Response to Area of Interest 2: Movement Telematics MassDOT RFI

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B- Roadway condition

What are the societal benefits of better pavement condition for non-motorists?

Road surface condition affect road/deriving safety and ride quality and is one of the dominant factors in rolling resistance, excess vehicle fuel consumption and the corresponding environmental impact. The US Roadway network with more than 8.7 million lane-miles of public roads and around 182 billion gallons of fuel consumption is one of the main contributors to Greenhouse Gas (GHG) emissions. Monitoring the surface condition and maintaining its quality is therefore crucial for a cleaner and safer road transportation infrastructure.

How do you envision MassDOT might use ubiquitous telematics data to supplement our existing (annually refreshed) pavement condition collection program that informs our resurfacing plan

The existing pavement condition monitoring approaches are not ideal due to one the following reasons: (i) are qualitative (say based on windshield surveys) and are not scalable (ii) utilize lightly instrumented systems and are scalable but not reliable due to the need for constant calibration (iii) use heavily instrumented systems (e.g. full-size laser instrumented vehicles), and are expensive and not scalable while in need of some calibration. In addition, the high cost and the time associated with the implementation of these strategies prevent frequent monitoring (particularly essential for roads subject to extreme environmental conditions) leading to sub-optimal maintenance decisions and resurfacing plans and loss of resources.

We have been working on a platform that uses **data analytics, AI and mechanics of road-vehicle interaction** to look at road surface conditions, excess fuel consumption and CO2 footprint. The proposed platform:

I. Uses crowdsourced vehicle vibration data to ``quantitively" evaluate road condition at a massive scale (entire road network)
II. Does (I) almost continuously
III. Does (I) and (II) with an accuracy comparable to road profilers

What sustainability metrics (like fuel consumption) are you able to provide insight into that could also correlate to safety improvements?

Our approach relies on using crowd-sourced data from ubiquitous telematics devices such as driver's cellphones, and/or our partner telematics companies to estimate road roughness, the associated fuel/energy consumption and GHG emissions efficiently and quickly. The latter is a unique feature of what we have been working on for the past several years and is "only" possible

through leveraging the mechanics of vehicle-road interaction. The integration of our quantitate and scalable metrics (imagine a near- continuously updated map of IRI for the entire network) into the pavement management systems enables optimal resource allocation and maintenance decisions. This not only leads to better road conditions with less CO2 footprint but also improves the safety of roadway network; note road condition is directly linked to the risk of accidents through a variety of ways such as vibration induced tire-road separation and lack of contact, road roughness-induced impaired steering, etc.

Show us something unique about your work that would provide new actionable insight for MassDOT in helping us prioritize resources.

The limitations in financial resources available to transportation authorities along with an ever-increasing number of initiatives for sustainable development in road transportation call for low-cost, efficient, and scalable technologies that can reliably characterize road roughness over the entire roadway network and help make optimized maintenance decisions via integration in pavement management systems. Our proposed platform offers a clear path for such an integration has the potential to significantly improve the state of roadway network through prioritizing road segments with the highest return. A unique feature of what we have been working on, besides its reliability and scalability, is the link to fuel consumption and CO2 footprint which is "only" possible through leveraging the mechanics of vehicle-road interaction.

How would your tool support insights in both heavily populated areas and more rural areas in Massachusetts?

Using crowd-sourced data from ubiquitous telematics devices such as driver's cellphones, tablets, or other partner telematics companies, we anticipate the development of a "cost-effective and efficient" platform to monitor road surface conditions with wide coverage both in rural and heavily populated areas. The valuable information provided in the form of international roughness index, excess fuel consumption and GHG emissions allows the transportation authorities to make informed decisions for road maintenance and enables optimal resource allocation.

If you offer telematics services, please also answer the following questions:

*Demonstrate that you can conflate your data insights to MassDOT road inventory file (see MassDOT Assets below) **and** to Open Street Map or describe in some detail the process required to do this for roadway segments and the estimated time involved to do so.*

The quantitative metrics of road roughness index, excess fuel consumption and corresponding environmental footprints can be integrated into MassDOT GIS-based asset management system (pavement condition) as an additional layer as well as well as OSM. The efficiency of our approach would allow the metrics to be estimated frequently and with wide coverage to enable optimal maintenance plans.

Please describe how you protect and preserve privacy with your product.

Our platform does not require any information about the driver or vehicle. All data is collected in anonymized manner. We also use GPS locations (not of the drivers) but of the insights derived only for mapping purposes.

If relevant, please share how MassDOT would be involved in developing the product or if there are any opportunities for customization.

The data collection could be through state vehicles, perhaps through a state developed mobile application used by state employees as well as users who have subscribed to such an app or via partnering via a telematics data provider (we have our own app and are already working with two major providers). Funding from state is requested to finalize the proof-of-concept stage of the development and take the proposed platform to a stage where it is ready for large scale deployment.