Intelligent Transportation Systems
U.S. Department of Transportation

ITS and Connectivity: A New Paradigm

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A Changing Paradigm for ITS

ITS is, once again, enabling a paradigm shift, driven by:

- Complexity of problems
- Innovative wireless technologies

Our challenge

- Embrace new approaches
- Leverage innovation and the market

Without

- Stopping progress, as we prepare for
- Emerging opportunities

ITS Enabled Operational Focus

- **Successes**:
  - FHWA created an Office of Operations
  - AASHTO created an operations subcommittee
  - State DOTs reorganized for operations
  - Transit already had an operational focus
  - Deployment of ITS progressed
    - 150 TMCs
    - 65% population covered by 511
    - 4700 DMS
    - 36 metro areas with real-time info on DMS
    - 1500 transit agencies using GPS
    - 45 States are part of CVISN

The Paradigm Shift for ITS

The first paradigm shift for ITS: Operations

ITS Program Headlines:

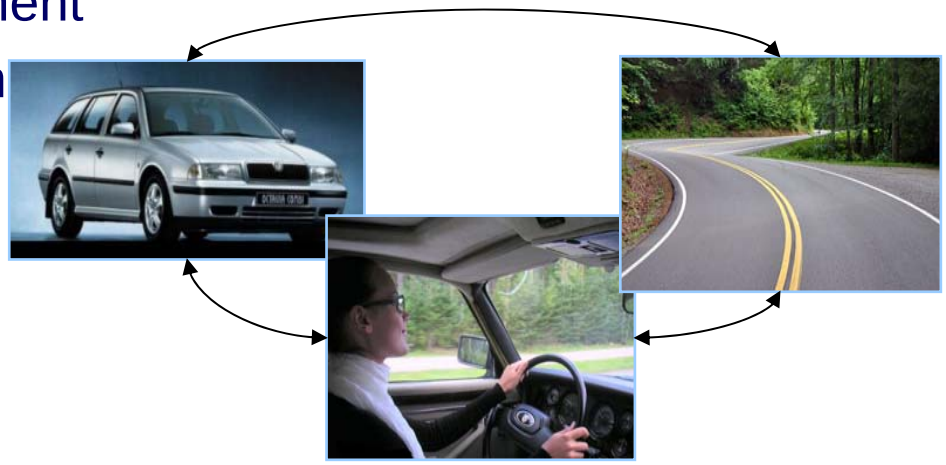
- Field operational tests
- Deployment
- Integration

The second paradigm shift for ITS:

The Paradigm Shift for ITS

Connectivity

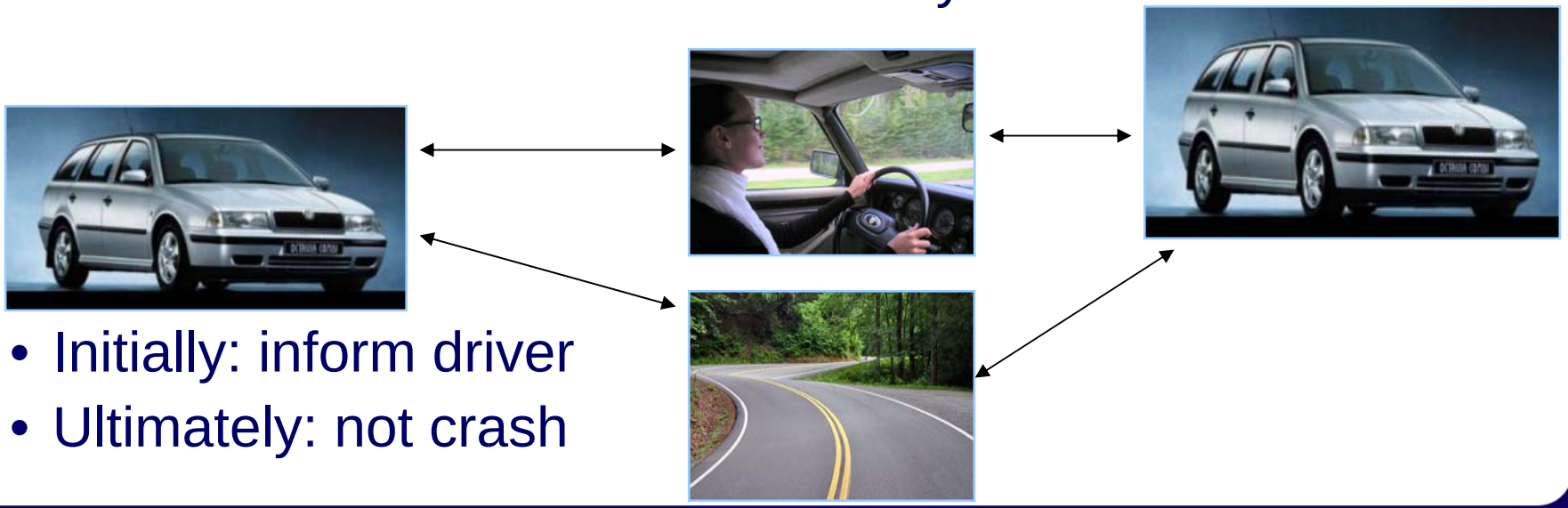
- **Safety technologies in all vehicles**
- **Multi-modal solutions**
  - Seamless Service for
    - System management
    - Travel information
    - Pricing



Connectivity

Safety Technology for Situational Awareness Around the Vehicle

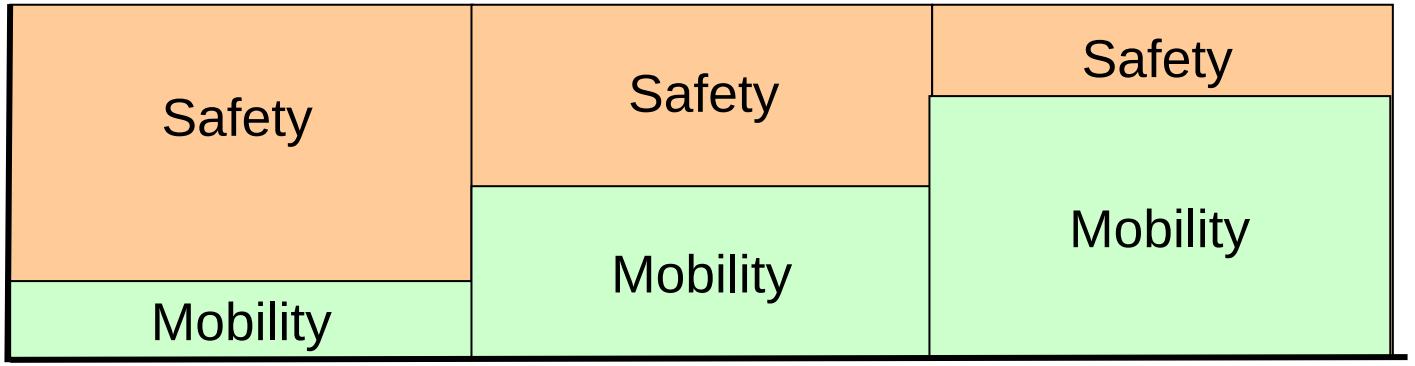
- Autonomous technology
- Vehicle to vehicle connectivity
- Vehicle to infrastructure connectivity



- Initially: inform driver
- Ultimately: not crash

Wireless Vehicle Communications

Benefits



V2V		V2I		Nomadic	
Apps	Tech	Apps	Tech	Apps	Tech
Left-turn Asst Emergency Brake Warn Icy Condition Blind Spot Travel Info Platooning	DSRC MANET? 4G?	Curve Speed Warning Stop Sign Warning Signal Violation Traffic Mgmt Road Wx Alert Navigation	DSRC Cell phone 3G WiFi WiMAX MANET	Curve Speed Warning Stop Sign Warning Transit Mgmt Performance Measures Navigation Traffic Mgmt Planning	DSRC Cell phone 3G WiFi WiMAX MANET

Safety Benefits

Crash Types	Frequency*	Severity**	V2V	V2I
Control Loss without Prior Vehicle Action	529	478		
Road Edge Departure without Prior Vehicle Maneuver	334	270		X
Lead Vehicle Stopped	975	240	X	X
Vehicle(s) Not Making a Maneuver – Opposite Direction	124	206	X	
Straight Crossing Paths at Non-Signalized Junctions	264	174	X	X
Pedestrian Crash Without Prior Vehicle Maneuver	39	144		
Vehicle(s) Turning at Non-Signalized Junctions	435	138	X	X
Running Red Light	254	135		
LTAP/OD at Signalized Junctions	220	121	X	
LTAP/OD at Non-Signalized Junctions	190	113	X	
Lead Vehicle Decelerating	428	100	X	
Lead Vehicle Moving at Lower Constant Speed	210	78	X	
Vehicle(s) Changing Lanes – Same Direction	[illegible]	74	X	X
Object Crash without Prior Vehicle Maneuver	55	19		
Following Vehicle Making a Maneuver	85	18	X	
Non-Collision Incident	46	13		
Vehicle(s) Parking – Same Direction	48	11	X	
Pedalcyclist Crash with Prior Vehicle Maneuver	18	11		
Backing Up Into Another Vehicle	131	9	X	
Road Edge Departure While Backing Up	66	6		
Lead Vehicle Accelerating	19	4	X	
Vehicle Turning and Signalized Intersections	35	4		
Evasive Action with Prior Vehicle Maneuver	13	4		
Object Crash with Prior Vehicle Maneuver	30	3		
Animal Crash with Prior Vehicle Maneuver	23	2		
Other	36	21		

*Number of crashes (thousands) **Functional Years Lost (thousands)

V2V Safety Research - Applications

- **Applications Development** (precompetitive)
  - Emergency Brake Lights
  - Forward Collision Warning
  - Lane Change Warning
  - Intersection Movement Assist
  - Do-Not-Pass Warning
  - Control Loss Warning
- **Next set crash types**
  - Head on
  - Intersection
  - Pedestrian & Motorcycles

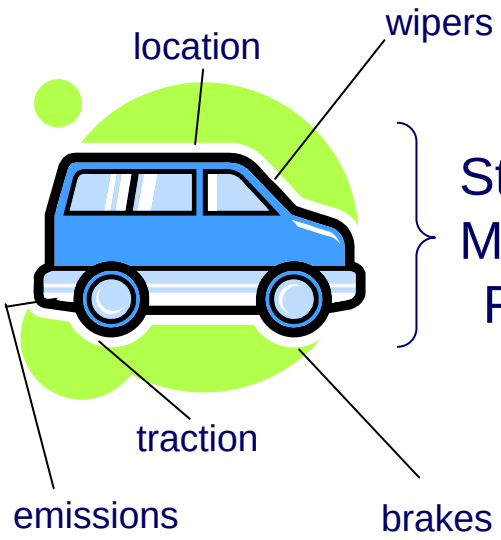
V2V Safety Research - Applications

- **Applications Development** (precompetitive)
  - Message sets
  - Algorithms
  - Driver issues
    - Interface
    - Performance
  - Performance Evaluation
    - Performance Specs
    - Object test procedures
    - Effectiveness/benefits

V2V Safety Research - Interoperability

- **Standards development & testing**
  - Message sets
  - Communication protocols
- **Certification**
  - Performance requirements
  - Test procedures and testing verification
- **Security and scalability**
- **Positioning**

Weather and Environmental Applications



Standard Message Format

Weather & Environmental Information

Applications

- NWS forecast
- Private forecast
- Road weather management
- Traveler info providers

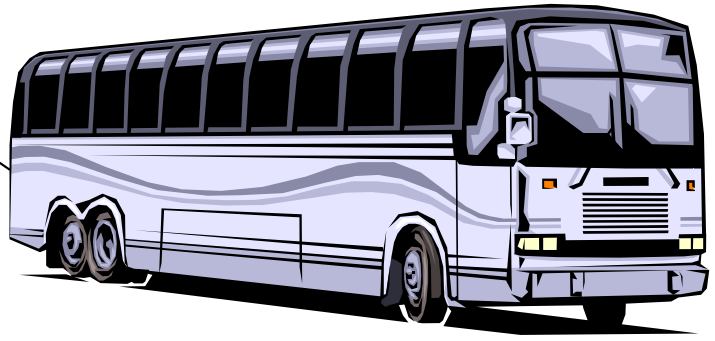
Weather and Environmental Research

- **Standards development and testing**
- **Research analysis and evaluation on**
  - Data quality
  - Use for weather applications
- **Applications – Road Weather Management**
  - Advisory
  - Control
  - Treatment

Connectivity

Multi-modal Solutions for Situational Awareness of the Transportation System

- Modal choice
- Real-time information on all roads, all modes
  - Freeways and arterials
  - Transit
  - Parking
- Pricing



Nomadic Devices: Opportunities

Devices
- Cell phones
- GPS cell pho
- Aftermarket r
- Other

Applications

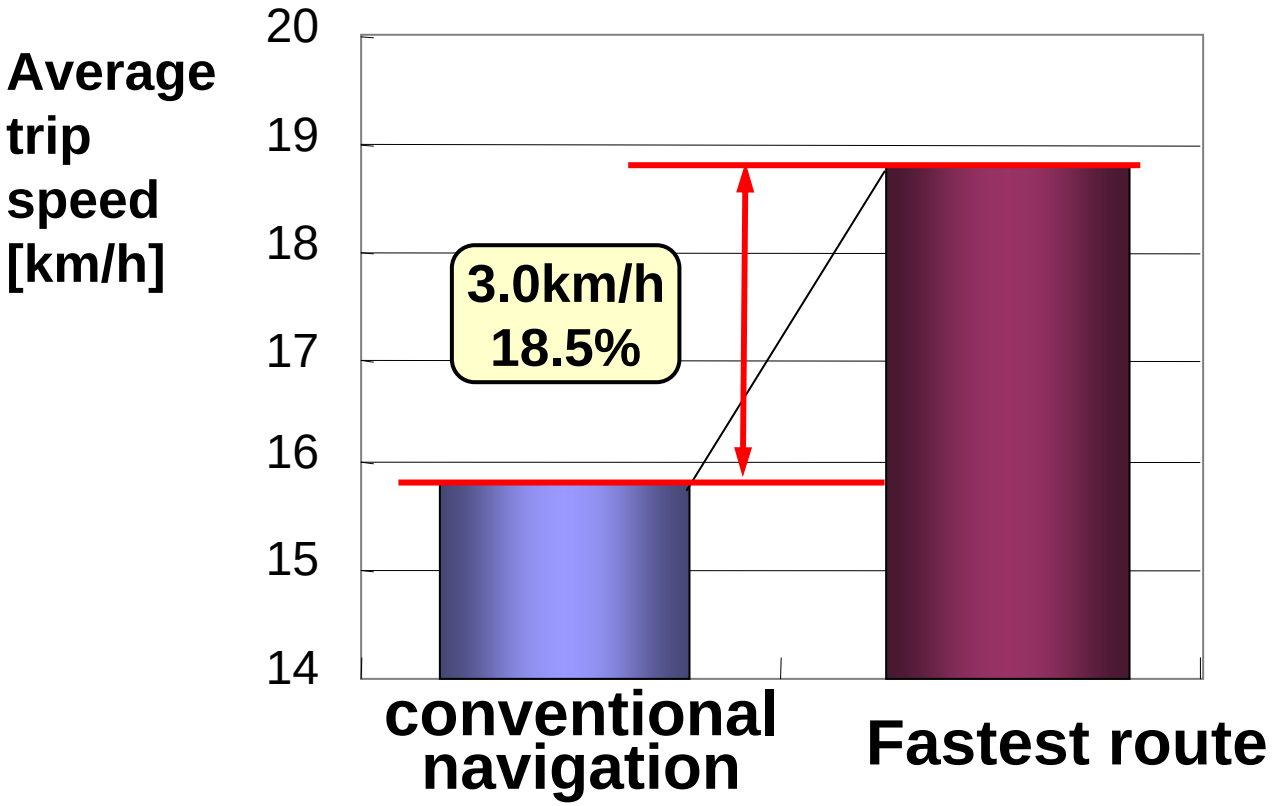
Mobility
- Planning
- Performance Measures
- Traffic Management
- Transit Management
- Freight Management
- Rural Applications

Safety
- Curve Speed Warning
- Stop Sign Warning

Nomadic Devices

- Standards development and testing
- Data quality and evaluation
- Applications development
- Procurement approaches
- Safety research and testing

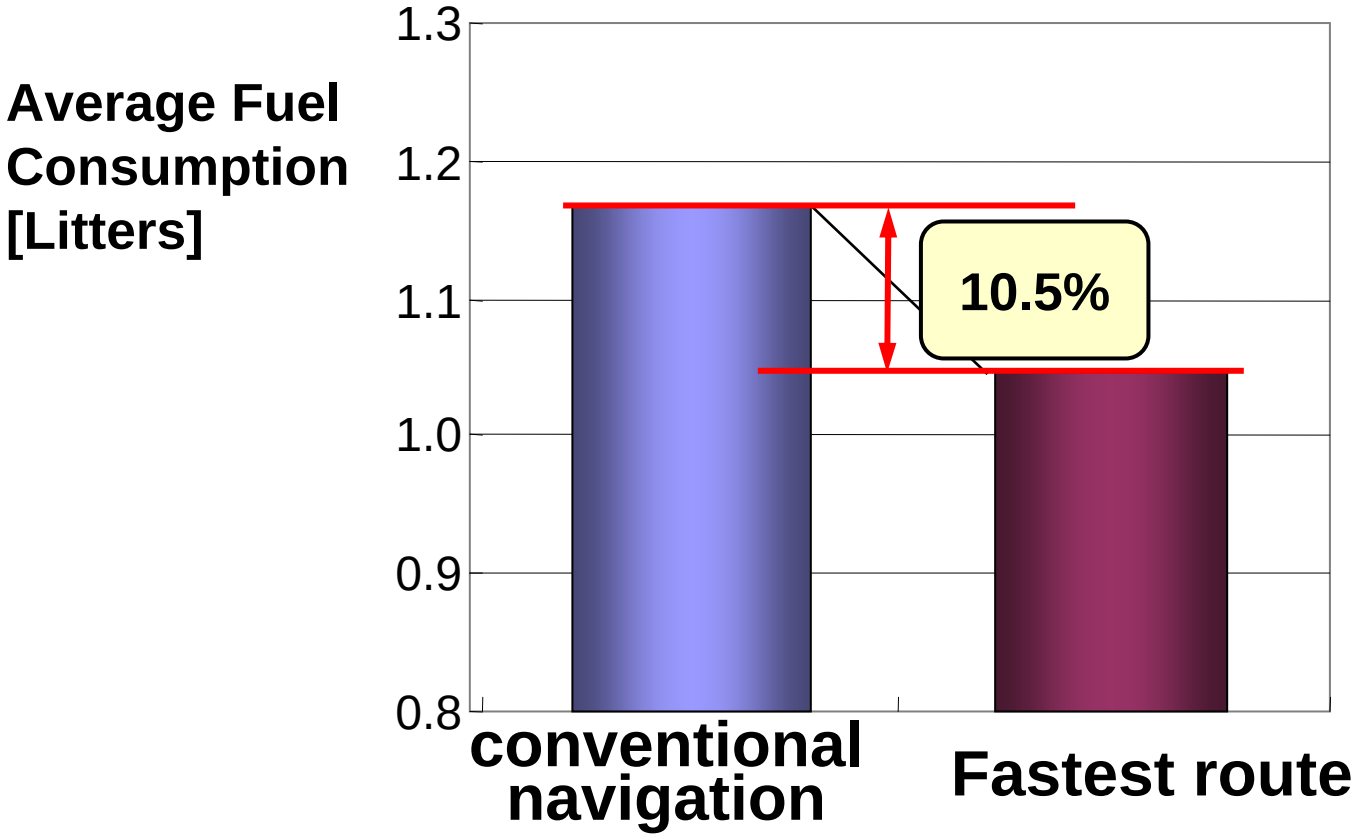
Average trip speed was 18.5% faster than conventional navigation.



Comparison of average trip speed during Feb '07

Nissan Motor Co.

Average Fuel Consumption was 10.5% less than conventional navigation.



Comparison of Fuel Consumption during Feb '07

Nissan Motor Co.

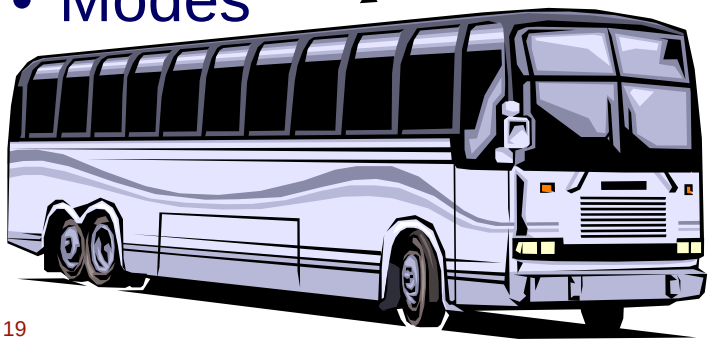
Connectivity: Open Platform

Safety Technology

Multi-modal Solutions

Interoperability across

- Devices
  - DSRC
  - 3G, 4G, WiFi
  - Other
- Modes



Safety

- 41,059 fatalities/year
- 2.49 million injuries
- 6 million crashes/year
- $230 billion economic cost/year
- 1.37 fatality rate

Congestion

- Crashes are 25% of all congestion
- Congestion will increase by 50% in 10 years
- Congestion has grown 400% in 20 years in small cities
- Americans will spend a week stuck in traffic
- $78 billion/year

Weather
Today: Partly sunny. High 50. Low 30.
Friday: Mostly sunny. High 46. Low 34.
Details, Page B8

123RD YEAR NO. 11 ...

The Washington Post

THURSDAY, DECEMBER 16, 1999

Bad Traffic Grows Worse, Study Says

By ALAN SIPRESS
Washington Post Staff Writer

Severe congestion has spread to vast stretches of Washington area highway where only three years ago traffic moved freely, drastically slowing commuters on roads such as I-95, I-270 and the Capital Beltway, according to a regional study released yesterday.

The analysis by the Metropolitan Washington Council of Governments, based on extensive aerial photography, represents the most comprehensive overview yet of the region's congestion and confirms what many weary commuters already know: Traffic has grown considerably worse. Since COG's last study in 1996, daily backups have developed on dozens more miles of highway, aggravating traffic that was already ranked the second-worst in the country behind the Los Angeles area.

The swelling congestion on the Beltway is perhaps the most dramatic illustration. Morning commuters had previously encountered severe tie-ups on the Maryland portion of the outer loop between Interstate 95 and Georgia Avenue. But now that bumper-to-bumper traffic stretches 13 miles farther, all the way across the American Legion Bridge to the Dulles Toll Road.

"It has gotten quite a bit worse over quite a short period of time," said Ronald F. Kirby, COG's director of transportation planning. "It was bad only up there in Maryland. Now it's getting bad in Virginia."

The finding that the region's congestion is now spreading like an epidemic comes only weeks before the Virginia and Maryland legislatures are expected to tackle proposals for raising billions of dollars to expand roads and transit.

But the COG analysis offers a sobering lesson, because it shows

See TRAFFIC, A20, Col. 1

Morning Congestion has spread on the Capital Beltway:

BY WILLIAM MCNULTY—THE WASHINGTON POST

Washington Beltway has five of the nation's most notorious

Commission: More spending on transportation required

Slow going getting slower

■ Beltway: *We're stuck on commuting by car. As a result, we're spending more time stuck in traffic on Interstate 695.*

One in a series of occasional articles

By LIZ ATWOOD
SUN STAFF

Caution: congestion ahead. State officials are trying everything to ease traffic on the Baltimore Beltway ... tearing up a bridge to make way for another widening, pinpointing rush-hour snags by satellite and adding emergency vehicles to help stranded motorists.

Despite those efforts and millions of dollars spent, traffic on the 50-mile loop is getting worse. "We can expect the congestion to grow over time," says Parker Williams, administrator of the State Highway Administration.

More than 500,000 vehicles a day jam the roadway that was originally built to handle 80,000. A Baltimore-area resident spends an average of 47 hours a year stuck in traffic, much of it on Interstate 695, the heart of the area's transportation network. That's twice as much as 10 years ago, according to a study recently released by the Texas Transportation Institute.

Persuading drivers to use car pools and mass transit is critical to alleviating the congestion, Williams says. Mass transit is used for only 4 percent of the 14 million commuter trips made daily in Maryland.

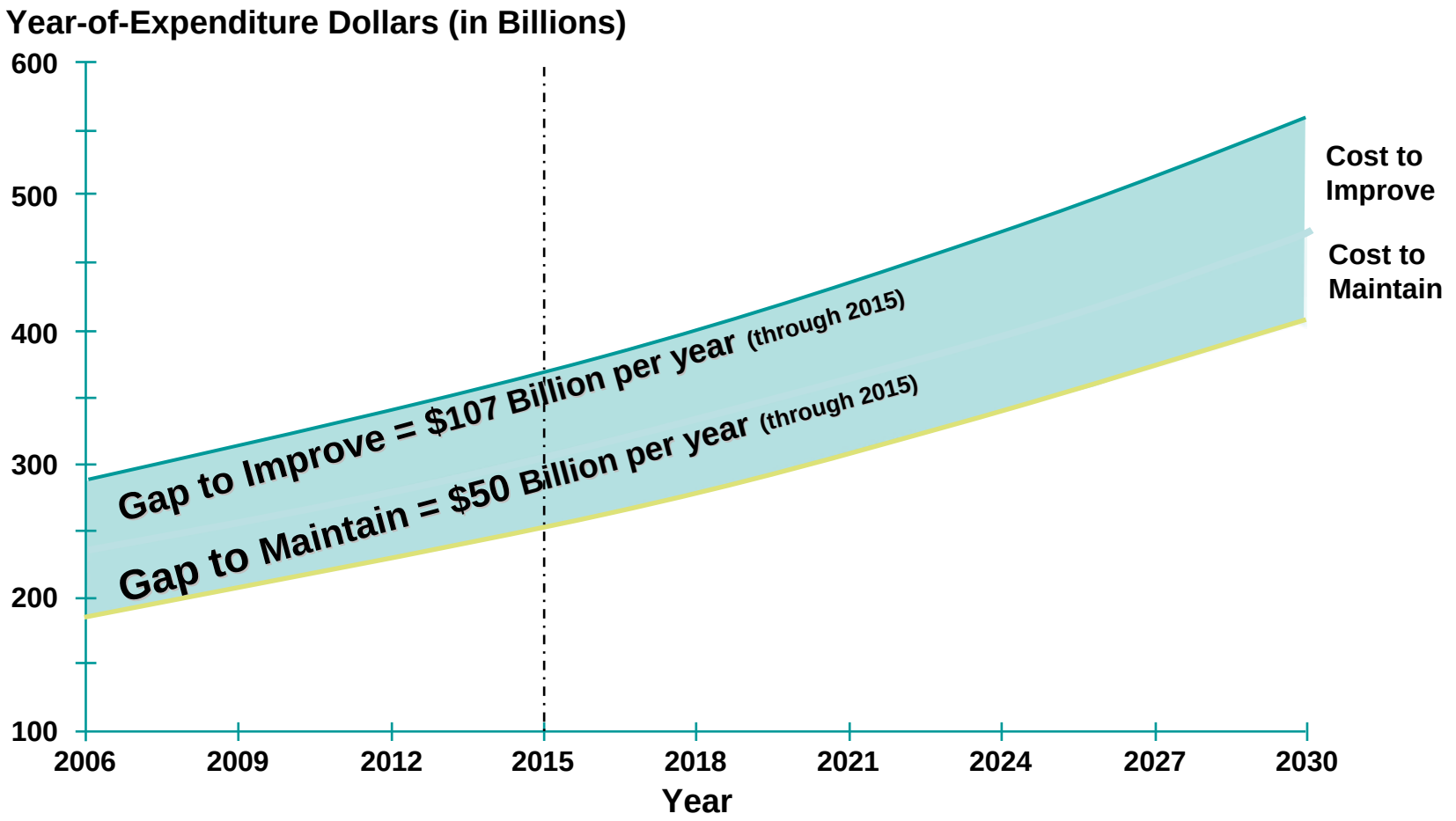
For most, driving to work is a way of life.

"I just got into the habit of driving," says R.D. Randall, as he passes the Metro station on Old Court Road on his way from [See Beltway, 7a]

Environmental Concerns

- 25% of GHG emissions are from transportation sector
- 33% of all CO_2 emissions from fossil fuel were from transportation
- 60% of those resulted from gasoline consumption by personal vehicles
- 100 million people in the US live in counties that exceed air quality standards for ozone and particulates

Limited Public Resources



Source: *U.S. Chamber Funding Highway and Public Transportation Study* (2005)

Complex Transportation Problems

Transportation Problems

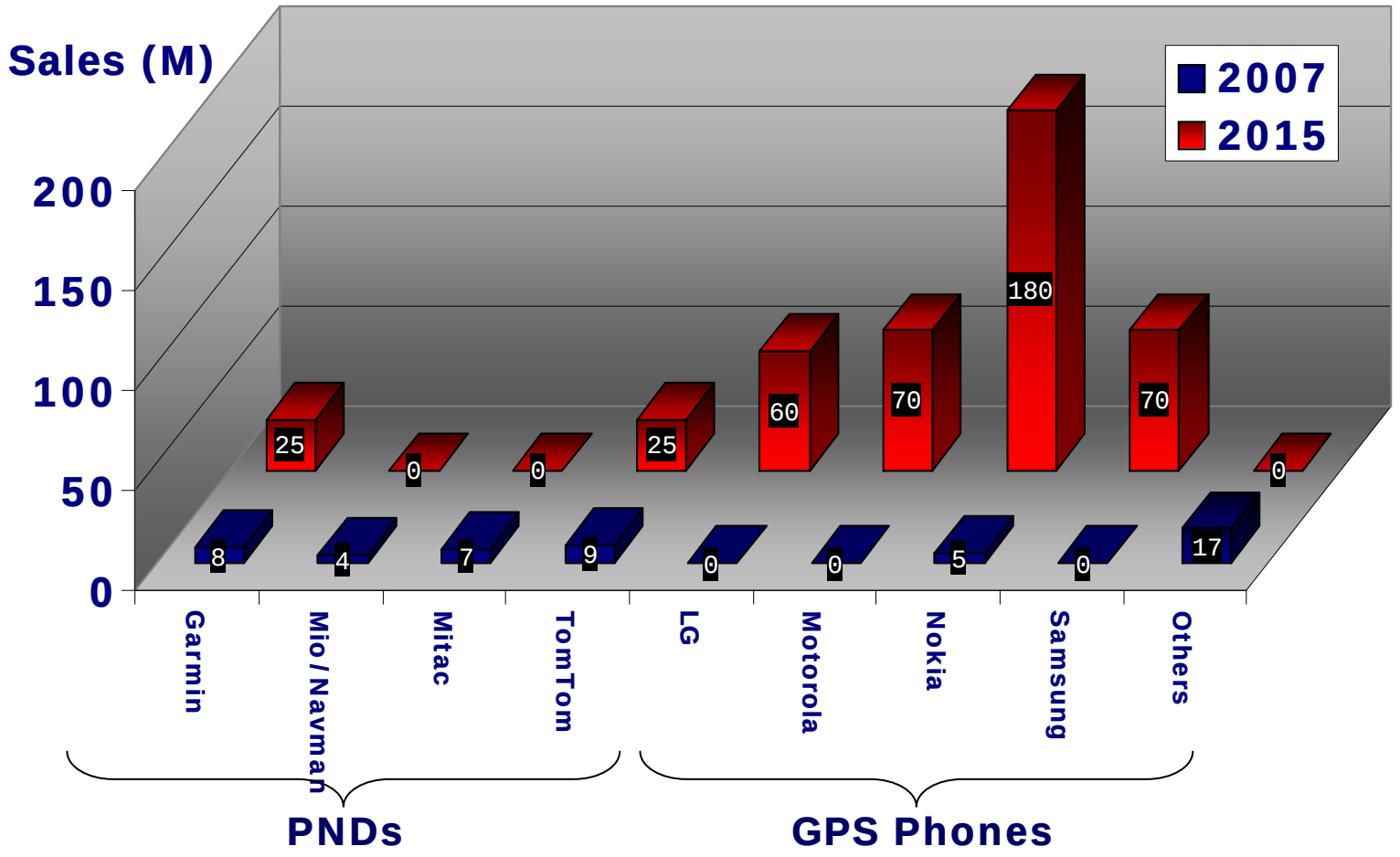
- Safety
- Congestion
- Productivity
- Environment

System Performance

BUT
No sustainable Funding source

Navigation Device Sales Estimates: 2007 vs. 2015

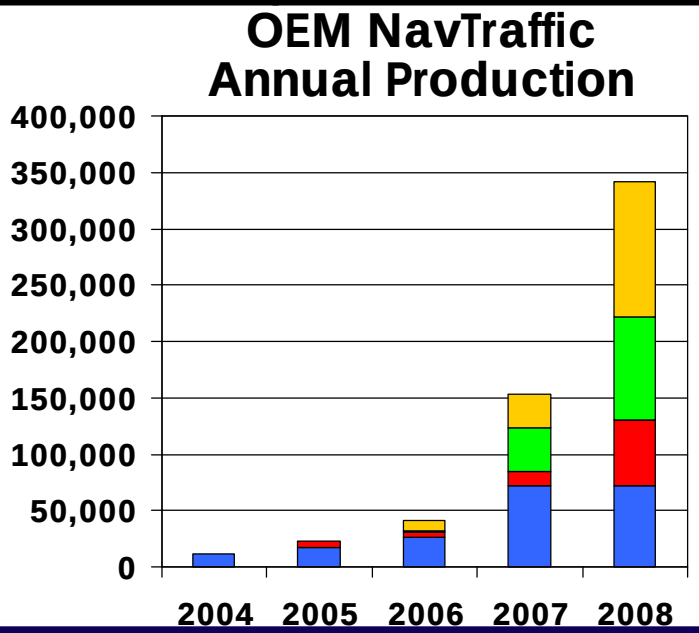
Source: Telematics Research Group, Inc. (TRG)



Automotive Adoption of Real-Time Traffic

Number of OEM Models with available factory-installed XM NavTraffic

OEM	Traffic Intro	2004	2005	2006	2007	2008	2009
Honda/Acura	MY 2005	1	1	4	4	-	-
GM/Cadillac	MY 2005	1	1	1	1	-	-
Toyota/Lexus	MY 2007	0	0	2	5	-	-
Nissan/Infiniti	MY 2007	0	0	2	8	-	-
Ferrari	MY 2008	0	0	0	1	-	-
Total		**2**	**2**	**9**	**19**	**40+**	**50+**

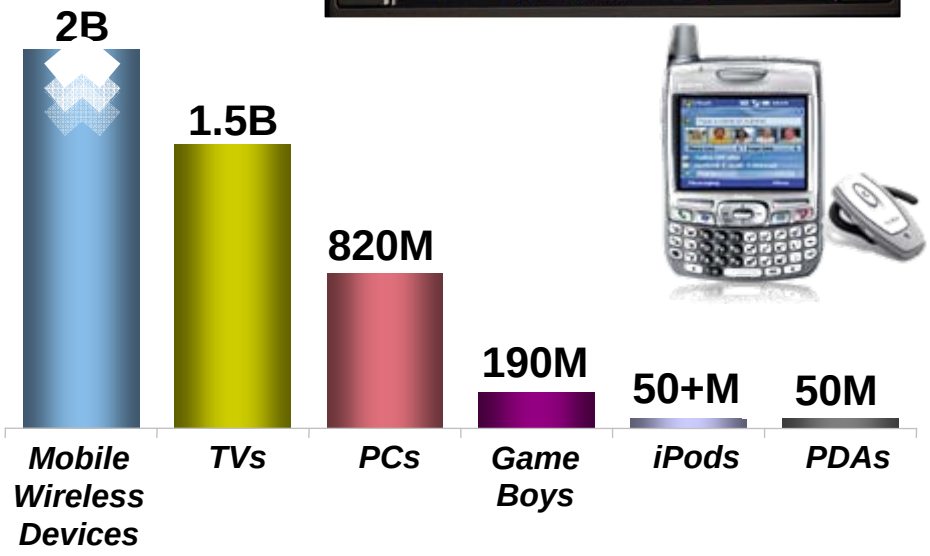


Source: Vehicle Traffic Information Coalition

Information Technology Explosion

- Expectations for information
- Ubiquitous Connectivity
- Hand-held devices
- Person-to-person Networking

A Wireless World



Slow ITS Deployment

Observations: Public Sector

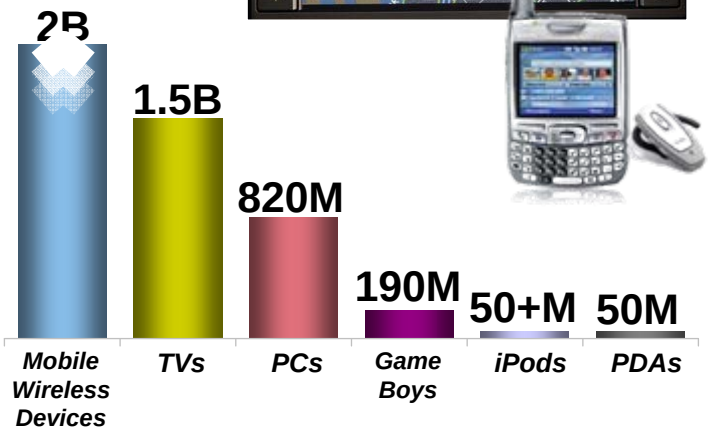
- General but slow acceptance of technology in transportation
  - ITS use has grown: TIM, signals, freeway mgt, transit mgt, toll collection, CVISN
  - ITS investment is slow; constrained resources
  - Data limitations (extent and quality) limit value
  - Slow to innovate
  - Cautious contracting
  - Low risk

Wireless Technology Revolution

Observations: Technology Private Sector

- Fast technology evolution
  - Growing use of navigation systems (on 69% of all models)
  - Growing desire to deliver real-time traffic information
  - Data quality and extent is limited
  - Many technologies are vying to be the data solution
  - OEMs are looking to technology for vehicular safety
  - Adept at innovation
  - Risk taking is rewarded
  - Quick to market

The Paradigm Shift for ITS



Leverage the market

Wireless World

Safety & System Performance

The Paradigm Shift for ITS

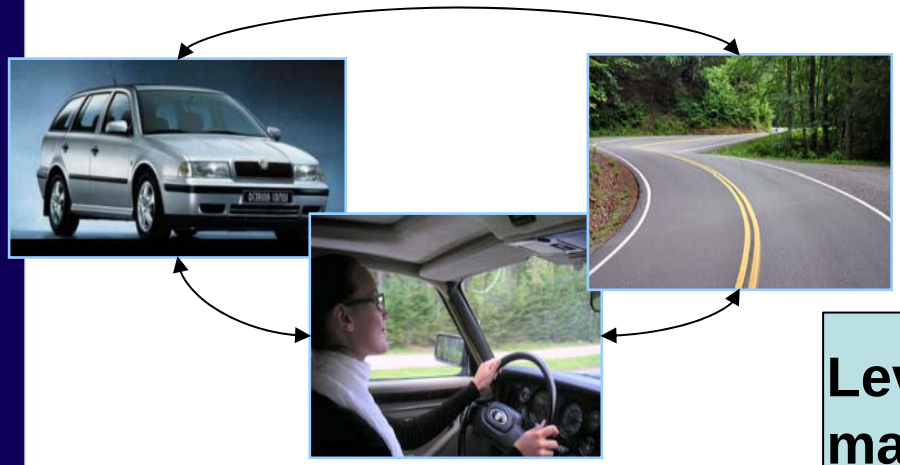
How do we use the unique attributes of public sector agencies to create incentives to achieve the desired outcome?

- NCAP (Stars on Cars)
- Right of Way
- Funding
- Standards
- Regulation
- Other?

The Paradigm Shift for ITS: **Leverage the Market**

Connectivity: Open Platform

- **Safety technologies in all vehicles**
- **Multi-modal solutions**



Leverage the market

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