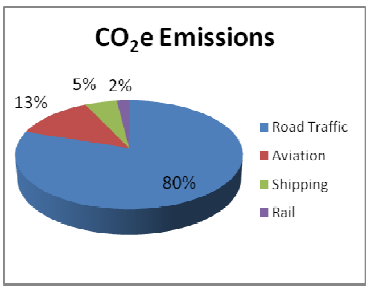
PAE Services for Road Transport

Transport is a major source of air pollution and greenhouse gas emissions worldwide. In Australia, for example, about 14% of total greenhouse gas emissions come from transport – and this percentage is increasing at a significant rate. Transport CO_2 emissions have increased by 30% in the period 1990-2005 and they are expected to almost double in the period 1990-2020. The majority (80%) of these emissions come from road transport and the remainder from aviation, shipping and rail, as shown in the chart below.



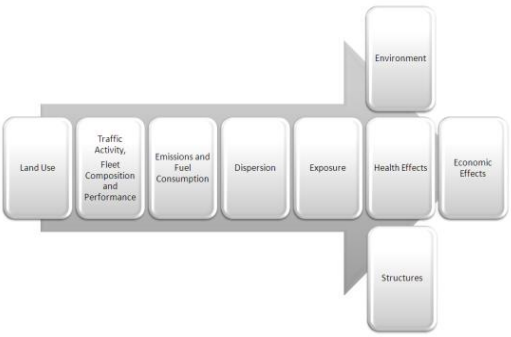
Source: BTRE "Australian Transport Statistics 2007" p.25

From an air quality perspective, road transport is particularly important since it emits large quantities of harmful chemicals close to population centres. In fact, around the world, road traffic is the dominant anthropogenic source of air pollution in urban areas, and this is increasingly the case despite stricter vehicle emissions standards and associated reductions in vehicle emissions (per vehicle). With continued growth in traffic and increased congestion levels, the challenge facing policymakers is to apply more meaningful ways to assess the impact of traffic on the environment.

Traffic Emissions Models

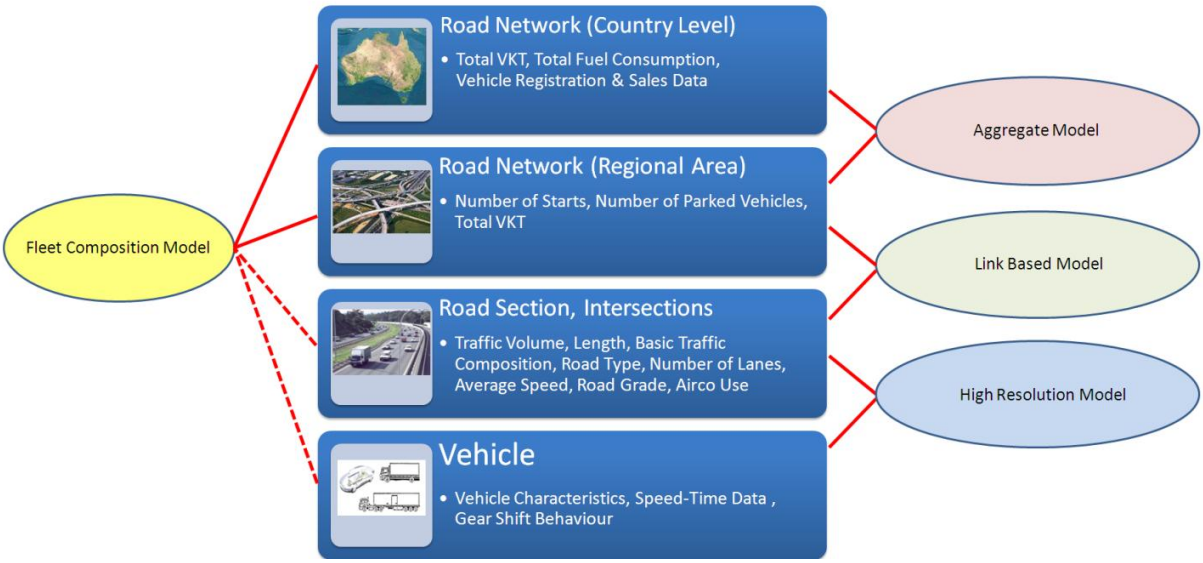
At this point in time, the most useful way to assess the impact of traffic on air quality is to use models. Models are an effective tool for two main reasons. Firstly, given the large number and variety of on-road vehicles and the many factors that influence emissions and fuel consumption from individual vehicles, it is not feasible to adequately measure traffic emissions in the field. So models are needed to do this. Secondly, from a policy perspective, it is necessary to examine trends in traffic emissions and to make projections into the future. Again, this can be achieved with models that can quantify traffic impacts on the environment.

As the chart below illustrates, applying models to assess impact of traffic requires a multidisciplinary approach. This is because the relationships between air pollution, greenhouse gas emissions and road traffic are complex. The starting point is to collect all relevant traffic activity data from either traffic models or measurements. These data are then used as inputs to road traffic emission (factor) models to predict fuel consumption and emission loads. Using this information, dispersion models are then employed to predict air pollutant concentration levels, which, when combined with knowledge of where sensitive receptors (e.g. population) are situated in time and place, leads to an assessment of exposure levels and health effects. Using models in this way can determine the magnitude of the combined effects on health, structures and the environment and in turn the economic effects of traffic air pollution.



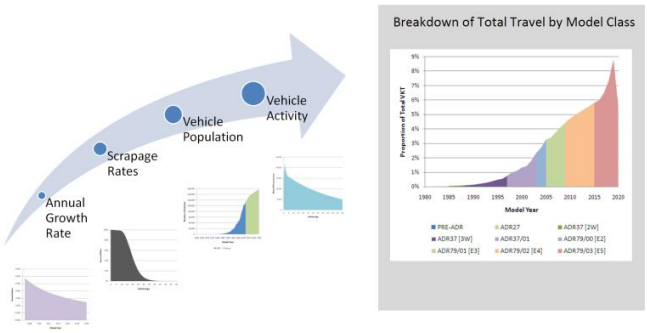
The Need for Specialist Advice

Given the complexities associated with road transport emissions, specialist advice is imperative in order to prevent erroneous outcomes. Pacific Air & Environment (PAE) has the capability of performing transport emission (including fuel consumption) and air quality modelling and more general transport studies. PAE uses (and is further developing) a model framework that matches the quality and level of detail of available traffic data and takes into account specific requirements (e.g. accuracy) at each scale of interest (local, regional, national, international). The model framework is shown below.



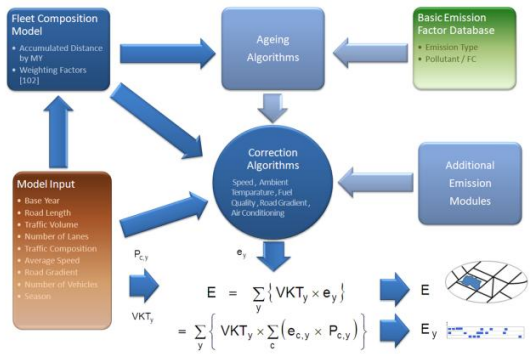
Using the Appopriate Models

The model framework incorporates a fleet composition model to generate information on the proportion of total travel for each individual vehicle class in the emission models. These proportions or “weighting factors” are then used to compute composite emission factors (grams/km, grams/s) reflecting a less detailed vehicle classification scheme that matches the available traffic input data.

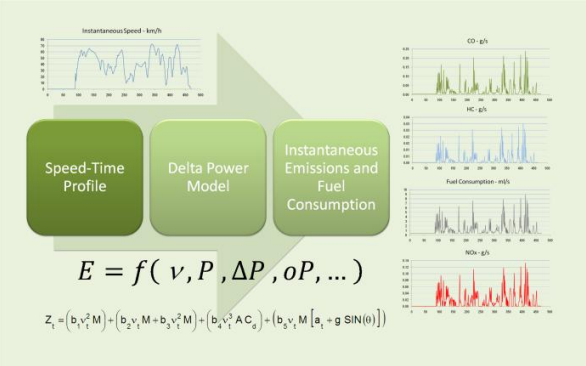


For a particular project, the objective determines the size of the study area and the study type (screening, non-screening), which then determines the appropriate emission model to use:

1. The **aggregate model** combines data on national traffic activity (e.g. from the Australian Bureau of Statistics) with appropriate emission factors (e.g. on dioxins). This information can be used to assess, for instance, the relative importance of Australian vehicle emissions to other sources. National emission inventories are also needed to verify compliance with international agreements (e.g. national emission ceilings, greenhouse gas emissions).
2. The **link based model** operates at a higher resolution (examining, say, a road section) and typically accepts traffic data from strategic transport models for the development of urban emission inventories and policy scenario testing. Assessment of regional air quality, for example the prediction of photochemical smog levels, is commonly based on these motor vehicle emission inventories. The “screening version” of the link based model can be used for road level or local area assessments (e.g. environmental impact statements).



3. The **high resolution model** (under development) operates at the highest temporal and spatial resolution and, combined with local air quality dispersion models, can be employed to carry out, for example, hot spot analysis and impact assessment of traffic management measures. It gives a more accurate prediction of emissions and fuel consumption than the screening version of the link based model, which is important in cases where sensitivity is required. For instance, in cases with poor air quality close to guideline values (e.g. at critical locations such as a new residential area near a busy highway) or in cases where policy measures are likely to cause relatively small impacts on emissions and fuel consumption (e.g. specific traffic management measures such as dynamic speed limits, traffic signal coordination, metering signals).



For more information on quantification of road traffic impacts on air quality and greenhouse gas emissions or general transport studies, please contact Dr. Robin Smit at (+61) 7 3004 6400.

Why We Need an Effective Approach to Assessing Traffic Emissions and Fuel Consumption

"*The increased pressure on Brisbane's air quality can be mainly attributed to growing vehicle emissions…*"
(Draft Brisbane City Council Transport Plan 2006-2026, p. 11)

"There is an improved community awareness of environmental issues and therefore higher expectation that the Department [of Main Roads] will commit funding to provide air quality management measures…"
(Draft Road Air Quality Management Code of Practise, June 2008, p. 4-5)

"*It is important to have current, robust emission data for the purposes of emission modeling and to inform policy development with respect to vehicle emission management. Vehicle emissions modeling is important in developing strategies to manage vehicle emissions and in the analysis and assessment of strategies that are proposed to help manage and improve urban air quality. In the absence of robust Australian data, analysis is forced to rely on overseas data that may not be valid for Australian conditions*"
(NISE 2 Study, Department of Environment & Heritage, 2005, p. 9)

"*Vehicle emissions modeling is important in developing strategies to manage vehicle emissions and in the analysis and assessment of strategies that are proposed to help manage and improve urban air quality.*"
(NISE 2 Study, Department of Environment & Heritage, 2005, p. 9)

"The desire of an increasingly affluent population for vehicle characteristics that increase fuel consumption (power, weight, accessories, 4WD) has meant that potential reductions in fuel consumption made possible by technological advances have not been fully realized. This is a world-wide trend in the automobile sector, and it cautions against undue optimism about reducing reductions in fuel use and emissions stemming from technological change" (Bureau of Transport and Regional Economics, Information Sheet 18, 2002, p.4)