A First Investigation of Truck Drivers’ Preferences and Behaviors Using a Prototype Cooperative Adaptive Cruise Control System


Introduction

- Cooperative Adaptive Cruise Control (CACC) enables shorter vehicle following distances than traditional ACC due to enhanced string stability.
- CACC can increase traffic density, relieve traffic congestion, and increase energy efficiency.
- The impacts of CACC on drivers’ experience and performance are still largely unexplored.

On Road Experiments

Participants

- 9 professional fleet truck drivers from the US and Canada

Trucks:

Volvo Class 8 trucks with PATH developed CACC (Cooperative Adaptive Cruise Control) capabilities

DSRC Communication

Driver-CACC Interaction

Driver-Vehicle Interface (DVI)

Time Gap Selection Built-in

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Test Route

From Richmond:
- I580 ➔ Highway 24 ➔ I-680 ➔ I-580 ➔ I-5

Task Procedure for Drivers

- Training before Walnut Creek
- After Walnut Creek, drivers free to choose preferred time gap
- Switched driver position at Westley
- Drove back via the same route.

Test Results

Driver Demographic

- Mean Age: 48
- Number and Gender: 9 Male
- Familiarity with ACC: 1.4 / 7
- Familiarity with collision warning systems: 2.1 / 7
- Familiarity with truck platoon: 0.7 / 7

T-Gap Preference: Levels 3 & 4

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Truck Position Preference in a CACC String

- 5 drivers didn’t notice the difference between 2nd & 3rd
- 2 noticed the difference in braking system performance
- Only 1 driver reported that truck position affected his road vision and he preferred the 3rd truck

Cut-in and Road Grade Effect

- Comfort with CACC response to cut-in: 5.2 / 7
- Trust in CACC response to cut-in: 5.0 / 7
- Reliability of CACC on upgrades: 4.6 / 7
- Reliability of CACC on downgrades: 3.1 / 7

Concluding Remarks

- A first human factors study on cooperative adaptive cruise control for truck platooning
- Participants preferred time-gaps 1.2 s and 1.5 s the most
- The impact of truck position is very limited on driver vision and he preferred the 3rd truck
- Reliable CACC response to cut-in
- Less reliable CACC response to road negative grade

Acknowledgments

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