CONNECTED AND AUTOMATED VEHICLES: 
*Policy, Planning, and Implementation*

Howard Wood, Vice President
WSP | Parsons Brinckerhoff
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“The future is already here — it's just not very evenly distributed”

- William Gibson, 1999
SAFETY TECHNOLOGY MILESTONES

1929: Four wheel brakes
1939: Buick offers factory-installed turn signals
1951: Air bag invented (but not adopted until the 1970s)
1970: Daimler-Benz introduces first anti-lock braking system
2000: Mercedes-Benz debuts lane departure warning system for trucks
2004: Volvo invents Blind Spot Information System
2007: Volvo introduces driver fatigue alarm system
COMFORT AND CONVENIENCE TECHNOLOGY

MILESTONES

➔ 1911: Electric starters
➔ 1925: Cigarette lighters
➔ 1930: Car radio
➔ 1946: Car phones (80 pounds!)
➔ 1956: Power steering
➔ 1958: Cruise control
➔ 1965: 8-track tape decks
➔ 1970: Cassette tape decks
➔ 1985: Compact disc players
➔ 1995: In-vehicle navigation systems
➔ 2004: Bluetooth penetration reaches 250 million vehicles
➔ 2015: Autopilot (Tesla, BMW)
AUTOMATED/DRIVERLESS

Source: Google
# NHTSA Automated Vehicle Levels

<table>
<thead>
<tr>
<th>Level 0</th>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
<th>Level 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Driver only</td>
<td>Assisted</td>
<td>Partial</td>
<td>Conditional</td>
<td>Full</td>
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<tr>
<td></td>
<td>Active high beam</td>
<td>Traffic jam assist</td>
<td>Collision avoidance</td>
<td>Valet self-parking</td>
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<tr>
<td></td>
<td>Collision imminent braking</td>
<td>Adaptive cruise &amp; lane keeping</td>
<td>Automated highway</td>
<td>Highway point-to-point</td>
</tr>
<tr>
<td></td>
<td>Cruise control</td>
<td>Self-parking (with driver)</td>
<td>Automated urban</td>
<td>Urban point-to-point</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Technology</th>
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<tbody>
<tr>
<td>Radar</td>
</tr>
<tr>
<td>Forward sensors</td>
</tr>
<tr>
<td>LIDAR &amp; 360° radar</td>
</tr>
<tr>
<td>High accuracy GPS</td>
</tr>
<tr>
<td>Multi-domain controller</td>
</tr>
<tr>
<td>Forward, HD &amp; IR cameras</td>
</tr>
<tr>
<td>V2X</td>
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<tr>
<td>Internal moment unit</td>
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</tbody>
</table>

**Today** → **2020** → **2025+**

[Image: Delphi logo]

[Image: WSP logo]
THE RACE TO AUTOMATED VEHICLES

Phase 1 (now to 2016): 'Passive' autonomous driving

Phase 2 (2015 to 2019): Limited driver substitution

Phase 3 (2018 to 2022): Complete autonomous capability

Phase 4 (two decades): 100% autonomous penetration, utopian society

Source: Company data, Morgan Stanley Research
AUTONOMOUS VEHICLE IMPLICATIONS

- Increased VMT?
- Legal Liability?
- Auto Industry Disruption?
- Increased Urban Sprawl?
- Acceptance of “Computer Driver”?
- Insurance Industry Disruption?
- Revenue Impacts?
TESLA FATAL CRASH – JUNE 29, 2016

“…neither the human nor the machine could distinguish the white-colored body of the truck from the sky.”
CONNECTED VEHICLES
CONNECTED VEHICLES

Connected Vehicles

- Cooperative communications systems
- Linking vehicles together, to the roadside, and to the “cloud”
- Interoperable systems that work across all equipment and manufacturers
KEY INFRASTRUCTURE SYSTEM ELEMENTS

5.9 GHz DSRC Roadside Units

Signal Controller/Cabinet Upgrades

Backhaul Communication and Data Management

Infrastructure-Based Messaging
IMPORTANT CONNECTED VEHICLE MILESTONES

- Fast, local area, short range communication
  - 1999: FCC allocated 75MHz of spectrum at 5.9GHz for Dedicated Short Range Communication (DSRC)
  - 2004: FCC adopted technical rules for DSRC
  - Wireless Access in Vehicular Environments (WAVE) = set of standards within the DSRC suite to support cooperative and safety critical applications.
  - Vehicle to vehicle applications include forward collision warning, and Intersection collision warning
  - **Safety Pilot (2012):** University of Michigan and a consortium of automobile manufacturers, including GM, Ford and Toyota among others.
SIGNIFICANT FEDERAL RESEARCH INITIATIVES
2012 CONNECTED VEHICLE SAFETY PILOT MODEL DEPLOYMENT

→ Michigan Transportation Research Institute/US DOT
→ Largest field test of connected vehicles ~ $50 million
  ▪ More than 3,000 vehicles
  ▪ DSRC
  ▪ 24 roadside equipment installations
  ▪ 12 next generation traffic signal controllers
  ▪ Backhall communications network for data exchange
→ Work has helped to inform Notice of Proposed Rulemaking for Vehicle-to-vehicle communications
WYOMING I-80 CORRIDOR (2015)

→ Weather focus
→ 3,470 wind related crashes between 2002 and 2012
→ RWIS data to vehicles
NEW YORK CITY CV PILOT PROGRAM (2015)

→ Pedestrian safety focus
→ V2V Technology, communication with traffic signal controllers
→ 10,000 city-owned and fleet vehicles
→ Applications
  ▪ Red light violation warning
  ▪ Pedestrian in crosswalk warning
  ▪ Mobile accessible pedestrian signal system
TAMPA (2015)

→ AM congestion focus
→ Applications
  ▪ Curve speed warning
  ▪ Intelligent traffic signal system
  ▪ Intersection movement assist
  ▪ Mobile accessible pedestrian signal
  ▪ Transit signal priority
MDOT CONNECTED/AUTOMATED VEHICLE SUPPORT

- Michigan Department of Transportation
- Regional deployment plan
- Focus on Vehicle to Infrastructure (V2I) applications
- Extensive industry involvement
US DOT SMART CITY CHALLENGE

#SMARTCOLUMBUS
OUR PANELISTS TODAY

1. Sean Kelley, PE, MBA, Senior Vice President, Mannik & Smith Group
   M-City and Honda TRC: development of autonomous & connected vehicle test facilities

2. Joanna Pinkerton, PE, Co-Director Honda/OSU Partnership at Ohio State University
   Regional autonomous and connected vehicle deployment: Honda TRC, US 33 corridor, and tri-state developments

3. Jason Sudy, AICP, Founding Principal, Side Street Planning
   How autonomous vehicles will reshape our cities, and why it should matter to you