



Washington Traffic Safety Commission

Advanced Driver Assistance System Survey | C+C Research Report

June 2021

Research Objectives

To: Gain a deeper understanding of the use, attitudes, experience and perceptions of ADAS technologies for drivers who have advanced driver-assistance systems (ADAS) in their vehicles.

In a way that:

- Provides an understanding of perceptions, misconceptions, benefits, usefulness, and safety associated with ADAS
- Assesses understanding of ADAS capabilities, intended use and how frequently drivers engage these technologies,
- Provides an understanding of drivers' overall experience using them
- Assesses distracted driving behaviors among those who have and use these technologies

So that: WTSC can develop an effective campaign that raises awareness regarding the safety concerns with improper use of these technologies and educates drivers on their proper use.



Research Approach

Methodology:

C+C conducted a 10-minute online survey of n=1014 Washington drivers who were:

- Over the age of 18, and
- Whose primary vehicle is a 2017 model or newer in order to ensure that most participants had at least one of the ADAS technologies of interest

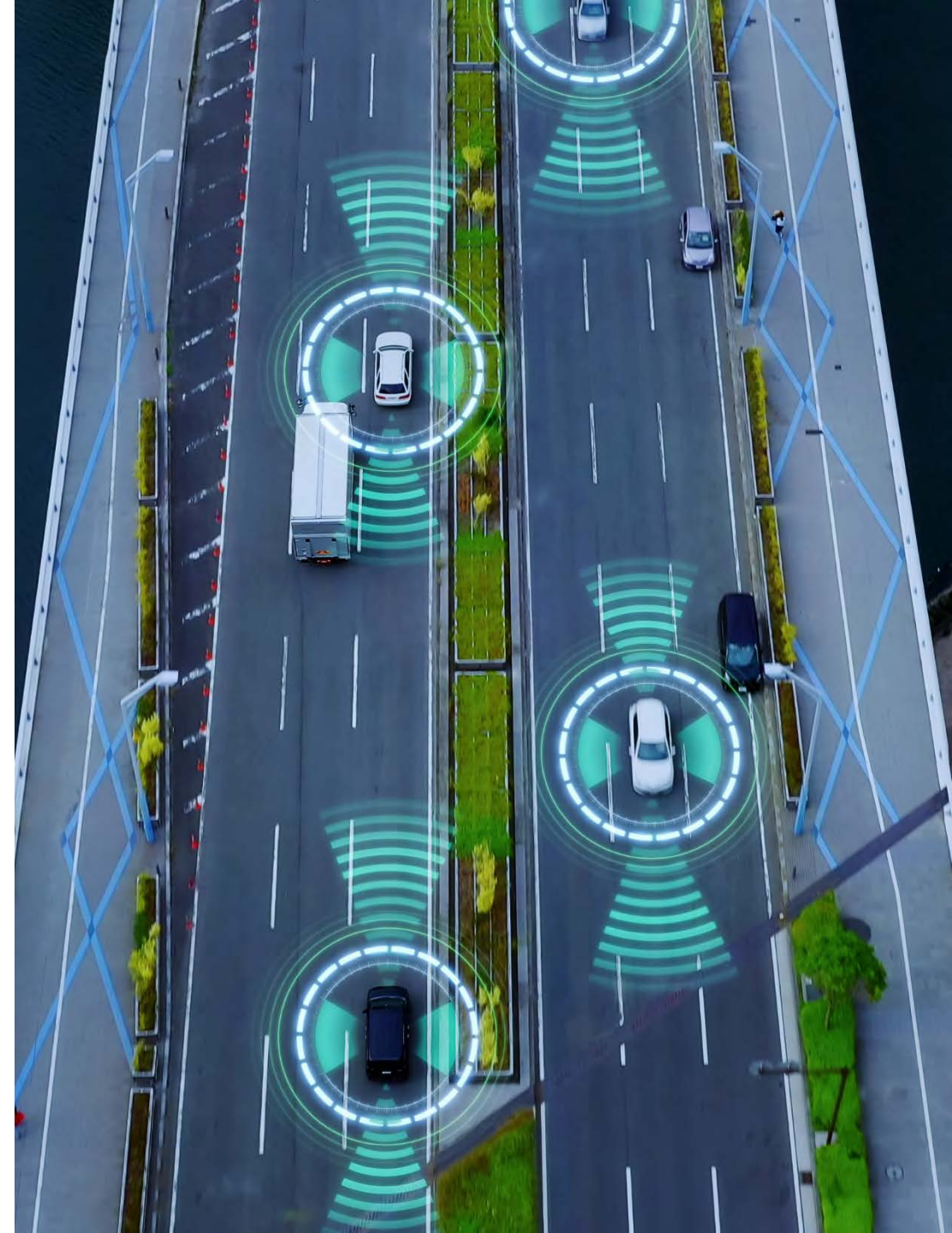
The survey was developed by C+C in conjunction with the WTSC.

ADAS technologies covered in the survey:

- Lane departure warning (LDW),
- Lane keeping assist (LKA),
- Forward collision warning (FCW),
- Automatic emergency braking (AEB),
- and Adaptive cruise control (ACC)

Notes on this survey

- We note that the statements regarding ADAS technology capabilities presented to participants were based on generalized definitions of features and their functionality, and so particular make and model features might vary slightly (Q10-14).
- Of the 1,014 participants, 176 said they did not have or were not sure they had any of the 5 features and exited the survey. A further 72 said they had not used or experience any of the ADAS features they did have (and exited), leaving the number who completed the majority of the survey at 766.
- Significance is reported at a 95% confidence level. This means that in 95 out of 100 repetitions of the survey the results will not vary more than $\pm 3\%$.



Executive Summary



Key Points: Perceptions and experience

- 1) Self-reported understanding of all 5 features is consistently high across ADAS technologies.
- 2) Most report feeling comfortable with ADAS technologies; disabling or wanting to disable them is rare. However, a moderate proportion say they need more information.
- 3) Being surprised or startled by a systems' activation, and the problems this can cause, and the perception that the feature does not work correctly are common sources of concern cited across ADAS technologies.
- 4) Many participants have experienced avoiding a crash owing to these features, though a small but potentially concerning number report having almost had a crash due to them.

(Data reported on the following slides)



Key Points: Beliefs and behaviors

- 1) Participants believe all 5 technologies decrease crash risk overall, though statistically significant differences in safety perceptions of risk exist.
- 2) Overall most participants were able to identify correct statements about ADAS capabilities, but 84% had at least one erroneous belief about an ADAS technology, suggesting further education is needed. Comments show that some confuse LDW and LKA, and FCW and AEB.
- 3) Although participants who use LKA and ACC together self-report equal or lower likelihood of engaging in unsafe behaviors, 40% report being more likely to engage in at least one unsafe behavior while using these features together.

(Data reported on the following slides)



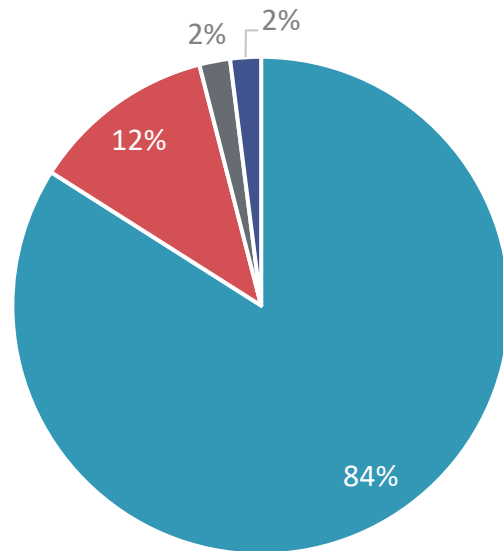
ADAS technology	N(%) who report having ADAS technology	Understanding rated "extremely" or "moderately well"	Perceived decrease in risk (any)	% who report 'avoiding'/'almost getting into' a crash owing to technology	% who have at least one erroneous belief about technology
Lane departure warning	571 (56%)	85%	77%	48%/9%	77%
Lane keeping assistance	504 (50%)	85%	74%	48%/11%	64%
Forward collision warning	625 (62%)	82%	80% ↓	56%/10%	82%
Automatic emergency braking	527 (52%)	77%	75%	55%/12%	72%
Adaptive cruise control	643 (63%)	79%	64%	37%/9%	52%

↓ Significantly more likely to be perceived as decreasing risk of a crash than all other ADAS



Summary: Lane departure warning (LDW)

Level of comfort with feature



- Comfortable
- Need more information
- Would like to disable
- Have disabled

Which of the following best describes your feelings about this feature?

Issues of concern

(Reasons for disabling or reporting a bad experience)

- Annoyance with or general dislike of the feature
- The experience of being surprised by the alert
- The perception that it does not work properly (instances where the system seemed to pick up lines other than lane markers or otherwise activates incorrectly)
- The belief that the feature is unnecessary

Participant experience in their own words

“The first time I experienced this was a surprise. The steering wheel shook.”

“At this point I do not need this feature. I pay attention when I am driving. I tried it just to see what it did.”

“It thinks I am going outside the lane a lot and it beeps at me. It is annoying.”

“It goes off constantly.”

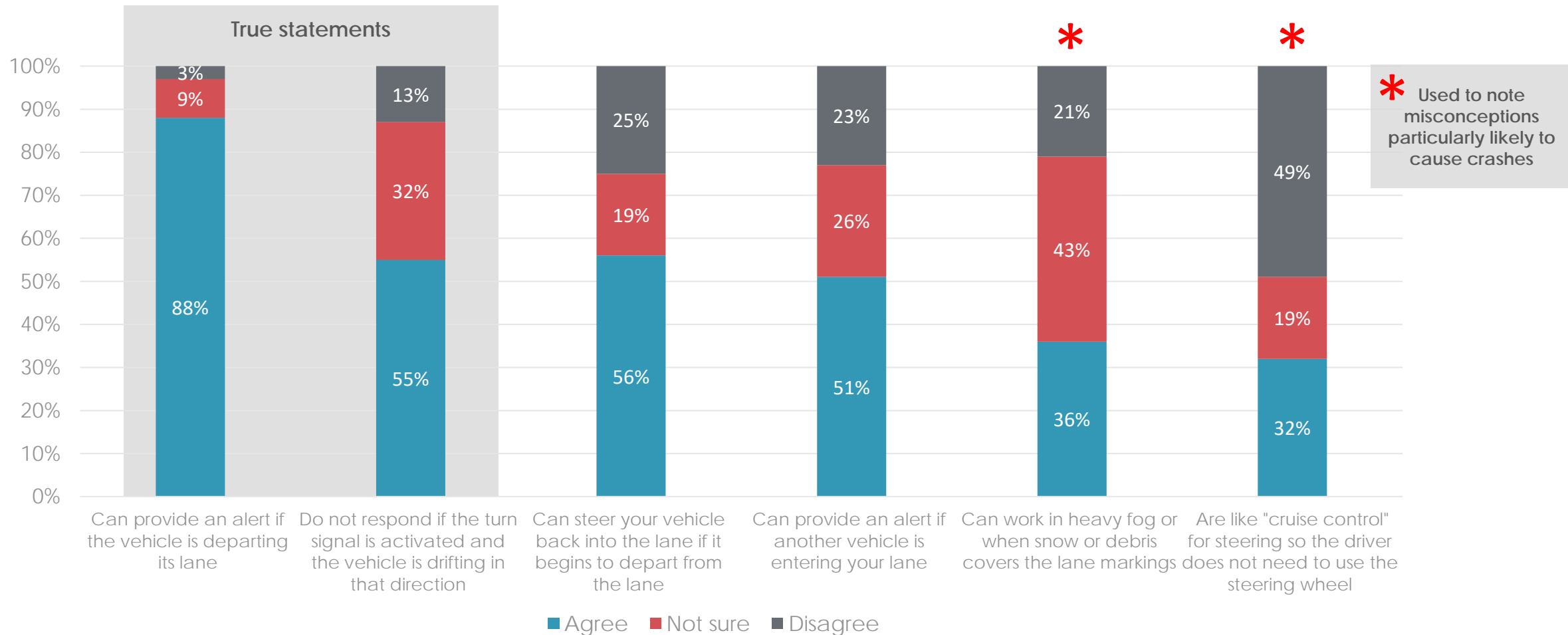
“Picks up markings other than the outer lines.”

“It does a poor job of reminding me about when I’m in the lane, often due to recent construction or weather. This makes those harder to focus [at] points in time even more difficult and more risky.”



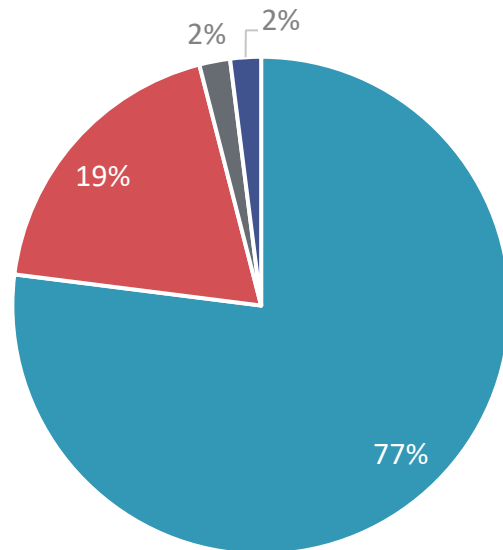
Beliefs about lane departure warning systems

77% of participants with LDW have at least one erroneous belief



Summary: Lane keeping assistance (LKA)

Level of comfort with feature



- Comfortable
- Need more information
- Would like to disable
- Have disabled

Which of the following best describes your feelings about this feature?

Issues of concern

(Reasons for disabling or reporting a bad experience)

- General discomfort with the experience of the feature, especially feeling surprised by it
- The perception that the feature does not functioning correctly, that it seems to have difficulty picking up lane markings
- The perception that there is a tendency to overcorrect
- The experience that bad roads make the feature not work properly

Participant experience in their own words

“The roads are bad in my town and it goes off when I am in the center of the lane because it thinks I’m hitting the edges.”

“When trying to change lanes without a blinker because of things in the road it can cause me to return to lane and hit them.”

“Lane centering didn’t work as intended on two lane road with curves - would not stay in lane, hunted from side to side of road.”

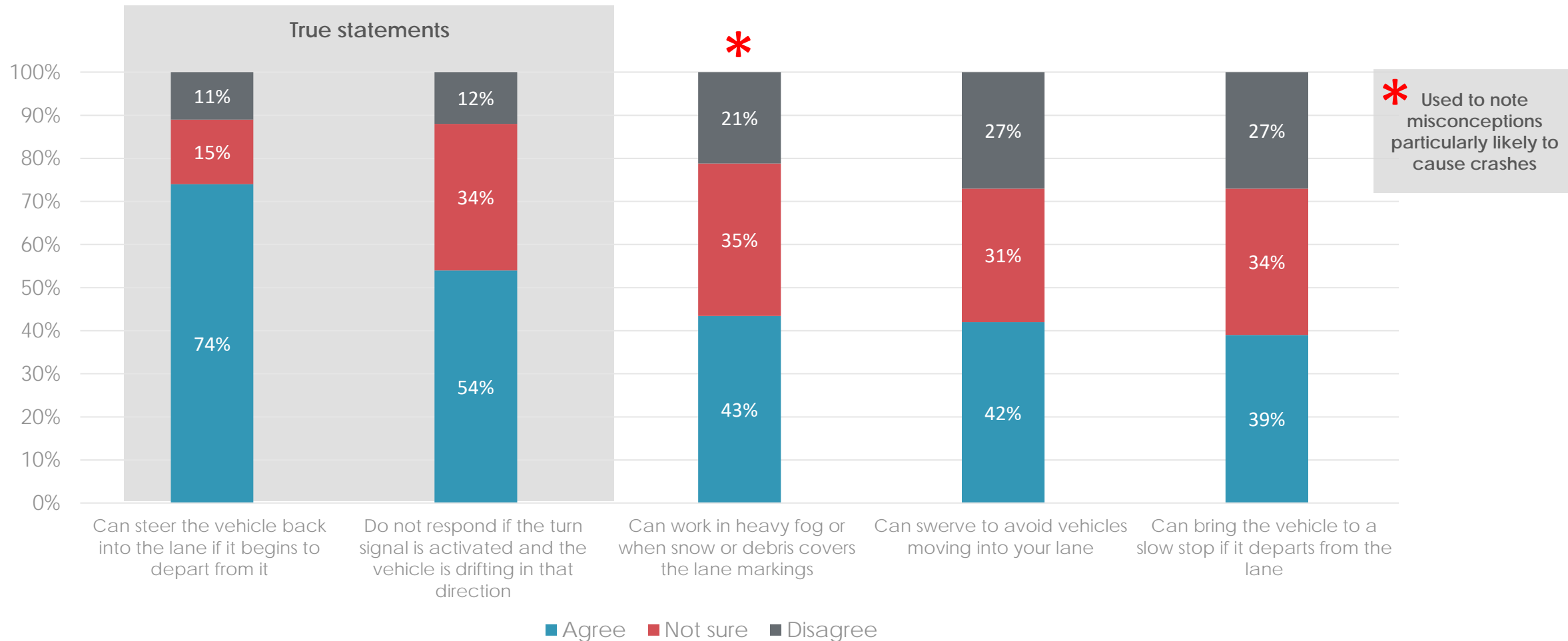
“Only works half the time, doesn’t keep a lane in many cases.”

“I don’t like the idea of it.”



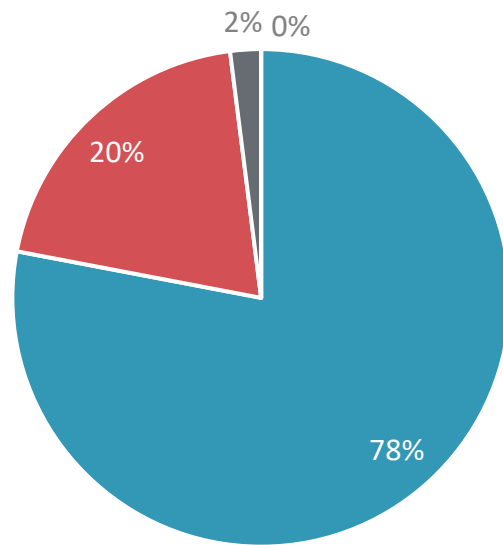
Beliefs about lane keeping assistance systems

64% of participants with LKA have at least one erroneous belief



Summary: Forward collision warning (FCW)

Level of comfort with feature



- Comfortable
- Need more information
- Would like to disable
- Have disabled

Which of the following best describes your feelings about this feature?

Issues of concern (Reasons for disabling or reporting a bad experience)

- The perception that the system is either too sensitive or disruptive to work safely and properly, for instance the experience of 'false alarms' where there is an unnecessary warning
- The experience of feeling startled or surprised

Participant experience in their own words

"Sometimes oncoming cars on the other side of the street would trigger this."

"It's too sensitive, even at its lowest setting."

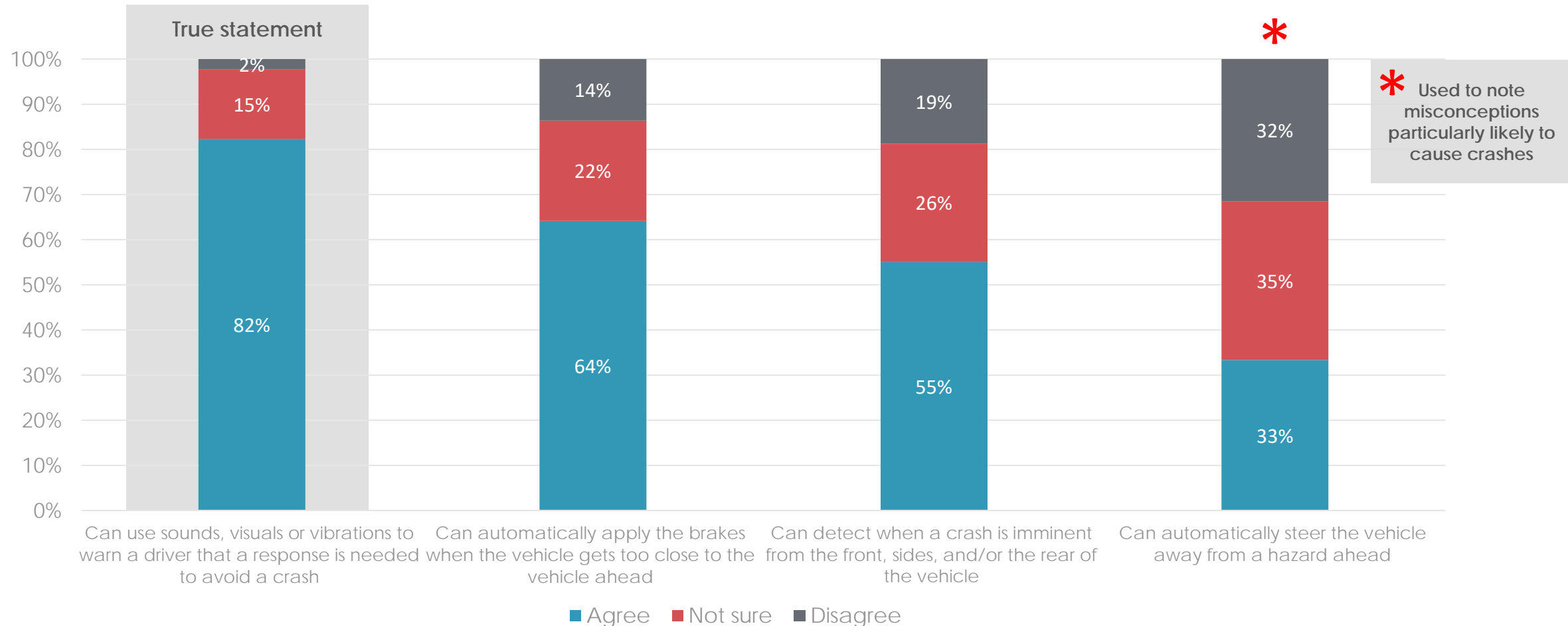
"The sensors on my car are far too sensitive and will go off if I hit a pothole on the road or if it is raining/snowing really hard."

"It startles me more than it helps me."



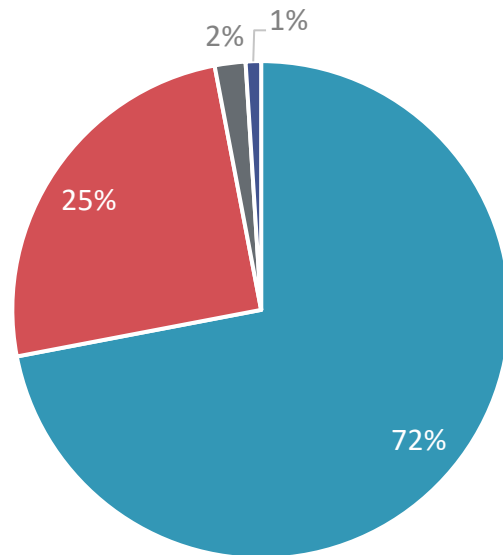
Beliefs about forward collision warning systems

82% of participants with FCW have at least one erroneous belief



Summary: Automatic emergency braking (AEB)

Level of comfort with feature



- Comfortable
- Need more information
- Would like to disable
- Have disabled

Which of the following best describes your feelings about this feature?

Issues of concern (Reasons for disabling or reporting a bad experience)

- The perception that it is too sensitive and activates unnecessarily
- The feeling of being surprised by the system's activation
- The perception that the feature causes too rapid or drastic a slowdown that could lead to an accident

Participant experience in their own words

"Startled me and caused me to jerk the steering wheel when there was no imminent danger of a crash."

"It slows the car down too drastically. It cannot take into account when I can move over to pass a car turning right."

"It slows down suddenly, I have almost been rear ended due to this."

"When going around someone turning this triggers sometimes and slams on the breaks and can cause someone behind me to hit me."

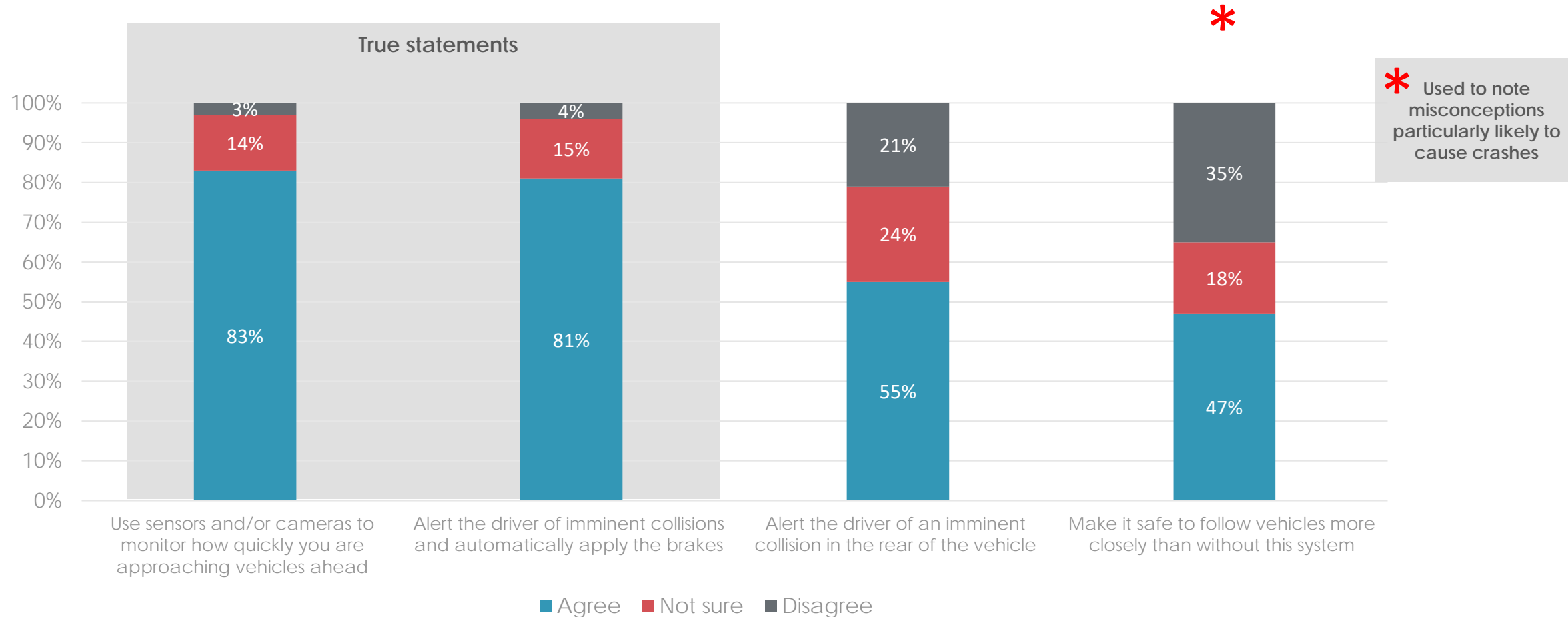
"It comes on while I'm then currently in charge of the situation."

"I don't think it works very well. A dip on the road will sometimes activate this feature and might cause an accident."



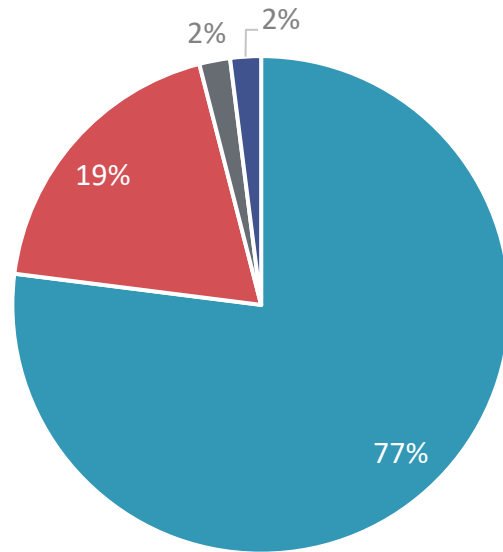
Beliefs about automatic emergency braking systems

72% of participants with AEB have at least one erroneous belief



Summary: Adaptive cruise control (ACC)

Level of comfort with feature



- Comfortable
- Need more information
- Would like to disable
- Have disabled

Which of the following best describes your feelings about this feature?

Issues of concern

(Reasons for disabling or reporting a bad experience)

- The feeling of being surprised by the system's activation
- Dislike of the acceleration functionality
- Frustration that the system is too 'conservative' in its distance settings

Participant experience in their own words

"I don't use cruise control so this feature isn't relevant to me."

"It keeps you too far away and gives no warning, just slows so if you would normally pass you have to pay attention to your speedometer."

"Very jerky acceleration that seems like it was uncontrollable."

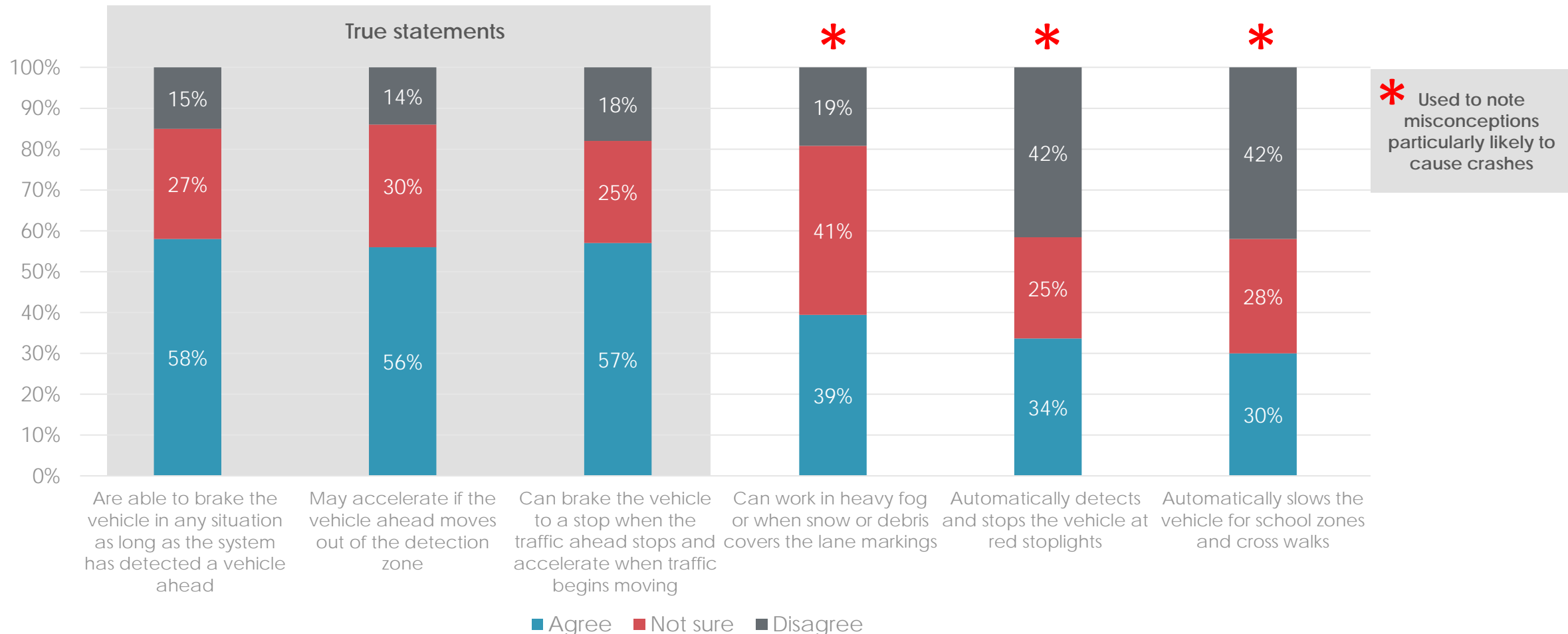
"I was not expecting the auto to slow down."

"Let me tailgate."



Beliefs about adaptive cruise control systems

52% of participants with ACC have at least one erroneous belief



Q14. Please indicate whether you agree or disagree with the following statements adaptive cruise control systems. | n= 397



Beliefs about using LKA and ACC together

58% of participants who report having both features use them together

71% believed they could use LKA and ACC on unsafe road types

On what kind of roads do you use lane keeping assistance and adaptive cruise control together?

Road type	% selected
Highways	78%
City streets	44%
Two-lane roads in rural areas	40%
Suburban streets	35%
Roads with leaves or debris on them	21%
Unpaved or dirt roads	14%
Other kinds of roads	2%
None of the above	1%

51% believed they could do so in unsafe weather conditions

In what kind of weather conditions do you use lane keeping assistance and adaptive cruise control together?

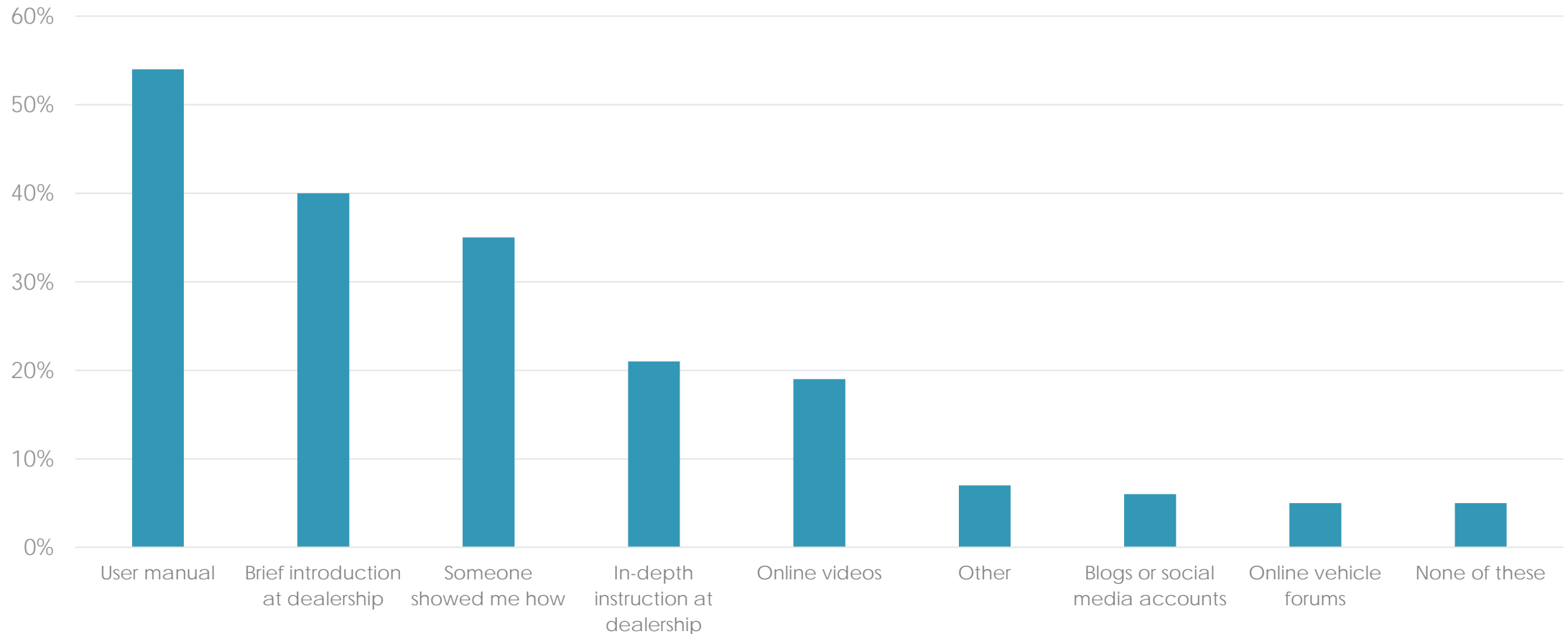
Weather condition	% selected
Clear	69%
Light rain	51%
Heavy rain	40%
Heavy fog	34%
Snow	32%
Other	2%
None of the above	3%



Indicates an unsafe road type or weather condition



User manual, dealership introduction, and other people are the most common ways of learning how ADAS technologies work



Q9 In what ways have you learned about these features | n = 766



Questions?



Appendix



Participant snapshot

AGE

18-24	167 (16.5%)
25-34	213 (21.0%)
35-44	259 (25.5%)
45-54	142 (14.0%)
55-64	106 (10.5%)
65+	127 (12.5%)

GENDER

Female	615 (60.7%)
Male	399 (39.3%)

RACE/ETHNICITY

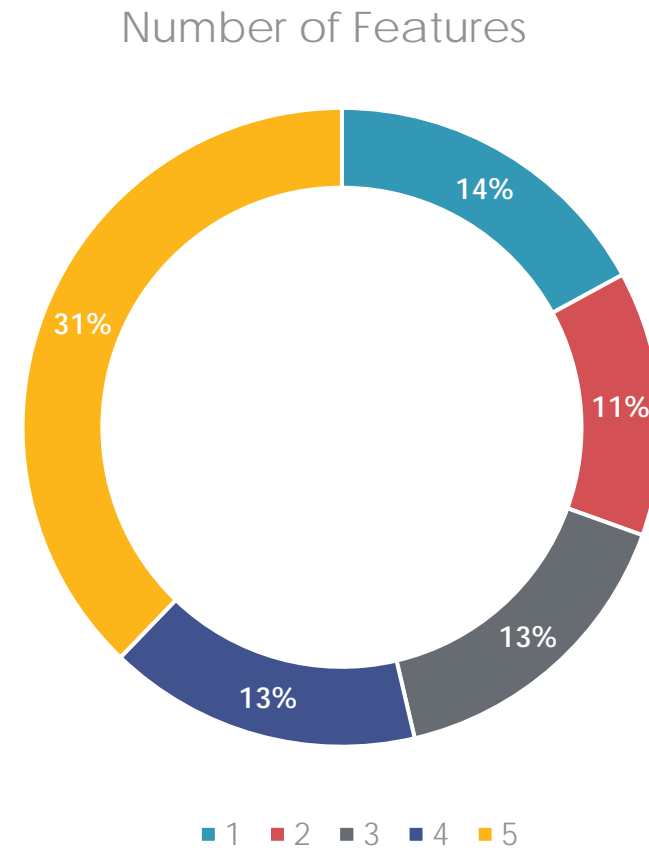
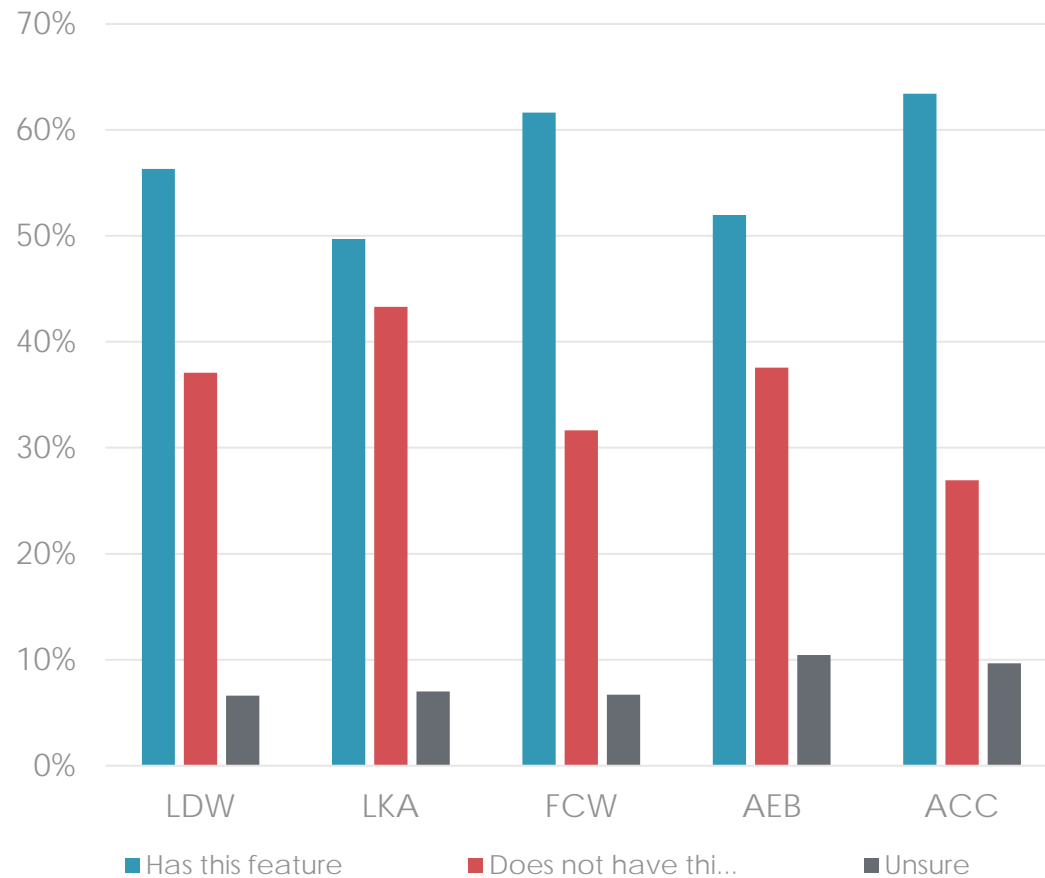
African-American	61 (6.1%)
Asian-American	108 (10.8%)
Hispanic/Latino-American	76 (7.6%)
Indian-American	13 (1.3%)
Native American	9 (0.9%)
White American	666 (66.6%)
Multi-racial	38 (3.8%)
Other	29 (2.9%)

n=1,014 total



Incidence of features among participants

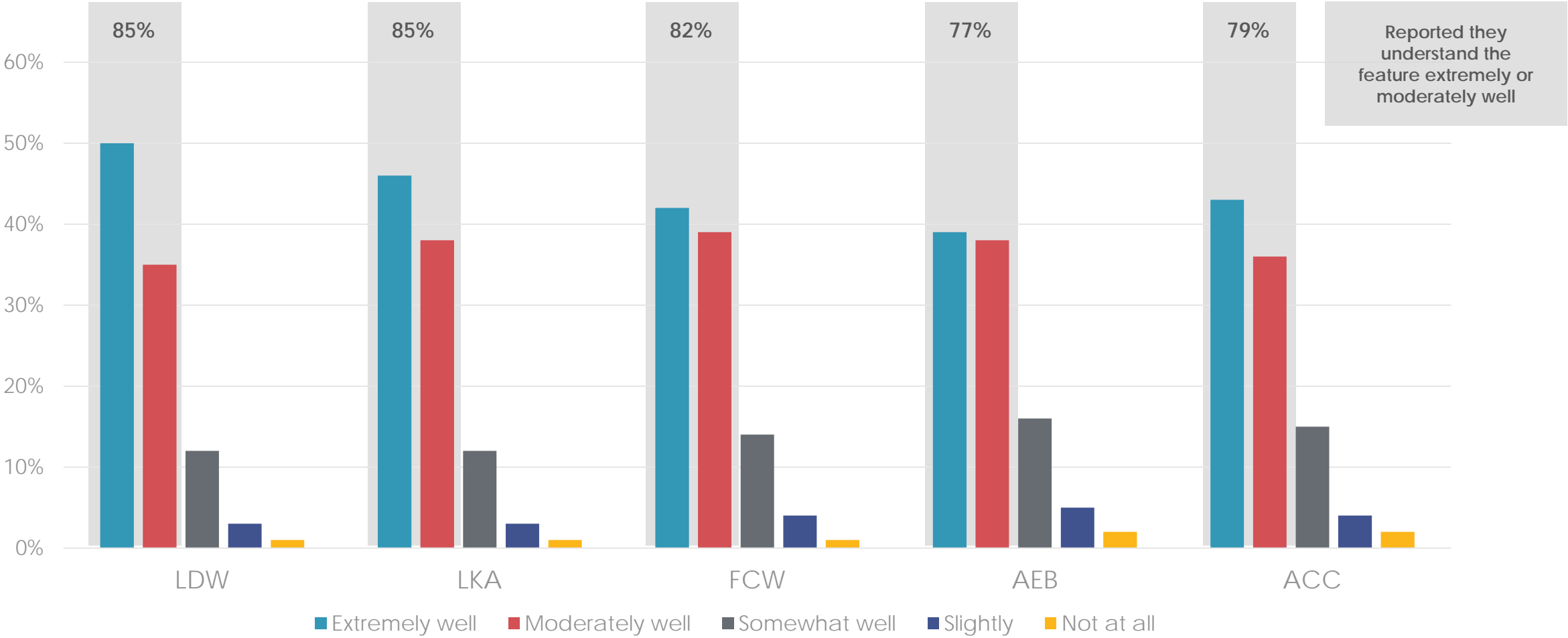
17% of participants said they were unsure or did not have all 5 features and exited the survey



Q4: To the best of your knowledge, does your vehicle have the following features | n = 1,014



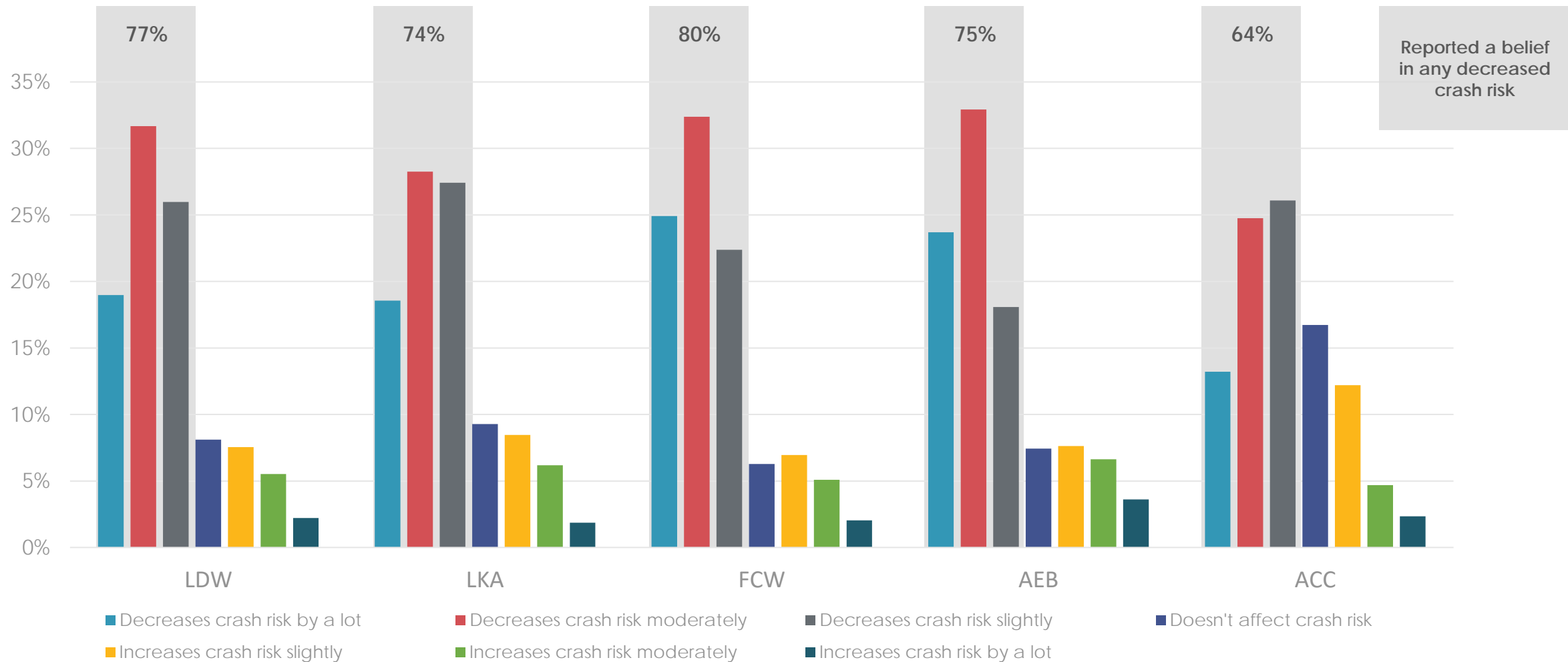
Self-reported understanding of ADAS technologies was high and consistent overall



Q6: In general, how well do you feel you understand when and how to use these features | n = 766



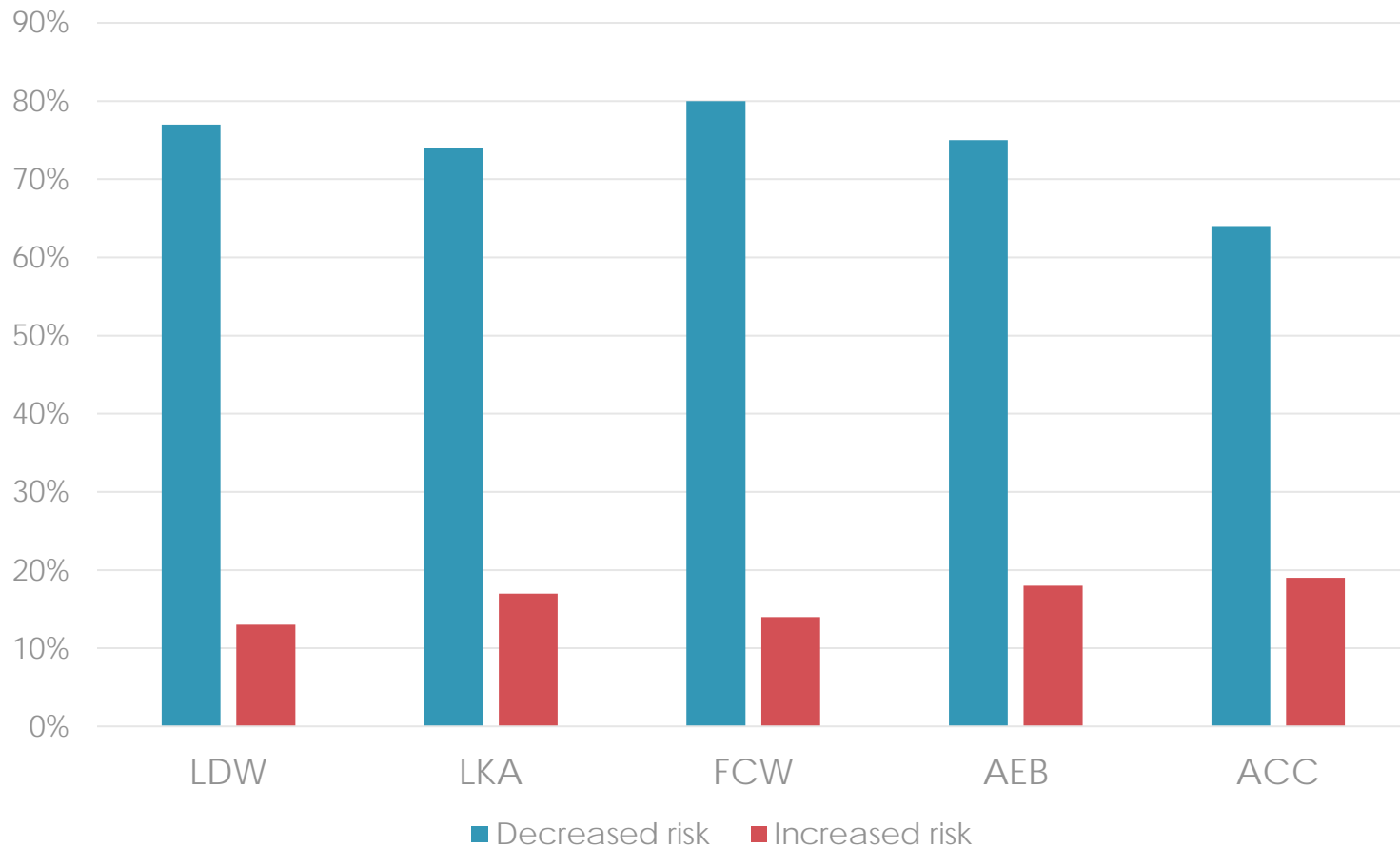
All 5 technologies were believed to decrease risk overall



Q7: How do you think these features affect the risk of getting into a crash, if at all? | n = 766



Significant differences exist in perceptions of risk by system



- **Adaptive cruise control** was more likely to be perceived as **increasing risk of a crash** than all other ADAS
- **Forward collision warning** was more likely to be perceived as **decreasing risk of a crash** than all other ADAS



Characteristics of participants who believe ADAS technologies increase risk

More likely to have or be:

- Male
- 35-44 years old
- A professional degree
- Children



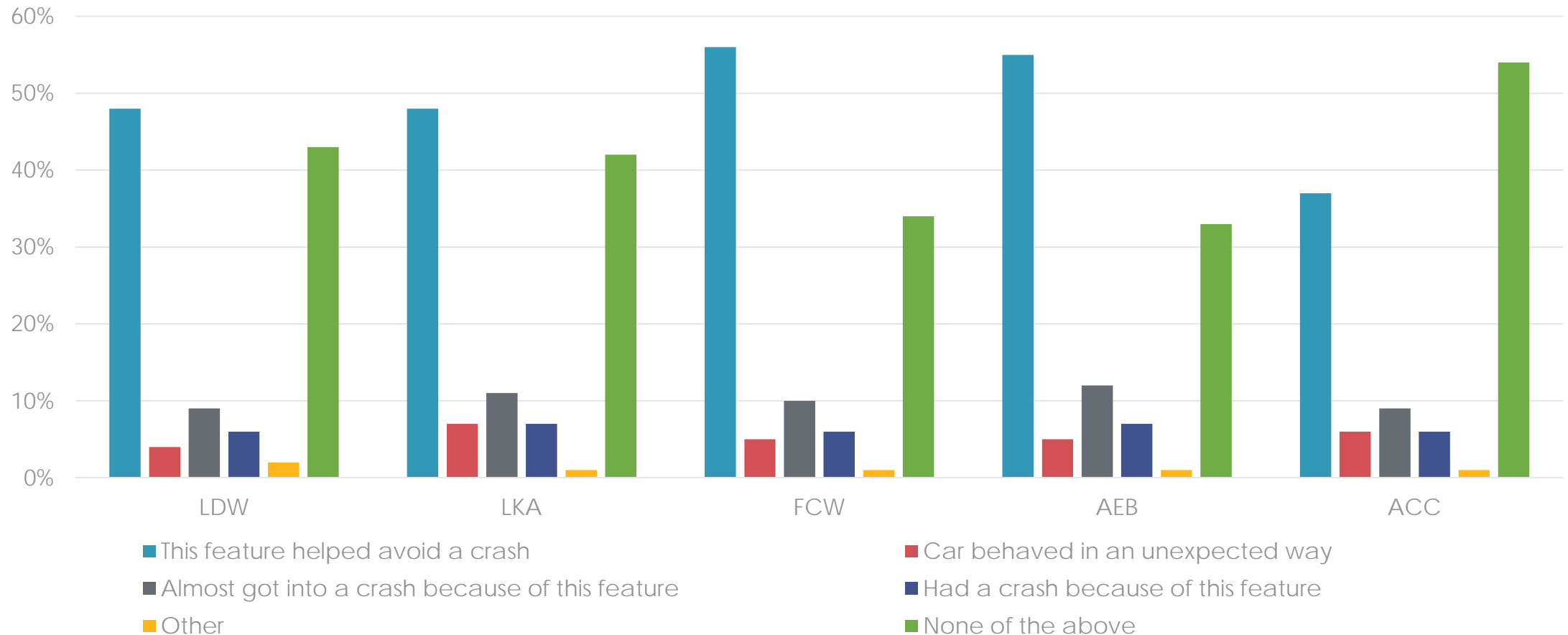
Key Finding

Many participants report avoiding a crash owing to these features, though a small percentage report almost getting into a crash.

Being surprised or startled by a systems' activation, and the problems this can cause, and the perception that the feature does not work correctly are common sources of concern cited across ADAS technologies.



Many had avoided a crash owing to an ADAS technology



Q15: Have you had any of the following experiences with these features? | n = # of participants with that technology

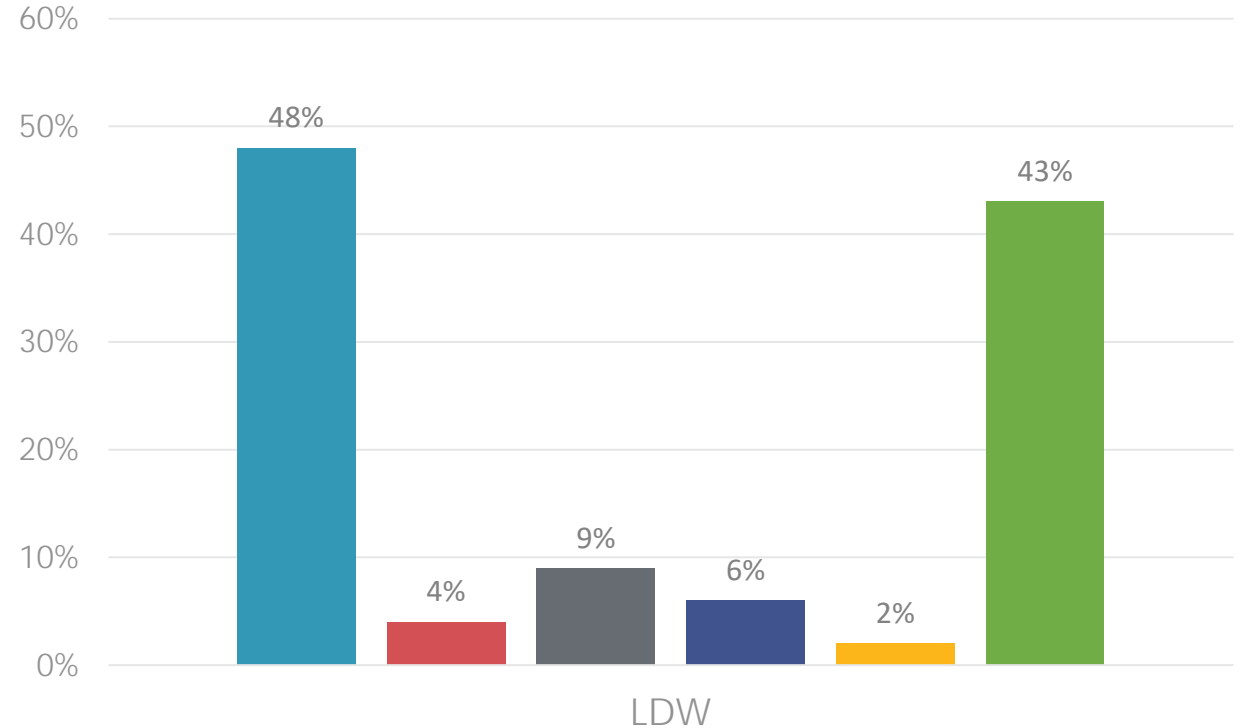


Lane departure warning: Responses in "Other" or "Car behaved in an unexpected way"

- Instances where the system seemed to pick up lines other than lane markers (one mentioned newly tarred areas reflecting sunlight) or otherwise activates incorrectly (e.g. in a construction zone)
- Experiencing surprise at the alert

“The first time I experienced this was a surprise. The steering wheel shook.”

“Picked up markings other than the outer lines.”

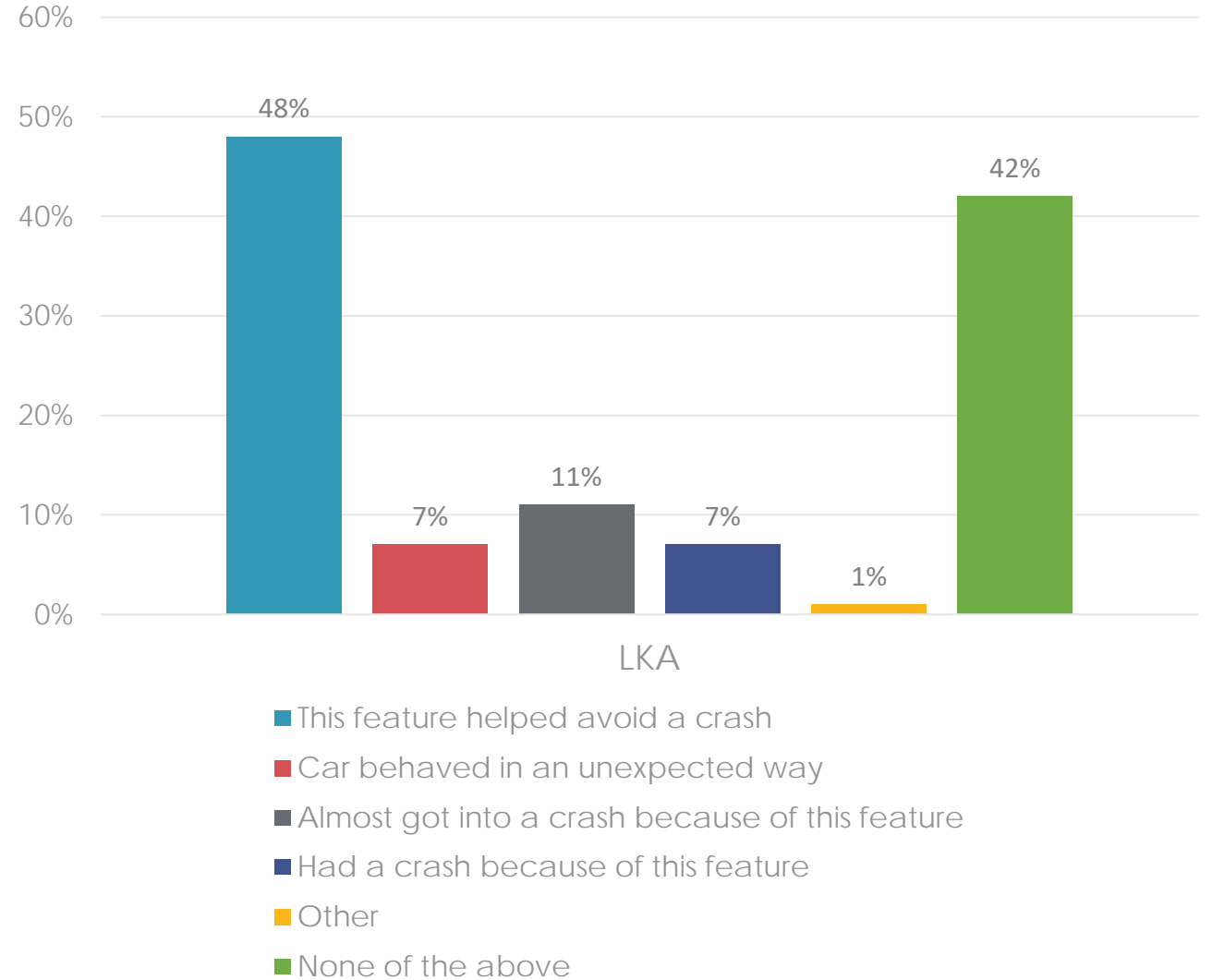


- This feature helped avoid a crash
- Car behaved in an unexpected way
- Almost got into a crash because of this feature
- Had a crash because of this feature
- Other
- None of the above

Lane keeping assistance: Responses in "Other" or "Car behaved in an unexpected way"

- The feature seemed to have difficulty picking up the lane markings
- A tendency to overcorrect or drift
- General discomfort with the experience of the feature

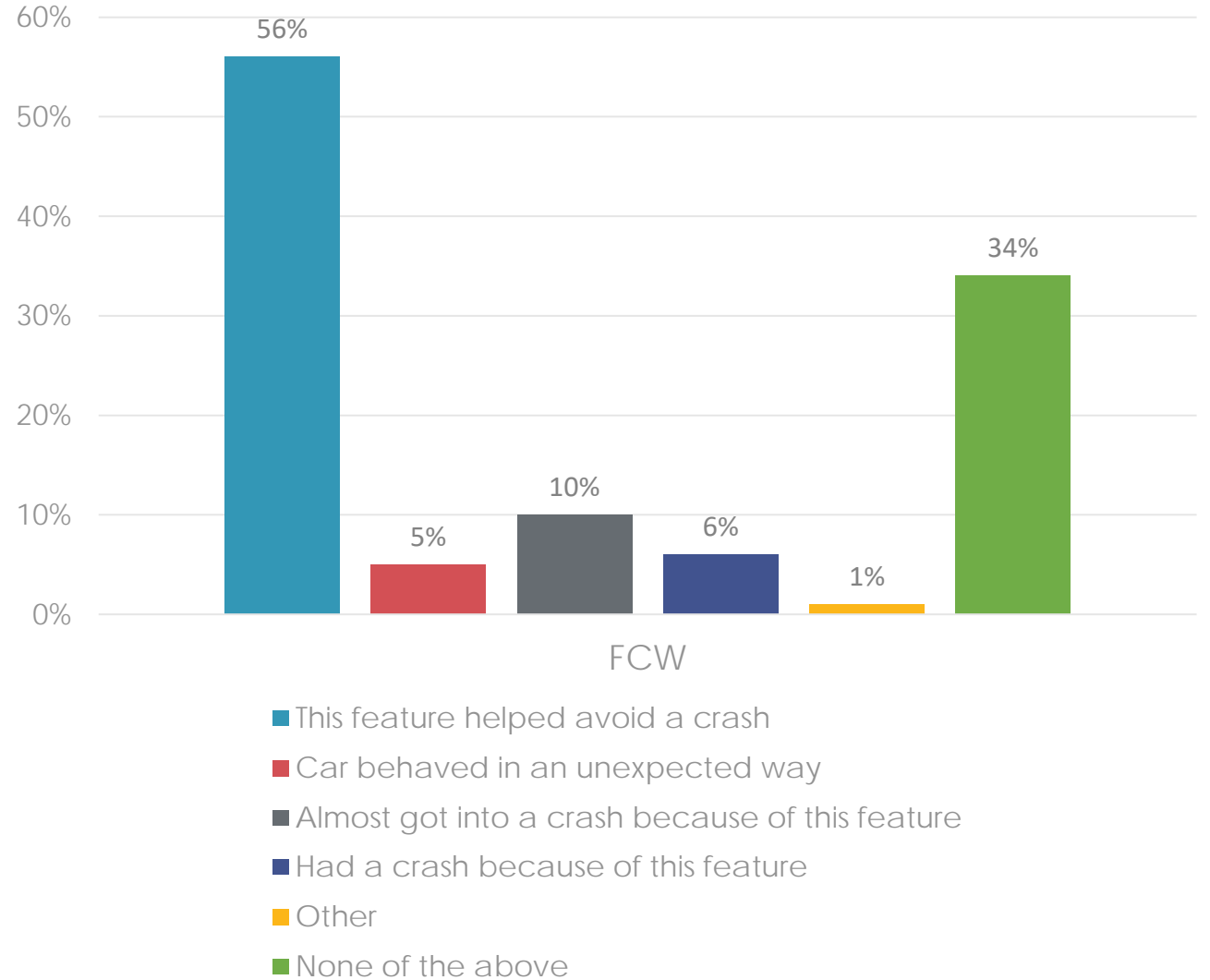
“Lane centering didn't work as intended on two lane road with curves - would not stay in lane, hunted from side to side of road.”



Forward collision warning: Responses in “Other” or “Car behaved in an unexpected way”

- ‘False alarms’ where the system gives an unnecessary warning

“Sometimes oncoming cars on the other side of the street would trigger this.”

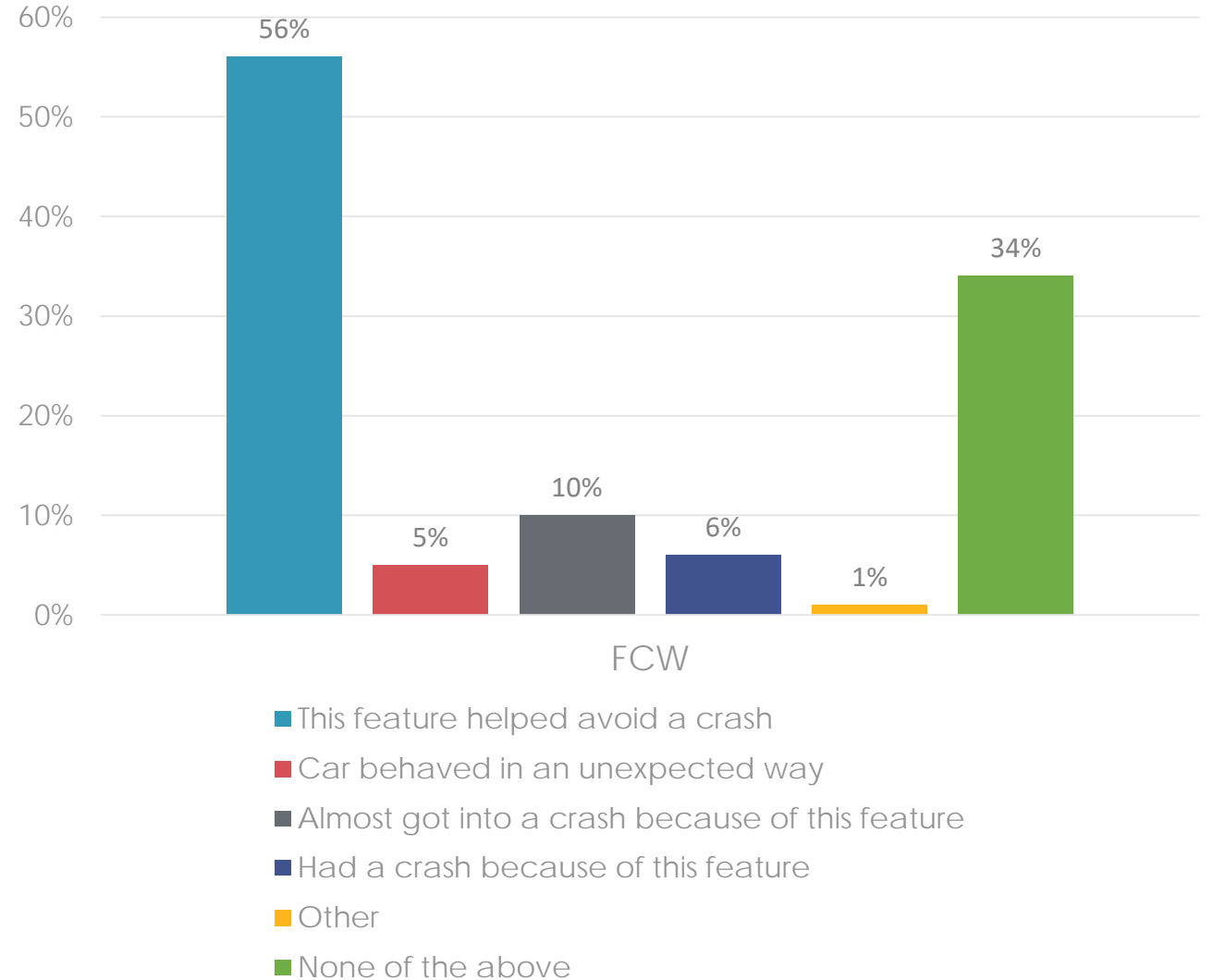


Q15: Have you had any of the following experiences with these features? | 11 responses

Automatic emergency braking: Responses in “Other” or “Car behaved in an unexpected way”

- The system activating incorrectly (one mentioned an area in their parking garage that sets it off)
- Being surprised by the system’s activation

“Startled me and caused me to jerk the steering wheel when there was no imminent danger of a crash.”

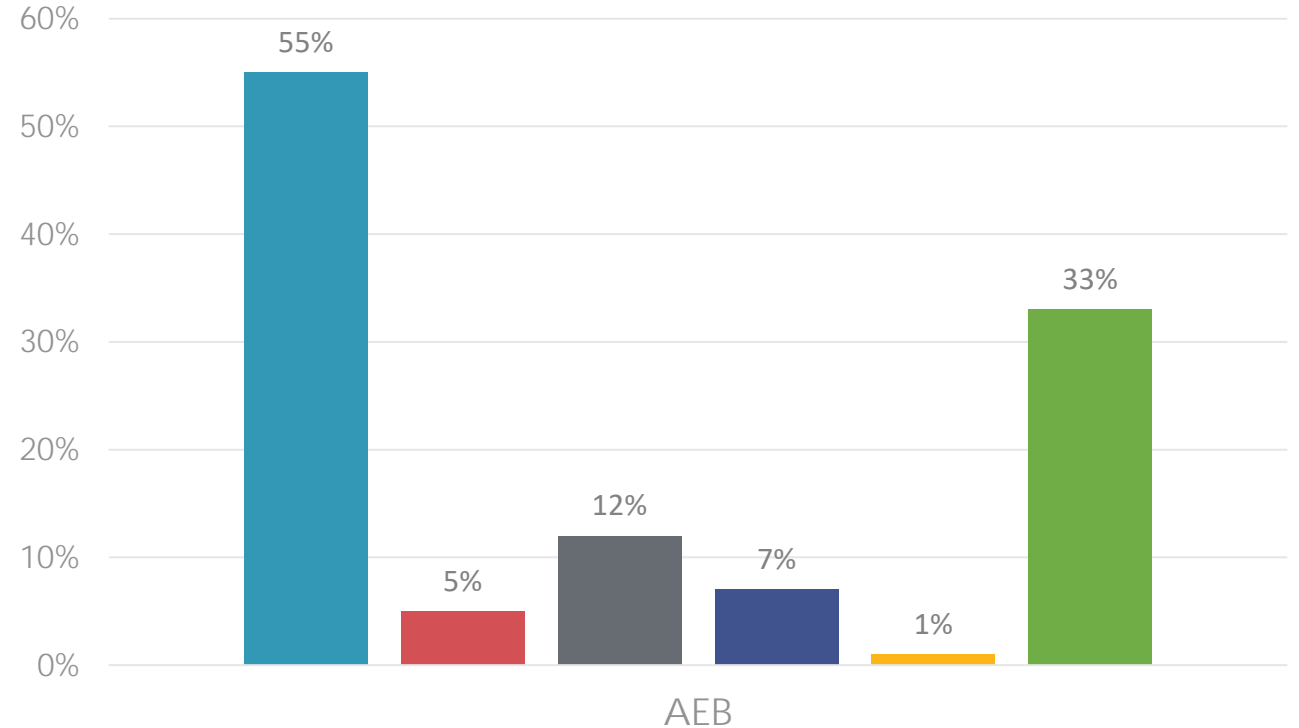


Adaptive cruise control: Responses in “Other” or “Car behaved in an unexpected way”

- Being surprised by the system’s activation
- Disliking the acceleration functionality
- Frustration that the system is too ‘conservative’ in its distance settings

“Very jerky acceleration that seems like it was uncontrollable.”

“Not expecting the auto to slow down.”



- This feature helped avoid a crash
- Car behaved in an unexpected way
- Almost got into a crash because of this feature
- Had a crash because of this feature
- Other
- None of the above

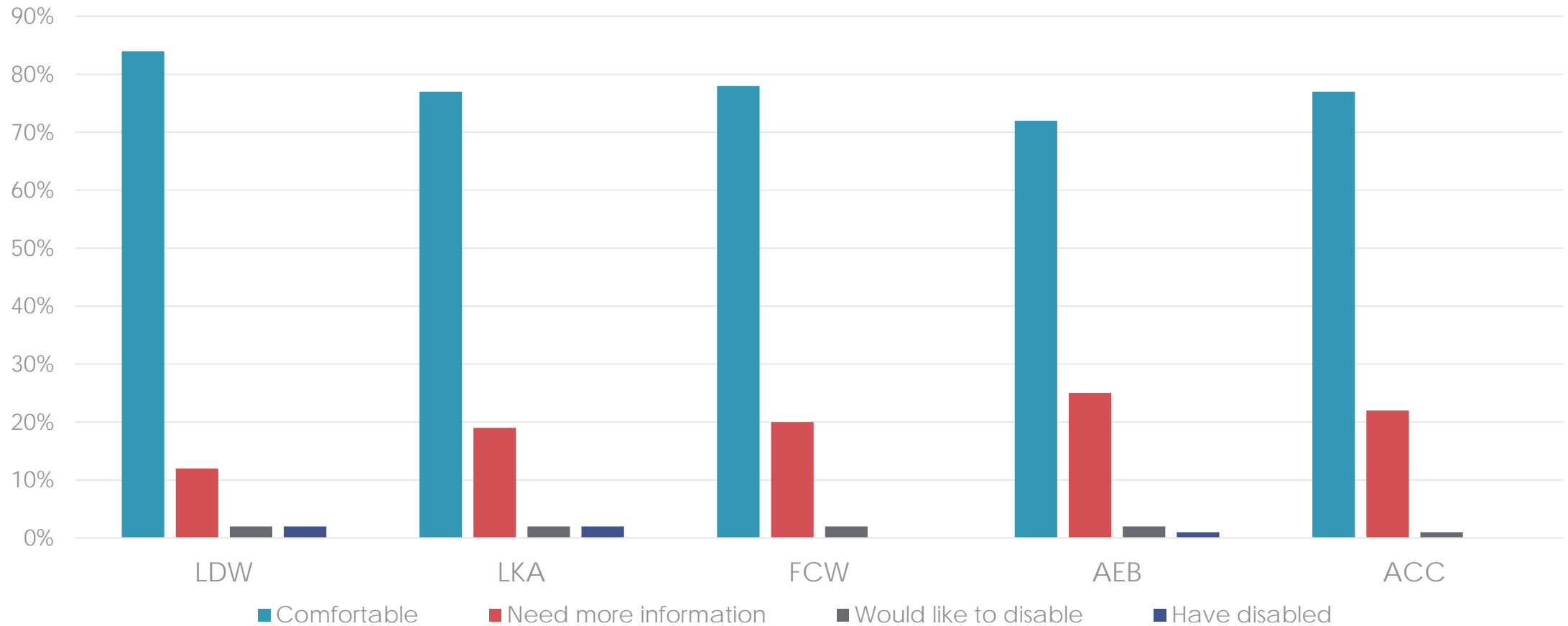
Key Finding

Most report feeling comfortable with their ADAS technologies, though a moderate proportion want more information about them.

Disabling and even wanting to disable ADAS technologies is rare at a combined 9% of participants who reported having any ADAS technology.



Most participants feel comfortable with their ADAS technologies, though some would like more information



Q8: Which of the following statements best describes your feelings about these features? | n = 766



Disabling features or wanting to do so is rare

LKA and LDW are the most frequently disabled.

- Most who had disabled features were women (n=16, 76%)
- Most frequently aged 35-44 (n=8, 38%)
- Were less likely to have learned about features through all means mentioned (significantly less so from online videos or being showed by someone else)

Feature	Disabled by participant (n)	Want to disable but have not (n)
LKA	9	10
LDW	9	9
AEB	4	11
FCC	2	9
ACC	2	8
Total n (%)	26 (3%)	47 (6%)

Q8: Which of the following statements best describes your feelings about these features?
A: "I have disabled this feature" or "I would like to disable this feature" | n=766

Reasons for disabling or wanting to disable lane departure warning systems

- Annoyance with or generally disliking the feature is the most commonly mentioned reason
- A few mentioned feeling that it is unnecessary
- A few mentioned feeling it does not work properly

“At this point I do not need this feature. I pay attention when I am driving. I tried it just to see what it did.”

“I hate using it.”

“It thinks I am going outside the lane a lot and it beeps at me. It is annoying.”

“It goes off constantly.”

“[I] don’t like the noise.”

“Tells me out of the lane when I’m not.”

“It does a poor job of reminding me about when I’m in the lane, often due to recent construction or weather. This makes those harder to focus [at] points in time even more difficult and more risky.”

Q8: Which of the following statements best describes your feelings about these features?

A: “I have disabled this feature” or “I would like to disable this feature” | 10 responses

Reasons for disabling or wanting to disable lane keeping assistance systems

Participants were equally likely to give the following reasons:

- Bad roads make the feature not work properly
- The perception that it does not function well or correctly
- Dislike or discomfort with the feature

“Our roads are terrible and it keeps telling me I’m out of my lane, even though I’m in the center.”

“The roads are bad in my town and it goes off when I am in the center of the lane because it thinks I’m hitting the edges.”

“When trying to change lanes without a blinker because of things in the road it can cause me to return to lane and hit them.”

“Only works half the time, doesn’t keep a lane in many cases.”

“I hate using it.”

“I don’t like the idea.”

Q8: Which of the following statements best describes your feelings about these features?
A: “I have disabled this feature” or “I would like to disable this feature” | 4 responses

Reasons for disabling or wanting to disable forward warning collision systems

Participants feel the system is either too sensitive or disruptive to work safely and properly.

“It’s too sensitive, even at its lowest setting.”

“The sensors on my car are far too sensitive and will go off if I hit a pothole on the road or if it is raining/snowing really hard.”

“It startles me more than it helps me.”

Q8: Which of the following statements best describes your feelings about these features?

A: “I have disabled this feature” or “I would like to disable this feature” | 3 responses

Reasons for disabling or wanting to disable automatic emergency braking systems

Participants provided the following reasons:

- The perception that the feature causes too rapid or drastic a slowdown that could lead to an accident
- That it is too sensitive and activates unnecessarily

“It slows the car down too drastically. It cannot take into account when I can move over to pass a car turning right.”

“It slows down suddenly, I have almost been rear ended due to this.”

“When going around someone turning this triggers sometimes and slams on the breaks and can cause someone behind me to hit me.”

“It comes on while I'm then currently in charge of the situation.”

“I don't think it works very well. A dip on the road will sometimes activate this feature and might cause an accident.”

Reasons for disabling or wanting to disable adaptive cruise control systems

Participants felt the feature was not relevant to their driving habits or did not like the limitations they felt it placed on their driving.

“I don’t use cruise control so this feature isn’t relevant to me.”

“It keeps you too far away and gives no warning, just slows so if you would normally pass you have to pay attention to your speedometer.”

“Let me tailgate.”

Q8: Which of the following statements best describes your feelings about these features?

A: “I have disabled this feature” or “I would like to disable this feature” | 3 responses

Key Finding

While most participants were able to correctly identify the main function of ADAS technologies, many were unsure or had erroneous beliefs about them

84% of participants who reported having any ADAS technology have at least one erroneous belief about them, suggesting that participants' confidence in their knowledge of these technologies may constitute a safety risk



Participants with any erroneous beliefs are more likely to be or have:

- 18-34
- A professional degree

And are more likely to report:

- Learning about features through **in-depth instruction at the dealership, online videos, and blogs or social media accounts**
- **Having avoided a crash** due to an ADAS technology
- **'Frequently'**: Reading or watching something, Posting to social media, Looking up something on their phone, Eating a snack or meal
- **'Every time they drive'**: Taking both hands off the wheel, Looking up something on their phone

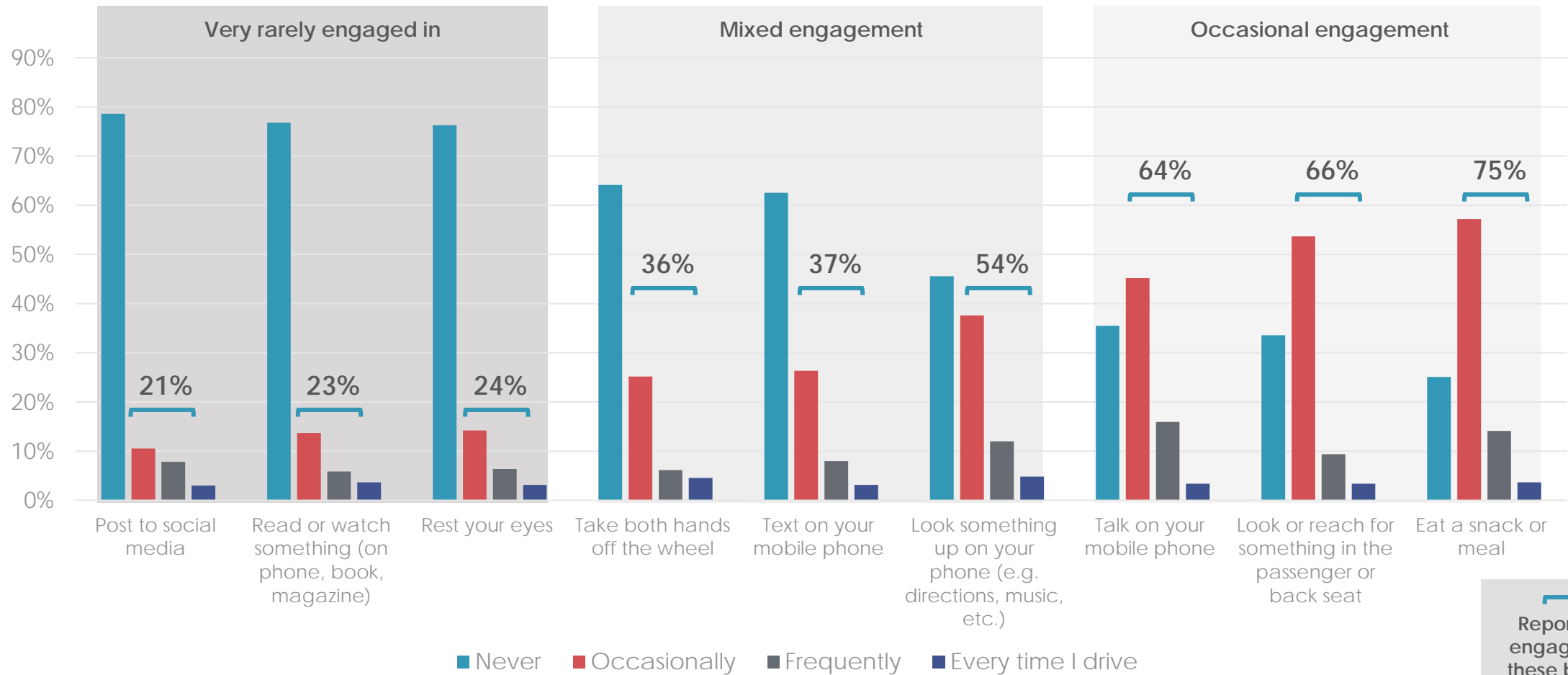
Key Finding

Most participants self-report engaging in some unsafe driving behaviors some of the time.

Only 9% of participants with any ADAS technology say they 'never' engage in any of the 9 behaviors prompted in the survey.



Frequency participants engage in unsafe driving behaviors falls roughly into three tiers

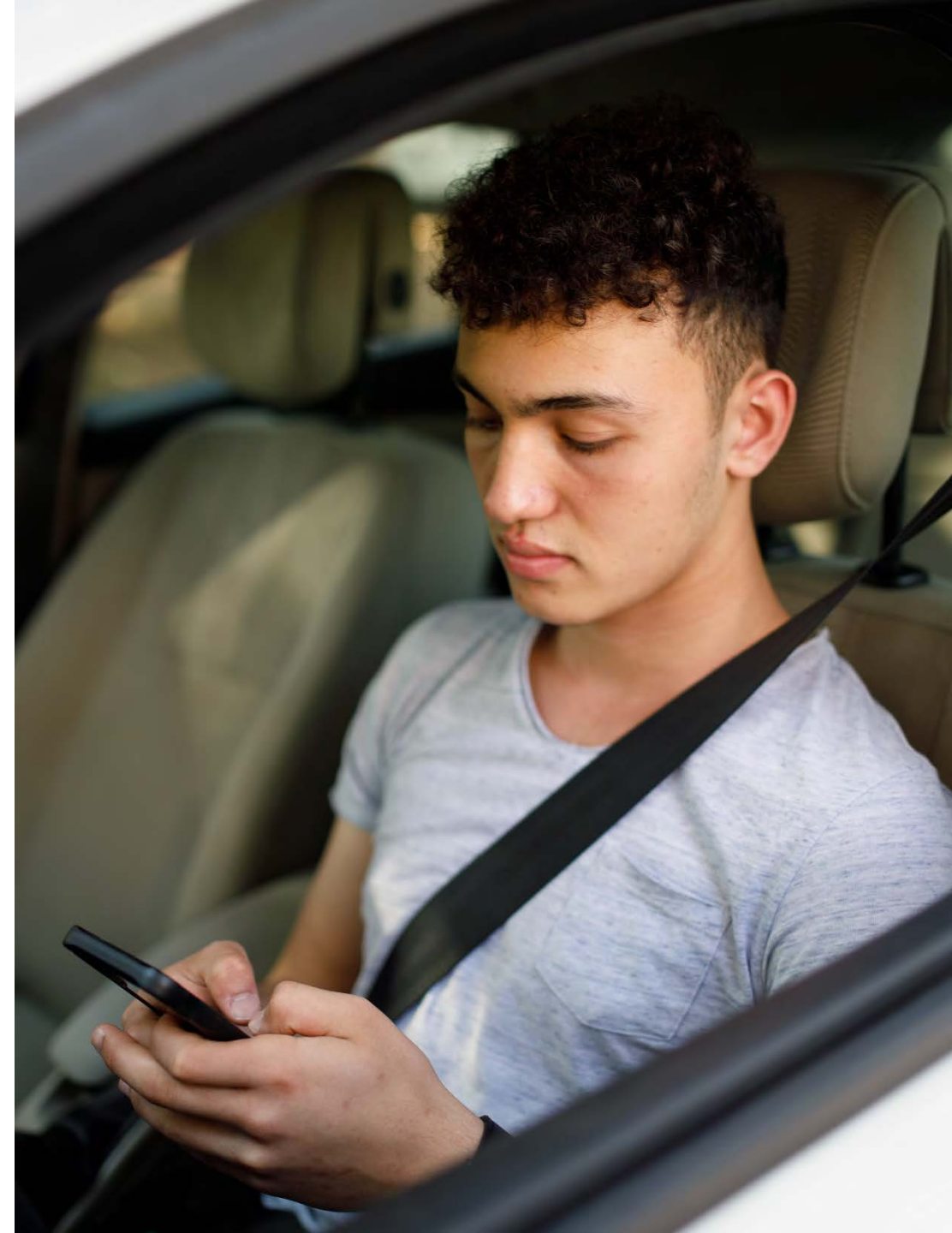


Q16: How often do you do the following while driving, in general? | n=766



Characteristics of participants who self-report engaging in unsafe behaviors

- Male (more likely to choose 'every time I drive' for all behaviors)
- Ages 18-44



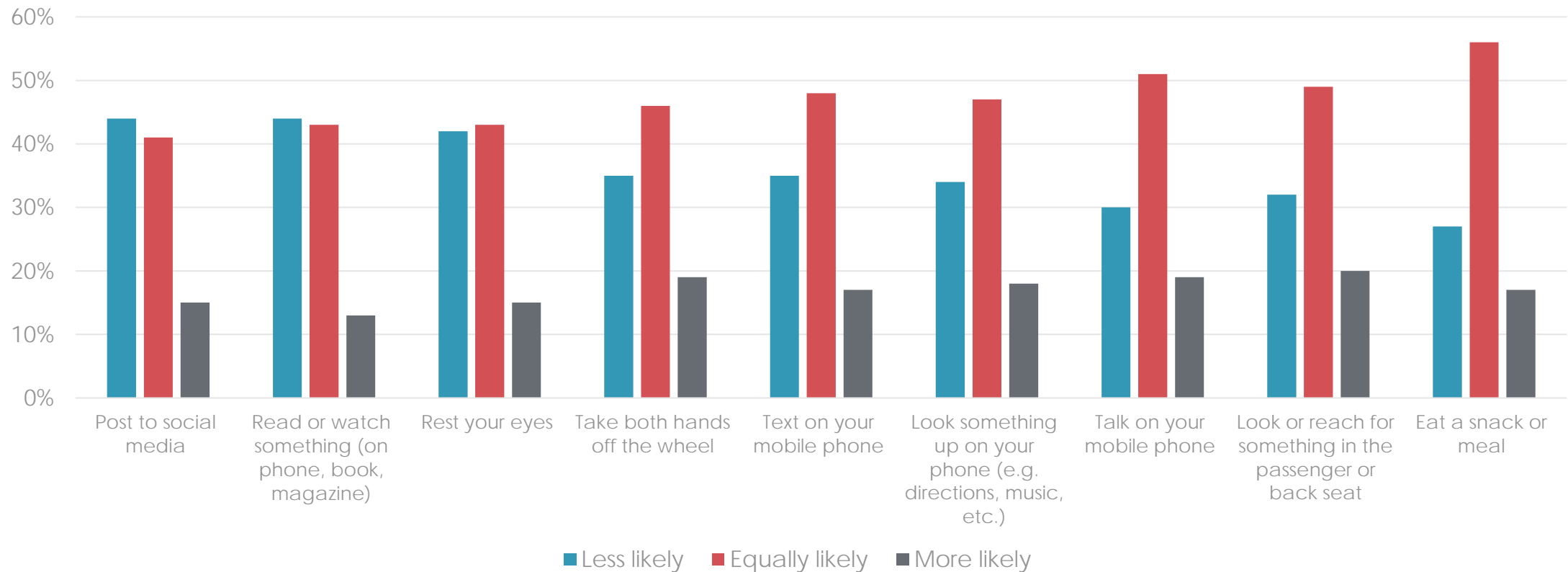
Key Finding

Although participants who use LKA and ACC together self-report equal or lower likelihood of engaging in unsafe behaviors overall, 40% of them report being more likely to engage in at least one unsafe behavior.

58% of participants who report having both features in their vehicle say they use the features together.



Most feel they are equally or less likely to engage in these behaviors when driving with LKA and ACC both engaged



Q18: When using lane keeping assistance and adaptive cruise control together, are you more, equally, or less likely to: | n=230



Participants who self-report being more likely to engage in unsafe behaviors using LKA and ACC are more likely to be:

- Male
- 18-24

And are more likely to report:

- Using LKA and ACC together in **heavy fog** and **heavy rain** and on **city streets**
- The belief that **all unsafe behaviors** are somewhat or completely safe
- The belief that ACC “automatically slows the vehicle for school zones and cross walks”
- To report ‘**frequently**’ posting on social media, talking on their phone, reaching for something in the passenger or back seat, looking up something on their phone, and eating a snack or meal

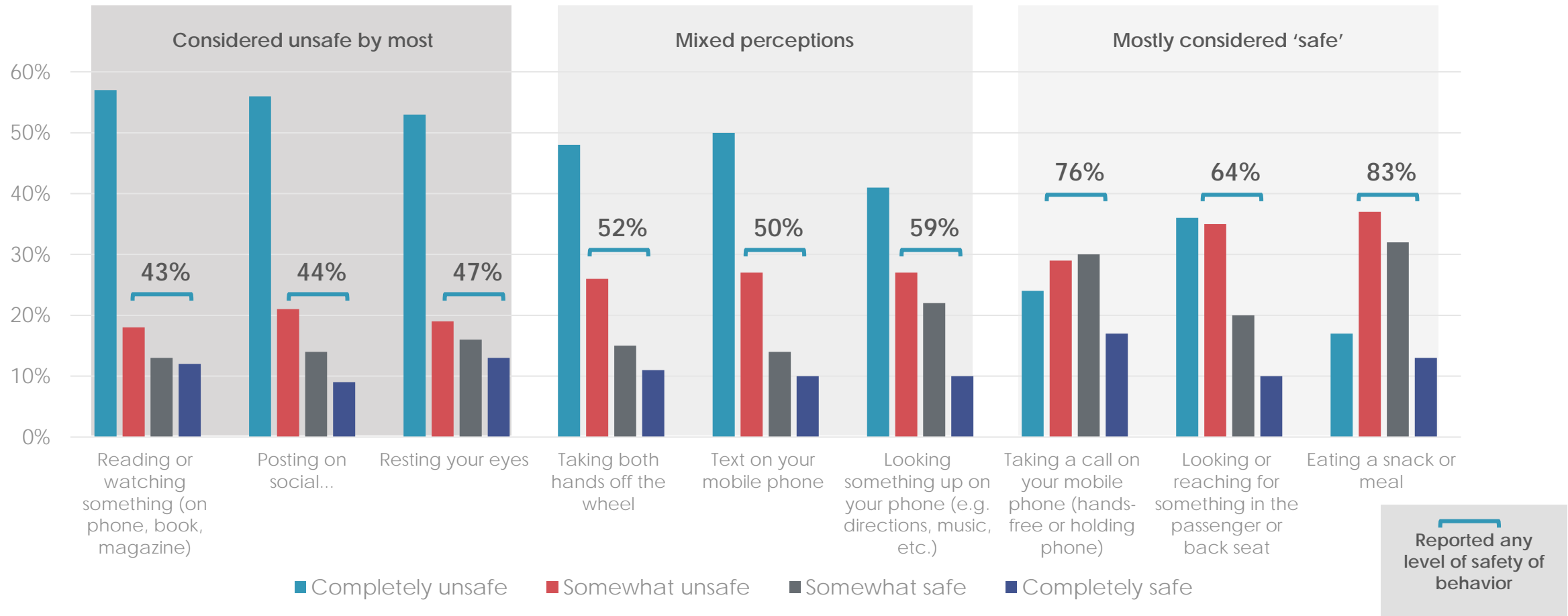
Participants consistently believe a quarter to a third of 'other drivers' are more likely to engage in these behaviors



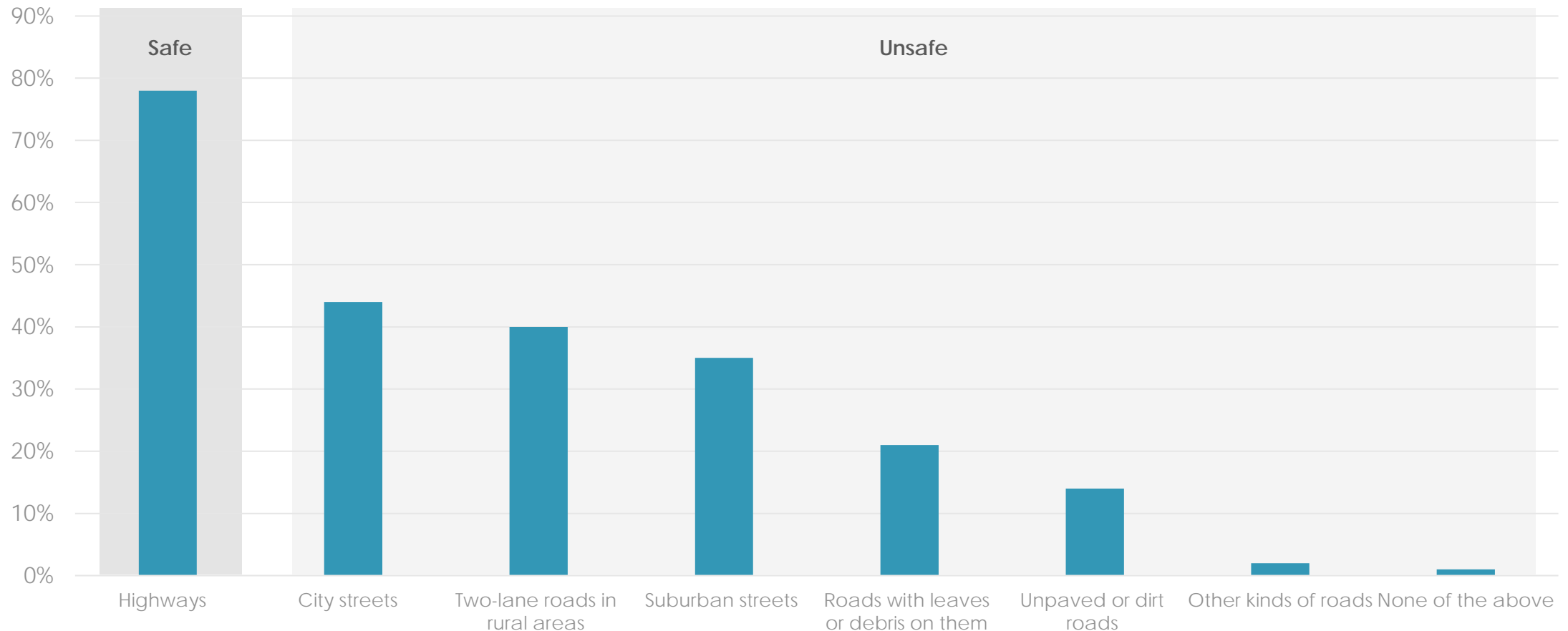
Q19: Do you think other drivers are you more, equally, or less likely to do the following while using lane keeping assistance and adaptive cruise control together | n=230



Safety perceptions of driving behaviors among drivers who use LKA and ACC together reflect tiers of engagement in behaviors by full population



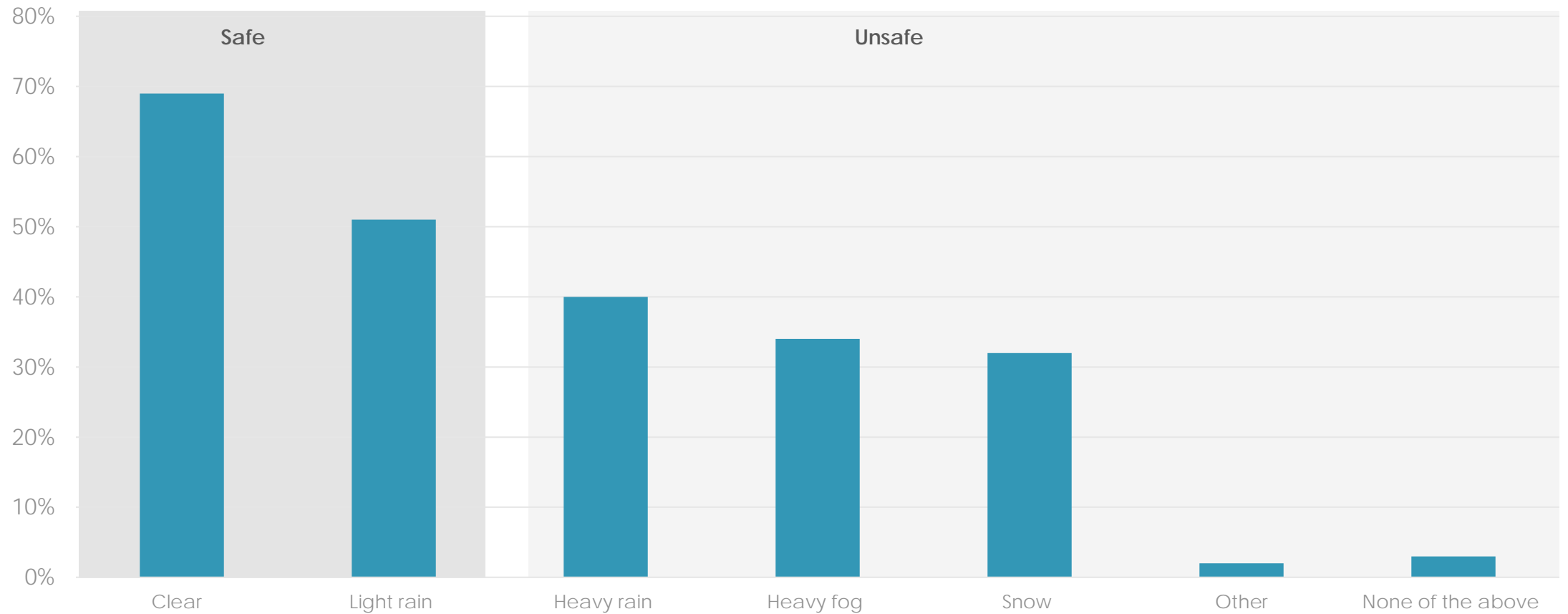
71% believed they could use LKA and ACC on unsafe road types



Q21: On what kind of roads do you use lane keeping assistance and adaptive cruise control together? | n=230



51% believed they could do so in unsafe weather conditions



Q22: In what kind of weather conditions do you use lane keeping assistance and adaptive cruise control together? | n=230



Participants who said they have seen or heard messages about ADAS technologies

HAVE SEEN MESSAGING	
Yes	389 (38.9%)
No	556 (55.6%)
Don't know	55 (5.5%)

MESSAGING LOCATION			
Facebook	169 (43.4%)	Billboard	44 (11.3%)
Twitter	99 (25.4%)	Workplace	41 (10.5%)
Instagram	116 (29.8%)	Law enforcement	21 (5.4%)
Radio	91 (23.4%)	Another person	69 (17.2%)
Television	177 (45.5%)	Other online platform	34 (8.7%)
Roadway electronic message boards	51 (13.1%)	Other	27 (6.9%)
Newspaper	86 (22.1%)	None of the above	10 (2.6%)

Q2: In the past 30 days, did you read, see or hear any messages about how to safely use advanced driver assistance systems in your vehicle. These systems include a range of safety technologies that help the driver when they are driving. | n=1,014

Q3: Where did you read, see or hear about that? | n=389



Thank you!

