SP 2003- 07 - ABSTRACT

ESTIMATING THE INCREASE IN EMISSIONS ASSOCIATED WITH INDUCED TRAVEL FROM ROAD CAPACITY EXPANSIONS AND TRAFFIC FLOW IMPROVEMENT PROJECTS

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The key objective of the proposed research is to determine whether road schemes that increase the availability of road space or which smooth the flow of traffic results in increased vehicle pollution. Economic theory has found that increases in road space and the consequent decreases in travel time will tend to increase total vehicular travel. This is known as induced demand, a subject that has been debated by transport planners for decades. Recent research research has led to a growing consensus on the inducing effects of new road capacity (Noland & Lem, 2002). The net impacts on vehicle pollution have largely been a matter of conjecture with some arguing that policies to reduce congestion (by adding more road space) will reduce pollution. This occurs due to reductions in stop and go traffic and the smoothing of total vehicle flow. These questions, while frequently debated amongst transport and environmental planners, have yet to be clearly analyzed using adequate methodologies. This project uses a combination of simulation and statistical methodologies to evaluate the overall strategic policy question of how changes in available road capacity effects vehicle emissions.

The basic approach used in this research was to simulate a capacity expansion using the VISSIM microsimulation model. This allows for the estimation of second-by-second vehicle speed changes and accounts for acceleration events that tend to lead to large quantities of emissions. The emissions were modeled using the CMEM modal emissions model that provides second-by-second estimates of emissions. Our strategy was to estimate the emissions from an initial condition and for the initial stage after a capacity expansion. This then shows the reduction in emissions from smoothing the traffic flow. We then simulate induced travel by increasing the vehicle flow through the network. Vehicles are added until a "break even" point is found, such that emissions are the same as before the capacity addition. This then represents the level of induced trips that will cancel out any initial emission reduction. Figure 1 shows the test network, Figure 2 shows the procedure used in flowchart form, and Figure 3 shows results for carbon monoxide emissions. In this case, between 18% and 26% additional vehicles can be accommodated before the break even point is reached, well within typical estimates of induced travel. Effects differ based on the pollutant measured.

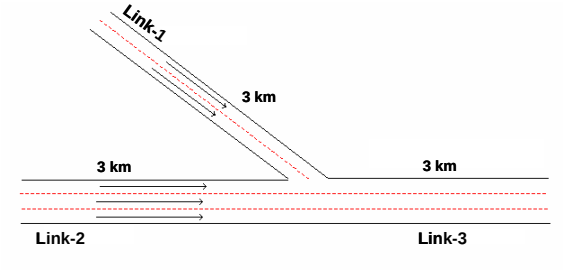

Figure 1: Motorway merge road geometry

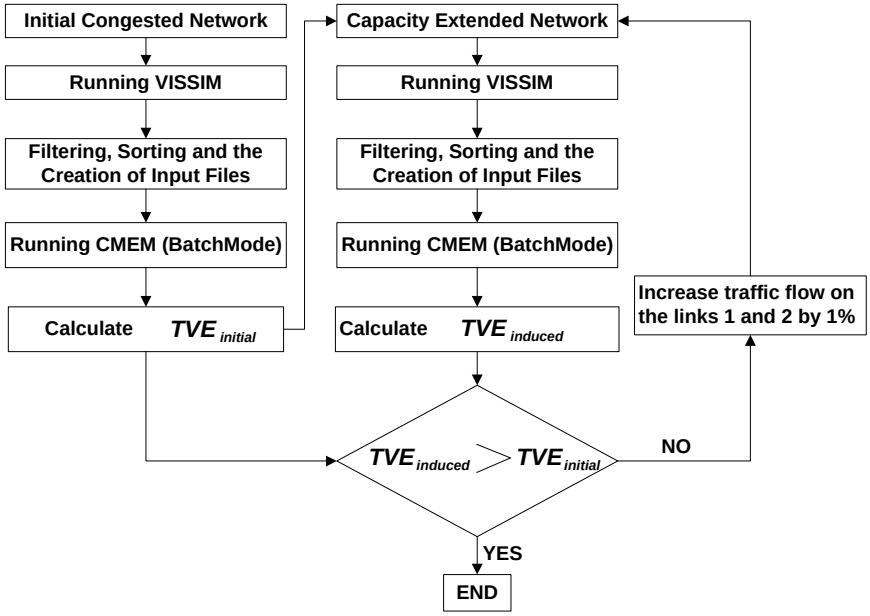

Figure 2: The Linkage of VISSIM and CMEM for Identification of "break-even point"

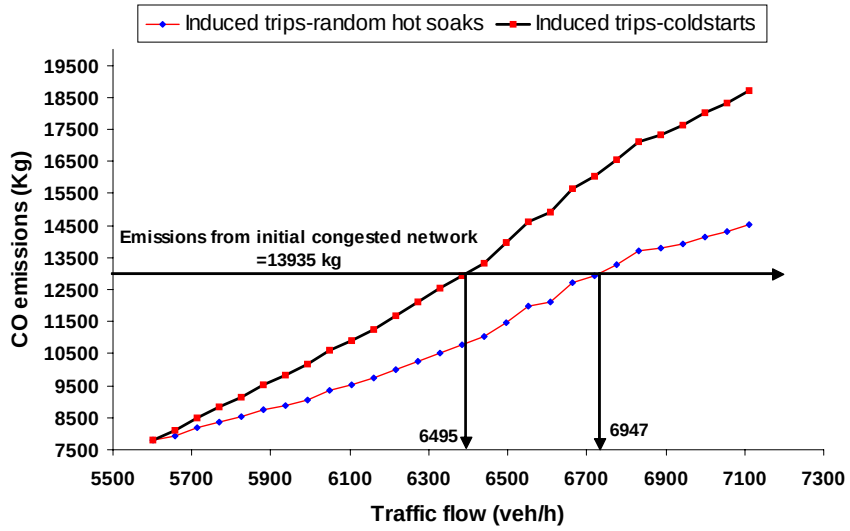

Figure 3: Identification of the break-even point for CO

Simulations were also conducted where the vehicle fleet was varied, ranging from no control technology, to the cleanest possible fleet within the CMEM database. Of interest in these results is that the benefits of smoothing the traffic flow diminish as the fleet becomes cleaner. Thus, while the short term benefits of smoothing traffic are diminished, the long term consequence of inducing more emissions increases, albeit at a much lower level of absolute emissions.

MANUSCRIPTS, PUBLICATIONS AND PRESENTATIONS FROM THIS RESEARCH

Peer-reviewed journal:

- Noland, Robert B., and Mohammed A. Quddus, "Flow improvements and vehicle emissions: effects of trip generation and emission control technology", Transportation Research D (Transport and Environment), 11(1), (2006), 1-14

Presentations:

- Universities Transport Studies Group 2005 Conference, Bristol, 2005
- 9th Annual Computers in Urban Planning and Urban Management, London, 2005
- Successes and Failures in Traffic Demand Management Symposium, Edinburgh, 2005
- 13th World Clean Air and Environmental Protection Congress, London, UK, 2004

Student dissertation:

- Chevallier, Estelle, "A Microscopic Modelling Framework for Estimating Emissions from Traffic Management Policies, unpublished MSc dissertation, University of London, 2005