

## Cooperative Truck Platooning Trials on Canadian Public Roads under a Commercial Operation in Winter Driving Conditions

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### ABSTRACT

Cooperative Truck Platooning System (CTPS) is a promising connected and automated vehicle (CAV) technology that allows close-proximity following in platoon formation through longitudinal vehicle dynamic control of connected trucks and using the automated steering control for vehicle lateral dynamic control. The CTPS operation under winter driving conditions is challenging and the success of using CTPS in commercial trucks for freight transport under real-world driving conditions needs to be assessed. This study presents the experimental results of the first CTPS demonstration on Canadian public roads, using two class-8 trucks. The on-road trials were conducted on Queen Elizabeth II Highway between Calgary and Edmonton during the winter season. A total of 20 CTPS trials were performed with the participation of eight different drivers. The platooning trucks were tested at ambient temperatures ranging from 8 to -24 °C, and the weight for each truck ranged from 15,586 to 38,791 kg.

The experimental results confirmed the possibility of using CTPS with 3 to 5 sec platooning distances under various road surface conditions including bare dry, bare wet, and partly snow covered. The total mileage of the CTPS trials was about 22,850 km, and the covered distance during platooning engagement was about 3,150 km. The platooning engagement ratio varied from 40.7% to 96.0%, when the road surface condition was bare wet. The results show that the heavy acceleration by the follower truck could be avoided for certain driving conditions during platooning, but there were many occasions that the follower truck had higher accelerations compared to that of the follower truck during platooning. In addition, fuel consumption and tailpipe nitrogen oxides (NOx) emissions of the two trucks were measured. These allow the assessment of the CTPS technology for reducing fuel consumption and reducing NOx emissions in commercial heavy-duty trucks under real-world winter driving conditions.

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