LTRC Technical Summary Report 433
LTRC Proj. No. 03-2SS ~ State Proj. No. 736-99-1108

January 2009

Louisiana Transportation Research Center

4101 Gourrier Ave., Baton Rouge, LA 70808

Analysis of Louisiana Vehicular Input Data for MOBILE 6

Introduction

The Clean Air Act Amendments (CAAA) of 1990 require that non-attainment and air quality maintenance areas regularly conduct regional emissions analyses. In Louisiana, Baton Rouge and Lake Charles are ozone non-attainment areas while New Orleans is an air quality maintenance area. Eleven parishes in the state were non-compliant with respect to air quality at the time of the study, and the number was expected to increase in the future. The metropolitan authorities in the state felt the need to identify the most cost-effective way to conduct these analyses.

The standard means of estimating vehicle emissions in metropolitan areas is the use of the Environmental Protection Agency's (EPA's) MOBILE model. The most recent version of the model, MOBILE 6, has more comprehensive data input requirements than earlier models. The need thus existed to identify the most efficient and reliable way to obtain the input data for MOBILE 6 applications in metropolitan areas in Louisiana.

Objective and Scope

The overall objective of this study was to formalize the data collection and preparation process that provides, or can assist in providing, input to MOBILE 6 for metropolitan areas in Louisiana. This was achieved by identifying existing sources of data that satisfy at least some of the data input needs, investigating alternative methods of data input collection, developing procedures to prepare input data in the required format, and documenting the data collection and preparation process so that it can be reviewed, assessed, and, if necessary, amended over time.

The developers of MOBILE 6 emphasize that while an extensive set of default values are available for use in the model, local values should be used wherever possible. Since vehicle miles traveled (VMT) is one of the input items that are locally sensitive, alternative methods of estimating local VMT were investigated.

LTRC Report 433

Principal Investigator:
Chester G. Wilmot, Ph.D., P.E.

LTRC Contact:
Chester G. Wilmot, Ph.D., P.E.
Phone (225) 578-4697

Louisiana Transportation Research Center

Sponsored jointly by the Louisiana Department of Transportation and Development and Louisiana State University

4101 Gourrier Avenue
Baton Rouge, LA 70808-4443
www.ltrc.lsu.edu

Research Approach

The research approach adopted in this study was to conduct a literature review, define the input requirements of MOBILE 6, determine existing data, investigate alternative methods of data collection, establish the data in the required format, and document the process. In the literature review, particular attention was given to literature distributed by the EPA, the Travel Model Improvement Program (TMIP), the California Air Resources Board (CARB), and the Transportation Research Board. Information from the literature review was used to identify the input data requirements of MOBILE 6 and the format in which the data is required. Data sources used by agencies conducting emissions analysis in the past were also reviewed and assessed. Past practice in establishing VMT by road type, vehicle class, and time of day, and the sources of data used to establish these values were noted. A procedure to estimate VMT and speed area using Global Positioning System (GPS) instruments in vehicles was investigated. In addition, an alternative means of estimating VMT using a detailed classification of roadway segments and observed traffic volumes from the Highway Performance Monitoring System (HPMS) was tested and evaluated.

Conclusions

Input required by MOBILE 6 includes information on the setting characteristics in which vehicle emissions are being investigated, the fuel used by vehicles in the study area, vehicle fleet characteristics, and vehicle activity. Information on the first two items are easy to obtain since they include information such as altitude, average humidity, and ambient temperature, in the case of the setting of the study, and sulfur content, volatility, and additive level of local gasoline for the second. Vehicle fleet characteristics required by MOBILE 6 include the age, weight, fuel type, and average annual mileage accumulation of vehicles in the study area. The physical features of the vehicle fleet (i.e., vehicle age, weight, and fuel type) can be obtained from local vehicle registration records; however, vehicles observed on the road are not closely matched to registration records due to differential use of individual vehicles. Mileage accumulation rates by vehicle type and age are not easily obtained from existing sources, and the use of national default values included in MOBILE 6 are recommended. The last group of input data, vehicle activity, is the most difficult to obtain. It includes estimates of VMT, speed, and vehicle starts and soaks in the area by class of road, vehicle type, and hour of the day. VMT information is typically estimated using either travel demand models or a method based on traffic counts from the Highway Performance Monitoring Study (HPMS). In the HPMS method, the Annual Average Daily Traffic (AADT) within each category of road (distinguished by functional class, location, and volume group) is assumed to apply to all road sections within that group, and VMT is estimated by multiplying the AADT by the total length of road sections in a group and summing over all categories of roads by functional class, type of vehicle, and hour of the day. The method produces accurate estimates, but it relies on the premise that the volume group of each road section is known. Given that the purpose of the method is to estimate the volume on a road section, it is odd that it should rely on being able to correctly specify the range of the volume of traffic on a section. Proponents of the method argue that by rotating traffic counts among road sections and observing trends in traffic growth, it is not difficult to assign a road section to the appropriate volume group. However, it is not known how well the method works because it can only be tested against those road sections where traffic counts have been made and the road section has automatically been assigned to the correct volume group. If a road section is assigned to the wrong volume group, the error introduced by the method could be large.

An alternative method replacing volume group with a road description in terms of number of lanes, lane width, and speed limit was investigated. When tested on links in the Louisiana highway network that had traffic counts, this method produced a correlation coefficient between estimated and observed AADT values of 0.93. Using the same observation points, the method using volume groups had a correlation of 0.99. However, the volume group method automatically assigns the correct volume group when a traffic count is provided, which includes all the observation points in the test above. It is not known what correlation would be achieved if all sections were included in the analysis. This would provide a true comparison among the methods because the method developed in this study can be expected to provide similar accuracy on the sections without traffic counts as those with traffic counts.

The feasibility of using GPS-equipped vehicles to estimate VMT and speed was tested using data from a six-day GPS-based survey of 100 households in Lexington, Kentucky in 1996. The data set was too small to provide accurate estimates, but it was sufficient to show that the method is feasible. It also showed that in Lexington, freeway VMT would be overestimated six-fold if default values were used, and arterial VMT would be underestimated by 50 percent if default values were used. For local streets in Lexington, local and default VMT values were similar. The difference is due to the few freeways and abundance of arterials in Lexington, but it does emphasize how important it is to use local data rather than default data whenever possible. The speed estimates from the GPS-based survey compared well with the default values by facility type.

Recommendations

1. Local input data to MOBILE 6 should be used whenever possible.
2. Guidelines produced by the EPA regarding the application of MOBILE 6 should be closely adhered.
3. The new method of estimating VMT should be tested against the conventional method in a controlled experiment to determine the relative accuracy of each method.

NOTICE: This technical summary is disseminated under the sponsorship of the Louisiana Department of Transportation and Development in the interest of information exchange. The summary provides a synopsis of the project's final report. The summary does not establish policies or regulations, nor does it imply DOTD endorsement of the conclusions or recommendations. This agency assumes no liability for the contents or its use.