13TH ANNUAL AASHTO INTERNATIONAL DAY

2016 ITS World Congress, Melbourne, Australia
Sunday, October 10, 2016 • 8:00 a.m.—Noon

PROCEEDINGS
The American Association of State Highway and Transportation Officials (AASHTO) was honored to hold its 13th Annual AASHTO International Day at the World Congress on Intelligent Transport Systems in Melbourne, Australia. Beginning in Nagoya, Japan in 2004, AASHTO Day has taken place at the outset of the ITS World Congresses, attracting a wide array of outstanding speakers and participants to discuss the challenges and opportunities facing public agencies as they deploy technologies to transform our transportation systems. This year in Melbourne, AASHTO International Day took place on the first day of the World Congress, holding three sessions comprising a dozen speakers and nearly 100 attendees from around the world. The session topics (listed below) offered speakers from around the world the opportunity to update their colleagues on the challenges and opportunities that the transportation stakeholder community face as they integrate new and emerging technologies to improve safety, mobility, and environmental sustainability of their transportation systems.

- Policy and Regulatory initiatives to support existing/legacy intelligent transportation systems (ITS) technology deployments and their transition to accommodate and adapt emerging operations strategies
- Programs to mainstream connected vehicles (CV) and autonomous vehicles (AV) and their influence on and relationship with Transportation Infrastructure Operators
- Research and Development to integrate current and upcoming technologies to mainstream ITS, CV, and AV systems

We thank the U.S. Department of Transportation’s Joint Program Office both for its support of AASHTO International Day and its ongoing policy and program leadership in the field of connected and automated vehicles.

For the second year running, proceedings from the AASHTO International Day have been assembled for sharing and use, not only by those who attended the event but others from around the world who might benefit from the presentations and subsequent conversations that took place. The proceedings in Appendix A include “take aways” from the week written by three U.S. state DOT officials. We believe their reflections have value not only for their peers in the United States, but also their colleagues from around the world. The proceedings and the presentations made by the speakers can be found on the National Operations Center of Excellence (NOCoE) website, transportationops.org.

We hope you find these resources useful.

Sincerely,

Bud Wright  
Executive Director,  
The American Association of State Highway and Transportation Officials (AASHTO)

Shailen Bhatt  
Executive Director, Colorado DOT  
Chair, Subcommittee on Transportation Systems Maintenance and Operations  
Chair, V2I Deployment Coalition AASHTO
Overview

The 13th Annual AASHTO International Day took place on Monday, October 10, 2016 at the outset of the ITS World Congress in Melbourne, Australia. The event began with a welcome and opening remarks from Bud Wright, Executive Director, AASHTO; Nick Koukoulas, CEO, AustRoads; and Shailen Bhatt, Executive Director, Colorado DOT. The speakers noted the strong turnout for AASHTO Day and underscored their appreciation for the participation of all three ITS regional associations and 12 speakers from around the world, presenting on a range of topics involving ITS technologies and transportation infrastructure.

In Appendix A, this document shares the perspective of three U.S. state DOT officials who attended AASHTO International Day and reflected on what they learned and how it may be applied to planning and policy at the operations level.

A brief synopsis of each presentation follows to summarize the major points covered by each speaker. Each speaker’s full presentation has been posted along with these proceedings on the National Operations Center of Excellence website for easy access by those interested in AASHTO Day’s deliberations.

Around the world, the collaboration among public agencies, the private sector, academia, and non-profit associations contribute to a very fertile and effective environment helping to make the vision of connected and automated vehicles a long term reality. In the United States, AASHTO wishes to draw particular attention to the U.S. Department of Transportation’s Joint Program Office—the key federal agency bringing policy leadership and technical support to the transportation sector. Without these partnerships, our national and international progress would be slow going. The following presentations affirm their importance, as seen by how much more quickly we are advancing than we thought even possible a few years ago.

Session 1
Policy and Regulatory Initiatives to Support Existing/Legacy ITS Technology Deployments and Their Transition to Accommodate and Adapt Emerging Operations Strategies

Kirk Steudle, Director, Michigan Department of Transportation, moderated the session and called on each of the following speakers to offer their remarks.

Ken Leonard, Director, ITS Joint Program Office (JPO), U.S. Department of Transportation
Director Leonard highlighted that in February, NHTSA announced a decision to move forward with a rule requiring V2V devices to be installed in new cars. In August, NHTSA released the advance notice of proposed rulemaking (ANPRM) and a supporting comprehensive research report on V2V communications technology. The report includes analysis of the JPO’s research findings in key areas such as technical feasibility, privacy and security; and preliminary estimates on costs and safety benefits. The ANPRM, which closed in late September, sought input from the public and stakeholders on these findings. The input will help support the U.S. DOT’s regulatory work to eventually require V2V devices in new light vehicles. Plans are in place to issue a Notice of Proposed Rulemaking (NPRM) later in 2016.
The Director noted that the U.S. Department of Transportation continues to seek stakeholder input on preparations by the Federal Highway Administration (FHWA) guidance for the development of connected vehicle infrastructure (V2I) deployment guidance and deployment coalition planning. U.S. DOT would like input from transportation infrastructure owner/operators on draft FHWA guidance aimed at supporting successful implementation and operations of connected vehicle technologies. It should be noted that the deployment of V2I technologies will be voluntary and is not coupled with the National Highway Traffic Safety Administration’s (NHTSA) proposed rulemaking for Vehicle-to-Vehicle (V2V) communications.

Finally, the Director shared that additional ITS JPO Resources are being allocated to assist in a range of areas, including deployment research data exchange, connected vehicle test beds, professional capacity building ITS training, open source data applications portal (OSADP), and a connected vehicle help desk. These efforts will help further the goals of the JPO’s strategic plan and collaboration efforts with the broader stakeholder community.

*Claire Depre, Head of Unit, Unit C.3—Intelligent Transport Systems, Directorate-General for Mobility and Transport, European Commission*

Ms. Depre provided an update on EU Policy for connected, cooperative, and automated vehicles. She noted that as recently as 2013, research was still very much present in connected, cooperative, and automated driving. Now, in 2016, the focus is on deployment.
To support a common vision across the EU and among public and private stakeholders, the focus of C(onnected)-ITS is meant to set the scene for the pan-European deployment of connected, cooperative, and automated driving. The main outcomes of the C-ITS Platform underscore:

- commonly agreed C-ITS services for deployment across the EU;
- a common vision to tackle cyber security detailed in an agreed trust model;
- an assessment of C-ITS benefits across Europe, based on a hybrid communication approach with kick start for road safety-related services based on ITS-G5 communication and allowing integration of cellular where and when available and appropriate;
- guiding principles for access to in-vehicle data; and
- a detailed analysis on privacy and data protection, basis to work on privacy by design, and implementation of new requirements according to new general data protection regulation.

With these organizing principles in mind, the EU is concentrating on connected roads to ensure interoperability through large deployment projects in member states. C-Roads will concentrate on harmonized deployment of C-ITS in line with needs and priorities of member states, definition of specifications (security, communication, etc.), test suited and cross-border pilots, and cooperation with EC and C-ITS platform (see the accompanying Depre presentation for more details).

To support all of these efforts, a master plan will be developed to establish the pan-European strategy for the deployment of connected and cooperative driving.
Dr. Kang Kyeong-Pyo, Research Fellow, Korean Transportation Institute

Dr. Kang provided a very helpful review of the evolution of ITS in Korea. From 1991 to 2000, the country saw the introduction and legislative underpinnings of ITS and its potential to address the nation’s transportation challenges. 2001 to 2010 saw the development and expansion of ITS tools and services. And in the current decade and beyond, next generation technologies and solutions continue to emerge and are adopted and continually adapted to improve system performance.

### ITS Services

- ITS services implemented by public and private sectors
- Integration and Standardization for interoperability and compatibility
- Updating ATMS, ATIS, UTCS, BIS/BMS, and EFCS using the up-to-date ITS technologies

Source: Korean Transportation Institute

Essential to the effective provision of ITS services is the need to continually enhance the country’s ITS Plan. As understanding of transportation challenges is improved through more data and greater research, and with the ongoing improvements in the technologies themselves, the Plan must remain a living document to incorporate ongoing learnings in the field.

Central to Korea’s learnings and further enhancement of ITS is its C-ITS Pilot Deployment initiative. It seeks via its pilot system deployment to develop and install RSE, TMC, and OBUs; recruit voluntary drivers; and develop and provide 15 C-ITS safety applications to drivers. With the evaluation component, it will conduct driver acceptance analysis, safety effectiveness verification, and cost-benefit analysis. Also, through further foundation research, it will develop domestic technical standards, a device certification system, and analyze areas for legal system improvement (see the Kang presentation for more details).

Paul Retter, CEO National Transport Commission, Australia

CEO Retter spoke about the key role of the NTC in Australia; its job is to develop national reforms to improve outcomes for Australia’s land transport systems. It is also responsible for national land transport laws and, increasingly, the NTC is advising governments on the strategic issues likely to affect them in the longer term. In Australia, two questions are
fundamental to any effort to improve its transportation system.

- How can regulations catch up to the technology that is already out there, or almost out there, so that nations can benefit from it?
- Instead of continually playing catch up, how can Australia move to a more responsive regulatory environment that allows new and innovative technologies to be realized more easily while still being introduced safely?

When it comes to current regulations catching up to the technology that is already available, Australia is focused on connected and automated vehicles. It is working on amending the current regulatory framework to support this and other emerging technologies. This work began in November last year after Australia's transport ministers asked the NTC to look at the regulatory barriers to automated vehicles.

The initial review has found a lot of potential regulatory barriers to automated road vehicles; 716, in fact. Many of these regulatory barriers have to do with the legal expectation that a vehicle has a human driver who is responsible for controlling the vehicle and is therefore liable if something goes wrong. However, in a connected and automated future, there may not be a human driver, so who, or what, is in control of the vehicle and therefore liable if anything goes wrong? In very simple terms, the future of automated vehicle technology in any country will be determined by how well that question is answered because manufacturers and technology companies need certainty about their liabilities before rolling technology out at scale; consumers need certainty about their responsibilities before taking up the technology en masse; and enforcement agencies need clarity on liability, too.

Choosing the right regulatory tool is part of the challenge, as is prioritizing the barriers in a logical sequence that aligns with the types of technology reaching our roads.

This leads to the second important question to address: How can Australia stop playing catch-up to technology? While the future cannot be predicted, questions can be asked about it and the likely drivers of change can be considered. From there, thinking can expand to how those drivers might play out. Four main factors are likely to drive change over the next 20 to 25 years or so:

- automation;
- data availability and sharing, which covers things like big data, better real-time analytics, and connected vehicle technology;
- shared mobility or “ride sharing;” and
- increased consumer demand for convenience and new services.

Where will these key drivers of change take Australia? Their effects could be vast and endless, changing everything that we know and do today.

While there are always a lot of “what ifs” when it comes to the future, it is fairly safe to say that Australia’s transport system will undergo transformational change over the next few decades, and this will require a much more responsive regulatory environment to meet the challenges and take advantage of the opportunities that flow from them.
**Session 2**  
Programs to Mainstream CV and AV and Their Influence on and Relationship with Transportation Infrastructure Operators

Paul Trombino, Director, Iowa Department of Transportation moderated this session and welcomed the following speakers to offer their remarks.

**Shailen Bhatt, Executive Director, Colorado Department of Transportation.**
Director Bhatt provided background on the U.S. Vehicle to Infrastructure Deployment Coalition (V2I DC), sharing that the coalition is built around the concept of creating a single point of reference for a broad range of stakeholders involved in V2I deployment.

The U.S. DOT arranged for the coalition to be established through the collaborative efforts of AASHTO, ITS America, and ITE. Representatives from the three associations form a project team that facilitates and support the coalition activities.

![V2I Deployment Coalition Structure](source_url)

*Source: V2I Deployment Coalition*

The coalition includes five technical working groups. The working groups operate with direction and oversight from the executive committee. The CAV-ELT (shown in orange) is not technically part of the V2I DC, but is closely coordinated and involves executives from the government and automobile industry sides to collaborate on policy issues.

There is a start-up challenge issue with V2I in that there likely won’t be many vehicles equipped with dedicated short range communications (DSRC) until there is the infrastructure to talk to. Similarly, DOTs are somewhat reluctant to put in too much DSRC infrastructure until there are vehicles to talk to. So, the SPaT (signal phase and timing) challenge is an attempt to get past this gridlock.

It recognizes that many state and local DOTs have not deployed any DSRC systems, and they need to “get their feet wet” doing so. Fortunately, SPaT at the intersections is a
relatively simple deployment to pursue. SPaT is a great enabler for several other V2I Applications, including red light violation warning. So, the challenge is out there for about 20 intersections to be equipped with SPaT DSRC broadcasts in each of the 50 states by 2020. It is recognized that this will be a combination of state and local DOTs accomplishing this, as not all signals are on DOT roads.

The initial benefits will largely be internal. DOTs are going to learn a lot about DSRC deployment and have a better understanding of the deployment and operations costs for DSRC. This will also allow the DOTs to work with the OEMs to test some of their applications at multiple locations and therefore test interoperability.

A second key outcome of the V2I DC was a workshop that involved the infrastructure owners and operators (i.e. state and local DOTs) and the original equipment manufacturers (OEMs, i.e., the auto industry). This came as a result of discussing many of the issues in the V2I DC and a recognition that the time is right to work together on issues such as:
- the SPaT Challenge,
- defining exactly what data will be shared from the vehicle to the infrastructure and vice versa, and
- discussing prioritized, day one applications.

This workshop occurred at the end of September 2016, and both groups agreed to create a forum to continue discussions.

The V2I DC was originally funded as approximately an 18-month effort. Nearing the end of the initial 18 months, there is a commitment to continue the V2I DC. Therefore, Phase 2 is being planned right now and will begin in January 2017. Some key changes that are expected (but not yet finalized):
- There are three pilot deployments (Tampa, New York City, and Wyoming) that are moving towards deployment. The timing is good for the V2I DC to increase interactions with these sites.
- We are looking to expand the V2I DC to include more representation from DOT maintenance vehicle fleets. Maintenance vehicles have been communicating with the infrastructure to send and receive data between vehicles (typically using radio or cellular communications) and there will be mutual benefits of getting more involvement from individuals working on these systems.
- Finally, as noted, there is an agreed ongoing commitment to interact with the OEMs.

Dr Chin Kian Keong, Land Transport Authority, Singapore
Dr. Chin presented an update on the Singapore Autonomous Vehicle Initiative (SAVI). This is an important effort and one that will be a major element to highlight at the Singapore World Congress in 2019. In a city-state the size of Singapore, the challenges are straightforward: increasing travel demand, land constraints, a shortage of labor, and an aging population.
The strategies are equally straightforward as shown in the following visual.

Source: Land Transport Authority, Singapore

When it comes to the role of autonomous vehicles (see the accompanying Chin presentation for more details), their value propositions are extremely important to Singapore:
- increase productivity: autonomous buses tackle problem of labor shortage
- increase road safety: AVs enable aging population to maintain freedom of mobility while ensuring safe driving
- optimize road capacity: AVs enable ageing population to maintain freedom of mobility while ensuring safe driving
- enable new mobility: AV mobility-on-demand and AV vehicle-sharing schemes complement walking and cycling in new towns
- increase R&D value added: Singapore is a living laboratory and is ideal for conducting test-bed for AV development and deployment

Dr. Chin concluded by stating that:
- Singapore continues to expand its V2I cooperative ITS applications, 5.9GHz DSRC standardization, AV and V2X cybersecurity.
- AVs provide opportunities to support a sustainable transportation eco-system within Singapore.
- The convergence of autonomous vehicles (AVs) and connected vehicles (CVs) is likely to influence and change the way V2X technologies are deployed.
- Appropriate standards are key to catalyzing and supporting the implementation of V2X technologies in future ITS applications.

All of these efforts will combine to address the challenges and needs of Singapore’s unique setting and make for a safer, more mobile, environmentally sustainable nation.
Alois Schedl, Chief Executive Officer, ASFINAG

CEO Schedl offered a look at automated vehicles from the perspective of the Austrian Motorway operator: ASFINAG. ASFINAG was founded in 1982 and is 100 percent owned by the Republic of Austria. It maintains 164 Tunnels, 5,192 Bridges, and 400 Junctions. Its financing is exclusively user-financed, earmarking of revenues for ASFINAG’s tasks.

The main challenges of automated driving relate to the different degrees of automation on the roads:
- New traffic management strategies needed? For mixed traffic of conventional and automated vehicles
- Infrastructure upgrades needed? E.g., digitalization, connectivity, etc.
- Adaptation of legal frameworks needed? E.g., traffic and vehicle regulations

Connectivity with Automated Vehicles
A key enabler for future traffic management

The benefits of digital infrastructure are real:
- The digital infrastructure supports the testing and introduction of AVs.
- Key elements are real-time traffic information, digital communication interfaces, video detection, HD maps, etc.
- It provides important connectivity with AVs.

In summary, Austria’s motorway operator ASFINAG plays a central role in testing and introduction of AVs. Digital infrastructure and connectivity are key enablers for managing mixed traffic, especially in the introduction phase, and are necessary to integrate automated vehicles in the traffic management. Further, interconnection of infrastructure and vehicles requires cooperation between automobile OEMs and road operators.
Craig Hutton, Director General, Strategic Policy, Transport Canada

Director General Hutton offered the Canadian perspective on connectivity and automation.

First and foremost, connectivity and automation will have far-reaching impacts on the transportation sector and the economy as a whole. It will entail:
- large-scale exploitation of information and communication technologies;
- growing emphasis on digitization, data, and analytics;
- intelligent, sensor-based infrastructure;
- overall movement towards the creation of smart cities; and
- new players, business models, and urban mobility solutions.

In the Canadian context: there are a number of key anticipated benefits of CVs and AVs:
- Efficiency: Traffic congestion costs the Canadian economy more than $6 billion annually. CV/AVs will help increase competitiveness by reducing transportation costs and decreasing congestion.
- Safety: Over 500,000 motor vehicle collisions occur annually, resulting in more than 1,800 fatalities in Canada. CV/AVs will improve road safety by significantly reducing the severity of these collisions.
- Environment: CV/AVs have the potential to reduce environmental impacts by improving traffic flows and the movement of goods and people
- Accessibility and Mobility: AVs will improve the access to transportation and mobility of Canadians who cannot drive a vehicle, including individuals with disabilities.

The considerations for success are several-fold:
- Collaboration Will Be Key: Canada must work both internationally and continentally to develop standards, regulations, and deployment approaches.
- Government Has a Role to Play: Its critical role will be with respect to national and continental interoperability, stakeholder coordination, regulations, privacy, safety, cybersecurity, and infrastructure readiness.
- Canada Has Cutting-Edge Capabilities: It must establish strong competitive position by building on key areas of strength, including our world-class automotive facilities, and information technology and clean technology sectors.

Director General Hutton concluded:
- Technology deployment and data-driven initiatives have the ability to contribute solutions to today’s transportation system challenges.
- New possibilities for transportation are being created through integration of technological innovation with existing systems to drive improvements to safety and efficiency; environmental sustainability; expansion of mobility; and opportunities for growth, jobs and investments.
- Policy, regulatory, and deployment issues will continue to be key considerations with the emergence of new transportation technologies.
Session 3
Research and Development to integrate current and upcoming technologies to mainstream ITS, CV, and AV systems

Malcolm Dougherty, Director, Caltrans (the California Department of Transportation), moderated the panel and called on the following speakers for their remarks.

Neil Pedersen, Executive Director, Transportation Research Board (TRB)
Director Pedersen shared the range of TRB-orchestrated research and development initiatives taking place to integrate technologies to mainstream ITS, CV, and AV Systems.

He reminded the audience that the National Cooperative Highway Research Program (NCHRP) at TRB addresses issues integral to the state Departments of Transportation (DOTs) and transportation professionals at all levels of government and in the private sector. The NCHRP provides practical, ready-to-implement solutions to pressing problems facing the industry. Recently, the NCHRP compiled a catalog of institutional, legal, policy, and operational issues affecting transportation agencies. Issues were prioritized and project descriptions were developed with objectives, scope, outcomes, budget, schedule, and linkages to other projects. As a result, $3.5 million has been authorized for tasks in each of the following areas.

Policy:
- Policy and Planning Actions to Advance Agency Goals Through CV and AV Systems
- Implications of Automation for Motor Vehicle Codes
- Business Models to Facilitate Deployment of CV Infrastructure to Support AV Operations

Planning:
- Providing Support to the Introduction of CV/AV Impacts into Regional Transportation Planning and Modeling Tools
- Dedicating Lanes for Priority or Exclusive Use by CVs and AVs

Data:
- Cybersecurity Implications of CV/AV Technologies on State and Local Transportation Agencies
- Planning Data Needs and Collection Techniques for CV/AV Applications
- Data Management Strategies for CV/AV Applications for Operations

Deployment:
- Impacts of Regulations and Policies on CV and AV Technology Introduction in Transit Operations
- Challenges to CV and AV Applications in Truck Freight Operations
- Road Markings for Machine Vision

Dissemination:
- Summary of Existing Studies on the Effects of CV/AV on Travel Demand
- Catalog of Automated Vehicle Deployments
- Strategic Communications Plan for NCHRP 20-102

Director Pedersen guided the audience to the TRB website to obtain more information on each of these initiatives.
Takashi Nishio, Director, ITS Policy and Program Office, Road Bureau, Ministry of Land, Infrastructure, Transport, and Tourism (MLIT), Japan

Director Nishio shared with the audience the long and rich history of ITS development in Japan, including its vehicle information and communication system (VICS) and electronic toll collection system (ETC) as shown in the visual below.

One of the recent innovations is ETC 2.0, an expanded version of the world’s first V2I service (ITS spot service). With the advent of ETC 2.0, high-speed, large-capacity, two-way communication between installed roadside units and on-board equipment in vehicles makes it possible to provide a variety of services. In addition to ETC and information on traffic congestion over a wide area, ETC 2.0 provides both photos and audible warnings about congestion around blind curves, snow on the road, and other potentially dangerous situations, helping to ensure driving safety. The system also uses probe data gathered by the vehicle, such as the vehicle's driving record in terms of speed and location, steering changes, braking, and so on, to provide a variety of services. ETC 2.0 works in tandem with car navigation systems to provide additional services such as safe driving support, ideal route selection based on the toll, and guidance for large vehicles.

Director Nishio also shared that a cross-ministerial strategic innovation promotion program (SIP) was established in the Council for Science, Technology, and Innovation. SIP will conduct a large-scale pilot project beginning in 2017 to market level 2 systems by 2020. Further institutional studies that have been started hope to enable marketing of level 3 systems around 2020.
The range of areas to be addressed are:
• development and verification of automated driving system,
• basic technologies to reduce traffic fatalities and congestion,
• international cooperation, and
• deployment for next generation urban transport.

Hermann Meyer, CEO, ERTICO
CEO Meyer affirmed that just as has been experienced by the other regions, the European experience has identified significant factors influencing the deployment of ITS.

First are the societal needs:
• increasing mobility demands from people and goods,
• a wish for more safety and reduced energy consumption, and
• a similar wish for more comfort.

Second are the emerging technologies:
• The Cloud enables enormous storage and processing capacities of data and ubiquitous accessibility.
• Communication technologies continue to advance very quickly, allowing for tailor-made services for specific ITS-related communication needs. (4G/5G, ITS G5, and Digital Broadcasting provide important milestones for the deployment of ITS.)

Third is consumer acceptance:
• People are already highly connected today. They are already using this connectivity via computers, tablets, and smart phones to enrich and facilitate their travel arrangements.
• ITS combines information and communication technologies, sensors, maps, and other data for applications and services to enable seamless journeys of people and goods that are more affordable; safer; cleaner; and more comfortable on road, rail, air, and maritime.

Source: ERTICO/ITS Europe
Policy challenges and the benefits from addressing them are clear. Alongside them are equally important challenges and concerns by stakeholders involved in delivering the ITS services starting from collecting data, to processing data, to communicating data, to the provision of services for end users. Questions include:

- What will be the role of the road operators and traffic management centers?
- Will there still be a need for all these infrastructure-based technologies to survey and manage the traffic when vehicles are already doing it and service providers start managing the traffic?
- Is there a need for cooperation between road operators and these service providers to provide consistent services to the user?
- How to make an investment decision in such a fast moving market with different stakeholders: The telecommunication world has a time horizon for investment decisions of 3 to 6 months, vehicle manufacturers of 3 to 7 years, and road operators of 5 to 15 years.
- Will there be shifts in market power where service providers use their customer base to negotiate prices and quality with transport operators and vehicle manufacturers?

In summary, the vehicle of the future will be shaped and managed by current and emerging innovations regarding the internet of things, cooperative ITS, cooperative traffic management, and connected and automated driving (see the accompanying presentation by CEO Meyer for more details). ERTICO/ITS Europe and its European partners continue to focus on these challenges on the road to their effective deployment in the years to come.

Dennis Walsh, General Manager (Land Transport Safety), Customer Services Safety & Regulation, Department of Transport and Main Roads, Australia

General Manager Walsh cited the country’s national policy and direction that has helped shape its approach toward connected and automated vehicles. Among the key elements are:

- national road safety strategy 2011–20,
- national transport commission (NTC) work program and regulatory review,
- Austroads strategic plan 2016–20,
- Austroads national intelligent transport system (ITS) architecture—based on European frame, and
- iMOVE cooperative research center proposal

A very robust action plan is central to executing these strategies. Among the major actions to address are:

- Establish a regulatory framework for testing automated vehicles.
- Develop national operational guidelines to support the on-road use of automated vehicles.
- Undertake priority trials and research of ITS.
- Develop a connected vehicle (C-ITS) infrastructure road map.
- Publish a C-ITS statement of intent on standards and deployment models.
- Develop a nationally agreed deployment plan for the security management of connected and automated vehicles.
- Investigate options to provide enhanced geo-positioning information to the land transport sector.
- Improve the availability of open data in the transport sector.
- Explore options to increase the uptake of telematics and other technologies for regulatory and revenue collection.
- Evaluate low-cost technologies to improve safety at rail level crossings.
- Explore how data from telematics and other ITS can be used to optimize operations and planning for port precincts and intermodal terminals.
• Develop a national framework for public transport ticketing.
• Investigate the costs, benefits, and possible deployment models for automatic crash notification.
• Explore the merits of adopting new safety and traffic management technologies.

Much progress has been made in these areas (see the accompanying Walsh presentation for more details) and given the federal/state form of governance that Australia operates under, the role of states is essential in taking on these efforts (see the visual below).

State-led Initiatives – AVs and C-ITS

Source: Land Transport Safety, Queensland Government (Australia)
APPENDIX A
Take-Aways from the Melbourne World Congress:
The Perspective of Three U.S. State Departments of Transportation

Sondra Rosenberg
Assistant Director, Planning,
Nevada Department of Transportation

Around the world, transportation agencies and providers are struggling with a number of emerging, in some cases disruptive, trends. This includes rapid population increases in urban areas, exponential growth in data collection and availability, and rapid technology change. These trends lead to increasing congestion, emissions, traffic crashes, and increasing customer expectations for real-time data and a variety of mobility choices available at any time, or any place.

Government transportation agencies, particularly U.S. state DOTs, have been generally operating under similar responsibilities and organizational structures since the 1950s. Some have adapted more than others, but few are prepared for the disruptive change to vehicle technology, big data, mobility as a service, and the resulting change in traveler behavior. We will need to prepare for and embrace this change or risk being left behind in the transportation world of the 21st century.

Role of government is changing. Each agency should review what its essential functions are. Government, generally is responsible for protecting society. This likely means a change in the way provide and operate the transportation system. Private entities will play a much larger role in the future and partnerships with those private operators and data/analytics companies will be essential. Equally essential to provide safe and efficient transportation will be partnerships across sectors, such as land use, energy, environment, and data. These partnerships have never been more possible or promising. The expectation of the traveler of the future (very near future) is the “Netflix” or “Yelp” of transportation. Real time information about a variety of transportation choices, and payment options will be expected at the public finger tips.

State DOTs need to have honest discussions about what their role is in the future of mobility and mobility as a service and partner with other entities that can provide the other roles. This will likely include letting go of some of the things we aren’t good at and get help to make us even better at what we are good at. This may include data sharing and management. Better data leads to better information which leads to more efficient operations (from plowing snow, to evacuations, to operating the system during large events) and better policy. This will also include a shift in focus from the efficient movement of vehicles to the efficient movement of people and goods.

Because of the fast-moving nature of technology, it will surpass the ability of governments to properly regulate, if we expect all-encompassing regulations. However, we have the opportunity to set frameworks and minimum performance or outcome-based regulations to guide technology development, while working on detailed rulemaking at a slower pace to
provide more details. We have an opportunity and a duty to ensure that future mobility is safe, efficient, and environmentally and financially sustainable

Some of the upcoming needs/questions for transportation agencies to address may include:
1. What is the transportation sector’s role and responsibility with respect to the environment, including but not limited to, pollution, GHG, and sustainable land use. Does/should this be consistent across state lines?
2. Consistency in driving laws from state to state and eventually country to country, particularly with the emergence of autonomous vehicles.
3. What is the public role of providing mobility access to all people regardless of location, income, or physical ability?
4. What is the public role of providing high-capacity transit options, versus allowing low-volume, technologically advanced options to evolve? We cannot build, ride-share, or engage in mobility as a service only to make our way out of congestion.
5. How can we better use technology to more effectively communicate with our customers (public, other disciplines, etc.)?
6. How can these technological changes be used to more effectively collect sustainable revenue for transportation infrastructure.
7. Regulations—focus on minimum outcome/performance-based needs, not maximums, not all encompassing—leave the details for rulemaking. Minimum safety requirements (performance based) will not change much. Details will change as technology changes. Think about the desired outcome, not the path. Let private sector worry about the path there—gives both sides something to strive for to meet public expectation and safety.

Blaine Leonard
ITS Program Manager,
Utah Department of Transportation

Sorting through a week’s worth of varied and fascinating presentations and discussions, I have three primary take-aways:

1. The broad themes of the World Congress seem to be mobility and connectivity.
   a. Previous conferences focused on connected vehicles, and more recent ones on automated vehicles. While this Congress had a strong focus on automated vehicles, this focus was wrapped in the larger context of mobility. It is not transportation, it is mobility, and mobility will be seen differently in the future than it is today. Cars are becoming the “third living place”, between the home and office, and will serve a purpose broader than just getting us from one place to another.
   b. We are wiring up the planet. Mobility is just one part of the smart city of the future, which is an element of the “Internet of Things” (IoT). One speaker called this the “IoT Eco-System” and another referred to it as the “Internet of everything.” There is a much bigger picture here than we usually see, coming from our transportation perspective. We need to start being more inclusive and involved in the connected system.
   c. Connectivity yields big data. Big data can yield big understanding. There is a lot more information available now than ever before, including crowd-sourced vehicle data, location analytics, travel demographics, etc. We need to learn how to leverage these resources, from transactional systems to real time systems to enabling insights.
   d. The mobility focus has shifted from transportation agencies to the public sector. Up until five or six years ago, government transportation agencies were the only entities
that had transportation data, or cared about it. Today, our agencies are just one small part of this mobility data world. Further, there are many other data elements beyond mobility data that are integrated into the overall big data field. We need to break out of our agency silos and explore new models. One speaker put it this way: “The transportation industry is on the verge of a massive software-driven market disruption, setting the stage for a significant change in the way we think about travel, city design, and transport more broadly.”

e. While much of the emphasis is on automated vehicles, there is broad consensus that automated vehicles will need to be connected. Connectivity involves cellular, GNSS, DSRC, and other solutions, and is not always traffic management focused. The Europeans seems to be shifting toward cellular for traffic applications (looking toward 5G cellular); other areas of the world still have DSRC (5.9, 5.8, and other spectrum) in their plan. No single technology will be the winner in this transformation; they will all have a place.

2. Technology is moving forward at a rapid pace on many fronts, bringing a broad range of change. This is not a surprise to us, since we are all amidst, but it requires us to shift our thinking to take advantage of these technologies. Several enlightening points were made by speakers at the Congress:
   a. We need to enable, not inhibit change. Regulations will inevitably follow implementation.
   b. “Change has changed.” It is a journey not a destination, because there often is no “end point.” We are implementing by doing, and learning along the way.
   c. Technology is not the challenge, public acceptance is. We need to do trials to get the public involved with the new technology so they can accept the changes. They will never embrace them by simply “seeing” them; they need to get hands-on experience.
   d. “Those who are really confident about their future plans are just shortsighted.” We do not know what the penetration rates of various technologies will be, but we can paint a picture of the future. We need to accept some degree of “unknown” in this process, and envision a future within a set of broad boundaries.
   e. There are a number of “drivers” pushing this technology, including: safety, congestion, urban mobility, demographic shifts (age demographics, urbanization, etc), connected devices (IoT), the sharing economy, big data and the cloud, connected and automated cars, machine learning, cooperative road networks, emerging business models, quality-of-life issues, and access (to everything).

3. We should view our transportation networks as systems, not corridors. We are too often trapped in the project view of a road as a stand-alone corridor. But, what we really have is a network that all works interactively. We need to evaluate the system, and then identify key roles for each element, or corridor, within that system.
   a. Freeways are our most important roadways, we cannot afford for them to be “car parks”. They move the most people and are the key to mobility. We need to prioritize freeways over arterials and make them work.
   b. VicRoads has evaluated all roads in their system and assigned priorities for each—cars, buses, trucks, bicycles, pedestrians, etc. Based on this, they are managing them according to those prioritized uses, and planning improvements accordingly. Many of our state DOTs do not have that kind of access or responsibility for local roads, but if we view our transportation as a mobility network, and work together as a set of agencies, this might be possible for us.
Summarizing from these three messages, there are several things that I believe state and local transportation agencies should be doing to take advantage of, and adapt to, these trends. They include:

- We need to start being more inclusive and involved in the connected system, and play a role with our local jurisdictions, helping to bring them together to work as a team. This will require us to break out of our silos, within our agencies and in our communities.
- We need to be proponents of this change, and not stand in the way. This requires us to be forward thinking, to take a few risks, and to accept some unknowns. To enable the change, in a public sense, we need to be involved in trials—getting new technology in the hands of the public.
- We need to learn how to leverage these new resources, including the massive data that is available. This will require us to rethink our skill sets and diversify the skills of the people on our teams.
- We need to continue to pursue vehicle connectivity. There is some consensus that successful automated vehicles will be connected. We have a role to play in connectivity, and despite the fact that there are other connectivity modes, we should not advocate our role and responsibility. Again, this will involve a little risk and some uncertainty.
- We should begin thinking more at a system level. Our road networks are systems, and we should evaluate their operation in that mode. This will, again, require that we include other transportation partners in the process. We also need to think on a system level about transportation and mobility and how it impacts society and all of society’s functions.

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Considering the week and the diversity of information and perspectives presented, there were many areas that offer potential near-term, follow-up activities that the AASHTO Subcommittee on Transportation System Management and Operations (STSMO) could consider as enhancements to existing efforts. Recognizing that the intensity, breadth, and focus associated with connected and autonomous vehicles was a major focal point of this World Congress, it is assumed that thoughts relative to STSMO’s efforts in this area are covered elsewhere. Otherwise, the highlighted areas below are centered around operational concepts and strategies being considered and deployed now by leading transportation agencies as they attempt to maximize the safety and mobility of their existing systems.

Managed Motorways

There were several tracks associated with the concept of managed or smart highways that provided examples of leading operational-focused efforts undertaken to improve system performance. While many, if not most, of the example strategies themselves can be found here in the states, approaches to how they are deployed and managed may offer new insights. VicRoads, several European countries, and recent U.S. led initiatives provided excellent examples and could be explored as possible resources relative to webinars, peer exchanges, and other methods of information exchange. Potential topical areas include:
Performance  
**Operationalized System Performance:** There were several examples of the use of real-time performance management applications that were deployed and used to drive situational awareness and provide enhanced decision-support capabilities. These dashboard systems, combined with clear operational objectives, provide foundational capabilities agencies use to drive real-time system management.

Infrastructure  
**ITS Infrastructure:** As new sources of data and information become available, many agencies are redefining their system objectives, architectures, and associated infrastructure to reflect the options and expanded capabilities they bring.

**Operational strategies and roadway geometric features:** There were several example corridors where the capabilities associated with operational deployments provided the ability to consider traditional roadway features from a new perspective. Concepts around repurposing available roadway width, designing entrance and exit ramps to reflect operational objectives, and linking arterial design with overall system operational objectives were all examples of leading efforts in this area.

Concept of Operations  
**Using “con ops” as a more direct link between system performance objectives and overall system design:** This would include defining operational strategies and needed capabilities from both the perspectives of system performance as well as how these strategies can be utilized to overcome limitations in, or reduce the need to expand roadway geometry.

Operational Objectives in the Context of System Planning  
VicRoads provided interesting insights into their system planning efforts and their success in providing clear linkages between the various levels of multimodal system planning and the resulting operational objectives of the various components of the road system. In particular, they highlighted aspects such as:  
- Linking roadway classification and modal objectives; and  
- Defining operational and management strategies and their associated performance objectives in the context of classification and modal objectives.

Organizing for Technology Innovation  
There were several presentations and discussions from leading agencies describing or alluding to their efforts to organize around the objectives of enhancing their capabilities to develop, deploy, support, and sustain new technologies and operational strategies. This could have association with current STSMO workforce development efforts and potentially broadens the perspective from considering operations work force needs to how to integrate and support innovation across the mainstream agency processes and activities. Topics might include:  
- Background and objectives leading to the need for organizational change;  
- New organizational structures;  
- Disciplines (multi-disciplines) within divisions and workgroups;  
- Roles and interaction within the overall internal organization; and,  
- External partnerships.