

APPENDIX

Table A1. Contributing Factor Taxonomy

General Factor	Sub-Factor	Specific Factor*	
Driver	Recognition	Inadequate surveillance	
		Inattention	
		External distraction	
		Internal distraction	
		Other	
Decision	Decision	Too fast for conditions	
		Too fast to respond to unexpected actions of others	
		Too fast for curve/turn	
		False assumption of other's action	
		Illegal maneuver	
		Inadequate evasive action	
		Incorrect evasive action	
		Misjudgment of gap or other's speed	
		Following too closely	
		Aggressive driving behavior	
Turned with obstructed view			
Other			
Performance	Performance	Overcompensation	
		Poor directional control	
		Panic/freezing	
		Other	
Non-Performance	Non-Performance	Sleep, actually asleep	
		Heart Attack or Other Physical Ailment	
		Other	
Vehicle	-	Brakes	
		Engine, steering, suspension, transmission	
		Tires	
		Other	
Environmental	Roadway	Slick roads (ice, debris, etc.)	
		View obstructions	
		Signs/signals	
		Road design	
	Other		
	Atmospheric	Atmospheric	Fog/rain/snow
			Glare
Other			

*Detailed definitions and examples for each specific factor can be found in the NMVCCS Field Coding Manual (NHTSA 2008).

Potential ADAD Interventions – List of ADAS Features

ADAS considered for this study were compiled from a combination of MyCarDoesWhat.org (website created by The National Safety Council and the University of Iowa), the Consumer Reports Nomenclature Initiative (<https://www.consumerreports.org/car-safety/car-safety-features-less-confusing-names/>), and manufacturer-specific ADAS suggested during expert panel case reviews.

- Active Park Assist
- Adaptive Cruise Control (ACC)
- Adaptive Head Lights
- Automatic Emergency Braking (AEB)
 - Cyclist Detection
 - Pedestrian Detection
- Back-Up Warning (BUW)
- Brake Control Systems (BCS)
 - Anti-lock Braking System
 - Electronic Stability Control
 - Traction Control
- Blind Spot Warning (BSW)
- Brake Assist (BA)
- Curve Speed Warning (CSW)
- Driver Alcohol Detection System for Safety
- Driver Monitoring (DM)
- Following Distance Warning System
- Forward Collision Warning (FCW)
- High Speed Warning (HSW)
- Hill Descent Assist
- Intersection Assist (IA)
- Intelligent Clearance Sonar
- Intelligent Speed Adaptation
- Lane Departure Warning (LDW)
- Lane Keeping Assist (LKA)
- Obstacle Detection
- Parking Sensors
- Rear Cross Traffic Alert
- Temperature Warning
- Tire Pressure Monitoring System
- Vehicle-to-Vehicle (V2V)
- Vehicle-to-Infrastructure (V2I)

Inter-Rater Reliability

Results

Agreement of all contributing factors in a single crash occurred in 24% (n=90) of crashes; the median number of inconsistent contributing factors between the two coders was one factor. Critical factor agreement occurred in 73% (n=270) of crashes. Among the remaining 27% of crashes where critical factors differed between coders, it was noted that the critical factor selected by one coder was identified as a contributing factor by the second coder 81% (n=78) of the time. Complete agreement (all contributing factors + critical factor) between coders occurred in 22% (n=80) of crashes. Upon completion of the weekly case review vetting process, the study team was in unanimous (100%) agreement with the final list of contributing and critical factors.

Agreement of all potential ADAS interventions in a single crash occurred in 17% (n=64) of crashes; the median number of inconsistent ADAS between the two coders was one ADAS. The median percent agreement of potential ADAS interventions in a single crash was 67%. Upon completion of the weekly case review vetting process, the study team was in unanimous (100%) agreement with the final list of potential ADAS interventions.

Discussion

The current study utilized a combination of inter-rater coding, study team case reviews, and expert panel case reviews. Given the number of contributing factors and potential ADAS interventions considered for each crash as well as the plethora of data available in SHRP 2 for each event, we anticipated low initial inter-coder agreement and the need for an extensive vetting process. However, despite this complexity, complete agreement among contributing factors was achieved for nearly a quarter of the crashes. The disagreement between coders was typically limited to only one or two contributing factors. Critical factor agreement was very good; even among the crashes where critical factors were different, the disagreement was simply regarding which contributing factor was the *critical* factor. Rarely was there a complete discordance between the critical factors selected between coders. Similarly, initial ADAS intervention agreement was low, but the difference was again typically only 1-2 ADAS features. That said, for more complex crashes, we emphasize the utility of using a study team and expert panel vetting process. Such processes have been used previously in crash scene investigation research (Durbin et al. 2001; Arbogast et al. 2007). The expert panel collaboration as part of this project proved invaluable in generating the final list of factors and potential ADAS interventions.

References

- Arbogast, KB, Kent, RW, Menon, RA Ghata, Y, Durbin DR, Rouhana SW. Mechanisms of Abdominal Organ Injury in Seat Belt-Restrained Children. *J Trauma* 2007;62:1473–1480.
- Durbin D, Bhatia E, Holmes J, et al. Partners for child passenger safety: a unique child-specific crash surveillance system. *Accid Anal Prev.* 2001;33:407– 412.

Table A2. Potential ADAS Interventions Across Incident Type (All Crashes)

ADAS	Rear-End	Road Departure	Intersection	Other	Total
AEB	24%	18%	4%	2%	48%
BCS	4%	22%	0%	0%	26%
BSW	1%	0%	1%	1%	3%
BA	7%	3%	4%	2%	16%
CSW	0%	5%	0%	0%	5%
DM	16%	5%	3%	1%	24%
FCW	25%	1%	3%	1%	29%
HSW	1%	7%	0%	0%	8%
IA	0%	0%	6%	1%	6%
LDW/LKA	0%	14%	0%	0%	15%
V2V	22%	1%	8%	7%	38%
V2I	2%	33%	2%	2%	39%
Other	2%	21%	1%	8%	32%

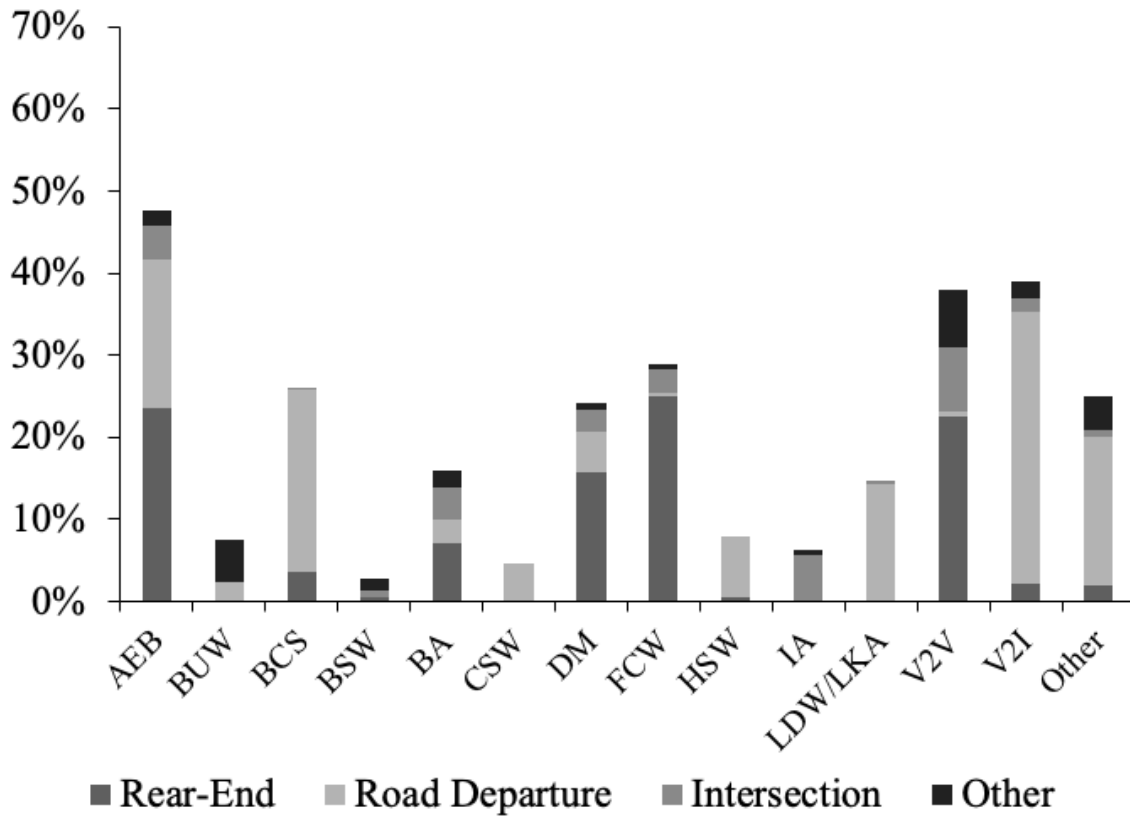


Figure A1. Potential ADAS interventions for *at-fault* SHRP 2 crashes.

Table A3. Potential ADAS Interventions Across Incident Type (Most Severe)

ADAS	Rear-End	Road Departure	Intersection	Pedestrian/Cyclist	Total
AEB	42%	6%	11%	5%	64%
BCS	0%	13%	2%	0%	14%
BSW	3%	0%	2%	0%	5%
BA	20%	0%	9%	2%	31%
CSW	0%	5%	0%	0%	5%
DM	19%	8%	6%	2%	35%
FCW	44%	2%	0%	0%	46%
HSW	3%	11%	0%	0%	14%
IA	0%	0%	13%	3%	16%
LDW/LKA	0%	6%	0%	0%	6%
V2V	36%	0%	20%	0%	56%
V2I	8%	5%	8%	0%	21%
Other	5%	8%	0%	5%	18%

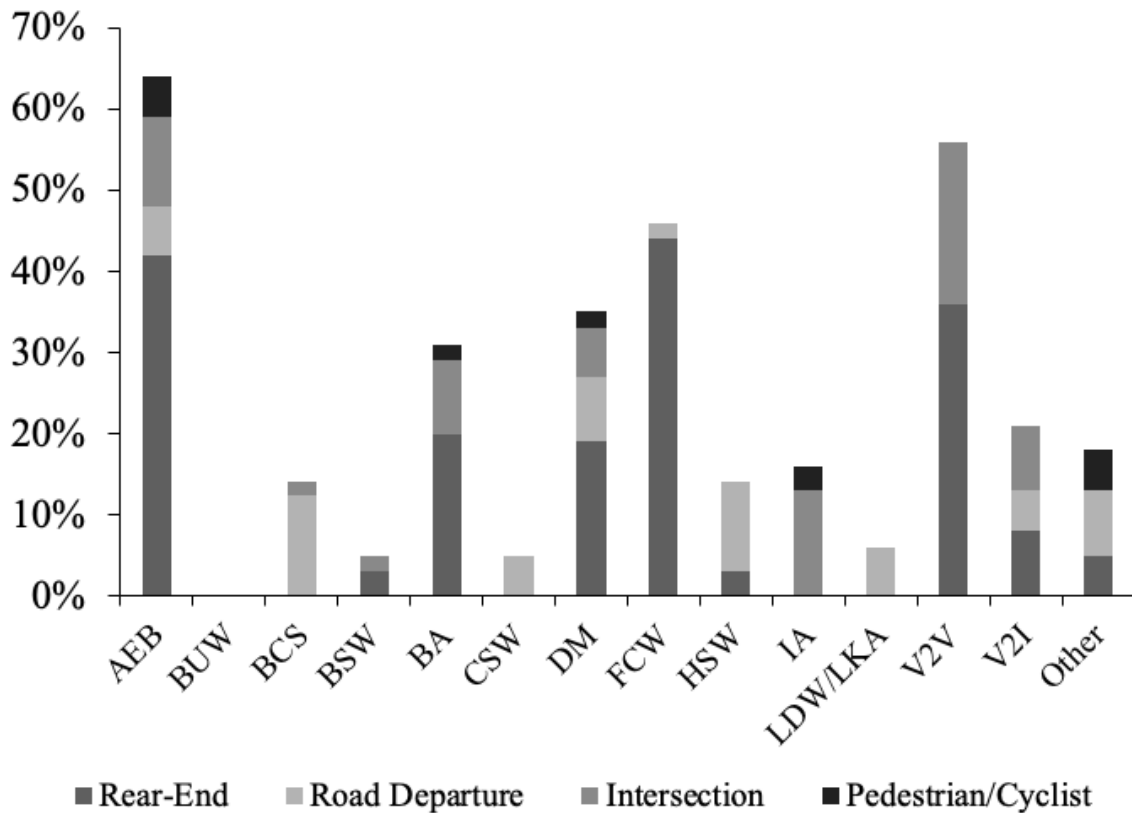


Figure A2. Potential ADAS interventions for *most severe* SHRP 2 crashes.

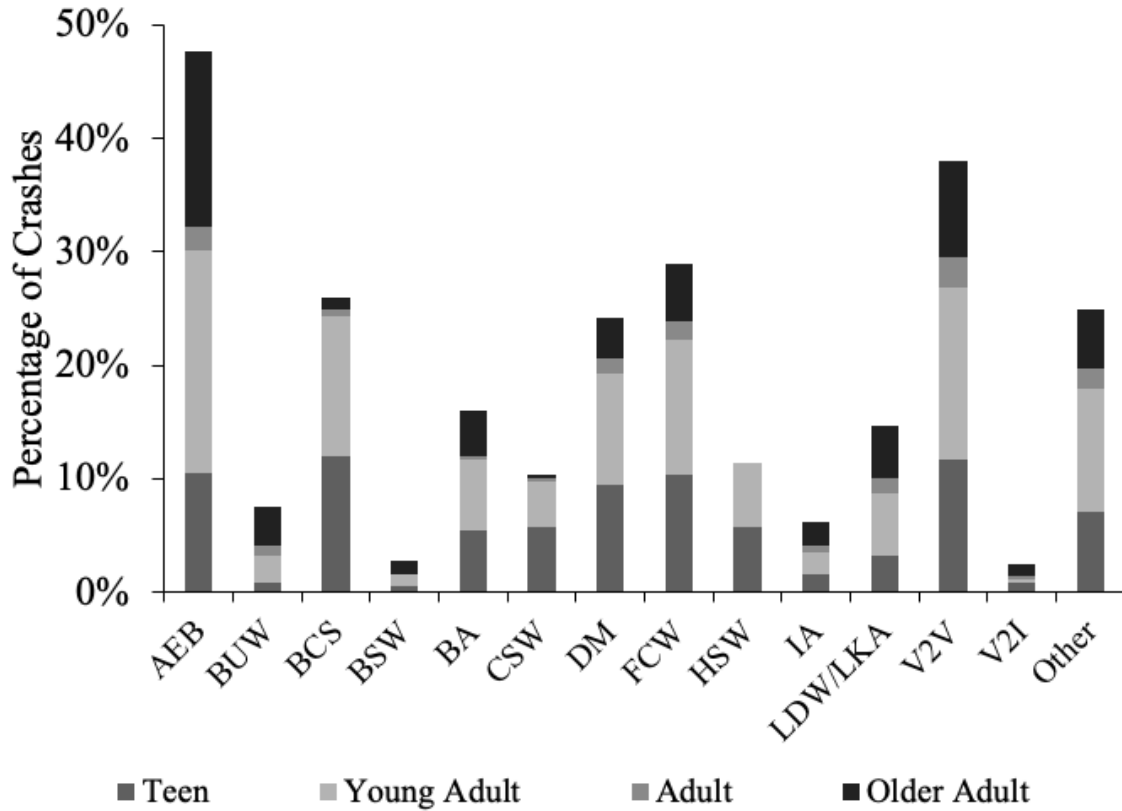


Figure A3. Potential ADAS interventions by age group.