Reducing Emissions and Noise at Truck Bottlenecks:
I-90/94 in Chicago, IL

U.S. Department of Transportation
Federal Highway Administration

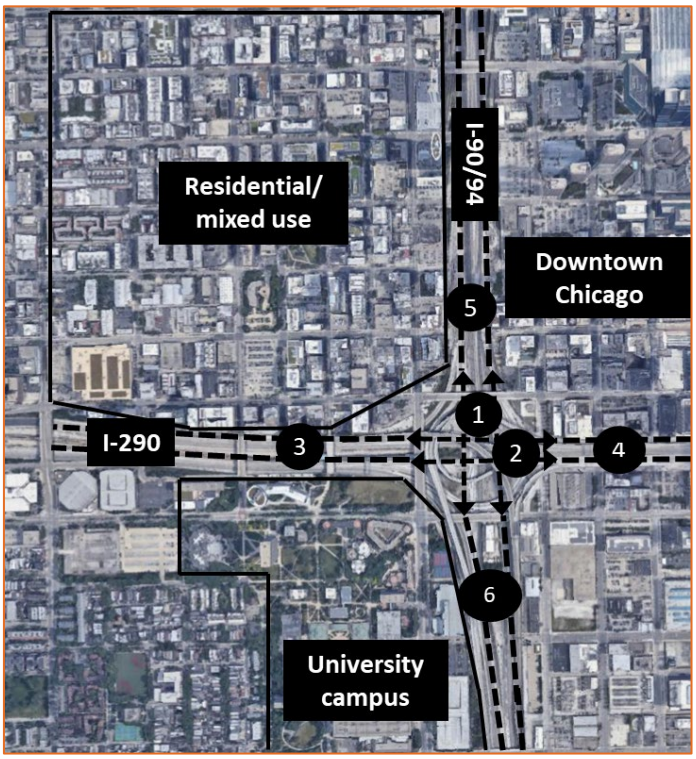
About the Research

The FHWA undertook research to provide information on strategies to address truck emissions and noise at truck freight bottlenecks, including major highway bottlenecks and intermodal connectors. The effects of hypothetical strategies including infrastructure, operations, vehicle technology, and noise-specific measures, were modeled at three case study locations.

Area Overview

Interstate 90/94 through central Chicago, IL ranks among the top 25 truck bottlenecks in the U.S. based on total truck delay per mile. This highway carries over 200,000 vehicles per day, of which 11–16 percent are trucks. Chicago is a major manufacturing, warehousing, and logistics hub and nearly 60 percent of the heavy truck traffic on I-90/94 have at least one destination within the region.

A multiyear project is underway to reconstruct the I-90/94 interchange with I-290 serving the western suburbs. Adjacent to this interchange are found high-density residential and mixed-use neighborhoods, as well as a major university campus.



Numbers show modeled links.
Aerial image source: Google Earth.

Overall Findings

Capacity and/or operational strategies to maintain higher peak period speeds could reduce emissions.

Truck replacement and clean truck strategies could have large emissions benefits if applied to most trucks serving the region.

Noise benefits of strategies affecting traffic flow were very small. Noise-specific measures may be needed to substantially reduce noise from trucks.

The additional volume of trucks that might be shifted to rail on this corridor is small compared to total truck volumes. The expected emissions and noise benefits are also small.

Hypothetical Strategies Tested in Chicago

Six strategies were tested for emissions impacts (CO, VOC, NO_X, $PM_{2.5}$, PM_{10}, CO_2e, MSATs) and four strategies were tested for noise impacts in this case study. Note these are hypothetical strategies and results may vary by location and input assumptions.

Reconstruct I-90/290 interchange

Reduces emissions by up to 7% in the morning and up to 15–20% in the afternoon peak. Very small noise reduction (<1 decibel) in the peak noise hour.

Truck-only lanes

Reduces emissions by 5–64% depending upon the pollutant and time period. Very small noise reduction (<1 decibel).

Connected/automated vehicles maintaining free-flow for all traffic

Reduces emissions of most pollutants by 20–70% in peak periods.

Retire and replace pre-2007 trucks

Reduces pollutant emissions by 10–17% by replacing all older local trucks (7%), or up to 26% by also replacing older through trucks (11%).

Electrify trucks

Reduces emissions up to 3% at 2030 projected market penetration levels (3–5%) and 7–22% at 2045 levels (20-45%); very small noise reduction (<1 decibel).

Shift through truck traffic to rail

Reduces truck emissions by less than 1% for shifting half of Detroit-Milwaukee tonnage.

Create buffer zones

Reduces noise by up to 5 decibels for a 100-foot buffer zone when no noise barrier is present, or 1 decibel when a barrier is already present.

Methodology and Key Assumptions

- Emissions and noise from on-road vehicles (cars, trucks, buses) were modeled using the U.S. EPA MOVES3 model (7–8 a.m. and 4–5 p.m. weekday traffic) and FHWA Traffic Noise Model v3.0 or v3.1 (4–5 p.m. weekday traffic). Rail emissions and noise are not included.
- Baseline traffic volume and speed data were taken from the FHWA Database for Analysis of Noise and Air Quality (DANA). Changes in vehicle activity are based on a variety of assumptions documented in the project report.
- The hypothetical strategies have not been evaluated for feasibility, costs, or other benefits or impacts. Nothing in this case study should be construed as a recommendation.