Analysis of Platooning Trucks to Better Understand Dynamic Air Flow

Oversight

- 2017 Truck Platooning Track Test in Lawrence Berkeley National Laboratory (LBNL) and Transport Canada and National Research Council Canada
- FY 18-19 and FY 20 track testing provided some key insights
- 2017 Truck Platooning Track Test in Lawrence Berkeley National Laboratory (LBNL) and Transport Canada

Overview

- 2017 Truck Platooning Track Test included numerous additional onboard instrumentation not previously available
- 2017 Truck Platooning Track Test Campaign with Lawrence Berkeley National Laboratory (LBNL) and Transport Canada

Introduction

- Background platooning from other traffic (could change the baseline to include the rest of the traffic)

Approach

- Detailed analysis for addition of onboard sensors and J1939 CANBUS data stream from 2017 track testing
- Analysis of the track test data with Lawrence-Livermore National Laboratory wind tunnel wind average drag measurement
- Detailed data analysis for additional onboard sensors

Accomplishments: Wind Analysis

Wind Speed Analysis

- Actual measured wind speeds from the Cobra Probe for the middle and trailing trucks are significantly lower than the on-track test truck when gaps are between 6 m and 9 m
- Varying wind speeds from the Cobra Probe for the middle and trailing trucks show a significant difference, especially for the closer following distances
- Wind speeds are determined using the J1939 CANBUS native data stream capture

Wind Angle Analysis

- Wind angle affects the effectiveness of the air flow on the leaders and followers
- Wind angle impacts the effectiveness of the air flow on the middle and trailing trucks
- Correcting and calibrating some of these sensors to track-side sensors, NREL developed Nalu-Wind, which simulated turbulent flows within a wind farm

Wind Speed and Direction Analysis

- Gap distances do not define speed and direction for all trucks
- Lead truck gap distances have a significant effect on the wind angle and speed for the middle truck
- Wind angle and speed are determined using the J1939 CANBUS native data stream capture

Air Temperature Analysis

- Middle and trailing trucks have slightly elevated air temperature at the Cobra Probe
- Temperature and velocity data show a significant change in pattern for the closer following distances
- This data set could also prove very valuable for validating a next-generation computational fluid dynamics model for simulating turbulent flows within a wind farm

Future Work

- This data set could also prove very valuable for validating a next-generation computational fluid dynamics model for simulating turbulent flows within a wind farm

Summary

- Track testing has shown significant fuel savings potential for truck platooning, but much work remains to better understand dynamic air flow in truck platoons
- This is encouraging in that the planned further analysis may yield even more detailed findings from the standard platooning scenarios.

Authors

- Mike Lemmi and Chen Zhang
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