Challenges and Opportunities in the Age of Technology Transformation in Transportation

WTS Connecticut – Transportation Mini-Series

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Topics

• Session Objectives
• Evolution of Transportation Technology
• Stage 1: Smart Drivers
• Stage 2: Smart Cars and Connected Technology
• Stage 3: Semi-Automated Cars and Services
• Stage 4: Autonomous/Self-Driving Cars
• Challenges
• Opportunities
Session Objectives

- Discuss the evolution of technology
- Highlight trends in transformation
- Draw parallels to similar transformations in financial services and telecoms industries
- Identify how you can develop an individualized strategy to succeed
Evolution of Transportation Technology

- Stage 1: Smart Drivers
- Stage 2: Smart Cars and Connected Technology
- Stage 3: Semi-Automated Cars and Services
- Stage 4: Autonomous/Self-Driving Cars
- Lessons learned from other industries
  - Financial Services
  - Telecom
Evolution Stage 1: Smart Drivers

• ITS beginnings from 1980’s as IVHS
• Connectivity between
  • Infrastructure systems was limited
  • Cars was non-existent
  • Cars and infrastructure was non-existent
• Primary goals
  • Informed drivers are smart drivers
  • Provide dynamic updates on traffic conditions
  • Help improve safety and mobility through driver education
Evolution Stage 2: Smart Cars and Connected Technology

• Connected Vehicle Technology
  • Vehicle-to-Vehicle (V2V)
  • Vehicle-to-Infrastructure (V2I)
  • Infrastructure-to-Infrastructure (I2I)

• Applications
  • In-Vehicle Safety
  • Mobility
  • Infotainment
Evolution Stage 2: US DOT Connected Vehicle Research

- Connected Vehicle Ann Arbor Safety Pilot
  - Worlds Largest real-world test of DSRC CV tech
  - Approximately 3000 vehicles
  - Conducted by University of Michigan Transportation Research Institute (UMTRI)

- Connected Vehicle PlugFests

- Connected Vehicle Test Beds
  - Southeast Michigan Test Bed
  - Affiliate Test beds with 55 members currently
Evolution Stage 2: US DOT Connected Vehicle Research

• Safety Benefits
  • Significantly reduce fatalities, and injuries
  • 5.5 million cashes and 30000+ fatalities annually

• Mobility Benefits
  • Save lost time, fuel, and lost wages being stuck in traffic ($121 B, $818/per capita – 2012 TTI figures)
  • Improve national productivity

• Environment Benefits
  • Reduce loss of fuel and environmental impact of about $27b – 2012 TTI figures
Evolution Stage 2: Infrastructure efforts in CV Technology

- Mobilize input and outreach among members using Task Forces and Stakeholder groups
  - ITE CV/AV Task Force
  - ITE ITS standards committees and councils
  - AASHTO CV Working Group
  - AASHTO CV Deployment Coalition
  - ITE/AASHTO/ITSA V2I Deployment Coalition
  - AASHTO CV Executive Leadership Team
  - ITSA Leadership Circle for V2I Startups
  - ITSA CV Task Force
Evolution Stage 2: Infrastructure efforts in CV Technology

• Analysis and Reports as owners/operators and Stakeholder of CV infrastructure
  • AASHTO Footprint Analysis
  • ITE Journal Articles on CV Cybersecurity
  • ITE/USDOT ePrimer on ITS
  • Development of ITS and CV Standards

• Professional Capacity Building (PCB) modules for ITS and CV

• Workshops, Seminars and Roadshows on CV Program Areas
Evolution Stage 2: Connected Technology Applications and Services

- CV Application and Services can be rendered
  - In Car using wireless and/or OBE
  - Mobile Devices such as cell phone, tablet, iPad etc.
- CV Application and Services cater to
  - In-Vehicle Safety
  - Mobility
  - Infotainment
  - Connectivity to other systems
Evolution Stage 2: Connected Technology
Applications and Services Providers

- CV Application and Services Providers in the market today belong to
  - Telecom service providers
  - Automaker affiliates
  - Academic institutions
  - Electronics manufacturers
  - Public institutions
  - Academic research institutions
- For example, look at the USDOT CV Test bed affiliates
Evolution Stage 2: NHTSA Regulations and timelines on V2V Technology

• USDOT’s NHTSA Issues Advance Notice of Proposed Rulemaking to Begin Implementation of Vehicle-to-Vehicle Communications Technology on August 18, 2014

• The ANPRM will be available at Regulations.gov docket (NHTSA-2014-0022) and members of the public will have the opportunity to comment for 60 days

• http://www.nhtsa.gov/About+NHTSA/Press+Releases/2014/NHTSA-issues-advanced-notice-of-proposed-rulemaking-on-V2V-communications
Evolution Stage 2: NHTSA Regulations and timelines on V2V Technology

- Benefits of USDOT’s NHTSA PRM to Begin Implementation of Vehicle-to-Vehicle Communications Technology
  - Improve safety through advanced warnings of unsafe conditions
  - Prevent up to 592,000 crashes and save 1083 lives per year
  - Safety applications help drivers avoid Forward Collision, blind spot, do not pass, and stop light/stop warnings
Evolution Stage 2: NHTSA Regulations and timelines on V2V Technology

• USDOT’s NHTSA Issues a research report to support the ANPRM called, "Vehicle-to-Vehicle Communications: Readiness of V2V Technology for Application".
  • This report is available at the following link,
  • The report estimates costs and benefits while addressing the privacy and security concerns
Evolution Stage 3: Semi-Automated Cars and Services

- Google
  - Google Car – Research ONLY
  - Open Automotive Alliance (OAA) for Android
  - OAA – started by Audi, GM, Google, Honda, Hyundai, and NVIDIA. Currently 44 members

- Nissan ConnectSM Mobile Apps Connected Car

- GM “Super Cruise” commercial vehicles in 2017
  - V-V communications
  - Partial auto pilot mode (hands free and foot free)
Evolution Stage 3: Semi-Automated Cars and Services

- GM “Super Cruise” commercial vehicles in 2017
  - Driver Assist
  - Driver Awareness
  - Innovative Safety Assist
- Discuss briefly the following automakers
  - Mercedes-Benz
  - Acura
  - Volvo
  - Subaru
Evolution Stage 3: Semi-Automated Cars and Services

- AT&T connected car services
  - 2 million cars in 2014
  - 10 million cars by 2017
- Airbiquity
- Bosch Group
- Delphi
- Panasonic
- Motorola
Evolution Stage 4: Autonomous/Self-Driving Cars

• Basic Definition: As an autonomous vehicle, it is capable of sensing its environment and navigating without human input.

• Also called: Driverless cars, self-driving cars, driver-free cars etc.

• Uses one or more of technologies such as Radar, Lidar, GPS, Computer Vision
Evolution Stage 4: Autonomous/Self-Driving Cars

• NHTSA established a system to classify and distinguish levels of automation based on the level of control. Goes from level 0 (complete driver control) to level 4 (no driver control expected)

• Forbes article predicts that the Google driverless car unleashes a $2T a year market revenue opening up public and private services. In a test with Google car, a 95% blind man runs errands or can visit the doctor without help
Evolution Stage 4: Autonomous/Self-Driving Cars

• Popular misconception: Autonomous cars are geeks and rich peoples toys
• Correction: Quite contrary they could enable delivering public services at a low cost to remote locations, economically disadvantaged and elderly populations (one of the largest growing demographic segments in US)
Evolution Stage 4: Autonomous/Self-Driving Cars

- Popular misconception: Autonomous cars are would increase the cost of ownership
- Correction: Quite contrary they could enable lowering insurance to a fraction of today's cost due to safety features as also researched by Columbia University research study. The increased cost of purchase could be more than offset by the lowered insurance cost, especially for young drivers
Popular misconception: Autonomous cars are for rich countries only

Correction: Contrarily these cars reduce the overall miles of highway needed to be built due to shorter braking distances and higher lane capacities. This technology would enable developing countries leap frog the conventional investment cycle, in much the same it happened in telecom. China and India never had a robust landline system, and that helped in accelerated mobile phone system whose footprint is now bigger than US.
Challenges

• Traditional Transportation models do not address the mode shifts and user shifts and would be less effective

• Metrics such as Vehicle ownership, occupancy, O-D, parking, trip generation, miles driven are likely to change dramatically

• Revenue and tax collection is likely to be impacted even more

• Insurance industry is likely to be disrupted in a big way
Challenges

• Transportation planners and engineers will need to interface with technologists to manage services based on ever changing technology
• Electronics, IT and automotive engineering professions are likely to play a major role in technology transformation in transportation while lacking the domain knowledge of transportation or experience with human factors related to it.
Challenges

• The biggest challenge likely is a need to develop a business model where public and private entities own the overall CV/AV system.

• Transportation engineers will be need to cross train in one or more fields of IT, telecommunications, automotive engineering and understand its basics in order to manage the overall transportation system
Challenges

In the open environment of CV/AV where automobiles, infrastructure, mobile devices and cloud based services are connected, standards and rules be needed to be written for:

- Security
- Privacy
- Reliability
Opportunities - Communication

• New opportunities for those willing to cross train and leverage transportation domain knowledge

• Better opportunities to improve public safety resulting in positive public feedback

• Improved prospects for those who good communication and interpersonal skills
Opportunities – Systems Engineering

• Systems Engineering skills helps one identify needs clearly from an end user’s perspective.
• Systems Engineering also helps trace the needs to requirements and design, weeding out bias.
• Systems Engineering also helps personnel from multiple disciplines articulate needs and requirements and design in plain English.
• Greater success to those who have experience in using processes such as Systems Engineering in order to ensure that the right systems are built the first time.
Opportunities – Entrepreneurs

• Better employment opportunities in the private sector due to the new $2T economy based on transportation

• Technology helps demonstrate value to the client and achieve higher revenue collection

• Newer services can be created leveraging data across diverse industries such as telecoms, transportation, retail sales and financial services leading to newer positions
Professionals in Transportation, make the transition!

• “AVOID THE KODAK MOMENT in transportation”
Contact

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ITE has developed 37 course modules in the Year 1 and 2 of the program

• Both Systems Engineering and Non-Systems Engineering curriculum in path in initial courses

• Available here: www.pcb.its.dot.gov/standards_training.aspx
## ITS Standards Professional Capacity Building Program

### Year 3 Course Development

<table>
<thead>
<tr>
<th>Sequence#</th>
<th>Course Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>C201</td>
<td>Introduction to the Simple Network Management Protocol (SNMP) and its Applications in the Field Devices Based on NTCIP Standards (L)</td>
</tr>
<tr>
<td>C202</td>
<td>Introduction to the Application Level Protocols for Center-to-Center Communication System Interface Implementation (NTCIP 2306 XML) (L)</td>
</tr>
<tr>
<td>I231</td>
<td>Vehicle-to-Infrastructure (V2I) ITS Standards for Project Managers</td>
</tr>
<tr>
<td>I241</td>
<td>Vehicle-to-Vehicle (V2V) ITS Standards for Project Managers</td>
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<tr>
<td>T203a</td>
<td>How to Develop Test Cases for ITS Standards Test Plan</td>
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<tr>
<td>T203b</td>
<td>How to Develop Test Cases for ITS Standards Test Plan</td>
</tr>
<tr>
<td>T204a</td>
<td>How to Develop Test Procedures for ITS Standards Test Plan</td>
</tr>
<tr>
<td>T204b</td>
<td>How to Develop Test Procedures for ITS Standards Test Plan</td>
</tr>
<tr>
<td>A307a</td>
<td>Understanding User Needs for ATC Version 6 Controller (Non-SEP Path)</td>
</tr>
<tr>
<td>A307b</td>
<td>Specifying Requirements for ATC Version 6 Controller (Non-SEP Path)</td>
</tr>
<tr>
<td>A334a</td>
<td>Understanding User Needs for 1207 RM Std v2 (A334a)</td>
</tr>
<tr>
<td>A334b</td>
<td>Specifying Requirements for 1207 RM Std (A334b)</td>
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<tr>
<td>T334</td>
<td>Applying your test plan to the 1207 RM Std v2</td>
</tr>
<tr>
<td>T312</td>
<td>Applying your test plan to the 1209 TSS Std v2</td>
</tr>
<tr>
<td>A315b</td>
<td>Specifying Requirements for Actuated Traffic Signal Controllers (ASC) Based on NTCIP 1202 Standard (LO 3 &amp; 6), B1</td>
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ITS Standards Professional Capacity Building Program

- Transit Course Development
  - Introduction to Transit ITS Standards
  - TCIP Part 1
  - TCIP Part 2
  - Traveler Information, Part 1
  - Traveler Information, Part 2
  - Transit Management, Part 1
  - Transit Management, Part 2
  - Electronic Payment Systems
  - Transit Signal Priority (Arterial Management)
  - Connected Vehicle/Emerging Technologies
ITE developed the ePrimer for ITS JPO:

- [http://www.pcb.its.dot.gov/ePrimer.aspx](http://www.pcb.its.dot.gov/ePrimer.aspx)

Webinars

- May 13 - ITS ePrimer Module 7: Public Transportation
- May 15 - ITS ePrimer Module 14: ITS Emerging Opportunities and Challenges