

# Low Speed Automated Shuttle Testing: From Closed Track to On-Road Trial

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## BACKGROUND

### Why was undertaking this research important?

- Automated vehicles (AVs) are becoming increasingly prevalent across the transportation system with many Canadian jurisdictions currently testing or planning to test Low Speed Automated Shuttles (LSAS).
- This trial provided a Canadian perspective on how to conduct an LSAS trial safely and highlighted how to evaluate the functionalities of an LSAS on a private test track.
- A real world on-road trial raised the operational challenges and successes of LSAS, using the EasyMile EZ10, pictured below.



Fig 1: EasyMile EZ10 Shuttle

## AIMS

### What were the project objectives?

- The main objective was to gain a better understanding of the shuttle's automated driving capabilities (including safe interactions with pedestrians, cyclists, geese and low speed motor traffic).
- Results from this trial are to be used to inform Transport Canada approaches to safe testing AVs, such as the development of guidance documents and the department's participation in standards development.

## METHOD

### Closed Track Testing

- Testing was conducted at the Area X.O private test facility in Ottawa.
- The shuttle was tested under seventeen scenarios that were designed to represent realistic on-road situations.
- Most scenarios were adapted from ISO 22737 (Intelligent Transport Systems).
- Testing was conducted with 4Active Systems Dummy Propulsion system (pictured below); this is used by Euro NCAP for Automatic Emergency Braking (AEB) testing for passenger vehicles.



Fig 2: 4Active System Setup

### On-Road Pilot

- The on-road trial took place on a 1500m loop at Tunney's Pasture, a federal work campus in Ottawa.
- The site typically has 10,000 employees on site but due to COVID-19 only 5% of employees were present.
- The trial's main focus was evaluating how the shuttle performed while driving the route and transporting riders. The route accessed key buildings in the area as well as the local bus and train stop.

## RESULTS

### Closed Track Testing

- The shuttle successfully completed every test without any impacts with the test dummies.
- The shuttle came the closest to impacting a dummy in the occluded test where a dummy would cross in front of the shuttle suddenly after hiding behind a vehicle.
- When the LSAS had more time to perceive the test dummy with its on-board LiDAR it led to more controlled, low deceleration braking to avoid an impact.

### On-Road Pilot

- Conducted over a 10 day period and transported 670 riders.
- The trial was open to a limited general public, but in order to mitigate risks of large crowds and COVID-19 exposure, the trial was not publicly advertised.
- When the weather was clear the shuttle operated as expected with few slow downs or stops.
- However, when there was significant rain or enough wind to begin blowing leaves around the shuttle would slow down or occasionally totally stop.

## DISCUSSION

### Lessons Learned and Next Steps

- Testing confirmed that the protocols used (ISO22737 and EuroNCAP) are relevant and applicable in a real world environment.
- Testing in more weather conditions is important.
- It should be noted that the LSAS can reduce its cruising speed when approaching road side obstacles such as parked cars. This advanced feature poses a challenge when conducting current conventional vehicle test methodologies.