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From: **Stuart Batterman** <stuartb@umich.edu>
Date: Mon, Jun 3, 2019 at 11:39 AM
Subject: Re: connecting with Stuart Batterman re: Air Pollution
To: [redacted]

Hi [redacted]

Thanks for the contact. You have cited my study in your "Presolicitation Report: 1-496 and I-270 P3 Program, December 2018. " Page 16 notes:

> *"Montgomery and Prince George's counties are designated nonattainment areas for 8-hour ozone levels in 201821, a key driver of which is traffic idling. By reducing highway congestion, the P3 Program is expected to reduce traffic idling and emissions of pollutants contributing to ground-level ozone in the Region.*
>
> *Studies have shown that roadway congestion, characterized by slower speeds and increased acceleration/deceleration leads to higher concentrations of other harmful air pollutants such as carbon monoxide, nitrogen oxides and volatile organic compounds especially near the roadway[22]."*
>
> [22] See: K. Zhang et al./Atmospheric Environment 45 (2011) 1929-1939. "Vehicle emissions in congestion: Comparison of work zone, rush hour and free-flow conditions."

A portion of this is true but overall this paper should not be used to suggest environmental benefits from the proposed P3 Program for many reasons:

- Critically, our paper focused on vehicle emission factors, i.e., emissions per vehicle-mile, not the aggregate or (total) emission from the project. Total emissions depend on both the traffic volume and the emission factors. For example, an expansion adding 4 lanes to the existing 8 lanes that soon reach capacity would represents a 50% increase in volume or VMT, all things being equal. The change in the VMT would likely to be larger than the changes in the emission factors, and thus would offset any benefits of free flow conditions.

- Emission factors in work zones compared to free-flow conditions, on a gram per mile-vehicle basis, may be higher or lower, depending on the pollutant and type of vehicle. Some of this complexity is shown in Fig. 3 in the paper.

- Ozone formation is complex, and it may be more affected by NOx than VOCs. We saw smaller changes of NOx in cases associated with traffic conditions. This is important since ozone is the key air pollution problem in the region.

- While some of the larger (percentage) changes were seen for CO, very few places have problems meeting the ambient standards (NAAQS) for this pollutant.

- We did not report on ambient concentrations, contrary to the report's statement. Concentrations depend on aggregate emissions, not just emission factors. If aggregate emissions increase, then so would concentrations.

- Results depend on local conditions, e.g., current vehicle mix (age, types, etc.), climate, traffic patterns, and volume of vehicles. We used data for one highway in SE Michigan from nearly a decade ago, that may not reflect current conditions in Maryland. The studied road has many more trucks (about 10-12% I believe) than the 495 loop, which can disproportionately affect results.

- Emission estimates must be updated. We represented a snap shot of conditions pertinent nearly a decade, using the CMEM emissions model and vehicle data for Michigan. The current emission model is MOVES. It is important to use current vehicle emissions data since technology has changed considerably. MOVES is the EPA model that incorporates the latest data. It allows projections into the future. Often, projects use MOVES to look out 10, 20 or more years into the future. I believe that assessments are much more robust if both current or very near-term conditions, as well as future scenarios, are evaluated.

Overall, as stated, this paper should not be used to support of environmental benefits associated with the proposed project. Rather, traffic studies, ozone modeling, and other air quality assessments including conformity assessments are needed. I'll include our paper from 2011, just in case.

I hope that this is helpful.

Best regards,
Stuart Batterman


**Zhang et al - Vehicle Emissions in Congestion - Atmos Environ 2011.pdf**
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