

Participant ID \_\_\_\_\_

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For questions about this study, please contact Andrew Krum at 540-231-0353 or akrum@vti.vt.edu

For questions about the approval of this research, please contact the Virginia Tech IRB at 540-231-3732 or irb@vt.edu.

## FINAL CAS TECHNOLOGY QUESTIONNAIRE

### Questionnaire

Collision Mitigation Technologies are safety systems that alert drivers to unfolding conflicts and automatically take action if the driver does not respond to unfolding conflicts. Please answer the following questions **based your opinions and any past experiences with CAS technology**. To answer, **check only one box** for each statement that best expresses your answer (unless indicated otherwise). The questionnaire will take about 25 minutes to complete.

**General Use of the Collision Mitigation Technology**

1. Based on your opinions and experiences, please indicate how much you agree with the following statements

	Strongly Agree	Agree	Slightly Agree	Neutral	Slightly Disagree	Disagree	Strongly Disagree
a) Collision mitigation technology makes drivers safer	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b) Collision mitigation technology makes driving easier	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c) I'm less distracted and make fewer errors while using collision mitigation technology	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d) I rely on collision mitigation technology to alert me to potential accidents	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e) False alerts negatively affect my performance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
f) I find the technology easy to understand	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
g) Collision mitigation technology is useful in bad weather or traffic	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
h) Collision mitigation technology works properly in bad weather or traffic	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
i) Collision mitigation technology should be installed as standard equipment in commercial vehicles	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
j) The technology gives alerts too early	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
k) I would recommend collision mitigation technology to drivers at other companies	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

## Following Distance Alert

The collision mitigation technology has a following distance alert that beeps when the distance between the truck and the vehicle ahead is closing. The alert beeps faster as the distance closes. The following questions ask about this alert.

2. Based on your opinions and experiences, the **following distance** alert...

	Strongly Agree	Agree	Slightly Agree	Neutra l	Slightly Disagree	Disagree	Strongly Disagree
a) ...is easy to hear in all situations	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b) ...is good at getting a drivers' attention back to driving	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c) ...helps drivers avoid a crash	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d) ...distracts or annoys drivers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e) ...works properly in all weather conditions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
f) ...works properly in all traffic conditions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
g) ...encourages drivers to pass slow lead vehicles	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
h) ...works well on curved roads	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
i) ...causes drivers to pay less attention to the road	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

3. What percentage of following distance alerts do you think were false alerts (that is, alerts in response to objects that are not in the path of the vehicle)?

\_\_\_\_\_%

4. What percentage of following distance alerts do you think were safety-critical (that is, alert drivers to a potential collision)?

\_\_\_\_\_%

5. What are the top three things you liked about the following distance alert?

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_

6. What are the top three things you disliked about the following distance alert?

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_

## Stationary Object Alert

The collision mitigation technology has a stationary object alert that beeps when a stationary object on the road is detected. The following questions ask about this alert.

7. Based on your opinions and experiences, the **stationary object alert**...

	Strongly Agree	Agree	Slightly Agree	Neutral	Slightly Disagree	Disagree	Strongly Disagree
a) ...is easy to hear in all situations	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b) ...is good at getting drivers' attention back to driving	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c) ...helps drivers avoid a crash	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d) ...distracts or annoys drivers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e) ...works properly in all weather and traffic conditions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
f) ...works properly in all traffic and traffic conditions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
g) ...works well on curved roads	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
h) ...causes drivers to pay less attention to the road	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

8. What percentage of stationary object alerts do you think were false alerts (that is, alerts that activate in response to objects that are not valid threats, such as overpasses and guard rails)?

\_\_\_\_\_%

9. What percentage of stationary object alerts do you think were safety-critical (that is, alert drivers to a potential collision)?

\_\_\_\_\_%

10. What are the top three things you liked about the stationary object alert?

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_

11. What are the top three things you disliked about the stationary object alert?

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_

## Impact Alert

The collision mitigation technology has an impact alert that presents lights on the dash, rapidly beeps to alert you to an imminent collision. The following questions ask about this alert.

12. Based on your opinions and experiences, the **impact alert** ...

	Strongly Agree	Agree	Slightly Agree	Neutral	Slightly Disagree	Disagree	Strongly Disagree
a) ...is easy to hear in all situations	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b) ...is good at getting drivers' attention back to driving	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c) ...helps drivers avoid a crash	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d) ...distracts or annoys drivers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e) ...works in all weather conditions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
f) ...works in all traffic conditions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
g) ...works well on curved roads	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
h) ...causes drivers to pay less attention to the road	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

13. What percentage of impact alerts do you think were false alerts (that is, alerts that activate in response to objects that are not valid threats, such as vehicles in a different lane)?

\_\_\_\_\_%

14. What percentage of impact alerts do you think were safety-critical (that is, alert drivers to a potential collision)?

\_\_\_\_\_%

15. What are the top three things you liked about the impact alert?

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_

16. What are the top three things you disliked about the impact alert?

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_

## Automatic Emergency Braking (AEB)

The collision mitigation technology can apply the truck's brakes to help you avoid an imminent collision. The following questions ask about this activation.

2) Based on your opinions and experiences, the **automatic emergency braking** applied at the last moment...

	Strongly Agree	Agree	Slightly Agree	Neutral	Slightly Disagree	Disagree	Strongly Disagree
a) ...is beneficial	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b) ...is the most appropriate action for the vehicle to take	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c) ...works well in all weather conditions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d) ...works well in all traffic conditions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e) <b>...is good at getting drivers' attention back to driving</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
f) <b>...helps drivers avoid a crash</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
g) <b>...distracts or annoys drivers</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
h) <b>...works well on curved roads</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
i) <b>...causes drivers to pay less attention to the road</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

17. What percentage of AEB activations do you think were false activations (that is, activations in response to objects that are not valid threats, such as vehicles in a different lane)?  
\_\_\_\_\_%

18. What percentage of the AEB activations do you think were safety-critical (that is, activations in response to a potential collision)?  
\_\_\_\_\_%

19. What are the top three things you liked about the automatic braking?

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_

20. What are the top three things you disliked about the automatic braking?

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_

## Adaptive Cruise Control (ACC)

When engaged, the adaptive cruise control maintains a constant headway to a slowing lead vehicle by reducing throttle, applying the engine retarder, and applying the truck's brakes when needed. The following questions ask about this feature.

21. Based on your opinions and experiences, please rate the statements about **adaptive cruise control** below.

	Strongly Agree	Agree	Slightly Agree	Neutra l	Slightly Disagree	Disagree	Strongly Disagree
a) It is clear when ACC has detected a lead vehicle	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b) ACC's de-throttling is helpful in keeping a safe distance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c) ACC's engaging the engine retarder is helpful in keeping a safe distance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d) ACC's braking helps keep a safe distance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e) ACC automatically slowing the truck when lead traffic slows is annoying to drivers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
f) ACC works properly in all weather conditions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
g) The ACC works properly in all traffic conditions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
h) ACC applies a sufficient amount of braking	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
i) ACC works on curved roads	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
j) Drivers know when they need to start braking because ACC isn't sufficient	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
k) Drivers pay less attention to the road when using ACC	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

22. What percentage of the times ACC slowed the vehicle automatically do you think were false alerts (that is, slowing in response to objects that are not valid threats, such as vehicles in a different lane)?  
\_\_\_\_\_%

23. What percentage of the times ACC slowed the vehicle do you think were safety-critical (that is, slowing in response to a potential collision)?  
\_\_\_\_\_%

24. What are the top three things you liked about the ACC feature?

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_

25. What are the top three things you disliked about the ACC feature?

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_



**Lane Departure Alert**

The collision mitigation technology has a lane departure alert that beeps when the truck crosses a lane marking when the turn signal is not activated. The following questions ask about this alert.

26. Based on your opinions and experiences, the **lane departure alert**...

	Strongly Agree	Agree	Slightly Agree	Neutral	Slightly Disagree	Disagree	Strongly Disagree
a) ...is easy to hear in all situations	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b) ...is good at getting drivers' attention back to driving	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c) ...helps drivers avoid a crash	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d) ...distracts or annoys drivers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e) ...works well, assuming lane markings are in good condition	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
f) ...works properly in all weather conditions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
g) ...works properly in all traffic conditions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
h) ...works properly in all lighting conditions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
i) ...works well on curved roads	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
j) ...causes drivers to pay less attention to the road	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

27. What percentage of lane departure alerts do you think were false alerts (for example, alerts that activate in response to faded lane markings in construction zones)?  
 \_\_\_\_\_%

28. What percentage of lane departure alerts do you think were safety-critical (that is, helps correct an unintentional lane drift)?  
 \_\_\_\_\_%

29. What are the top three things you liked about the lane departure warning?

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_

30. What are the top three things you disliked about the lane departure warning?

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_

31. Please rank which technologies work best for you, from 1 (Best) to 6 (Worst).

- Following Distance Alert
- Stationary Vehicle Alert
- Impact Alert
- Adaptive Cruise Control
- Lane Departure Warning
- Automatic Emergency Braking

32. Which kinds of alerts do you prefer? (Please check all that apply)

- Audio alerts
- Visual alerts
- Vibration or haptic alerts

33. Have your opinions on collision mitigation technology changed over the last 3 months? If so, how?

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34. Have you had any issues with maintenance or calibration of the technology? For example, dirt, bugs, rain, ice, sunlight glare, bumps, or vibration?

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35. Do you have any suggestions on how to improve collision mitigation technology?

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36. Have you seen any unintended consequences from using collision mitigation technology?

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**Thank you for participating in this questionnaire.**