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How Future Trends in Automotive Technology Will Affect Highways

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Two Trends in Auto Technology Will Significantly Affect Highways

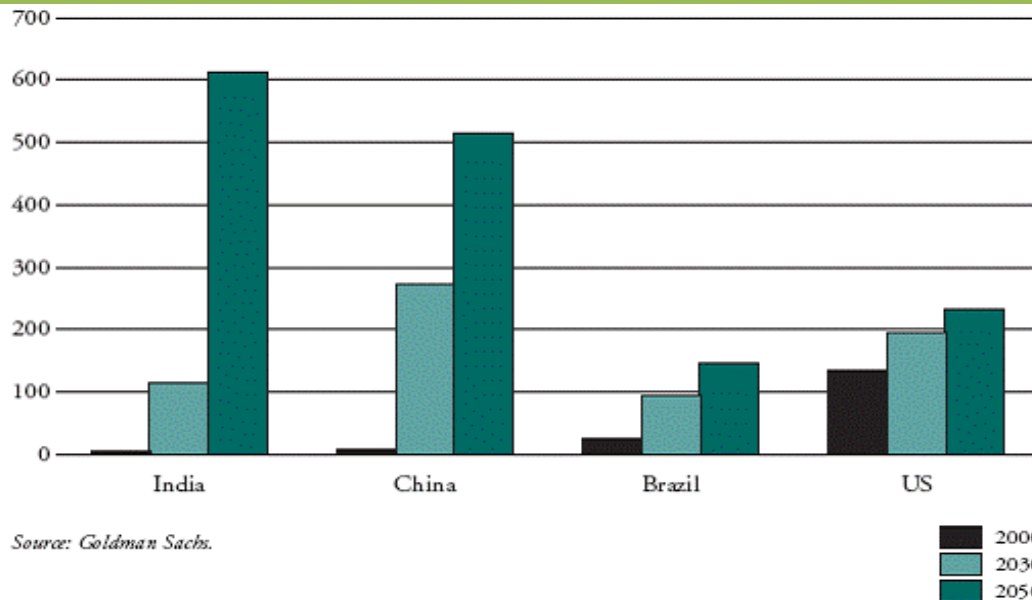
- More fuel-efficient vehicles
- Smarter cars



Fuel Prices Will Increase Because of a Rapid Increase in Demand

- Worldwide the number of cars on the road will double from 1 billion to 2 billion in twenty years
- Trend fastest in China, India, and Brazil

Total Cars Owned (IN, CN, BZ, US) (millions)



Trend 1: Fleet Fuel Efficiency Increase

- Drivers will seek fuel efficient vehicles so they can afford higher fuel prices
- Governments will require higher fuel efficiency to hold down prices and to reduce greenhouse gas emissions.
- U.S. fuel efficiency targets for cars, light trucks and Sport Utility Vehicles:
 - 35.5 mpg by 2016
 - 54.5 mpg by 2025



Same Strategies Needed for Climate Change and to Slow Increase in Fuel Prices

- Double fuel efficiency of new passenger cars and trucks by 2030, and of entire fleet by 2050
- Four technologies can help



Conventional – Chevy Cruze

- The 2011 Chevy Cruze
“Best Highway Mileage of
Any Gas Engine in
America”
- **28 MPG city/42 MPG
highway**
- Lighter Weight, More
Efficient Engine, Reduced
Aerodynamic Drag, Less
Tire Rolling Resistance.
- MSRP \$16,525
- DIESEL Chevy Cruze
model planned for 2013 –
could get 51 MPG highway



Hybrid – Toyota Prius

- Introduced to markets worldwide in 2001
- Third generation: 2009 – present
- **51 MPG city, 48 MPG highway**
- Powered by gasoline and batteries
- MSRP \$23,520



Plug-In Electric Vehicle - Nissan Leaf

- Plug-in Hybrid, 100% electric
- Can travel 100 miles/charge on its 24 kWh lithium-ion battery
- Zero Greenhouse Gas Emissions
- MSRP \$32,780



Hydrogen Fuel Cell, Compressed Natural Gas and Biofuel Vehicles

Honda FCX Clarit

- 74 MPG, Sedan, Concept only

Chevrolet Equinox Fuel Cell

- 43 MPG, SUV, Concept only

BMW Hydrogen 7

- Sedan, Concept only



To Meet Climate GHG Reduction Goals Will There be a Big Shift of Highway Trips to Transit?

- No
- AASHTO's goal is to quadruple transit ridership by 2050
- If we are successful, transit's share of "annual surface Passenger miles traveled," will increase from 1% to 2%. The share carried by car, truck and motorcycle will drop from 95% to 93%
- (2008 Total Surface Passenger Miles Traveled- 4.9 trillion: Cars&Trucks 4.7 trillion, Transit 54 billion)



To Meet Climate GHG Reduction Goals Will There be a Major Shift of Freight From Truck to Rail?

- No
- Some long-haul freight will shift from truck to rail. Rail intermodal will grow at 4% annually.
- Freight in the future will tend to be lighter in weight & higher in value
- By 2050, the market share of freight by value carried by trucks will grow from 93% to 94%



Summary: Growth in U.S. Highway Demand by 2050

- The number of trucks on the road by 2050 is expected to increase from 6 to 12 million
- Highway vehicle miles traveled is expected to increase from 3 trillion today to 4.5 trillion by 2050
- Americans will continue to rely on highway travel to meet personal travel needs and freight mobility needs
- Substantial additional highway capacity will be needed



Trend 2: Smarter Cars to Save Lives and Improve Customer Convenience

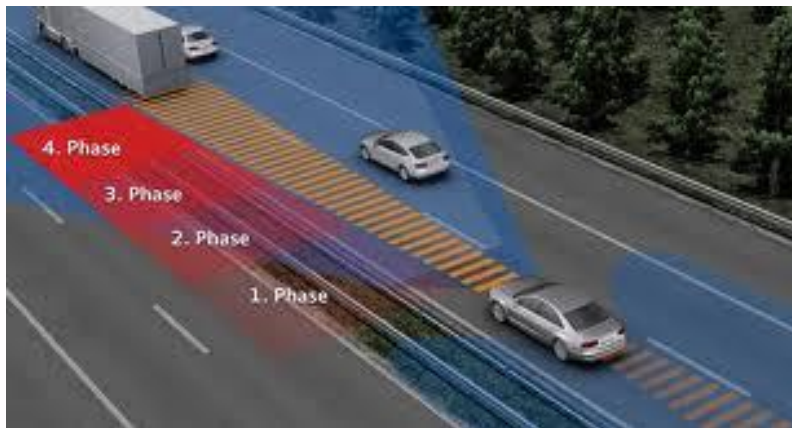
Today's ITS Technologies

- **Cell Phones: Real time traffic and parking information**
- **Traveler information**
 - 511 Traveler information USA
 - 2010 Inrix offers national travel time map to state DOT's and AASHTO Mobile app
- **GPS Navigation**
 - Navteq
 - Tom Tom
- **Open Road Tolling**



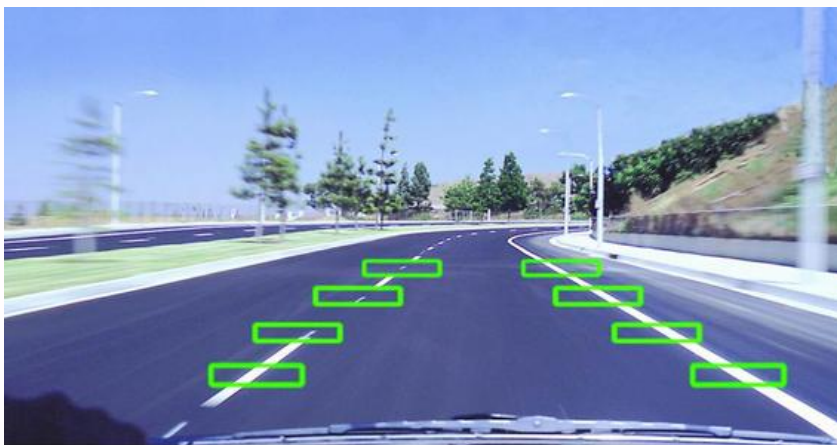
Adaptive Cruise Control

- Can maintain safe following distances and provide collision warnings or apply brakes



Lane Departure Systems

- Can avoid run off the road collisions and head-on collisions
- Major cause of fatalities rural roads



Camera's view of the road ahead as it tracks lane markings



Night Vision

- Pedestrian accidents
- Animals
- BMW - 1000 feet
- At 60 MPH gives 11 seconds of advanced warning



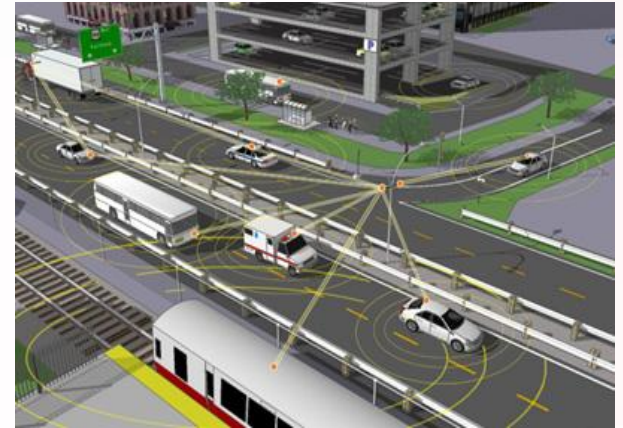
Back Up Camera

- Now readily available
- Cameras can be used for blind spot warnings & lane merging



Connected Vehicle Effort

- Global effort underway
 - 360 degrees of awareness
 - Dedicated Short Range Communication (DSRC)
 - High speed cellular
 - NHTSA Decision 2013



Smart Vehicle of the Future

- Connected Vehicles with:
 - Broadcast message “Here I am, here is where I am going and here is my speed” V2V, and V2I
 - Lane departure systems
 - Radar and adaptive cruise control
 - Night vision
 - Real time information systems



Future Infrastructure

- Intersections with communication systems
 - Operated by government or industry
- Application stores for transportation
 - Operated by government and private commerce
- Financial transactions
 - User fees – government
 - Payments – private commerce



Summary

- Smarter cars will have technology which reduces intersection collisions, runoff the road accidents, and gives drivers more time to react to danger.
- Real-time traveler information will help drivers avoid delays, pick best routes and find parking.
- Electronic tolling will move traffic more efficiently.

