

telematics

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In this issue:

Paths to portable profits

An analysis of the features needed to profit from portable devices

Look back, leap forward

Lessons learnt from the last decade of telematics and predictions for the next

Saved by the map

How navigation systems can do much more than show you the way

Detroit Showguides

Telematics Detroit Showguide p31

Intelligent Vehicle Safety Seminar Showguide p47

Mobile Location Enabled Services Showguide p53

Line of sight

*The future of telematics mapped
out at Detroit 2007*



Getting Real – Measuring Quality and Accuracy for Real-Time Traffic Data in the 21st Century



As auto OEM's and others race to incorporate real time traffic data on more navigation systems than ever before, the issue of data quality and its delivery to customers is paramount to competitive advantage. **Craig Chapman** examines new and innovative methods for measuring and understanding the quality of real-time traffic information.

TRAFFIC CONGESTION continues to grow at a rapid pace throughout the world's major metropolitan areas. No longer satisfied to listen to radio traffic reports while sitting in the very traffic they are trying to avoid, or view a web-cam showing conditions on a stretch of road (was that pointing east or west?) from fifteen minutes earlier, consumers now expect real-time guidance on how they can shorten their route or steer clear of traffic congestion.

If the traffic information isn't reliable – whether delivered over a portable navigation system, a car's embedded navigation system, a web portal or a cell-phone – your customer will simply walk out the door.

As automotive OEM's, navigation device suppliers and others move quickly to deliver real-time traffic information, the significance of quality in traffic solutions and the criteria used to evaluate quality are more important than ever before.

So, what is meant by real-time traffic, and, more importantly, how do you measure the quality of the information being delivered?

Types of real-time traffic information

Incident information: Incident reports are often heard via radio or TV broadcasts and, until recently, were state-of-the-art in traffic data reporting. A standard broadcast such as, "On I-405, southbound traffic is currently slow between NE 8th and the I-90 interchange", reflects the three key

components of incident information: space, time and accuracy.

"I-405 southbound/between NE 8th and the I-90 interchange" indicates the location (space; "currently" indicates time; and accuracy is referenced by the current conditions on that particular route.

Vehicle accidents, construction and significant congestion are types of

road. Traffic flow is typically used for traffic-enabled routing and visualization of traffic speed conditions.

The market and road coverage of traffic flow information in the US has increased dramatically over the past eighteen months due to recent innovations in disruptive technologies, such as the integration of GPS information from vehicles travelling on roads with traditional

embedded and road-side sensors. For example, only 5,000-7,000 miles of US roads have traditional sensors; however, INRIX's aggregation of more than 625,000 commercial vehicles in its Smart Dust Network has increased the coverage of real-time flow to nearly 50,000 miles.



Inrix seattle real time

incident information. Special cases of incidents are flow incidents – a derived quantity, summarising traffic flow data into an alert that highlights specific areas of congestion. Since incidents are typically reported in descriptive (as opposed to quantitative) terms, they are generally less valuable than actual speeds on road segments for use in traffic-aware routing applications.

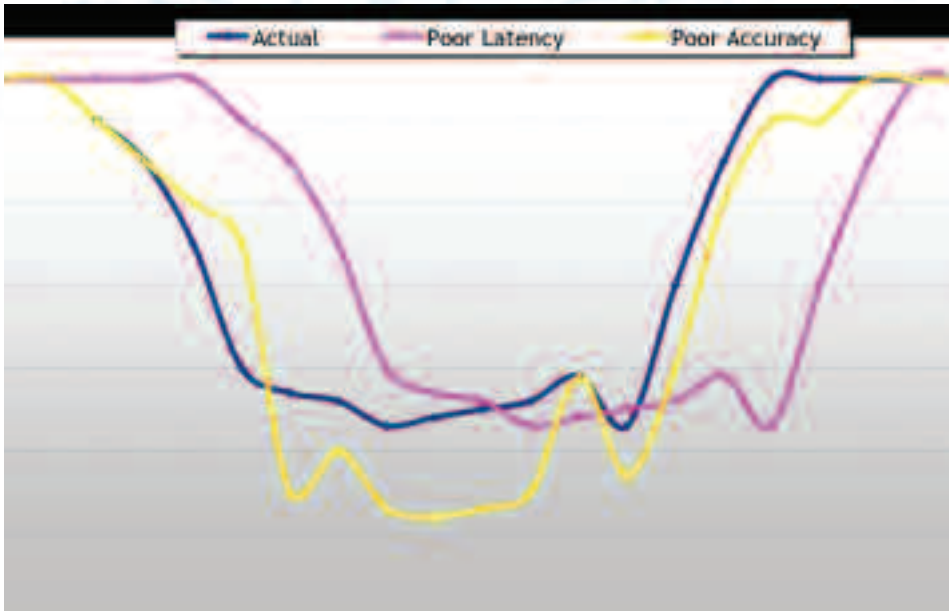
Traffic flow information is defined as the average speed and congestion level of vehicle flow assessed at the current time, across all lanes, along a stretch of

Space, time and accuracy – the three dimensions of traffic data quality

The concept of spatial resolution asks the question: "Is the information localised to the correct stretch of road?" In other words, does the data

accurately represent the location and the extent of any congestion? Does the data cover the roads where most people are driving? Are enough road segments included to provide actionable results? This concept is generally governed by the granularity of the base data and the overall coverage area.

When considering real-time traffic, it is clear that time is a critical dimension. The traffic information must describe current conditions, or it runs the risk no longer being consistent with the present situation.



Inrix accuracy latency

Accuracy is essentially the “correctness” of traffic information (i.e. speed or incident details). Given that the information is timely and associated with specific road segments, does it present an accurate description of the travel conditions?

Evaluating the quality of traffic information

Possible inaccuracies in incident messaging include the most obvious – when an incident should be reported but isn’t – typically because it is a) out of date, b) incorrect in the precise location or extent, or c) inaccurate in its message.

Another equally important inaccuracy is when an incident is reported when it shouldn’t be – often a result of unacceptable latency. This can happen when the traffic solution continues to report an incident that has cleared some time ago.

The most significant qualitative dimensions of real-time traffic flow data are accuracy and time (latency). The chart below shows the independent impact of these two elements.

The actual condition of traffic flow is simulated in the graph by the dark blue line. The pink line represents an exact replication of measurement of those conditions with added latency. The latency results in a delay in detecting

traffic slow down as well as the persistence of the reported slowdown beyond when it is cleared up. The independent impact of latency, in the extreme, can be that the reported incident has no overlap with the time that the slowdown actually occurs. On the graph, the independent impact of poor accuracy in traffic detection is shown in yellow. This shows that a slowdown was detected in time with the actual situation. However the speed values are somewhat different from what the data indicated.

In addition to the qualitative impact of accuracy and latency, there are sometimes perceived inaccuracies as they relate to visualisation of traffic. This is typically caused by a small section of localised congestion where the consumer may briefly slow to a low speed as he traverses the segment. While he may perceive increased traffic congestion, the impact on the average speed across a longer segment may be very small and have minimal impact on his routing choice or total travel time.

Another issue that can have a differential impact on routing versus traffic visualisation is across-lane averages. For example, one lane may be congested as it merges onto a ramp, while other lanes are free-flowing. In this case, the “reported speed” traffic flow information will reflect the actual flow-count

weighted mean of the lane speeds. The lane with the highest volume-flow of vehicles will dominate the reported speed, and hence the majority of actual speed measurements. As a result of this fluctuation and resulting impact of lane-to-lane variability, reported speed information can often fluctuate by up to 20%.

Additional considerations for measuring traffic data quality

There is no absolute, objective measurement that works to measure traffic data quality requirements across the broad spectrum of use-case scenarios and the diversity of integration implementations with navigation applications.

OEMs and application vendors must evaluate a variety of factors including their unique application needs and specific scenarios they are utilising for the integration and delivery of traffic information.

‘Ground truth testing’ is the most popular method of measuring the accuracy of traffic incident and/or flow data. It involves the actual driving of roads across a market with the explicit purpose of gathering enough measurable data to evaluate the accuracy, latency, and spatial resolution of the reported traffic. The ground truth data is collected by test vehicles utilizing a combination of GPS tracking instruments and driver observation and is then evaluated against an archived version of data reported by a traffic provider.

The quality of the data can be assessed by the three main dimensions in traffic quality – the degree of overlap between the “effective” and transmitted traffic information in space and time; and the third - accuracy: Do the results of the effective and transmitted incidents or flow information correlate? ■

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