

TRANSFORMING IDEAS INTO SOLUTIONS

Research Results

Environmental April 2025

Project Title:

Assessment of Paved Road Dust Emissions (Road Dust) Modeling

Task Number: 3785

Start Date: January 2, 2022

Completion Date: December 31, 2024

Task Manager:

Simon Bisrat Senior Environmental Planner simon.bisrat@dot.ca.gov



DRISI provides solutions and knowledge that improves California's transportation system.

Assessment of Paved Road Dust **Emissions (Road Dust) Modeling**

This task is intended to provide Caltrans engineers and planners new methods for assessing road dust, and new baseline data on the scope and scale of road dust in the State Highway System.

WHAT WAS THE NEED?

As exhaust (tailpipe) emissions of particulate matter (PM) from motor vehicles continue to decrease over time, road dust emissions have become an increasingly important component of project-level PM emissions. Air quality specialists must use the United States Environmental Protection Agency's (U.S.-EPA) Emission Factor Handbook (AP-42) road dust equation to estimate road dust PM emissions in project-level air quality analyses. However, as described in one of the California Department of Transportation (Caltrans) Division of Environmental Analysis Tech memos (Title: Assessment of Paved Road Dust Emissions Modeling Methods) dated June 30, 2020, there are several key limitations in the current AP-42 road dust emission factor model that contribute to an unknown magnitude of uncertainty in estimating PM road dust emissions in air quality analyses in Caltrans projects. Moreover, the current AP-42 road dust emission factor model has not been verified against high traffic volume transportation projects (note that high traffic volume can be easily found in most of urban areas in California). Accordingly, PM road dust emissions by the current AP-42 method for California freeways with high volumes are questionable. In fact, it is believed that the current AP-42 road dust method would likely yield biased PM emissions for high traffic volume transportation projects. Accordingly, a more reasonable and realistic road dust PM emission factor model is needed for air quality analyses in Caltrans projects.

WHAT WAS OUR GOAL?

The goal of this research project was to deliver a more reasonable and realistic road dust (PM10 and PM2.5) emissions factor model (equation), and field testing means, for

ADA Notice: Users with accessibility issues may contact the California Department of Transportation, Division of Research, Innovation and System Information. For TTY assistance, call the California Relay Service at 711, email: pm2.communications@dot.ca.gov or write Caltrans, DRISI - MS-83, P.O. Box 942873 Sacramento, CA 94273-0001



Assessment of Paved Road Dust Emissions (Road Dust) Modeling



WHAT DID WE DO?

Under this task, a novel road dust collection system has been designed that utilizes a modified van with a vacuum collection system that samples road dust on freeways. They then tested the road dust collection system in a range of traffic flows from 1000 vehicles per hour to 14,000 vehicles per hour in the State Highway System. The specific geographic scope of the study occurred in CA-91, CA-60, CA 71, CA 55, I-15, I-215 freeway, Chicago Avenue, and lowa Avenue across 3 counties of California. Based on the data sets collected at these locations, the researchers designed a new mechanistic model for PM emissions estimates.

WHAT WAS THE OUTCOME?

The van-based road dust collection system effectively sampled road dust on freeways, without disrupting traffic. Further, the researchers demonstrated the utility of the novel mechanistic model, determining the quantity, distribution, composition and additional characteristics of road dust in the test area. This model provides comparable PM emissions estimates to the U.S.-EPA standard AP-42 model and may be more broadly applicable to a wider range of conditions, including high traffic. Road dust is a significant pollutant of concern, and this research expands the state of knowledge regarding how to study it further.

WHAT IS THE BENEFIT?

The results of this project provide Caltrans and other regulatory agencies a new, efficient, and scalable method for assessing road dust's impact to air quality on highways and urban roads. That is valuable because the scope and scale of road dust pollution is not very well understood, but these are expected to increase. That is due to various factors including California's projected population growth with additional vehicle miles traveled in the State Highway System, and with heavier-duty car adoption such as electric vehicles, which currently emit comparably higher PM from brakes and tires (two of the primary constituents of PMs) than conventional cars, on a per-vehicle basis. Therefore, if utilized further, this collection system and mechanistic model could extend Caltrans ability to test for road dust across at the project level and the larger State Highway System scale, to develop improved models in the future. Such a model, that more fully characterizes road dust existing conditions and how the pollutant levels change would provide Caltrans and other regulatory agencies a clearer understanding of the scope and scale of road dust, and when to consider regulatory adjustments. The model may also be developed further and potentially considered in the future as a Federal Equivalent Method regarding road dust emissions. That would improve Caltrans transportation project planning process, test novel road dust mitigation methods, advance the Department's compliance with the California Environmental Quality Act and National Environmental Policy Act more efficiently, and ultimately support improved public health.

Research Results

LEARN MORE

https://dot.ca.gov/-/media/dot-media/programs/ research-innovation-system-information/documents/ final-reports/5-task-3785-final-report-combined-2.pdf

The contents of this document reflect the views of the authors, who are responsible for the facts and accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the California Department of Transportation, the State of California, or the Federal Highway Administration. This document does not constitute a standard, specification, or regulation. No part of this publication should be construed as an endorsement for a commercial product, manufacturer, contractor, or consultant. Any trade names or photos of commercial products appearing in this document are for clarity only.

© Copyright 2025 California Department of Transportation. All rights reserved.