Autonomous TMA Truck (ATMA)
CDOT Evaluation and Performance Verification

Developed By

SCOM 2018 – Charlotte, NC
Project Vision

Supporting ROADx

Supporting ROADx

Technology Committee

Policy

Funding/Risk Strategy Framework

People

Workforce of the Future

Planning

Project Level Deep Dives Five Year Strategy
Project Vision

• Remove driver from TMA truck
• Decrease risk of operations
• Increase efficiency of operations
• Pursue cutting-edge technology to improve highway management
Project Goals

1. Installation of system on CDOT piece of equipment
2. Identification of limitations and anomalies in track setting
3. Log open highway miles in striping operation
4. Interchangeability of lead vehicle – sweeper or mower
How it Works

• ATMA will autonomously follow a leader vehicle
  • Leader transmits position, speed, heading
  • Follower matches leader’s movements using steering, throttle, brake actuators
Installation of System

- Follower systems pre-installed
  - Can be retrofitted to existing trucks
- Retrofit leader vehicle with
  - Antennas
  - Navigation module
  - Communications module
- CDOT striping truck completed in ½ day
How it Works

• Front mounted radar on follower provides obstacle detection

• Only reacts to obstacles in the path between leader and follower

• Emergency stops upon obstacle detection
Performance Evaluation

• CDOT developed a set of scenarios to verify the capabilities

• First week of performance evaluation conducted on closed track – June 26-30, 2017
Performance Evaluation

• Team from Kratos and Royal Truck and Equipment were on site.

• Tests were downloaded with equipment and GPS data
Gap Control

- Straight line following for 4000’ with desired speed 7 mph (striping operation speed) and desired gap 60m
- Recorded gap is measured antenna to antenna: 60m bumper to bumper is 68.89m antenna to antenna
Driverless Run
Results

- Lane accuracy within +/- 4 in
- Gap distance much more consistent than human driver
- Accurate following in cornering and slalom setups
- Performed turns as tight as 45 ft radius
- Identified software and hardware changes to be made
  - CDOT’s production model will address issues found in evaluation of prototype
  - Further suggested modifications will be implemented in future
Future Modifications

• Full user interface with
  • Adjustable gap distance
  • Diagnostics monitoring
  • Video livestream with switchable camera views
  • Test mode to check radar system during pre-trip
• “Pause Mode” allowing ATMA to be stopped while leader continues
• “Tight turn mode” allowing vehicle to make tight U-turns
  • Making this a separate mode used only in turning around allows for the straight line driving to be much smoother
Operational – Fort Collins, CO Event

- Fort Collins – August 18th, 2017
- https://www.youtube.com/watch?v=8GPcbtVaqnY
- https://www.youtube.com/watch?v=N-GkbFXq3Ts
Operational – Fort Collins, CO Event

• First time in painting operation on public road

• Face book Live Event
  • Internet — 421 online stories
  • TV/Radio — 41 stories
  • In total, that's 945 hits for an estimated reach of 297,084,950 and publicity value of $2,378,632.62
FHWA Peer Exchange – Greeley, CO

- FHWA Peer Exchange
  September 19 & 20\textsuperscript{th} 2017
  - 15 States
  - Live Operation on State Highway 34
- Discussions
  - Policy
  - Operations
  - Project Development
  - Future Steps – Pool Fund
SENATE BILL 17-213

BY SENATOR(S) Hill and Moreno, Baumgardner, Cooke, Crowder, Gardner, Holbert, Lambert, Lundberg, Marble, Smallwood, Tate, Todd, Williams A., Zenzinger, Grantham;
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CONCERNING AUTHORIZATION FOR AUTOMATED DRIVING SYSTEMS TO CONTROL MOTOR VEHICLES THROUGHOUT COLORADO.
Policy and Operational Usage

• Task Force including CDOT & CSP & Revenue to Review
  • Risk, Public Relations, Operations & Policy

• Autonomous CSP & CDOT Process
  1. Operational Domain
  2. Certifications
     1. Safety Assessment
     2. Driver
     3. Vehicle
     4. Insurance
     5. Special Event
  3. Other

AUTONOMOUS CERTIFICATION PROCESS

The state of Colorado believes in a shared vision of a safer highway system by advancing the deployment of autonomous vehicle technologies. The autonomous certification process outlines the expected safety, driver, vehicle and insurance certifications prior to deployment and following Senate Bill 213 should the vehicle not currently be able to meet all driving rules and regulations.
Autonomous Truck Mounted Attenuator Operations Plan

Contents
CDOT Operating Plan ...................................................... 2
Scope ........................................................................ 2
Non-Autonomous Operation ........................................... 2
Autonomous Operation .................................................... 2
Safety Observer .............................................................. 2
Authorized Use ............................................................ 2
Operating Procedure ....................................................... 3
Emergency Stop Conditions ............................................. 3
Crash / Incident Involving ATMA ................................... 3
Authority and Adoption .................................................. 4
Completed Goals and Future Steps

• Goal #3 (Complete) - Log Highway Miles
  • June 2018 – 7 Miles
  • July 2018 – 50 Miles

• Goal #4 – Interchangeability
  • Additional Leader Vehicle (Paint Truck) Planned
Future Steps

• Next Purchases
  • Additional Trucks with enhancements
  • Additional Leader Kit to optimize use
  • Fall 2018

• Develop - Pool Fund
  • Autonomous Maintenance Technology (AMT)
  • Solicitation # 1460
  • To push for improvements needed
Timeline Summary and Future Steps

- February 2017 - Initiated Project
- SCOM 2017 – Set Goals and Developed Plan
- April 2018 – CSP Final Inspection
- May 2018 – State of Colorado Approval
- June 2018 – Go Live
Pool Fund

- Pool Fund – TPF 5(380)
  - Autonomous Maintenance Technology (AMT)
- Activities
  - Mission and Vision Document
  - Project Management
  - Bi-Weekly Calls

- Member States - Alabama, California, Colorado, Illinois, Kansas, Minnesota, Ohio, Texas and Washington
- $650k Committed @ $25k/yr
Questions?
Thank you

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