

INTERCONNECTING VEHICLES WITH ROAD INFRASTRUCTURE

AN MPO PERSPECTIVE ON AUTONOMOUS VEHICLES AND CONNECTED VEHICLE TECHNOLOGY

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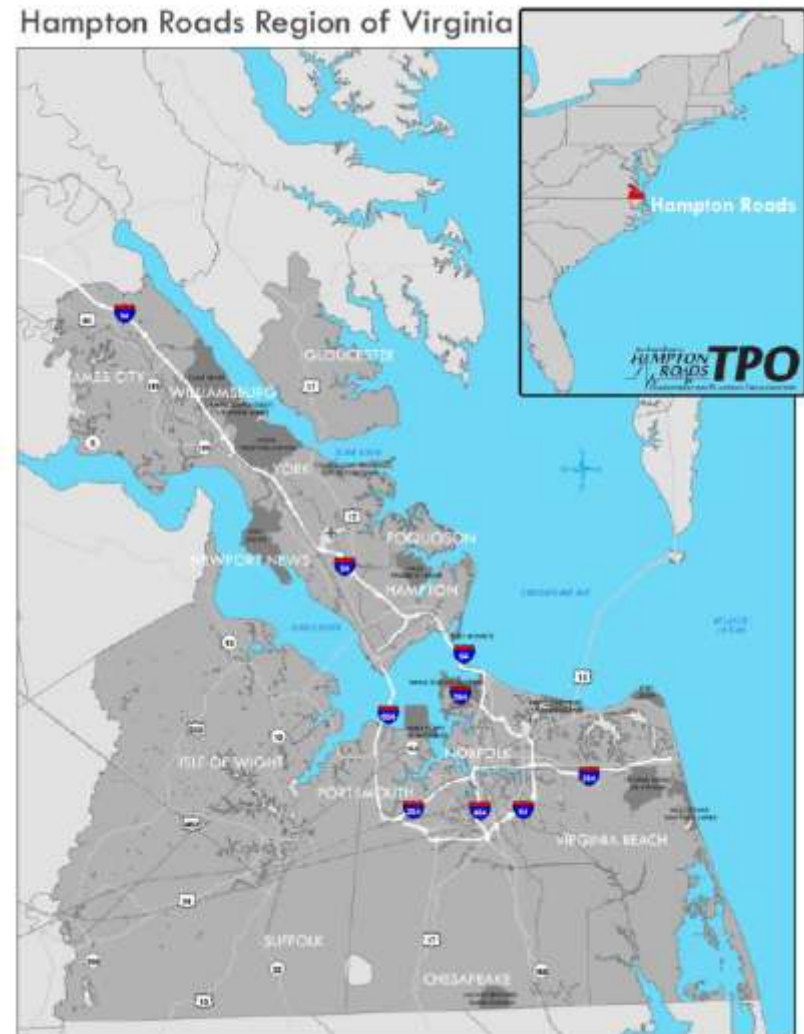
Hampton Roads Transportation Planning Organization

HAMPTON ROADS

TRANSPORTATION PLANNING ORGANIZATION

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- Population: 1.7 million
- Federally mandated
- One of fourteen MPOs in the Commonwealth of Virginia.
- Comprised of elected officials and representatives from local, state, federal, and transit agencies, as well as other stakeholders.
- Virtually all highway or transit projects or programs to be constructed or conducted within the metropolitan planning area must receive approval by the HRTPO in order to proceed.



HRTPO CORE FUNCTIONS

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Long-Range Transportation Plan and Prioritization

Transportation Improvement Program

Congestion Management Process

Public Participation

Technical Programs

- Safety Planning
- Freight Planning
- Passenger Rail Planning
- HOV and Congestion Pricing
- Corridor and Intersection Studies
- Security – Emergency Evacuation & Critical Infrastructure
- Intelligent Transportation System & Operations Planning
- Transportation Planning & Engineering Studies

Rural Transportation Planning

COMMON QUESTIONS

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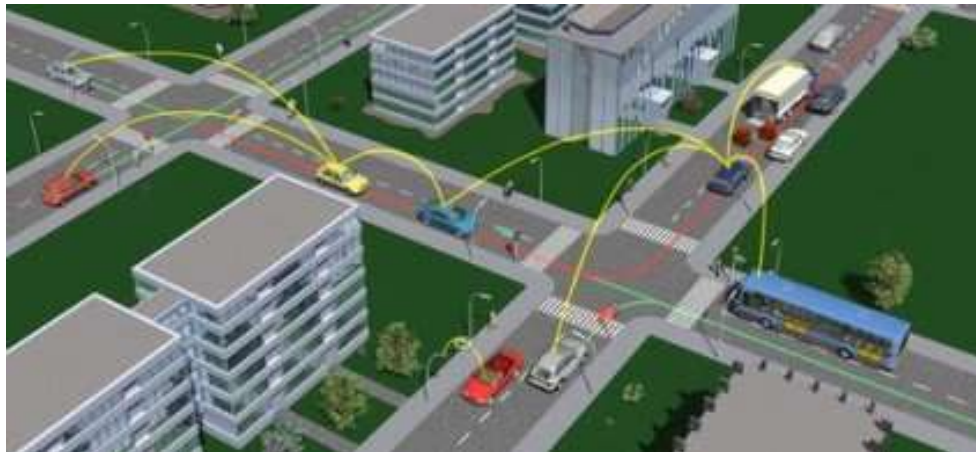
- What are the anticipated impacts of connected and automated vehicles on traffic safety, mobility, congestion, and environment, especially on a local/urban network?
- What will a local agency need to do to be prepared for connected and automated vehicles?
- What are the anticipated capital, O&M, and personnel costs that will be required to deploy vehicle-to-infrastructure (V2I) systems?
- How do connected and automated vehicles fit into an existing regional ITS architecture?
- Are there deployment scenarios that outline anticipated rates of installation and related benefits?
- What are the roles of government (federal, state and local) versus private industry?

BACKGROUND: AUTONOMOUS & CONNECTED VEHICLES

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The public and private sector have been working on driverless vehicle technology in an effort to allow for the safest and most efficient transportation system.

- **Autonomous Vehicles** use sensors and photo imagery to drive themselves.
- **Connected Vehicle Technology** would assist the driver by providing information and resources.



TIMELINE: VISION TO REALITY

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ESTIMATES OF ANNUAL BENEFITS FROM AUTONOMOUS VEHICLES (US ONLY)

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	10%	50%	90%
CRASH COST SAVINGS			
Lives Saved	1,100	9,600	21,700
Fewer Crashes	211,000	1,880,000	4,220,000
Economic Cost Savings	\$5.5 B	\$48.8 B	\$109.7 B
Comprehensive Cost Savings	\$17.7 B	\$158.1 B	\$355.4 B
Economic Cost Savings per AV	\$430	\$770	\$960
Comprehensive Cost Savings per AV	\$1,390	\$2,480	\$3,100
CONGESTION BENEFITS			
Travel Time Savings (M Hours)	756	1,680	2,772
Fuel Savings (M Hours)	102	224	724
Total Savings	\$16.8 B	\$37.4 B	\$63.0 B
Savings per AV	\$1,320	\$590	\$550
OTHER AV IMPACTS			
Parking Savings	\$3.2 M	\$15.9 M	\$28.7 M
Savings per AV	\$250	\$250	\$250
VMT Increase	2.0%	7.5%	9.0%
Changes in Total # of Vehicles	-4.7%	-23.7%	-42.6%
ANNUAL SAVINGS			
Economic Costs only	\$25.5 B	\$102.2 B	\$201.4 B
Comprehensive Costs	\$37.7 B	\$211.5 B	\$447.1 B
ANNUAL SAVINGS PER AV			
Economic Costs only	\$2,000	\$1,610	\$1,670
Comprehensive Costs	\$2,960	\$3,320	\$3,900
NET PRESENT VALUE OF AV BENEFITS MINUS ADDED PURCHASE PRICE			
Economic Costs	\$5,210	\$7,250	\$10,390
Comprehensive Costs	\$12,510	\$20,250	\$26,660

Source: Eno Center for Transportation.

IMPACTS TO TRANSPORTATION PLANNING

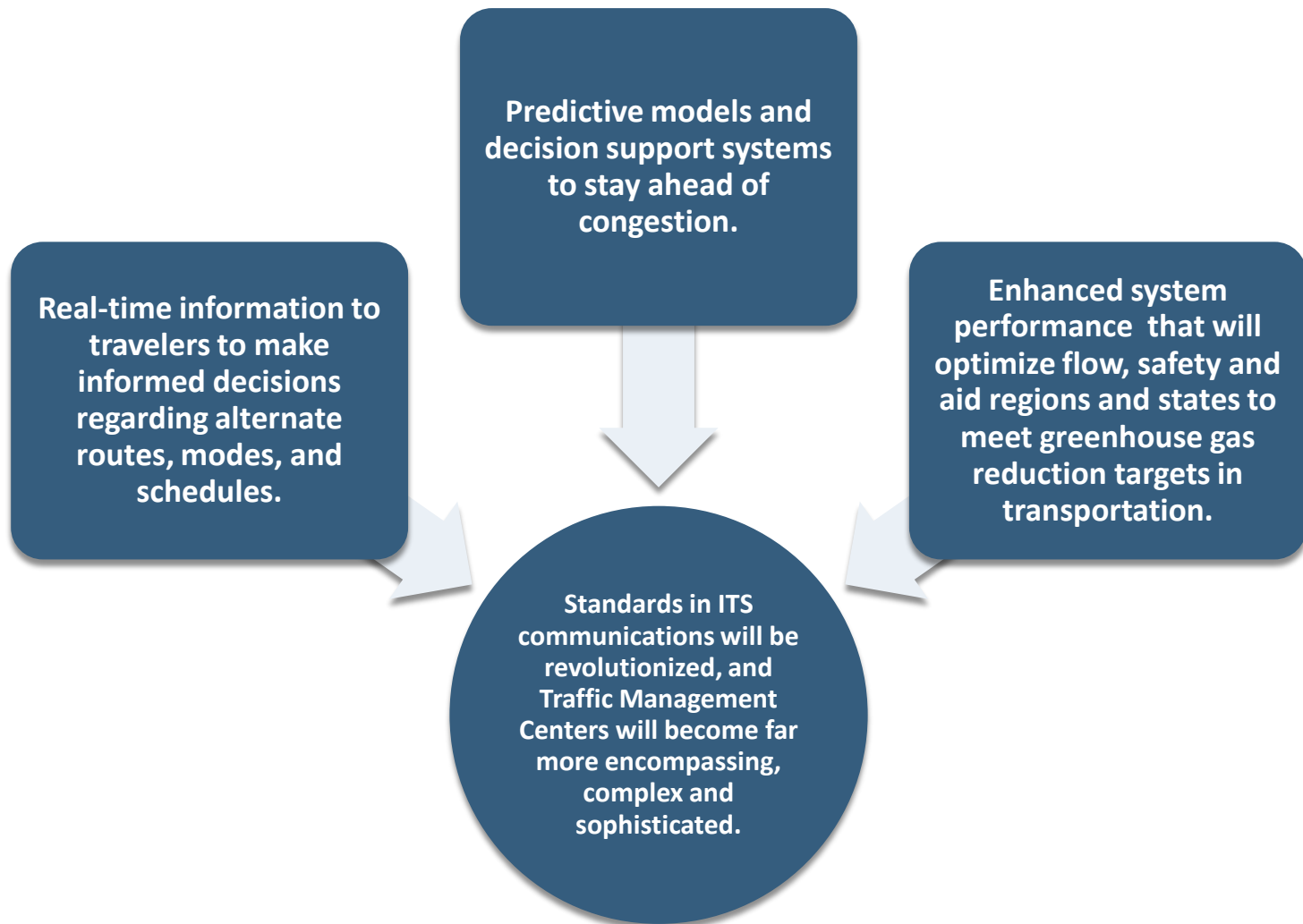
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Autonomous Vehicles/Connected Vehicle Technology are expected to increase in the capacity of roads primarily due to cars being able to run more closely together with improved safety and accuracy.

- Highway agencies and city authorities will quickly come under pressure to develop corridors and precincts that enable vehicles to communicate with infrastructure and will need to include the sensors, transmitters and cabling required to produce and expand a connected network.
- Funding will be shifted from road capacity improvements to ITS infrastructure improvements as a cost-effective strategy.
- Smart infrastructure developers will "future-proof" new roads now with capacity to become interactive or to have easily adapted layout changes.
- New and refurbished road infrastructure will need to reflect the evolving "driving" patterns and behaviors of all types of vehicles. Such infrastructure development will need to challenge the current roles and dominance of vehicle modes between cars, buses, taxis and bicycles.

IMPACTS TO ITS AND NETWORK INFRASTRUCTURE SYSTEMS

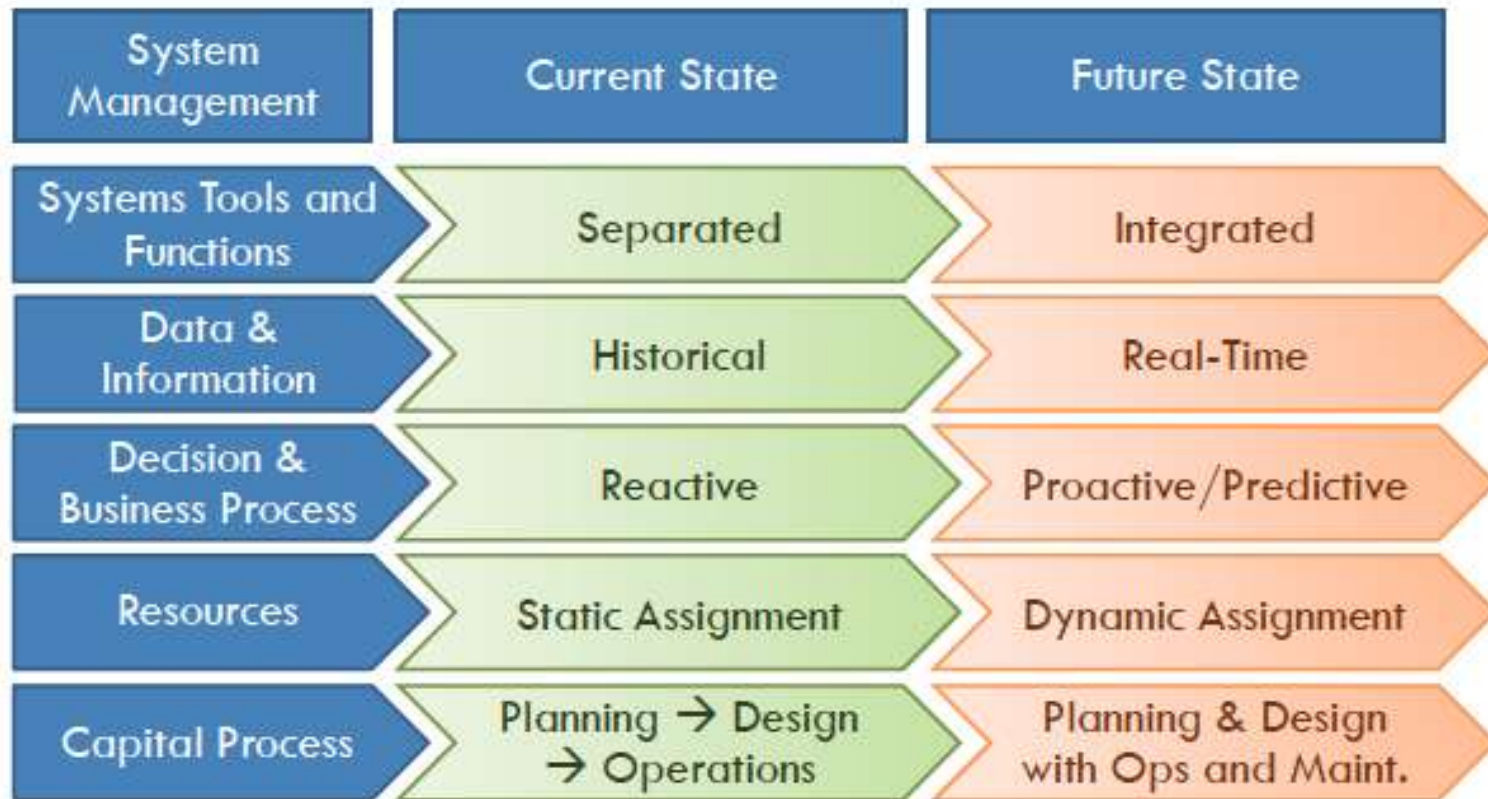
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IMPACTS TO ITS AND NETWORK INFRASTRUCTURE SYSTEMS

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Evolution of the System Management System



Slide Source: Caltrans February 2014 presentation http://www.dot.ca.gov/hq/tpp/offices/owd/past_files/Connected_Corridors_Traffic_Ops_Feb2014.pdf

IMPACTS TO LEGAL FRAMEWORK/REGULATIONS

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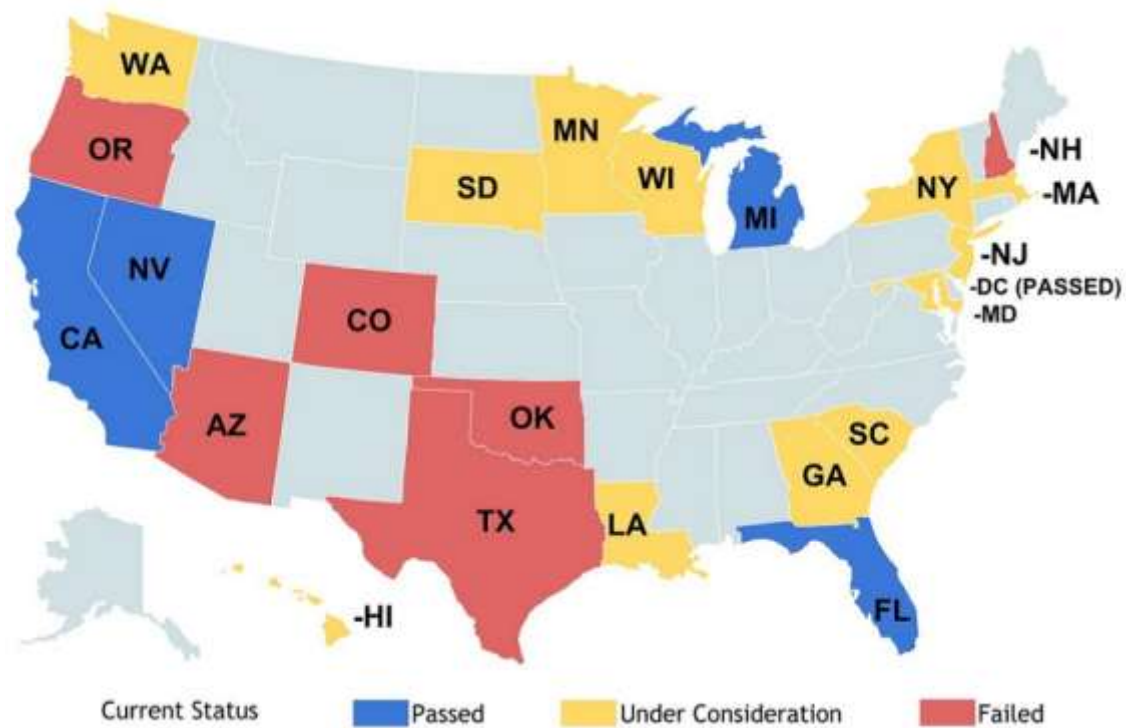
- **State vehicle codes probably do not prohibit—but may complicate—automated driving.**

- Codes assume the presence of licensed human drivers who are able to exercise human judgment, and particular rules may functionally require that presence.

- **In May 2013, the National Highway Traffic Safety Administration:**

- outlined the definition of an autonomous vehicle
- issued a working policy statement advising all states to leave safety standards up to federal regulators.

- **To streamline manufacturing, a uniform set of regulations and laws is necessary**



POTENTIAL CHALLENGES/ISSUES

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□ **Cyber Security**

- Technology is vulnerable to hackers and viruses

□ **Reduced Local and State Revenues**

- Drastic reductions in fines from traffic violations are anticipated and States and local governments would have to operate without a substantial source of revenue.

□ **Toll Roads**

- Toll Roads are expected to increase after the full integration of autonomous vehicles and ITS.
- As vehicles become increasingly more efficient, the government will have to find another source of revenue for transportation improvements. Some predict an increase in toll roads on the highways.

PLANNING AND PARTNERSHIPS: INTEGRATION

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Institutional

- Coordination to collaboration between various agencies and jurisdictions that transcends institutional boundaries.

Operational

- Multi-agency and cross-network operational strategies to manage the total capacity and demand of the corridor.

Technical

- Sharing and distribution of information, and system operations and control functions to support the immediate analysis and response.

USDOT APPROVED CONNECTED VEHICLE TEST BEDS

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Source: U.S. Department of Transportation

EXAMPLE OF PARTNERSHIP – TAMPA, FL

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The Tampa Hillsborough Expressway Authority (THEA) is offering its access-controlled toll road, arterial feeder roads, and office facilities to businesses to test and develop technologies that advance autonomous vehicles.



1 of 10 sites nationwide where researchers can study the safety and performance of automated vehicles. Partners include Federal, State, local, institutional, and local agencies.



Certain segments of the expressway would be closed to regular traffic during non-peak hours to see how automated cars work together on the road.

THANK YOU

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www.hrtpo.org