

Project Information Form

Project Title:	MOVES-Matrix for High-Performance Emission Rate Model Applications
University:	Georgia Institute of Technology
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Total Project Cost:	\$95,000.00
Agency ID or Contract Number:	GT-DOT-215 DTRT13-G-UTC29
Start and End Dates:	October 2016 – September 2018
Brief Description of Research Project:	<p>The MOtor Vehicle Emission Simulator (MOVES) model was developed by the U.S. Environmental Protection Agency (USEPA) to estimate emissions from on-road and off-road vehicles in the United States. The MOVES model represents a significant improvement over the older MOBILE series of modes, primarily because emission rates are now truly modal in nature. Emission rates are now a function of power surrogates, which depend on speed and acceleration. Traffic simulation model outputs and smartphone GPS data can provide second-by-second vehicle activity data in time and space, including vehicle speed and acceleration. Coupling high-resolution vehicle activity data with appropriate MOVES emission rates further advances research efforts designed to assess the environmental impacts of transportation design and operation strategies. However, the MOVES interface is complicated, and the structure of input variables and algorithms involved in running MOVES to assess operational improvements makes analyses cumbersome and time consuming. The MOVES interface also makes it difficult to assess complicated transportation networks and to undertake analyses of large-scale systems that are dynamic in nature.</p> <p>The MOVES-Matrix system developed by the research team can be used to perform emissions modeling activities in a fraction of the time it takes to perform even one single individual MOVES run. The MOVES-Matrix approach involves running the MOVES model iteratively, across all potential input variable combinations, and using the resulting multidimensional array of pre-run MOVES outputs in emissions modeling. The research team configured MOVES to run on a distributed computing cluster, obtaining MOVES energy consumption and emission rate outputs</p>



	<p>for each vehicle class, model year, and operating condition, by calendar year, fuel composition (summer, winter, and transition fuels), local Inspection/Maintenance (I/M) program, meteorology, and other variables of interest. The team ran MOVES 146,853 times to generate the on-road emission rate matrices for Atlanta. More than 90 billion emission rates populate the primary output matrix, but implementation tools developed by the team generate matrix subsets for specific applications to speed up the analytical processes. In 2017-2018, the team developed MOVES-Matrix 2.0, which now integrates engine start, soak, evaporative, and truck hoteling emissions. The resulting emission rate matrices allow users to link emission rates to assess big data projects (such as regional emissions for emission inventory development) and to support near-real-time evaluations of changes in emissions for large, dynamic transportation systems. In the case study applications performed by the team, emission rate generation with MOVES-Matrix is 200-times faster than using the batch mode of MOVES graphic user interface in the same computer environment and the process predicts exactly the same emissions result.</p>
Describe Implementation of Research Outcomes (or why not implemented): Place any photos here	
Impacts/Benefits of Implementation (actual, not anticipated):	
Web Links <ul style="list-style-type: none">• Reports• Project website	<p>https://ncst.ucdavis.edu/project/moves-matrix-for-high-performance-emission-rate-model-applications/</p> <p>https://escholarship.org/uc/item/3xp5z35t</p>