Bentley®
Advancing Infrastructure

Improving Community Health through Detailed Emissions Modeling

Using Streetlytics Data, the Bay Area Air Quality Management District Was Able to Develop an Accurate Roadway Emissions Inventory

Project Summary

Organization:
Bay Area Air
Quality Management District

Solution:
Roadway Emissions Inventory
Powered by Streetlytics

Location:
West Oakland,
California, USA

Project Objective:
- To identify disparities in health outcomes due to air pollution in West Oakland.
- To develop targeted strategies for reducing emissions and exposures that will benefit West Oakland residents.

Products Used:
Streetlytics®

Fast Facts

- Streetlytics data enabled the Air District to develop a detailed emissions inventory along each roadway segment in West Oakland.
- The Air District found that Streetlytics contained an accurate, detailed roadway map and its associated telematics data not available through other vendors.
- The Air District compared Streetlytics freeway volumes with traffic counts measured by Caltrans and found Streetlytics to be consistent in terms of magnitude, weekday/weekend splits, and diurnal patterns.

The Need

The California Legislature created the Bay Area Air Quality Management District (Air District) in 1955 as the first regional air pollution control agency in the United States. The Air District regulates stationary sources of air pollution in the nine counties that surround San Francisco Bay, with the goal of achieving and maintaining state and national ambient air quality standards.

Since the Air District's inception, the regional air quality has steadily improved in the San Francisco Bay Area with some communities still experiencing higher pollution levels than others. These communities are generally near pollution sources such as freeways, busy distribution centers, and large industrial facilities generating emissions that may adversely impact public health.

In 2017, the California State Assembly passed Assembly Bill 617 (AB617) to reduce exposures in communities most impacted by air pollution. AB617 explicitly places the responsibility for developing and implementing "community focused" strategies on local air districts through partnerships with the environmental justice community. The objective of AB617 is to seek air quality improvements through:

- adoption of an expedited schedule for requiring best available retrofit control technology (BARCT) on existing sources;
- deployment of community air monitoring systems in local communities; or
- development and implementation of an approved community emission reduction plan based on local scale modeling analysis.

West Oakland was selected as the first community to be evaluated under AB617 by the Air District due to its proximity to surrounding freeways, the Port of Oakland, major railyards, and heavy industries. Not only does the Air District's regional modeling identify West Oakland as having the highest estimated cancer risk, but health statistics show that their residents experience higher rates of asthma, cancer, heart disease, and strokes compared to averages across Alameda County.

The Project

The Air District, partnering with local environmental justice advocates, community members, industry representatives, and other stakeholders, formed a Steering Committee to develop a community emission reduction plan, referred to as the West Oakland Action Plan. The goal of this action plan was to reduce the health effects of air pollution in West Oakland through adoption of targeted mitigation strategies. The major pollutants of concern were:

- fine particulate matter linked to respiratory illness;
- diesel exhaust emitted from trucks, ships, and locomotives and generators; and
- toxic compounds leading to potential cancer risk.

Since the health impact varies by one's exposure and location, the Air District developed a bottom-up emissions model that accounted for block-by-block variation in emissions from multiple sources including: the Port of Oakland, trains and railyards, permitted sources, cars and trucks, truck-related business, and ships, ferries, and other harbor crafts.

One critical element of the inventory was obtaining roadway activity data at a local level. To develop a bottom-up inventory, the Air District required detailed and reliable data on the roadway network and corresponding link level vehicle counts and movements.

| Port of Oakland	Trains and Railyards	Permitted Sources	Cars and Trucks	Truck-related Businesses	Ships, Ferries, Harbor Craft
Trucks, ships, harbor craft, locomotives, cargo-handling equipment, and other off-road equipment	Passenger and freight	Metal processors, scrap handlers, diesel engines, backup generators, boilers, and gas stations	Trucks, ships, harbor craft, locomotives, cargo-handling equipment, and other off-road equipment	US Postal Distribution Center, parking, scrap handlers	

The Solution

After discussions with several vendors, the Air District contracted with Citilabs®, now part of Bentley Systems, to acquire Streetlytics data for Alameda and Contra Costa counties as it was found to be the only provider of the detailed roadway telematics needed for the emission inventory and modeling analysis. The following datasets were used in combination with other sources to develop the detailed roadway emission inventory:

1. An accurate geospatial roadway network

2. Average vehicle counts by season, day of week, and hour of day along each roadway segment

3. Average vehicle speed per hour for each roadway segment

4. Roadway segment characteristics including number of lanes, length, mode of travel restrictions, truck routes, truck prohibitions, roadway type, and roadway surface type

Using the Streetlytics data combined with emission factors from EMFAC2017 and other supplemental data, the Air District was able to develop a detailed emissions inventory that included running exhaust, running loss, tire wear, brake wear, and resuspended road dust along each roadway link in West Oakland. An example of the detailed segment specific emissions results is provided in the graphic at the top of the right-hand column.

In 2020, after a successful delivery of the first four items, the Air District expanded their use of Streetlytics data by acquiring the complete nine-county San Francisco Bay Area dataset. This will allow the Air District to develop detailed roadway emissions inventories for the remaining communities selected in the Bay Area under the AB617 program over the next five years. The Air District has also amended the contract to include the purchase of a much-needed roadway elevation dataset for the Bay Area to improve the accuracy of the modeling analysis. Streetlytics plans to expand their comprehensive suite

2017 Average Daily Emissions of PM2.5 on Weekday

PM2.5 (g/day)
- 0 – 10
- 10 – 50
- 50 – 100
- 100 – 500
- 500 – 1,000
- 1,000 – 10,000
- 10,000 – 15,000
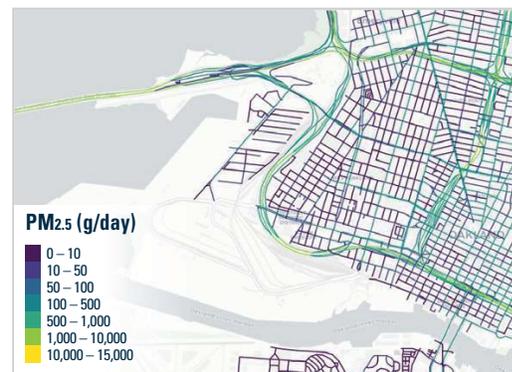
of transportation related datasets by offering products defining truck splits by roadway links and surrounding building heights.

Stakeholder/End User Benefits

The modeled results from the roadway analysis were combined with results from the other source categories to develop a comprehensive exposure and risk map for West Oakland. The findings show neighborhood variations in predicted cancer risk and exposure to fine particulate matter depending on their proximity to significant sources. The figure below shows that West Oakland neighborhoods such as Third Street, West Prescot, and Seventh Street are near high-emission sources and have high cancer risk. However, the Hoover-Foster area had less emissions and a lower cancer risk.

Based on the analysis, the Steering Committee recommended targeted strategies aimed at reducing emissions from the most important sources in West Oakland, reducing exposures by filtering pollutants, and moving pollution sources away from residents. The goal is to achieve an overall reduction in cancer risk of 200 in a million by 2025 and 110 in a million by 2030.

"Without the [Streetlytics] roadway telematics data, the block-by-block contribution from trucks would be the same across all areas," said Virginia Lau, advanced project advisor of the Air District. "Streetlytics data played a vital role in helping us develop the detailed roadway emissions inventory."

Neighborhood Sources and Targets
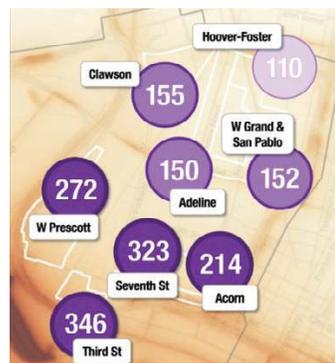
Cancer Risk

Source apportionments drill down into what's responsible