SUMMIT ON ALL-ELECTRONIC TOLLING, MANAGED LANES & INTEROPERABILTY

JULY 12-14, 2015
MIAMI, FL

THE TECHNOLOGY, SCIENCE & POLITICS OF MOBILITY

IBTTA
TOLLING. MOVING SMARTER.

Delegates heard about the most recent, state-of-the-art and complex AET, Managed Lanes and Interoperability projects—how were they implemented, what went right and what went wrong, what was the toughest obstacle and how was it conquered—all from the perspective of their peers from around the globe.

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EXECUTIVE SUMMARY

The parallels were unmistakable in mid-July as participants made their way through the three tracks of IBTTA's *Summit on All-Electronic Tolling, Managed Lanes & Interoperability*, July 12-14, 2015, in Miami. Throughout the conference, presentations and audience discussion reflected:

- A constantly increasing depth of experience with electronic tolling systems.
- A shift in emphasis from single technologies to integrated systems, often combining two or three separate tolling entities along a single route.
- An enduring commitment to safe, reliable mobility.
- The fundamental importance of clear, user communication, to explain the benefits of electronic tolling and understand customer needs and concerns.

"We're meeting the challenges of our communities and our daily commuters every day, providing better mobility options for everyone," said IBTTA President **Javier Rodriguez**, P.E., Executive Director of the Miami-Dade Expressway Authority. "What we provide are practical, innovative, financially sustainable, tangible solutions that become catalysts to our companies and our communities."

The sessions on AET traced the decision points on the road to an all-electronic system, some of the key negotiating points between agencies and potential vendors, and the importance of clear communication—with users, and with all the contractors involved in complex projects. Several presentations focused on the effort to bring transponder use as close to 100 percent of vehicles as possible, while accommodating the small pool of often infrequent users who cannot or will not make the switch to ETC.

One panelist linked highway aesthetics to his agency's ability to boost transponder use from 60 percent to more than 90 percent of users in a little more than a decade. "The product is the road, and we must make sure the environment and the experience are good for the customer," he said. "It's not just about asphalt and bridges. The highway is also one of the largest gardening companies in the country."

Panelists looked at opportunities to optimize all-electronic tolling systems at all stages, from construction through operation. Focal points included enforcement of construction specifications, performance incentives for integrators and contractors, flexible toll arrangements for tourist traffic, adapting collection policies in response to higher violation rates and back office strategies to handle higher customer service volumes.

Sessions also addressed the growing volume of data agencies must manage to process a larger number of point-to-point transactions on today's integrated tolling systems. "The bottom line is that the requirements are disrupting the tech vendors," noted one consultant. For the foreseeable future, panelists said, license plate recognition will be an essential component of any AET system.

The fundamental purpose of the more than two dozen express lane facilities in operation across the United States is to deliver choice for customers who want reliable travel times, a panelist said. That means the three primary operational needs on an express lane are dynamic pricing, timely incident response and the visibility of a real-time collection system, all of which depend on sound policies and procedures, effective communications and the right technology tools, staffing and operations center facilities.

Rating agencies tend to assess managed lanes on the same criteria as other toll roads, but with greater emphasis on traffic and revenue forecasts. Analysts pay close attention to the structure of each project, and to the human behaviors, that shape drivers' choices along a complex managed lane network. While

dynamic rates "are viewed very favorably," a panelist explained, free access policies affect the overall performance of a managed lane, and "that's something we monitor very carefully."

Another panelist pointed to one of the underlying factors in the viability of an express lane project: A managed facility "succeeds from the operational breakdown of the general purpose (non-priced) lanes," so if conditions in those lanes improve, "it diminishes the actual revenue potential" of the roadway. He listed a series of demand and revenue variables that can affect a project's financial performance, noting that any managed lane operator must strike an ongoing balance between revenue and demand management.

Panelists also discussed system models that integrate multiple modes in managed lane corridors, with one researcher warning that managed lanes are usually less financially successful when their goal is to support transit.

Summit participants discussed the monumental effort to deliver national interoperability across the United States by September 2016, as well as the solid progress toward regional interoperability in the U.S. and several European countries. "This didn't happen just because of a stroke of the pen in Congress or in the White House," said one session moderator. IBTTA members have been thinking about interoperability since 2008, and the biggest success factor has been "the efforts of this organization and its members, just pushing forward to get a solution, and have something that is viable and successful."

In the northeastern United States, "interoperability isn't something new," one speaker noted. "We've been doing it for 20-something years." The E-ZPass system began with three states in the 1990s, and early proponents figured they'd be "wildly successful" with a million customers. Today, E-ZPass covers 26 agencies in 15 states, and has just over 28 million devices distributed through all 50 states plus Puerto Rico. In Europe, following an 18-month effort to bring together the main players in the Regional European Electronic Toll Service (REETS), several countries are now entering a pilot phase of system development.

Panel discussions explored the gradual evolution of interoperability standards and certifications, focusing on the integration of system components as well as the actual process for collecting payments. As systems became more complex, multiple integrators entered the field and unrelated services became available alongside electronic toll collection, it became necessary to set standards rather than leaving it to individual vendors to ensure performance. Several tolling agencies are also actively considering the pros and cons of peer-to-peer networks and interoperability hubs, with most of the momentum now shifting toward central hubs.

INTRODUCTION: AN INDUSTRY ON THE MOVE

IBTTA President **Javier Rodriguez**, P.E. Executive Director of the Miami-Dade Expressway Authority, welcomed more than 600 participants from 14 countries to his hometown. With highway finance legislation receiving serious legislative attention and U.S. tolling agencies moving toward national interoperability, he said it was a momentous time to attend the annual AET Summit.

"We're meeting the challenges of our communities and our daily commuters every day, providing better mobility options for everyone," Rodriguez said, and there's never been a better time to assert the value that tolling can deliver.

"What we provide are practical, innovative, financially sustainable, tangible solutions that become catalysts to our companies and our communities," he told participants. "It's not just about the tolls. We're transforming our communities."

Rodriguez pointed to the success of IBTTA's *Moving America Forward* campaign in bringing positive attention to tolling and the tolling industry. Yahoo.com recently ran a list of nine steps to a pain-free family road trip, and taking a toll road made the list. "The interesting thing is that 700 million people log onto yahoo.com in a month," he said. "We've got the formula. We have to communicate it."

Florida Transportation Secretary **Jim Boxold** underscored the "exceptional story" Florida has to tell as the third-most populous state in the U.S. With about 20 million residents and more than 100 million visitors per year, he said, "on any given day, for each resident there are five visitors wandering around the state." The resulting private sector jobs rely on a "good-quality transportation system to make them happen."

With more than 730 centerline miles of tolled facilities, Floridians are "very proud of our transportation network, and we are proud of the role technology has played in our highway infrastructure," Boxold said. The state benefits from a strong transportation trust fund, completed a US $9.3-billion work program last year, and makes tolling a matter of customer choice wherever it is offered. "All of our road users, whether they choose to pay the toll or not, are benefiting, and that is an important element in managing congestion without expanding a corridor."

Alan Williamson, P.E. made a brief presentation to mark the 75th anniversary of the Pennsylvania Turnpike, the first superhighway in the United States.

DELIVERING ON THE PROMISE OF MOBILITY

Throughout the Summit, panelists and participants explored the challenges involved in delivering efficient, reliable mobility—particularly in crowded urban corridors—and the track record that tolling agencies have amassed for delivering on the promise through all-electronic tolling, managed lanes and increasingly, interoperability.

One group of panelists dug into the issues agencies have faced and the solutions they've come up with to get new projects built. Presentations from Dallas, Miami, Stockholm and northern Virginia brought home the challenges involved in:

- Adding highway capacity in a dense urban area.
- Keeping congested corridors flowing during complex construction projects.
- Understanding customers' driving behaviors and helping them navigate different types of lanes, safely and at high speed, when routes and access points are in flux.
- Coordinating the activities of multiple projects, vendors, consortia and jurisdictions along a single route, or at different points along an extended corridor.
- Optimizing the location and precision specifications of each component of a new road, from cameras and gantries to conduits and cabling.
- Planning projects and placing infrastructure to anticipate future roadway improvement projects.
- Earning public support and confidence by ensuring that a project operates efficiently from its first day of operation.
- Integrating highway infrastructure improvements with broader municipal initiatives to improve quality of life, reduce air and noise pollution and improve mobility across all modes.

On one of the projects, a panelist noted that the requirement to keep general purpose lanes open at all times was enforced by penalties of up to $75,000 per lane during peak periods, "so the charges for any closure were really, really significant." Another panelist facing similar circumstances stressed the importance of effective planning. "We had to make timely decisions when things came up, and there was no going back and forth," he said. "You had to have the plan set, and then you had to work the plan."

In another community, public and political expectations meant that a complex system had to be operating perfectly on the day it opened. "Everything had to be in place," a panelist recalled. "Cameras, roadside, back office" all had to be fully operational. "Points of sale had to have equipment, people had to know how to use them, and call centers had to be up and running…You had to get it right." But the day after a congestion pricing system took effect, every fourth car disappeared from the road, "so people could actually see that the system was working."

ALL-ELECTRONIC TOLLING: HOW AGENCIES BUILD SUCCESSFUL CONVERSIONS

With a growing body of experience, IBTTA member agencies are becoming ever more adept at defining the ingredients of a successful conversion to all-electronic tolling. One panelist defined a series of key questions for agencies embarking on their first AET projects: whether to start with a pilot project or undertake a system-wide conversion, how best to divide requirements across multiple requests for proposals (RFPs), whether key functions like customer service should incorporate knowledge of local roadways, and how to structure contractor payments and incentives.

"What proposers want to know is how much work they can expect," the panelist said. His particular agency was in a position to supply a lot of legacy data and some traffic projections, but "what they didn't have was information about their cash customers," a data gap that represented a risk for AET providers. In the end, it was left to vendors to decide where volume-based price breaks would take effect.

Another project demonstrated the need for clarity in all directions—keeping the public informed at all stages in a construction project, setting clear incentives and disincentives for contractors with detailed playbooks, and establishing "micro-milestones" that are communicated clearly to all parties. A panelist recommended scheduling lane closures for Friday nights to be ready for peak traffic Monday morning, monitoring roadway cameras constantly, analyzing downstream traffic to optimize flow, preparing for "lots of late nights" right through the implementation period, setting schedules that are flexible enough to accommodate changes, and documenting problems that can be avoided on future projects.

A persistent, thorny issue for AET systems is the small percentage of infrequent users who never join the system. "We're talking about the unknown, low-margin, low-value customers," a panelist said. "They're driving at high speed, most of them don't know they're on a toll road, and they don't know what to do."

A tolling agency's goals in embracing AET are to eliminate cash tolls, collect tolls from all customers, reduce collection costs and address revenue leakage. But in a business where 80 of the transactions come from users who are billed twice a year or less, it isn't clear whether it makes economic sense to capture the most infrequent customers.

One jurisdiction tried to address the problem by giving transponders away, rather than incurring the transaction costs of issuing invoices. A panelist listed a series of other solutions, including:

- Providing clearer instructions for infrequent users, reminding them that they're using a toll road, they have payment options available to them and there are consequences for non-payment.
- Providing multiple payment options, including online systems, mobile apps, interactive voice response (IVR) systems, kiosks and call centers.
- Encouraging infrequent customers to use cheaper, more convenient payment channels.
- Finding and working with a partner who already "owns" the unknown customer.

The other option is to push as far as possible in the direction of 100 percent customer adoption of AET. One operator boosted AET registrations from 60 percent in 2002 to more than 90 percent today by

offering 100 percent free-flow, post-paid trips along one of the longest electronic tolling systems in the world. Credit card billing keeps the system operating smoothly, and effective marketing gives the agency a keen understanding of customer behavior.

"The product is the road, and we must make sure the environment and the experience are good for the customer so they'll return," a panelist said. "It's not just about asphalt and bridges. The highway is also one of the largest gardening companies in the country."

Rather than outsourcing the "unpleasant task" of enforcing delinquent accounts, the system uses real-time alerts and pulls over drivers who've failed to pay their tolls after three communications. Vehicles are impounded if necessary, but "we're not the police. We're not willing to chase you. If the customer isn't willing to stop, we go through the courts the same way any other business would," the panelist said. The goal is not to be "aggressive" with violators, but to deal with them in a way that "helps paying customers feel better about paying."

A number of panelists focused on the evolution of tolling systems over the decades, from ticket and cash systems through open-road tolling, electronic toll collection and, finally, AET. With a wealth of operating experience to draw on, a panel of U.S. tolling executives reflected on the potential to optimize all-electronic systems at all stages, from construction through operation. Their efforts focused on:

- Improving contractors' and transportation departments' appreciation of the precise specifications behind tolling operations—one construction contractor was initially irritated when an agency insisted on redoing a gantry that had been built to a 19-foot height when the design plans called for 17.8 feet.
- Setting incentives for integrators and contractors to complete projects on time or ahead of schedule.
- Maximizing transponder use, while introducing a "one-time toll"—a five-day payment option based on license plate imaging—to meet customer needs in regions with high volumes of tourist traffic.
- Adapting collection policies in response to higher violation rates, while seeking to maximize the accuracy of image capture following conversion to AET.
- Adopting the concept of "universal agents" that make it easier to allocate call center staff where demand is greatest, while minimizing the number of people a customer has to talk to, to resolve a complaint.
- Accommodating higher call center and email volumes to respond to customer queries and concerns.
- Setting key performance indicators—one state has 50 of them—and measuring and reporting on every aspect of system operation.

One agency executive reported that the fines associated with an increase in violations actually increased overall revenues. But the income came with a cost. "The public perception that the agencies are imposing fines so that we can rack up violation revenue has hurt our image."

But another agency found that its customers grew to love its "drive now, pay later" video billing system. "Consistency is key," a panelist said. During the transition to AET, "we had a mix of cash and express lanes, which led to violations that had a fee and [AET] violations that did not have fines, and that created confusion for customers." Over time, however, congestion has decreased, accident rates are down, travel times have improved and the agency has seen five percent annual growth—partly because of new facilities, partly due to the efficiency of AET.

The flurry of relatively recent efficiency improvements stood in marked contrast to old-style toll ticket and, eventually, barrier systems that couldn't keep up with rising traffic volumes. A couple of panelists recalled the moment when agencies found they had no more space to build toll plazas, at a time when inequities and rate imbalances were beginning to appear across the segments of different tolling systems. Over the last 10 years, many of those legacy systems have given way to point-to-point transactions that rely on "a lot of video, a lot of data," with at least one agency maintaining a terabyte of records to support its billing and customer relationships.

"The bottom line is that the data requirements are disrupting the tech vendors," one consultant said, with a single trip often requiring three to five license plate images compiled into a single transaction.

A panelist said license plate recognition (LPR) will be a priority in AET systems for the foreseeable future, given the number of vehicles that have yet to receive RFID tags and the rate at which transponders are damaged, batteries run out, and technologies change. He listed accuracy, attachment rates, confidence in LPR results and the rate of excluded plates as key success factors.

Another panelist agreed that vehicle imaging technology has its limits and acknowledged the trade-off between perfect capture and total cost. "Being realistic, we do have systems with a vast variety of imaging capture systems out there," he said. But the ultimate question is "how much you would spend to fix which part of the problem." A simple set of key performance indicators can help back offices devote their efforts to maximize business outcomes.

A couple of panelists pointed to a gradual shift in contracting philosophy for vehicle imaging systems, with agencies focusing their criteria on the outcomes they expect. "Processing becomes the vendor's responsibility, and their job is to provide accurate results," said one senior industry executive. "The owner doesn't care how. They just get a price per million transactions. It'll be a popular way to contract that gives vendors the chance to provide the product you need."

MANAGED LANES: WHERE FINANCIAL MANAGEMENT MEETS TECHNOLOGICAL INNOVATION

With more than two-dozen express lane facilities in place in the United States since the mid-1990s, a panelist said many agencies are shifting their definition of operations from pavement, guardrails and tolling systems to delivering a product to the customer. "Operating express lanes is about choice for customers who want reliable travel times," he said. "One key aspect of that is the real-time pricing for supply and demand," which means the three primary operational needs on an express lane are dynamic pricing, timely incident response and the visibility of a real-time collection system.

The panelist listed the support systems required to deliver on the promise of a managed lane, from policies and procedures, effective communications, to the right technology tools, staffing and operations center facilities. As more agencies find themselves operating managed lanes in coordination with contiguous facilities, systems will be required to help them coordinate functions like ramp metering, lane reversals, dynamic speed limits and lane use, dynamic shoulder lanes and transit services.

When rating agencies assess the debt behind an express lane project, they try to understand the human behaviors behind the choices drivers make along a complex managed lane network. "If it's financed in the aggregate, as long as somebody is taking a segment somewhere, that's viewed as a positive," a panelist said. But if each segment is planned in isolation, "that's an adverse scenario for the segment that isn't used."

Rating agencies tend to assess managed lanes on the same criteria as other toll roads, but with greater emphasis on traffic and revenue forecasts, the panelist explained. The best project, from a financier's standpoint, is located in a large, urban area with a strong commuter population and good prospects for

long-term growth. Dynamic rates "are viewed very favorably, because they allow the concessionaire to maximize revenue," he said. "However, it also leads to some uncertainty" for users who don't know exactly what they'll pay for a trip. Free access policies like HOV2 and HOV3 affect the overall performance of a managed lane, and "that's something we monitor very carefully."

Another panelist pointed to one of the underlying factors in the viability of an express lane project: A managed facility "succeeds from the operational breakdown of the general purpose lanes," so if conditions in those lanes improve, "it diminishes the actual revenue potential" of the roadway. He listed a series of demand and revenue variables that can affect a project's financial performance, noting that any managed lane operator must strike an ongoing balance between revenue and demand management.

Key considerations include the configuration of the road, access and exit points, roadway changes or improvements that affect travel time savings and, most important, the toll policies and business rules that determine pricing and payments.

He also stressed the need to understand the distribution of behavioral traits in sub-markets that are "very small, but large in terms of their reach." A managed lane operator is not concerned with drivers who can afford to pay for access to the roadway, so much as with "people who need it when they need it," he said. "So the law of averages doesn't really apply. You're looking at outliers" who will put a premium on predictability, reliability and safety, in addition to those who just follow an established driving habit.

He said variability and volatility are important on facilities where a 10 percent change in traffic can translate into a 30 to 40 percent impact on revenue.

A couple of panelists described major managed lane projects in Florida and Virginia that demonstrated the multi-billion-dollar scale and corresponding complexity of modern highway upgrades, as well as the equally huge opportunity to combat congestion with multi-facility, multi-modal projects.

The session on managed lane technology focused on the shift toward connected vehicles, the uses of Big Data, the growing importance of enforcement technology, and methods of anticipating and addressing the capacity issues that arise when vehicles leave a tolled facility.

"You've seen and heard the statement for years" that highway operators can't build their way out of congestion, said one panelist. "I really dislike it. I detest it. Because it isn't true." State and federal programs in the United States all focus on adding capacity to ease congestion, so "what they're saying is that you have to build your way out of congestion, but do it in a different way. You have to use technology. You have to use innovation. You have to use your intellect and your ideas to come up with new ways to build your way out of congestion, not the old way."

Panelists also discussed system models that integrate multiple modes in managed lane corridors, with one researcher warning that the lanes are usually less financially successful when their goal is to support transit. Integrated projects must also be designed to meet a wider range of technical requirements, beginning with the basic need for lanes that are wide enough to accommodate buses as well as cars.

INTEROPERABILITY: SURGING TOWARD THE DEADLINE

With U.S. tolling agencies pushing hard to meet a September 2016 deadline for full national interoperability, and European agencies progressing toward regional interoperability across several countries, participants paused to review the industry's monumental effort to make the hope a reality.

"This didn't happen just because of a stroke of the pen in Congress or in the White House," a session moderator noted. IBTTA members have been thinking about interoperability since 2008, and the biggest

success factor has been "the efforts of this organization and its members, just pushing forward to get a solution, and have something that is viable and successful."

In the U.S., IBTTA committees have successfully identified two protocols for interoperable tolling systems, finalized a requirements document, established specifications and performance testing procedures, and developed business rules and interface control options for a national system. A draft governance document is expected for stakeholder review in early 2016. By the end of the process, the moderator said, "we're looking for the identification and selection of that one existing protocol that best serves the requirements we've put together."

Panelists traced the achievements of the various regional toll collection systems that are already in place, beginning with the E-ZPass Interagency Group, where "interoperability isn't something new," one speaker noted. "We've been doing it for 20-something years." The system began with three states in the 1990s, and early proponents figured they'd be "wildly successful" with a million customers. Today, E-ZPass covers 26 agencies in 15 states, has just over 28 million devices distributed through all 50 states plus Puerto Rico, and has added new transponders at a rate of two million per year over the last four or five years, not including replacements.

The panelist said E-ZPass accounts for 65 percent of U.S. toll transponders, 70 percent of all transactions, and 79 percent of toll revenue, with 47 percent of its $10 billion in annual revenue exchanged among members. He attributed the system's success to a very nimble protocol, "rock-solid" technology and well-defined business rules that are flexible enough to allow individual agencies to operate as they see fit.

A European panelist traced the continent's gradual progression from an unsuccessful attempt at EU-wide interoperability, to the decision in 2013 to introduce the Regional European Electronic Toll Service (REETS). After an 18-month effort to bring together the two main players in the system, toll operators and tag providers, Europe is now entering a pilot phase, with an information platform that will facilitate cooperation and information sharing. The pilot will operate in France and Spain, which are already up and running, as well as Italy, Austria, Germany, Denmark and Poland.

Another panelist noted that Ireland is already compliant with European interoperability standards, with customers accustomed to relying on one account, one bill and one onboard unit. "We like to toll," he said. "We don't think it's a dirty word." Ireland's National Roads Authority established standard business rules for anyone who wants to operate a toll road, and the country accumulated experience with both hub and peer-to-peer networks before setting up its Information Exchange Agent (IEA) as a central interoperability clearinghouse. The eventual goal is to get information from 17 different platforms flowing freely and quickly through the single system.

A U.S. panelist traced the gradual evolution of interoperability standards and certifications, focusing on the integration of system components as well as the actual process for collecting payments. As systems became more complex, multiple integrators entered the field, and unrelated services became available alongside electronic toll collection, he said, it became necessary to set standards rather than leaving it to individual vendors to ensure performance.

"It's not static, it's ever changing, and we're trying to stay ahead of it," he told participants.

Panelists from several U.S. tolling agencies traced the history and evolution of interoperability in their regions and explored the pros and cons of peer-to-peer networks and interoperability hubs. In different parts of the country, interoperability agreements have been put in place among multiple tolling authorities in a single state, or across two or more state agencies. Although tag protocols and technologies continue to evolve and change, "the equipment part is the easy side," said one agency executive. "It's the business rules, it's making it all work in the back office that makes it really complex."

A participant suggested a network of regional hubs is the only practical option for the United States, given the reality of trying to harmonize electronic tolling operations across 100 or more agencies in different parts of the country. One panelist asserted that, "quite frankly, peer-to-peer is exhausted, and I've already been told that if I come back and say we're doing another peer-to-peer hub, I'll be lynched." Another panelist said the key questions in a central hub are who gets to participate, and who covers overhead costs. A speaker representing a successful peer-to-peer system acknowledged, "it probably makes sense to go to a hub approach."

Panelists and participants also explored the complexities of getting customers to use an interoperable system, helping them understand what it will cost them and having a response in place when systems break down. "It's so much more than the logo. It's what our customers and potential customers think about when they see our logo," said one agency representative. "It takes a village to create a positive customer experience, including internal and external partnerships.

She described an ongoing, multi-faceted outreach campaign that had earned more than 1,000 customer testimonials for her agency's toll tag.

A panelist from Italy suggested improving the customer experience with an integrated loyalty card system, rather than a collections approach focused specifically on tolling. He described a system in Europe in which 3.1 million payment cards and 1.8 million loyalty cards produce 871 million transactions and 26 million invoices per year, including €4.5 billion in intermediated (between operators) tolls.

The system extends beyond interoperable tolling to a range of other mobility-related payments "because we realize that consumers, but also our business customers, need and want a single point of reference for managing their mobility services." Once the vendor began treating the payment process itself as a valued commodity, it made sense to integrate toll collection with parking payments, ferry services that enable customers to skip the queue at the ticket office, and congestion charging in one major metropolitan area, all with a single account and point of contact.

A key challenge for tolling agencies is to make electronic tolling available to customers who need or prefer to use cash. A panelist described an established retail format that can be used to integrate "unbanked" or "underbanked" customers into an all-electronic system, using their choice of gift cards or mobile handsets. The approach avoids collection issues with users who have no fixed address, and can neatly sidestep any unpleasantness associated with receiving a post-transaction invoice.

Successful tollway operations also depend on employee satisfaction, a panelist stressed. "You've invested in understanding your customers," she said. "I would challenge you to understand your employees. Happy employees mean happy customers, and that means improving your bottom line."

While salary and compensation are important, the panelist said other things matter, too, when researchers ask employees what they find most satisfying about their jobs. She described a successful program to keep employees informed, provide ongoing training opportunities, solicit employee input and build their engagement, foster friendships, provide recognition and create a sense that employees are working for a greater good—all values that are particularly important for younger generations entering the workforce.

EMBRACING THE FUTURE

Participants began the Summit by looking to the future, with an exercise in which they worked in small groups to consider four scenarios that could play out by the year 2065:

- **Priced roads,** in which all road usage comes with a charge to drivers.

- **Autonomous vehicles,** in which cars that allow no driver intervention arrive on the market in 2030 and become the norm by 2065.
- **Desert America,** in which coastal cities are submerged by sea level rise and inland regions face extreme droughts and water shortages.
- **Free energy,** in which solar technologies supply energy at no cost to homes, commercial buildings and vehicles of all kinds.

Participants were asked to situate themselves in their scenarios, then "backcast" to the present to determine:

- What happened, or didn't, to bring the scenario to life.
- What obstacles society had to overcome for the scenario to become a reality.
- What trends transportation professionals harnessed, or failed to harness, along the way.
- What implications the scenario held for the transportation sector.

In their groups, participants observed that:

- Autonomous vehicles will give users more time to work, thanks to the free time in their vehicles on the way to and from their workplaces. Then again, the likelihood of commuting to an office in 40 years will be "slim to none."
- The main problem with autonomous vehicles will be that "pedestrians won't be autonomous."
- Congestion, travel times and pollution will decrease. But with driving more efficient and convenient than walking, obesity will be rampant.
- Pricing systems may have to track a vehicle's location, since the value of a road will depend on its characteristics.
- Road pricing will lead drivers to optimize their vehicle use. Carpooling and transit will both become more popular, and users will think twice before hopping in the car to go to the corner store.
- Charges based on freight weight or volume will change the way goods are shipped.
- Road pricing will drive up the cost of consumer goods.
- A shrinking land mass and concentrated population will put new and different pressures on infrastructure and drive up demand for transit.
- Changing mindsets will lead to more effective sustainability policies, but the circumstances will also require more centralized planning.
- The risk of war for limited resources will necessitate a new era of cooperation, with America rebuilding itself as a more integrated part of the global community. Otherwise, "really ugly things could happen."
- An era of free energy will put more vehicles on the road, possibly travelling at higher speeds. (Although governments will find a different way to charge for mobility services.)
- Universal access to free energy will make it easier for developing countries to compete on world markets.
- Energy storage will be a key issue.