TRANSPORTATION IN COLORADO

TRANSPORTATION SHOULDN’T MAKE LIFE HARD
People Should Move Easily To Work, Home, School And Fun
GOODS SHOULD MOVE EASILY UP THE HILL, TO THE STORE & TO MARKET
CHOOSING HOW YOU MOVE SHOULD BE SEAMLESS
Innovation & Partnership Should Move Us Forward

TOGETHER WE GO
OUR AGENCY: OUR FOCUS

**MONITORS**
- 278 of 522 Avalanche Paths

**MAINTAINS, & REPAIRS**
- More THAN 23,000 Highway Lane Miles

**SPENDS**
- $69 MILLION PER YEAR ON SNOW REMOVAL

**KEEPS**
- 35 Mountain Passes OPEN YEAR-ROUND

**ADMINISTERS**
- ABOUT $11 MILLION IN FEDERAL GRANTS FOR TRANSIT OPERATORS

**OVERSEES**
- $41 MILLION IN FEDERAL AVIATION GRANTS FOR AIRPORTS

**MAINTAINS**
- 3,447 BRIDGES

**OVERSEES**
- 28 BILLION ANNUAL VEHICLE MILES TRAVELED

**MANAGES**
- OVER $5 MILLION IN FEDERAL GRANTS FOR SAFE DRIVING PROGRAMS
WHY ISN’T IT EASY? GROWTH AND $$

1991
- 3.3 million people
- 27.7B VMT*
- $125.70 per person

2015
- 5.4 million people
- 50.5B VMT*
- $68.54 per person

2040
- 7.8 million people
- 72.3B VMT*
- $41.16 per person

*Vehicle Miles Traveled

All numbers adjusted for inflation.
MAKING IT EASIER: ADVANCED MOBILITY

SAFETY

80% reduction in crashes per NHTSA estimates

MOBILITY

40 to 400% increase in capacity
MAKING IT EASIER: ADVANCED MOBILITY
ROADX | FIRST AUTONOMOUS COMMERCIAL TRUCK DELIVERY

https://www.youtube.com/watch?v=QboKzb3haK8
ROADX | FIRST AUTONOMOUS IMPACT PROTECTION VEHICLE

https://www.youtube.com/watch?v=N-GkbFXq3Ts
Autonomous Mobility Task Force

Colorado Department of Transportation
Colorado State Patrol
Department of Revenue (Dept. of Motor Vehicles)
SB 17-213 Overview

- SB 17-213 passed in 2017 and set foundation for autonomous vehicles

“Automated Driving System (ADS)” Definition
  - Hardware and software that are collectively capable, without any intervention or supervision by a human operator, of performing all aspects of the dynamic driving task for a vehicle on a part-time or full-time basis, described as levels 4 and 5 automation in SAE International Standard J3016, as it existed in September 2016.

Key point of SB 17-213:
  - If an ADS cannot comply with every state and federal law, **the ADS may still be tested in Colorado if approved by CSP and CDOT**
SB 17-213: CDOT to Report to TLRC

• Requires CDOT to report to the Transportation Legislation Review Committee by September 1 of each year, beginning September 1, 2018, concerning the testing of Automated Driving Systems in Colorado
CDOT, CSP, and DOR Collaboration

- CDOT, CSP, and DOR have been collaborating since 2016 about autonomous mobility.
- Continued coordination to form a group to work out process as directed under SB 17-213.
- Autonomous Mobility Task Force which began meeting on a monthly basis in September 2017.
Autonomous Mobility Task Force Charter

Responsibilities:

• Provide policy direction for autonomous mobility in state of Colorado

• Monitor National Highway Transportation Safety Administration (NHTSA) and federal rules and regulations as well as other state rules and regulations

• Per SB 17-213, develop the process and provide approval when the Automated Driving System (ADS) cannot comply with every state and federal law that applies to the function that the system is operating

• Serve as a resource and clearinghouse, collaborating on process and experiences with others states, stakeholders and industry
Membership

- Staff from each agency, representing legislative affairs, various operations under each agency, deputy director or deputy chief, and attorneys from the Office of Attorney General
- Other participants invited for specific issue expertise as needed
Responsibilities

• Establish a clear checklist of expectations, submittals and coordination with the entity
  • The checklist tracks current guidance from NHTSA
• Establish template with any required insurance provisions
• Establish a working agreement with the entity on expectations for testing and any assumptions of liability
• Establish expectations related to coordination with other entities and jurisdictions
• Issue final determination of approval of testing on Colorado roads
Decision-Making and Final Approval

- Decision-making by consensus
- Task Force coordinates with local jurisdictions (including city government and law enforcement) during possible deployments
- Final approval authority is with the CDOT Deputy Director and the CSP Deputy Chief
Approval Process - Generally

- A company indicates interest in testing their ADS in Colorado
- Task Force provides Task Force’s Checklist on what is expected to test ADS
- Entity applies to Task Force by submitting information requested in Checklist
- Task Force considers application, including inviting entity representatives to engage with the Task Force representatives
- CSP and CDOT coordinate with entity to observe safe operation of ADS
- CDOT verifies insurance requirements and DOT completes licensing
- Task Forces makes recommendation for approval for final signatures
Autonomous Driving Checklist
Provided by Entity

• Operational Domain (Operating parameters and limitations of the ADS, Object and Event Detection and Response, requested testing)
• Safety Assessment Certification
• Driver Certification (Certify the applicant’s driver testing and training program specific to the ADS)
• Vehicle Certification (Identify each vehicle used during testing/deployment to include VIN, vehicle type, and other unique identifiers such as the year, make, and model)
• Insurance Certification
**Example: EasyMile Testing on Dec 4, 2017**

<table>
<thead>
<tr>
<th><strong>Submission Date</strong></th>
<th>November 2, 2017</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Company(ies)/Person(s)</strong></td>
<td>EasyMile Inc.</td>
</tr>
<tr>
<td><strong>Business Address</strong></td>
<td>6144 Panasonic Way, Denver, CO 80249</td>
</tr>
<tr>
<td><strong>Name and Title of Primary Contact</strong></td>
<td>Lauren Isaac, Director of Business Initiatives</td>
</tr>
<tr>
<td><strong>Vehicle(s) Name</strong></td>
<td>EZ10</td>
</tr>
<tr>
<td><strong>Vehicle Description</strong></td>
<td>Autonomous shuttle which may be controlled by an operator.</td>
</tr>
<tr>
<td><strong>Requested Testing Duration</strong></td>
<td>December 4, 2017 from 4-6pm</td>
</tr>
</tbody>
</table>
Internet of Roads
Total Miles: +2,000

Stage 1: $17M
Stage 2: $30M
Stage 3: $250M*

Total Cost: $297M

* Assumes CDOT fiber build, no P3 leveraged funds
• 0.8 km segment to be constructed at US 285 - Red Mountain Pass
• Immediate alerts to first responders if a vehicle leaves the roadway
• Future capabilities include inductive charging
Roadside equipment efficiently connects to the utility grid and distributes power to the roadway.

Power source embedded into the roadway wirelessly transfers energy to vehicles while in motion.

Minimal power storage needed within the vehicle because the batteries receive power from the roadway on the go, allowing longer trips and less battery storage.
ROADX | ARRIVO MODEL

https://www.youtube.com/watch?v=C3gEO138RIQ
Smart Mobility Plan

Technology Tool Kit for Planning

Demand and Supply Modeling a Connected/Autonomous Future

Statewide Fiber Plan

Statewide Transportation Plan