

COLORADO
Department of
Transportation





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
MOUNTAIN
PASSES
35
OPEN YEAR-ROUND**

**ADMINISTERS
ABOUT \$1.5
BILLION
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**

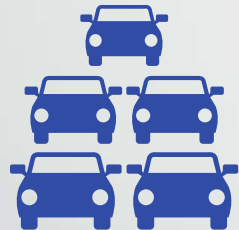


WHY ISN'T IT EASY? GROWTH AND \$\$

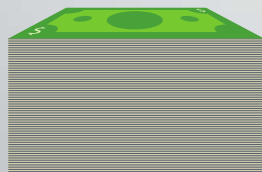
1991



3.3 million



27.7B VMT*

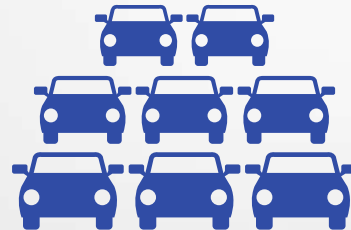


\$125.70
per person

2015



5.4 million



50.5B VMT*

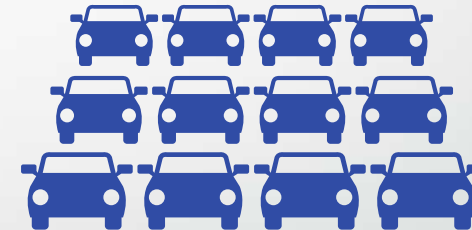


\$68.54
per person

2040



7.8 million



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

½¢ sales tax
to pay for
transit



MAKING IT EASIER: ADVANCED MOBILITY



ROADX
ACCELERATING TECHNOLOGY

COMMUTING



SUSTAINABILITY



TRANSPORT



SAFETY



CONNECTION



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

Submission Date	November 2, 2017
Company(ies)/Person(s)	EasyMile Inc.
Business Address	6144 Panasonic Way, Denver, CO 80249
Name and Title of Primary Contact	Lauren Isaac, Director of Business Initiatives
Vehicle(s) Name	EZ10
Vehicle Description	Autonomous shuttle which may be controlled by an operator.
Requested Testing Duration	December 4, 2017 from 4-6pm



COLORADO
Department of Transportation



COLORADO
State Patrol
Department of Public Safety



COLORADO
Department of Revenue

<https://www.youtube.com/watch?v=1niXPeB7p9s>

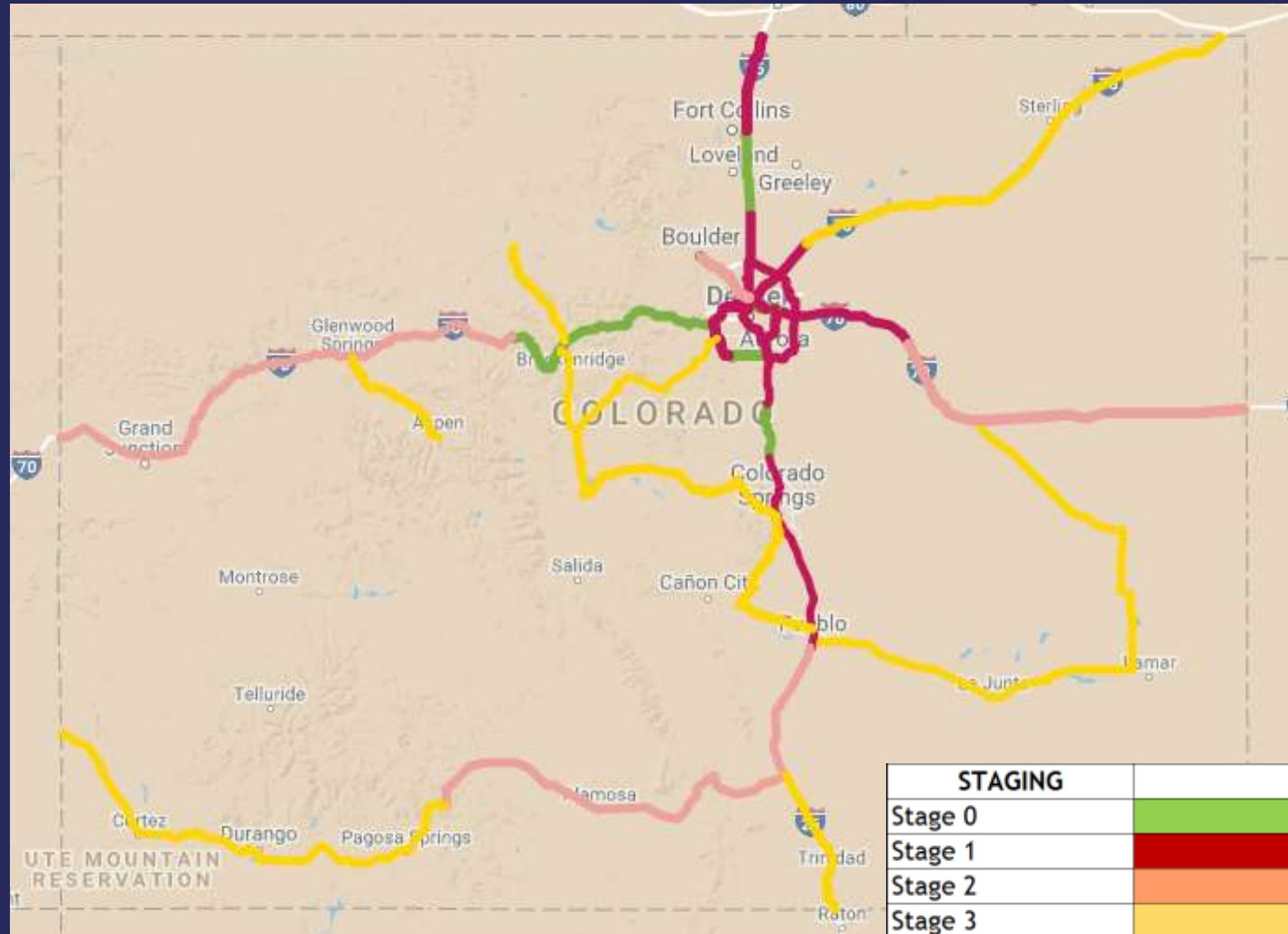
ROADX | PLANNING

Internet of
Roads
Total Miles:
+2,000

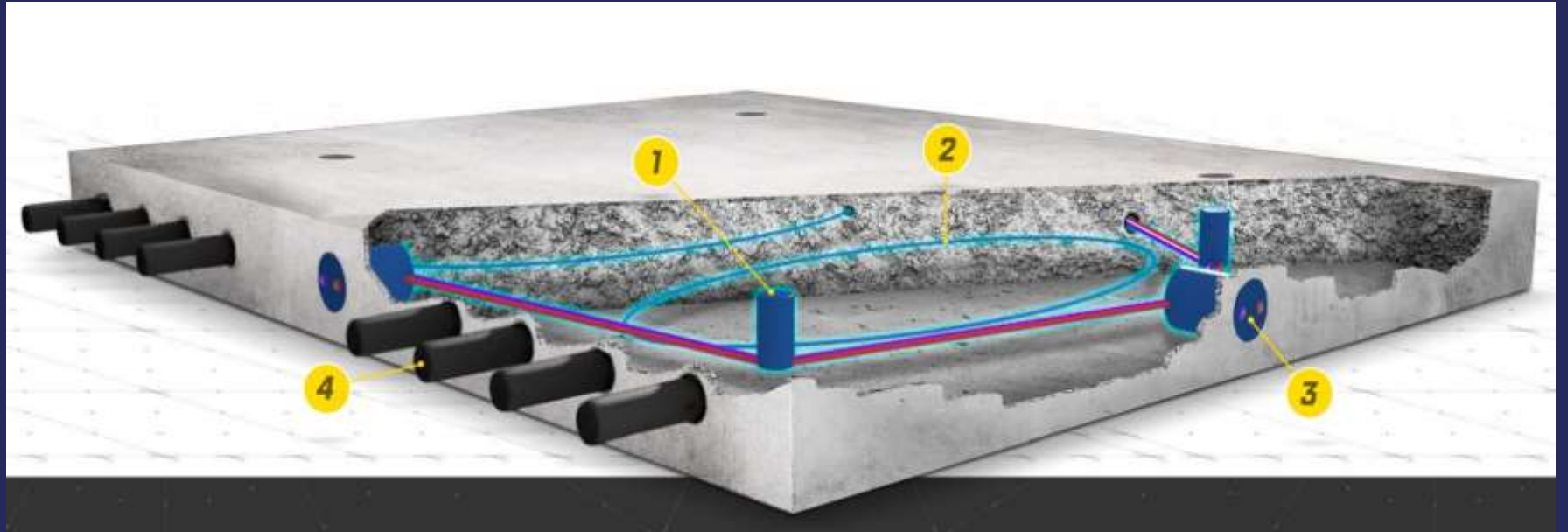
Stage 1: \$17M
Stage 2: \$30M
Stage 3: \$250M*

Total Cost:
\$297M

* Assumes CDOT fiber
build, no P3 leveraged
funds

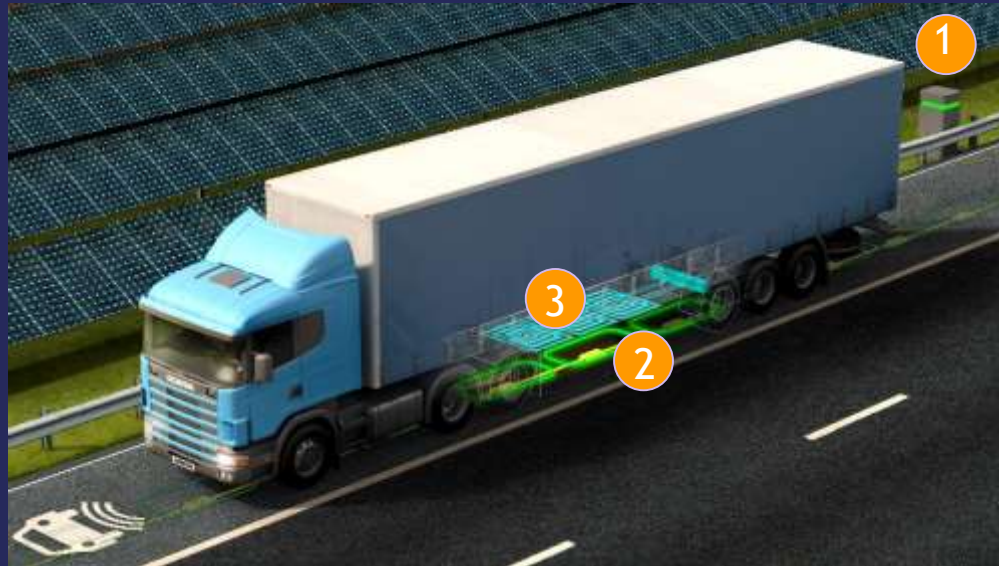


ROADX | SMART PAVEMENT



- 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

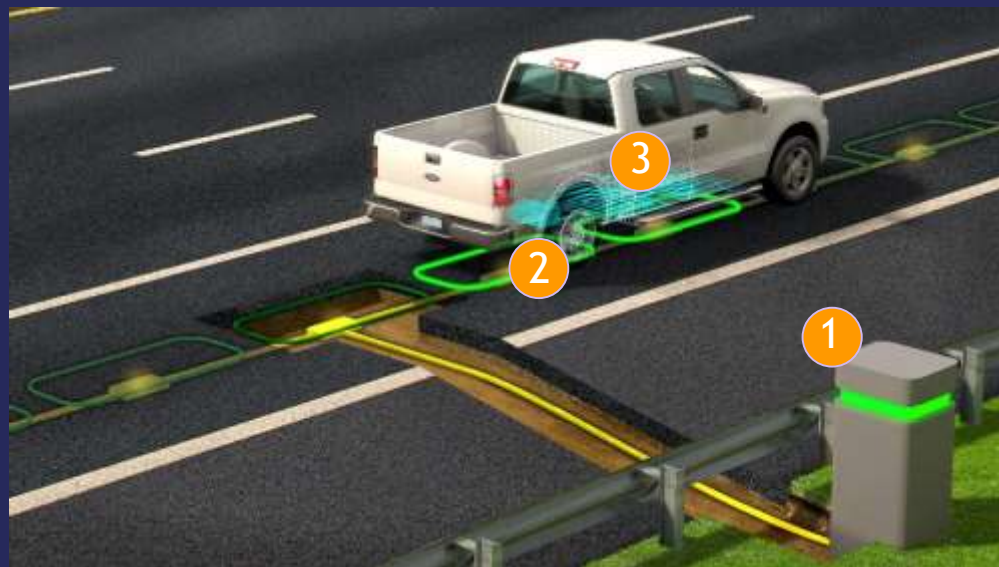
ROADX | SMART POWERED LANES



1 Roadside equipment efficiently connects to the utility grid and distributes power to the roadway.

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

3 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 | HYPERLOOP ONE TEST



hyperloop | one

ROADX | ARRIVO MODEL



ARRIVO City Zipper

<https://www.youtube.com/watch?v=C3gEO138RIO>

ROADX | PLANNING



Smart Mobility Plan

Technology Tool Kit
for Planning

Demand and Supply
Modeling a
Connected/
Autonomous Future

Statewide Fiber
Plan

Statewide
Transportation Plan

