Dangerous Road Congestion Alert Technology

Weimin Huang, Jingwei Xu, and Bruce Bernhardt

HERE North America

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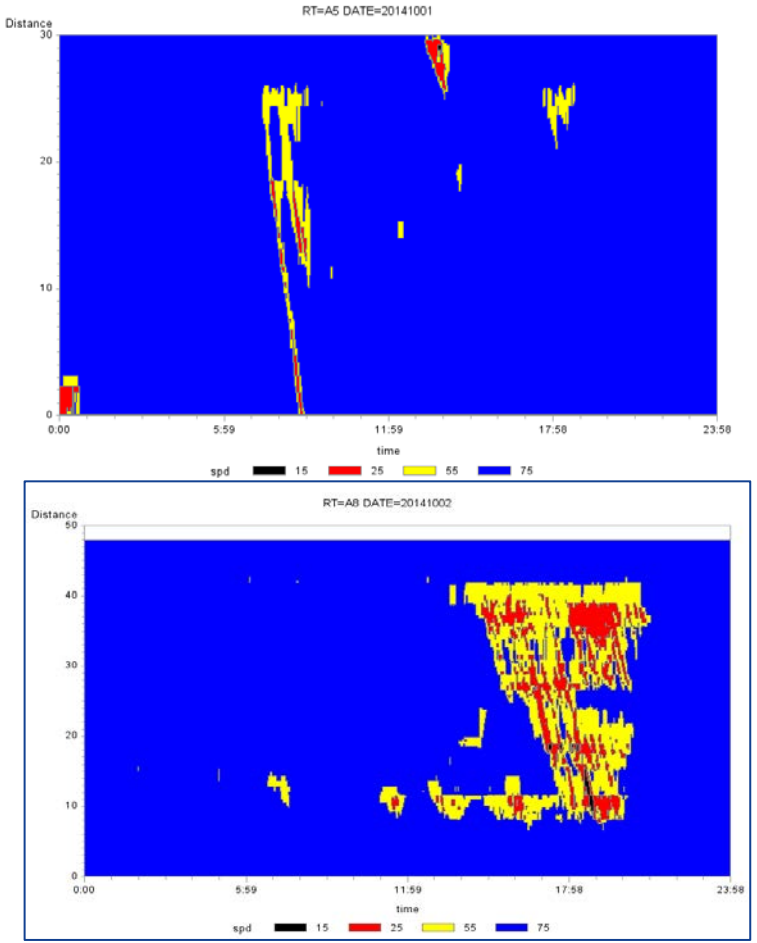
Wide moving jams

- One particular phenomenon is the formation of “wide moving jams” (WMJ)
  - Vehicles in these jams have very low speeds and are densely packed, the jams themselves are travelling backwards, and the term “wide” is used to reflect the fact that this jam propagation has a spatial length much larger than the jam’s temporal width.
  - WMJ can occur spontaneously in mostly free-flow region or insider of congestion
- Can be explained by “3-phase traffic theory” (Kerner)



Identify bottlenecks

- Past studies focused on of a speed change between a pair of upstream-downstream detectors
  - “if the upstream speed is less than 40 mph and the downstream speed is more than 20 mph greater than the upstream speed” (Chen 2004) to identify the activation of a bottleneck
  - 5 mph maximum upstream speed and a 15 mph speed differential on 3-min aggregation produced the best result (Bertini 2008)

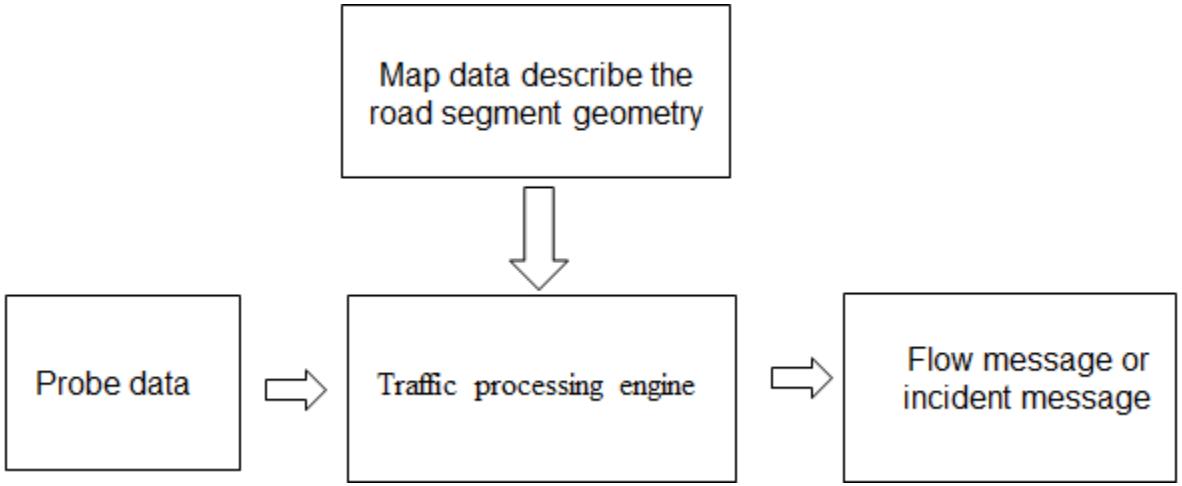
ASDA/FOTO models for VMJ

- ASDA/FOTO models (Kerner 2009) were developed to recognize the three traffic phases. The FOTO (Forecasting of traffic objects) model reconstructs and tracks synchronized flow, while ASDA (Automatische Staudynamikanalyse: Automatic Tracking of Moving Jams) model reconstructs and tracks wide moving jams.
  - Detects synchronized flow when $v <= v_{syn}$;
  - Detects a wide moving jam when $v < v_{jam}$ and $q < q_{jam}$;
  - Detects free flow when $v > v_{syn}$
  - v_{syn}, v_{jam}, and q_{jam} are model parameters.
  - needs both speed and volume data

Existing techniques and real-time system

- The disadvantages of the existing techniques in a real-time traffic service environment
  - they rely on archived historical data, which lead to an unacceptable high latency in a real-time system
  - Most of them are applicable to static bottlenecks only, while the congestion has many other forms
  - Some the advanced technique also need volume data which is hard to obtain in real-time for a traffic service provider, especially on lower functional class roads where ITS volume detection equipment is rare.

HERE Processing Engine

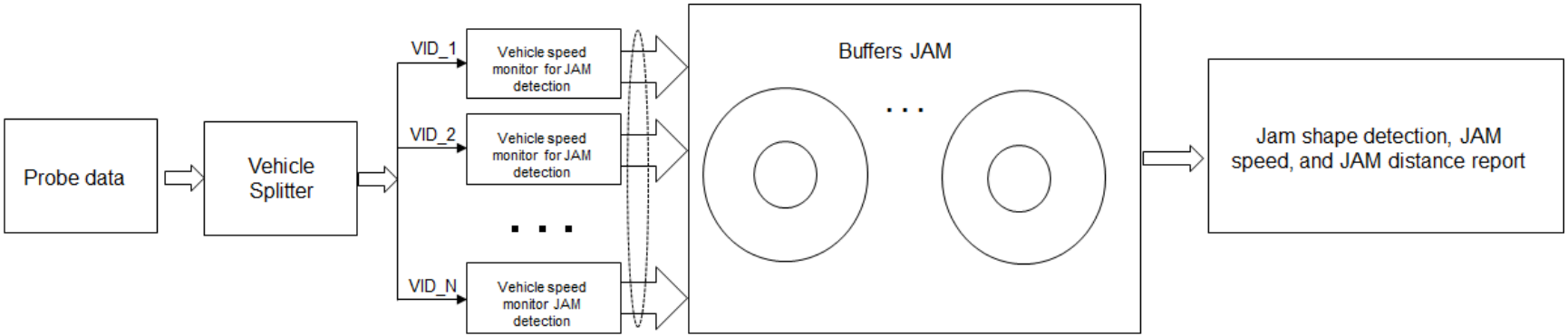


- Upon receiving real time probe data, the processing engine normally performs steps such as map matching, pathing, etc. and then outputs an estimate of the current travel speed and associated incidents for a given road segment (e.g. road link or TMC).

HERE solution

- Our existing traffic service can report real time static incidents on a specific road segment and warning messages to upstream drivers ahead of incidents based on the multiple input resources.
- However, this is not sufficient to fully help drivers for the best understanding of the road traffic conditions and thus make smart driving decisions.
- Dangerous Road Congestion Alert (patent pending)
  - An intelligent traffic process engine system capable of detect different road traffic congestion jam shapes and thus provide the better traffic services to customers by delivering warning message ahead of the time before hitting the traffic area.
  - (1) the processing engine to identify the congestion Jam on a road segment.
  - (2) using time buffering technology, the shapes of the traffic congestion jam are identified
  - (3) the estimation of the jam location, delay, and the length of the jam.
  - (4) the delivery of the warning message over multiple platforms.

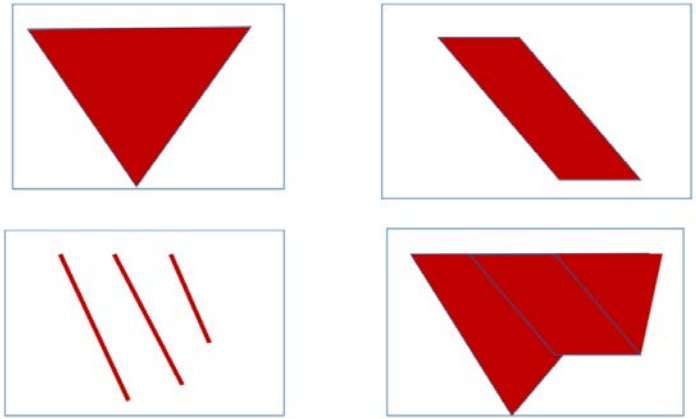
Traffic JAM detection system



- Probe data are grouped and cached by their vehicle ID before the jam processing part.
- Once the jam is detected per vehicle, it will be buffered into the predefined buffer ring associated to its corresponding road segment.
- The JAM is dynamically allocated into the buffer ring it belongs to which is growing dynamically per JAM distance or time.

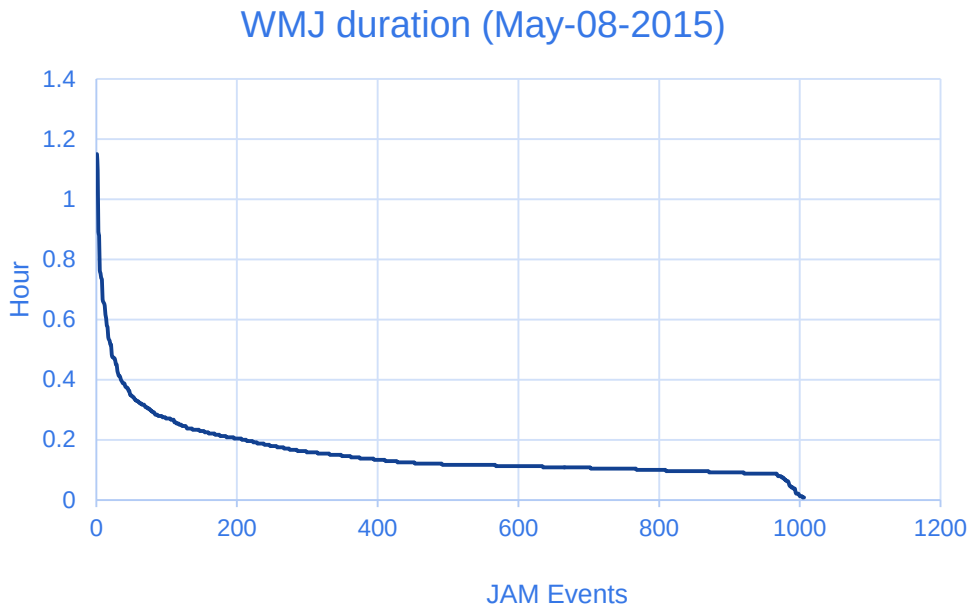
Traffic jam shapes

- HERE system aims to detect various JAM shapes
  - Bottlenecks and WMJ
  - Accurate identification of such shapes are the key for service quality reporting. It directly decides the road traffic conditions and can thus be used for traffic prediction.



Sample result

- The aforementioned method applied for some Germany markets. The following are the test results for May 8, 2015.
- 1006 unique Jam events were identified on May 08 2015.



Future work

- Refine the identification process, apply them in more markets.
- Examine the freeway methodology on arterial roads.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Maps for Life

Questions