

HOW TO MEASURE VEHICLE MILES OF TRAVEL (VMT) FOR AIR POLLUTION AND GREENHOUSE GAS (GHG) EMISSIONS

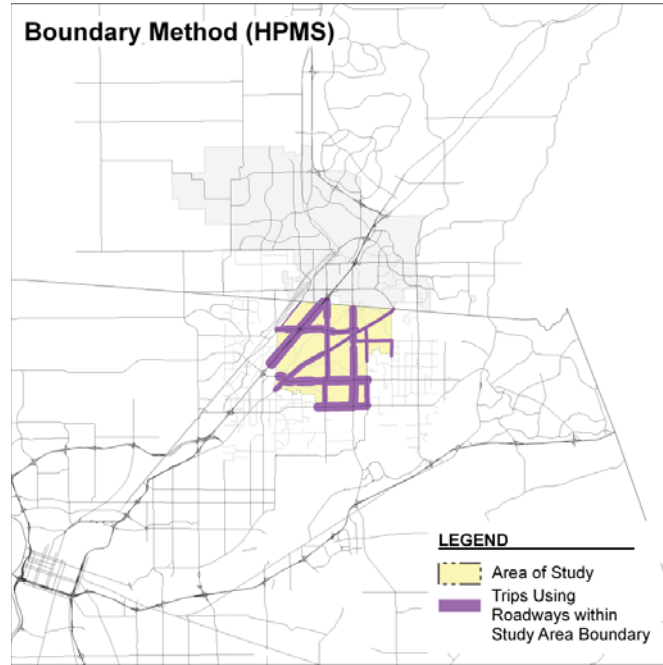
The current state of the practice for measuring VMT to estimate air pollutant or GHG emissions includes the following two accounting methods.

- **Boundary Method** – a boundary based estimate captures all the VMT on a roadway network within a specified geographic area such as the physical limits of a city or project area. A common source of boundary-based VMT is the Highway Performance Monitoring System (HPMS). The HPMS estimates VMT for all roadways within cities and counties based on their jurisdictional boundaries even if those roadways are interstate freeways carrying a significant amount of interregional travel.
- **Origin-Destination (OD) Method** – an OD estimate tracks all the vehicle trips being generated by a geographic area (i.e., a city) across the entire regional network. This method allows for the isolation of different types of VMT as follows.
 - o Internal-internal (II) VMT: Includes all trips that begin and end entirely within the geographic area of study.
 - o One-half of internal-external (IX) VMT: Includes one-half of trips with an origin within the geographic area of study and a destination outside of this area. This assumes that the geographic area under study shares half the responsibility for trips traveling to other areas.
 - o One-half of external-internal (XI) VMT: Includes one-half of trips with an origin outside of the geographic area of study and a destination within this area. Similar to the IX trips, the geographic area of study shares the responsibility of trips traveling from other areas.
 - o External-external (XX) VMT: Trips through the geographic area of study are not included. This approach is consistent with the concept used for the IX and XI trips. Therefore, the XX VMT would be assigned to other areas that are generating the trips.

A visual representation and comparison of the VMT estimation methods is provided below. The boundary based method is commonly used in GHG inventory preparation because the data is readily available through the HPMS. However, as shown below, the boundary-based method tends to underestimate VMT by not accounting for the full length of trips. For CEQA, we recommend use of the OD method to fully account for all the VMT generated by the area of study. This allows for a complete understanding of VMT generation and should lead to more effective mitigation measures. Some agencies though may require use of the boundary based estimate (i.e., the Bay Area Air Quality Management District) because air pollutants and GHGs are typically measured with stationary devices that can only register emissions from the vehicle traffic passing by. In these cases, we should strive to provide both estimates. We also recommend stratifying the VMT estimates by speed increments (i.e., 0-5, 5-10, 10-15... miles per hour) for use with emissions models such as EMFAC or MOVES to generate final emissions estimates.

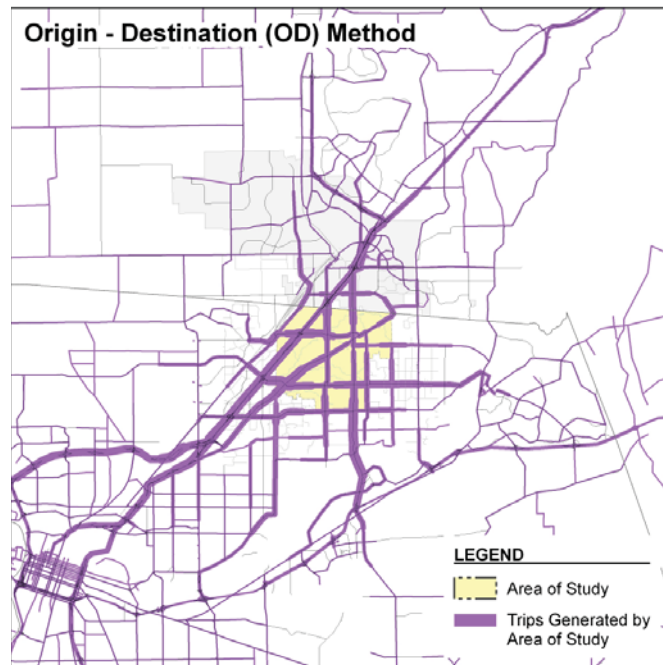
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CASE STUDY: City of Citrus Heights, CA



Year 2005 VMT Estimate

Total Daily VMT (HPMS) - 1,000,110



Year 2005 VMT Estimate

II Daily VMT - 136,025
IX Daily VMT - 630,440
XI Daily VMT - 623,013
Total Daily VMT - 1,389,478