk/Jockey%20Club%20LVTRDEC.pdf>. The centre is to be a shared resource between the *Department of Automotive Engineering* and local technological universities with 50% of its resources dedicated to testing, research and development and Emissions related projects and the other 50% to the education and training of students from any of the aforementioned institutions. It should be borne in mind that large vehicles (trucks and buses) pollute our atmosphere to a much greater extent than cars. Every means should therefore be employed to reduce the environmental footprint of large vehicles, which is a significant part of the mission of this new centre.
11. It should be noted that no matter what needs to be done to clean up our environment, we need good quality graduates / expert manpower, specifically trained in key specialist areas, in order to realize all intended goals. To this end, the *JC Large Vehicle Testing [R&D] and Emissions Centre* would make a hugely worthwhile contribution to the community, for many years to come.
12. In early 2006, the funding of this new centre was frozen by the JC due to understandable concerns relating to a possible relocation of the parent campus; Hong Kong Institute of Vocational Education (Lee Wai Lee) to Tseung Kwan O. Now that details related to the relocation of the Lee Wai Lee campus have apparently been settled, it would be beneficial to the local community if the funding were now unfrozen and architectural / building related work re-commenced.

Public Education

13. A change in the mindset / culture of the public at large is urgently needed. If the public fail to gain an understanding and a strong empathy towards environmental protection it will be extremely difficult, if not impossible, to secure any significant improvements. This is particularly important regarding the need amongst the business community to invest in environmental protection media in order to sustain our resource base.
14. The most important action would be to educate all concerned, especially teachers, who may then cascade information to the pupils / students in their care, to encourage a much stronger empathy for environmental protection.
15. Also, driver training manuals need to include the topics of (i) eco-driving and (ii) environmental protection. Furthermore, learner drivers need to be trained in the ways they may get the best out of any given vehicle in terms of minimizing fuel consumption and harmful emissions at the same time as maximizing road safety.

Commercial Vehicle Sector

16. The HKSARG currently closely monitors the quality of maintenance applied to buses operated by franchise companies. However, this seems not to be the case regarding the vast number of commercial vehicles, apart from the annual statutory vehicle examination presently enforced. A comparable set of high quality and effective controls therefore needs to be applied across all vehicles used for the purpose of hire or reward. It seems

evident that commercial vehicles need to be organized into groupings which can be placed under the authority of Registered Professional Automotive Engineers who would be made responsible for all safety and environmental aspects. Once better organised, 'home grown' professional automotive engineers may more effectively help steer transport companies towards seeking continual improvement regarding challenges associated with the operational effectiveness, safety and environmental protection issues confronting the industry today.

N.B. It should be noted that the Department of Automotive Engineering of the HKIVE (LWL) is currently producing high quality graduates who are destined to become tomorrow's new breed of professional automotive Engineers. However, changes in workplace quality, remuneration and career structure etc., are needed to attract and retain such precious human resources in the industry.

Age of Vehicle Stock

17. The average age of the vehicle fleet (all types) in Hong Kong needs to be kept as low as possible. This will better ensure that the community gains the intended benefits from the most recent vehicle technologies designed to (i) make vehicles safer for both occupants and pedestrians, (ii) economize on fuel and (ii) counter harmful (both regulated and unregulated) emissions (including CO₂). Euro-IV is one good example of the latest regulations and associated technologies imported into Hong Kong from Europe.

Aggressive Driving

18. Aggressive driving, such as rapid acceleration, speeding and severe braking need to be discouraged. Using eco driving techniques, fuel consumption can be greatly improved, emissions minimised, road safety enhanced and 'wear and tear' on the vehicle systems and tyres hugely reduced. All of these benefits lead to lower operating costs and possible future reductions in insurance premiums. For all drivers, eco driving will save costs / significantly enhance profit margins (for the commercial sector) and reduce exhaust emissions.

19. The relevant authorities need to more effectively enforce speed limits by more widespread application of the wide range of modern technologies designed for the purpose. Other countries are applying such technology to great effect for making roads safer and also reducing fuel consumption and exhaust emissions across all vehicles.

N.B. The Department of Automotive Engineering has carried out an interesting study on Vehicle Fuel Consumption and Eco Driving and a report has been released.

(See report at: http://aedatabase.vtc.edu.hk/Fuel%20Economy_Eco-Driving.pdf)

Driver Selection, Training and Development

20. It is critically important for commercial transport / bus companies to employ drivers who are suitable, from a psychological point of view, to become good drivers. By using psychometric testing, drivers who have the tendency to drive aggressively should be weeded-out for special training and if such training / retraining fails, they should be advised to seek alternative employment. Methods applied for the selection, monitoring, training and professional development of drivers should therefore be a requirement and should be enhanced over time.

Motor Fuels

21. Ways and means must be employed to ensure that diesel vehicles running in and around Hong Kong (including cross-border vehicles) use only high quality ultra low sulphur

- diesel (ULSD) fuel readily available in Hong Kong. Methods need to be employed to neutralize any financial gain presently enjoyed by certain drivers using, or bringing into Hong Kong, poor quality, high sulphur fuel. Modern vehicles with sophisticated engine and emission control systems need to run on high quality fuel (e.g. ULSD / City-diesel) in order to operate smoothly and efficiently and to realize designed emission levels.
22. Having already converted taxis use to the well proven Liquid Petroleum Gas (LPG) technology benefits have been realized. LPG also needs to be applied to light buses and vans as quickly as possible. Furthermore, it should be made possible to convert privately owned gasoline vehicles to run on LPG.
 23. The use of bio-fuels (e.g. bio-diesel) and blending of bio-fuels with fossil fuels, where this has been proved to be beneficial, should be actively promoted by the HKSARG.
N.B. Diesel engine manufacturers in the World (European Automobile Manufacturers Association, Alliance of Automobile Manufacturers, Engine Manufacturers Association, Japan Automobile Manufacturers Association) as declared in the World-Wide Fuel Charter (December 2002), approve the mixing of bio-diesel into fossil diesel fuel up to a 5% content level.

Hybrid & Electric Vehicles

24. The use of hybrid and electric vehicles should be encouraged by providing financial incentives. For example, such as lower (or zero) first registration tax and lower (or zero) annual license charges. However, to fully benefit from hybrid technology, drivers also need to be trained on how to apply eco-driving techniques to get the best fuel economy.

Vehicle Specifications

25. We need to ensure that new vehicles are able, not simply to meet present standards (Type Approval), but to continue meeting these over the service life of the vehicle. New vehicles may meet the new standards but after a few years of service may fall below the required levels. One way to achieve this is ensure proper maintenance is applied and also to introduce more frequent roadworthiness / emissions checks (perhaps annually) for all vehicles, including private cars.

Availability of Vehicle Technical Data

26. Vehicle manufacturers should be required to make all repair manuals openly available to the Hong Kong public. Access to good quality data will enable small and medium sized repairers achieve a better level of quality when servicing / repairing vehicles.
27. The *Automotive Engineering Department* has introduced the HKSARG-sponsored *Automotive Engineering DataBase Centre* located at the HKIVE (LWL) campus. Website at: <http://aedatabase.vtc.edu.hk> This centre is dedicated to serving the needs of small and medium sized repairers, with the data, advice and consultancy services they must have, in order to satisfactorily diagnose, service and repair vehicles. This centre is dedicated to driving incremental improvements in the quality of vehicle servicing.

Vehicle Sharing

28. Car and taxi sharing should be encouraged to reduce both traffic congestion and pollution, especially in urban areas. The fuel consumption per person, of a vehicle carrying two persons instead of one, is effectively halved! A car or taxi carrying five occupants is therefore an optimal arrangement. Furthermore, a bus carrying 100 passengers will enjoy

greatly reduced fuel consumption, per person, compared to a private car or taxis carrying one or two persons. However, a bus carrying only a handful of passengers would incur a big fuel consumption rate, so bus companies need to pay attention to route loadings, peak and off-peak times.

Actions to Mediate Against Poor Visibility / High Pollution in Urban Areas

29. There are a number of ways to minimize the number of vehicles entering the urban area and hence reduce urban pollution levels. In London, Mayor Livingstone has introduced a ‘traffic congestion’ charge to great effect and is now considering the introduction of ‘low emission zones.
30. In Paris, on days when the pollution index is high, the authorities only allow ‘even’ numbered (license plate) vehicles one day and ‘odd’ numbered vehicles the next day, into the urban areas, thereby lowering congestion by encouraging vehicle sharing.
31. In Germany, only vehicles installed with Government ‘low pollution’ badges may be used on the roads when pollution levels are high. Also, bio-fuels are widely available and promoted in a number of European countries.

Zero Roadside Pollution Levels

32. The famous Hong Kong Trams emit **zero** pollution at the roadside although the power station, from which they source their electricity, pollutes the atmosphere. However, to source the motive power of the whole fleet of trams from a single power station is much more environmentally friendly, compared with the case of diesel buses, where each bus has its own engine, exhausting copious amounts of gaseous and raw heat pollution at the roadside and affecting the health of pedestrians. In the case of the power station, if it is converted to produce cleaner emissions, then trams, light rail cars and trolley buses would, in turn, become even more environmentally friendly than they are today.
33. The Citybus Trolley Bus project (covered by a report published on the website of the AE department <http://aedatabase.vtc.edu.hk/A%20Green%20Solution.rtf>) needs careful consideration / reconsidered, as these, similar to trams and light rail systems, emit zero emissions at the roadside. The modern Citybus Trolley Bus, as can be seen in the report, is the first “*Made in Hong Kong*” double-deck, air conditioned, zero roadside emission bus capable of accommodating more than 100 passengers. This ‘first’ for Hong Kong could be exported to the Mainland as a useful ‘green’ technology for use in other urban areas (which presently pollute the whole of the PRD).
34. Diesel buses, operating in urban areas, should be replaced by hybrid buses or modern trolley buses. Hybrid buses provide the operator with better fuel consumption and lower emissions levels at the roadside. Such vehicles may even exhibit lower operating costs, especially trolley buses, and are normally much more energy efficient compared with present day diesel buses.

Retrofitting / Upgrading

35. Older vehicles need to be modified / retrofitted to upgrade all technical specifications relating to emissions and safety standards.
N.B. It should be noted that the HKSARG EPD are currently requiring the retrofitting of certain types of commercial vehicles and buses.

Commuter Logistics

36. Low priced (subsidized) car parking should be made available near to suburban MTR, KCRC, Bus and Ferry stations / piers to encourage drivers to use mass transport as the preferred means to enter and leave urban areas.

Idling Engines

37. Severe penalties should be applied to penalize drivers who idle their engines for excessive periods of time, whilst the vehicle is stationary. A stationary vehicle with its engine idling is 100% inefficient because it is not moving. Tour buses and coaches may be installed with auxiliary engines to drive the air conditioning plant of the vehicle while it is stationary. Regarding enclosed / underground car parks, there needs to be much higher penalties for drivers caught idling their engines, in such enclosed places.

Traffic Congestion

38. The authorities should strive to minimise traffic congestion. Stationary vehicles waste 100% of their fuel and heavily pollute the surrounding environment. Likewise, slow moving vehicles (caught in traffic congestion) suffer low fuel efficiency and hence pollute more than faster moving vehicles. Such congestion is usually associated with the urban areas where there are often masses of pedestrians adversely affected by the pollution and heat released to the atmosphere by slow moving traffic.
39. Traffic control / road planning systems must be put in place aimed at keeping vehicles on the move and if possible to provide information to drivers regarding the best routes to take to avoid serious congestion. Satellite navigation / Internet / traffic information systems (which inform drivers of alternatives - under real time conditions) may be applied to assist drivers to avoid congested places.

Pedestrian Zones

40. A wider application of pedestrianisation of busy urban, shopping areas needs to be introduced to provide a safe, more comfortable and healthier environment for people to freely walk about. Restaurant and café owners may provide services such as alfresco dining, within these vehicle-free areas, which would then become more attractive to both tourists and shoppers alike. Pedestrian areas are now very popular in many cities around the world for shopping, resting and other leisure / dining activities.
N.B. Some small-scale projects have been tried but these now need to be extended and multiplied.

Smokey Vehicle Spotter Programme

41. The smoky vehicle spotter programme could be expanded and the penalties against the polluters greatly increased. However, means to ensure stricter compliance levels when carrying out opacity tests, with the aid of a dynamometer, must be realized.

Best Practice

42. A set of Best Practices needs to be developed by the Government so that those involved in operating / driving vehicles (or whatever) may access such a guide, adopt best practice and become more environmentally responsible persons.

Concluding Remarks

43. It must be mentioned here that there is no such thing as an “*Environmentally friendly internal combustion engine*”. All internal combustion engines suck in large amounts of air and exhaust larger and much hotter amounts of gaseous substances which are harmful to our environment! The sooner we stop combusting, and find a replacement for the internal combustion engine, the better the chance we will have to secure the goals embodied in our CE’s *Blue Skies* Initiative.
44. Hybrid vehicle technology, with its electric drive system and associated internal combustion engine, takes us closer to the prospect of a viable *All-electric vehicle*, but is only a first step towards this goal.
45. Even if most of these initiatives are quickly implemented, we would still need to continue our best efforts to find more sustainable alternatives to counter / replace our current bad practices. We must put in place sustainable policies to ensure that our children and their children’s children may enjoy a pleasant and safe environment.
46. We all must breathe the air which has been badly polluted by vehicles, planes, ships, restaurants and power stations, and the like. The evidence that Global Warming is being accelerated by human activity is now quite overwhelming.
47. If you think about it carefully, we have **NO CHOICE** but to quickly mend our ways or else our collective future will quickly become severely limited. Every single person needs to take action in order to save our race.
48. This list of initiatives is by no means an exhaustive one and will be updated in due course.

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Version 2.1: October, 2007