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Equity Assessment of Transportation Should Incorporate Materials, Supply Chains, and Targeted Mitigation Policies

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Issue

California must build, operate, and maintain transportation infrastructure while ensuring that the health of communities and the planet are not compromised. In addition to vehicle emissions, supply chain inputs and energy use from constructing and maintaining transportation projects (e.g., roads, airports, bridges) result in pollution that contributes to climate change and impacts the health of local communities. Project-specific air and noise pollution can further burden vulnerable populations. By assessing transportation projects using a life-cycle perspective, all relevant emission sources and activities from raw material production, supply chain logistics, construction, operation, maintenance, and end-of-life phases of a project can be analyzed and mitigated.

Our team recently created frameworks to assess the life-cycle human health and climate change impacts from six types of transportation projects: (1) roadways; (2) marine ports; (3) logistical distribution centers; (4) railyards; (5) bridges and overpasses; and (6) airports. We also conducted two case studies, one involving routine resurfacing and vehicle operations on roads within the San Francisco (SF) Bay Area using 2019 data; and the other involving annual marine, cargo, rail, and trucking operations at the Port of Oakland in 2020. Both case studies assessed fine particulate matter (PM2.5) and greenhouse gas (GHG) emissions, noise impacts, and monetized damages to demonstrate how decision-makers can better incorporate the full environmental impacts of transportation systems and equity concerns into mitigation solutions.

Key Research Findings

Road repair and maintenance can significantly contribute to the full scope of impacts from transportation systems. In the SF Bay Area case study, direct emissions from on-road vehicles accounted for only 35% of inhaled PM2.5 relative to road resurfacing and related material deliveries and material/fuel supply chain activities (see Figure 1). The breakdown is almost the reverse for GHG emissions, with 65% of climate change-inducing emissions coming from vehicle operations. In the Oakland case study, emissions from the operation of ocean-going vessels (OGVs) dominate the environmental impacts attributable to port activities since road surface repair and maintenance is limited and fuel consumption is not documented.

Electrification strategies would yield greater relative reductions in GHG emissions than PM2.5 exposure in the SF Bay Area. Complete vehicle electrification would result in an almost 97% reduction in annual GHG emissions, but would only lower human intake of PM2.5 by two thirds as communities would still be exposed to particulates from vehicle brake and tire wear (see Figure 1). Delaying complete

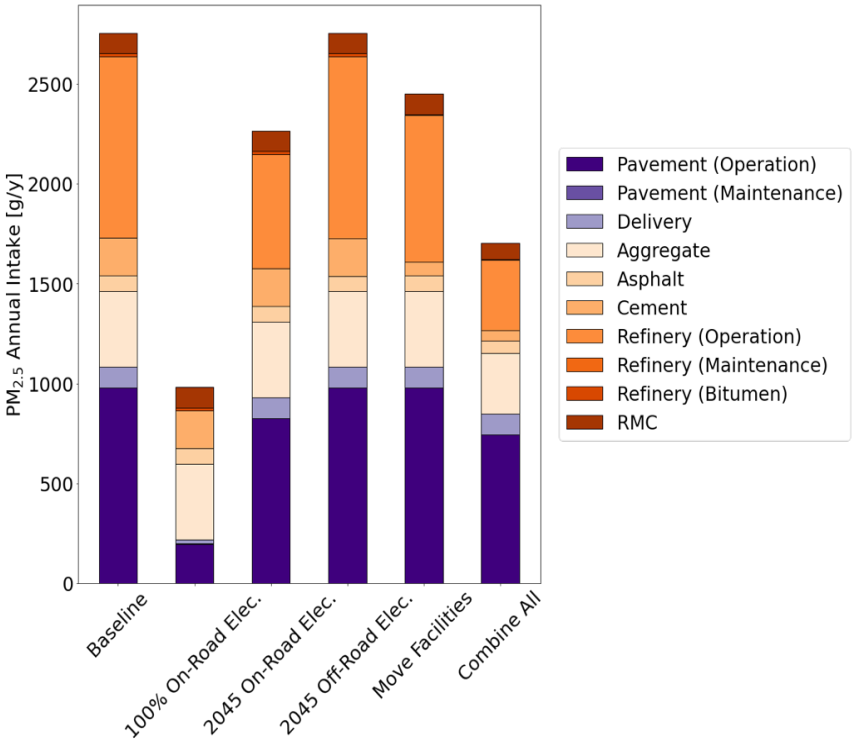

Figure 1. (Annual PM2.5 intake within San Francisco Bay Area for baseline and mitigated conditions.

Notes: Pavement (Operation): Vehicles using roadways; Delivery: Construction material deliveries; RMC: Ready-mixed concrete.

Better accounting of produced and consumed resources can inform analysis. Production volumes for refining crude oil are publicly available at the facility level. Commercial airports publish fuel sales for aircraft. The state should likewise mandate tracking and public availability of the same type of information for concrete, cement, asphalt, and aggregate production facilities. Ports, such as the Port of Oakland, should track and publish fuel sales for OGVs and commercial harbor craft. Publishing these commodity production and consumption data, together with an integrated equity assessment, will aid policy makers in better analyzing the environmental impacts from California's transportation projects.

electrification to 2045 would result in continuing high levels of exposure. Our study suggest that a suite of mitigation strategies is needed to tackle both climate change and health impacts from transportation systems.

Environmental mitigation policies need to be equitable and tailored to address the sources that impact communities the most. Our study shows that emissions and noise pollution differentially affect communities by race and income level. People of color in the Bay Area are disproportionally exposed to PM2.5 from 65% of sources in the SF roadway study, especially from cement, concrete and asphalt production, while the White population is only disproportionately exposed to 47% of sources. The Black population is disproportionally exposed to 97% of the pollution sources attributable to the Port of Oakland, highlighting the need for policies such as AB 617 that address air pollution impacts and environmental justice in local communities.

More Information

This policy brief is drawn from the UC ITS report "Mitigating Exposure and Climate Change Impacts from Transportation Projects: Environmental Justice-Centered Decision-Support Framework and Tool" and the peer-reviewed journal article "Pavement resurfacing and supply chains are significant contributors to PM2.5 exposure from road transportation". Both are available at www.ucits.org/research-project/2022-28. For more information, please contact Arpad Horvath at horvath@berkeley.edu.

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