EXPERTS TALK

Making Sense of ITS Trends and Technologies with **Pete Marshall**

How to Know Which Traffic Technologies to Pursue As Data and Automation Advance

Intelligent transportation systems are increasingly common in our streets and highways, helping agencies maximize roadway throughput, identify bottlenecks, and prevent and clear crashes to keep everyone moving. ITS focuses on the devices that detect traffic and on data about traffic behavior and movement. With the proliferation of smartphones and connected vehicles, agencies have more tools and information on how people travel and the impact of traffic on our roadways. But making sense of how and when to best use the new technologies and data streams can be challenging.

Pete Marshall is HDR's ITS technology program development lead. He has managed large, complex ITS programs to integrate vehicles, system users and infrastructure. His recent work focuses on ITS systems and their interaction with connected vehicle solutions and emerging data sources. In this interview he helps readers make sense of the latest ITS technologies and opportunities.

Q. What's new and trending in ITS today?

A. We have a wealth of new sources of data. Agencies traditionally have relied on limited or incomplete self-collected data from their own devices and sensors in the pavement or beside the road. Now they have third parties offering data based on crowd sourcing, mobile applications, connected and autonomous vehicles, and other sources. These new data streams are becoming more real time and are beginning to substitute for the traffic volume, travel time, speed and delay data that typically drives ITS processes and operations.

These new data streams can help agencies improve the performance of traffic management systems because the data is more robust, more comprehensive, and in many cases, more reliable. The richer data sets also provide the ability to apply artificial intelligence and machine learning techniques to predict traffic performance and incidents and allow agencies to take proactive steps to manage traffic, rather than simply reacting to data as it streams by. The next generation of traffic management systems will incorporate some of these techniques and agencies can start to imagine operational management use cases for real-time prediction.

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A related trend is that safety-driven ITS technologies and applications are invaluable to public agencies as they refocus their Vision Zero programs to address the rise in national roadway crashes and fatality rates experienced in the last three years. ITS and CAV technologies have tremendous potential to contribute to reversing crash rates and reducing fatalities over what can be accomplished by non-technology-based tools. ITS technologies can reduce secondary crashes by quickly detecting incidents and warning approaching drivers. CAV applications increase a driver's situational awareness and can warn of a crossing vehicle about to run a red light, a pedestrian about to cross in front of a car, or an upcoming traffic signal about to turn red. These are huge safety benefits.

Q. What is happening behind the scenes that makes ITS work smarter?

A. Automation is helping agencies work smarter. For example, many agencies measure success by the time it takes them to detect and clear incidents. A recent trend is using technology to automate responses to certain incidents to decrease the time required to clear them, thus reducing delays and the potential for secondary crashes.

The traditional way to handle an incident is that a motorist or witness calls 911 or notifies the traffic management center, which prompts a human operator to look at a nearby camera to confirm and assess the situation. The operator can then take an action such as rerouting traffic or changing the variable message sign alerts in the surrounding area or posting a Twitter alert to warn drivers. The critical path in this scenario is how long it takes for the incident to get the operator's attention.

What if we could automate some of those steps through rule-based algorithms thereby reducing the elapsed time before action is taken? Automation can monitor data and detect a traffic slowdown lasting, for example, more than 10 minutes or stretching more than 2 miles and be programmed in that instance to automatically put up a VMS warning and send a text to alert an operator. The operator can then follow up with more targeted actions based on the unique situation. Such automation could more efficiently detect and automate the initial response to everyday incidents, reducing the response and clearance time and freeing human operators to focus on more complex situations. So far there are a number of

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working examples, and there's a lot of research showing promise.

Q. How can an agency sort through the new technologies and data sources to decide which ones are worth investigating and which aren't likely to pan out?

A. The tech industry has recognized an opportunity with traffic data, so agencies probably feel as if every week brings a new start-up service offering a new solution. It can be overwhelming to keep up with.

Some tips on sorting through what's worth considering for budget-limited agencies:

1. **Is the technology clearly aimed at a problem that needs solving?** Cool technology in search of a problem most often does not provide a solid value proposition.
2. **Ask yourself - is it mature enough?** Has it been tested in real-world conditions, or only in the lab or under simulation? Lack of testing on the street with demonstrated results certainly increases risks of implementation.
3. **Are other agencies trying it?** What is the history of any pilot projects and what were the results? Pilots are often done under very controlled conditions and budgets so consider how similar the conditions are to your application.
4. **Can you test it in a pilot program or other incremental use?** A pilot or limited deployment is often essential to determining if a technology can help with your specific problem. Equally important is a pilot's utility in identifying maintenance and management issues with the system and evaluating if it is sustainable long term.

USDOT has a new grant program — **SMART Grants** — to help public sector agencies conduct demonstration projects using advanced technologies to improve transportation efficiency and safety. They're looking for solutions that are beyond R&D but not widely deployed yet, to let agencies test out new technologies in a trial environment. This is just the sort of real-world testing we need to help agencies evaluate which new solutions truly offer promise.

Q. Building more lanes used to be the default solution to improve mobility, but now agencies rely more on technology to move more people more efficiently using the infrastructure we've already built. Where are you seeing this approach notably succeed?

A. Florida Department of Transportation District 4 has adopted this mindset in an interesting and proactive way. In Broward County they're preparing for a new complex system to system interchange impacting I-95 and local SW 10th St that will take multiple years and impact traffic on both I-95 and local SW 10th St, which serves as an extension of the Sawgrass Expressway for the connection to I-95 from the west.

To get ahead of the curve and mitigate traffic during construction, FDOT has commissioned a project in advance of the interchange reconstruction to manage traffic on the surrounding arterials. The area has 25 miles of arterials on six different corridors, so the good news is there are alternate routes for traffic. But it's a very complex network so FDOT decided to install full instrumentation on these arterials — microwave detection, cameras, connected vehicle systems — to detect the traffic flows on all these arterial routes. Having this data baseline from all of the devices will allow traffic operators to advise drivers of the most efficient routes to use while the interchange is being reconstructed. But the really exciting part of the project is the inclusion of a real-time in-vehicle messaging system using mobile phone applications that will provide motorists with construction zone advisories, queue warnings, lane closures, predicted delays and other information. This system will be permanent after the construction and become part of District 4's Arterial Management System.

I don't know of any place that has done this before to this extent.

Q. What lessons can you share from your experience in delivering technology system programs?

A. ITS is part of most major highway programs, including design-build programs on which I have worked for years, where their delivery details make a big difference in project success. Integrating ITS systems across platforms and operations is a critical component to a successful project.

One lesson learned, particularly from design-build delivery, is that agencies need consistency in their devices. For example, many agencies would prefer not to leave the choice of specific field devices up to a contractor because varying devices, such as CCTV cameras, provided on every project can lead to maintenance and inventory headaches. In one state what worked well was blanket contracts with component vendors where the owner had pre-screened vendors of compatible systems and told the contractor to choose among pre-screened vendors. The contractor had latitude in where and how to place devices but was sure to be using devices the DOT knew would integrate into their existing system. So this strikes a balance to identify and specify what matters, while leaving the contractor to innovate where they bring the most value.

Another lesson learned is to make sure the technology has some longevity to it. In the early days of ITS we were often using devices repurposed from the telecommunications or security industries because that's what was available. That first generation ITS technology became obsolete quickly. As the industry has matured we can expect a longer lifecycle for technology. Ideally we're using systems advanced enough so you can expect them to last a few years before being obsolete but developed enough so they're not the newest. Still, as with the rest of the technology world, this is an ongoing challenge.

Finally, we are seeing a convergence, industry-wide, of ITS, CAVs, electrified vehicle technologies, and tolling technologies with a high degree of data integration between them. Agencies will need to navigate this inevitable convergence when planning and designing next generation systems.

Inspiration & Advice

Q. How did you get started in ITS?

A. When I first entered the industry there was no such thing as ITS, at least not formally. I started as a traffic engineer, and the highway world was just beginning to envision and implement more technology-based traffic management solutions. Very few agencies had roadside cameras or other devices for routine traffic management tasks. Before long, the industry and FHWA introduced Intelligent Vehicle Highway Systems, and the NTCIP (National Transportation Communications for ITS Protocol) standards.

These concepts slowly became ITS over time and traffic engineers started using these tools to manage traffic, a trend which just kept accelerating and from there we never looked back. I just sort of hitched my wagon to it early and came along for the ride.

Q. You've worked for consulting firms and system vendors, and you've represented owner agencies. From that perspective what advice can you share with others building their career in ITS?

A. I think it is important to have a broad perspective on all aspects of the industry and the technology. ITS involves field devices and construction, electronics, communications technologies, software, systems engineering, backend systems, operations, maintenance, traffic engineering, data processing, information technology, and increasingly, cloud hosting and cybersecurity. My advice would be to learn at least a little about as many of these as you can, as they all must come together for a successful ITS program. This may mean having a few varying roles or positions in your career, but don't be afraid of getting outside your comfort zone and trying something new.

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