84TH ANNUAL MEETING & EXHIBITION

IBTTA

TOLLING. MOVING SMARTER.

SEPTEMBER 11-14, 2016
DENVER, CO

PEOPLE, PARTNERSHIPS & PROGRESS

TABLE OF CONTENTS

EXECUTIVE SUMMARY

People, Partnerships and Progress was the theme when the International Bridge, Tunnel and Turnpike Association (IBTTA) convened its *84th Annual Meeting & Exhibition* in Denver, Colorado September 11-14.

Throughout the conference, panelists looked ahead to a dynamic but uncertain future, with familiar toll technologies evolving in parallel with disruptive new developments—from connected and autonomous vehicles, to Big Data analytics, to drones. A highly anticipated presentation by alumni of the IBTTA Leadership Academy connected the future of toll roads to their history, making it clear that solid partnerships will be at the center of the industry's development over the next 25 years.

"The world sees a toll road," a panelist said. "The operator sees a very complex enterprise at the crossroads of technology, public safety and a changing future."

Panelists from Colorado stressed the tradition of collaboration that has helped make the state a highway mobility success story. Colorado Lieutenant Governor **Donna Lynne** expressed her admiration for the engineering marvels that "facilitate commerce, recreation, and all of the things we need to do." City of Thornton Mayor **Heidi Williams,** Vice-Chair of the E-470 Public Highway Authority, traced the development of a regional network that "planted the seeds of collaboration" among the private, public and non-profit sectors, driving a deliberate effort to diversify the state economy.

IBTTA Second Vice President and E-470 Executive Director **Tim Stewart** pointed to the road's economic impact, including $34.8 billion in real estate valuation along the corridor, 407,000 homes built within the impact area, and 132,000 jobs created. Another panelist described the wider funding challenges facing Colorado, with a state transportation budget that has fallen from $125.70 to $68.94 per capita.

"We've added to our system. We have two million more people here," a state official said. "We're dealing with more signals, more costs, and we as a government agency are past the point of doing more with less," he told participants. "We're now in the era of doing less with less." Other speakers traced the evolution of the region's electronic toll system, stressing the importance of cross-sector collaboration and the value of variable-price lanes as a congestion management tool.

Throughout the Annual Meeting, panel presentations came back to the need for collaborative tools and concepts—from public-private partnerships, to smart cities, to multi-modal transportation, to Big Data—that can only succeed at the junction between jurisdictions, disciplines, and sectors. One tollway planner said the future of his system will depend on three factors: power, fiber, and communications. "We can't build our way out of congestion, so that's the way we're looking at it: what opportunities do we have through technology," he said.

From the beginning of the conference to the end, it was a foregone conclusion that technology would be the main focus or a key cornerstone of every topic under discussion. With tolling interoperability high on the agenda in dozens of countries, U.S. agencies took stock of their multi-year push to harmonize roadway and back office systems across the country, while toll operators from other continents traced their progress to date and lessons learned. Panelists also discussed the rapid rise of connected and autonomous vehicles, with one of them pegging the potential economic value of the next generation of vehicle technology at $3 to $4 trillion.

"Without connected vehicles, you will not be able to improve the capacity of the highway system," he said. But participants heard multiple views and predictions on the speed with which connected and autonomous vehicles will enter the transportation system, and whether they will increase or reduce per capita vehicle miles travelled.

A transitional question, meanwhile, is whether it will be necessary and practical to establish separate lanes for connected and autonomous vehicles—and whether toll roads are already in an ideal position to offer that service.

Panelists also placed autonomous vehicle development in the context of a wider trend that takes in smart cities, multi-model technology, and sustainability, as well as more granular but still tremendously important developments like car-sharing, mobile payments, and urban tolling. "I do believe some disruptions are coming down the road that will shake things up quite a bit," said one presenter, but "the revenue generated by folks in this room is irreplaceable. It can't go away, especially with a declining gas tax."

With a rare period of legislative stability in the United States following the passage of the *Fixing America's Surface Transportation (FAST) Act,* panelists and participants dug into the longer-term funding and financing issues facing highway transportation. The group explored the full range of revenue models, from tolling and managed lanes to a variety of mileage-based systems. In a session on the credit implications of different financing alternatives, a panelist noted that the tolling industry as a whole is showing "marked improvement" in its medians for traffic growth, with a 4.9 percent increase in 2015 compared to 2.8 percent in 2014. Median operating revenue was up 6.5 percent in 2015.

The constant tension between data privacy and data mining was a continuing theme. On one hand, tolling agencies are determined to keep up their successful track record for protecting vital customer data and preventing data breaches before they occur, while preparing to confront any future cybersecurity issues as they arise. On the other, several panelists pointed to the growing opportunity to maximize efficiencies and business opportunities by making better use of the aggregate data that agencies have in hand.

A couple of panelists focused the cybersecurity discussion on structures and vulnerabilities that are specific to tolling agencies. One of them encouraged participants to think of roadside components, back office systems and customer service as separate security zones, each with their own equipment, IP addresses, vulnerabilities, interconnections, and cybersecurity strategies.

At the same time, another group of presenters urged agencies to make better use of the business intelligence embodied in the data they routinely collect. "The amount of data created on a daily basis is so big that people argue about what to call a number with that many zeros," a panelist said, and nowhere is the potential of that data more obvious than in tolling, where many organizations are still "rich in data, but poor in insights."

Panelists also discussed a more complex communications environment in which attention spans are short, phone texting is dominant, and stakeholders expect to be consulted or informed—sometimes at 3:00 AM. They repeatedly stressed the value of interacting on the social media platforms where key audience groups already gather, with one speaker saying she couldn't imagine not making good use of the tool that has become the leading daily activity in the United States.

INTRODUCTION

The International Bridge, Tunnel and Turnpike Association (IBTTA) convened its *84th Annual Meeting & Exhibition* in Denver, Colorado, one of the fastest-growing states in the United States, and in a community that has known the benefits of all-electronic tolling for many years. From the moment the conference began, panelists and participants stressed the commitment to collaboration and achievement that have made Colorado a highway mobility success story.

Colorado Lieutenant Governor **Donna Lynne** acknowledged the engineering marvels—from the state's transportation systems, to the wood bridges along Peru's Inca Trail that she had been touring just 24 hours before—that "facilitate commerce, recreation, and all of the things we need to do." She noted that "many of us who are civilians in this world take our transportation infrastructure for granted, and you are the people who make us move and live the kind of lives we need."

IBTTA President **Buddy Croft,** Executive Director of the Rhode Island Turnpike and Bridge Authority, traced the key initiatives IBTTA had undertaken in the course of the year, including conformance testing for national toll interoperability, a landmark survey on toll technology utilization across the U.S., and an upcoming visioning summit that will bring together 17 key transportation associations in Washington, DC. "The transportation industry can better prepare to drive the debate," he said, starting from a "commitment to technology, and to making the lives of our customers easier and more convenient."

During the Annual Meeting, IBTTA officially announced the winners of its prestigious Toll Excellence Awards for 2016 and recognized **Alain Estiot,** Managing Director of Toll Collect GmbH, **Mike Heiligenstein,** Executive Director of the Central Texas Regional Mobility Authority and **John McCuskey,** recently-retired Executive Director of the E-470 Public Highway Authority, as honorary members.

EMBRACING A COLLABORATIVE FUTURE

Throughout the conference, panelists debated the likely dimensions of a dynamic but uncertain future, with familiar toll technologies evolving in parallel with disruptive new developments—from connected and autonomous vehicles, to Big Data analytics, to drones. A highly anticipated presentation by alumni of the IBTTA Leadership Academy connected the future of toll roads to their history, making it clear that solid partnerships will be at the center of the industry's development over the next 25 years.

"The world sees a toll road," a panelist said. "The operator sees a very complex enterprise at the crossroads of technology, public safety and a changing future."

But whatever other adjectives describe that future, look no farther than Colorado for evidence that the road ahead will be technologically advanced and relentlessly collaborative. City of Thornton Mayor **Heidi Williams,** Vice-Chair of the E-470 Public Highway Authority, traced the collaborative tone back to the 1980s recession, when local businesses realized that "the traditional competitive model was harming our economic growth and our success." The resulting regional network "planted the seeds of collaboration" among the private, public and non-profit sectors, driving a deliberate effort to diversify the state economy, and helping to pull Colorado out of its economic slump.

Denver also owes its existence and present-day form largely to a group of private investors who built a spur line to the transcontinental railroad, after hearing that the main line would travel through Cheyenne, Wyoming. That history "has been the foundation of how we think of transportation still," a panelist said. "It's transformational in terms of our future." Nearly 150 years later, reliable mobility is central to the community's work force strategy—and to Denver's ability to offer new arrivals a quality of life that means getting out to mountain recreation areas *and* getting home on time.

With that in mind, the panelist said the Denver Metro Chamber of Commerce developed a set of transportation funding principles that focuses on:

- Ensuring long-term, sustainable investment
- Considering state-wide implications of local decisions
- Attaching user fees to all new infrastructure to support long-term maintenance, and
- Factoring in generational and technological shifts that are transforming "the way we think about getting around, and get information about getting around."

Colorado has recognized that "there is no project we can do that does not require all the sectors to work together to accomplish," she added. "One thing we've been working on in Colorado is to move away from this notion that one sector can blame the other" when something goes wrong. That kind of messaging "lowers people's confidence in our capacity to do it in the future," underscoring that collaboration today is essential to the state's future success.

IBTTA Second Vice President and E-470 Executive Director **Tim Stewart** pointed to the road's economic impact, including $34.8 billion in real estate valuation along the corridor, 407,000 homes built within the impact area, and 132,000 jobs created. By its very existence, E-470 saves 14.8 million driving hours and $26.1 million in travel time per year, while reducing crashes and improving safety. "E-470 saves lives," Stewart said. "That's our key, primary focus."

Shailen Bhatt, Executive Director of the Colorado Department of Transportation, made the case for revenue from toll operations and managed lanes, noting that he sometimes has to push back against demands that the state do more with less. With the state's population and vehicle miles travelled (VMT) on the rise, CDOT's budget is down from $125.70 per capita in 1991 to $68.94 today.

"We've added to our system. We have two million more people here. We're dealing with more signals, more costs, and we as a government agency are past the point of doing more with less," he told participants. "We're now in the era of doing less with less. I can't take the same amount of peanut butter, smear it over more toast, and expect to have the same level of service." CDOT's two priorities to maximize effectiveness: Greater reliance on highway technology, and managed lanes.

Other speakers traced the evolution of the region's electronic toll system, stressing the importance of cross-sector collaboration and the value of variable-price lanes as a congestion management tool.

Throughout the Annual Meeting, panel presentations came back to the need for collaborative tools and concepts—from public-private partnerships, to smart cities, to multi-modal transportation, to Big Data—that can only succeed at the junction between jurisdictions, disciplines, and sectors. One tollway planner said the future of his system will depend on three factors: power, fiber and communications.

"We can't build our way out of congestion, so that's the way we're looking at it: what opportunities do we have through technology," he said. The panelist said his agency's mission is to move people, goods, and service to support local, state, and regional economies. With close connections to the state DOT, transit agencies, the freight industry, and other transportation modes, the accent is on establishing a solid infrastructure backbone, with enough redundancy built in, to take maximum advantage of data analytics, connected autonomous vehicles and smart roadway technologies designed to improve the driving experience.

One participant asked how quickly tolling agencies are likely to embrace the multiple technological revolutions now under way, given that many of them are government agencies. Panelists pointed to the popularity of smart cities

programs, designed to help local governments embrace disruptive technologies, and to public sector partnerships with tech leaders like Amazon and Google.

A session moderator said there is plenty of room for innovation from smaller entities, public and private. "The future isn't all about the big tech companies or the larger organizations," he said. "There is space for the small and medium enterprises. But it has to be through partnerships and collaboration."

Award-winning photographer and keynote speaker **Pete McBride** left participants with a very different—and very compelling—view of the future landscape in which tolling agencies will do business. With the mighty Colorado River rapidly drying out, and 15 of the 16 glaciers that feed it now threatened by climate change, McBride stressed the need to "remind people that water doesn't just come from taps," while striving to "make things more efficient and work better."

TECHNOLOGY FOR TODAY AND TOMORROW

From the beginning of the conference to the end, it was a foregone conclusion that technology would be the main focus or a key cornerstone of every topic under discussion. The only questions were how many transformative, disruptive applications participants would have time to discuss in 2½ days, how quickly they would enter widespread use—and what tiny proportion of them were even on the radar as recently as five years ago.

TOLL SYSTEM INTEROPERABILITY

With tolling interoperability high on the agenda in dozens of countries, U.S. agencies took stock of their multi-year push to harmonize roadway and back office systems across the country, while toll operators from other continents traced their progress to date and lessons learned. A U.S. panelist noted that agency volunteers working through IBTTA had identified three candidate protocols for a national system, completed conformance testing on two of the three, and would soon be moving into field performance testing and financial analysis to ultimately determine the "national" ETC protocol. The goal is to complete the process by late 2017.

A panelist from South Africa described an interoperability model that took several years to plan, but now spans three concessionaires managing 1,270 kilometers of capacity across the country. "We have achieved commercial and technical integration through a central clearing process and, yes, it works," he said.

Another speaker said the emerging European Electronic Toll Service (EETS) offers interoperability and more: it will simplify international billings for concessionaires, promote market competition and cost efficiency, deliver better services, and facilitate migration of existing toll systems and introduction of new ones. "It takes people working together and speaking the same language," the speaker noted, but 15 European countries are now implementing EETS and the number is growing steadily.

A tolling executive from Ireland cited three success factors for an interoperability system that has been extended to 11 new toll roads in the last decade: the system is "baked in" to the country's private-public tolling partnerships, implemented through a central clearinghouse hub, and supported by a multi-party legal framework, with 14 parties currently involved.

The panelist noted that most of the "stress points" en route to implementation "were commercial and contractual, rather than technical and operational." But now, the system is working: The Irish hub processes €11 million in transactions per month, volume is growing by five to six percent per year, electronic toll collection now accounts for more than 50 percent of all transactions, and the system has opened the door for Irish concessionaires to sell tags to out-of-country customers. "Interoperability is really the backbone of ETC in Ireland," he said.

Participants also heard in-depth interoperability updates from Europe, Asia, and Mexico. "Don't get tied up in the technology," urged one panelist. "This is probably the biggest key to having a successful project."

CONNECTED AND AUTONOMOUS VEHICLES

While interoperability is clearly one of today's leading highway technology innovations, connected and autonomous vehicles emerged decisively as tomorrow's next big thing.

A panelist pegged the potential economic value of the next generation of vehicle technology at $3 to $4 trillion, adding that a great deal will depend on how those technologies develop. "Without connected vehicles, you will not be able to improve the capacity of the highway system," he said. "You'll need to know what's happening three, four, five cars ahead of you." Other speakers referred to connected vehicle platooning as one of the best opportunities to boost capacity and efficiency. But the panelist said there is still a lot of discussion and some controversy around connected vehicle technologies, and whether dedicated short-range communication (DSRC) is the best path to implementation.

Google is driving toward the highest level of autonomy in the four-stage scheme developed by the U.S. National Highway Traffic Safety Administration (NHTSA), the panelist said. But with 90 percent of U.S. crashes attributable to human factors, and 1.2 million crash deaths per year world-wide, there are considerable safety gains to be achieved with more modest levels of automation.

Analysts and researchers—including some Annual Meeting participants—have yet to reach a consistent conclusion on whether connected and autonomous vehicles will increase or reduce per capita VMT. "If you think about basic economics, you're reducing the cost of traveling," a panelist said. And "if you reduce the cost of any good, the demand is going to go up." Some mobility specialists have concluded that automated and shared vehicles will help optimize the number of vehicles on the road, while dramatically reducing demand for parking space since they needn't stand idle. Others note that the empty, self-driving vehicles still take up road space when they've been dispatched, and could even raise concerns about terror threats unless access is restricted.

A transitional question, meanwhile, is whether it will be necessary and practical to establish separate lanes for connected and autonomous vehicles—and whether toll roads are already in an ideal position to offer that service. Participants discussed a variety of factors that could speed up or slow down autonomous vehicle adoption.

A panelist described three connected vehicle deployment pilots recently contracted by the U.S. Department of Transportation, noting that the Tampa-Hillsborough Expressway Authority (THEA) is the delivery agent for a study of four downtown corridors in the mid-sized Florida city. Across the four settings, "the interactions between cars, trucks, pedestrians, and the streetcar present an entirely different set of environments," he said. But the ultimate issue is that "there are going to be a large number of devices, very expensive devices, deployed in this infrastructure, and part of what the feds are interested in is how to sustain those devices. How will you pay for the operation and maintenance of those devices over a long-term period of time, to make these kinds of systems viable?"

In many communities, he added, it will take a combination of gas taxes, state and local taxes, and tolls to ease the "competitive crunch" for funds between highways and transit services. "We believe the public sector and the private sector have a role to play together in making these systems, both transit and connected vehicles, commercially sustainable," the panelist said. "You've heard the term, 'mobility as a service.' It's really a P3 that usually makes that happen, with the public agency making some investment in the infrastructure and the private company bringing products and services" that might also bring a revenue share back to the public sector partner.

DISRUPTIVE TRENDS

Panelists in one session discussed autonomous vehicle development in the context of a wider trend that takes in smart cities, multi-model technology, and sustainability—which the moderator defined as the use of innovative technologies to deliver safe energy, reduce emissions, cut congestion, address growing urbanization, accommodate an aging population, and save lives. "The mission is to explore future mobility trends on Earth, on our planet," he said. "You all listened to [keynote speaker] Pete McBride. In the future, there shouldn't be a river without water flowing into the ocean."

Another session placed automated vehicles alongside car-sharing services, mobile payments, urban tolling, and other disruptive trends that are combining to fundamentally transform transportation and mobility. "I don't believe the tolling industry is a bubble about to be burst," one panelist said. "I do believe some disruptions are coming down the road that will shake things up quite a bit," but there's time to prepare and the need for tolls won't diminish.

"The revenue generated by folks in this room is irreplaceable. It can't go away, especially with a declining gas tax."

The panelist pointed to corporate car fleets as a possible response to declining rates of personal ownership among Millennials, noting that liability and insurance costs will make it impossible for most individuals to acquire the next generation of technology-enabled cars until regulatory issues have been sorted out. One possible outcome: Companies like Uber and Google will "flood cities with autonomous vehicles" until traffic volume spikes, cities will be forced to respond with congestion charges—and if cities can levy per-passenger-mile tolls, the option will open up for highway tolling agencies, as well. The next five to 10 years should also see cloud computing and mobile payment companies emerge as original equipment manufacturers (OEMs), the panelist said, "and they have cash to burn."

HIGHWAY FINANCING 2.0

With a rare period of legislative stability in the United States following the passage of the *Fixing America's Surface Transportation (FAST) Act,* panelists and participants took the opportunity to dig into the longer-term funding and financing issues facing highway transportation.

One panelist traced the results of a joint Florida Department of Transportation-Federal Highway Administration (FHWA) study that concluded that the majority of toll road users will willingly pay an additional charge for better traffic conditions on a managed lane. "Once customers understood they had a choice to use the express lanes, there was overwhelming support behind building these lanes," he reported—particularly when they realized the alternative was a 40-year wait for new infrastructure. Only about 30 percent were unwilling to consider managed lanes as an option.

Public opposition does sometimes develop, though, and "when you are an elected official, you are very sensitive when you get pushback from citizens," said a state legislator from Texas. But "everyone can agree that infrastructure is a core function of government," which is why the state passed two constitutional amendments directing revenue from sales taxes and oil and gas levies to general purpose highways.

Even with those funding streams, however, "citizens spend an inordinate amount of time in traffic—and I can testify to that myself," he added. That means "we need to have all the tools in the toolbox, and tolling has to be one of those tools." But in a nod to the voters who elect him, the panelist said there must be some way to keep tolls temporary while still meeting long-term highway funding needs.

Voters want to know that "one day the tolling will go away on this road," he said. "My constituents vote every two years, so I agree with that."

He added: "As big as Texas is—and it is the 10th-largest economy in world—we must understand that infrastructure needs always exceed the ability to build that infrastructure."

Another speaker focused on the $95 million over five years the FAST Act allocates under Title 6, *Innovation/Transportation for Tomorrow.* The program supports vehicle miles travelled/road usage charging studies by individual state departments of transport or groups of states—a significant step, the panelist said, since "this is the first time Congress has funded mileage study programs through the states." Florida's Turnpike Enterprise has been actively engaged in developing policies for express lane implementation and evaluating the revenue potential and possible impacts of a series of local pilot projects.

The funds are being used to test different approaches to mileage-based systems, looking for ways to minimize administrative costs, boost public awareness, and address lingering community concerns about privacy and data theft. "With more public awareness," the panelist noted, "people will recognize that there would never be a road usage charging program in which you would have to have a smart phone, or only one type of technology," since technology choice is one of the signature strengths of the whole approach.

Another session addressed the credit implications of different financing alternatives and P3s through the eyes of the bond rating agencies that evaluate the projects. "We have been covering toll roads since the Pleistocene era," said one panelist. But with the transformative development of new highway information technology systems, it's a "whole new world," with toll roads "evolving as rapidly as tech industries are." She said the tolling industry as a whole is showing "marked improvement" in its medians for traffic growth, posting a 4.9 percent increase in 2015 compared to 2.8 percent in 2014. Median operating revenue was up 6.5 percent in 2015.

The figures show that revenue and traffic are coming in "faster than expected and faster than forecast," the panelist noted. "On the down side, toll roads are seen as a way to finance other projects that cannot support themselves on their own." She added that leverage is the key risk with some emerging forms of alternative finance, citing at least one tolling agency that had "judiciously taken on new roads that are subsidized by other components."

The panelist said P3 agreements in different jurisdictions can take a variety of different forms, as long as the sponsor and the off-taker agree on the fixed time period and the broader contractual framework in which payments will be made. She also made a strong case against specifying a sunset date for tolls. "Eventually, tolls will go away," she said. "But there are no free roads, and someone has to invest and pay for them."

Another session looked into the potential power of transportation asset management to anticipate and combat the inevitable physical decline of highway infrastructure. "While you're sitting here listening to me, it's all deteriorating," a panelist warned. And given the scale of that infrastructure, a 1 percent to 5 percent improvement in asset management efficiency could translate into a "huge amount of money."

With the exception of natural disasters, the panelist said the causes of transportation infrastructure deterioration can be modeled and predicted, leading to management approaches that are more sophisticated than just filling the biggest pothole. By gathering data on the condition of all the assets in an agency's portfolio, then conducting predictive analysis, a tolling agency can meet provisions in recent U.S. Congressional legislation that set higher expectations for roadway conditions and reporting.

As a reference point, the panelist cited a five-step assessment matrix from FHWA that covers asset condition, required levels of service and performance, criticality of assets to sustain performance delivery, investment strategies for asset operations, maintenance, replacement, and improvement, and long-term funding strategies. In an informal poll by the

session moderator, fewer than 10 percent of session participants said they were using any kind of asset management analytics.

DATA PRIVACY VS. DATA ANALYTICS

The constant tension between data privacy and data mining was a continuing theme during the Annual Meeting. On one hand, tolling agencies are determined to keep up their successful track record for protecting vital customer data and preventing data breaches before they occur, while preparing to confront any future cybersecurity issues as they arise. On the other, several panelists pointed to the growing opportunity to maximize efficiencies and business opportunities by making better use of the aggregate data that agencies have in hand.

 "For those of us who are responsible for critical infrastructure, often iconic infrastructure, security isn't a new topic," said former IBTTA President **Kary Witt,** Bridge Manager with the Golden Gate Bridge Highway and Transportation District. "We've been taking measures to protect our facilities from physical attack for decades." Since the attacks of September 11, 2001, "we have focused on physical and operational security with laser-like focus, made incredible progress," and invested "countless millions of dollars."

But with the advent of electronic tolling systems, agencies store and transmit sensitive data with every transaction, "and our customers have an expectation that their information is safe in our hands," he said. While data breaches are less dramatic than physical attacks, "the damage is no less devastating," given the tremendous impact on customers' financial and personal lives, and hence on agencies' operations and financial well-being.

A succession of panelists warned against complacency on cyber-security, stressing that the only question is *when,* not *whether* a tolling agency will eventually be targeted by a cybersecurity threat—and *when* one of those attempts will succeed. Data security specialists from the U.S. government and the private sector warned that the United States is a leading target for hackers, with 2,000 confirmed intrusions in 2015 costing an average of $15 million each to remediate. The global cost is $575 billion and 200,000 jobs per year, and "most of us in the security industry think those figures are underestimated," an FBI assistant special agent told participants. In contrast to the popular image of a home-based hacker in a hoodie, panelists said today's threats often come from state or state-sponsored foreign actors seeking to short-circuit the research and development phase of new product development.

"What we have on the threat side is an amazing dynamic," a panelist said. "You have a marketplace of information-sharing between threat actors. It's no longer the single guy…these are professional organizations," complete with business models and marketing plans, customer support and tool developers.

"It's a very alarming trend. The business model is absolutely creative. They know exactly how much to charge Grandma for her photos. They know exactly how much to hold a hospital for ransom to get the money back and release the information."

A key concern is the continuing growth in the "detection deficit," the time it takes organizations to discover their systems have been infiltrated and their data lost or compromised. "That deficit has grown over the years to an average of about eight months," the panelist said. "Over an eight-month period, a threat actor can probably steal everything that you have."

To confront the threat, panelists urged participants to treat cybersecurity as a senior executive-level priority, assign resources and set written policies to establish a sound information security posture, conduct outside vulnerability assessments and in-house security drills, and, especially, build and constantly maintain employee awareness. "This is

really the delta between the actions you take and the potential for you to become a victim," the FBI panelist said. "The more training you do, the less likely you are to be a victim."

"There is no silver bullet solution to this," agreed a panelist whose cybersecurity experience extends to the White House situation room. "It takes a comprehensive approach." He encouraged participants to adopt next-generation prevention technology, and automate the process of scanning for and detecting threats. Another panelist recommended deleting any data you don't need, archiving anything you can, segmenting in-house networks to slow down broader attacks and using security tokens to make in-house data meaningless to unauthorized intruders.

A couple of panelists brought the conversation back to structures and vulnerabilities that are specific to tolling agencies. One of them encouraged participants to think of roadside components, back office systems and customer service as separate security zones, each with their own equipment, IP addresses, vulnerabilities, interconnections and cybersecurity strategies. He and two other speakers discussed encryption and other multi-layered security technologies, including cloud-based systems that hand operational security to a provider that has the technical knowledge and track record to maximize system safety.

But alongside the loud note of caution, participants also heard about the immense, unprecedented opportunities in the cascade of Big Data entering tolling systems from all directions. "We are constantly generating and collecting data," a panelist said, with every purchase or phone call a customer makes. "The amount of data created on a daily basis is so big that people argue about what to call a number with that many zeros. People don't even have a number to describe it," and 90 percent of all the data in existence was created in the last two years.

Nowhere is the potential of that data more obvious than in tolling, where many organizations are still "rich in data, but poor in insights," the panelist noted. The opportunity will just expand with the advent of new mobility business models and connected and autonomous vehicles, another speaker noted, but that transformation will also require deeper insights on how the system functions and how best to optimize it.

A number of panelists pointed to Big Data as an opportunity to move beyond reporting on what happened—how much revenue an agency collected, or how many drivers were on the road at a particular time—to understanding *why* those things happened. Across a tolling operation, data can be collected and used in a multitude of areas, from congestion forecasting and management, to customer reward programs, to field crew assignments.

In day-to-day operations, pricing systems and revenues can be optimized by tracking demographics, trip purpose, time of day and perception of alternative routes, a speaker noted. The added layer of data-driven insight can also boost satisfaction, another presenter advised, in an era when "customers expect you to know them, show them that you know them and show them that you care about them."

"Big data costs money, but not as much as you think, and analytics makes money by translating into safety gains, efficiency gains and enhanced user experience," a panelist said. "Your customer will have an experience. The question is: have you designed that experience?"

CONNECTING WITH CUSTOMERS

While the imperative of effective, responsive customer communication hasn't changed, a couple of panelists explored a more complex communications environment in which stakeholders expect to be consulted or informed—sometimes at 3:00 AM—and agencies can target and interact with distinct audiences of employees, customers and decision-makers via social media. "We have to communicate everything under the sun to our stakeholders," said one panelist. "We want to engage and inform them in a way that helps them understand why we make the decisions we make."

In an era when attention spans are short and phone texting is dominant, the panelist pointed to video as an outreach medium that engages multiple senses and can hold an audience longer. Effective multimedia doesn't require a massive production budget, but it does bring its own challenges at every step along the way. Another speaker focused on smart phone apps as a widely-distributed, increasingly popular tool for delivering essential real-time information and building community engagement—as long as content is made available through voice-activated, hands-free systems that keep drivers' attention on the roadway.

More broadly, a presenter pointed to social media as the leading daily activity in the United States, adding that she couldn't imagine why a tolling agency would choose *not* to engage online. She stressed the value of delivering fresh, relevant, engaging content that builds an agency's brand pro-actively—which means making social media outreach the responsibility of the entire communications team, rather than expecting an intern to get it done.

A panel also addressed the difficult issue of toll charges on rental cars and its implications for customer satisfaction and tolling agencies' business relationships.

CONCLUSION

The closing session of the Annual Meeting brought a varied program together by connecting the unprecedented opportunities in new technology with the relationships tolling agencies build with their customers. "We're dealing with people, we're dealing with our customers and therefore we have to offer them a reliable, good service," a panelist stressed. To meet that standard, he said the future of transportation will have to be multi-model, customer-centric, digitized and decarbonized, with mobility services tailored to the needs of specific audience segments.

To prepare for that future, "we first have to put the customer at the center of all our activities," he stressed. That means understanding and segmenting the user base to get at the specific needs and concerns of regular motorists, truck drivers, fleet operators and even motorcyclists. With the right market intelligence, agencies will be able to introduce simple, elegant tolling solutions that deliver safety, reliability and real-time information. "People understand that a good service has a price," the panelist said, "but the payment solution has to be simple."

He added that technology alone won't solve the challenges in highway mobility. "A well-received service provider needs a strong customer orientation, a clear strategy and a corporate culture based on cooperation, innovation and openness," he said.

A panelist traced his agency's work on customer safety education, including an innovative campaign that targeted more than 48,000 children in more than 400 schools as the *next* generation of highway drivers.