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# Exposure to Traffic-Related Air Pollution is Rarely Considered When Planning Bicycle Routes but It Should Be

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## Issue

Local, regional, and state agencies in California are making efforts to increase bicycle infrastructure and ridership. In most areas, bicycle routes are a subset of vehicle routes and new bicycle infrastructure is created by adding bicycle lane(s) to existing roadways. The planning process for identifying bicycle routes typically considers available right-of-way, existing roadway infrastructure (e.g., presence of bridges, number of intersections), vehicular traffic volume, safety concerns, and built environment factors (e.g., attractive land uses such as shopping districts, scenic views), among other factors. However, exposure to traffic-related air pollution is rarely considered in this process. This oversight can have negative impacts on bicyclists given they are directly exposed to vehicular exhaust and experience an increased breathing rate during biking. Exposure to traffic-related air pollution has been proven to contribute to a wide range of health problems such as lung and heart diseases<sup>1,2</sup>.

## Key Research Findings

**Considering the exposure to traffic-related air pollution can change the outcome of bicycle route planning.** To illustrate this point, we compare two alternative bicycle routes for connecting the City of Riverside's downtown with the University of California, Riverside campus (Figure 1). Ten factors are included in the analysis: connection to desirable land uses (e.g., employment zones, parks, schools, transit centers, shopping districts), posted speed limit, total number of lanes, road shoulder width, traffic volume, terrain and road grade, roadside parking, presence of physical barriers (e.g., bridges, number of intersections), and total exposure to traffic-generated fine particles (one type of air pollution that can cause lung and heart diseases). When the total exposure to fine particles is left out of the analysis or given a lower weight relative to the other factors, the University Ave. (road segment between red dots in Figure 1) is identified as the best bike route option. However, if the total exposure to fine

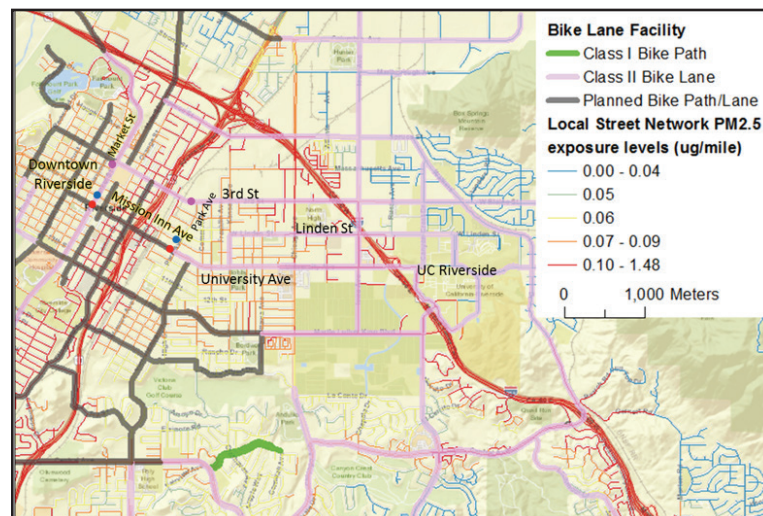


Figure 1. Road segments between red dots and between blue dots represent two alternatives for a new bicycle route in the City of Riverside, California.

particles is included in the analysis and given a higher weight relative to other factors, then Mission Inn Ave. (road segment between blue dots in Figure 1) is the better bicycle route option.

**Traffic volume alone is not a sufficient surrogate for the level of traffic-related air pollution on the road.** While, in general, more traffic on a road means poorer air quality, this is not always the case. The level of traffic-related air pollution on any road also depends on how congested the traffic is, the type of vehicles (e.g., cars or trucks) on the roadway and the age of the vehicles, weather conditions (e.g., wind speed and wind direction), terrain (e.g., open road in suburb or street canyon in central business district), and other factors. To obtain air pollution data for the purpose of bicycle route planning, the level of traffic-related air pollution on the roads should be measured, if possible, or modeled by considering these other factors.

**The spatial resolution of existing air quality data is not adequate for bicycle route planning.** There are only 40 air quality monitoring stations in the six-

county region of the Southern California Association of Governments. This means, for many cities, the entire city is represented by a single air quality reading. This is not sufficient for bicycle route planning as the variation in the levels of air pollution on different roads in the city are not captured. Therefore, it is not possible to tell whether the air quality on one route is better or worse than the air quality on another route.

### Further Reading

This policy brief is drawn from the “Biking in Fresh Air: Consideration of Exposure to Traffic-Related Air Pollution in Bicycle Route Planning” research report prepared for the California Department of Transportation by Kanok Boriboonsomsin and Ji Luo with the Center for Environmental Research and Technology at University of California, Riverside. The report can be found here: <https://ncst.ucdavis.edu/project/biking-in-fresh-air-consideration-of-exposure-to-traffic-related-air-pollution-in-bicycle-route-planning-2/>

<sup>1</sup>Weichenthal, S., R. Kulka, P. Bélisle, L. Joseph, A. Dubeau, C. Martin, D. Wang, and R. Dales. Personal exposure to specific volatile organic compounds and acute changes in lung function and heart rate variability among urban cyclists. *Environmental research*, Vol. 118, 2012, pp. 118-123.

<sup>2</sup>World Health Organization. *Health effects of transport-related air pollution*. Edited by Michal Krzyzanowski, Birgit Kuna-Dibbert, and Jürgen Schneider, ISBN 92-890-1373-7, 2005.

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