Vehicle Routing to Mitigate Human Exposure to Traffic-Related Air Pollutants

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Introduction

• ITS technology often aims at improving traffic safety and mobility.
• Recently, more ITS applications have also focused on reducing mass emissions (e.g. CO₂, NOx) and improve environmental performance.
• For example, Eco-signal operations and Eco-routing applications. (see Barth et al., Boriboonsomsin et al., Ahn et al., Rakha et al.)
• However, the applications have not considered from a pollutant exposure/burden point of view.

Route options will lead to different emission/exposure for:

Objectives

• The pollutant exposure of local populations near roadways is estimated and used as a weight for vehicle routing to reduce overall exposure, while also considering economical travel duration.
• Considers a range of details regarding spatial and temporal factors.
• The concept is particularly valuable for routing or regulating high-emitting vehicles near sensitive communities such as schools or disadvantaged neighborhoods.

Modeling Method

Scope

• Only primary fine particle (PM2.5) directly coming out of tailpipes
• Only emissions when vehicles running on roadways
• Time resolution of one hour
• Three case studies in Southern California
• Analysis range from 2010 to 2018 calendar year

Modeling tools

• Traffic model: Riverside County Transportation Analysis Model
• Emission model: EMFAC2014 (http://www.arb.ca.gov/emfac/)
• Dispersion model: R-LINE (https://www.cmascenter.org/r-line/)

Introduction

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Case A: Reseda – Northridge Area

10:00 a.m. on a typical work/school day in May 2010. One heavy-duty diesel semi truck of Model Year 2005

Case B: Long Beach Area

10:00 a.m. on a typical work/school day in May 2018. One heavy-duty diesel semi truck of Model Year 2012.

Case C: BH Neighborhood

10:00 a.m. on a typical work/school day in May 2018. One heavy-duty diesel semi truck of Model Year 2012.

Facilities, origins, destinations, and example trips in Long Beach Area

Areas for future improvements:

• It is found that the total pollutant exposure by target population groups can be greatly reduced with small adjustments to route choice.

Conclusions and Future Improvements

• Collect traffic, weather, and population activity datasets in real time. More population groups, such as workers, commuters’ exposure can be accounted for.
• Fuel consumption, carbon dioxide emissions, and economic impacts should also be evaluated.

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