TRAFFICCAST™

Why the "C" in TrafficCast is Green

How TrafficCast Helps Mitigate Traffic Congestion, Reduce Vehicles' Environmental Impact and Supports Sustainability

Value of Accurate Travel-time Information –

The most critical variable in commuters' choice of route and transportation mode as well as the overall management of a transportation network is travel time, as investigated across a number of studies in the Transportation Research Board's (TRB) second Strategic Highway Research Program (SHRP 2).

Until recently, travel time could not be (or only very expensively) measured directly. Instead, it was derived from fixed-point road speeds determined by underground loop systems or roadside radar systems that were expensive to install, operate and (especially) maintain. As a consequence, travel times were limited to a subset of expressways in a small number of urban markets, and further constrained by accuracy and reliability for anything other than short, freeway routes.

Nevertheless, the environmental benefits of accurate travel times informing route choice and transportation mode are significant. In May 2009, McKinsey & Company published an extensive study of carbon emissions due to transportation, evaluating alternative approaches to carbon emissions abatement. It focused on factors such as benefit vs. investment, near- and long-term measures, new vehicle technologies and their influence on the universal vehicle fleet and finally the impact of traffic flow, travel times and driving behavior. One particularly relevant conclusion:

> *"…Improving traffic flow and driving behavior yield a per-tonne (of CO_2 abated) benefit to society that is greater than the average benefit from fuel-efficiency measures. A number of these <traffic mitigation> measures could be achieved in relative short order, making them especially attractive for the period from 2010 to 2020..."*[1] *(see chart on last page)*

For example, following deployment of congestion tolling technology and associated traveler information systems in Stokholm in 2006/7, traffic congestion decreased 25%, resulting in a reduction of inner-city road traffic emissions by 8-14%; while greenhouse gases such as carbon dioxide fell by as much as 40% in the city center, and even reduced by 3% in the surrounding rural counties.[2]

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[1] *Roads Toward a Low Carbon Future: Reducing CO_2 emissions from passenger vehicles in the global road transportation system*, McKinsey & Co.: May, 2009

[2] *Driving Change in Stockholm: the Stockholm Road Charging System,* IBM: April, 2007

To ease congestion and mitigate related emissions, it is critical to gather data, efficiently analyze the data and provide traveler-friendly access to actionable information related to travel times, route options, and transportation corridors. While the US faces significant challenges in maintaining a globally competitive transportation infrastructure, technology tools are emerging to make better use of what is already in place. As IBM Chairman Sam Palmisano noted in his address to the 2010 Annual Meeting of the Intelligent Transportation Society of America,

> *"…We have the tools and know-how to address the challenges. Intelligent technologies are emerging to enable transportation networks and users to communicate with each other, improving system performance, safety and convenience—making IT just as important to 21st century transportation as airplanes, asphalt and petroleum were in the last century..."*

TrafficCast and the Delivery of Actionable Information

The focus of TrafficCast is travel time – in real-time, as a forecast, or provided as historical trend data. In particular, individual route travel-times, personalized for commuters, travelers and commercial transportation, finally enable drivers to make informed decisions on their route choices. Collectively, as route alternates are chosen to minimize individual travel times, such decisions will more effectively exploit the capacity of the road network, thereby mitigating congestion.

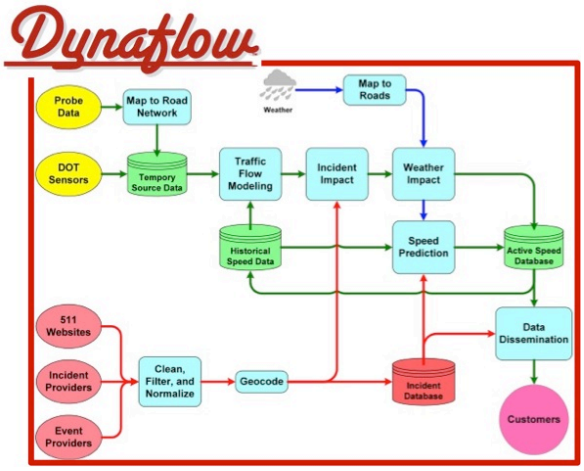
Navigation content provided the first meaningful personalized travel information in the digital age. Most navigation devices, however, are informed by relatively static "arrival time" data based on route inputs, mainly because reliable, comprehensive road speed data across both expressways and arterials has not been available.

Moreover, for most journeys, travelers do not require navigation advice. They know how to get home, to the office, to Grandma's, in multiple ways. The best route choice requires accurate travel times. Analogous to the "invisible hand" of financial markets, such optimized route decisions guide an efficient utilization of the road network, mitigating congestion and reducing emissions.

To finally enable informed route choices through accurate travel times, TrafficCast offers two distinct product lines: Dynaflow™, a national "map" of current and forecast road speeds, and BlueTOAD™ a roadside technology that probes vehicles for existing, anonymous data markers to directly measure travel time.

Dynaflow

Dynaflow 2.0 is TrafficCast's signature data feed of prevailing road speeds, for "real-time", historic and forecast environments in the top 102 markets. A contraction of "Dynamic Traffic Flow" (with a respectful nod to Buick's innovative automatic transmission of the 1940's and 50's), Dynaflow is the result of sophisticated filtering and modeling of more than 100 million GPS data crumbs each day, combined with other speed inputs such as public sensors and TrafficCast's own BlueTOAD.



Specifically, TrafficCast has taken advantage of relatively recent technological advances in GPS tracking devices and related data communications to source local and regional GPS data that best proxies driving patterns of commuters, travelers and commercial drivers. With these inputs, efficient TrafficCast filtering algorithms and sophisticated flow data modeling, Dynaflow is the industry leader in consistently accurate speed data. Dynaflow 3.0, released in the Fall of 2010, delivers even more coverage: over 800,000 miles of US roads including the interstate corridors connecting urban centers.

Such coverage greatly expands the road speed and travel time information beyond the limited public sensor networks available today. And Dynaflow does so without installation of additional road infrastructure along with associated power and data connections. Instead, through intelligent technologies it integrates existing data sources to deliver a much broader and comprehensive map of current and forecast road speeds.

Dynaflow addresses the environmental impact of traffic congestion in four principal ways, broadly related to the driver's aim of minimizing their travel times:

Personal Route Planning

The Dynaflow forecast data set enables pre-trip planning of routes. Dynaflow matches known historical speeds on road segments with forecast factors such as weather, construction, and seasonal factors. The resulting information supports an array of applications delivered across a range of interactive platforms, dynamically forecasting speeds against a route's road segments, refined by desired departure or even arrival times. Whether choosing tonight's commute home or planning next week's journey, forecast road speeds, Dynaflow forecast speed data supports smart route decisions.

Enroute Advisories

Once on the road, Dynaflow's report of current conditions can advise drivers when alternates are advised due to unexpected changes to travel times. Unlike the relatively short range travel time postings enabled by traditional speed sensors, or the broadcast radio reports of general conditions, the goal of Dynaflow data is to provide timely advisories at decision points where alternate route choices for one's personal are feasible. The key to delivery is the application interface to safely and easily communicate advised route changes, such as audio messages and heads-up display. Just saving tens of minutes of drive time per week will significantly reduce personal fuel consumption and overall CO_2 emissions.

Commercial Logistics

Commercial fleets, from local delivery services to long-haul truckers, are in a constant battle to optimize their routes. While they have a number of weapons, from scheduling software to mobile communications to tracking technologies, to assist them, the key variables of current and forecast road speeds and related travel times have been elusive. As a result, logistics managers and dispatch operators cannot plan the most efficient routes based on real-time conditions but instead rely on gross assumptions related to road network performance and driver behaviors. Road speeds are especially critical to mitigate bottleneck conditions resulting from distribution choke points such as ports of entry and warehouse facilities. While the effect of better informed logistics and dispatch decisions is similar to the route choices of commuters – improved travel times – the environmental impact is arguably even greater, through the reduction of time trucks and big rigs spend on the road, and more efficient operations when they are.

Regional Planning

With limited resources available to the public sector, and increasing demands on transportation infrastructure, a high priority for departments of transportation, regional planners and other public sector agencies is congestion mitigation. These agencies have a number of statistical models at their disposal, but the most critical data input – road speeds and travel times – has been expensive, time-consuming and of questionable reliability. As a result, multi-million dollar decisions related to regional transportation often rely on relatively small statistical samples. At a macro level, Dynaflow offers baseline data for public agencies to consider seasonal, regional and inter-city factors in their efforts to mitigate congestion, support transit and enhance economic development. Again, the potential environmental impact of better-informed transportation decisions is significant.

At the same time, TrafficCast recognized the need for micro data related to speed, travel times and route behaviors. That need led the company to develop BlueTOAD.

BlueTOAD

BlueTOAD™ by TrafficCast is an advanced traffic monitoring technology that detects anonymous Bluetooth™ signals from passing vehicles. Subsequent detections by BlueTOAD devices along the road are matched through rigorous filtering and integrated processing to determine travel times, road speeds and route behaviors.

BlueTOAD emerged from the company's research into academic initiatives with Bluetooth detection as well as our own expertise in mobile communications and traffic data modeling. Unlike traditional sensor data, which estimates travel times from road speeds derived from algorithmic models related to road capacities, BlueTOAD directly measures travel times and average road speeds across road segments. The result is highly accurate travel time data that can be combined across road segments for route and alternate route travel times. The detections can also be aggregated over time to provide a comprehensive data set reflecting route decision behaviors supporting robust Origin/Destination Studies and Trip Length Analyses, both critical to transportation planning initiatives.

The environmental benefits of BlueTOAD include both the impact of its data output as well as the characteristics of the technology itself.

BlueTOAD Data Output

Applications benefiting from BlueTOAD's precise traveler information data include:

- **Work Zone Congestion Mitigation:** The State of Illinois has deployed BlueTOAD during major construction projects to better inform drivers of delays and offload congestion onto alternate routes.

- **Signal Timing:** A number of studies have shown that traffic signal timing has significant impact on carbon emissions. When timing is optimized, congestion is

minimized and emissions are reduced. While "adaptive" signal technologies enable considerable flexibility in how signals sequence through red, yellow, green and arrows, reliable travel time data – the definitive measure of the success of optimized signals – has been expensive to collect for evaluations, or maintain for dynamic input. BlueTOAD is involved in a number of initiatives in this area.

- **Arterial Travel Times**: Depending on location, arterial roadways (non-expressways) accounted for up to 50% of all vehicle travel miles. Sensor instrumentation to provide granular travel times and speeds on arterial roadways, however, is virtually unheard of. This data gap stymies the ability of agencies to inform the public of viable route alternatives, since data that might be available on expressways cannot be associated with arterials. BlueTOAD provides an exceptionally cost effective way to "instrument" any roadway, even those without available power and data connectivity. Again, comprehensive data will enable informed decisions by both drivers and road operators. The resulting mitigation of congestion will alleviate emissions.

- **Origin/Destination – Trip Length Analysis:** O/D studies and trip length analysis are standard measures of performance in nearly all meaningful planning initiatives. They are particularly valuable in resource allocations related to infrastructure development projects. Such projects invariably involve significant environmental impact, among other factors, but data collection to support the analysis has been expensive, statistically limited and even questionable: postcard surveys, limited video surveillance, "floating car" drive tests, etc. The State of Wisconsin is among the first to deploy BlueTOAD to capture long-term O/D route behaviors in consideration of the building of major roadway infrastructure to alleviate arterial congestion crossing a major interstate.

BlueTOAD Technology Characteristics

Beyond the positive environmental impacts resulting from the application of data made possible by BlueTOAD, the technology itself is notable for its sustainable characteristics:

- **Energy consumption – Independent Operation**: When configured for cellular data backhaul powered by a battery, required energy is refreshed by a solar panel. The panel is certified to produce sufficient charging capacity across all latitudes in the United States, in temperatures ranging from –30°C to 60°C (approximately -22°F to 140°F). As such, BlueTOAD consumes zero carbon-based fuels for operations.

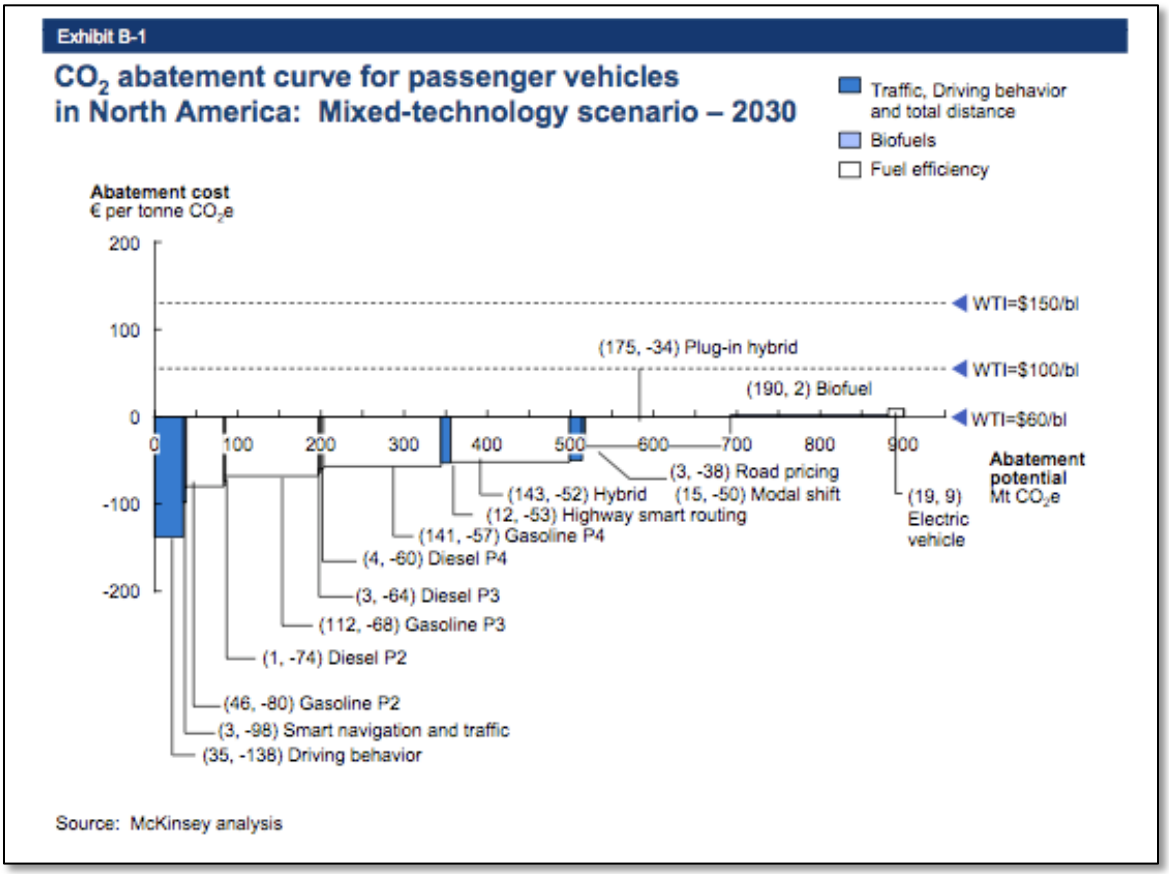
- **BlueTOAD Battery –** Lead-acid batteries are considered an environmental success story. More than 80% of lead produced in the United States is used in lead-acid batteries and 98% of all battery lead and plastic is recycled.

- **Energy Consumption – Integrated Operation:** When configured to operate with a local power source and wired data connection, BlueTOAD is designed to typically draw 80 mA of electricity, far less than comparable sensors. When communicating data through an existing data channel, BlueTOAD can even operate through highly efficient Power Over Ethernet (POE).

- **Installation –** BlueTOAD can adapt to a variety of installation scenarios; it is a rare circumstance when any new infrastructure is required. With its compact size and weight, and optional independent operation, BlueTOAD can be affixed to round light poles, I-beam sign supports, oblong overpass pilings, or just about any existing roadside structure. In integrated operations, BlueTOAD is again using existing infrastructure such as signal cabinets. As a result, the environmental impact of BlueTOAD installation is negligible.

- **Maintenance –** BlueTOAD software enables automated systems monitoring, Over the Air (OTA) diagnostics and device reboot. Barring catastrophic events (e.g. physical assault, vehicular crashes, direct lightning strikes), it is highly unlikely that any on-site maintenance of BlueTOAD units will be required following installation.

About TrafficCast *- TrafficCast is the leader in travel time forecasting and traffic information, developing technology, applications and content for the interactive, mobile, enterprise and public sector markets. TrafficCast analyzes real-time data from expressways and major arterials as well as information from secondary and tertiary roadways, weather conditions, roadway incidents and events, construction, and historical traffic patterns. The company is based in Madison, Wisconsin, with offices in Los Angeles, Philadelphia, Atlanta and Shanghai. http://trafficcast.com/*



"Exhibit B-1": Chart illustrating relative value of various approaches to mitigating carbon emissions due to transportion from *Roads Toward a Low Carbon Future: Reducing CO_2 emissions from passenger vehicles in the global road transportation system*, McKinsey & Co., May, 2009