

# Triennial Strategic Plan - TRB Information Systems and Technology Committee (ABJ50)

January 2018

<b>Committee Name and Number:</b>	ABJ50, Information Systems and Technology
<b>Committee Chairperson:</b>	Shannon Barnes, CSG Government Solutions
<b>TSP Three-Year Period:</b>	April 2018 to April 2020
<b>Date Prepared:</b>	January 2018

## 1. Committee Future Outlook Statement

### *Committee Scope*

This committee is concerned with:

- Identifying opportunities, challenges and risks for transportation agencies associated with emerging information technology developments
- Advancing the state of the practice in the development and application of information systems and technologies in transportation for greater productivity and efficiency

Specific *technologies* of interest include:

- Sensors (broadly defined to include infrastructure sensors, probe vehicles, unmanned aerial vehicles and remote sensing technologies, among others)
- Mobile computing platforms and applications
- Cloud computing; “big data” analytics/data mining; data integration platforms

Specific *applications* of interest include:

- Deployment of connected vehicles and autonomous vehicles;
- Smart infrastructure – using sensor technology to enhance safety and monitor infrastructure condition;
- eConstruction techniques including use of 3D/4D design models to enhance construction efficiencies;
- Data integration/fusion, management, mining and presentation tools that support transportation agency decision making as well as traveler selection of mode/route/time of travel; and

Specific *concerns* of interest include:

- Keeping critical transportation infrastructure safe and resilient
- Organizational, workforce, and management strategies needed to meet the accelerated pace of technology changes impacting the industry
- How to implement new technologies into day-to-day use
- Addressing expectations for open data available everywhere;

## 2. Factors and Influences that will Shape the Committees Activities

Over the next three years, the committee's activities and areas of focus will be influenced by the following key trends:

- *Emerging issues and trends* in intelligent transportation systems (ITS), cybersecurity, data integration and analytics, connected/autonomous vehicles etc. will influence the ability of transportation organizations to maintain the essential capabilities needed to continue to fulfill their missions
- *Growing cybersecurity and data privacy concerns*, and the need to balance these concerns with expectations for open data – from anywhere, at any time.
- *Rapidly developing technologies for connected and autonomous vehicles*
- *Explosion of data from multiple sources* – including cell-phones, mobile LiDAR, infrastructure sensors, and connected & autonomous vehicles, creating both challenges and opportunities related to “big data” storage, management, integration, mining, analytics and access.
- *Development of new sensor technologies and data collection platforms* that present challenges and opportunities in how to use them effectively, manage their data flows, and implement them into workflows and decision support processes.
- *Increased private sector involvement in provision of transportation, and in collection of data* – commercialized data providers, outsourced maintenance and operations services and use of public/private partnerships for infrastructure development and operations has significant implications for data sharing, integration and use for management decision making.
- *Emergence of new information technology service delivery approaches*, including cloud-based infrastructure-as-a-service and software-as-a-service models, statewide information technology consolidation, and shared service models.
- *Continued shifts to enterprise-wide, business-centric approaches for data management and software architecture*, which requires new skill sets and new working relationships between information technology and business units, and execution of deliberate strategies for integrating data across existing application silos.
- *Increased adoption of open data policies*, in which agencies make data sets freely available to the public, enabling development of independent 3<sup>rd</sup> party applications for making use of the data.

### 3. Critical Issues in Transportation

The committee’s focus on making more effective use of information technology helps transportation agencies achieve their missions in a more efficient manner; thus the work of this committee *indirectly* supports each of the critical issues that have been identified by TRB. Specific committee research interests that *directly* pertain to the TRB critical issues are listed in Table 1 below.

**Table 1. Information Systems and Technology Research for Critical Transportation Issues**

Critical Issue	Committee Research Areas
System Performance: reliability and resilience	<ul style="list-style-type: none"> <li>- Deployment of connected and autonomous vehicles</li> <li>- Leveraging crowd-sourced information on congestion and incidents</li> <li>- Information technologies supporting fusion, archiving and retrieval/display across multiple data sources</li> <li>- Data and application architectures for ITS – traveler information, incident management, active traffic management; including open source, cloud computing, semantic models</li> </ul>
Safety	<ul style="list-style-type: none"> <li>- Use of smart infrastructure technology to improve safety</li> <li>- Best management practices for cybersecurity risk assessment and mitigation</li> </ul>
Energy, Climate and Environment	<ul style="list-style-type: none"> <li>- Applications of sensor technology for monitoring of environmentally sensitive areas, and for acquisition of 3D geospatial data and asset inventories in support of climate change adaptation</li> <li>- Use of information technology to manage and mitigate environmental impacts of construction projects</li> </ul>
Funding for Public Infrastructure	<ul style="list-style-type: none"> <li>- Sensor technologies for tolling that support moving from the gas tax to a travel/VMT-based tax</li> </ul>
Institutions: 20 <sup>th</sup> century institutions mismatched to 21 <sup>st</sup> century missions	<ul style="list-style-type: none"> <li>- Data sharing in the context of outsourced services and public/private partnerships</li> <li>- Cloud computing and shared IT service models for greater agility and efficiency</li> <li>- Implementation of new sensor technologies and platforms into existing and new workflows for supporting transportation agency decision making processes</li> </ul>
Innovation	<ul style="list-style-type: none"> <li>- Meeting new information technology workforce needs</li> </ul>

## 4. ABJ50 Committee Plan

The committee's plan for the next three years is presented below, organized into six goal areas.

### **Goal #1: Research**

Engage a diverse mix of researchers and transportation agency staff to identify critical research questions, develop research agendas, issue calls for papers and pursue avenues for advancing research projects.

Strategy options include but are not limited to:

- Work with committee members to identify research needs and draft & submit new research needs statements.
- Identify priority research needs for advancing the state of the practice. Some suggested items are:
  - ✓ Applications of Sensing Technologies for Traffic Operations, Safety and Asset Management
  - ✓ Making the System Safe and Secure- Cybersecurity
  - ✓ The integration of transportation systems into broader smart community capabilities such as Smart Cities and Smart Connected Corridors.
  - ✓ Transformative leadership models needed to meet the significant expansion of information technology into the day-to-day planning, construction, maintenance, and operations of a state DOT
  - ✓ Capturing and Integrating data from heterogeneous sources to support agency decision making and traveler information
  - ✓ Adapting IT management and service strategies to leverage new technologies and address customer expectations

### **Goal #2: Collaboration**

Work with other TRB committees and task forces on cross cutting issues to provide a broad perspective, avoid duplicative efforts and maximize involvement of interested parties. Strategies include:

- Coordinate with the DOTs on technology and workforce issues specifically on issues of concern to DOT IT and ITS executives.
- Continue the joint subcommittee on Sensing Technologies with the Geographic Information Science and Applications Committee (ABJ60), and add coordination with related committees and subcommittees, such as the subcommittee on Unmanned Aircraft Systems (AV060 (1)).
- Continue the joint subcommittee on Construction Information Technology with the Construction Management Committee (AFH10).
- Continue collaboration with ABR10 Standing Committee on Critical Infrastructure Protection, (ABR10), and Standing Committee on Intelligent Transportation Systems (AHB15)
- Through section meetings, keep abreast of research topics of interest to other committees in the Data Section and pursue opportunities for joint sponsorship of sessions and workshops.

### **Goal #3: Information Sharing**

Provide opportunities – in person, by email and online - for exchange of best practices, research findings and ideas among researchers and practitioners. Strategies include:

- Annual Meeting Sessions – continue to sponsor a committee “flagship” session covering information technology advances in transportation, as well as a poster or podium session highlighting the top papers received.
- Annual Meeting Workshops – continue to co-sponsor workshops and sessions on Sensing Technologies and Construction Information Technology each year.
- Mid-Year Meeting – hold a committee meeting in person or by conference call
- Webinars – plan and carry out at least one webinar per year to share information on particular topics of interest to a wider community than can be reached at annual and midyear meetings.
- Build a “research watch list” through a bi-annual request to committee members and friends, and post this on the committee web site with links to relevant project information.

### **Goal #4: Agency and Industry Liaisons**

Maintain strong liaisons with both transportation agency information technology executives and information technology industry leaders to ensure that the committee stays current on key issues of concern and to maximize opportunities for technology transfer across agencies, and from research into practice. Strategies include:

- ✓ Include members of relevant AASHTO committees on emails, and periodically solicit their opinions on research needs.
- ✓ Continue the current practice of including one or more members of DOT IT Executives as committee members.
- ✓ Maintain liaison with the USDOT CIO and periodically invite staff members so committee meetings to share information about USDOT IT activities and discuss opportunities of mutual interest
- ✓ Use a portion of each committee meeting to involve transportation agency information technology executives in a discussion of key issues and concerns and related research needs.
- ✓ Identify representatives of key information technology companies that serve or impact the transportation agency market to serve as committee members or friends. Invite these individuals to speak at committee meetings or sponsored sessions and workshops.

### **Goal #5: Communication**

Keep committee members and friends informed about committee activities and opportunities for participation. Strategies include:

- ✓ Maintain an active TRB Communications Coordinator, responsible for the committee web site and information sharing with other communications coordinators
- ✓ Maintain and improve the current committee web site - include information about the committee scope, subcommittee scopes and contacts, research agendas, research watch lists, upcoming activities, meeting minutes, and presentations
- ✓ Add a help wanted section to the website with “job descriptions” for committee roles that need to be filled.
- ✓ Maintain an up to date committee friends list
- ✓ Use email to the full committee members and friends lists to provide advance announcements of annual and mid-year meeting events

## **Goal #6: Member Involvement**

Attract a diverse and active membership representing key areas of interest and provide opportunities for committee members to take on leadership roles to strengthen the capabilities and reach of the committee. Strategies include:

- ✓ Annual review of the membership list and recruitment of new members to meet the following objectives:
  - Critical mass and depth of expertise for each of the major committee focus areas
  - Mix of public sector (state DOT and other transportation agency), private sector (industry) and academic representation
  - Geographic, racial, age, and gender diversity
- ✓ Recruit additional regular members, new young members and international members to bring the committee membership level up to 25 regular members, 5 international members and 4 young members.
- ✓ Maintain the following leadership positions: subcommittee chairs, communications coordinator, paper review chair, research committee liaison. Provide recognition and support for individuals serving in these roles and actively recruit members to fill open slots.

## **5. Committee History (2015 – 2018)**

### ***Paper Review***

- 2017
  - ✓ 47 papers reviewed; 23 recommended for presentation, 8 recommended for publication
- 2016
  - ✓ 40 papers reviewed; 24 recommended for presentation, 3 recommended for publication
- 2015
  - ✓ 49 papers reviewed; 23 recommended for presentation, 6 recommended for publication

### ***Research***

- 2017
  - ✓ Submitted synthesis proposal to study the new role of the COT CIO
  - ✓ Submitted synthesis proposal to study Transportation Infrastructure Connectivity
- 2016
  - ✓ Call for papers submitted “Sensing Technologies for Effective and Efficient Transportation Data Collection.” 46 papers were submitted
  - ✓ Submitted RNS “Increasing Understanding of Unmanned Aerial System (UAS) Capabilities to Address Transportation Infrastructure Issues”.
  - ✓ The AFH10 subcommittee worked on 5 Research Need Statements (RNSs) during the past year. The five RNSs are:

- RNS-1 Alternative Technologies for Mitigating the Risk of Accidents in the Work Zone (AFH10(1)) - Behzad Esmaeili (UNL)
- RNS-2: Framework for Designing and Managing Data and Information Workflows for Transportation Assets (AFH10(1)) (Submitted for Funding) -- David Jeong (ISU) and Daniel Tran (KU)
- RNS-3: A Guide to Automate Project Progress Control by Leveraging LiDAR and 3D/4D information models (AFH10(1)) -- Yelda Turkan (OSU) and Yongwei Shan (OSU)
- RNS-4: How to Integrate and Enhance Existing Project Management Systems in Managing Construction Field Data for Different Project Delivery Methods (AFH10(1)) -- Asregedew Woldesenbet (UNL)
- RNS-5: Material Tracking in the Transportation Construction Industry (AFH10(1)) -- Deepak Sharma (CSU Fullerton), and Katherine Holtz (TxDOT)

➤ 2015

✓ **Sensing Technologies**

- Applications of remote sensing (electro-optical- and RADAR-based systems, as well as satellite, airborne, and ground-based platforms) in transportation – opportunities and challenges
- Integration of data from remote sensing with other geospatial data
- Applications of sensor technology for infrastructure mapping and monitoring
- Applications of sensor technologies for tolling that support moving from the gas tax to a travel/VMT-based fee

✓ **IT for Construction Management**

- Information technologies for Improving efficiencies on the construction site
- Use of 3D and 4D facility information models for life cycle infrastructure management
- Use of information technology to manage and mitigate environmental impacts of construction projects
- Speeding adoption of proven technologies by public sector organizations

✓ **IT for ITS/Connected Vehicles**

- Data and application architectures for ITS – traveler information, incident management, active traffic management
- Addressing exponential increases in the amount of data being collected – growing issues with managing and storing these data
- Information technologies supporting fusion, archiving and retrieval/display across multiple data sources
- Integrating and visualizing network wide traffic data
- Roles and relationships between IT and ITS units

✓ **IT Technology Architectures and Service Models**

- Opportunities for innovation and efficiency improvements in state DOT IT Management
- Effective transportation agency IT organizational structures and partnerships given trends towards consolidation of state IT resources
- Strategies for transitioning to service oriented architectures and software as a service
- Strategies and technologies for enterprise data management

- Use of mobile technologies for data collection and transmittal – policies, processes, technologies, and implications for data management and security
- Moving Public IT Resources into the Cloud – opportunities and issues
- ✓ **Semantic Technologies and Data Exchange Standards**
  - Data exchange standards for efficient infrastructure management throughout the life cycle
  - Data standards in the context of outsourcing and P3's – what models exist (within or external to transportation) for building data reporting standards into contracts?
  - Applications of semantic technologies for transportation information management and search

## Events

### ➤ 2017

- ✓ Automated Vehicles Symposium 2017 CAV Breakout Session
- ✓ Connected and Autonomous Vehicles: What Transportation Organizations Need to Know
- ✓ Big Data Innovations for Big Decisions
- ✓ e-Construction, Part 1 and 2: Implementation and Lessons Learned from Practitioners
- ✓ Geospatial Innovations in Transportation 359 Innovative Big Data Solutions for Transportation Challenges – Katy Salamati and Dr. Yinhai Wang
- ✓ Sensing Technology Innovations in Multimodal Transportation
- ✓ Information Technology Applications in Transportation
- ✓ Big Data Analytics in Transportation
- ✓ Lidar and Transportation: Field Applications and Practical Implications
- ✓ Opportunities and Challenges of Big Data Applications in Transportation Project Delivery and Management
- ✓ Advanced Practices for Roadway Data Extraction and Integration
- ✓ Sensing Technologies for Transportation Applications

### ➤ 2016

- ✓ CIO Roundtable - Doug Couto facilitated a CIO roundtable titled State DOT CIO Roundtable: Issues facing DOTs and the role of the CIO in a data driven organization
- ✓ Industry Roundtable – Shannon Barnes facilitated a roundtable discussion with industry partners on the topic “What are the biggest challenges facing DOT’s in the future. Discussion focused on big data, transparency and security.
- ✓ AFH10 subcommittee provided a workshop titled “Opportunities and Challenges of Big Data Applications in Transportation Project Delivery and Management” The workshop included six presentations, followed by a panel discussion
- ✓ AFH10 sub-committee provided a webinar was: “Towards Cyber Physical Systems in Construction”.
- ✓ Sensing Technologies for Transportation Sunday workshop

### ➤ 2015

- ✓ Workshop 110 (with ABJ60): Sensing Technologies for Transportation Applications
- ✓ Workshop 169 (with AFH10): Digital Design Standards
- ✓ Session 199 (with ABJ20, ABJ60, and ANB20): Improving Safety Programs Through Data Governance and Data Business Planning

- ✓ Session 332: Extracting Information from Images: Technology Innovations in Sensing and Detection
- ✓ Poster Session 377: Information Technology Applications in Transportation 2015
- ✓ Session 396: Fast-forward 10 Years: How Information Technology Is Changing Transportation Planning, Engineering, and Operations (Committee’s first annual “flagship” session)
- ✓ Session 850 (with ABE40): Transportation Cybersecurity: Are We Hanging by a Thread?

## **Committee Meetings**

- **2018**
  - ✓ ABJ50 Information System and Technology Committee Meeting
  - ✓ Information Systems in Construction Management, AFH10(1), Joint Subcommittee of AFH10, ABJ50
  - ✓ ABJ50 Research Subcommittee
  - ✓ ABJ50(1) Sensing Technologies Subcommittee
- **2017**
  - ✓ ABJ50 Mid-Year Sub-Committee Meeting - DOT/CIO and TRB ABJ50 Information Systems and Technology
  - ✓ ABJ50 Information System and Technology Committee Meeting
  - ✓ Information Systems in Construction Management, AFH10(1), Joint Subcommittee of AFH10, ABJ50
  - ✓ ABJ50 Research Subcommittee
  - ✓ ABJ50(1) Sensing Technologies Subcommittee
- **2016**
  - ✓ ABJ50 Mid-Year Sub-Committee Meeting – conference call
  - ✓ ABJ50 Information System and Technology Committee Meeting
  - ✓ Information Systems in Construction Management, AFH10(1), Joint Subcommittee of AFH10, ABJ50
  - ✓ ABJ50 Research Subcommittee
  - ✓ ABJ50(1) Sensing Technologies Subcommittee
- **2015**
  - ✓ Committee meeting including vendor presentations from ESRI and Oracle, a USDOT CIO update, and a repeat of the DOT CIO Roundtable
  - ✓ AFH10 Subcommittee meeting