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### PEER REVIEW OF “POPULATION AND ACTIVITY OF ON-ROAD VEHICLES IN MOVES201X”

This report is well written, and methodologies and assumptions are adequately described. EPA staff have applied sound methodologies to address the data gaps.

The emergence of fine-grained vehicle activity data such as vehicle telematics has provided a great opportunity to establish the values of MOVES parameters based on larger and more representative data. The reviewer strongly supports the use of these and other similar datasets in updating MOVES parameters and methods.

## GENERAL COMMENTS:

- The methodologies and datasets described in the document are substantial improvements to the MOVES model. Some of the national values described in the document are widely used by practitioners for SIP and conformity analyses. Any improvement to them based on more recent data from larger samples will translate into more accurate emissions inventories.
- FHWA, state DOTs, and state air agencies have also started initiatives to use these new sources of data for establishing local and regional parameters used in MOVES-based emissions inventories. EPA and FHWA can play a central role to coordinate these efforts which can greatly benefit all parties.
- Section 3.2. – AEO numbers are influenced by assumptions regarding energy prices and can vary between different releases of the AEO report. The reviewer suggests an evaluation of the impact of these changes on the numbers used for MOVES.
- Section 3.2. – AEO has multiple scenarios. Please specify which scenario was adopted to be used for MOVES. The reviewer suggests including more details on AEO assumptions and methods that are relevant to the numbers used for MOVES.
- Section 6.2.2 – The light truck vs. cars population and their driving behaviors have seen substantial changes since 2001. The reviewer suspects that RMAR of 0.885 might not be a valid number anymore.
- Section 6.2.2 - The reviewer is surprised to see that vehicle types 31 and 32 have the same RMAR. The reviewer suspects that vehicle types 21 and 31 have similar usage patterns and probably the same RMAR.
- Section 6.2.3. – The reviewer suspects that the assumption of “the same annual mileage accumulation rate for each age” might not be valid for older school buses. Old school buses are often retired to other uses such as kid’s clubs or after school programs that might have different usage patterns.
- Section 6.2.4 – Cities and local governments track the mileage and fuel usage of their fleet. These datasets could be a useful resource for quality control and validation purposes.
- Section 9.1. - A TxDOT research study developed local drive schedules for major metropolitan areas of Texas. These drive schedules and the data used

for developing them can be used for quality control and validation purposes by EPA.

- Section 10.1.1 – Please specify the basis for selecting the list of states that Verizon Telematics data was acquired.
- Page 69, Section 10.1.1 – “All of the activity by vehicles was assumed to occur within the county assigned to the vehicle by their registration location.” This is a common assumption by practitioners when performing emissions inventories. However, it is a common knowledge that it is not accurate. Has there been any evaluation of the potential biases or errors because of this assumption?
- Page 87 - Please specify the basis for assuming 80% for hotelling time to power accessories.
- Page 108 – Has there been any validation of the assumption of “all trips are 10 hours long”?
- Section 14.2 & 14.3 – the reviewer suspects that Equation 21 might lead to overestimation for urban counties and underestimation for rural counties. Has there been any evaluation of the impact of the underlying assumptions of Equation 21?

## PEER REVIEW CHARGE QUESTIONS:

1. *Do you have any recommendations of better sources or techniques for projecting bus populations and VMT estimates?*

Travel Demand Models (TDM) and transportation conformity documents from nonattainment areas can be a useful source of information for projecting transit bus VMT. The VMT projections are derived from the best local knowledge (especially land use and demographics) available at the time of the analysis and in theory one of the most reliable sources for VMT projections. The transportation conformity documents are generally available through MPOs' websites.

The following table shows an example from North Central Texas Council of Government's (NCTCOG) 2016 Conformity Document (Section 5.6.1, available at <http://www.nctcog.org/trans/air/conformity/2016TransportationConformity.asp>).

Transit Name	2017	2027	2037	2040
DART Bus	71,308	79,175	90,049	90,049
FWTA Bus	17,903	31,532	38,658	38,672
DCTA Bus	3,583	6,379	6,379	6,379
Rail	18,795	23,623	37,410	37,410
<b>Total Daily VMT</b>	<b>111,589</b>	<b>140,709</b>	<b>172,496</b>	<b>172,510</b>

Besides nonattainment areas, all medium and large metropolitan areas in the U.S. have travel demand models that produce VMT projections. EPA can potentially obtain the travel forecasts from a large sample of metropolitan areas working with organizations such as Association of Metropolitan Planning Organizations (AMPO).

VMT projections from the above sources can be used for validation and quality control.

2. *Are there any sources of vehicle survivability or scrappage information that are missing, particularly for heavy-duty vehicles? Are there alternatives to this approach for estimating age distributions for future calendar years?*

The reviewer is not aware of any alternative sources of information for vehicle survivability or scrappage. All the applications that the reviewer has encountered to-date are based on MOVES defaults.

3. *As described in Sections 10 and 12, EPA intends to use information from instrumented vehicles to develop default inputs for idle and start activity for heavy-duty trucks. EPA has not yet completed this analysis, so the draft report does not include results. However, EPA would appreciate feedback on its proposed techniques and data sources.*

The proposed techniques and overall methodology are valid and appropriate for extracting information regarding start and idling activity for HDVs. While the datasets are valid, the reviewer has a concern about the representativeness of them to establish national default values. A more diverse sample (i.e. from more states) would address this concern. I am aware of at least one HDV data collection effort in Texas that might be of use for this purpose. A survey of subject matter experts at TRB Annual Meeting 2018 can help identifying other potential sources of data relevant to this purpose.

4. *In Section 11, EPA has updated the national default hotelling rate to be consistent with current hours-of-service regulations. For this updated report, EPA evaluated studies of extended activity to inform the hotelling rate, but found that the studies did not report hotelling activity data in sufficient detail for EPA to update its national hotelling rate. For example, Frey et al. (2012) did not report extended idle and APU usage that occurred for stop durations between 3 and 7 hours, and less than 15 minutes. As described in Sections 10 and 12, EPA is currently analyzing truck activity data from the instrumented truck database maintained by the National Renewable Energy Laboratory (NREL). From this data set, EPA can obtain detailed data on extended idling, but not hotelling activity when the main engine is not on, including when the driver is using an APU. By using EPA's current hotelling activity distribution assumptions about the fraction of hotelling that operators idle the main engine, EPA could potentially use the NREL database to inform the national hotelling rate, instead of using the current assumptions with hours-of-service. Would you recommend that EPA use this approach (instrumented truck data on extended idling and assumptions regarding the hotelling activity distribution) to estimate the national hotelling rate?*

The reviewer strongly supports the proposed approach (i.e. using data from instrumented vehicles); however, the reviewer has a concern with regards to representativeness of the NREL dataset for calculating national default values. Some providers of fleet management services (such as Teletrac Navman, ITURAN, Omnitrac) are specifically monitoring idling and start events. In theory, their dataset can provide EPA with a larger sample.

The reviewer acknowledges the difficulties with obtaining reliable information on APU usage. A series of truck driver surveys can be a useful source of data. The following are additional sources that might be of use to refine the APU usage:

- 2016 Annual Fleet Fuel Study, North American Council for Freight Efficiency. [http://www.truckingefficiency.org/sites/truckingefficiency.org/files/reports/NA\\_CFE%202016%20Annual%20Fleet%20Fuel%20Study%20FINAL%20Report%20082316\\_0.pdf](http://www.truckingefficiency.org/sites/truckingefficiency.org/files/reports/NA_CFE%202016%20Annual%20Fleet%20Fuel%20Study%20FINAL%20Report%20082316_0.pdf)
- A Survey of Fuel Economy and Fuel Usage by Heavy-Duty Truck Fleets (2016), UMTRI, <http://umich.edu/~umtriswt/PDF/SWT-2016-12.pdf>

5. *As described in Sections 10 and 12, EPA intends to use information from Verizon Telematics to develop default inputs for idle and start activity for light-duty cars and trucks. Are there any concerns about using this data source? In particular, do you recommend any techniques that would allow us to investigate selection bias or other bias in the data?*

The reviewer supports the use of vehicle telematics data; however, the reviewer has a concern with regards to representativeness of the selected states in the Verizon Telematics dataset that EPA has obtained. The reviewer strongly suggests adding a few additional states. Selection of these states could be based on considerations such as trade corridors, freight hubs/ports, population, and VMT. To investigate the selection bias, the reviewer suggests identifying relevant datasets from the literature and work with the authors to obtain the information. Most of these alternative datasets are incomplete and limited (both temporally and spatially); however, they can be used for quality control and validation of different parameters.

6. *EPA has not updated the average speed distributions in MOVES since MOVES2014. New information, such as the telematics analytics used in the CRC A-100 analysis, "Improvement of Default Inputs for MOVES and SMOKE-MOVES,"<sup>1</sup> may be available in time for inclusion in the next version of MOVES. How important is it to update the national average speed distributions to account for such data?*

It is very important; however, the reviewer suggest EPA to wait and consider all the available options. For example, FHWA is in the process of starting an initiative to develop methods and tools to generate county-level average speed distributions based on National Performance Management Research Dataset (NPMRDS) and HPMS. These tools and methods will be based on processed speed data (5-min interval) for a large sample of roads in the United States. These tools and methods can be used by EPA to update the MOVES default values. The reviewer suggests that the EPA staff obtain more information from FHWA headquarters air quality and transportation conformity team.

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<sup>1</sup> See [https://crcao.org/reports/recentstudies2017/A-100/ERG\\_FinalReport\\_CRCA100\\_28Feb2017.pdf](https://crcao.org/reports/recentstudies2017/A-100/ERG_FinalReport_CRCA100_28Feb2017.pdf).

7. *EPA has not updated the geographical allocation of activity since MOVES2014, but it intends to update these allocations when Version 2 of the 2014 National Emission Inventory is available. Are there any concerns about using the new data with the same MOVES2014 approach described in this report?*

The reviewer suggests that EPA considers the use of NPMRDS v2.0 dataset for quality control of the restricted access roads. The FHWA initiative mentioned in response to question 6 also involves assignment of VMT to MOVES road types. The reviewer suggests that the EPA staff obtain more information from FHWA headquarters air quality and transportation conformity team.

8. *EPA is considering a new approach for estimating heavy-duty source mass and heavy-duty fixed mass factors such that they vary by regulatory class and are more closely linked to the actual mass of the heavy-duty vehicles. Details on the proposal for updating source mass values are provided in Attachment A to this Peer Review Charge. Would the new approach be an improvement for MOVES? Are the proposed data sources and analysis approaches appropriate and reasonable? Are there better data sources or techniques for estimating bus source mass?*

The reviewer believes that the proposed approach is an improvement for MOVES and the proposed methods and data sources are appropriate and reasonable. The reviewer is not aware of better data sources or techniques for this purpose.