

**Impacts of
Electric, Connected,
& Automated Vehicles**

David Huft, SDDOT Research Program Manager
South Dakota Transportation Commission
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Presentation Outline


- Vehicle Technologies
 - Electric Vehicles
 - Connected Vehicles
 - Automated Vehicles
- Adoption Outlook
- USDOT Roles
- State Roles
- Useful Resources

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Definitions

- Electric Vehicle—Powered substantially or entirely by electricity
- Connected Vehicle—Actively communicates with other vehicles, infrastructure, road users
- Automated Vehicle—Drives with little or no driver interaction
- Definitions are not mutually exclusive

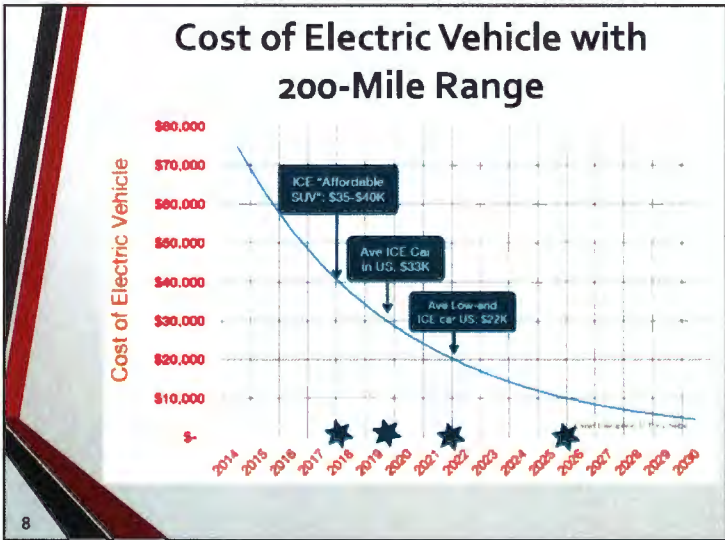
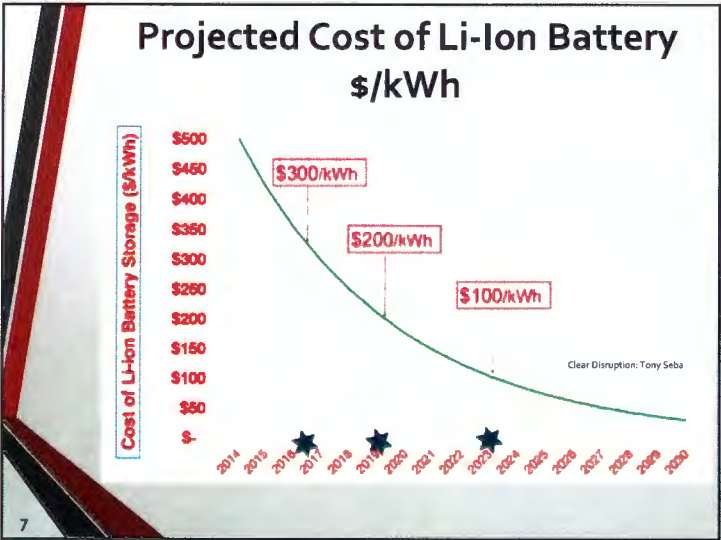
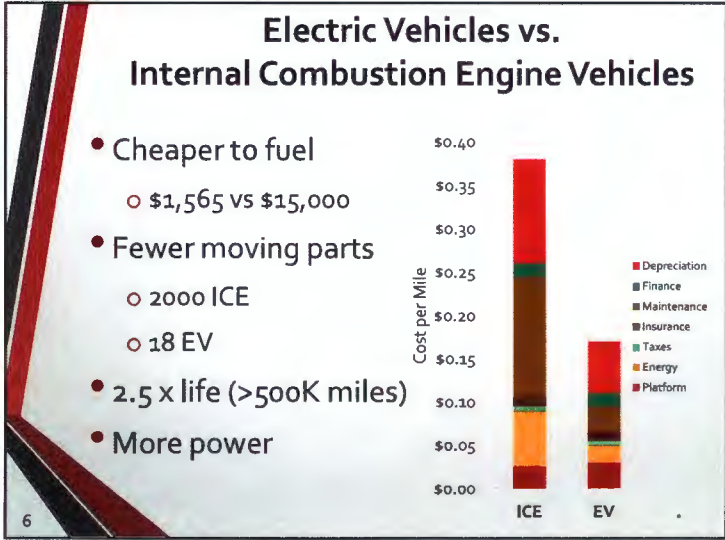
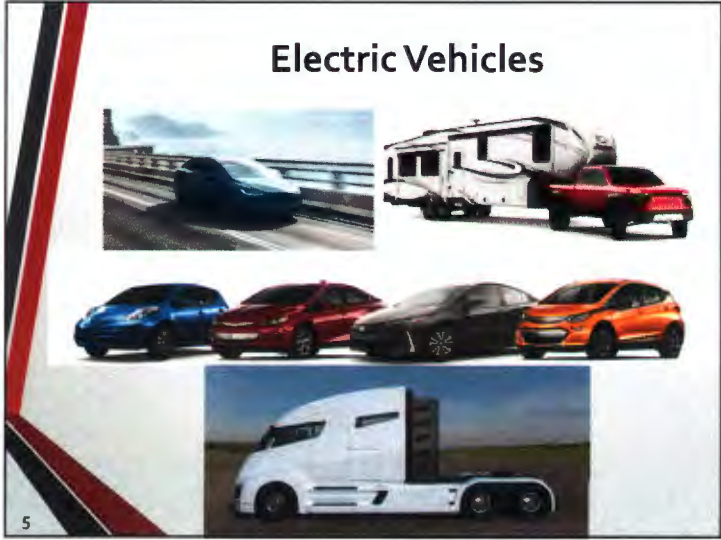
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Electric Vehicles

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EV Issues

- Charging Infrastructure
- Cold Weather
- Crash Response
- Road Use Charges

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Connected Vehicles

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Connected Vehicle Messaging

- Vehicle-to-Vehicle (V2V)
- Vehicle-to-Infrastructure (V2I)
- Vehicle-to-Anything (V2X)

Basic Safety Message (by vehicle)

- Location
- Heading
- Speed

Other Messages

- Traffic Signals
- Speed Limits
- Incidents
- Work Zones
- Snowplows
- Distress Calls
- Railroad Crossings
- School Buses
- etc.

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Traffic Signal Example





- V2V, V2I, V2X communication
- Signal Phase and Timing (SPaT)
- 20 signals in every state by 2020?

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Connected Vehicles Truck Platooning

- Both trucks manned, steered
- Lead truck operated manually
- Follow truck headway controlled by radar





- 5% fuel savings front
- 10% rear

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Connected Vehicles Truck Platooning

- Safe braking distance reduced




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HB1068 (2019)

The Transportation Commission shall promulgate rules...to authorize the testing and operation of groups of individual motor vehicles traveling in a unified manner at electronically coordinated speeds and distance intervals that are closer than otherwise allowed...The commission may include:

- Procedures for requesting and granting authority for testing and operation
- A fee (≤\$100) for administrative costs
- Reporting requirements
- Authorized routes, times, and periods of operation
- Authorized vehicle types and required markings
- Driver requirements
- Prohibited use (weather, highway conditions, special events, traffic incidents, emergencies or other contingencies)
- Other speed, size, and operational restrictions

Truck Platooning Potential in NW Passage



Truck Platooning Research and Implementation, NorthWest Passage, CPCS Transcom Inc.

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Connected Vehicle Issues

- Operational Changes
- Deployment Cost
- Technology Choices
 - Digital Short Range Communications
 - 5G Cellular
 - Satellite
- Data Backhaul
- Cybersecurity

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Automated Vehicles




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Automated (or Autonomous) Vehicles




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Levels of Automation




Level 0 No Automation	Level 1 Driver Assistance	Level 2 Partial Automation
	Assists driver in some situations	Can control speed and lane position in certain conditions
		
In complete control at all times	Must monitor, engage controls, and be ready to take control	Must monitor and be ready to take control

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Preparing for Automated Vehicles: Traffic Safety Issues for States, Governors Highway Safety Association

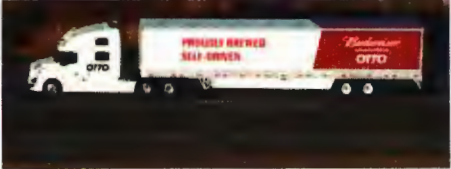
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Levels of Automation (Highly Automated)


Level 3 Limited Self-Driving	Level 4 Full Self-Driving Certain Conditions	Level 5 Full Self-Driving All Conditions
Can control in some conditions and inform driver when needed	Can be in full control and operate without a driver	Can operate without a human driver or occupants
		
Must be ready to take control quickly when informed	Not needed	Not needed

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Truck Automation

I-25 Colorado 

I-10 California - Texas 



Volvo Concept

5th Avenue NYC 1900 Where is the car?



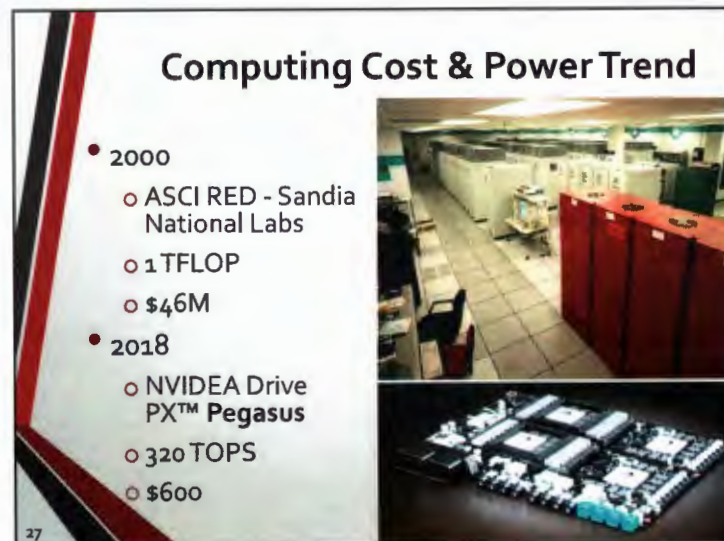
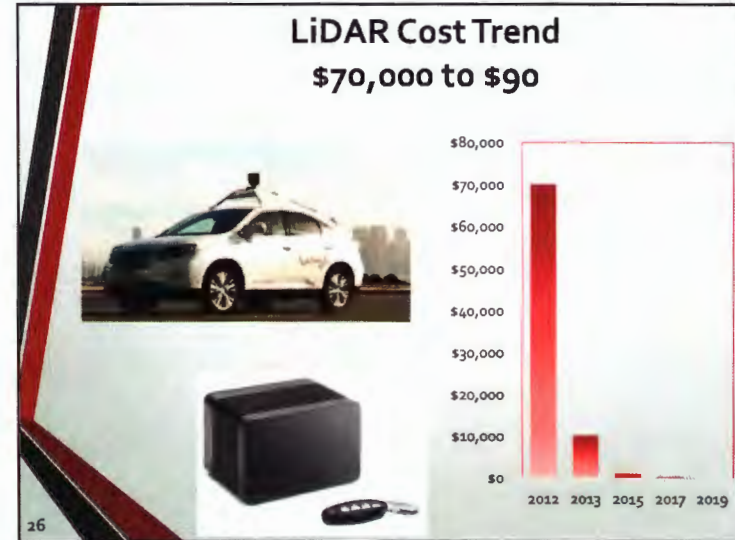
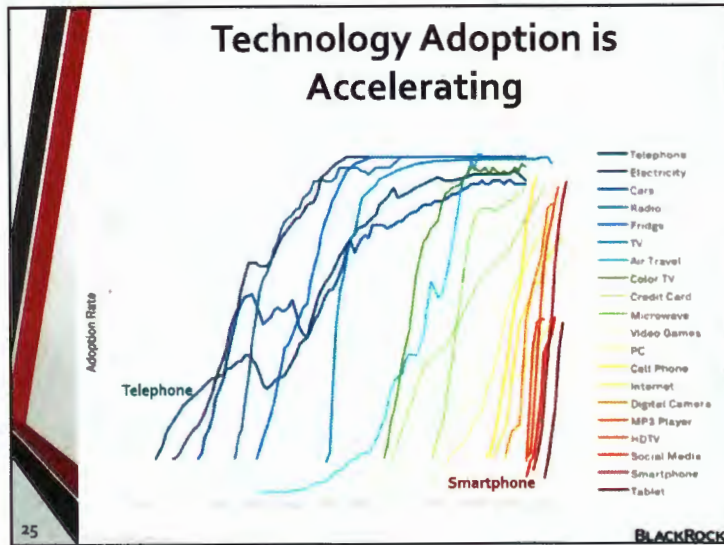
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5th Avenue NYC 1913 Where is the horse?



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Level 4 & 5 Vehicle Adoption


Stage	Decade	Vehicle Sales	Vehicle Fleet	Vehicle Travel
Large price premium	2020s	2 – 5%	1 – 2%	1 – 4%
Medium price premium	2030s	20 – 40%	10 – 20%	10 – 30%
Small price premium	2040s	40 – 60%	20 – 40%	30 – 50%
Standard on most new vehicles	2050s	80 – 100%	40 – 60%	50 – 80%

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U.S. Department of Transportation
Automated Vehicles 3.0
PREPARING FOR THE FUTURE OF TRANSPORTATION




USDOT Position on Automated Vehicles

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Benefits of Automated Vehicles

- Safety
- Congestion
- Energy & Pollution
- Mobility
- Land Use
- Economic Vitality




Preparing for the Future of Transportation: Automated Vehicles 3.0 USDOT

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USDOT AV Principles


- Safety first priority
- Technology neutral
- Modernize regulations (remove barriers)
- Consistent regulation and operation
- Prepare proactively
- Protect and enhance freedom



Secretary Elaine L. Cho
U.S. Department of Transportation

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USDOT Roles



- NHTSA—Federal Motor Vehicle Safety Standards
- FMCSA—Commercial Vehicle Operation, Drivers, Maintenance
- FTA—Transit Agency Safety Plans
- FHWA—Manual on Uniform Traffic Control Devices, Technology Standards

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State Responsibilities

- Human driver licensing
- Motor vehicle registration
- Traffic law enactment & enforcement
- Safety inspections
- Insurance & liability regulation
- Planning, building, managing, operating road & transit infrastructure

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State AV Laws & Legislation

AS OF JUNE 2018



- 13 states authorized a study
- 9 states require truck platooning
- 6 states authorize testing **with** a human operator
- 2 states authorize testing **without** a human operator
- 1 state and D.C. authorize full deployment **with** a human operator
- 11 states authorize full deployment **without** a human operator

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State Policy Considerations

- AV Stance
 - "Cutting edge" or "wait and see"?
 - Permissive or regulatory?
- Vehicle Registration
 - Identify AV Level?
- Driver Licensing
 - Operator training
 - Driver education
 - License testing
 - Examiner training
 - License needed for Level 4 – 5?

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State Policy Considerations

- Enforcement
 - Traffic laws
 - Communicating to AV, occupants
 - Crash response
 - Crash investigation, use of vehicle data
- Commercial Vehicles
 - Screening
 - Inspection
 - Hours of service
 - Safety responsibility
 - Platooning
- Insurance
 - Financial responsibility

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State Policy Considerations

- Highway Infrastructure
 - Design (lanes, signing, pavement markings...
 - Maintenance
 - Roadside electronics
 - Communication backhaul
 - Workforce skills
- Safety
 - Vehicle capability
 - Distraction
 - Driver Impairment
 - Peds & bikes
- Data Systems
 - Privacy
 - Cybersecurity

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State AV "Best Practices"

- Create AV Task Force
- Review, revise statutes & rules
- Define AV testing requirements
- Define AV deployment requirements
- Educate AV owners and road users
- Incorporate AV information into state data systems
- Review insurance requirements

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National Involvement

- Governor's Highway Safety Association
- American Association of Motor Vehicle Administrators
- Commercial Vehicle Safety Alliance
- AASHTO Committee on Transportation System Operations
- NCHRP Impacts of Automated Driving Systems on the Future of Transportation Safety
- NCHRP Impacts of CV/AV on State and Local Transportation Agencies
- NCHRP Initiating the Systems Engineering Process for Rural Connected Vehicle Corridors
- North/West Passage Pooled Fund Study
- Lee Axdahl (DPS)
- Jane Schrank (DPS)
- Capt. John Broers (DPS)
- Dave Huft (DOT)
- Joel Jundt (DOT)
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Useful Online Resources

- Preparing for the Future of Transportation Automated Vehicles 3.0 (USDOT)
- Preparing for Automated Vehicles: Traffic Safety Issues for States (GHSA)
- Jurisdictional Guidelines for the Safe Testing and Deployment of Highly Automated Vehicles (AAMVA)
- Strategies to Advance Automated and Connected Vehicles: Briefing Document (NCHRP)
- Autonomous Vehicle Pilots Across America (NLC)

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Questions?

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Contact

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Thank You!!

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