

# Module 14: ITS Emerging Opportunities and Challenges

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## Purpose

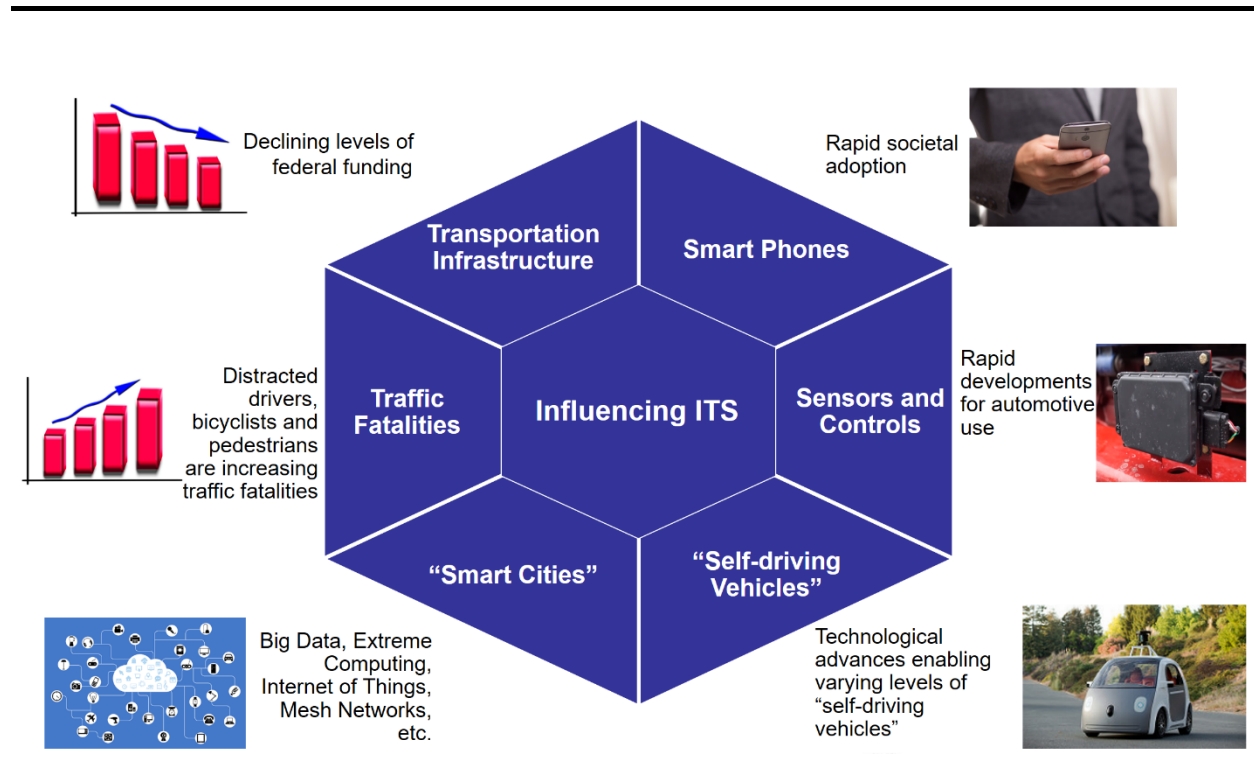
Intelligent transportation systems (ITS), like other technology fields, is changing and evolving at an unprecedented pace, opening new fields and applications in transportation even as they challenge current assumptions and practices. Indeed, more than previous generations of ITS, this one is driven by data—lots and lots of it. And all that data is collected, mined, processed, analyzed, stored, and disseminated, which presents both opportunities and challenges to the field of transportation engineering.

The purpose of this webinar is to gain an understanding of how ITS has evolved in the past 25 years, the significant changes in the roles played by the public and private sectors, the key technological and societal trends are responsible for those changes and a glimpse into the future of ITS.

## Objectives

The learning objectives of this module are to understand the following:

- ITS: Past, Present and Future
- What are emerging trends that will affect ITS?
- What are the opportunities and challenges for transportation professionals?



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## Six Major Trends in Technology and Society

Major Trends in Technology and Society at Large significantly influence the way ITS has, is and will evolve.

Here are six trends worth noting:

- Declining levels of funding for transportation infrastructure (Reduces the ability of the public sector to repair, maintain and build infrastructure)
  - Rapid societal adoption of smart phones (Increases end user access to traffic and transportation information)
  - Rapid developments in sensors and controls for automotive use (Enables commoditization of Automated Driver Assist Systems (ADAS))
  - Technological advances enabling varying levels of so-called “self-driving vehicles” (Reshaping urban areas)
  - Big Data, Extreme Computing, Internet of Things enabling Smart Cities (Technological breakthroughs have created fundamental, underlying foundations for Smart Cities)
  - Distracted drivers, bicyclists and pedestrians are increasing traffic fatalities
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	Public Sector	Private Sector
Infra— structure	1) Maintain physical transportation infrastructure 2) Build ITS architecture and tools for “Vehicle to Infrastructure and Vehicle to Vehicle (V2X)”	Contract services to public sector to build physical and IT infrastructures
Vehicles	Mandate vehicle ITS standards and devices to interface with ITS architectures and tools	Incremental improvements in safety and reliability
Travelers	Collect traffic information to disseminate to travelers for “intelligent” travel choices	Use traffic data provided by public sector to make smarter travel choices

## The First 20 Years of ITS

The first 20 years of ITS, the public sector was expected to maintain the physical transportation infrastructure AND build a new ITS architecture and tools for V2X.

Government agencies were expected to mandate standards and devices for the emergence of a new generation of “smart” vehicles. And Travelers were the target beneficiaries, able to receive traffic information to help them make smart travel choices.

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	Public Sector	Private Sector
Infra— structure	1) Physical: Struggling to maintain status quo 2) ITS: Transitioning from V2X to “Connected & Automated (sic) Vehicles”	Smart Cities, Internet of Things, Big Data, Cloud Computing, Mesh Networks, etc. are rapidly creating traffic and travel data <i>owned by the private sector</i>
Vehicles	NHTSA Defines Autonomous Driving Levels 1-5	Powerful sensors, computers and controls are significantly improving collision avoidance at the individual vehicle level
Travelers	Disseminating enhanced public sector network traffic data by combining it with privately collected, crowd-sourced data (e.g., WAZE, Google Maps, etc.)	ITS is shifting from <b>system to user-optimization</b> with high penetration of smart phones and highly accurate traffic/travel apps using crowd-sourced data

## The Maturation of ITS (2010-2015)

In the past 5 years, technological breakthroughs have shaped the evolution of ITS in significant ways.

Due to declining revenues from outdated federal fuel taxes, government agencies have struggled just to maintain the status quo in physical infrastructure, let alone build out a national ITS infrastructure. They gradually transitioned from building a nationwide “Vehicle-to-Infrastructure” and “Vehicle-to-Vehicle” system to endorsing and pilot testing some connected vehicle field tests. The National Highway and Transportation Safety Administration published definitions of five levels of Autonomous Driving, and public sector traffic and transportation news and information broadcasts were made more accurate and timely by incorporating real-time traffic conditions collected and reported by privately-developed, crowd-sourced mobile phone apps.

Meanwhile, huge strides were made in the private sector. Leveraging the concept of “Smart Cities”, private companies have built substantial information technology infrastructure components such as wireless internet, mesh networks, big data repositories, cloud computers, supercomputers, etc.—and the people to build and create with them—to record and analyze data collected from mobile sources carried by travelers and installed on vehicles. Automotive manufacturers have incorporated powerful sensors, computers and electronic controls to help drivers avoid collisions. And travelers now actively and passively contribute vast amounts of real time, location-referenced data using apps loaded by informed choice onto their mobile devices, creating high-quality, crowd-sourced traffic and transportation information for themselves.

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	Public Sector	Private Sector
Infra— structure	Focus will be on repairing and maintaining physical infrastructure (including ordinary traffic engineering and signage as well as expanding intelligent traffic signal systems to improve traffic flow)	Transportation Networks will become elements of Smart Cities, and the private sector will own much of the data
Vehicles	Will promote advances in collision avoidance systems to reduce V2V and “Vehicle-to-Pedestrian” (V2P) collisions	Vehicles will become Internet Protocol (IP) nodes, collecting data for Smart Cities companies
Travelers	Step up efforts to reduce collisions resulting from distracted drivers and distracted pedestrians/bicycles.	Travelers will make trip choices based on user-optimized constraints, subject to algorithms used by private companies providing crowd-sourced traffic information and navigation services

### Major Shift in Public and Private Sector Roles (2016-Future)

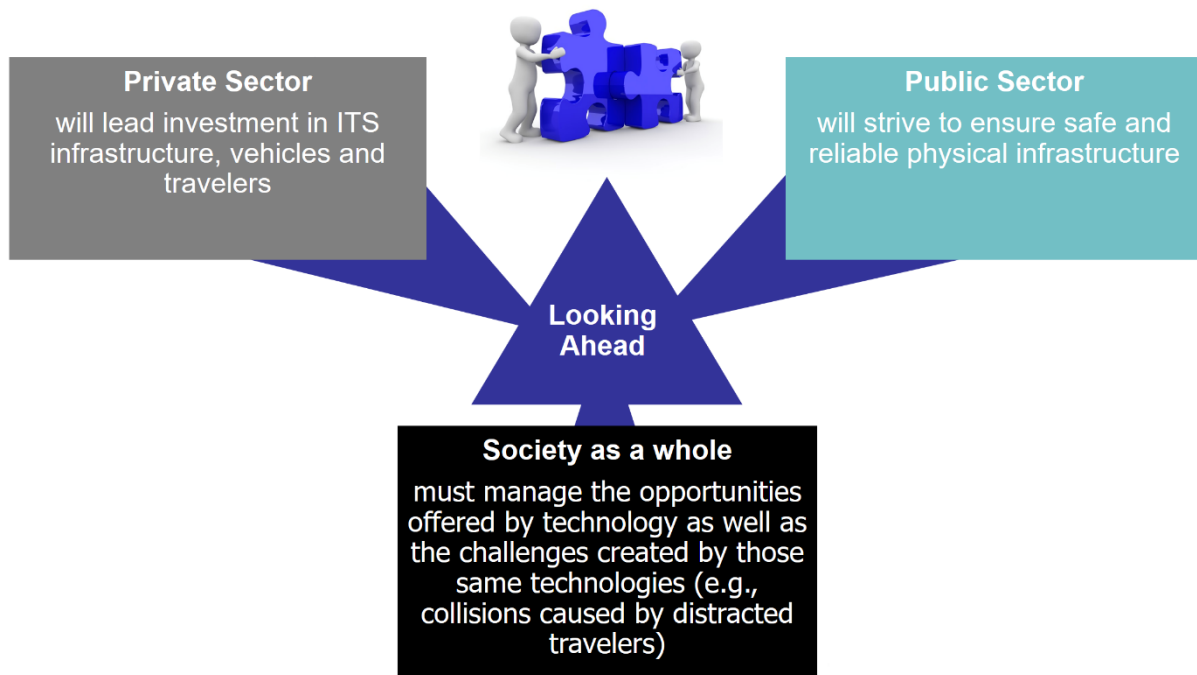
Looking to the near future, technology and social trends experienced in the past several years have created a radically different balance between public and private sector investments and influence in the world of intelligent transportation systems.

Government agencies responsible for transportation infrastructure are likely to re-focus resources on traffic engineering fundamentals, such as repairing and maintaining roads, bridges, tunnels and rails. Public investment in ITS will likely be limited to a few pilot tests of Connected Vehicles, with heightened attention to the increase in vehicular collisions with bicycles and pedestrians due to distracted driving, cycling and walking.

Private sector investments will seek to leverage data collected from vehicles and travelers build “smarter” cities by improving the quality of information available to managers of transportation infrastructure and individual travelers.

ITS will increasingly be driven by the private sector, with a strong dependence on public sector stewardship of the built environment.

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## Summary

- Private sector investments in Smart Cities, Internet of Things, Big Data, Extreme Computing, Cloud Storage and Computing are shifting traffic and transportation data collection, management and mining from the public sector to private sector.
  - Public sector investments in physical infrastructure (roads, bridges, tunnels and rails).
  - Self-Driving/Advanced Driver Assisted vehicles are reducing collisions, but low penetration of such systems and rapid increases in distracted drivers and pedestrians/bicyclists texting and using smart phones are creating new collision hazards that did not previously exist.
  - Anti-collision technologies should be incentivized by insurance companies and federal and state departments of transportation
  - Public awareness must be raised to reduce distracted driving, bicycling and walking
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## Opportunities and Challenges for Transportation Professionals

### 1 “It’s All About the Data”

- Whoever owns transportation and traffic data will have the most influence over how ITS will evolve into a core component of Smart Cities
- Public-private partnerships that can collect, mine, clean and analyze the data together will create the potential for dramatically improving the health and well-being of our cities and urban regions



ITS will be the transportation component of Smart Cities.

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- Public-private partnerships that can collect, mine, clean and analyze the data together will create the potential for dramatically improving the health and well-being of our cities and urban regions

### 2 “Traditional” transportation planning, design, engineering, construction, operations and maintenance are still critical

- These disciplines must “keep up” by becoming smarter, faster and less expensive with new techniques, materials, management information systems in order to continue to deliver safe and reliable infrastructure for society



### 3 ITS and traditional transportation professionals must keep up with technological and societal trends in order to stay relevant and productive



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## References and Resources

Information about emerging ITS applications and technologies can be found in many key resources, such as the following.

Big Data, Extreme Computing, Mesh Networks and Internet of Things

<http://www.ciscoinvestments.com/news/veniam-announces-22-million-series-b-funding-disrupt-connected-vehicles-smart-cities/>

<http://www.forbes.com/sites/bernardmarr/2016/03/15/17-predictions-about-the-future-of-big-data-everyone-should-read/#4efa3da8157c>

<http://www.forbes.com/sites/louiscolombus/2016/01/18/2016-roundup-of-cloud-computing-and-enterprise-software-predictions/#493d1ae12230>

<http://www.securitymagazine.com/articles/84986-how-mesh-networks-form-the-backbone-of-smart-cities>

<http://www.masstransitmag.com/blog/12125778/kinetic-mesh-networks-improve-mass-transit-communications>

<http://www.mcs.anl.gov/group/extreme-computing>

<http://www.techradar.com/us/news/internet/10-ways-the-internet-of-things-could-change-the-world-in-2016-1310631>

Data enabling Smart Cities

<https://www.transportation.gov/smartcity>

[http://www.its.dot.gov/itspac/Dec2014/Smart\\_Connected\\_City\\_FINAL\\_111314.pdf](http://www.its.dot.gov/itspac/Dec2014/Smart_Connected_City_FINAL_111314.pdf)

<http://www.vulcan.com/Areas-of-Practice/Philanthropy/Key-Initiatives/Smart-City-Challenge>

<http://smartcitiescouncil.com/smart-cities-information-center/transportation>

Rapid societal adoption of smart phones

<http://www.pewinternet.org/2015/04/01/us-smartphone-use-in-2015/>

<http://www.statista.com/statistics/201182/forecast-of-smartphone-users-in-the-us/>

Apps enabled by crowd-sourced data

<https://www.getaround.com>

<https://www.waze.com>

Rapid developments in sensors and controls for automotive use

<http://www.iihs.org/iihs/ratings/crash-avoidance-features>

<http://www.nhtsa.gov/About+NHTSA/Press+Releases/U.S.+Department+of+Transportation+Releases+Policy+on+Automated+Vehicle+Development>

<http://www.densodynamics.com/all-about-v2x-talking-car-technology/>

Technological advances enabling self-driving

<http://www.extremetech.com/tag/self-driving-cars>

Declining levels of funding for transportation infrastructure

<http://www.pbs.org/newshour/making-sense/highway-trust-fund-keeps-bridges-falling-will-congress-pay-bill/>

<https://www.transportation.gov/highway-trust-fund-ticker>

Distracted travelers are increasing traffic fatalities

<http://www.distraction.gov>

[http://www.cdc.gov/motorvehiclesafety/distracted\\_driving/](http://www.cdc.gov/motorvehiclesafety/distracted_driving/)

<http://www.nhtsa.gov>

[http://bits.blogs.nytimes.com/2013/07/24/lahood-says-companies-must-wake-up-to-distracted-driving/?\\_r=0](http://bits.blogs.nytimes.com/2013/07/24/lahood-says-companies-must-wake-up-to-distracted-driving/?_r=0)

<http://www.nytimes.com/2016/02/24/science/driving-distractions-study.html>

Professional Associations:

American Association of State Highway Transportation Officials:

<http://tiq.transportation.org>

Institute of Electrical and Electronic Engineers: <http://www.comsoc.org/>

Institute of Transportation Engineers: <http://www.ite.org/standards/index.asp>

International Bridge, Tunnel and Turnpike Association: <http://www.ibtta.org/Tollways/List.cfm>

Society of Automotive Engineers: <http://training.sae.org/seminars/c1025/>

Federal:

<http://www.its.dot.gov/>

[http://www.cdc.gov/motorvehiclesafety/distracted\\_driving/](http://www.cdc.gov/motorvehiclesafety/distracted_driving/)

<http://www.nhtsa.gov>

Media:

<http://www.technologyreview.com/>

<http://www.engadget.com/>

<http://www.wired.com/>



<http://thinkinghighways.com/>