Title
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Estimating Emissions Using an Integrated Traffic Model

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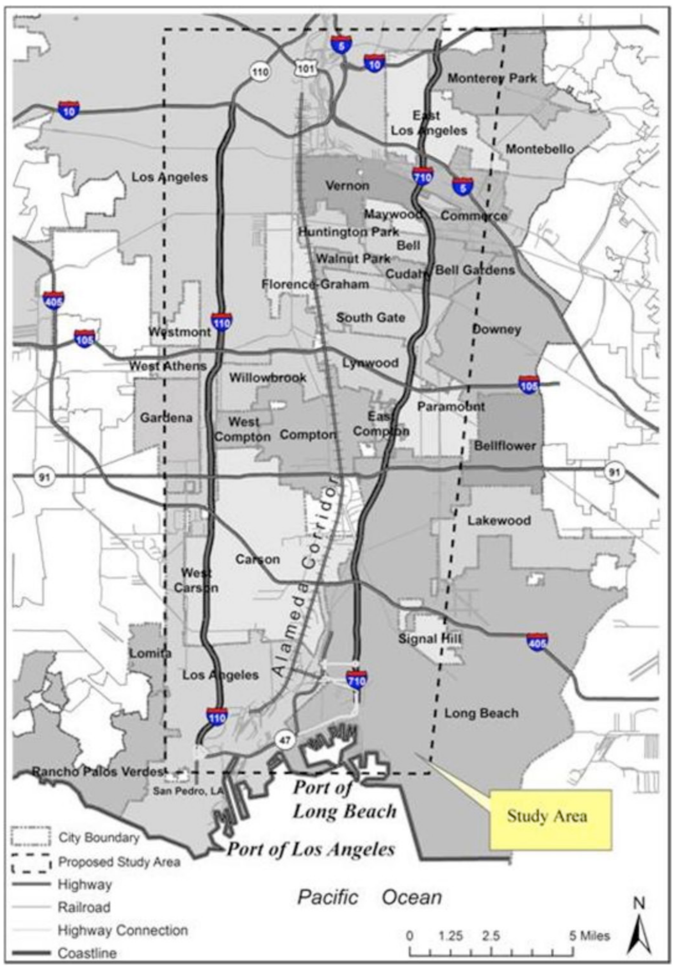
ISSUE

Currently, there is no efficient way to estimate emissions from traffic on big transportation networks, such as the freeway links that connect downtown Los Angeles to the San Pedro Bay Ports complex. This transportation corridor is particularly vital because the ports handle more than a third of the U.S. container trade. Yet the economic vitality of this area is threatened by congestion and air pollution from freight operations.



The study area encompassed the freeway links that connect downtown Los Angeles to the San Pedro Bay ports, which generate enormous economic value that is threat end by the effects of congestion and pollution.

The "gold standard" tool for estimating vehicle emissions is microsimulation, but it can only be used for small and medium-sized networks because of its data and computational demands. Macroscopic models are less data-hungry. However, they are also too coarse to predict air pollutant emissions for specific corridors. In the middle ground, "mesoscopic" models are also available, but can also require exceptional computational power and have other limitations.

RESEARCH FINDINGS

We combined two models in a novel way to estimate emissions for a range of air pollutants on the freeway network serving the San Pedro Bay Ports. Our integrated model, abbreviated as MCDKW, estimates tailpipe emissions from the major

Table comparing estimations by microsimulator and the integrated model of the four major pollutants.

		Total Network Emissions (kg)			
		TOG	NO_x	CO_2	PM_{10}
AM Peak (7 am to 8 am)	Microsimulator (TransModeler)	141.8	586.8	466,503	30.1
	Integrated Model (MCDKW)	146.4	620.5	509,535	31.6
	Difference (%)	3.21%	5.74%	9.22%	4.95%
Night time (2 am 3 am)	Microsimulator (TransModeler)	20.1	105.5	74,442	4.8
	Integrated Model (MCDKW)	18.7	90.7	71,832	4.2
	Difference (%)	-7.00%	-14.00%	-3.52%	-12.18%

The integrated model performed very close to the microsimulator during the AM Peak, when the greatest congestion and emissions are found.

pollutants found in the corridor: carbon dioxide (CO_2), particulate matter (PM_{10}), nitrogen oxides (NO_x), and total organic gases (TOG). Estimates are comparable to those obtained via microsimulation. Interestingly, results are closest during congested conditions when tailpipe emissions are highest. Most importantly, our integrated model cuts total computational time by an order of magnitude. In addition, our integrated model needs only a single run. And it does not need the same level of detail to represent a freeway network. Such savings are important to cash-strapped governments that need to estimate the likely emission impacts of future transportation and land-use scenarios.

RECOMMENDATION

Regulators concerned with traffic-related emissions on large networks should consider allowing modelers to use mesoscopic traffic models (such as the MCDKW model) that can adequately represent congestion along with appropriate emissions models. This would simplify regulatory analyses, reduce errors, and cut costs.

This policy brief is a product of the University of California Transportation Center, located at UC Berkeley: 2614 Dwight Way, Berkeley, CA, 94720. It is drawn from the full report, "Incorporating Vehicular Emissions into an Efficient Mesoscopic Traffic Model: An Application to the Alameda Corridor, CA" Qijian Gan, Jielin Sun, Wenlong Jin, and Jean-Daniel Saphores, which can be found at http://www.uctc.net/research/papers/UCTC-FR-2011-02.pdf