Tome

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Bicycle to Vehicle (B2V) Data Request for Information

Due: End of Day - Monday March 16th, 2020

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B2V Background

In 2017, Tome began working on various projects within a larger open and collaborative bicycle-to-vehicle (B2V) safety program. Tome has since engaged with companies from the cycling, automotive and smart city industries to create communications solutions for drivers and vulnerable road users (VRUs).

As part of this effort, a B2V Advisory Board (EAB) was created in April 2018 and currently maintains ongoing relationships with the Crash Avoidance Metrics Partnership (CAMP), Confederation of the European Bicycle Industry (CONEBI), Consumer Technology Association (CTA), PeopleForBikes, Society of Automotive Engineers (SAE), United Nations Economic Commission for Europe (UNECE) Technical Committee, and the U.S. Department of Transportation Federal Highway Administration.

B2V Executive Advisory Board Members

About Tome

Tome engineers believe that the future of mobility tech innovation is about connections in the real world -- the social fabric, hard wires and invisible over-the-air signals that link the people, products and tools we need to live, work and thrive. Founded in 2014 by serial entrepreneurs Jake Sigal and Massimo Baldini, Tome employs the best minds and the right technology to solve complex problems by creating software that brings people together in an increasingly mobile landscape. Powered by a healthy blend of engineering skill, trusted research and raw creative energy, Tome works fast to replace red tape with rocket fuel in the lab. The team stands uniquely positioned to go beyond software development by improving user experiences and marketing products for clients.

Request for VRU Data

Tome is requesting access to accumulated data sets illustrating where, when and how VRUs -- including cyclists, scooter users and pedestrians -- share roads with motor vehicles. Of particular interest to Tome are the fine-grain motions of VRUs; factors and influences affecting how VRUs behave on the road; stress indicators and previous incident data; and increasing the rate, accuracy and responsiveness of VRU detection by advanced driver-assistance systems (ADAS).

Requested data may be pre-anonymized, aggregated or otherwise obscured. Tome can also perform these operations on any data received. This data may be limited by terms of service provisions, including those covering the copying, storing or application to a specific problem domain. The data may be provided freely or may require a paid license.

This RFI document includes the categories of data needed with use case examples and response instructions. Nonconforming responses are acceptable, as well.

Categories of Data Needed

Data Category	Examples	Data Sources	Potential Use Cases
Where and When VRUs Use Roads	Which roads do VRUs use? What times of day and which times of year are VRUs present?	Logged VRU activity via sensors attached to bicycle/scooter or smartphones Connected infrastructure with capability to detect and identify equipped or unequipped VRUs Additional sensors for monitoring (e.g. weather for pattern tracking)	Predictive algorithms (What happens if the number of bicycles / scooters / pedestrians or other characteristics of this road change?) Installation of additional or enhanced infrastructure (SPaT-connected, or stand-alone flashing lights) Generating and transmitting BSM/PSM messages on behalf of unequipped VRUs from connected infrastructure

What VRUs Do On the Road (Dynamics)	How fast does a bicycle, scooter or pedestrian travel? Which lane do VRUs use (e.g. the left-turn lane) How quickly does a cyclist, scooter user or pedestrian accelerate, decelerate and yaw/rotate?	Logged anonymized pedestrian and cyclist activity via fine-grain sensors (accelerometers, high-resolution GPS/GNSS receivers, and IMUs) or smartphone apps	Predictive algorithms based around stored data Better cyclist, scooterist user and pedestrian modeling for driving simulations (used in ADAS and A/V validation)
Stress Indicators and Previous Incident Data (Accident Analysis)	Which roads feel safe/unsafe? Where have vehicle/VRU collisions occurred in the past, even when not reported to the NHTSA.	Crowd-sourced feedback via smartphone apps "Unofficial" incident databases Incident databases maintained by the government (e.g. NHTSA)	Building pattern recognition engines and predictive algorithms to determine if a specific segment of road is likely to be unsafe Real-time mapping and prediction of road segment safety
Improving and Expanding ADAS Detection	Non-line-of-sight detection, increasing confidence in ADAS sensor systems, categorizing VRUs (pedestrian, cyclist, scooter user, etc.)	Vehicle image data sets (for optical cameras, LiDAR signatures or general 3D motion signatures) Wireless safety messages or high-resolution, real-time location data	Collision avoidance by the vehicle via earlier or better detection of VRUs

How to Respond

Please email responses by end of day **Monday March 16th, 2020** to:
Angela Fessler - angela@tomesoftware.com - You will receive confirmation on receipt.

Technical Responses

1. Please provide a description about the data available for vehicles and/or vulnerable road users (VRUs) and list the category or categories (from the table above) to which it applies.
    1.1. In addition to response, please provide a short (single paragraph) high-level overview of your data and application for VRU use cases.
2. Please include answers to specific items:
    2.1. Is an API available for this data set?
    2.2. Is this data in the data set updated in real-time?
        2.2.1. If not, how often is the data updated?
    2.3. Which VRUs does your data pertain to? (cyclists, scooters, pedestrians, etc)
    2.4. Does your data contain information related to vehicle behavior?
    2.5. Does this data set contain information about road characteristics or infrastructure?
    2.6. What other data (if any) is contained in the data set other than vehicle and VRU information?

Commercial Terms

1. Is there a charge for the data set? If so, what is the cost?
2. Is this data set open? If so, where is it accessible?
3. If not free or open, is there a sample data set available for review? If so, please provide instructions on how to access or request access.
4. Does this data set consume data from other sources? If so, please provide a description of the other sources.
5. Please provide company contact info (for business and technical, if they are different contacts).

Appendix A - Core VRU Vulnerability Questions

Tome plans to collect data available from RFI respondents to answer questions included but not limited to the examples below.

Cyclist Behavior in Urban Environments

	Priority	Question Type	Question
1	Priority #1	Cyclist Dynamics	What is the lateral distance from a vehicle that cyclists are comfortable driving alongside?
2	Priority #2	Cyclist Behaviors	How do cyclists react when they are about to be in a collision? Brake, swerve, inaction? How effective is that action?
3	Priority #3	Accident Analysis	What is the percentage of cyclists aware of the incoming vehicles, or are most collisions completely unexpected?
4	Priority #2	Accident Analysis	For the scenarios in Figure 1 (below) with a turning host vehicle and oncoming/same direction cyclist, what percent of collisions are due to a visual obstruction (A-pillar, hoodline, a nearby vehicle, roadside objects, outside driver field of view, etc.)?
5	Priority #1	Cyclist Dynamics	For the scenarios in Figure 1 (below) with a turning host vehicle and oncoming/same direction as the cyclist, when a cyclist brakes to avoid a turning vehicle, how far away from the collision point are cyclists when they: a) Begin braking? b) Come to a complete stop?
6	Priority #3	Accident Analysis	What is the effect of host speed mitigation on fatality/injury/no harm? This can be answered generally, but Tome is also interested in the scenarios of interest diagramed.
7	Priority #1	Cyclist Dynamics	What are common speed distributions cyclists travel when they are in a roadway and what are common speed distributions when they are on a sidewalk?
8	Priority #1	Cyclist Dynamics	What would be a speed dependent max yaw rate or lateral acceleration a cyclist would feel comfortable making as an "aggressive maneuver" (i.e. trying to avoid an accident)?
9	Priority #3	Cyclist Behaviors	Does a cyclist feel they have pedestrian yield rights when then drive on the roadway or do they feel they must obey vehicle traffic laws? Do those behaviors change on a sidewalk?

10	Priority #2	Cyclist Behaviors	Are there speeds at which cyclists do not feel comfortable driving on sidewalks (or said differently, what are the conditions a cyclist would drive in the roadway rather than on a sidewalk)?
11	Priority #3	Cyclist Behaviors	If a cyclist is traveling down a two-lane road (opposing traffic) and their own lane is unoccupied, when a vehicle in the adjacent lane is approaching, will the cyclist bias their lateral lane position? Under what circumstances will the cyclist bias their lateral lane position?
12	Priority #1	Cyclist Behaviors	For the scenario of interest with an **oncoming** bicycle in a turn, will a cyclist change their longitudinal behaviors or lateral behaviors before the host has begun turning (i.e. what kind of defensive driving does the cyclist do)?
13	Priority #1	Cyclist Behaviors	Will a cyclist overtake a vehicle in its same lane that is traveling slower, on its right, between the vehicle and the road edge?
14	Priority #1	Cyclist Behaviors	Same scenario as #13, is there a minimum separation distance from the vehicle they are overtaking a cyclist would like, or is there a minimum lateral separation gap the cyclist would feel is appropriate to pass on the right?
15	Priority #1	Cyclist Behaviors	Same scenario as #14, are there scenarios that a cyclist would definitely not try and pass on the right?
16	Priority #1	Cyclist Dynamics	How fast for an average cyclist to stop from 10,15 and 20 kph for an emergency brake in terms of deceleration and time needed?
17	Priority #1	Cyclist Behaviors	What's the average deceleration or common behavior for an average cyclist (with 10,15 and 20 kph) when there is an oncoming vehicle (with 10,15 and 20 kph) that start turning to enter the cyclist's path?
18	Priority #1	Cyclist Behaviors	What's the average minimal distance that an average cyclist could accept to let the vehicle (with 10,15 and 20 kph) turning in front of the cyclist?
19	Priority #1	Cyclist Dynamics	What's the capability for an average cyclist to avoid a stationary object or vehicle on their path in terms of reaction time before impact with respect to the lateral distance, lateral speed, and the lateral acceleration (if applicable)?

20	Priority #1	Cyclist Dynamics	For the scenarios in Figure 1 (below) with an oncoming cyclist: A. What's the distribution of host vehicle speed/deceleration that driver would like themselves to go first (turning in front of on-coming cyclist)? B. What's the distribution of cyclist speed/deceleration that driver would like to let the cyclist go first? C. What's the distribution of lateral distance that driver would like themselves to go first? D. What's the distribution of lateral distance that the driver would like the cyclist to go first?
21	Priority #1	Cyclist Dynamics	For the scenarios in Figure 1 (below) with a turning host vehicle and oncoming/same direction cyclist, what is the percent of turns that: a) Cyclist brakes to avoid a vehicle? b) Vehicle brakes to avoid a bicycle? c) Both braking of bicycle and vehicle is performed? d) No braking of either bicycle or vehicle is performed?
22	Priority #1	Cyclist Dynamics	For the scenarios in Figure 1 (below) with a host vehicle and an oncoming or same direction cyclist, to what extent do cyclists slow down before the vehicle has begun turning?

Figure 1 - Example Cycling Vulnerability Use Case Diagram