Minimizing the Impact of Freight Traffic on Disadvantaged Communities

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Project Objective

The authors assessed whether eco-routing of freight traffic can improve transportation sustainability, and studied the cost-benefit trade-off for a carrier accounting for emissions in its routing decisions. They also explored geofencing as a tool to protect disadvantaged communities from freight traffic impacts.

Problem Statement

Freight traffic can have a disproportionate impact on disadvantaged communities, including reduced safety, increased congestion, and exposure to pollutants and noise. While there are ongoing efforts targeting truck emissions through the adoption of cleaner and zero-emission vehicle technologies, truck fleet turnover can take a considerable amount of time and resources. In the meantime, operational improvement initiatives can be efficient options for addressing global climate change and reducing local pollution impacts, especially to disadvantaged communities. Policy initiatives that incentivize carriers to account for emissions in their routing decisions (eco-friendly truck routing) could generate short-term emissions reductions while the adoption of cleaner modes of delivery gathers pace.

Research Methodology

The authors developed advanced routing tools to understand the effects of eco-routing in the Southern California Association of Governments (SCAG) region, and the implementation of geographically constrained management strategies.

Results

The authors found that eco-routing can generate significant emissions reductions, but with a potential increased private cost (Figure 1). The current lack of incentives for the carrier and for society and carrier combined creates a barrier to implementing system-wide eco-routing. In some cases, the increase in costs to the carrier outweighs benefits to the society from reduced emissions at current social cost of emission levels. This suggests that the current values of social cost impacts from pollutants are too low.

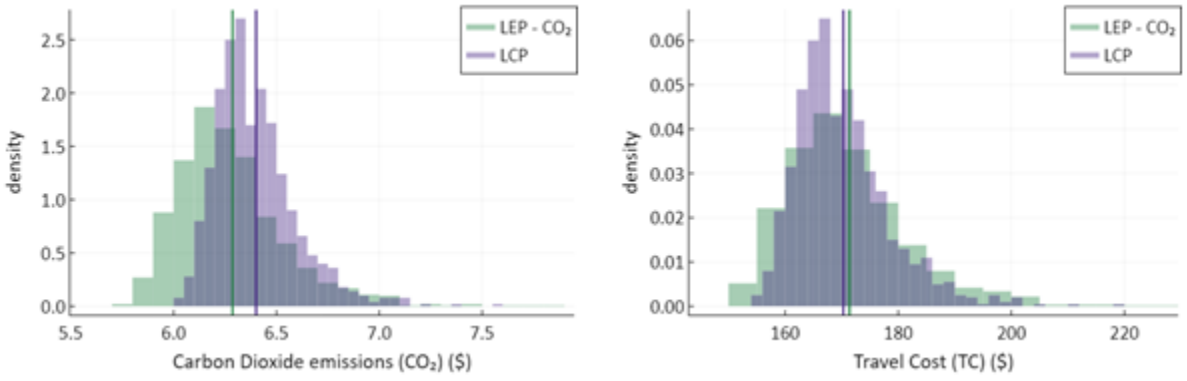

Figure 1. Carbon Dioxide emissions and costs of eco-routing vs. least-cost routing

Given that passenger cars can comprise about 95% of the urban traffic, the system-wide reductions in emissions from network-wide freight eco-routing are modest. Truck eco-routing can generate emission reductions in the order of 1% to 5% at lower passenger car congestion levels. For individual routes, this reduction can be much larger. Without other system interventions, eco-routing can have a greater effect during off-peak hours, i.e., early morning and late night, when passenger car traffic is significantly lower.

While eco-routing can generate localized benefits, it can also shift emissions to other geographic areas (Figure 2). However, simulations showed that spatial variations in emissions did not disproportionately affect disadvantaged communities in the region.

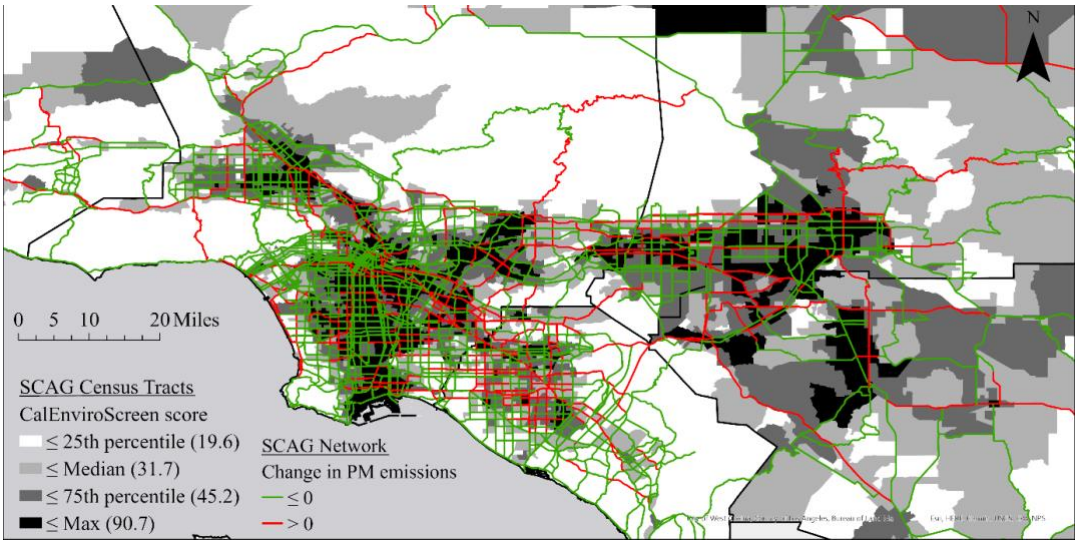

Figure 2. Spatial effects of eco-routing

Geofencing, in which carriers must pay a fee to drive within heavily impacted areas, can be implemented as a tool to reduce exposure to criteria pollutants in specific areas. The authors concentrated on the disadvantaged Southeast Los Angeles (SELA) region, and found that eco-routing and geofencing could reduce emissions by as much as 70% due to reduced truck travel within the geofence, although the geofenced area may also experience increased passenger car traffic. Emissions improvements in the geofenced area would not disproportionally affect, either positively or negatively, other disadvantaged communities in the region (Figure 3).

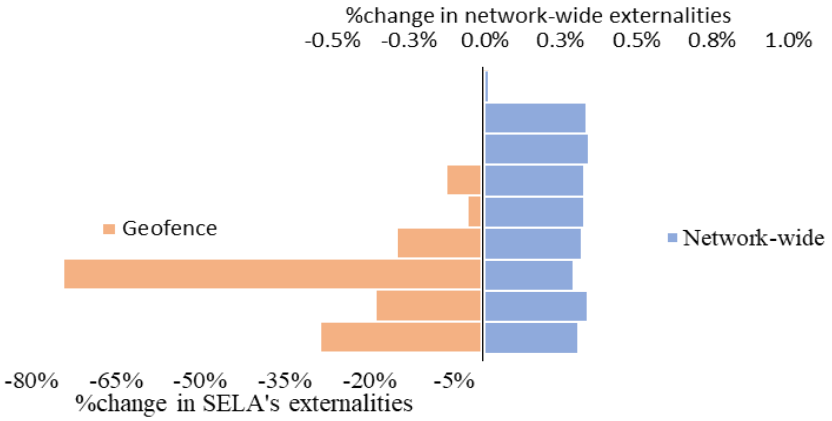

Figure 3. Local and network-wide impacts of geofencing SELA

The full report can be found at https://escholarship.org/uc/item/9qg2318x. For more information about the findings presented in this brief, please contact Miguel Jaller at mjaller@ucdavis.edu.