# SUMMIT ON ALL-ELECTRONIC TOLLING, MANAGED LANES & INTEROPERABILITY



#### JULY 24-26, 2016 BOSTON, MA

#### **TECHNOLOGY & BUSINESS OF INNOVATIVE TOLLING**



Mid-way through a year marked by decisive progress on national interoperability, continuing growth of managed lanes and rapid introduction of transformative new technologies, the International Bridge, Tunnel and Turnpike Association (IBTTA) welcomed a record 620 participants from 17 countries to its 2016 Summit on All-Electronic Tolling, Managed Lanes & Interoperability.

## **TABLE OF CONTENTS**

| Executive Summary                                |
|--|
| Introduction4                                    |
| The New England Story5                           |
| Toward Interoperability 2.0: 'Less Can Be More'7 |
| Managed Lanes: Strategies to Deliver Results     |
| Connected and Autonomous Vehicles9               |
| It's About the Customer11                        |
| A New Era for Tolling and Mobility12             |
| Conclusion: A Glimpse of the Future12            |

#### **EXECUTIVE SUMMARY**

Mid-way through a year marked by decisive progress on national interoperability, continuing growth of managed lanes and the rapid introduction of transformative new technologies, the International Bridge, Tunnel and Turnpike Association (IBTTA) welcomed a record 620 participants from 17 countries to its 2016 *Summit on All-Electronic Tolling, Managed Lanes & Interoperability.* 

"It's about mobility. It's about moving people. It's about moving goods," and all of that depends on the widest possible collaboration and partnerships, said IBTTA President **Buddy Croft**, Executive Director of the Rhode Island Turnpike and Bridge Authority. "Let's never forget to remind people of how good we are and what we have to offer. Because if we don't define ourselves, someone else is going to try to do it for us."

Early in the Summit, participants got a deep dive into the diversity of user financing practices, policies, and experimentation going on in several parts of New England, a region that has established itself as one of the hubs of the global tolling industry. Massachusetts Secretary of Transportation **Stephanie Pollack** said her agency had been excited to implement all-electronic tolling and become an active member of IBTTA. "We're proud of our history of innovation, and innovative tolling is going to be a part of our future," she said.

MassDOT Highway Administrator **Thomas Tinlin** said the \$375 million the state collects from its 214 million tolled transactions each year delivers safer roads to everyone who drives the state's highways. "If we lost that money and we couldn't fill potholes, or show up to accident scenes in a timely manner, folks would not be happy, and frankly folks would not be safe," he said.

The Summit was a moment for participants to reflect on the often arduous push toward national toll interoperability in the United States, while looking ahead to the technology innovations that will herald the next generation of interoperability. They heard about a new multi-protocol transponder that allows users to pay their tolls on most U.S. systems through a single account, mobile apps that make all-electronic tolling more convenient for customers while cutting the cost of video tolling, and options for streamlining the industry's practices for managing accounts receivable.

In sessions on managed lanes, panelists talked about the outreach required to "get to yes" on a new project, and the time it takes for users to learn new lane configurations over the first few months of operation. Discussion highlighted the importance of education and marketing, using innovative tools like sports team partnerships, holiday season campaigns, billboards, "snackable" content on mobile apps and a "Captain Timesaver" motif to highlight the benefits of congestion management.

A moderator pointed to projects where cooperation between tolling and transit agencies more than quadrupled express bus ridership. "This is a huge win for transit commuting, and it's something we hope can be replicated on all the other express toll lanes in metropolitan areas," he said. Meanwhile, with future networks of managed lanes a near certainty, a couple of tolling authorities are thinking about how to standardize pricing, HOV preferences and operating policies from a customer standpoint.

A participant called for great clarity and consistency on two important issues for managed lanes: the pressure to agree to toll caps (price limits) that can severely undermine the efficient operation of a managed lane, and the expectation that managed lane revenue will fund unrelated projects. He noted that express lanes already deliver significant support to transit "by putting that \$1 billion worth of infrastructure on the ground that allows transit to get there."

With the rise of connected and autonomous vehicles, it will be up to the tolling industry to carve out its own role in a highway technology space that it no longer exclusively occupies. In response to an audience poll, 74 percent of

participants said IBTTA should organize the industry as a whole to play an active role in shaping the rollout of connected and autonomous technologies.

"This is a case of eat or be eaten," said one participant. "The toll industry is a minority part of the national highway system, and if we don't unify and speak out strongly, we risk being ignored and paying the price later on."

An audience member said it needn't be an either-or proposition, suggesting that the industry "work together with the technologists to figure it out." Technology specialists "are more willing to take risks than some of the agencies are," she said. "So there's potentially a good marriage there, but we need to be open to accommodating it." In a straw poll, a decisive majority of participants agreed with that statement.

Much of the discussion during the Summit focused on the potential of self-driving vehicles to dramatically increase safety, when 94 percent of crashes involve some element of human error. "The goal is to be able to begin the transition as quickly as possible and have these automated vehicles on the road. Then over time, with consumer acceptance, you'll see fewer and fewer legacy vehicles," a panelist said. In time, connected vehicles "are not going to be causing the crashes. You'll have legacy vehicles hitting the cars."

With 1.5 million people around the world dying in traffic collisions each year, another panelist said connected vehicles could have an impact on 70 to 80 percent of crashes affecting unimpaired drivers. But he predicted the technology's penetration won't likely exceed 25 percent before 2030, and warned against committing "automation abuse" by introducing the new technologies without due regard for the consequences for human performance.

Several panelists pointed to shifts in familiar notions of customer expectations, with the arrival of new generations of consumers who drive less, make wider use of transit and multiple transportation modes, are 2½ times more likely to adopt new technology when they encounter it, expect reliable, user-friendly mobility experiences—and by an overwhelming majority of 79 percent, are willing to pay for express lanes.

Throughout the Summit, panelists and participants gave snapshots of a new era for tolling and mobility, driven by sudden innovations and evolving practices that will be enabled by technology, responsive to customers, and designed to deliver safer, more efficient mobility to an ever-larger pool of customers. "We are moving forward," said one session moderator, "we've covered a lot of ground in the last four years, and we have a ways to go, obviously."

#### **INTRODUCTION**

IBTTA President **Buddy Croft**, Executive Director of the Rhode Island Turnpike and Bridge Authority, welcomed participants to the association's biggest-ever all-electronic tolling conference. "IBTTA is on an uptick," he said, with 620 participants from 17 countries attending the conference and a record number of exhibitors outside an annual meeting.

"One of the reasons we've got such a wonderful turnout is the content," he added. "People like to attend conferences that speak to things that are important to them and to what they do in their industry."

Croft recapped the association's work on national interoperability for the United States, its continuing outreach to likeminded transportation associations, and its successful *Moving America Forward* advocacy campaign. And he pointed to the tremendous changes he's seen in the decade he's been involved with IBTTA. "You're experts in transportation, not just tolling," he told participants. "It's about mobility. It's about moving people. It's about moving goods," and all of that depends on the widest possible collaboration and partnerships.

"Let's never forget to remind people of how good we are and what we have to offer," he concluded. "Because if we don't define ourselves, someone else is going to try to do it for us."

Massachusetts Secretary of Transportation **Stephanie Pollack** said her agency had been excited to implement allelectronic tolling and become an active member of IBTTA. "We're proud of our history of innovation, and innovative tolling is going to be a part of our future," she said. MassDOT Highway Administrator **Thomas Tinlin** said the \$375 million the state collects from its 214 million tolled transactions each year delivers safer roads to everyone who drives the state's highways.

"If we lost that money and we couldn't fill potholes, or show up to accident scenes in a timely manner, folks would not be happy, and frankly folks would not be safe," he said. Some critics might wrongly perceive AET as a cash grab, but "we in the transportation business know the real reasons. It's our never-ending quest to increase safety and decrease crashes, increase air quality, and decrease congestion."

#### THE NEW ENGLAND STORY

New England is one of the hubs of the global tolling industry, with a diversity of systems in place in four out of six states and a fifth one, Connecticut, giving serious consideration to reinstating tolls. Summit participants got a deep dive into the practices, policies and experimentation going on in several parts of the region.

MassDOT Highway Administrator **Thomas Tinlin** said the state has achieved transponder usage rates of 73 percent on its Western Turnpike, 81 percent on the Boston Extension, 74 percent across its tolled tunnels and bridges and 85 percent on the new Tobin Bridge AET system. Recognizing that AET "is the biggest public-facing system in the history of transportation in MassDOT," he said the agency had emphasized public and media education when it implemented two-way tolling on the Tobin three weeks previously. While the conversion to all-electronic systems produced incremental cost savings, "it's not about the money," Tinlin stressed. "We're not going to build ourselves out of congestion. Technology is the solution."

IBTTA President **Buddy Croft**, Executive Director of the Rhode Island Turnpike and Bridge Authority, said his state faces familiar challenges with highway infrastructure funding, even though it's the smallest by size in the country. "We have 12 lanes," he told participants. "Not 12 facilities. Twelve lanes." But it still took years to come up with a response to the state's funding gap.

**Peter Garino,** Chief Operating Officer at the Rhode Island Department of Transportation, showed a video, set to the tune of *Born to Be Wild*, that traced the state's transition from bad news to good on infrastructure upgrades. It chronicled groundbreakings and financial awards for bridge improvement projects, new job numbers, higher weight limits on the Great Island Bridge after 20 years of restrictions and support from business and elected leaders for Governor Gina Raimondo's RhodeWorks truck tolling program.

RhodeWorks will bring the state up to the federal government's 90 percent minimum sufficiency standard for bridges within a decade, Garino said, while saving \$1 billion compared to the previous trajectory for bridge repairs and reconstruction. "It costs less if you catch a bridge before it goes over the cliff and costs that much more for reconstruction," he told participants, explaining that RhodeWorks tolls are limited to trucks because tractor trailers represent 70 percent of the damage to the infrastructure. "We need to get those folks who are benefiting the most from our bridges to pay their fair share."

**Peter Mills,** Executive Director of the Maine Turnpike Authority, said a 70 percent E-ZPass penetration rate means his state still faces serious challenges with cash payments as traffic volumes rebound from recession-era lows. Many cash payers come from four Canadian provinces and Vermont, a state that "has no tolling or interest in identifying its citizens," he said. But the Turnpike sticks with cash because it's cheaper than trying to collect a \$1 or \$3 payment "from someone you don't know and with whom you have no relationship."

Toll reciprocity between Maine, Massachusetts and New Hampshire is working well, Mills said, for reasons that go beyond the individual payment. "It's not unusual for us to get that person on the phone, and if it's a trucking company we'll find out they've still got other tolls owed, and they come clean. And at some point they get turned into E-ZPass customers."

But for other jurisdictions, "what about good, old fashioned information reciprocity?" he asked. Mills traced the Turnpike Authority's efforts to identify the "wildcat truckers" from New Brunswick and Quebec who use the road without paying.

**Laura Marriott,** Toll Collections Manager at the New Hampshire Department of Transportation, drew on her own early experience as a toll collector to recount the introduction of Open Road Tolling (ORT) at her state's Hampton and Hooksett toll plazas. It was obvious by 2008 that the "short but very important stretch of road" through the state was beyond full capacity, with congestion that continued through the day and "absolutely horrible" air quality. Introduction of the Hampton ORT system in 2010 "really opened things up, and I know the public surely appreciated it," she said. The system still has its challenges, but New Hampshire ruled out AET after a close look at the corridor's traffic profile and the significant potential for leakage: with 54 percent of violations coming from out of state, AET would risk \$44 million in lost revenues.

The Hooksett ORT plaza opened over the Memorial Day weekend in 2013. When NHDOT added video enforcement on the cash collection lane not long afterwards, toll attendants "breathed a sigh of relief," Marriott said. "They take it personally when someone goes through and doesn't pay their toll."

Most recently, New Hampshire issued a tender to convert the Bedford toll plaza, a heavily commuter-based facility, to ORT with multi-protocol readers. The state also reviewed its toll classification system, which has remained unchanged since Marriott began working as a toll collector in 1986. The best approach to an update will likely be to combine it with a rate increase, and Marriott said the DOT is considering a weight-based system: "The trucks are really beating on our roads pretty hard," she said, but a rate per axle means semis pay the same toll as pickup trucks with trailers.

**Thomas Maziarz,** Chief of the Connecticut Department of Transportation's Bureau of Policy and Planning, said his state still carries baggage from the toll system it discontinued in the 1980s, including serious traffic backups, asbestos risks for toll collectors due to wear and tear on brake pads, and "a number of horrific fatalities at the toll stations, as large trucks plowed into the back of the queue." So beyond the challenge any jurisdiction would face in trying to introduce tolling, "we have a long memory of how bad the old tolling system was. We're having to go through a re-education process just to discuss the possibility of tolling in Connecticut."

Connecticut has been looking at tolling primarily as a congestion management tool, but is becoming increasingly interested in the revenue potential, Maziarz said. He credited the federal Value Pricing Pilot Program with funding the studies that analyzed the potential in detail: "In the short term, the amount of knowledge and understanding of what would happen if we instituted tolling was just phenomenal," he said. The state's studies showed that, lucrative as border tolling would be, a statewide system would generate much more revenue, in the range of \$250 to \$350 million per year after costs.

Mills pointed to the diversity of tolling systems in New England, stressing that "we're all making correct decisions after studying carefully the profile of our travelers, and balancing that against the available real estate." With so many factors to consider in the transition from cash to AET, "you really need to do an evaluation, as we did, to get to the bottom line of what the surcharge is going to be, then make a good political decision about whether you're going to impose that on your drivers."

#### **TOWARD INTEROPERABILITY 2.0: 'LESS CAN BE MORE'**

**Dave Kristick,** Deputy Executive Director and Director of Operations for the E-470 Public Highway Authority, traced the history and achievements to date in a six-year effort to achieve national interoperability between regional tolling systems in the United States. While Summit participants reflected on the often arduous push toward interoperability, several panelists focused on the technology innovations on the near horizon that will herald the *next* generation of interoperability. Presentations focused on:

- Multi-protocol transponder technologies that can offer immediate, practical solutions to meet the 2016 deadline for national interoperability;
- Options for mobile apps that build on widespread use of smart phones to make the tolling experience more convenient for customers, while supplementing video tolling with readings that reduce the overall cost of the process;
- Lessons learned from the accounts receivable management industry that will improve collection rates by shifting customer behaviors and relationships; and
- Insights from the development of autonomous vehicles that hint at the shape and form of the next generation of interoperability systems.

A panelist described a new multi-protocol transponder that has been available since mid-May and allows users to pay their tolls on most U.S. systems through a single account. The transponder module is integrated into the rear view mirror, where it isn't distracting for the driver and is perfectly placed for readers.

"It contains all the predominant protocols in use in the United States," he said, "and the important aspect here is that as this transponder is read by the individual agencies, it looks like a local tag." The system offers agencies guaranteed payment, with no need to change out their existing AET systems.

"I get this question all the time," he said. "Seriously, there are no changes needed for any of the agencies in their infrastructure, hardware, or any of the back office systems." He added that any vendor could produce a similar product, but "we don't see a lot of companies clamoring to do this because the volume of customers that need national interoperability is not that great right now. It's a very specific segment of the population."

Another panelist pointed to mobile technology as an opportunity to streamline the tolling experience for customers, while addressing the costs associated with video tolling. One available app, launched in nine languages in Poland late last year, allows users to check their toll balances, add funds to their accounts, edit payment and account details, calculate their tolls, find the nearest customer service center, receive real-time notifications or check their account histories. The video enhancement app, meanwhile, supplements the existing image capture system, making it easier and cheaper to verify transactions. Potential future applications include advanced traffic management, accurate level of service calculations, incident reporting, HOV declarations, mobile commerce and parking apps.

A panelist noted that the tolling industry only recently moved to systems in which 30 to 40 percent of their revenue collection occurs post-transaction, making this the ideal time to look at the experience of the accounts receivable management industry. Technology can be used more effectively to find and contact customers with payments due, educate and motivate them, offer them multiple payment options and tap data mining opportunities to optimize transactions.

He pointed to one simple fix for account management systems: while 15 to 20 percent of first notices sent by mail are returned with bad addresses, and mail is the least popular communication method for customers with payments due, "guess what's the number one way tolling agencies contact you when there's a problem with your account," he said.

"It's not only the one you don't want [to receive]. It's the one that costs the most." Agencies could make it easier for customers to pay their bill, using available cash and web-based networks that would even allow them to pay at a grocery store. But that can be easier said than done for public agencies.

"The reason it hasn't taken off in the tolling industry is that very few technical implementations have taken place in the last three or four years," the panelist noted. Public entities have to plan capital projects years in advance, "and by the time we get to the actual implementation, the technology is at least two years old—we specified x, and now it's morphing into y. That's just one of the challenges that public agencies face with keeping their technologies up to date."

Looking to the future, a panelist said tolling agencies have already done a good job of sharing data and building the financial and transaction systems that are the cornerstone for national interoperability. But customers' rapid adoption of cloud-based, mobile, "frictionless" commerce gives some hint at the third-party platforms that will set the contours of Interoperability 2.0.

"Standing between you as a toll authority and the users of your roadway will be these third-party services where people do their business," he said. "They shop, they spend, they manage their financial affairs," and more and more transactions will map back to the consolidated platforms where customers gather. He cited BestPass and PrePass as systems that already serve that kind of intermediary role for the trucking industry.

The result may be that tolling agencies see their customer counts decline, with individual accounts consolidating into single systems like GM, Amazon or cell phone companies. If that happens, in-house head counts will fall, back offices will shrink, geocoding could bring an end to the need for transponders, and marketing budgets will largely become redundant.

"You don't have to market yourself, be distinctive, be cute and fuzzy as a toll authority, when all you're doing is charging people for mobility," he said. "You can focus on what you do best: running the roads, capturing transactions and now, using Interoperability 2.0 tools to go to where your customers are. From the customer's perspective and yours, less can be more."

#### **MANAGED LANES: STRATEGIES TO DELIVER RESULTS**

Fifteen years after the Texas Transportation Institute coined the term "managed lanes," their use is expanding rapidly, creating a wealth of opportunities for tolling agencies to learn by experience and make a powerful tool even better. Summit panelists talked about the public and legislative outreach required to "get to yes" on a new managed lane project, and the time it takes for users to learn new lane configurations over the first few months of operation.

Presentations and discussion pointed to education and marketing as the crucial common denominator—to make the case and dispel the myths about managed lanes, then help drivers navigate the lanes safely and efficiently. Panelists talked about a variety of marketing strategies, including partnerships with local sports teams, holiday season campaigns, billboards, and extensive use of social media. One tolling agency relies heavily on short, "snackable" content on mobile apps, and created a "Captain Timesaver" motif to highlight the benefits of congestion management. "Your content needs an emotional or humorous edge, or it's just white noise," a panelist stressed.

A session moderator said it was brilliant of one agency to redesignate its general purpose lanes as *local* lanes, to underscore the role of the adjacent express lanes in managing congestion.

A panelist said it made intuitive sense to drivers when they saw managed lanes introduced along existing toll roads in Florida; the key question was how to set up signage, so that users knew what to expect. Questions sometimes arise

about the regional allocation of toll revenue, but "first and foremost, we try to remind people that the express lane is a congestion management tool," the panelist said. A number of regions within Florida's Turnpike Enterprise are also looking at how revenues can support bus rapid transit.

Some agencies have been making a transition from HOV2 to HOV3 lanes, with one panelist pointing to the significant difference in revenue in his jurisdiction. "We are completely open to allowing HOV2, but we need somebody to pay \$30 million," he said, "and that was certainly a very different conversation." Another agency had to make the change because its HOV2 lane was already congested: "We were focused on management, not revenue," a panelist said.

A session moderator pointed to express lane projects where cooperation between tolling and transit agencies had more than quadrupled express bus ridership. "This is a huge win for transit commuting, and it's something we hope can be replicated on all the other express toll lanes in metropolitan areas," he said.

With future networks of managed lanes a near certainty, a couple of tolling authorities are thinking about how to standardize pricing, HOV preferences, and operating policies from a customer standpoint. One jurisdiction adopted "CPR" (constant, predictable, repeatable) as its motto for a set of policies that was developed in one region, then applied across a state-wide agency. Another metropolitan area found it challenging to harmonize HOV standards and payment rules across multiple managed lane projects. "It comes down to carpooling, and the willingness to make the shift," a panelist said. "But people are starting to see the value of consistency from the driver's perspective."

Another state decided to accept "some consistent inconsistency" to accommodate differences in user profiles and project financing across its various managed lanes. "We want to make sure we're not married to an exact delivery method for a project," a panelist said. "For public efficacy, it's important to show that you evaluated each corridor and figured out what project works with that specific corridor, so it doesn't look like you're squeezing a square peg into a circular hole."

The same jurisdiction has been using short-term bridge loans to accelerate managed lane construction, to broaden its operating experience with the lanes without having to wait for tolling revenue to accumulate.

A participant cited two issues to be clarified at the national level: the pressure to agree to toll caps (price limits) that can severely undermine the efficient operation of a managed lane, and the expectation that managed lane revenue will fund unrelated projects. He noted that express lanes already deliver significant support to transit, "by putting that \$1 billion worth of infrastructure on the ground that allows transit to get there." A session moderator agreed that "it pales into insignificance that you're not giving them operating subsidy money as well," when a reliable lane enables a jurisdiction to quadruple daily transit ridership in five years. "We've never seen anything do that before, and we have to make more of that as a terrific benefit" of express lanes.

The moderator added that "siphoning off revenue for other purposes seems totally counterproductive, but it's something elected officials don't understand at all. That's a challenge." A panelist noted the frequent expectation that a project will give something back if it involves shifting an HOV2 lane to HOV3. "If I could have offered 100 hours' more transit service per month, a lot of people would have been happy with that," she said. A participant responded that express lanes are "an excellent opportunity for toll agencies to foster and support the idea of integrated mobility solutions" that urban areas will need to counter congestion.

#### **CONNECTED AND AUTONOMOUS VEHICLES**

Facilitator **Seth Kahan** introduced the discussion of new and emerging technologies with a video of a starling murmuration, a celebrated spectacle in which the bird flock together and form what humans see as a fantastic array of

acrobatic moves. The experience "shows how, from a distance, there's great order to what often feels like chaos inside," Kahan said.

The drive to national interoperability has seen many players at work, he told participants. "But as you step back into the great span of time, you'll see an evolution. You'll see increasingly ordered choices being made, trends emerging, and the coalescing of a lot of forces into a unifying front. That's the stage we've seen with every kind of technology that is emerging today," and the question for transportation and tolling professionals is whether they'll play the role of victim, agent or driver in the next phase of that evolution.

With the rise of connected and autonomous vehicles, Kahan said, it will be up to the tolling industry to carve out its own role in a highway technology space that it no longer exclusively occupies. In response to an audience poll, 74 percent of participants said IBTTA should organize the industry as a whole to play an active role in shaping the rollout of connected and autonomous technologies.

"This is a case of eat or be eaten," said one participant. "The toll industry is a minority part of the national highway system, and if we don't unify and speak out strongly, we risk being ignored and paying the price later on."

Another audience member said it needn't be an either-or proposition, suggesting that the industry "work together with the technologists to figure it out. The reality is that they think differently, they think in a way that we don't, and that enables them to enter this space" in a way that could be a starting point for closer collaboration.

Whereas tolling agencies necessarily focus on the present-day challenge of collecting highway revenue, "the technologists really think in a future that we don't necessarily fully comprehend," she added. "They're more willing to take risks than some of the agencies are. So there's potentially a good marriage there, but we need to be open to accommodating it." In a straw poll by the facilitator, a decisive majority of participants agreed with that statement.

Much of the discussion during the Summit focused on the potential of self-driving vehicles to dramatically increase safety, when 94 percent of crashes involve some element of human error. "The goal is to be able to begin the transition as quickly as possible and have these automated vehicles on the road. Then over time, with consumer acceptance, you'll see fewer and fewer legacy vehicles," a panelist said. Before long, crashes will not be caused by the growing autonomous fleet, but by its interaction with older vehicles during the three decades it will take to complete the changeover.

"They're not going to be causing the crashes," he added. "You'll have legacy vehicles hitting the cars."

With 1.5 million people around the world dying in traffic collisions each year, another panelist said connected vehicles could have an impact on 70 to 80 percent of crashes affecting unimpaired drivers. But he predicted the technology's penetration won't likely exceed 25 percent before 2030, and warned against committing "automation abuse" by introducing the new technologies without due regard for the consequences for human performance.

One panelist foresaw introduction of dedicated lanes for autonomous vehicles, to avoid mixing fleets. A participant recalled an instance in the last couple of decades when the U.S. government identified 450,000 critical intersections across the country that would need instrumentation to make intelligent transportation work. "When they computed the cost of that, they pulled the plug on the program," he said. The panelist said dedicated lanes are now much less costly—the technology is cheaper and can be installed in mobile phones or other existing infrastructure.

A participant said the rise of connected and autonomous vehicles reminded him of the introduction of RFID in the early 1990s—which led to the development of seven competing protocols that the industry is now working hard to

harmonize. "This time around, we can't screw it up, because someone else will fix it for us," he warned. And if Apple or Visa enter the space, "once they get traction they really get traction."

A panelist said companies like Visa are already building e-commerce platforms into vehicles, against the expectation that 250 million vehicles around the world will be connected to the cloud by 2020. "By 2040, the vast majority of vehicles on your roadways will be fully autonomous," he said, and that shift could undermine the tolling industry's competitive advantage.

"Toll roads are safer, and that matters to customers," he said. "But if driving is 80-90 percent safer and most of those gains are on other roads, your advantage goes down." Moreover, "if driving is no longer drudgery, but the vehicle can be a place of consumption and connection, an extra five minutes on a side road to avoid a toll road may well be worth it."

Another panelist noted that Ford, Google, Lyft, Uber and Volvo had already formed a non-profit coalition to support deployment of self-driving vehicles in the United States. In a scenario where "the driver is the passenger" and "there is zero expectation that the driver will ever have to intervene in the driving task," he said, "you open up the world" for populations that can't manage the driving task on their own.

A complete, reliable self-driving solution contrasts sharply with the recent fatal crash in which a Tesla autopilot (and the driver) failed to detect a roadway hazard—since handing control back to the driver is one of the toughest challenges in autonomous vehicle development. "It's a much harder technology task," the panelist said, "but it answers the questions about human error."

Another speaker said adoption rates for new technology "can vary dramatically, and we don't know where autonomous vehicles actually fit on the curve. Technology alone is not the issue. Adoption comes about as a result of trust, and Millennials don't yet trust self-driving cars."

The next dramatic shift, a panelist said, would result from the adoption of driverless freight. "All of a sudden, the rail-truck market share could change dramatically, and that could happen very quickly."

### **IT'S ABOUT THE CUSTOMER**

Several panelists looked at how familiar notions of customer service and customer acceptance are shifting, given the rise of new technologies and the arrival of new generations of consumers. A couple of speakers painted a picture of an unprecedented demographic of Generation Y/Millennial customers born between 1980 and 1989 who are now the largest segment of the population, drive less, make wider use of transit and multiple transportation modes, are 2½ times more likely to adopt new technology when they encounter it, expect reliable, user-friendly mobility experiences— and by an overwhelming majority of 79 percent, are willing to pay for express lanes.

Summit presentations placed this change in expectations at the center of a new profile of digital customers who are connected, mobile and active in online social communities. "They learn online, they shop online, they exercise online and they travel online," a panelist said. They're inclined to try out services like Uber, Lyft and Airbnb, and "all of them are moving into our industry."

Other panelists pointed out that consumer acceptance is hardly a new issue in transportation—from red light cameras, to speed analyzing devices, to all-electronic tolling, emerging technologies are routinely met with skepticism by some part of the driving public. "As you all move forward in dealing with electronic tolling, don't take those negative messages

too lightly," one speaker advised. "Because momentum can build, and it can overtake an opportunity to make the driving environment safer, less congested and more efficient."

Customer acceptance issues are also touching other elements of the transportation community, sometimes in unexpected ways. Insurance companies "are open ears right now" on automated and connected vehicles, the speaker noted, understanding that they will be expected to respond in a timely way if new technologies can measurably reduce crash risk. Another panelist said his state's American Automobile Association chapter has been having trouble attracting younger members, while services like Waze exceed 50 million users.

#### A NEW ERA FOR TOLLING AND MOBILITY

Time and again, Summit panelists and participants gave snapshots of a new era for tolling and mobility, driven by sudden innovations and evolving practices that will be enabled by technology, responsive to customers and designed to deliver safer, more efficient mobility to an ever-larger pool of customers. They suggested that:

- Tolling will become more like a utility, like water and sanitation, functioning as a small but essential piece of an integrated transportation system.
- Multimodal transportation systems will reflect continued migration to urban cores and increased telecommuting, while accommodating the large number of roadway users who must still travel longer distances on a regular basis. Increasingly, these systems will be interoperable across modes.
- Tolling agencies will have access to vastly more data, generated by ever-increasing levels and sophistication of connectivity and by an ever-wider array of connected devices. Big Data systems are already making it possible for some IBTTA members to use predictive analytics to better understand key customer segments and deploy their services accordingly.
- In a customer-centric future, users will choose among an array of integrated options to travel to work or entertainment, including autonomous and connected vehicles, buses, rail or walking.
- The software on which tolling authorities depend will become ever more efficient: agencies that upgrade out-ofdate systems now can expect smaller file sizes, with 33 percent fewer lines of code and 40 percent fewer files, capable of handling twice as many connections at twice the speed while requiring less staff support.
- Agencies will have much greater ability to track costs associated with different types of transactions, model competing scenarios and identify pricing alternatives that optimize net revenue.
- Roadside concessions will become an integral part of all-electronic tolling agencies' efforts to maintain direct contact with customers, when toll collectors are no longer the day-to-day face of the industry. Concessions are already shifting to accommodate dramatic changes in customer demographics, needs and expectations—from faster stopovers, to Wi-Fi access before they head back out on the road. Concession operators will increasingly use point-of-sale data to maximize customers' purchasing behavior and satisfaction with their rest area experience.
- As many of these transitions play out, tolling and other transportation professionals will necessarily use integrated design thinking to test concepts that shake up the habits of an entrenched system. A couple of panelists and participants recommended starting with simple functionality—following the example of innovators from Starbucks to smart phones—then building on successful experiences.

#### **CONCLUSION: A GLIMPSE OF THE FUTURE**

Amid the day-to-day manifestations of an industry in rapid transition, the 2016 *Summit on All-Electronic Tolling, Managed Lanes & Interoperability* featured some solid glimpses of a future that was taking shape before participants' eyes. On the final day of the conference, IBTTA President **Buddy Croft** announced the winners of IBTTA's 2016 Toll Excellence Awards, all of whom will receive formal recognition at the association's *84<sup>th</sup> Annual Meeting & Exhibition* in September:

- Administration & Finance: Florida's Turnpike Enterprise
- Customer Service & Market Outreach: North Carolina Turnpike Authority
- Social Responsibility: The Foothill/Eastern Transportation Corridor Agency
- Technology: Harris County Toll Road Authority
- Toll Operations, Engineering & Maintenance: Central Florida Expressway Authority
- Private Sector Innovation: CDM Smith

The closing session wrapped up with a standing ovation for a group of four Northeastern University students, each of whom traced their own research on how tolling and other forms of user financing will help the next generation of Bostonians live in a smarter, more livable city. They included:

- Ahmed Halawani on use of traffic signals to improve safety on urban multi-lane roads;
- Sara Rauwolf on creating a market for curbside residential parking;
- · Linghong Zou on dynamic mileage-based usage fees; and
- Alice Wang on congestion pricing for emerging mobility services.

A comment from one session moderator summed up the sense of achievement, opportunity and challenge that pervaded the entire Summit: "We are moving forward, we've covered a lot of ground in the last four years and we have a ways to go, obviously."