

PROJECT SUMMARY

MnDOT Autonomous Bus Pilot

Project Location:

MnROAD Facility

Start – Finish Date:

September 2017 – May 2018

Project Status:

Complete

Project Partners:

WSB
AECOM
First Transit
EasyMile, Inc.

MnDOT Project Cost:

\$230,000

Projects with Similar Characteristics:

Med City Mover
Drive MN
Bear Tracks AV Shuttle
goMARTI

Project Description:

The MnDOT Autonomous Bus Pilot project consisted of deploying a Level 4 shuttle provided by EasyMile on the MnROAD facility. The bus was used for several rounds of public demonstrations as well as testing at the MnROAD facility during winter conditions. The bus could hold up to 12 people and had a range of typical driving speeds from 2 to 11 miles per hour. Demonstrations were conducted in various winter conditions with several variables which can be found in the table below.

Weather Conditions	Variables
Clear Weather / Bare Pavement	Automated Shuttle Bus Only
Uncontrolled Winter Weather	Obstacles (Work Zone Barrel)
Controlled Winter Weather	Other Cars, Pedestrians, Bicycles

Project Objective:

- Enhance partnerships between government and industry to advance connected and automated vehicle technology in Minnesota.
- Enhance public knowledge about automated vehicles (AVs), provide opportunities for public demonstration, and obtain public feedback.
- Identify infrastructure gaps and solutions for safe operation of automated vehicles.
- Identify challenges and solutions with operating automated vehicles in winter conditions.



Figure 1: Automated Bus at MnROAD Facility

Project Accomplishments:

- Gained an improved understanding of winter weather operations of AV technology.
- Obtained public feedback through multiple AV demonstrations.
- Continued relationships with AV vendors.



Key Findings:

Winter Weather

The AV bus operated well under dry pavement conditions, but snow caused the following issues:

- Falling snow, blowing snow, loose snow, and exhaust fumes on very cold days were detected as obstructions, causing the vehicle to slow or stop.
- Snowbanks caused issues with pre-programmed routes, requiring removal for testing and demonstrations to continue.
- Vehicle wheel slippage due to snow/ice build-up on the tracks occasionally caused the vehicle to not respond to its location.
- Accumulation of dirt or salt spray could impact vehicle performance, necessitating clean sensors.
- Lower temperatures increased battery charging times.

Lighting

Daytime and nighttime lighted conditions did not impact shuttle performance.

Public Opinion

The pilot had a total of 3,100 participants ride in the shuttle, and overall public opinion was favorable towards the AV pilot. Public concerns focused on vehicle safety and security. Survey responses from an event indicated that most participants were excited about the AV technology they observed and would like to see more AV technology deployed.

Lessons Learned:

- Winter weather can significantly impact AV shuttle operations and battery charging capabilities.
- Documented bus operator procedures are useful for consistent public demonstrations.
- Digital observation records for numerical entries such as temperature, wind, and time of day are recommended for future analysis due to timestamps being recorded with the data.

Potential Next Steps for MnDOT:

- Work with transit partners to find opportunities to use AV technology to enhance transit services and begin by directly engaging with local transit providers.
- Work with the disabled community to research how AV technology can improve mobility; consider a focus group with local disability groups.
- Perform a literature search and outreach to AV shuttle manufacturers on updates to winter weather performance.