

## **Mobile Source Air Toxics (MSAT) Analysis Quick-Start Guide**

This guide serves as quick overview of the MSAT emissions analysis process. It progresses through the necessary steps, and provides cross-references to the FHWA MSAT workshop materials, which contain additional guidance and technical information. If you have questions on this material, contact Michael Claggett or Jeff Houk with the Federal Highway Administration (FHWA) Resource Center Air Quality Team (contact information is provided below).

Disclaimer: This does not constitute official technical guidance, but reflects our view of a reasonable technical approach, and the approach we use when we conduct analysis. Other approaches may be possible.

### **Step 1 – Identify the affected transportation network**

The simplest scope of analysis is to only calculate emissions for those roadway segments that would be constructed as part of the project. But in order to better capture the MSAT emissions that would be generated as a result of implementing the project, it's best to define an affected transportation network. This would include the constructed roadway segments, as well as other links where traffic volumes are expected to change as a result of the project.

As a practical consideration, a volume change threshold needs to be adopted as the basis for including or excluding links in the affected transportation network. One suggested threshold is a plus or minus five percent change in volumes (rounded to the nearest per cent). Interagency consultation partners may conclude that higher or lower thresholds are appropriate; the key is that these thresholds be applied consistently for all analysis years and project alternatives. (FHWA is not suggesting that areas must develop a separate new traffic analysis methodology strictly for MSAT analysis. Areas will generally need to work with the information they have already developed for other purposes. For very large corridor projects, it may be easier to simply run the regional travel model than to identify a project network.)

Analysts may find that this step results in different affected networks for different alternatives. In cases like this, some analysts prefer to consolidate the networks so that the same roadway links are analyzed for all alternatives, while others prefer to maintain distinct networks for each alternative. Distinct networks allow for the most accurate comparison of percentage differences in emissions between each alternative and No Action, while consolidating the networks facilitates direct comparison of alternatives to each other. Distinct networks may also be a better approach when a project involves alternatives in significantly different geographic locations (alignments) that would affect different populations.

*For more information on this step, see pages 98-100 of the MSAT Workshop Materials. Also, for an actual example, see the “Class Exercise” and “Step 1” tabs of the spreadsheet “Class Exercise.xls”.*

## **Step 2 – Add parameters to characterize travel activity**

The next step is to calculate speeds for the individual links in the affected transportation network, and to identify other travel parameters that might affect emissions and thus should be reflected in MOBILE6.2 modeling. One important parameter is facility type, since MOBILE6.2 calculates emissions factors separately for four different facility types (freeway, arterial, local and ramp), and the speed equations (discussed below) are dependent on facility type. Also important for modeling emissions are VMT fractions (fractions of cars, light trucks, heavy trucks, etc.), which may be different for different roadway links or facility types (depending on available information).

The FHWA workshop relies on a Texas Transportation Institute (TTI) methodology for calculating congested speeds, based on anticipated volumes and capacity. Project alternatives will affect capacity and may also affect volumes. For un-congested situations (in both Build and No Action), daily average speeds may suffice. However, for congestion relief projects, analysts should at least model peak and off-peak speeds, and ideally, hourly speeds. If hourly counts are unavailable for the roadways in question, the MOBILE6.2 default VMT BY HOUR fractions can be used to disaggregate annual average daily traffic volumes (AADT) into hourly traffic volumes for purposes of hourly speed calculations.

The reason for this can be traced to the relationship between emissions and speeds in the MOBILE6.2 model. An “emissions vs. speed” graph for most of the MSATs would look like a hockey stick, with a sharp decline in emissions between 2.5 and 20 mph, and a more gradual decline after that. Thus, it is important to capture the improvements in speeds during congested hours in order to fully reflect the MSAT benefits of reducing congestion. An analysis that uses peak and off-peak speeds, or hourly speeds, will show a larger decline in MSAT emissions between No Action and Build than an analysis that uses daily average speeds. (For the same reason, it might be useful to look at directional speeds, although no one to our knowledge has done this yet for project analysis.)

*See pages 101-104 of the MSAT Workshop Materials and the “Step 2” tab of the spreadsheet “Class Exercise.xls”.*

## **Step 3 – Calculate VMT**

The next step is to calculate vehicle miles of travel (VMT) for each of the links in the affected transportation network. VMT is the product of traffic volume and segment length. This will be used later in the emissions calculations. VMT may be calculated on a daily basis, for peak and off-peak, or hourly, depending on how speeds are calculated.

*See page 105 of the MSAT Workshop Materials.*

#### **Step 4 – Predict MSAT emission factors**

MOBILE6.2 is used to calculate MSAT emission factors for each individual combination of facility type, speeds, and VMT fractions identified in the previous steps. For projects with a very large number of links, it may be more efficient to generate “look-up” tables in MOBILE6.2 for a range of speeds by facility type and VMT fractions. Suggested analysis years are a present-day baseline, opening day, and the design year.

Since MSAT health concerns in the transportation context are related to chronic exposures, the MOBILE6.2 model inputs should reflect annual average conditions – similar to modeling conducted for conformity or State Implementation Plan (SIP) development purposes for particulate matter of size  $\leq 2.5 \mu\text{m}$  (PM<sub>2.5</sub>). These would include annual average temperatures, fuel parameters, etc. Like PM<sub>2.5</sub>, it is possible to use either an annual average, seasonal, or monthly approach; however, since the goal is to generate emissions estimates only for comparison of alternatives and No Action, an annual average approach may be all that is really necessary.

Diesel particulate matter (DPM) emission factors are not calculated directly by the model. Users need to multiply the “Total Exhaust PM” emission factor for each of the diesel vehicle classes (LDDV, LDDT, and HDDV) by the corresponding VMT fraction, and sum the results. This will result in a VMT-weighted composite DPM emission factor. Note that the DPM emission factor will not change with speed or facility type, unlike the factors for the other MSATs.

*Pages 106-192 of the MSAT Workshop Materials provide guidance on MOBILE6.2 MSAT modeling. Pages 175-209 present several modeling tools developed by the FHWA Resource Center to assist with MSAT emissions modeling. Pages 177-188 are a MOBILE6.2 Implementation Summary table that presents all of the relevant commands and data sources in table format. Pages 189-192 provides an example MOBILE6.2 input file for project-level MSAT analyses. Pages 192-209 gives details on FHWA’s Easy Mobile Inventory Tool (EMIT) for developing mobile source emission factors and emission inventories.*

#### **Step 5 – Compute MSAT emissions**

Once emissions factors are generated with MOBILE6.2, calculating emissions is a simple matter of multiplying VMT for each link by the speed-specific emissions factor for each link, and then summing all the links. Pay attention to units—the diesel particulate emissions factor will be in grams per mile (or g/VMT), while the emissions factors for the other MSATs are reported in milligrams per mile (or mg/VMT).

*See pages 107-108 of the MSAT Workshop Materials.*

If you have additional questions, please contact:



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