Air Quality Dispersion Model Research:
AERMOD RLINE/XT Source Type

U.S. Department of Transportation
Federal Highway Administration

About the Research of New Source Types in EPA's AERMOD MODEL: Evaluating RLINE and RLINEXT

The Federal Highway Administration teamed up with Georgia Department of Transportation, New Mexico Department of Transportation and the Virginia Department of Transportation to evaluate the latest source type introduced by the Environmental Protection Agency (EPA) in their AERMOD Dispersion Model. Additional information on these source types can be found in EPA's Guidance on New R-LINE Additions.

Project Purpose

- Evaluation of the AERMOD RLINE and RLINEXT source types to help determine usability.
- Comparison of run times of the new source types versus existing AERMOD VOLUME and LINE source types.
- Verification of the model operation by conducting detailed analysis to improve understanding of where further model development may be needed.
- Potential use of the RLINE source type prior to regulatory approval.
- Methods to simplify process of preparing shapefiles and MOVES files for input into AERMOD.
- Not a model validation exercise.

New Mexico DOT and the **University of New Mexico** teamed up to develop a Geographical User Interface that allows user to take the MOVES files and place them into AERMOD quickly and accurately.

The Python-based tool enables conversion of GIS layers to AERMOD Sources, corresponding emission rates from MOVES output and near-road receptors. Including:

- Generating geometry of RLINE and RLINEXT
- Generating near-road and gridded receptors
- Converting emission rates from per link or mile units to AERMOD units
- Compiling AERMOD "_inp" file
- Running AERMOD
- Organizing results and visualization

The tool can be accessed here: https://github.com/FHWA/GIS_AERMOD_Project

Findings

The continued improvement of regulatory dispersion models for transportation applications depends on enhancing the current model. The researchers identified these enhancements by evaluating the full range of typical transportation applications such as project types, configurations, operating conditions, setting etc. Other applications such as high-volume facilities with and without noise walls require more field data than is currently available.

For more information on dispersion models or any of the documents referenced here, please go to: *https://www.fhwa.dot.gov/environment/air_quality/conformity/methodologies/dm.cfm*

Georgia DOT Partnered with Georgia Institute of Technology

This case study analysis investigates the differences in AERMOD-predicted pollutant concentrations across input source types (AREA, VOLUME, LINE, RLINE, and RLINE/RLINEXT without barriers). AERMOD microscale dispersion modeling was performed for the Atlanta I-75/I-575 Northwest Corridor subarea, including freeway corridors, managed lanes, connecting arterials, and intersections serving the area. Modeling was conducted for all link-receptor pairs, for each hour of the year using the AERMET meteorological files, and emissions rates are estimated using MOVES, based on predicted speed and volume by hour.

Major findings were:

- Differences in concentrations between different source types need additional research.
- Source types influence predictions, but link mass flux, receptor distance to roadway, and wind speed and direction influence concentration estimates much more than the selection of source type.
- Results estimate that the largest differences in concentrations appear near the interchanges with arterials.
- RLINEXT predicted lower concentrations, but modeling barrier effects was challenging. Sensitivity analysis for RLINEXT with barriers suggests that barrier height and distance to the roadway impact predictions, and that these impacts vary with wind direction.

Virginia DOT Partnered with the Consulting Firm AECOM

This research concentrates on the review of trends of concentration predictions for various road configurations by varying inputs using both RLINE and RLINEXT.

This included:

- Simple cases – straight roadway with and without barrier, curve with and without barrier, depressed roadway, elevated roadway.
- Intersection cases.
- Hypothetical freeway in northern Virginia.
- Sensitivity – source height, initial vertical dimension, wind direction.
- Major findings were:
- Concentrations were not as intuitive as expected and concentration profiles seem to be influenced far beyond what would be expected for perpendicular winds.
- The width of the roadway affects the horizontal plume spread.
- The initial plume vertical dimension is related to the meander of the plume.
- Mean plume height has significant effects on the overall prediction of concentrations.
- Barrier algorithms, especially for parallel winds, would benefit from additional research.

Data from Virginia can be accessed here: Zip file https://www.fhwa.dot.gov/environment/air_quality/conformity/methodologies/rline_test_files.zip