U.S. Department
of Transportation
**National Highway
Traffic Safety
Administration**

www.nhtsa.dot.gov
people saving people

DOT HS 809 901 **August 2005**

Automotive Collision Avoidance System Field Operational Test

Methodology and Results Appendices

This document is available to the public from the National Technical Information Service, Springfield, Virginia 22161

Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT HS 809 901		

4. Title and Subtitle	5. Report Date
Automotive Collision Avoidance System Field Operational Test Methodology and Results Appendices	August 2005
	6. Performing Organization Code
7. Author(s)	8. Performing Organization Report No.
9. Performing Organization Name and Address University of Michigan Transportation Research Institute, 2901 Baxter Rd., Ann Arbor, MI 48109 AND General Motors Research and Development Center, 30500 Mound Road, Warren, MI 48090	10. Work Unit No. (TRAIS) 11. Contract or Grant No. DTNH22-99-H-07019
12. Sponsoring Agency Name and Address National Highway Traffic Safety Administration U.S. Department of Transportation 400 Seventh Street S.W. Washington D.C.	13. Type of Report and Period Covered Final research report 14. Sponsoring Agency Code

15. Supplementary Notes

Work conducted by the University of Michigan Transportation Research Institute under contract and in collaboration with General Motors.

16. Abstract

The Automotive Collision Avoidance System field operational test (or ACAS FOT) project was led by General Motors (with Delphi playing a major supporting role) under a cooperative agreement with the U.S. Department of Transportation. The work conducted by the University of Michigan Transportation Research under this project is the subject of this two-volume report. This work involved developing the FOT methodology, gathering the FOT data, and the analysis and interpretation of this massive dataset. The FOT involved exposing a fleet of 11 ACAS-equipped Buick LeSabre passenger cars to 12 months of naturalistic driving by lay drivers from southeastern Michigan. The ACAS system included both a forward crash warning (FCW) system and an adaptive cruise control (ACC) system. The goal of the FOT was to examine the suitability of the ACAS system for widespread deployment from the perspectives of both driving safety and driver acceptance. Ninety-six drivers participated in the project, with an accumulation of 137,000 miles of driving. Data included over 300 data signals collected at 10 Hz with corresponding samples of video of the forward driving scene and the driver's face. A set of subjective instruments were uses to capture information about the driver and their self-reported tendencies, as well as post-drive questionnaires, interviews (which included video replays of alert experiences), and focus groups. Results indicated that ACC was widely accepted by drivers, whereas the acceptance of FCW was mixed (due to false alarms) and was not found to be significantly related to FCW alert rate. ACC was found to be benign from a traffic safety perspective, with possible benefits resulting from the marked reduction in short (<1 second) headways and reduced passing behavior observed during ACC driving. While incidents were found in which the FCW may have contributed to a timely driver response to an emerging rear-end crash conflict, the frequency or magnitude of such conflicts in manual driving was unchanged when FCW was enabled. In addition, headways in manual driving with FCW enabled were found to increase on freeways and also during daytime driving.

17. Key Word	18. Distribution Statement
Forward crash warning, adaptive cruise control, crash avoidance, crash warning, FCW, ACC, ACAS, longitudinal control, rear-end crash, driver assistance systems	Unrestricted

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
None	None	928	

Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

Table of Contents

Appendices

APPENDIX A

DATA SIGNALS LIST

This appendix contains a listing of all the channels collected by the DAS on the ACAS FOT vehicles. Many of these channels relate directly to fields in the ACAS database. Table erd1.1 has seven columns that are defined as:.

- Id—a unique identification number
- Table—indicates in which table or file are stored and consequently their format and frequency, i.e., 10 Hz, 2 Hz, transition or summary
- Channel Name—a unique name that generally maps into the field name of the relational database
- Type—the size and type of the logged measure
- Units—the units of the channel as logged, where applicable
- Description—a short note that describes the channel in words
- StyleId—a pointer into table erd1.3. StyleId only applies to channels of the data type Byte and is used to relate a number between 0 and 255 with a particular state.

Table erd1.2 defines the histograms that were saved to disk during the FOT. The fields of this table are defined as:

- Id—a unique identification number
- Name—a unique name
- Description—a short note that describes the histogram in words
- SourceName—the name of the source channel that constitutes the histogram
- SortName—the name of the categorical sorting channel. For example, if the source channel is Air-Spring Pressure and the sorting channel is Gear, a separate Air-Spring Pressure histogram will be made of for each value of Gear.
- Center—an example bin-center value
- Width—the bin width value
- Min—the minimum bin value
- Max—the maximum bin value

Table ERD1.1. ACAS DAS Channel list

Id	Table	Name	Type	Units	Description	StyleId
17	AccBraking	Time	Long Integer	csec	Time in centiseconds since das started	0
238	AccBraking	AttainedDecel	Single Float	g's	Attained deceleration	0
163	AccBraking	AccDecelRequested	Single Float	g's	Acc decel requested	0
428	Audio	Audio	Audio	none	Driver voice	0
140	Bytes	SpeedTooHigh	Byte	none	Speed too high	1
444	Bytes	GapSetting	Byte	none	Acc Gap Setting	50
162	Bytes	AbsActive	Byte	none	Abs active	1
161	Bytes	TcActive	Byte	none	Traction control active	1
160	Bytes	AcasDisabled	Byte	none	Acas disabled (i.e. true 1st week)	1
157	Bytes	AutoBrake	Byte	none	Automated braking	11
149	Bytes	HudPosition	Byte	none	Hud position adjustment	11
148	Bytes	HudBrightness	Byte	none	Hud brightness adjust	11
145	Bytes	Comment	Byte	none	Comment button	11
141	Bytes	SlipperyRoad	Byte	none	Slippery road	1
418	Bytes	HUDMute	Byte	none	HUD radio mute command	1
139	Bytes	HeavyRain	Byte	none	Heavy rain	1
123	Bytes	RainRateConf	Byte	none	Rain rate confidence	23
122	Bytes	RoadSurfaceConf	Byte	none	Road surface confidence	23
121	Bytes	DistractionConf	Byte	none	Distraction confidence	23
120	Bytes	RainRate	Byte	none	Rain rate from fusion	26
119	Bytes	RoadSurface	Byte	none	Road surface condition	27
118	Bytes	Distraction	Byte	none	Driver distraction level	25
115	Bytes	LaneChangeConf	Byte	none	Lane change confidence	23
465	Bytes	ThrottleOverride	Byte	none	Throttle Override gated by engaged	1
171	Bytes	AccNotReady	Byte	none	Acc not ready	1
198	Bytes	Bridge	Byte	none	Fusion bridge flag	1
181	Bytes	HudBrightnessEnd	Byte	none	End Hud brightness adjust	11
180	Bytes	HudBrightnessBegin	Byte	none	Begin Hud brightness adjust	11
179	Bytes	HudPositionEnd	Byte	none	End hud position adjustment	11
178	Bytes	HudPositionBegin	Byte	none	Begin hud position adjustment	11
177	Bytes	SWRadioBtnsRel	Byte	none	Steering wheel radio buttons released	11
176	Bytes	SWRadioBtnsPress	Byte	none	Steering wheel radio buttons pressed	11
175	Bytes	SWRadioBtnsActive	Byte	none	Steering wheel radio buttons active	11
441	Bytes	TcSwitch	Byte	none	Traction control switch	11
172	Bytes	AccSpeedLimited	Byte	none	Acc speed limited	1
113	Bytes	LaneChange	Byte	none	Lane change state	24
170	Bytes	AccServiceAcc	Byte	none	Acc service acc	1

Id	Table	Name	Type	Units	Description	StyleId
169	Bytes	AccServiceAlert	Byte	none	Acc service alert	1
168	Bytes	AccCleanSensor	Byte	none	Acc clean sensor	1
412	Bytes	HUDFault	Byte	none	HUD Fault	0
413	Bytes	HUDMessage	Byte	none	HUD lower right message	43
415	Bytes	HUDSetSpeed	Byte	mph	HUD set speed	0
417	Bytes	HUDSensitivityIcon	Byte	none	HUD sensitivity icon	45
419	Bytes	HUDSound	Byte	none	HUD sound	46
173	Bytes	AccTightCurve	Byte	none	Acc tight curve	1
54	Bytes	Dark	Byte	none	Dark sense	1
94	Bytes	Alert	Byte	none	Imminent alert	1
85	Bytes	Sensitivity	Byte	none	FCW sensitivity	40
67	Bytes	Brake	Byte	none	Brake active	11
55	Bytes	TurnSignal	Byte	none	Turn signals	32
53	Bytes	LowTire	Byte	none	Low tire sense	1
52	Bytes	Wipers	Byte	none	Wiper switch state	13
49	Bytes	PRNDL	Byte	none	PRNDL	12
83	Data	FcwTargetId	Byte	none	DVI target Id	0
203	Data	Vp	Single Float	m/sec	Velocity of CIPV	36
67	Data	Brake	Byte	none	Brake active	11
157	Data	AutoBrake	Byte	none	Automated braking	11
17	Data	Time	Long Integer	csec	Time in centiseconds since das started	0
446	Data	TransitionDistance	Byte	m	Road Transition Distance	0
445	Data	TransitionType	Byte	none	Road Transition Type	49
444	Data	GapSetting	Byte	none	Acc Gap Setting	50
76	Data	CIPVRangeRate	Single Float	m/sec	Range rate of closest in-path vehicle	34
86	Data	CIPV	Byte	none	Closest in-path vehicle target id	0
81	Data	FcwAlertLevel	Byte	none	DVI alert level	0
77	Data	CIPVAzimuth	Single Float	deg	Centroid of closest in-path vehicle	35
155	Data	AxFiltered	Single Float	m/sec2	Filtered longitudinal acceleration	0
448	Data	TransitionConfidence	Byte	none	Road Transition Confidence	23
39	Data	Steer	Short Integer	deg	Steering wheel angle	0
165	Data	Engaged	Byte	none	Acc/Ccc active from direct wire	1
457	Data	CIPVStage	Byte	none	Stage of closest in-path vehicle	20
74	Data	DGps	Byte	none	Differential gps flag	1
61	Data	GpsHeading	Single Float	deg	Gps heading	19
60	Data	NumberOfSats	Byte	none	Number of sattelites from Gps	0
59	Data	Longitude	Double Float	deg	Longitude from gps	15
58	Data	Latitude	Double Float	deg	Latitude from gps	15
46	Data	AbsSpeed	Single Float	m/sec	Vehicle speed from abs	36
43	Data	YawRate	Single Float	deg/sec	Yaw rate	0
440	Data	TransSpeed	Single Float	m/sec	Speed from transmission	36

Id	Table	Name	Type	Units	Description	StyleId
38	Data	Throttle	Single Float	%	Throttle opening	0
195	Data	FcwActive	Byte	none	Fcw active	1
394	Data	SystemHealth	Byte	none	ACAS system health	52
75	Data	CIPVRange	Single Float	m	Range to cosest in-path vehicle	33
134	Data	FcwRange	Single Float	m	DVI target range	33
104	Data	LaneGeoSource	Byte	none	Lane geometry source bitmap - 1=Yaw, 2=Map, 4=Vision, 8=Scene Tracker, 16=Predictive	0
103	Data	FarValidity	Byte	m	Far-range validity distance	0
102	Data	NearValidity	Byte	m	Near-range validity distance	0
521	Data	Headway	Single Float	sec	Headway = CIPVRange/TransSpeed	0
101	Data	FarConf	Byte	none	Far-range geometry confidence	23
125	Data	RadarIndex	Long Integer	none	Extended radar scan index	0
126	Data	ThreatIndex	Long Integer	none	Extended threat scan index	0
127	Data	TargetIndex	Long Integer	none	Extended target selection scan index	0
85	Data	Sensitivity	Byte	none	FCW sensitivity	40
133	Data	FcwTargetType	Byte	none	Fcw target type	30
459	Data	FcwStage	Byte	none	Stage of Fcw object	20
135	Data	FcwRangeRate	Single Float	m/sec	Range rate of dvi target	34
136	Data	FcwAzimuth	Single Float	deg	Centroid of dvi target	35
137	Data	Distance	Single Float	m	Trip distance	0
92	Data	C2	Single Float	1/m2	C2 from data fusion	0
88	Data	CIPS	Byte	none	Closest in-path stationary target id	0
90	Data	C0	Single Float	1/m	C0 from data fusion	0
91	Data	C1	Single Float	1/m2	C1 from data fusion	0
143	Data	FcwSubAlgorithm	Byte	none	Fcw sub algorithm	31
487	Data	RoadClass	Byte	none	Functional Road Class	55
99	Data	NearConf	Byte	none	Near-range geometry confidence	23
312	DFTh	LaneChangeSource	Byte	none	Lane change source	0
314	DFTh	FusionSceneOffsetConf	Byte	none	Scene tracker offset confidence from fusion	23
334	DFTh	CIPVRangeThreat	Byte	m	CIPV range from threat assessment	0
333	DFTh	NhtsaTargetType	Byte	none	Nhtsa target type	30
332	DFTh	FcwSubTargetId	Byte	none	Fcw sub algorithm target id	0
331	DFTh	AlertLevelAlgorithm2	Byte	none	Alert level algorithm 2	0
315	DFTh	FusionSceneOffset	Single Float	m	Scene tracker offset from fusion	0
211	DFTh	YawOk	Byte	none	Yaw health from Data fusion status	1
330	DFTh	ThreatCount	Long Integer	none	Threat sequence counter	0
217	DFTh	SensorOk	Byte	none	Sensor Ok from threat assessment status	1
214	DFTh	SceneOk	Byte	none	Scene-tracker health from Data fusion status	1
325	DFTh	RadarInputsOk	Byte	none	Radar inputs okay for threat assessment	1
213	DFTh	VisionOk	Byte	none	Vison health from Data fusion status	1
327	DFTh	SystemOk	Byte	none	System Ok from threat assessment status	1

Id	Table	Name	Type	Units	Description	StyleId
326	DFTh	FusionInputsOk	Byte	none	Fusion inputs okay for threat assessment	1
216	DFTh	DVIOk	Byte	none	DVI Ok from threat assesment status	1
218	DFTh	ThreatOk	Byte	none	Threat assesment Ok from threat assesment status	1
329	DFTh	FcwAlgorithm	Byte	none	Algorithm used from threat assessment	0
328	DFTh	ShowVehicleIcon	Byte	none	Show Vehicle Detected Icon	1
212	DFTh	MapOk	Byte	none	Map health from Data fusion status	1
324	DFTh	TargetInputsOk	Byte	none	Target selected inputs Ok	1
249	DFTh	DVICounter	Long Integer	none	DVI sequence counter	0
215	DFTh	FusionOk	Byte	none	Fusion health from Data fusion status	1
475	DFTh	Gmr1AlertLevel	Byte	none	Gmr1 alert level	0
111	DFTh	HeadingConf	Byte	none	Heading in lane confidence	23
112	DFTh	LaneWidthConf	Byte	none	Lane width confidence	23
108	DFTh	LaneWidth	Single Float	m	Lane width	0
107	DFTh	HeadingInLane	Single Float	deg	Vehicle heading angle in lane - positive = going right	0
106	DFTh	LaneOffset	Single Float	m	Host offset from lane center - positive = right	0
129	DFTh	NhtsaAlertLevel	Byte	none	NHTSA algorithm alert level	0
131	DFTh	NhtsaTargetId	Byte	none	NHTSA algoritm target id	0
93	DFTh	ThreatIndexRaw	Long Integer	none	Threat assessment scan index	0
479	DFTh	Gmr1SubAlgorithm	Byte	none	Gmr1 sub algorithm	31
308	DFTh	MessageStatus	Byte	none	New message bitmap - 1=Yaw, 2=Map, 4=Vision, 8=Scene Tracker, 16=Predictive	0
477	DFTh	Gmr1TargetId	Byte	none	Gmr1 algoritm target id	0
311	DFTh	HeadingSource	Byte	none	Vehicle heading source	0
466	DFTh	NhtsaSubAlgorithm	Byte	none	Nhtsa sub algorithm	31
144	DFTh	Rca	Byte	m	Fcw imminent alert range threshold	0
449	DFTh	ShowNeedsService	Byte	none	Show Needs Service Soon	1
305	DFTh	FusionCounter	Long Integer	none	Fusion sequence counter	0
335	DFTh	RangeOnset	Byte	m	Range onset from threat assessment	0
416	DFTh	HUDVehicleIcon	Byte	none	HUD vehicle icon	44
414	DFTh	HUDSpeed	Byte	mph	HUD vehicle speed	0
110	DFTh	LaneOffsetConf	Byte	none	Lane offset confidence	23
310	DFTh	OffsetSource	Byte	none	Lateral offset source	0
17	DFTh	Time	Long Integer	csec	Time in centiseconds since das started	0
478	DFTh	Gmr1TargetType	Byte	none	Gmr1 target type	30
40	Doubles	Odometer	Double Float	m	Odometer reading	48
209	Face	VideoTime	Long Integer	csec	Time of video system	0
372	Face	FaceVideo	Video	none	Driver face video	0
164	Floats	SetSpeed	Single Float	m/sec	Acc/Ccc set speed	36
41	Floats	OutsideTemperature	Single Float	deg C	Outside air temperature	0
209	Forward	VideoTime	Long Integer	csec	Time of video system	0
205	Forward	ForwardVideo	Video	none	Forward scene camera	0

Id	Table	Name	Type	Units	Description	StyleId
281	Map	Geometry110	Single Float	m	Forward road geometry 110 m	0
278	Map	Geometry80	Single Float	m	Forward road geometry 80 m	0
291	Map	Uncertainty90	Single Float	m	Forward road geometry uncertainty 90 m	0
282	Map	Geometry120	Single Float	m	Forward road geometry 120 m	0
275	Map	Geometry50	Single Float	m	Forward road geometry 50 m	0
283	Map	Uncertainty10	Single Float	m	Forward road geometry uncertainty 10 m	0
284	Map	Uncertainty20	Single Float	m	Forward road geometry uncertainty 20 m	0
285	Map	Uncertainty30	Single Float	m	Forward road geometry uncertainty 30 m	0
286	Map	Uncertainty40	Single Float	m	Forward road geometry uncertainty 40 m	0
287	Map	Uncertainty50	Single Float	m	Forward road geometry uncertainty 50 m	0
288	Map	Uncertainty60	Single Float	m	Forward road geometry uncertainty 60 m	0
289	Map	Uncertainty70	Single Float	m	Forward road geometry uncertainty 70 m	0
290	Map	Uncertainty80	Single Float	m	Forward road geometry uncertainty 80 m	0
279	Map	Geometry90	Single Float	m	Forward road geometry 90 m	0
257	Map	GpsUsed	Byte	none	True if new data this sequence	1
267	Map	Paved	Byte	none	On paved road	1
268	Map	ConsecutiveMapMatch	Byte	none	Number of consecutive map match	0
269	Map	GeometryBasis	Byte	none	Forward road geometry source	22
271	Map	Geometry10	Single Float	m	Forward road geometry 10 m	0
265	Map	LimitedAccess	Byte	none	On limited access road	1
264	Map	Tunnel	Byte	none	In tunnel	1
263	Map	OnBridge	Byte	none	On bridge	1
262	Map	Ramp	Byte	none	On ramp	1
277	Map	Geometry70	Single Float	m	Forward road geometry 70 m	0
258	Map	DGpsUsed	Byte	none	True if new data this sequence	1
276	Map	Geometry60	Single Float	m	Forward road geometry 60 m	0
256	Map	WheelSpeedData	Byte	none	True if new data this sequence	1
255	Map	OdometerUsedMap	Byte	none	True if new data this sequence	1
254	Map	YawUsedMap	Byte	none	True if new data this sequence	1
251	Map	MapCounter	Long Integer	none	Map sequence counter	0
17	Map	Time	Long Integer	csec	Time in centiseconds since das started	0
272	Map	Geometry20	Single Float	m	Forward road geometry 20 m	0
273	Map	Geometry30	Single Float	m	Forward road geometry 30 m	0
274	Map	Geometry40	Single Float	m	Forward road geometry 40 m	0
266	Map	SurfaceStreet	Byte	none	On surface street	1
259	Map	NavTech	Byte	none	True if new data this sequence from Map	1
303	Map	DistanceToIntersection	Single Float	m	Distance to intersection	0
485	Map	SegmentRank	Byte	none	Map segment rank	53
486	Map	LinkClass	Byte	none	Map link class	54
292	Map	Uncertainty100	Single Float	m	Forward road geometry uncertainty 100 m	0
280	Map	Geometry100	Single Float	m	Forward road geometry 100 m	0

Id	Table	Name	Type	Units	Description	StyleId
304	Map	Classification	Byte	none	Forward road geometry classification	41
302	Map	DistanceToTJunction	Single Float	m	Distance to T-junction	0
301	Map	DistanceToTunnel	Single Float	m	Distance to tunnel	0
296	Map	DistanceToCurveEnd	Byte	m	Distance to end of curve	0
293	Map	Uncertainty110	Single Float	m	Forward road geometry uncertainty 110 m	0
294	Map	Uncertainty120	Single Float	m	Forward road geometry uncertainty 120 m	0
295	Map	DistanceToCurve	Byte	m	Distance to curve	0
300	Map	DistanceToFork	Single Float	m	Distance to fork	0
297	Map	Curvature	Byte	m	Radius of curvature	0
298	Map	ValidPoints	Byte	none	Number of valid points	0
299	Map	DistanceToOverpass	Single Float	m	Distance to overpass	0
17	RawDvi	Time	Long Integer	csec	Time in centiseconds since das started	0
69	RawDvi	DVI	Can Packet	none	Can message from DVI	0
68	RawFusion	Fusion	Can Sequential	none	Data fusion messages 0x0C1 - 0x0C4	0
17	RawFusion	Time	Long Integer	csec	Time in centiseconds since das started	0
250	RawMap	Map	Can Sequential	none	Map geometry packets 0xA1 - 0xAD	0
17	RawMap	Time	Long Integer	csec	Time in centiseconds since das started	0
47	RawRadar	RadarMessage	Can Indexed	none	40 packet radar message	0
125	RawRadar	RadarIndex	Long Integer	none	Extended radar scan index	0
17	RawRadar	Time	Long Integer	csec	Time in centiseconds since das started	0
17	RawScene	Time	Long Integer	csec	Time in centiseconds since das started	0
71	RawScene	Scene	Can Packet	none	Scene tracking can packet	0
228	RawSensor	Sensor	Can Sequential	none	Sensor message	0
17	RawSensor	Time	Long Integer	csec	Time in centiseconds since das started	0
70	RawTarget	TargetSelection	Can Sequential	none	Target selection message 0x100	0
17	RawTarget	Time	Long Integer	csec	Time in centiseconds since das started	0
17	RawThreat	Time	Long Integer	csec	Time in centiseconds since das started	0
66	RawThreat	ThreatAssessment	Can Sequential	none	Threat Assessment packets 0x161 -0x164	0
17	RawVision	Time	Long Integer	csec	Time in centiseconds since das started	0
72	RawVision	Vision	Can Packet	none	Vision can packet 0x481	0
400	Sensor	YawRateHealth	Byte	none	Yaw Rate health	58
244	Sensor	AccReqDecelQbit	Byte	none	Acc requested decel Q bit	1
406	Sensor	MapDataHealth	Byte	none	Map database health	58
405	Sensor	MapMatchHealth	Byte	none	Map matching health	58
404	Sensor	MapINSHealth	Byte	none	Map INS health	58
403	Sensor	ThreatHealth	Byte	none	Threat health	58
402	Sensor	TargetHealth	Byte	none	Target selection health	58
42	Sensor	BatteryVoltage	Single Float	volts	Battery voltage	18

Id	Table	Name	Type	Units	Description	StyleId
408	Sensor	SceneHealth	Byte	none	Scene health	58
63	Sensor	GpsSpeed	Single Float	m/sec	Speed from gps	36
167	Sensor	AccAlert	Byte	none	Acc alert from direct wire	1
399	Sensor	GpsHealth	Byte	none	Gps health	58
34	Sensor	BrakeStatus	Byte	none	Brake status byte	0
37	Sensor	AzPtoP	Single Float	g's	Peak-to-peak vertical acceleration from ABS	0
398	Sensor	AccelerometerHealth	Byte	none	Accelerometer health	58
397	Sensor	RadarHealth	Byte	none	Radar health	58
396	Sensor	Class2Health	Byte	none	Class 2 health	58
395	Sensor	SensorAtoDHealth	Byte	none	Sensor a/d and direct i/o health	58
17	Sensor	Time	Long Integer	csec	Time in centiseconds since das started	0
45	Sensor	Ax	Single Float	m/sec2	Longitudinall acceleration, positive forward	16
401	Sensor	FusionHealth	Byte	none	Fusion health	58
239	Sensor	GpsWeek	Long Integer	none	Gps week from sensor	0
158	Sensor	ExtendedBrake	Byte	none	Extended brake switch	11
44	Sensor	Ay	Single Float	m/sec2	Lateral acceleration, positive right	16
242	Sensor	BrakeFailure	Byte	none	Brake controller malfunction	1
407	Sensor	VisionHealth	Byte	none	Vision health	58
240	Sensor	GpsTime	Long Integer	msec	Gps millisecs in week from sensor	0
154	Sensor	Az	Single Float	m/sec2	Vertical acceleration, positive down	0
156	Sensor	VDot	Single Float	m/sec2	Delta vehicle speed	0
237	Sensor	Class2	Byte	none	True if new data this sequence	1
236	Sensor	OdometerUsedSensor	Byte	none	True if new data this sequence	1
235	Sensor	VelocityUsed	Byte	none	True if new data this sequence	1
234	Sensor	AxUsed	Byte	none	True if new data this sequence	1
233	Sensor	YawUsedSensor	Byte	none	True if new data this sequence	1
232	Sensor	GpsUsedSensor	Byte	none	True if new data this sequence	1
230	Sensor	SensorCounter	Long Integer	none	Sensor sequence number	0
166	Sensor	AccDetect	Byte	none	Acc detect vehicle ahead	1
241	Sensor	AccAlertReady	Byte	none	Acc alert ready	1
464	STV	CIPSXolc	Single Float	m	CIPS lateral offset	0
368	STV	VisionError	Byte	none	Vision error other	1
463	STV	CIPVXolc	Single Float	m	CIPV lateral offset	0
128	STV	TargetIndexRaw	Long Integer	none	Target selection scan index	0
124	STV	PIPT	Short Integer	none	PIPT bitmap	0
343	STV	SceneC0	Single Float	1/m	C0 from scene tracking	0
370	STV	VisionVideoError	Byte	none	Vision video working	1
354	STV	SceneOperational	Byte	none	Scene-tracker health	1
353	STV	SceneTargets	Byte	none	Number of targets used in scene tracking	0
352	STV	SceneHeadingConf	Byte	none	Heading confidence from scene tracking	23
351	STV	SceneLaneOffsetConf	Byte	none	Offset confidence from scene tracking	23

Id	Table	Name	Type	Units	Description	StyleId
350	STV	SceneLaneChangeConf	Byte	none	Lane change confidence from scene tracking	23
349	STV	SceneLaneChange	Byte	none	Lane change state from scene tracking	24
348	STV	SceneC1Conf	Byte	none	C1 confidence from scene tracking	23
347	STV	SceneC0Conf	Byte	none	C0 confidence from scene tracking	23
346	STV	VisionC0	Single Float	1/m	C0 from vision	0
355	STV	SceneRadarError	Byte	none	Radar target message error in scene tracking	1
344	STV	SceneC1	Single Float	1/m2	C1 from scene tracking	0
356	STV	SceneConfX	Byte	none	X confidence from scene tracking	23
342	STV	MaxRange	Byte	m	Maximum valid road geometry range from scene tracking	0
341	STV	SceneHeading	Single Float	deg	Vehicle heading angle in lane - positive = going right	0
340	STV	SceneLaneOffset	Single Float	m	Host offset from lane center - positive = right	0
323	STV	GeometrySource	Byte	none	Road geometry source used in target selection	42
322	STV	RoadOk	Byte	none	Valid road state data in target selection	1
321	STV	HostOk	Byte	none	Valid host state data in target selection	1
320	STV	VehicleOk	Byte	none	Valid vehicle data in target selection	1
319	STV	RadarOk	Byte	none	Valid radar data in target selection	1
318	STV	TargetOk	Byte	none	Target ok flag	1
316	STV	TargetCount	Long Integer	none	Sequence number for target	0
345	STV	VisionC1	Single Float	1/m2	C1 from vision	0
366	STV	VisionLaneChange	Byte	none	Lane change state from vision	24
369	STV	VisionVehicleError	Byte	none	Vision kinematic error	1
367	STV	VisionOperational	Byte	none	Vision health	1
365	STV	VisionZone2Conf	Byte	none	Zone2 confidence from vision	23
364	STV	VisionZone1Conf	Byte	none	Zone1 confidence from vision	23
363	STV	VisionHeadingConf	Byte	none	Heading confidence from vision	23
362	STV	VisionLaneOffsetConf	Byte	none	Offset confidence from vision	23
359	STV	VisionLaneOffset	Single Float	m	Host offset from lane center - positive = right	0
360	STV	VisionHeading	Single Float	deg	Vehicle heading angle in lane - positive = going right	0
361	STV	VisionLaneWidth	Single Float	m	Lane width from vision	0
17	STV	Time	Long Integer	csec	Time in centiseconds since das started	0
528	Summary	HudPositionCount	Long Integer	none	Hud Position Count	0
534	Summary	RangeHist	FloatHistogram	none	Range histogram	0
527	Summary	OutsideTemperatureHist	FloatHistogram	none	Outside temperature Histogram	0
535	Summary	SpeedHist	FloatHistogram	none	Trans Speed histogram	0
526	Summary	TransitionTypeSpeedHist	CategoryHistogram	none	Transition Type Histogram	0
525	Summary	VehicleIconSpeedHist	CategoryHistogram	none	HUD Vehicle Icon Histogram	0
524	Summary	SensitivityCount	Long Integer	none	Sensitivity setting transitions	0
522	Summary	GapCount	Long Integer	none	Gap setting transitions	0
540	Summary	SteerSpeedHist	FloatHistogram	none	Steer and speed histogram	0
539	Summary	YawRateSpeedHist	FloatHistogram	none	Yaw rate and speed histogram	0

Id	Table	Name	Type	Units	Description	StyleId
529	Summary	HudBrightnessCount	Long Integer	none	Hud Brightness Count	0
541	Summary	SetSpeedHist	FloatHistogram	none	Set speed histogram	0
537	Summary	DasVoltageHist	FloatHistogram	none	Das Voltage Hist	0
536	Summary	BatteryVoltageHist	FloatHistogram	none	Battery Voltage Hist	0
523	Summary	HudMessageHist	CategoryHistogram	none	Hud Message Histogram	0
557	Summary	FarConfHist	CategoryHistogram	none	Far confidence histogram	0
565	Summary	AxFilteredHist	FloatHistogram	none	Ax filtered histogram	0
22	Summary	TripStart	Double Float	none	Absolute date/time corresponding to test time = 0 in access date/time format	0
564	Summary	RoadSurfaceHist	CategoryHistogram	none	Road surface histogram	0
563	Summary	LaneChangeHist	CategoryHistogram	none	Lane change histogram	0
40	Summary	Odometer	Double Float	m	Odometer reading	48
562	Summary	RainRateHist	CategoryHistogram	none	Rain rate histogram	0
520	Summary	DarkHist	CategoryHistogram	none	Dark histogram	0
560	Summary	LaneOffsetConfHist	CategoryHistogram	none	Lane offset confidence histogram	0
561	Summary	DistractionHist	CategoryHistogram	none	Driver distraction histogram	0
558	Summary	NearConfHist	CategoryHistogram	none	Near confidence histogram	0
542	Summary	PrndlHist	CategoryHistogram	none	Prndl histogram	0
556	Summary	AlertCount	Long Integer	none	Count of imminent alerts	0
555	Summary	CrashIconCount	Long Integer	none	Count of Crash Icons	0
554	Summary	ImminentSoundCount	Long Integer	none	Count of Imminent Sounds	0
550	Summary	StationaryTargetsHist	CategoryHistogram	none	Stationary Targets Histogram	0
549	Summary	MovingTargetsHist	CategoryHistogram	none	Moving Targets Histogram	0
548	Summary	StoppedTargetsHist	CategoryHistogram	none	Stopped Targets Histogram	0
547	Summary	AllTargetsHist	CategoryHistogram	none	All Targets Histogram	0
546	Summary	BridgeTargetsHist	CategoryHistogram	none	Bridge Targets Histogram	0
559	Summary	HeadingConfHist	CategoryHistogram	none	Heading confidence histogram	0
190	Summary	LastLongitude	Double Float	deg	Last Longitude where NumberOfSats >=3	15
137	Summary	Distance	Single Float	m	Trip distance	0
160	Summary	AcasDisabled	Byte	none	Acas disabled (i.e. true 1st week)	1
484	Summary	SystemHealthHist	CategoryHistogram	none	System Health Histogram	0
567	Summary	HardBrakeCount	Long Integer	none	Count of hard brake events	0
568	Summary	SpeedRoadHist	FloatHistogram	none	Trans Speed and road class histogram	0
443	Summary	DriverControlRequiredCount	Long Integer	none	Count of Driver Control Required	0
426	Summary	TrunkTemperatureHist	FloatHistogram	none	Trunk temperature Histogram	0
425	Summary	ChassisTemperatureHist	FloatHistogram	none	Chassis temperature Histogram	0
185	Summary	AutoAlignMin	Single Float	deg	Minimum auto alignment angle	0
186	Summary	AutoAlignMax	Single Float	deg	Maximum auto alignment angle	0
519	Summary	BrakeCount	Long Integer	none	Count of manual brake applications	0
189	Summary	LastLatitude	Double Float	deg	Last Latitude where NumberOfSats >=3	15

Id	Table	Name	Type	Units	Description	StyleId
492	Summary	SensitivityRoadHist	CategoryHistogram	none	Sensitivity by road class histogram	0
191	Summary	DistanceEngaged	Single Float	m	Distance engaged	0
192	Summary	DistanceWipers	Single Float	m	Distance with wipers on	0
193	Summary	DistanceDark	Single Float	m	Distance in the dark	0
194	Summary	DistanceFcwActive	Single Float	m	Distance with Fcw active	0
196	Summary	LastTime	Long Integer	csec	Last time for test	0
197	Summary	Engagements	Long Integer	none	Count of enagagements	0
385	Summary	AutoBrakeCount	Long Integer	none	Count of auto brake events	0
200	Summary	FirstCount	Long Integer	none	First sequence count from threat assesment	0
201	Summary	WarmStart	Byte	none	True if ignition happened with the das running	1
202	Summary	CommentCount	Long Integer	none	Comment count	0
371	Summary	FirstTime	Long Integer	csec	First time for test	0
187	Summary	AutoAlignAverage	Single Float	deg	Average auto alignment angle	0
508	Summary	TargetHealthHist	CategoryHistogram	none	Target health counts	0
518	Summary	WiperHist	CategoryHistogram	none	Wiper Histogram	0
517	Summary	AccCleanSensorCount	Long Integer	none	Count of Acc clean sensor	0
516	Summary	TcSwitchHist	CategoryHistogram	none	Traction control histogram	0
515	Summary	TcSwitchCount	Long Integer	none	Count of traction control switch	0
514	Summary	TcCount	Long Integer	none	Count of traction control events	0
513	Summary	AbsCount	Long Integer	none	Count of abs events	0
512	Summary	MapMatchHealthHist	CategoryHistogram	none	Map Matchhealth counts	0
511	Summary	MapDataHealthHist	CategoryHistogram	none	Map Data health counts	0
510	Summary	MapINSHealthHist	CategoryHistogram	none	MapINS health counts	0
509	Summary	ThreatHealthHist	CategoryHistogram	none	Threat health counts	0
493	Summary	GapRoadHist	CategoryHistogram	none	Gap by road class Histogram	0
502	Summary	Class2HealthHist	CategoryHistogram	none	Class2 health counts	0
497	Summary	GapSpeedHist	CategoryHistogram	none	Gap by speedHistogram	0
499	Summary	VisionHealthHist	CategoryHistogram	none	Vision health counts	0
501	Summary	SensorAtoDHealthHist	CategoryHistogram	none	SensorAtoD health counts	0
507	Summary	FusionHealthHist	CategoryHistogram	none	Fusion health counts	0
503	Summary	RadarHealthHist	CategoryHistogram	none	Radar health counts	0
504	Summary	AccelerometerHealthHist	CategoryHistogram	none	Accelerometer health counts	0
505	Summary	GpsHealthHist	CategoryHistogram	none	Gps health counts	0
506	Summary	YawRateHealthHist	CategoryHistogram	none	YawRate health counts	0
500	Summary	SceneHealthHist	CategoryHistogram	none	Scene health counts	0
530	Summary2	HtmEngagedHist	FloatHistogram	none	Headway time margin histogram - ccc/acc	0
491	Summary2	RRDotEngagedHist	FloatHistogram	none	Range Rate Histogram - engaged	0
531	Summary2	HtmNotEngagedHist	FloatHistogram	none	Headway time margin histogram - not ccc/acc	0
498	Summary2	RangeSpeedHist	FloatHistogram	none	Range and speed histogram	0
569	Summary2	RRDotNotEngagedHist	FloatHistogram	none	Range Rate Histogram - not engaged	0
17	TimeChec	Time	Long Integer	csec	Time in centiseconds since das started	0

Id	Table	Name	Type	Units	Description	StyleId
	k					
209	TimeCheck	VideoTime	Long Integer	csec	Time of video system	0
462	Versions	TargetAlgorithmVersion	Byte	none	Target Algorithm Version	0
461	Versions	TargetApplicationVersion	Byte	none	Target Application Version	0
460	Versions	TargetVehicleVersion	Byte	none	Target Vehicle Version	0
152	Versions	SensorVersion	Byte	none	Sensor module software version	0
153	Versions	SystemVersion	Byte	none	ACAS system version	0
455	Versions	DspVersionMinor	Byte	none	Radar Dsp Version minor	0
454	Versions	DspVersionMajor	Byte	none	Radar Dsp Version major	0
453	Versions	RadarMasterFld	Byte	none	Radar Master Version Fld	0
452	Versions	RadarMasterPro	Byte	none	Radar Master Version Pro	0
451	Versions	RadarMasterRel	Byte	none	Radar Master Version Rel	0
245	Versions	DviVersion	Byte	none	DVI software version	0
456	Versions	DspVersionDevelop	Byte	none	Radar Dsp Version Develop	0

Table erd1.2. Histograms created by the DAS

Id	Name	SourceName	SortName	Center	Width	Min	Max
425	ChassisTemperatureHist	ChassisTemperature		0	5	-40	60
426	TrunkTemperatureHist	TrunkTemperature		0	5	-40	60
491	RRDotEngagedHist	CIPVRange	RangeRateCategory	5	5	5	125
498	RangeSpeedHist	CIPVRange	SpeedCategory	5	5	5	125
527	OutsideTemperatureHist	OutsideTemperature		0	5	-40	60
530	HtmEngagedHist	Headway	SpeedCategory	2	.1	.3	3
531	HtmNotEngagedHist	Headway	SpeedCategory	2	.1	.3	3
534	RangeHist	CIPVRange	Engaged	5	5	5	125
535	SpeedHist	TransSpeed	Engaged	1	1	1	40
536	BatteryVoltageHist	BatteryVoltage		12	.5	11	15
537	DasVoltageHist	Vin		12	.5	11	15
539	YawRateSpeedHist	YawRate	SpeedCategory	2	2	-20	20
540	SteerSpeedHist	SteerFloat	SpeedCategory	0	2	-20	20
541	SetSpeedHist	SetSpeed		10	1	10	36
565	AxFilteredHist	AxFiltered	Engaged	0	.2	-6	3
568	SpeedRoadHist	TransSpeed	RoadClass	1	1	1	40
569	RRDotNotEngagedHist	CIPVRange	RangeRateCategory	5	5	5	125

Table ERD1.3. Style id definitions

Id	StyleName	Value	CategoryName
1	TrueFalse	0	False
1	TrueFalse	1	True
11	OnOff	0	Off
11	OnOff	1	On
12	PRNDL	0	Unknown
12	PRNDL	1	Park
12	PRNDL	2	Reverse
12	PRNDL	3	Neutral
12	PRNDL	4	OverDrive
12	PRNDL	6	Drive1
12	PRNDL	7	Drive2
12	PRNDL	8	Drive3
12	PRNDL	9	Drive
13	Wiper	0	Off
13	Wiper	1	Delay5
13	Wiper	2	Delay4
13	Wiper	3	Delay3
13	Wiper	4	Delay2
13	Wiper	5	Delay1
13	Wiper	6	Low
13	Wiper	7	High

Id	StyleName	Value	CategoryName
20	Stages	0	Invalid
20	Stages	1	1st
20	Stages	2	2nd
20	Stages	3	Mature
20	Stages	4	Coasted
20	Stages	5	Merged
20	Stages	6	Killed
22	GeometrySources	0	None
22	GeometrySources	1	GPS
22	GeometrySources	2	DeadReckoning
22	GeometrySources	3	GPS&DeadRec
23	Confidences	0	None
23	Confidences	1	Low
23	Confidences	2	Medium
23	Confidences	3	High
24	LaneChangeStates	0	None
24	LaneChangeStates	1	Change Right
24	LaneChangeStates	2	Change Left
25	DistractionLevels	0	None
25	DistractionLevels	1	Low
25	DistractionLevels	2	Medium
25	DistractionLevels	3	High
26	RainRates	0	None
26	RainRates	1	Low
26	RainRates	2	Medium
26	RainRates	3	High
27	SurfaceConditions	0	None
27	SurfaceConditions	1	Low
27	SurfaceConditions	2	Medium
27	SurfaceConditions	3	High
30	TargetTypes	0	Invalid
30	TargetTypes	1	CIPV
30	TargetTypes	2	CIPS
30	TargetTypes	3	PIHP
31	SubAlgoritms	0	Fcw inhibit
31	SubAlgoritms	1	Closing target
31	SubAlgoritms	2	Tailgating
31	SubAlgoritms	3	Acc max decel
32	TurnSignals	0	None
32	TurnSignals	1	Left
32	TurnSignals	2	Right
32	TurnSignals	3	Both
40	Sensitivities	1	s1

Id	StyleName	Value	CategoryName
40	Sensitivities	2	s2
40	Sensitivities	3	s3
40	Sensitivities	4	s4
40	Sensitivities	5	s5
40	Sensitivities	6	s6
41	GeometryClassification	0	NoMapMatch
41	GeometryClassification	1	Unknown
41	GeometryClassification	10	GentleCurveToStraight
41	GeometryClassification	11	SharpCurveToStraight
41	GeometryClassification	2	Straight
41	GeometryClassification	3	StraightToStraight
41	GeometryClassification	4	StraightToGentleCurve
41	GeometryClassification	5	StraightToSharpCurve
41	GeometryClassification	6	StraightToSCurve
41	GeometryClassification	7	GentleCurve
41	GeometryClassification	8	SharpCurve
41	GeometryClassification	9	Scurve
42	TargetGeoSources	0	Yaw
42	TargetGeoSources	1	Fusion
43	DVIMessages	0	Blank
43	DVIMessages	1	Malfunction
43	DVIMessages	2	DriverControlRequired
43	DVIMessages	3	SetSpeed
43	DVIMessages	4	SharpCurve
43	DVIMessages	5	SpeedTooFast
43	DVIMessages	6	DirtyRadar
43	DVIMessages	7	HeavyRain
43	DVIMessages	8	Slippery
43	DVIMessages	9	NeedsService
44	Icons	0	Blank
44	Icons	1	Cyan
44	Icons	2	Amber2
44	Icons	3	Amber3
44	Icons	4	Amber4
44	Icons	5	Amber5
44	Icons	6	Crash
45	SensitivityIcons	0	Blank
45	SensitivityIcons	1	FCW-1
45	SensitivityIcons	10	ACC-4
45	SensitivityIcons	11	ACC-5
45	SensitivityIcons	12	ACC-6
45	SensitivityIcons	2	FCW-2
45	SensitivityIcons	3	FCW-3

Id	StyleName	Value	CategoryName
45	SensitivityIcons	4	FCW-4
45	SensitivityIcons	5	FCW-5
45	SensitivityIcons	6	FCW-6
45	SensitivityIcons	7	ACC-1
45	SensitivityIcons	8	ACC-2
45	SensitivityIcons	9	ACC-3
46	Sounds	0	none
46	Sounds	1	Imminent
46	Sounds	2	Message
49	Transitions	0	Unknown
49	Transitions	1	Straight
49	Transitions	2	Curve
49	Transitions	3	StraightToCurve
49	Transitions	4	CurveToStraight
49	Transitions	5	SCurve
50	Gaps	1	g1pt0
50	Gaps	2	g1pt2
50	Gaps	3	g1pt4
50	Gaps	4	g1pt6
50	Gaps	5	g1pt8
50	Gaps	6	g2pt0
52	SystemHealths	0	NoneOk
52	SystemHealths	1	CriticalOk
52	SystemHealths	2	NonCriticalOK
52	SystemHealths	3	AllOk
53	SegmentRanks	0	Non-Artery
53	SegmentRanks	1	Collector
53	SegmentRanks	2	Secondary
53	SegmentRanks	3	Primary
53	SegmentRanks	4	Inter-Metro
54	LinkClasses	0	Unknown
54	LinkClasses	1	Limited Access
54	LinkClasses	10	Ferry Lane
54	LinkClasses	11	Walkway
54	LinkClasses	2	Limited Access@grade
54	LinkClasses	3	Thruway
54	LinkClasses	4	Local Street
54	LinkClasses	5	Frontage
54	LinkClasses	6	Ramp
54	LinkClasses	7	Access Road
54	LinkClasses	8	Connector
54	LinkClasses	9	Alley
55	RoadClasses	0	Ramp

Id	StyleName	Value	CategoryName
55	RoadClasses	1	Interstate
55	RoadClasses	2	Freeway
55	RoadClasses	3	Arterial
55	RoadClasses	4	MinorArterial
55	RoadClasses	5	Collector
55	RoadClasses	6	Local
55	RoadClasses	7	Unpaved
55	RoadClasses	8	Unknown
58	Healths	0	NoData
58	Healths	15	Data

APPENDIX B

INFORMATION LETTER

INFORMATION LETTER - ACAS FOT

Dear Driver,

The University of Michigan Transportation Research Institute, General Motors Corporation and the National Highway Traffic Safety Administration are conducting a study of driver assistance devices for passenger vehicles. The two particular devices of interest are referred to as adaptive cruise control (ACC) and forward collision warning (FCW). We are examining the impact of these devices on driving safety, comfort, and convenience.

You have qualified to participate in a research study in which you are being asked to drive a research vehicle that is equipped with both adaptive cruise control (ACC) and forward collision warning (FCW) systems on public roadways. Participation in this study requires traveling to UMTRI, participating in one hour of training on use of the systems, use of the research vehicle as your personal vehicle for approximately four weeks (26 days), completing some questionnaires, and taking part in a debriefing session when you return the vehicle.

In addition, we would like to use information contained in your State of Michigan driving record to examine how accident history and driver behavior correlate. With your permission, and through an agreement between the University of Michigan and the Michigan Secretary of State, your driving record in the State of Michigan would become part of this study.

For the first six (6) days you have the research vehicle it will operate just like any other car (i.e., it will not have the ACC or FCW systems activated). For the remaining twenty (20) days of your participation the research vehicle will have the ACC and FCW system activated. The activation of the systems will take place automatically on the sixth night you have the vehicle, and only when the vehicle is turned off. The specific date and time that the activation of the ACC and FCW systems will take place will be told to you in advance, and recorded in the glove compartment of your vehicle.

Upon arriving at UMTRI you will be asked to review a document very similar to this one which is known as an informed consent form (it will list all of the same requirements and conditions of being a participant). You will be asked to acknowledge reading the informed consent form and agreeing to the conditions outlined in the form by providing your signature. You will also be required to show us your driver's license.

You alone will be trained to use the research vehicle. As such, no one other than you is permitted to drive the vehicle during your participation. While there are no limitations on where you chose to drive the research vehicle within the continental United States, you are not permitted to take the research vehicle outside of the continental United States for any reason. In addition, to participate in this study you must also agree to abide by the following:

1. The research vehicle cannot be used to tow any form of trailer, or haul any material greater than what the vehicle was designed to accommodate.
2. You may not, or allow others to, remove, modify, or tamper with any components of the research vehicle, ACC or FCW systems, or data collection system. You must receive verbal permission from the researchers prior to allowing any mechanical work to be performed on the research vehicle.
3. The research vehicle cannot be used to transport flammable materials (e.g., gasoline).
4. You are responsible for purchasing fuel for the research vehicle for the duration which it is assigned to you.
5. You are solely responsible for all tickets and violations for the duration which the research vehicle is assigned to you.
6. You agree to report as early as possible to UMTRI any problems, malfunctions, or accidents with the research vehicle.
7. If at any time, and for any reason, the researchers deem it necessary that the research vehicle be returned to UMTRI, you must either return the vehicle or make arrangements for UMTRI personnel to retrieve it.
8. You must return the research vehicle at the specified date and time your participation is scheduled to end.

In this study you will be instructed on how to use the forward collision warning and adaptive cruise control systems prior to testing. You will be asked to watch an instructional video, receive instruction from a researcher, and take the vehicle for a demonstration drive with a researcher present. During the demonstration drive a researcher will instruct you on where to drive, and ask you to use the driver assistance systems. The researcher will also be present to answer any questions you may have.

Whenever the engine of the research vehicle is running, an on-board computer will be recording information about the car and how it is being operated. In addition, video cameras will be used to record images of the road and other traffic in front of the vehicle as well as images of your face. The video images of your face will include audio in order to record comments you make about the way the research vehicle operates. All of this data is being recorded in order to understand not only how you operate the adaptive cruise control (ACC) and forward collision warning (FCW) systems, but also to gain greater insights on driver behavior in general.

Optional Review of Select Events. When you return the research vehicle, you will be asked to review (watch and comment on) a small number (10-12) of video recordings which include an image of your face. During this review the researchers hope to gain a better understanding of your thoughts and impressions of the adaptive cruise control and forward collision warning systems. This process will be very informal, but we would like to record your voice in order to accurately document your comments. This review will provide you with added opportunity to point-out your "likes and dislikes" of how the systems operate. You may decline to take part in this review of select video recordings without penalty or compromise to your participation in this study.

At no time during this study will you be asked to perform any unsafe driving actions. The University of Michigan and General Motors Corporation require you to abide by the following conditions in order to participate in this study.

1. You must possess a valid operator's license, display such a license, and comply with all license restrictions.
2. Properly use safety belts.
3. Obey all applicable motor vehicle laws, codes, and regulations.
4. Drive in a defensive manner, anticipating situations where incidents are likely to occur.
5. You must not be under the influence of alcohol, and have abstained from drinking alcohol for no less than 12 hours prior to driving the research vehicle. However it is preferred that you abstain from alcohol for more than 12 hours, particularly if you have been drinking to excess.
6. You must not operate the research vehicle while under the influence of any medications that may impair your ability to drive.

There are certain medical conditions that exclude you from participating in this study. You are excluded from participating if you suffer from one or more of the following medical conditions:

1. If you suffer from profound loss of hearing or vision that is uncorrected.
2. If you regularly take any drugs or substances which may impair your ability to drive.
3. If you have symptomatic heart disease with chest pain; shortness of breath or light headedness which you experience at rest or when walking one block or less; rhythm disturbances associated with light headedness or fainting; require defibrillation; or you have experienced a heart attack within the past six (6) months.
4. If you have suffered brain damage from a stroke, tumor, head injury, or infection; and the resulting effects are visual loss, blurring or double vision; weakness, numbness, severe tremors or funny feelings in the arms, legs, or face; trouble swallowing, slurred speech; uncoordination or loss of control; trouble walking, trouble thinking, remembering, talking, or understanding.
5. If you have been diagnosed with seizures or epilepsy, and suffered a seizure in the last 12 months.
6. If you suffer from a respiratory disorder such as asthma or chronic bronchitis that results in obvious or continuous shortness of breath, or requires oxygen therapy.
7. If you suffer from motion sickness that occurs often, occurs in mild to moderate conditions (for example riding in a car), or results in severe symptoms when it does occur. If you have suffered in the past 12 months from inner ear problems, dizziness, vertigo, or balance problems, or suffer from Meniere's disease.
8. If you suffer from Diabetes, and as a result are required to take insulin, or have had symptomatic hypoglycemia in the past three (3) months.
9. If you suffer from migraine or tension headaches greater than two (2) times a month, or take narcotic medications for these headaches.

10. If you are pregnant or you believe you are pregnant. If you are uncertain whether you may be pregnant, UMTRI will provide you with a pregnancy test that can be performed in private prior to completing the informed consent.

Furthermore, you may not participate in this study if you have been convicted within the past 36 months of any of the following motor vehicle violations:

1. Driving while your operator's license is suspended, revoked, or denied.
2. Vehicular manslaughter, negligent homicide, felonious driving or felony with a vehicle.
3. Operating a vehicle while impaired, under the influence of alcohol or illegal drugs, or refusing a sobriety test.
4. Failure to stop or identify under a crash (includes leaving the scene of a crash; hit and run; giving false information to an officer).
5. Eluding or attempting to elude a law enforcement officer.
6. Traffic violation resulting in death or serious injury.
7. Any other significant violation warranting suspension of license.

RISKS: While participating in this study, you will be subject to all the risks that are normally present when driving a passenger car on public roads. It is believed that using the adaptive cruise control (ACC) or forward collision warning (FCW) systems will not make driving any more hazardous than normal. However, caution should be used when operating a vehicle with which you are not familiar. The adaptive cruise control device you will be using will automatically accelerate and decelerate the test vehicle in order to maintain a set distance separation (headway) between the test car and other cars that you follow. The level of deceleration you may experience is comparable to that of modestly applying the car brakes. The forward collision warning system will present visual and auditory warnings to you in instances where the system determines you must intervene to avoid an accident.

Be aware that accidents can happen at any time when driving, and that you cannot rely on any test device being studied to prevent an accident. In the unlikely event that an accident occurred; you, the test vehicle, as well as any other persons or property involved, would be covered under an insurance policy held by The University of Michigan and General Motors No Fault insurance. However, that does not preclude other insurance coverage from involvement: including your personal injury protection (PIP) insurance - otherwise referred to as no-fault insurance, your health insurance, and General Motors automotive insurance. The specifics of a claim cannot be stated before hand because it is a coordination of benefits issue involving various carriers. The University insurance coverage is coordinated with other insurances, the priorities being determined to a large extent by the insurance laws of the State of Michigan. You may what to consult your personal automotive insurance provider with any additional questions regarding insurance coverage. A participant may be held liable for damages resulting from an accident if afterwards it is determined that the participant knowingly misrepresented his/her eligibility to take part in the study.

In the unlikely event of physical injury resulting from participating in this study, the University will provide medical treatment in accordance with the determination by the University of its responsibility to provide such treatment. If an accident occurs, the standard procedure should be to remove yourself and others from harms way and call for emergency services (police and emergency medical technicians). The research vehicle is equipped with a fire extinguisher, first aid kit, and cellular telephone. Only after you and any passengers are out of harms way should you contact researchers at UMTRI using the cellular phone provided with the vehicle. The research team at UMTRI will be available via pager on a 24 hour-a-day basis to answer questions or assist you should a need arise.

BENEFITS: The results of this study will provide valuable guidance for the development of driver assistance systems for passenger cars. By participating in this study, you will be lending your experience and expertise to support highway safety research. The direct benefit to you as an individual for participating is use of a new vehicle that can be used for unlimited travel (other than the previously mentioned restrictions).

COMPENSATION: You will be compensated $250 for participating in this study. Your participation in the study will require approximately ten (10) hours of your time outside of your regular or planned driving. Your time commitment is being estimated on the basis of how much time you will spend traveling to and from UMTRI (up to 6 hours), being trained to drive the vehicle (1 hour), completing questionnaires (up to 2 hours), and participating in a debriefing upon returning the research vehicle (1 hour). While the researchers retain the right to terminate your participation in the study at any time, you will be compensated in full should the study be terminated prior to its planned completion. In addition, you will also be compensated in full should you withdraw from participating in the study for any reason.

CONFIDENTIALITY: The University of Michigan Transportation Research Institute, General Motors Corporation and the National Highway Traffic Safety Administration are gathering information on the use of adaptive cruise control and forward collision warning systems in passenger cars. While we are interested in driver behavior, we are not testing you or your skills. If you agree to participate in this study, your name will not be voluntarily released to anyone who does not work on this project. Your name will not appear in any reports or papers written about the project. Any identifying information contained in your State of Michigan driving record will also be treated with strict confidentiality. Should the researchers choose to use an image of your face or recorded comments in a presentation or publication your identity will be concealed unless you permit unrestricted use of the recordings.

<u>Optional use of video images</u>: If you agree, video images of your driving (continuous or single framed) may be used for scientific, educational, and outreach purposes. You will be asked for unrestricted permission to use the video recordings of your driving, which will contain images of your face and audio recordings of your voice. You may decline to permit unrestricted use of the recordings without penalty or compromise to your participation in this study.

<u>Optional questionnaire</u>: If you agree, an optional questionnaire will be provided to you that can be completed at home. While we will already ask that you complete a questionnaire when you return the research vehicle, this additional questionnaire could be completed, and postmarked, up to 30 days afterwards. In exchange for agreeing to complete and return the “take home” questionnaire you will be mailed a check for $50 shortly after we receive the questionnaire back from you. The estimated time to complete the take-home questionnaire is 30 minutes. You may decline to complete the “take home” questionnaire without penalty or compromise to your participation in this study.

Recall that you have the right to withdraw from the study at any time without penalty.

The University of Michigan Transportation Research Institute, General Motors Corporation and the National Highway Traffic Safety Administration hope that you will agree to participate in this study. If you have any questions, please feel to contact us.

ACAS FOT
Attn: Mary Lynn Mefford
UMTRI
2901 Baxter Road
Ann Arbor, MI 48109-2150

Call toll free (866) 833-0002
Fax (734) 764-1221
Email: mlmeff@umich.edu

APPENDIX C

INFORMED CONSENT

INFORMED CONSENT FORM – ACAS FOT

CONDITIONS OF PARTICIPATION

The University of Michigan Transportation Research Institute, General Motors Corporation and the National Highway Traffic Safety Administration are conducting a study of driver assistance devices for passenger vehicles. The two particular devices of interest are referred to as adaptive cruise control (ACC) and forward collision warning (FCW). We are examining the impact of these devices on driving safety, comfort, and convenience.

You have qualified to participate in a research study in which you are being asked to drive a research vehicle that is equipped with both adaptive cruise control (ACC) and forward collision warning (FCW) systems on public roadways. Participation in this study requires traveling to UMTRI, participating in one hour of training on use of the systems, use of the research vehicle as your personal vehicle for approximately four weeks (26 days), completing some questionnaires, and taking part in a debriefing session when you return the vehicle.

In addition, we would like to use information contained in your State of Michigan driving record to examine how accident history and driver behavior correlate. With your permission, and through an agreement between the University of Michigan and the Michigan Secretary of State, your driving record in the State of Michigan would become part of this study.

For the first six (6) days you have the research vehicle it will operate just like any other car (i.e., it will not have the ACC or FCW systems activated). For the remaining twenty (20) days of your participation the research vehicle will have the ACC and FCW system activated. The activation of the systems will take place automatically on the sixth night you have the vehicle, and only when the vehicle is turned off. The specific date and time that the activation of the ACC and FCW systems will take place will be told to you in advance, and recorded in the glove compartment of your vehicle.

You alone will be trained to use the research vehicle. As such, <u>no one other than you is permitted to drive the vehicle</u> during your participation. While there are no limitations on where you chose to drive the research vehicle within the continental United States, you are not permitted to take the research vehicle outside of the continental United States for any reason. In addition, to participate in this study you must also agree to abide by the following:

1. The research vehicle cannot be used to tow any form of trailer, or haul any material greater than what the vehicle was designed to accommodate.
2. You may not, or allow others to, remove, modify, or tamper with any components of the research vehicle, ACC or FCW systems, or data collection system. You must receive verbal permission from the researchers prior to allowing any mechanical work to be performed on the research vehicle.
3. The research vehicle cannot be used to transport flammable materials (e.g., gasoline).
4. You are responsible for purchasing fuel for the research vehicle for the duration which it is assigned to you.
5. You are solely responsible for all tickets and violations for the duration which the research vehicle is assigned to you.
6. You agree to report as early as possible to UMTRI any problems, malfunctions, or accidents with the research vehicle.
7. If at any time, and for any reason, the researchers deem it necessary that the research vehicle be returned to UMTRI, you must either return the vehicle or make arrangements for UMTRI personnel to retrieve it.
8. You must return the research vehicle at the specified date and time your participation is scheduled to end.

In this study you will be instructed on how to use the forward collision warning and adaptive cruise control systems prior to testing. You will be asked to watch an instructional video, receive instruction from a researcher, and take the vehicle for a demonstration drive with a researcher present. During the demonstration drive a researcher will instruct you on where to drive, and ask you to use the driver assistance systems. The researcher will also be present to answer any questions you may have.

Whenever the engine of the research vehicle is running, an on-board computer will be recording information about the car and how it is being operated. In addition, video cameras will be used to record images of the road and other traffic in front of the vehicle as well as images of your face. The video images of your face will include audio in order to record comments you make about the way the research vehicle operates. All of this data is being recorded in order to understand not only how you operate the adaptive cruise control (ACC) and forward collision warning (FCW) systems, but also to gain greater insights on driver behavior in general.

Optional Review of Select Events. When you return the research vehicle, you will be asked to review (watch and comment on) a small number (10-12) of video recordings which include an image of your face. During this review the researchers hope to gain a better understanding of your thoughts and impressions of the adaptive cruise control and forward collision warning systems. This process will be very informal, but we would like to record your voice in order to accurately document your comments. This review will provide you with added opportunity to point-out your "likes and dislikes" of how the systems operate. You may decline to take part in this review of select video recordings without penalty or compromise to your participation in this study.

At no time during this study will you be asked to perform any unsafe driving actions. The University of Michigan and General Motors Corporation require you to abide by the following conditions in order to participate in this study.

1. You must possess a valid operator's license, display such a license, and comply with all license restrictions.
2. Properly use safety belts.
3. Obey all applicable motor vehicle laws, codes, and regulations.
4. Drive in a defensive manner, anticipating situations where incidents are likely to occur.
5. You must not be under the influence of alcohol, and have abstained from drinking alcohol for no less than 12 hours prior to driving the research vehicle. However it is preferred that you abstain from alcohol for more than 12 hours, particularly if you have been drinking to excess.
6. You must not operate the research vehicle while under the influence of any medications that may impair your ability to drive.

EXCLUSION CRITERIA

There are certain medical conditions that exclude you from participating in this study. You are excluded from participating if you suffer from one or more of the following medical conditions:

1. If you suffer from profound loss of hearing or vision that is uncorrected.

2. If you regularly take any drugs or substances which may impair your ability to drive.

3. If you have symptomatic heart disease with chest pain; shortness of breath or light headedness which you experience at rest or when walking one block or less; rhythm disturbances associated with light headedness or fainting; require defibrillation; or you have experienced a heart attack within the past six (6) months.

4. If you have suffered brain damage from a stroke, tumor, head injury, or infection; and the resulting effects are visual loss, blurring or double vision; weakness, numbness, severe tremors or funny feelings in the arms, legs, or face; trouble swallowing, slurred speech; uncoordination or loss of control; trouble walking, trouble thinking, remembering, talking, or understanding.

5. If you have been diagnosed with seizures or epilepsy, and suffered a seizure in the last 12 months.

6. If you suffer from a respiratory disorder such as asthma or chronic bronchitis that results in obvious or continuous shortness of breath, or requires oxygen therapy.

7. If you suffer from motion sickness that occurs often, occurs in mild to moderate conditions (for example riding in a car), or results in severe symptoms when it does occur. If you have suffered in the past 12 months from inner ear problems, dizziness, vertigo, or balance problems, or suffer from Meniere's disease.

8. If you suffer from Diabetes, and as a result are required to take insulin, or have had symptomatic hypoglycemia in the past three (3) months.

9. If you suffer from migraine or tension headaches greater than two (2) times a month, or take narcotic medications for these headaches.

10. If you are pregnant or you believe you are pregnant. If you are uncertain whether you may be pregnant, UMTRI will provide you with a pregnancy test that can be performed in private prior to completing the informed consent.

Furthermore, you may not participate in this study if you have been convicted within the past 36 months of any of the following motor vehicle violations:

1. Driving while your operator's license is suspended, revoked, or denied.
2. Vehicular manslaughter, negligent homicide, felonious driving or felony with a vehicle.
3. Operating a vehicle while impaired, under the influence of alcohol or illegal drugs, or refusing a sobriety test.
4. Failure to stop or identify under a crash (includes leaving the scene of a crash; hit and run; giving false information to an officer).
5. Eluding or attempting to elude a law enforcement officer.
6. Traffic violation resulting in death or serious injury.
7. Any other significant violation warranting suspension of license.

INFORMED CONSENT

I agree to the conditions of participation as outlined above regarding my health conditions, driving record and my responsibilities when using this vehicle.

1. As a participant, I will drive an instrumented car that is equipped with adaptive cruise control (ACC) and forward collision warning (FCW) systems on public roads as part of my regular or planned driving.

    a. I will have an opportunity to experience and practice the use of the forward collision warning and adaptive cruise control systems in the presence of a researcher.

    b. I will be asked to drive the research vehicle and to experience the adaptive cruise control and forward collision warning systems.

c. At the conclusion of participation, I will be asked to complete a questionnaire regarding my impressions of these systems and take part in a debriefing about my experience with the adaptive cruise control (ACC) and forward collision warning (FCW) systems.

d. Video cameras will be used to record the traffic and roadway conditions in front of the research vehicle as well as an image of me driving the vehicle. Both my voice and my face will be included on this video recording.

2. A researcher will provide me hands-on instruction on use of the adaptive cruise control (ACC) and forward collision warning (FCW) systems, and take part in a demonstration drive in which I will be able to experience these systems while a researcher is present. The researcher will familiarize me with the adaptive cruise control and forward collision warning devices, as well as the test vehicle in which they are installed. Also, the researcher will provide me with specific instructions on where to drive during this demonstration.

3. At no time in this study will I be asked to perform any unsafe driving actions.

4. While driving in this study, I will be subject to all risks that are normally present while driving a passenger car on public roads. The use of adaptive cruise control (ACC) and forward collision warning (FCW) are intended to make driving safer and more comfortable. However, caution should be exercised when operating a vehicle with equipment with which one is not familiar. I understand that the adaptive cruise control device will automatically accelerate and decelerate the test vehicle in order to maintain a selected distance separation (headway) between the test car and any car I am following, and that the level of deceleration is comparable to that of moderately applying the car brakes. I understand that I should avoid becoming over reliant on the adaptive cruise control or forward collision warning systems, and I am aware that accidents can happen at any time while driving. I understand that the existence of the adaptive cruise control and forward collision warning systems on the test vehicle will not eliminate the possibility of an accident occurring.

5. Should an accident occur; I the driver, the test vehicle, as well as any other persons or property involved, would be covered under an insurance policy held by The

University of Michigan and General Motors No Fault insurance. However, that does not preclude other insurance coverage from involvement: including my personal injury protection (PIP) insurance - otherwise referred to as no-fault insurance, my health insurance, and General Motors insurance. The specifics of a claim cannot be stated before hand because it is a coordination of benefits issue involving various carriers. The University insurance coverage is coordinated with other insurances, the priorities being determined to a large extent by the insurance laws of the State of Michigan. I may want to consult my personal automotive insurance provider with any additional questions regarding insurance coverage. I understand that I may be held liable for damages resulting from an accident if afterwards it is determined that I knowingly misrepresented my eligibility to take part in the study.

6. In the unlikely event of physical injury resulting from participating in this study, the University will provide medical treatment in accordance with the determination by the University of its responsibility to provide such treatment. If an accident occurs, the standard procedure should be to remove myself and others from harms way and call for emergency services (police and emergency medical technicians). The research vehicle is equipped with a fire extinguisher, first aid kit, and cellular telephone. Only after I and any passengers are out of harms way should I contact researchers at UMTRI using the cellular phone provided with the vehicle. The research team at UMTRI will be available via pager on a 24 hour-a-day basis to answer questions or assist you should a need arise.

7. The results of this study will provide the University of Michigan Transportation Research Institute, General Motors Corporation, and the National Highway Traffic Safety Administration with valuable information for the development of future driver assistance and safety systems. By participating in this study, I am lending my experience and expertise as a driver to support safety research regarding the future use of driver assistance systems in passenger cars. I understand that I will not be informed as to the results of this study, and that the only direct benefit to me as an individual for participating is use of a new vehicle that can be used for unlimited travel during my participation in the study (other than the previously mentioned restrictions).

8. I will be compensated $250 for participating in this study. I understand that participation in this experiment will take approximately ten (10) hours of my time

outside of my regular or planned driving. While the researchers retain the right to terminate my participation in the study at any time, I will be compensated in full should the study be terminated prior to its planned completion.

9. The University of Michigan Transportation Research Institute is gathering information on driver assistance devices, and not testing me. My name will not be released to anyone who is not working on the project. My name will not appear in any reports or papers written about the project. Any identifying information contained in my State of Michigan driving record will also be treated with strict confidentiality. It is possible, should I be involved in an accident during testing, that The University of Michigan Transportation Research Institute will have to release data on my driving in response to a court order.

10. The researchers, employees of The University of Michigan Transportation Research Institute, will answer any questions that I may have about this study. The researcher in charge of this testing is:

James R. Sayer, Ph.D.
The University of Michigan Transportation Research Institute
Human Factors Division
2901 Baxter Rd., Ann Arbor, MI 48109-2150

Call toll free (866) 833-0002
Fax (734) 764-1221
Email: jimsayer@umich.edu

Information about the approval of this study and your rights as a participant can be obtained from:

IRB Behavioral Sciences Committee, Human Subjects Protection Office
1040 Fleming Administration Building
Ann Arbor, Michigan 48109-1340
Telephone: 734 936-0933 FAX: 734 647-9084
Email: IRB-Behavsci-Health@umich.edu

11. If information becomes available which might reasonably be expected to affect my willingness to continue participating in this study, this information will be provided to me.

12. Participation in this study is voluntary. I understand that I may withdraw from this study at any time, and for any reason, without penalty. Should I withdraw, I

will be compensated in full ($250). The researchers also retain the right to terminate the study at any time. However, should the study be terminated by the researcher prior to its planned completion I will be compensated in full.

13. I understand that if at any time, and for any reason, the researchers deem it necessary that the research vehicle be returned to UMTRI, I must either return the vehicle or make arrangements for UMTRI personnel to retrieve it. I agree to return the research vehicle after 26 days at the specified date and time my participation is schedule to end.

I HAVE READ AND UNDERSTAND THE TERMS OF THIS AGREEMENT. I VOLUNTARILY CONSENT TO PARTICIPATE IN THIS STUDY.

________________________	______________________	______/_______/______
Name (Print)	Signature	Date

____
Address

(_____)________________________
Telephone

Optional use of video images: I agree to permit the unrestricted use of the video recordings of my driving (continuous or single framed) to be used for scientific, educational, and outreach purposes. I am aware that these recordings will contain images of my face and audio recordings of my voice. I am aware that I may decline to permit the unrestricted use of the recordings without penalty or compromise to my participation in this study.

Signed: ____________________________________ Date: ____________________

Optional questionnaire: I agree to receive a questionnaire that can be completed at home. While I will have already completed a questionnaire when I return the research vehicle, this additional questionnaire could be completed, and postmarked, up to 30 days after I've returned the vehicle to UMTRI. In exchange for agreeing to complete and return the "take home" questionnaire, I will be mailed a check for $50 shortly after UMTRI receives the questionnaire back from me. The estimated time to complete the take-home questionnaire is 30 minutes. I recognize that I may decline to complete the "take home" questionnaire without penalty or compromise to my participation in this study.

Signed: ____________________________________ Date: ____________________

Optional Review of Select Events. When I return the research vehicle, I agree to review (watch and comment on) a small number (10-12) of video recordings which include an image of my face. I understand that the purpose of this review of the video images is to allow researchers to gain a better understanding of my thoughts and impressions of the adaptive cruise control and forward collision warning systems. This process will be very informal, but I understand that my voice will be recorded in order to accurately document my comments. This review will provide me with added opportunity to point-out my "likes and dislikes" of how the systems operate. I recognize that I may decline to take part in this review of select video recordings without penalty or compromise to your participation in this study.

Signed: ___________________________________ Date: ___________________

APPENDIX D

INSTRUCTIONAL VIDEO TRANSCRIPT

Instructional Video Transcript

Welcome to The University of Michigan Transportation Research Institute. Thank you for finding the time to participate in the automotive collision avoidance system's field operational test.

The research vehicle that you are being asked to drive is a Buick LeSabre. Our research vehicle is equipped with two new technologies, Forward Collision Warning (FCW) and Adaptive Cruise Control (ACC).

Information about the FCW and ACC systems will be presented on a head-up display, as will vehicle speed. Most of the controls that you will use to operate FCW and ACC are located on the steering wheel.

FCW and ACC work by gathering data about objects located in front of the vehicle. Data is collected in two ways: from the radar sensor mounted in the grill and from a video camera mounted on the interior mirror. Additional video and audio recordings of you, the driver, will be collected to help us interpret and observe your response to using these new systems.

FCW provides audio and visual warnings if you rapidly approach a slow or stopped object. FCW will also warn if you are following another vehicle too closely. FCW is only a warning system and is alerting you to the potential for a collision. FCW does not decelerate the vehicle.

ACC works like conventional cruise control when there are no other vehicles in your path. When you encounter a slower moving vehicle, ACC uses the throttle and brakes to automatically slow your vehicle down and keep pace. When ACC is engaged, the FCW system will still provide warnings. However, the ACC system itself will not detect stationary or very slow moving objects. Therefore, ACC should be disengaged when approaching stationary or slow moving vehicles. ACC cannot be engaged at speeds below 25 mph and ACC will automatically stop working at speeds below 20 mph. Caution should be exercised when using ACC outside of the freeway or expressway environment. In addition, you should not use ACC on winding roads, in heavy stop and go traffic, when the roads are slippery, or when visibility is low such as fog, rain or snow.

Finally, ACC should be turned off on freeway exits and when transitioning between freeways.

Basic Car Operation

For the most part, the Buick LeSabre is similar to others car with which you are familiar. The basic operation of this vehicle is very similar to your own car. However, as with any new vehicle, please take some time to familiarize yourself with the features of the Buick LeSabre.

The Buick LeSabre is equipped with side airbags, a front driver and passenger airbag and three point safety belts. You will be required to wear your seat belt whenever you are operating the research vehicle. If installing a child restraint or car seat, please refer to the Buick LeSabre's owner's manual located in the glove compartment.

In the event that you need to change a flat tire, please refer to the owner's manual for instructions. The spare tire can be removed from the trunk without disturbing the research equipment installed there.

Please note that the vehicle's hazard light switch is located on top of the steering column.

Controls for adjusting the outside rear-view mirrors are located on the driver's side door. Along with adjusting the seat and the location of the steering wheel, a research assistant will aid you in adjusting the mirrors. Take a moment to familiarize yourself with the controls for adjusting the temperature inside the vehicle.

Controls for adjusting the vertical location of the head-up display image, as well as its brightness, are located on the instrument panel just to the left of the steering column. Please adjust the brightness of the head-up display, particularly at night, so that the display is no brighter than necessary. Place the image as low in the field of view as possible, but ensure that you can see the entire head-up display.

Please take a few moments before you drive to make sure that your seat position, mirror adjustments, and location of the head-up display are to your liking.

FCW

FCW becomes active when you are traveling at speeds greater than 25 mph. When driving with FCW activated, the display that you see will look very similar to this:

Notice that in the bottom right hand corner of the head-up display there are two cars. These two cars are separated by symbols representing radar waves. The number of radar waves between these two cars ranges from one to six and indicates the alert-timing adjustment that you have selected. One wave represents the minimum alert timing and six waves represent the maximum alert timing setting.

You can adjust the alert timing by using the button located on the steering wheel that is labeled GAP/WARN. Pressing the top half of this button will increase the FCW alert timing, and pressing the bottom half will decrease the alert timing.

The alert timing that you select is remembered when you turn the car off. The next time that you start the car, the previously selected alert timing will be displayed.

Based upon the distance to objects in front of you, how fast you are traveling, and the alert timing that you select, the FCW system will display one of three alert levels:

The first level merely indicates that the system recognizes a vehicle in front of you. The second level provides cautionary information, and the amber icon increases in size as the likelihood for driver intervention increases. The third level is an imminent warning and is accompanied by a tone. This level indicates that driver control is likely required in order to prevent a collision.

Adjustments to the alert timing will determine when you will see the icons on the head-up display. The higher the alert timing, the earlier you will see the icons. The lower the alert timing the later you will see them. Regardless of the alert timing that you select, the timing of the imminent alert, accompanied by the audio signal, will always be the same.

Here are some examples of FCW display: Note that as the threat of a collision increases, the color and size of the icon change. When you see the second level of warning, indicating the need for driver control is likely, you should prepare or begin to apply the brakes.

You may receive a FCW when another vehicle cuts in front of you. A car slowing in order to make a right or left hand turn may also prompt a FCW.

Again, you as the driver, must be prepared to apply the brakes whenever you are presented with the imminent warning.

Note that there are instances when the vehicle that you are tracking can leave your lane, exposing other slower moving vehicles

Please recall, regardless of the alert timing that you select, the timing of the imminent alert will always be the same.

On occasion, you might experience a false FCW alert. In other words, there are infrequent instances when the FCW system may present an alert when no threat actually exists. Examples of road side objects that might produce a false FCW alert are mailboxes, sign posts, light poles and guard rails. In particular, these items may produce false forward collision warnings if they are located close to the road's edge or straight ahead of you as you approach a curve.

When you apply the brake pedal, the FCW system is disabled. Therefore, when the FCW system presents an alert, the alert can be extinguished by applying the brakes.

ACC

The controls that you will use when engaging ACC are similar to the controls that you would use for conventional cruise control. All of these controls are located on the steering wheel. To turn ACC on, you must press the ON/OFF button on the lower left-hand portion of the steering wheel. When ACC is on, a small light, adjacent to the button will be illuminated.

To engage ACC, you must first reach your desired speed, and then by depressing the SET button, which is located on the lower right-hand portion of the steering wheel, the speed at which you are traveling will be captured by the system. The set speed will be displayed in the lower right portion of the head-up display. Once ACC is engaged, the system will maintain the speed you select as long as there are no slower moving vehicles in your path.

When you encounter a slower vehicle, the first priority of ACC will be to maintain the following distance that you will select. To maintain this following distance, the ACC system will use the vehicle's throttle and brakes to slow your vehicle down to the same speed of the vehicle that you are following. Once that vehicle leaves your path, the ACC system will automatically return to the set speed that you selected, that is assuming that there are no additional vehicles in your path.

Directly below the set speed will be a display of the following distance that you select. This display looks very similar to the FCW alert timing display, but bars are used in place of radar waves. The following distance can be adjusted using the same GAP/WARN button that you used to adjust the forward collision alert timing. The number of bars represents the following distance with one bar representing the shortest distance, and six bars being the longest following distance.

Once the ACC system is engaged you can adjust your set speed in one mph increments by using the ACCELERATION/DECLERATION button on the lower right portion of the steering wheel.

ACC works like conventional cruise control in that the driver can override the system at any time by using the accelerator or the brake pedal. Note that the vehicle's brake lamps are illuminated whenever ACC slows the vehicle.

Recall, additional caution should be used when using ACC outside of the freeway or expressway environment.

MESSAGES

There are four messages that the FCW or ACC system might display; heavy rain limits radar, driver control required, dirty radar needs cleaning and malfunction.

If you are driving in conditions of heavy rain, the HEAVY RAIN LIMITS RADAR message will be displayed. While driving in heavy rain additional caution should be used as the distant at which the sensor can detect objects is shortened.

The DRIVER CONTROL REQUIRED message is displayed when the ACC system slows the vehicle to less than 20 mph. When the vehicle reaches 20 mph and the ACC system is engaged, the driver needs to take control of the vehicle by using either the brake or the throttle.

If you receive the DIRTY RADAR NEEDS CLEANING message it means that the exterior of the radar needs to be cleaned. Please you the cleaner and paper towel that we have provided. Only clean the radar when it is safe to do so.

The MALFUNCTION message is displayed when there is a fault with either the ACC or FCW systems that prevents it from operating.

EMERGENCY PROCEDURES

Located on the dash to the right of the steering wheel is the comment button. The comment button has been installed so that drivers can provide comments or suggestions on how the ACC system and FCW systems work. This button can be pressed at any time the vehicle is running and there is no limit to the number of times you may provide comments. When pressed, the driver will have their spoken comments record for 20 seconds. The comment button should be used whenever the driver feels that it is warranted. It helps to relieve the burden of remembering all of one's comments when returning the vehicle.

Located on the interior rear-view mirror is the OnStar control panel. The OnStar system may be used by drivers to summon emergency services or roadside assistance. In the event of an accident, drivers should press the OnStar emergency button labeled with the red cross which will summon emergency services to your location. This button should only be used if there is an accident. In the event that you need roadside assistance, press the button labeled with the OnStar logo.

In the event of an accident, your first priority should be your safety and the safety of any passengers. If there are any injuries, seek immediate medical attention. When you feel that it is safe to do, call or page the UMTRI researchers using the cellular telephone provided to you and located in the center console of the car. This telephone should be only used to contact UMTRI researchers and only if there has been an accident, a vehicle breakdown, or you need additional information about how to use the vehicle. Should an accident occur, you will be asked to complete a driver incident report. A copy of this document is located in the red envelope inside the glove compartment of the vehicle. Proof of insurance and the vehicle's registration are also located in this envelope. The pager and telephone numbers for contacting UMTRI researchers are located on the outside of this envelope.

Please feel free at any time to contact the researchers if you have questions regarding the research vehicle or your participation in this study. UMTRI researchers are available via pager 24 hours a day should there be an emergency or a vehicle breakdown. For less urgent matters, please call using the toll free number or email address provided. All contact information is located in the glove compartment and along side of the cellular telephone we've provided.

Again, thank you for taking the time to participate in our study. We hope that you enjoy your experience. Your participation is providing us with valuable insights and allowing us to design better FCW and ACC systems.

This page was intentionally left blank

APPENDIX E

POST-DRIVE QUESTIONNAIRE

WITH DESCRIPTIVE STATISTICS

This page was intentionally left blank

Participant #__________

Date __________

Adaptive Cruise Control and Forward Collision Warning

ACC and FCW System Questionnaire and Evaluation

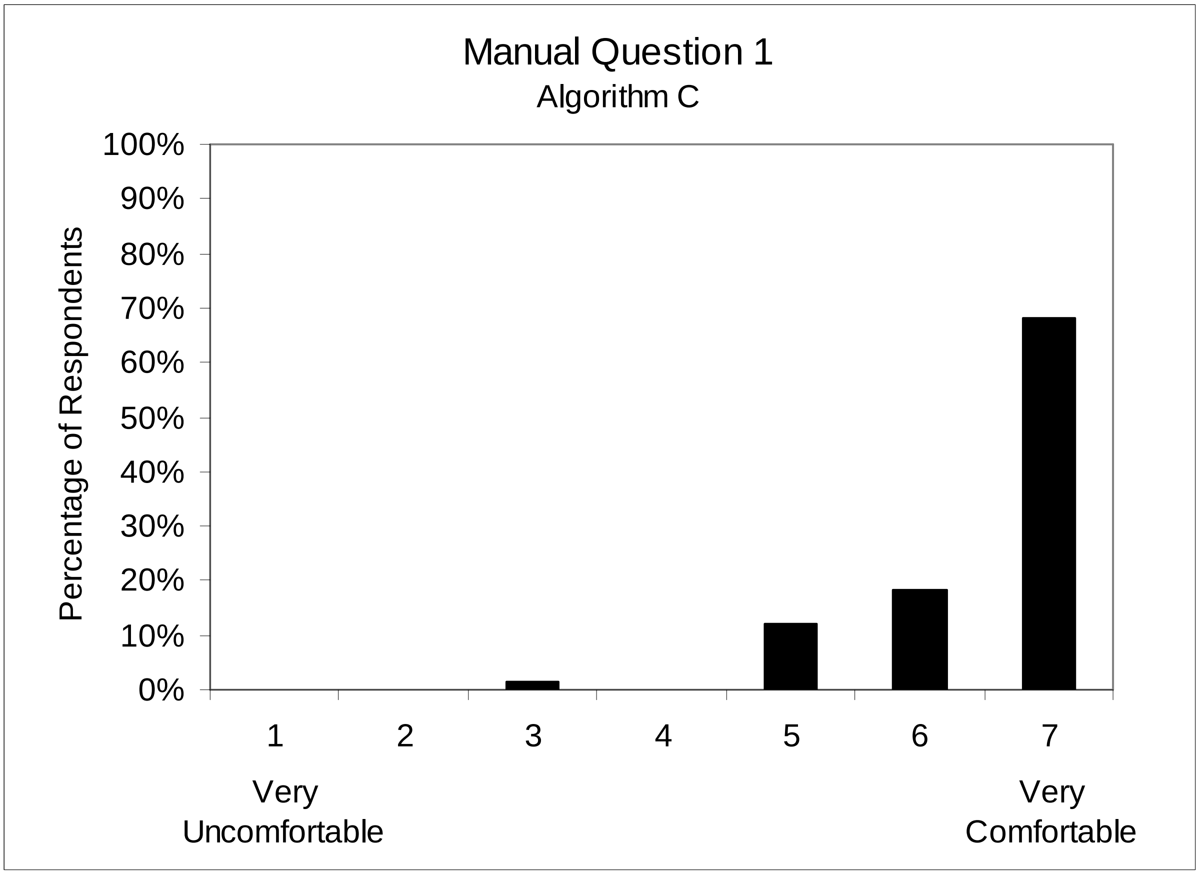
Please answer the following questions. If you need to, you may include comments alongside the questions to clarify your responses.

Examples:

A.) Strawberry ice cream is better than chocolate.

1	2	3	4	5	6	7
Strongly Disagree						Strongly Agree

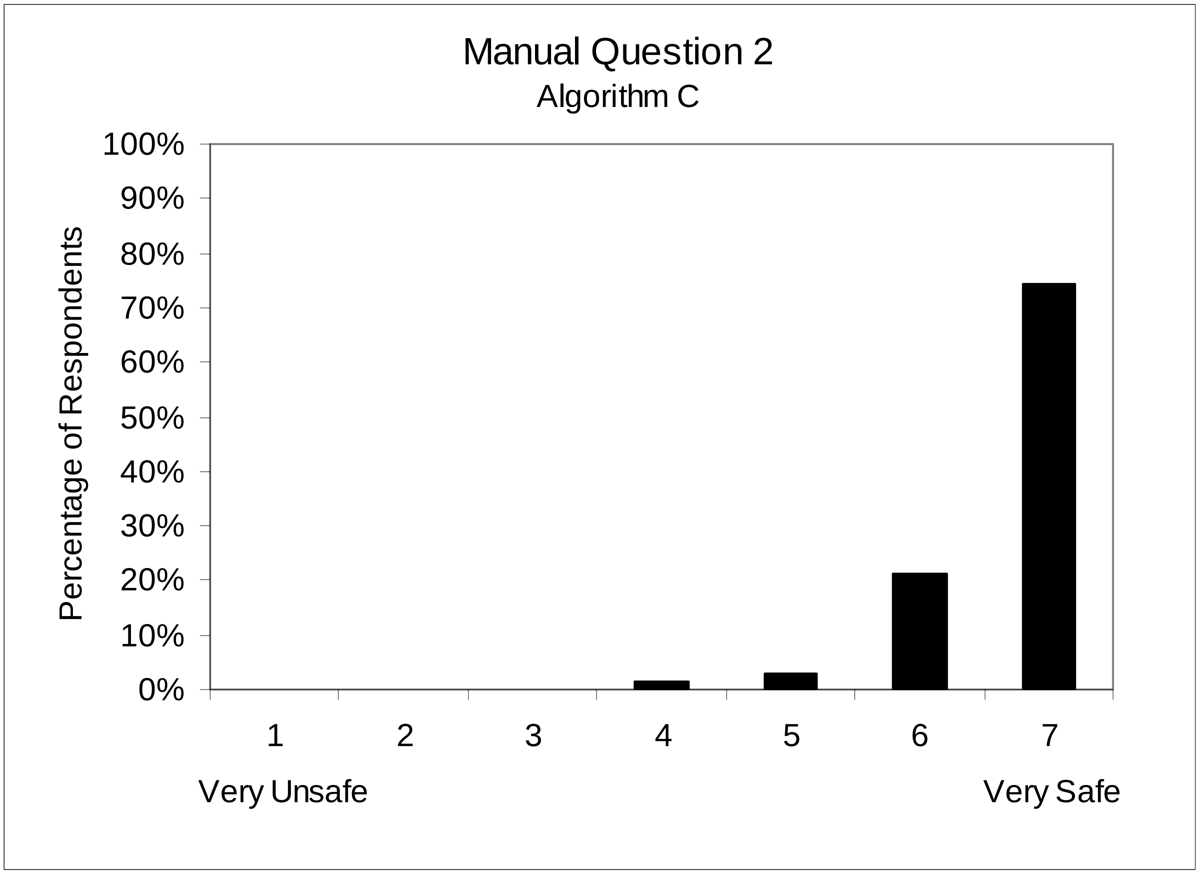
You would circle the "1" if you really liked chocolate ice cream, or you might really like strawberry ice cream. In which case you would circle the "7."



1. How <u>comfortable</u> did you feel driving the car manually?

	Males		Females		Overall	
Younger (20-30)	6.1	(1.3)	6.5	(0.7)	6.3	(1.0)
Middle-Aged (40-50)	6.6	(0.7)	6.5	(0.7)	6.6	(0.7)
Older (60-70)	6.9	(0.3)	6.4	(0.9)	6.6	(0.7)
Overall	6.5	(0.9)	6.5	(0.8)	6.5	(0.8)

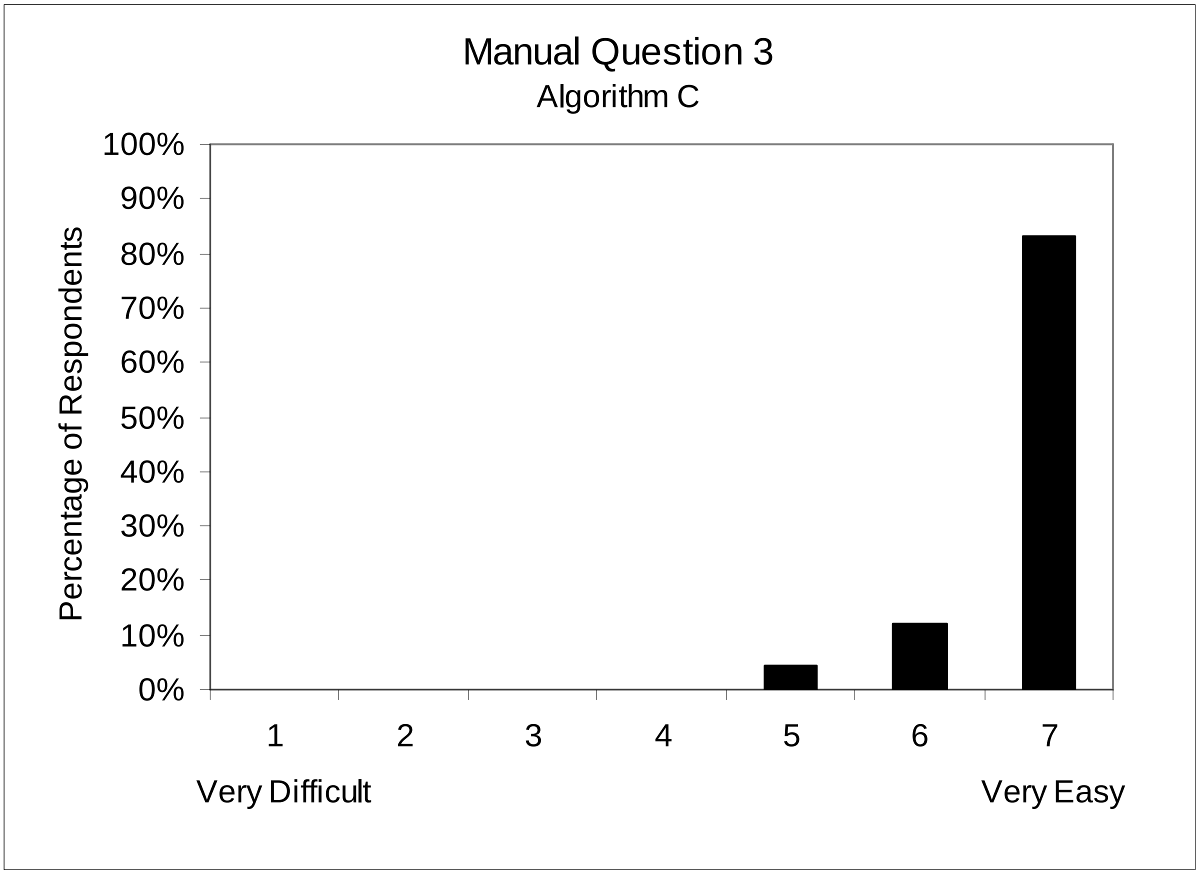
Values in cells represent the mean response and (standard deviation)



2. How <u>safe</u> did you feel driving the car manually?

	Males		Females		Overall	
Younger (20-30)	6.3	(1.0)	6.8	(0.4)	6.5	(0.8)
Middle-Aged (40-50)	6.8	(0.4)	6.5	(0.7)	6.7	(0.6)
Older (60-70)	6.9	(0.3)	6.7	(0.5)	6.8	(0.4)
Overall	6.7	(0.7)	6.7	(0.5)	6.7	(0.6)

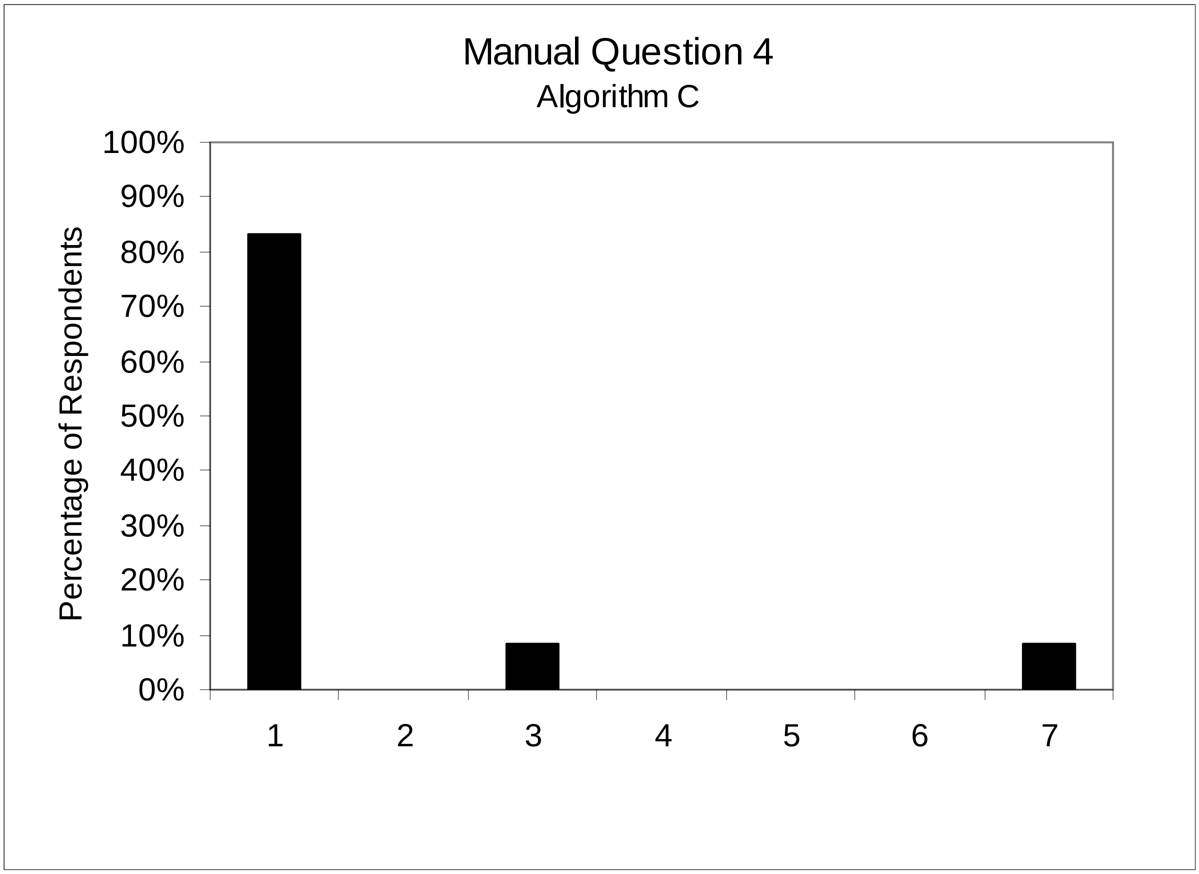
Values in cells represent the mean response and (standard deviation)



3. How easy or difficult was it to drive the car manually?

	Males		Females		Overall	
Younger (20-30)	6.4	(0.9)	6.9	(0.3)	6.6	(0.7)
Middle-Aged (40-50)	6.9	(0.3)	6.7	(0.5)	6.8	(0.4)
Older (60-70)	6.9	(0.3)	6.9	(0.3)	6.9	(0.3)
Overall	6.7	(0.6)	6.8	(0.4)	6.8	(0.5)

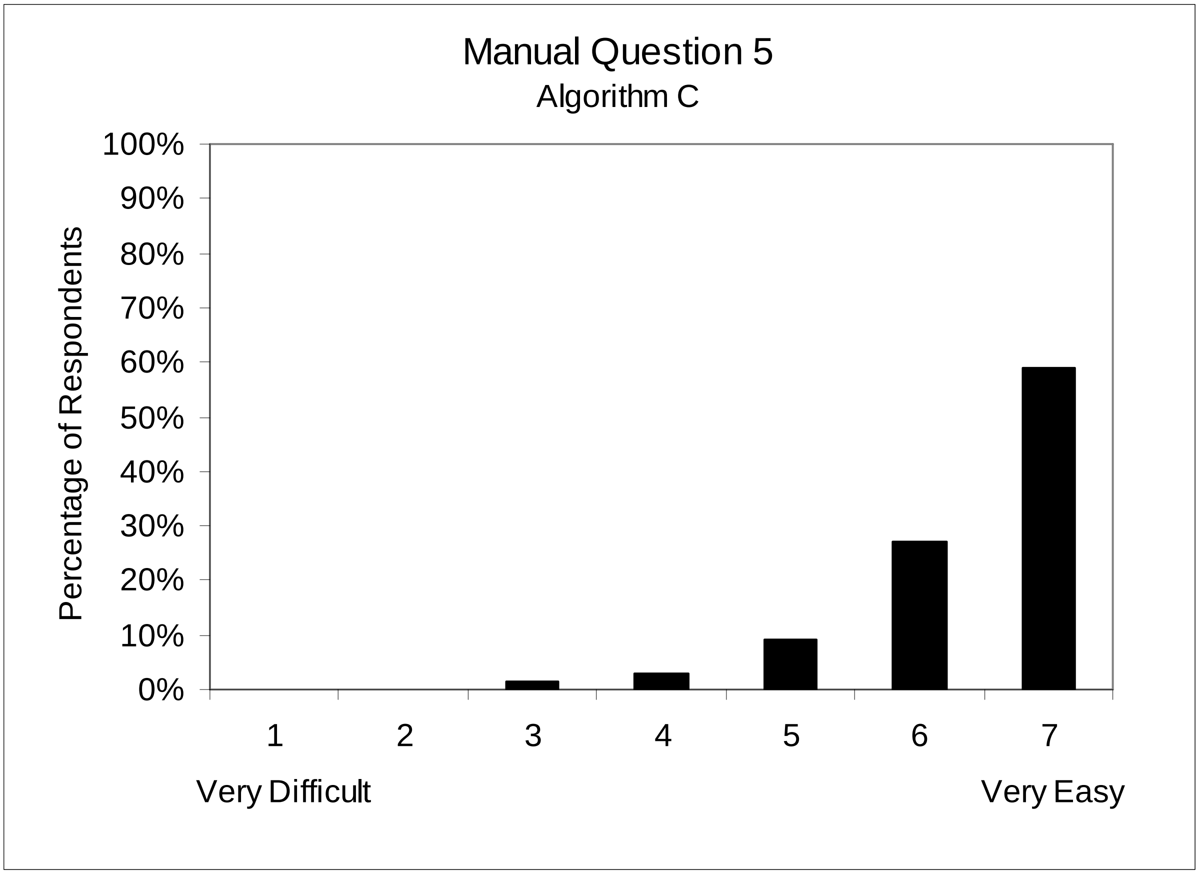
Values in cells represent the mean response and (standard deviation)



4. While driving manually, please tell us the number of times, if ever, you came close to experiencing a rear-end collision? ________

	Males	Females	Overall
Younger (20-30)	0.8 (2.1)	0.1 (0.3)	0.5 (1.5)
Middle-Aged (40-50)	0.3 (0.9)	0.4 (0.5)	0.3 (0.7)
Older (60-70)	0.1 (0.3)	0.2 (0.4)	0.1 (0.4)
Overall	0.4 (1.3)	0.2 (0.4)	0.3 (1.0)

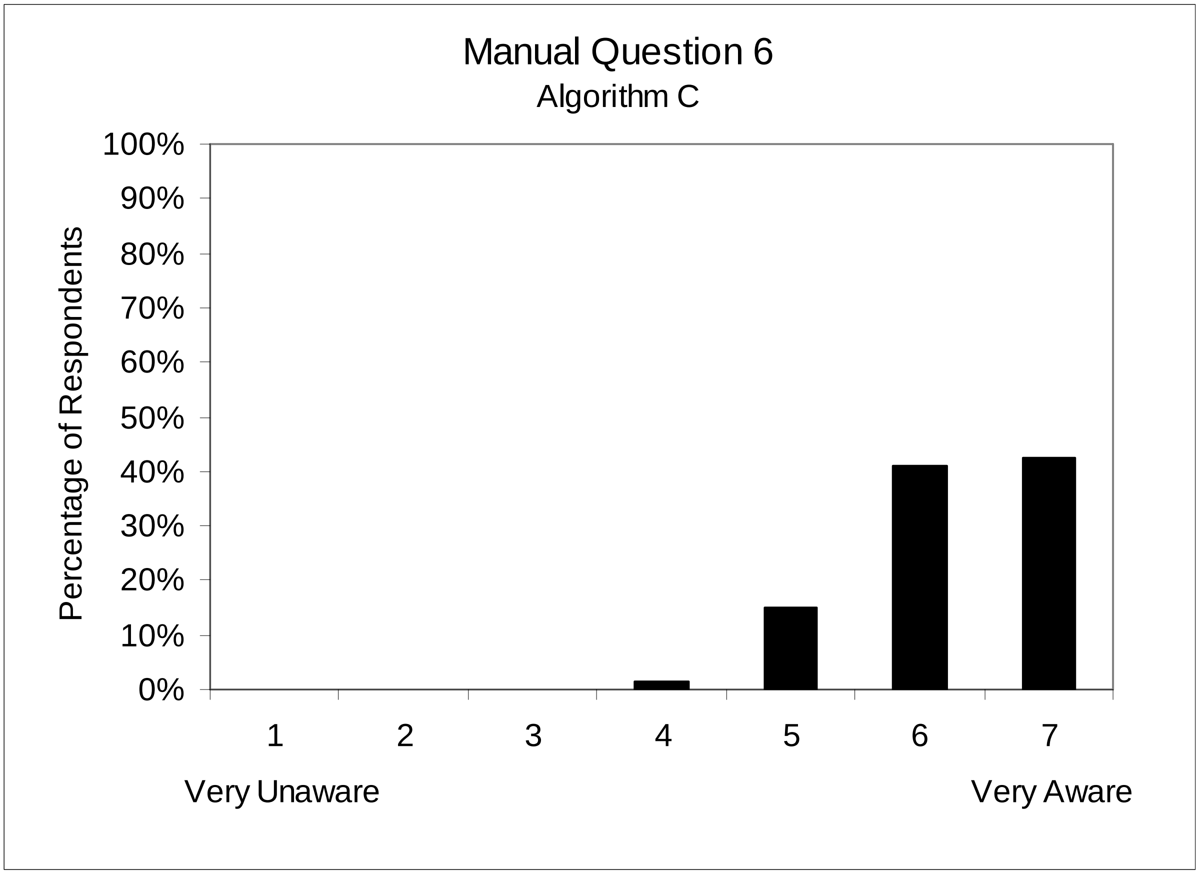
Values in cells represent the mean response and (standard deviation)



5. How <u>easy or difficult</u> did you find it to maintain a <u>safe distance</u> to the preceding vehicle when driving manually?

	Males		Females		Overall	
Younger (20-30)	6.6	(0.7)	6.2	(1.3)	6.4	(1.0)
Middle-Aged (40-50)	6.0	(1.1)	6.5	(0.7)	6.2	(0.9)
Older (60-70)	6.5	(0.5)	6.6	(0.9)	6.5	(0.7)
Overall	6.4	(0.8)	6.4	(1.0)	6.4	(0.9)

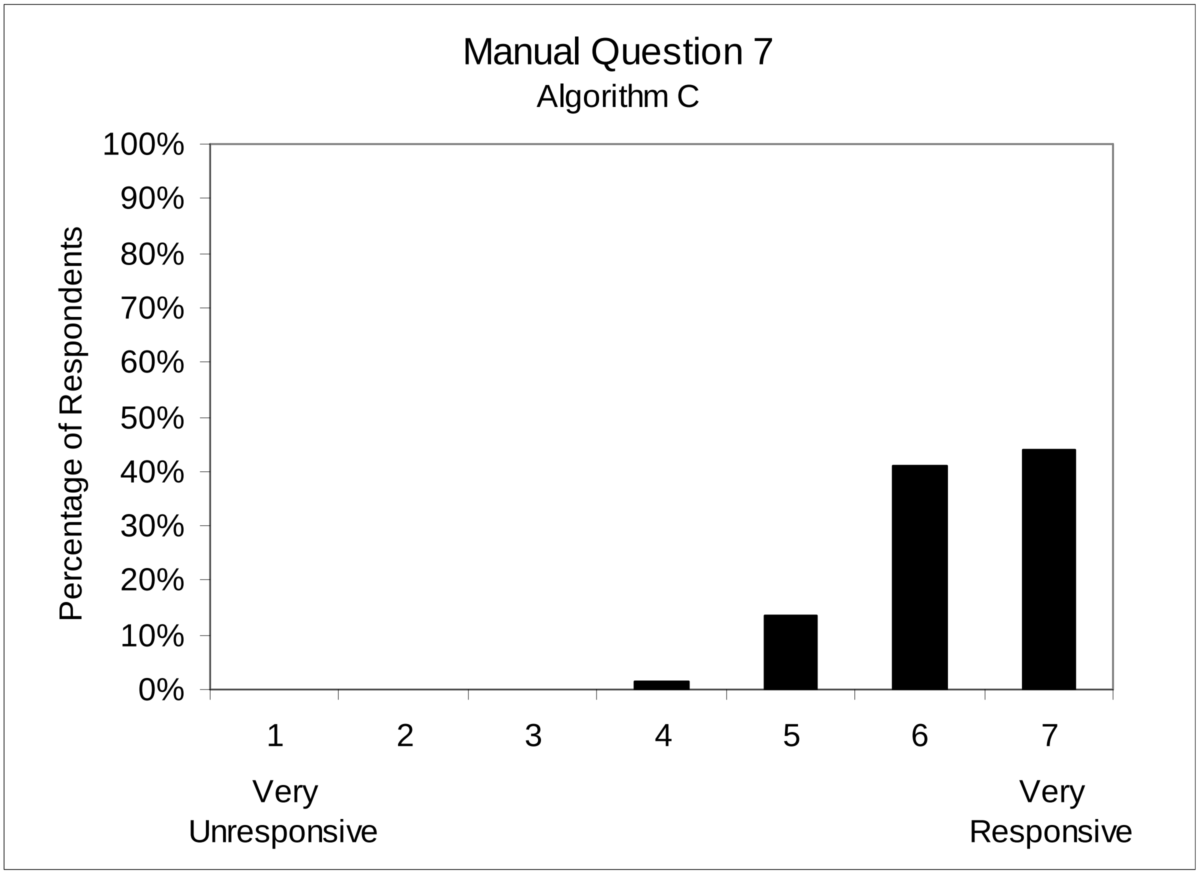
Values in cells represent the mean response and (standard deviation)



6. When driving manually, how <u>aware</u> were you of the driving situation (surrounding traffic, posted speed, traffic signals, etc)?

	Males	Females	Overall
Younger (20-30)	5.9 (0.7)	6.2 (0.9)	6.0 (0.8)
Middle-Aged (40-50)	6.2 (0.8)	6.1 (0.8)	6.1 (0.8)
Older (60-70)	6.6 (0.5)	6.5 (0.8)	6.5 (0.7)
Overall	6.2 (0.7)	6.2 (0.8)	6.2 (0.8)

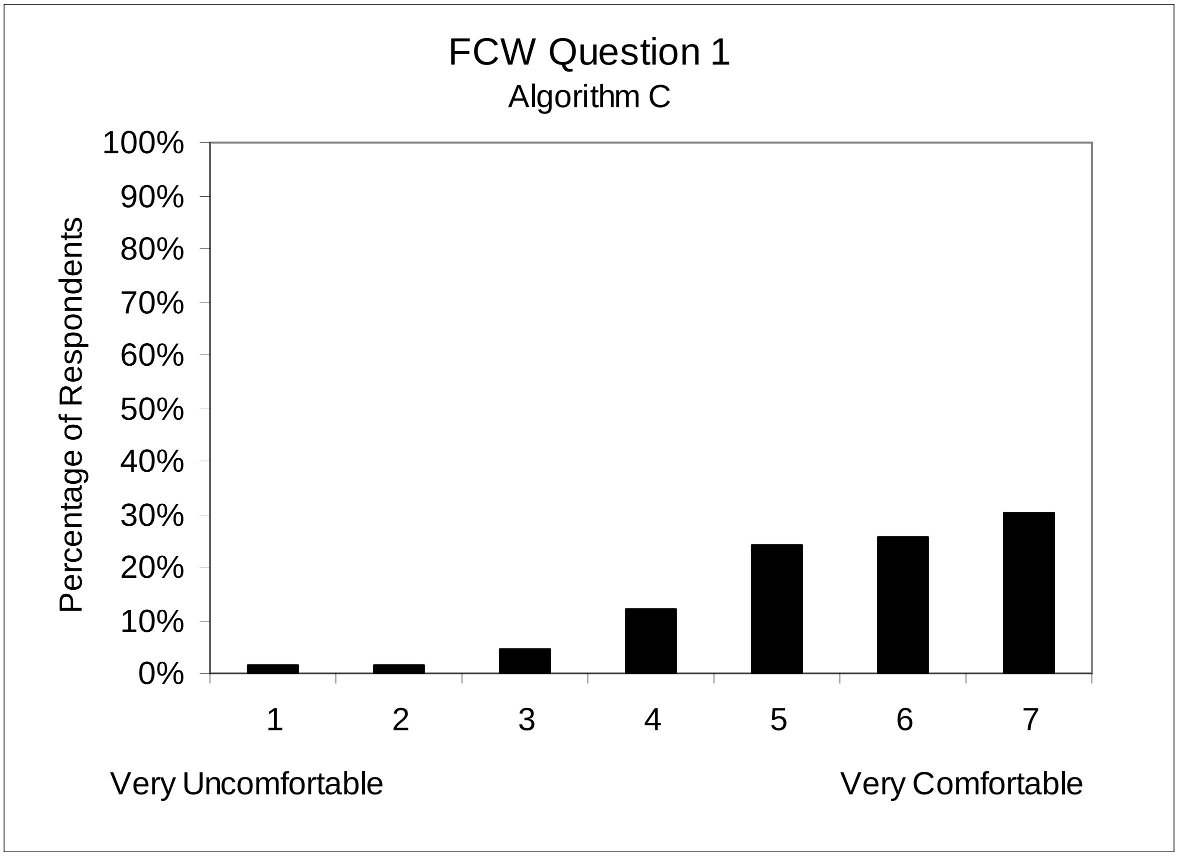
Values in cells represent the mean response and (standard deviation)



7. When driving manually, how responsive were you to the actions of vehicles around you?

	Males		Females		Overall	
Younger (20-30)	6.1	(0.7)	6.0	(0.6)	6.0	(0.7)
Middle-Aged (40-50)	6.3	(0.8)	6.3	(0.8)	6.3	(0.8)
Older (60-70)	6.7	(0.5)	6.3	(1.0)	6.5	(0.8)
Overall	6.4	(0.7)	6.2	(0.8)	6.3	(0.8)

Values in cells represent the mean response and (standard deviation)

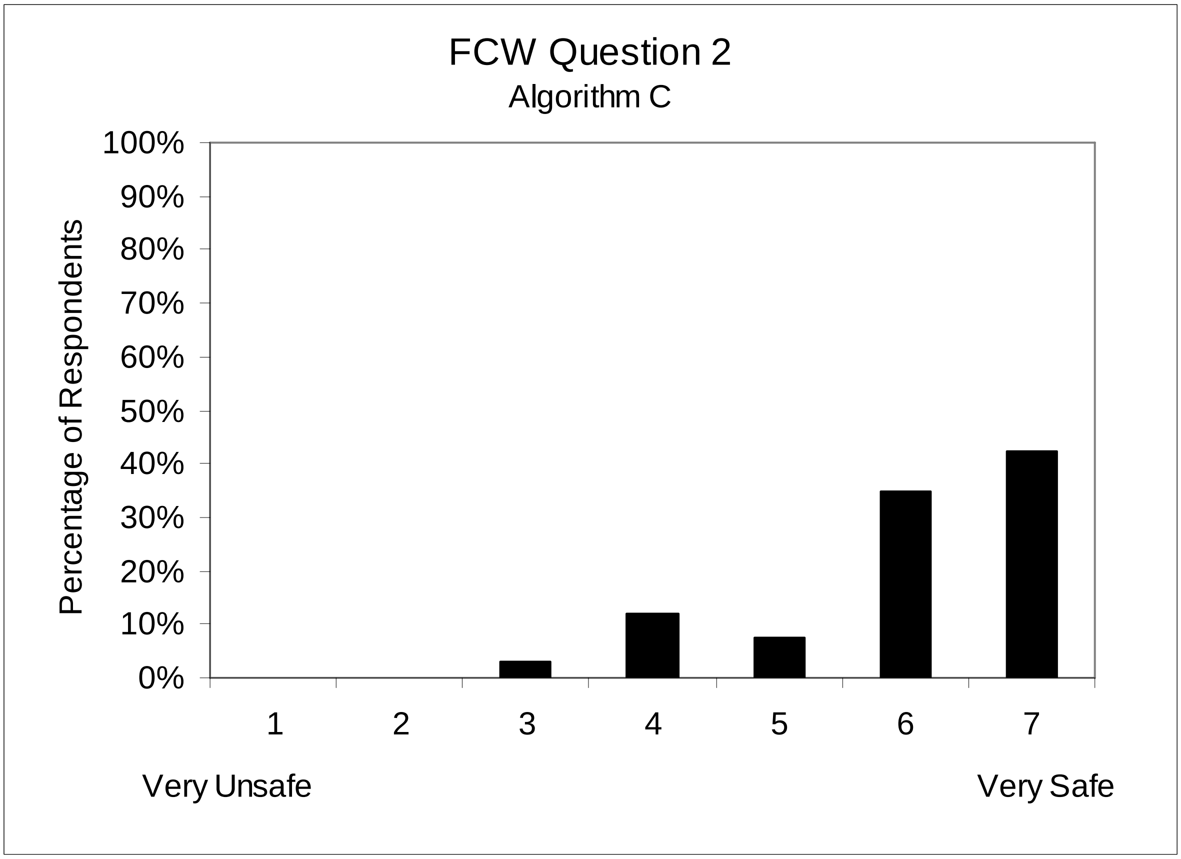


1. How <u>comfortable</u> did you feel using forward collision warning (FCW)?

*	Males	Females	Overall
Younger (20-30)	5.5 (1.3)	5.5 (1.6)	5.5 (1.4)
Middle-Aged (40-50)	5.2 (1.6)	4.8 (1.4)	5.0 (1.5)
Older (60-70)	5.9 (1.0)	6.3 (1.0)	6.1 (1.0)
Overall	5.5 (1.3)	5.5 (1.4)	5.5 (1.4)

Values in cells represent the mean response and (standard deviation)

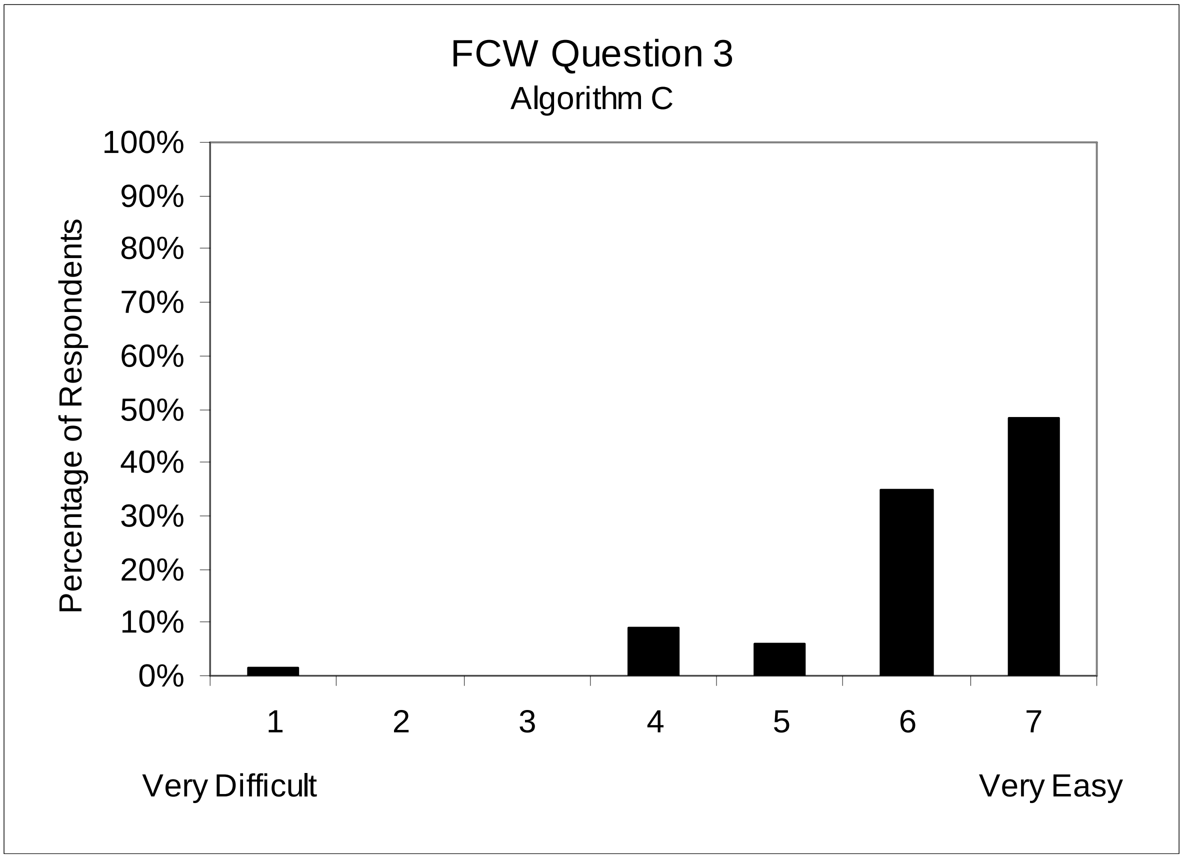
* = Significant difference associated with participant age, $H(2) = 6.767$, $p = .034$



2. How safe did you feel while driving the car using FCW?

	Males		Females		Overall	
Younger (20-30)	6.1	(0.7)	5.4	(1.6)	5.7	(1.2)
Middle-Aged (40-50)	5.8	(1.2)	6.4	(0.5)	6.1	(0.9)
Older (60-70)	6.5	(0.9)	5.9	(1.4)	6.2	(1.2)
Overall	6.2	(1.0)	5.9	(1.3)	6.0	(1.1)

Values in cells represent the mean response and (standard deviation)



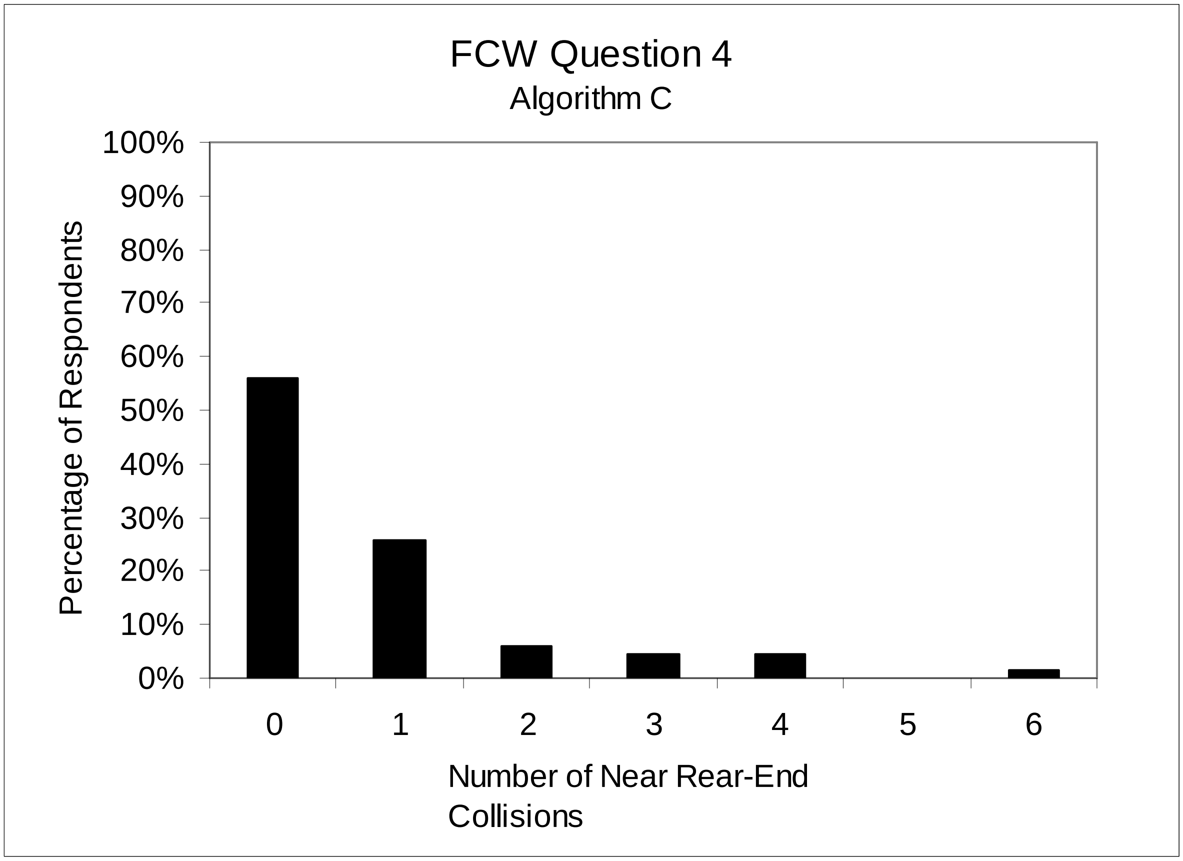
3. How easy or difficult did you find it to maintain a safe distance to the preceding vehicle when using FCW?

* †	Males		Females		Overall	
Younger (20-30)[1]	6.6	(0.7)	6.5	(0.9)	6.5	(0.8)
Middle-Aged (40-50)[1]	5.9	(1.1)	5.5	(0.9)	5.7	(1.0)
Older (60-70)	6.0	(1.7)	6.5	(0.9)	6.2	(1.4)
Overall	6.2	(1.3)	6.2	(1.0)	6.2	(1.1)

Values in cells represent the mean response and (standard deviation)

* = Significant difference associated with participant age, $H(2) = 10.103$, $p = .006$

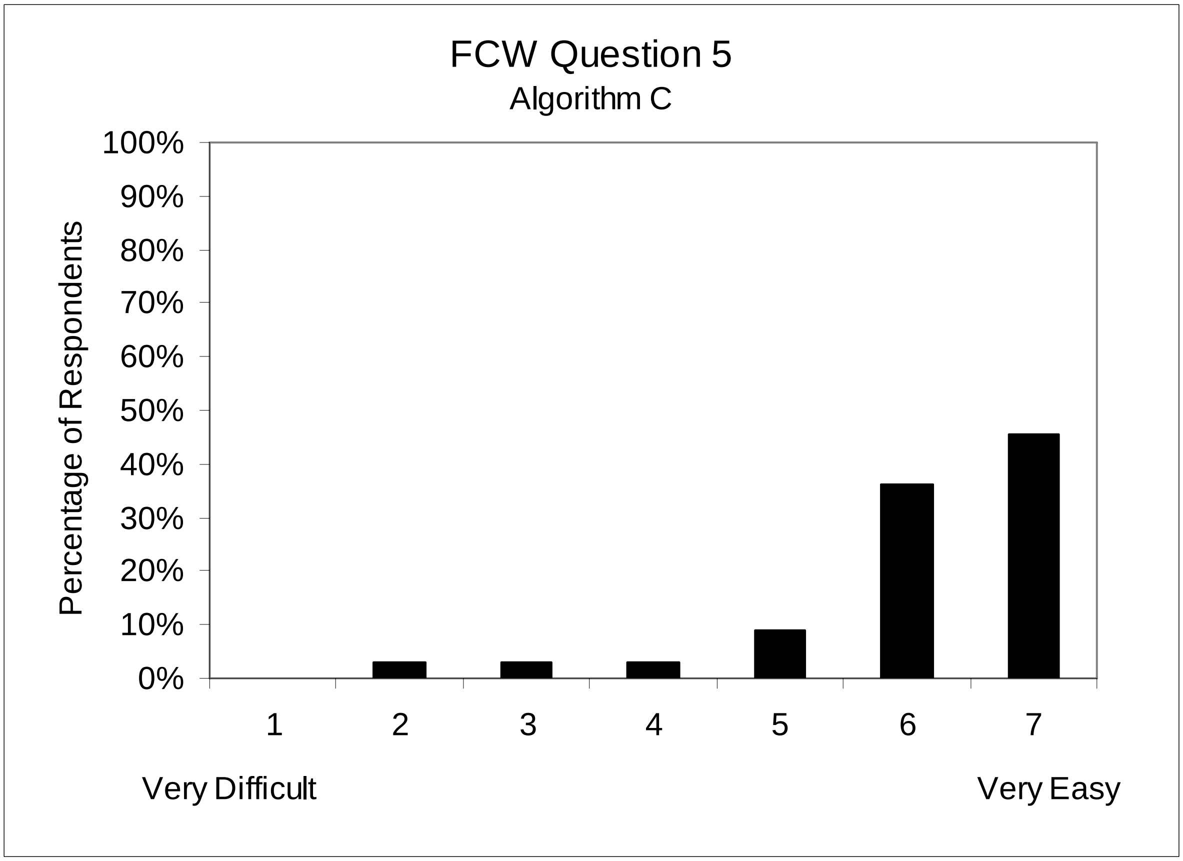
† = Significant difference associated with the interaction of participant age and gender, $H(5) = 12.107$, $p = .033$



4. While using FCW, please tell us the number of times, if ever, you came close to experiencing a rear-end collision? ________

	Males		Females		Overall	
Younger (20-30)	1.1	(1.7)	0.8	(1.1)	1.0	(1.4)
Middle-Aged (40-50)	0.6	(1.2)	1.2	(1.7)	0.9	(1.4)
Older (60-70)	0.6	(1.0)	0.4	(0.7)	0.5	(0.9)
Overall	0.8	(1.3)	0.8	(1.2)	0.8	(1.3)

Values in cells represent the mean response and (standard deviation)



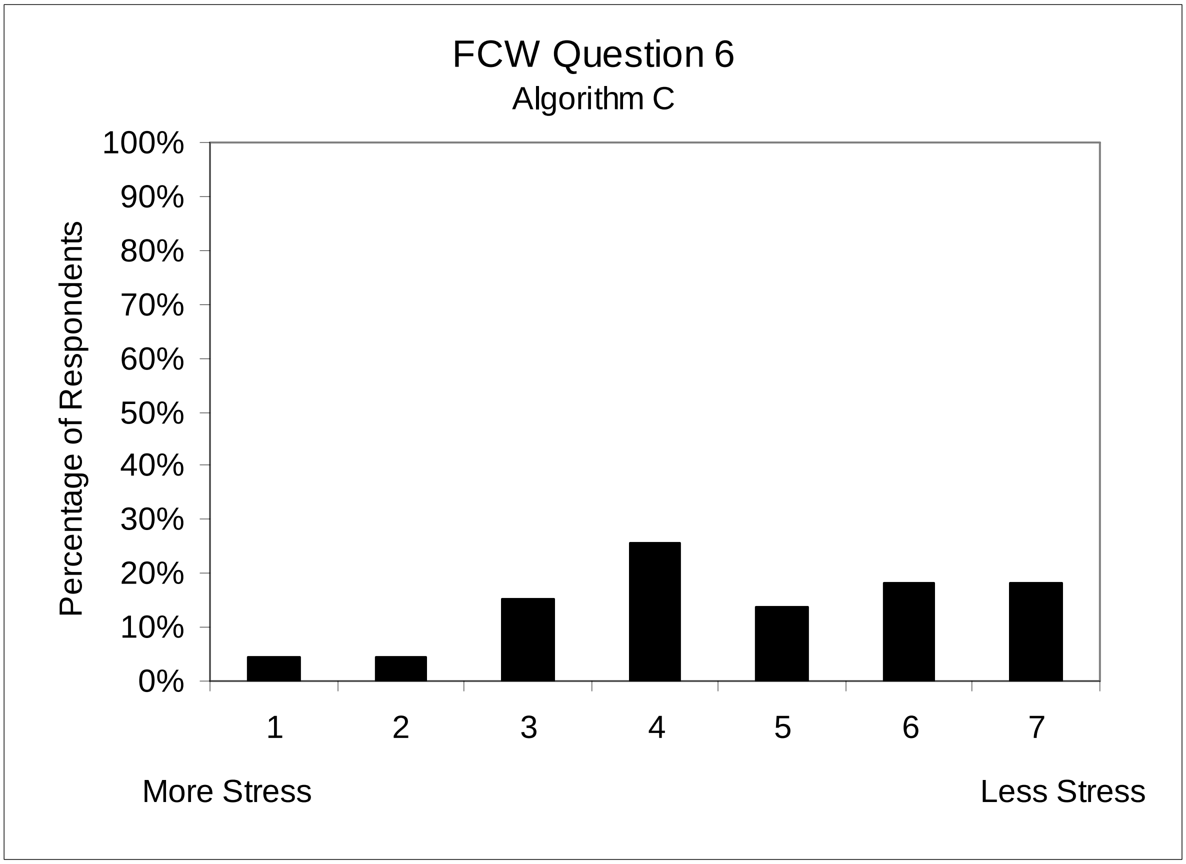
5. How easy or difficult did you find it to drive using FCW?

* †	Males		Females		Overall	
Younger (20-30)	6.0	(0.89)	6.3	(1.6)	6.1	(1.2)
Middle-Aged (40-50) [1]	5.1	(1.8)	5.9	(0.5)	5.5	(1.4)
Older (60-70) [1]	6.7	(0.5)	6.5	(0.5)	6.6	(0.6)
Overall	5.9	(1.3)	6.2	(1.0)	6.1	(1.2)

Values in cells represent the mean response and (standard deviation)

* = Significant difference associated with participant age, $H(2) = 12.309$, $p = .002$

† = Significant difference associated with the interaction of participant age and gender, $H(5) = 15.064$, $p = .010$

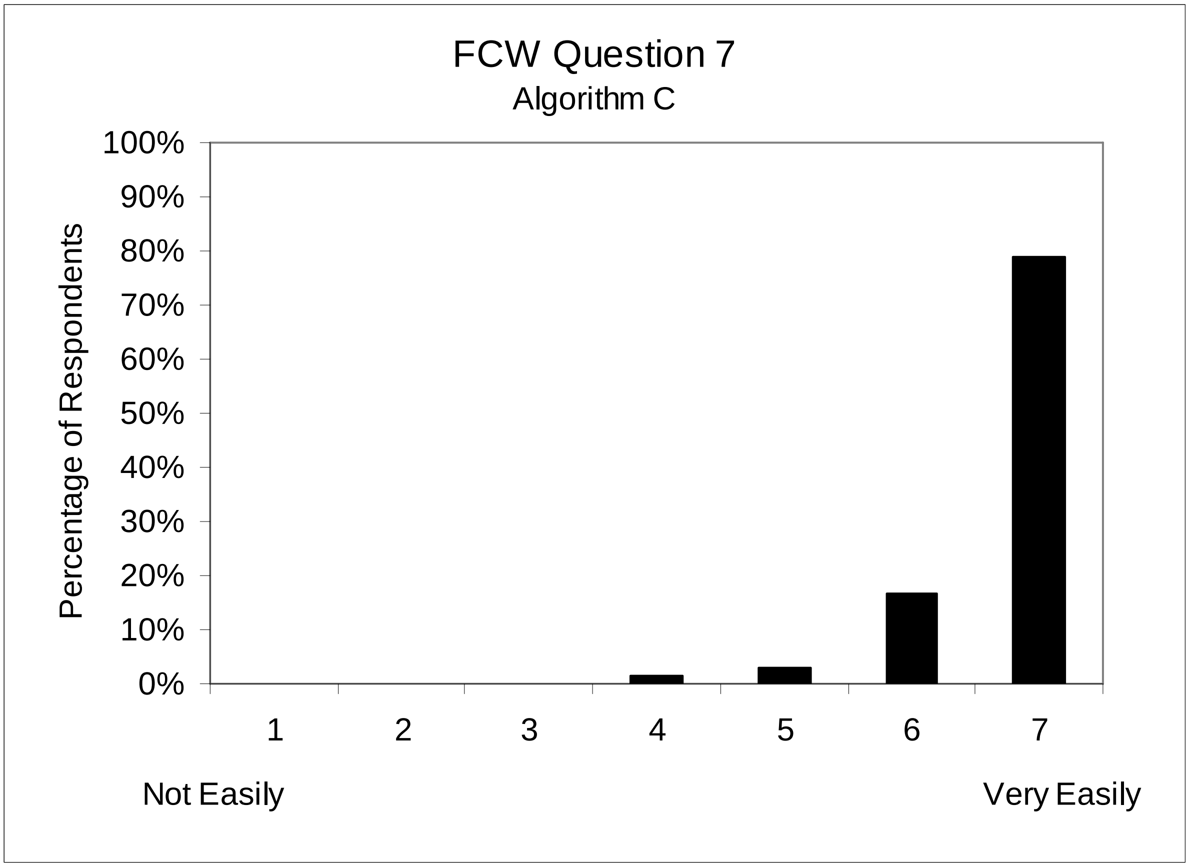


6. Did you experience more or less stress when driving with FCW as compared to manual driving?

*	Males	Females	Overall
Younger (20-30)	3.8 (1.7)	4.5 (1.9)	4.2 (1.8)
Middle-Aged (40-50)	4.6 (1.4)	4.1 (1.8)	4.4 (1.6)
Older (60-70)	5.4 (1.5)	5.5 (1.4)	5.5 (1.4)
Overall	4.6 (1.6)	4.7 (1.8)	4.7 (1.7)

Values in cells represent the mean response and (standard deviation)

* = Significant difference associated with participant age, $H(2) = 7.189$, $p = .027$

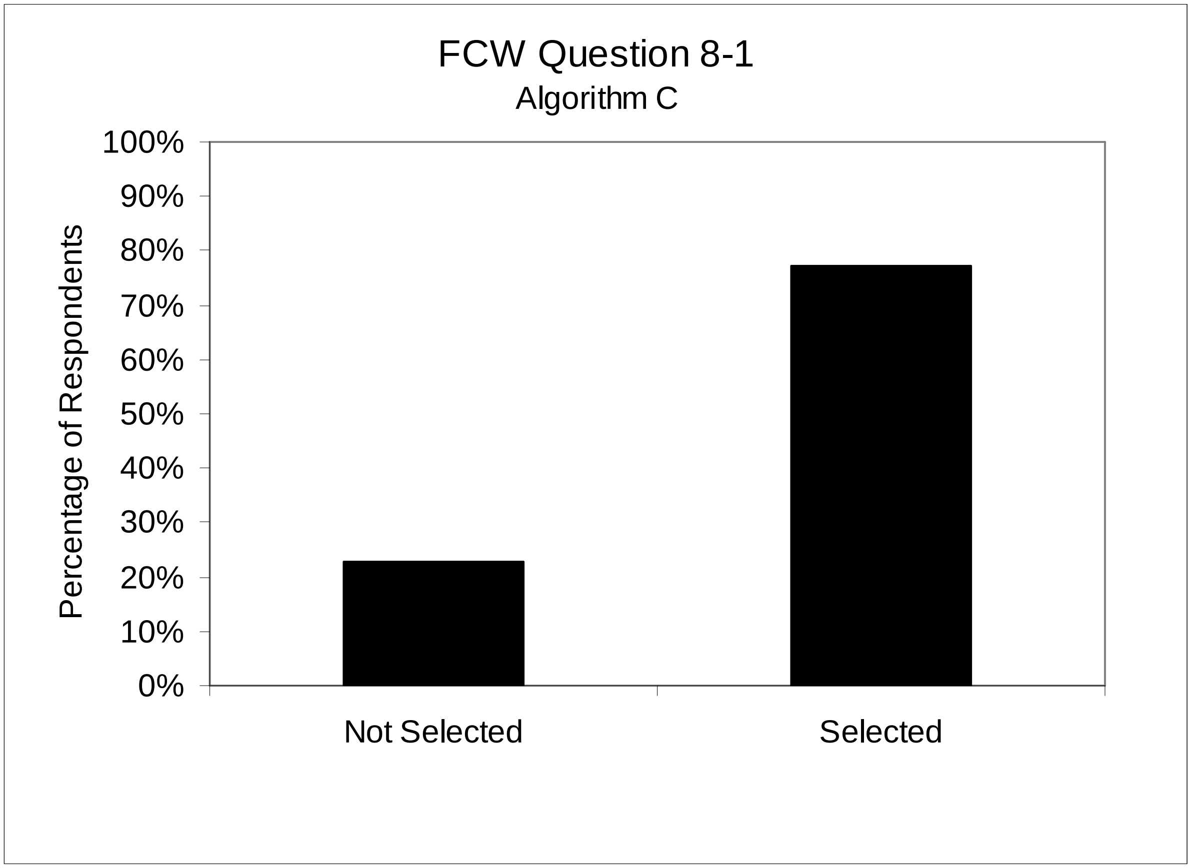


7. How easily were you able to recognize alerts from FCW?

	Males	Females	Overall
Younger (20-30)	6.8 (0.4)	6.5 (0.9)	6.7 (0.7)
Middle-Aged (40-50)	6.5 (0.7)	6.6 (0.7)	6.6 (0.7)
Older (60-70)	6.9 (0.3)	6.9 (0.3)	6.9 (0.3)
Overall	6.8 (0.5)	6.7 (0.7)	6.7 (0.6)

Values in cells represent the mean response and (standard deviation)

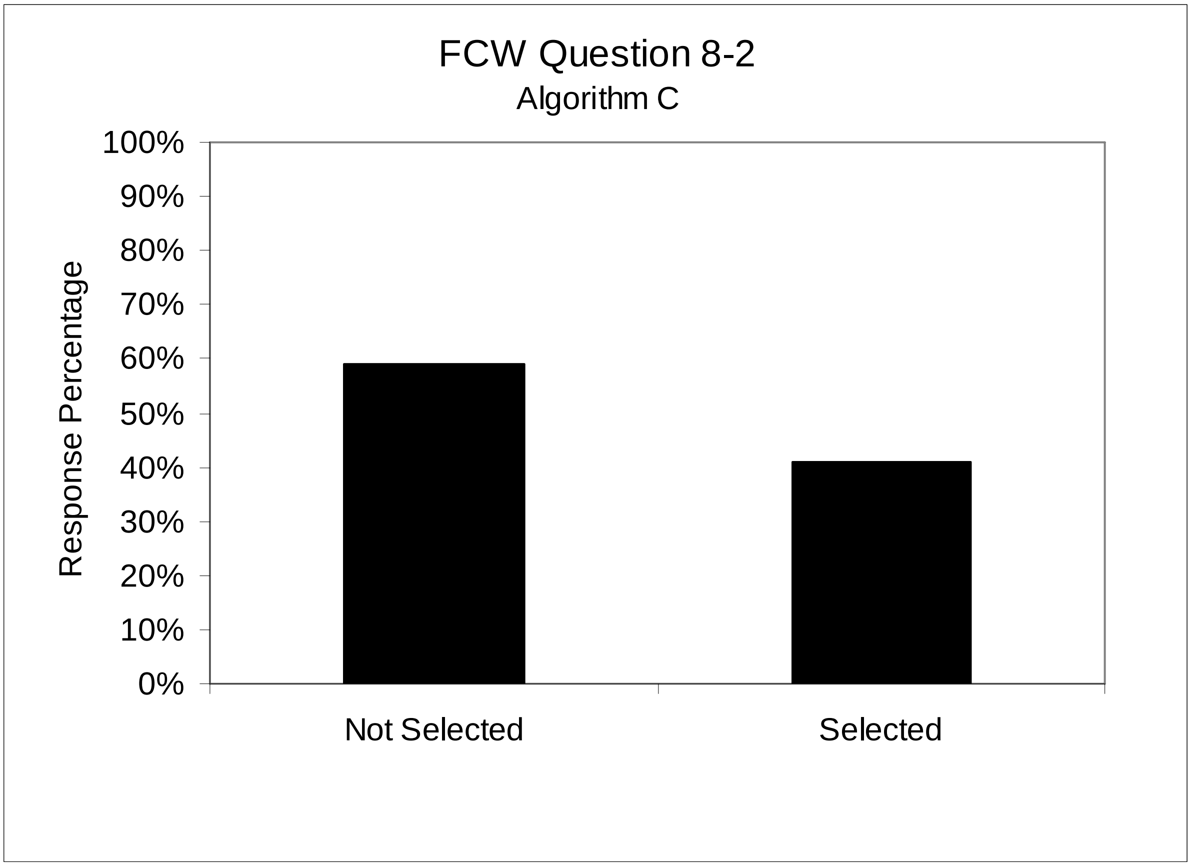
8. If you did change the FCW alert timing adjustment, which of the following factors caused you to change the setting.



8-1 The Traffic Conditions

	Males		Females		Overall	
Selected	Yes	No	Yes	No	Yes	No
Younger (20-30)	10	1	8	3	18	4
Middle-Aged (40-50)	9	2	8	3	17	5
Older (60-70)	8	3	8	3	16	6
Overall	27	6	24	9	51	15

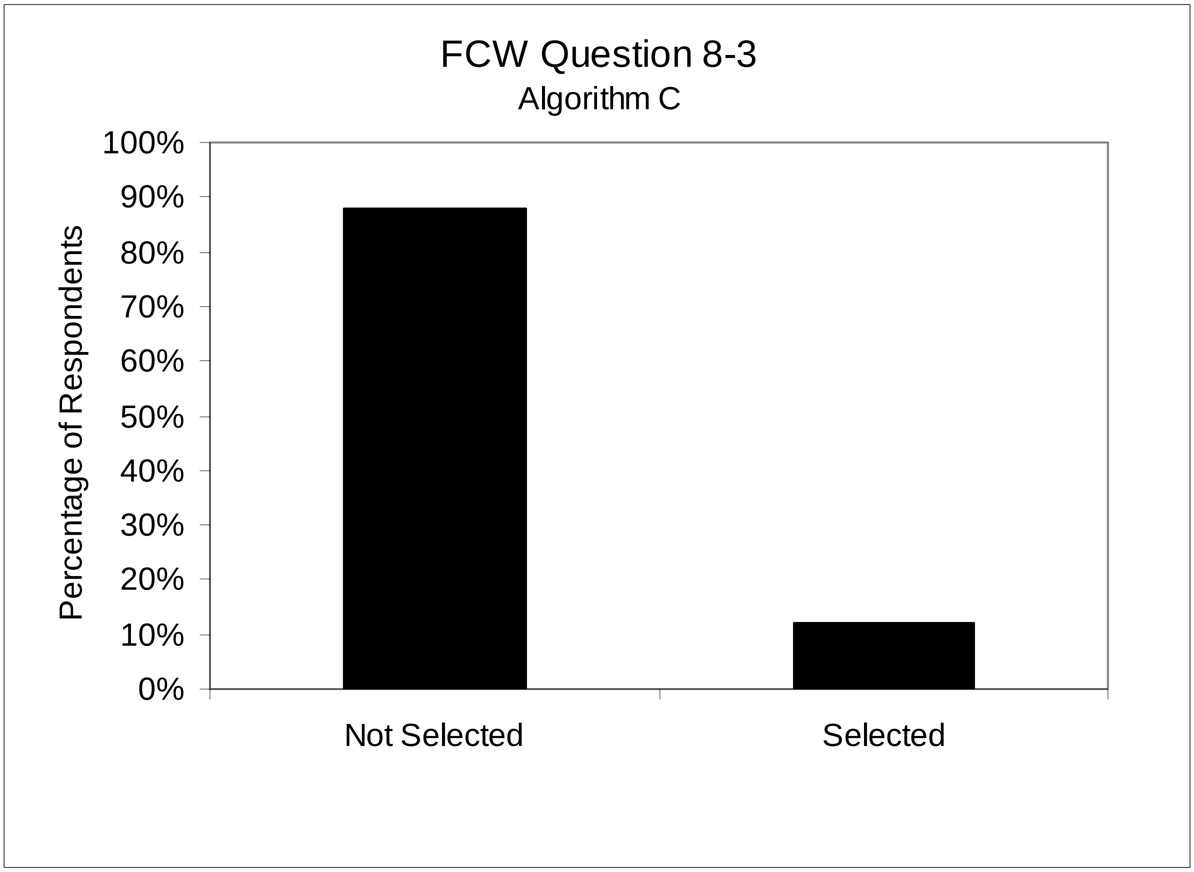
Values in cells represent the frequency of response for each indicated demographic division



8-2 The Weather Conditions

	Males		Females		Overall	
Selected	Yes	No	Yes	No	Yes	No
Younger (20-30)	6	5	4	7	10	12
Middle-Aged (40-50)	6	5	2	9	8	14
Older (60-70)	4	7	5	6	9	13
Overall	16	17	11	22	27	39

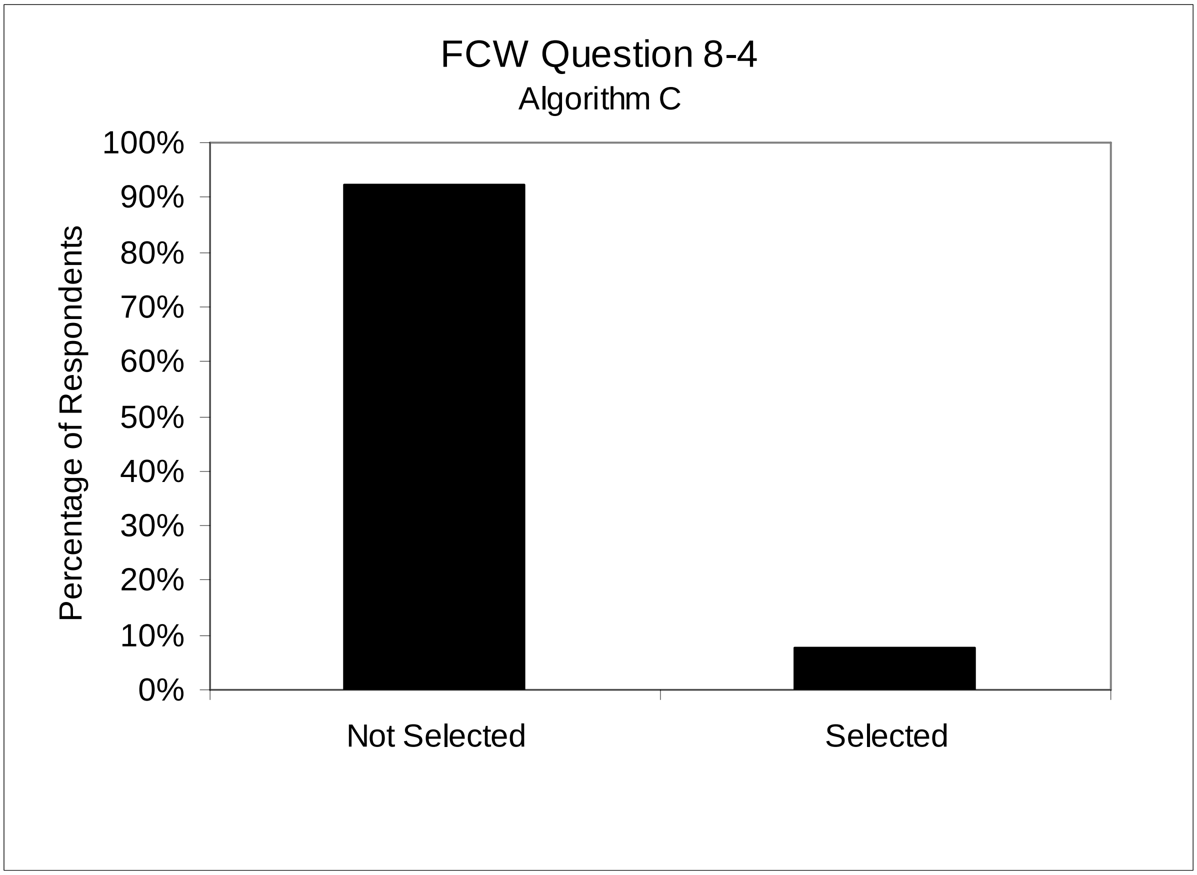
Values in cells represent the frequency of response for each indicated demographic division



8-3 Whether I was in a rush

	Males		Females		Overall	
Selected	Yes	No	Yes	No	Yes	No
Younger (20-30)	3	8	2	9	5	17
Middle-Aged (40-50)	0	11	2	9	2	20
Older (60-70)	1	10	0	11	1	21
Overall	4	29	4	29	8	58

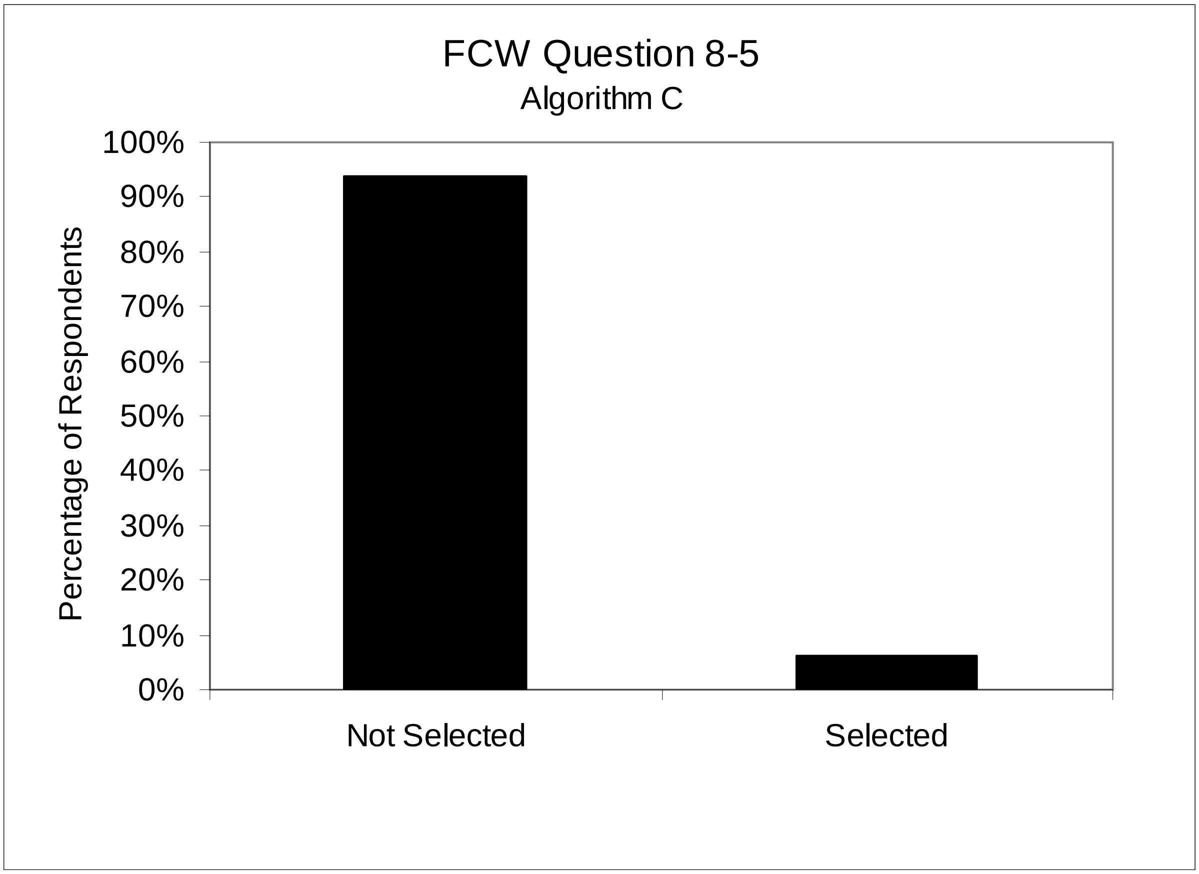
Values in cells represent the frequency of response for each indicated demographic division



8-4 Whether I was Tired

	Males		Females		Overall	
Selected	Yes	No	Yes	No	Yes	No
Younger (20-30)	0	11	3	8	3	19
Middle-Aged (40-50)	1	10	0	11	1	21
Older (60-70)	0	11	1	10	1	21
Overall	1	32	4	29	5	61

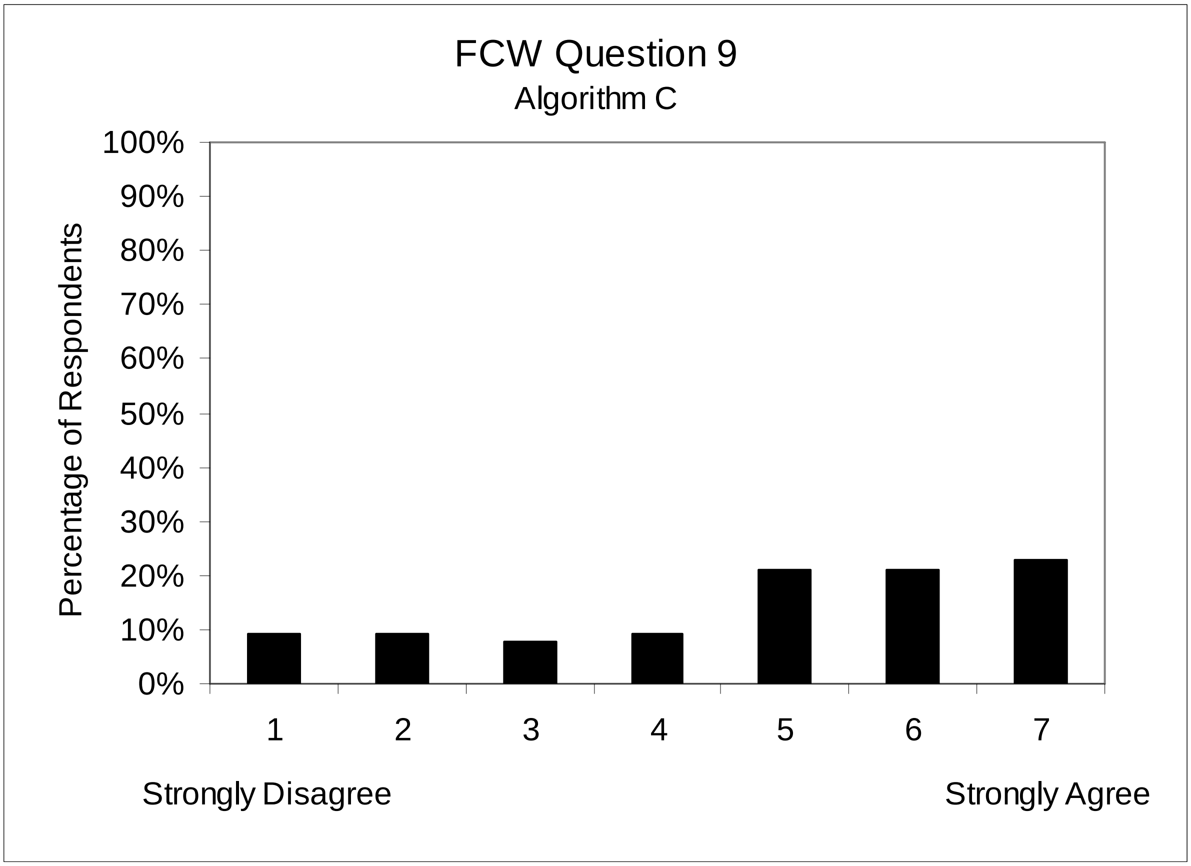
Values in cells represent the frequency of response for each indicated demographic division



8-5 Whether I felt Alert

	Males		Females		Overall	
Selected	Yes	No	Yes	No	Yes	No
Younger (20-30)	0	11	2	9	2	20
Middle-Aged (40-50)	0	11	1	10	1	21
Older (60-70)	0	11	1	10	1	21
Overall	0	33	4	29	4	62

Values in cells represent the frequency of response for each indicated demographic division



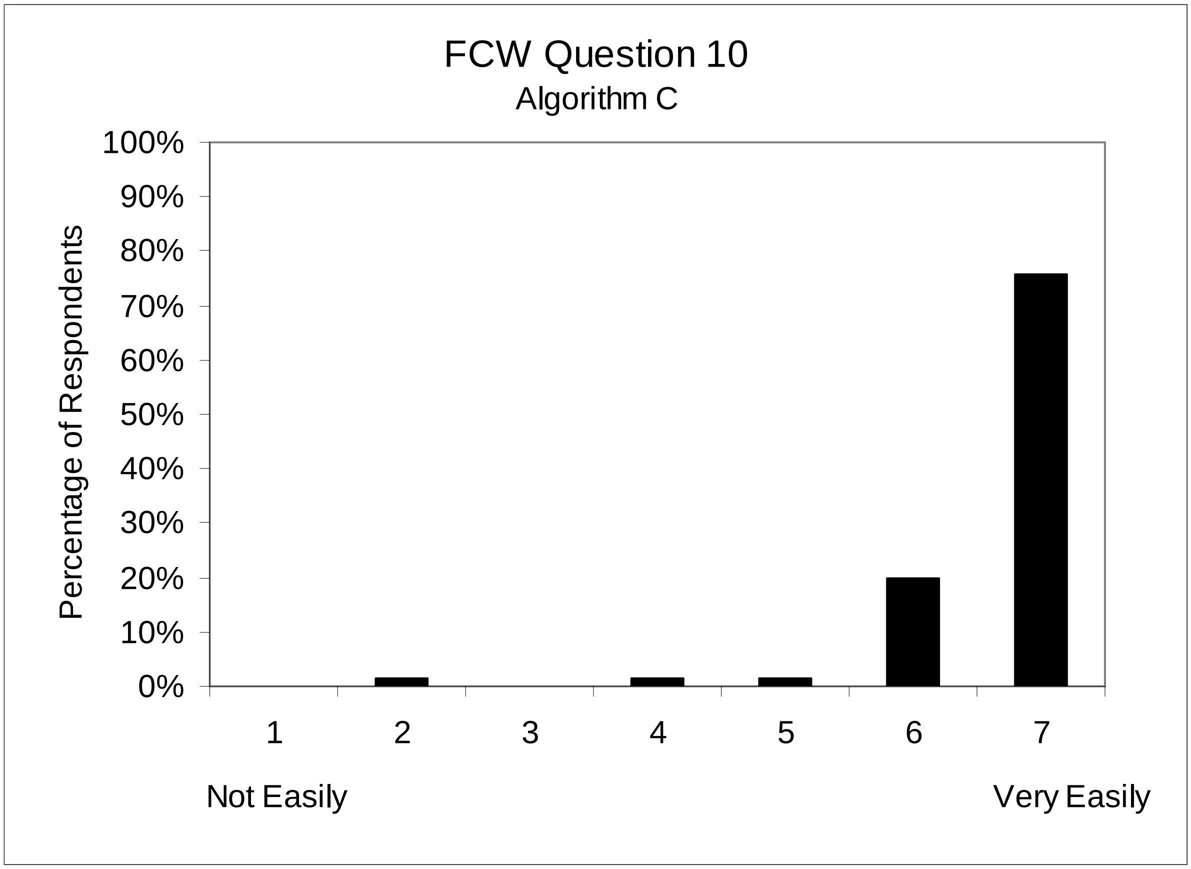
9. Overall, I think the crash alert got my attention quickly in rear-end crash situations but it was not overly annoying if I felt the alert was unnecessary.

* †	Males		Females		Overall	
Younger (20-30)[1]	3.6	(1.9)	4.8	(2.0)	4.2	(2.0)
Middle-Aged (40-50)[2]	4.5	(2.2)	4.0	(1.7)	4.2	(1.9)
Older (60-70)[1,2]	5.6	(1.8)	6.2	(1.1)	5.9	(1.5)
Overall	4.6	(2.0)	5.0	(1.8)	4.8	(1.9)

Values in cells represent the mean response and (standard deviation)

* = Significant difference associated with participant age, $H(2) = 12.548$, $p = .002$

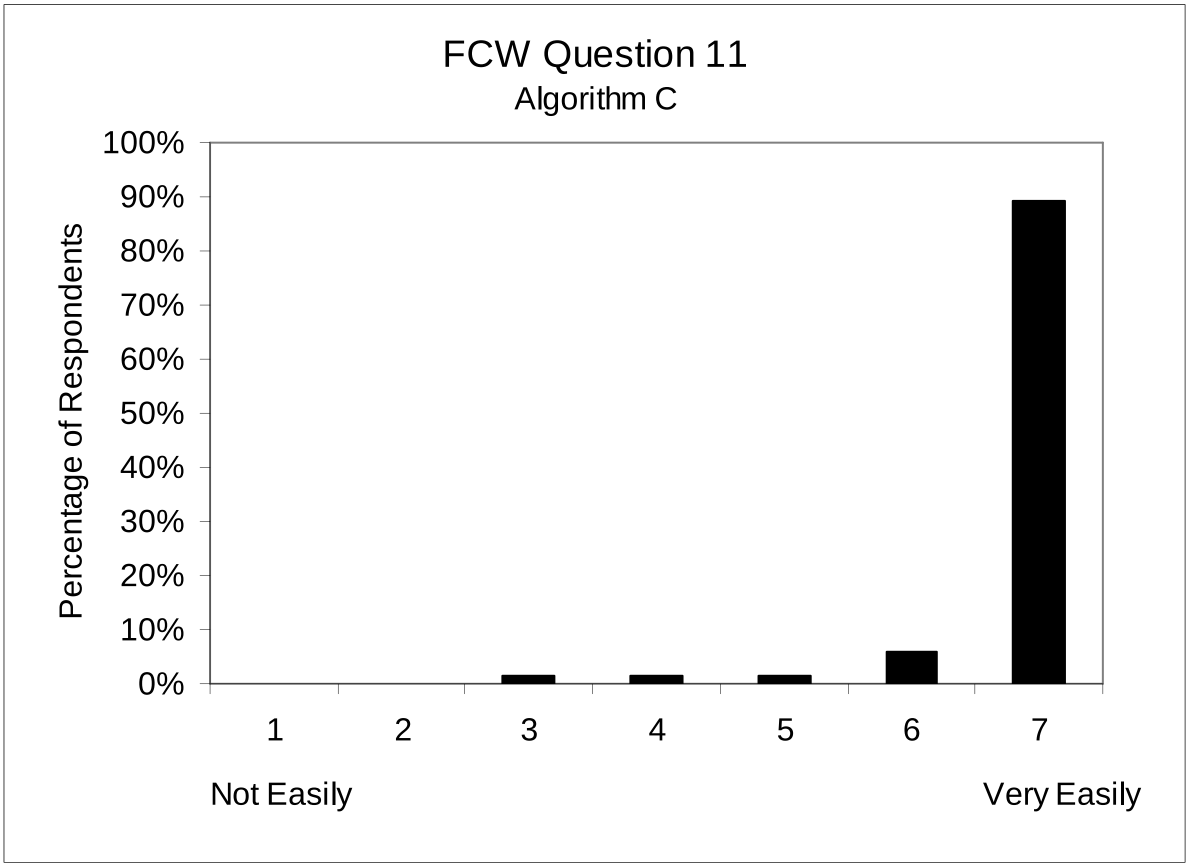
† = Significant difference associated with the interaction of participant age and gender, $H(5) = 15.789$, $p = .007$



10. How easily were you able to detect the visual crash alerts?

	Males	Females	Overall
Younger (20-30)	6.6 (0.5)	6.5 (0.9)	6.5 (0.7)
Middle-Aged (40-50)	6.5 (1.5)	6.5 (0.7)	6.5 (1.1)
Older (60-70)	6.9 (0.3)	6.9 (0.3)	6.9 (0.3)
Overall	6.7 (0.9)	6.6 (0.7)	6.7 (0.8)

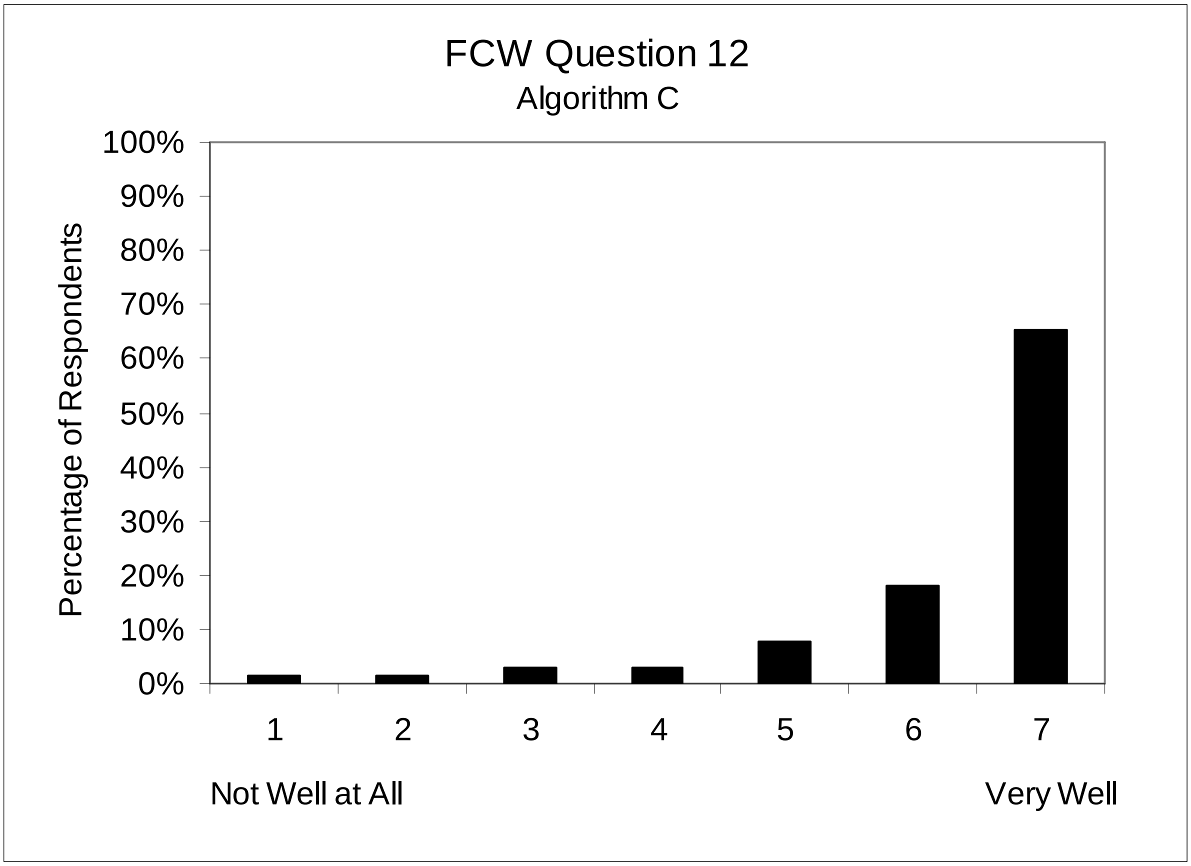
Values in cells represent the mean response and (standard deviation)



11. How easily were you able to detect the audio crash alert?

	Males		Females		Overall	
Younger (20-30)	6.8	(0.4)	6.6	(0.9)	6.7	(0.7)
Middle-Aged (40-50)	7.0	(0.0)	6.6	(1.2)	6.8	(0.9)
Older (60-70)	6.9	(0.3)	6.8	(0.6)	6.9	(0.5)
Overall	6.9	(0.3)	6.7	(0.9)	6.8	(0.7)

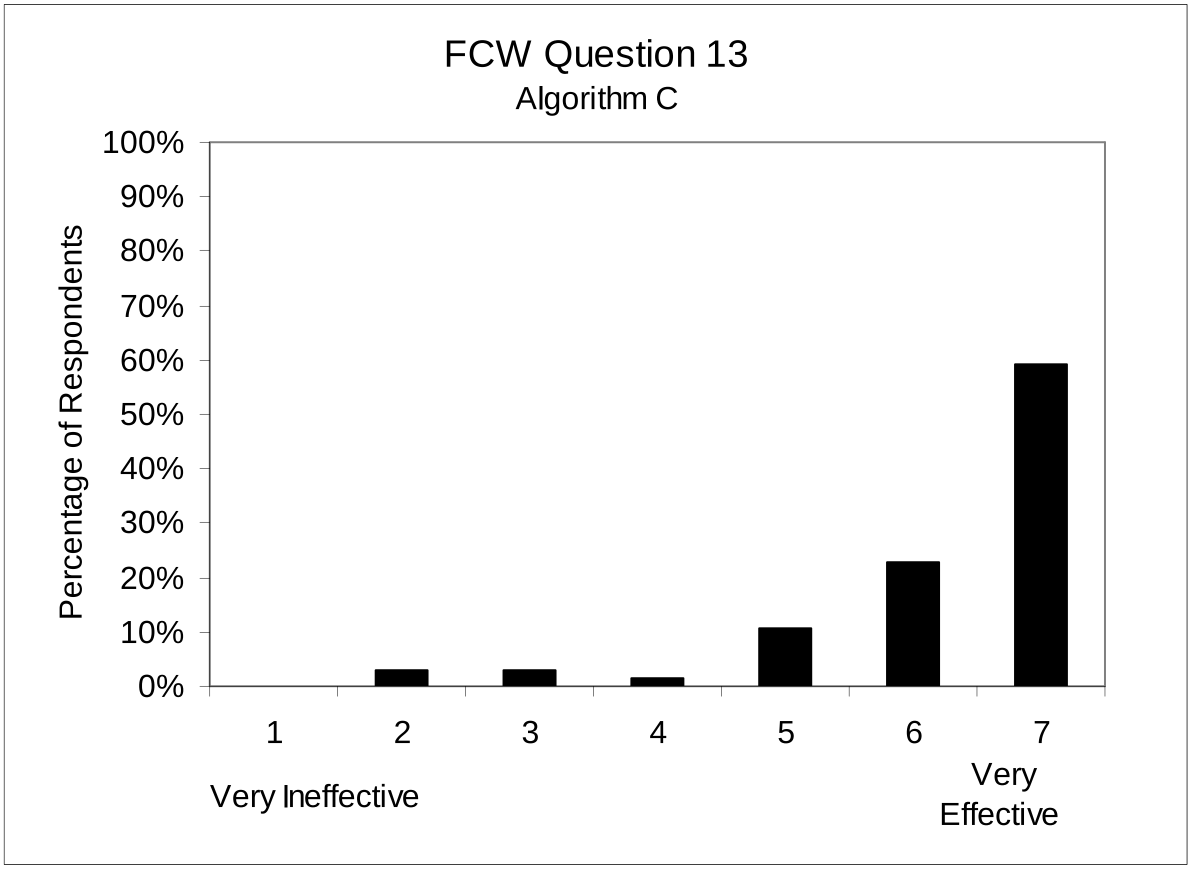
Values in cells represent the mean response and (standard deviation)



12. For the visual alert, how well could you identify whether the alert signaled a cautionary situation (a moderate threat) versus a situation in which you may be about to crash (an imminent threat)?

	Males	Females	Overall
Younger (20-30)	6.5 (0.7)	6.1 (1.8)	6.3 (1.4)
Middle-Aged (40-50)	6.0 (1.7)	5.7 (1.3)	5.9 (1.5)
Older (60-70)	6.7 (0.5)	6.6 (1.2)	6.7 (0.9)
Overall	6.4 (1.1)	6.2 (1.5)	6.3 (1.3)

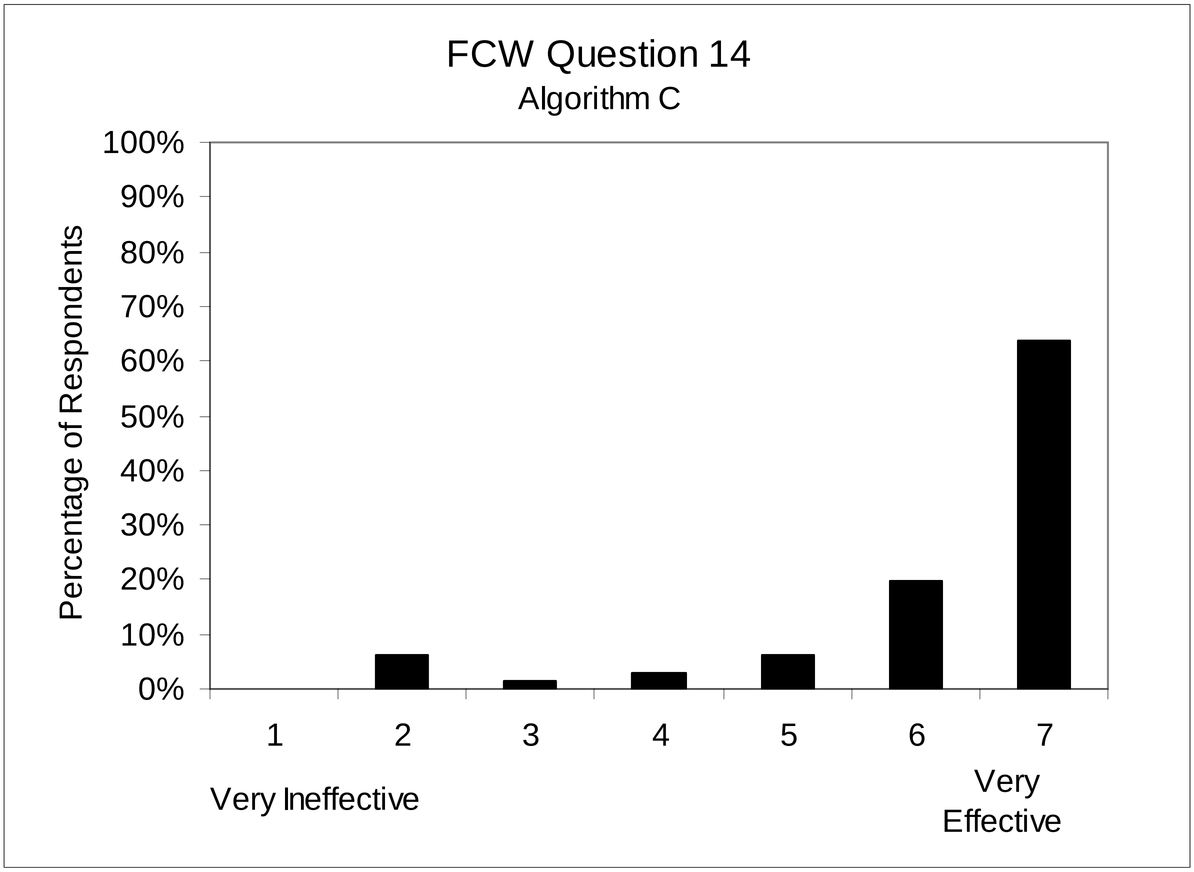
Values in cells represent the mean response and (standard deviation)



13. How effective were the visual alerts at getting your attention quickly?

	Males		Females		Overall	
Younger (20-30)	5.5	(1.6)	6.5	(0.5)	6.0	(1.2)
Middle-Aged (40-50)	6.0	(1.8)	6.4	(0.8)	6.2	(1.4)
Older (60-70)	6.6	(0.7)	6.5	(0.8)	6.5	(1.0)
Overall	6.1	(1.5)	6.4	(0.9)	6.2	(1.2)

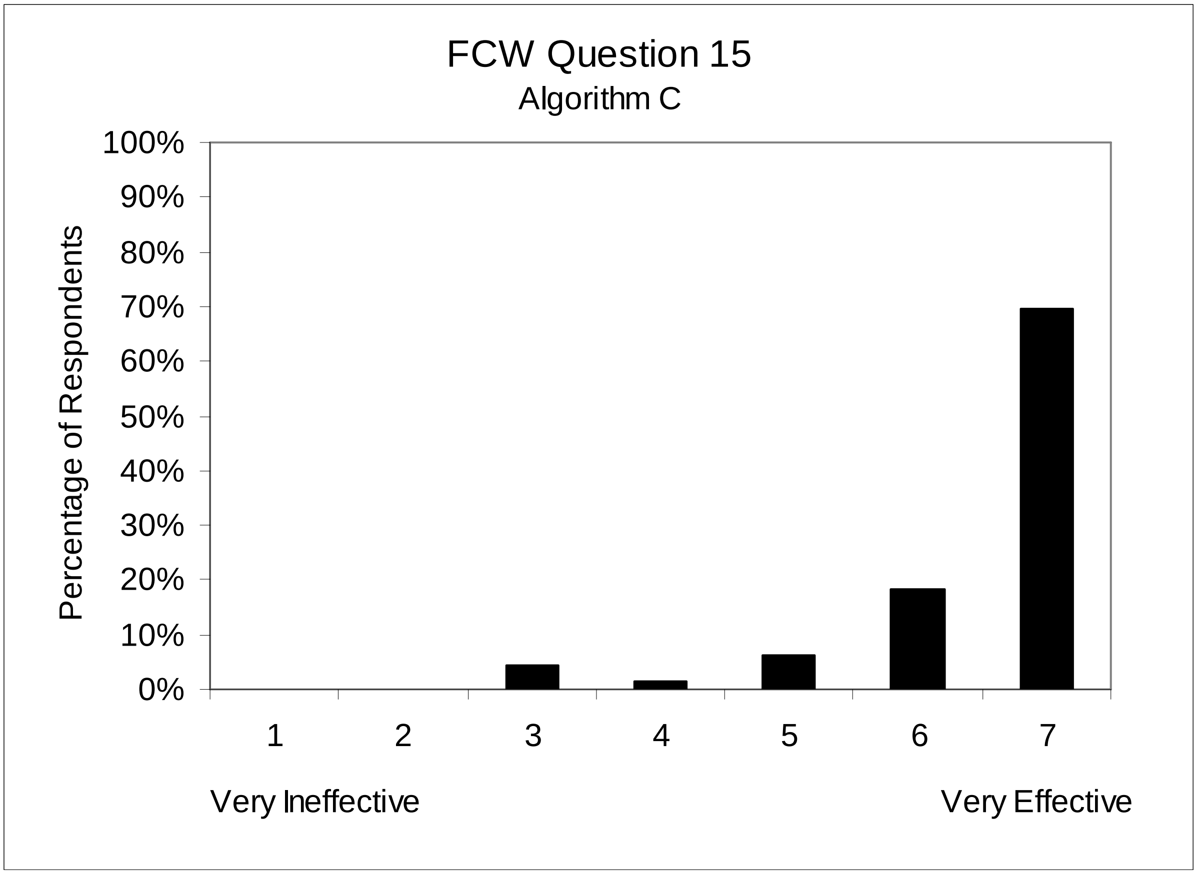
Values in cells represent the mean response and (standard deviation)



14. How effective was the audio alert in communicating a situation in which you may be about to crash (an imminent threat)?

	Males	Females	Overall
Younger (20-30)	6.3 (1.5)	6.1 (1.0)	6.2 (1.3)
Middle-Aged (40-50)	6.6 (0.7)	5.6 (2.0)	6.1 (1.6)
Older (60-70)	6.5 (1.5)	6.3 (1.3)	6.4 (1.4)
Overall	6.5 (1.3)	6.0 (1.5)	6.2 (1.4)

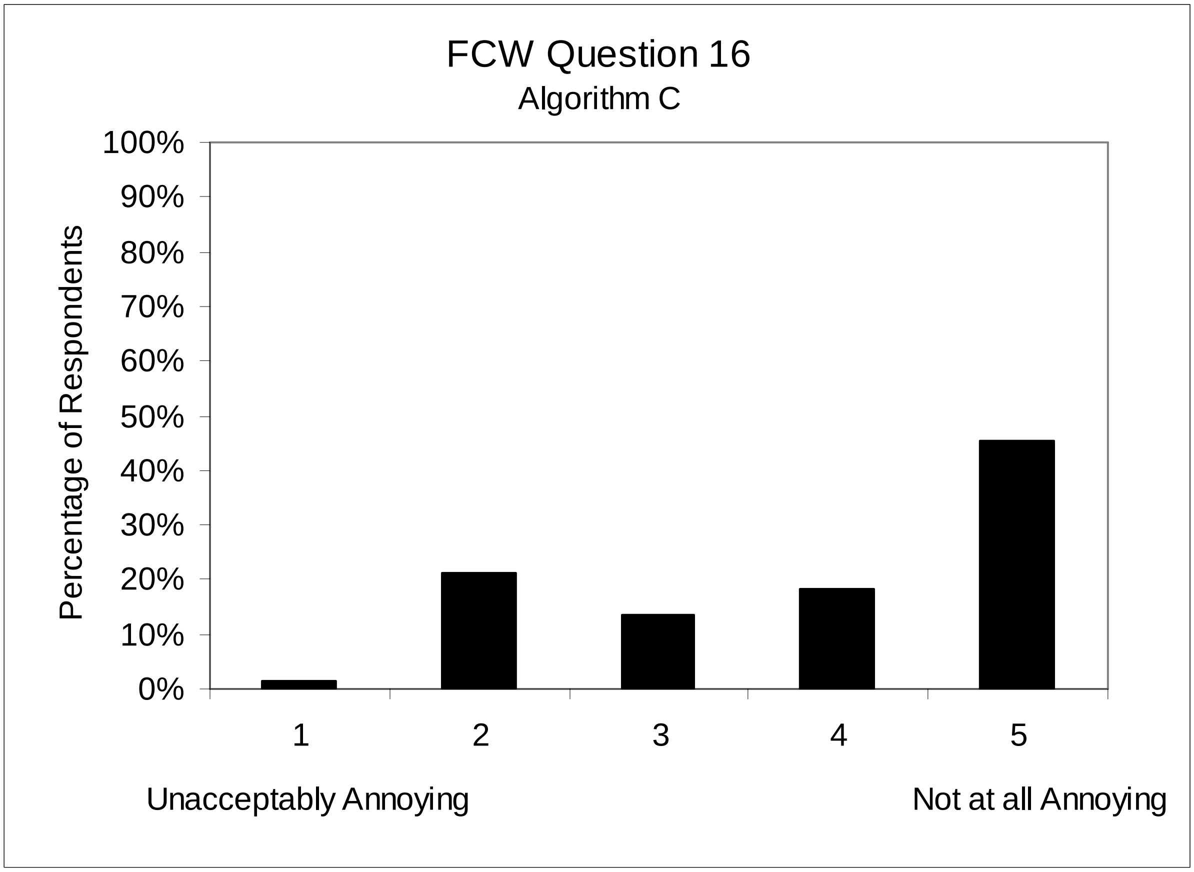
Values in cells represent the mean response and (standard deviation)



15. How effective was the auditory alert at getting your attention quickly?

	Males		Females		Overall	
Younger (20-30)	6.2	(1.3)	6.4	(0.9)	6.3	(1.1)
Middle-Aged (40-50)	6.7	(0.6)	6.2	(1.6)	6.5	(1.2)
Older (60-70)	6.7	(0.6)	6.6	(0.7)	6.7	(0.6)
Overall	6.5	(0.9)	6.4	(1.1)	6.5	(1.0)

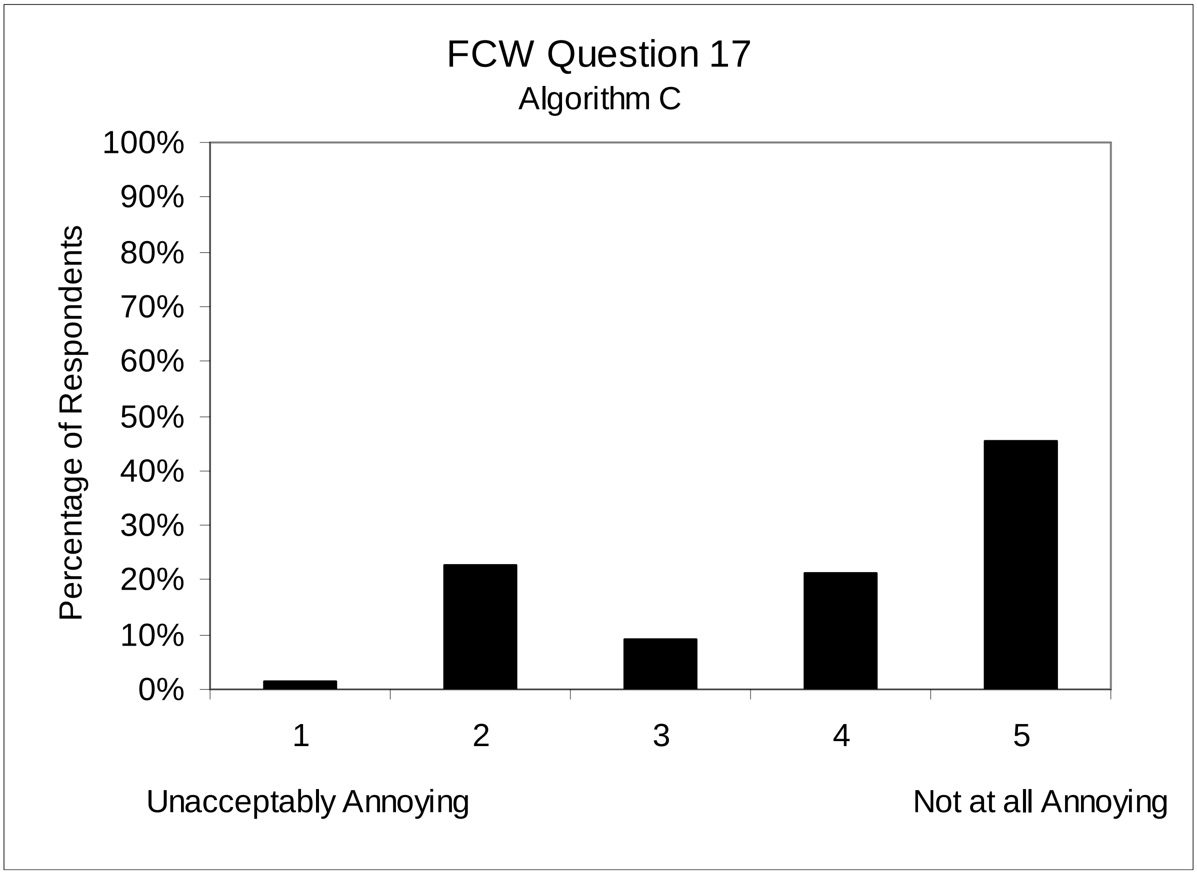
Values in cells represent the mean response and (standard deviation)



16. How annoying were the visual alerts that signaled a cautionary situation (a moderate threat)? Please check the one option that best applies.

	Males	Females	Overall
Younger (20-30)	2.8 (1.3)	3.9 (1.2)	3.4 (1.3)
Middle-Aged (40-50)	4.3 (1.0)	3.3 (1.2)	3.8 (1.2)
Older (60-70)	4.3 (1.1)	4.5 (1.0)	4.4 (1.1)
Overall	3.8 (1.3)	3.9 (1.2)	3.8 (1.3)

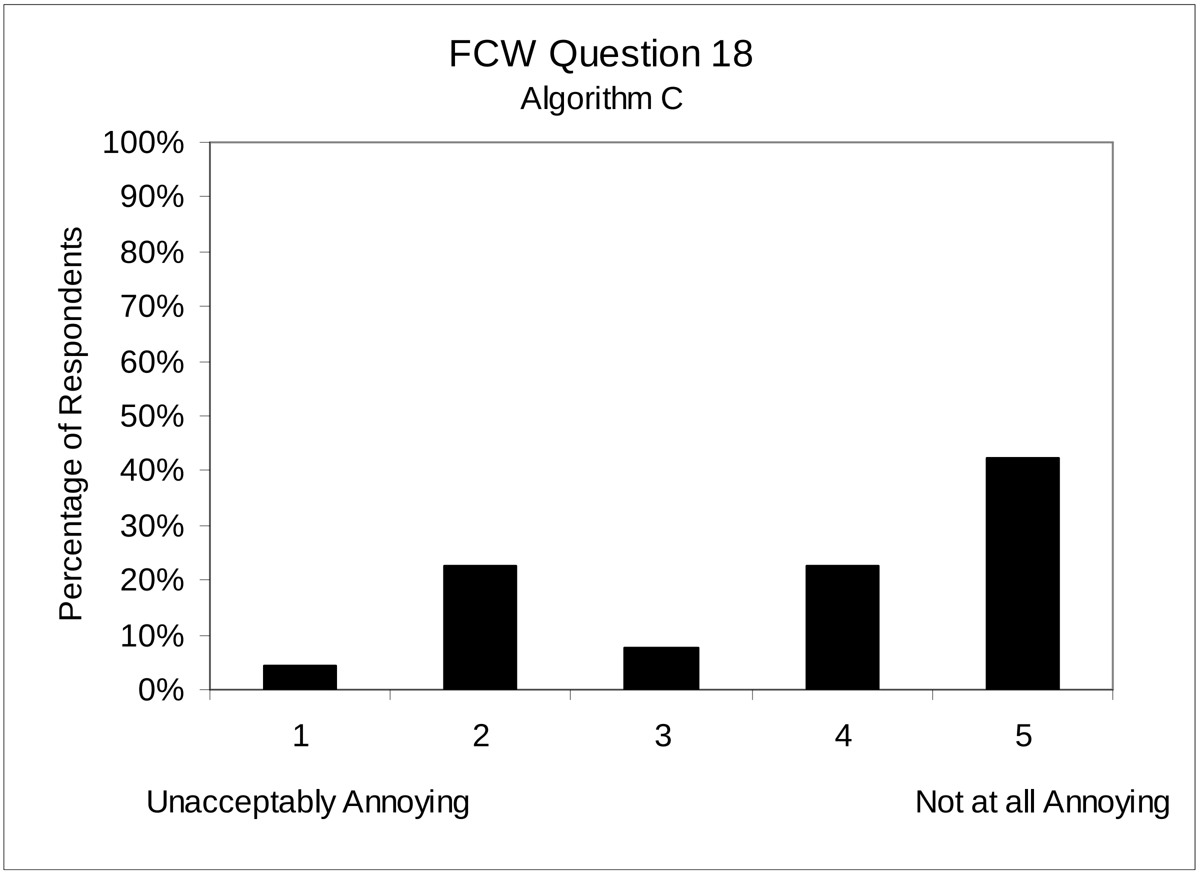
Values in cells represent the mean response and (standard deviation)



17. How <u>annoying</u> was the visual alert that signaled a situation in which you may be about to crash (an imminent threat)? Please check the one option that best applies.

	Males	Females	Overall
Younger (20-30)	3.5 (1.4)	3.8 (1.4)	3.6 (1.4)
Middle-Aged (40-50)	3.6 (1.2)	3.0 (1.2)	3.3 (1.2)
Older (60-70)	4.7 (0.6)	4.5 (0.9)	4.4 (0.8)
Overall	3.9 (1.2)	3.8 (1.3)	3.9 (1.3)

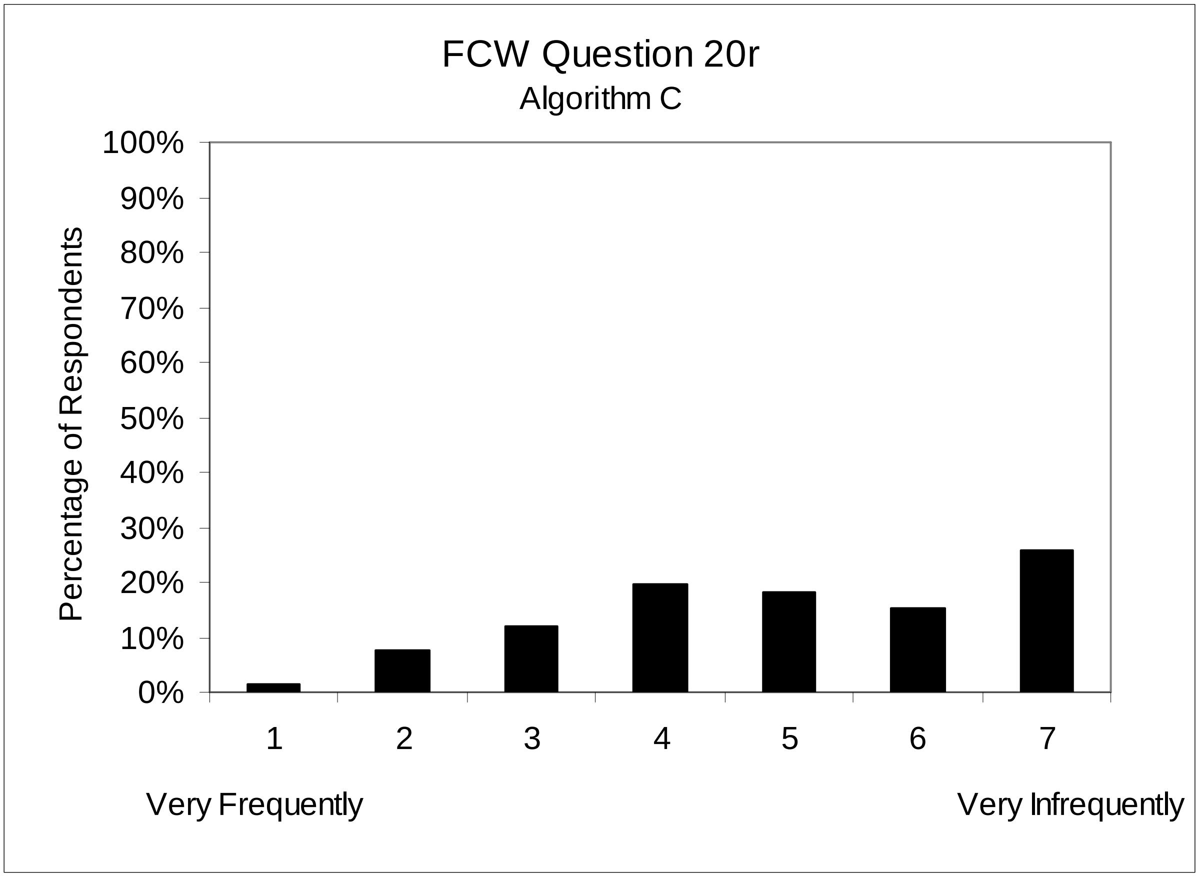
Values in cells represent the mean response and (standard deviation)



18. How annoying was the auditory alert that signaled a situation in which you may be about to crash (an imminent threat)? Please check the one option that best applies.

	Males		Females		Overall	
Younger (20-30)	2.9	(1.1)	3.4	(1.8)	3.1	(1.5)
Middle-Aged (40-50)	3.5	(1.3)	3.6	(1.2)	3.5	(1.2)
Older (60-70)	4.5	(0.9)	4.6	(0.7)	4.6	(0.8)
Overall	3.6	(1.3)	3.9	(1.4)	3.8	(1.3)

Values in cells represent the mean response and (standard deviation)



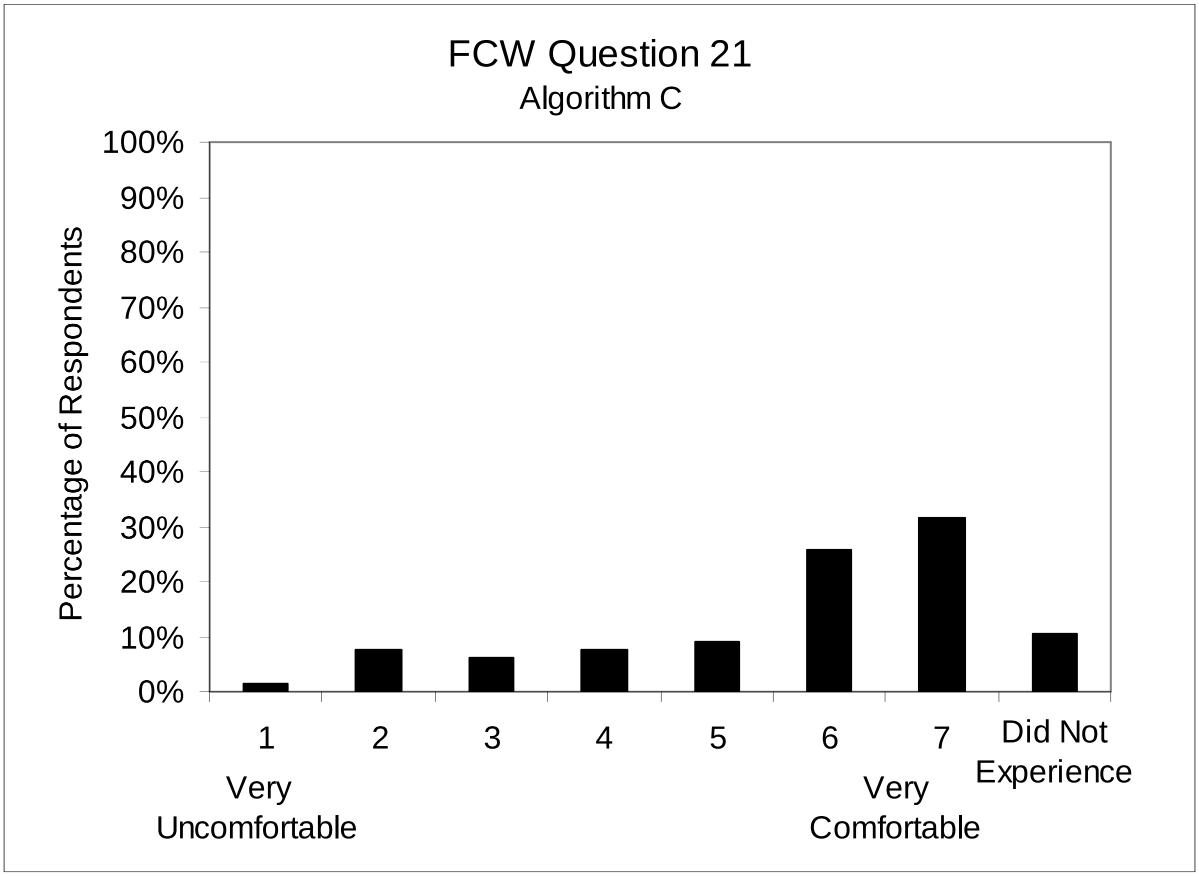
20. How often, if ever, did FCW give you a warning that was false (i.e. there were no other vehicles to warn about)? (*The original question allowed for the option of "never" represented by a "0". For this evaluation, 0's have been recoded as 7's: "very infrequently")*

*	Males	Females	Overall
Younger (20-30)[1]	4.0 (1.7)	4.8 (1.5)	4.4 (1.6)
Middle-Aged (40-50)	4.6 (1.9)	4.9 (1.6)	4.8 (1.7)
Older (60-70)[1]	6.2 (1.3)	5.1 (1.6)	5.6 (1.5)
Overall	4.9 (1.8)	4.9 (1.5)	4.9 (1.7)

Values in cells represent the mean response and (standard deviation)

* = Significant difference associated with participant age, $H(2) = 6.429$, $p = .040$

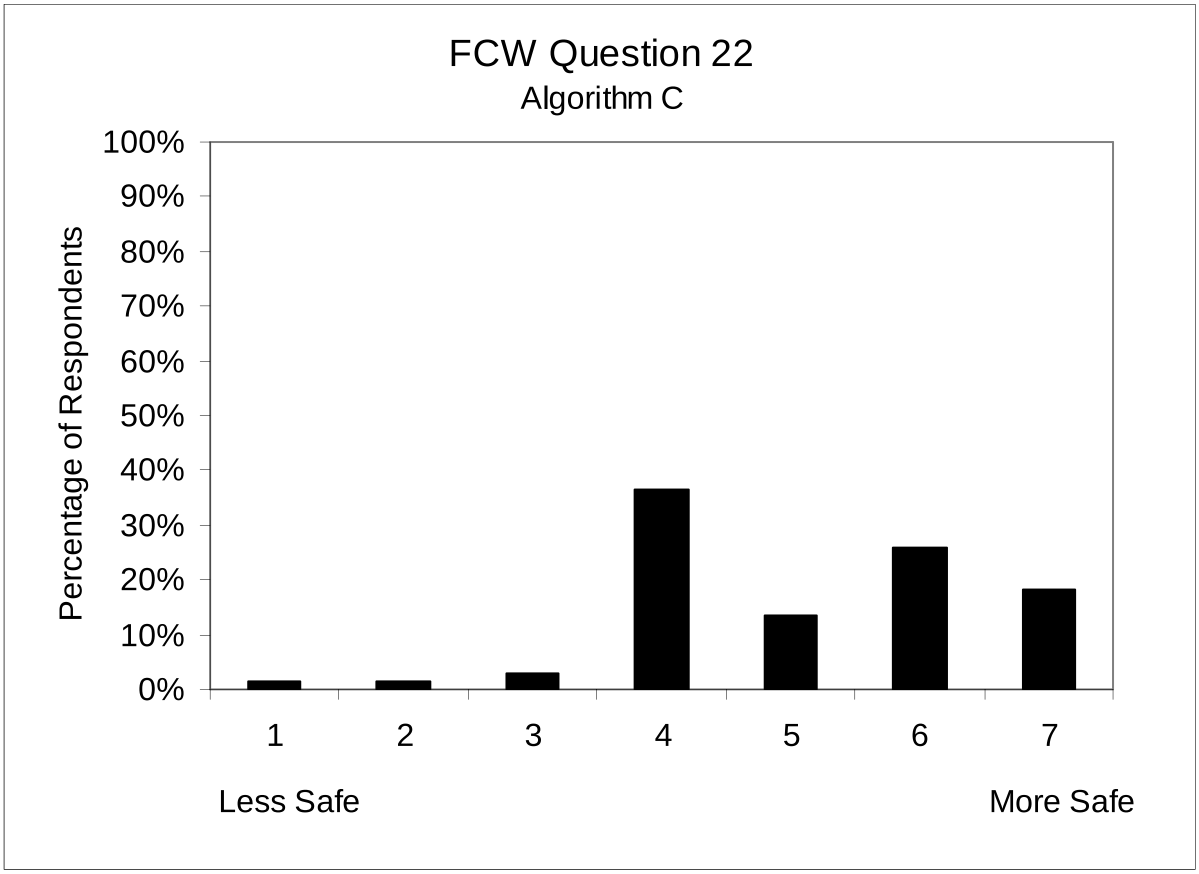
† = Significant difference associated with the interaction of participant age and gender, $H(5) = 15.789$, $p = .007$



21. How comfortable did you feel using FCW in adverse weather conditions?

	Males	Females	Overall
Younger (20-30)	5.4 (1.8)	5.3 (1.9)	5.3 (1.8)
Middle-Aged (40-50)	5.2 (2.0)	5.7 (1.7)	5.5 (1.8)
Older (60-70)	5.5 (1.4)	5.6 (1.9)	5.6 (1.6)
Overall	5.4 (1.7)	5.5 (1.8)	4.9 (2.3)

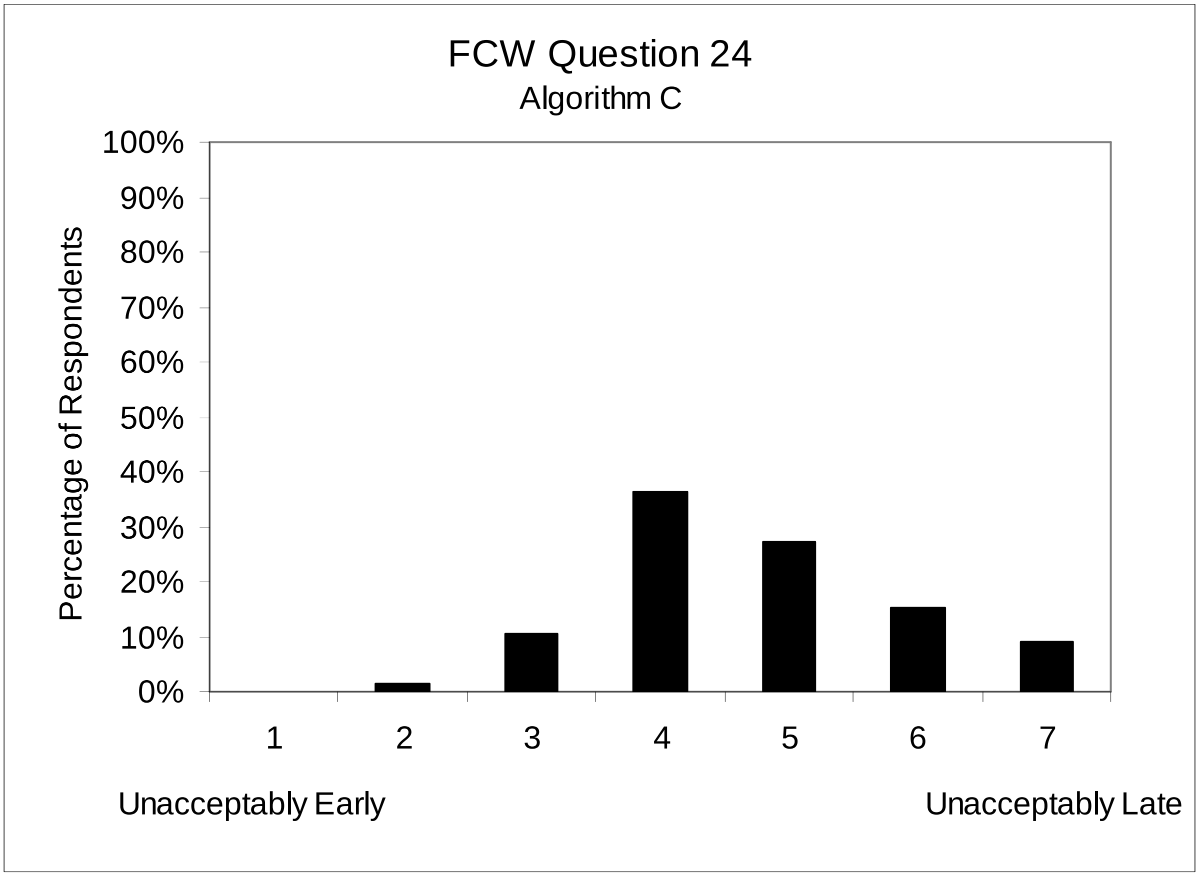
Values in cells represent the mean response and (standard deviation)



22. When using FCW, do you feel you drove more or less safely than when driving manually?

	Males	Females	Overall
Younger (20-30)	4.5 (0.9)	5.4 (1.6)	5.0 (1.3)
Middle-Aged (40-50)	5.2 (1.7)	5.0 (1.2)	5.1 (1.4)
Older (60-70)	5.1 (1.3)	5.4 (1.5)	5.2 (1.4)
Overall	4.9 (1.3)	5.2 (1.4)	5.1 (1.4)

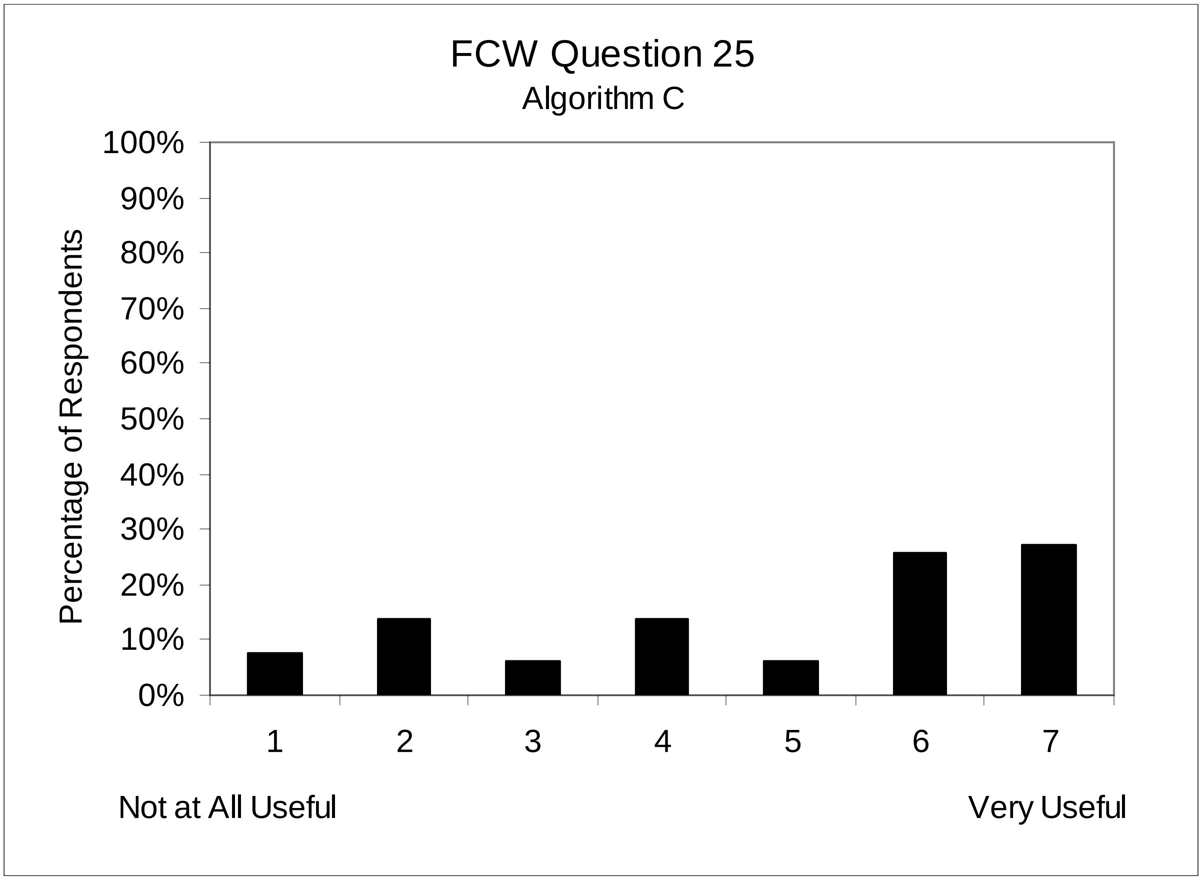
Values in cells represent the mean response and (standard deviation)



24. Overall, evaluate the timing of the auditory alert when FCW was responding to a vehicle ahead. Please check the one option that best applies.

	Males	Females	Overall
Younger (20-30)	4.6 (1.4	4.3 (0.6)	4.5 (1.1)
Middle-Aged (40-50)	5.5 (1.1)	4.2 (1.0)	4.8 (1.2)
Older (60-70)	5.0 (1.2)	4.7 (1.3)	4.9 (1.2)
Overall	5.0 (1.2)	1.0 (4.8)	4.7 (1.2)

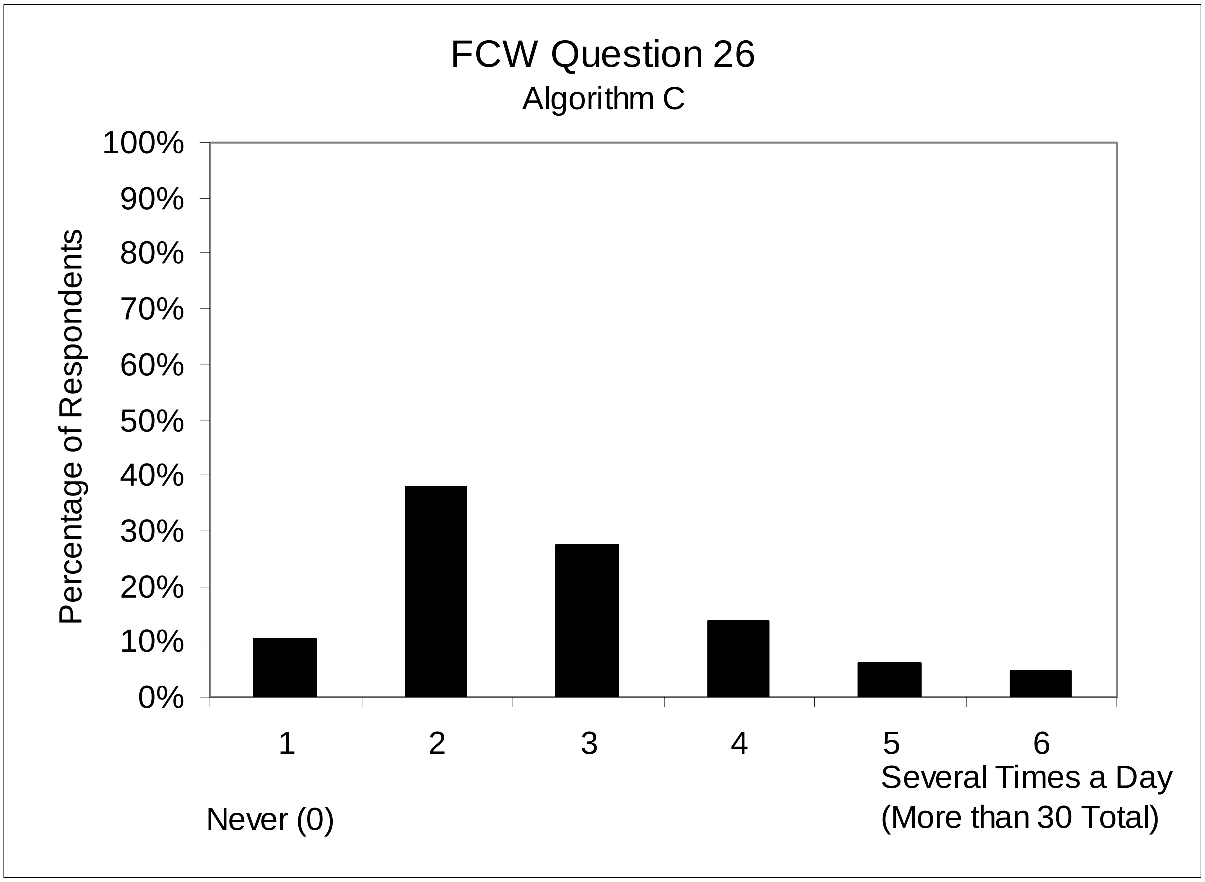
Values in cells represent the mean response and (standard deviation)



25. Overall, please rate the extent to which FCW alerts were useful in providing a warning about a driving situation that might result in a collision.

	Males	Females	Overall
Younger (20-30)	4.2 (1.9)	4.3 (2.4)	4.2 (2.1)
Middle-Aged (40-50)	5.0 (2.2)	4.5 (2.1)	4.8 (2.1)
Older (60-70)	5.5 (1.8)	5.5 (1.9)	5.5 (1.8
Overall	4.9 (2.0)	4.8 (2.1)	4.8 (2.1)

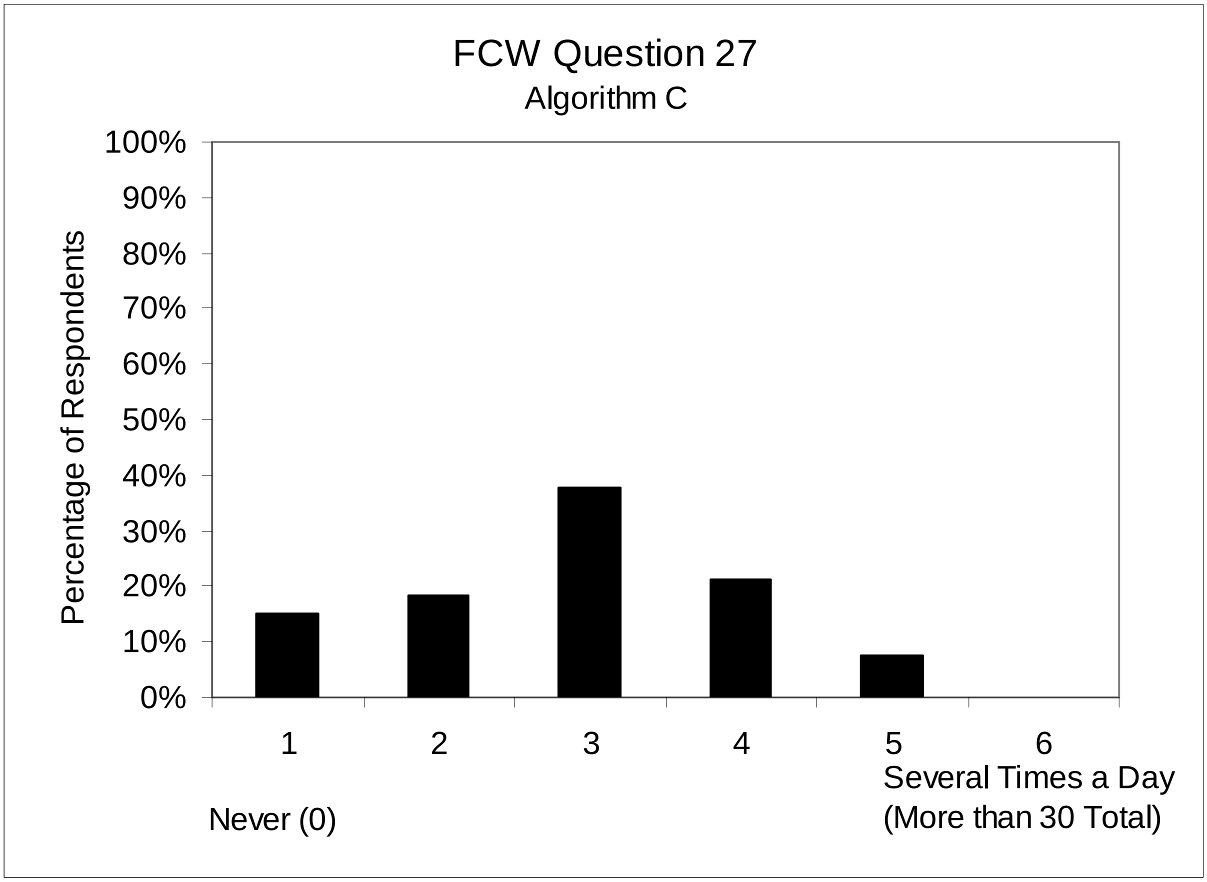
Values in cells represent the mean response and (standard deviation)



26. How often, if ever, did FCW give you an alert in a situation that you felt was appropriate? Please check the one option that best applies.

	Males	Females	Overall
Younger (20-30)	3.2 (1.5)	2.5 (1.2)	2.9 (1.4)
Middle-Aged (40-50)	2.8 (1.4)	2.6 (1.1)	2.7 (1.2)
Older (60-70)	2.9 (1.4)	2.7 (0.9)	2.8 (1.2)
Overall	3.0 (1.4)	2.6 (1.1)	2.8 (1.3)

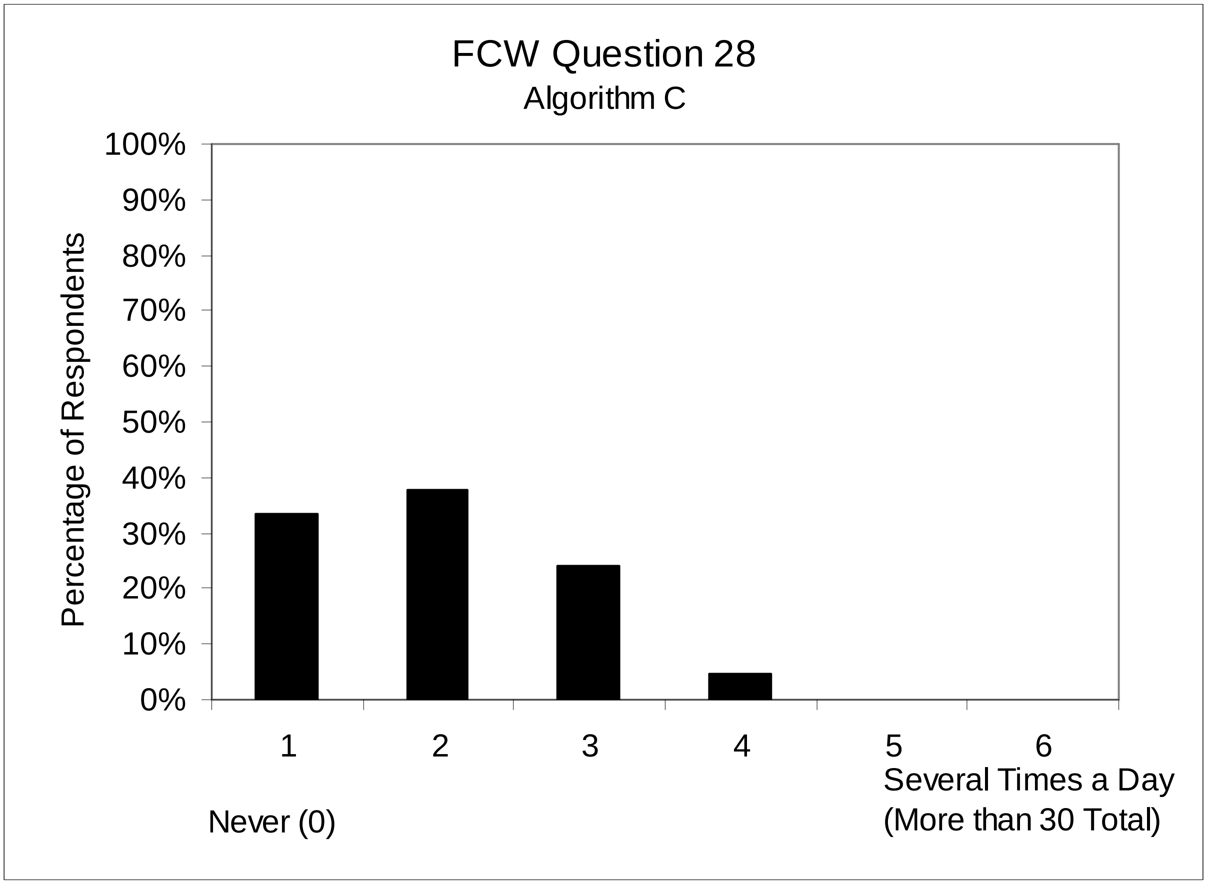
Values in cells represent the mean response and (standard deviation)



27. How often, if ever, did FCW give you an alert in a situation that you felt was not appropriate? Please check the one option that best applies.

	Males	Females	Overall
Younger (20-30)	3.1 (0.8)	3.2 (1.3)	3.1 (1.1)
Middle-Aged (40-50)	3.2 (1.1)	3.2 (0.6)	3.2 (0.9)
Older (60-70)	2.4 (1.2)	2.3 (1.4)	2.3 (1.3)
Overall	2.9 (1.1)	2.9 (1.2)	2.9 (1.1)

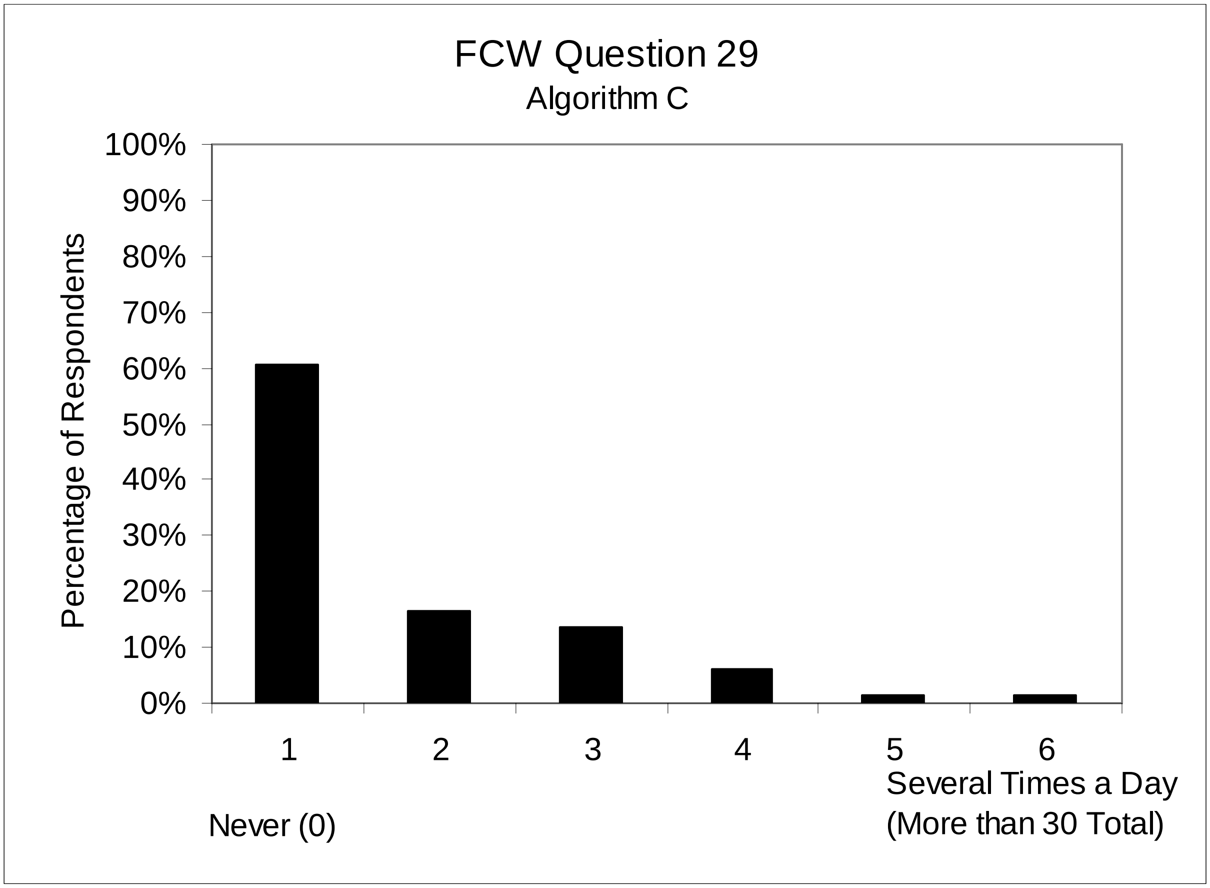
Values in cells represent the mean response and (standard deviation)



28. How often, if ever, did FCW give you an alert where you could not identify the source of the alert? Please check the one option that best applies.

	Males	Females	Overall
Younger (20-30)	2.5 (0.9)	2.0 (0.8)	2.3 (0.9)
Middle-Aged (40-50)	2.1 (0.7)	2.1 (0.7)	2.1 (0.7)
Older (60-70)	1.7 (1.0)	1.5 (0.9)	1.6 (1.0)
Overall	2.1 (0.9)	1.9 (0.8)	2.0 (0.9)

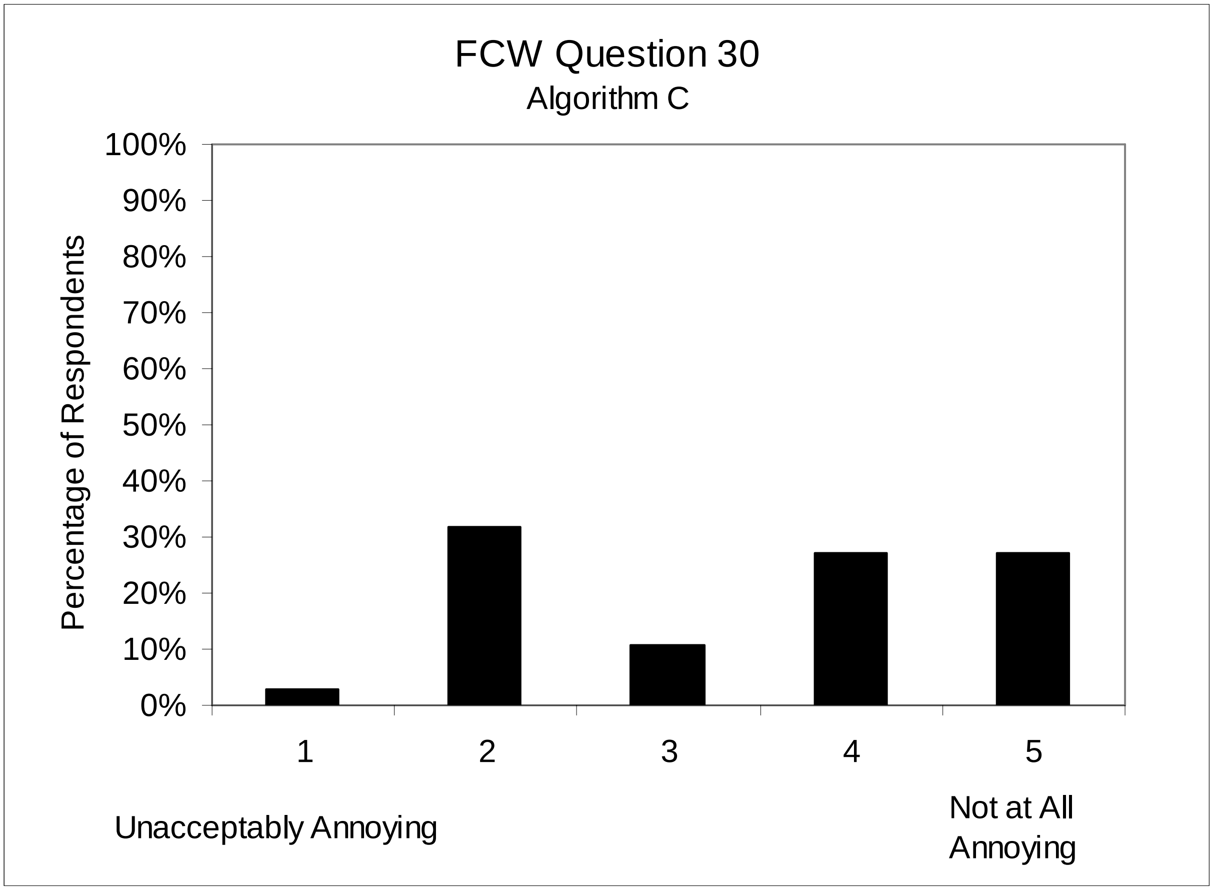
Values in cells represent the mean response and (standard deviation)



29. How often, if ever, did FCW not give you an alert when you felt that one was necessary? Please check the one option that best applies.

	Males	Females	Overall
Younger (20-30)	1.7 (1.3)	1.6 (0.8)	1.7 (1.0)
Middle-Aged (40-50)	2.0 (1.3)	1.4 (0.7)	1.7 (1.0)
Older (60-70)	1.9 (1.3)	1.9 (1.5)	1.9 (1.4)
Overall	1.9 (1.2)	1.6 (1.1)	1.8 (1.2)

Values in cells represent the mean response and (standard deviation)

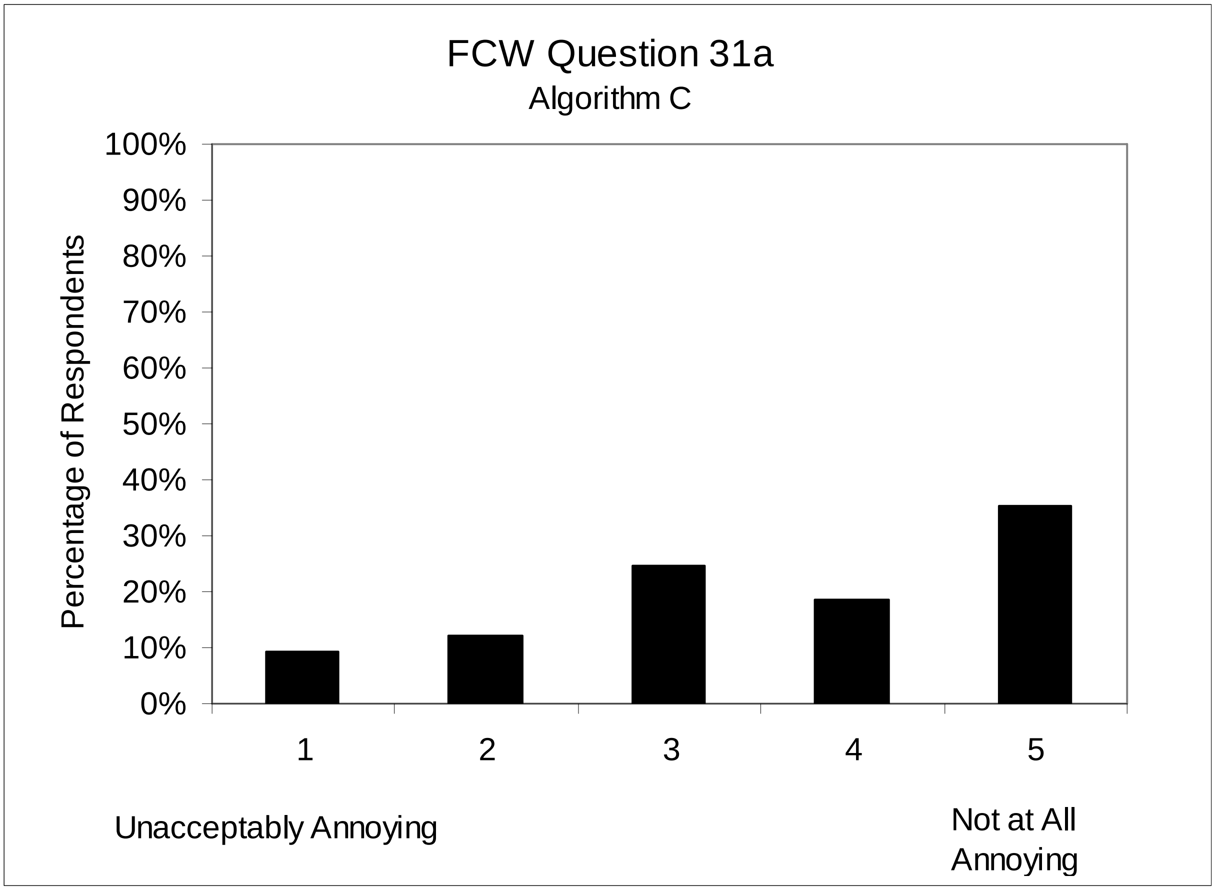


30. Overall, indicate the annoyance level associated with unnecessary FCW alerts

	Males	Females	Overall
Younger (20-30)	2.2 (0.8)	3.1 (1.2)	2.6 (1.1)
Middle-Aged (40-50)	3.5 (1.2)	3.0 (1.1)	3.2 (1.2)
Older (60-70)	4.5 (0.7)	4.4 (1.0)	4.5 (0.9)
Overall	3.4 (1.3)	3.5 (1.3)	3.4 (1.3)

Values in cells represent the mean response and (standard deviation)

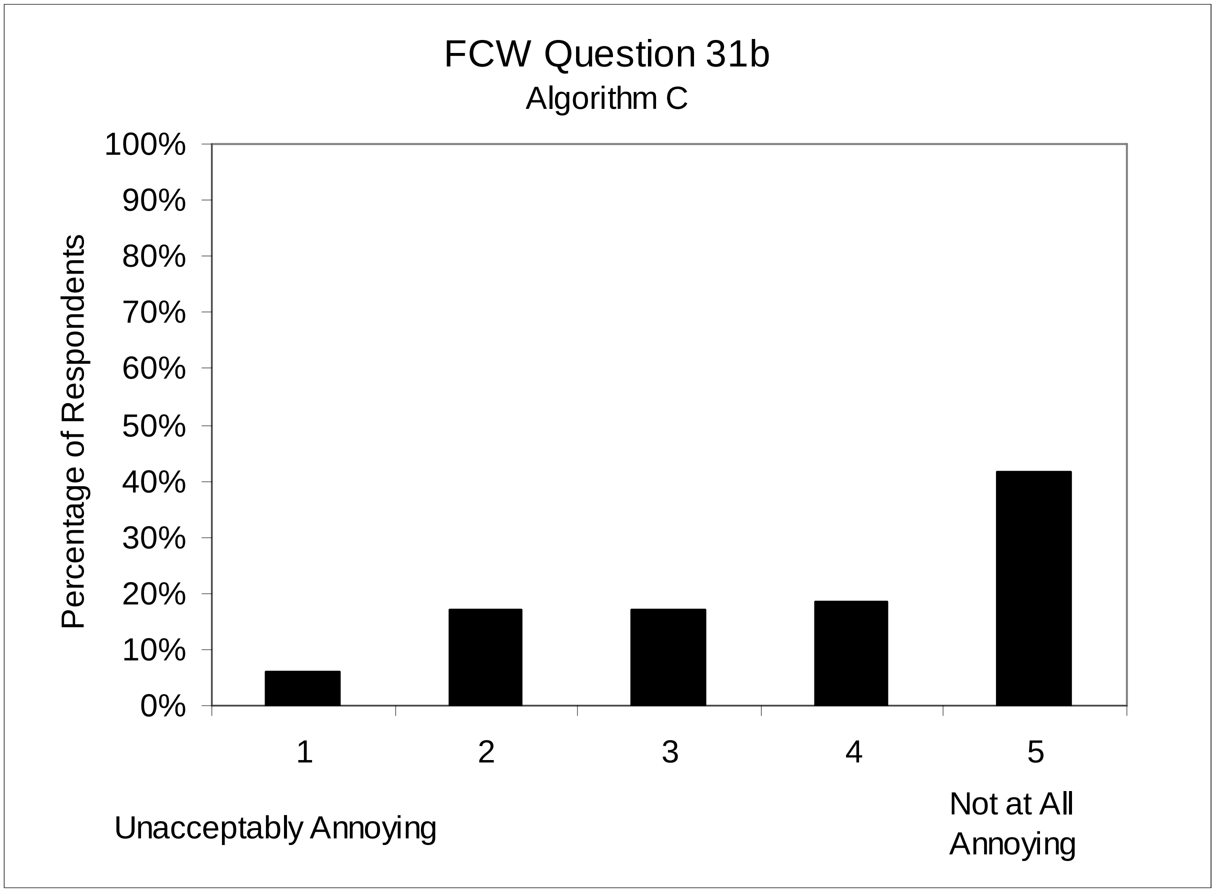
31. Indicate the annoyance level associated with the events listed below which could result in unnecessary FCW alerts



31a. When a vehicle ahead of me turned

	Males	Females	Overall
Younger (20-30)	2.8 (1.4)	3.4 (1.4)	3.1 (1.4)
Middle-Aged (40-50)	3.5 (1.2)	2.7 (1.0)	3.1 (1.2)
Older (60-70)	4.4 (1.0)	4.8 (0.4)	4.6 (0.8)
Overall	3.6 (1.3)	3.6 (1.3)	3.6 (1.3)

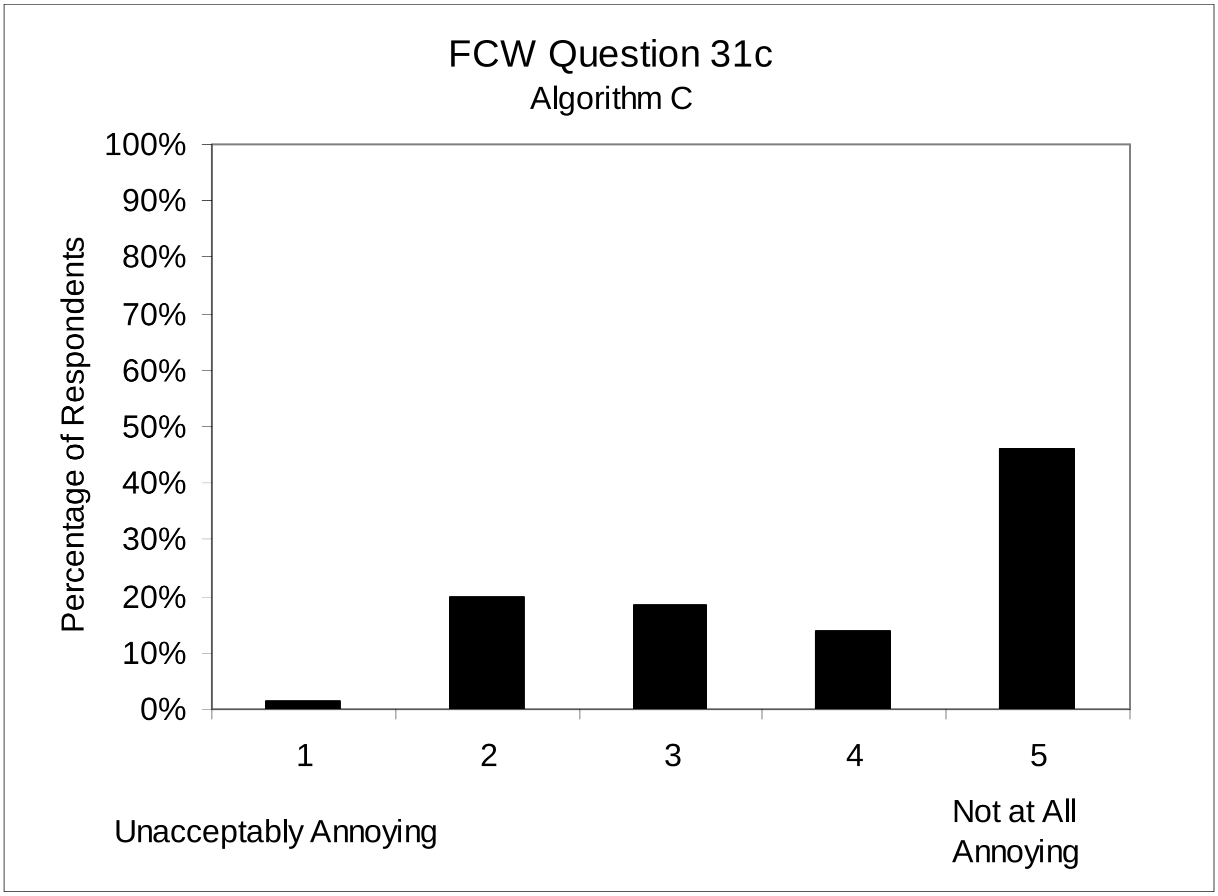
Values in cells represent the mean response and (standard deviation)



31b. When I passed a moving vehicle

	Males		Females		Overall	
Younger (20-30)	2.6	(1.3)	3.6	(1.4)	3.1	(1.4)
Middle-Aged (40-50)	3.9	(1.1)	3.3	(1.4_	3.6	(1.3)
Older (60-70)	4.4	(0.9)	4.6	(0.8)	4.5	(0.9)
Overall	3.6	(1.3)	3.8	(1.4)	3.7	(1.3)

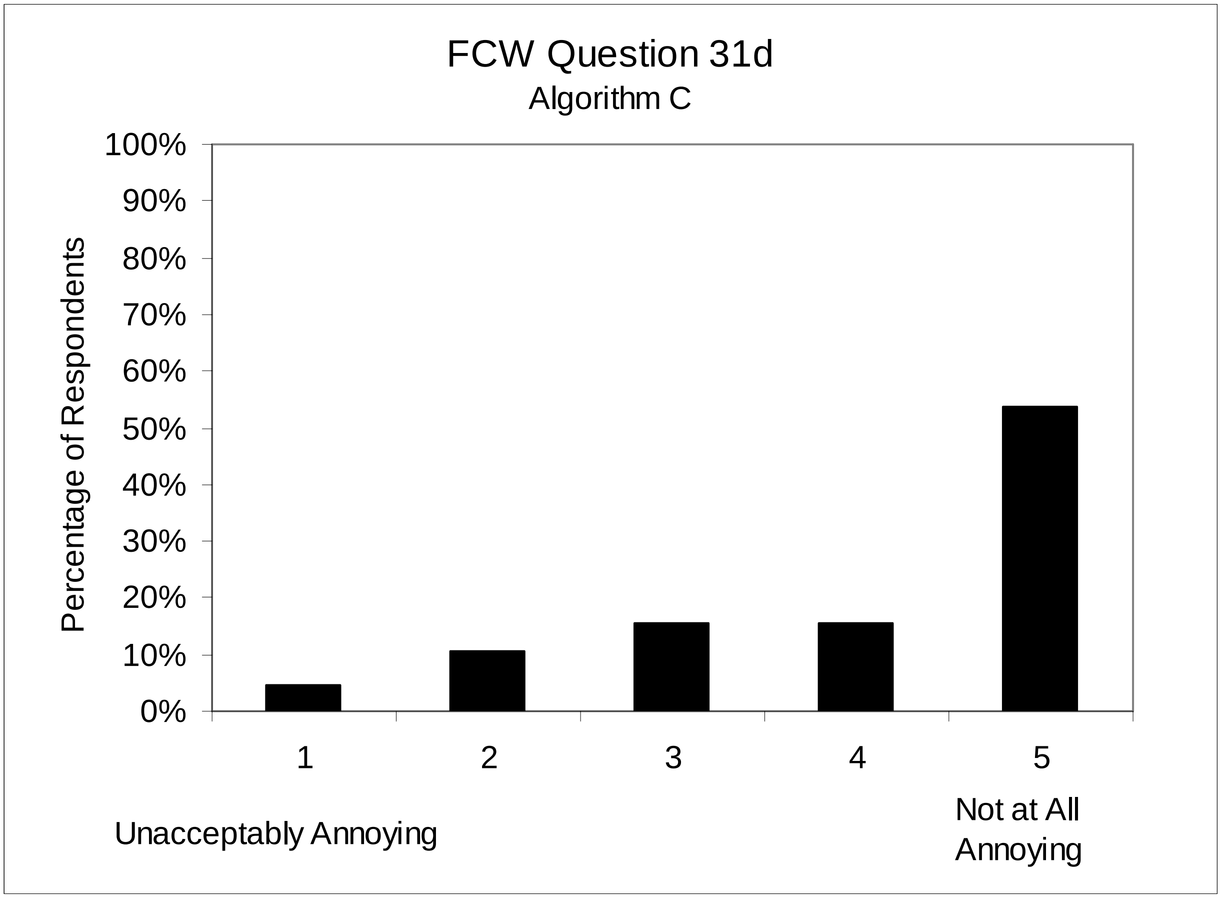
Values in cells represent the mean response and (standard deviation)



31c. When a vehicle ahead changed lanes

	Males	Females	Overall
Younger (20-30)	2.9 (1.3)	3.7 (1.3)	3.3 (1.3)
Middle-Aged (40-50)	3.9 (1.1)	3.0 (1.3)	3.4 (1.2)
Older (60-70)	4.5 (0.7)	4.9 (0.3)	4.7 (0.6)
Overall	3.8 (1.2)	3.9 (1.3)	3.8 (1.3)

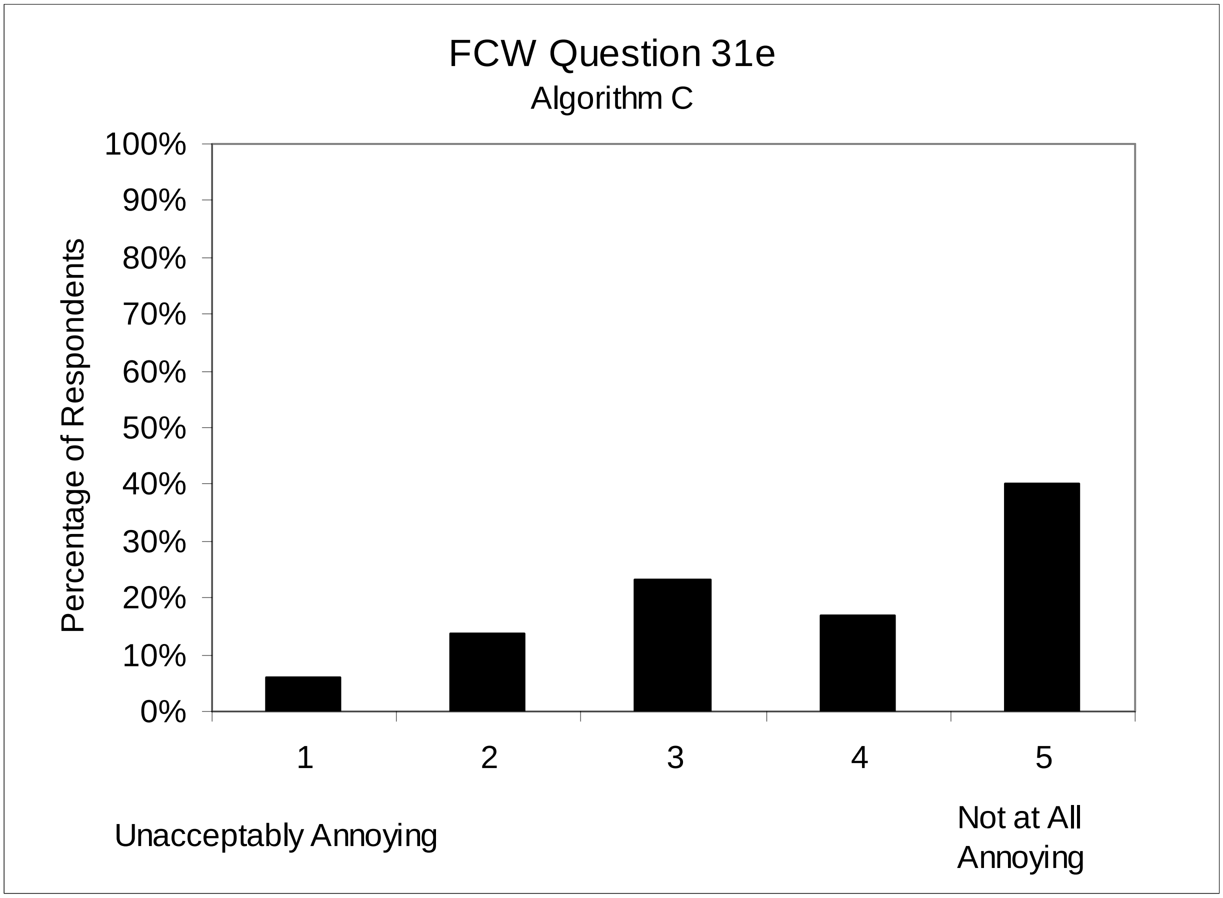
Values in cells represent the mean response and (standard deviation)



31d. When my vehicle changed lanes

	Males	Females	Overall
Younger (20-30)	3.5 (1.3)	4.3 (0.9)	3.9 (1.2)
Middle-Aged (40-50)	4.0 (1.1)	2.9 (1.6)	3.4 (1.4)
Older (60-70)	4.6 (0.9)	4.9 (0.3)	4.8 (0.7)
Overall	4.0 (1.2)	4.0 (1.3)	4.0 (1.2)

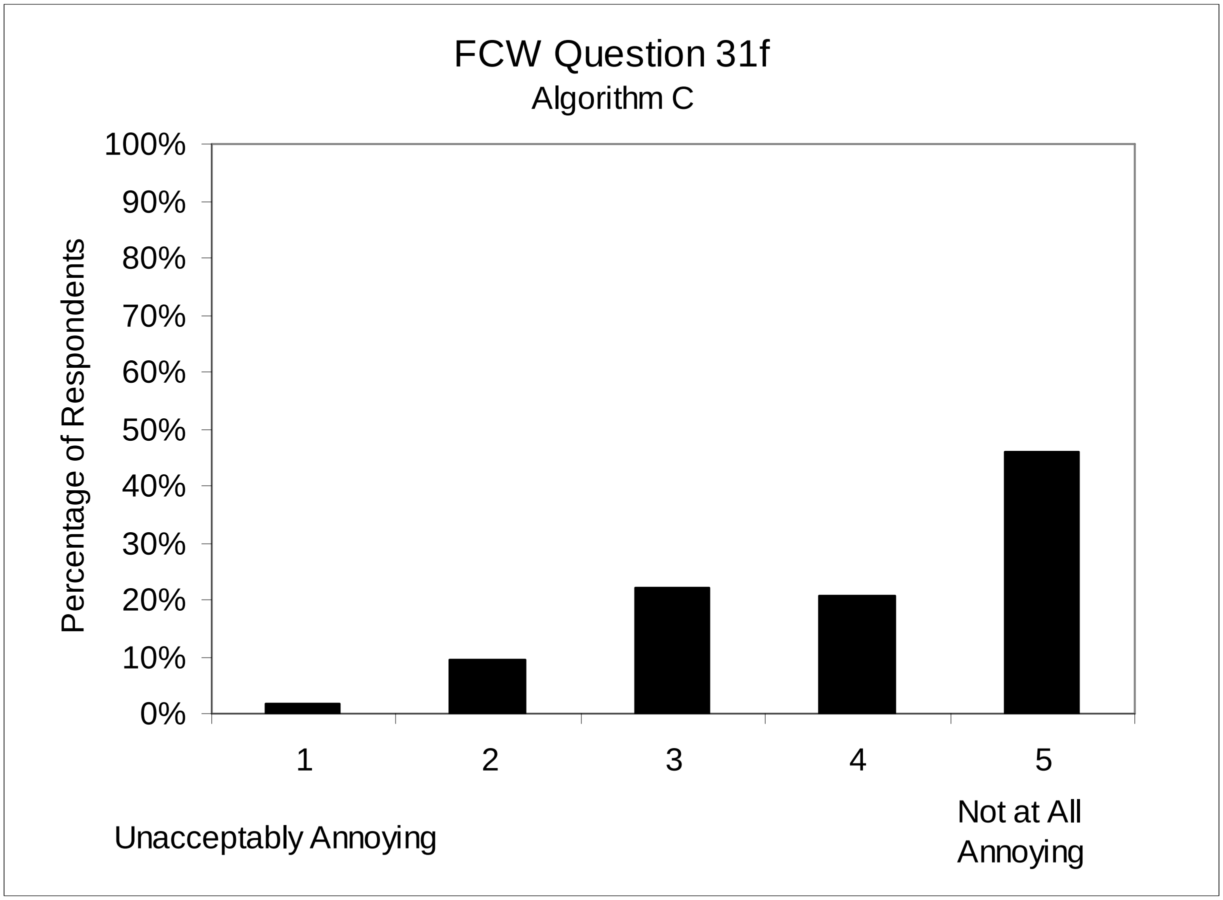
Values in cells represent the mean response and (standard deviation)



31e. When a vehicle cut in front of me

	Males	Females	Overall
Younger (20-30)	3.4 (1.4)	3.3 (1.7)	3.3 (1.5)
Middle-Aged (40-50)	3.5 (1.0)	3.2 (1.0)	3.3 (1.0)
Older (60-70)	4.2 (1.3)	4.7 (0.5)	4.5 (1.0)
Overall	3.7 (1.3)	3.7 (1.4)	3.7 (1.3)

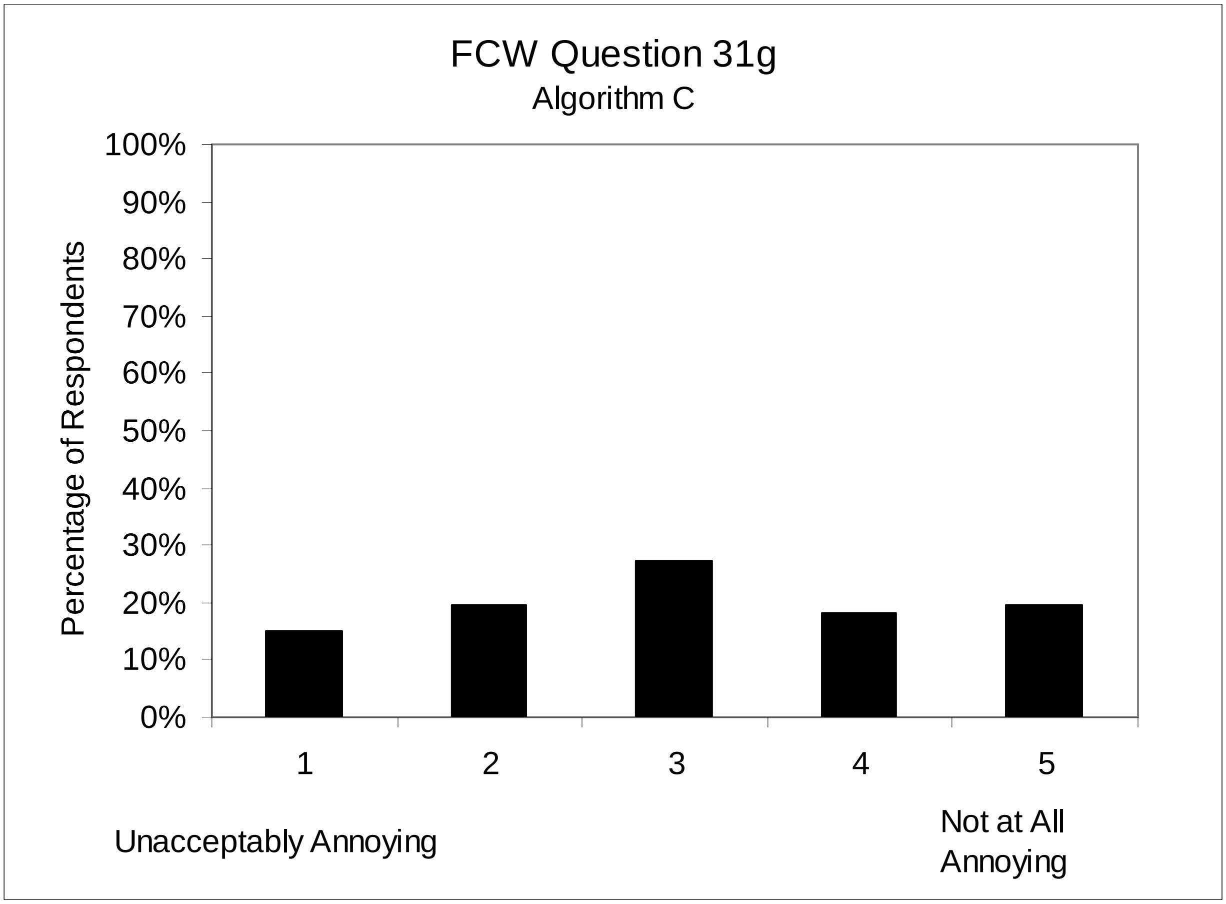
Values in cells represent the mean response and (standard deviation)



31f. When I cut in behind another vehicle

	Males	Females	Overall
Younger (20-30)	3.1 (1.2)	3.3 (1.7)	3.5 (1.3)
Middle-Aged (40-50)	4.1 (1.0)	3.2 (1.0)	4.0 (1.0)
Older (60-70)	4.5 (0.8)	4.7 (0.5)	4.6 (0.7)
Overall	3.9 (1.2)	4.1 (1.0)	4.0 (1.1)

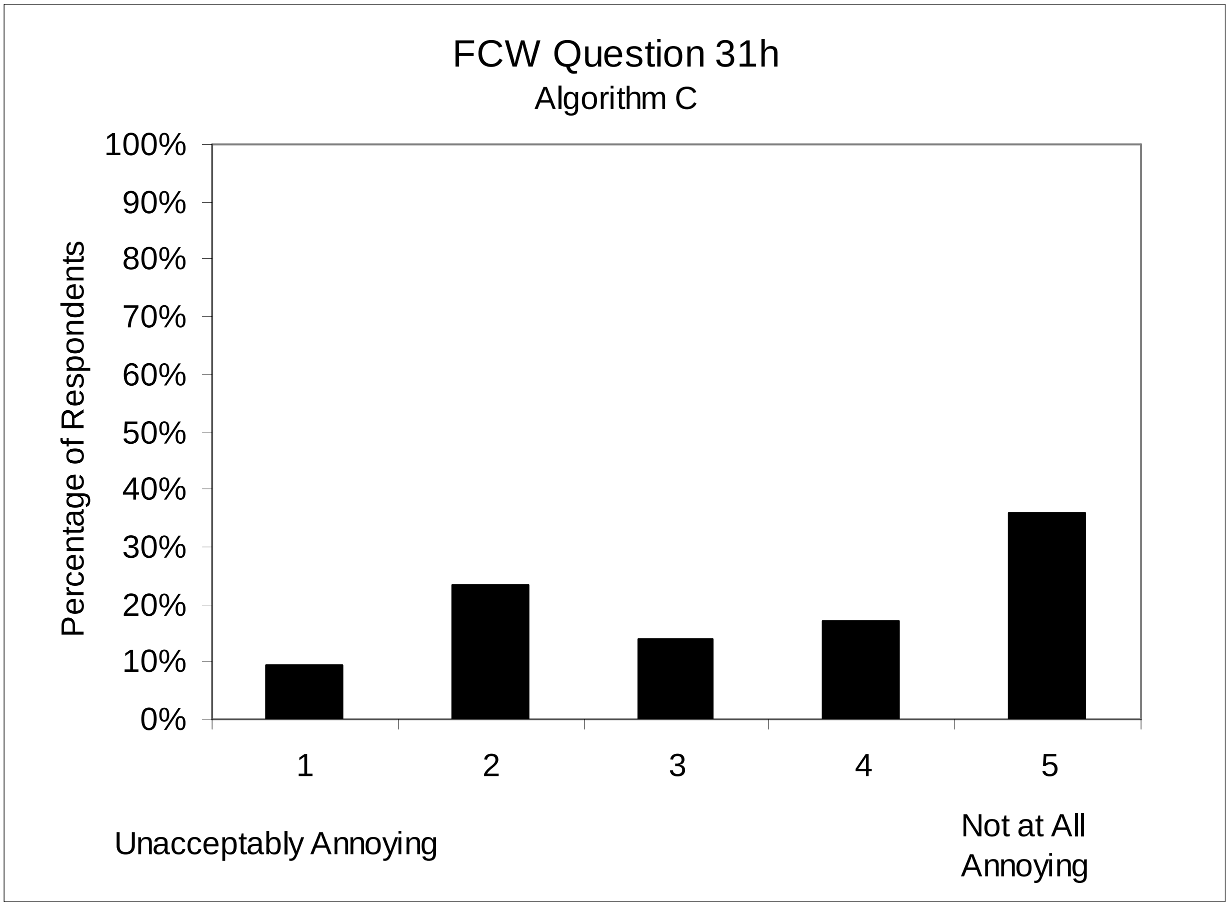
Values in cells represent the mean response and (standard deviation)



31g. When I passed a sign, light post or guardrail

	Males	Females	Overall
Younger (20-30)	2.2 (1.4)	3.4 (1.1)	2.8 (1.4)
Middle-Aged (40-50)	2.6 (1.3)	2.8 (1.2)	2.7 (1.2)
Older (60-70)	3.5 (1.3)	3.9 (1.2)	3.7 (1.2)
Overall	2.8 (1.4)	3.4 (1.2)	3.1 (1.3)

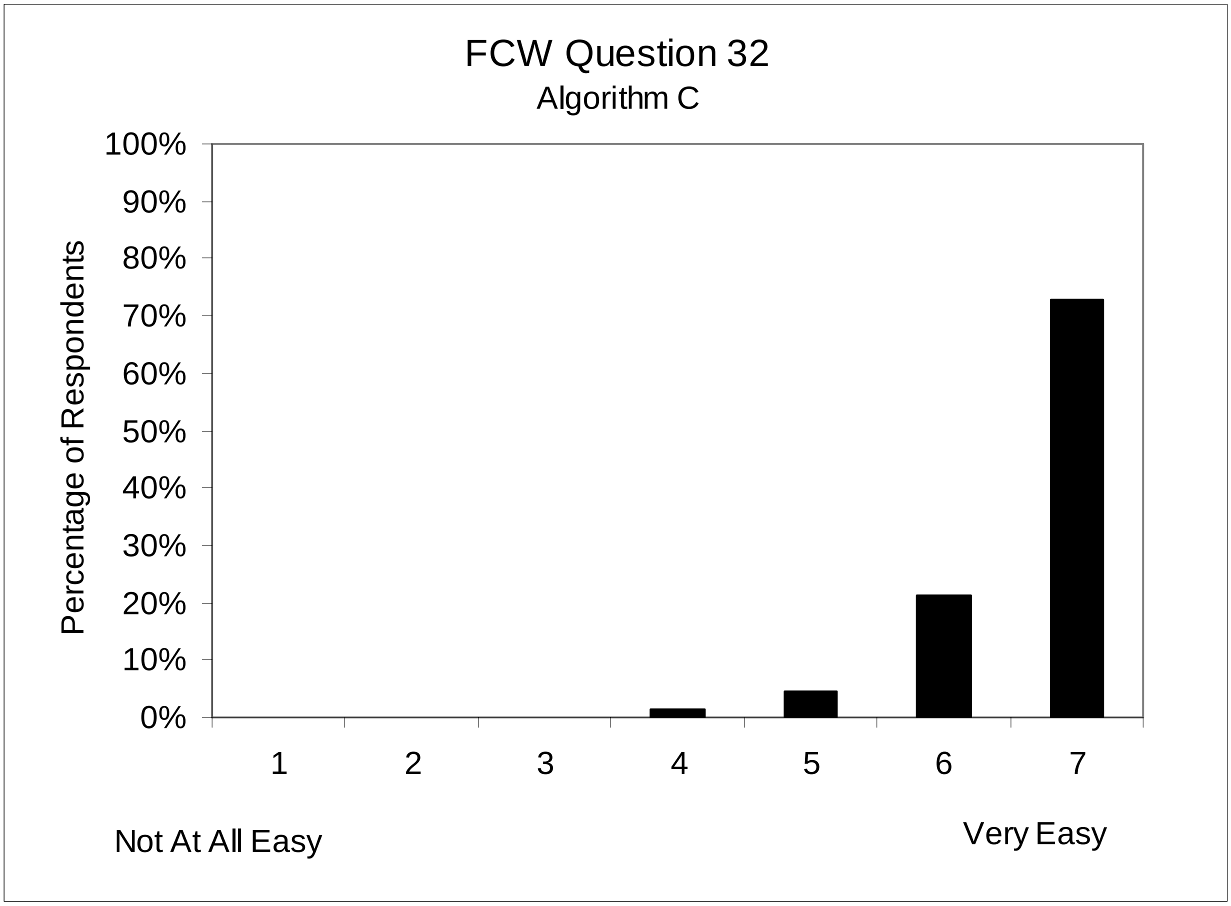
Values in cells represent the mean response and (standard deviation)



31h. When I passed a parked vehicle

	Males	Females	Overall
Younger (20-30)	2.2 (1.2)	3.9 (1.4)	3.0 (1.5)
Middle-Aged (40-50)	3.4 (1.3)	3.5 (1.3)	3.5 (1.3)
Older (60-70)	3.9 (1.5)	3.9 (1.3)	3.9 (1.4)
Overall	3.2 (1.5)	3.8 (1.3)	3.5 (1.4)

Values in cells represent the mean response and (standard deviation)

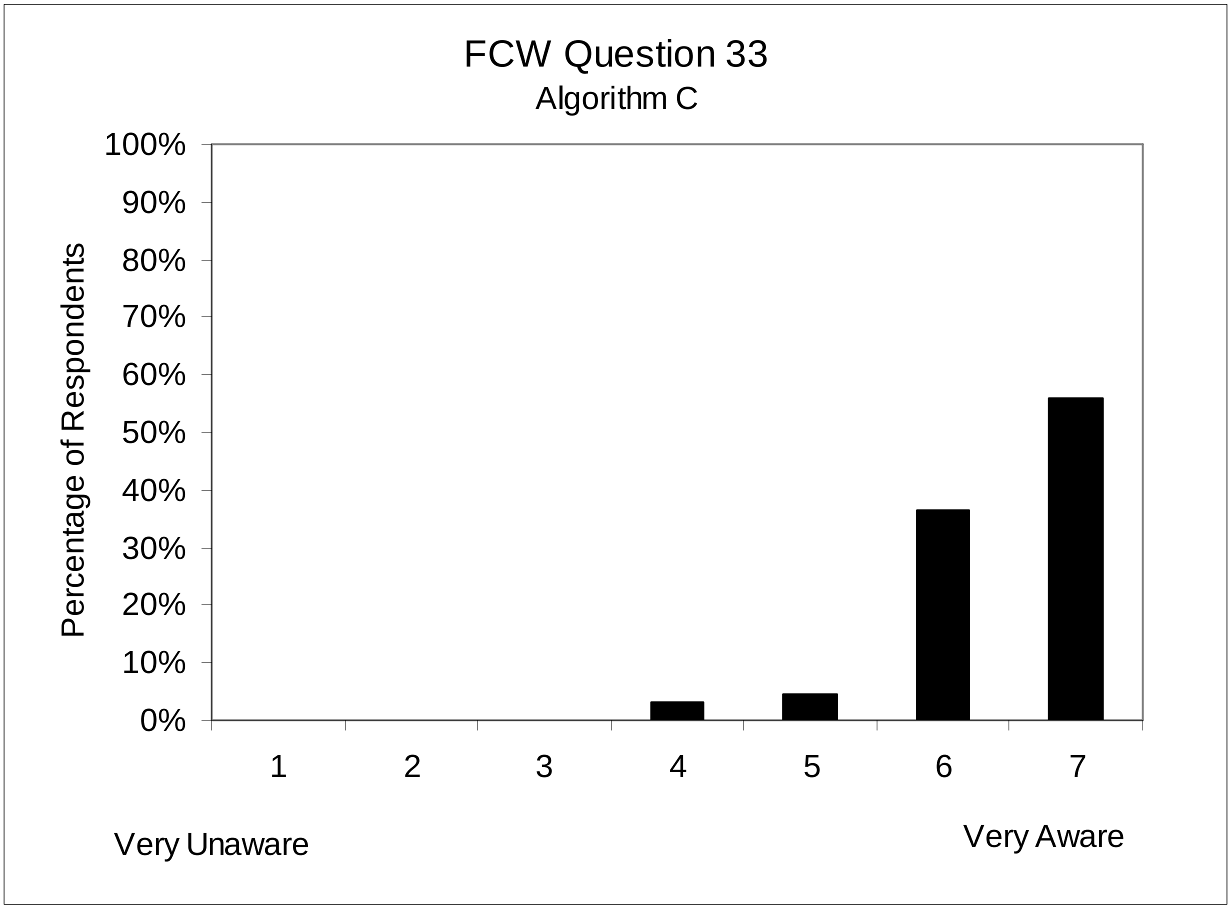


32. Overall, how easy was it to remember how to use and operate FCW while driving?

*	Males		Females		Overall	
Younger (20-30)	6.9	(0.3)	6.5	(0.7)	6.7	(0.6)
Middle-Aged (40-50)	6.5	(0.9)	6.5	(0.7)	6.5	(0.8)
Older (60-70)	7.0	(0.0)	6.5	(0.7)	6.8	(0.5)
Overall	6.8	(0.6)	6.5	(0.7)	6.7	(0.6)

Values in cells represent the mean response and (standard deviation)

* = Significant difference associated with participant gender, $H(1) = 4.7$, $p = .030$



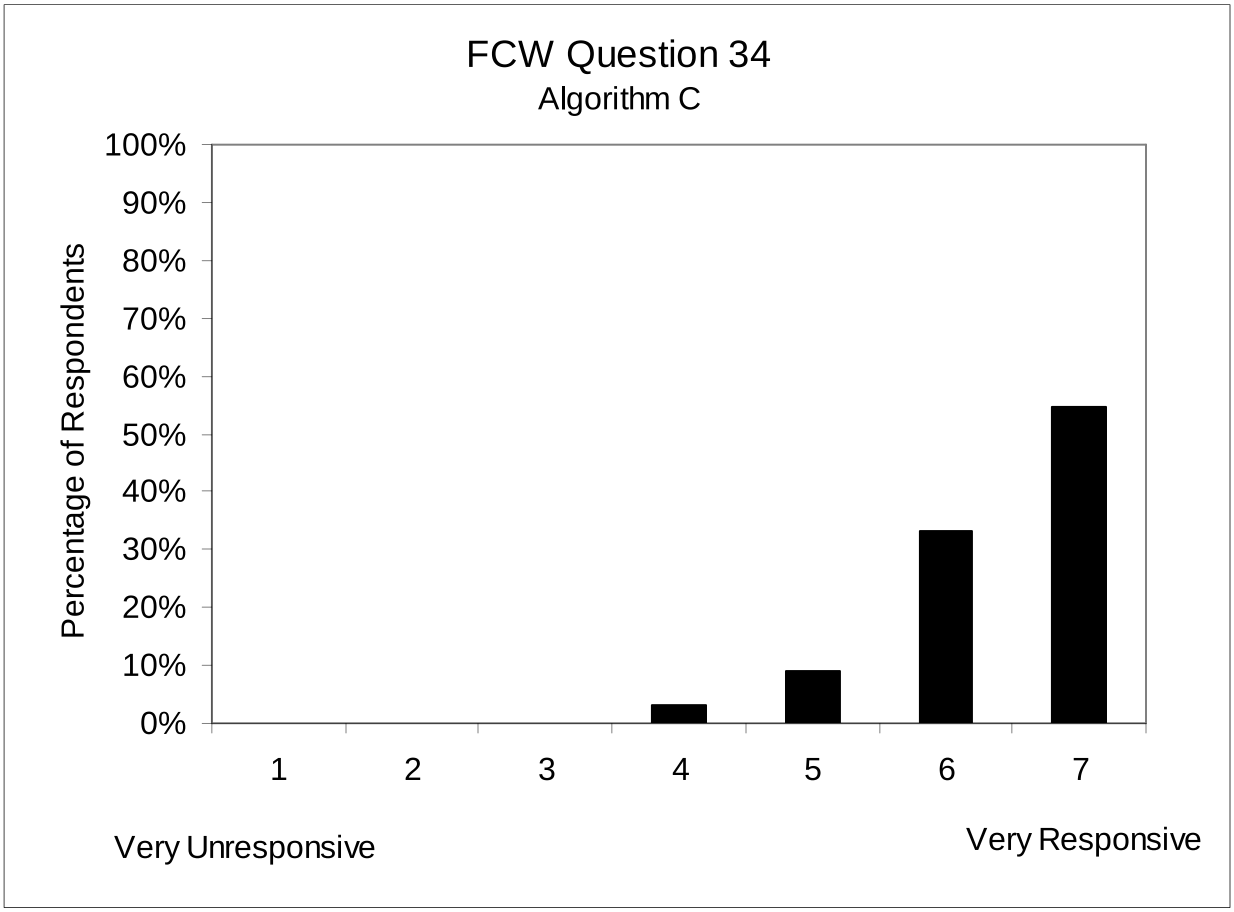
33. When using FCW, how aware were you of the driving situation (surrounding traffic, posted speed, traffic signals, etc)?

*†	Males	Females	Overall
Younger (20-30)[1]	5.9 (0.8)	6.5 (0.5)	6.2 (0.7)
Middle-Aged (40-50)[2]	6.5 (0.5)	6.1 (1.0)	6.3 (0.8)
Older (60-70)[1,2]	6.9 (0.3)	6.9 (0.3)	6.9 (0.3)
Overall	6.4 (0.7)	6.5 (0.8)	6.5 (0.7)

Values in cells represent the mean response and (standard deviation)

* = Significant difference associated with participant age, $H(2) = 16.359$, $p < .001$

† = Significant difference associated with the interaction of participant age and gender, *H*(5) = 18.981, *p* = .002



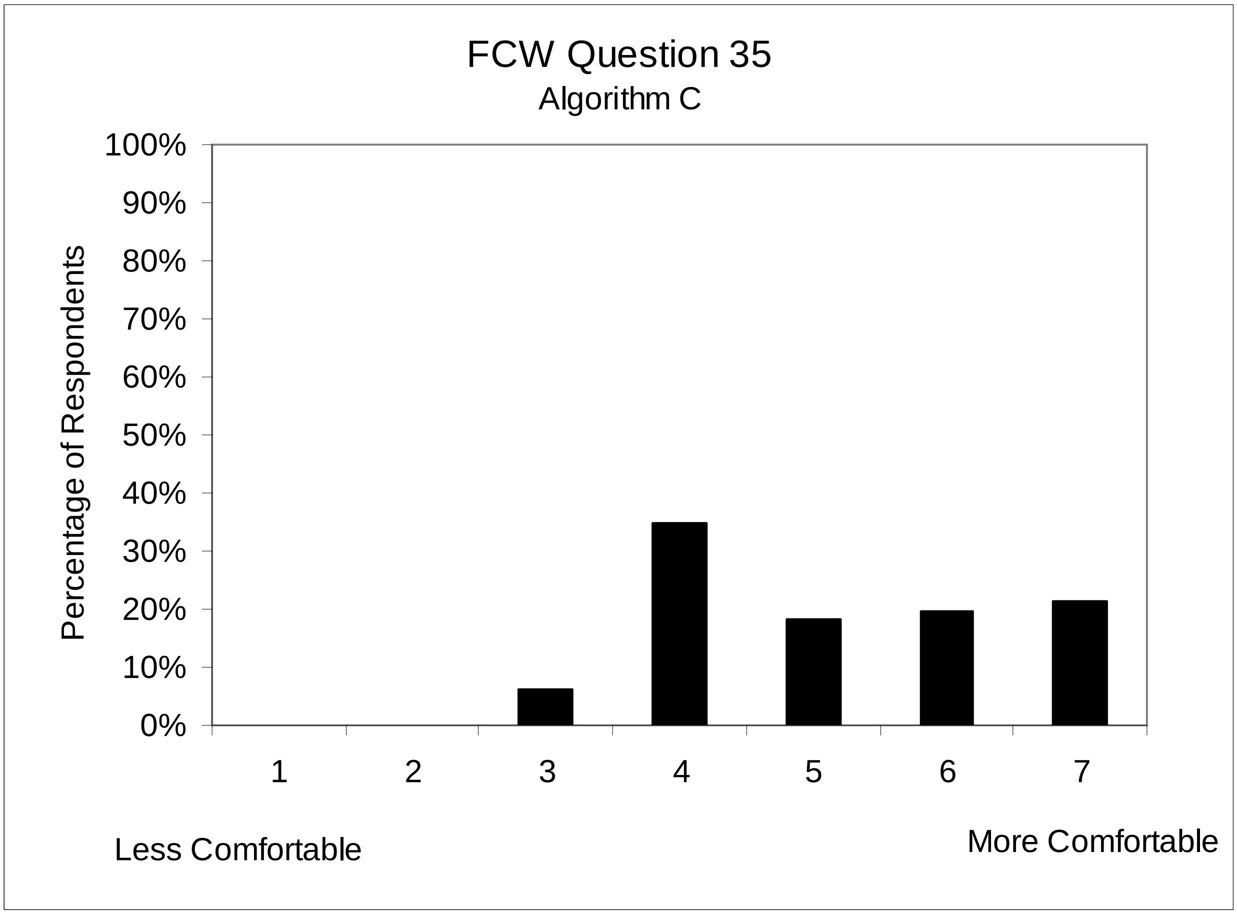
34. When using FCW, how responsive were you to the actions of vehicles around you?

*†	Males	Females	Overall
Younger (20-30)[1]	6.4 (0.7)	6.0 (0.8)	6.2 (0.7)
Middle-Aged (40-50)[2]	6.1 (0.9)	6.1 (0.9)	6.1 (0.9)
Older (60-70)[1,2]	6.9 (0.3)	6.9 (0.3)	6.9 (0.3)
Overall	6.5 (0.8)	6.3 (0.8)	6.4 (0.8)

Values in cells represent the mean response and (standard deviation)

* = Significant difference associated with participant age, *H*(2) = 17.114, *p* < .001

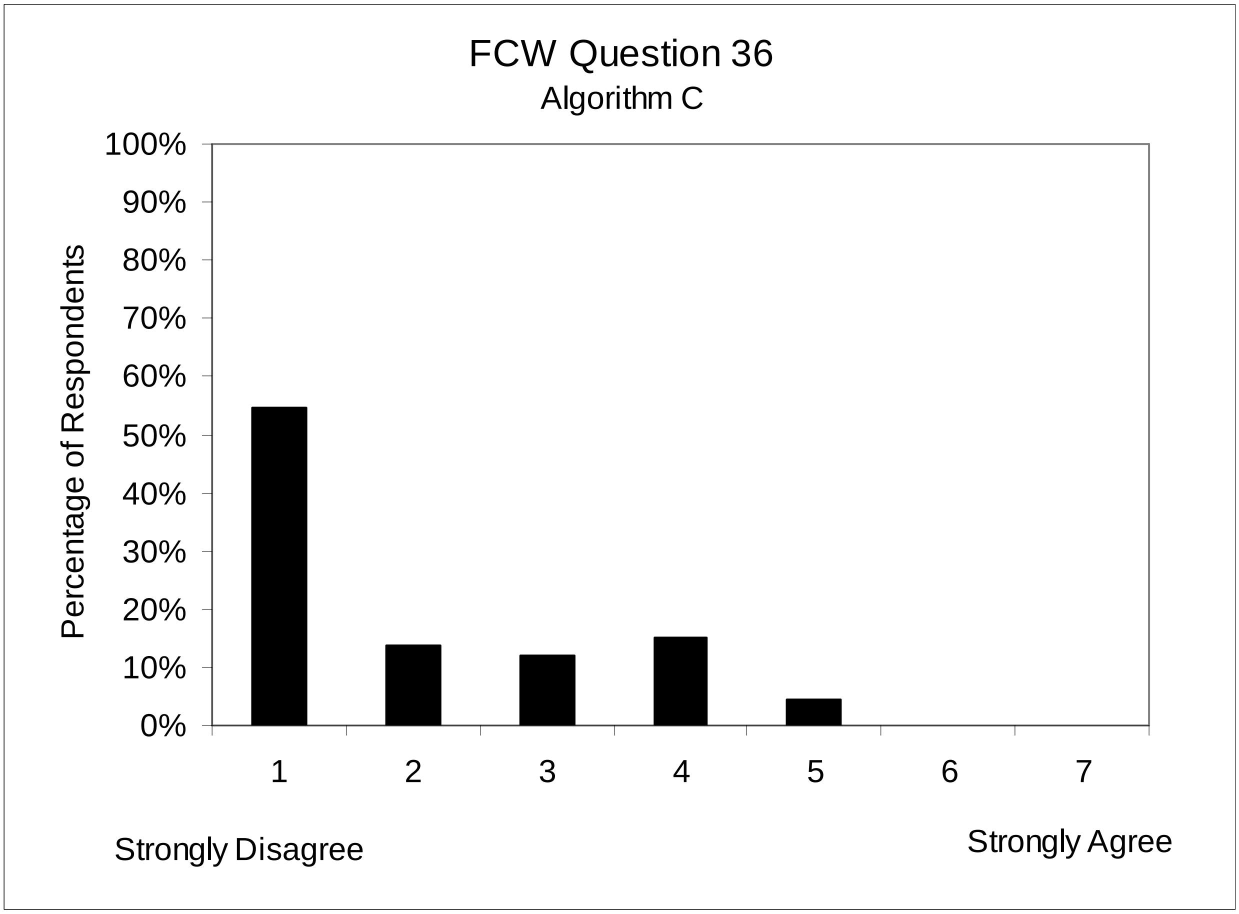
† = Significant difference associated with the interaction of participant age and gender, $H(5) = 18.255$, $p = .003$



35. Did you feel more comfortable performing additional tasks, (e.g., adjusting the heater, operating the radio, talking on a cellular telephone, etc.) while using the FCW system as compared to manual driving?

	Males	Females	Overall
Younger (20-30)	4.9 (0.8)	5.1 (1.4)	5.0 (1.1)
Middle-Aged (40-50)	5.2 (1.5)	4.8 (0.9)	5.0 (1.2)
Older (60-70)	5.6 (1.6)	5.3 (1.4)	5.5 (1.5)
Overall	5.2 (1.3)	5.1 (1.2)	5.2 (1.3)

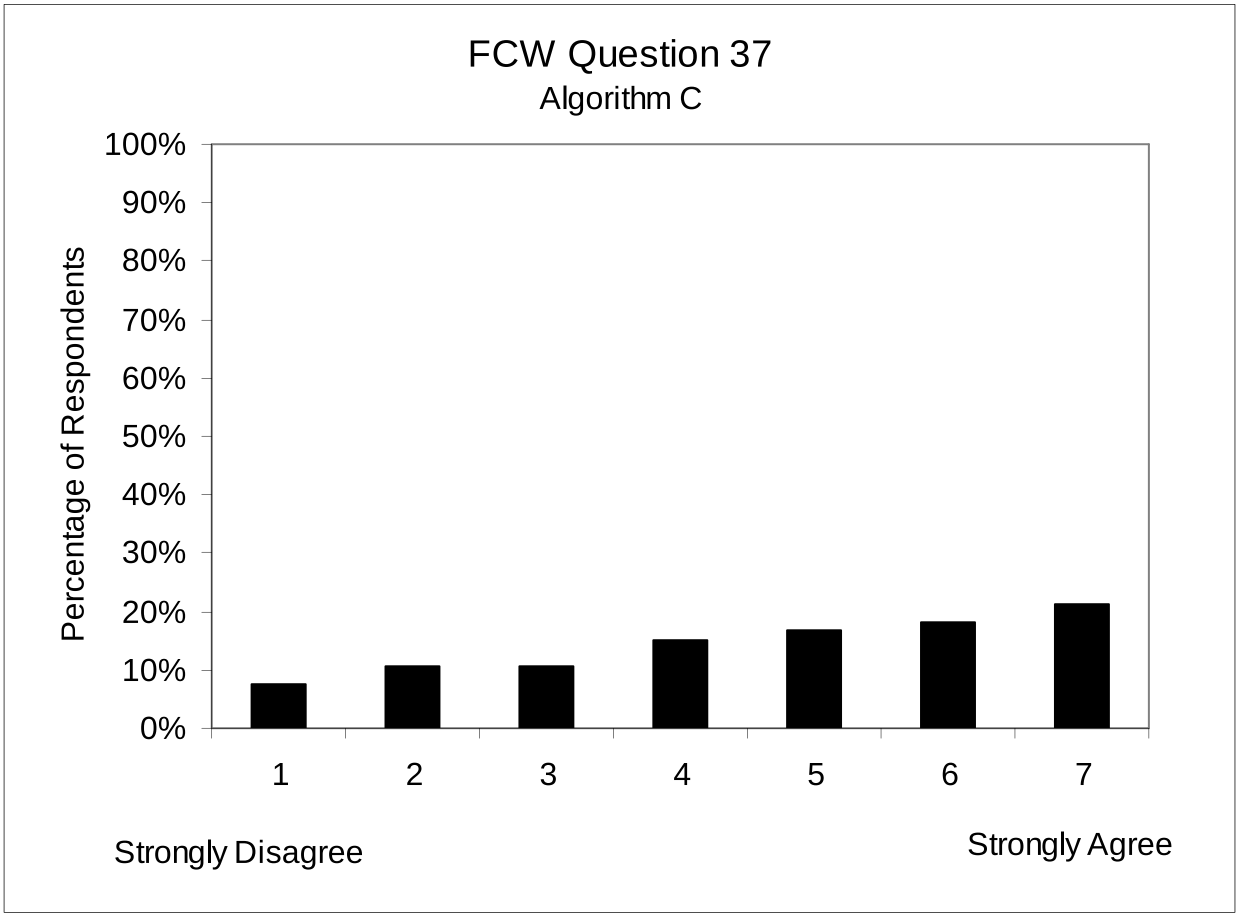
Values in cells represent the mean response and (standard deviation)



36. Overall, I found myself relying too much on the FCW system.

	Males	Females	Overall
Younger (20-30)	2.0 (1.4)	1.9 (1.1)	2.0 (1.3)
Middle-Aged (40-50)	2.3 (1.5)	2.2 (1.5)	2.2 (1.5)
Older (60-70)	1.8 (1.3)	1.9 (1.2)	1.9 (1.2)
Overall	2.0 (1.4)	2.0 (1.3)	2.0 (1.3)

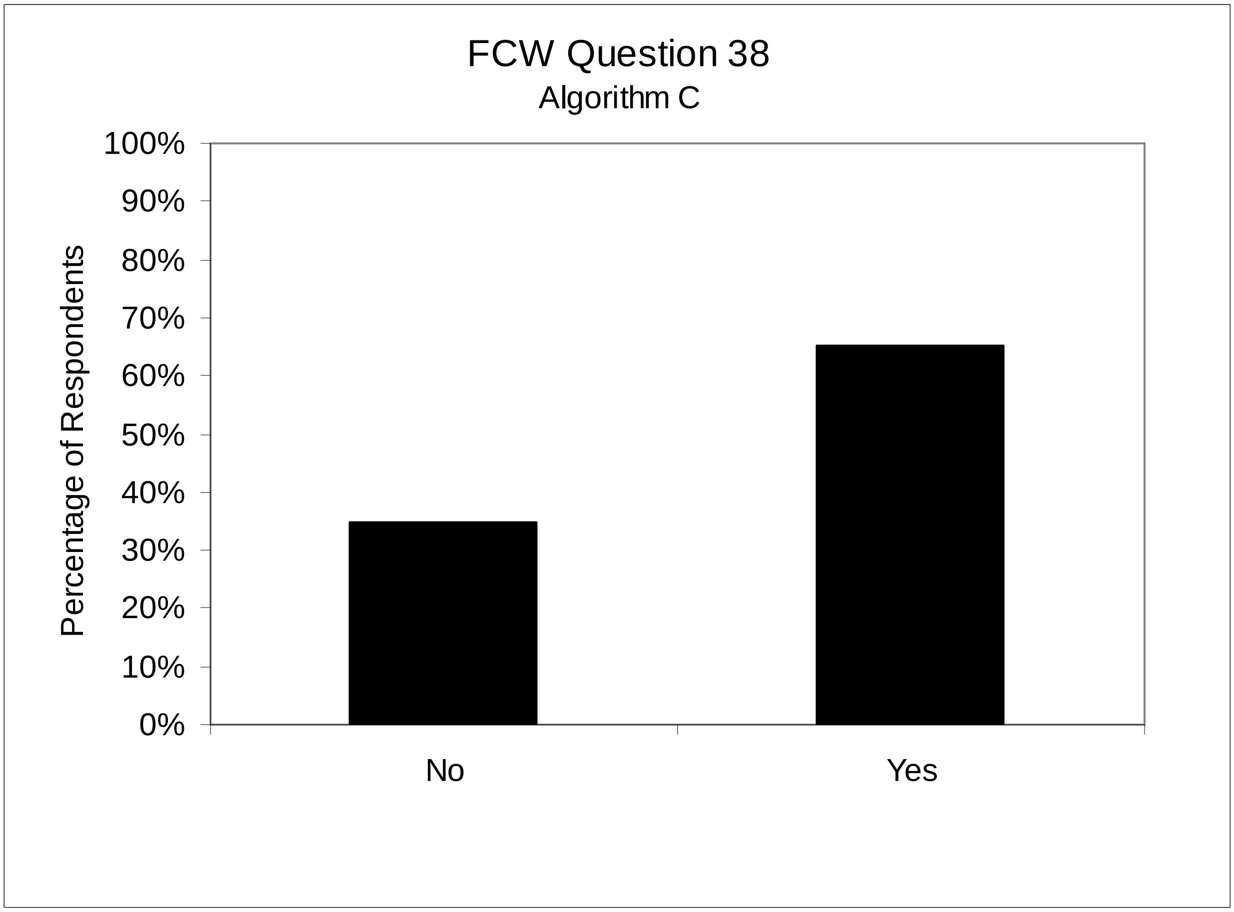
Values in cells represent the mean response and (standard deviation)



37. Overall, I think that FCW is going to increase my driving safety.

	Males	Females	Overall
Younger (20-30)	4.6 (1.6)	4.5 (2.2)	4.5 (1.8)
Middle-Aged (40-50)	5.0 (1.7)	3.8 (2.1)	4.4 (2.0)
Older (60-70)	4.8 (1.9)	5.0 (2.2)	4.9 (2.0)
Overall	4.8 (1.7)	4.4 (2.1)	4.6 (1.9)

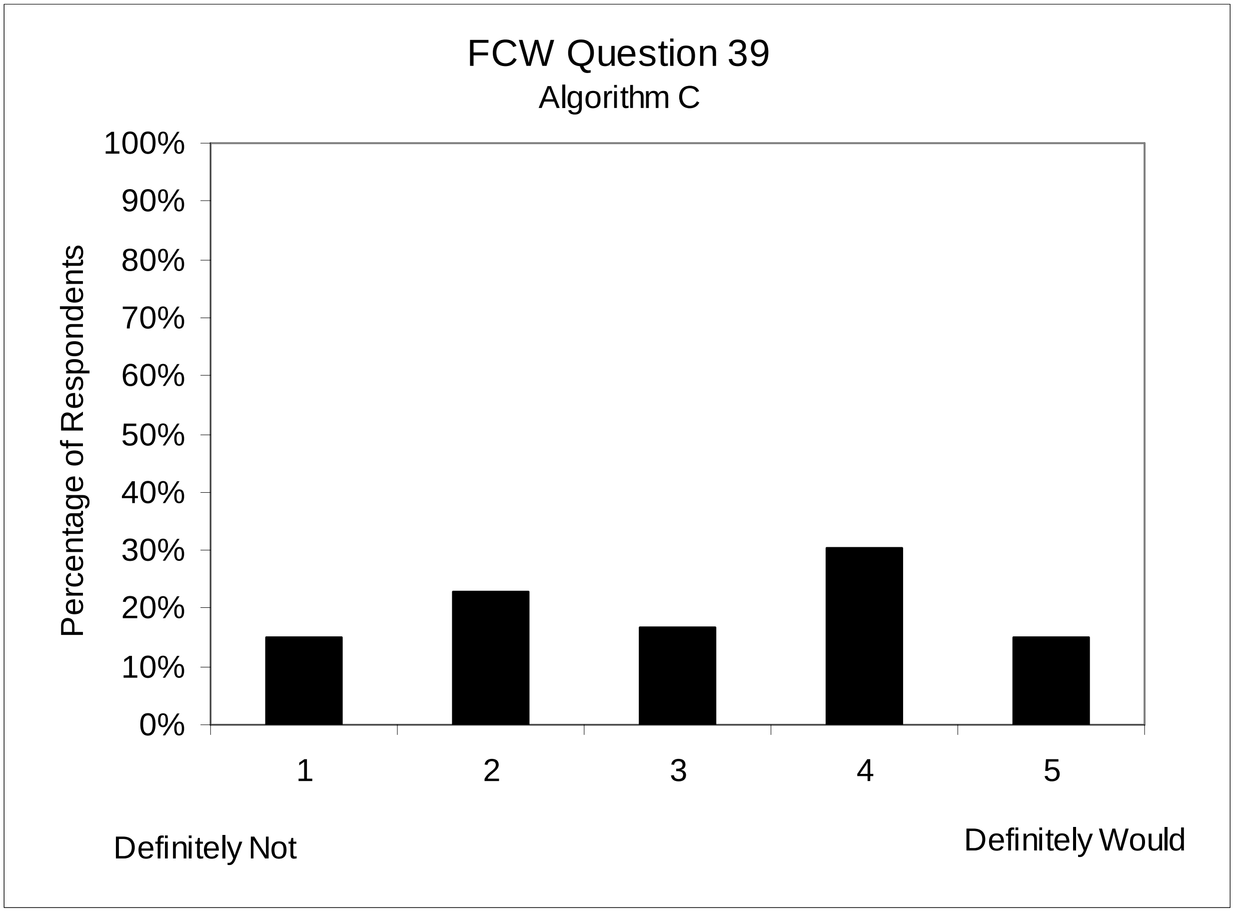
Values in cells represent the mean response and (standard deviation)



38. Would you recommend to your child, spouse, parents – or other loved ones – to use FCW?

	Males		Females		Overall	
	No	Yes	No	Yes	No	Yes
Younger (20-30)	6	5	3	8	9	13
Middle-Aged (40-50)	4	7	4	7	8	14
Older (60-70)	3	8	3	8	6	16
Overall	13	20	10	23	23	43

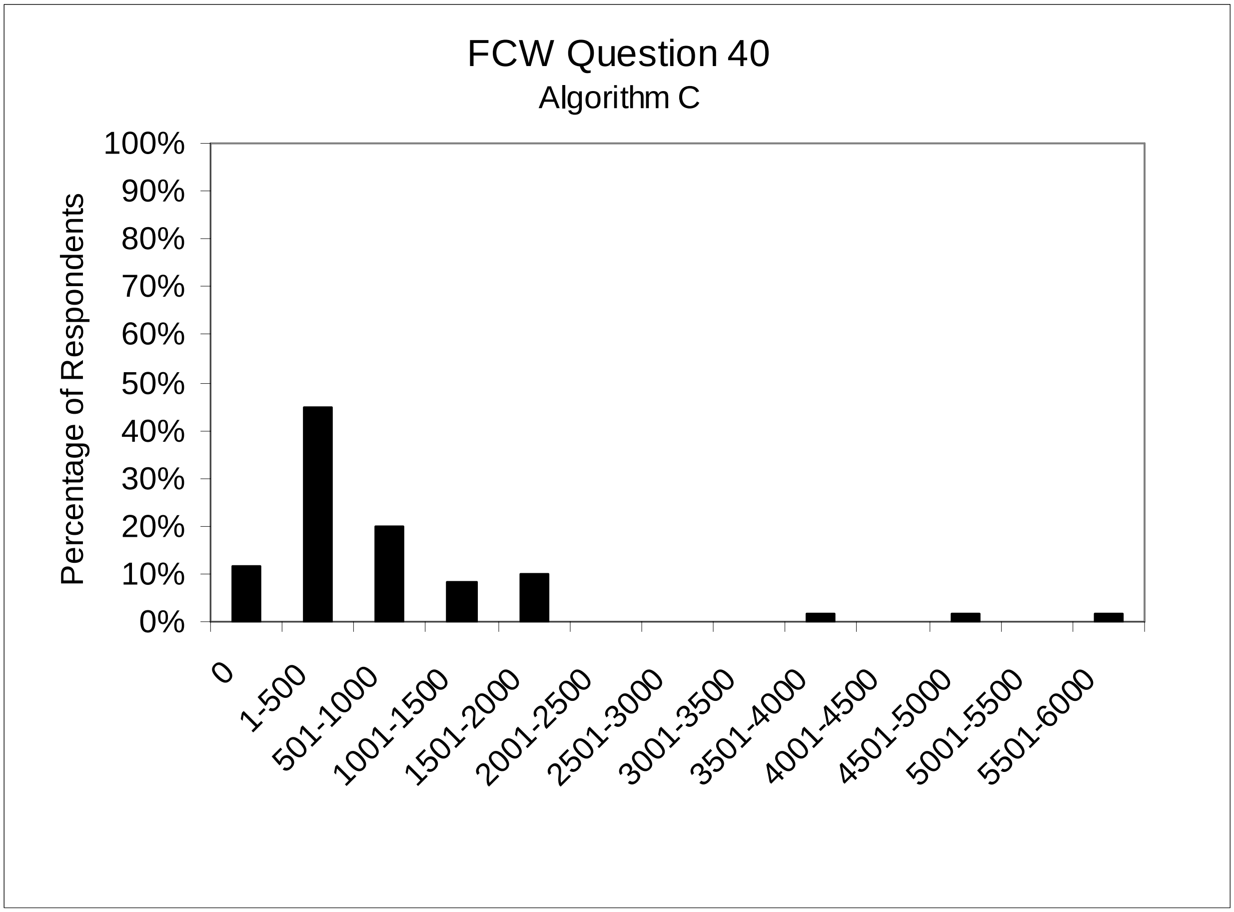
Values in cells represent the frequency of response for each indicated demographic division



39. How likely would you be to consider purchasing FCW if you were purchasing a new vehicle today?

	Males	Females	Overall
Younger (20-30)	2.4 (1.2)	2.8 (1.3)	2.6 (1.3)
Middle-Aged (40-50)	3.3 (1.5)	2.7 (1.3)	3.0 (1.4)
Older (60-70)	3.5 (1.4)	3.7 (1.0)	3.6 (1.2)
Overall	3.1 (1.4)	3.1 (1.3)	3.1 (1.3)

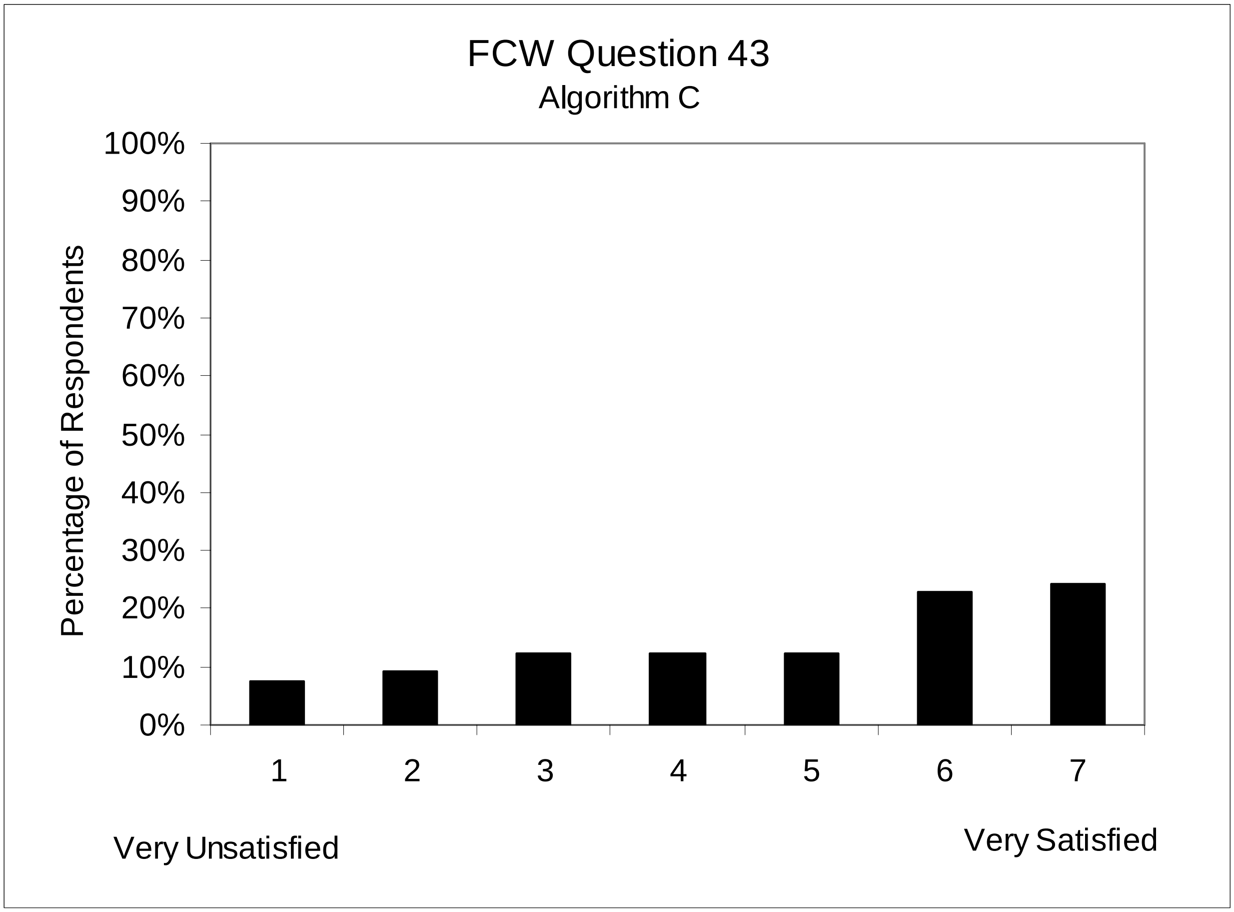
Values in cells represent the mean response and (standard deviation)



40. At what price level might you begin to feel this feature is too expensive to consider purchasing?

	Males		Females		Overall	
Younger (20-30)	1620.0	(2115.4)	835.0	(713.4)	1227.5	(1588.4)
Middle-Aged (40-50)	540.0	(676.9)	594.9	(606.7)	567.5	(626.2)
Older (60-70)	680.0	(670.9)	1215.0	(1127.4)	947.5	(943.7)
Overall	946.7	(1381.5)	881.6	(856.8)	3.1	(1.3)

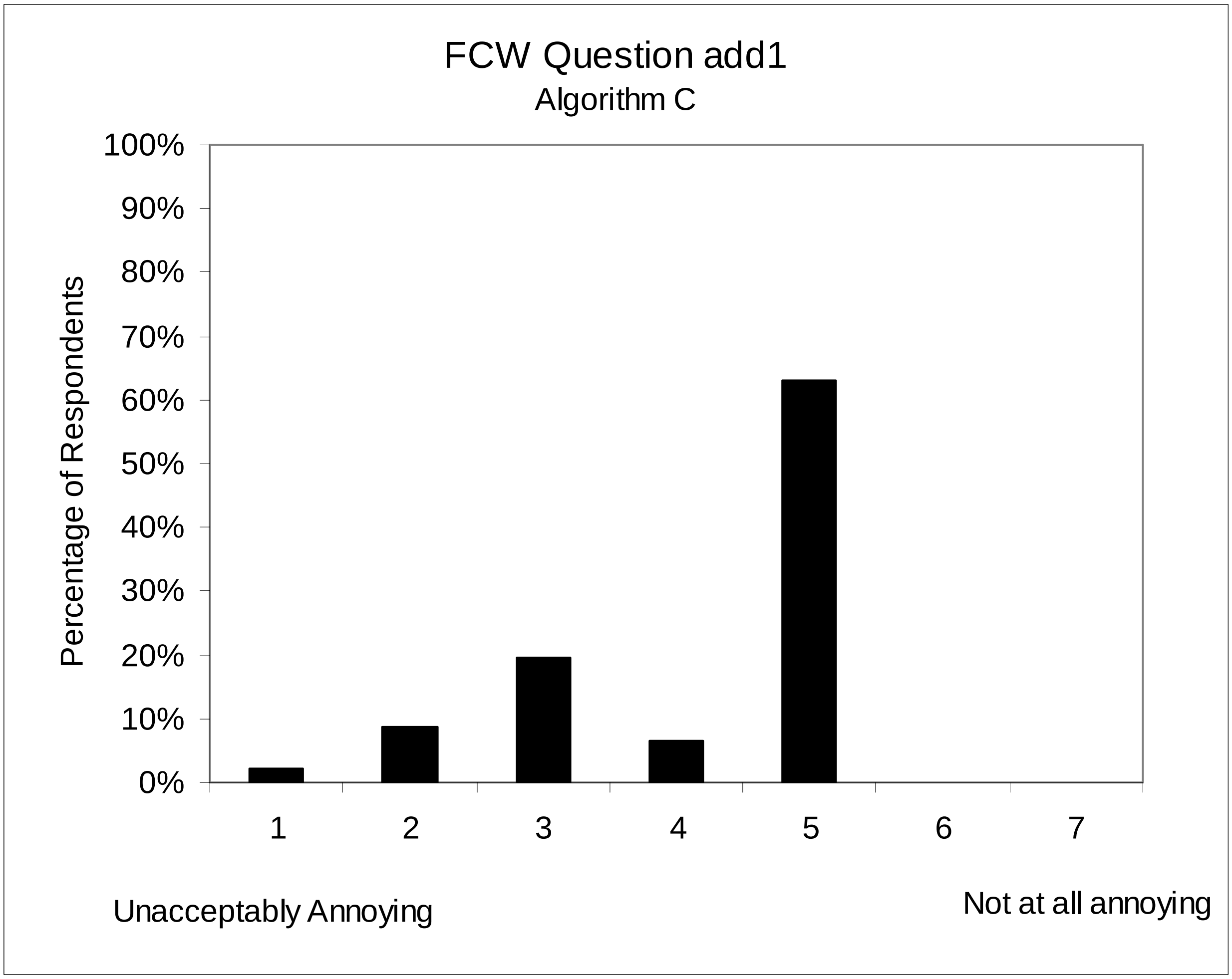
Values in cells represent the mean response and (standard deviation)



43. Overall, how satisfied were you with the FCW system?

	Males	Females	Overall
Younger (20-30)	4.2 (1.7)	4.5 (2.1)	4.3 (1.9)
Middle-Aged (40-50)	4.6 (2.4)	4.5 (2.1)	4.5 (2.2)
Older (60-70)	5.1 (1.6)	5.8 (1.7)	5.5 (1.7)
Overall	4.6 (1.9)	4.9 (2.0)	4.8 (2.0)

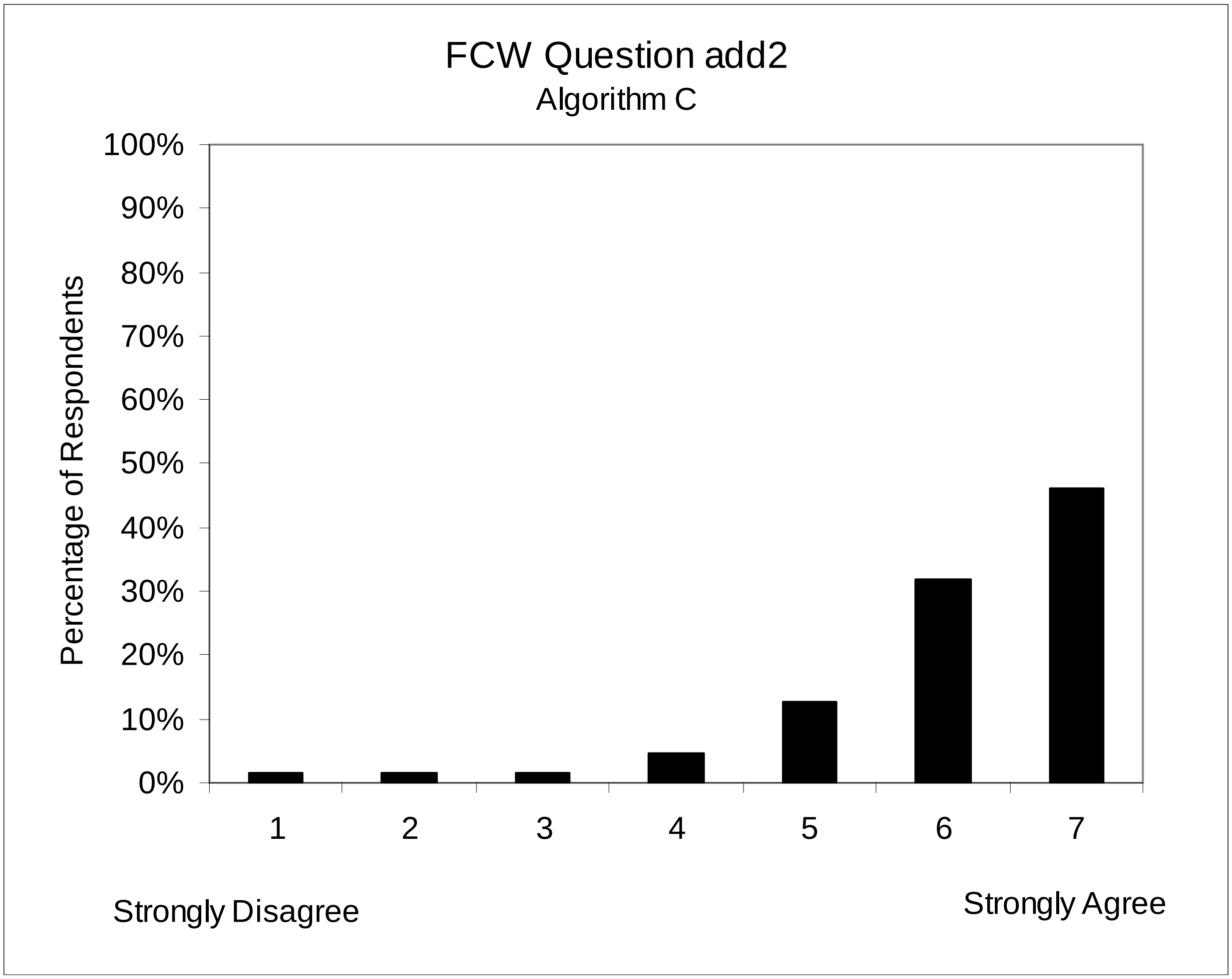
Values in cells represent the mean response and (standard deviation)



addQ1. Did you notice that the radio was muted when an imminent alert was presented? Overall, indicate the annoyance level associated with the radio being muted with imminent FCW alerts.

	Males	Females	Overall
Younger (20-30)	3.6 (1.6)	4.4 (1.1)	4.0 (1.4)
Middle-Aged (40-50)	4.5 (0.8)	4.0 (1.2)	4.3 (1.0)
Older (60-70)	4.3 (1.2)	4.7 (0.6)	4.5 (0.8)
Overall	4.1 (1.3)	4.3 (1.1)	4.2 (1.2)

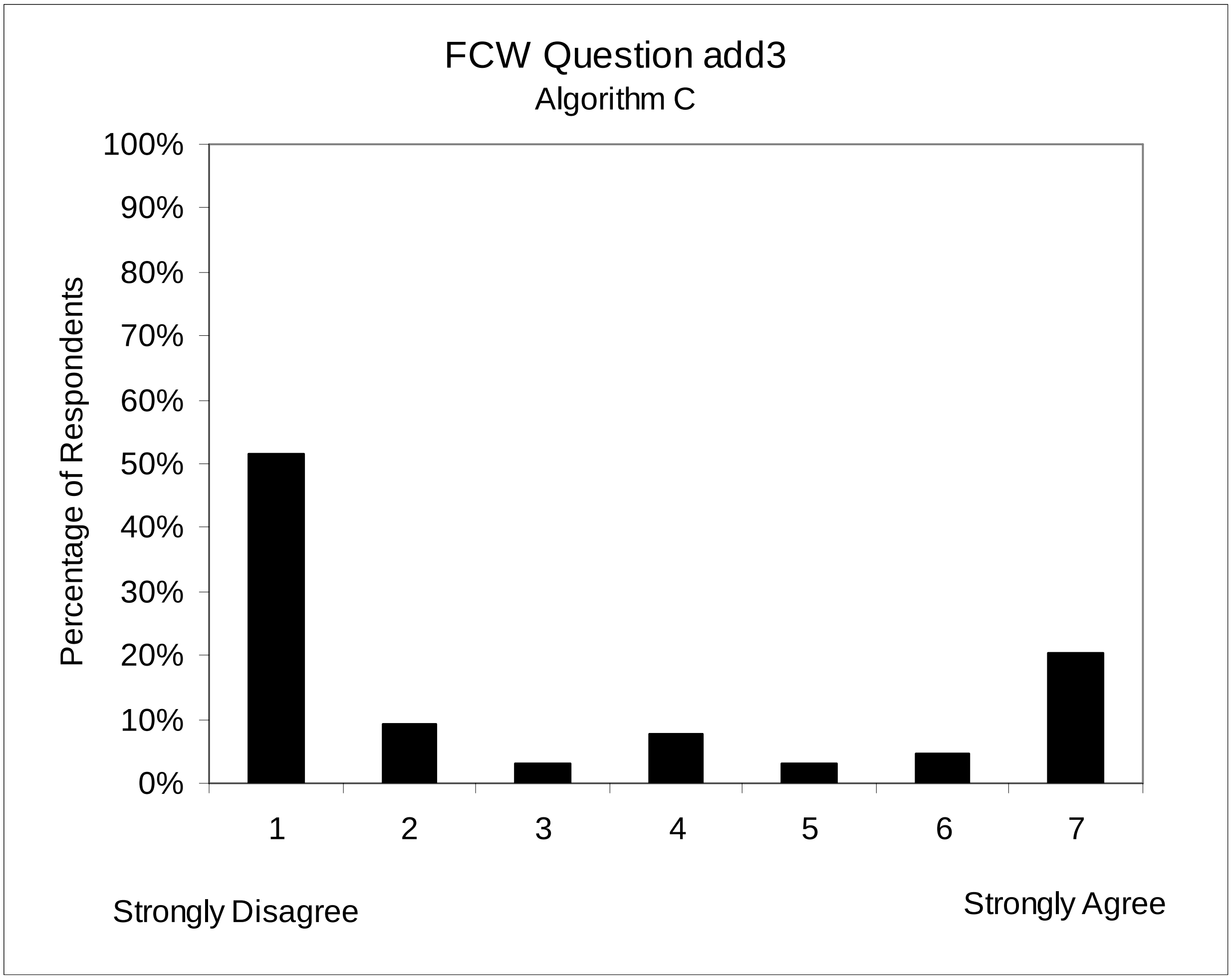
Values in cells represent the mean response and (standard deviation)



addQ2. I experimented enough with changing the FCW alert timing adjustment to understand the full range of adjustment available to me.

	Males	Females	Overall
Younger (20-30)	6.1 (1.7)	6.0 (1.3)	6.0 (1.4)
Middle-Aged (40-50)	6.1 (0.9)	5.6 (1.8)	5.9 (1.4)
Older (60-70)	6.1 (0.9)	6.4 (1.0)	6.2 (0.9)
Overall	6.1 (1.2)	6.0 (1.4)	6.0 (1.3)

Values in cells represent the mean response and (standard deviation)



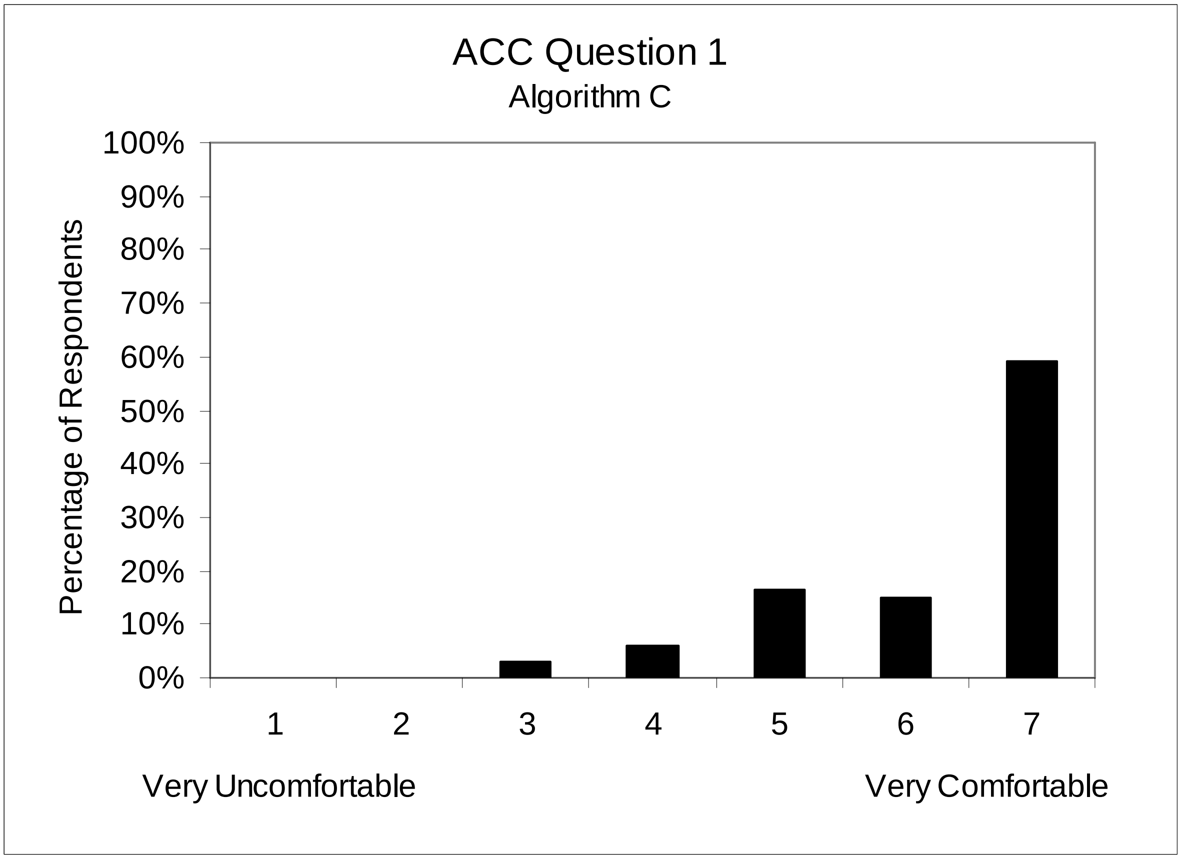
addQ3. I would have used an on/off switch at some point, had it been provided, to turn off the FCW system for the rest of my experience.

*†	Males	Females	Overall
Younger (20-30)[1]	4.6 (2.6)	3.5 (2.7)	4.0 (2.6)
Middle-Aged (40-50)	2.5 (2.2)	3.8 (2.5)	3.1 (2.4)
Older (60-70)[1]	1.0 (0.0)	2.5 (2.4)	1.8 (1.9)
Overall	2.7 (2.4)	3.2 (2.5)	3.0 (2.5)

Values in cells represent the mean response and (standard deviation)

* = Significant difference associated with participant age, $H(2) = 10.723$, $p = .005$

† = Significant difference associated with the interaction of participant age and gender, $H(5) = 15.427$, $p = .009$

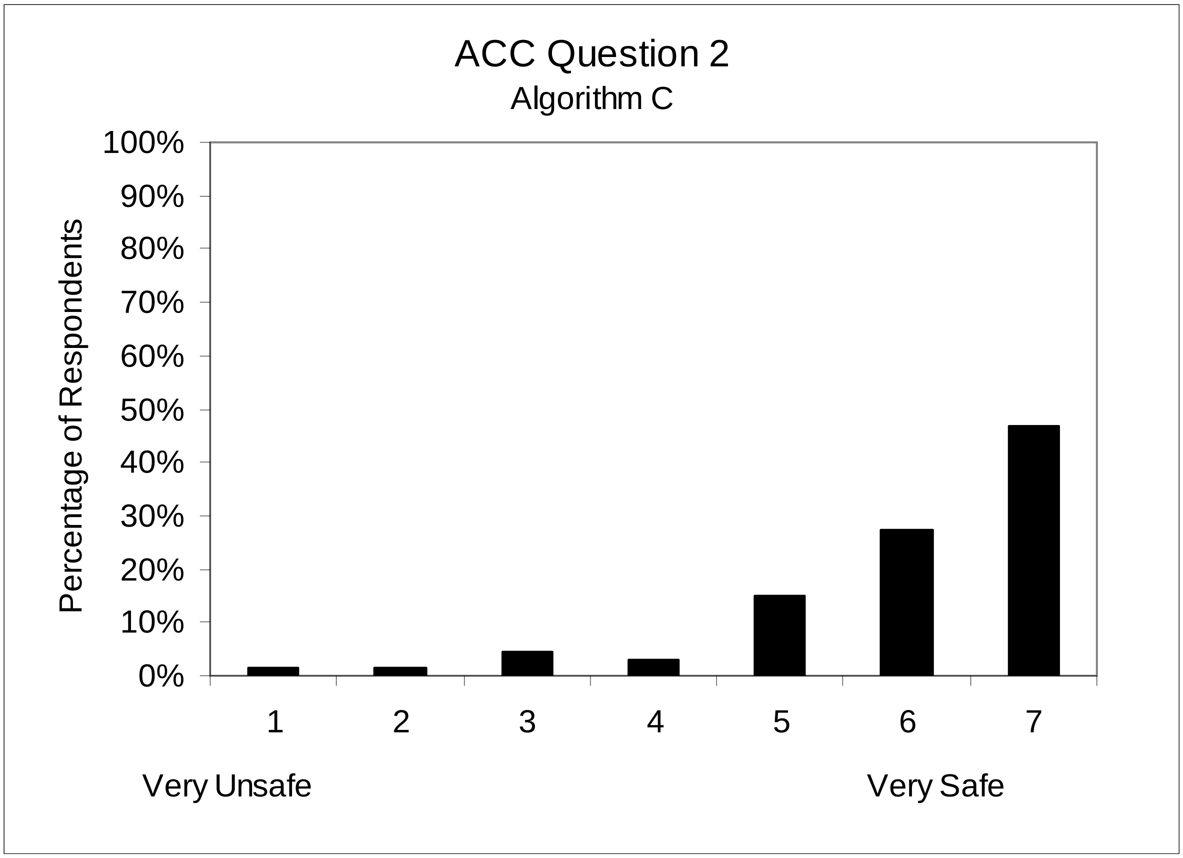


1. How <u>comfortable</u> did you feel using adaptive cruise control (ACC)?

*	Males	Females	Overall
Younger (20-30)	6.1 (1.2)	6.2 (1.2)	6.1 (1.2)
Middle-Aged (40-50)	5.8 (1.5)	5.9 (0.8)	5.9 (1.2)
Older (60-70)	6.9 (0.3)	6.4 (1.1)	6.6 (0.8)
Overall	6.3 (1.2)	6.2 (1.0)	6.2 (1.1)

Values in cells represent the mean response and (standard deviation)

* = Significant difference associated with participant age, $H(2) = 7.180$, $p = .028$

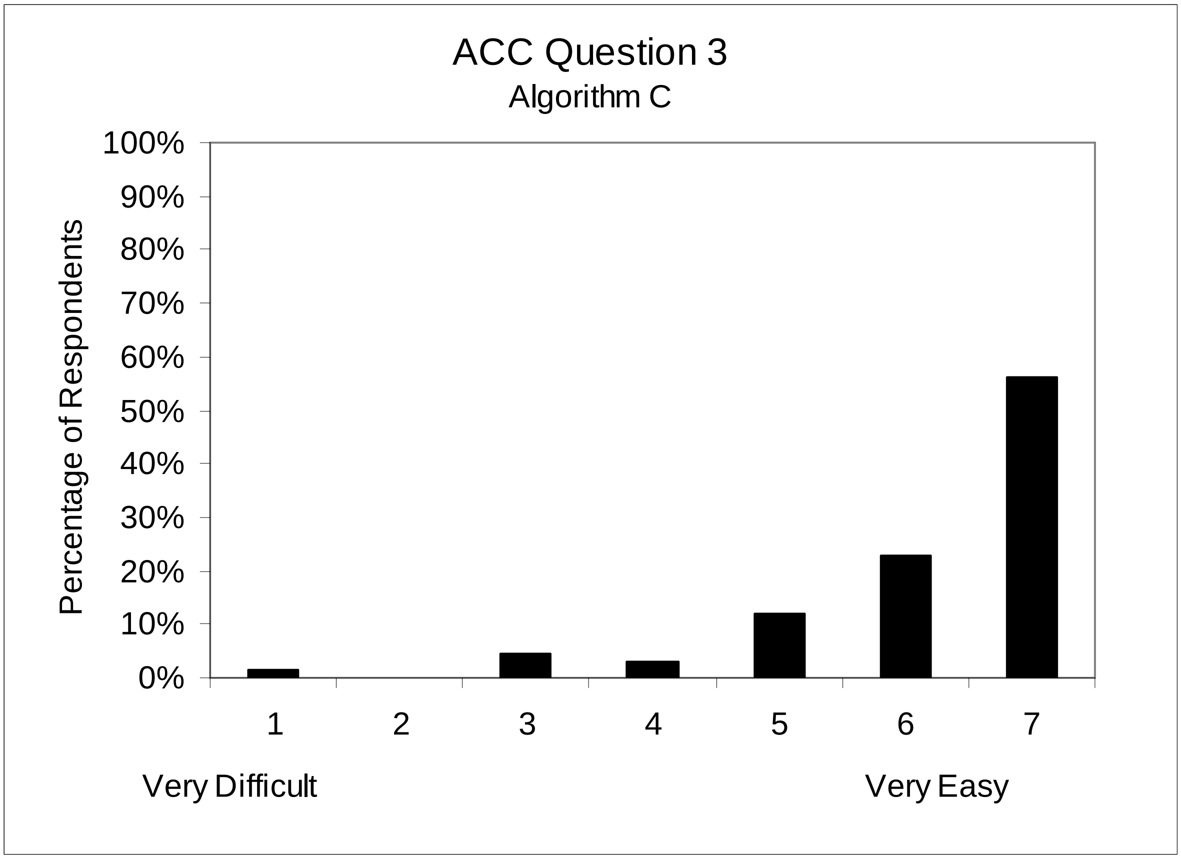


2. How safe did you feel driving the car while using ACC?

*	Males		Females		Overall	
Younger (20-30)[1]	5.2	(2.0)	6.1	(1.0)	5.6	(1.6)
Middle-Aged (40-50)[2]	5.6	(1.4)	5.9	(0.8)	5.8	(1.2)
Older (60-70)[1,2]	6.7	(0.6)	6.4	(1.3)	6.5	(1.0)
Overall	5.8	(1.6)	6.1	(1.1)	6.0	(1.3)

Values in cells represent the mean response and (standard deviation)

* = Significant difference associated with participant age, $H(2) = 9.601$, $p = .008$

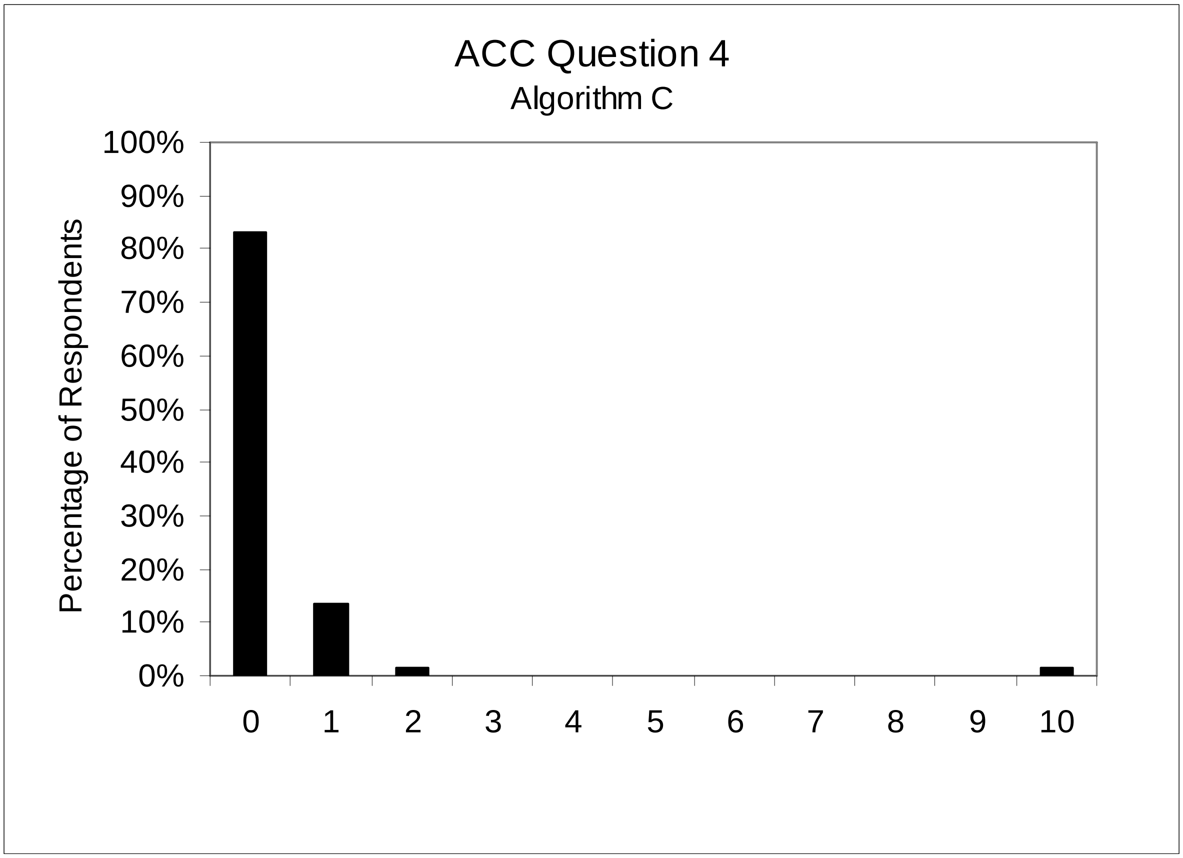


3. How easy or difficult did you find it to maintain a safe distance to the preceding vehicle when using ACC?

*	Males		Females		Overall	
Younger (20-30)	6.1	(1.4)	6.4	(0.8)	6.2	(1.1)
Middle-Aged (40-50)[1]	5.5	(1.6)	5.7	(1.7)	5.6	(1.6)
Older (60-70)[1]	6.6	(0.7)	6.6	(0.8)	6.6	(0.7)
Overall	6.1	(1.3)	6.2	(1.2)	6.2	(1.3)

Values in cells represent the mean response and (standard deviation)

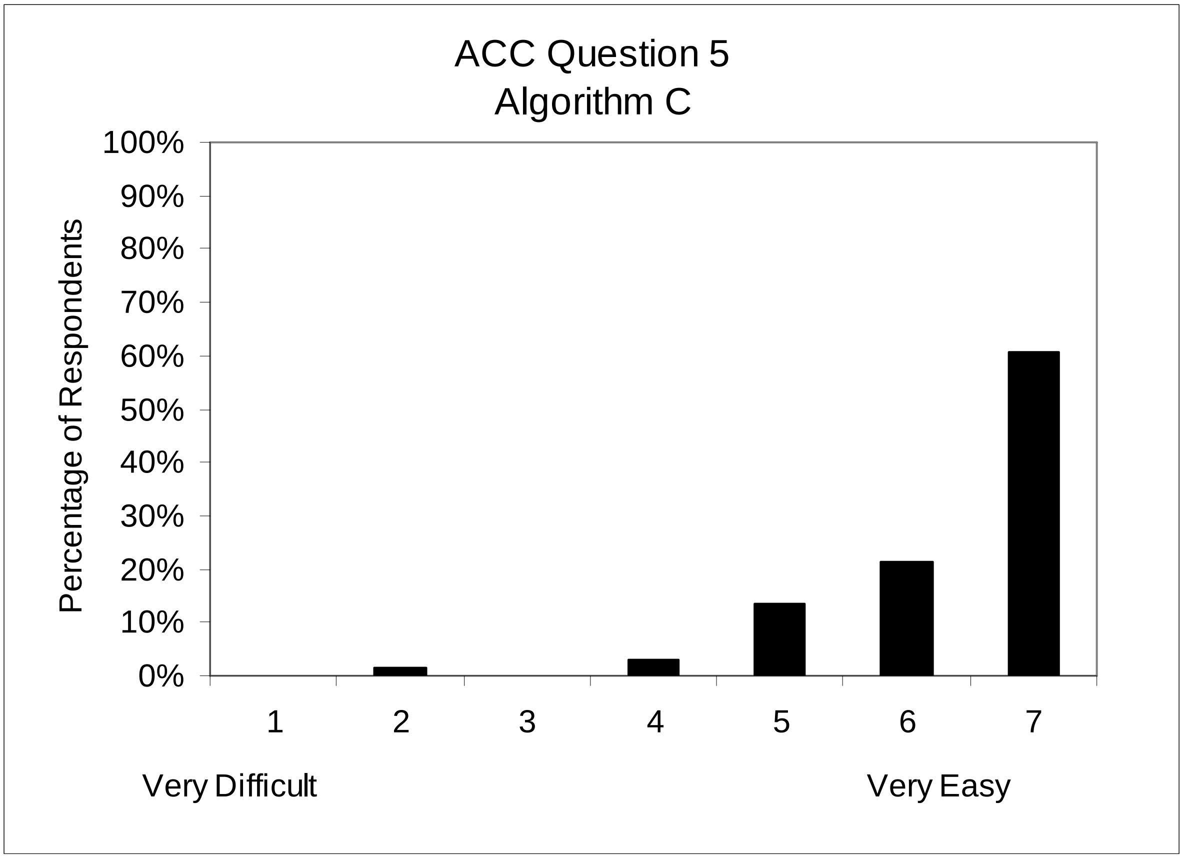
* = Significant difference associated with participant age, $H(2) = 7.291$, $p = .026$



4. While using ACC, please tell us the number of times, if ever, you came close to experiencing a rear-end collision? ________

*	Males	Females	Overall
Younger (20-30)	0.4 (0.7)	0.1 (0.3)	0.2 (0.5)
Middle-Aged (40-50)	1.0 (3.0)	0.1 (0.3)	0.5 (2.1)
Older (60-70)	0.1 (0.3)	0.3 (0.5)	0.2 (0.4)
Overall	0.5 (1.8)	0.2 (0.4)	0.3 (1.3)

Values in cells represent the mean response and (standard deviation)

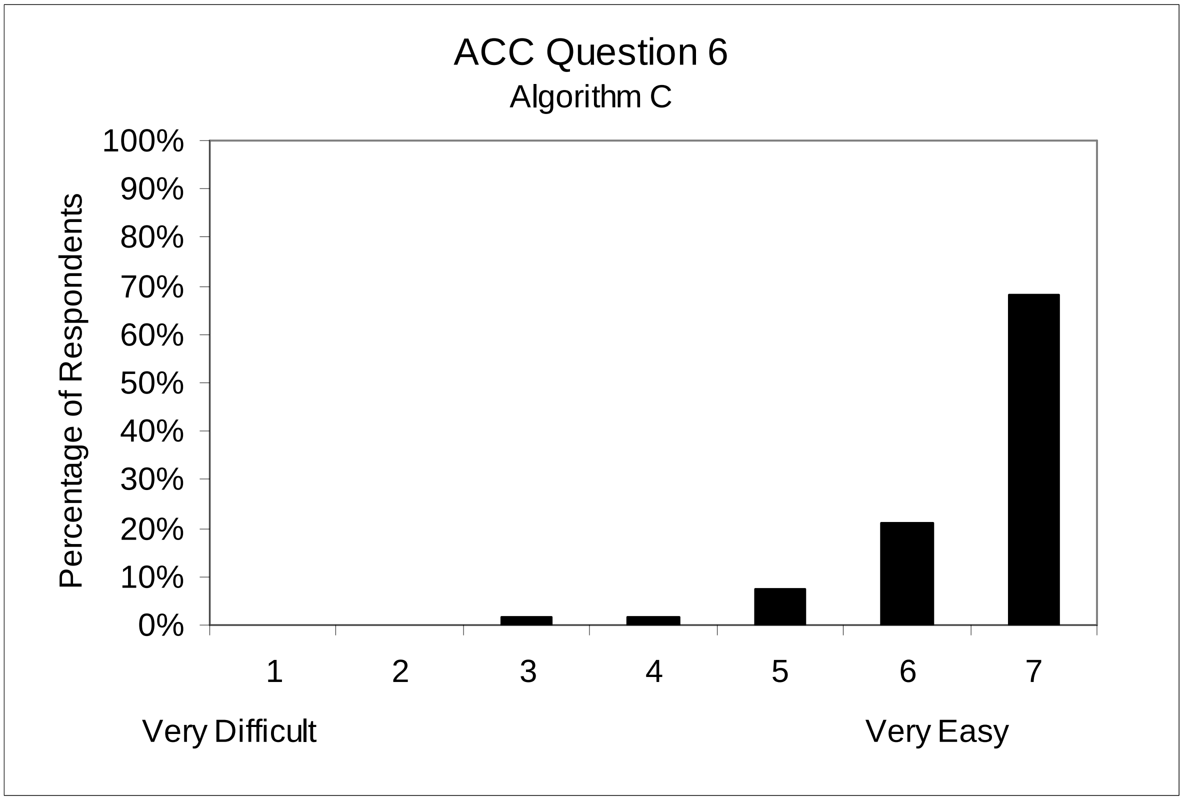


5. How <u>easy or difficult</u> did you find it to drive using ACC?

*	Males		Females		Overall	
Younger (20-30)	6.3	(1.0)	6.3	(0.9)	6.3	(0.9)
Middle-Aged (40-50)	6.5	(0.8)	5.6	(1.5)	6.0	(1.3)
Older (60-70)	6.8	(0.6)	6.6	(0.7)	6.7	(0.6)
Overall	6.5	(0.8)	6.2	(1.1)	6.3	(1.3)

Values in cells represent the mean response and (standard deviation)

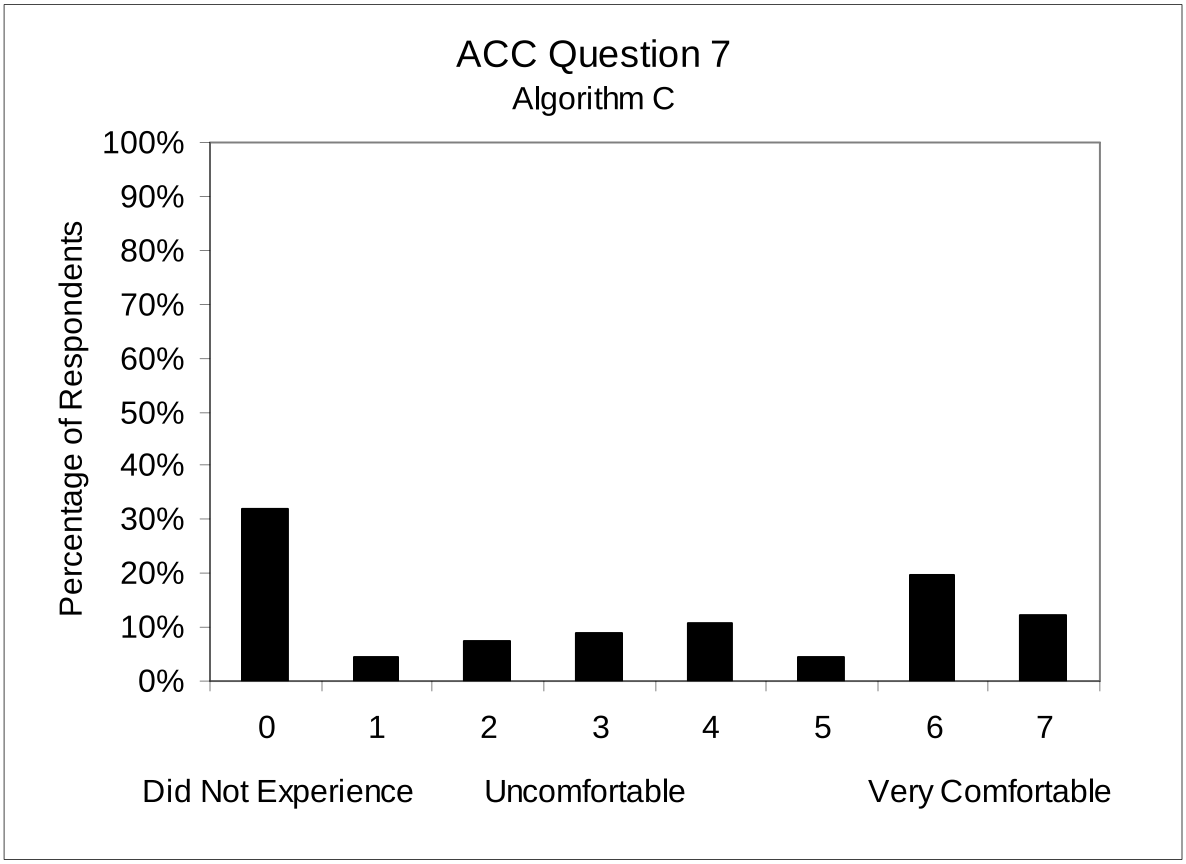
* = Significant difference associated with participant age, $H(2) = 6.107$, $p = .047$



6. How easy or difficult was it to understand and use the following distance (gap) adjustment for ACC?

	Males	Females	Overall
Younger (20-30)	6.7 (0.5)	6.5 (0.7)	6.6 (0.6)
Middle-Aged (40-50)	6.5 (0.7)	6.1 (0.9)	6.3 (0.8)
Older (60-70)	6.8 (0.6)	6.5 (1.3)	6.6 (1.0)
Overall	6.7 (0.6)	6.4 (1.0)	6.5 (0.8)

Values in cells represent the mean response and (standard deviation)

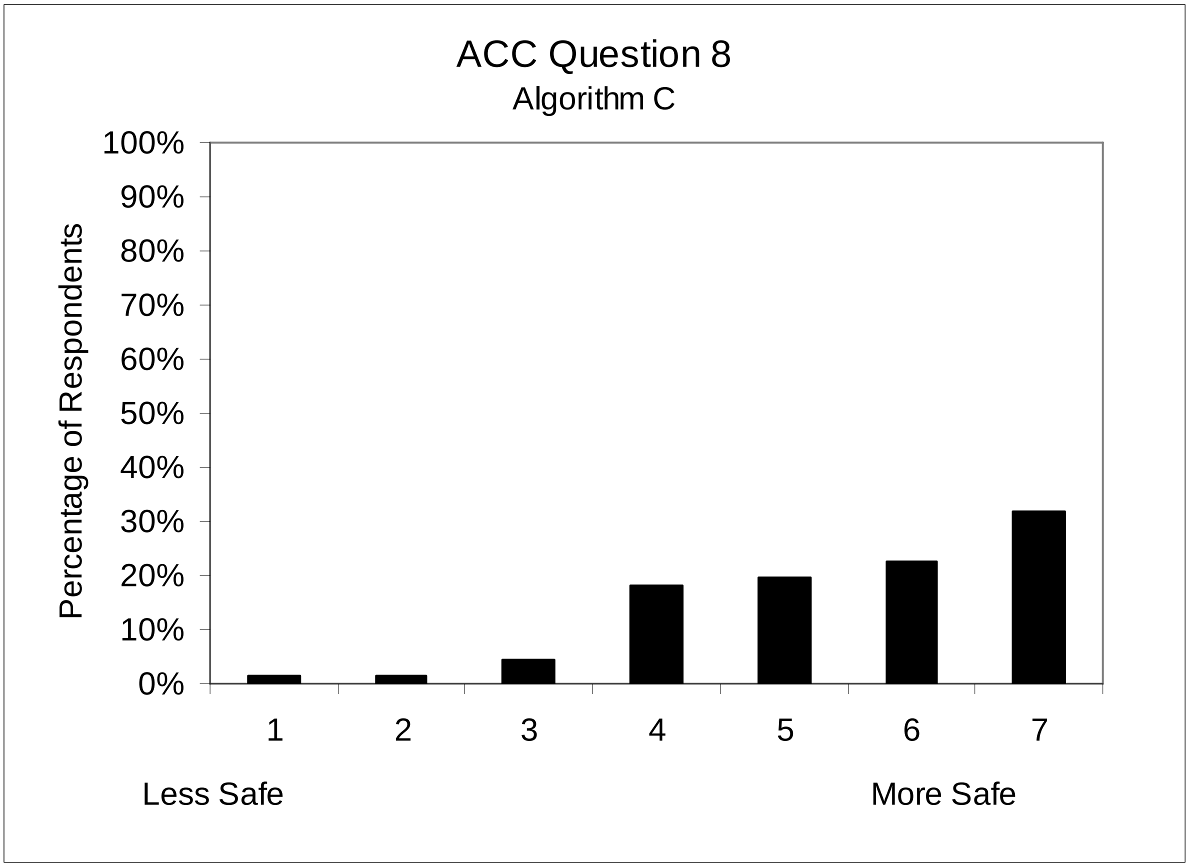


7. How <u>comfortable</u> did you feel using ACC in adverse weather conditions?

*	Males		Females		Overall	
Younger (20-30)	2.7	(2.6)	3.1	(2.4)	2.9	(2.4)
Middle-Aged (40-50)	3.7	(2.9)	1.7	(2.6)	2.7	(2.9)
Older (60-70)	5.4	(2.3)	2.3	(2.2)	3.8	(2.7)
Overall	3.9	(2.7)	2.4	(2.4)	3.2	(2.7)

Values in cells represent the mean response and (standard deviation)

* = Significant difference associated with participant gender, $H(1) = 5.529$, $p = .019$

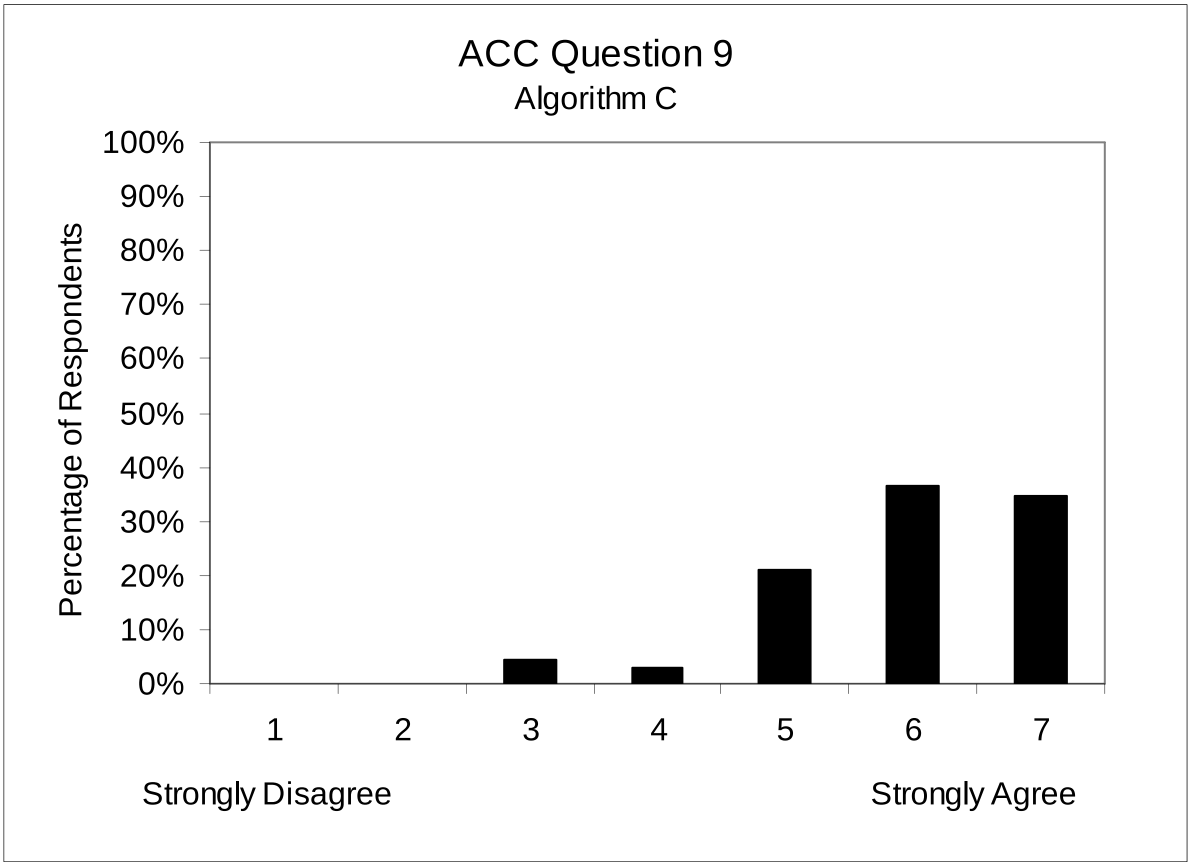


8. When using ACC, do you feel you drove more or less safely than when driving manually?

*	Males		Females		Overall	
Younger (20-30)	4.9	(1.9)	5.7	(1.3)	5.3	(1.7)
Middle-Aged (40-50)[1]	5.1	(1.3)	5.0	(0.8)	5.0	(1.0)
Older (60-70)[1]	6.4	(0.8)	5.8	(1.7)	6.1	(1.3)
Overall	5.5	(1.5)	5.5	(1.3)	5.5	(1.4)

Values in cells represent the mean response and (standard deviation)

* = Significant difference associated with participant age, $H(2) = 9.016$, $p = .011$



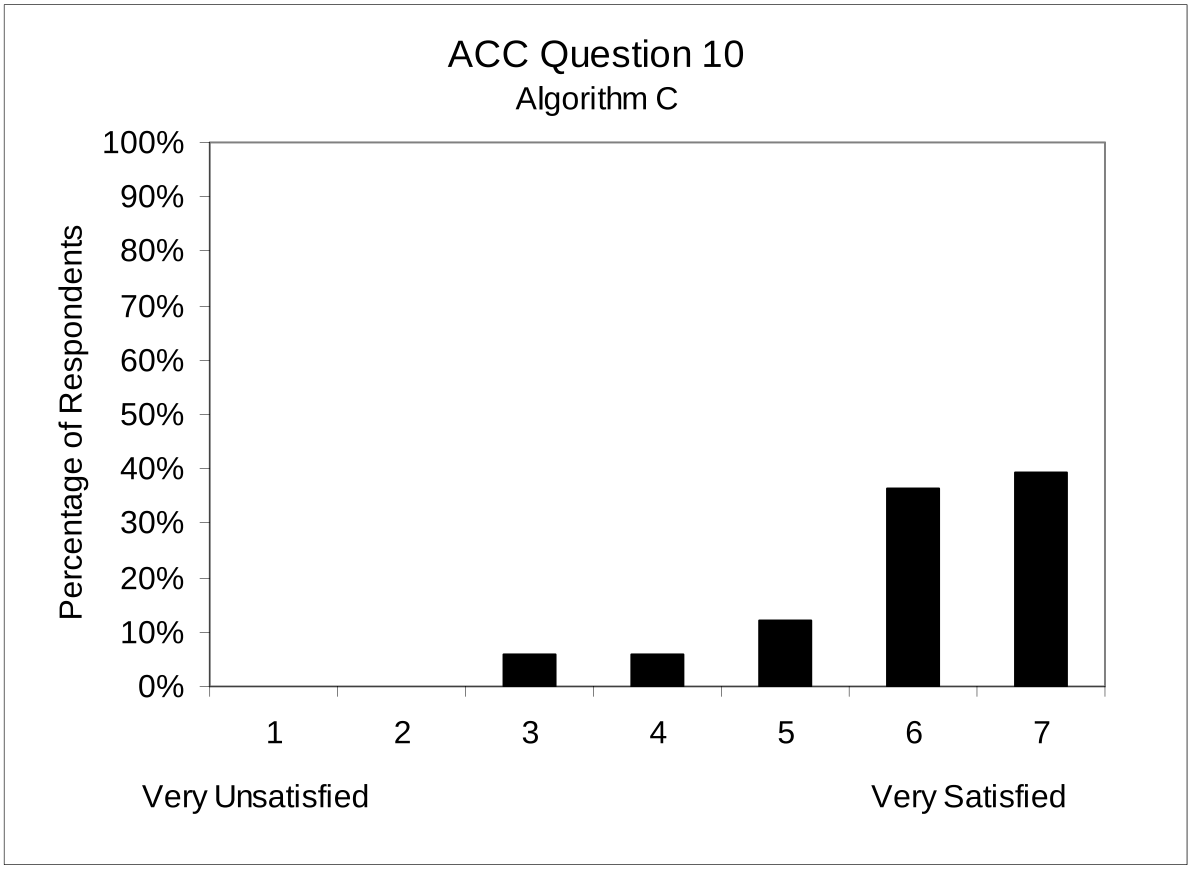
9. Overall, I felt the operation of the ACC system was predictable.

*†	Males		Females		Overall	
Younger (20-30)[1]	5.6	(1.2)	5.3	(1.1)	5.5	(1.1)
Middle-Aged (40-50)	5.9	(1.0)	5.9	(0.5)	5.9	(0.8)
Older (60-70)[1]	6.5	(0.7)	6.5	(1.2)	6.5	(1.0)
Overall	6.0	(1.0)	5.9	(1.2)	5.9	(1.1)

Values in cells represent the mean response and (standard deviation)

* = Significant difference associated with participant age, $H(2) = 12.830$, $p = .002$

† = Significant difference associated with the interaction of participant age and gender, $H(5) = 13.846$, $p = .017$



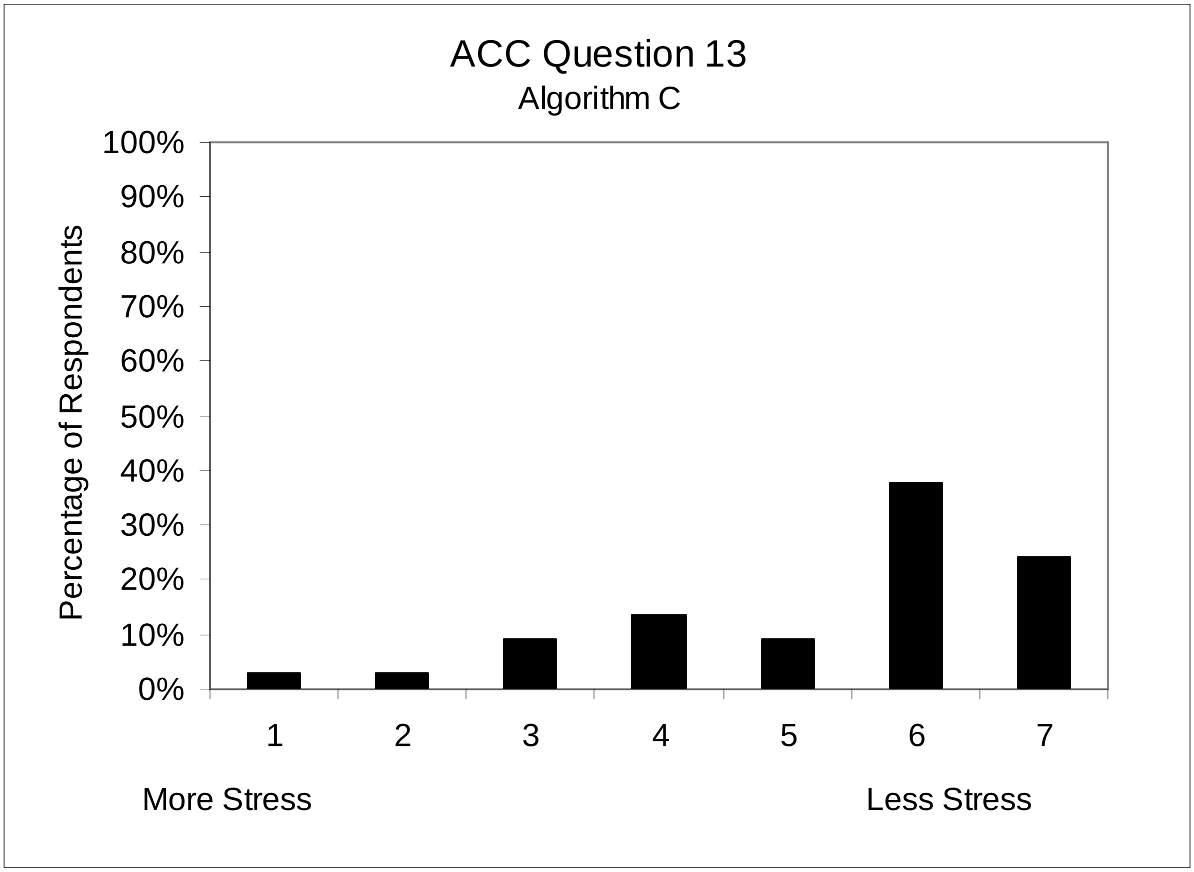
10. Overall, how <u>satisfied</u> were you with the ACC system?

*†	Males		Females		Overall	
Younger (20-30)[1]	5.7	(1.2)	5.6	(1.4)	5.7	(1.3)
Middle-Aged (40-50)[2]	5.6	(1.1)	5.6	(0.9)	5.6	(1.0)
Older (60-70)[1,2]	6.6	(0.5)	6.5	(1.2)	6.6	(0.9)
Overall	6.0	(1.1)	5.9	(1.2)	6.0	(1.1)

Values in cells represent the mean response and (standard deviation)

* = Significant difference associated with participant age, $H(2) = 14.890$, $p = .001$

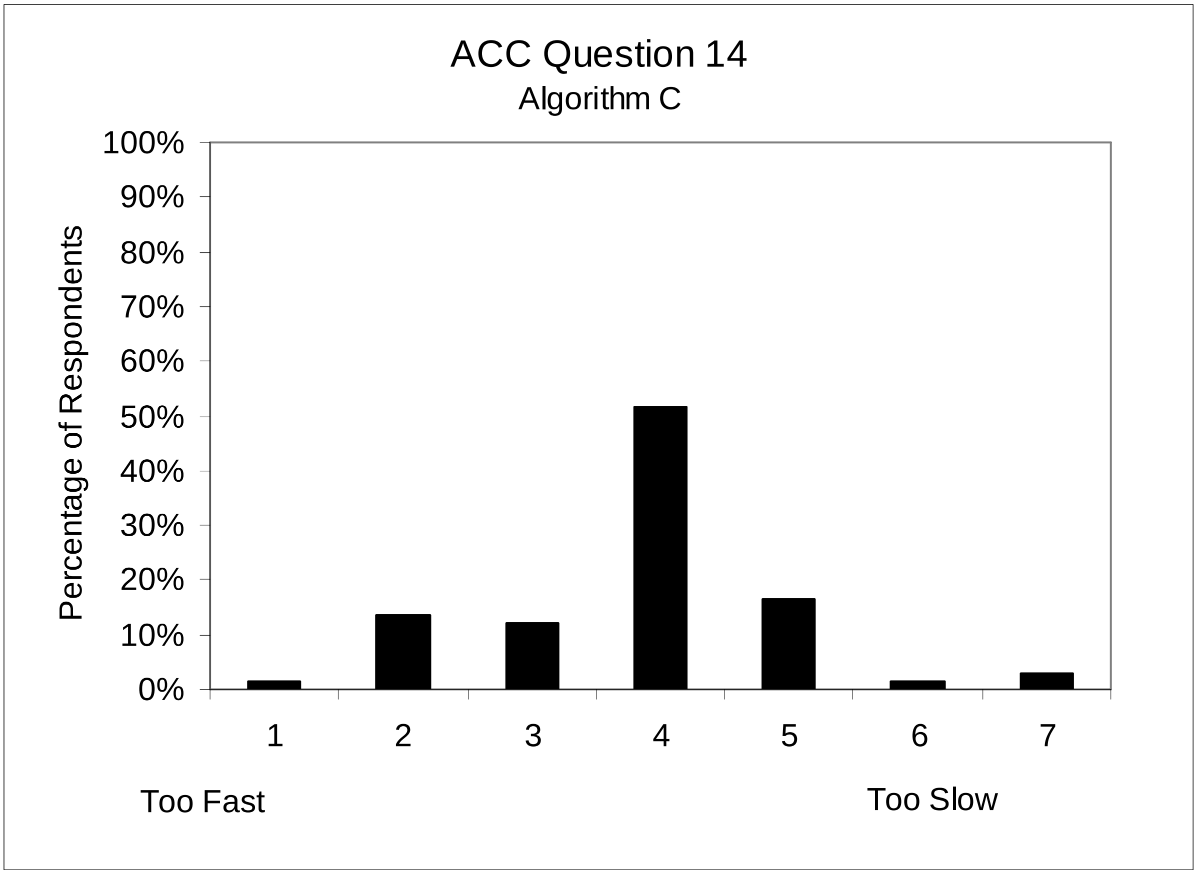
† = Significant difference associated with the interaction of participant age and gender, $H(5) = 15.010$, $p = .010$



13. Did you experience more or less stress when driving with ACC as compared to manual driving?

	Males	Females	Overall
Younger (20-30)	5.4 (1.4)	4.8 (2.1)	5.1 (1.8)
Middle-Aged (40-50)	5.5 (1.3)	4.6 (1.6)	5.1 (1.5)
Older (60-70)	6.2 (1.0)	5.5 (1.8)	5.8 (1.5)
Overall	5.7 (1.3)	5.0 (1.8)	5.3 (1.6)

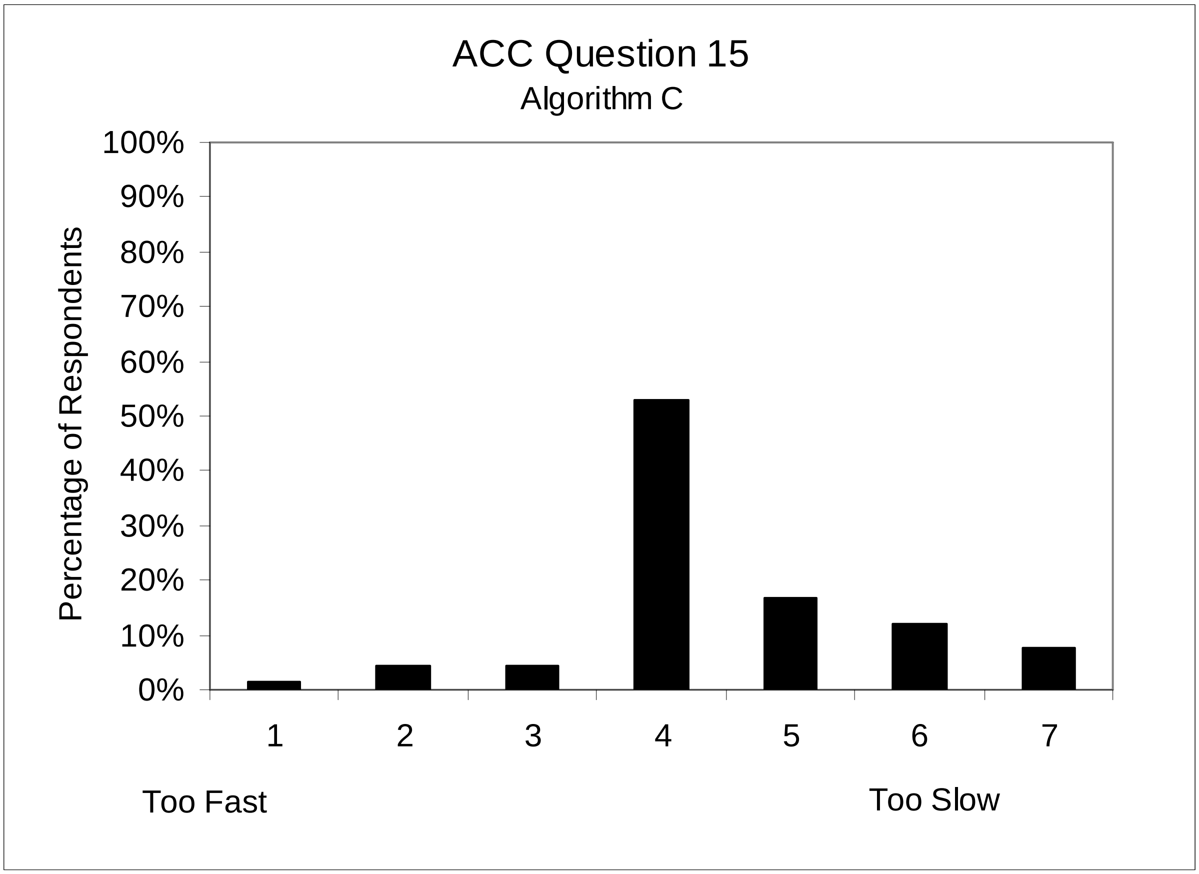
Values in cells represent the mean response and (standard deviation)



14. What did you think of the deceleration provided by ACC when following other vehicles?

	Males	Females	Overall
Younger (20-30)	3.8 (1.5)	3.4 (0.8)	3.6 (1.2)
Middle-Aged (40-50)	3.9 (1.6)	4.0 (0.9)	4.0 (1.3)
Older (60-70)	3.8 (1.2)	4.2 (0.6)	4.0 (0.9)
Overall	3.8 (1.4)	3.8 (0.8)	3.8 (1.1)

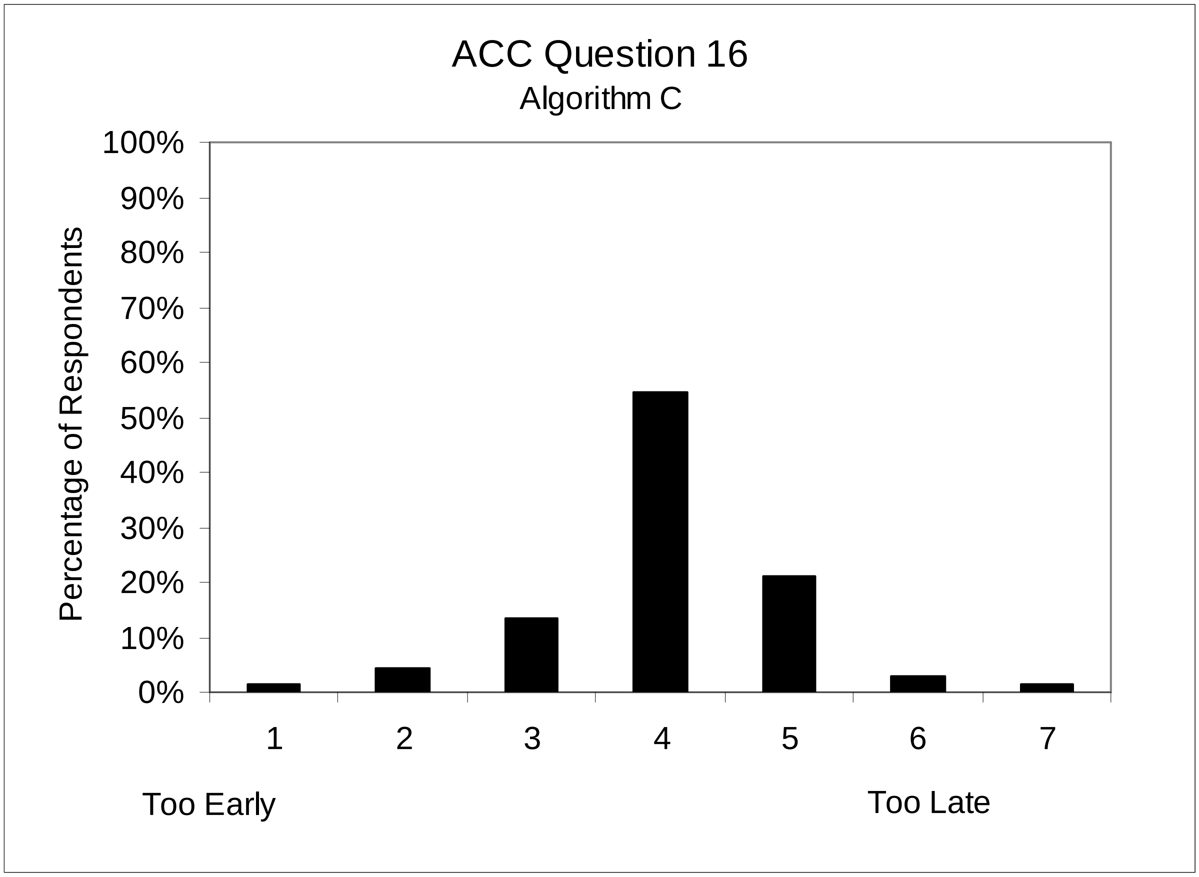
Values in cells represent the mean response and (standard deviation)



15. What did you think of the acceleration provided by ACC when pulling into an adjacent lane to pass other vehicles?

	Males	Females	Overall
Younger (20-30)	4.8 (1.0)	3.7 (1.5)	4.3 (1.2)
Middle-Aged (40-50)	4.5 (1.4)	4.6 (1.1)	4.5 (1.3)
Older (60-70)	4.5 (1.0)	4.6 (1.2)	4.5 (0.9)
Overall	4.6 (1.1)	4.3 (1.3)	4.5 (1.2)

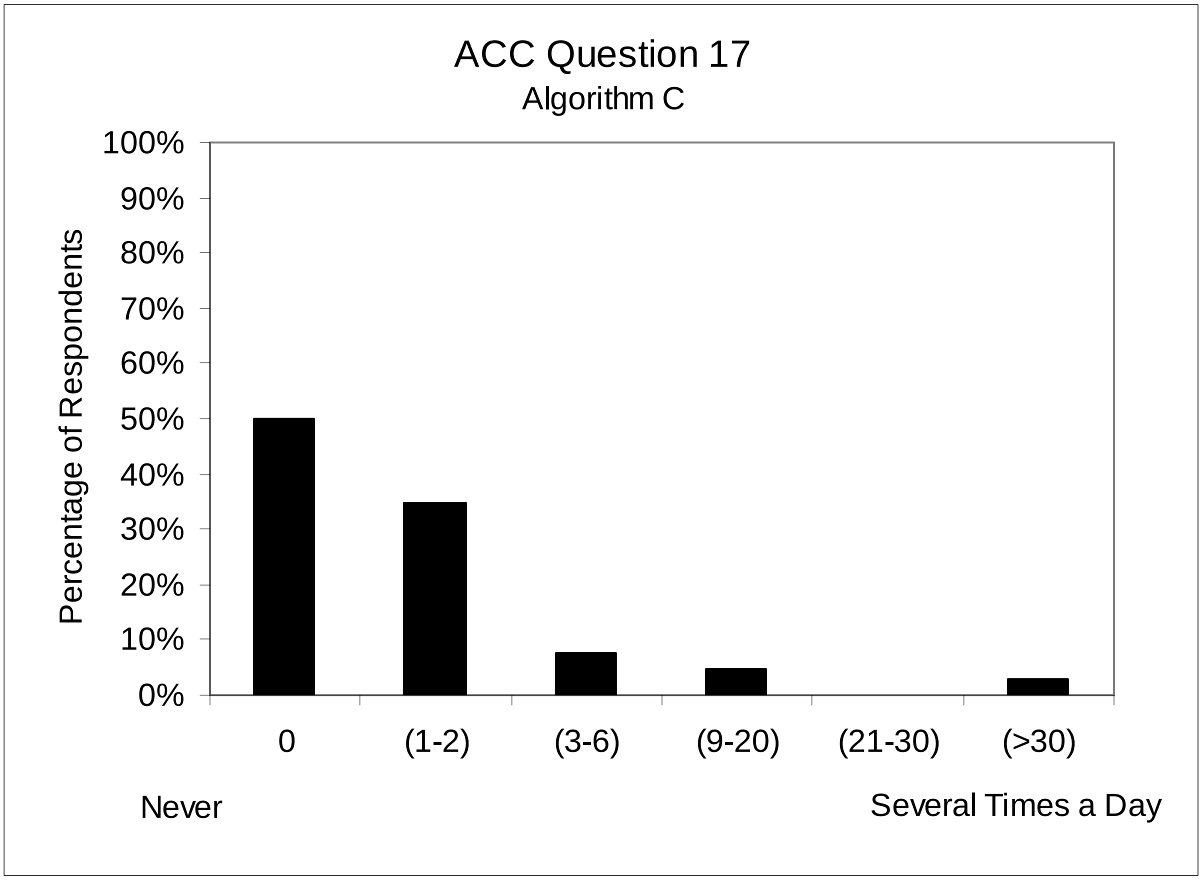
Values in cells represent the mean response and (standard deviation)



16. What did you think of the timing of ACC braking in response to a vehicle ahead?

*	Males	Females	Overall
Younger (20-30)	3.6 (0.9)	4.2 (0.6)	3.9 (0.8)
Middle-Aged (40-50)	4.4 (1.5)	3.9 (1.0)	4.1 (1.3)
Older (60-70)	4.1 (0.9)	4.1 (0.5)	4.1 (0.8)
Overall	4.0 (1.2)	4.1 (0.7)	4.0 (1.0)

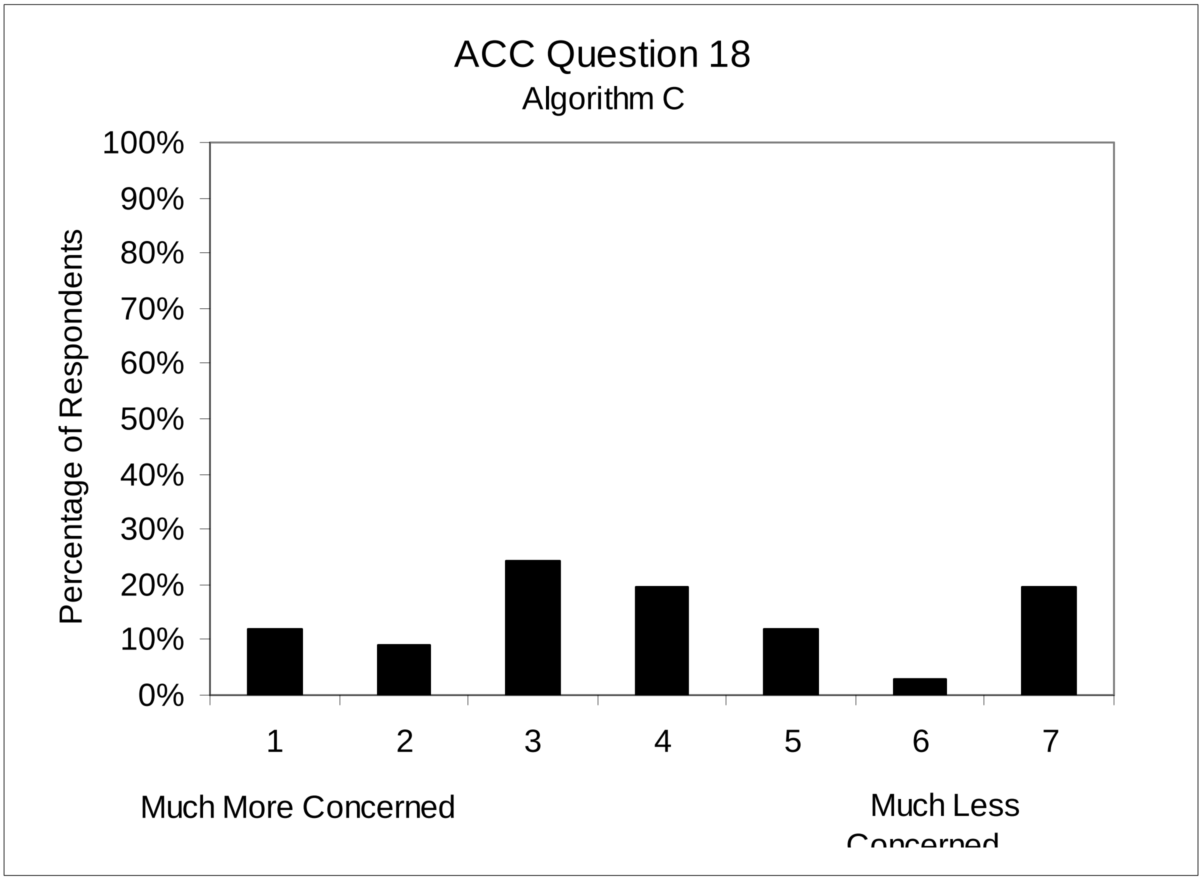
Values in cells represent the mean response and (standard deviation)



17. How often, if ever, did you experience "unsafe" distances to the vehicle ahead when using ACC? Please check the one option that best applies.

*	Males	Females	Overall
Younger (20-30)	2.0 (0.9)	1.5 (0.7)	1.7 (0.8)
Middle-Aged (40-50)	2.2 (1.5)	1.4 (0.5)	1.8 (1.2)
Older (60-70)	2.1 (1.4)	1.6 (1.1)	1.9 (1.3)
Overall	2.1 (1.3)	1.5 (0.8)	1.8 (1.1)

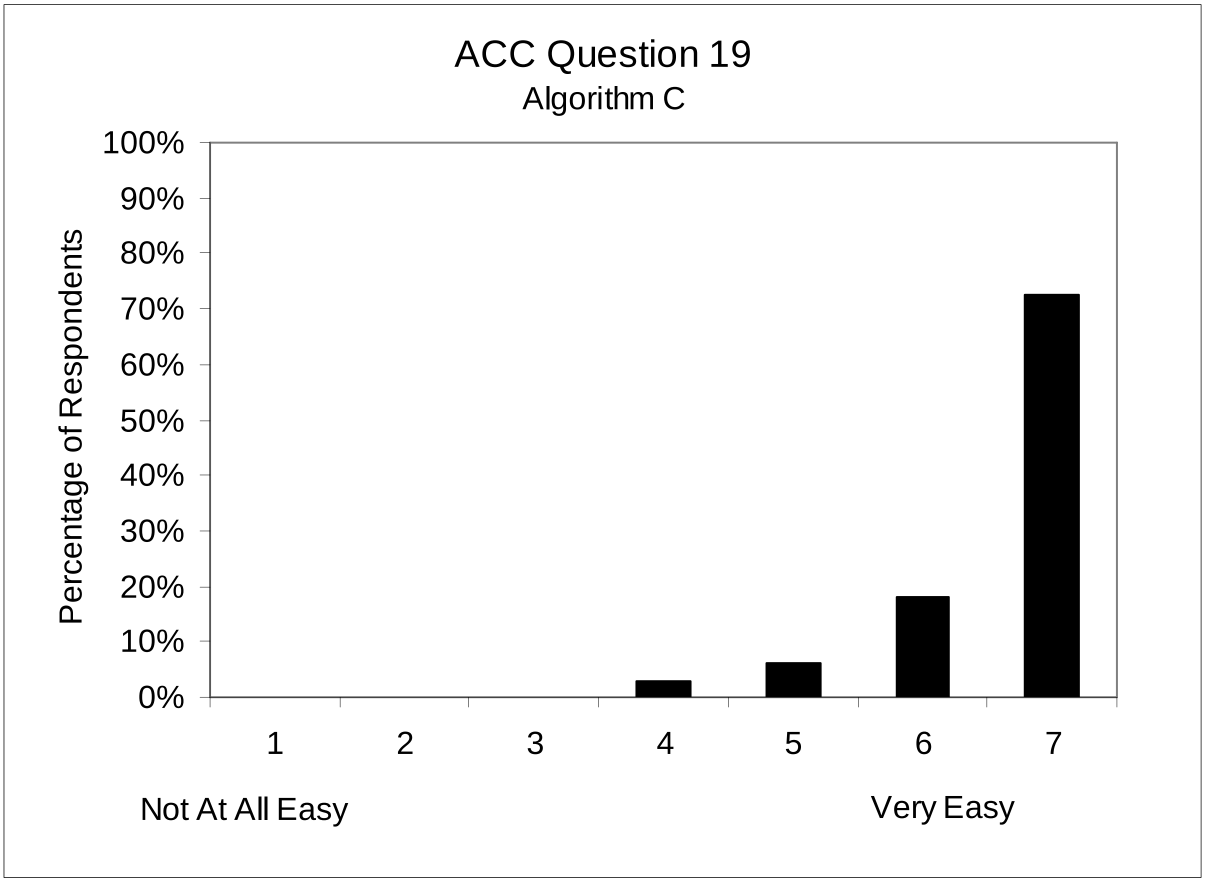
Values in cells represent the mean response and (standard deviation)



18. Relative to manual driving, how concerned were you about traffic behind you when using ACC?

*	Males		Females		Overall	
Younger (20-30)	3.7	(2.1)	4.6	(2.1)	4.2	(2.1)
Middle-Aged (40-50)	3.1	(1.2)	4.5	(2.1)	3.8	(1.8)
Older (60-70)	4.2	(2.1)	3.8	(1.9)	4.0	(2.0)
Overall	3.7	(1.8)	4.3	(2.0)	4.0	(1.9)

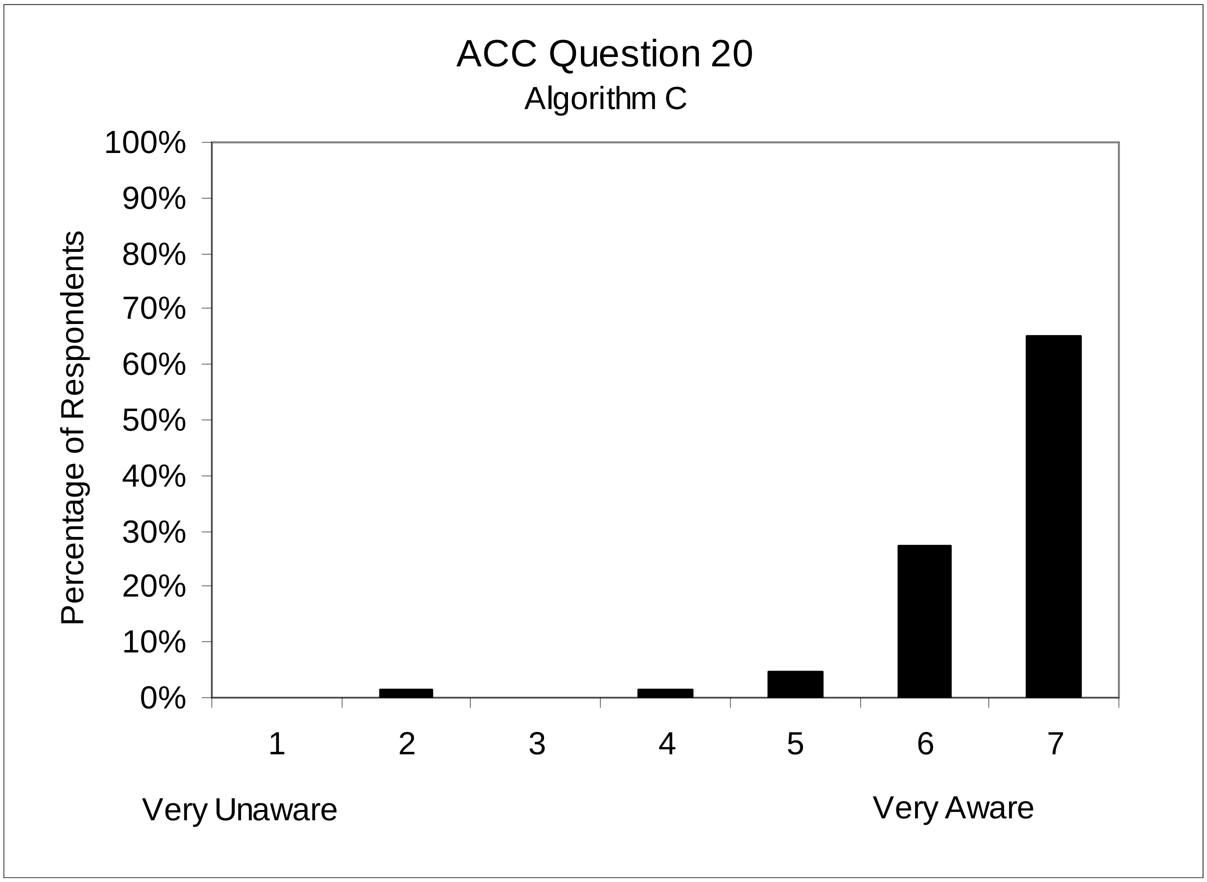
Values in cells represent the mean response and (standard deviation)



19. Overall, how easy was it to remember how to use and operate ACC while driving?

	Males		Females		Overall	
Younger (20-30)	6.8	(0.4)	6.6	(0.7)	6.7	(0.6)
Middle-Aged (40-50)	6.6	(0.7)	6.2	(1.0)	6.4	(0.9)
Older (60-70)	6.9	(0.3)	6.5	(1.0)	6.7	(0.8)
Overall	6.8	(0.5)	6.4	(0.9)	6.6	(0.7)

Values in cells represent the mean response and (standard deviation)

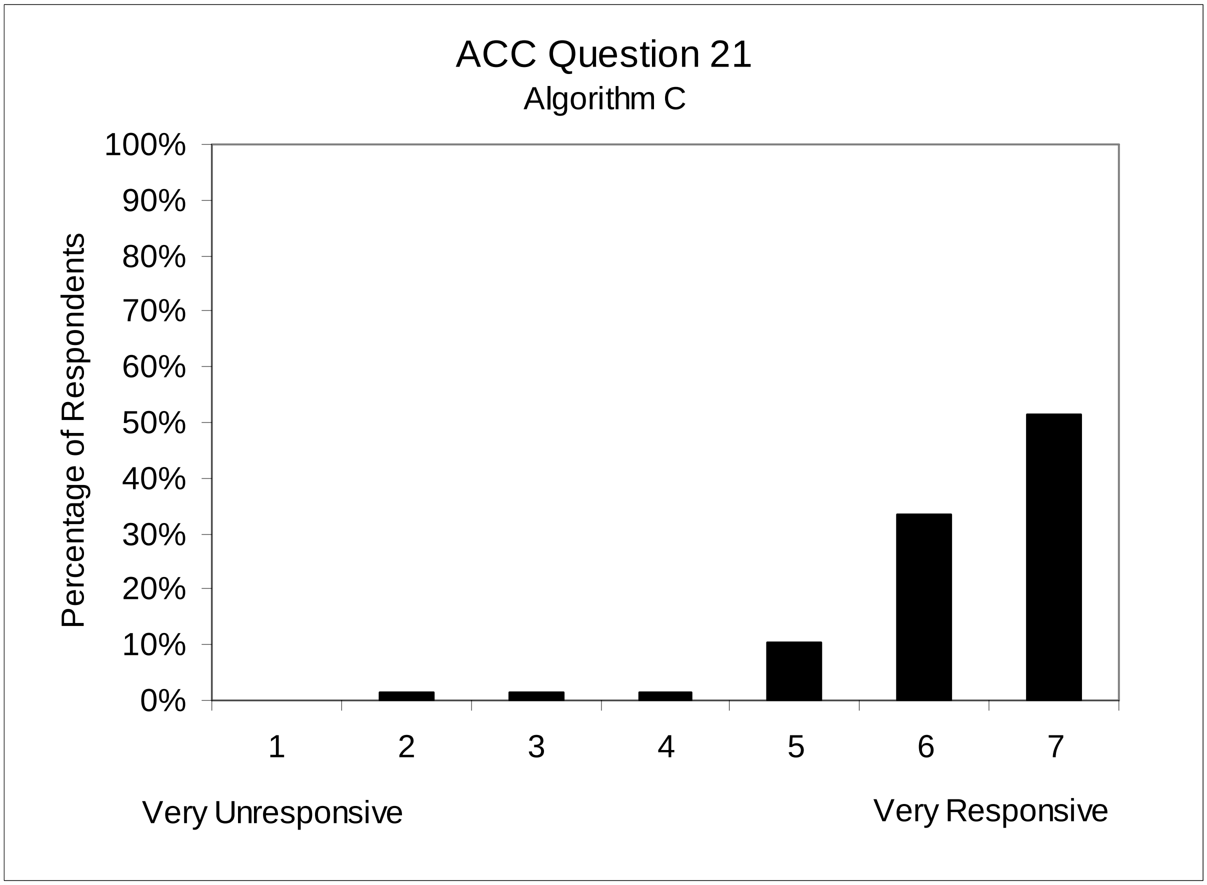


20. When using ACC, how aware were you of the driving situation (surrounding traffic, posted speed, traffic signals, etc)?

*	Males	Females	Overall
Younger (20-30)	6.3 (1.5)	6.4 (0.7)	6.3 (1.1)
Middle-Aged (40-50)	6.4 (0.7)	6.5 (0.7)	6.4 (0.7)
Older (60-70)	6.7 (0.9)	6.9 (0.3)	6.8 (0.7)
Overall	6.5 (1.1)	6.6 (0.6)	6.5 (0.9)

Values in cells represent the mean response and (standard deviation)

* = Significant difference associated with participant age, $H(2) = 8.544$, $p = .014$

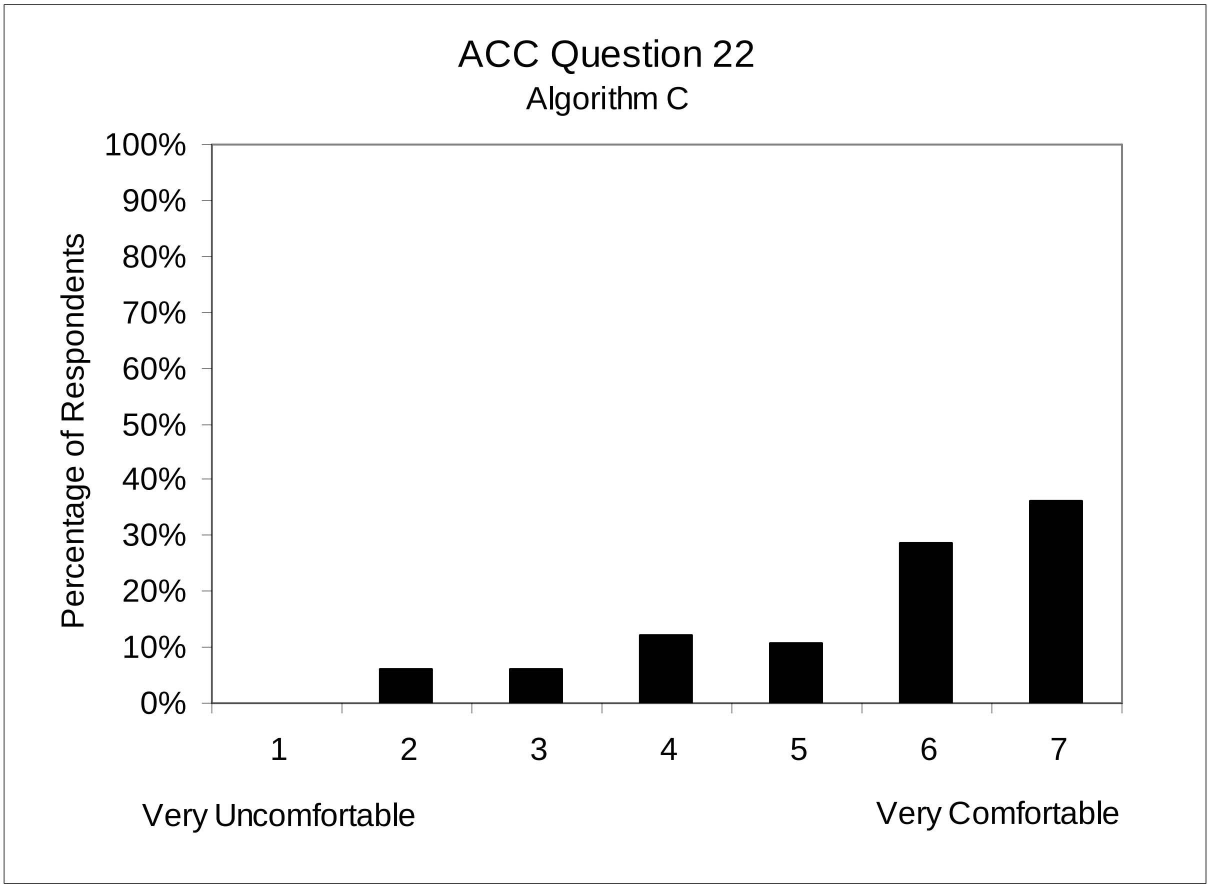


21. When using ACC, how responsive were you to the actions of vehicles around you?

*	Males		Females		Overall	
Younger (20-30)[1]	6.0	(1.4)	5.8	(1.3)	5.9	(1.3)
Middle-Aged (40-50)	6.1	(0.9)	6.2	(0.9)	6.1	(0.9)
Older (60-70)[1]	6.7	(0.5)	6.8	(0.4)	6.8	(0.4)
Overall	6.3	(1.0)	6.3	(1.0)	6.3	(1.0)

Values in cells represent the mean response and (standard deviation)

* = Significant difference associated with participant age, $H(2) = 10.168$, $p = .006$

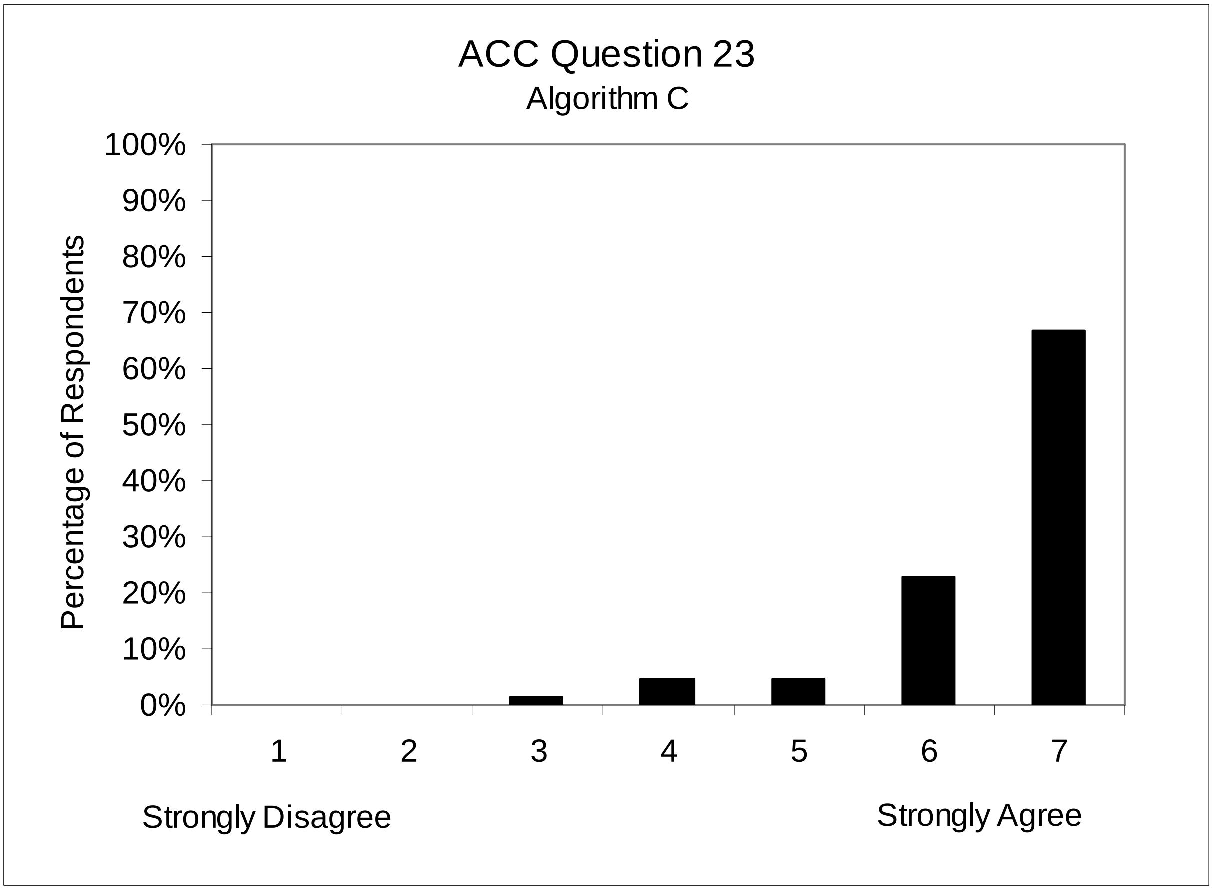


22. How comfortable did you feel with your ability to change lanes (to pass other cars) using ACC?

*	Males	Females	Overall
Younger (20-30)	5.5 (1.9)	5.4 (1.7)	5.5 (1.7)
Middle-Aged (40-50)[1]	5.2 (1.5)	4.9 (1.4)	5.0 (1.5)
Older (60-70)[1]	6.1 (1.2)	6.5 (1.0)	6.3 (1.1)
Overall	5.6 (1.6)	5.6 (1.5)	5.6 (1.5)

Values in cells represent the mean response and (standard deviation)

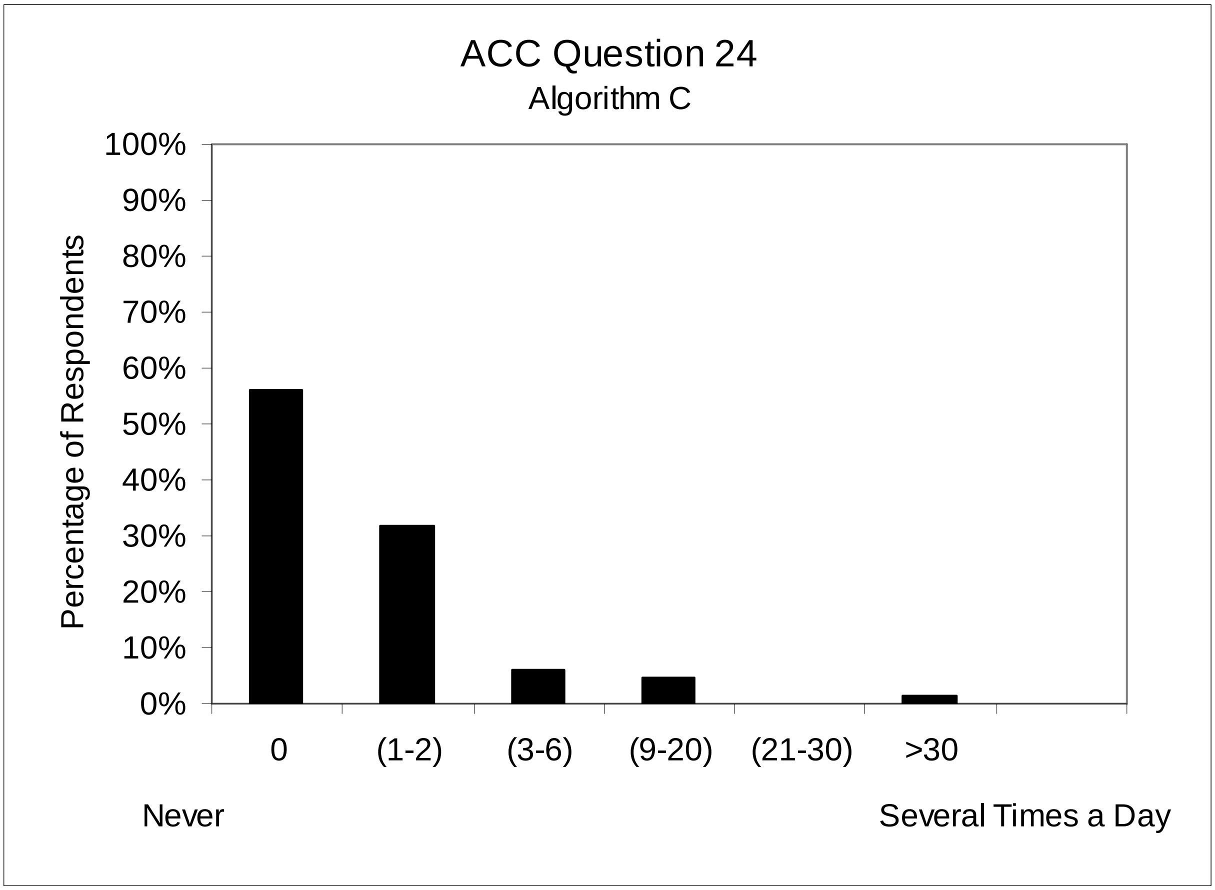
* = Significant difference associated with participant age, $H(2) = 9.058$, $p = .011$



23. When I was using ACC, I understood when I had to take control – either by accelerating or braking.

	Males	Females	Overall
Younger (20-30)	6.6 (0.5)	6.1 (1.4)	6.4 (1.0)
Middle-Aged (40-50)	6.1 (1.2)	6.5 (0.7)	6.3 (1.0)
Older (60-70)	6.7 (0.6)	6.9 (0.3)	6.8 (0.5)
Overall	6.5 (0.9)	6.5 (0.9)	6.5 (1.9)

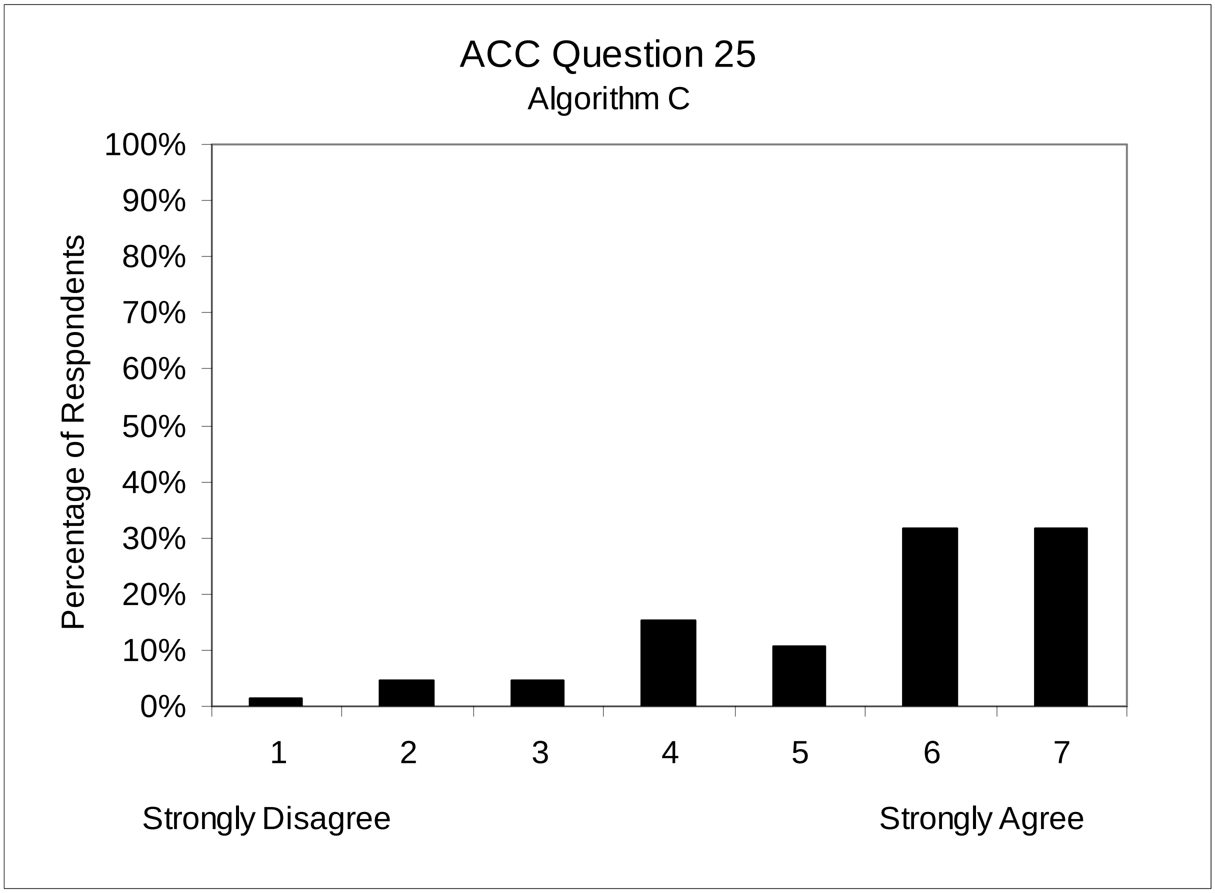
Values in cells represent the mean response and (standard deviation)



24. How often, if ever, did you inadvertently experience “unsafe” following distances when using ACC? Please check the one option that best applies.

	Males		Females		Overall	
Younger (20-30)	2.0	(0.9)	1.3	(0.6)	1.6	(0.8)
Middle-Aged (40-50)	1.9	(1.5)	1.5	(0.7)	1.7	(1.2)
Older (60-70)	1.7	(0.9)	1.5	(0.9)	1.6	(0.9)
Overall	1.9	(1.1)	1.4	(0.8)	1.7	(1.0)

Values in cells represent the mean response and (standard deviation)

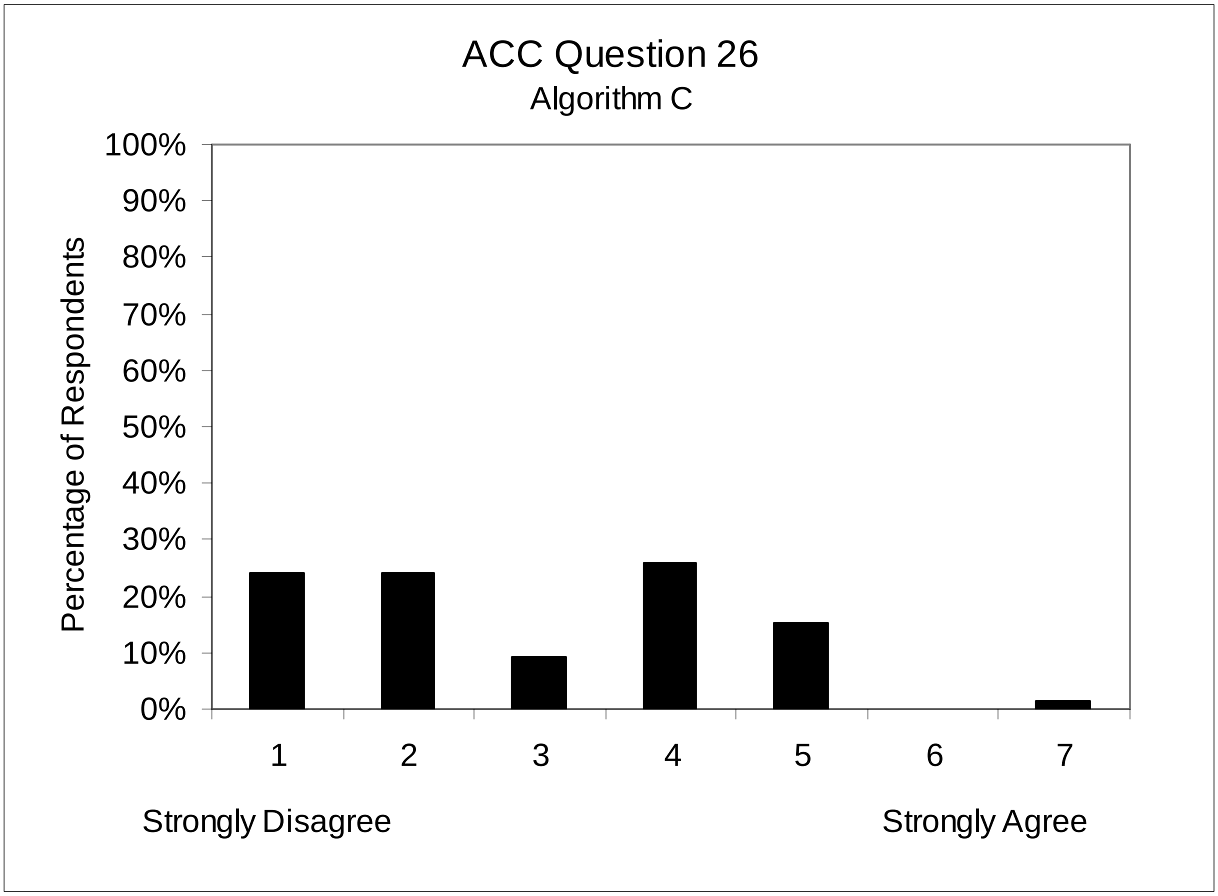


25. Overall, do you think ACC is going to increase your driving safety?

*	Males		Females		Overall	
Younger (20-30)	5.4	(1.5)	5.3	(1.7)	5.3	(1.6)
Middle-Aged (40-50)[1]	5.2	(1.7)	4.9	(1.6)	5.0	(1.6)
Older (60-70)[1]	6.2	(1.0)	6.2	(1.4)	6.2	(1.2)
Overall	5.6	(1.5)	5.5	(1.6)	5.5	(1.5)

Values in cells represent the mean response and (standard deviation)

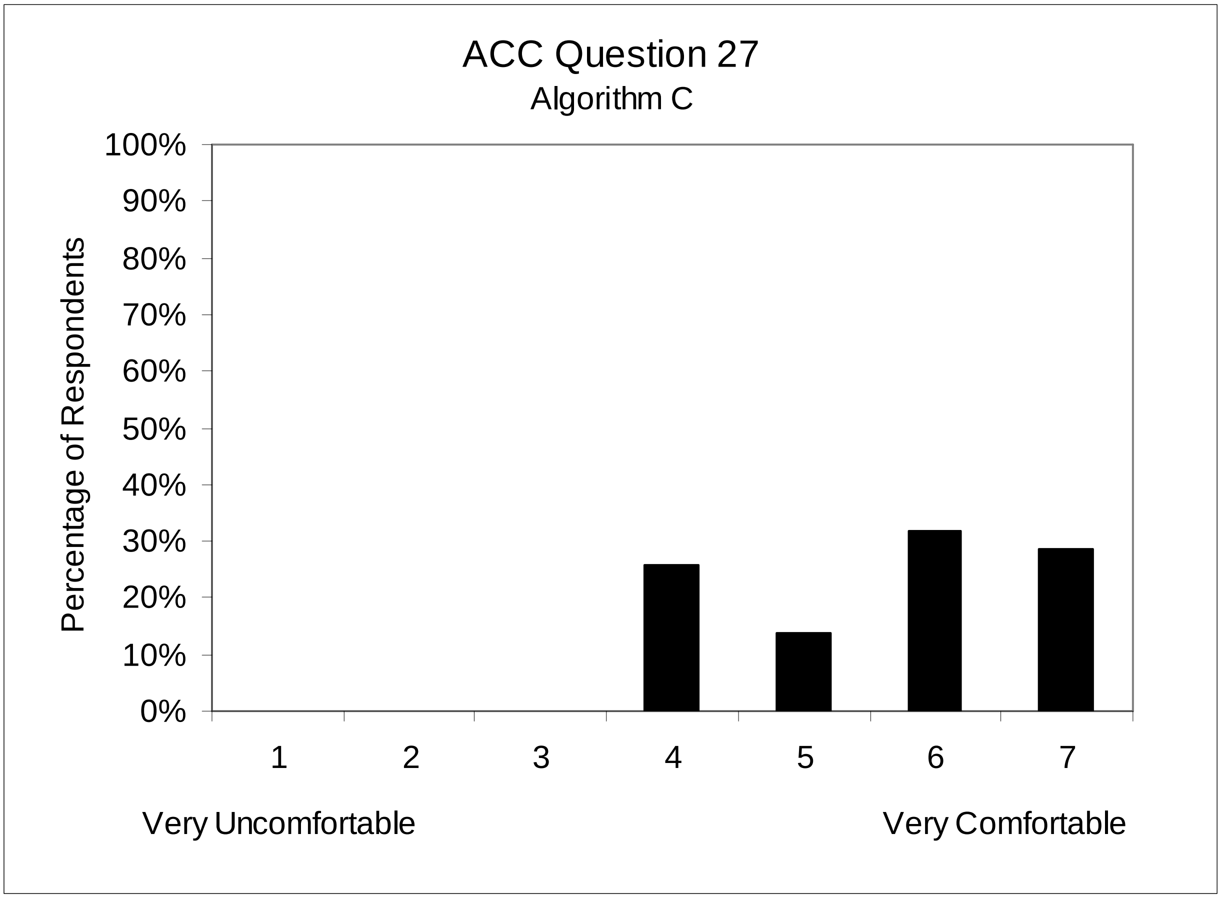
* = Significant difference associated with participant age, $H(2) = 8.117$, $p = .017$



26. Overall, I found myself relying too much on the ACC system?

	Males	Females	Overall
Younger (20-30)	2.9 (1.4)	2.5 (1.5)	2.7 (1.4)
Middle-Aged (40-50)	3.5 (1.7)	3.5 (1.6)	3.5 (1.6)
Older (60-70)	2.7 (1.4)	2.2 (1.5)	2.5 (1.4)
Overall	3.0 (1.5)	2.8 (1.6)	2.9 (1.5)

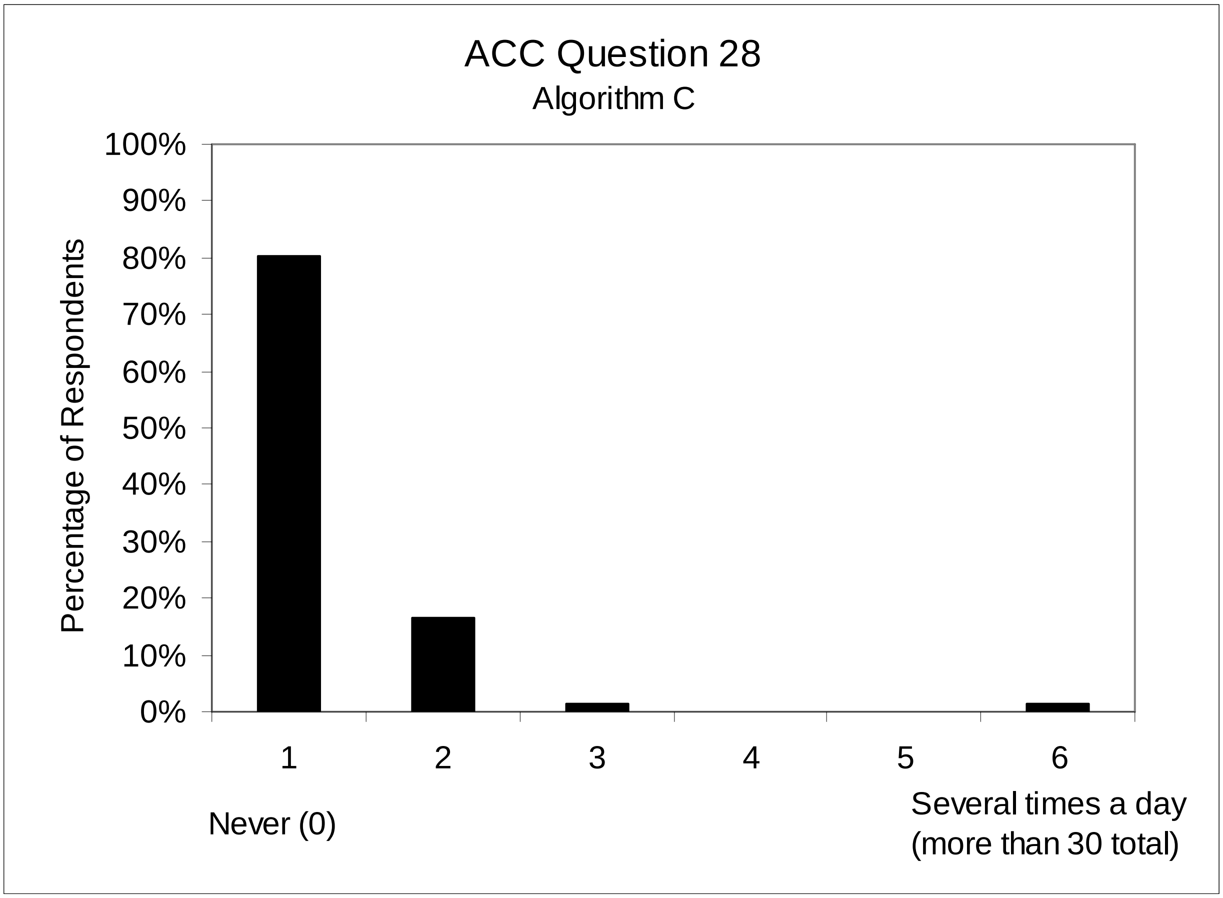
Values in cells represent the mean response and (standard deviation)



27. Did you feel more comfortable performing additional tasks, (e.g., adjusting the heater, operating the radio, talking on a cellular telephone, etc.) while using the ACC system as compared to manual driving?

	Males	Females	Overall
Younger (20-30)	6.1 (0.5)	5.5 (1.4)	5.8 (1.1)
Middle-Aged (40-50)	5.8 (1.0)	4.9 (1.0)	5.4 (1.1)
Older (60-70)	5.9 (1.2)	5.5 (1.4)	5.7 (1.3)
Overall	5.9 (0.9)	5.3 (1.3)	5.6 (1.2)

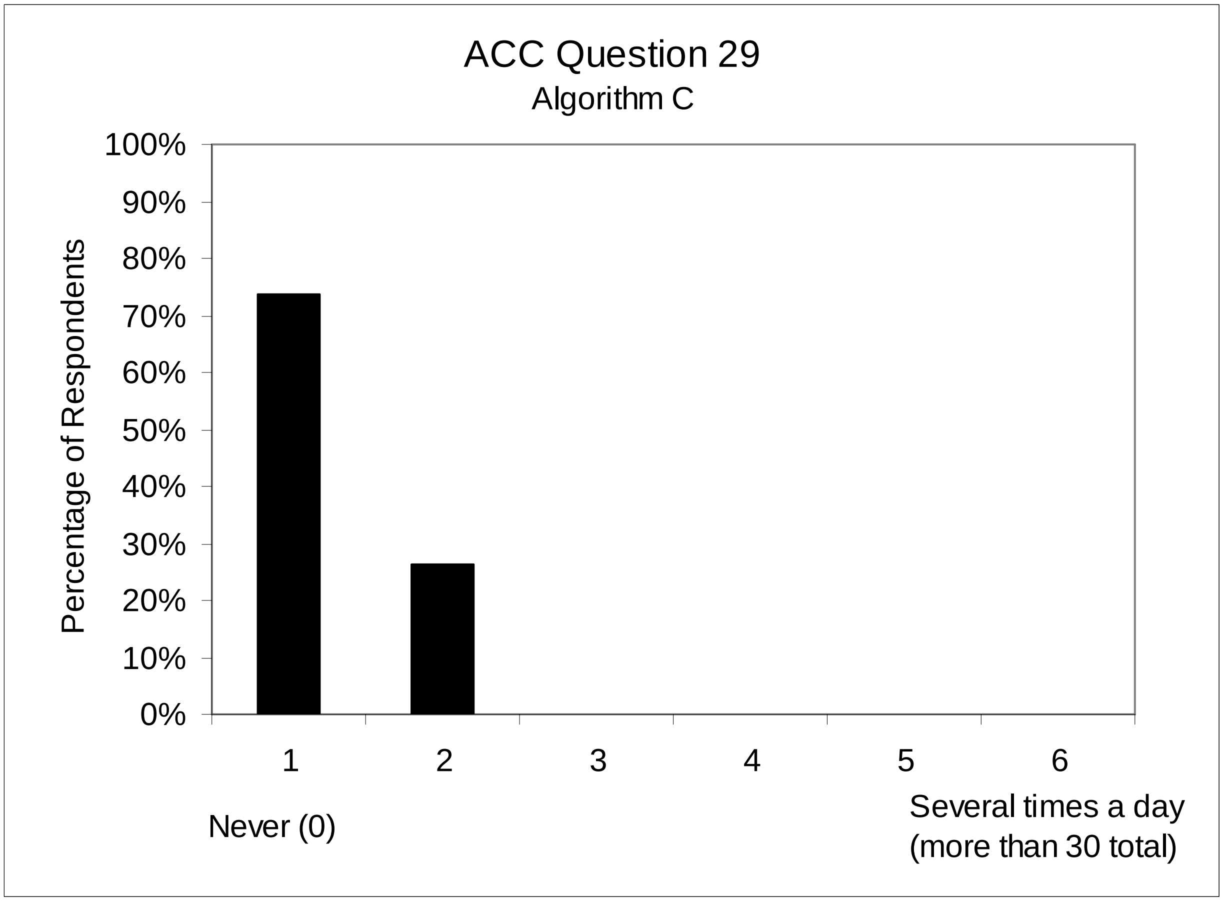
Values in cells represent the mean response and (standard deviation)



28. While using ACC, how often, if ever, did the system not indicate the presence of a vehicle when one did exist (missed a vehicle)? Please check the one option that best applies.

	Males	Females	Overall
Younger (20-30)	1.3 (0.5)	1.3 (0.5)	1.3 (0.5)
Middle-Aged (40-50)	1.7 (1.5)	1.0 (0.0)	1.4 (1.1)
Older (60-70)	1.2 (0.4)	1.2 (0.6)	1.2 (0.5)
Overall	1.4 (0.9)	1.2 (0.4)	1.3 (0.7)

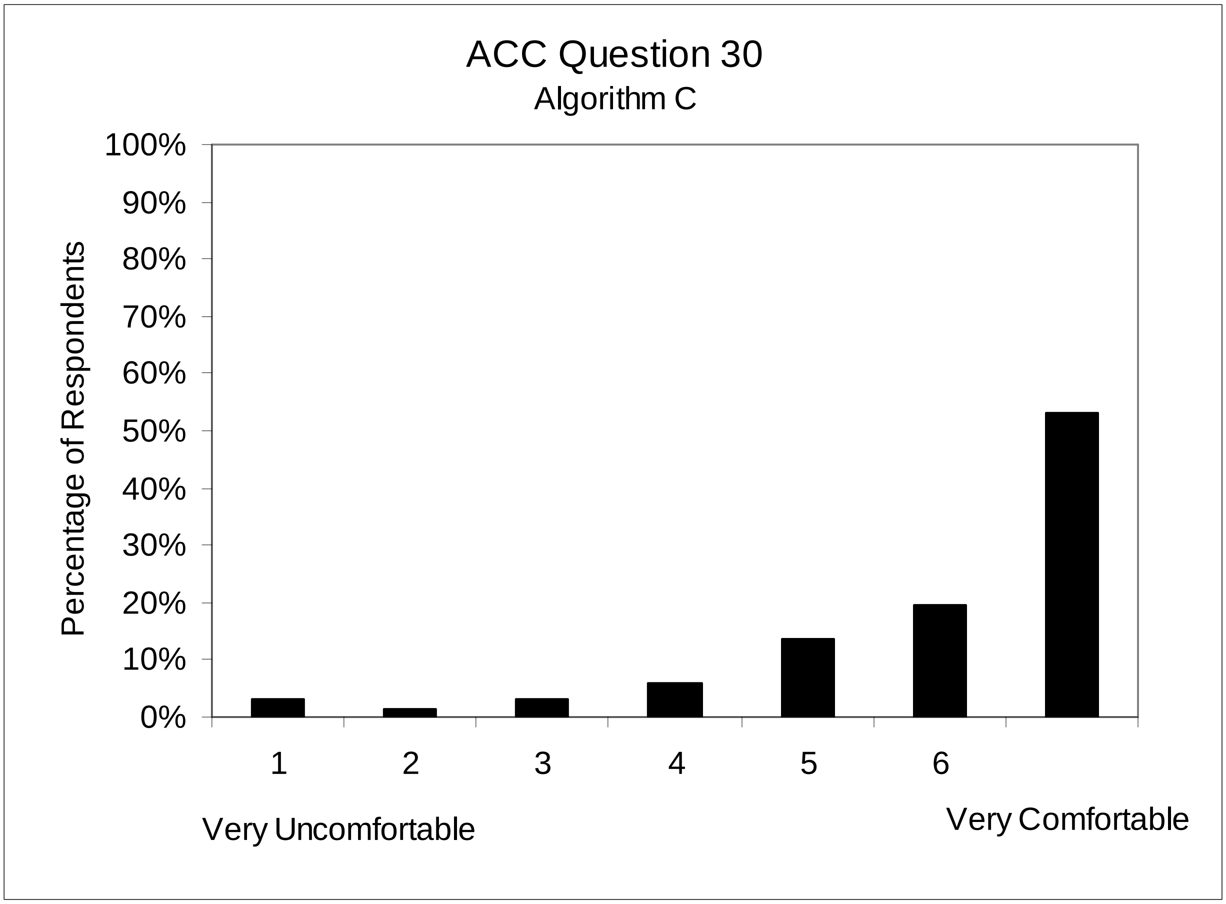
Values in cells represent the mean response and (standard deviation)



29. While using ACC, how often, if ever, did the system indicate the presence of a vehicle when none existed (falsely detect)? Please check the one option that best applies.

	Males		Females		Overall	
Younger (20-30)	1.5	(0.5)	1.3	(0.5)	1.4	(0.5)
Middle-Aged (40-50)	1.3	(0.5)	1.0	(0.0)	1.1	(0.4)
Older (60-70)	1.4	(0.5)	1.2	(0.4)	1.3	(0.5)
Overall	1.4	(0.5)	1.2	(0.4)	1.3	(0.4)

Values in cells represent the mean response and (standard deviation)

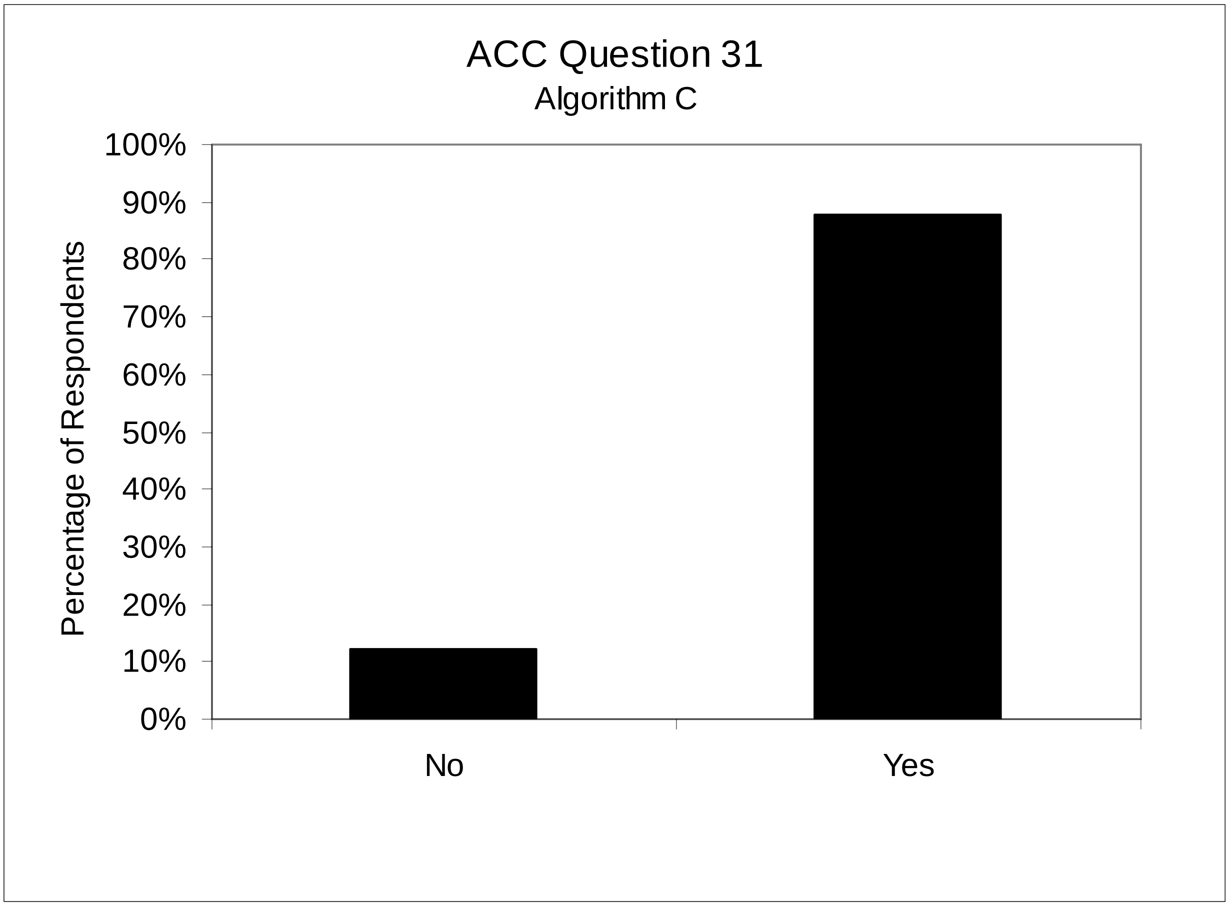


30. How comfortable did you feel using forward collision warning (FCW)?

*	Males	Females	Overall
Younger (20-30)	5.5 (1.8)	5.5 (1.9)	5.5 (1.8)
Middle-Aged (40-50)	5.6 (1.7)	6.1 (1.3)	5.9 (1.5)
Older (60-70)	6.6 (0.9)	6.5 (1.0)	6.5 (1.0)
Overall	5.9 (1.5)	6.0 (1.4)	6.0 (1.5)

Values in cells represent the mean response and (standard deviation)

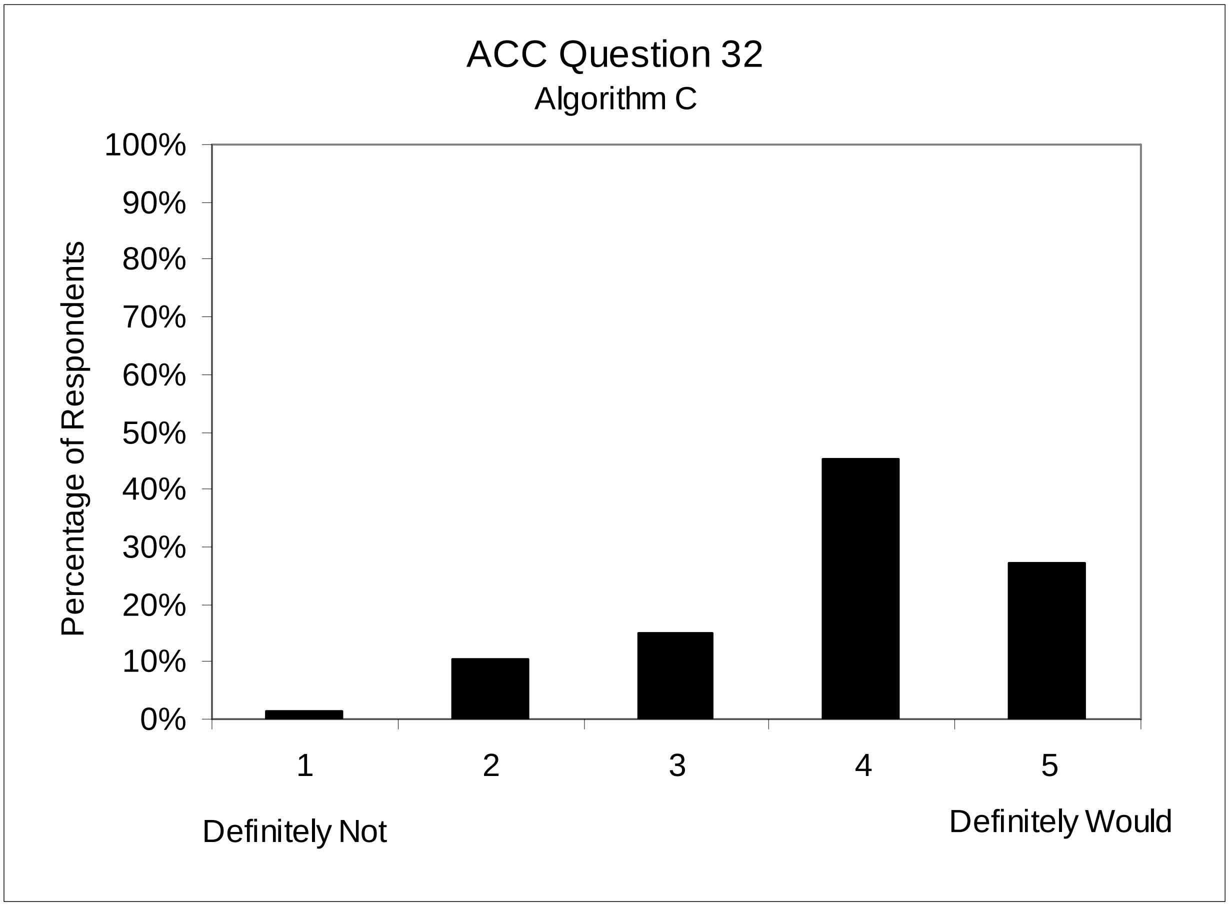
* = Significant difference associated with participant age, $H(2) = 6.979$, $p = .031$



31. Would you recommend to your child, spouse, parents – or other loved ones – to use ACC?

	Males		Females		Overall	
	No	Yes	No	Yes	No	Yes
Younger (20-30)	1	10	2	9	3	19
Middle-Aged (40-50)	1	10	3	8	4	18
Older (60-70)	0	11	1	10	1	21
Overall	2	31	6	27	8	58

Values in cells represent the frequency of response for each indicated demographic division

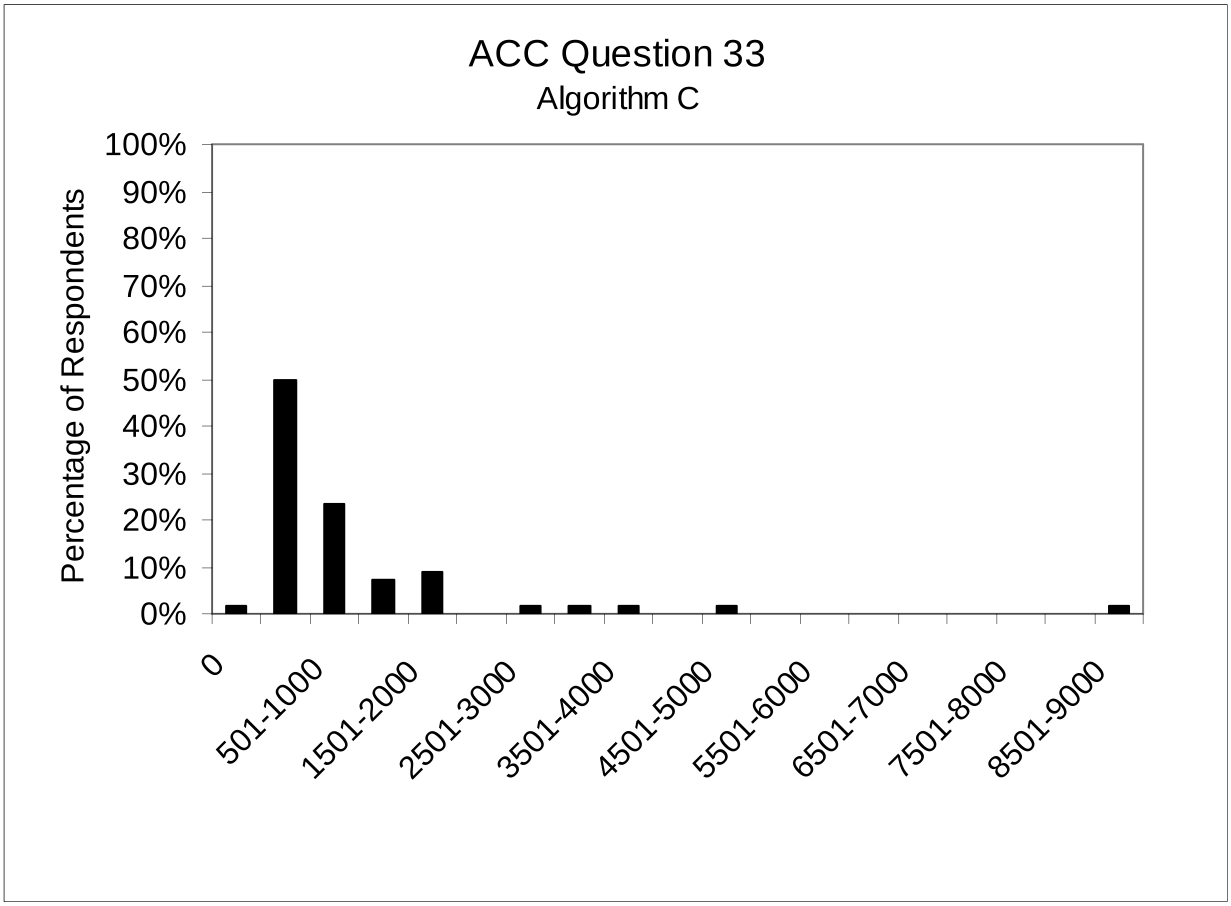


32. How likely would you be to consider purchasing ACC if you were purchasing a new vehicle today?

*	Males	Females	Overall
Younger (20-30)	3.5 (1.0)	3.7 (0.9)	3.6 (1.0)
Middle-Aged (40-50)	3.7 (1.1)	3.5 (1.1)	3.6 (1.1)
Older (60-70)	4.5 (0.7)	4.2 (0.9)	4.3 (0.8)
Overall	3.9 (1.0)	3.8 (1.0)	3.9 (1.0)

Values in cells represent the mean response and (standard deviation)

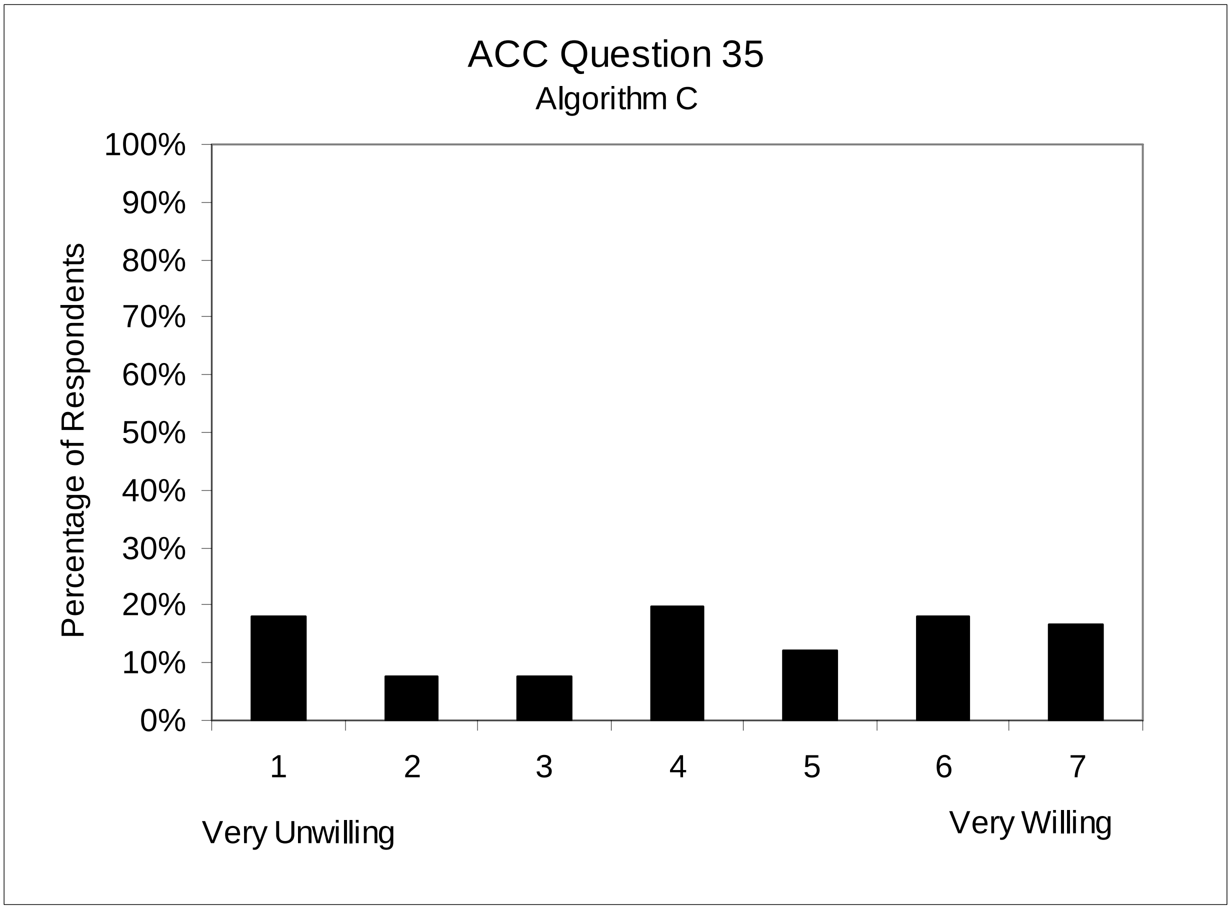
* = Significant difference associated with participant age, $H(2) = 7.752$, $p = .021$



33. At what price level might you begin to feel this feature is too expensive to consider purchasing?

	Males		Females		Overall	
Younger (20-30)	2440	(2749.6)	1000.0	(696.0)	1758	(2131.0)
Middle-Aged (40-50)	259	(400.0)	611.0	(469.6)	499.9	(378.6)
Older (60-70)	603	(685.0)	1477.8	(1304.6)	1042	(1057.5)
Overall	1826	(1175.0)	1029.6	(933.3)	1124.5	(1480.5)

Values in cells represent the mean response and (standard deviation)

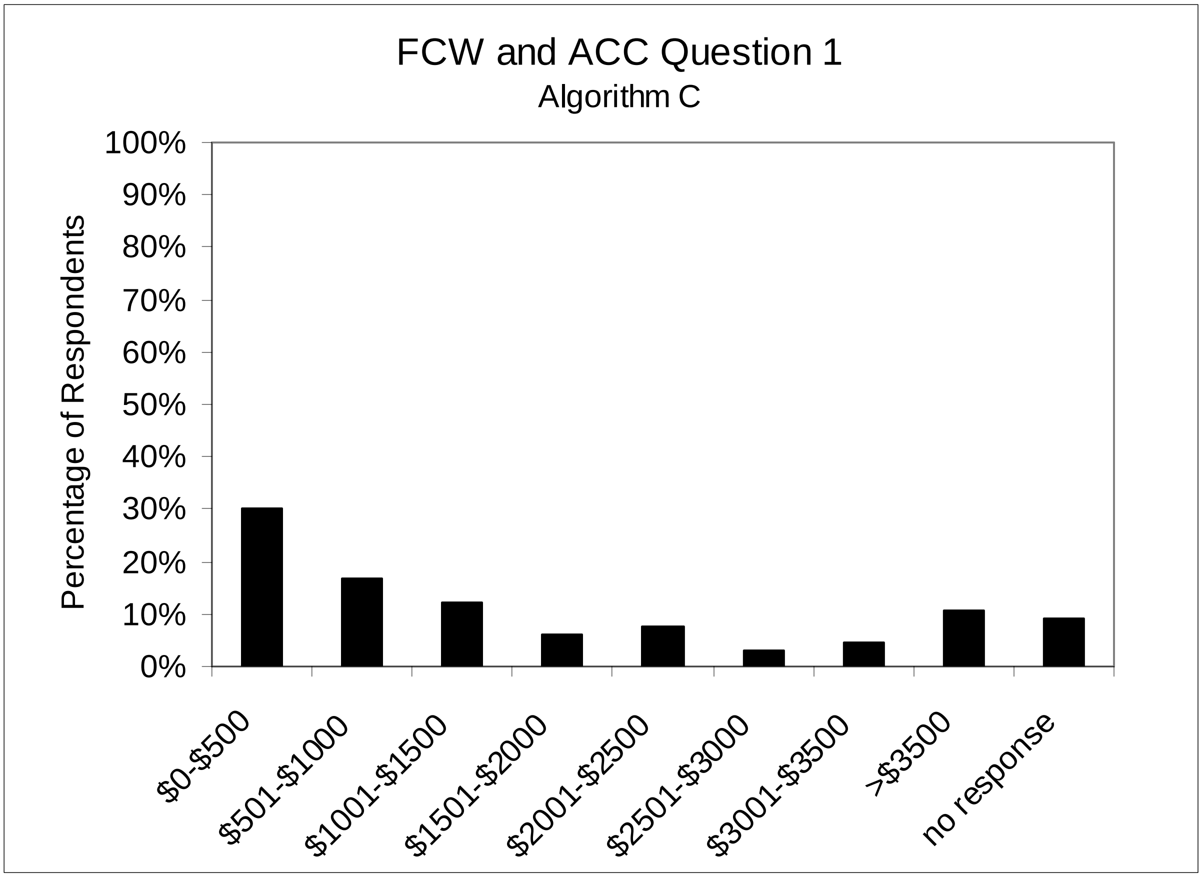


35. How willing are you to use ACC in adverse road conditions?

*	Males	Females	Overall
Younger (20-30)	4.6 (2.0)	4.1 (2.1)	4.4 (2.0)
Middle-Aged (40-50)	4.2 (2.1)	3.9 (1.7)	4.0 (1.9)
Older (60-70)	5.6 (1.7)	2.8 (2.2)	4.2 (2.4)
Overall	4.8 (2.0)	3.6 (2.0)	4.2 (2.1)

Values in cells represent the mean response and (standard deviation)

* = Significant difference associated with participant gender, $H(1) = 5.941$, $p = .015$

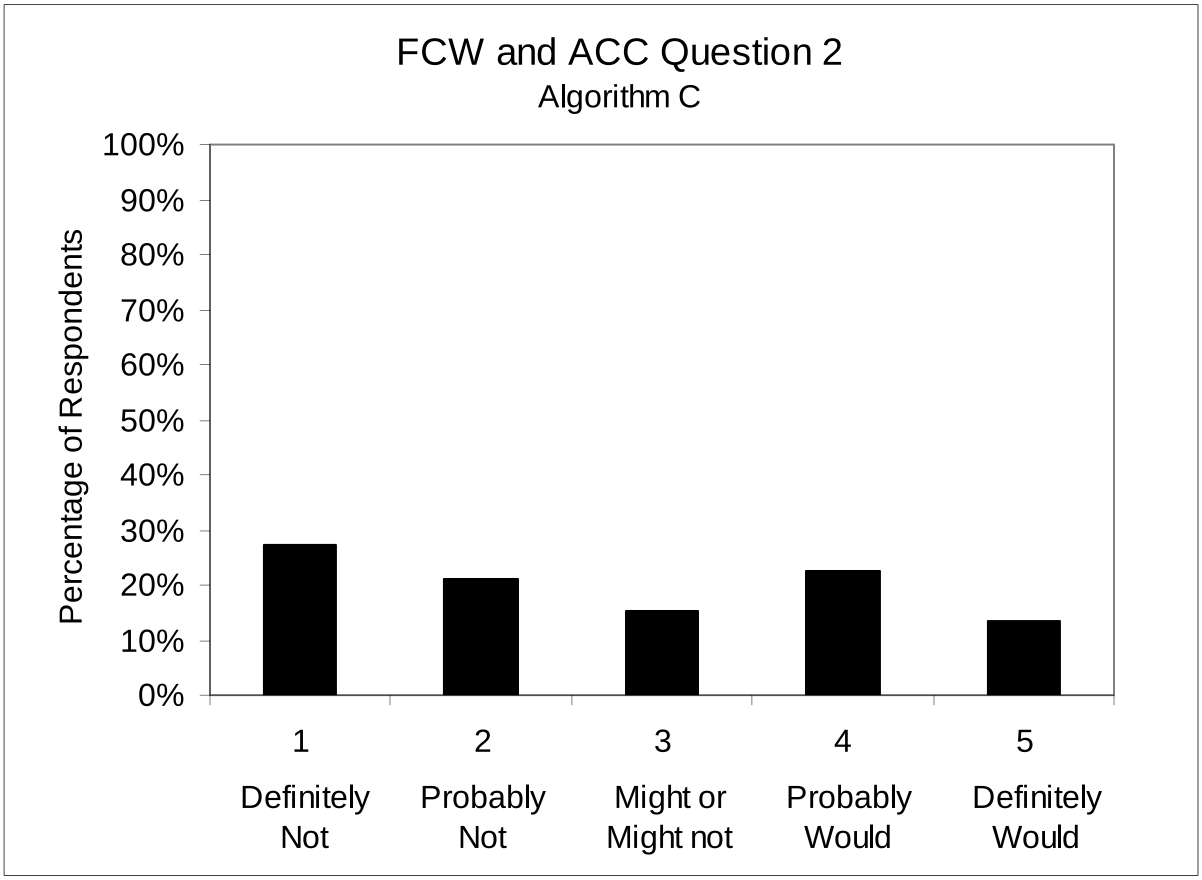


1. At what price level might you begin to feel that a system like you experienced (both ACC and FCW) is too expensive to consider purchasing?

   $_______________

	Males		Females		Overall	
Younger (20-30)	4027	(4703)	1705	(1229)	2921	(3626)
Middle-Aged (40-50)	940	(975)	950	(896)	945	(912)
Older (60-70)	1211	(1005)	2240	(1638)	1753	(1438)
Overall	2153	(3212)	1632	(1356)	1893	(2459)

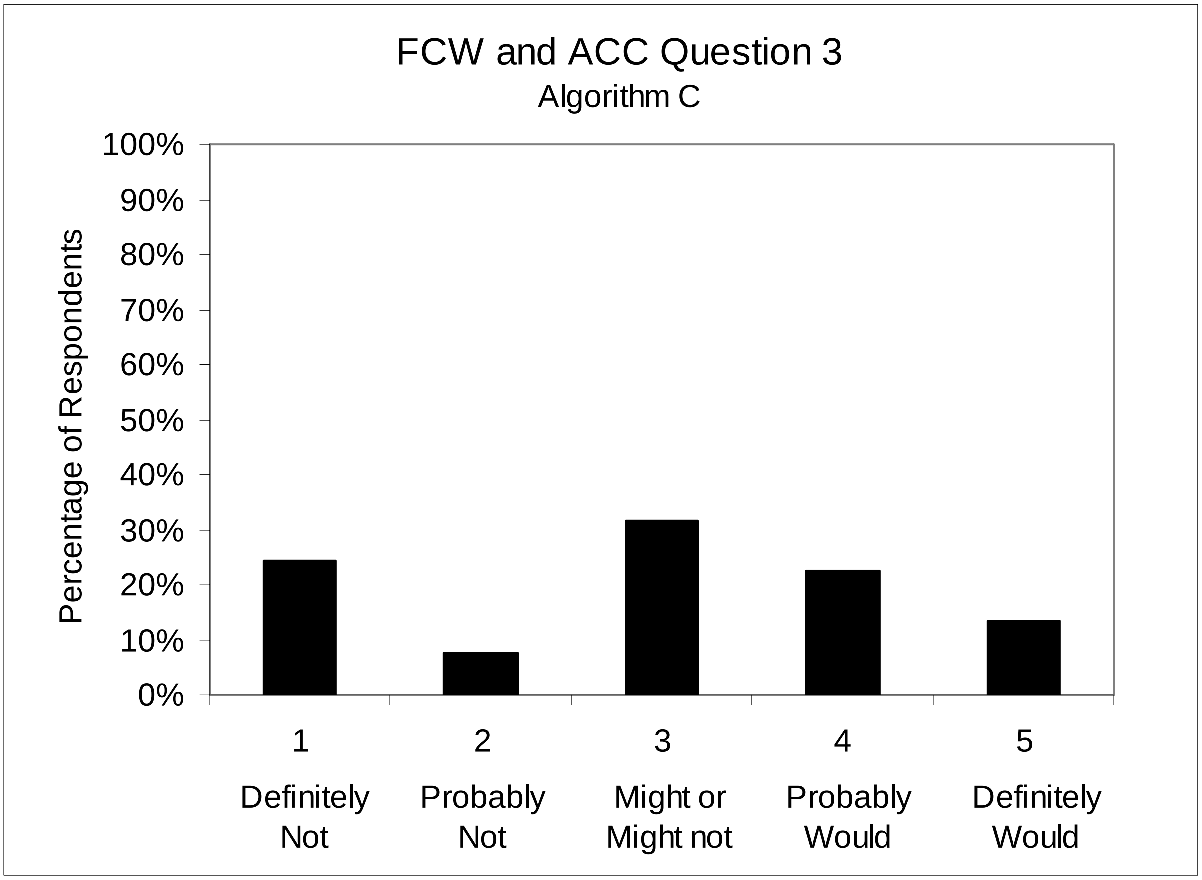
Values in cells represent the mean response and (standard deviation)



2. At $1600, for a combined ACC and FCW system like you experienced, how likely would you be to consider purchasing this combined system if you were purchasing a new vehicle today?

	Males		Females		Overall	
Younger (20-30)	2.8	(1.3)	3.1	(1.4)	3.0	(1.4)
Middle-Aged (40-50)	2.3	(1.3)	2.4	(1.6)	2.3	(1.4)
Older (60-70)	2.9	(1.4)	3.0	(1.5)	3.0	(1.5)
Overall	2.7	(1.4)	2.8	(1.5)	2.7	(1.4)

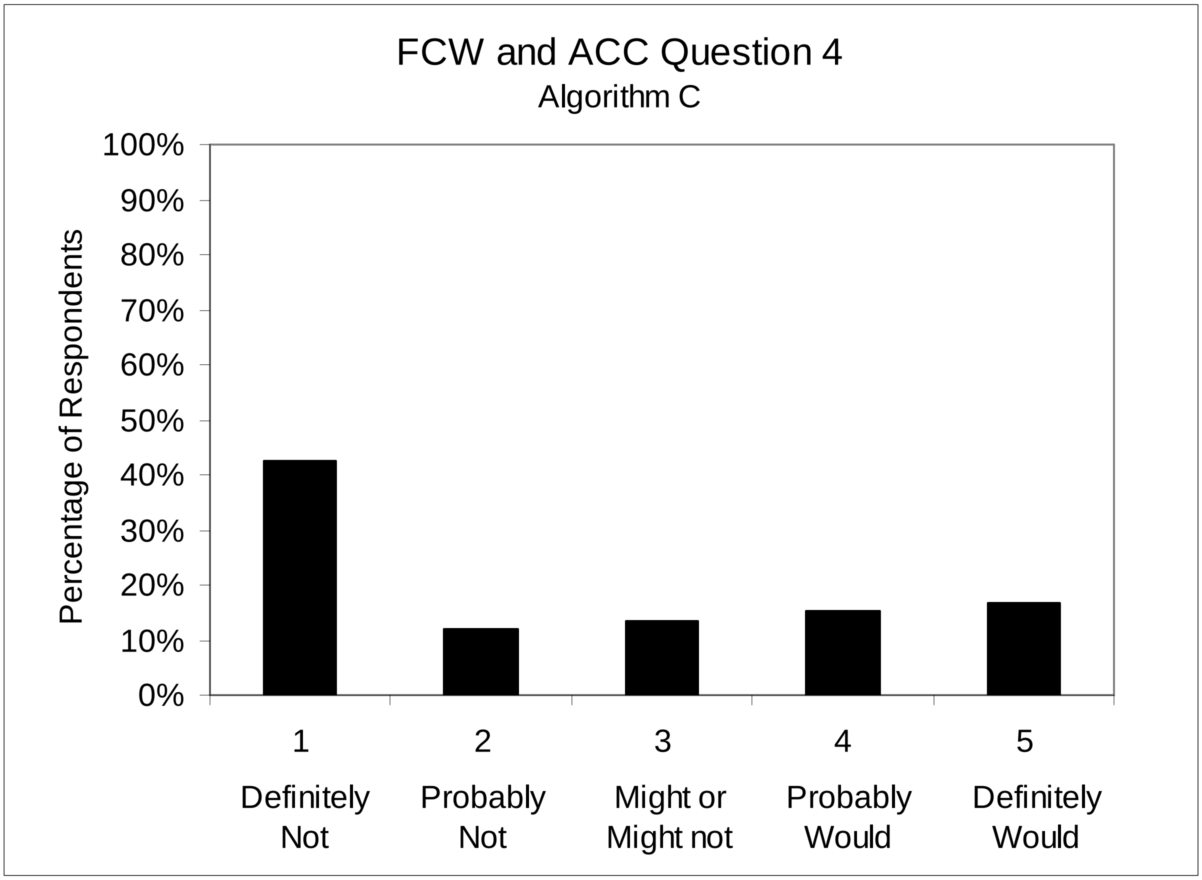
Values in cells represent the mean response and (standard deviation)



3. At $1000, how likely would you be to consider purchasing ACC if you were purchasing a new vehicle today?

	Males		Females		Overall	
Younger (20-30)	3.4	(1.4)	2.9	(1.2)	3.1	(1.3)
Middle-Aged (40-50)	2.0	(1.0)	2.7	(1.4)	2.4	(1.3)
Older (60-70)	3.1	(1.4)	3.5	(1.4)	3.3	(1.4)
Overall	2.8	(1.4)	3.1	(1.3)	2.9	(1.4)

Values in cells represent the mean response and (standard deviation)

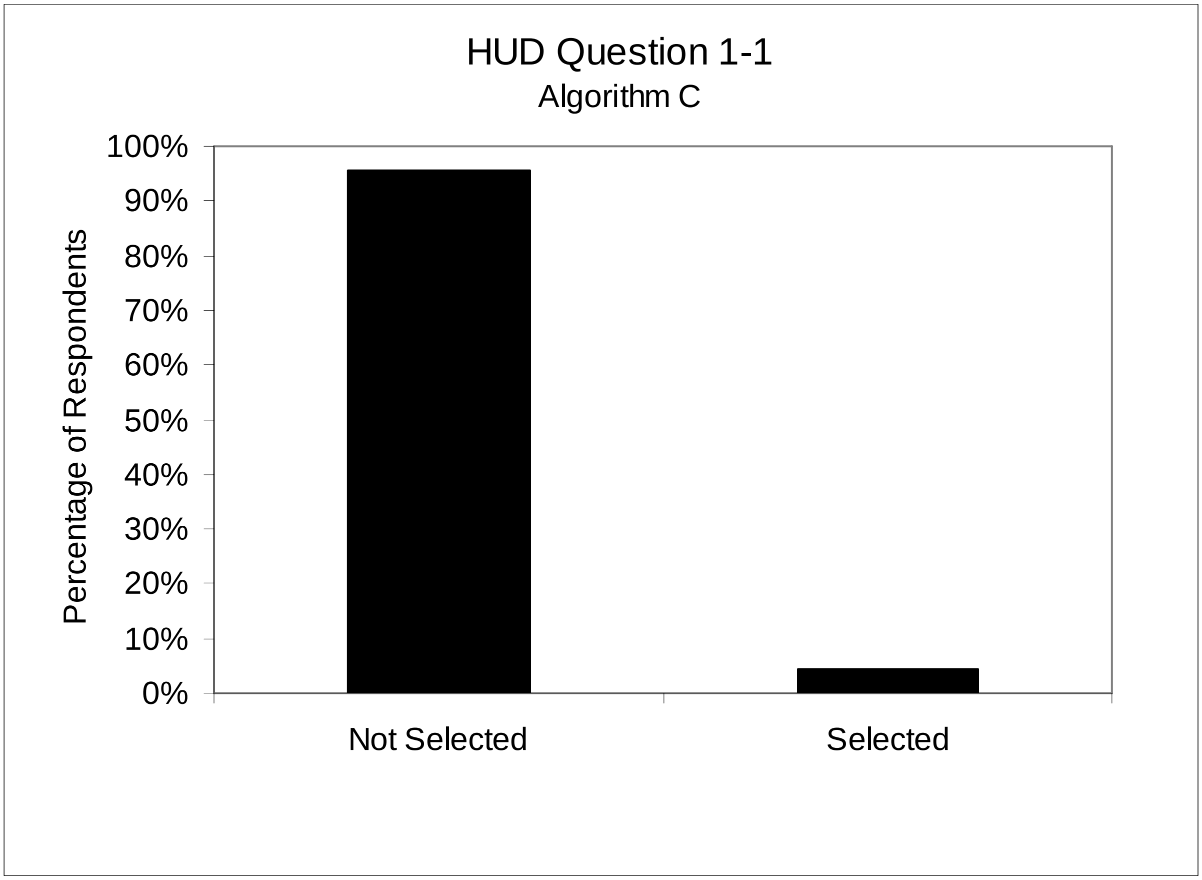


4. At $1000, how likely would you be to consider purchasing FCW if you were purchasing a new vehicle today?

	Males		Females		Overall	
Younger (20-30)	2.5	(1.5)	2.3	(1.6)	2.4	(1.5)
Middle-Aged (40-50)	2.4	(1.8)	2.4	(1.6)	2.4	(1.6)
Older (60-70)	2.5	(1.6)	3.1	(1.5)	2.8	(1.6)
Overall	2.5	(1.6)	2.6	(1.5)	2.5	(1.6)

Values in cells represent the mean response and (standard deviation)

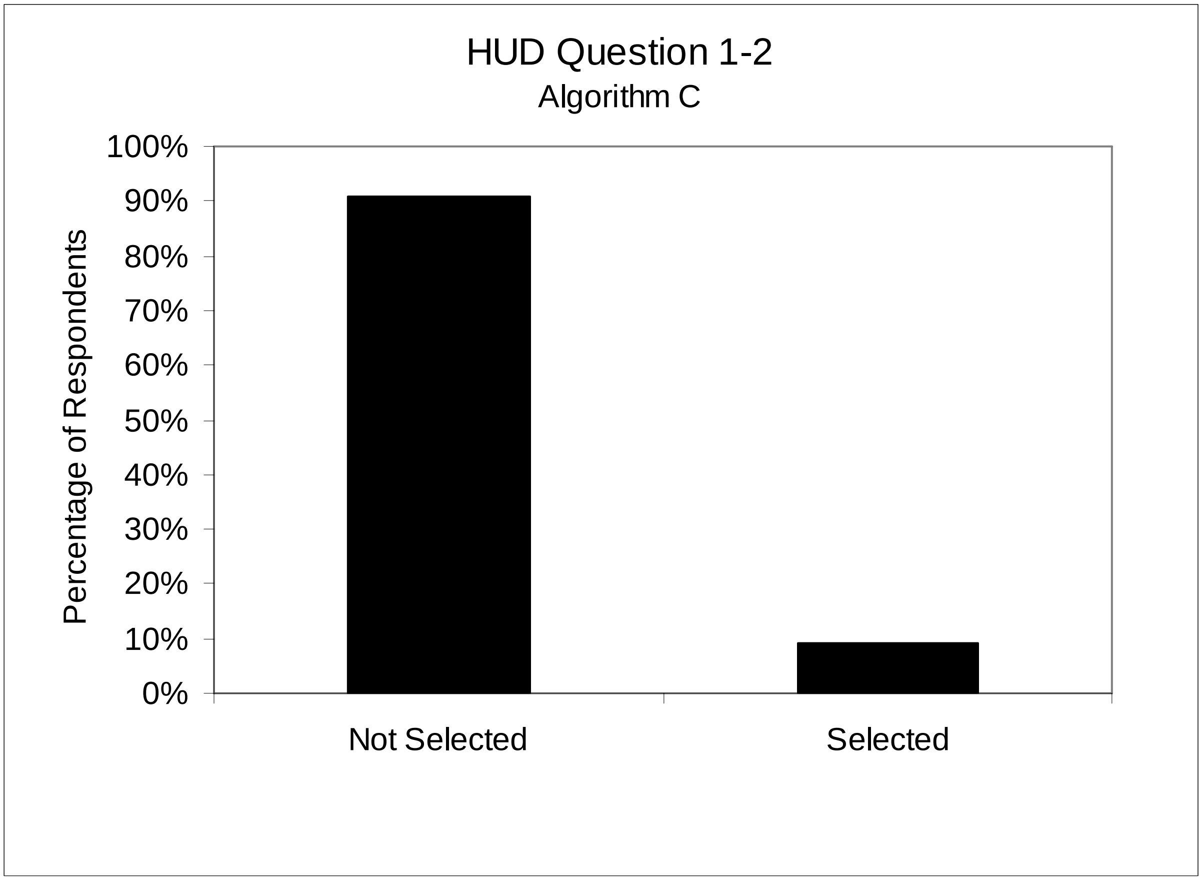
1. Do you think that any, or all, of the information shown on the HUD should be removed and displayed in the head-down instrument panel (i.e., located behind the steering wheel). Please check each feature that you would like to see moved from the HUD to the head-down instrument panel.



1-1 ____ Speedometer

	Males		Females		Overall	
	No	Yes	No	Yes	No	Yes
Younger (20-30)	11	0	12	0	23	0
Middle-Aged (40-50)	11	0	8	3	19	3
Older (60-70)	11	0	10	0	21	0
Overall	33	0	30	3	63	3

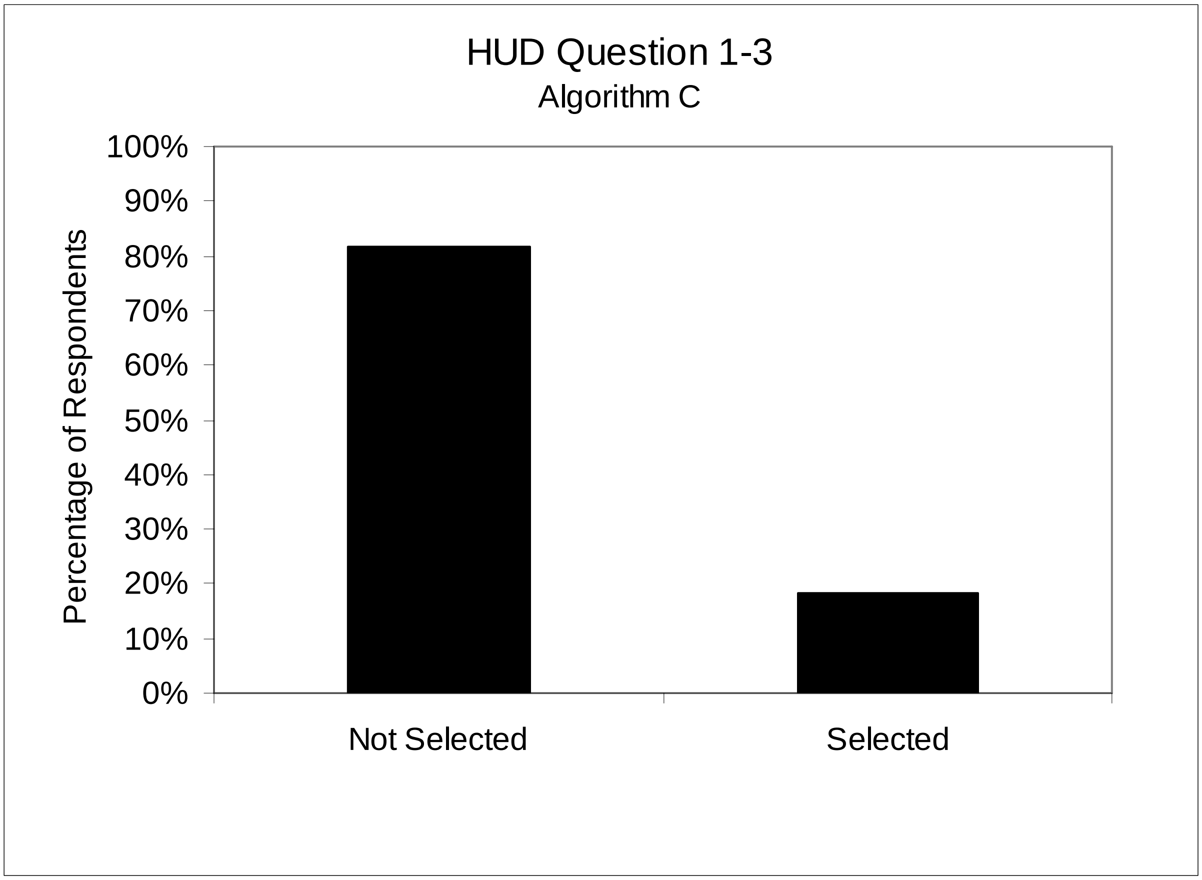
Values in cells represent the frequency of response for each indicated demographic division



1-2 ____ Vehicle ahead symbol

	Males		Females		Overall	
	No	Yes	No	Yes	No	Yes
Younger (20-30)	9	2	11	1	20	3
Middle-Aged (40-50)	11	0	9	2	20	2
Older (60-70)	11	0	9	1	20	1
Overall	31	2	29	4	60	6

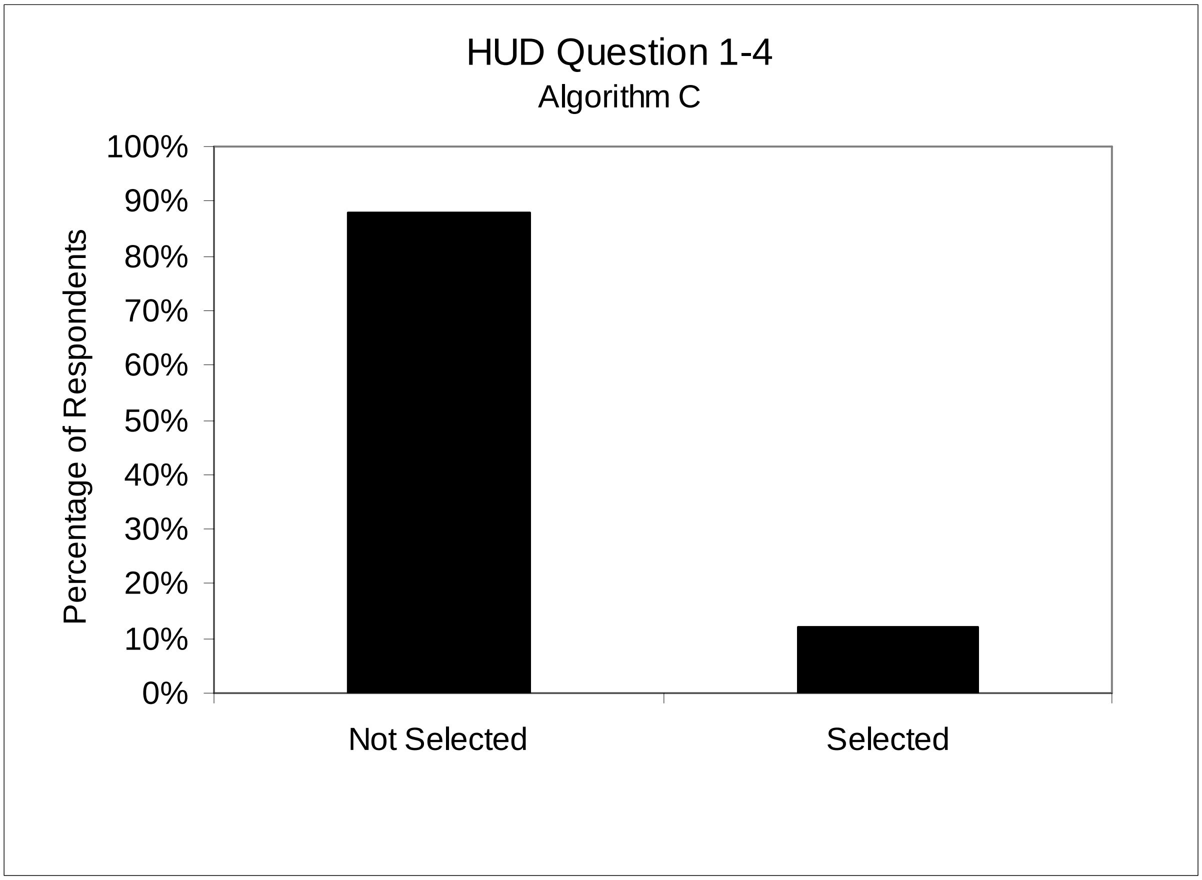
Values in cells represent the frequency of response for each indicated demographic division



1-3 _____ System State Messages (e.g. Malfunction)

	Males		Females		Overall	
	No	Yes	No	Yes	No	Yes
Younger (20-30)	9	2	8	4	17	6
Middle-Aged (40-50)	11	0	7	4	18	4
Older (60-70)	11	0	8	2	19	2
Overall	31	2	23	10	54	12

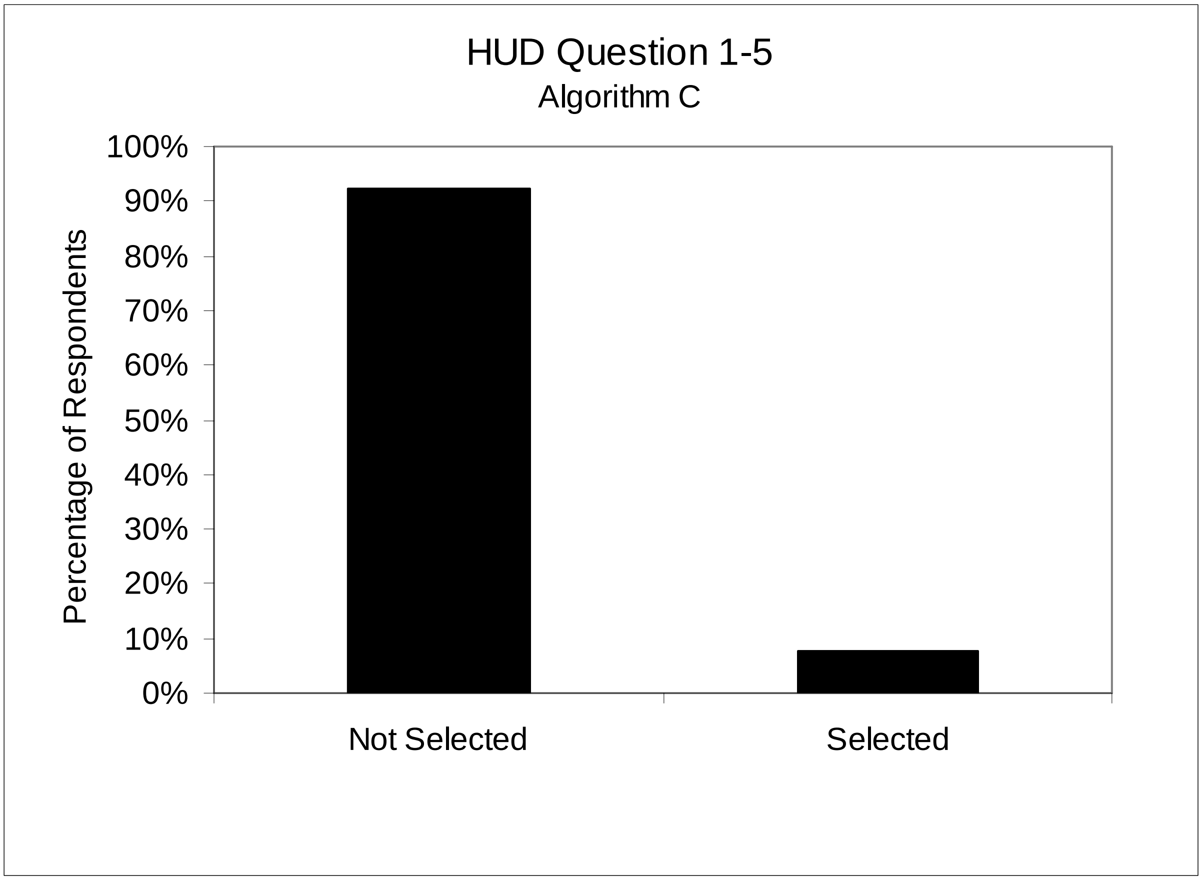
Values in cells represent the frequency of response for each indicated demographic division



1-4 _____ ACC gap/headway setting

	Males		Females		Overall	
	No	Yes	No	Yes	No	Yes
Younger (20-30)	9	2	11	1	20	3
Middle-Aged (40-50)	10	1	9	2	19	3
Older (60-70)	11	0	8	2	19	2
Overall	30	3	28	5	58	8

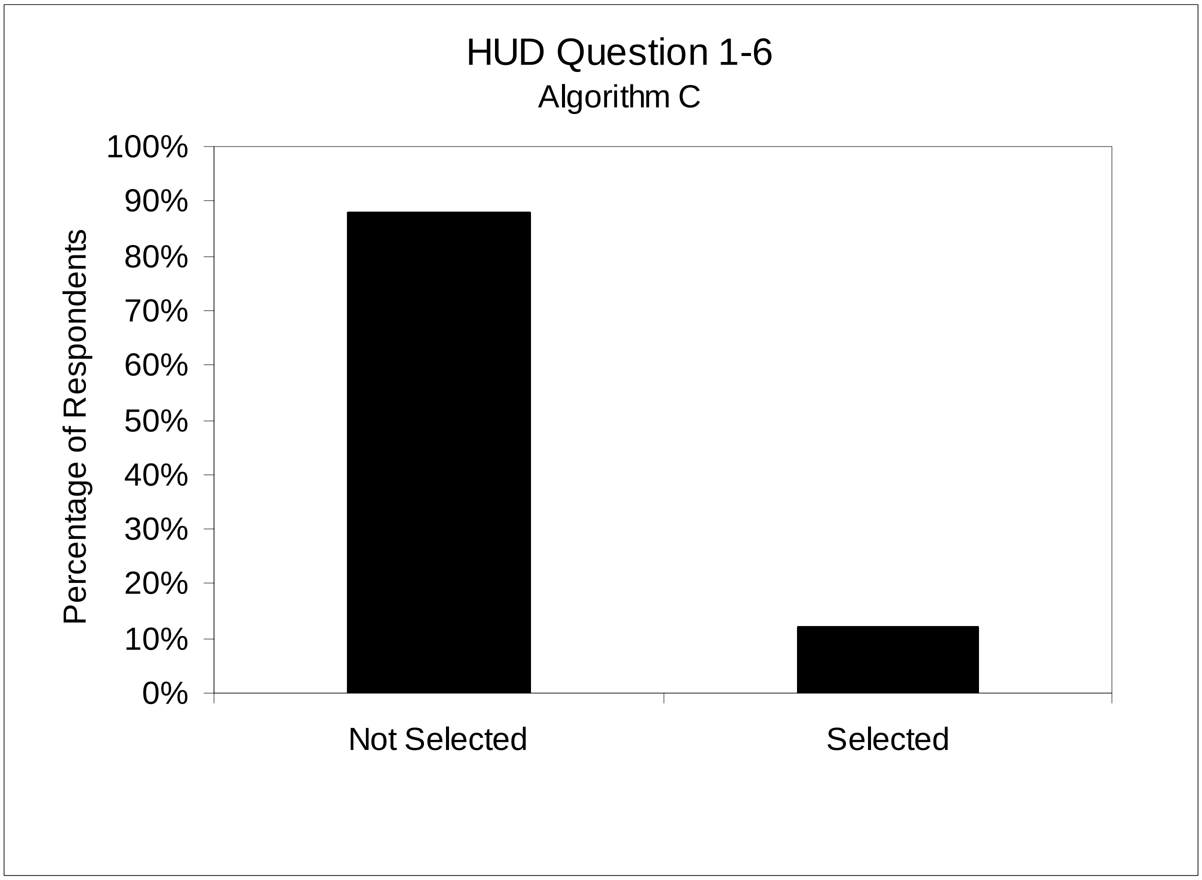
Values in cells represent the frequency of response for each indicated demographic division



1-5 _____ ACC set speed

	Males		Females		Overall	
	No	Yes	No	Yes	No	Yes
Younger (20-30)	10	1	10	2	20	3
Middle-Aged (40-50)	10	1	10	1	20	2
Older (60-70)	11	0	10	0	21	0
Overall	31	2	30	3	61	5

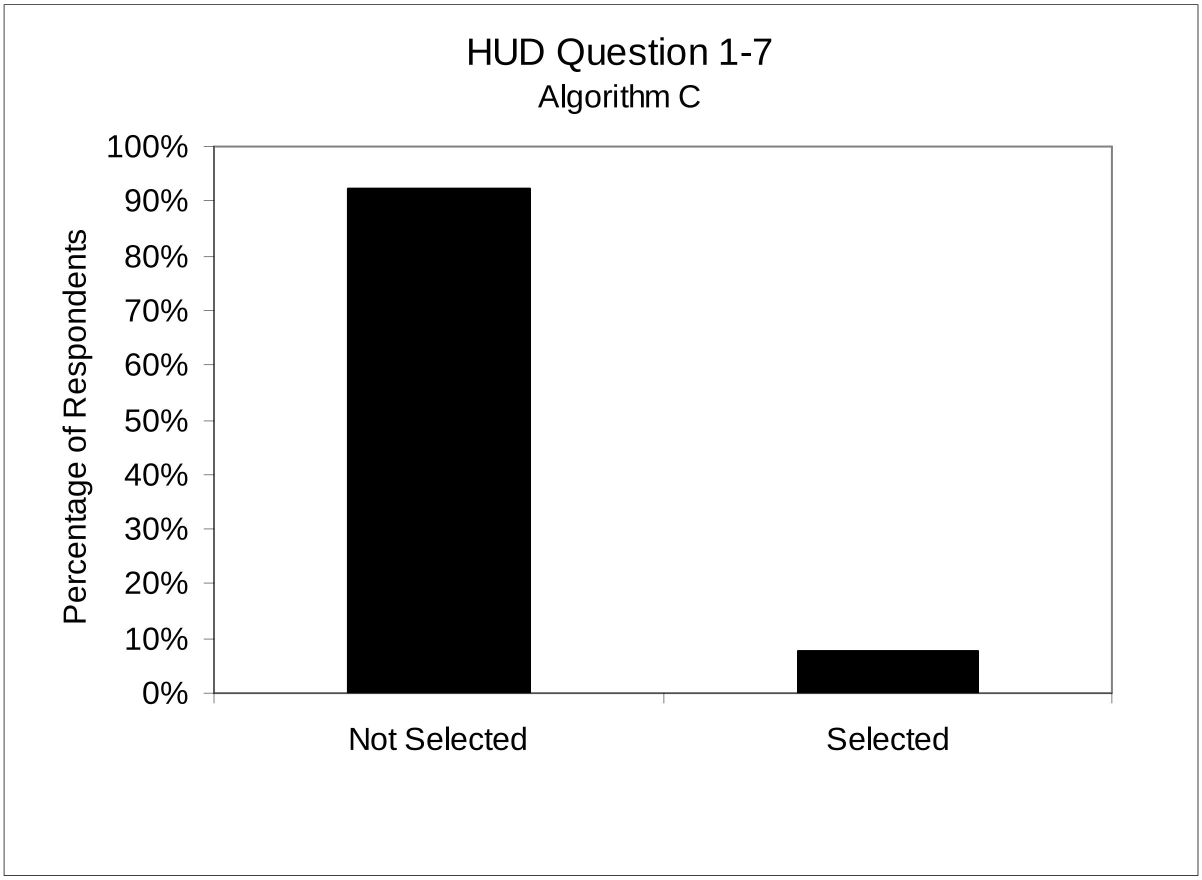
Values in cells represent the frequency of response for each indicated demographic division



1-6 _____ FCW alert timing setting

	Males		Females		Overall	
	No	Yes	No	Yes	No	Yes
Younger (20-30)	9	2	10	2	19	4
Middle-Aged (40-50)	10	1	9	2	19	3
Older (60-70)	11	0	9	1	20	1
Overall	30	3	28	5	58	8

Values in cells represent the frequency of response for each indicated demographic division

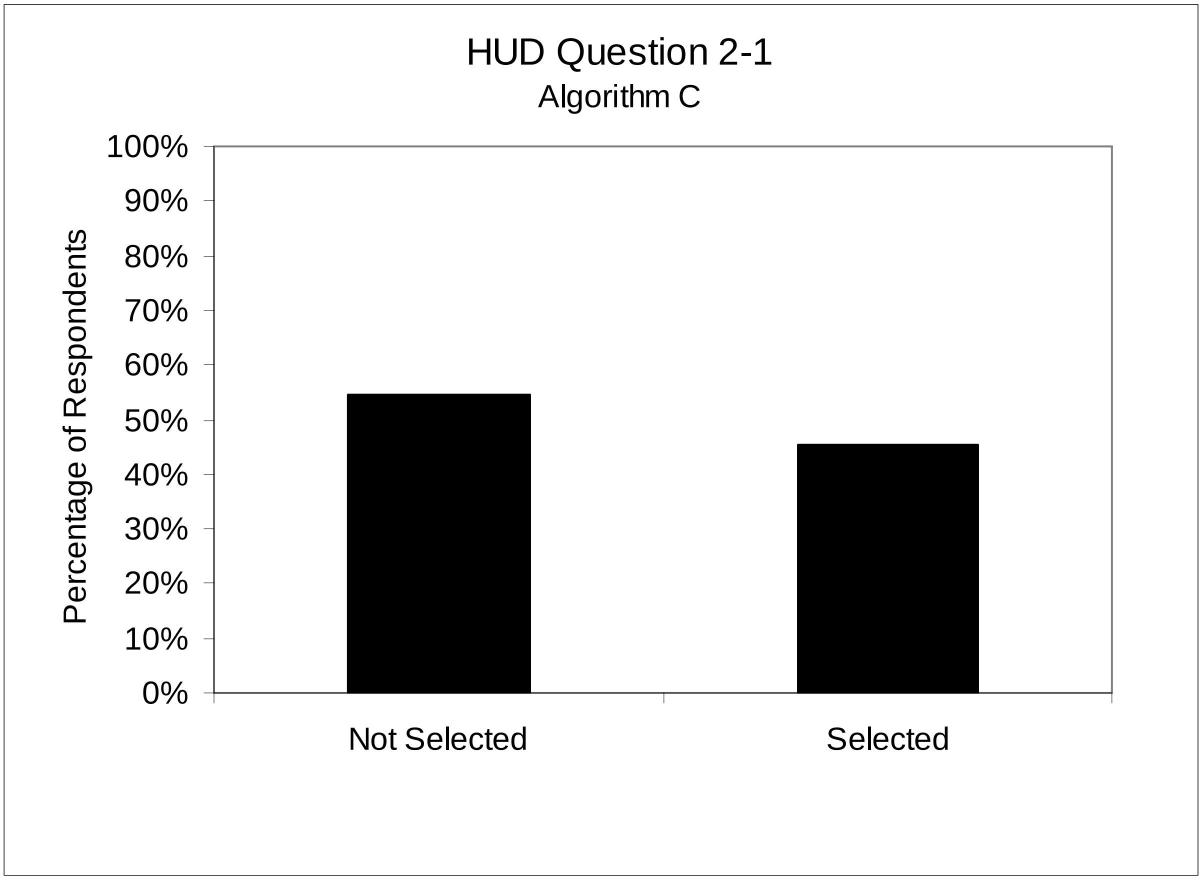


1-7 ____ Crash alerts (icons)

	Males		Females		Overall	
	No	Yes	No	Yes	No	Yes
Younger (20-30)	10	1	10	2	20	3
Middle-Aged (40-50)	10	1	10	1	20	2
Older (60-70)	11	0	10	0	21	0
Overall	31	2	30	3	61	5

Values in cells represent the frequency of response for each indicated demographic division

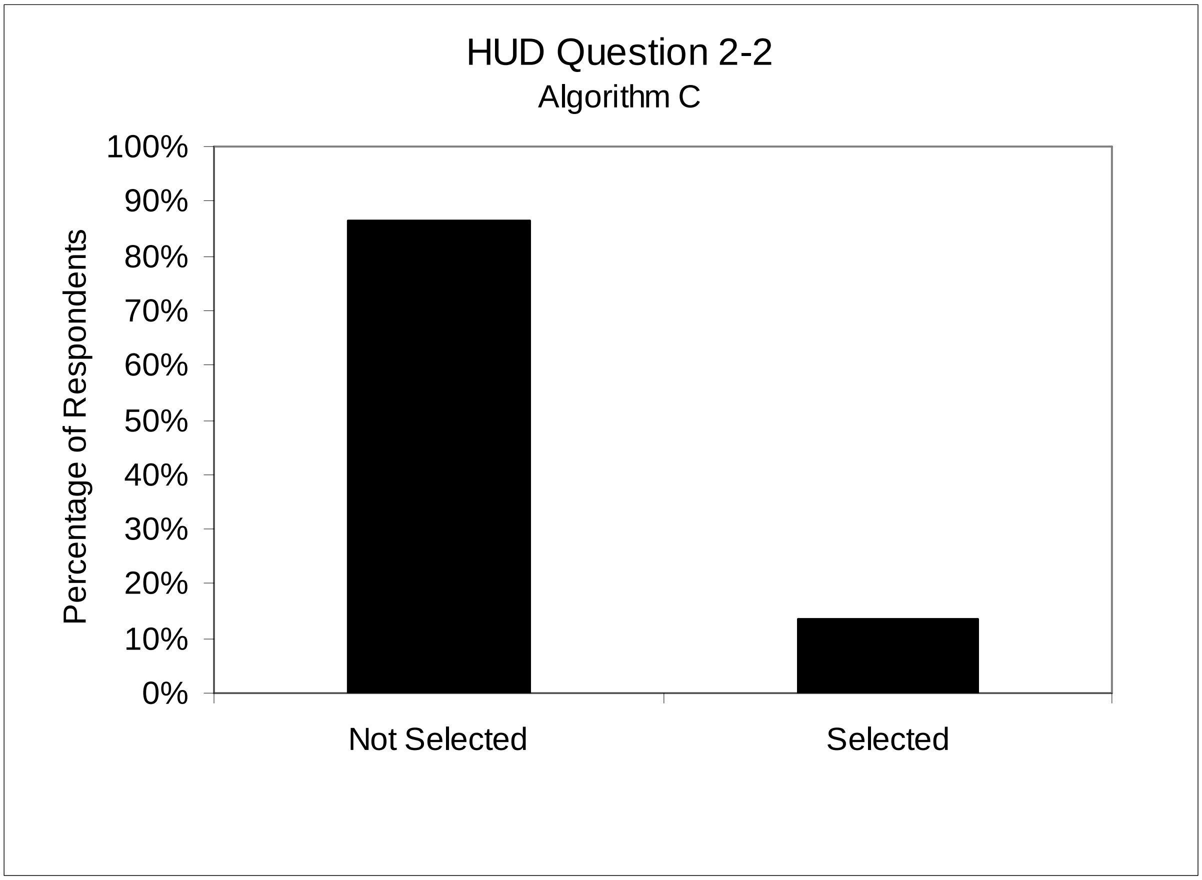
2. Which of the following items do you prefer to be displayed only when you are making adjustments, as opposed to being shown all of the time like in the system you experienced (check all that apply)?



2-1 ____ ACC gap/headway setting

	Males		Females		Overall	
	No	Yes	No	Yes	No	Yes
Younger (20-30)	4	7	5	7	9	14
Middle-Aged (40-50)	9	2	2	9	11	11
Older (60-70)	10	1	6	4	16	5
Overall	23	10	13	20	36	30

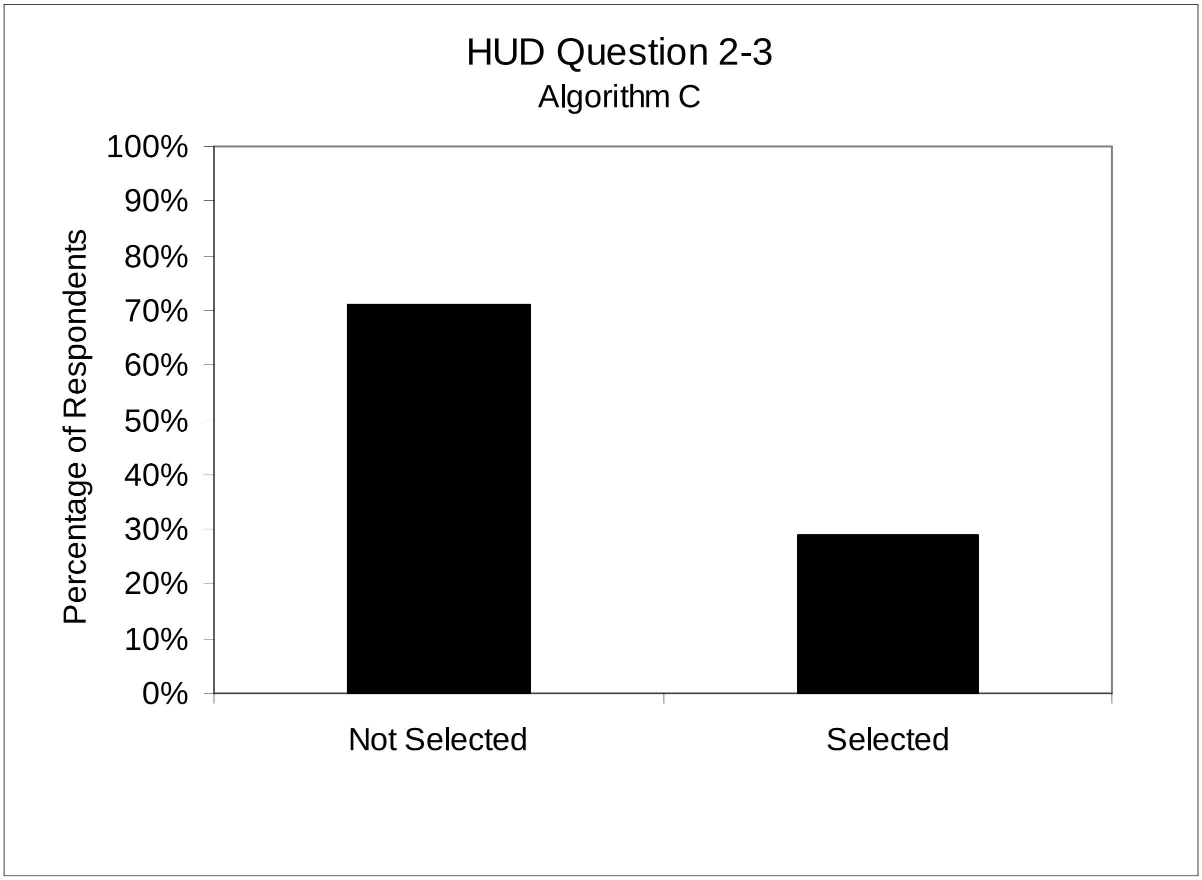
Values in cells represent the frequency of response for each indicated demographic division



2-2 ____ ACC set speed

	Males		Females		Overall	
	No	Yes	No	Yes	No	Yes
Younger (20-30)	11	0	11	1	22	1
Middle-Aged (40-50)	10	1	7	4	17	5
Older (60-70)	9	2	9	1	18	3
Overall	30	3	27	6	57	9

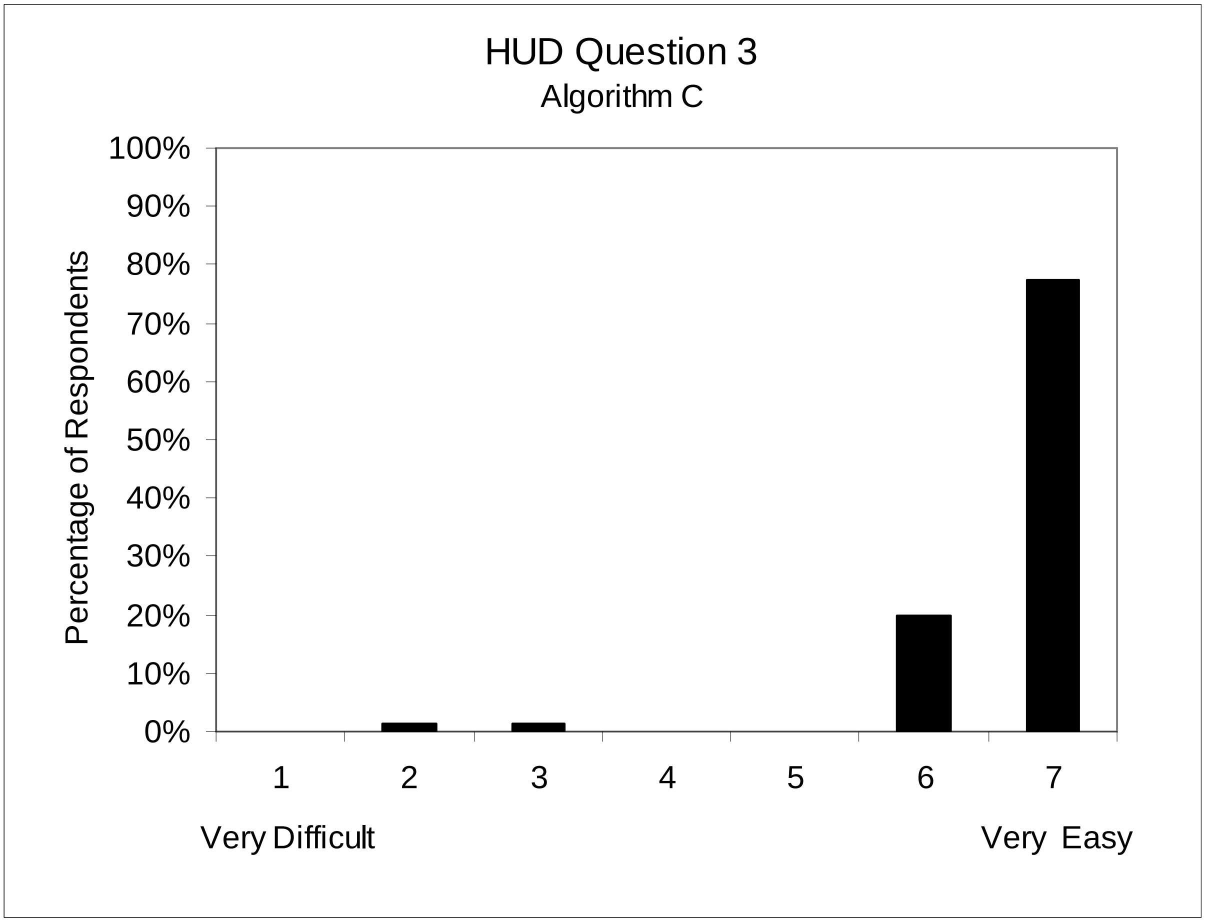
Values in cells represent the frequency of response for each indicated demographic division



2-3 ____ FCW alert timing setting

	Males		Females		Overall	
	No	Yes	No	Yes	No	Yes
Younger (20-30)	7	4	7	5	14	9
Middle-Aged (40-50)	8	3	7	4	15	7
Older (60-70)	9	2	9	1	18	3
Overall	24	9	23	10	47	19

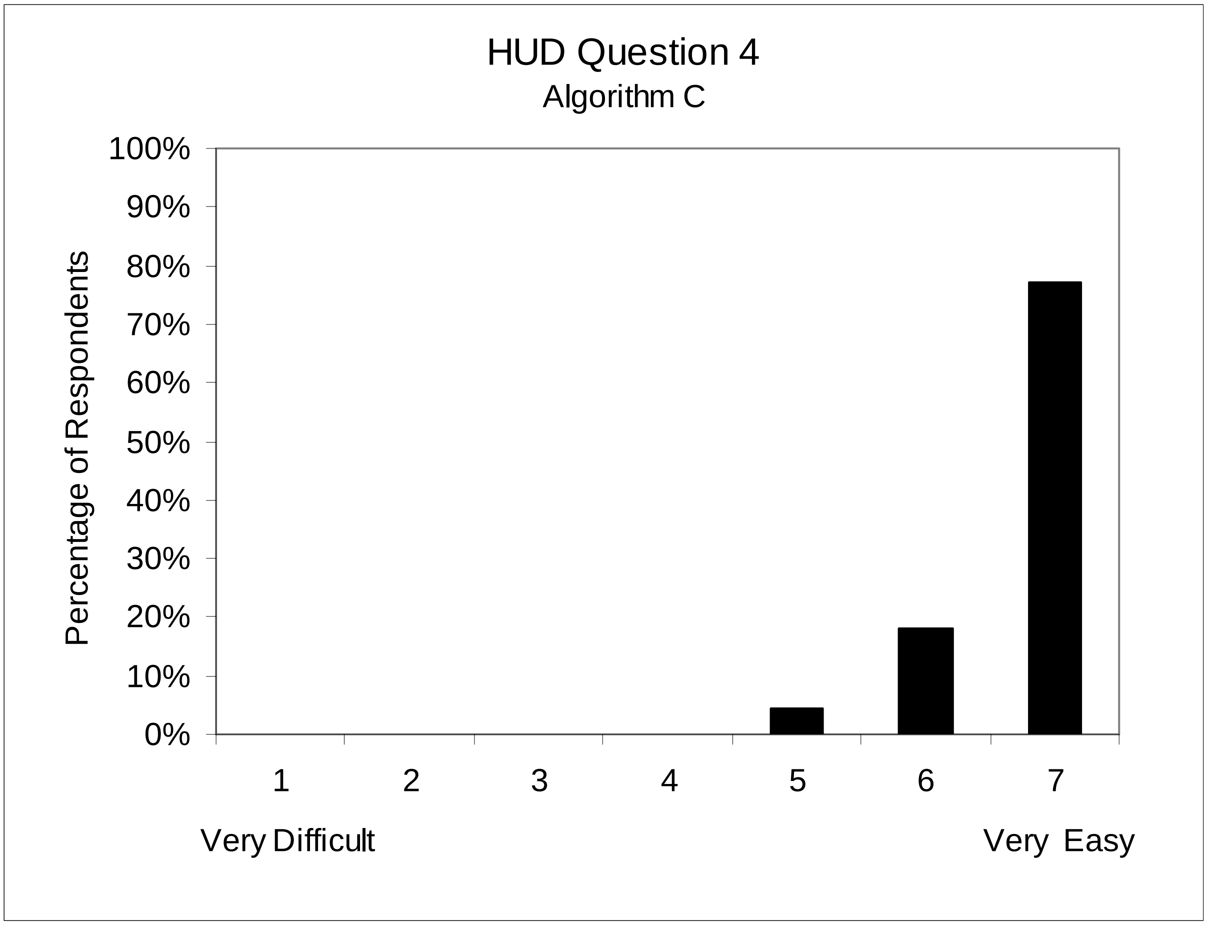
Values in cells represent the frequency of response for each indicated demographic division



3. How easy was it to see the HUD?

	Males		Females		Overall	
Younger (20-30)	6.4	(1.5)	6.8	(0.4)	6.6	(1.1)
Middle-Aged (40-50)	6.4	(1.2)	6.7	(0.5)	6.5	(0.9)
Older (60-70)	6.8	(0.4)	6.9	(0.3)	6.9	(0.4)
Overall	6.5	(1.1)	6.8	(0.4)	6.7	(0.8)

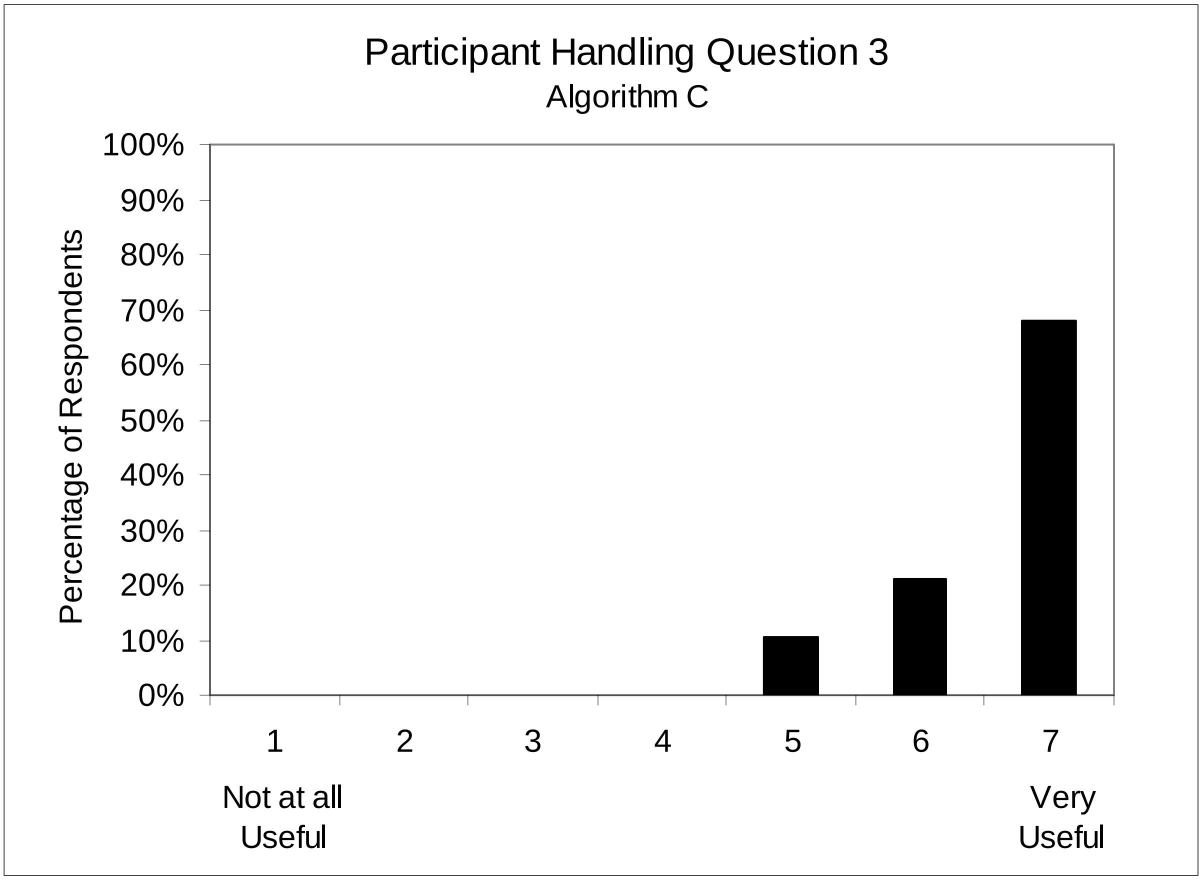
Values in cells represent the mean response and (standard deviation)



4. How easy was it to drive and see the HUD at the same time?

	Males		Females		Overall	
Younger (20-30)	6.6	(0.7)	6.8	(0.6)	6.7	(0.6)
Middle-Aged (40-50)	6.6	(0.7)	6.5	(0.5)	6.6	(0.6)
Older (60-70)	6.8	(0.4)	7.0	0.0	6.9	(0.3)
Overall	6.7	(0.6)	6.8	(0.5)	6.7	(0.5)

Values in cells represent the mean response and (standard deviation)



3. How useful was the training video in understanding how to use ACC and FCW?

	Males		Females		Overall	
Younger (20-30)	6.6	(0.7)	6.5	(0.8)	6.5	(0.7)
Middle-Aged (40-50)	6.2	(0.9)	6.7	(0.5)	6.5	(0.7)
Older (60-70)	6.7	(0.5)	6.7	(0.6)	6.7	(0.6)
Overall	6.5	(0.7)	6.6	(0.7)	6.6	(0.7)

Values in cells represent the mean response and (standard deviation)

APPENDIX F

TAKE-HOME QUESTIONNAIRE

Participant #__________

Date __________

Adaptive Cruise Control and Forward Collision Warning
Take Home ACC and FCW System Questionnaire and Evaluation

Dear Participant,

You have been asked to complete the following questionnaire regarding your experiences driving the research vehicle equipped with adaptive cruise control and forward collision warning. Please complete the questions to the best of your ability, but feel free to call us should you require any clarification or explanation (toll free 866-833-0002). You may skip any questions you do not feel comfortable answering and still receive the full amount ($50) we have agreed to pay you in exchange for your time. However, you must complete and postmark the attached pre-paid, self-addressed envelope within 30 days of having returned the research vehicle to UMTRI. It is important that you have completed the questionnaire while your experiences with the vehicle are still fresh in you memory. Once we have received the questionnaire from you, we will initiate a check for $50 from the University of Michigan made out in your name. This questionnaire contains the same types of questions as those you were asked to complete when you returned the vehicle, but again feel free to call us should you require any clarification or explanation.

Thank you once again for your time and willingness to take part in this research project. We hope you have enjoyed participating.

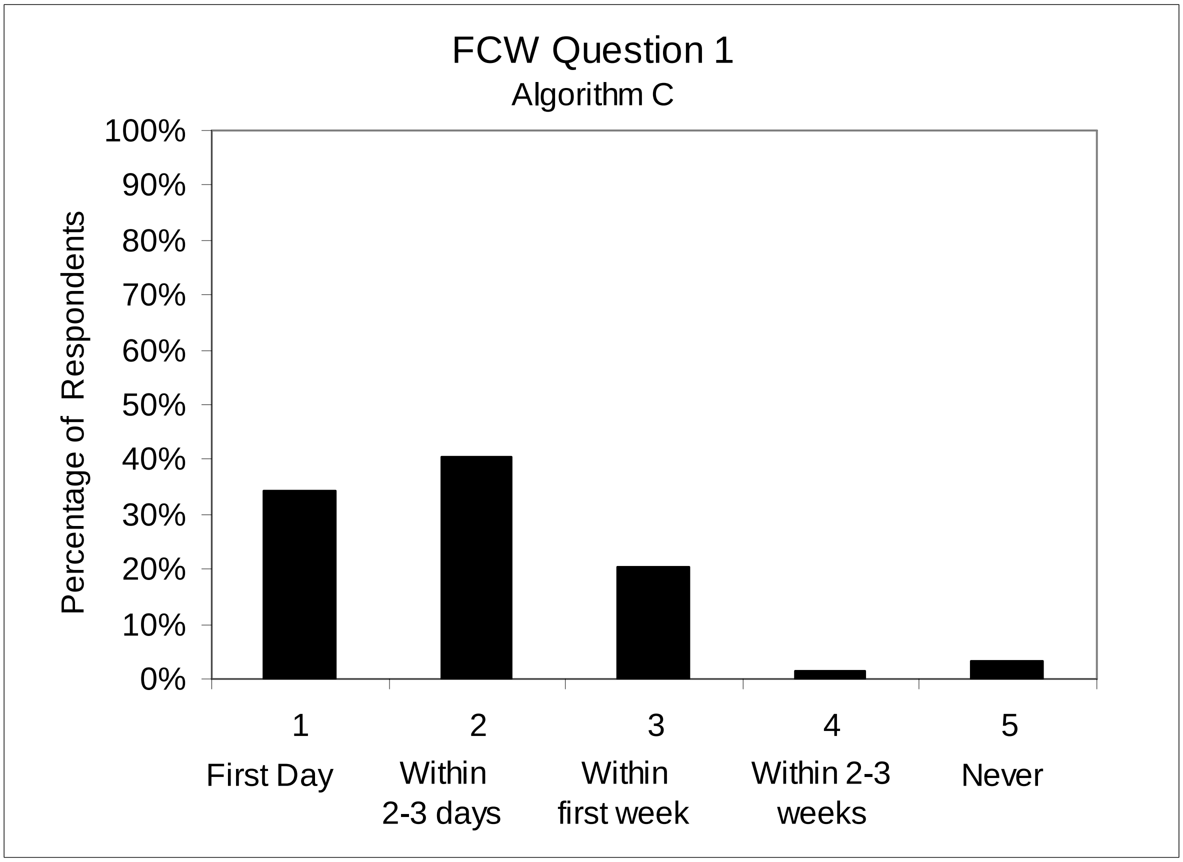
Jim Sayer, Mary Lynn Mefford and Joel Devonshire
University of Michigan Transportation Research Institute, Human Factors Division

Please answer the following questions. If you need to, you may include comments alongside the questions to clarify your responses.

Examples:
A.) Strawberry ice cream is better than chocolate.

1	2	3	4	5	6	7
Strongly Disagree						Strongly Agree

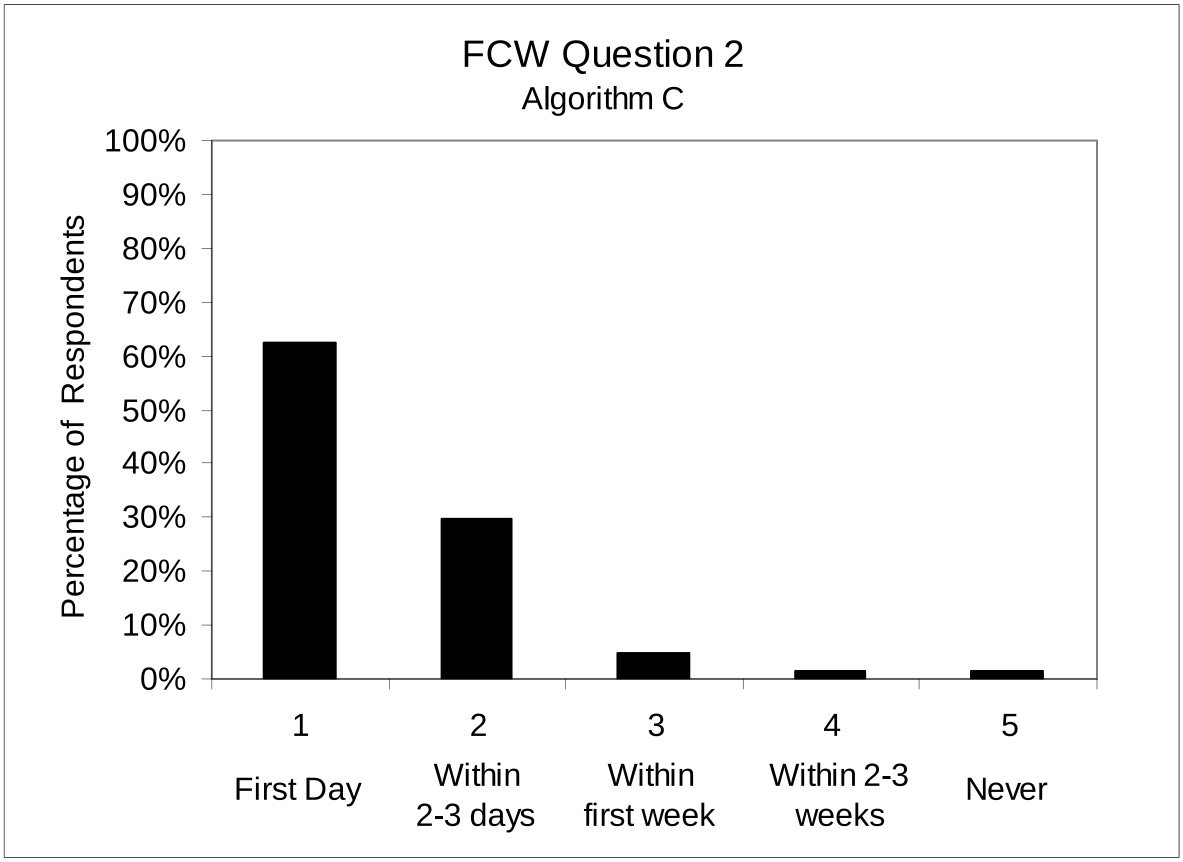
You would circle the "1" if you really liked chocolate ice cream, or you might really like strawberry ice cream. In which case you would circle the "7."



1. How long did it take before you became <u>comfortable</u> with the operations of FCW? (check one)

	Males		Females		Overall	
Younger (20-30)	1.8	(0.8)	1.9	(1.0)	1.9	(0.9)
Middle-Aged (40-50)	1.8	(0.8)	2.1	(0.7)	2.0	(0.7)
Older (60-70)	1.9	(1.2)	2.4	(1.2)	2.1	(1.2)
Overall	1.8	(0.9)	2.1	(1.0)	2.0	(1.0)

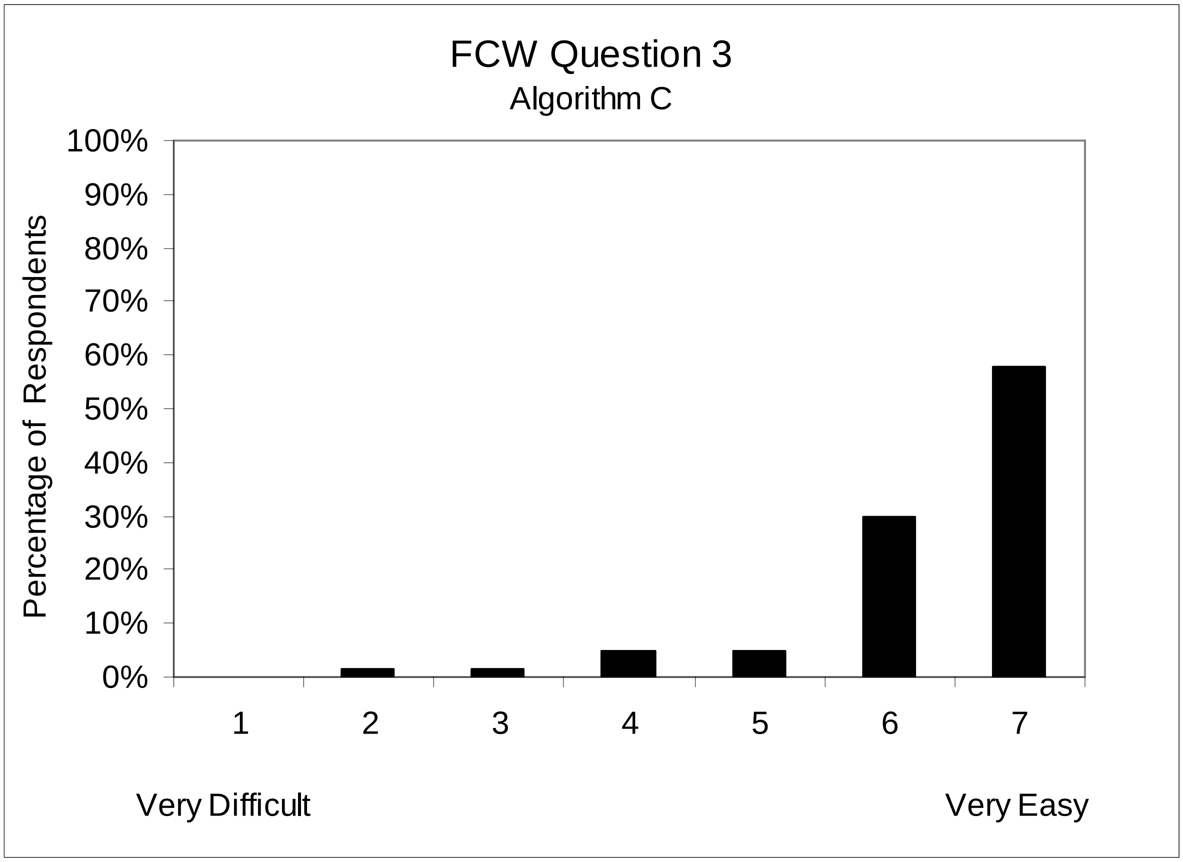
Values in cells represent the mean response and (standard deviation)



2. How long did it take before you <u>understood</u> the operation of FCW? (check one)

	Males		Females		Overall	
Younger (20-30)	1.9	(1.3)	1.2	(0.4)	1.6	(1.0)
Middle-Aged (40-50)	1.3	(0.5)	1.4	(0.5)	1.3	(0.5)
Older (60-70)	1.5	(0.7)	1.7	(1.0)	1.6	(0.8)
Overall	1.6	(0.9)	1.4	(0.7)	1.5	(0.8)

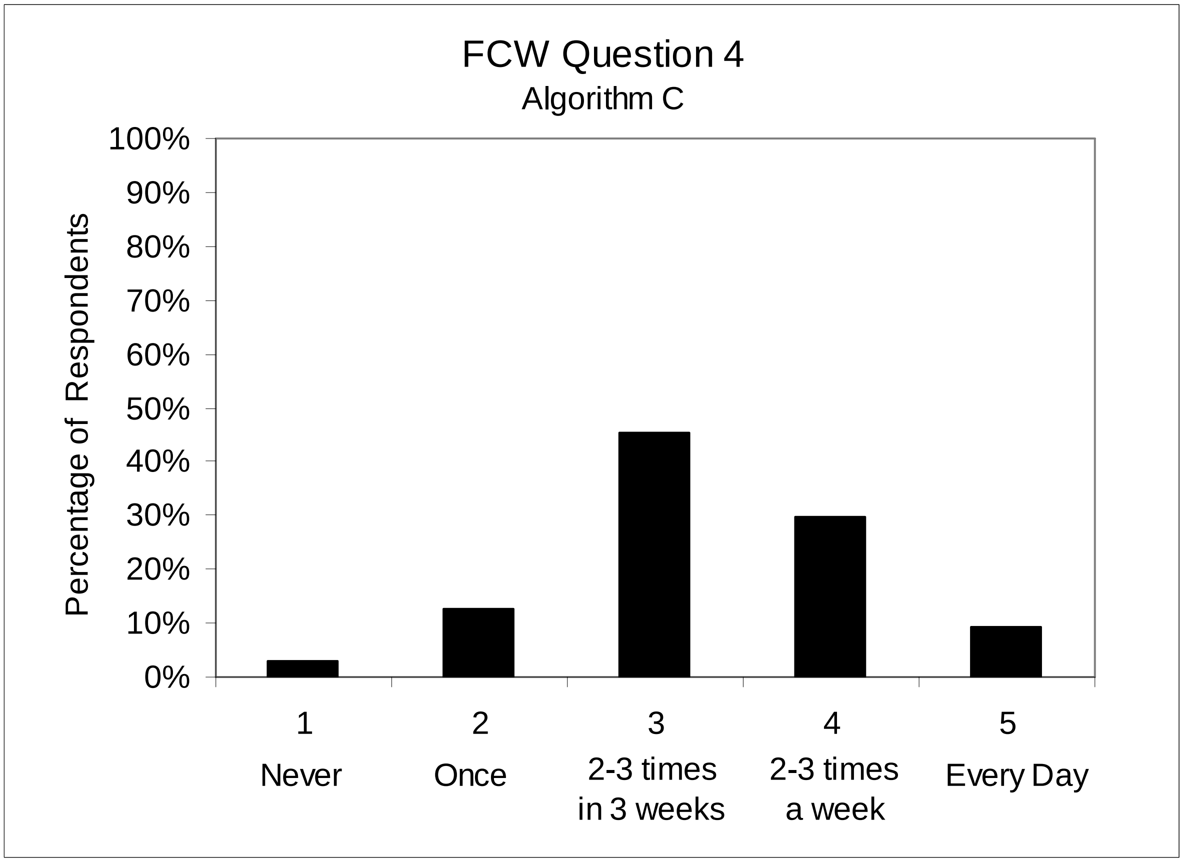
Values in cells represent the mean response and (standard deviation)



3. How easy or difficult was it to understand and use the alert timing adjustment for FCW?

	Males	Females	Overall
Younger (20-30)	6.1 (1.5)	6.4 (1.0)	6.3 (1.3)
Middle-Aged (40-50)	6.1 (0.9)	6.5 (0.7)	6.3 (0.8)
Older (60-70)	6.9 (0.3)	5.9 (1.4)	6.4 (1.1)
Overall	6.4 (1.1)	6.3 (1.1)	6.3 (1.1)

Values in cells represent the mean response and (standard deviation)

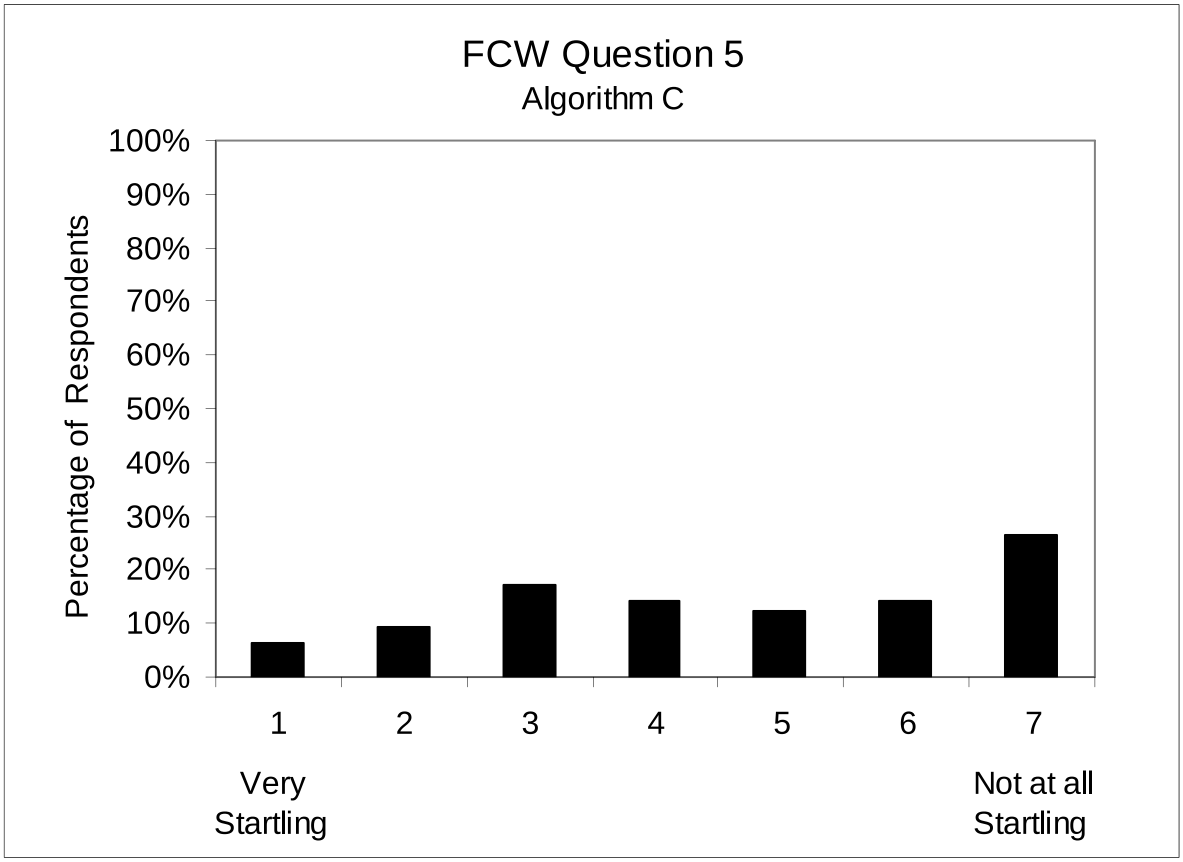


4. Select the statement which best describes how often you changed the FCW alert timing adjustment. (check one)

†	Males		Females		Overall	
Younger (20-30)	3.6	(1.0)	3.1	(1.2)	3.4	(1.1)
Middle-Aged (40-50)	3.7	(0.9)	3.2	(0.9)	3.5	(0.9)
Older (60-70)	3.0	(0.8)	3.2	(0.8)	3.1	(0.8)
Overall	3.4	(0.9)	3.2	(0.9)	3.3	(0.9)

Values in cells represent the mean response and (standard deviation)

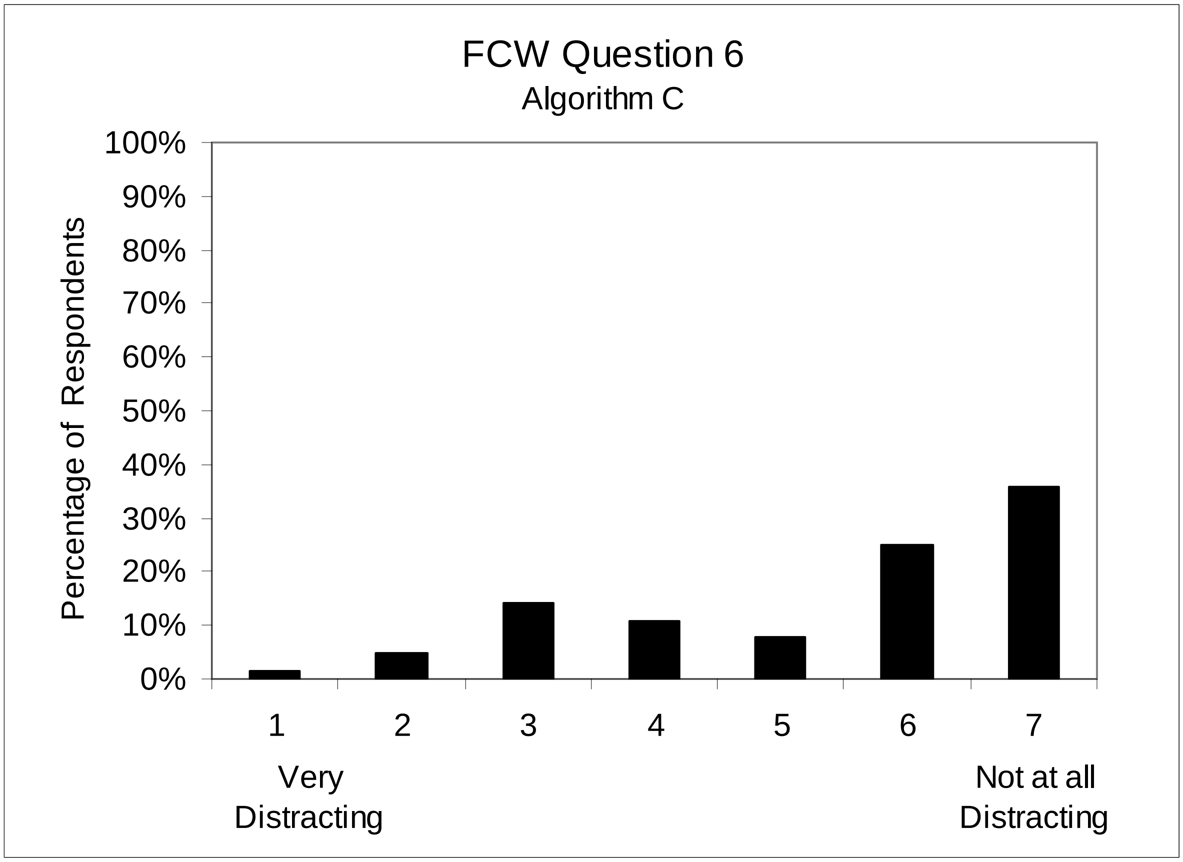
† = Significant difference associated with the interaction of participant age and gender, $H(5) = 11.102$, $p = .049$



5. How startling did you find the auditory alert when it occurred?

	Males		Females		Overall	
Younger (20-30)	4.2	(1.9)	4.0	(2.2)	4.1	(2.0)
Middle-Aged (40-50)	3.8	(2.0)	5.1	(1.6)	4.5	(1.9)
Older (60-70)	5.3	(2.2)	5.5	(1.3)	5.4	(1.8)
Overall	4.4	(2.1)	4.9	(1.8)	4.7	(2.0)

Values in cells represent the mean response and (standard deviation)



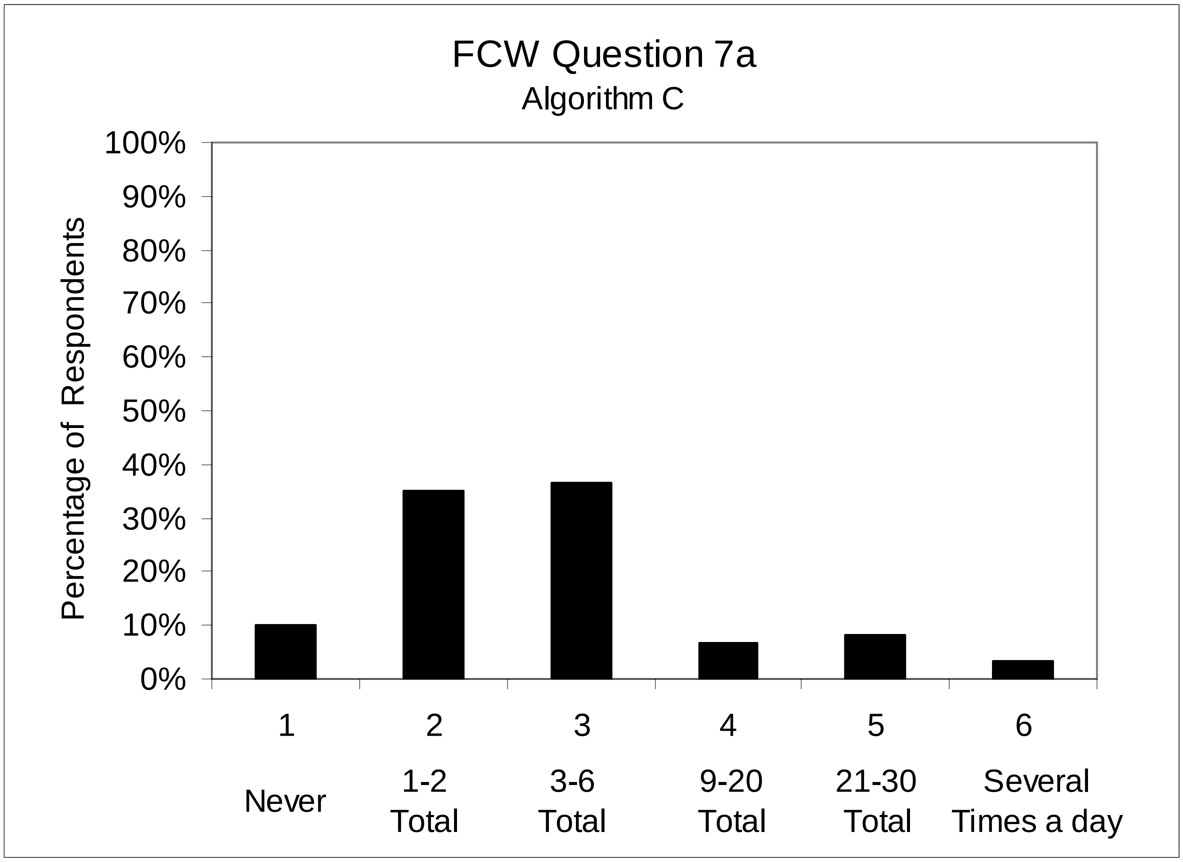
6. How distracting were the visual alerts that signaled a cautionary situation (a moderate threat)?

*	Males		Females		Overall	
Younger (20-30)[1]	4.0	(2.1)	5.2	(1.7)	4.6	(2.0)
Middle-Aged (40-50)	5.3	(1.6)	5.3	(1.6)	5.3	(1.5)
Older (60-70)[1]	6.3	(1.3)	6.1	(1.4)	6.2	(1.3)
Overall	5.2	(1.9)	5.5	(1.5)	5.4	(1.7)

Values in cells represent the mean response and (standard deviation)

* = Significant difference associated with participant age, $H(2) = 9.215$, $p = .010$

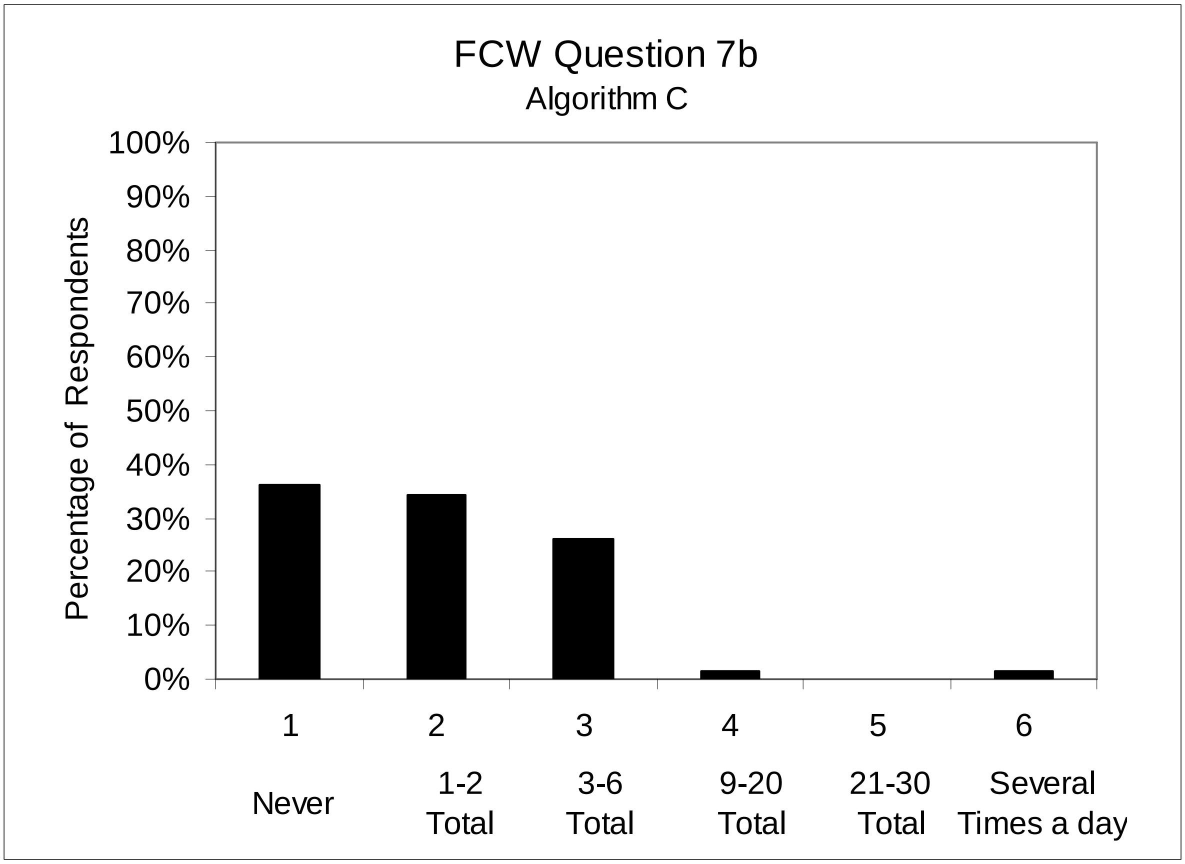
7. How frequently did each of the events listed below result in FCW alerts that you felt were not necessary? (write the number corresponding to the frequency in the space provided)



7a. When a vehicle ahead of me turned

	Males		Females		Overall	
Younger (20-30)	3.4	(1.2)	3.4	(1.7)	3.4	(1.5)
Middle-Aged (40-50)	2.5	(0.8)	2.6	(1.0)	2.6	(0.9)
Older (60-70)	2.7	(1.2)	2.1	(0.6)	2.4	(1.0)
Overall	2.9	(1.1)	2.7	(1.3)	2.8	(1.2)

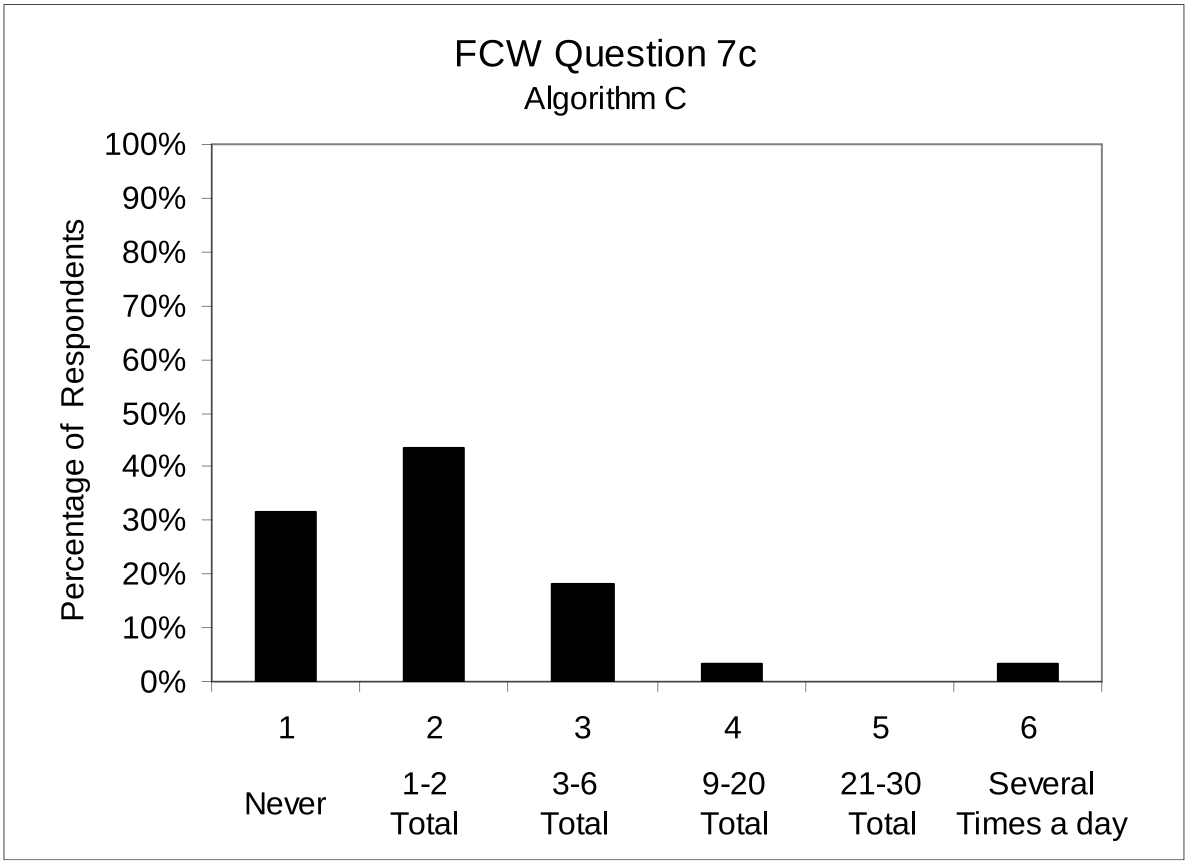
Values in cells represent the mean response and (standard deviation)



7b. When I passed a moving vehicle

	Males		Females		Overall	
Younger (20-30)	2.7	(0.7)	2.3	(1.5)	2.5	(1.2)
Middle-Aged (40-50)	2.0	(0.8)	1.8	(0.8)	1.9	(0.8)
Older (60-70)	1.8	(0.9)	1.5	(0.8)	1.7	(0.9)
Overall	2.1	(0.9)	1.9	(1.1)	2.0	(1.0)

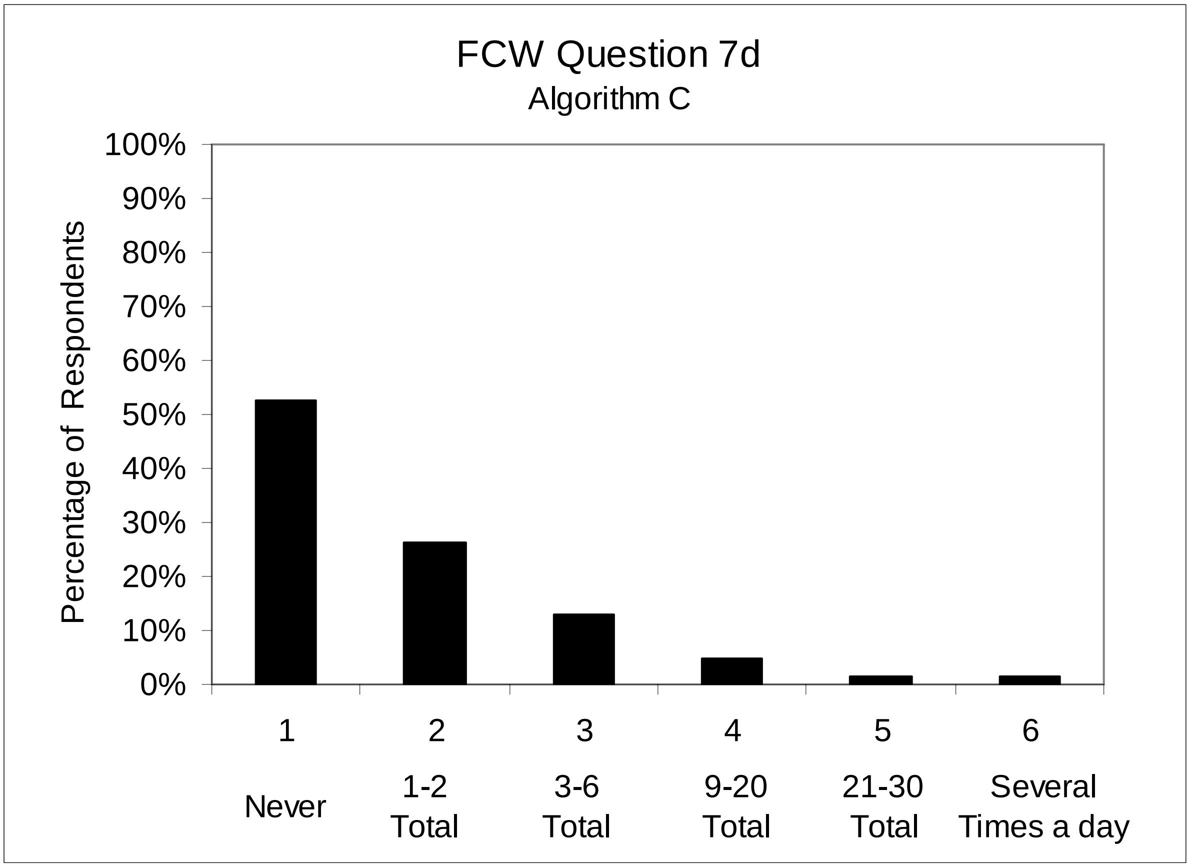
Values in cells represent the mean response and (standard deviation)



7c. When a vehicle ahead changed lanes

	Males		Females		Overall	
Younger (20-30)	2.6	(1.4)	2.1	(1.5)	2.3	(1.5)
Middle-Aged (40-50)	1.6	(0.9)	2.2	(1.0)	1.9	(1.0)
Older (60-70)	1.9	(0.7)	2.1	(0.8)	2.0	(0.7)
Overall	2.0	(1.1)	2.1	(1.1)	2.1	(1.1)

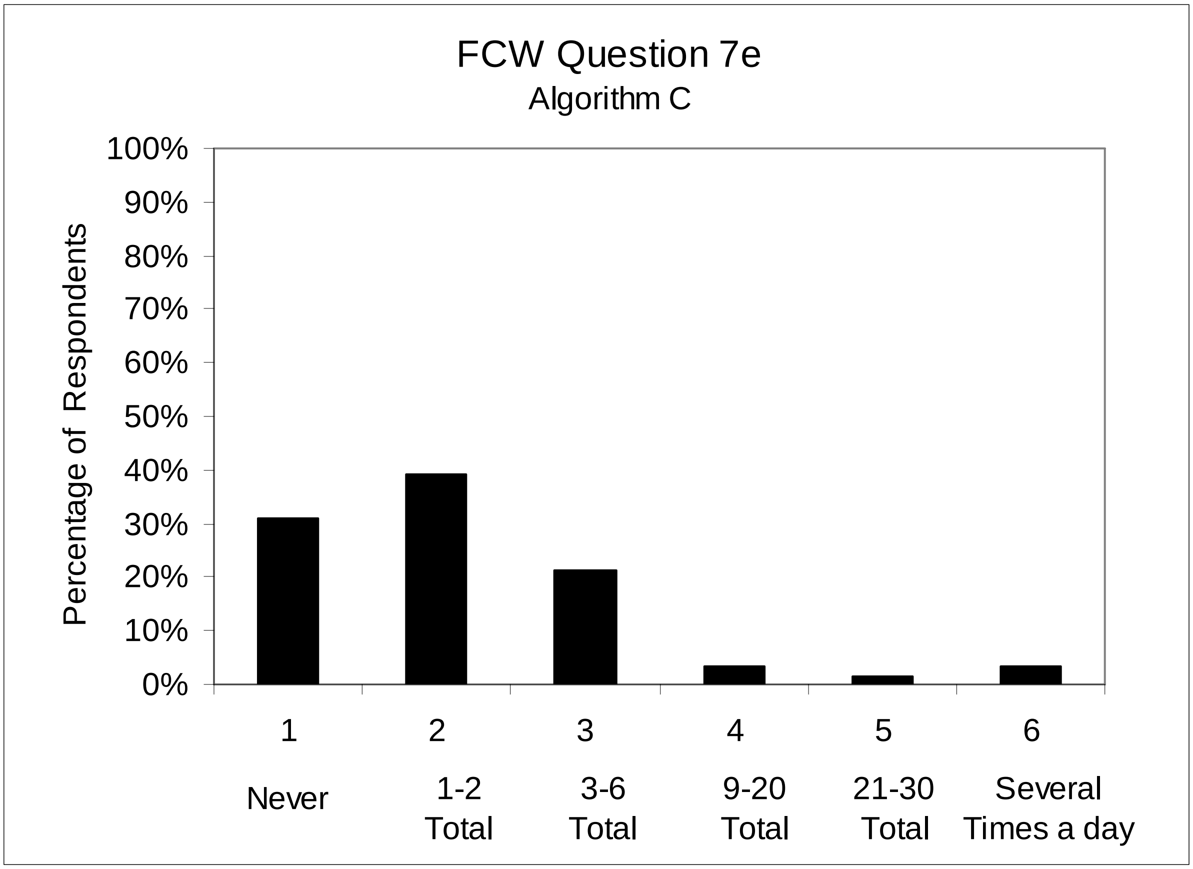
Values in cells represent the mean response and (standard deviation)



7d. When my vehicle changed lanes

	Males		Females		Overall	
Younger (20-30)	2.6	(1.0)	1.9	(1.6)	2.2	(1.4)
Middle-Aged (40-50)	1.6	(1.2)	2.1	(1.0)	1.9	(1.1)
Older (60-70)	1.5	(0.7)	1.3	(0.7)	1.4	(0.7)
Overall	1.9	(1.1)	1.8	(1.2)	1.8	(1.1)

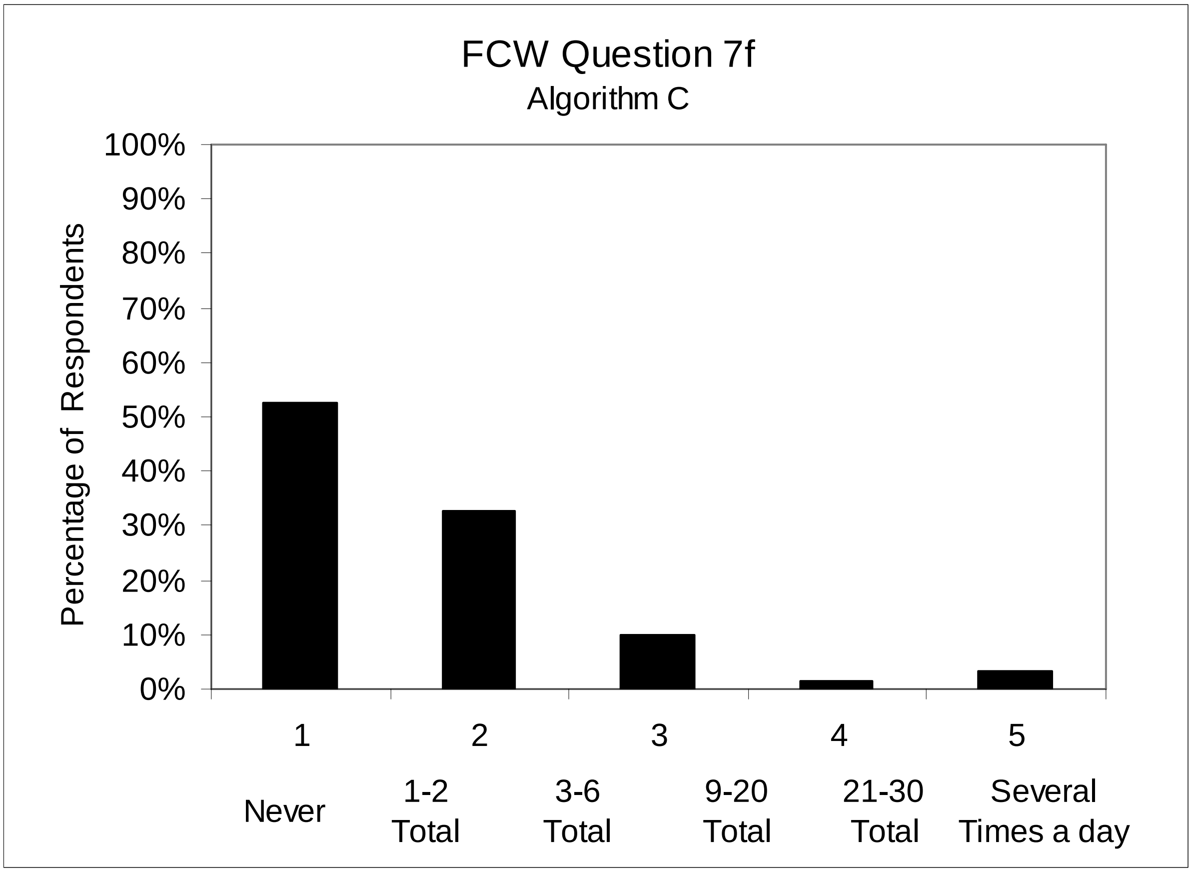
Values in cells represent the mean response and (standard deviation)



7e. When a vehicle cut in front of me

	Males	Females	Overall
Younger (20-30)	2.3 (0.9)	2.1 (1.5)	2.2 (1.2)
Middle-Aged (40-50)	2.1 (1.4)	2.1 (0.8)	2.1 (1.2)
Older (60-70)	2.3 (1.4)	2.0 (0.7)	2.2 (1.1)
Overall	2.2 (1.3)	2.1 (1.0)	2.1 (1.2)

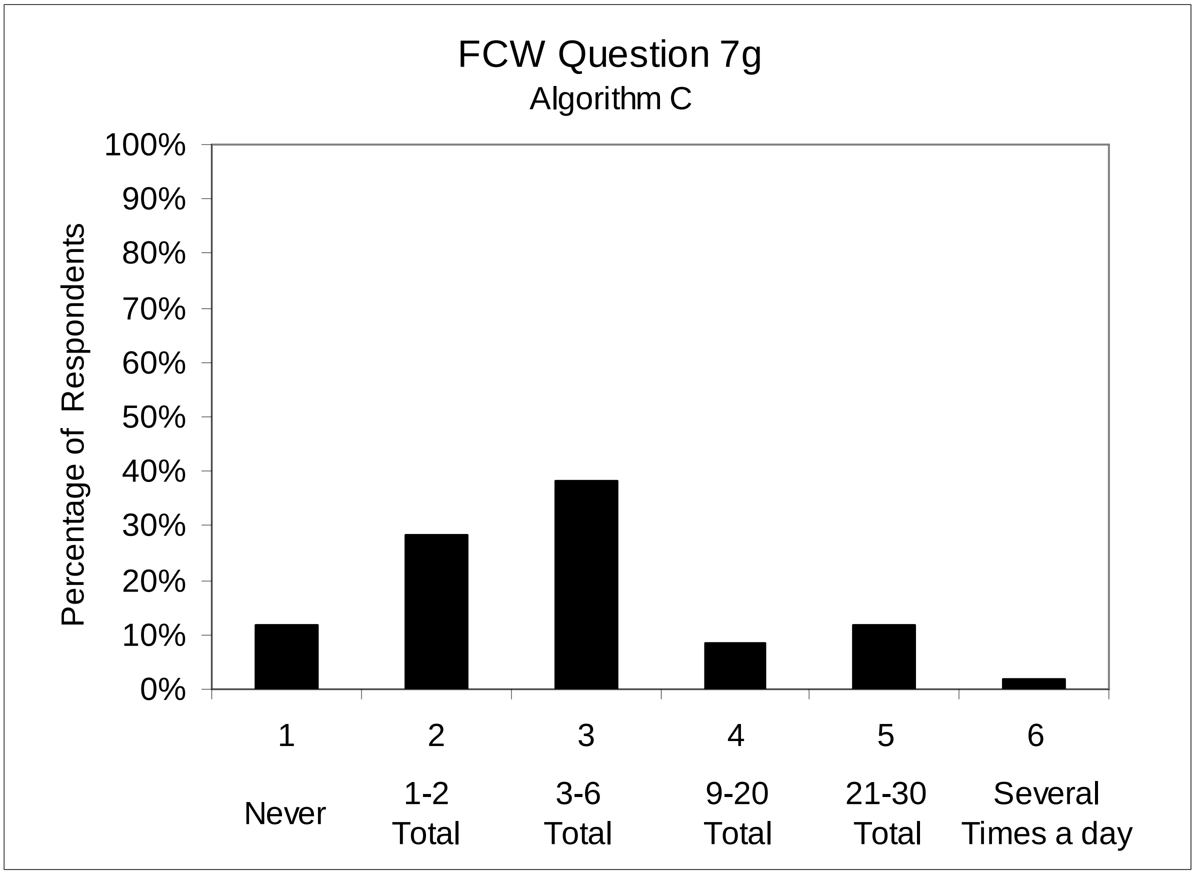
Values in cells represent the mean response and (standard deviation)



7f. When I cut in behind another vehicle

	Males		Females		Overall	
Younger (20-30)	2.1	(0.8)	1.7	(1.3)	1.9	(1.0)
Middle-Aged (40-50)	1.5	(0.9)	1.6	(0.7)	1.5	(0.8)
Older (60-70)	1.9	(1.3)	1.5	(0.7)	1.7	(1.0)
Overall	1.8	(1.0)	1.6	(0.9)	1.7	(1.0)

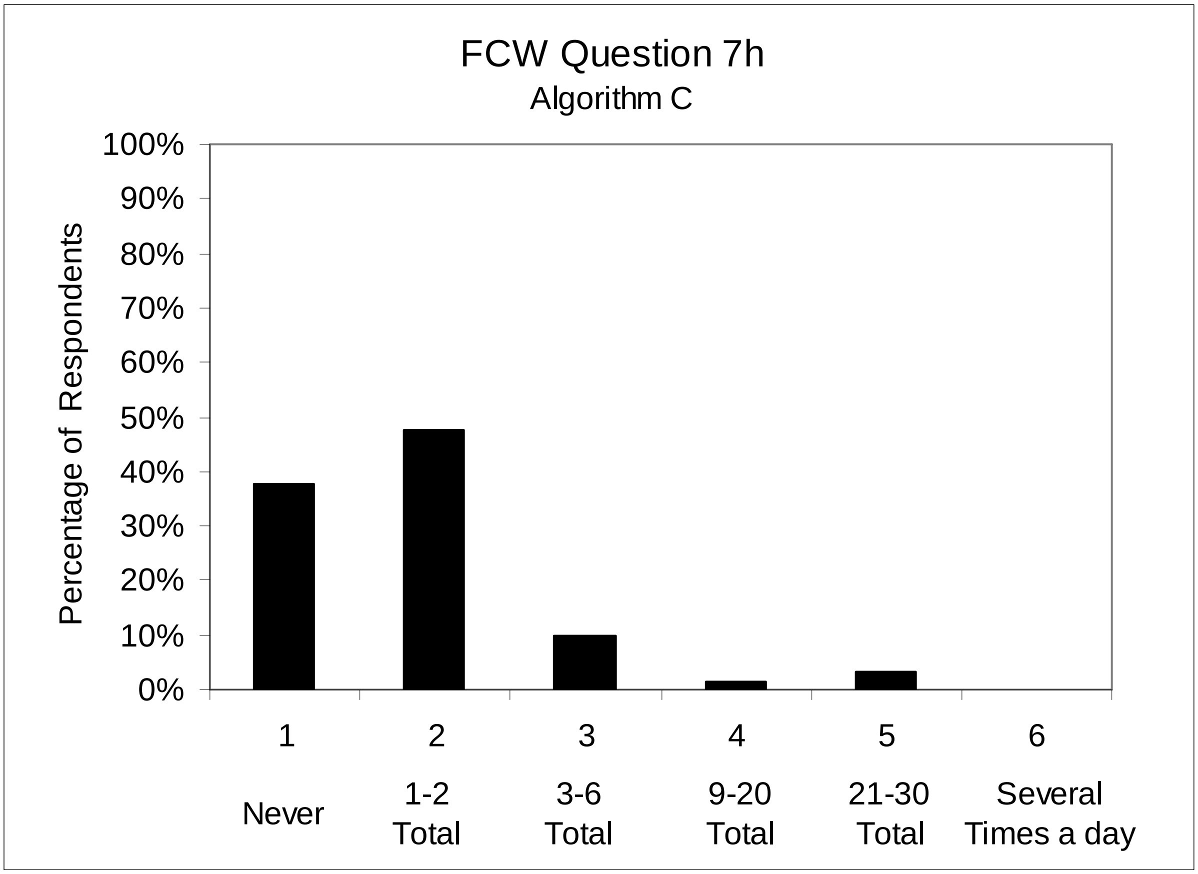
Values in cells represent the mean response and (standard deviation)



7g. When I passed a sign, light post or guardrail

	Males	Females	Overall
Younger (20-30)	3.1 (1.7)	2.2 (1.1)	2.7 (1.5)
Middle-Aged (40-50)	3.0 (1.0)	2.9 (0.9)	3.0 (1.0)
Older (60-70)	3.2 (1.4)	2.7 (0.9)	2.9 (1.2)
Overall	3.1 (1.3)	2.6 (1.0)	2.9 (1.2)

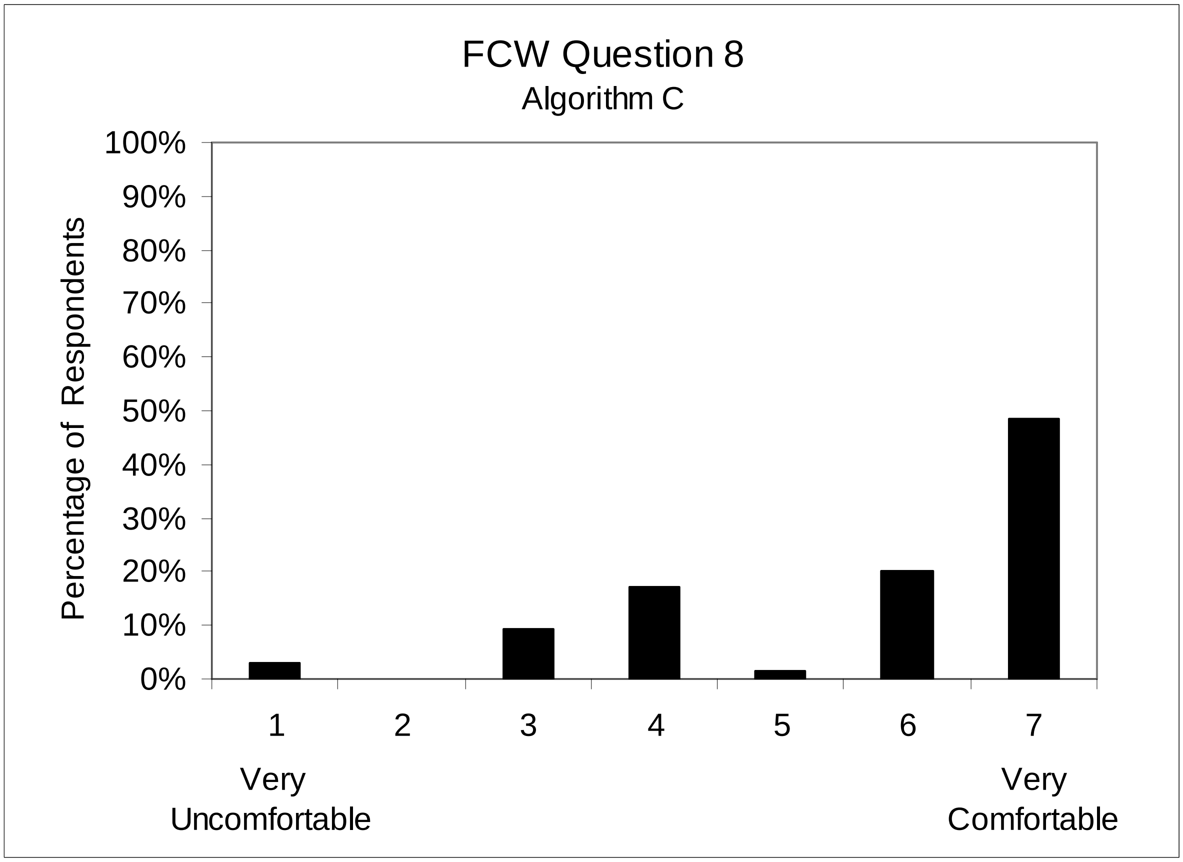
Values in cells represent the mean response and (standard deviation)



7h. When I passed a parked vehicle

	Males		Females		Overall	
Younger (20-30)	2.2	(0.9)	1.9	(1.2)	2.1	(1.1)
Middle-Aged (40-50)	1.9	(0.7)	1.7	(0.8)	1.8	(0.7)
Older (60-70)	2.0	(1.2)	1.4	(0.5)	1.7	(0.9)
Overall	2.0	(0.9)	1.7	(0.9)	1.9	(0.9)

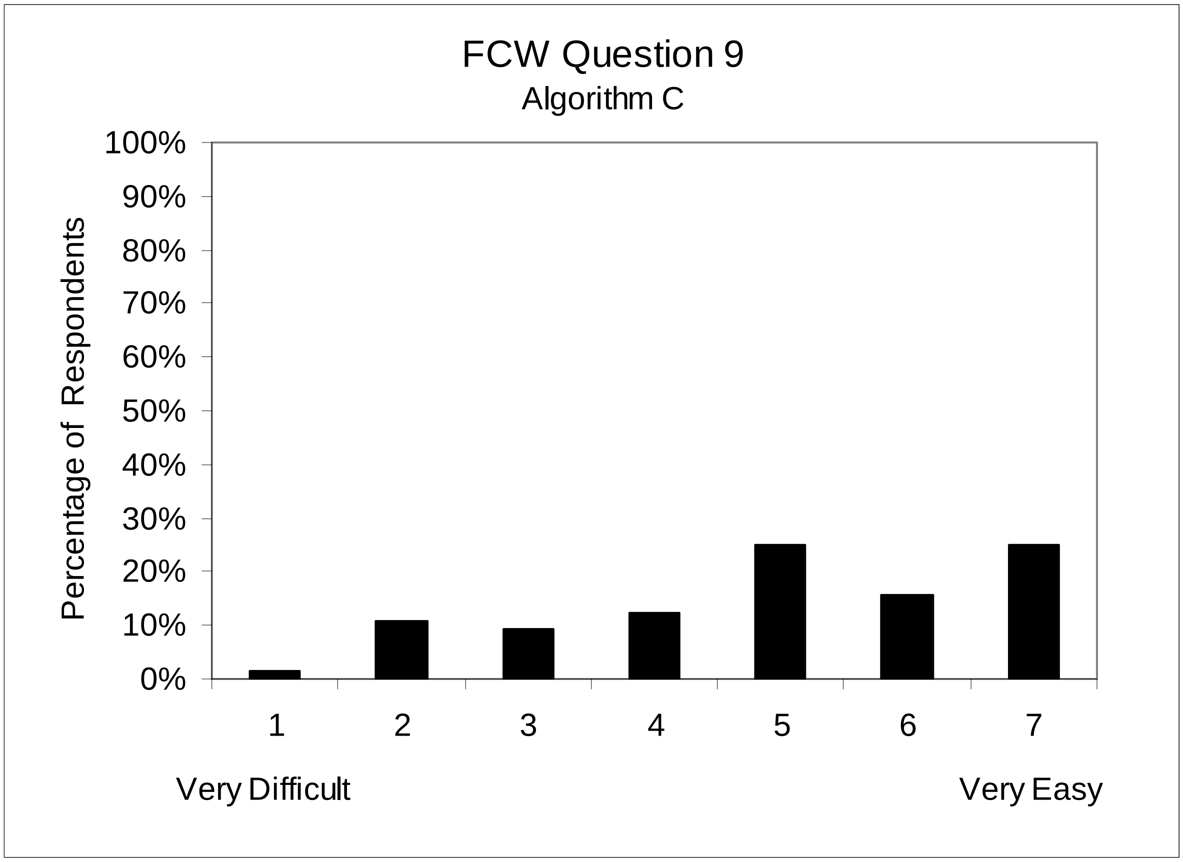
Values in cells represent the mean response and (standard deviation)



8. How comfortable would you feel if your child, spouse, parents–or other loved ones–drove a vehicle equipped with FCW?

	Males	Females	Overall
Younger (20-30)	5.0 (1.8)	5.1 (2.2)	5.1 (1.9)
Middle-Aged (40-50)	5.9 (1.5)	5.5 (1.9)	5.7 (1.7)
Older (60-70)	6.5 (0.9)	6.1 (1.4)	6.3 (1.2)
Overall	5.8 (1.5)	5.6 (1.8)	5.7 (1.7)

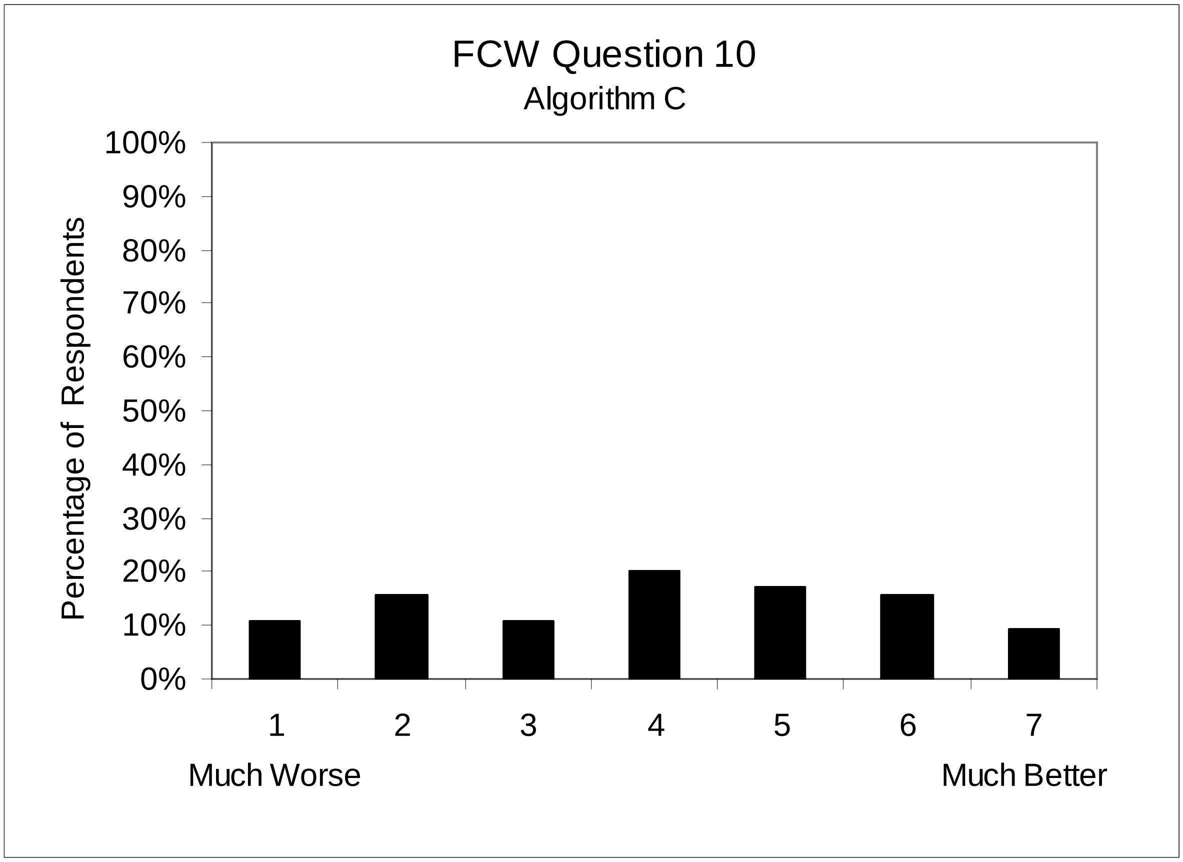
Values in cells represent the mean response and (standard deviation)



9. How <u>easy or difficult</u> do you feel it will be to market a vehicle equipped with FCW?

	Males		Females		Overall	
Younger (20-30)	5.2	(1.5)	4.6	(2.1)	4.9	(1.8)
Middle-Aged (40-50)	4.8	(1.6)	4.8	(1.9)	4.8	(1.7)
Older (60-70)	5.3	(2.0)	5.0	(1.4)	5.1	(1.7)
Overall	5.1	(1.7)	4.8	(1.8)	5.0	(1.7)

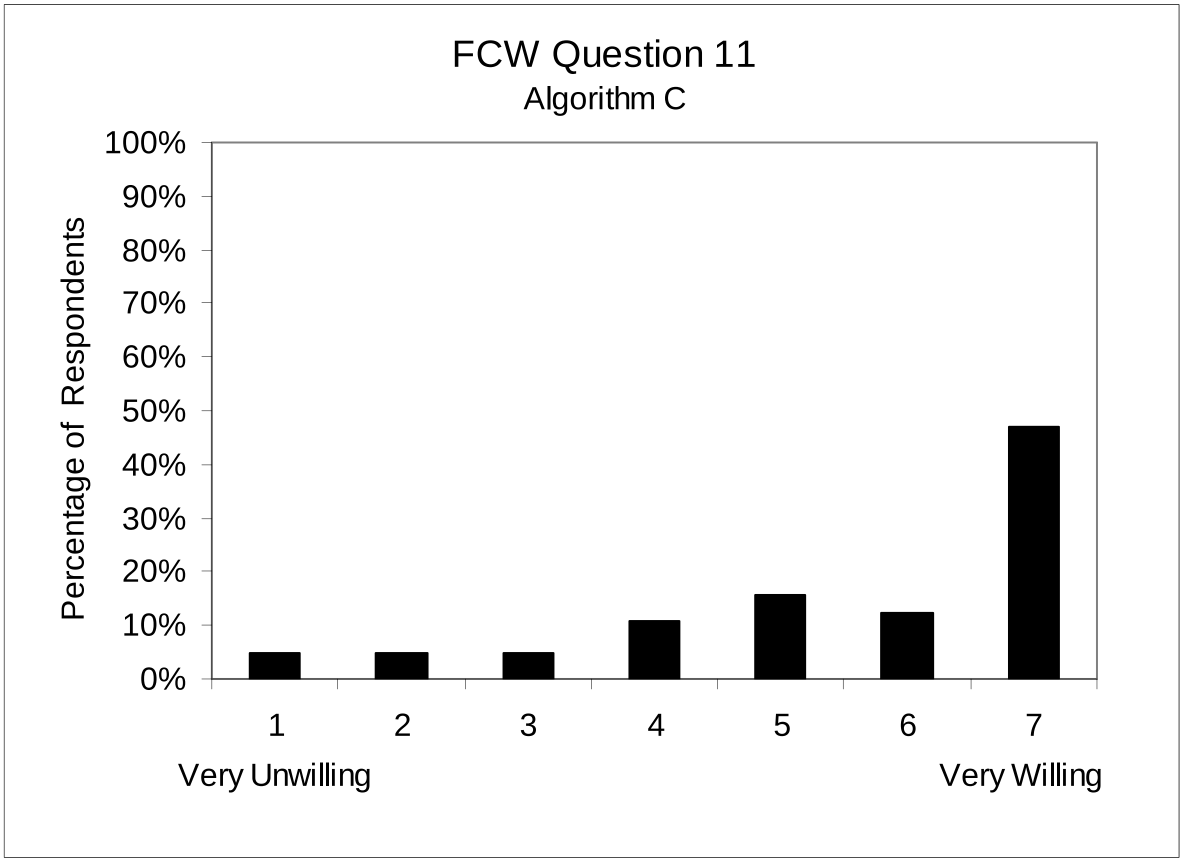
Values in cells represent the mean response and (standard deviation)



10. How would you rate FCW as a <u>safety system</u> as compared to anti-lock braking systems (ABS)?

	Males		Females		Overall	
Younger (20-30)	3.4	(2.1)	3.9	(2.1)	3.7	(2.1)
Middle-Aged (40-50)	4.2	(1.7)	3.9	(1.9)	4.0	(1.8)
Older (60-70)	4.5	(2.0)	4.2	(1.4)	4.3	(1.7)
Overall	4.0	(1.9)	4.0	(1.8)	4.0	(1.8)

Values in cells represent the mean response and (standard deviation)

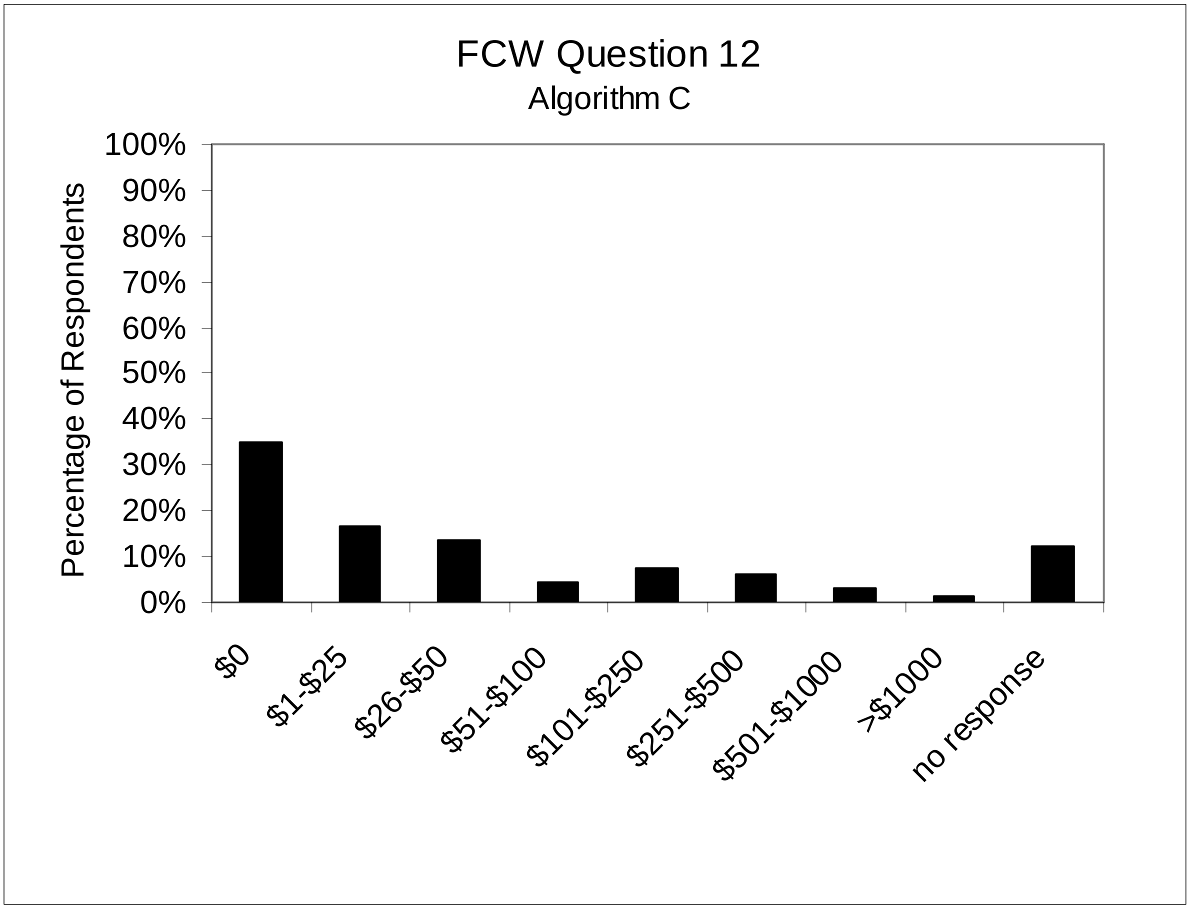


11. Would you be willing to rent a vehicle equipped with FCW?

*	Males	Females	Overall
Younger (20-30)	4.6 (2.1)	5.3 (1.8)	5.0 (2.0)
Middle-Aged (40-50)	5.7 (1.5)	5.0 (2.1)	5.4 (1.8)
Older (60-70)	6.6 (0.7)	5.8 (1.9)	6.2 (1.4)
Overall	5.7 (1.7)	5.4 (1.9)	5.5 (1.8)

Values in cells represent the mean response and (standard deviation)

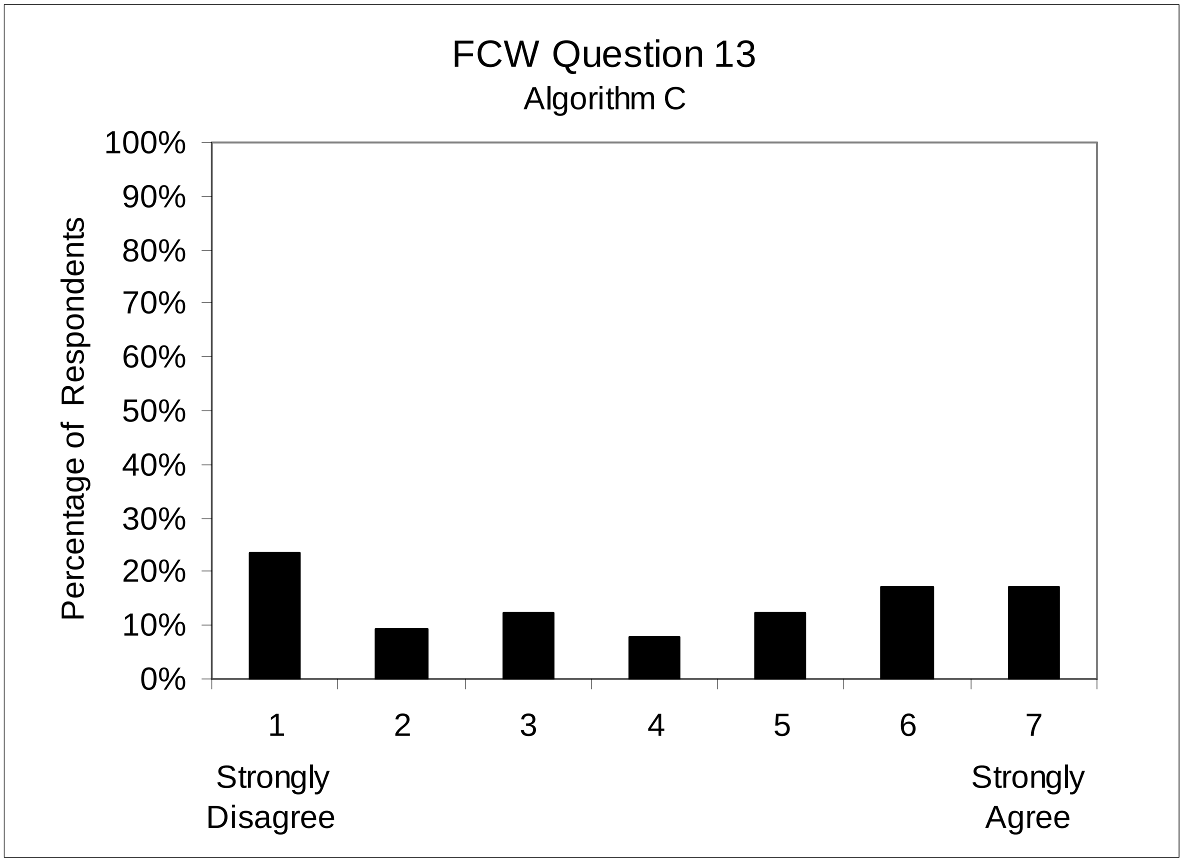
* = Significant difference associated with participant age, $H(2) = 6.415$, $p = .040$



12. Approximately, how much would you be willing to spend to rent a vehicle equipped with FCW? (free responses given in dollars and grouped for analysis)

	Males		Females		Overall	
Younger (20-30)	82.5	(158.8)	97.0	(151.7)	89.8	(151.3)
Middle-Aged (40-50)	19.1	(33.3)	368.1	(765.3)	193.6	(557.9)
Older (60-70)	202.2	(348.6)	12.3	(18.3)	112.8	(265.4)
Overall	95.2	(218.0)	176.4	(490.9)	137.4	(379.4)

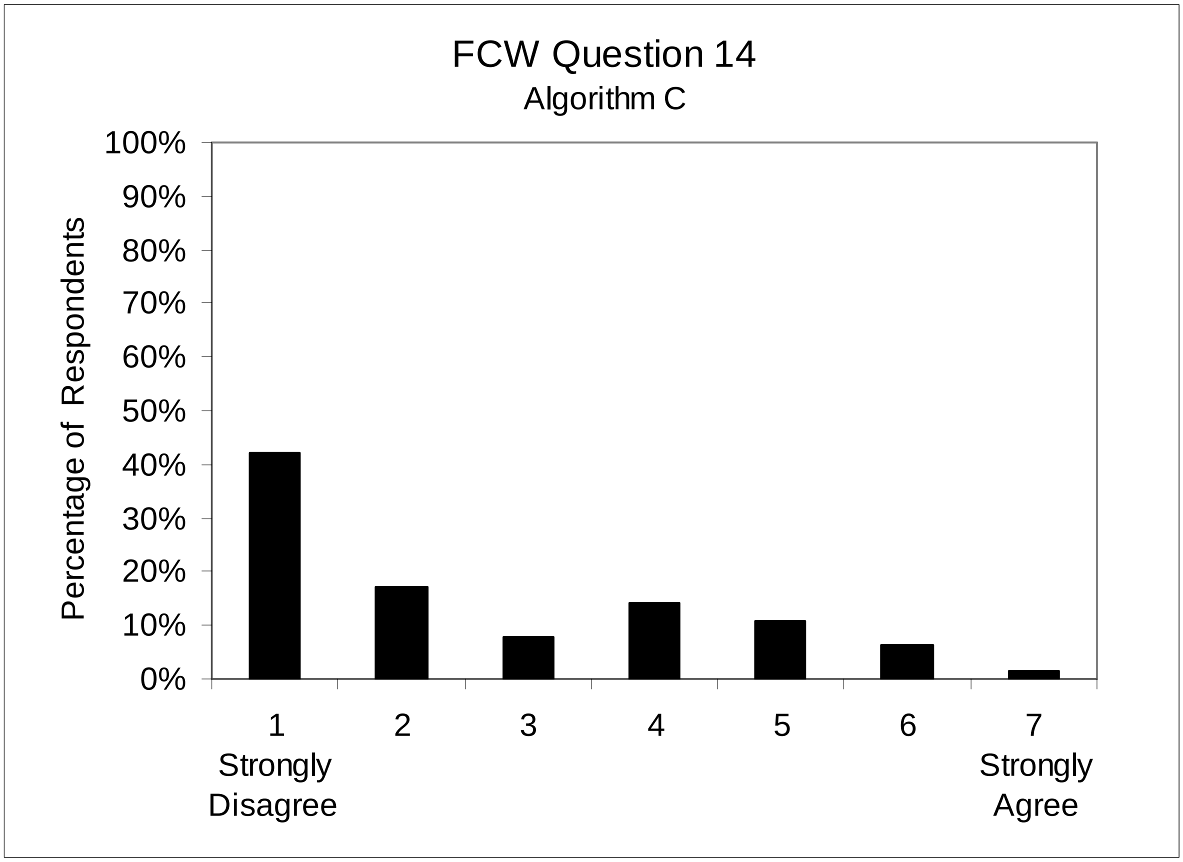
Values in cells represent the mean response and (standard deviation)



13. If I was designing an FCW system, I would add an alert timing setting that allowed me to receive alerts sooner than the most sensitive alert timing setting that I experienced with this FCW system.

	Males	Females	Overall
Younger (20-30)	3.6 (2.4)	3.3 (2.1)	3.5 (2.2)
Middle-Aged (40-50)	5.1 (2.1)	3.5 (2.4)	4.3 (2.4)
Older (60-70)	3.9 (2.1)	4.4 (2.5)	4.1 (2.2)
Overall	4.2 (2.2)	3.7 (2.3)	4.0 (2.2)

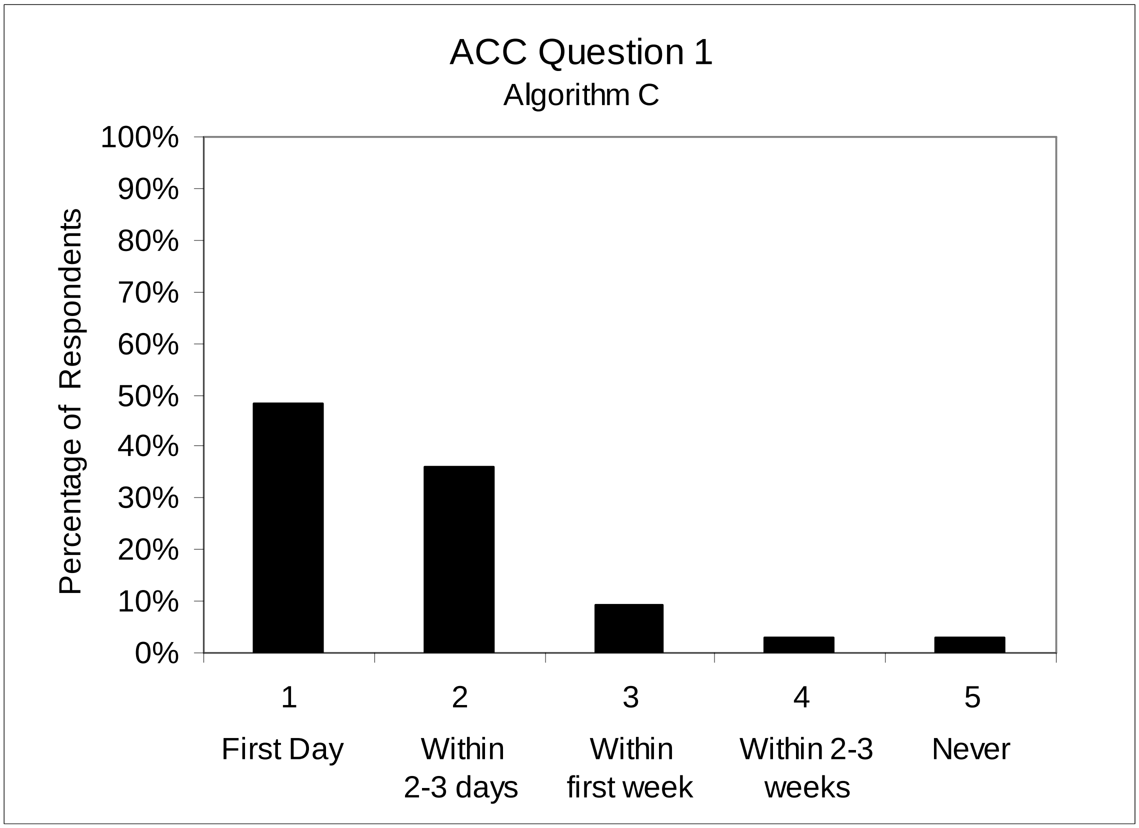
Values in cells represent the mean response and (standard deviation)



14. If I was designing an FCW system, I would add an alert timing setting that allowed me to receive alerts later than the least sensitive alert timing setting that I experienced with this FCW system.

	Males		Females		Overall	
Younger (20-30)	2.9	(1.9)	3.2	(1.8)	3.1	(1.8)
Middle-Aged (40-50)	2.2	(1.5)	2.9	(1.9)	2.5	(1.7)
Older (60-70)	2.7	(1.8)	1.7	(1.7)	2.2	(1.8)
Overall	2.6	(1.7)	2.6	(1.8)	2.6	(1.8)

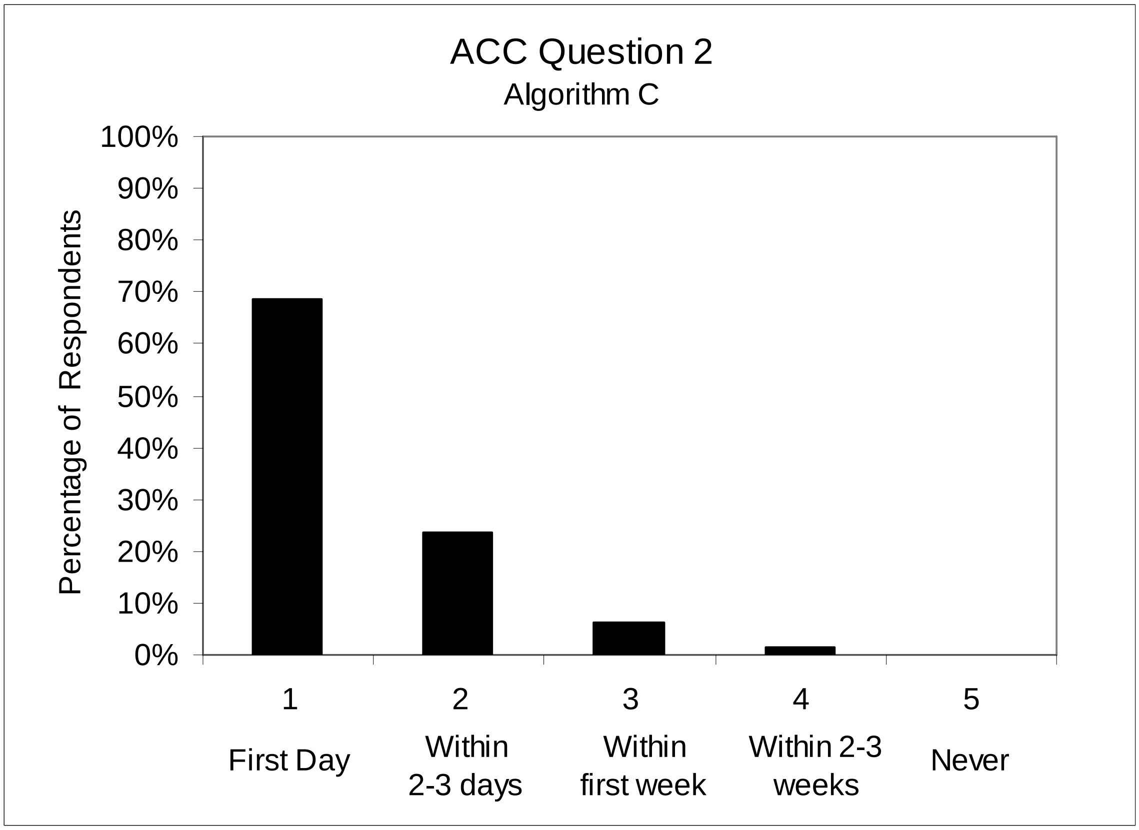
Values in cells represent the mean response and (standard deviation)



1. How long did it take before you became <u>comfortable</u> with the operations of ACC? (check one)

	Males		Females		Overall	
Younger (20-30)	1.5	(0.7)	2.0	(1.2)	1.8	(1.0)
Middle-Aged (40-50)	1.7	(1.3)	1.9	(0.8)	1.8	(1.1)
Older (60-70)	1.5	(0.5)	2.0	(1.1)	1.7	(0.9)
Overall	1.6	(1.0)	2.0	(1.0)	1.8	(1.0)

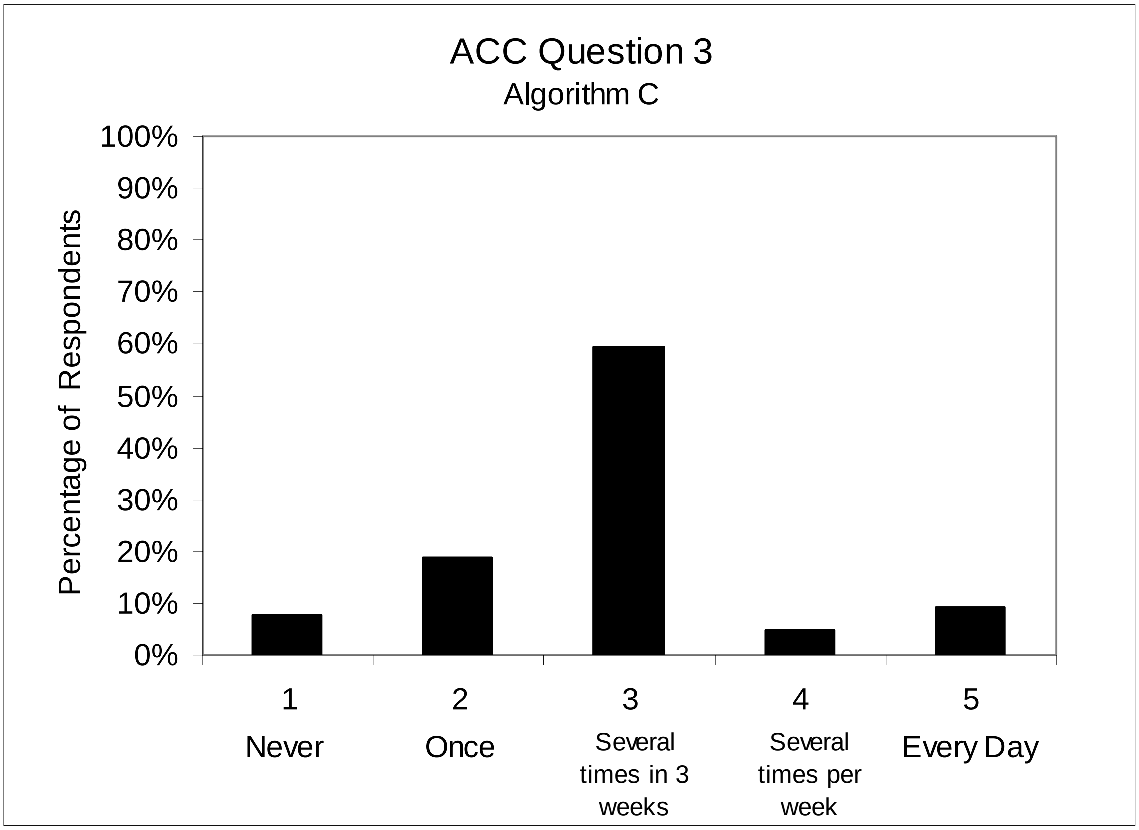
Values in cells represent the mean response and (standard deviation)



2. How long did it take before you understood the operations of ACC? (check one)

	Males	Females	Overall
Younger (20-30)	1.5 (0.7)	1.5 (0.8)	1.5 (0.8)
Middle-Aged (40-50)	1.2 (0.4)	1.4 (0.5)	1.3 (0.5)
Older (60-70)	1.4 (0.7)	1.5 (0.9)	1.5 (0.8)
Overall	1.3 (0.6)	1.5 (0.8)	1.4 (0.7)

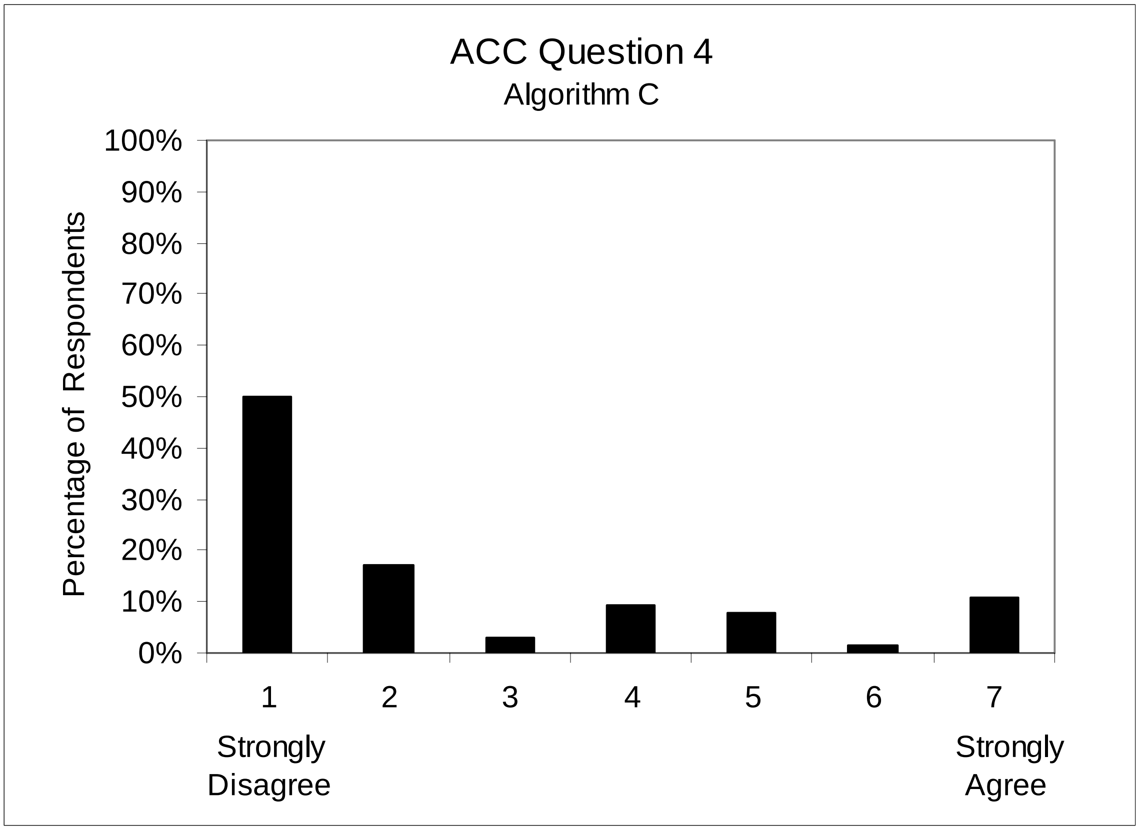
Values in cells represent the mean response and (standard deviation)



3. Select the statement which best describes how often you <u>changed</u> the ACC following distance (gap). (check one)

	Males		Females		Overall	
Younger (20-30)	3.5	(1.0)	2.6	(1.2)	3.1	(1.1)
Middle-Aged (40-50)	3.2	(1.0)	2.5	(0.8)	2.9	(0.9)
Older (60-70)	2.8	(1.1)	2.7	(0.5)	2.8	(0.8)
Overall	3.2	(1.0)	2.6	(0.8)	2.9	(1.0)

Values in cells represent the mean response and (standard deviation)



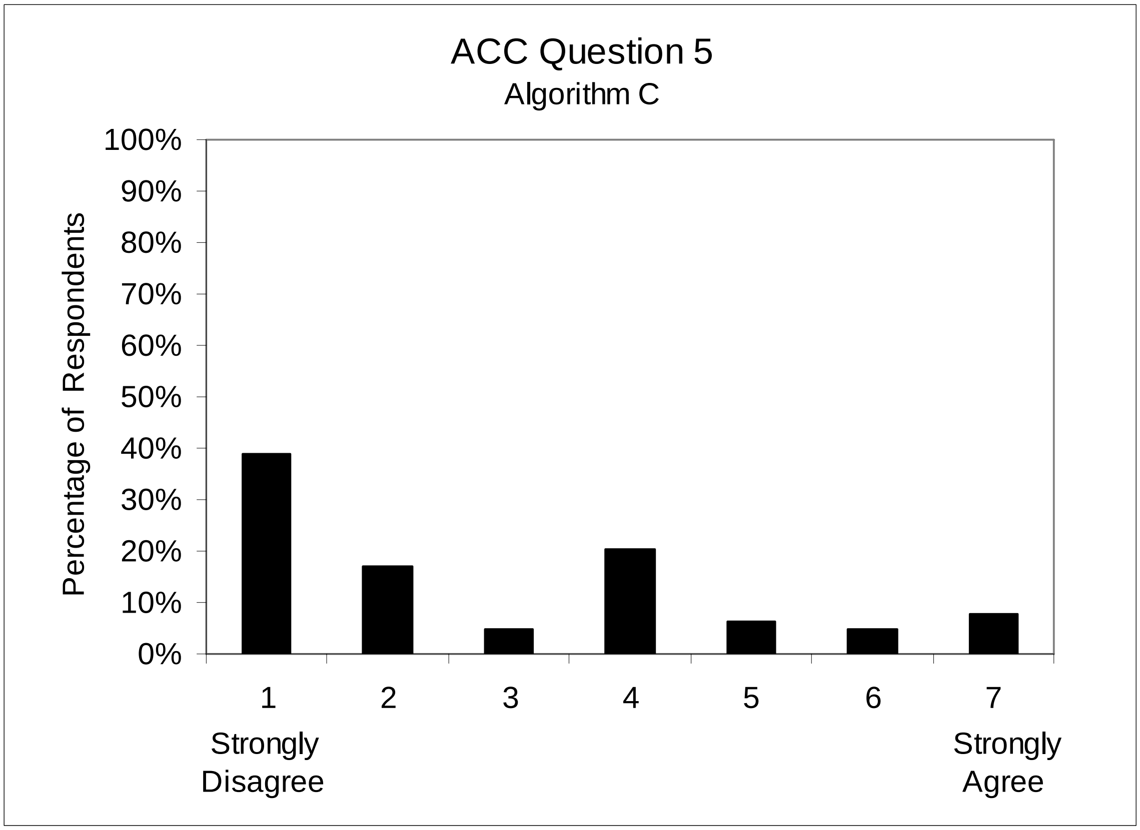
4. If I was designing an ACC system, I would add a following distance (gap) setting that allowed me to follow other vehicles more closely than the closest headway setting that I experienced with this ACC system.

*†	Males		Females		Overall	
Younger (20-30)[1]	4.2	(2.5)	3.4	(2.2)	3.8	(2.4)
Middle-Aged (40-50)	1.2	(0.4)	3.7	(1.9)	2.5	(1.9)
Older (60-70)[1]	1.7	(1.8)	1.4	(0.9)	1.5	(1.4)
Overall	2.3	(2.2)	2.8	(2.0)	2.6	(2.1)

Values in cells represent the mean response and (standard deviation)

* = Significant difference associated with participant age, $H(2) = 12.343$, $p = .002$

† = Significant difference associated with the interaction of participant age and gender, $H(5) = 21.496$, $p = .001$

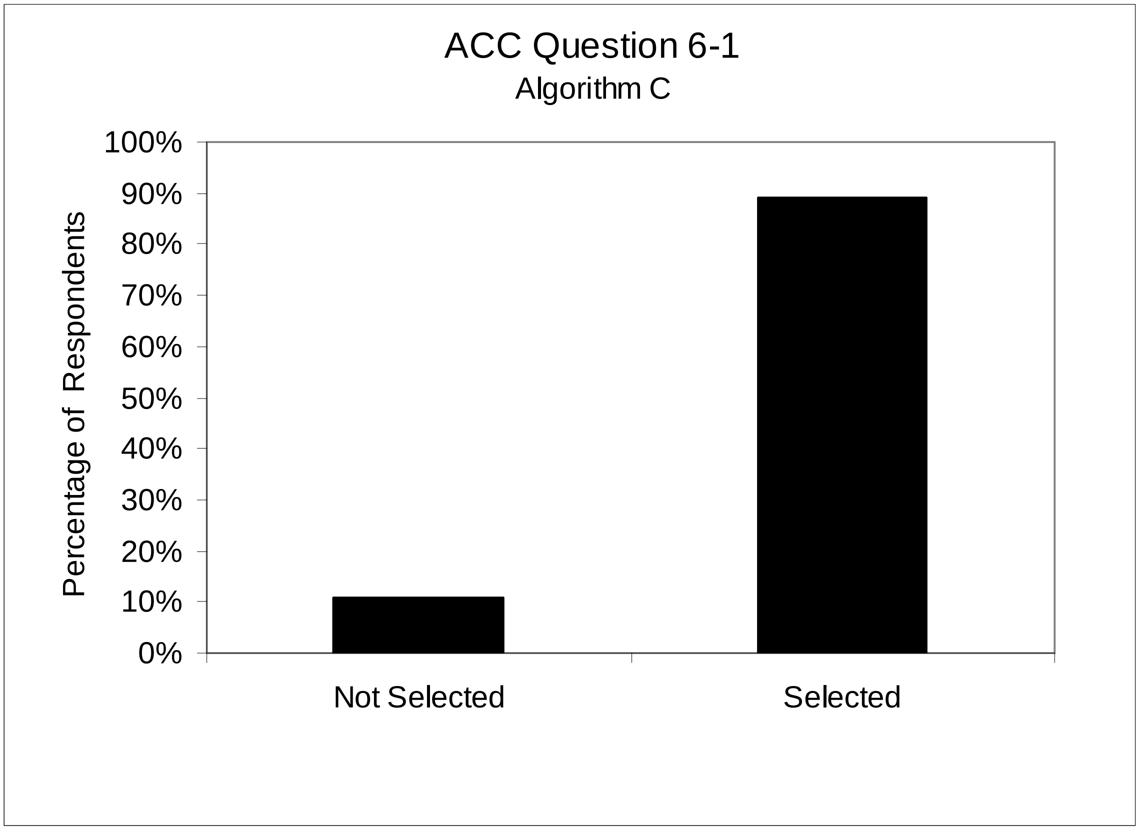


5. If I was designing an ACC system, I would add a following distance (gap) setting that allowed me to follow other vehicles farther than the farthest headway setting that I experienced with this ACC system.

	Males	Females	Overall
Younger (20-30)	3.0 (2.1)	2.8 (2.3)	2.9 (2.1)
Middle-Aged (40-50)	3.0 (2.3)	3.2 (1.3)	3.1 (1.8)
Older (60-70)	2.3 (2.0)	2.7 (2.1)	2.5 (2.0)
Overall	2.8 (2.1)	2.9 (1.9)	2.8 (2.0)

Values in cells represent the mean response and (standard deviation)

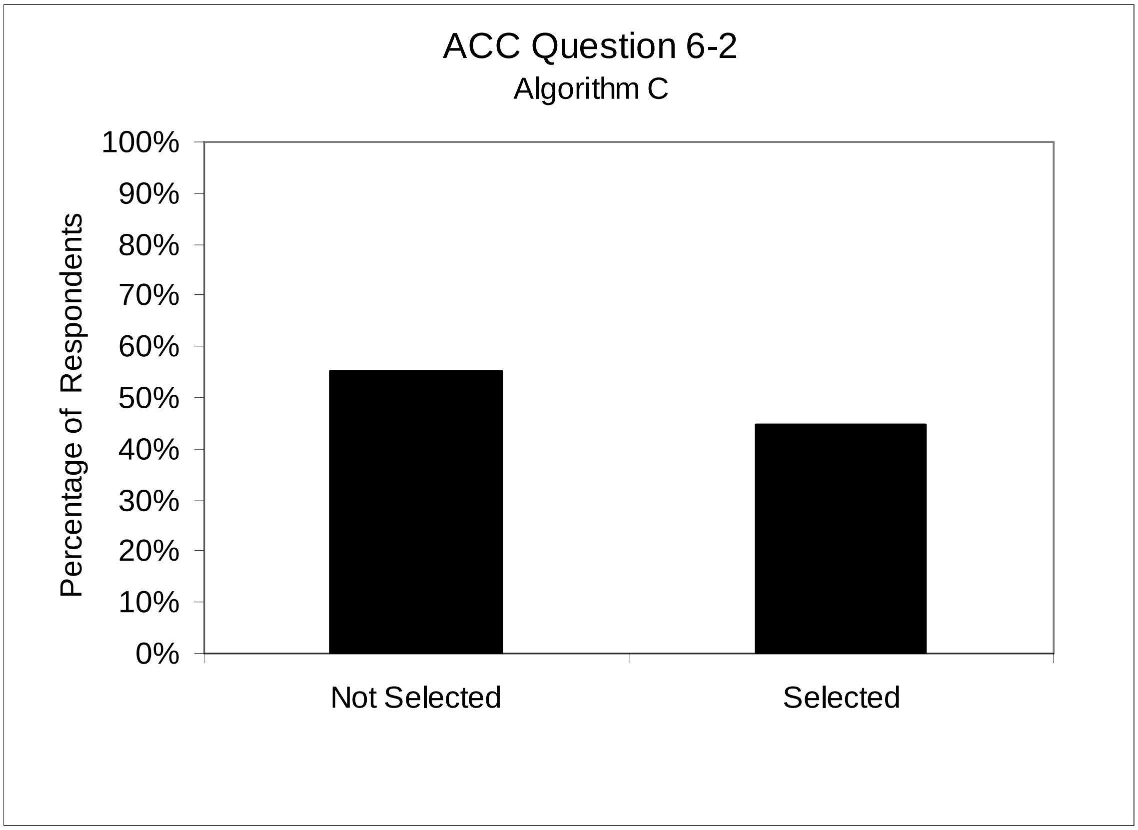
6. If you did change the ACC following distance adjustment, which of the following factors caused you to change the setting.



6-1 The traffic conditions

	Males		Females		Overall	
	No	Yes	No	Yes	No	Yes
Younger (20-30)	1	10	1	9	2	19
Middle-Aged (40-50)	1	11	3	8	4	19
Older (60-70)	1	9	0	11	1	20
Overall	3	30	4	28	7	58

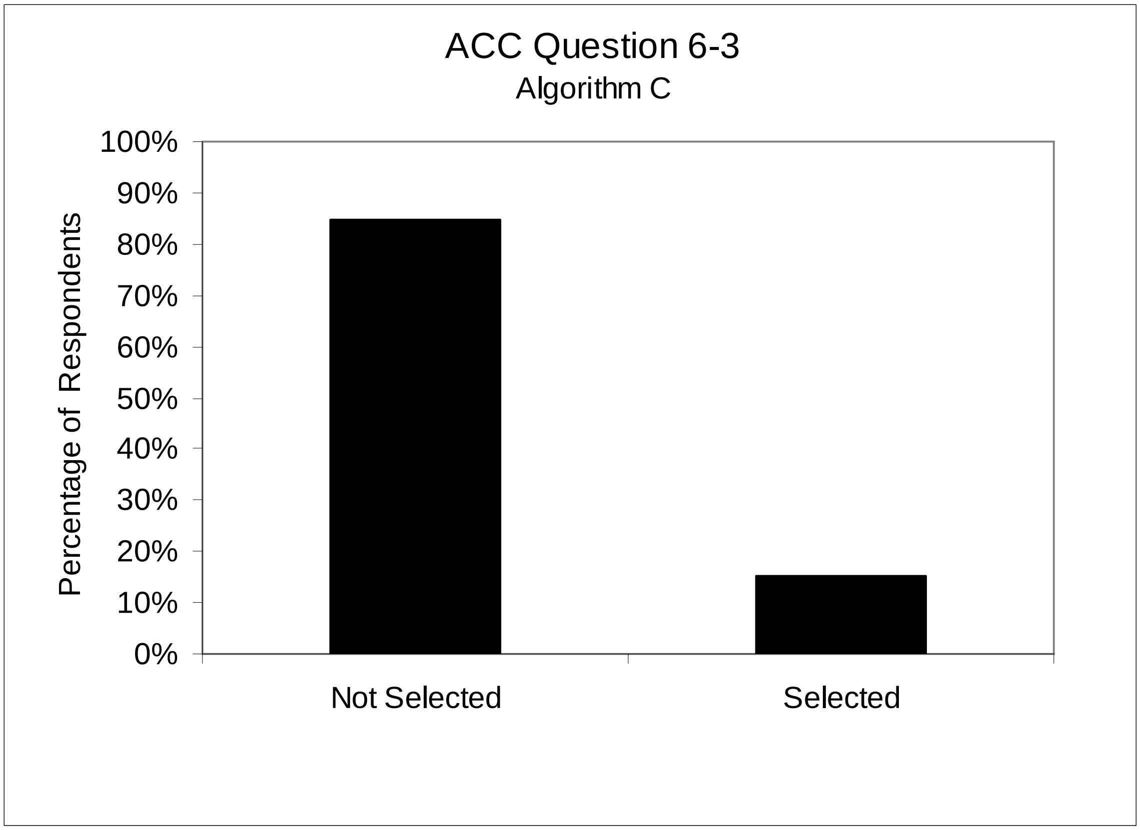
Values in cells represent the frequency of response for each indicated demographic division



6-2 The weather conditions

	Males		Females		Overall	
	No	Yes	No	Yes	No	Yes
Younger (20-30)	7	4	5	5	12	9
Middle-Aged (40-50)	5	7	9	2	14	9
Older (60-70)	7	5	5	6	12	11
Overall	19	16	19	13	38	29

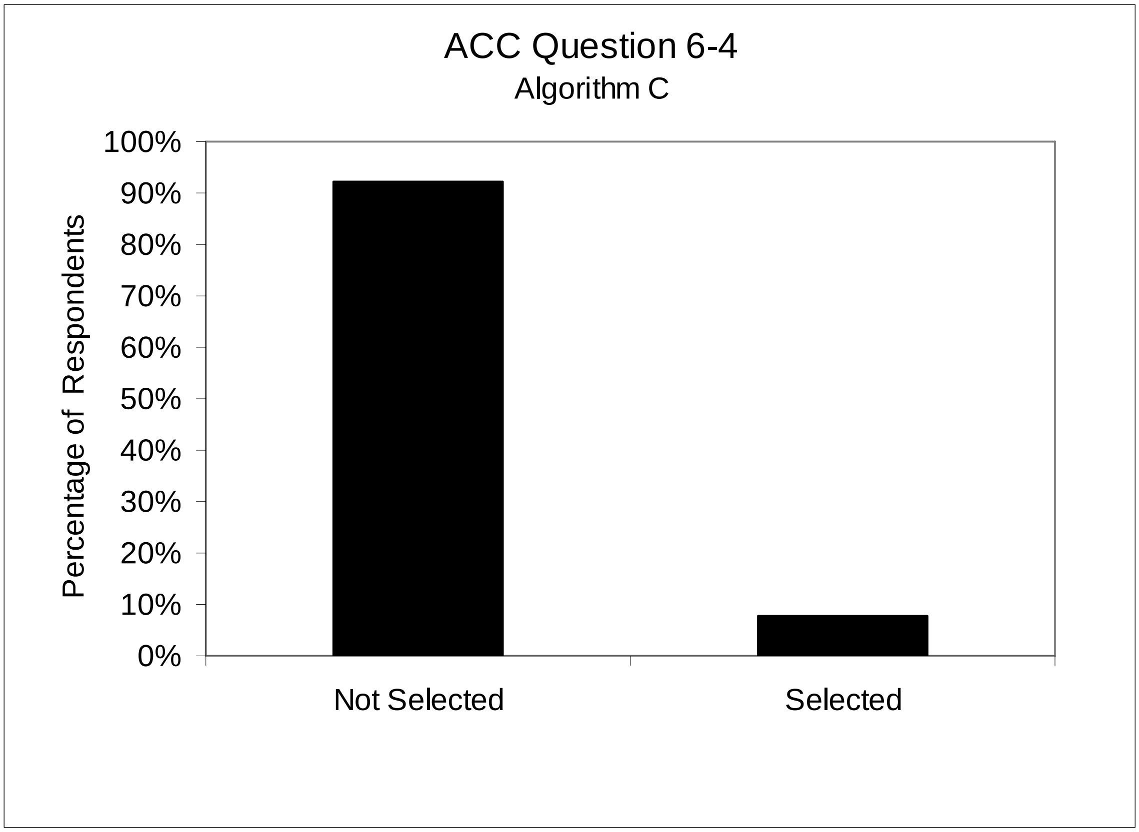
Values in cells represent the frequency of response for each indicated demographic division



6-3 Whether I was in rush

	Males		Females		Overall	
	No	Yes	No	Yes	No	Yes
Younger (20-30)	7	4	7	3	14	7
Middle-Aged (40-50)	10	2	10	1	20	3
Older (60-70)	10	0	11	0	21	0
Overall	27	6	28	4	55	10

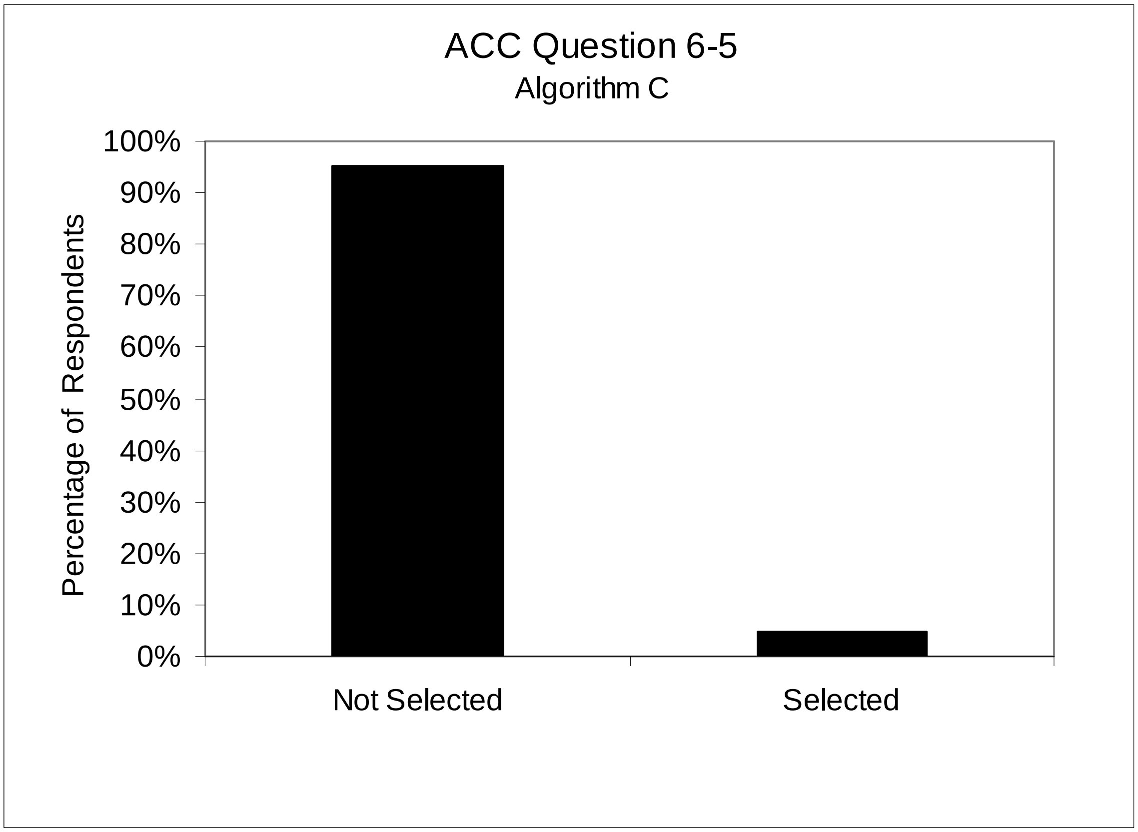
Values in cells represent the frequency of response for each indicated demographic division



6-4 Whether I was tired

	Males		Females		Overall	
	No	Yes	No	Yes	No	Yes
Younger (20-30)	10	1	8	2	18	3
Middle-Aged (40-50)	10	2	11	0	21	2
Older (60-70)	10	0	11	0	21	0
Overall	30	3	30	2	60	5

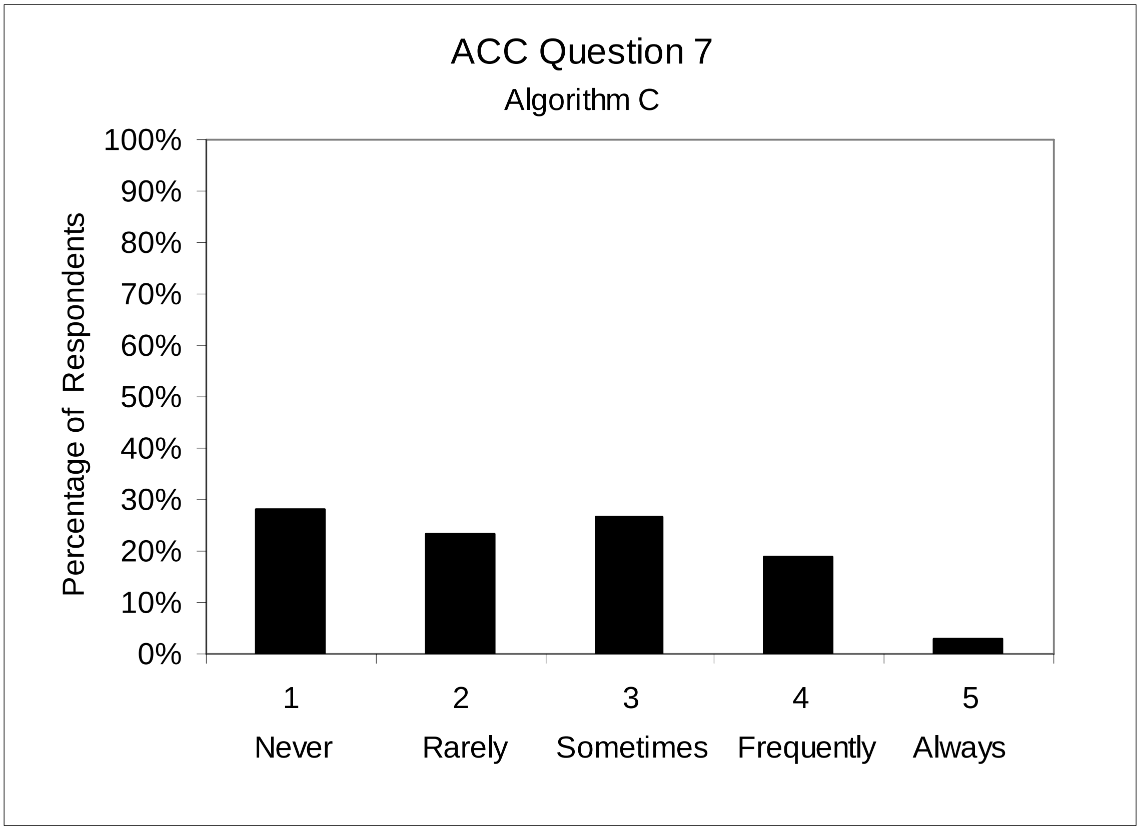
Values in cells represent the frequency of response for each indicated demographic division



6-5 Whether I felt alert

	Males		Females		Overall	
	No	Yes	No	Yes	No	Yes
Younger (20-30)	11	0	10	0	21	0
Middle-Aged (40-50)	11	1	10	1	21	2
Older (60-70)	9	1	11	0	20	1
Overall	31	2	31	1	62	3

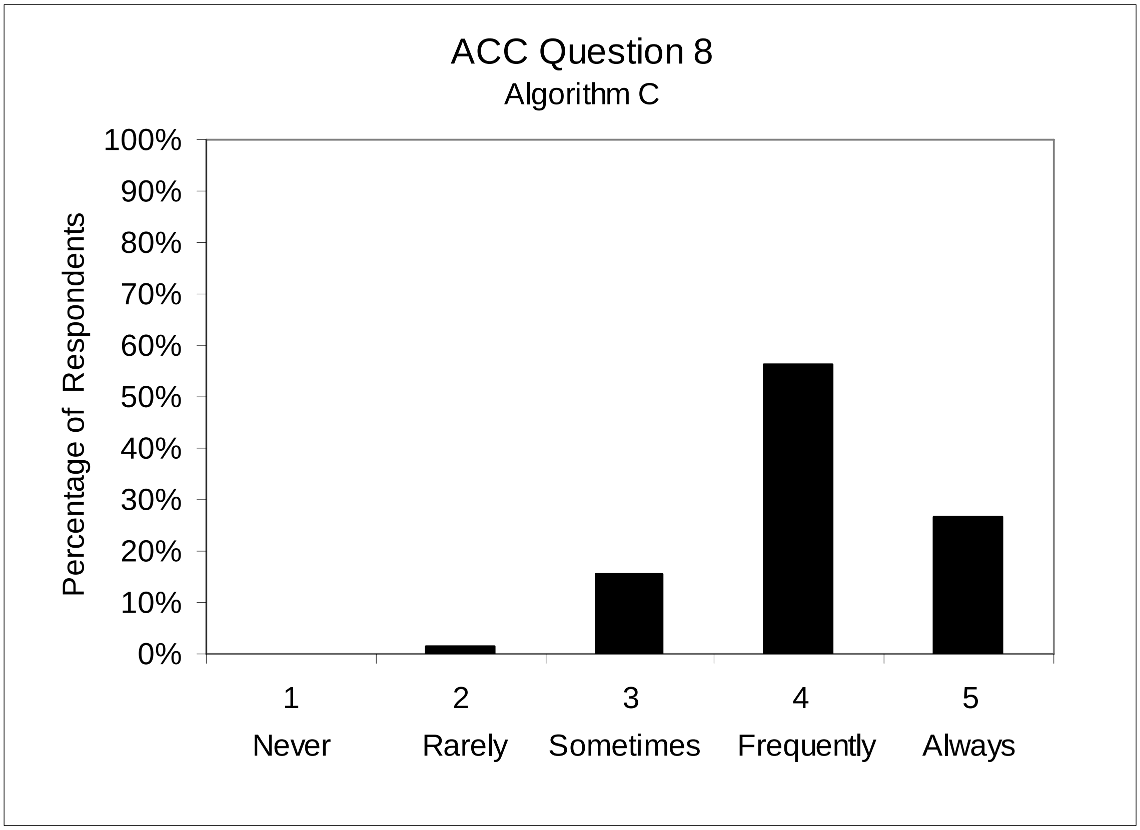
Values in cells represent the frequency of response for each indicated demographic division



7. How often did you use ACC at speeds below 55 mph? (check one)

	Males	Females	Overall
Younger (20-30)	2.9 (1.0)	1.6 (1.1)	2.3 (1.2)
Middle-Aged (40-50)	2.7 (1.1)	1.9 (0.9)	2.3 (1.1)
Older (60-70)	3.2 (1.3)	2.4 (1.0)	2.8 (1.2)
Overall	2.9 (1.1)	2.0 (1.0)	2.5 (1.2)

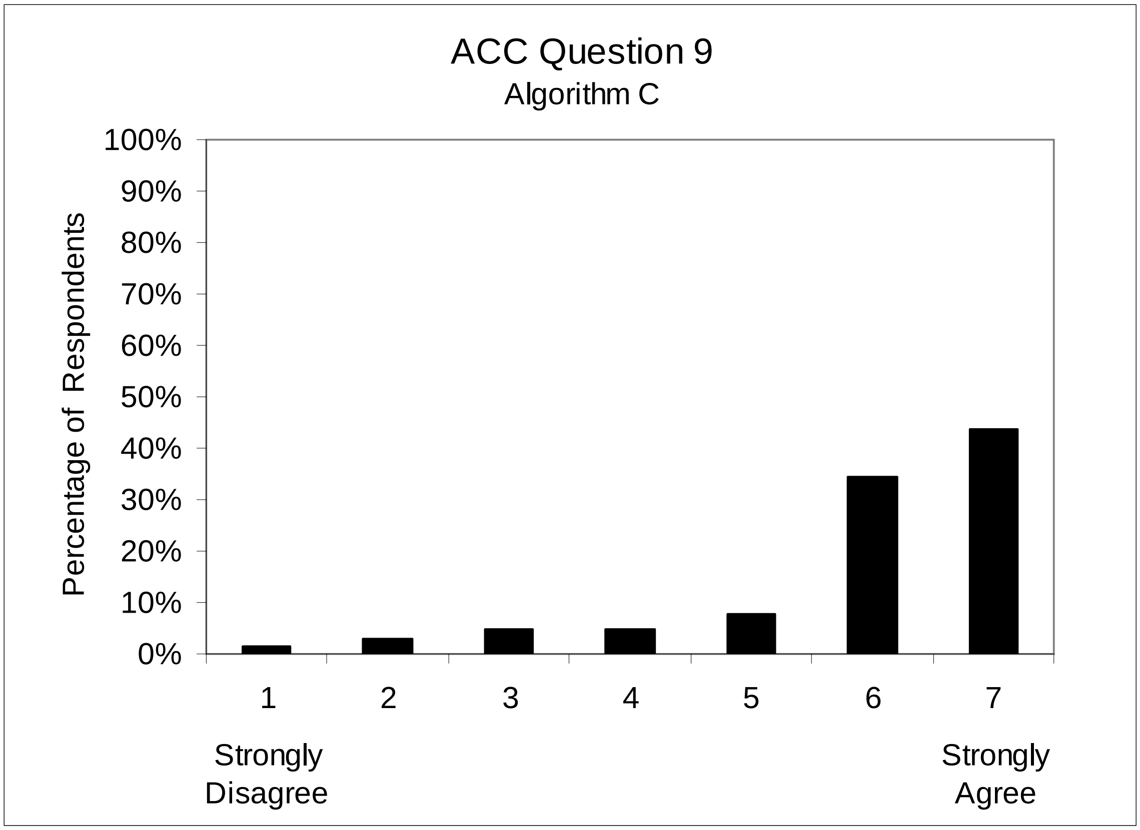
Values in cells represent the mean response and (standard deviation)



8. How often did you use ACC on the interstate (at speeds of 55 mph or more)? (check one)

	Males		Females		Overall	
Younger (20-30)	4.3	(0.5)	3.8	(0.9)	4.1	(0.8)
Middle-Aged (40-50)	3.9	(0.7)	3.7	(0.8)	3.8	(0.7)
Older (60-70)	4.5	(0.5)	4.3	(0.5)	4.4	(0.5)
Overall	4.2	(0.6)	3.9	(0.8)	4.1	(0.7)

Values in cells represent the mean response and (standard deviation)

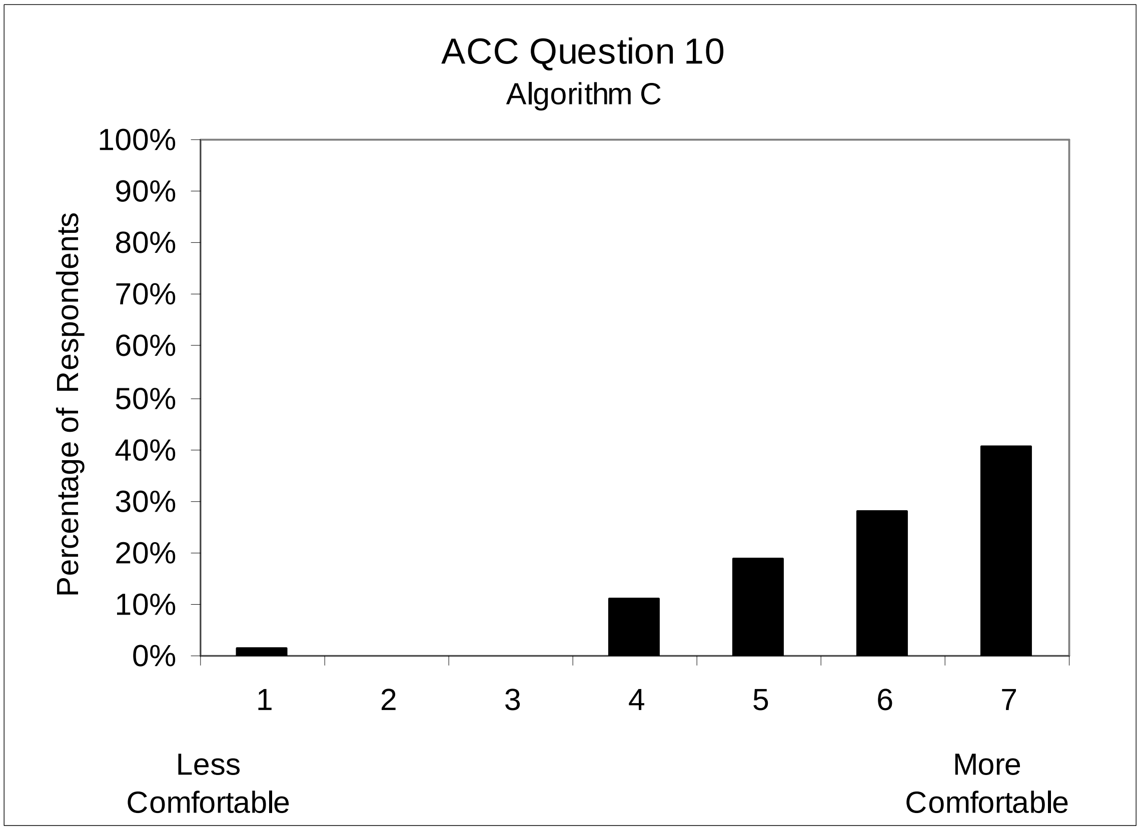


9. Overall, I felt the operation of the ACC system was predictable.

*	Males		Females		Overall	
Younger (20-30)[1]	6.0	(1.2)	4.6	(2.0)	5.3	(1.8)
Middle-Aged (40-50)	5.9	(1.3)	6.0	(0.9)	6.0	(1.1)
Older (60-70)[1]	6.5	(0.7)	6.4	(1.6)	6.5	(1.2)
Overall	6.2	(1.1)	5.7	(1.7)	5.9	(1.4)

Values in cells represent the mean response and (standard deviation)

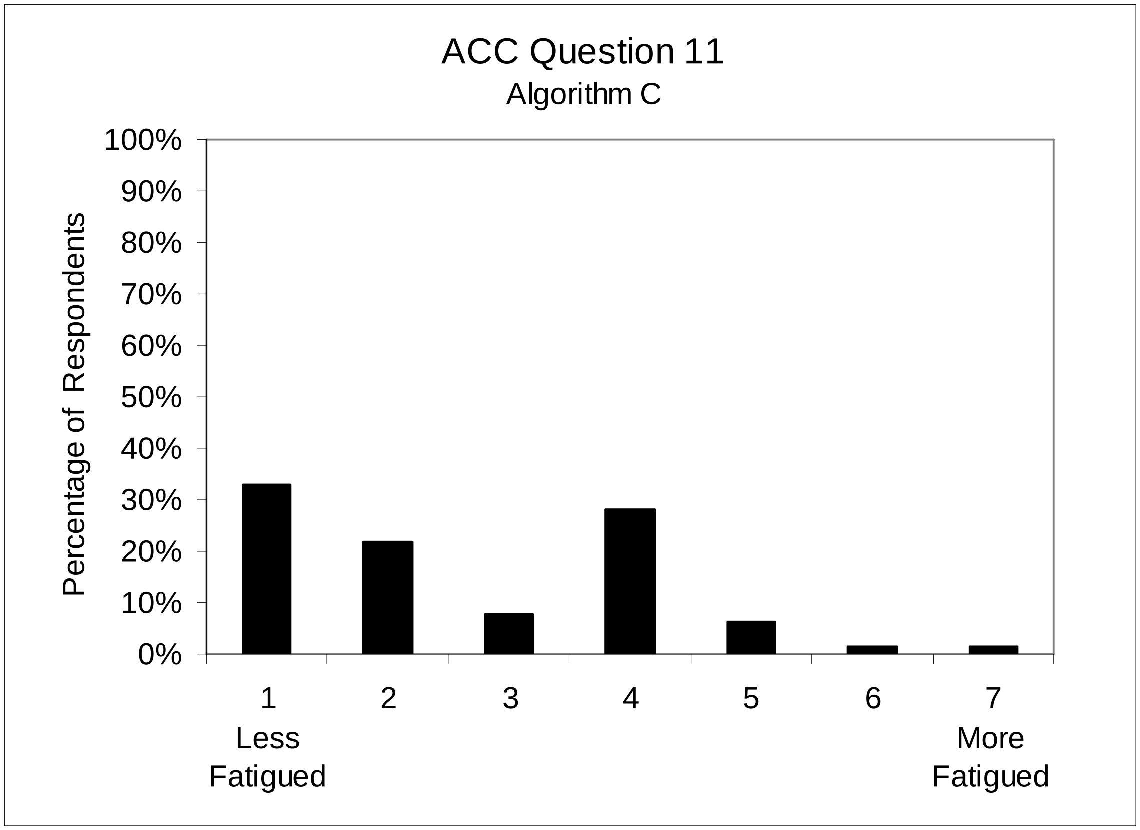
* = Significant difference associated with participant age, $H(2) = 8.769$, $p = .012$



10. In comparison to driving manually, how <u>comfortable</u> were you physically (your posture, legs, feet, etc.) when using ACC?

	Males		Females		Overall	
Younger (20-30)	6.2	(1.0)	6.3	(0.8)	6.3	(0.9)
Middle-Aged (40-50)	6.2	(0.8)	4.7	(1.5)	5.5	(1.4)
Older (60-70)	6.0	(1.1)	6.2	(1.3)	6.1	(1.2)
Overall	6.1	(0.9)	5.7	(1.4)	5.9	(1.2)

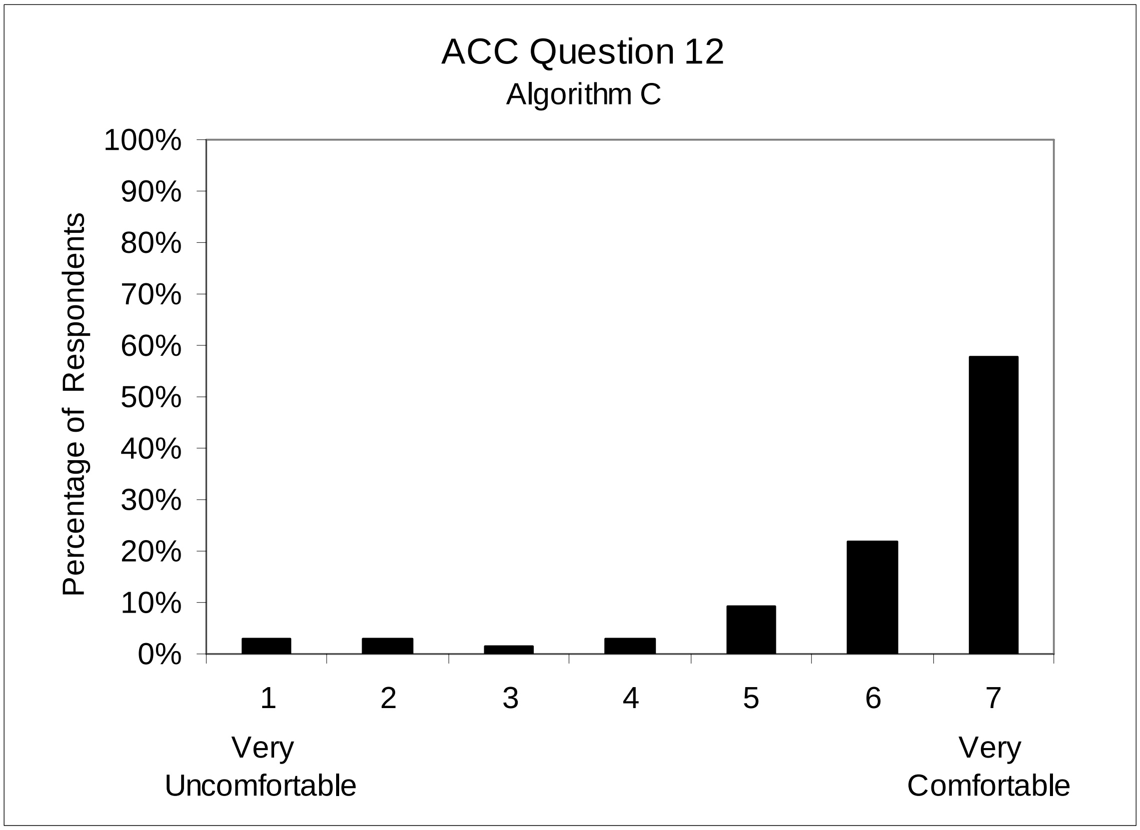
Values in cells represent the mean response and (standard deviation)



11. In comparison to driving manually, how <u>fatigued</u> were you when using ACC?

	Males		Females		Overall	
Younger (20-30)	3.0	(1.6)	2.7	(1.3)	2.9	(1.4)
Middle-Aged (40-50)	2.4	(1.3)	3.6	(1.6)	3.0	(1.6)
Older (60-70)	1.7	(1.0)	2.5	(1.9)	2.1	(1.5)
Overall	2.3	(1.4)	2.9	(1.7)	2.6	(1.5)

Values in cells represent the mean response and (standard deviation)



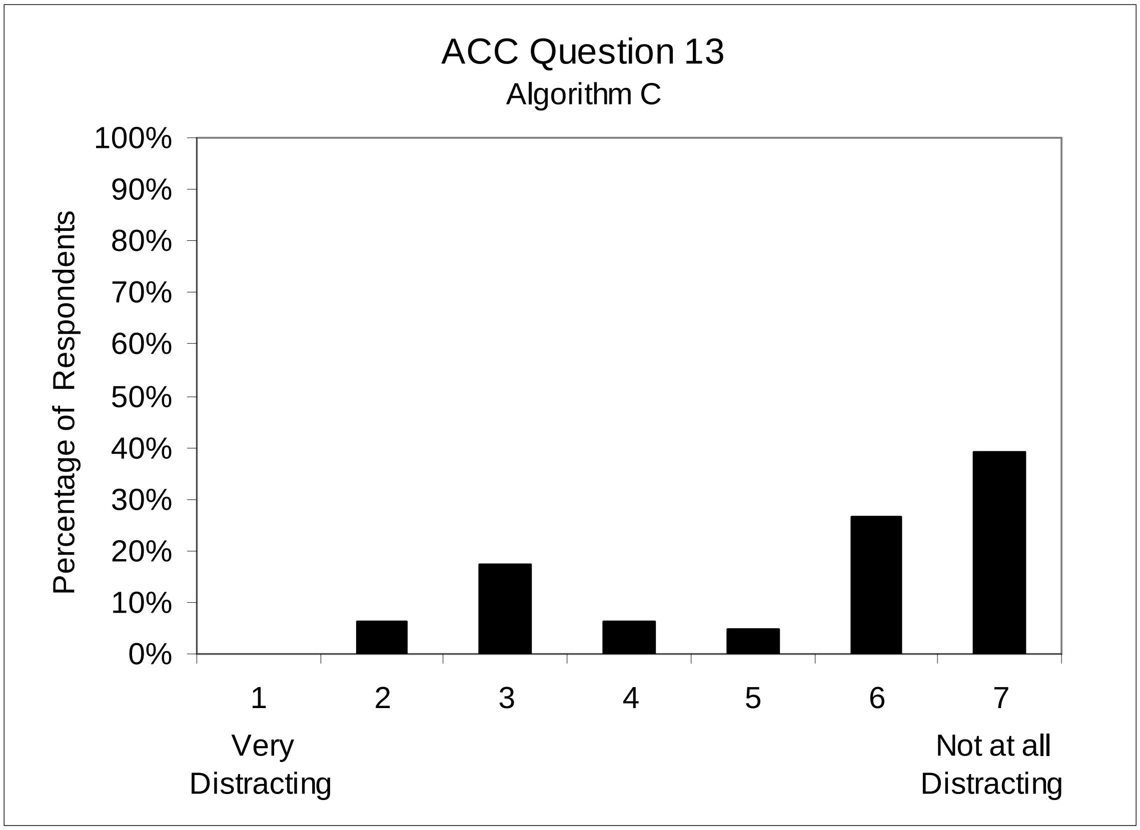
12. How <u>comfortable</u> would you feel if your child, spouse, parents–or other loved ones–drove a vehicle equipped with ACC?

*†	Males		Females		Overall	
Younger (20-30)	6.0	(1.9)	5.9	(1.6)	6.0	(1.7)
Middle-Aged (40-50)[1]	5.3	(2.1)	5.9	(1.1)	5.6	(1.7)
Older (60-70)[1]	6.9	(0.3)	6.5	(1.0)	6.7	(0.8)
Overall	6.1	(1.7)	6.1	(1.3)	6.1	(1.5)

Values in cells represent the mean response and (standard deviation)

* = Significant difference associated with participant age, $H(2) = 11.301$, $p = .004$

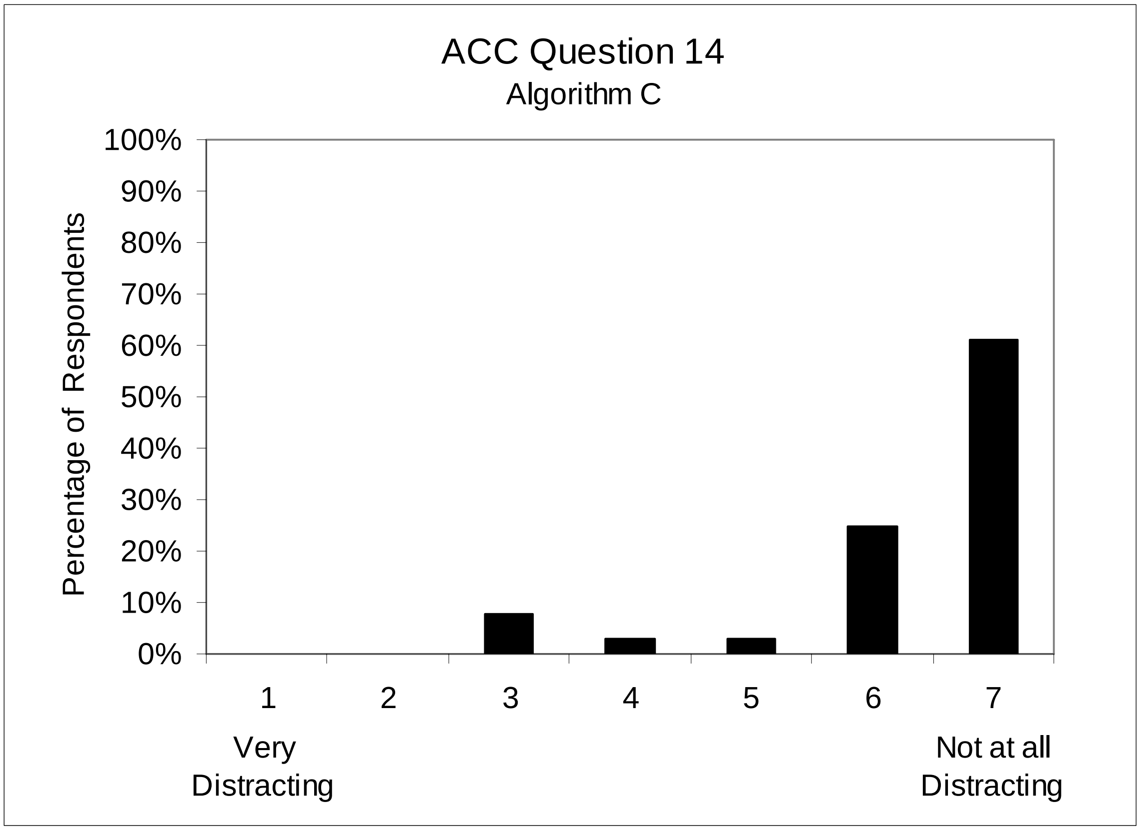
† = Significant difference associated with the interaction of participant age and gender, $H(5) = 11.965$, $p = .035$



13. How <u>distracting</u> did you find the ACC system operation (e.g., automatic acceleration and deceleration or warnings)?

	Males		Females		Overall	
Younger (20-30)	5.3	(1.8)	4.5	(2.1)	4.9	(1.9)
Middle-Aged (40-50)	5.2	(1.6)	5.3	(1.8)	5.2	(1.7)
Older (60-70)	6.2	(1.3)	6.2	(1.5)	6.2	(1.4)
Overall	5.6	(1.6)	5.3	(1.9)	5.5	(1.7)

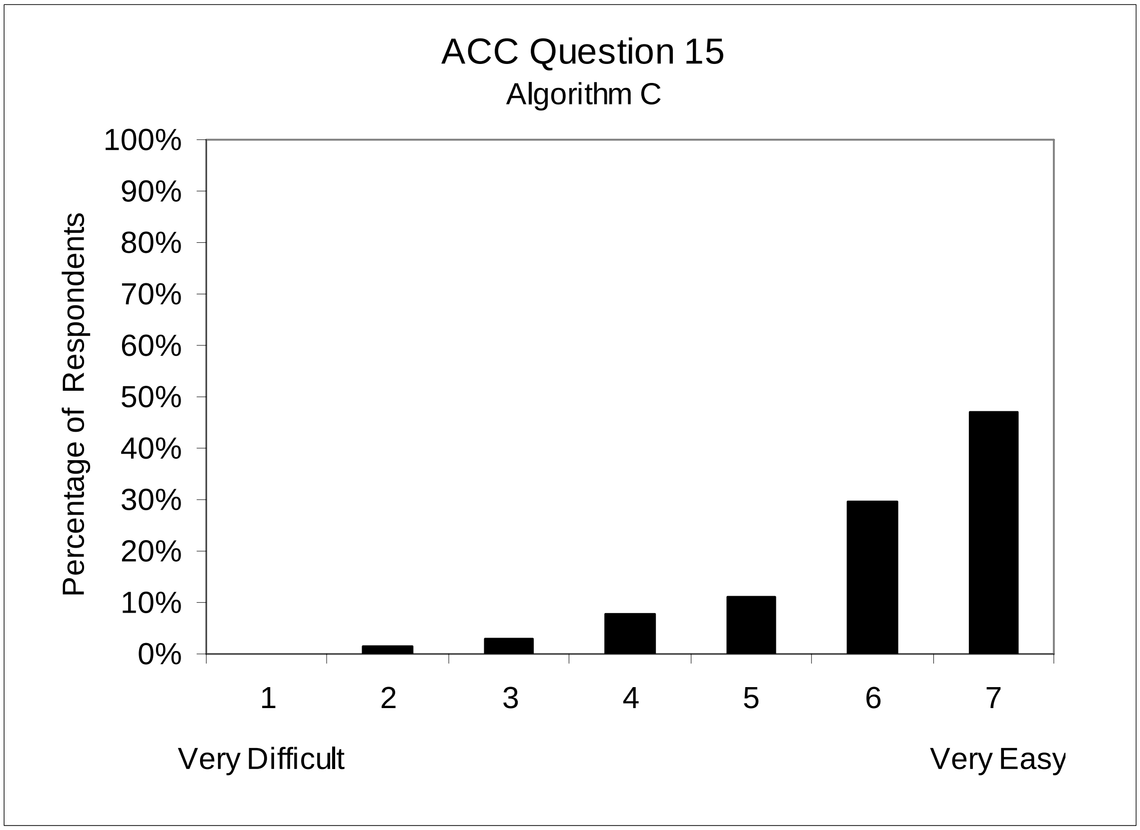
Values in cells represent the mean response and (standard deviation)



14. How distracting did you find the ACC system components (e.g., displays or control buttons)?

	Males		Females		Overall	
Younger (20-30)	6.3	(1.3)	6.3	(1.3)	6.3	(1.2)
Middle-Aged (40-50)	6.5	(1.0)	5.7	(1.5)	6.1	(1.3)
Older (60-70)	6.7	(0.5)	6.2	(1.4)	6.5	(1.1)
Overall	6.5	(1.0)	6.1	(1.4)	6.3	(1.2)

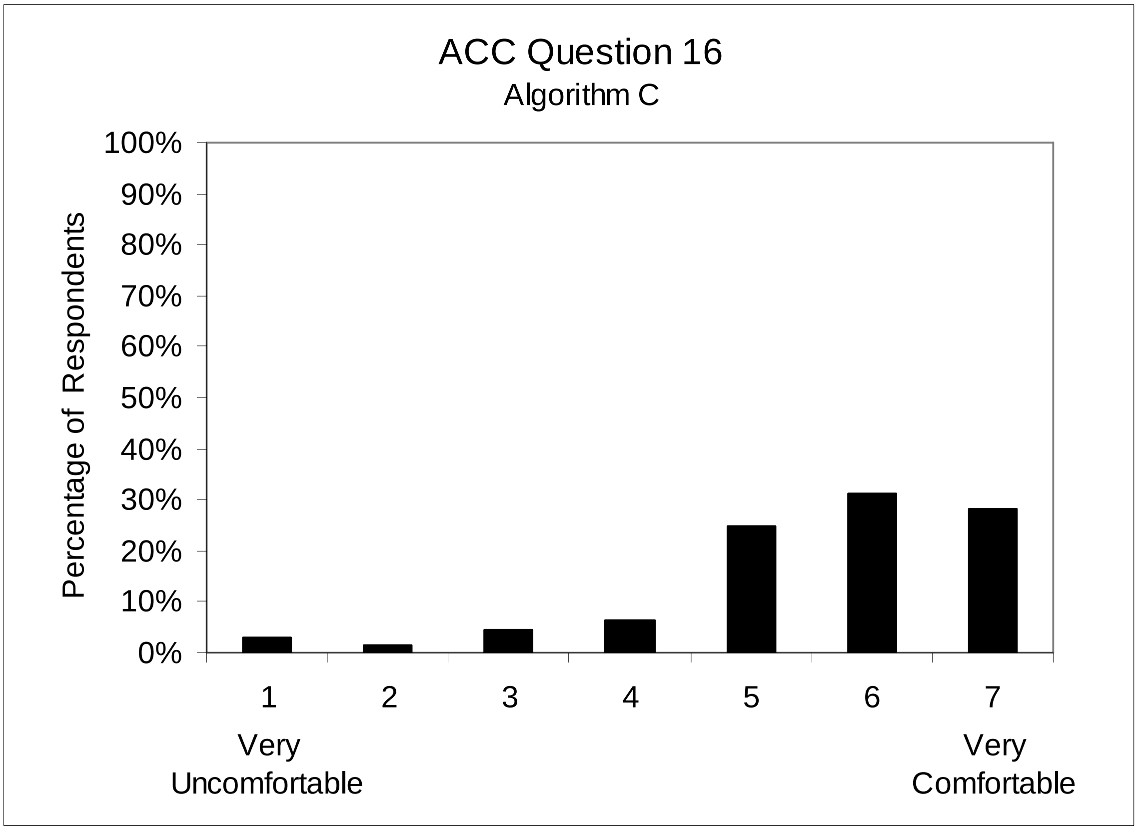
Values in cells represent the mean response and (standard deviation)



15. How <u>easy or difficult</u> do you feel it will be to market a vehicle equipped with ACC?

	Males		Females		Overall	
Younger (20-30)	6.4	(1.0)	6.1	(1.1)	6.3	(1.0)
Middle-Aged (40-50)	5.6	(1.5)	5.8	(1.6)	5.7	(1.5)
Older (60-70)	6.5	(0.7)	5.8	(1.1)	6.2	(1.0)
Overall	6.2	(1.1)	5.9	(1.3)	6.0	(1.2)

Values in cells represent the mean response and (standard deviation)

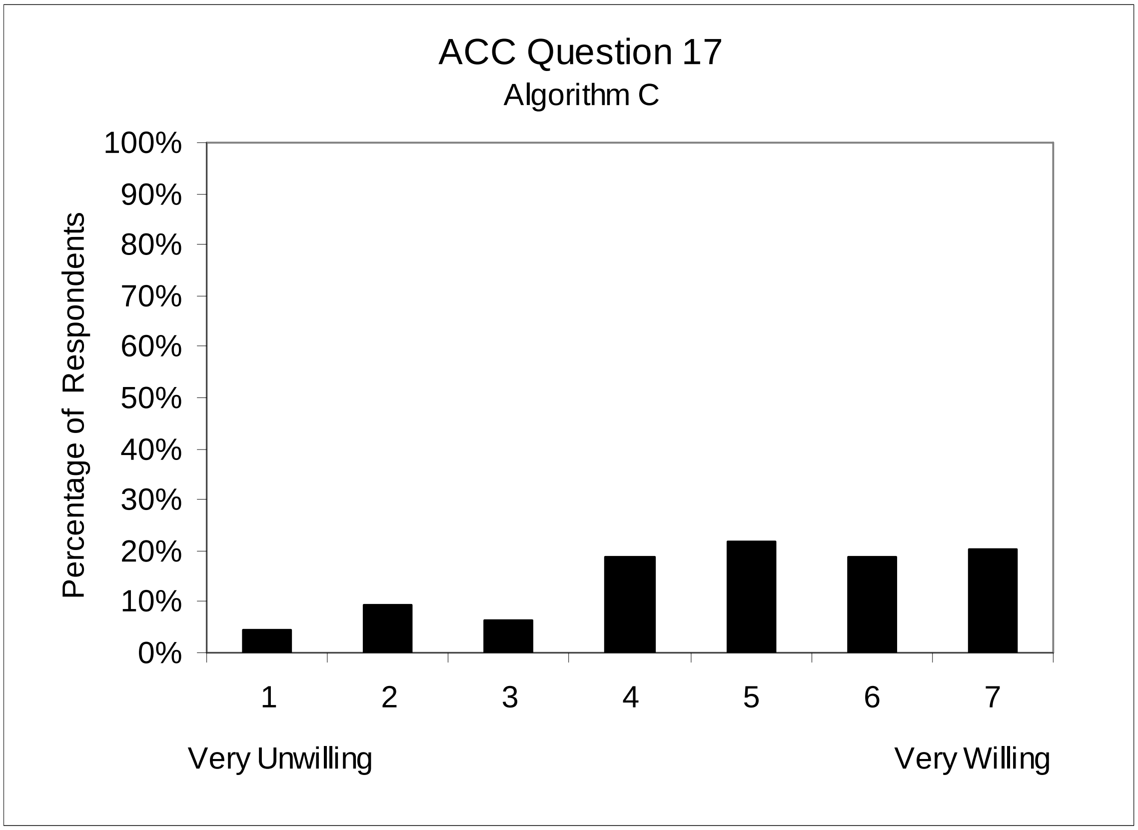


16. How <u>comfortable</u> did you feel having ACC slow your vehicle without feeling the need to depress the brake yourself?

*	Males		Females		Overall	
Younger (20-30)	5.5	(1.2)	4.8	(2.1)	5.2	(1.7)
Middle-Aged (40-50)	5.3	(1.7)	5.3	(1.3)	5.3	(1.5)
Older (60-70)	6.4	(0.8)	6.0	(0.9)	6.2	(0.9)
Overall	5.7	(1.3)	5.4	1.5	5.5	(1.4)

Values in cells represent the mean response and (standard deviation)

* = Significant difference associated with participant age, $H(2) = 6.120$, $p = .047$

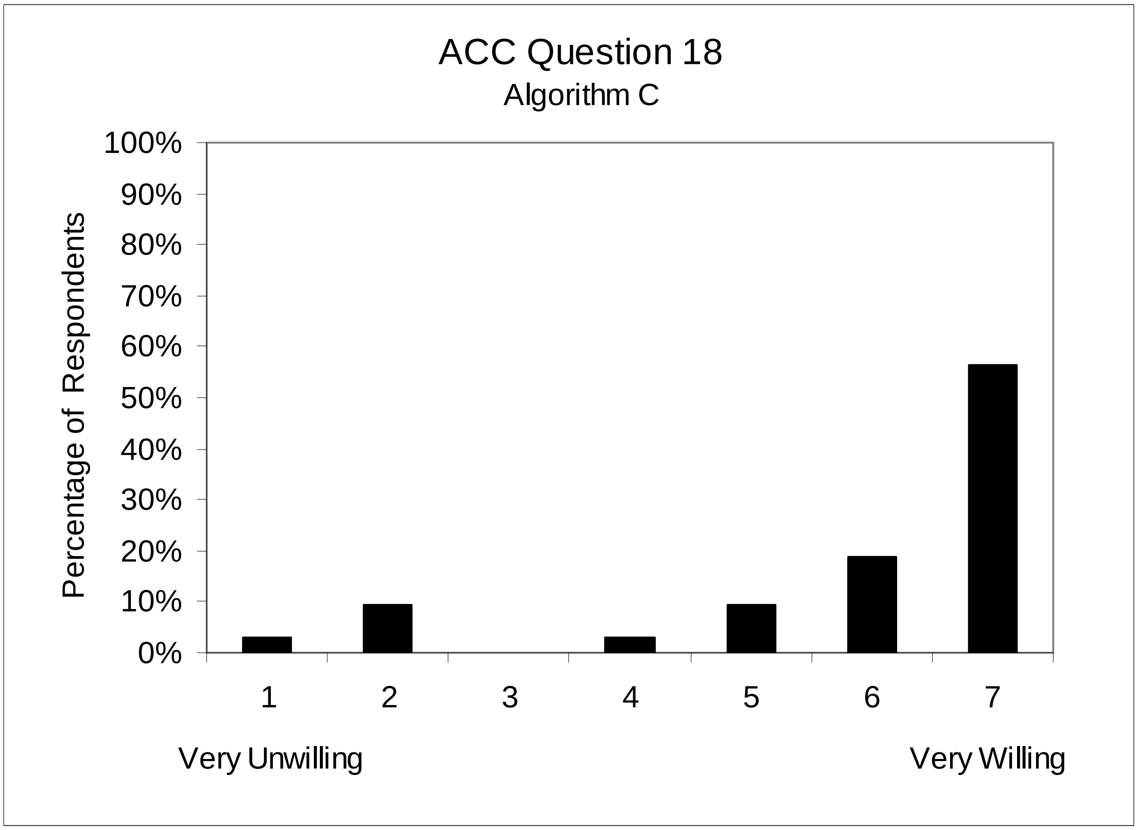


17. How willing are you to use ACC in varying traffic conditions?

*	Males		Females		Overall	
Younger (20-30)	4.9	(1.5)	4.2	(2.1)	4.6	(1.8)
Middle-Aged (40-50)[1]	4.6	(1.6)	3.8	(1.8)	4.2	(1.7)
Older (60-70)[1]	5.9	(1.0)	5.4	(1.7)	5.6	(1.4)
Overall	5.2	(1.5)	4.5	(1.9)	4.8	(1.7)

Values in cells represent the mean response and (standard deviation)

* = Significant difference associated with participant age, $H(2) = 8.330$, $p = .016$

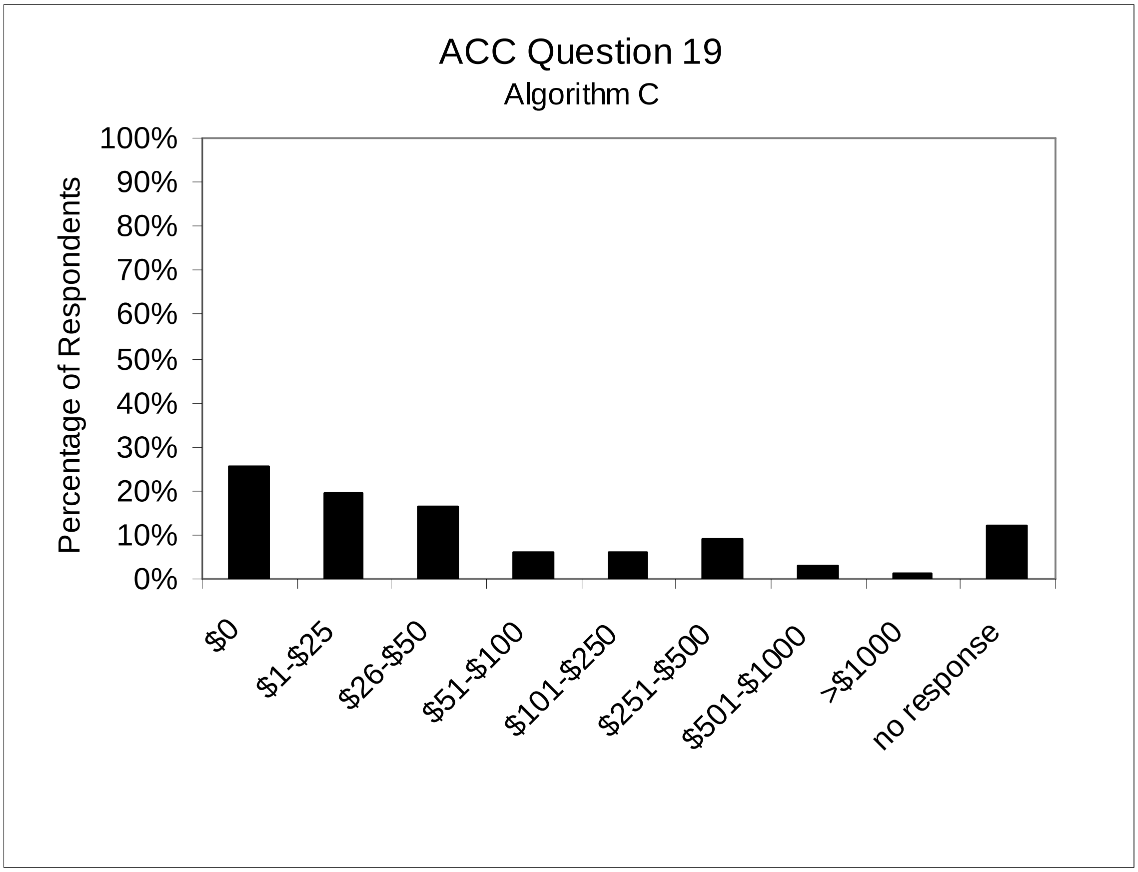


18. Would you be willing to rent a vehicle equipped with ACC?

*	Males		Females		Overall	
Younger (20-30)	6.4	(0.8)	5.5	(1.6)	6.0	(1.3)
Middle-Aged (40-50)	5.4	(2.4)	5.2	(2.1)	5.3	(2.2)
Older (60-70)	6.9	(0.3)	5.9	(2.0)	6.4	(1.5)
Overall	6.2	(1.6)	5.5	(1.9)	5.9	(1.8)

Values in cells represent the mean response and (standard deviation)

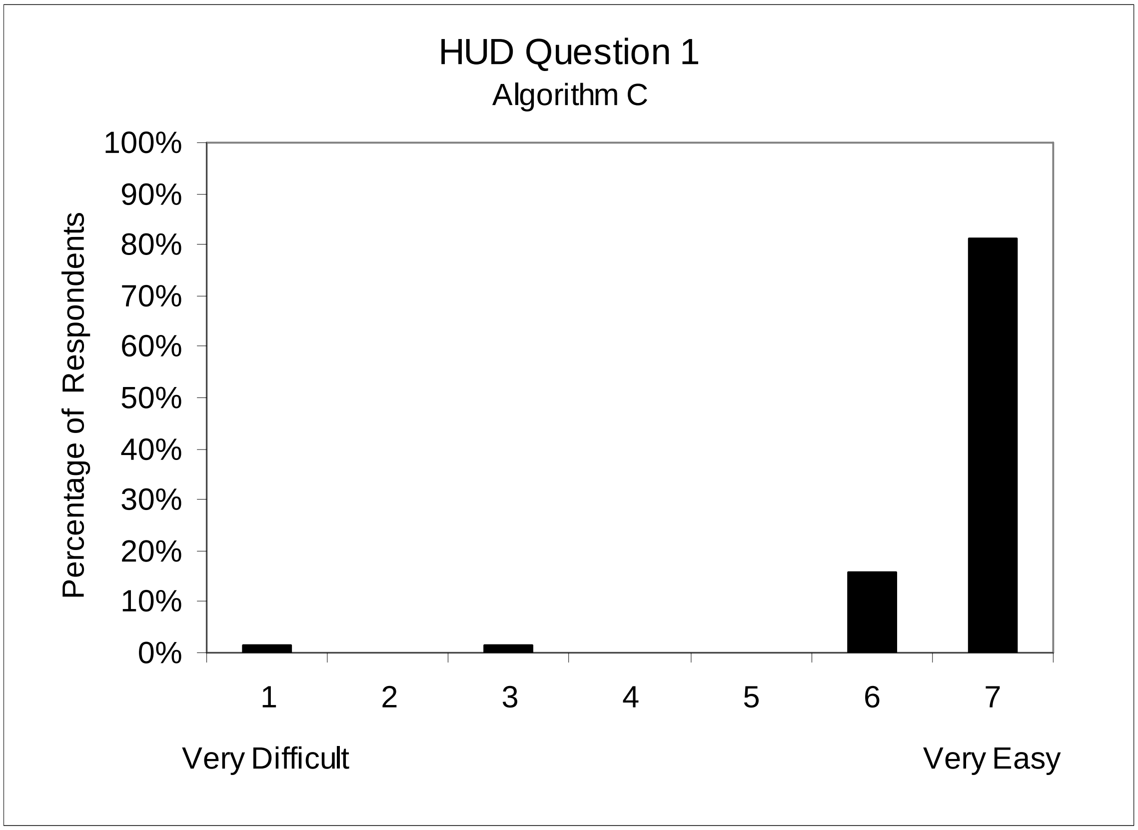
* = Significant difference associated with participant age, $H(2) = 7.152$, $p = .028$



19. Approximately, how much would you be willing to spend to rent a vehicle equipped with ACC? (free responses given in dollars and grouped for analysis)

	Males		Females		Overall	
Younger (20-30)	79.5	(150.3)	105.0	(148.9)	92.3	(146.2)
Middle-Aged (40-50)	52.1	(109.7)	193.5	(302.9)	126.2	(237.8)
Older (60-70)	380.0	(694.7)	16.9	(22.8)	209.1	(525.8)
Overall	163.3	(413.5)	114.3	(212.7)	138.8	(326.9)

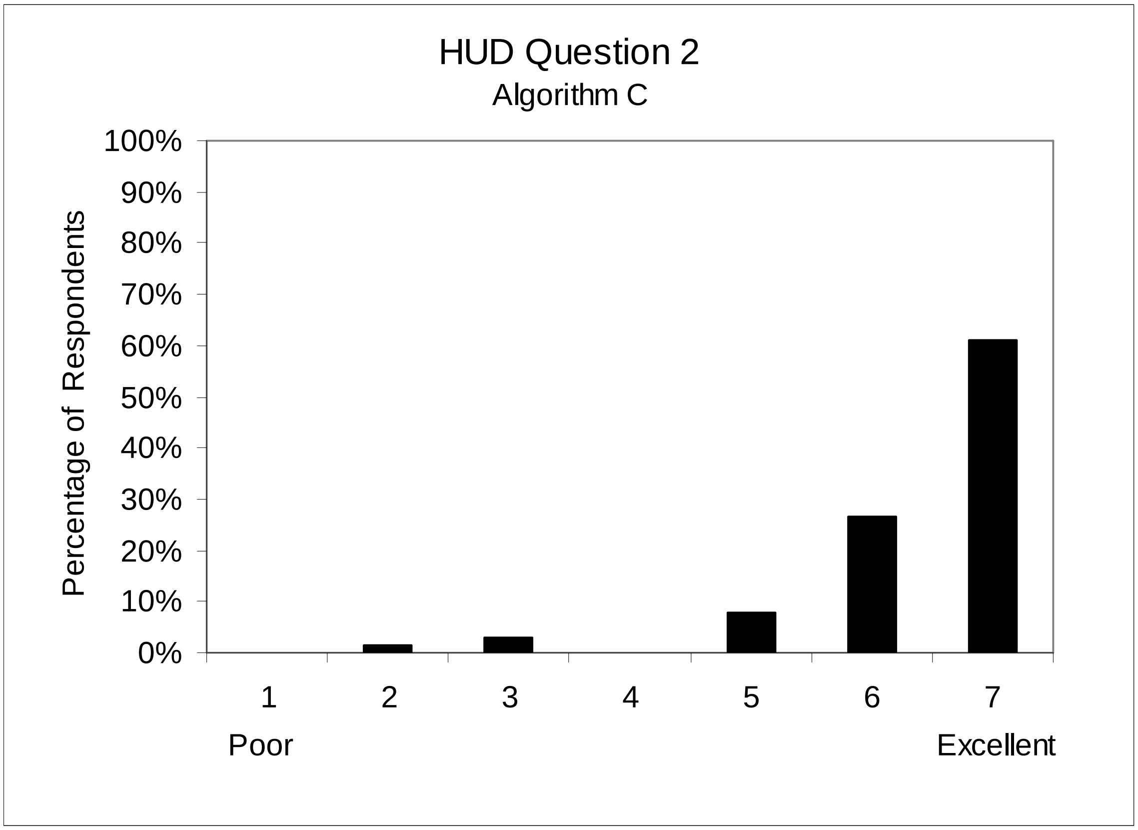
Values in cells represent the mean response and (standard deviation)



1. Overall, how easy was it to see all the information shown on the head-up display (HUD)?

	Males		Females		Overall	
Younger (20-30)	6.5	(1.2)	6.8	(0.4)	6.5	(1.4)
Middle-Aged (40-50)	6.8	(0.4)	6.9	(0.3)	6.7	(0.9)
Older (60-70)	6.2	(1.9)	6.8	(0.4)	6.9	(0.4)
Overall	6.5	(1.3)	6.8	(0.4)	6.6	(0.9)

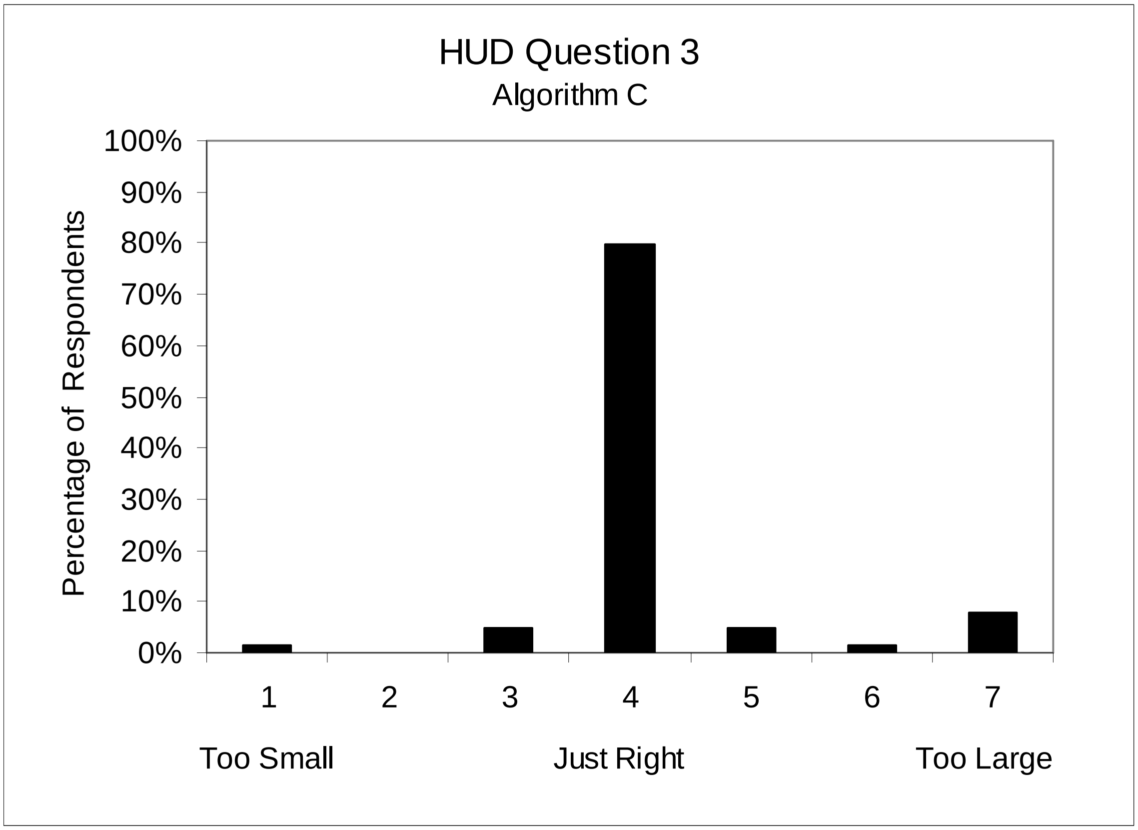
Values in cells represent the mean response and (standard deviation)



2. Overall, how would you rate the <u>location</u> of the information shown on the HUD?

	Males		Females		Overall	
Younger (20-30)	6.4	(1.2)	6.1	(0.8)	6.1	(1.4)
Middle-Aged (40-50)	6.9	(0.3)	6.7	(0.6)	6.2	(1.0)
Older (60-70)	6.0	(1.6)	6.1	(1.2)	6.8	(0.5)
Overall	6.4	(1.2)	6.3	(0.9)	6.2	(1.0)

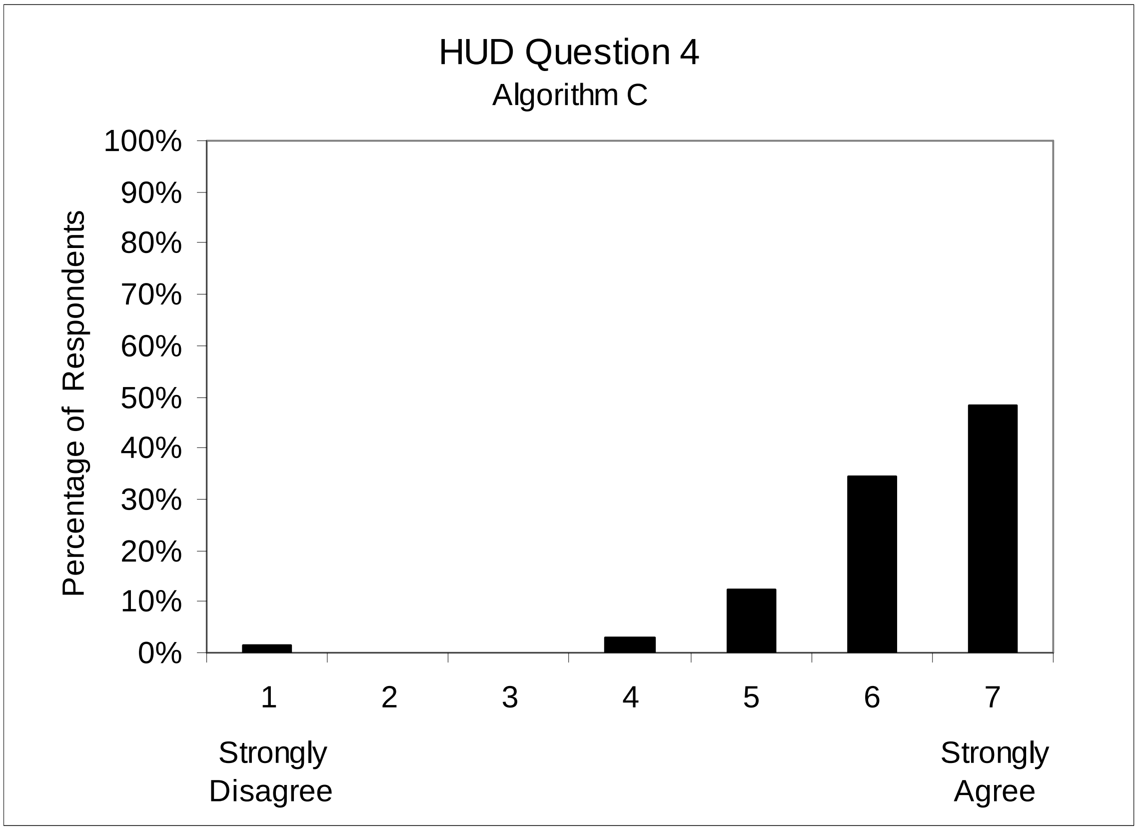
Values in cells represent the mean response and (standard deviation)



3. Overall, how would you rate the <u>size</u> of the information shown on the HUD?

	Males		Females		Overall	
Younger (20-30)	4.2	(1.0)	4.7	(1.2)	4.1	(0.8)
Middle-Aged (40-50)	4.3	(0.6)	4.0	(1.3)	4.5	(1.1)
Older (60-70)	3.9	(0.3)	4.2	(1.0)	4.1	(1.0)
Overall	4.1	(0.7)	4.3	(1.2)	4.3	(1.0)

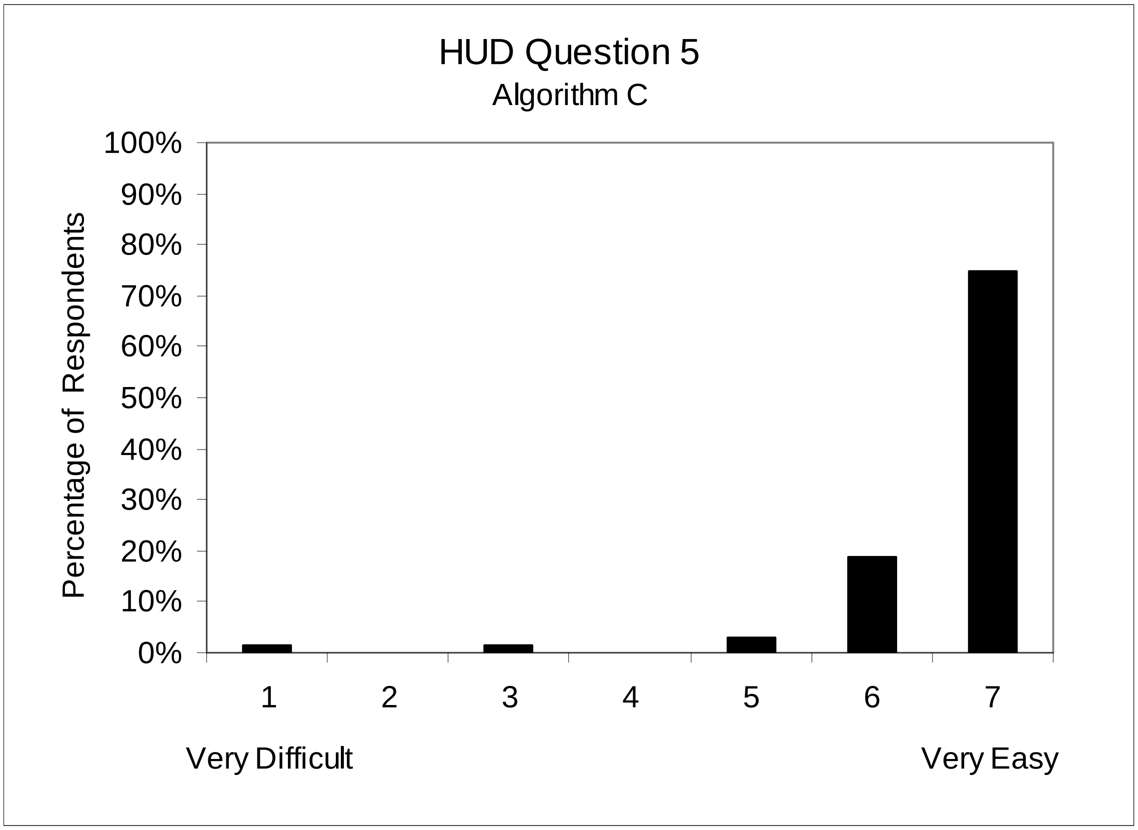
Values in cells represent the mean response and (standard deviation)



4. Do you think that the use of color improved your understanding of the FCW information presented in the HUD?

	Males		Females		Overall	
Younger (20-30)	6.3	(1.0)	6.3	(0.6)	6.2	(0.9)
Middle-Aged (40-50)	6.5	(0.5)	6.0	(1.8)	6.3	(0.8)
Older (60-70)	6.2	(0.8)	6.1	(1.1)	6.2	(1.3)
Overall	6.3	(0.8)	6.1	(1.3)	6.1	(1.0)

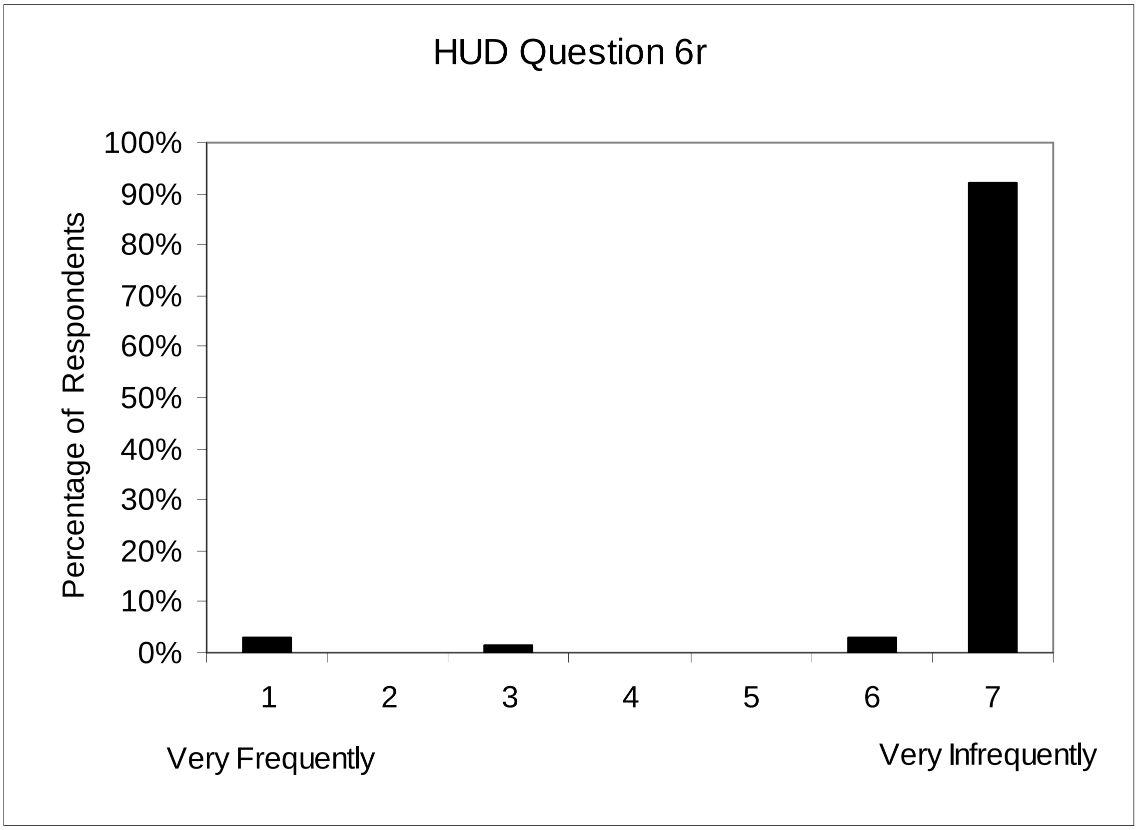
Values in cells represent the mean response and (standard deviation)



5. How easy was it to see the entire HUD while in your seated position?

	Males		Females		Overall	
Younger (20-30)	6.4	(1.2)	6.6	(0.5)	6.4	(1.4)
Middle-Aged (40-50)	6.9	(0.3)	6.8	(0.6)	6.5	(0.9)
Older (60-70)	6.1	(1.9)	6.7	(0.7)	6.9	(0.5)
Overall	6.5	(1.3)	6.7	(0.6)	6.5	(1.0)

Values in cells represent the mean response and (standard deviation)



6. Did you ever intentionally adjust the location of the HUD in such a way that you could not see all of the information displayed, and drove with the display in that position for an extended period.

	Males		Females		Overall	
Younger (20-30)	7.0	0.0	5.9	(2.4)	6.8	(0.9)
Middle-Aged (40-50)	7.0	0.0	6.9	(0.3)	6.5	(1.8)
Older (60-70)	7.0	0.0	6.5	(1.3)	7.0	(0.2)
Overall	7.0	0.0	6.4	(1.6)	6.6	(1.2)

Values in cells represent the mean response and (standard deviation)

APPENDIX G

DRIVER CHARACTERISTICS AND BIOGRAPHICAL DATA

DriverID	Gender	Date of Release	Age	AgeGroup	ZipCode	MedianIncomeHouseholds	MedianIncomeFamilies	PerCapIncome
1	F	3/20/2003	25	Y	48198	41,048	47,308	20,977
2	F	3/20/2003	21	Y	48135	52,264	58,635	21,564
3	M	3/27/2003	41	M	48103	61,809	80,468	32,957
4	F	3/28/2003	44	M	48108	49,882	65,257	29,290
5	M	4/4/2003	68	O	48103	61,809	80,468	32,957
6	M	4/4/2003	29	Y	48334	63,927	81,223	34,055
7	F	4/11/2003	66	O	49202	31,695	39,536	16,951
8	F	4/11/2003	29	Y	48204	25,449	29,174	13,381
9	M	4/17/2003	62	O	33919	43,027	53,324	30,171
10	M	4/17/2003	69	O	48036	44,886	55,716	25,490
11	M	4/17/2003	63	O	49253	50,057	64,630	23,227
12	F	4/24/2003	42	M	48108	49,882	65,257	29,290
13	M	4/24/2003	45	M	48103	61,809	80,468	32,957
14	F	5/2/2003	49	M	48239	49,556	56,856	22,892
15	F	5/2/2003	30	Y	48066	41,171	49,118	19,904
16	M	5/15/2003	45	M	48158	61,117	69,199	26,979
17	F	5/16/2003	25	Y	48047	62,348	71,424	26,256
18	M	5/16/2006	21	Y	48316	76,718	86,557	32,643
19	M	5/22/2003	62	O	48176	77,274	86,934	30,159
20	M	5/23/2003	66	O	48124	55,632	67,860	28,454
21	F	5/30/2003	65	O	48328	47,917	57,274	24,992
22	F	5/30/2003	46	M	48178	67,463	79,842	29,688
23	F	5/30/2003	42	M	48198	41,048	47,308	20,977
24	M	6/12/2003	26	Y	48331	97,089	109,185	43,625

DriverID	Gender	Date of Release	Age	AgeGroup	ZipCode	MedianIncomeHouseholds	MedianIncomeFamilies	PerCapIncome
25	F	6/12/2003	68	O	48192	45,525	56,106	22,945
26	F	6/19/2003	62	O	49290	56,730	62,500	23,069
27	M	6/19/2003	30	Y	48152	62,103	75,737	29,101
28	F	6/27/2003	43	M	48313	63,197	72,944	25,440
29	F	7/2/2003	25	Y	48340	31,342	36,615	15,450
30	M	7/2/2003	46	M	48219	39,300	45,610	17,696
31	M	7/3/2003	25	Y	49201	47,044	54,146	20,905
32	F	7/3/2003	29	Y	48195	46,927	56,710	23,219
33	M	7/10/2003	69	O	48080	44,538	57,954	24,905
34	F	7/11/2003	43	M	48204	25,449	29,174	13,381
35	M	7/17/2003	66	O	48192	45,525	56,106	22,945
36	F	7/17/2003	68	O	48116	69,968	82,851	31,880
37	F	7/24/2003	64	O	48302	112,099	138,188	71,985
38	M	7/24/2003	65	O	48230	81,161	104,331	45,935
39	M	7/24/2003	68	O	49233	42,198	45,278	24,514
40	M	7/31/2003	61	O	48430	60,463	72,355	27,863
41	F	7/31/2003	48	M	48235	40,041	46,903	18,936
42	F	7/31/2003	66	O	48152	62,103	75,737	29,101
43	F	8/7/2003	44	M	48043	37,884	50,650	21,787
44	F	8/8/2003	44	M	48226	29,770	42,292	21,272
45	F	8/14/2003	29	Y	48228	31,787	33,698	14,640
46	F	8/28/2003	29	Y	49221	41,924	49,054	18,471
47	M	8/28/2003	47	M	48169	67,593	71,499	27,225
48	M	8/29/2003	47	M	48236	82,567	96,282	45,428

DriverID	Gender	Date of Release	Age	AgeGroup	ZipCode	MedianIncomeHouseholds	MedianIncomeFamilies	PerCapIncome
49	M	8/29/2003	29	Y	48111	50,135	56,996	23,299
50	F	9/4/2003	65	O	49201	47,044	54,146	20,905
51	F	9/5/2003	43	M	48390	60,500	69,181	28,685
52	M	9/5/2003	49	M	48324	89,021	96,568	41,220
53	M	9/11/2003	43	M	48328	47,917	57,274	24,992
54	M	9/12/2003	46	M	48821	58,153	67,148	25,314
55	M	9/19/2003	22	Y	48240	48,131	54,371	20,638
56	M	9/25/2003	25	Y	48341	32,031	39,255	18,448
57	M	9/26/2003	45	M	48348	83,476	89,651	33,096
58	F	9/26/2003	64	O	48045	52,564	67,735	29,808
59	F	9/26/2003	30	Y	48307	62,484	76,424	31,376
60	F	10/3/2003	29	Y	48203	21,659	26,491	12,653
61	F	10/3/2003	46	M	48021	46,839	55,282	20,646
62	M	10/9/2003	64	O	48122	38,037	46,890	19,025
63	F	10/9/2003	50	M	48917	47,468	59,879	25,555
64	F	10/17/2003	68	O	48331	97,089	109,185	43,625
65	F	10/17/2003	44	M	48183	55,045	67,354	25,529
66	M	10/23/2003	25	Y	48309	81,444	95,516	35,876
67	M	10/23/2003	64	O	48072	57,620	66,968	27,507
68	F	10/30/2003	67	O	48213	24,633	26,832	11,300
69	F	10/31/2003	68	O	48911	39,491	43,628	18,554
70	M	10/31/2003	21	Y	48239	49,556	56,856	22,892
71	M	11/6/2003	67	O	48084	67,964	88,754	37,702
72	M	11/6/2003	29	Y	48021	46,839	55,282	20,646

DriverID	Gender	Date of Release	Age	AgeGroup	ZipCode	MedianIncomeHouseholds	MedianIncomeFamilies	PerCapIncome
73	F	11/7/2003	65	O	48067	52,122	67,614	30,851
74	M	11/14/2003	30	Y	48130	73,051	80,321	32,760
75	F	11/14/2003	25	Y	48213	24,633	26,832	11,300
76	F	11/20/2003	30	Y	48840	50,163	66,222	27,396
77	F	11/21/2003	22	Y	48114	78,171	84,631	32,042
78	M	11/26/2003	65	O	48081	53,347	62,310	26,301
79	F	11/26/2003	29	Y	48227	31,760	34,162	14,713
80	F	12/11/2003	30	Y	48204	25,449	29,174	13,381
81	F	12/12/2003	65	O	48382	78,982	85,873	35,995
82	M	12/12/2003	45	M	48212	25,777	29,081	11,968
83	M	12/19/2003	69	O	48170	67,360	87,796	35,899
84	M	12/20/2003	43	M	48359	60,114	70,385	25,746
85	F	12/19/2003	50	M	49265	60,688	69,005	23,876
86	M	12/19/2003	47	M	48336	55,837	72,073	28,888
87	F	1/8/2004	68	O	48167	79,579	98,346	39,885
88	F	1/8/2004	42	M	48035	48,973	57,224	22,881
89	M	1/9/2004	62	O	48442	53,438	60,936	23,046
90	F	1/15/2004	21	Y	48842	49,187	60,859	23,598
91	M	1/16/2004	47	M	48315	72,847	87,210	31,610
92	F	1/16/2004	43	F	48198	41,048	47,308	20,977
93	M	1/23/2004	26	Y	48823	33,153	63,701	23,259
94	M	1/23/2004	30	Y	48917	47,468	59,879	25,555
95	M	1/23/2004	24	Y	48840	50,163	66,222	27,396
96	M	1/30/2004	43	M	48045	52,564	67,735	29,808

DriverID	MaleMedEarnings FullTime	FemaleMedEarnings FullTime	PercPopWith PovertyStatus	PercFamiliesWith PovertyStatus	Occupation	WorkZipCode	TimesAtWork	Education
1	40,000	28,380	13.2	10.5	Hairstylist		T-F: 3:30-8, Sat. 10-5	GED
2	44,574	28,003	4.5	3.4	StayatHomeMum	N/A	N/A	10
3	51,937	37,278	5.5	2.6	Researcher	48105	M-F 7:30-4	Masters
4	47,541	34,196	8.8	5.2	Childcare	48108	7:30am-5:30pm	Bachelors
5	51,937	37,278	5.5	2.6	Psychiatrist	48104	8:45-6-6:45	MD
6	60,824	41,224	4.7	2.2	Contract Adm.	48334	10:30am-8pm	Bachelors
7	31,673	23,728	12.7	9.3	Retired	N/A	N/A	12
8	29,885	24,996	29.5	25.5	Teacher	48221	8:20-3:20	Bachelors
9	39,223	27,283	5.4	3.3	Retired	N/A	N/A	Bachelors
10	45,237	29,917	7.8	6.7	Retired	N/A	N/A	12
11	41,833	27,250	5.5	3.7	Engineer		3/wk	Bachelors
12	47,541	34,196	8.8	5.2	Secretary		7:30am-11:30am	Associates
13	51,937	37,278	5.5	2.6	Engineer	48103	9am	Masters
14	42,340	30,292	5.1	3.6	Accountant			Bachelors
15	40,197	26,243	7.9	6	Office Manager	48092	8am-4pm M-F	Associates
16	50,750	31,208	4.3	2.3	General Manager	48103	9-5pm	Associates
17	50,614	32,017	3.7	2.8	Production	48026	laid off	14
18	66,615	37,348	2.2	1.9	Advertising Mrg	48098	9-5 M-F	12
19	60,978	36,506	3.5	2.7	Professor	48106	varies	Ph.D.
20	51,336	36,236	3.3	1.9	Retired	N/A	N/A	O.D
21	42,452	30,980	6.4	4.9	Retired Office Mrg	N/A	N/A	12
22	60,549	35,272	3.5	2.1	Realtor	48116	varies	12
23	40,000	28,380	13.2	10.5	Admin Asst	48105	7-3	12
24	77,161	49,672	2.3	1.3	Financial Advisor	48182	8:30-5:30	Bachelors

Driver ID	MaleMed Earnings FullTime	FemaleMed Earnings FullTime	PercPopWith PovertyStatus	PercFamilies With PovertyStatus	Occupation	Work ZipCode	TimesAtWork	Education
25	46,079	28,563	5.9	4.3	Retired	N/A	N/A	12
26	47,557	26,979	4.6	3.2	Bus driver		Off for summer	Associates
27	55,373	37,088	3.7	2.3	Oral Surgeon	48152	8am-5pm	DDS
28	52,397	33,566	4.3	3.5	StayatHomeMum	N/A	N/A	12
29	31,505	24,391	19.7	16.1	Support Specialist		6pm-4am	12
30	37,283	30,110	17.5	13.9	Health Center Dir.	48219	9-6 M-F	Bachelors
31	40,759	27,777	7.7	5.2	Sales Manager	11788	M-Sat, 8-7pm	14
32	45,829	28,549	4.6	2.6	Closing Agent		4-7	13
33	46,031	31,571	4.1	2.9	Realtor	48239	9-?	12
34	29,885	24,996	29.5	25.5	Teacher	48223	1-5	post bachelor
35	46,079	28,563	5.9	4.3	Retired supervisor	N/A	N/A	1year of college
36	60,649	32,798	2.3	1.5	Retired	N/A	N/A	high school
37	100,000+	50,504	2.6	1.5	Computer specialist	48341	7:30-2:55	Masters
38	76,227	40,835	3.5	1.9	Consultant	48081	Various: 9-5	Bachelors
39	38,750	24,000	6.2	3.3	Retired GMC	N/A	N/A	12 + Trade school
40	54,172	32,833	4.5	3.2	Retired truck driver	N/A	N/A	10th
41	40,418	30,234	14.6	12.1	Accounting Assistant	48202	7:30am-4pm	1 year college
42	55,373	37,088	3.7	2.3	Aftercare teacher-early childhood	48034	1pm-6, summer: 8:30-1pm	Masters
43	41,050	28,064	14.1	10	Retired regional sales manager	N/A	N/A	1 year college
44	36,446	36,421	23.1	17.5	Registered representative	48226	8-4pm	high school
45	34,328	26,397	22.9	19.6	Operations shift supervisor	48108	5pm-6am	1year of college
46	34,784	24,844	8.9	5.7	Waitress	49221	3-10pm, 4-10pm, 11am-8pm (Sundays)	2 years college
47	52,267	32,276	3.8	2.7	Research tech	48108	7:30am-4:30pm	high school
48	72,115	45,970	2.7	1.9	Sales	48034	7-6	BBA

Driver ID	MaleMed Earnings FullTime	FemaleMed Earnings FullTime	PercPop With PovertyStatus	PercFamilies With PovertyStatus	Occupation	Work Zip Code	TimesAtWork	Education
49	44,247	29,620	7.4	5.4	Job Setter	48111	5am-1:30pm	1 year college
50	40,759	27,777	7.7	5.2	Retired Factory-Farmer	N/A	N/A	high school
51	53,199	32,363	4.4	2.9	Medical technologist	48382	3pm-11:30pm	4yr. University
52	68,629	42,288	2.3	0.9	Director of materials and QA	48034	9:30-5:30	MSA
53	42,452	30,980	6.4	4.9	fabrication/welder			high school
54	48,825	32,214	3.4	1.8	Maintenance supervisor	48821	7-3:30	1 year college
55	40,535	29,073	5.8	3.4	Driver		6am-6pm	high school
56	35,652	26,373	21.5	16.4	Service mechanic (unemployed)	N/A	N/A	high school
57	67,659	34,605	3.6	2.6	Arts Director		8-4	BS
58	47,495	31,742	5.4	3.2	retired bank clerk	N/A	N/A	high school
59	56,744	36,174	3.9	2.4	Office Manager	48307	M-F 8-4:30	Bachelors
60	31,600	24,951	35.3	30	Dealer (casino)		10am-10pm (varies)	high school
61	41,400	28,337	6.2	4	Unemployment Insurance Analyst	48202	7:30-5pm	4 yr. college
62	38,176	28,092	11.4	7.6	Letter Carrier	N/A	N/A	high school
63	45,020	31,666	5.9	4.8	Project Manager			15 (3 years college?)
64	77,161	49,672	2.3	1.3	Retired Teacher	N/A	N/A	35+30 hrs
65	51,869	31,077	5.1	4	Dental Hygienist	48192	M-Th. 7:30-5:30, F 8-12	Associates
66	73,507	45,439	2.9	1.9	Business Analyst	48098	M-F 7:30-5:30	Bachelors
67	50,276	36,624	3.6	2.5	Teacher		7:30-3	Masters +
68	26,623	24,096	33.6	30.1	Retired Insurance analyst	N/A	N/A	2 years college
69	36,058	26,988	12.1	10				Bachelors
70	42,340	30,292	5.1	3.6	Package Handler	48150	2:30am-7:30am	high school
71	63,705	41,334	2.8	1.7	Retired Financial manager			16 years
72	41,400	28,337	6.2	4	Teacher	48021	8:30-3:30	Masters

Driver ID	MaleMed Earnings FullTime	FemaleMed Earnings FullTime	PercPop With PovertyStatus	PercFamilies With PovertyStatus	Occupation	Work Zip Code	Times AtWork	Education
73	50,194	36,108	4.8	2.3	Skin care consultant		self-employed	high school
74	58,808	33,406	1.5	0.7	High school science teacher	48111	7-2:25	Masters
75	26,623	24,096	33.6	30.1	Computer Engr.	48202	9:30-4	4yrs of college-Associates
76	51,306	35,108	7.1	5.3	Bookkeeper	48917	8-4:30	general associates
77	61,633	32,204	2.7	1.8	Labtech, student (prelaw)		2-10:30	College Senior
78	49,397	31,689	3.4	2.4	Retired	N/A	N/A	Bachelors
79	33,115	26,328	24.3	20.6	Public School Teacher	48206	9am-4pm	Masters
80	29,885	24,996	29.5	25.5	Mortician	48204	9am-5pm	MBA
81	63,750	38,125	2.7	1.9	Admin Asst		9am-4pm	high school
82	30,024	23,049	29.3	25.4	Data Technician	48202	M-F 8am-5pm	BS
83	61,382	36,387	2.1	1.1	Retired-Teacher	N/A	N/A	MA +
84	51,721	30,032	4.9	3.5	Prepress Manager	48326	8am-2pm	high school
85	51,398	26,218	4.1	3.1	RN		7am-7:30pm	Associates
86	51,456	33,681	4.6	2.9	Self employed-insurance services	self-employed	7:30am-6:30pm	J.D.-Law
87	74,657	41,583	2.3	1.3	retired department secretary	N/A	N/A	high school
88	44,996	27,879	7	5.3	Floral Design	48082	8-6	high school
89	47,717	28,515	7	4.3	Certified Orthotist	48346	M-Th. 8:30-5	MAT
90	44,195	31,068	5.5	3.6	Customer Service /Student Hospitality			4 years college
91	68,190	36,692	3.9	2.4	Police Captain	48036	7am-3:30pm	Associates
92	40,000	28,380	13.2	10.5	Stock keeper I	48109	4am-12noon	2 years college
93	47,640	32,543	28.7	8.5	Booth Attendant (collect parking fees)	48823	8am-6pm	Bachelors
94	45,020	31,666	5.9	4.8	Sales	48911	7am-6pm	Bachelors
95	51,306	35,108	7.1	5.3	Substitute Teacher			BS
96	47,495	31,742	5.4	3.2	Tool Maker		5am-3:30pm	3 years college

DriverID	Make_ModelPrimary	Year Primary	Make_ModelSecondary	Year Secondary	ABS	YearsDriving	MINAnnualMileage	MAXAnnualMileage
1	Saturn/SL1	2002			No	8	16,000	16,000
2	Cadillac/Seville	1991	Chevy/Baretta	1991	Primary	5	10,000	10,000
3	Subaru/Legacy	2002	Mazda/Protégé	1996	Primary	26	15,000	15,000
4	Toyota/Camry	2002	Dodge/Intrepid	2002	Both	15	15,000	15,000
5	Toyota/4 Runner	1992	Saturn	1999	No	53	11,000	11,000
6	Plymouth/Breeze	1996			DK	13	18,000	18,000
7	Buick/Century	1994			No	48	10,000	10,000
8	Olds/Cutlass	1992			No	15	15,000	15,000
9	Lincoln/Town Car	1997			Primary	50	18,000	18,000
10	Ford/Crown Victoria	1996	Ford/Focus	2002	Both	54	12,000	12,000
11	GMC/Envoy	2003	Chevy/Lumina	1994	Both	48	35,000	35,000
12	Ford/Escort Wagon	1994			No	20	9,000	9,000
13	Honda/Accord	2003	Jeep	1996	Both	14	15,000	15,000
14	Ford/Aerostar	1992			DK	33	12,000	12,000
15	Kia/Spectra	2002	Ford/Ranger	1989	Primary	15	17,000	17,000
16	GMC/2500 Van	1995	Ford/Escort	1993	Primary	30	20,000	20,000
17	Chrysler/LeBaron	1991			No	16	25,000	25,000
18	Ford/Ranger	2000	Harley Davidson/Heritage	2003	No	6	25,000	25,000
19	Chrysler/Town and Country	1998	Lexus/RX300	1998	Both	46	15,000	15,000
20	Chev/Camaro	1999	Olds/Aurora	2001	No	50	15,000	15,000
21	Acura/Integra	2000	Dodge/Grand Sport	2003	Both	49	10,000	10,000
22	Chevy/Tracker	2001	Chevy/Lumina Van	1994	Primary	31	20,000	20,000
23	Dodge/Durango	2003	Dodge/Intrepid	2001	Primary	24	17,000	17,000
24	Pontiac/Grand Prix	2002	GMC/Jimmy	1997	Both	11	20,000	20,000

DriverID	Make_ModelPrimary	Year Primary	Make_ModelSecondary	Year Secondary	ABS	YearsDriving	MINAnnualMileage	MAXAnnualMileage
25	Chevy/Venture	2002				52	6,000	6,000
26	Olds/Regency	1997				44	12,000	12,000
27	Acura/Integra	1990	Ford/F150	1989	Secondary	14	21,000	21,000
28	Lincoln/Town Car	1994	Ford/F150	2001	Both	25	16,000	16,000
29	Pontiac/Grand AM	1994			Primary	10	10,000	10,000
30	Mercury/Mountaineer	2003	BMW/535i	1990	Primary	30	20,000	20,000
31	Ford/Explorer	2001	Olds/Intrigue	2000	Both	9	50,000	50,000
32	Jeep/Liberty	2002	Jeep/Wrangler	1999	Primary	13	25,000	25,000
33	Mercury/Marquis	1993	Plymouth/Voyager	1999	Both	48	17,000	17,000
34	Ford/Focus Wagon	2002			Primary	20	19,000	19,000
35	Ford/Explorer	2002	Ford/F-150	1994	Primary	50	15,000	15,000
36	Volvo/S40	2000	Lincoln/Town Car	2003	Both	50	6,300	6,300
37	Pontiac/SV Montana	2001			Primary	40	10,000	10,000
38	Chrysler/PT Cruiser	2003	Toyota/Echo	2001	Both	49	80,000	80,000
39	Pontiac/ Montana VAN	2000	Chevy/Lumina 4dr.	1996	Both	53	18,000	20,000
40	Chevrolet/Caprice	1992	Ford/F-350	1999	Both	44	20,000	20,000
41	Chevy	1992	Dodge/Dakota	1996	Primary	31	15,000	15,000
42	Dodge/Intrepid	1995	Chrysler/PT Cruiser	2002	Both	50	12,000	12,000
43	Cadillac/Eldarado	2002	Ford/excursion	2003	Both	31	12,000	12,000
44	Ford/T-bird	1996	Ford/F-150	1999	Secondary	28	15,000	15,000
45	Geo/Prizm	1992			No	14	20,000	20,000
46	Chevy/Blazer (S-10)	1988	Ford/Pickup	1986	Secondary	13	13,000	13,000
47	Dodge/Durango	1998	Plymouth/Neon	1998	Primary	31	25,000	25,000
48	Chrysler/Concorde	1994	Chrysler/Town and Country	2000	Secondary	31	25,000	25,000

DriverID	Make_ModelPrimary	Year Primary	Make_ModelSecondary	Year Secondary	ABS	YearsDriving	MINAnnualMileage	MAXAnnualMileage
49	Chevy/Cavalier	1997	Mercury/Villager	1996	Both	13	30,000	30,000
50	Ford/Crown Victoria	1995	Ford/F250	1992	Both	50	30,000	30,000
51	Ford/Explorer	1996	Mercury/Sable	2001	Both	26	20,000	20,000
52	Jeep/Liberty	2002			No	33	20,000	20,000
53	Ford/Explorer	1996	Chevy/Silverado	1989	Primary	27	15,000	15,000
54	Dodge/Caravan	1997	Chevy/Impala	1996	Both	30	15,000	15,000
55	Chevy/Silverado	1998			Primary	6	15,000	15,000
56	Dodge/Intrepid	1998			Primary	9	23,000	23,000
57	Pontiac/Bonneville	1992	Dodge/Caravan	2002	Both	29	25,000	25,000
58	Chevy/Tahoe	2002	Buick/Riveria	1996	Both	48	10,000	10,000
59	GMC/Trailblazer	2000			Primary	14	12,000	12,000
60	Ford/Focus	2000	Ford/Escort	1990	No	11	10,000	10,000
61	Ford/Taurus	1999			Primary	30	24,500	24,500
62	Cadillac/Deville	1991	Cadillac/Fleetwood	1991	Both	49	23,000	23,000
63	Buick/LeSabre Ltd.	2000			Primary	31	12,000	12,000
64	VW/Jetta	1996	GM/Pontiac-mini van	1998		40	10,000	10,000
65	Ford/Explorer	2003	Ford/Ranger	2002	Both	28	15,000	15,000
66	Saab/9-5	1999			Primary	9	14,000	14,000
67	Ford/Escape	2003	Chevy/Impala	2003	Both	48	20,000	20,000
68	Chevy/Lumina	1999			Primary	46	12,000	12,000
69	Chevrolet/Malibu	1999			Primary		8,000	10,000
70	Plymouth/Acclaim	1994			DK	4	20,000	20,000
71	Honda/Odyssey	2000	Nissan/Maxima	1995	Both	55	25,000	25,000
72	Saturn/L200	2002			Primary	15	15,000	15,000

DriverID	Make_ModelPrimary	Year Primary	Make_ModelSecondary	Year Secondary	ABS	YearsDriving	MINAnnualMileage	MAXAnnualMileage
73	Chrysler/300M	2002			Primary	49	12,000	12,000
74	Cadillac/CTS	2003	Chevy/Blazer	2000	Both	14	20,000	20,000
75	Ford/ZX2	1999			Primary	9	25,000	40,000
76	Chevy/S-10	1997			DK	14	15,000	15,000
77	Ford/Focus	2003			No	6	20,000	30,000
78	Mercury/Grand Marquis	2001			Primary	40	12,000	12,000
79	Mitsubishi/Galant	1999			Primary	11	25,000	25,000
80	Mercury/Grand Marquis	1992			DK	14	13,000	13,000
81	Buick/Regal	2000			Primary	49	25,000	25,000
82	Ford/Escort	1991			No	28	20,000	20,000
83	Ford/Crown Victoria	1998	Ford/Ranger	1994	Primary	52	18,000	18,000
84	Audi/GT sports Coupe	1986	Ford/Windstar	2000	Secondary	27	20,000	20,000
85	Jeep/Cherokee	2001	Jeep/Wrangler	2001	No	30	25,000	25,000
86	Pontiac/Montana	2002	GMC/Envoy	2002	Both	30	30,000	35,000
87	Honda/CRV	2004			Primary	53	6,000	6,000
88	Ford/Explorer	2002	Ford(Pontiac)/Grand Am	1996	Primary	26	12,000	12,000
89	Chevy/Malibu	2000	Chrysler/Town and Country	2003	Both	50	18,000	18,000
90	Saturn/LS Sedan	2000			No	3	13,000	13,000
91	Pontiac/Bonneville	1998	Pontiac/Bonneville	2000	Both	31	12,000	12,000
92	Chevrolet/Truck	2003			Primary	23	10,000	10,000
93	Toyota/Corolla	1991			No	10	20,000	20,000
94	GMC/Jimmy	2000	Pontiac/Grand AM	1999	Secondary	14	30,000	30,000
95	Chevrolet/ S-10	2003			Primary	8	16,000	16,000
96	Chrysler/LHS	1997	Chrysler/LHS	2002	Both	27	14,000	17,000

DriverID	CruiseUsage	Glasses_Contacts	Smoker	NotUseFaceCameraVideo	SeatedEyeHeightCM	DistanceEyeToIPCM	Hand
1	Seldom	Both	Yes		117.0	56.5	Left
2	Seldom	No	No		114.5	57.0	Left
3	Seldom	Glasses	No	**X**	114.3	56.0	Right
4	Seldom	No	No		109.9	46.0	Right
5	Occasional	No	No		117.0	59.0	Right
6	Seldom	No	No		116.3	60.0	Right
7	Occasional	Glasses	No		109.4	56.5	Right
8	Seldom	No	No		112.0	55.0	Right
9	Occasional	Reading	No		118.2	63.5	Right
10	Frequent	Reading	No		118.3	56.5	Right
11	Frequent	No	No		122.0	58.0	Right
12	Occasional	No	No		115.5	46.5	Right
13	Frequent	No	No		116.2	49.0	Right
14	Frequent	Glasses	No		113.8	55.0	Left
15	Frequent	Both	Yes		114.6	60.5	Right
16	Frequent	Glasses	Yes (not in car)		118.5	62.0	Right
17	Occasional	No	No		114.5	57.0	Right
18	Frequent	No	No	**X**	120.2	67.0	Right
19	Frequent	Glasses	No		113.9	58.5	Ambidextrous
20	Frequent	No	No		120.9	61.5	Right
21	Frequent	Contacts	No		113.6	47.0	Right
22	Seldom	No	No	**X**	113.8	64.0	Right
23	Occasional	No	Yes		113.9	55.0	Right
24	Frequent	Glasses	No		121.8	60.0	Right

DriverID	CruiseUsage	Glasses_Contacts	Smoker	NotUseFaceCameraVideo	SeatedEyeHeightCM	DistanceEyeToIPCM	Hand
25	Occasional	Glasses	No		116.6	49.0	Right
26	Occasional	Both	No		116.1	63.5	Right
27	Frequent	No	No		116.0	63.0	Right
28	Seldom	No	No		113.6	64.5	Right
29	Occasional	No	No		112.0	58.0	Right
30	Occasional	Contacts	No	X	118.4	58.5	Right
31	Frequent	No	No		112.0	57.0	Right
32	Seldom	No	No		118.8	58.0	Right
33	Frequent	Glasses	No		114.6	65.0	Right
34	Never	Glasses	No		114.6	55.0	Right
35	Frequent	Glasses	No		120.8	66.0	Right
36	Frequent	No	No	X	110.5	53.0	Right
37	Occasional	Glasses	No		107.4	44.0	Right
38	Frequent	Glasses	No		117.3	65.0	Right
39	Frequent	Glasses	No		117.2	63.0	Right
40	Frequent	No	No		123.1	63.5	Right
41	Seldom	Glasses	No		120.1	52.0	Right
42	Seldom	Glasses	No		121.8	56.0	Right
43	Occasional	No	Yes		119.4	63.0	Right
44	Occasional	Contacts	No		117.9	48.5	Right
45	Frequent	No	No		119.8	58.0	Right
46	Frequent	No	Yes		115.8	58.5	Right
47	Occasional	No	No		118.8	56.0	Right
48	Occasional	No	No		121.5	68.0	Right

DriverID	CruiseUsage	Glasses_Contacts	Smoker	NotUseFaceCameraVideo	SeatedEyeHeightCM	DistanceEyeToIPCM	Hand
49	Frequent	Glasses (reading)	No		124.9	63.0	Right
50	Frequent	Both	No		115.6	52.0	Right
51	Occasional	glasses (not for driving)	Yes (not in car)		118.3	61.0	Right
52	Frequent	No	No	**X**	125.4	65.0	Right
53	Occasional	glasses	Yes		121.9	62.0	Right
54	Frequent	glasses	No		119.7	60.0	Right
55	Seldom	No	No		116.6	63.0	Right
56	Frequent	No	No		120.5	64.0	Right
57	Frequent	glasses	No		121.0	67.0	Right
58	Occasional	Both	No		118.5	49.0	Right
59	Occasional	No	No		117.5	56.0	Right
60	Occasional	No	No		118.9	49.5	Right
61	Occasional	glasses	No		120.8	59.0	Left
62	Frequent	glasses	No		121.2	62.0	Right
63	Frequent	Both	No		117.2	59.0	Right
64	Occasional	glasses	No	**X**	118.7	57.0	Right
65	Occasional	Both	Yes		120.5	56.0	Right
66	Occasional	glasses (not required for driving)	No		123.7	60.0	Right
67	Frequent	Glasses	No		121.5	61.0	Right
68	Frequent	Glasses	No		120.0	48.0	Right
69	Seldom	Glasses	No		118.3	54.5	Right
70	Seldom	Both	No		124.3	57.0	Left
71	Frequent	glasses	No		120.5	60.0	Right
72	Occasional	No	No	**X**	119.8	58.5	Right

DriverID	CruiseUsage	Glasses_Contacts	Smoker	NotUseFaceCameraVideo	SeatedEyeHeightCM	DistanceEyeToIPCM	Hand
73	Occasional	glasses	No		116.6	48.5	Right
74	Frequent	Contacts	No		119.4	62.5	Right
75	Frequent	Both	No		116.5	50.0	Right
76	Never	glasses	Yes		113.6	57.0	Left
77	Frequent	No	Yes		116.0	56.0	Right
78	Frequent	Reading	Yes		119.3	57.0	Right
79	Occasional	glasses	Yes		123.4	60.0	Right
80	Occasional	No	No		119.4	58.5	Right
81	Occasional	glasses	No		118.7	55.0	Right
82	Seldom	glasses	No		120.4	51.0	Right
83	Frequent	glasses	No		119.6	55.0	Right
84	Occasional	glasses	Yes		124.5	59.0	Ambidextrous
85	Occasional	Glasses (reading)	Yes		121.1	51.0	Right
86	Frequent	Both	No		118.9	60.0	Left
87	Occasional	glasses	No	**X**	116.0	50.0	Right
88	Occasional	No	Yes		120.5	51.0	Right
89	Frequent	Glasses	No		121.5	65.0	Right
90	Frequent	Glasses	No		122.0	55.0	Left
91	Occasional	No	No		121.4	58.0	Right
92	Occasional	glasses	No		122.9	59.0	Right
93	Frequent	glasses	No		115.7	59.0	Right
94	Frequent	Both	No	**X**	120.2	61.0	Right
95	Frequent	No	No		121.9	64.0	Right
96	Occasional	No	Yes		120.4	59.0	Right

APPENDIX H

DETAILED CONTENTS OF THE DRIVER RELATED DATABASE

Detailed Contents of the Driver-Related Database

All questionnaire data collected from ACAS participants were placed into the Jake database on the ACASdb SQL server database. The tables on the Jake database include quantitative information from the following questionnaires: driver biographic information, DBQ, DSQ, postdriver questionnaire (all sections are in separate tables), and the take home questionnaire (all sections are in separate tables). Each table's format and structure are described individually below, listed alphabetically.

DBQ (Driver Behaviour Questionnaire)

The data from the DBQ is stored in the table jake..DBQ. In this table there are 32 columns. There is a column identifying the driver number, driver 1 through 96. There is one column for each question (Q1-Q24). The data in these columns is exactly as it was entered by the participants. These values are always whole numbers ranging from 0 to 5. Four questions also have a second column (Q5m, Q19m, Q15m, and Q2m) which was modified to allow a subscale score to be calculated for each participant. The original columns had missing data. In order to create subscale scores, these missing values needed to be filled. The missing data values were calculated by averaging the individual participant's responses on the other questions in the subscale and then placing this value in the missing data cell. This procedure allowed scale scores to be calculated, but the four modified columns should not be used for data analysis, they should only be used as a tool to calculate scale scores. The values in these cells are an average, so they are a fraction and are real numbers ranging from 0 to 5. The three remaining columns are the scale score columns (lapse, error, and violation). These are real numbers, as they are averages across the scale, and can range in value from 0 to 5. Though the range is from 0 to 5, the highest actual value for any of the scale scores is actually 2.125.

Biographic Driver Information

Biographic driver data are contained in the table jake..DriverInfo. There are 31 columns in this table. Any null values are null because the driver neglected *DriverID* contains the driver number, whole numbers 1-66. The column labeled G*ender* contains M's and F's representing male and female. The A*ge* column contains the participant's self reported age at the time the participant came to UMTRI to receive the vehicle; it is in whole numbers and ranges from 21 to 69. *AgeGroup* has three character choices: Y (younger), M (middle aged), O (older). The younger age group is composed of drivers age 20 to 30, middle aged is ages 40 to 50, and older is ages 60 to 70. The next column contains the driver's home zip code. This zip code was used in determining the values for the next seven columns (Median Income in 1999 in dollars (Households): *MedianIncomeHouseholds*, Median Income in 1999 in dollars (Families): *MedianIncomeFamilies*, Per Capita income in 1999 (dollars): *PerCapIncome*, Male: Median Earnings in 1999 of full-times year-round workers (dollars): *MaleMedEarningFullTime*, Female: Median Earnings in 1999 of full-time, year-round workers (dollars): *FemaleMedEarningsFullTime*, percent of population for whom poverty status is determined (all ages): *PercPopWithPoverStatus*, percent of population for whom poverty status is determined (families): *PecFamiliesWithPovertyStatus*). The values in these seven columns were obtained via the US Census bureau. These values were obtained for the driver's zip code, not for the individual driver. The following is a description of how the values were obtained:

> The US census bureau's website contained the income information desired for this report. The address is:
> http://factfinder.census.gov/home/saff/main.html?_lang=en
> To find the relevant information click on *data sets* on the left hand tool bar. A screen with summary file choices will appear, choose *Census 2000 Summary File 3 (SF 3) - Sample Data*. This will present options to choose from, select: *Geographic Comparison Tables*. Use the geographic pull down screen that appears, highlight: *3-digit ZIP code tabulation area*. Then select the beginning 3 digits of the ZIP code of interest and highlight this. Then highlight the one option available in table format and click *next*. Select the table *GCT-P14 Income and Poverty in 1999: 2000* from the menu; then, click *show result*. Now scroll through the results to find the full 5-digit ZIP code of interest and obtain the relevant information.

The column labeled *occupation* is self reported and is written out as the participant described the profession. *WorkZipCode* contains the zip code of the participant's work location. The *times at work* column contains the participant's report of the times of day he is at work. The *Education* column contains the self-reported highest level of education obtained by the participant. Education level is listed in pros. An attempt was made to enter the data in a uniform manner, such that the same degree levels were listed in the same manner, even if they were not originally written in the same way by the driver. The next column is *Make_ModelPrimary* which lists the make of the driver's primary vehicle, followed by the specific model of that vehicle. The make and model are separated by a back slash. The *YearPrimary* column lists the whole number year of the driver's primary vehicle and ranges from 1986 to 2004. *Make_ModelSecondary* lists the make of the driver's secondary vehicle, followed by the specific model of that vehicle. The next column, *YearSecondary*, contains the whole number year of the driver's secondary vehicle and it ranges from 1986 to 2003. Both of the columns containing information about the driver's secondary vehicle were left null if the driver did not indicate the use of a second vehicle. The column labeled *ABS* has five value choices: primary (indicating only the primary vehicle has anti-lock brakes), secondary (indicating only the secondary vehicle is equipped with anti-lock brakes), both (indicating both the primary and secondary vehicles have anti-lock brakes), no (indicating none of the vehicles are equipped with anti-lock brakes), and DK (indicating the driver does not know whether his vehicles have anti-lock brakes. *YearsDriving* is a self-reported field which indicates how many years the participant has been driving. The values in this column are in whole numbers. The column labeled *MINAnnualMileage* is recorded in whole numbers, ranging from 6,000 to 80,000 and represents the lower end of the range the driver provided on how many miles he drives annually. The question was actually designed to produce one number: approximate total mileage driven over the past year. However, several participants wrote in a range, ie 14000-17000. Therefore two columns were created, one for the minimum value of the range and one for the maximum value of the range. The next column, *MAXAnnualMileage,* represents the maximum value in the range of the total miles driven by a driver annually. This column also has a range of 6,000 to 80,000. The column *CruiseUsage* contains self report categorical data. There are three options: seldom, occasional, frequent. The column labeled *Glasses_Contacts* contains self-report categorical data. There are four possible values: no, glasses, contacts, or both. Occasionally there is an annotation in parentheses, helping to further classify an answer. For instance, an annotation might say "not for driving", meaning the driver does not where glasses fro driving. The next column is labeled *smoker*. This column either contains a Yes or a No, though two rows are notated with a "not in the car". The column *NotUseFaceCameraVideo* refers to whether or not a participant indicated that his face video was okay for public display. An "X" in a row indicates that the driver did not give permission to use his face video. The next column is *SeatedEyeHeightCM* and the values are real numbers. This column provides the driver's seated eye height in centimeters. The range is from 107.4 cm to 125.4 cm. *DistanceEyeToIPCM* contains the distance from the driver's eye to the instrument panel in centimeters. The values are real numbers that range from 44 cm to 68 cm. The column *hand* contains categorical values of either left, right, or ambidextrous and indicates the driver's handedness.

Driving Records

The data from the participants' State of Michigan driving records are stored in the table labeled jake..DrivingRecords. There are 40 columns in this table. Many of these columns were copied there from the information obtained from the Secretary of Sate and will not be explained in this description. All columns that were used for analysis or exclusion criteria will be explained. The first column is the *DriverID* which records the drivers number, 1 through 96. The next four columns, *Gender, Age, AgeGroup,* and *ZipCode* were all detailed in the *Biographic Driver Information* section. Please refer to this section for more information. The column labeled *Convictions* has a numeric value which refers to the date of the conviction, if applicable. The format of this value is the four digit year, followed by the day in that year. For instance, February 4th 2003 would be recorded as: 2003035. If the driver did not have a conviction then the cell is left null, as there is no relevant date. The next column of interest is labeled *con_ofn_cd* which represent the *conviction offense code*. This is a numeric value given to a specific type of violation. The next column is labeled *ViolationLabel* and contains a brief description of what the numeric code for the violation means. The following column, *acc_post_dt*, is the date an accident was posted where the driver was driving, if any. The numeric format for this column is the same as for the *convictions* column. The next column is labeled *acc_viol_cd* and is the numeric code for any applicable violation charged in relation to the accident. A zero is entered when there was no violation in connection with the accident. This code is explained in pros in the *accident_type* column. The columns *acc_cnts_inj* and *acc_cnts_kil* list the number of people injured or killed in the accident respectively. Potential participants were excluded if there was any number other than 0 in the *acc_cnts_kil* column.

DSQ (Driving Style Questionnaire)

The data from the DSQ is stored in the Table jake..DSQ. In this table there are 26 columns. There is a column identifying the driver number, driver 1 through 96. There is one column for each question (Q1-Q15). The data in these columns was maintained exactly as it was entered by each participant. These values are always whole numbers ranging from 0 to 5. Four questions also have a second column associated with them (Q8rev, Q9rev, Q10rev and Q15rev). These columns are the values of the question's original column recoded such that higher values mean more of the characteristic associated with the subscale. These columns were only used in order to calculate subscale scores. Subscale scores were calculated by averaging the individual participant's responses on all the questions in a particular subscale. There are six subscales: calmness, planning, social resistance, speed, deviance, and focus. These subscales are found in the literature. The values of the subscale scores are real numbers that range from 0 to 5. The ranges of the subscales are as follows: calmness: 2.666 to 5, planning: 1 to 5, social resistance: 0 to 5, speed: 0 to 5, deviance: 0 to 2.5, and focus 1.333 to 4.333.

PostdriveACC

The data from the ACC section of the post drive questionnaire can be found in the table jake..postdriveACC. The are 37 columns in this table. The first three columns represent the basic identifying information: DriverID (1-96), gender (M=male, F=female), and AgeGroup (Y=younger, M=middle aged, and O= Older). The following columns represent each question that could be coded numerically or was a yes/no question. Though columns Q33min and Q33max originate from one question, as do columns *Q7* and *Q7r*. Some participants entered a range rather than one value, thus two columns were created. One column contains the minimum value in the range and one the maximum value. If only one value was entered then that value is contained in both columns. Most of the questions were in the form of a Likert scale. Most often the higher the number the more positive the evaluation of the ACC system. The following questions were on a seven point Likert scale where positive values indicated positive feelings toward the ACC system: 1, 2, 3, 5, 6, 7 (there was also an option of 0 for did not experience), 8, 9, 10, 13, 18, 19, 20, 21, 22, 23, 25, 27, 30, and 35. Likert scales were either on a five, six or seven point scale. A few of the questions were asked in such a way that higher scores meant a lower evaluation of the ACC system. Three questions, 14, 15, and 16, were phrased with the middle value representing the most positive evaluation. Question 4 was a free response question where the participant was asked to enter any whole number value, no range was provided. The actual range was 0 to 10.

PostdriveFCW

The FCW section of the Postdrive questionnaire can be found in the table jake..fcw. There are 57 columns in this table. The first three are the standard columns of DriverID, Gender, and AgeGroup. The other 54 columns represent questions in the FCW portion of the question which could either be represented numerically or were yes/no. Most of the questions were on a Likert scale of either 5, 6, or 7 points. Most often, the higher the value the more positive the evaluation of the FCW system was. There were exceptions where the higher value indicated more negative appraisals or where the middle value indicated the best appraisal of the system. Question 4 was a free response question where the participant was asked to enter any whole number value, no range was provided. The actual range was 0 to 6. Question 8 was broken down into 5 columns. Question 8 had five choices; any and/or all of the five choices could have been selected by each participant. Each column represented one of the choices. A "1" indicates that the participant selected that option whereas a "0" indicates that the participant did not select that option. Question 20 is represented by two columns. The first column, Q20, is entered just as the participant entered their choice. The second, column Q20r has been recoded so that the choice "0" (never) is replaced by "7" (very infrequently) to prevent skewing the data and to make the scale have a consistent direction of positive evaluation. The final three columns do not have data entered for many of the participants. These columns are from an additional questionnaire, which was added in the middle of the study. The data from these questions (addQ1, addQ2, and addQ3) was recorded for the participants that were given this questionnaire.

PostdriveFCWAndACC

The data from the FCW and ACC section of the postdrive questionnaire can be found in the table jake..PostdriveFCWandACC. There are 8 column in this table. The first three are the basic identifying variables for each participant: DriverID, Age, and AgeGroup. The next five columns represent the four questions in the questionnaire. Question 1 is represented by two columns: Q1min and Q1max. Some participants entered a range rather than one single value for question 1, thus two columns were created. One column contains the minimum value stated and one the maximum. If only one value was stated then that value was entered in both columns. The following three questions were on Likert scales and are whole numbers that range from 1 to 5 with higher values indicated a more positive evaluation of the systems.

PostdriveHUD

The data from the HUD section of the postdrive questionnaire can be found in the table jake..PostdriveHUD. There are 15 columns in this table. The first three are the basic identifying variables for each participant: DriverID, Age, and AgeGroup. Question 1 is represented by 7 column and question 2 is represented by 3 columns. Both of these questions have the option for the participant to select as many options as they would like, from seven for question 1 and from three for question 2. A column was consequently created for each option. A "1" in a column means the participant selected that option while a "0" in a column indicates that the participant did not select that option. Questions three and four each were on a 7-point Likert scale where higher values indicated more positive evaluations of the HUD.

PostdriveManual

The data from the manual section of the postdrive questionnaire can be found in the table jake..PostdriveManual. There are 10 columns in this table. The first three are the basic identifying variables for each participant: DriverID, Age, and AgeGroup. The following seven columns are each for the one of the seven questions in this section. All of the questions, except for question 4, are whole number values on a seven-point Likert scale where higher values indicate more positive responses to the question. Question 4 is a free response where participants indicate a whole number value with no range provided. The actual range is 0 to 7.

PostdriveParticipantHandling

The data from the participant handling section of the postdrive questionnaire can be found in the table jake..PostdriveParticipantHandling. There are 4 columns in this table. The first three are the basic identifying variables for each participant: DriverID, Age, and AgeGroup. The final column contains the data from question 3, which is the only quantitative data in this section of the questionnaire. Questions 1 and 2 are both free response questions. Question 3 is on a seven-point Likert scale and the data are whole numbers.

TakeHomeACC

The data from the ACC section of the take home questionnaire can be found in the table jake..TakeHomeACC. There are 27 columns in this table. The first three columns are the basic identifying variables for each participant: DriverID, Gender, and AgeGroup. The remaining columns refer to the questions contained in the ACC section of the questionnaire which are either recorded numerically or a in a yes/no format. Question 6 is represented by 5 columns. Question 6 was allowed a participant to choose any number of the five options listed. Therefore, one column was created for each of those options. A "1" indicates that the participant selected the option whereas a "0" indicated that the participant did not choose that option. Question 19 is represented by two columns. Question 19 asked the participant to report a value, no range was provided. However, occasionally a participant stated a range, rather than one single value. Therefore, two columns for question 19 were created, one for the minimum value in the range and one for the maximum value. If the participant only stated one value then this value was recorded in both columns. The remaining columns represent one question. Most of the questions are on either a 5, 6, or 7 point Likert scale where higher values indicate more positive evaluations of the ACC system. Occasionally this is not the case.

TakeHomeFCW

The data from the FCW section of the take home questionnaire can be found in the table jake..TakeHomeFCW. There are 33 columns in this table. The first three columns are the basic identifying variables for each participant: DriverID, Gender, and AgeGroup. Most of the remaining columns each represent one question. Most of the questions are on either a 5, 6, or 7 point Likert scale where higher values indicate more positive feelings toward the FCW system. However occasionally questions are asked in a way so that this is not the case. Question 7 has 8 questions within it, each with its own column. There are also 8 columns that represent question 7 where the data has been modified. Several participants seemed to misunderstand the scale for question 7. Where possible, data were modified to reflect the correct scale. Where it was impossible to make a conclusive interpretation of a participant's response the cell was left null. These modified values are in columns Q7ra etc. Question 12 is represented by two columns. Question 12 asked the participant to report a value, no range was provided. However, occasionally a participant stated a range, rather than one single value. Therefore, two columns for question 12 were created, one for the minimum value in the range and one for the maximum value. If the participant only stated one value then this value was recorded in both columns.

<u>TakeHomeHUD</u>

The data from the HUD section of the take home questionnaire can be found in the table jake..TakeHomeHUD. There are 10 columns in this table. The first three columns are the basic identifying variables for each participant: DriverID, Gender, and AgeGroup. The remaining columns each represent the data from one question. Question 6 is represented by two columns. Question 6 is on a seven-point Likert scale and also had an option of "0" for never. Column Q6r contains data where 0's have been recoded as 7's so as not to skew data and to create a more consistent directionality for the question. Questions 1 through 5 are all on seven point Likert scales. Larger values indicate more positive reactions to the HUD, except for question 3 where the middle value of 4 is the most positive response.

<u>Time and Cars</u>

The table jake..TimeAndCars contains basic data on the time, data, and vehicle used by each participant (1-96). The first three columns are the basic identifying variables for each participant: DriverID, Gender, and AgeGroup. The next column, DateOfRelease, contains the date that the participant arrived to pick up a car for the study. It is in the format of date-month-year. The next column, TimeOfRelease, gives the time that the participant was scheduled to arrive in the form of hour.min.sec am or pm. The column DateOfReturnDebrief provides the date that the participant returned for the debrief in the format date-month-year. The next column, TimeOfReturn, provides the time that the participant was scheduled to return in the form hour.min.sec am or pm. The column *Vehicle* indicates the vehicle number the participant used for the study. The following column, *SecondaryVehicle* was null for most drivers but contained a second vehicle number for those participants who used a second vehicle during the course of the study. The column *MaxTripFirstCar* provides the maximum trip driven by the participant in the first vehicle (typically the only vehicle). The next column, *MaxTripSecondCar* provides the maximum trip taken in the second car used in the study. These two columns were only used in order to asses which vehicle was the first and which was the second one used.

Useful_SatisfyingACC

The data from question 36 in the ACC section of the postdrive questionnaire is contained in the table jake..useful_satisfyingACC. There are 10 columns in this table. The first column indicates the driverID (1-96). The remaining 9 columns each represent one of the items in question 36. They are similar to five point Likert scale questions. Positive adjectives anchor one end, while negative adjectives anchor the other end. Three of the questions are mirrored. In this table, a score of 5 indicates a value all the way to the positive side while a score of 1 indicates the most negative value on the scale. The columns are labeled with the positive adjective for each scale.

Useful_SatisfyingFCW

The data from question 42 in the FCW section of the postdrive questionnaire is contained in the table jake..useful_satisfyingFCW. There are 10 columns in this table. The first column indicates the driverID (1-96). The remaining 9 columns each represent one of the items in question 36. They are similar to five point Likert scale questions. Positive adjectives anchor one end, while negative adjectives anchor the other end. Three of the questions are mirrored. In this table, a score of 5 indicates a value all the way to the positive side while a score of 1 indicates the most negative value on the scale. The columns are labeled with the positive adjective for each scale.

APPENDIX I

CODING KEY FOR IMMINENT ALERTS AND SECONDARY BEHAVIORS

Coding Key: Imminent Alerts

Notes of interest:
Motivation and intent were important criteria. The motivations behind the driver's actions, when able to be clearly determined, weighed more heavily than the actual behaviors. Events were coded according to judgment with respect to why the alert went off—as though one was looking through the eyes of the driver.

Time of day
(Dusk was difficult to classify as either day or night; this classification was very subjective. Events were coded to reflect whichever the clip was most similar to, day or night.
0 = Day
1 = Night

Road condition
(Glare and reflection helped to determine whether the road was dry or wet.)
0 = Dry
1 = Wet (Any moisture on the road led to the classification as wet; there did not need to be standing water etc. The road was classified as *wet* if it was wet from snow but was not snow covered.)
2 = Snow covered (*Snow covered* would have included ice covered if it was observed, but it was never observed. If any portion of the road, including turn lanes, was covered in snow then the classification was *snow covered*.)

Precipitation
(Spots on the windshield or wiper activity helped determine if there was in fact precipitation.)
0 = None
1 = Rain (Light rain and drizzle were classified as rain, as were downpours.)
2 = Snow (This category included sleet. There were several cues which helped to indicate that the precipitation was in fact snow. Snow tended to be larger and fall more slowly than rain, snow looked like white flurries, snow was also present on the ground and this reinforced the classification as snow. Also, precipitation which occurred in December through February was assumed to be snow, and not rain. Snow could be could be coded in other months, but the assumption that the precipitation was snow was not as strong.)

Location of eyes at time of the alert
(This category was coded at the actual time of the alert, when the radar display showed100 for the alert level. Eye location was coded by what the reviewers could see of the driver's eyes at the time of the alert, even if they could not see the eyes preceding the alert. The reviewers coded the location of the driver's eyes even if they could only see one eye, as it was assumed that the driver's eyes moved in parallel. Because of the absence of an eye-tracking camera and the limitations of the face-camera, there was often some ambiguity about where the drivers were looking. The reviewers needed to be very confident in the location of the driver's eyes in order to code as a specific location. There were many instances when the reviewers were confident that the driver's eyes were not looking forward, but could not tell specifically where the eyes were looking. These instances were coded as 8s. One such example is when the driver appeared

to be looking at the camera. In this situation it was difficult to determine if the driver was looking at the camera intentionally, glancing out the corner, or looking slightly out the left window; therefore, it was coded as an 8. The determination of whether glances were still forward or it they were glances away was also very difficult and subjective. The reviewers agreed upon an area or "box" which they considered to be looking forward, this allowed for slight glances but even many scans across the forward scene were considered glances away. This process defined "looking forward" very narrowly and essentially meant straight forward. Glances toward the right of the forward scene, the right area of the windshield, were glances away and were coded as 8s.)

0 = Looking forward at forward scene (*Looking forward* included looking at the HUD.)
1 = Left outside mirror or window
2 = Looking over left shoulder (The driver's gaze needed to look over the driver's shoulder, though the driver's chin did not necessarily need to cross over the driver's shoulder.)
3 = Right outside mirror or window
4 = Looking over right shoulder (The driver's gaze needed to look over the driver's shoulder, though the driver's chin did not necessarily need to cross over the driver's shoulder.)
5 = Head down, looking at instrument panel or lap area (Looking at the HUD was not considered part of the instrument panel.)
6 = Head down, looking at center stack counsel area (*Counsel* means the area where the stereo, thermostat, and clock are located)
7 = Driver wearing sunglasses or glasses with glare (The glare prohibited the ability to classify where the eyes are looking. There were instances where drivers were wearing sunglasses but the reviewers felt that they could confidently identify the location of the drivers' eyes. In these instances eye location was recorded.)
8 = Cannot accurately evaluate eye location (An *8* is chosen when the reviewer was unsure of the eye position and/or classification within a reasonable level of confidence though not because of glasses. Typically the reviewer could see the actual eye, but could not determine where the gaze was directed. Eyes in transition were often coded as *8*, as it was unclear where the driver's gaze was at that particular moment.)
9 = Other (For example the driver may clearly be looking at passenger side floor. When a glance was coded as *other*, the location was noted in the notes section. The most common position recorded as *other* was the rear-view mirror.)

Location of eyes during the last non-forward glance
(and time from the last non-forward glance)

(If the driver's eyes were on the forward scene at the moment of the alert, but they had looked away during some portion of the clip previous to the alert, this location was recorded. The reviewers also recorded the amount of time between when the driver's gaze began to return to the forward scene and the moment of the alert, according to the radar display showing alert level "100". We did not count the actual moment of the alert; the time represents the time between the change in gaze and the alert. Time was recorded in tenths of seconds. If the driver was always looking forward, then the time from the last non-forward glance was left null, as that category was not applicable. If the driver was looking away one tenth of a second before the alert and then was looking forward at the time of the alert, the time from the last non-forward glance was recorded as 0. If their eyes were not visible, typically because of glare, for any portion of the clip, the location was coded as a 7, because one could not be certain there was not

a glance away. The only exception to this rule is when the reviewers could not see the driver's eyes and then the eyes became visible so that the reviewers could see the eyes and there was a glance away before the alert. This situation negates the fact that the reviewers could not see the eyes at the beginning of the clip because there was a non-forward glance after the portion where the eyes were unclassifiable. Of course, if the eyes were then unclassifiable again, before the alert but after the glance, the eyes were coded as a 7, because the reviewers could not be certain what happened during that portion of the clip. If one eye location could be determined and the other eye's location could not, location was still coded. Reviewers felt confident in coding eye position when only one eye could be seen because normally eyes move in parallel. If the driver's eyes were away before the alert and were in transition at the time of the alert, the last non-forward glance code reflected where they were looking at the time of the alert, not where they had previously been looking. For more details on eye location see the information on eye location at the time of the alert. The criteria for classifying a glance as a specific location are the same as the criteria for eye location at the time of the alert.)

0 = Always looking forward at the forward scene (*Looking forward* includes looking at the HUD.)
1 = Left outside mirror or window
2 = Looking over left shoulder
3 = Right outside mirror or window
4 = Looking over right shoulder
5 = Head down, looking at instrument panel or lap area
6 = Head down, looking at center stack counsel area (*Counsel* means the area where the stereo, thermostat, and clock are located)
7 = Driver wearing sunglasses or glasses with glare (Glare prohibited the ability to classify where the eyes are looking)
8 = Cannot accurately evaluate eye location (An *8* is chosen when the reviewer was unsure of the eye position and/or classification within a reasonable level of confidence though not because of glasses. Typically the reviewer could see the actual eye, but could not determine where the gaze was directed. Eyes in transition were often coded as *8*, as it was unclear where the driver's gaze was at that particular moment.)
9 = Other (For example the driver may clearly be looking at passenger side floor. When a glance was coded as *other*, the location was noted in the notes section. The most common position recorded as *other* was the rear-view mirror.)

Eyes on task at time of the alert

0 = No (The classification of *no* was only used when the reviewer could confidently determine that the driver's eyes were off the task of driving at the time of the alert, ie they were looking at a friend, the stereo system, etc.)
1= Yes (The classification of *yes* does not mean looking forward, it means that the driver's eyes were on the task of driving.)
2 = Cannot determine (For instance, the driver was wearing glasses with glare or the reviewer could not see the driver's eyes for some other reason. This classification was also used when the reviewer could not tell if the eye location was on task. For instance, the driver was looking out the window but it was unclear whether the driver was looking at traffic or at a fancy building that was distracting the driver's attention. In any case, the reviewer did not KNOW whether the driver was on task or not.)

Eyes in transition

(In order to classify the eyes as in transition, the driver's eyes must have been in transition at the time of the alert and they must have started the transition at least .1 sec before the alert. The eyes could not be at the very beginning of a transition or the very end of one, they must have been IN the transition at the time of the alert.)

0 = No
1 = Yes, towards forward scene
2 = Yes, away from forward scene
3 = Cannot tell (*Cannot tell* was selected when the driver was wearing sunglasses or the reviewer could not see the driver's eyes for some other reason; therefore it was uncertain whether they were in transition.)

Visual response to alert (and time to visual response)

(Reviewer coded the time that it took the driver to initiate a visual response to the alert, if a response was initiated, by filling in the number of 10ths of a second the response took. The time counted was the time between the alert and when the look was initiated, not including the moment of the alert nor the moment of response. If the response was initiated within 1.0 second then the driver was considered to have looked in response to the alert. The amount of time it took to look in response was always recorded for applicable situations, even if this was greater than 1.0 second. If the driver was already looking at the road and continued to look forward the code was null (not applicable). If the reviewer was not sure of the location of the driver's eyes then the time to visual response was left as null. The time to visual response was recorded for week one, even though there was no alert to respond to. The rationale for coding this was that a baseline would provide an idea of what a normal time to visual response was, as compared to the time to response with an alert.)

0 = Looked in response (The driver initiated a look in response to the alert within 1.0 seconds. Glances qualified as a look in response.)
1 = Did not look in response to alert (The driver did not look within 1.0 seconds of the alert.)
2 = NA (This option was always used for week one because there was no alert during week one, thus we could not code this category. This option was also selected when the driver was already looking forward at the time of the alert this category was not applicable.)
3 = Cannot tell (The driver was wearing sunglasses or other glasses with glare etc. and therefore the reviewer could not tell where the driver's eyes were.)

Visual Occlusion

(Occlusion was coded with regard to the driver as well as to the reviewer. For instance heavy rain or bright sun might have occluded the scene for both parties, whereas blurry video only occluded the scene for the reviewer. The occlusion did not necessarily have to impact the reviewer's ability to code the scene.)

0 = None
1 = Sun or headlight glare (This classification includes when the scene was white washed from the sun. Only headlight glare was included in this section, taillight glare was coded as other.)
2 = Other, specified in notes section (The most common entry was taillight glare.)

Startle response
(This was very subjective and the classification as such was often hotly debated. The driver had to be visibly rattled. The driver's startle was observed by body response and/or dialogue. Cursing was not sufficient to be coded as startle, as this may have been anger or frustration, not startle. This category tried to capture startle either to the situation or to the alert.)
0 = No
1 = Yes

Steering in response
0 = No steering in response to alert (Small jerky reactions or slight wiggling in response to the alert or to the situation was classified as a *0* and was not considered steering.)
1 = Driver steered partially or fully in response to the alert (Steering, for review purposes, was an evasive maneuver in an attempt to prevent striking a vehicle, thus there must have been a significant amount of steering.)

Hand location at time of alert
(Both hands were not often visible, so the reviewer coded what could confidently be inferred from the scene. At times, playing the video farther helped to determine what was ambiguous in a still frame at the time of the alert. For instance, at the time of the alert there may have been a small blur near the steering wheel. Upon continuation of the video the blur may have moved and come into view as a hand.)
0 = Cannot see the position of either hand or cannot determine the position of either hand (The reviewer coded *0* if a hand could be seen but the reviewer could not tell if it was on the wheel).
1 = At least one hand on steering wheel (This was coded when the position of one hand could not be determine but one could see that at least one hand was on the steering wheel).
2 = Both hands are on the steering wheel.
3 = At least one hand off the steering wheel (This was coded when the position of one hand could not be determine but at least one hand was clearly off the steering wheel.)
4 = One hand on, one hand off the steering wheel. (A *4* was classified when the reviewer could clearly see both hands, and one was on the wheel while the other was off.)
5 = Both hands off the steering wheel. (A *5* was classified when the reviewer could clearly see both hands, and both were off of the wheel.)

Road geometry
0 = Straight
1 = Curve (There must have been a curve of some substance in order to be considered a curve.)
2 = Approaching curve (The classification of *approaching curve* constituted situations where the driver was almost in a curve, not when there was simply a curve in the distance.)
3 = Lane shift (Road geometry was classified as a lane shift when there was a change in the lane structure, for instance, when a new lane was created. However, if the new lane was a turn lane then the road geometry was not a lane shift, as the scenario should have covered the fact that there was a turn lane, if that was relevant. Lane shifts were also considered shifts in traffic patterns, such as lane shifts in construction areas.)

Secondary Driving Behaviors

(Audio was utilized to assist in coding whenever possible. For instance, the reviewer may have heard the radio station change and also have seen the driver look at the counsel; this would indicate in-car system use. The default for non-driving behaviors was none.)

0 = None

Cell phone

- 10 = Conversation, in use (C*onversation* could be coded for listening, talking, or both while using the cell phone)
- 11 = Reaching for phone (This classification refers to when the driver reached for the handheld phone in order to speak on that phone. If the driver reached for the phone simply to answer the phone and talk on the headset the driver was wearing then the classification was *other*. Simply answering the phone involves far less physical activity by the driver than reaching for the phone and holding it during a conversation.)
- 12 = Dialing phone

Headset, hands free phone

- 20 = Conversation (This was selected when the reviewer could tell that the driver was in a conversation)
- 21 = Reaching for headset
- 22 = Unsure of activity level (The driver was wearing a headset but it was not clear whether the headset was in use. The driver may have been listening to someone or wearing it in case of an incoming call.)

Eating

- 30 = Highly involved (*High involvement* includes eating a burger, unwrapping food, etc.)
- 31 = Low involvement (*Low involvement* includes eating candy, grabbing chips etc.)

Drinking

- 40 = Highly involved (*High involvement* includes situations where the driver was trying to open a straw or bottle, blowing on a hot drink, etc.)
- 41 = Low involvement (*Low involvement* includes situations where the driver was sipping a drink, drinking without looking, etc.)

50 = Conversation (The driver and someone in the car are carrying on a conversation. The driver can be listening during clip, talking during clip, or doing both)

60 = In-car system use (The driver was actively adjusting something. For example, the driver was not just listening to the stereo; the driver was also adjusting the stereo etc. The car lighter was coded under the smoking section.)

Smoking

- 70 = Lighting (This classification includes the in-car lighter)
- 71 = Reaching for cigarettes or lighter (This classification includes the in-car lighter)
- 72 = Smoking

Grooming

- 80 = Highly involved (*High involvement* includes applying makeup, brushing hair, etc.)
- 81 = Low involvement (*Low involvement* includes scratching, running one's fingers Through his or her hair, etc.)

90 = Other/multiple behaviors, specified in notes section (These may include behaviors like whistling or classifications that the reviewer was unsure of, ie if the driver's lips were moving but there was no audio the behavior might be singing or conversation.)

Alert classification

1 = False alarm (There were two reasons for the classification of an event as a false alarm. The first was that the target was out of the lane throughout the episode or it was off the roadway, including both vehicles and stationary objects. The second was that the kinematics of the scenario did not make sense, for example, when there was a lead-vehicle deceleration error resulting in an alert.)

2 = True/nuisance alert (The target had to be a vehicle which was in the host's path for at least a portion of the episode. The event may have been viewed as either a needed alert or as a nuisance alert by the driver.)

3 =Instigated alert (An alert was classified as *instigated* if the driver deliberately drove in such a way as to provoke an alert. This does not apply to when the driver was in ACC and was trying to see if the system would brake sufficiently, as this was testing the ACC system rather than the FCW system.)

Target_

(A vehicle was considered in path if even a small portion, ie a rear bumper, of the lead vehicle remained in the host's lane at the time of the alert. Vehicles with both SUV and car characteristics, a very small SUV, were classified as a car. The classification as a car for these SUVs was because the body of the vehicle, in respect to how the host may follow it, is more in line with that of a car than that of an SUV.)

0 = Vehicle-in path--car

1 = Vehicle-in path--pickup, van, or SUV

2 = Vehicle-in path--other: motorcycle, semi, commercial vehicle, etc.

3 = Vehicle-out of path--car

4 = Vehicle-out of path--pickup, van, or SUV

5 = Vehicle-out of path--other: motorcycle, semi, commercial vehicle, etc.

6 = Construction (This includes all equipment associated with construction, ie barrels, cones, construction vehicles, etc.)

7 = Discrete roadside object (This classification includes sign posts, light poles, trees, fire hydrants, mailboxes, etc.)

8 = Overhead items (This classification includes items such as overhead signs and bridges.)

9 = Bridge support

10 = Guardrail/jersey barrier

11 = Other, to be specified in notes section

Target stationary/moving

(This category was coded using both visual cues and radar data. For vehicles that appeared to be either stopped or slowly moving visual cues were used if the cues were very clear, ie lane markings, but otherwise radar data was used to determine the classification.)

1 = Stationary (The target must have had a velocity of less than or equal to 1.3 m/sec in order to be classified as stationary.)

2 = Moving

3 = Stationary potential threat (The classification of a *3* was made when the target was a vehicle that was currently stopped (velocity of less than or equal to 1.3 m/sec), but had the potential to move at any moment, ie stopped cars with drivers in them.)

<u>Forward conflict scenario</u>

(These same scenarios will be used for the classification of supplementary scenarios as needed. The supplementary scenario column will also have the option of "0" = none. Supplementary scenarios are available in case there is another possible scenario or if the situation closely resembles another scenario which may be of interest to people working with that specific type of scenario.)

OHP (out of host's path)

100 = False alarm (There were two reasons for the classification of an event as a false alarm. The first was that the target was out of the lane throughout the entire episode or it was off the roadway, including both vehicles and stationary objects. The second was that the kinematics of the scenario did not make sense, for example, when there was a lead-vehicle deceleration error resulting in an alert.)

IHP (in host's path)

The following scenarios were initiated by the host vehicle (Note: this and the following subcategories apply to the stereotypes of scenarios, and may not apply to all cases. Nevertheless, these assumptions were used during some analyses.)

200 = Host tailgating (Tailgating was coded even if the lead was on an exit or entrance ramp. The criterion for tailgating was a headway of .8 sec or less. However, if the host was using ACC and the headway matched the criterion for tailgating it was NOT considered tailgating, because the system was controlling the headway, rather than the driver.)

210 = Host approaches an accelerating vehicle. (This typically occurred when the host misjudged the lead's acceleration and the host accelerated too fast on a vehicle that was accelerating as well, or also if the host was approaching a vehicle as a traffic light turned green.)

The following scenarios played out naturally with neither the host nor the lead vehicle changing accelerations.

220 = Host approaches slower vehicle that is traveling at constant speed. (The criteria for this classification were as follows: there were no brake lights visible, lead vehicle was always going slower than the host while the target was detected by ACAS, and the target did not appear to be decelerating, either visibly or using the radar data. Slight fluctuations in speed are normal, but the overall speed must have been fairly constant. Typically the lead was in the distance at the beginning of the clip and then moved into view as host gained on the lead.)

230 = Host approaches lead vehicle that is already stopped. (The lead vehicle must have been traveling under 1.3 m/sec during all portions of the clip where the lead was acquired as a target. Please see the notes on *target stationary/moving* for more details on how the determination of a target as stationary or moving was made.)

The following scenarios were initiated by the lead vehicle

240 = Host follows a lead vehicle that decelerates to an unpredictable stop (This scenario was classified as such when the traffic stopped, but the host driver may have thought traffic would just slow and not stop; no stop sign or traffic signal was in view. Event was coded as a 240 even if the lead had not stopped by the time of the alert, as long as the lead stopped within12.5 seconds of the alert (the regular viewing time plus a ten second continuation). For coding purposes *stop* means that the lead came very close to 0mph (less than or equal to 1.3 m/sec).)

250 = Host follows a lead vehicle that decelerates to a predictable stop. (This scenario occurred when there was a traffic light, stop sign, visibly stopped traffic, or the car in front of the lead had its brake lights on. These cues made it so that the host could logically anticipate that the lead would stop. Event could be coded as a *250* even if the lead had not stopped by the time of the alert, as long as the lead stopped within12.5 seconds of the alert (the regular viewing time plus a ten second continuation). For this scenario, a stop means coming very close to 0mph (less than or equal to 1.3m/sec).)

260 = Host follows a lead vehicle that decelerates in an unpredictable manner, but does not stop. (For this scenario, either the brake lights on the lead vehicle were visible or the lead was noticeably slowing even if the brake lights could not be seen, but the reason for slowing was not visible or it was not predictable, eg a cat crossing the street. The classification as a *260* was the default over a *270*.)

270 = Host follows a lead vehicle that decelerates in a predictable manner, but does not stop. (For this scenario the brake lights on the lead had to be visible or the lead was noticeably slowing even if the brake lights could not be seen. The code of *270* was only selected if it was clear why the lead needed to decelerate from the cues available, eg a slow moving piece of farm equipment was ahead, the car in front of the lead had its brake lights on, etc.)

THP (Transitional Host Path: one or both vehicles change lanes)
The following scenarios were initiated by the host vehicle

300 = Host cuts behind a lead vehicle. (A *300* was coded when the host cut into another lane closely behind the lead vehicle. This maneuver could not be part of a 2-lane pass, please see the description of a two lane pass for more details.)

310 = Host performs two-lane pass in order to pass. (This scenario involves the host cutting behind the lead in the process of making a 2-lane pass maneuver: host crossed the middle lane in order to enter a lane 2 lanes over from host's lane of origin. If 2 alerts occurred for the same smooth transition during a 2-lane pass then the reviewer coded the first alert as a *310* and did not code the second alert in the series. The reviewer commented on the scenario in the notes section, labeling the second alert as such in the notes section. A two-lane pass does NOT require 2 alerts.)

315 = Host performs two-lane pass to exit or to make a turn which is carried out within the time of the clip. (The scenario was classified as such when the host cut behind a lead in the process of making a 2-lane pass maneuver: host crossed the middle lane in order to enter a lane 2 lanes over from host's lane of origin. If 2 alerts occurred for the same smooth transition during a 2-lane pass then the reviewer coded the first alert as a *315* and did not code the second alert in the series. The reviewer commented on the scenario in the notes section, labeling the second alert as such in the notes section. A two-lane pass does NOT require 2 alerts.)

320 = Host changes lanes to pass lead vehicle. (The target for this alert type was the vehicle in the host's original lane. For this event, a pass was coded even if the host had not passed at the time of the alert as long as the host was acting like a pass was planned. For instance, the host was checking the mirrors and accelerating. If the pass was aborted and was not carried out during the entirety of the extended clip (10 additional seconds), then the reviewer classified the event as a pass and marked the scenario as aborted. Reviewer added notes when necessary. If the host was passing a vehicle waiting to turn then the reviewer coded whichever event seemed to be the reason for the alert and the other event could be chosen in the supplementary scenario section.)

330 = Host enters turn lane or other dedicated lane (e.g., exit lane), while approaching a lead vehicle in the new lane. (In this case, the target was the vehicle in the host's new lane.)

340 = Host enters a turn lane or other dedicated lane (e.g., exit lane), while approaching lead vehicle in original travel lane. (In this case, the target was the vehicle in the host's original lane.)

350 = Host weaves in order to avoid an obstacle but does not completely change lanes. (An event was coded as a *350* if the host did not completely change lanes in the process of avoiding an obstacle. This was not a planned maneuver; there was no turn signal or other indications of a lane change until the last moment--an evasive reaction.)

355 = Host weaves in order to avoid an obstacle and completely changes lanes. (An event was coded as a *355* if the host changed lanes completely in the process of avoiding an obstacle. The motivation for the lane change has to have been to avoid something in the original lane. This was not a planned maneuver; there was no turn signal or any other indications of a lane change until the last moment--an evasive reaction.)

The following scenarios were initiated by the lead vehicle

360 = Lead vehicle changes lanes and cuts in front of host. (The main precipitant of this scenario was the lead cutting in front of the host. This occurred when the lead was in a lane parallel to the host's and then cut in or merged close to the front of the host's vehicle.)

365 = Lead vehicle is forced to merge in front of host (An event was classified as a *365* when

the lead needed to merge into the host's lane because an entrance ramp was ending or a lane was ending for another reason, etc.)

370 = Lead executes a 2-lane pass. (This scenario was coded when the lead passed from a lane parallel to the host's, across the host's path, and then over to the parallel lane on the other side of the host's car. Lead was only in the host's path momentarily.)

380 = Lead vehicle in adjacent lane weaves or encroaches unintentionally/unknowingly into host's lane. (The classification of an event as a *380* refers to events where the lead entered the host's lane unintentionally and momentarily. The brief entry into the host's lane by the lead vehicle caused the alert.)

390 = A vehicle crossing the host's roadway travels straight across host's path (The scenario is characterized by a vehicle driving straight across the host's path. The target vehicle did not remain in the host's path; typically the radar hit the side of the crossing vehicle, and the intersecting paths were perpendicular to each other.)

400 = A vehicle makes a left turn across the host's path in order to travel in a direction other than that of the host. (In this scenario the crossing vehicle turned left, either from a perpendicular street or from a parallel lane traveling in the opposite direction of the host's lane. If the vehicle turned from a side street, then that vehicle crosses the host's path and then continues into a parallel lane traveling in the opposite direction. If the vehicle turned left from a parallel lane, then the turning vehicle crossed the host's path and continued onto a perpendicular street. The vehicle crossed the radar path with primarily a perpendicular angle, but the angle may be more steeply tilted than when the vehicle was simply crossing straight across the host's path in other scenarios.)

410 = A vehicle entering the host's roadway crosses host's path and moves in to a lane parallel to the host's lane in the same direction.

420 = A vehicle pulls out from a side street or driveway and pulls in front of host and into the host's lane. (This occurred when the lead started out perpendicular to the host car and turned into and in front of host's car.)

430 = Lead changes lanes out of host's lane. (This scenario developed when the lead departed the host's lane, but the situation was not covered by another described scenario. One instance of this situation is when the host could logically anticipate that the lead car would change lanes because of the lead's turn signal or another indication and therefore the host gained on the lead, sounding an alert.)

440 = Lead leaves host's lane to enter turn lane or other dedicated lane (Examples of dedicated lanes are exit ramps, turn lanes, etc.)

450 = Lead turns left from host's travel lane. (The target in this conflict is the turning car. The lead must have begun the turn, even very slightly, in order for the scenario to be coded as a *450*. If the lead's turn signal was on but the turn had not yet been initiated then the

event was coded as a predictable deceleration and given a supplementary scenario of *450*.)

460 = Lead turns right from host's travel lane. (The target in this conflict is the turning car. The lead must have begun the turn, even very slightly, in order for the scenario to be coded as a *460*. If the lead's turn signal was on but the turn had not yet been initiated then the event was coded as a predictable deceleration and given a supplementary scenario of *460*.)

Scenario Completion

0 = Completed
1 = Aborted

Supplementary Scenario

This category allowed reviewers to select a second scenario to which the situation could be attributed. The supplementary scenario could also be a scenario that preceded or followed the imminent scenario but may have contributed to the development of the actual scenario. This category was designed to be a reference list for people interested in scenarios that could have been classified in other ways. The category also allowed the reviewers to indicate two scenarios when the primary scenario was difficult to determine. If the reviewer did not indicate a supplementary scenario then a *0* was entered for none.

Notes

A notes section recorded any unusual events or ambiguous situations not covered by categories for a particular question. This section also contains general notes on the clip if there was anything significant taking place that was not adequately covered by the coding process. Please see Annex I-1 below for further details.

Annex I-1

Examples of items that will be captured in notes section, though other unforeseen events will also be noted.

Visual Occlusion

Rear taillights, glare from rain and wetness on the road, blurry video, dirty windshield, temporary incapacitation, sneezing, flying debris, faulty wiper/defroster, and object in or over eyes

Non-driving behaviors

Whistling, two or more behaviors, if there is no audio and the driver is clearly talking or singing but we could not tell which, insect in car, adjusting mirrors, reading map, reading other materials, checking watch, and yawning

Target

Shadows, embankments, etc.

APPENDIX J

IMMINENT ALERT COUNTS AND DISTANCE TRAVELED FOR INDIVIDUAL DRIVERS

Note: Distances are for valid trips only, and alerts are only usable alerts.

			Miles traveled in valid trips						FCW imm alerts & ACC alerts					
			ACAS disabled			ACAS enabled			ACAS disabled			ACAS enabled		
Driver	Age	Gender	CCC	Manual	Sum	ACC	Manual	Sum	CCC	Man	Sum	ACC	Man	Sum
1	Younger	F	10	334	344	120	895	1015	0	20	20	1	38	39
2	Younger	F	4	202	207	385	830	1215	0	7	7	0	39	39
3	Middle	M	1	98	99	32	247	279	0	11	11	0	71	71
4	Middle	F	50	297	347	82	935	1018	0	0	0	1	12	13
5	Older	M	58	170	228	489	669	1158	0	10	10	0	33	33
6	Younger	M	1	466	467	174	1005	1179	0	46	46	0	60	60
7	Older	F	130	251	381	425	415	840	1	10	11	8	14	22
8	Younger	F	0	692	692	9	1175	1184	0	23	23	1	41	42
9	Older	M	147	352	499	829	1010	1839	0	7	7	7	39	46
10	Older	M	45	119	165	77	293	371	0	1	1	6	6	12
11	Older	M	293	267	561	516	545	1061	2	36	38	6	52	58
12	Middle	F	0	73	73	404	581	985	0	6	6	0	29	29
13	Middle	M	3	137	141	330	326	657	0	7	7	6	17	23
14	Middle	F	83	170	252	296	424	721	1	14	15	3	34	37
15	Younger	F	2	305	307	827	807	1633	0	18	18	4	67	71
16	Middle	M	40	88	128	466	303	769	0	6	6	0	10	10
17	Younger	F	121	289	410	302	511	813	0	15	15	0	8	8
18	Younger	M	13	141	153	1054	1113	2167	0	8	8	0	39	39
19	Older	M	26	55	80	226	335	561	0	1	1	0	11	11
20	Older	M	65	124	189	920	614	1534	0	0	0	0	21	21
21	Older	F	19	76	95	204	477	681	0	4	4	0	15	15
22	Middle	F	13	230	243	63	1079	1142	0	2	2	0	8	8
23	Middle	F	3	73	77	12	421	433	0	0	0	0	8	8
24	Younger	M	31	135	166	256	279	535	0	9	9	0	21	21
25	Older	F	0	40	40	330	460	790	0	1	1	0	0	0
26	Older	F	287	237	524	197	657	853	0	2	2	0	9	9
27	Younger	M	29	312	342	437	781	1218	0	13	13	0	15	15
28	Middle	F	0	181	181	46	357	403	0	6	6	0	12	12
29	Younger	F	10	185	195	27	402	429	0	4	4	0	4	4
30	Middle	M	0	124	124	105	625	730	0	2	2	0	18	18
31	Younger	M	76	644	720	590	1049	1639	0	4	4	1	7	8
32	Younger	F	0	342	342	46	1219	1265	0	1	1	0	17	17
33	Older	M	391	524	915	106	241	348	0	11	11	0	7	7
34	Middle	F	5	789	794	92	2838	2930	1	11	12	0	8	8
35	Older	M	38	145	183	480	676	1155	0	8	8	2	20	22
36	Older	F	77	250	326	355	527	882	0	8	8	2	15	17
37	Older	F	8	99	106	1035	1549	2584	0	4	4	2	7	9
38	Older	M	133	349	481	843	1493	2336	0	7	7	2	29	31
39	Older	M	49	158	207	1005	637	1642	0	1	1	2	7	9
40	Older	M	32	195	227	234	663	898	0	6	6	0	18	18
41	Middle	F	0	337	337	16	886	902	0	3	3	0	9	9
42	Older	F	14	149	162	278	725	1003	0	0	0	0	12	12
43	Middle	F	30	106	137	55	238	293	0	8	8	0	11	11
44	Middle	F	45	276	321	649	1794	2443	0	1	1	1	15	16
45	Younger	F	81	193	274	673	612	1285	0	2	2	2	31	33
46	Younger	F	0	625	625	510	763	1273	0	3	3	0	1	1
47	Middle	M	43	148	191	383	903	1286	1	4	5	2	24	26

48	Middle	M	46	488	534	283	1182	1465	0	6	6	0	10	10
49	Younger	M	2	206	208	145	752	897	0	2	2	0	15	15
50	Older	F	106	320	426	2307	1054	3361	0	2	2	1	4	5
51	Middle	F	0	262	262	76	846	922	0	1	1	0	4	4
52	Middle	M	103	183	286	757	396	1154	1	2	3	2	5	7
53	Middle	M	1	196	197	56	381	437	0	5	5	0	4	4
54	Middle	M	117	223	340	495	578	1073	0	1	1	1	6	7
55	Younger	M	0	205	205	37	492	529	0	4	4	1	7	8
56	Younger	M	0	432	432	30	957	987	0	6	6	0	11	11
57	Middle	M	0	681	681	1008	880	1888	0	5	5	0	14	14
58	Older	F	9	198	207	625	1050	1675	0	5	5	3	17	20
59	Younger	F	14	326	341	252	879	1131	1	0	1	0	6	6
60	Younger	F	0	239	239	71	772	844	0	6	6	0	7	7
61	Middle	F	18	272	291	154	953	1107	0	7	7	0	13	13
62	Older	M	339	318	657	956	791	1747	1	4	5	1	11	12
63	Middle	F	49	149	198	82	310	392	2	3	5	5	12	17
64	Older	F	158	219	377	2126	551	2677	0	1	1	9	12	21
65	Middle	F	41	240	280	302	927	1229	0	3	3	0	7	7
66	Younger	M	15	308	323	40	612	652	0	4	4	0	9	9
67	Older	M	10	194	204	151	703	853	0	2	2	0	9	9
68	Older	F	126	281	407	127	481	608	1	1	2	0	5	5
69	Older	F	130	263	393	95	472	567	0	1	1	0	5	5
70	Younger	M	0	506	506	1365	987	2352	0	2	2	0	7	7
71	Older	M	207	141	348	1192	513	1704	0	2	2	2	15	17
72	Younger	M	0	139	139	259	316	575	0	3	3	5	4	9
73	Older	F	40	198	238	1277	242	1519	0	4	4	1	1	2
74	Younger	M	188	264	453	870	647	1517	0	5	5	1	14	15
75	Younger	F	0	297	297	203	583	787	0	7	7	2	17	19
76	Younger	F	268	296	563	332	968	1300	0	3	3	0	8	8
77	Younger	F	62	351	413	211	1123	1334	0	6	6	0	14	14
78	Older	M	103	128	231	205	227	432	0	2	2	7	5	12
79	Younger	F	7	135	142	26	703	729	0	5	5	0	12	12
80	Younger	F	0	277	277	390	939	1329	0	2	2	0	6	6
81	Older	F	124	239	363	47	551	597	0	0	0	0	4	4
82	Middle	M	34	243	277	583	851	1434	0	7	7	2	11	13
83	Older	M	703	446	1148	1230	773	2003	0	1	1	3	7	10
84	Middle	M	33	348	381	125	781	905	0	6	6	0	13	13
85	Middle	F	34	289	323	203	781	984	0	3	3	0	3	3
86	Middle	M	27	171	199	358	848	1206	0	1	1	2	12	14
87	Older	F	27	163	190	83	239	322	0	3	3	1	0	1
88	Middle	F	55	115	171	111	383	494	0	1	1	0	3	3
89	Older	M	191	296	487	259	595	854	0	2	2	7	2	9
90	Younger	F	46	278	324	192	254	446	0	3	3	0	2	2
91	Middle	M	108	308	416	199	1224	1423	0	1	1	0	17	17
92	Middle	F	0	92	92	0	292	292	0	0	0	0	4	4
93	Younger	M	55	277	332	211	240	451	0	2	2	0	4	4
94	Younger	M	23	358	382	640	1134	1774	0	3	3	0	6	6
95	Younger	M	66	172	237	423	540	963	0	0	0	0	9	9
96	Middle	M	5	143	148	48	258	306	0	1	1	0	3	3
Total, Algorithm A			828	3,934	4,761	4,995	10,159	15,154	4	216	220	43	552	595
Total, Algorithm B			657	2,290	2,947	4,643	8,414	13,057	-	73	73	-	199	199
Total, Algorithm C			4,715	18,201	22,915	28,566	49,825	78,391	8	228	236	72	634	706

APPENDIX K

FOUR MULTIFACTOR, REPEATED-MEASURES ANALYSES OF VARIANCE OF

THE PERCENTILE OF FOLLOWING TIME AT 1-SECOND HEADWAY TIME MARGIN

FOUR MULTIFACTOR ANALYSES OF THE PERCENTILE OF FOLLOWING TIME AT 1-SECOND HEADWAY TIME MARGIN

General Linear Model

Within-Subjects Factors

Category	*Values*	*Value definitions*
Lighting	Well-lit Darker	Vehicle light sensor: light Vehicle light sensor: dark
Road Type	Limited-Access Major surface	Road classes 1 and 2 Road classes 3, 4, and 5
Traffic Density	Sparse Moderate Dense	See section 5.8
ACAS	Enabled Disabled	ACAS enabled ACAS disabled

Between-Subjects Factors

Category	*Values*	*Value definitions*
Age Group	Younger Middle-aged Older	drivers in their twenties drivers in their forties drivers in their sixties

Dependent Variable

Percentile of following time at 1-second headway time margin =
(time following with HTM ≤ 1 sec) / (time following) x 100

* Note. In the *figure* that follows, this measure is shown as a percentile (0 to 100%); in *all of the tables* that follow, this measure is shown as a fraction (0 to 1), i.e., without the 100 multiplier.

Athe analyses are limited to main, two-way, and three-way effects.

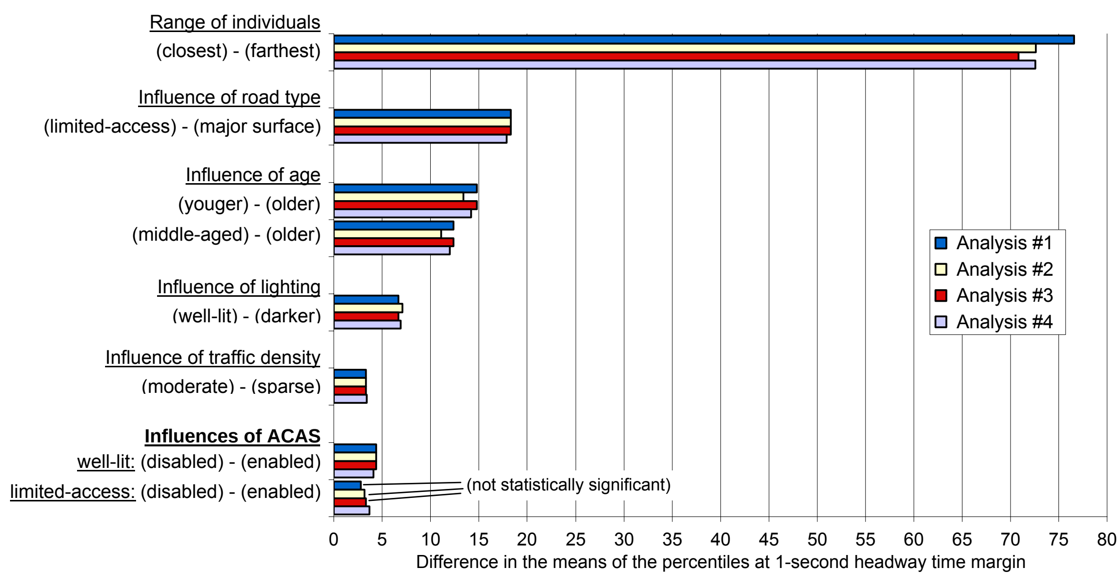
Data sources and filters:

All analyses

- Driving from valid trips of algorithm-C vehicles where:
  —cruise control is *not* engaged,
  —range rate to the vehicle ahead is within ± 2 m/s,
  —headway time margin is in the range of 0.25 to 3.05 seconds, and
  —speed > 11 m/s (25 mph).

Additional data filters

- Analysis #1: No additional filters.
- Analysis #2: Data from week 2 (first week of ACAS enabled) are excluded.
- Analysis #3: Data from time periods of 15-second duration immediately following disengagement of cruise control are excluded.
- Analysis #4: Data from week 2 (first week of ACAS enabled) are excluded and data from time periods of 15-second duration immediately following disengagement of cruise control are excluded.



Notes: 1) A positive value indicates a tendency for more tailgating in the first condition than in the second condition.
2) Results for *Range of individuals* are provided for comparison purposes and are not from multi-factor analyses.
3) Results from multifactor analyses are statistically significant (sig ≤.05) except where indicated.

Figure ERD2.1. Summary comparison of the results of four multifactor analyses

Results, analysis #1

Fixed Effects

Source	*Numerator df*	*Denominator df*	*F*	*Sig.*
Intercept	1	63.941	249.990	.000
AGE GROU	2	63.876	8.044	.001
LIGHTING	1	1194.051	42.775	.000
ACAS	1	1184.710	1.797	.180
ROAD TYPE	1	1188.162	340.319	.000
TRAFFIC DENS	2	1186.151	3.847	.022
AGE GROU * LIGHTING	2	1193.735	2.110	.122
AGE GROU * ACAS	2	1184.221	1.100	.333
AGE GROU * ROAD TYPE	2	1187.864	5.923	.003
AGE GROU * TRAFFIC DENS	4	1186.158	2.690	.030
LIGHTING * ACAS	1	1183.474	10.681	.001
LIGHTING * ROAD TYPE	1	1185.369	3.897	.049
LIGHTING * TRAFFIC DENS	2	1182.645	.327	.721
ACAS * ROAD TYPE	1	1183.522	2.573	.109
ACAS * TRAFFIC DENS	2	1182.246	1.509	.221
ROAD TYPE * TRAFFIC DENS	2	1182.957	1.171	.310
AGE GROU * LIGHTING * ACAS	2	1183.186	.008	.992
AGE GROU * LIGHTING * ROAD TYPE	2	1184.825	.253	.776
AGE GROU * LIGHTING * TRAFFIC DENS	4	1182.459	.616	.652
AGE GROU * ACAS * ROAD TYPE	2	1182.993	1.662	.190
AGE GROU * ACAS * TRAFFIC DENS	4	1181.928	1.798	.127
AGE GROU * ROAD TYPE * TRAFFIC DENS	4	1182.501	.324	.862
LIGHTING * ACAS * ROAD TYPE	1	1182.985	.533	.465
LIGHTING * ACAS * TRAFFIC DENS	2	1182.223	1.792	.167
LIGHTING * ROAD TYPE * TRAFFIC DENS	2	1182.468	.807	.446
ACAS * ROAD TYPE * TRAFFIC DENS	2	1182.565	.715	.489

a Dependent Variable: 1-sec percentile (as a fraction).

Estimated Marginal Means

1. Grand Mean(a)

Mean	Std. Error	df	95% Confidence Interval	
			Lower Bound	Upper Bound
.238	.015	63.918	.208	.269

a Dependent Variable: 1-sec percentile (as a fraction).

2. Age Group

Estimates(a)

Age Group	Mean	Std. Error	df	95% Confidence Interval	
				Lower Bound	Upper Bound
Younger	.293	.026	62.601	.241	.346
Middle-aged	.268	.026	64.090	.216	.321
Older	.154	.026	65.075	.101	.207

a Dependent Variable: 1-sec percentile (as a fraction).

Pairwise Comparisons(b)

(I) Age Group	(J) Age Group	Mean Difference (I-J)	Std. Error	df	Sig.(a)	95% Confidence Interval for Difference(a)	
						Lower Bound	Upper Bound
Younger	Middle-aged	.025	.037	63.343	1.000	-.066	.116
	Older	.139(*)	.037	63.832	.001	.048	.231
Middle-aged	Younger	-.025	.037	63.343	1.000	-.116	.066
	Older	.114(*)	.037	64.581	.010	.023	.206
Older	Younger	-.139(*)	.037	63.832	.001	-.231	-.048
	Middle-aged	-.114(*)	.037	64.581	.010	-.206	-.023

Based on estimated marginal means
* The mean difference is significant at the .05 level.
a Adjustment for multiple comparisons: Bonferroni.
b Dependent Variable: 1-sec percentile (as a fraction).

Tests of simple effect(a)

Numerator df	Denominator df	F	Sig.
2	63.912	7.947	.001

The F tests the effect of Age Group. This test is based on the linearly independent pairwise comparisons among the estimated marginal means.
a Dependent Variable: 1-sec percentile (as a fraction).

3. LIGHTING

Estimates(a)

Lighting	Mean	Std. Error	df	95% Confidence Interval	
				Lower Bound	Upper Bound
Well-Lit	.272	.016	72.878	.241	.304
Darker	.205	.016	85.679	.172	.237

a Dependent Variable: 1-sec percentile (as a fraction).

Pairwise Comparisons(b)

(I) Lighting	(J) Lighting	Mean Difference (I-J)	Std. Error	df	Sig.(a)	95% Confidence Interval for Difference(a)	
						Lower Bound	Upper Bound
Well-Lit	Darker	.068(*)	.010	1173.778	.000	.048	.088
Darker	Well-Lit	-.068(*)	.010	1173.778	.000	-.088	-.048

Based on estimated marginal means
* The mean difference is significant at the .05 level.
a Adjustment for multiple comparisons: Bonferroni.
b Dependent Variable: 1-sec percentile (as a fraction).

Tests of simple effect(a)

Numerator df	Denominator df	F	Sig.
1	1173.778	43.626	.000

The F tests the effect of Lighting. This test is based on the linearly independent pairwise comparisons among the estimated marginal means.
a Dependent Variable: 1-sec percentile (as a fraction).

4. ACAS

Estimates(a)

ACAS	Mean	Std. Error	df	95% Confidence Interval	
				Lower Bound	Upper Bound
Enabled	.232	.016	74.868	.201	.264
Disabled	.245	.016	82.877	.213	.277

a Dependent Variable: 1-sec percentile (as a fraction).

Pairwise Comparisons(b)

(I) ACAS	(J) ACAS	Mean Difference (I-J)	Std. Error	df	Sig.(a)	95% Confidence Interval for Difference(a)	
						Lower Bound	Upper Bound
Enabled	Disabled	-.013	.010	1164.641	.213	-.032	.007
Disabled	Enabled	.013	.010	1164.641	.213	-.007	.032

Based on estimated marginal means
a Adjustment for multiple comparisons: Bonferroni.
b Dependent Variable: 1-sec percentile (as a fraction).

Tests of simple effect(a)

Numerator df	Denominator df	F	Sig.
1	1164.641	1.554	.213

The F tests the effect of ACAS. This test is based on the linearly independent pairwise comparisons among the estimated marginal means.
a Dependent Variable: 1-sec percentile (as a fraction).

5. Limited access=1 Major surface=0

Estimates(a)

Limited access=1 Major surface=0	Mean	Std. Error	df	95% Confidence Interval	
				Lower Bound	Upper Bound
Major surface	.145	.016	76.285	.113	.177
Limited-access	.332	.016	81.671	.300	.364

a Dependent Variable: 1-sec percentile (as a fraction).

Pairwise Comparisons(b)

(I) Limited access=1 Major surface=0	(J) Limited access=1 Major surface=0	Mean Difference (I-J)	Std. Error	df	Sig.(a)	95% Confidence Interval for Difference(a)	
						Lower Bound	Upper Bound
Major surface	Limited-access	-.187(*)	.010	1168.122	.000	-.207	-.167
Limited-access	Major surface	.187(*)	.010	1168.122	.000	.167	.207

Based on estimated marginal means

* The mean difference is significant at the .05 level.

a Adjustment for multiple comparisons: Bonferroni.

b Dependent Variable: 1-sec percentile (as a fraction).

Tests of simple effect(a)

Numerator df	Denominator df	F	Sig.
1	1168.122	337.101	.000

The F tests the effect of Limited access=1 Major surface=0. This test is based on the linearly independent pairwise comparisons among the estimated marginal means.

a Dependent Variable: 1-sec percentile (as a fraction).

6. Traffic Density

Estimates(a)

Traffic Density	Mean	Std. Error	df	95% Confidence Interval	
				Lower Bound	Upper Bound
Sparse	.222	.017	94.064	.189	.255
Moderate	.255	.016	87.226	.223	.288
Dense	.238	.017	104.599	.204	.272

a Dependent Variable: 1-sec percentile (as a fraction).

Pairwise Comparisons(b)

(I) Traffic Density	(J) Traffic Density	Mean Difference (I-J)	Std. Error	df	Sig.(a)	95% Confidence Interval for Difference(a)	
						Lower Bound	Upper Bound
Sparse	Moderate	-.033(*)	.012	1165.611	.015	-.062	-.005
	Dense	-.017	.013	1168.124	.598	-.048	.014
Moderate	Sparse	.033(*)	.012	1165.611	.015	.005	.062
	Dense	.017	.012	1164.491	.527	-.013	.047
Dense	Sparse	.017	.013	1168.124	.598	-.014	.048
	Moderate	-.017	.012	1164.491	.527	-.047	.013

Based on estimated marginal means
* The mean difference is significant at the .05 level.
a Adjustment for multiple comparisons: Bonferroni.
b Dependent Variable: 1-sec percentile (as a fraction).

Tests of simple effect(a)

Numerator df	Denominator df	F	Sig.
2	1165.992	3.988	.019

The F tests the effect of Traffic Density. This test is based on the linearly independent pairwise comparisons among the estimated marginal means.
a Dependent Variable: 1-sec percentile (as a fraction).

7. Age Group * LIGHTING(a)

Age Group	Lighting	Mean	Std. Error	df	95% Confidence Interval	
					Lower Bound	Upper Bound
Younger	Well-Lit	.339	.027	72.507	.285	.393
	Darker	.248	.028	79.832	.192	.303
Middle-aged	Well-Lit	.303	.027	73.493	.249	.357
	Darker	.233	.028	85.657	.177	.290
Older	Well-Lit	.175	.027	72.636	.121	.229
	Darker	.133	.029	91.719	.075	.190

a Dependent Variable: 1-sec percentile (as a fraction).

8. ACAS * Age Group(a)

ACAS	Age Group	Mean	Std. Error	df	95% Confidence Interval	
					Lower Bound	Upper Bound
Enabled	Younger	.293	.027	73.927	.238	.347
	Middle-aged	.252	.027	75.081	.197	.307
	Older	.152	.027	75.602	.097	.206
Disabled	Younger	.294	.028	78.051	.239	.349
	Middle-aged	.284	.028	83.101	.228	.340
	Older	.156	.028	87.601	.100	.213

a Dependent Variable: 1-sec percentile (as a fraction).

9. Age Group * Limited access=1 Major surface=0(a)

Age Group	Limited access=1 Major surface=0	Mean	Std. Error	df	95% Confidence Interval	
					Lower Bound	Upper Bound
Younger	Major surface	.177	.027	76.367	.122	.231
	Limited-access	.410	.027	75.886	.355	.465
Middle-aged	Major surface	.180	.027	73.662	.126	.234
	Limited-access	.356	.028	85.098	.300	.412
Older	Major surface	.078	.028	78.864	.023	.134
	Limited-access	.230	.028	84.166	.173	.286

a Dependent Variable: 1-sec percentile (as a fraction).

10. Age Group * Traffic Density(a)

Age Group	Traffic Density	Mean	Std. Error	df	95% Confidence Interval	
					Lower Bound	Upper Bound
Younger	Sparse	.279	.028	86.468	.223	.335
	Moderate	.321	.028	85.858	.265	.378
	Dense	.279	.030	100.912	.221	.338
Middle-aged	Sparse	.222	.029	97.739	.164	.280
	Moderate	.288	.028	88.104	.232	.345
	Dense	.294	.029	99.861	.236	.352
Older	Sparse	.164	.029	98.189	.106	.222
	Moderate	.156	.028	87.725	.100	.213
	Dense	.142	.030	113.251	.082	.202

a Dependent Variable: 1-sec percentile (as a fraction).

11. ACAS * Lighting(a)

ACAS	Lighting	Mean	Std. Error	df	95% Confidence Interval	
					Lower Bound	Upper Bound
Enabled	Well-Lit	.249	.017	96.379	.215	.282
	Darker	.216	.017	111.759	.181	.250
Disabled	Well-Lit	.296	.017	102.639	.262	.330
	Darker	.194	.019	143.960	.157	.231

a Dependent Variable: 1-sec percentile (as a fraction).

12. LIGHTING * Limited access=1 Major surface=0(a)

Lighting	Limited access=1 Major surface=0	Mean	Std. Error	df	95% Confidence Interval	
					Lower Bound	Upper Bound
Well-Lit	Major surface	.168	.017	97.311	.135	.202
	Limited-access	.376	.017	101.829	.342	.410
Darker	Major surface	.122	.018	117.779	.087	.157
	Limited-access	.287	.019	138.318	.251	.324

a Dependent Variable: 1-sec percentile (as a fraction).

13. LIGHTING * Traffic Density(a)

Lighting	Traffic Density	Mean	Std. Error	df	95% Confidence Interval	
					Lower Bound	Upper Bound
Well-Lit	Sparse	.253	.018	134.663	.216	.289
	Moderate	.287	.018	123.103	.252	.323
	Dense	.277	.018	131.659	.241	.313
Darker	Sparse	.191	.019	165.228	.153	.229
	Moderate	.223	.019	143.062	.186	.260
	Dense	.200	.021	221.136	.158	.241

a Dependent Variable: 1-sec percentile (as a fraction).

14. ACAS * Limited access=1 Major surface=0(a)

ACAS	Limited access=1 Major surface=0	Mean	Std. Error	df	95% Confidence Interval	
					Lower Bound	Upper Bound
Enabled	Major surface	.147	.017	101.098	.113	.180
	Limited-access	.318	.017	106.564	.283	.352
Disabled	Major surface	.143	.018	113.176	.109	.178
	Limited-access	.346	.018	131.792	.310	.382

a Dependent Variable: 1-sec percentile (as a fraction).

15. ACAS * Traffic Density(a)

ACAS	Traffic Density	Mean	Std. Error	df	95% Confidence Interval	
					Lower Bound	Upper Bound
Enabled	Sparse	.209	.018	130.678	.173	.245
	Moderate	.244	.018	128.532	.208	.279
	Dense	.244	.019	150.976	.207	.282
Disabled	Sparse	.235	.019	169.145	.196	.273
	Moderate	.267	.018	136.813	.230	.303
	Dense	.232	.020	197.247	.192	.273

a Dependent Variable: 1-sec percentile (as a fraction).

16. Limited access=1 Major surface=0 * Traffic Density(a)

Limited access=1 Major surface=0	Traffic Density	Mean	Std. Error	df	95% Confidence Interval	
					Lower Bound	Upper Bound
Major surface	Sparse	.136	.018	127.577	.100	.172
	Moderate	.151	.018	126.919	.116	.187
	Dense	.148	.020	174.736	.109	.187
Limited-access	Sparse	.308	.020	173.147	.269	.346
	Moderate	.359	.018	138.639	.322	.395
	Dense	.329	.020	173.188	.290	.368

a Dependent Variable: 1-sec percentile (as a fraction).

17. ACAS * Age Group * LIGHTING(a)

ACAS	Age Group	Lighting	Mean	Std. Error	df	95% Confidence Interval	
						Lower Bound	Upper Bound
Enabled	Younger	Well-Lit	.321	.029	96.949	.264	.379
		Darker	.264	.030	106.429	.205	.323
	Middle-aged	Well-Lit	.269	.029	96.445	.211	.327
		Darker	.235	.030	112.552	.174	.295
	Older	Well-Lit	.155	.029	95.743	.098	.213
		Darker	.148	.031	116.388	.087	.208
Disabled	Younger	Well-Lit	.356	.029	99.836	.298	.414
		Darker	.231	.031	123.189	.170	.293
	Middle-aged	Well-Lit	.337	.030	105.462	.277	.396
		Darker	.232	.032	141.572	.168	.296
	Older	Well-Lit	.195	.030	102.654	.136	.254
		Darker	.118	.034	168.376	.051	.184

a Dependent Variable: 1-sec percentile (as a fraction).

18. Age Group * LIGHTING * Limited access=1 Major surface=0(a)

Age Group	Lighting	Limited access=1 Major surface=0	Mean	Std. Error	df	95% Confidence Interval	
						Lower Bound	Upper Bound
Younger	Well-Lit	Major surface	.207	.029	99.491	.149	.265
		Limited-access	.471	.029	97.353	.413	.529
	Darker	Major surface	.146	.031	114.976	.086	.207
		Limited-access	.349	.031	115.644	.289	.410
Middle-aged	Well-Lit	Major surface	.205	.029	95.417	.148	.263
		Limited-access	.400	.030	106.992	.341	.460
	Darker	Major surface	.155	.030	107.830	.095	.214
		Limited-access	.312	.033	147.810	.247	.376
Older	Well-Lit	Major surface	.093	.029	97.040	.035	.151
		Limited-access	.258	.030	101.236	.199	.316
	Darker	Major surface	.064	.032	130.996	.002	.127
		Limited-access	.201	.033	152.625	.136	.266

a Dependent Variable: 1-sec percentile (as a fraction).

19. Age Group * LIGHTING * Traffic Density(a)

Age Group	Lighting	Traffic Density	Mean	Std. Error	df	95% Confidence Interval	
						Lower Bound	Upper Bound
Younger	Well-Lit	Sparse	.316	.031	122.745	.255	.377
		Moderate	.355	.031	125.736	.293	.417
		Dense	.345	.032	135.535	.282	.408
	Darker	Sparse	.242	.032	140.958	.179	.306
		Moderate	.287	.032	132.332	.225	.350
		Dense	.214	.035	195.447	.144	.283
Middle-aged	Well-Lit	Sparse	.263	.033	147.199	.199	.327
		Moderate	.328	.031	122.923	.267	.389
		Dense	.318	.031	126.377	.256	.380
	Darker	Sparse	.182	.034	170.191	.115	.248
		Moderate	.248	.033	147.857	.184	.313
		Dense	.270	.036	203.737	.200	.340
Older	Well-Lit	Sparse	.179	.032	134.473	.116	.242
		Moderate	.179	.031	120.667	.118	.240
		Dense	.168	.032	133.127	.105	.231
	Darker	Sparse	.149	.035	185.611	.081	.217
		Moderate	.133	.033	149.238	.069	.198
		Dense	.116	.038	265.960	.040	.191

a Dependent Variable: 1-sec percentile (as a fraction).

20. ACAS * Age Group * Limited access=1 Major surface=0(a)

ACAS	Age Group	Limited access=1 Major surface=0	Mean	Std. Error	df	95% Confidence Interval	
						Lower Bound	Upper Bound
Enabled	Younger	Major surface	.174	.030	101.253	.116	.233
		Limited-access	.411	.030	101.875	.353	.470
	Middle-aged	Major surface	.170	.029	97.625	.112	.229
		Limited-access	.333	.030	111.124	.274	.393
	Older	Major surface	.095	.030	104.466	.036	.154
		Limited-access	.208	.030	106.771	.149	.267
Disabled	Younger	Major surface	.179	.030	112.933	.119	.239
		Limited-access	.408	.030	109.785	.349	.468
	Middle-aged	Major surface	.190	.030	104.956	.131	.249
		Limited-access	.379	.032	141.319	.315	.442
	Older	Major surface	.061	.031	121.894	.000	.123
		Limited-access	.251	.032	145.435	.187	.315

a Dependent Variable: 1-sec percentile (as a fraction).

21. ACAS * Age Group * Traffic Density(a)

ACAS	Age Group	Traffic Density	Mean	Std. Error	df	95% Confidence Interval	
						Lower Bound	Upper Bound
Enabled	Younger	Sparse	.251	.031	126.614	.190	.313
		Moderate	.332	.031	128.195	.270	.394
		Dense	.295	.032	144.842	.231	.359
	Middle-aged	Sparse	.221	.032	136.225	.158	.284
		Moderate	.268	.031	129.608	.205	.330
		Dense	.267	.032	145.062	.203	.331
	Older	Sparse	.153	.031	129.264	.091	.215
		Moderate	.131	.031	127.796	.069	.193
		Dense	.170	.033	163.308	.104	.236
Disabled	Younger	Sparse	.307	.032	136.628	.244	.370
		Moderate	.311	.031	129.642	.249	.373
		Dense	.263	.035	184.325	.195	.331
	Middle-aged	Sparse	.223	.034	181.289	.155	.291
		Moderate	.309	.032	140.186	.245	.372
		Dense	.321	.034	180.558	.253	.389
	Older	Sparse	.175	.035	191.337	.106	.244
		Moderate	.181	.032	140.732	.117	.244
		Dense	.113	.037	227.919	.041	.185

a Dependent Variable: 1-sec percentile (as a fraction).

Results, analysis #2

Fixed Effects

Source	Numerator df	Denominator df	F	Sig.
Intercept	1	63.968	243.805	.000
AGE GROU	2	63.916	7.225	.001
LIGHTING	1	1169.652	43.672	.000
ACAS	1	1160.597	1.895	.169
ROAD TYPE	1	1163.714	301.214	.000
TRAFFIC DENS	2	1161.520	3.437	.032
AGE GROU * LIGHTING	2	1169.269	2.619	.073
AGE GROU * ACAS	2	1159.815	.990	.372
AGE GROU * ROAD TYPE	2	1163.443	4.867	.008
AGE GROU * TRAFFIC DENS	4	1161.542	3.550	.007
LIGHTING * ACAS	1	1158.896	7.361	.007
LIGHTING * ROAD TYPE	1	1161.140	4.460	.035
LIGHTING * TRAFFIC DENS	2	1157.849	1.506	.222
ACAS * ROAD TYPE	1	1159.244	3.450	.063
ACAS * TRAFFIC DENS	2	1157.346	1.199	.302
ROAD TYPE * TRAFFIC DENS	2	1157.982	1.292	.275
AGE GROU * LIGHTING * ACAS	2	1158.483	.008	.992
AGE GROU * LIGHTING * ROAD TYPE	2	1160.679	.155	.856
AGE GROU * LIGHTING * TRAFFIC DENS	4	1157.709	.975	.420
AGE GROU * ACAS * ROAD TYPE	2	1158.552	1.169	.311
AGE GROU * ACAS * TRAFFIC DENS	4	1156.927	1.969	.097
AGE GROU * ROAD TYPE * TRAFFIC DENS	4	1157.514	.613	.653
LIGHTING * ACAS * ROAD TYPE	1	1158.518	.252	.616
LIGHTING * ACAS * TRAFFIC DENS	2	1157.551	1.449	.235
LIGHTING * ROAD TYPE * TRAFFIC DENS	2	1157.631	1.312	.270
ACAS * ROAD TYPE * TRAFFIC DENS	2	1157.847	.661	.517

a Dependent Variable: 1-sec percentile (as a fraction).

Estimated Marginal Means

1. Grand Mean(a)

Mean	Std. Error	df	95% Confidence Interval	
			Lower Bound	Upper Bound
.239	.015	63.953	.208	.269

a Dependent Variable: 1-sec percentile (as a fraction).

2. Age Group

Estimates(a)

Age Group	Mean	Std. Error	df	95% Confidence Interval	
				Lower Bound	Upper Bound
Younger	.291	.026	62.404	.238	.344
Middle-aged	.268	.027	63.919	.214	.321
Older	.157	.027	65.553	.104	.211

a Dependent Variable: 1-sec percentile (as a fraction).

Pairwise Comparisons(b)

(I) Age Group	(J) Age Group	Mean Difference (I-J)	Std. Error	df	Sig.(a)	95% Confidence Interval for Difference(a)	
						Lower Bound	Upper Bound
Younger	Middle-aged	.023	.037	63.160	1.000	-.069	.115
	Older	.134(*)	.038	63.970	.002	.041	.226
Middle-aged	Younger	-.023	.037	63.160	1.000	-.115	.069
	Older	.110(*)	.038	64.734	.014	.018	.203
Older	Younger	-.134(*)	.038	63.970	.002	-.226	-.041
	Middle-aged	-.110(*)	.038	64.734	.014	-.203	-.018

Based on estimated marginal means
* The mean difference is significant at the .05 level.
a Adjustment for multiple comparisons: Bonferroni.
b Dependent Variable: 1-sec percentile (as a fraction).

Tests of simple effect(a)

Numerator df	Denominator df	F	Sig.
2	63.944	7.170	.002

The F tests the effect of Age Group. This test is based on the linearly independent pairwise comparisons among the estimated marginal means.
a Dependent Variable: 1-sec percentile (as a fraction).

3. LIGHTING

Estimates(a)

Lighting	Mean	Std. Error	df	95% Confidence Interval	
				Lower Bound	Upper Bound
Well-Lit	.274	.016	73.028	.243	.306
Darker	.203	.017	87.617	.170	.236

a Dependent Variable: 1-sec percentile (as a fraction).

Pairwise Comparisons(b)

(I) Lighting	(J) Lighting	Mean Difference (I-J)	Std. Error	df	Sig.(a)	95% Confidence Interval for Difference(a)	
						Lower Bound	Upper Bound
Well-Lit	Darker	.071(*)	.011	1149.289	.000	.050	.092
Darker	Well-Lit	-.071(*)	.011	1149.289	.000	-.092	-.050

Based on estimated marginal means
* The mean difference is significant at the .05 level.
a Adjustment for multiple comparisons: Bonferroni.
b Dependent Variable: 1-sec percentile (as a fraction).

Tests of simple effect(a)

Numerator df	Denominator df	F	Sig.
1	1149.289	44.487	.000

The F tests the effect of Lighting. This test is based on the linearly independent pairwise comparisons among the estimated marginal means.
a Dependent Variable: 1-sec percentile (as a fraction).

4. ACAS

Estimates(a)

ACAS	Mean	Std. Error	df	95% Confidence Interval	
				Lower Bound	Upper Bound
Enabled	.232	.016	76.544	.200	.264
Disabled	.245	.016	83.204	.212	.278

a Dependent Variable: 1-sec percentile (as a fraction).

Pairwise Comparisons(b)

(I) ACAS	(J) ACAS	Mean Difference (I-J)	Std. Error	df	Sig.(a)	95% Confidence Interval for Difference(a)	
						Lower Bound	Upper Bound
Enabled	Disabled	-.013	.011	1140.594	.210	-.034	.007
Disabled	Enabled	.013	.011	1140.594	.210	-.007	.034

Based on estimated marginal means
a Adjustment for multiple comparisons: Bonferroni.
b Dependent Variable: 1-sec percentile (as a fraction).

Tests of simple effect(a)

Numerator df	Denominator df	F	Sig.
1	1140.594	1.573	.210

The F tests the effect of ACAS. This test is based on the linearly independent pairwise comparisons among the estimated marginal means.
a Dependent Variable: 1-sec percentile (as a fraction).

5. Limited access=1 Major surface=0

Estimates(a)

Limited access=1 Major surface=0	Mean	Std. Error	df	95% Confidence Interval	
				Lower Bound	Upper Bound
Major surface	.147	.016	77.200	.115	.179
Limited-access	.330	.016	82.770	.297	.363

a Dependent Variable: 1-sec percentile (as a fraction).

Pairwise Comparisons(b)

(I) Limited access=1 Major surface=0	(J) Limited access=1 Major surface=0	Mean Difference (I-J)	Std. Error	df	Sig.(a)	95% Confidence Interval for Difference(a)	
						Lower Bound	Upper Bound
Major surface	Limited-access	-.183(*)	.011	1143.726	.000	-.204	-.162
Limited-access	Major surface	.183(*)	.011	1143.726	.000	.162	.204

Based on estimated marginal means

* The mean difference is significant at the .05 level.

a Adjustment for multiple comparisons: Bonferroni.

b Dependent Variable: 1-sec percentile (as a fraction).

Tests of simple effect(a)

Numerator df	Denominator df	F	Sig.
1	1143.726	297.807	.000

The F tests the effect of Limited access=1 Major surface=0. This test is based on the linearly independent pairwise comparisons among the estimated marginal means.

a Dependent Variable: 1-sec percentile (as a fraction).

6. Traffic Density

Estimates(a)

Traffic Density	Mean	Std. Error	df	95% Confidence Interval	
				Lower Bound	Upper Bound
Sparse	.222	.017	96.320	.189	.256
Moderate	.255	.017	88.237	.222	.288
Dense	.238	.018	107.779	.203	.273

a Dependent Variable: 1-sec percentile (as a fraction).

Pairwise Comparisons(b)

(I) Traffic Density	(J) Traffic Density	Mean Difference (I-J)	Std. Error	df	Sig.(a)	95% Confidence Interval for Difference(a)	
						Lower Bound	Upper Bound
Sparse	Moderate	-.033(*)	.012	1140.806	.025	-.062	-.003
	Dense	-.016	.013	1143.849	.742	-.048	.017
Moderate	Sparse	.033(*)	.012	1140.806	.025	.003	.062
	Dense	.017	.013	1139.898	.569	-.014	.048
Dense	Sparse	.016	.013	1143.849	.742	-.017	.048
	Moderate	-.017	.013	1139.898	.569	-.048	.014

Based on estimated marginal means
* The mean difference is significant at the .05 level.
a Adjustment for multiple comparisons: Bonferroni.
b Dependent Variable: 1-sec percentile (as a fraction).

Tests of simple effect(a)

Numerator df	Denominator df	F	Sig.
2	1141.411	3.517	.030

The F tests the effect of Traffic Density. This test is based on the linearly independent pairwise comparisons among the estimated marginal means.
a Dependent Variable: 1-sec percentile (as a fraction).

7. Age Group * LIGHTING(a)

Age Group	Lighting	Mean	Std. Error	df	95% Confidence Interval	
					Lower Bound	Upper Bound
Younger	Well-Lit	.340	.027	72.663	.285	.395
	Darker	.241	.028	80.668	.185	.298
Middle-aged	Well-Lit	.304	.028	73.601	.250	.359
	Darker	.231	.029	86.707	.174	.288
Older	Well-Lit	.178	.027	72.821	.123	.233
	Darker	.137	.029	95.746	.078	.195

a Dependent Variable: 1-sec percentile (as a fraction).

8. ACAS * Age Group(a)

ACAS	Age Group	Mean	Std. Error	df	95% Confidence Interval	
					Lower Bound	Upper Bound
Enabled	Younger	.287	.028	74.747	.232	.343
	Middle-aged	.251	.028	75.872	.196	.306
	Older	.157	.028	79.042	.101	.213
Disabled	Younger	.294	.028	78.196	.238	.350
	Middle-aged	.284	.028	83.429	.228	.341
	Older	.157	.029	88.118	.100	.214

a Dependent Variable: 1-sec percentile (as a fraction).

9. Age Group * Limited access=1 Major surface=0(a)

Age Group	Limited access=1 Major surface=0	Mean	Std. Error	df	95% Confidence Interval	
					Lower Bound	Upper Bound
Younger	Major surface	.176	.028	77.064	.121	.232
	Limited-access	.405	.028	76.214	.350	.460
Middle-aged	Major surface	.184	.028	73.811	.129	.239
	Limited-access	.351	.029	86.116	.294	.408
Older	Major surface	.081	.028	80.795	.025	.137
	Limited-access	.233	.029	86.154	.176	.290

a Dependent Variable: 1-sec percentile (as a fraction).

10. Age Group * Traffic Density(a)

Age Group	Traffic Density	Mean	Std. Error	df	95% Confidence Interval	
					Lower Bound	Upper Bound
Younger	Sparse	.276	.029	87.169	.219	.333
	Moderate	.324	.029	86.796	.267	.381
	Dense	.273	.030	103.233	.213	.332
Middle-aged	Sparse	.220	.030	100.130	.161	.279
	Moderate	.289	.029	88.614	.231	.346
	Dense	.294	.030	101.180	.235	.354
Older	Sparse	.172	.030	101.951	.113	.231
	Moderate	.153	.029	89.313	.095	.210
	Dense	.147	.031	119.304	.085	.209

a Dependent Variable: 1-sec percentile (as a fraction).

11. ACAS * LIGHTING(a)

ACAS	Lighting	Mean	Std. Error	df	95% Confidence Interval	
					Lower Bound	Upper Bound
Enabled	Well-Lit	.252	.017	98.089	.218	.286
	Darker	.212	.018	120.133	.176	.247
Disabled	Well-Lit	.296	.017	103.717	.262	.330
	Darker	.194	.019	146.678	.157	.232

a Dependent Variable: 1-sec percentile (as a fraction).

12. LIGHTING * Limited access=1 Major surface=0(a)

Lighting	Limited access=1 Major surface=0	Mean	Std. Error	df	95% Confidence Interval	
					Lower Bound	Upper Bound
Well-Lit	Major surface	.171	.017	98.357	.137	.205
	Limited-access	.377	.017	103.556	.343	.412
Darker	Major surface	.123	.018	123.306	.087	.159
	Limited-access	.283	.019	144.216	.245	.320

a Dependent Variable: 1-sec percentile (as a fraction).

13. LIGHTING * Traffic Density(a)

Lighting	Traffic Density	Mean	Std. Error	df	95% Confidence Interval	
					Lower Bound	Upper Bound
Well-Lit	Sparse	.250	.019	138.771	.213	.287
	Moderate	.286	.018	124.995	.250	.322
	Dense	.286	.019	134.346	.249	.323
Darker	Sparse	.194	.020	174.602	.155	.234
	Moderate	.224	.019	148.391	.186	.262
	Dense	.190	.022	236.984	.148	.233

a Dependent Variable: 1-sec percentile (as a fraction).

14. ACAS * Limited access=1 Major surface=0(a)

ACAS	Limited access=1 Major surface=0	Mean	Std. Error	df	95% Confidence Interval	
					Lower Bound	Upper Bound
Enabled	Major surface	.150	.017	105.771	.116	.185
	Limited-access	.314	.018	111.747	.279	.349
Disabled	Major surface	.144	.018	114.671	.109	.179
	Limited-access	.346	.019	134.062	.310	.383

a Dependent Variable: 1-sec percentile (as a fraction).

15. ACAS * Traffic Density(a)

ACAS	Traffic Density	Mean	Std. Error	df	95% Confidence Interval	
					Lower Bound	Upper Bound
Enabled	Sparse	.210	.019	139.907	.173	.247
	Moderate	.243	.018	133.176	.207	.280
	Dense	.243	.020	163.424	.204	.281
Disabled	Sparse	.235	.020	172.974	.196	.274
	Moderate	.267	.019	139.253	.230	.304
	Dense	.233	.021	202.172	.192	.274

a Dependent Variable: 1-sec percentile (as a fraction).

16. Limited access=1 Major surface=0 * Traffic Density(a)

Limited access=1 Major surface=0	Traffic Density	Mean	Std. Error	df	95% Confidence Interval	
					Lower Bound	Upper Bound
Major surface	Sparse	.138	.018	131.185	.101	.174
	Moderate	.152	.018	129.816	.115	.188
	Dense	.152	.020	186.633	.112	.191
Limited-access	Sparse	.307	.020	182.950	.267	.347
	Moderate	.358	.019	142.900	.321	.396
	Dense	.325	.020	179.157	.285	.364

a Dependent Variable: 1-sec percentile (as a fraction).

17. ACAS * Age Group * LIGHTING(a)

ACAS	Age Group	Lighting	Mean	Std. Error	df	95% Confidence Interval	
						Lower Bound	Upper Bound
Enabled	Younger	Well-Lit	.324	.030	98.792	.265	.383
		Darker	.251	.031	110.597	.190	.311
	Middle-aged	Well-Lit	.272	.030	97.868	.213	.330
		Darker	.230	.031	117.068	.169	.292
	Older	Well-Lit	.161	.030	97.607	.102	.219
		Darker	.154	.032	133.166	.090	.217
Disabled	Younger	Well-Lit	.356	.030	100.797	.297	.415
		Darker	.232	.032	125.075	.170	.295
	Middle-aged	Well-Lit	.337	.030	106.651	.277	.397
		Darker	.231	.033	144.159	.166	.296
	Older	Well-Lit	.195	.030	103.741	.135	.255
		Darker	.119	.034	172.098	.051	.187

a Dependent Variable: 1-sec percentile (as a fraction).

18. Age Group * LIGHTING * Limited access=1 Major surface=0(a)

Age Group	Lighting	Limited access=1 Major surface=0	Mean	Std. Error	df	95% Confidence Interval	
						Lower Bound	Upper Bound
Younger	Well-Lit	Major surface	.211	.030	100.965	.152	.270
		Limited-access	.469	.030	98.684	.410	.528
	Darker	Major surface	.142	.031	118.962	.080	.204
		Limited-access	.341	.031	118.028	.279	.403
Middle-aged	Well-Lit	Major surface	.209	.029	96.220	.151	.268
		Limited-access	.400	.030	108.797	.339	.460
	Darker	Major surface	.158	.030	109.836	.098	.219
		Limited-access	.303	.033	153.222	.237	.369
Older	Well-Lit	Major surface	.093	.030	97.907	.034	.151
		Limited-access	.263	.030	103.286	.204	.323
	Darker	Major surface	.069	.033	141.956	.005	.134
		Limited-access	.204	.034	162.841	.137	.271

a Dependent Variable: 1-sec percentile (as a fraction).

19. Age Group * LIGHTING * Traffic Density(a)

Age Group	Lighting	Traffic Density	Mean	Std. Error	df	95% Confidence Interval	
						Lower Bound	Upper Bound
Younger	Well-Lit	Sparse	.313	.032	125.832	.250	.375
		Moderate	.354	.032	127.713	.291	.417
		Dense	.354	.032	139.254	.290	.418
	Darker	Sparse	.239	.033	143.588	.174	.304
		Moderate	.294	.032	137.113	.230	.357
		Dense	.192	.036	205.445	.121	.263
Middle-aged	Well-Lit	Sparse	.256	.033	151.573	.191	.322
		Moderate	.329	.031	124.814	.267	.391
		Dense	.328	.032	128.411	.265	.390
	Darker	Sparse	.183	.035	179.868	.114	.251
		Moderate	.248	.033	150.726	.183	.313
		Dense	.261	.036	210.765	.189	.333
Older	Well-Lit	Sparse	.182	.032	139.363	.118	.246
		Moderate	.175	.031	122.475	.113	.237
		Dense	.176	.032	135.450	.112	.239
	Darker	Sparse	.161	.036	201.993	.091	.232
		Moderate	.130	.034	157.608	.064	.196
		Dense	.118	.040	297.178	.039	.197

a Dependent Variable: 1-sec percentile (as a fraction).

20. ACAS * Age Group * Limited access=1 Major surface=0(a)

ACAS	Age Group	Limited access=1 Major surface=0	Mean	Std. Error	df	95% Confidence Interval	
						Lower Bound	Upper Bound
Enabled	Younger	Major surface	.173	.030	105.024	.113	.232
		Limited-access	.402	.030	104.163	.343	.462
	Middle-aged	Major surface	.178	.030	99.252	.119	.237
		Limited-access	.324	.031	115.408	.263	.385
	Older	Major surface	.100	.031	113.233	.039	.161
		Limited-access	.215	.031	115.826	.153	.276
Disabled	Younger	Major surface	.180	.031	114.408	.119	.241
		Limited-access	.408	.031	111.133	.347	.468
	Middle-aged	Major surface	.189	.030	106.125	.130	.249
		Limited-access	.379	.033	143.909	.314	.443
	Older	Major surface	.062	.031	123.751	.000	.124
		Limited-access	.252	.033	148.361	.187	.317

a Dependent Variable: 1-sec percentile (as a fraction).

21. ACAS * Age Group * Traffic Density(a)

ACAS	Age Group	Traffic Density	Mean	Std. Error	df	95% Confidence Interval	
						Lower Bound	Upper Bound
Enabled	Younger	Sparse	.245	.032	129.854	.182	.308
		Moderate	.337	.032	132.819	.273	.400
		Dense	.281	.033	153.774	.215	.347
	Middle-aged	Sparse	.216	.033	145.555	.151	.281
		Moderate	.269	.032	131.767	.206	.332
		Dense	.268	.033	149.761	.202	.333
	Older	Sparse	.168	.033	144.518	.103	.232
		Moderate	.124	.032	134.950	.060	.188
		Dense	.180	.035	187.643	.111	.249
Disabled	Younger	Sparse	.307	.032	139.087	.243	.371
		Moderate	.311	.032	131.775	.248	.374
		Dense	.265	.035	188.683	.196	.334
	Middle-aged	Sparse	.223	.035	185.578	.154	.292
		Moderate	.308	.033	142.762	.244	.373
		Dense	.321	.035	184.809	.252	.390
	Older	Sparse	.176	.036	196.130	.106	.246
		Moderate	.182	.033	143.350	.117	.246
		Dense	.114	.037	234.099	.040	.187

a Dependent Variable: 1-sec percentile (as a fraction).

Results, analysis #3

Fixed Effects

Source	Numerator df	Denominator df	F	Sig.
Intercept	1	64.134	251.096	.000
AGE GROU	2	64.041	9.293	.000
LIGHTING	1	1184.413	42.360	.000
ACAS	1	1174.972	2.495	.115
ROAD TYPE	1	1178.271	325.946	.000
TRAFFIC DENS	2	1176.581	3.853	.021
AGE GROU * LIGHTING	2	1184.065	2.570	.077
AGE GROU * ACAS	2	1174.422	1.430	.240
AGE GROU * ROAD TYPE	2	1177.983	8.025	.000
AGE GROU * TRAFFIC DENS	4	1176.574	1.994	.093
LIGHTING * ACAS	1	1173.266	7.764	.005
LIGHTING * ROAD TYPE	1	1175.357	4.025	.045
LIGHTING * TRAFFIC DENS	2	1172.865	.286	.752
ACAS * ROAD TYPE	1	1173.673	3.316	.069
ACAS * TRAFFIC DENS	2	1172.433	2.380	.093
ROAD TYPE * TRAFFIC DENS	2	1173.488	1.261	.284
AGE GROU * LIGHTING * ACAS	2	1172.989	.208	.812
AGE GROU * LIGHTING * ROAD TYPE	2	1174.822	.531	.588
AGE GROU * LIGHTING * TRAFFIC DENS	4	1172.664	.524	.718
AGE GROU * ACAS * ROAD TYPE	2	1173.176	1.072	.342
AGE GROU * ACAS * TRAFFIC DENS	4	1172.063	1.603	.171
AGE GROU * ROAD TYPE * TRAFFIC DENS	4	1172.974	.090	.986
LIGHTING * ACAS * ROAD TYPE	1	1172.965	.066	.797
LIGHTING * ACAS * TRAFFIC DENS	2	1172.495	1.531	.217
LIGHTING * ROAD TYPE * TRAFFIC DENS	2	1172.484	.715	.489
ACAS * ROAD TYPE * TRAFFIC DENS	2	1172.901	1.574	.208

a Dependent Variable: 1-sec percentile (as a fraction).

Estimated Marginal Means

1. Grand Mean(a)

Mean	Std. Error	df	95% Confidence Interval	
			Lower Bound	Upper Bound
.237	.015	64.122	.207	.267

a Dependent Variable: 1-sec percentile (as a fraction).

2. Age Group

Estimates(a)

Age Group	Mean	Std. Error	df	95% Confidence Interval	
				Lower Bound	Upper Bound
Younger	.294	.026	62.545	.242	.345
Middle-aged	.270	.026	64.339	.218	.322
Older	.146	.026	65.498	.094	.199

a Dependent Variable: 1-sec percentile (as a fraction).

Pairwise Comparisons(b)

(I) Age Group	(J) Age Group	Mean Difference (I-J)	Std. Error	df	Sig.(a)	95% Confidence Interval for Difference(a)	
						Lower Bound	Upper Bound
Younger	Middle-aged	.024	.037	63.439	1.000	-.066	.114
	Older	.147(*)	.037	64.014	.000	.057	.237
Middle-aged	Younger	-.024	.037	63.439	1.000	-.114	.066
	Older	.123(*)	.037	64.917	.004	.033	.214
Older	Younger	-.147(*)	.037	64.014	.000	-.237	-.057
	Middle-aged	-.123(*)	.037	64.917	.004	-.214	-.033

Based on estimated marginal means
* The mean difference is significant at the .05 level.
a Adjustment for multiple comparisons: Bonferroni.
b Dependent Variable: 1-sec percentile (as a fraction).

Tests of simple effect(a)

Numerator df	Denominator df	F	Sig.
2	64.114	9.186	.000

The F tests the effect of Age Group. This test is based on the linearly independent pairwise comparisons among the estimated marginal means.
a Dependent Variable: 1-sec percentile (as a fraction).

3. LIGHTING

Estimates(a)

Lighting	Mean	Std. Error	df	95% Confidence Interval	
				Lower Bound	Upper Bound
Well-Lit	.270	.016	73.410	.239	.301
Darker	.203	.016	86.703	.171	.235

a Dependent Variable: 1-sec percentile (as a fraction).

Pairwise Comparisons(b)

(I) Lighting	(J) Lighting	Mean Difference (I-J)	Std. Error	df	Sig.(a)	95% Confidence Interval for Difference(a)	
						Lower Bound	Upper Bound
Well-Lit	Darker	.067(*)	.010	1164.088	.000	.047	.087
Darker	Well-Lit	-.067(*)	.010	1164.088	.000	-.087	-.047

Based on estimated marginal means
* The mean difference is significant at the .05 level.
a Adjustment for multiple comparisons: Bonferroni.
b Dependent Variable: 1-sec percentile (as a fraction).

Tests of simple effect(a)

Numerator df	Denominator df	F	Sig.
1	1164.088	42.052	.000

The F tests the effect of Lighting. This test is based on the linearly independent pairwise comparisons among the estimated marginal means.
a Dependent Variable: 1-sec percentile (as a fraction).

4. ACAS

Estimates(a)

ACAS	Mean	Std. Error	df	95% Confidence Interval	
				Lower Bound	Upper Bound
Enabled	.229	.016	75.234	.198	.260
Disabled	.244	.016	84.050	.212	.276

a Dependent Variable: 1-sec percentile (as a fraction).

Pairwise Comparisons(b)

(I) ACAS	(J) ACAS	Mean Difference (I-J)	Std. Error	df	Sig.(a)	95% Confidence Interval for Difference(a)	
						Lower Bound	Upper Bound
Enabled	Disabled	-.015	.010	1154.915	.141	-.035	.005
Disabled	Enabled	.015	.010	1154.915	.141	-.005	.035

Based on estimated marginal means
a Adjustment for multiple comparisons: Bonferroni.
b Dependent Variable: 1-sec percentile (as a fraction).

Tests of simple effect(a)

Numerator df	Denominator df	F	Sig.
1	1154.915	2.174	.141

The F tests the effect of ACAS. This test is based on the linearly independent pairwise comparisons among the estimated marginal means.
a Dependent Variable: 1-sec percentile (as a fraction).

5. Limited access=1 Major surface=0

Estimates(a)

Limited access=1 Major surface=0	Mean	Std. Error	df	95% Confidence Interval	
				Lower Bound	Upper Bound
Major surface	.145	.016	76.471	.114	.176
Limited-access	.328	.016	83.030	.296	.360

a Dependent Variable: 1-sec percentile (as a fraction).

Pairwise Comparisons(b)

(I) Limited access=1 Major surface=0	(J) Limited access=1 Major surface=0	Mean Difference (I-J)	Std. Error	df	Sig.(a)	95% Confidence Interval for Difference(a)	
						Lower Bound	Upper Bound
Major surface	Limited-access	-.183(*)	.010	1158.264	.000	-.204	-.163
Limited-access	Major surface	.183(*)	.010	1158.264	.000	.163	.204

Based on estimated marginal means

* The mean difference is significant at the .05 level.

a Adjustment for multiple comparisons: Bonferroni.

b Dependent Variable: 1-sec percentile (as a fraction).

Tests of simple effect(a)

Numerator df	Denominator df	F	Sig.
1	1158.264	321.966	.000

The F tests the effect of Limited access=1 Major surface=0. This test is based on the linearly independent pairwise comparisons among the estimated marginal means.

a Dependent Variable: 1-sec percentile (as a fraction).

6. Traffic Density

Estimates(a)

Traffic Density	Mean	Std. Error	df	95% Confidence Interval	
				Lower Bound	Upper Bound
Sparse	.220	.017	97.017	.187	.253
Moderate	.253	.016	87.699	.221	.286
Dense	.237	.017	105.494	.203	.271

a Dependent Variable: 1-sec percentile (as a fraction).

Pairwise Comparisons(b)

(I) Traffic Density	(J) Traffic Density	Mean Difference (I-J)	Std. Error	df	Sig.(a)	95% Confidence Interval for Difference(a)	
						Lower Bound	Upper Bound
Sparse	Moderate	-.034(*)	.012	1156.209	.016	-.062	-.005
	Dense	-.017	.013	1158.697	.570	-.048	.014
Moderate	Sparse	.034(*)	.012	1156.209	.016	.005	.062
	Dense	.016	.012	1154.664	.554	-.013	.046
Dense	Sparse	.017	.013	1158.697	.570	-.014	.048
	Moderate	-.016	.012	1154.664	.554	-.046	.013

Based on estimated marginal means
* The mean difference is significant at the .05 level.
a Adjustment for multiple comparisons: Bonferroni.
b Dependent Variable: 1-sec percentile (as a fraction).

Tests of simple effect(a)

Numerator df	Denominator df	F	Sig.
2	1156.423	3.931	.020

The F tests the effect of Traffic Density. This test is based on the linearly independent pairwise comparisons among the estimated marginal means.
a Dependent Variable: 1-sec percentile (as a fraction).

7. Age Group * LIGHTING(a)

Age Group	Lighting	Mean	Std. Error	df	95% Confidence Interval	
					Lower Bound	Upper Bound
Younger	Well-Lit	.342	.027	72.720	.288	.395
	Darker	.245	.028	80.081	.191	.300
Middle-aged	Well-Lit	.301	.027	74.141	.248	.355
	Darker	.238	.028	86.696	.182	.294
Older	Well-Lit	.167	.027	73.374	.113	.221
	Darker	.126	.029	93.549	.069	.183

a Dependent Variable: 1-sec percentile (as a fraction).

8. ACAS * Age Group(a)

ACAS	Age Group	Mean	Std. Error	df	95% Confidence Interval	
					Lower Bound	Upper Bound
Enabled	Younger	.291	.027	74.151	.237	.344
	Middle-aged	.251	.027	75.355	.197	.305
	Older	.146	.027	76.203	.092	.200
Disabled	Younger	.296	.027	78.268	.242	.351
	Middle-aged	.289	.028	84.522	.233	.344
	Older	.147	.028	89.526	.091	.203

a Dependent Variable: 1-sec percentile (as a fraction).

9. Age Group * Limited access=1 Major surface=0(a)

Age Group	Limited access=1 Major surface=0	Mean	Std. Error	df	95% Confidence Interval	
					Lower Bound	Upper Bound
Younger	Major surface	.176	.027	76.550	.122	.230
	Limited-access	.411	.027	76.154	.357	.465
Middle-aged	Major surface	.180	.027	73.796	.127	.234
	Limited-access	.359	.028	86.754	.304	.415
Older	Major surface	.078	.027	79.109	.024	.133
	Limited-access	.215	.028	86.373	.159	.270

a Dependent Variable: 1-sec percentile (as a fraction).

10. Age Group * Traffic Density(a)

Age Group	Traffic Density	Mean	Std. Error	df	95% Confidence Interval	
					Lower Bound	Upper Bound
Younger	Sparse	.283	.028	87.126	.227	.339
	Moderate	.320	.028	86.227	.264	.376
	Dense	.278	.029	101.589	.220	.336
Middle-aged	Sparse	.226	.029	100.967	.168	.284
	Moderate	.287	.028	88.525	.231	.344
	Dense	.296	.029	100.891	.238	.353
Older	Sparse	.150	.029	103.298	.092	.208
	Moderate	.152	.028	88.355	.096	.208
	Dense	.137	.030	114.232	.078	.197

a Dependent Variable: 1-sec percentile (as a fraction).

11. ACAS * LIGHTING(a)

ACAS	Lighting	Mean	Std. Error	df	95% Confidence Interval	
					Lower Bound	Upper Bound
Enabled	Well-Lit	.248	.017	97.442	.215	.281
	Darker	.210	.017	113.193	.176	.244
Disabled	Well-Lit	.292	.017	104.819	.258	.326
	Darker	.196	.019	148.014	.159	.233

a Dependent Variable: 1-sec percentile (as a fraction).

12. LIGHTING * Limited access=1 Major surface=0(a)

Lighting	Limited access=1 Major surface=0	Mean	Std. Error	df	95% Confidence Interval	
					Lower Bound	Upper Bound
Well-Lit	Major surface	.168	.017	97.932	.135	.201
	Limited-access	.372	.017	104.429	.338	.406
Darker	Major surface	.122	.018	118.843	.087	.157
	Limited-access	.285	.018	142.843	.248	.321

a Dependent Variable: 1-sec percentile (as a fraction).

13. LIGHTING * Traffic Density(a)

Lighting	Traffic Density	Mean	Std. Error	df	95% Confidence Interval	
					Lower Bound	Upper Bound
Well-Lit	Sparse	.250	.018	140.124	.214	.286
	Moderate	.285	.018	124.646	.249	.320
	Dense	.276	.018	133.474	.240	.311
Darker	Sparse	.190	.019	174.764	.151	.228
	Moderate	.222	.018	144.691	.185	.258
	Dense	.198	.021	224.480	.157	.239

a Dependent Variable: 1-sec percentile (as a fraction).

14. ACAS * Limited access=1 Major surface=0(a)

ACAS	Limited access=1 Major surface=0	Mean	Std. Error	df	95% Confidence Interval	
					Lower Bound	Upper Bound
Enabled	Major surface	.146	.017	101.802	.113	.180
	Limited-access	.312	.017	108.318	.278	.346
Disabled	Major surface	.143	.017	114.143	.109	.178
	Limited-access	.345	.018	137.207	.309	.381

a Dependent Variable: 1-sec percentile (as a fraction).

15. ACAS * Traffic Density(a)

ACAS	Traffic Density	Mean	Std. Error	df	95% Confidence Interval	
					Lower Bound	Upper Bound
Enabled	Sparse	.200	.018	133.654	.164	.236
	Moderate	.243	.018	130.190	.207	.279
	Dense	.244	.019	153.241	.207	.281
Disabled	Sparse	.240	.020	181.427	.201	.278
	Moderate	.263	.018	138.306	.227	.300
	Dense	.229	.020	200.095	.189	.269

a Dependent Variable: 1-sec percentile (as a fraction).

16. Limited access=1 Major surface=0 * Traffic Density(a)

Limited access=1 Major surface=0	Traffic Density	Mean	Std. Error	df	95% Confidence Interval	
					Lower Bound	Upper Bound
Major surface	Sparse	.135	.018	128.870	.100	.171
	Moderate	.151	.018	128.191	.115	.186
	Dense	.148	.020	177.075	.110	.187
Limited-access	Sparse	.304	.020	187.601	.265	.343
	Moderate	.356	.018	140.514	.319	.392
	Dense	.325	.019	176.015	.287	.364

a Dependent Variable: 1-sec percentile (as a fraction).

17. ACAS * Age Group * LIGHTING(a)

ACAS	Age Group	Lighting	Mean	Std. Error	df	95% Confidence Interval	
						Lower Bound	Upper Bound
Enabled	Younger	Well-Lit	.321	.029	98.017	.264	.378
		Darker	.260	.030	107.239	.202	.319
	Middle-aged	Well-Lit	.267	.029	97.517	.210	.325
		Darker	.234	.030	113.491	.175	.294
	Older	Well-Lit	.156	.029	96.795	.099	.213
		Darker	.136	.030	118.970	.076	.196
Disabled	Younger	Well-Lit	.362	.029	100.507	.304	.420
		Darker	.231	.031	124.365	.170	.291
	Middle-aged	Well-Lit	.335	.030	108.133	.277	.394
		Darker	.242	.032	146.260	.179	.306
	Older	Well-Lit	.178	.030	105.882	.120	.237
		Darker	.116	.034	174.914	.049	.182

a Dependent Variable: 1-sec percentile (as a fraction).

18. Age Group * LIGHTING * Limited access=1 Major surface=0(a)

Age Group	Lighting	Limited access=1 Major surface=0	Mean	Std. Error	df	95% Confidence Interval	
						Lower Bound	Upper Bound
Younger	Well-Lit	Major surface	.207	.029	100.154	.149	.264
		Limited-access	.477	.029	98.429	.419	.534
	Darker	Major surface	.146	.030	115.971	.086	.206
		Limited-access	.345	.030	116.644	.285	.405
Middle-aged	Well-Lit	Major surface	.206	.029	96.001	.148	.263
		Limited-access	.397	.030	110.229	.338	.456
	Darker	Major surface	.155	.030	108.669	.096	.214
		Limited-access	.322	.033	152.811	.257	.386
Older	Well-Lit	Major surface	.092	.029	97.659	.034	.149
		Limited-access	.242	.029	104.765	.184	.301
	Darker	Major surface	.065	.031	132.365	.003	.127
		Limited-access	.187	.033	160.535	.122	.252

a Dependent Variable: 1-sec percentile (as a fraction).

19. Age Group * LIGHTING * Traffic Density(a)

Age Group	Lighting	Traffic Density	Mean	Std. Error	df	95% Confidence Interval	
						Lower Bound	Upper Bound
Younger	Well-Lit	Sparse	.328	.031	125.104	.267	.389
		Moderate	.354	.031	126.968	.293	.415
		Dense	.343	.032	136.983	.280	.405
	Darker	Sparse	.238	.032	142.545	.175	.301
		Moderate	.286	.031	133.709	.224	.348
		Dense	.212	.035	198.209	.143	.281
Middle-aged	Well-Lit	Sparse	.258	.033	153.765	.193	.322
		Moderate	.326	.031	124.106	.265	.386
		Dense	.321	.031	128.936	.259	.382
	Darker	Sparse	.195	.034	180.185	.128	.262
		Moderate	.249	.032	149.579	.186	.313
		Dense	.270	.035	206.712	.201	.340
Older	Well-Lit	Sparse	.164	.032	142.072	.101	.227
		Moderate	.174	.031	122.873	.113	.235
		Dense	.163	.031	134.546	.101	.225
	Darker	Sparse	.136	.035	203.347	.066	.205
		Moderate	.131	.032	151.030	.067	.195
		Dense	.111	.038	270.246	.036	.186

a Dependent Variable: 1-sec percentile (as a fraction).

20. ACAS * Age Group * Limited access=1 Major surface=0(a)

ACAS	Age Group	Limited access=1 Major surface=0	Mean	Std. Error	df	95% Confidence Interval	
						Lower Bound	Upper Bound
Enabled	Younger	Major surface	.173	.029	101.954	.115	.231
		Limited-access	.408	.029	103.036	.350	.466
	Middle-aged	Major surface	.170	.029	98.254	.113	.228
		Limited-access	.331	.030	112.589	.272	.391
	Older	Major surface	.095	.029	105.248	.037	.154
		Limited-access	.196	.030	109.416	.137	.255
Disabled	Younger	Major surface	.179	.030	113.885	.120	.239
		Limited-access	.414	.030	110.669	.354	.473
	Middle-aged	Major surface	.190	.029	105.743	.132	.249
		Limited-access	.388	.032	148.372	.324	.451
	Older	Major surface	.061	.031	123.065	.000	.122
		Limited-access	.233	.033	154.200	.168	.297

a Dependent Variable: 1-sec percentile (as a fraction).

21. ACAS * Age Group * Traffic Density(a)

ACAS	Age Group	Traffic Density	Mean	Std. Error	df	95% Confidence Interval	
						Lower Bound	Upper Bound
Enabled	Younger	Sparse	.249	.031	129.055	.188	.311
		Moderate	.330	.031	129.482	.269	.392
		Dense	.292	.032	146.497	.229	.356
	Middle-aged	Sparse	.215	.032	137.703	.153	.278
		Moderate	.267	.031	130.939	.206	.329
		Dense	.269	.032	148.080	.206	.333
	Older	Sparse	.135	.031	134.255	.073	.197
		Moderate	.131	.031	130.152	.070	.193
		Dense	.171	.033	165.421	.106	.237
Disabled	Younger	Sparse	.317	.032	138.123	.254	.379
		Moderate	.310	.031	130.960	.248	.371
		Dense	.263	.034	186.856	.195	.330
	Middle-aged	Sparse	.237	.035	197.008	.169	.306
		Moderate	.308	.032	141.749	.245	.370
		Dense	.322	.034	183.047	.255	.389
	Older	Sparse	.164	.035	212.088	.094	.234
		Moderate	.173	.032	142.334	.110	.236
		Dense	.103	.036	231.452	.032	.175

a Dependent Variable: 1-sec percentile (as a fraction).

Results, analysis #4

Fixed Effects

Source	*Numerator df*	*Denominator df*	*F*	*Sig.*
Intercept	1	64.193	245.042	.000
AGE GROU	2	64.115	8.477	.001
LIGHTING	1	1159.535	41.788	.000
ACAS	1	1149.857	2.622	.106
ROAD TYPE	1	1152.897	286.995	.000
TRAFFIC DENS	2	1150.959	3.716	.025
AGE GROU * LIGHTING	2	1159.065	3.130	.044
AGE GROU * ACAS	2	1148.982	1.265	.283
AGE GROU * ROAD TYPE	2	1152.635	6.372	.002
AGE GROU * TRAFFIC DENS	4	1150.957	2.477	.043
LIGHTING * ACAS	1	1147.605	5.522	.019
LIGHTING * ROAD TYPE	1	1150.168	4.138	.042
LIGHTING * TRAFFIC DENS	2	1147.279	1.626	.197
ACAS * ROAD TYPE	1	1148.707	4.230	.040
ACAS * TRAFFIC DENS	2	1146.595	1.967	.140
ROAD TYPE * TRAFFIC DENS	2	1147.437	1.556	.211
AGE GROU * LIGHTING * ACAS	2	1147.194	.065	.937
AGE GROU * LIGHTING * ROAD TYPE	2	1149.725	.339	.712
AGE GROU * LIGHTING * TRAFFIC DENS	4	1147.109	.802	.524
AGE GROU * ACAS * ROAD TYPE	2	1148.011	.805	.448
AGE GROU * ACAS * TRAFFIC DENS	4	1146.120	1.692	.150
AGE GROU * ROAD TYPE * TRAFFIC DENS	4	1146.914	.110	.979
LIGHTING * ACAS * ROAD TYPE	1	1147.525	.028	.866
LIGHTING * ACAS * TRAFFIC DENS	2	1146.791	.792	.453
LIGHTING * ROAD TYPE * TRAFFIC DENS	2	1146.587	1.315	.269
ACAS * ROAD TYPE * TRAFFIC DENS	2	1147.235	1.548	.213

a Dependent Variable: 1-sec percentile (as a fraction).

Estimated Marginal Means

1. Grand Mean(a)

Mean	Std. Error	df	95% Confidence Interval	
			Lower Bound	Upper Bound
.237	.015	64.181	.206	.267

a Dependent Variable: 1-sec percentile (as a fraction).

2. Age Group

Estimates(a)

Age Group	Mean	Std. Error	df	95% Confidence Interval	
				Lower Bound	Upper Bound
Younger	.291	.026	62.310	.239	.343
Middle-aged	.269	.026	64.140	.217	.322
Older	.149	.026	66.120	.096	.202

a Dependent Variable: 1-sec percentile (as a fraction).

Pairwise Comparisons(b)

(I) Age Group	(J) Age Group	Mean Difference (I-J)	Std. Error	df	Sig.(a)	95% Confidence Interval for Difference(a)	
						Lower Bound	Upper Bound
Younger	Middle-aged	.022	.037	63.222	1.000	-.069	.113
	Older	.142(*)	.037	64.202	.001	.050	.233
Middle-aged	Younger	-.022	.037	63.222	1.000	-.113	.069
	Older	.120(*)	.037	65.127	.006	.029	.212
Older	Younger	-.142(*)	.037	64.202	.001	-.233	-.050
	Middle-aged	-.120(*)	.037	65.127	.006	-.212	-.029

Based on estimated marginal means
* The mean difference is significant at the .05 level.
a Adjustment for multiple comparisons: Bonferroni.
b Dependent Variable: 1-sec percentile (as a fraction).

Tests of simple effect(a)

Numerator df	Denominator df	F	Sig.
2	64.168	8.401	.001

The F tests the effect of Age Group. This test is based on the linearly independent pairwise comparisons among the estimated marginal means.
a Dependent Variable: 1-sec percentile (as a fraction).

3. LIGHTING

Estimates(a)

Lighting	Mean	Std. Error	df	95% Confidence Interval	
				Lower Bound	Upper Bound
Well-Lit	.271	.016	73.565	.240	.303
Darker	.202	.017	88.902	.169	.235

a Dependent Variable: 1-sec percentile (as a fraction).

Pairwise Comparisons(b)

(I) Lighting	(J) Lighting	Mean Difference (I-J)	Std. Error	df	Sig.(a)	95% Confidence Interval for Difference(a)	
						Lower Bound	Upper Bound
Well-Lit	Darker	.070(*)	.011	1139.085	.000	.049	.091
Darker	Well-Lit	-.070(*)	.011	1139.085	.000	-.091	-.049

Based on estimated marginal means
* The mean difference is significant at the .05 level.
a Adjustment for multiple comparisons: Bonferroni.
b Dependent Variable: 1-sec percentile (as a fraction).

Tests of simple effect(a)

Numerator df	Denominator df	F	Sig.
1	1139.085	41.884	.000

The F tests the effect of Lighting. This test is based on the linearly independent pairwise comparisons among the estimated marginal means.
a Dependent Variable: 1-sec percentile (as a fraction).

4. ACAS

Estimates(a)

ACAS	Mean	Std. Error	df	95% Confidence Interval	
				Lower Bound	Upper Bound
Enabled	.229	.016	77.092	.197	.260
Disabled	.244	.016	84.413	.212	.277

a Dependent Variable: 1-sec percentile (as a fraction).

Pairwise Comparisons(b)

(I) ACAS	(J) ACAS	Mean Difference (I-J)	Std. Error	df	Sig.(a)	95% Confidence Interval for Difference(a)	
						Lower Bound	Upper Bound
Enabled	Disabled	-.016	.011	1129.889	.137	-.037	.005
Disabled	Enabled	.016	.011	1129.889	.137	-.005	.037

Based on estimated marginal means
a Adjustment for multiple comparisons: Bonferroni.
b Dependent Variable: 1-sec percentile (as a fraction).

Tests of simple effect(a)

Numerator df	Denominator df	F	Sig.
1	1129.889	2.215	.137

The F tests the effect of ACAS. This test is based on the linearly independent pairwise comparisons among the estimated marginal means.
a Dependent Variable: 1-sec percentile (as a fraction).

5. Limited access=1 Major surface=0

Estimates(a)

Limited access=1 Major surface=0	Mean	Std. Error	df	95% Confidence Interval	
				Lower Bound	Upper Bound
Major surface	.147	.016	77.390	.115	.179
Limited-access	.326	.016	84.362	.294	.359

a Dependent Variable: 1-sec percentile (as a fraction).

Pairwise Comparisons(b)

(I) Limited access=1 Major surface=0	(J) Limited access=1 Major surface=0	Mean Difference (I-J)	Std. Error	df	Sig.(a)	95% Confidence Interval for Difference(a)	
						Lower Bound	Upper Bound
Major surface	Limited-access	-.179(*)	.011	1132.921	.000	-.200	-.158
Limited-access	Major surface	.179(*)	.011	1132.921	.000	.158	.200

Based on estimated marginal means

* The mean difference is significant at the .05 level.

a Adjustment for multiple comparisons: Bonferroni.

b Dependent Variable: 1-sec percentile (as a fraction).

Tests of simple effect(a)

Numerator df	Denominator df	F	Sig.
1	1132.921	282.762	.000

The F tests the effect of Limited access=1 Major surface=0. This test is based on the linearly independent pairwise comparisons among the estimated marginal means.

a Dependent Variable: 1-sec percentile (as a fraction).

6. Traffic Density

Estimates(a)

Traffic Density	Mean	Std. Error	df	95% Confidence Interval	
				Lower Bound	Upper Bound
Sparse	.220	.017	99.599	.186	.253
Moderate	.254	.016	88.939	.221	.287
Dense	.236	.017	108.786	.202	.271

a Dependent Variable: 1-sec percentile (as a fraction).

Pairwise Comparisons(b)

(I) Traffic Density	(J) Traffic Density	Mean Difference (I-J)	Std. Error	df	Sig.(a)	95% Confidence Interval for Difference(a)	
						Lower Bound	Upper Bound
Sparse	Moderate	-.034(*)	.012	1130.503	.019	-.064	-.004
	Dense	-.016	.014	1133.440	.682	-.049	.016
Moderate	Sparse	.034(*)	.012	1130.503	.019	.004	.064
	Dense	.018	.013	1128.996	.518	-.013	.049
Dense	Sparse	.016	.014	1133.440	.682	-.016	.049
	Moderate	-.018	.013	1128.996	.518	-.049	.013

Based on estimated marginal means
* The mean difference is significant at the .05 level.
a Adjustment for multiple comparisons: Bonferroni.
b Dependent Variable: 1-sec percentile (as a fraction).

Tests of simple effect(a)

Numerator df	Denominator df	F	Sig.
2	1130.855	3.758	.024

The F tests the effect of Traffic Density. This test is based on the linearly independent pairwise comparisons among the estimated marginal means.
a Dependent Variable: 1-sec percentile (as a fraction).

7. Age Group * LIGHTING(a)

Age Group	Lighting	Mean	Std. Error	df	95% Confidence Interval	
					Lower Bound	Upper Bound
Younger	Well-Lit	.343	.027	72.869	.288	.397
	Darker	.240	.028	80.921	.184	.295
Middle-aged	Well-Lit	.303	.027	74.246	.249	.358
	Darker	.236	.028	87.787	.179	.292
Older	Well-Lit	.168	.027	73.584	.114	.223
	Darker	.130	.029	98.348	.072	.188

a Dependent Variable: 1-sec percentile (as a fraction).

8. ACAS * Age Group(a)

ACAS	Age Group	Mean	Std. Error	df	95% Confidence Interval	
					Lower Bound	Upper Bound
Enabled	Younger	.285	.027	74.988	.231	.340
	Middle-aged	.250	.027	76.160	.196	.305
	Older	.150	.028	80.170	.095	.206
Disabled	Younger	.297	.028	78.399	.242	.352
	Middle-aged	.288	.028	84.890	.232	.345
	Older	.148	.029	90.126	.091	.205

a Dependent Variable: 1-sec percentile (as a fraction).

9. Age Group * Limited access=1 Major surface=0(a)

Age Group	Limited access=1 Major surface=0	Mean	Std. Error	df	95% Confidence Interval	
					Lower Bound	Upper Bound
Younger	Major surface	.176	.028	77.242	.121	.231
	Limited-access	.406	.027	76.494	.351	.461
Middle-aged	Major surface	.184	.027	73.926	.130	.238
	Limited-access	.355	.028	87.853	.298	.412
Older	Major surface	.081	.028	81.076	.025	.136
	Limited-access	.218	.029	88.985	.161	.275

a Dependent Variable: 1-sec percentile (as a fraction).

10. Age Group * Traffic Density(a)

Age Group	Traffic Density	Mean	Std. Error	df	95% Confidence Interval	
					Lower Bound	Upper Bound
Younger	Sparse	.280	.028	87.880	.224	.337
	Moderate	.322	.028	87.181	.266	.379
	Dense	.271	.030	103.981	.212	.330
Middle-aged	Sparse	.224	.030	103.540	.166	.283
	Moderate	.288	.029	89.046	.231	.344
	Dense	.296	.030	102.276	.238	.355
Older	Sparse	.155	.030	107.850	.095	.214
	Moderate	.152	.029	90.607	.095	.209
	Dense	.141	.031	120.484	.080	.202

a Dependent Variable: 1-sec percentile (as a fraction).

11. ACAS * LIGHTING(a)

ACAS	Lighting	Mean	Std. Error	df	95% Confidence Interval	
					Lower Bound	Upper Bound
Enabled	Well-Lit	.251	.017	99.261	.217	.284
	Darker	.207	.018	122.496	.171	.242
Disabled	Well-Lit	.292	.017	106.008	.258	.326
	Darker	.197	.019	151.010	.159	.234

a Dependent Variable: 1-sec percentile (as a fraction).

12. LIGHTING * Limited access=1 Major surface=0(a)

Lighting	Limited access=1 Major surface=0	Mean	Std. Error	df	95% Confidence Interval	
					Lower Bound	Upper Bound
Well-Lit	Major surface	.171	.017	99.019	.137	.204
	Limited-access	.372	.017	106.348	.338	.406
Darker	Major surface	.123	.018	124.559	.088	.159
	Limited-access	.280	.019	149.837	.243	.318

a Dependent Variable: 1-sec percentile (as a fraction).

13. LIGHTING * Traffic Density(a)

Lighting	Traffic Density	Mean	Std. Error	df	95% Confidence Interval	
					Lower Bound	Upper Bound
Well-Lit	Sparse	.246	.019	144.687	.210	.283
	Moderate	.283	.018	126.663	.247	.319
	Dense	.284	.018	136.324	.248	.321
Darker	Sparse	.193	.020	185.648	.154	.232
	Moderate	.224	.019	151.198	.187	.262
	Dense	.188	.022	240.916	.145	.230

a Dependent Variable: 1-sec percentile (as a fraction).

14. ACAS * Limited access=1 Major surface=0(a)

ACAS	Limited access=1 Major surface=0	Mean	Std. Error	df	95% Confidence Interval	
					Lower Bound	Upper Bound
Enabled	Major surface	.150	.017	106.607	.116	.184
	Limited-access	.308	.018	114.413	.273	.342
Disabled	Major surface	.144	.018	115.726	.109	.179
	Limited-access	.345	.019	139.776	.308	.382

a Dependent Variable: 1-sec percentile (as a fraction).

15. ACAS * Traffic Density(a)

ACAS	Traffic Density	Mean	Std. Error	df	95% Confidence Interval	
					Lower Bound	Upper Bound
Enabled	Sparse	.200	.019	143.920	.163	.237
	Moderate	.244	.018	135.875	.208	.280
	Dense	.242	.019	166.133	.204	.280
Disabled	Sparse	.240	.020	185.925	.200	.279
	Moderate	.264	.019	140.897	.227	.300
	Dense	.230	.021	205.336	.190	.271

a Dependent Variable: 1-sec percentile (as a fraction).

16. Limited access=1 Major surface=0 * Traffic Density(a)

Limited access=1 Major surface=0	Traffic Density	Mean	Std. Error	df	95% Confidence Interval	
					Lower Bound	Upper Bound
Major surface	Sparse	.137	.018	132.638	.101	.173
	Moderate	.151	.018	131.232	.115	.187
	Dense	.152	.020	189.414	.112	.192
Limited-access	Sparse	.302	.020	199.079	.262	.342
	Moderate	.356	.019	145.845	.319	.393
	Dense	.320	.020	182.304	.281	.359

a Dependent Variable: 1-sec percentile (as a fraction).

17. ACAS * Age Group * LIGHTING(a)

ACAS	Age Group	Lighting	Mean	Std. Error	df	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Enabled	Younger	Well-Lit	.323	.029	99.988	.264	.381
		Darker	.247	.030	111.535	.188	.307
	Middle-aged	Well-Lit	.270	.029	99.006	.212	.328
		Darker	.231	.031	118.157	.170	.291
	Older	Well-Lit	.159	.029	98.791	.100	.217
		Darker	.142	.032	138.393	.079	.206
Disabled	Younger	Well-Lit	.362	.030	101.510	.304	.421
		Darker	.232	.031	126.357	.170	.294
	Middle-aged	Well-Lit	.336	.030	109.458	.276	.396
		Darker	.241	.033	149.133	.176	.305
	Older	Well-Lit	.178	.030	107.124	.119	.237
		Darker	.118	.034	179.081	.050	.186

a Dependent Variable: 1-sec percentile (as a fraction).

18. Age Group * LIGHTING * Limited access=1 Major surface=0(a)

Age Group	Lighting	Limited access=1 Major surface=0	Mean	Std. Error	df	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Younger	Well-Lit	Major surface	.211	.030	101.681	.152	.269
		Limited-access	.474	.029	99.878	.416	.533
	Darker	Major surface	.141	.031	120.095	.080	.203
		Limited-access	.338	.031	119.129	.277	.399
Middle-aged	Well-Lit	Major surface	.209	.029	96.836	.151	.267
		Limited-access	.397	.030	112.204	.337	.457
	Darker	Major surface	.159	.030	110.755	.099	.218
		Limited-access	.313	.033	158.595	.247	.378
Older	Well-Lit	Major surface	.092	.029	98.563	.034	.150
		Limited-access	.245	.030	107.110	.186	.304
	Darker	Major surface	.069	.032	143.686	.005	.133
		Limited-access	.191	.034	173.716	.123	.258

a Dependent Variable: 1-sec percentile (as a fraction).

19. Age Group * LIGHTING * Traffic Density(a)

Age Group	Lighting	Traffic Density	Mean	Std. Error	df	95% Confidence Interval	
						Lower Bound	Upper Bound
Younger	Well-Lit	Sparse	.324	.031	128.514	.262	.386
		Moderate	.353	.031	129.058	.291	.415
		Dense	.351	.032	140.876	.288	.415
	Darker	Sparse	.237	.032	145.336	.173	.301
		Moderate	.292	.032	138.683	.228	.355
		Dense	.191	.036	208.629	.120	.261
Middle-aged	Well-Lit	Sparse	.253	.033	158.559	.188	.319
		Moderate	.326	.031	126.107	.264	.388
		Dense	.330	.032	131.147	.268	.393
	Darker	Sparse	.196	.035	190.618	.127	.265
		Moderate	.249	.033	152.622	.184	.314
		Dense	.262	.036	214.099	.191	.333
Older	Well-Lit	Sparse	.163	.033	147.592	.098	.227
		Moderate	.170	.031	124.835	.109	.232
		Dense	.172	.032	137.009	.109	.235
	Darker	Sparse	.147	.036	223.561	.075	.218
		Moderate	.133	.033	162.627	.067	.199
		Dense	.111	.040	302.383	.032	.189

a Dependent Variable: 1-sec percentile (as a fraction).

20. ACAS * Age Group * Limited access=1 Major surface=0(a)

ACAS	Age Group	Limited access=1 Major surface=0	Mean	Std. Error	df	95% Confidence Interval	
						Lower Bound	Upper Bound
Enabled	Younger	Major surface	.171	.030	105.835	.112	.231
		Limited-access	.399	.030	105.522	.340	.458
	Middle-aged	Major surface	.178	.029	99.936	.120	.237
		Limited-access	.323	.031	117.109	.262	.383
	Older	Major surface	.100	.030	114.254	.039	.160
		Limited-access	.201	.031	120.830	.140	.262
Disabled	Younger	Major surface	.181	.031	115.438	.120	.241
		Limited-access	.413	.030	112.086	.353	.473
	Middle-aged	Major surface	.190	.030	106.968	.130	.249
		Limited-access	.387	.033	151.346	.322	.452
	Older	Major surface	.061	.031	125.049	.000	.123
		Limited-access	.234	.033	157.591	.169	.300

a Dependent Variable: 1-sec percentile (as a fraction).

21. ACAS * Age Group * Traffic Density(a)

ACAS	Age Group	Traffic Density	Mean	Std. Error	df	95% Confidence Interval	
						Lower Bound	Upper Bound
Enabled	Younger	Sparse	.243	.032	132.630	.181	.306
		Moderate	.335	.032	134.287	.272	.397
		Dense	.277	.033	155.743	.212	.342
	Middle-aged	Sparse	.212	.033	147.346	.148	.277
		Moderate	.268	.032	133.226	.205	.331
		Dense	.271	.033	153.054	.206	.336
	Older	Sparse	.144	.033	152.046	.079	.208
		Moderate	.129	.032	140.154	.066	.192
		Dense	.179	.035	190.481	.110	.247
Disabled	Younger	Sparse	.317	.032	140.730	.253	.380
		Moderate	.310	.032	133.218	.247	.372
		Dense	.265	.035	191.486	.196	.334
	Middle-aged	Sparse	.236	.035	202.131	.167	.306
		Moderate	.307	.032	144.481	.243	.371
		Dense	.322	.035	187.564	.253	.390
	Older	Sparse	.166	.036	217.912	.094	.237
		Moderate	.174	.032	145.123	.110	.238
		Dense	.104	.037	238.032	.031	.177

a Dependent Variable: 1-sec percentile (as a fraction).

APPENDIX L

EVALUATION OF SECONDARY BEHAVIORS WITH ACC

The data acquisition system was programmed to capture a five second long video clip from both the forward and driver-face cameras every five minutes that the engine was running, with the first exposure coming after the vehicle had been running for five minutes. A random sample of five percent of the driver face clips were examined for evidence of secondary, non-driving, behaviors. This five percent was stratified by week. Only clips in which the vehicle was traveling 25 mph (the minimum speed at which FCW is active and ACC can be engaged) or faster were included in the sample. In other words, 5 percent of the clips from week one, five percent of the clips from week two, etc, when the vehicle was going faster than 25 mph, resulted in a total 890 clips. The approach of stratifying the sample by week was utilized in order to better understand how participant behaviors may or may not change with exposure to the FCW and ACC systems without the risk of obtaining a disproportionate sample from one portion of the driving experience.

For purposes of evaluating secondary, non-driving, behaviors with ACC, only clips in which either conventional or adaptive cruise control where engaged are reviewed in this section of the report. This additional conditionality left 276 clips to be examined. Clips not involving conventional or adaptive cruise control (i.e., manual driving) are discussed in Section 7.1.8 of this report. Table 8.1.9.1-1 shows that, of the 276 clips, more clips from male participants where examined for secondary behaviors relative to female participants, 163 versus 113.

Table 8.1.6-1 Counts of exposure clips reviewed by gender

Gender	Week 1- CCC Engaged	Week 2- ACC Engaged	Week 3- ACC Engaged	Week 4- ACC Engaged	Total Clips
Female	13	25	35	40	113
Male	30	42	38	53	163
Total Clips	43	67	73	93	276

The distribution of clips by age group reveals that a roughly equal number of clips for the younger and middle-age groups were examined, while significantly more were viewed for the older participant group (Table 8.1.6-2). Table 8.1.6-3 provides the distribution of exposure clips reviewed for evidence of secondary, non-driving, behaviors for the combination of participant gender, age group, and driving week.

Table 8.1.6-2 Counts of exposure clips reviewed by gender

Age Group	Week 1- CCC Engaged	Week 2- ACC Engaged	Week 3- ACC Engaged	Week 4- ACC Engaged	Total Clips
Younger	7	11	21	21	60
Middle-Age	9	13	18	25	65
Older	27	43	34	47	151
Total Clips	43	67	73	93	276

Table 8.1.6-3 Counts of exposure clips reviewed by gender and age group

Gender x Age	Week 1- CCC Engaged	Week 2- ACC Engaged	Week 3- ACC Engaged	Week 4- ACC Engaged	Total Clips
Younger Female	5	4	12	7	28
Middle-Age Female	3	3	5	3	14
Older Female	5	18	18	30	71
Younger Male	2	7	9	14	32
Middle-Age Male	6	10	13	22	51
Older Male	22	25	16	17	80
Total Clips	43	67	73	93	276

Table 8.1.6-4 provides counts for a variety of secondary, non-driving, behaviors that were observed in the sample of exposure videos as a function of participant gender and age group for the first week (ACAS disabled, conventional cruise control used). A complete list of the keys used to code the exposure videos for evidence of secondary, non-driving, behaviors is included in Appendix HF11. The total number of clips in which secondary behaviors were observed for each gender-by-age group combination is provided at the bottom of the table, along with the percentage of clips in which secondary behaviors were observed. On average, during the first week while using conventional cruise control, participants were engaged in secondary, non-driving, behaviors 7% of the time, based upon the sampling. Older male drivers were the only participants observed to engage in secondary behaviors while using CCC. This occurred in only

three clips, two involving conversation (not cellular telephone) and one in which low-involvement grooming took place.

Table 8.1.6-4 Counts of exposure clips containing secondary behaviors by participant gender and age group during week 1 (ACAS disabled and conventional cruise control in use)

Non-driving Behavior	Female Younger	Female Middle-Age	Female Older	Male Younger	Male Middle-Age	Male Older	Total Clips
Cell phone: conversation, in use							0
Cell phone: reaching for							0
Cell Phone: dialing							0
Conversation						2	2
Drinking: high involvement							0
Drinking: low involvement							0
Eating: high involvement							0
Eating: low involvement							0
Grooming: high involvement							0
Grooming: low involvement						1	1
Headset/hands-free phone: conversation							0
Headset/hands-free phone: reaching for headset							0
Headset/hands-free phone: unsure if any activity							0
In-car system use							0
None	5	3	5	2	6	19	40
Other/multiple behaviors							0
Smoking: lighting a cigarette							0
Smoking: reaching for cigarettes or lighter							0
Smoking							0
Total # of Clips	5	3	5	2	6	22	43
Clips w/ non-driving behaviors (%)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	3 (13.6)	3 (7.0)

Table 8.1.6-5 provides the relative frequency with which secondary, non-driving, behaviors were observed in the sample of exposure videos as a function of participant gender and age group for weeks 2 through 4 (ACAS enabled, adaptive cruise control in use). On average, during weeks 2 through 4 participants were engaged in secondary, non-driving, behaviors 20% of the time, based upon the sampling. However, under these conditions, it was male participants, young males in particular, who

were most likely on a percentage basis to engage in secondary behaviors (27%) compared to the remaining gender-by-age group segments of the population. Older females were least likely (15%).

Table 8.1.6-5 Counts of exposure clips containing secondary behaviors by participant gender and age group during weeks 2-4 (ACAS enabled but no adaptive cruise control in use)

Non-driving Behavior	Female Younger	Female Middle-Age	Female Older	Male Younger	Male Middle-Age	Male Older	Total Clips
Cell phone: conversation, in use				3	4		7
Cell phone: reaching for							0
Cell Phone: dialing							0
Conversation	2	1	9	2	2	10	26
Drinking: high involvement							0
Drinking: low involvement					1		1
Eating: high involvement							0
Eating: low involvement			1				1
Grooming: high involvement							0
Grooming: low involvement	1	1			2	2	6
Headset/hands-free phone: conversation							0
Headset/hands-free phone: reaching for headset							0
Headset/hands-free phone: unsure if any activity				1			1
In-car system use							0
None	19	9	56	22	34	46	186
Other/multiple behaviors	1			2	2		5
Smoking: lighting a cigarette							0
Smoking: reaching for cigarettes or lighter							0
Smoking							0
Total # of Clips	23	11	66	30	45	58	233
Clips w/ non-driving behaviors (%)	4 (17.4)	2 (18.2)	10 (15.2)	8 (26.7)	11 (24.4)	12 (20.7)	47 (20.2)

The secondary task most frequently recorded, again on a percentage basis, was conversation (non-cellular telephone) which was observed in approximately 11% of the exposure clips. This was followed by telephone conversation (3%) and low-involvement grooming (3%). Again, as seen in the results presented in section 7.1.8, it is hypothesized that the increase in observing conversation by the participants when the ACC system was enabled is quite possibly associated with the novelty of having the ACAS system and participants' desire or excitement at the opportunity to explain how the ACAS system operated to passengers in the vehicle.

Lastly, Table 8.1.6-6 provides the count of exposure clips containing secondary behaviors for all weeks (1 - 4) while either conventional or adaptive cruise control was in use, collapsed across all drivers. The bottom row of this table contains the percentages of clips in which participants were engaged in secondary behaviors. These percentages show the relative frequency of observing participants taking part in non-driving behaviors increases between weeks 1 and 2, and remains more than twice the baseline for weeks 3 and 4. This difference across the four weeks was found to be statistically significant using a Pearson χ^2 test, χ^2 (1, N = 614) = 4.261, p = .039. In contrast, there was no apparent effect of FCW on secondary behaviors (section 7.1.8). However, other than the change in participant involvement in conversation (non-cellular), which is hypothesized to be associated with the novelty of having the ACAS system, the pattern and frequency of other common secondary behaviors changed only slightly. In other words, categories such as telephone conversation and low-involvement grooming are more frequent when using ACC relative to CCC, but not nearly as sizable as the rate of increase in conversation.

Overall, there was a change in the relative frequency with which participants took part in secondary, non-driving, behaviors when the ACC system was enabled relative to the baseline of CCC. However, the most substantive change was an increase in the relative frequency of conversation taking place inside the vehicle (non-cellular telephone) hypothesized to be associated with the novelty of having the ACC system, and the desire of participants to describe the system or participation in the ACAS study to passengers. The pattern and frequency of other common forms of secondary behavior that were observed in the sample of exposure videos did not change in conjunction with the enablement of the ACC system, although they occurred somewhat more frequently.

Table 8.1.6-6 – Counts of exposure clips containing secondary behaviors by weeks 1-4 (engaged).

Non-driving Behavior	Week 1 CCC	Week 2- ACC	Week 3- ACC	Week 4- ACC	Total Clips
Cell phone: conversation, in use		2	2	3	7
Cell phone: reaching for					
Cell Phone: dialing					
Conversation	2	9	9	8	28
Drinking: high involvement					
Drinking: low involvement				1	1
Eating: high involvement					
Eating: low involvement				1	1
Grooming: high involvement					
Grooming: low involvement	1	2	3	1	7
Headset/hands-free phone: conversation					
Headset/hands-free phone: reaching for headset					
Headset/hands-free phone: unsure if any activity				1	1
In-car system use					
None	40	51	58	77	226
Other/multiple behaviors		3	1	1	5
Smoking: light a cigarette					
Smoking: reaching for cigarettes or lighter					
Smoking					
Total # of Clips	43	67	73	93	276
Clips w/ non-driving behaviors (%)	3 (0.07)	16 (0.24)	15 (0.20)	16 (0.17)	50 (0.18)

APPENDIX M

ACC DRIVING CORRESPONDING TO OWNER'S MANUAL ADVISORIES

ACC DRIVING CORRESPONDING TO OWNER'S MANUAL ADVISORIES

This appendix presents example evidence drawn from FOT data to address each of a diverse set of possible safety issues that have been under consideration as precautions or advisories for an ACC owner's manual.   For each of twelve such advisories that are considered, evidence from the FOT served to indicate the extent to which the tested group of drivers exhibited the pertinent behavior while driving with ACC.

The full scope of the owner's manual examination has covered twelve separate subjects. Each subject is delineated below beginning with the topic in question, followed by a brief paraphrase of the owner's manual statement that addresses the topic. Results of the analysis are then presented based upon evidence drawn from the FOT dataset. Because this entire analysis pertained to ACC only and involved many queries that yielded sparse results, the choice was made to study these issues using the whole FOT dataset covering all 96 drivers (thereby not confining this study area to Algorithm-C subjects, only). Note that the ACC control algorithm was unchanged over all 96 subjects, although some differences in the presentation of alerts in ACC driving did apply across the full group of drivers (see Section 3.1.3.) None of those differences in alert production are believed to have significantly affected the following results.

Moderate Traffic Conditions

The owner's manual issue:

"ACC allows you to keep cruise control engaged in moderate traffic conditions."

Pertinent Result from FOT:

The issue pertains to encouraging the driver to choose "moderate" rather than any of the more conflicted, but unspecified, types of driving conditions for ACC engagement. Section 6.1 of this report previously showed that ACC was utilized broadly during the FOT, as follows:

- ACC was selected as the control mode over the full range of traffic densities, as defined herein, although the utilization levels do drop substantially as density increases. Over all road types, utilizations dropped by about half as the traffic went from "sparse" to "dense" conditions.

- ACC was utilized over a broad range of road types, although the utilization levels do drop by about two-thirds in going from freeways to the surface-type roads that are characterized by more complex patterns of traffic interaction. ACC utilization on surface roads was seen to be 17% which is almost three times the corresponding rate of CCC utilization on the same road type.

Conclusion:

On the order of a third of all ACC usage was seen to take place under traffic conditions that may not be generally judged as "moderate", given the type of traffic-induced headway conflicts that seem pertinent to driver supervision of ACC control. Thus, the owner's manual advisory addresses a widespread behavior. Further, it would seem that the rather high utilization of ACC that was observed on surface roads together with the substantially-higher likelihood for kinematic conflict on such roads calls for a specific precaution to minimize ACC use in the surface-road environment.

Moderate Braking Capability of ACC

The owner's manual issue:

"ACC can apply limited braking (that is…) comparable to moderate application of the vehicle's brakes…"(implying that ACC braking may be insufficient to manage the headway condition when greater-than-moderate braking levels are required.)

Pertinent Result from FOT:

Brake applications seen in manual driving provide a reference set against which to compare the severity of braking levels applied automatically by the ACC autobraking controller. In order to obtain a relatively uniform driving condition within which to make comparisons, the following query was posed as the means for culling out manual and ACC braking data:

- The vehicle is operating on a freeway.
- The traffic density level is medium.
- The host vehicle's speed at the moment of brake application is above 55mph.
- The duration of the brake application is longer than 1 second.

Shown in Figure 8.77 are the cumulative distributions of the peak decelerations measured in 8,643 manual braking applications and 1,613 ACC autobraking applications under the conditions cited above. Figure 8.78 presents the tail of the same distribution for decelerations lying to the left of -2 m/s^2 to better illustrate the relationship between the two curves in what might arguably be identified as the 'moderate' regime of deceleration. We note the following:

- When ACC was engaged under the indicated conditions, the system's autobraking controller produced decelerations exceeding –2 m/s^2 about half as frequently per brake application as occurred in the manual mode of driving. Presumably, this result derives from the longer headways and continuous ACC control action that may work to moderate peak braking requirements, in contrast to human control.
- Noting that only about 0.3% of these ACC autobraking applications reached the –3 m/s^2 authority limit of the ACC controller, the ACC driver quite rarely encountered the braking limit of the system under this most-common of freeway driving conditions. (The full set of sixty limit-autobraking events from the FOT was analyzed and discussed in Section 8.1.9 of the main text of this report.)

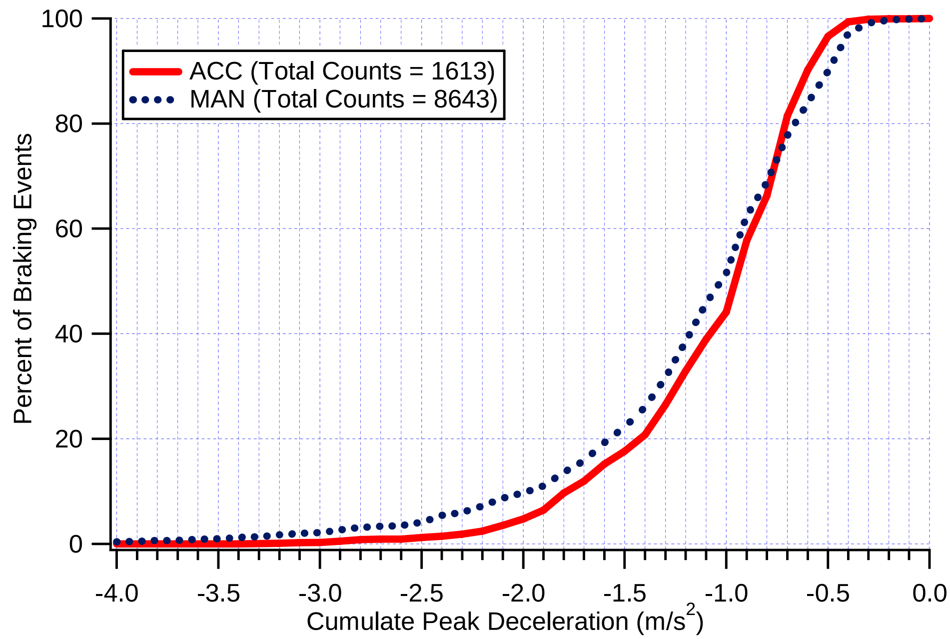


Figure 8.77. Peak Decelerations reached by means of ACC autobraking and braking during manual driving under the defined conditions

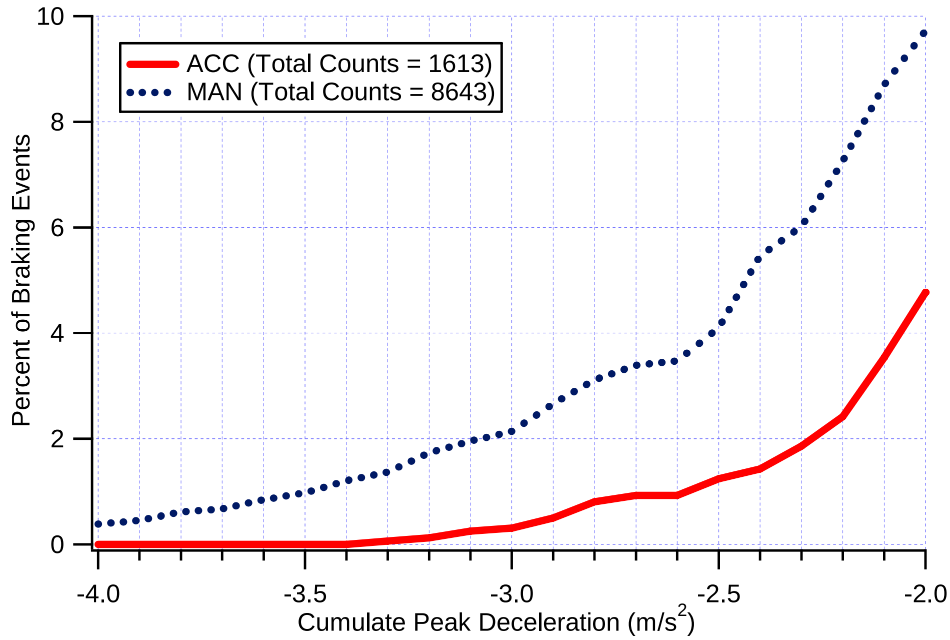


Figure 8.78. The low-probability tail of peak decelerations reached by means of ACC autobraking and braking during manual driving under the defined conditions

Conclusion:

ACC's "moderate" braking capability serves to manage the overwhelming majority of all headway demands arising under the common, medium-traffic freeway conditions. Furthermore, ACC operates in such as way that it ventures into the moderate deceleration range about half as frequently per brake application as when under manual control, for the same driving conditions. Notwithstanding these characteristics of ACC operation, the owner's manual advisory is patently warranted—perhaps even more so due to the rarity of such events. Clearly, in most cases, the driver must intervene when ACC's braking authority level is exceeded by the demands of inter-vehicular conflict—and must be ready to do it expeditiously (as is addressed, next). Nevertheless, all the evidence from the FOT indicates that cases in which the driver did stay engaged up to the 0.3-g autobraking limit of ACC control were quite rare and were extinguishing rapidly over the three weeks of driving with the ACC function available.

Readiness to Intervene

The owner's manual issue:

(because ACC has limited braking capability and will not respond to some obstacles…) "you should be ready to take action and apply the brakes."

Pertinent Result from FOT:

This question of readiness to intervene can be tested both in terms of the severity of braking applications that are made in the course of ACC intervention, broadly, and the time delay in the driver's braking response to an ACC alert. That is, it is proposed that both high levels of deceleration, upon intervening with a brake application, and long time delays may imply some lack of readiness. Each is addressed, below:

- The results on ACC braking intervention that were presented previously under Section 8.1.7 included data showing that the deceleration levels obtained following manual intervention on ACC control are roughly comparable to those deriving either from manual intervention on CCC control or brake applications made in the course of manual driving, under comparable conditions.
- The delay that occurs in manual application of braking as a control intervention on ACC can be roughly illustrated by means of braking delays that followed the presentation of ACC alerts. Such data are shown in Figure 8.79, below. Seventeen cases were identified in which a manual braking intervention followed an ACC alert, with the brake pedal being applied for at least 2 seconds in duration so as to focus on cases in which a substantial brake application was apparently needed. The figure shows that many of these seventeen cases involved braking delays that are quite short relative to commonly-recognized human performance delays, apparently indicating that the drivers tended to detect the conflict in advance of the alert presentation, itself. Along these lines, it is believed that haptic perception of the autobraking-induced deceleration constitutes a powerful cue for drawing the driver's attention to the forward scene and that autobraking may often have preceded the ACC alert for conflicts that built up over several seconds.

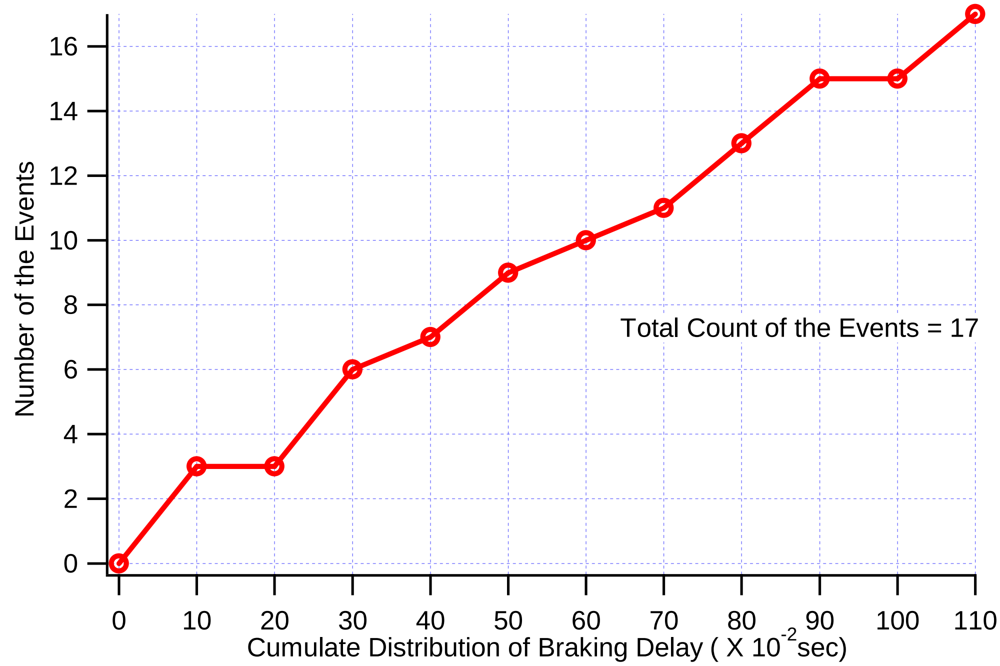


Figure 8.79. Delay in driver-applied braking following the onset of an ACC alert

Conclusion:

The available data suggest that the FOT drivers operated with a rather high level of readiness for intervening upon ACC control. Although the FOT subjects were, in fact, advised during their orientation to be ready to intervene on ACC control, the short braking delays shown above are believed to be aided by the haptic cue of the ACC autobraking response that precedes the presentation of alerts triggered by moving vehicles. Again, the candidate owner's manual advisory regarding readiness to intervene seems to be a patently-wise instruction for drivers.

Winding Roads

The owner's manual issue:

(Because ACC may not detect a vehicle ahead on curves…) "do not use ACC on winding roads."

Pertinent Result from FOT:

The primary concern on winding roads pertains to the limited azimuth coverage of the radar sensor such that an 'in-range' vehicle may not be detected because it is 'out-of-azimuth.' The span of the radar's azimuth sweep covers a total of 15 (i.e., 7.5 to the left and right of center). If we assume another degree of coverage either way (for a total of 8.5) arising from target-vehicle half-width at 100 meters plus lane-position modulation by the host and/or the target vehicle, one can show that an automobile target will fall out of detection when the ratio of Range/Radius exceeds the fractional radian of the curve layout that falls within the radar's sensing arc, or 8.5/57.3 = 0.15 radians. By this constraint, the nominal 100-meter sensing range of the radar is effectively reduced whenever the curve radius is less than 667 meters (since 100/667= 0.15).

Accordingly, a query was performed to recover travel data by curve radius, as follows:

- Vehicle speed > 25 mph
- Radius < 667m
- ACC engaged for 2 or more continuous seconds within the speed and radius window

All data showing ACC engagement under these conditions were examined in the context of ACC utilization with and without "tightly-curved" roadways. Shown in Table 8.4.1 is a comparison of distances traveled overall and distances traveled on roads having curves tighter than 667-meter radius during the ACAS-enabled period of the FOT. To the right are shown the ACC utilization percentages that apply, above 25 mph, for all driving and on the tightly-curved portions of the respective roadways. It is useful to observe the following:

- ACC was generally utilized less on tightly-curved road segments, with the exception of the collector, local, and unpaved road types.
- Several other factors that are likely to covary with curve radius, for example the urban versus rural location of interstates/freeways, may have strongly affected the ACC utilization choice, such as the differences in traffic density on urban versus rural freeways.
- While the actual radii of the "tightly-curved" segments are shorter, of course, on the lower-speed roadways such as collectors and local streets compared to, say, freeways, one should note that the risk due to shorter detection ranges may be somewhat offset by the reduced speeds, themselves.

Table 8.4. Distances and ACC utilization levels overall and on tightly-curved segments of roads in each road-type category

RoadClass	Overall Distance with ACAS Enabled (miles)	Tightly-curved Overall Distance with ACAS Enabled (miles)	ACC Engaged (miles)	ACC Engaged on Tight Curves (miles)	ACC Utilization Overall (%)	ACC Utilization on Tight Curves (%)
Ramp	1474	260	147	13	10	5
Interstate	35722	509	21433	234	60	46
Freeway	17424	281	8364	84	48	30
Arterial	4101	76	1107	20	27	26
Minor Arterial	12742	233	1402	23	11	10
Collector	17222	447	1894	103	11	23
Local	5336	138	160	8	3	6
Unpaved	543	9	3	1	1	7
Unknown	13196	423	4223	85	32	20
Total	94021	1944	38733	571		

Conclusion:

The data show that on the order of 2% of all ACC driving is conducted on road segments whose instantaneous radius is less than that needed for this ACC system's detection of passenger vehicles in the same lane at a range of 100 meters. Thus, the owner's manual advisory does address a distinctly-observed situation in ACC driving.

Slippery Roads

The owner's manual issue:

(Because slippery roads may threaten control loss…) "do not use ACC on slippery roads".

Pertinent Result from FOT:

The only measured variable in the FOT that pertains to road friction is the status of the windshield wipers. That is, the wiper-on state is assumed to denote ambient precipitation and thus a somewhat lower frictional condition, albeit with an accompanying affect on visibility, as well (see the next subsection discussing the visibility issue).

In Section 6.2.2 of this report, it was observed that the overall utilization of ACC with wipers on was only about half of the level of utilization with wipers off. Comparing the wet/dry ACC utilizations across drivers, Figure 8.80 shows the cumulative distribution of individual utilization levels for the "with" and "without" wiper condition. We see the following:

- Compared to the without-wiper (i.e., dry) case in which only about 20% of the drivers chose as little as10% or less utilization of ACC, the with-wiper (i.e., wet) condition saw more than half of the drivers choose a utilization of 10% or less.
- Correspondingly, the 50^{th}-percentile driver employed ACC in the without-wiper condition at the 32% utilization level compared to only about a 7% utilization level with wipers on.
- There is virtually no segment of the driver sample that did not reduce its ACC utilization level at least to some degree in the with-wiper state relative to the condition without wipers on.

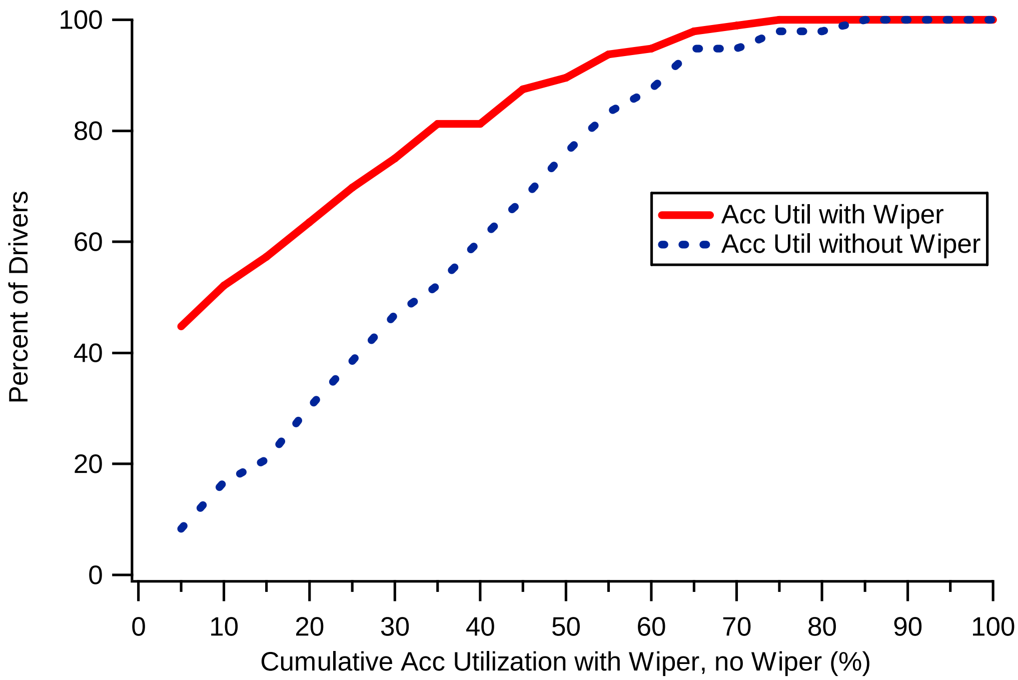


Figure 8.80. ACC Utilization with and without wipers turned on

Conclusion:

Most drivers substantially reduce their levels of ACC utilization when the wipers are on compared to a baseline case when the wipers are off. Nevertheless, approximately 3.9% of the ACC-engaged miles in the FOT were run in the wipers-on state. The owner's manual advisory on low-friction appears to involve a factor to which driver's are generally attentive.

Low Visibility Conditions

The owner's manual issue:

(Because human vision and ACC performance becomes limited in low-visibility conditions…) "do not use ACC when visibility is low."

Pertinent Result from FOT:

No data variable measured in the FOT serves to explicitly identify the visibility condition. As discussed above, however, it is recognized that a drop in visibility during ambient precipitation may have accounted for some of the reduction in ACC utilization that was observed when the wipers were turned on. Thus, we refer to the same results relating ACC to the wiper status as a means of at least obliquely addressing the connection between ambient visibility and ACC usage.

Conclusion:

Although the ambient visibility condition could not be directly identified in FOT data, the evidence of large reductions in ACC utilization when the wipers are on may indicate a visibility-related component in the more cautious response of ACC drivers to ambient precipitation.

Leaving the ACC Switch ON

The owner's manual issue:

(Because leaving the ACC switch ON would cause the vehicle to go directly into the cruise mode if a button were inadvertently hit…) "keep the ACC switch OFF until you want to use cruise control."

Pertinent Result from FOT:

It is straightforward to summarize the practice of leaving the ACC switch in the ON state by simply inspecting the switch state during the ACAS-enabled portions of the FOT. Shown in Table 8.5 is a tally of several logical relationships between the ACC switch state and trips made when ACAS was enabled. Figure 8.82 presents a pie-chart showing the three logical states that add up to the total of 9,572 trips that are covered in the analysis.

- The ACC switch is very commonly in the ON state as the trip begins (or, at least as the data record of the new trip begins, given a nominal 1-minute delay for booting the DAS package following ignition.)
- In 43% of the trips (i.e., 4148/9572), the ACC switch is ON throughout the entire trip without ACC ever becoming engaged.
- In only 8% of the cases (i.e., 795/9572) does the ACC switch become turned ON during a trip that began with it OFF.

It is acknowledged that any change in the state of the ACC switch that prevailed during the DAS boot-up transient, following ignition, is simply unknown. On the other hand, since DAS data are recorded all the way to the ignition-off event, the state of the ACC switch at the end of any trip has been accurately reported.

Table 8.5. Trip counts by the state of the ACC ON/OFF switch

	Switch ON during whole trip	Trip starts* with Switch ON	Trip starts* with Switch OFF— Turned ON Later in trip	Switch never ON during whole trip	Switch ON for whole Trip— ACC never engaged
Trips	5577	6202	795	2575	4148

* as reportable from DAS recordings that begin approximately 1 minute following ignition.

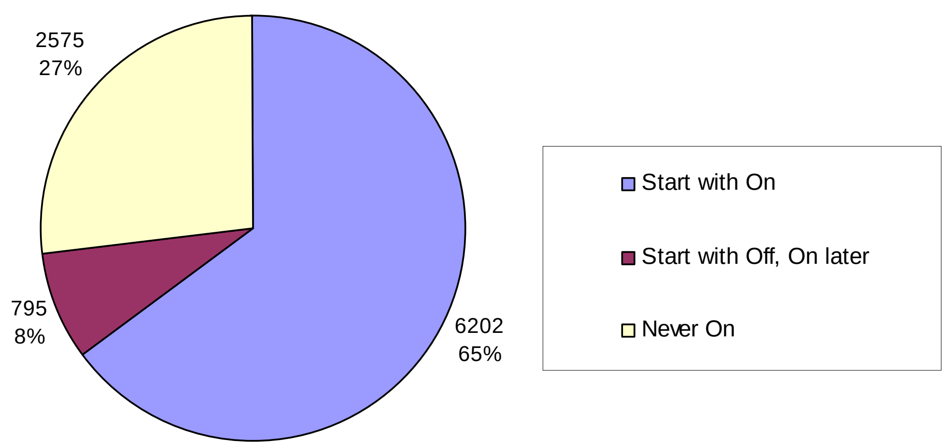


Figure 8.82. Breakdown of ACAS-enabled trips by the state of the ACC ON/OFF switch

Conclusion:

The owner's manual advisory regarding the ACC switch state addresses an issue that applies to a majority of all trips that were made in the FOT with ACAS enabled. However, no evidence exists as to whether inadvertent engagement occurred during this field test. If the risk of inadvertent engagement of ACC is important for operational safety, it is salient that this risk prevailed in well more than half of all miles driven in the FOT. The owner's manual advisory seems quite appropriate given the prevalence of the condition it addresses, although the overwhelming behavioral preference exhibited here suggests that the practice of driving with the ACC switch ON will still dominate experience unless, for example, the switch self-deactivates (i.e., defaults to an OFF state) at the end of each trip. It is also worth noting that ACC control switches can be configured in a variety of ways—some more accessible for inadvertent actuation than others.

Stationary Objects

The owner's manual issue:

(Because ACC may not detect and react to stationary or slow-moving objects in your lane…) "do not use ACC when approaching (them)".

Pertinent Result from FOT:

A dataset was sought for exploring the conditions in which stationary and slow-moving targets were encountered during ACC engagement. The driver responses to such threats were also examined. The selected query posed the following constraints:

- ACC is engaged
- A stationary (CIPS) target or a moving (CIPV) target that is traveling slowly, at less than a tenth of the host's speed, has been detected ahead of the host for a time duration of at least 2 seconds
- The time-to-collision to this target is less than 4 seconds

A total of 36 incidents were identified matching this query. In all 36 of these cases, ACC became disengaged within 4 seconds from the time in which the target first appeared. Shown in Figure 8.83 is a breakdown of the road types on which these events occurred and Figure 8.84 breaks down the three alternative means by which disengagement took place. The Figures indicate the following:

- In the road-type breakdown, all events (32) that involved a known road type all took place on surface streets. (Please note that although substantial numbers of stationary targets were also detected on freeways, none appeared from this query because such targets tend to be short-lived in that environment.)

- The disengagement breakdown shows that 27 of the 36 cases were followed by one of the two types of switch events that reveal driver-applied braking (termed TCC (traction control) and BLS (brake lamp system) brake switches), and 9 of the events culminated in the very-slow-speed self-disengagement of the ACC controller (termed PCM (pressure control module) Inhibit) that occurs at just a few mph.

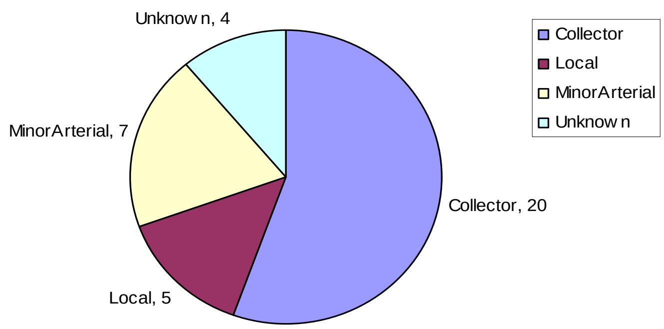


Figure 8.83 Breakdown of ACC stationary/slow-moving targets by road type

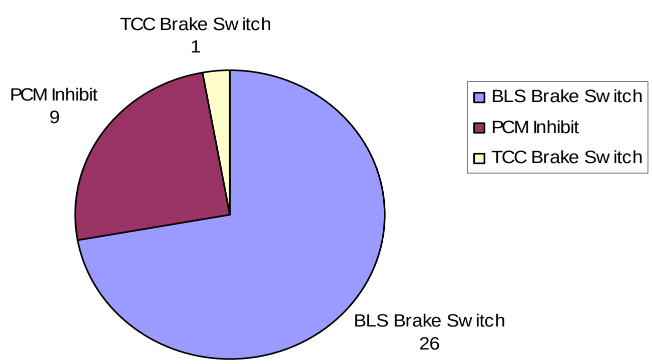


Figure 8.84 Breakdown of ACC stationary/slow-moving targets by means of disengagement from ACC control

Figure 8.85 presents the full set of 36 events in terms of two time-related measures. Each event is depicted both by the time duration over which the target persisted (i.e., the solid, irregular line going diagonally upward from 2 seconds to 7 seconds) and by the time delay between the target's first detection and the moment of ACC disengagement (i.e., the triangle icons), for each of the events ranked along the horizontal axis by their increasing value of CIPS duration. The data show that:

A. The targets in question were seen to persist for a period of 2 to almost 7 seconds (where 2 seconds was the query-specified minimum for this data set.)
B. All 27 of the cases that involved driver-applied braking (i.e., the BLS and TCC designations) resulted in ACC disengagement within 2 seconds of the detection as a stationary/slow-moving target. In 16 of these events, ACC became disengaged in less than 1 second. Overall, this group of 27 events suggests that drivers must have been reasonably attentive to their role as the ACC supervisor since their braking-response delays fell within the broadly-recognized range of human-reaction capability.
C. All 7 cases that involved disengagement delays of longer than 2 seconds pertained to the PCM-style of auto-disengagement that normally entails following another vehicle down to a virtual halt, with ACC self-terminating in the vicinity of near-zero speed. Such cases are generally taken to indicate a rather benign, but in any case felt to be a deliberate control choice on the part of the ACC driver.

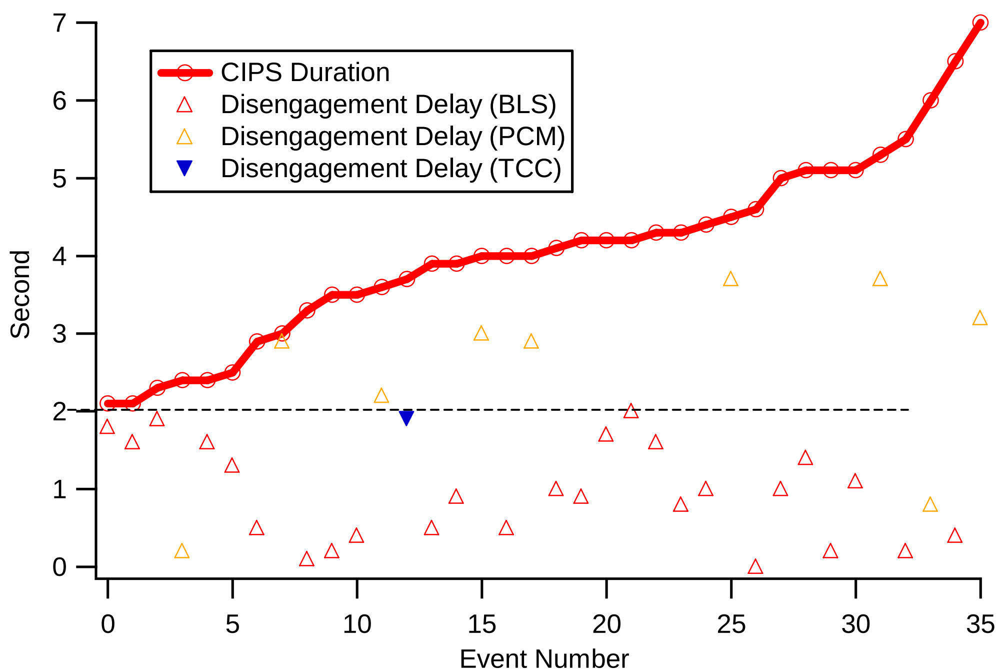


Figure 8.85. CIPS durations and the delay before disengaging ACC in response to each

Conclusion:

Stationary and slow-moving objects that persist for significant time periods of time as a conflict during ACC driving appeared only rarely during the FOT and never on freeways. Noting the incidents that did occur on surface streets, the rate of their encounter was approximately once every 80 miles of ACC engagement on minor-arterial-, collector-, and local-type roadways, as a group. When manual braking was applied to disengage ACC and to resolve these conflicts, the relatively-short reaction times suggest that drivers had been reasonably attentive to the threat of stationary and slow-moving objects. The owner's manual advisory does address a clearly-observed phenomenon.

Stopped Vehicles that Suddenly Appear

The owner's manual issue:

(Because ACC may not detect a stopped vehicle that appears suddenly in your lane…) "your complete attention is always required and you should be ready…to brake."

Pertinent Result from FOT:

Two basic queries were created for the purpose of finding a suddenly-appearing-CIPS target that may have posed a challenge under ACC control. Shown in Table 8.6 is a listing of the criteria defining each of two stages in the two queries plus, at the right, the numbers of events found to correspond to each. The table shows the following:

- In Case 1, a total of 35 events were found in which a CIPS target appeared within 2 seconds after losing a CIPV target that was being tracked by the ACC system at relatively long range rather than under active headway control. Of this group, 9 incidents culminated in ACC disengagement within 4 seconds following the acquisition of the CIPS target.
- The breakdown of disengagement modes is shown at the right, indicating the same sort of mixed mechanisms for disengagement as were seen in the prior discussion of stationary/slow-moving target encounters. One incident in this set involved disengagement by pressing the ACC OFF switch.
- In Case 2, a total of 8 events were found in which a CIPS target appeared within 2 seconds of losing a CIPV target in relation to which the ACC system had been controlling headway. Of this group, 4 incidents culminated in ACC disengagement within 4 seconds following the acquisition of the CIPS target.
- The breakdown of disengagement codes for this set of cases shows only manual braking and the PCM auto-disengagement event that results from following a vehicle down to near-zero speed under ACC control.

Table 8.6. Cases of a stopped vehicle that suddenly appears, while in ACC control

Criteria	Number of cases				
	Total	Means of ACC Disengagement			
		Driver-applied braking (BLS pedal switch)	PCM Inhibit	Clear State	ACC On/Off Switch
Case 1 • ACC is engaged • Host vehicle is tracking a CIPV target • CIPV target is lost and a CIPS target is acquired within 2 seconds	35				
Case 1 + • ACC is disengaged within 4 seconds after CIPS is acquired	9	4	3	1	1
Case 2 • ACC is engaged • Host vehicle is controlling headway behind a CIPV target • CIPV is lost and a CIPS is acquired within 2 seconds	8				
Case 2 + • ACC is disengaged within 4 seconds after CIPS is acquired	4	1	3	0	0

Conclusion:

The results indicate that the stated precaution does address a case that is seen in FOT data, although rather rarely. Of 13 incidents that culminated in ACC disengagement and which may, thus, be candidates for the conflict suggested in the owner's manual advisory, most were resolved by either driver-applied braking or by the very-slow-speed auto-disengagement that normally implies a deliberate, benign, tactic on the part of the driver.

Resting Foot on the Accelerator Pedal

The owner's manual issue:

(Because manual application of the accelerator pedal will prevent ACC from automatically applying the brakes …) "do not rest your foot on the accelerator pedal when using ACC".

Pertinent Result from FOT:

The intent of the advisory is to discourage the inadvertent form of throttle override that causes the headway control function of ACC to be suspended, such that the headway clearance to a preceding CIPV would be increasingly intruded upon. The query employed for finding examples of this behavior posed the following constraints:

- ACC is engaged
- host speed is less than ACC set speed
- throttle override is detected

The following results were obtained:

- Some 996 cases of throttle override were identified, of which:
  - ◊ 852 had a sustained CIPV target by which to explain ACC operation below the set speed;
  - ◊ half lasted 5 seconds or less while a tenth were longer than10 seconds in duration;
  - ◊ a tenth yielded an average Vdot acceleration level that was less than 0.1 m/s^2 — perhaps connoting the kind of inadvertent application of the throttle pedal toward which the owner's manual advisory is directed.

Conclusion:

Since it is not possible to know the driver's intent, one can only surmise whether any of the observed throttle overrides were inadvertent, as is implied by the 'resting foot' scenario of this advisory. The recovered data support the precaution as a possible issue only insofar as substantial numbers of throttle override events do have the combination of an impeding CIPV target, several seconds of sustained override, and relatively low acceleration levels that indicate a very light pedal application. The reader is also directed to section 8.1.1 for further discussion of conflicts arising from throttle override.

ACC on Freeway Exit Ramps

The owner's manual issue:

(Because ACC may lose track of the vehicle ahead…while entering or exiting on freeway ramps…) "disengage ACC before entering a highway ramp and do not use ACC on exit ramps."

Pertinent Result from FOT:

The data in table 8.7 show simple counts of events in which ACC usage takes place while traveling on ramps, per se. Illustrating the cases contained in the final row of the table, Figure 8.86 plots the delay exhibited from the time of entering an exit ramp to the point of ACC disengagement. An "exit ramp"in this parlance is a ramp-coded road segment that is entered by the host vehicle from a freeway-coded segment but transitions to a surface-street segment at its other end. The table and Figure show the following:

- ACC was engaged during part or all of the traversal of approximately 19% of the 8852 ramps that were encountered during the 3 weeks of ACAS-enabled driving.
- Of this group, only 110, or about 6% of the cases of ACC usage on a ramp involve entering the ramp in a state of engagement and disengaging before leaving it.
- Most of these cases, or a total of 81 out of the 110, involve an exit ramp.
- Figure 8.86 illustrates that about half of the disengagements on exit ramps occur within about 12 seconds of having entered the ramp.
- Even longer disengagement delays—stretching out to 20 seconds and more—suggest that ACC is occasionally kept engaged virtually to the end of the exit ramp, where the prolonged delay period is presumably made possible by the ability to follow a decelerating vehicle down, in continuous ACC engagement, until the PCM inhibit function affords auto-disengagement at very-low speed.

Table 8.7. Ramp traversals and ACC Engagement

Description of Case	Count
Ramps traversed during the 3 weeks with ACAS enabled	8852
Incidents for which ACC is engaged during part or all of the ramp traversal	1680
Incidents for which ACC is engaged when the ramp is entered, but is disengaged before leaving it	110
Incidents for which ACC is engaged when a ramp is entered, but is disengaged before leaving it, and the ramp is an EXIT ramp	81

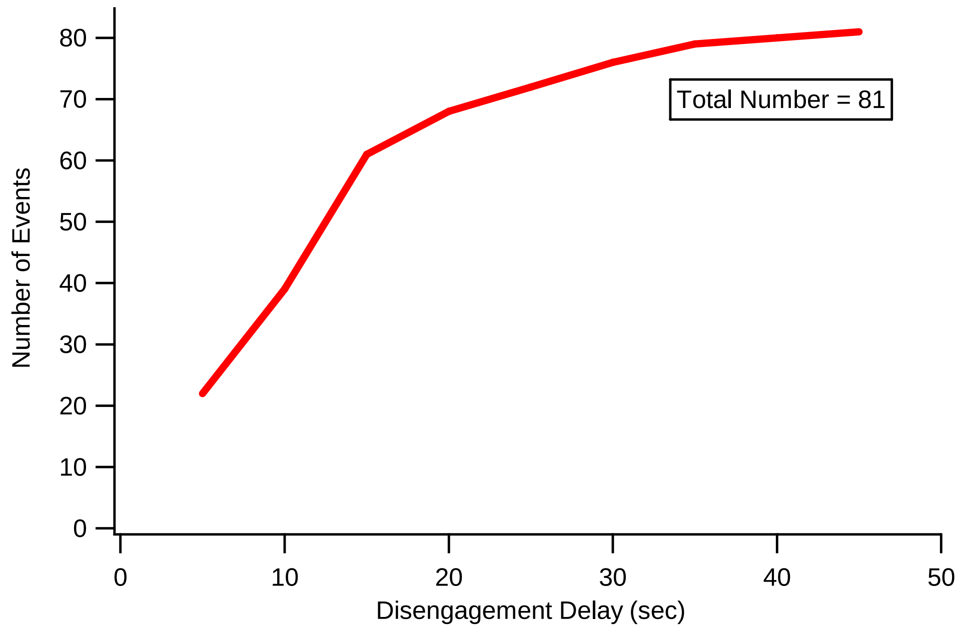


Figure 8.86. Cumulative Distribution of Disengagement Delay after Entering an Exit Ramp

Conclusion:

ACC driving while on at least some portion of a freeway ramp occurred with 19% frequency during the FOT. The specific case of ACC usage on an EXIT ramp occurred approximately once for every 250 miles of ACC engagement on freeways. The owner's manual advisory does seem pertinent for the specific cases of exit and entrance ramps. On the other hand. most freeway-to-freeway transition ramps will not actually pose the curve-radius problem that otherwise prompts the advisory, thus posing a very common case in which drivers may readily perceive that the precaution is overly generalized.

ACC Response to Cut-ins

The owner's manual issue:

(Because ACC may not detect a (cut-in) vehicle until it is completely within your lane…) "be ready to take action and apply the brakes yourself."

Pertinent Result from FOT:

FOT data were queried to recover cases that may shed light on the readiness of drivers to intervene upon ACC after a cut-in by another vehicle. The query involved the following provisions:

- The host vehicle is traveling on a freeway.
- The host vehicle speed is at or above 50 mph.
- ACC is engaged.
- The host vehicle does not change lanes during the cut-in sequence.
- As the sequence begins, an initial CIPV target is more than 3 seconds ahead of the host in the same lane.
- The host vehicle's range behind the initial CIPV is essentially fixed, such that the Rdot value is at zero +/- 1.5 m/s.
- A new CIPV target appears at a range less than that of the preceding CIPV target.

Of 693 incidents satisfying the above constraints (which were also reported previously in Section 8.1.5), a subset of 162 events were further distinguished by the following braking response on the part of the host vehicle:

- Either an ACC autobraking or manual braking application begins within 5 seconds following appearance of the new CIPV target.

This subset of cut-in events is addressed in Figure 8.87, showing a breakdown of 123 cases of ACC autobraking and 39 cases in which manual braking was applied by the driver. The data show that the majority of either the autobrake or manual-brake responses that do occur begin within 1 second of the appearance of the new cut-in target. The remainder of the cases show the brake actuation beginning over a broad range of apparent delay times. It is interesting to note that both the autobrake and manual types of brake response include cases showing rather long delay following the cut-in. The implication is that cut-ins occasionally occur in such a way that braking is not needed right away and some delay in the response may simply reflect the driver monitoring the time-development of the kinematic conflict (and assessing the need for any control response).

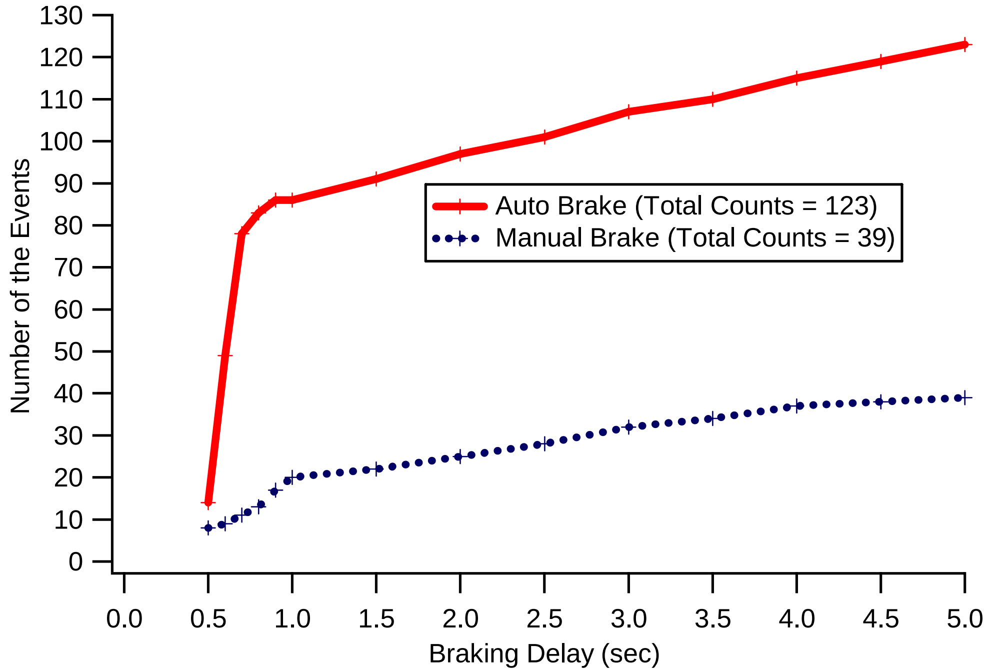


Figure 8.87. Cumulative Braking Delay after Cut-in occurs ahead of the ACC driver

Conclusion:

The cut-in phenomenon is experienced under ACC control. Further, approximately 6% of the cut-ins examined here from ACC driving on freeways were seen to prompt driver brake intervention. Although approximately two-thirds of those manual responses took place within the range of normal human reaction times following the cut-in, the other third involved longer delays whose suitability for addressing the conflict are not examined here. In any case, the owner's manual advisory regarding cut-in seems a prudent reference to a scenario that arises.

APPENDIX N

POST-DRIVE QUESTIONNAIRE FREE-RESPONSE SUMMARY
ALGORITHM C DRIVERS

Note: Numbers listed in front of each response represent the driver's ID number

MANUAL

1. **Please describe situations or conditions that made you feel uncomfortable.**
    - 37: Not sure about some of the features the first few days
    - 42: needed to familiarize myself w/control panel. Finding the clock in an unfamiliar location took my eyes off the road. Otherwise I was comfortable.
    - 43: Very stiff gear shifting, because odometer is displayed on windshield never look @ manual odometer or instrument cluster.
    - 45: Parking in my narrow driveway (MY car is little)
    - 51: Just getting to know a new vehicle was uncomfortable but only for 1-2 days.
    - 53: Trying to get comfortable w/a different car
    - 55: To low to ground
    - 63: I drive a LeSabre, so there wasn't much difference btw. research vehicle and mine.
    - 64: The car is larger than the Jeta I usually drive
    - 66: It took 2-3 days to get comfortable with 1)the car's size (handling and such) 2)the head up display, and 3)the gear shift
    - 68: Left side rear mirror made approaching car lights very dim. Had difficulty judging distance to move left.
    - 70: I'm not used to driving a car quite that large, & bumped a few curbs during turns, couldn't park well, etc.
    - 72: Parking, tight situations in traffic
    - 75: The only conditions that made me feel uncomfortable was driving a big car than my own.
    - 76: Parking
    - 77: The snow-when I was braking
    - 79: Once I became familiar w/the controls I felt comfortable driving the car
    - 81: Driving on snow and ice in Ohio in someone else's vehicle.
    - 82: Much larger car (some time to get used to) Controls Different (newer car)
    - 83: Except for different "knobs/buttons" it drove same as my fully loaded Ford Crown V.C.
    - 85: Familiarizing to the gear shifter and different button display (for a short period)
    - 90: When I first drove the car everything was bigger (steering wheel) so was hard to adapt to (like making turns).
    - 91: Knowledge of driving a "new" vehicle having to search for controls.
    - 92: In very bad weather
    - 94: Car did not drive well during snowy or icy conditions.
    - 95: I don't recall and specific events that caused me to feel uncomfortable.

2. **While driving manually, please tell us the number of times, if ever, you came close to experiencing a rear-end collision? _____**
   If so, please describe the conditions under which it occurred:
   - 31: raining or when a car cut me off
   - 41: A car turned out In front of me.
   - 46: I had a car cut me off, but the FCW system would not of helped in that situation. (This did occur during the first 6 days)
   - 49: I was with my father in law when he turned to get off on exit but the exit ramp was full of cars
   - 56: Lady was driving next to me and cut over with out signaling and came to a sudden stop.
   - 58: Car on my right made a left turn in front of me (It crossed lanes)
   - 61: Can't remember –I think someone pulled out in front of me suddenly.
   - 69: Car chg. lanes no signal
   - 70: I can't recall any close calls
   - 73: Right lane stopped and I was cut off
   - 82: May have been, but can't remember at this time. Most difficult in parking lots.
   - 85: (none) The braking system was much more responsive than my current vehicle.
   - 86: I-696 W: Snowy conditions, I-75 N a B16 Beaver: Wet roads, M-10 at "mixing bowl": Wet roads
   - 87: At least I don't remember of one.
   - 88: Some one cut in front of me entering expressway
   - 89: Snowing, slippery, another driver cit front of me.
   - 92: When another car stop very fast to turn without using signal.

FCW

1. **Please describe situations or conditions that made you feel uncomfortable when using FCW**
   - 32: At first when I was trying to get used to driving with it on
   - 34: While driving in a hurry. Driving through construction zones (false warnings)
   - 35: I wasn't uncomfortable but am skeptical
   - 38: Did not seem to trigger when I was coming up on vehicle
   - 39: The alarm would be off and shock me at first\
   - 42: It took awhile to sense the actual distance represented by gap symbols. I was never sure whether to trust the technical system or my own perception, response system. I termed this internal juggle: split consciousness, virtual/actual.
   - 43: When if ever screen flashing red/amber crash car came up (last stage visual was disturbing)
   - 44: alert warning which seemed unnecessary at time. False alerts ie guard rails traveling in an exit lane when an alert sounded for no apparent reason.

- 45: The beeping was annoying
- 46: Sometimes the car would not detect a car in front of me. (motorcycle in the dark near left edge line, vehicles in curves)
- 47: I found myself focusing on the HUD in the beginning
- 48: I found the FCW distracting when driving. Initially I had a tendency to look to see how it working versus focusing on the traffic.
- 51: It seemed to "go off" the most when coming up to I car I know was turning.
- 53: False alarms
- 54: Testing the system, by allowing myself to get closer to cars than I might normally.
- 55: Some time gave wrong warning
- 56: Driving around curves and in-stop-and-go traffic
- 57: First of all, it wasn't working properly for a couple of weeks. I didn't feel confident that it would alert soon enough.
- 58: I did not feel it gave a "crash warning" soon enough
- 60: It didn't alert me early enough. I would hit the brake before it responded.
- 62: Getting used to it and trying to make it work
- 61: When it went off when there was no car in front of me.
- 63: Lots of false alerts-
- 64: Comfort level increased as I used the system. Went from a 3 to a 5
- 65: I thought it was distracting. If set to gap of one car when it wasn't going on all the time—light would not come on soon enough to stop a crash in my opinion—if set higher than that it was coming on more often –but was distracting and annoying.
- 66: When FCW signaled an imminent collision when I least expected it. A few times it went off, triggered by the road bending.
- 67: Discomfort simply resulted from the fact that was testing the equipment.
- 70: The false alerts distracted me.
- 71: Learning curve to rely on FCW
- 72: When the alarm sounded and there was no danger to the car
- 75: I felt uncomfortable with this (yellow) car popping up all the time
- 79: There were times when the FCW signal would sound when I was not in immediate danger of a collision
- 80: There were a few times I felt the icon either did or did not react appropriately
- 81: Did not feel distances were accurate.
- 82: Warnings tend to come up fast at higher speeds
- 83: Since it was only a warning system I had no problems adjusting to it. I had to get used to a few false alarms.
- 84: Warnings seem to change too quickly. (Warnings came on a little too late and then a little too fast)
- 85: Adjusting to the display on the windshield I found distracting at first but after a while it seemed normal.

- 86: Congested traffic on interstates and heavy traffic on roads like Orchard Lake and Telegraph. It just took a little longer to get accommodated to it.
- 87: I sometimes felt it may not warn me on time.
- 88: Time it to for warning (too delayed)
- 89: Unsure at first few days and then comfortable with it.
- 90: The very first time the crash warning went off was a shock.
- 91: Uncomfortable until continued use then very comfortable.
- 92: When I was using it for the first time.
- 93: When I would get a near collision (imminent) warning because of a car which I accelerated past as it was merging out of my lane
- 95: The FCW would sound off for false objects which caused me uncomfortable at times and was a distraction.
- 96: After getting used to the system I had no difficulty

2. Please describe situations or conditions that made you feel unsafe when using FCW

32: False warning

34: I felt reasonably safe, however the warnings are very distracting. It's like having someone in the car telling you to "slow down" or "watch out for that car"

35: I felt that by the time the alert sounded I'd already braked down

36: The car slowed down but took time to return to speed (this refers to ACC)

41: Sometimes I would catch myself looking a little more & the car on the windshield more so than the road.

42: In city traffic lights. If the speed drops below 25mph the system stops, yet traffic accidents are possible as some drivers cut in front suddenly and unlawfully. Watching traffic or watching the icons is juggling my attention and taxing my energy.

45: The warning made me nervous

46: Only because it was new.

47: I tended to look around more; alarm was startling/loud

48: Same as above

53: The chance of depending on the system more than being aware

54: When cars became too close

57: I felt safe because I wasn't relying on it, and knew I could manually intervene at any moment.

64: On freeway when cars ahead had come to a complete sop I could not wait for the system to tell me to take control (ACC???)

65: Because it is somewhat distracting I feel I focus entirely on my driving and not the orange lights.

66: At times I felt that I could be distracted by the visual and audio warnings.

67: I would occasionally get closer to a vehicle in front to see how the system worked.

68: I found that I break before the FCW warning tended to.

75: It's not that I felt unsafe. I just didn't understand a car will need FCW. It was no help to me.
81: Attempted to engage FCW (at a slow speed) I don't feel FCW responded.
82: Large trucks next to the car sometimes set a warning off even if not coming into the lane.
83: At first it was a bit alarming to have auditory alarm go off.
84: There was not enough warning time between warning levels.
85: Sometimes it would pick up misc. guardrails, etc. and surprise me with the flash of orange display.
87: Same as above. I was afraid it may not warn me on time. However as time went by, I began to feel more safe.
88: People pulling out in front of you
90: I didn't feel any safer having it versus not having it.
91: When the space was at a low number
93: Same as above—the warning distracted me from driving.

4. While driving using FCW, please tell us the number of times, if ever, you came close to experiencing a rear-end collision? _____
If so, please describe the conditions under which it occurred:

31: Raining, or when someone was cutting me off
33: Car cutting or rapidly changing from extreme outside lane to extreme inside lane
38: Coming up on cars, the beeper did not go off.
41: FCW would go off if a car turned in front of me.
42: One was below 25 mph when a crazy driver made a right turn from the left lane while I was approaching a light in the right lane. My husband stopped me.
45: I was trying to play w/the warning/see how close I had to be to make it go off.
48: Car cut in front of me in a lane change.
51: I'm sure FCW considered me coming close but as described before the preceding car was obviously turning.
52: I myself not relying on the FCW most of the time.
53: Some turned @the last second (car was turning right)
56: Driving through traffic and it moving consistently and cars just stopped.
57: I did get close a few times intentionally to test the system
60: Someone cut me off while I was driving (3 cut-ins)
61: Passing a truck too closely (2 times) can't remember others.
64: 1st day of driving with FCW, car cut in front of me.
65: In my opinion –possibly one or so—but none that I was alarmed or shaken about.
66: It was after work on Crooks where it over passes M-59. I glanced to my right at the cars on M-59. I remember haring the warning signal and immediately stopping the car, only to see that there was only a few feet between me and the car in front of me.

67: Car in front of me stopped. I had lots of room to stop but it was closer than usual.
71: Preceding car unexpectedly turned right very slowly
72: Car in front stopped suddenly
74: The car in front of me on a 50 MPH road stop/slowed way down for no reason.
79: Both times I was distracted by the CD player and my eyes were not on the road. The FCW brought my attention back to the road and prevented an accident.
80: One I did on purpose to show off the system. The second was a car that made a sudden stop.
82: Probably were times, but can't recall the situation
83: Several times I had to intervene but I don't recall any near collisions.
84: First time FCW went off, it appeared that I misjudged the speed distance between myself and car ahead.
86: People cutting into my lane or distracted by passengers.
88: Car in front sudden stop to turn.
89: No emergency situations—I did try test situations
90: The snow storm on the freeway with the patch of ice.
92: Other cars changing lane or not use signal.
93: A car was stoped at a light and I got a warning as I came up on it.
94: Although the alarm went off several times, I don't feel I was ever in any danger of crashing into anything.
95: Preceding car was turning right while I was trying to locate an object somewhere in the car.

5. **Please describe any difficulties you had when using FCW**
32: Paying too much attention to the cars on the display instead of the road
34: You wind up breaking a lot with FCW. This may not be a bad thing in some cases, but sometimes I'd slow down coast a little and give the car a bit of gas and get "too close" and the warning would alert me.
42: In the beginning, fiddling with gap adjustment was a bit challenging. Now it's easier and I decided to keep it at one or two gap marks and leave it at that as being useful.
43: finding a comfortable distance setting while driving in traffic somewhat distracting-rather set at a stop.
44: false alerts
45: It made me nervous when I wasn't expecting it.
47: There was a lot of false alarms
52: I would not rely on the FCW
53: A couple of false alarms/malfunctions
54: False warnings caused by gaurdrails and signs.
57: To clarify, it wasn't "difficult" to use, I just felt I shouldn't rely on it.
64: Became easier as month passed. In heavy traffic I prefer not to use the system. (ACC??)
65: Aside from it being distracting—it was easy to use.

66: Sometimes I found the images to be distracting. I think by the third week I became used to them.
71: Not operative when brakes applied
74: Display on MAX sensitivity was annoying
79: Once I became accustomed to the icons it was fairly easy.
81: I only felt safe when using the 6 car length distance.
82: One "Malfunction", worked again after cleaning and 'rest' for an hour.
84: It seemed like there were a lot of false warnings.
85: Radar is very sensitive to dips and valleys on the road. Display would disappear and reappear.
86: Heavy rain-snow obscured system extreme cold on 2 days-system was temperamental.
87: The only difficulty was simply a matter of getting used to it.
90: Sometimes the signals would distract me ex. dirty radar.
93: The FCW times –aprox 4 I got near collision warning were reading which were not potential collisions this make it slightly difficult..
94: I found myself looking at the car more often that I should have. (Thought that looking at the HUD distracted attention from the road)

19. Were there ever situations when the FCW system operated in a manner that you did not understand or was opposite of what you expected? If so, please explain:

32: When a car turned in front of me it would give auditory warnings right away
33: Object on side of road when going around curves
34: There were times when the auditory warning went off, but the volume didn't change on the radio. At the moment I didn't know if it was a moderate threat or an imminent threat.
35: I actually expected that on a couple of occasions the warning system was late signaling
37: The FCW aler would flash when passing under some bridges that had large signs, but I understood why.
38: Did not trigger alert when I came close to rear end of another vehicle
40: Did not work well. (felt he should have gotten imminent alerts when he got very close to another car and was approaching them. Hi didn't get them.)
41: Yes, when the alert would go off and I was just pulling over to the side of the street to let another car pass.

42: Yes, but I don't remember many particulars—mostly in adjusting those gap marks.
44: yes, as in example of question #1
46: No—it operated as explained.
49: I was driving the car and the alert went off for no reason at all.
52: I found it reacting more to things I didn't consider a threat rather than the car in front of me.
53: No. I expected it to give off some false signals.
56: Operated exactly how I was told it would act.

58: Audio Alert signaled at some underpasses-did not know when it would signal-some barrels at curves in road but not all.

59: On the expressway it would show a car even if it was far away.

60: Yes, some time it gave me alerts when no one was around. Sometimes it didn't alert me when it should have.

61: One time went off, no one in front of me. One time I decreased the gap, but the visual still looked like it did before.

62: Three false alarms

63: For example, in my lane w/ no traffic ahead of me, and cars in both lanes on wither side (none crossing my lane) and I got an imminent threat alert. (she has also drawn a diagram)

65: Occasionally the auditory alert would go off when I didn't feel it was needed.

66: Yes, on several occasions both the audio and visual alerts signaled an imminent crash when I knew such signaling was unnecessary.

67: It seemed to pick up on non-threatening conditions on the right (bridges, parked cars) and signal but not on what I saw as identical or similar condition on the left.

70: The auditory alert would sound when the FCW system "woke-up" after starting the car. The imminent alert never alerted me to any imminent threat

72: Several times an imminent threat sounded w/out actual dangers.

74: Yes, I sometimes received a visual alert very quickly without receiving an auditory signal

77: yes, the green car would show up when cars were way far ahead of me and flash on and off when I had it set on the minimum level.

78: When approach a car at a stop light the FCW system did not responce

79: The malfunction display appeared once and I was unsure why.

80: Yes! Only once when the system alerted me of an imminent threat, but the car did not appear to be that close.

81: The auditory came on when a bus in front of me pulled over and signaled just as I approached it.

82: A few times, around standing cars or objects.

83: I was made to understand that some false readings would occur—except for some road signs, etc there were no prob.

84: False warnings at odd times.

85: Sometimes on 2 lane roads with curves would pick up oncoming cars for an instant.

86: None- It is not sensitive to objects in curve such as mail boxes or landscapes?

89: Only when the radar screen was dirty.

91: It activated and I quickly looked around and determined that there was no threat.

93: Times I got an imminent threat warning when passing a car merging out of my lane.

94: No. But there were some alerts that I didn't expect such as pulling out of a parking space, when I pulled forward the alarm went off and I was driving slowly and still had 2 ft. in front of me. (Was going slowly too under 25 mph.)

95: None that I can recall @ the moment.

23. Were there ever situations when you did not <u>understand</u> the FCW information displayed? If so, please explain:

35: Yes—Late? (Received a malfunction and dirty radar messages while driving. They cleared w/o turning of the car)
37: When it was a false alert, I did undertand why
38: Yes—could not explain—just went off.
41: When the imminent threat would go off and there was no need to.
60: It told me that it was heavy rain, and it wasn't raining (restated car and it cleared)
61: A couple of times I got a malfunction just by parking, or pulling out of a parking place.
62: Failure one day (HUD failure)
76: I think it was set off by going up a hill once.
81: When first using I thought the vehicle icon would only appear at the high end of distance selected.
91: Not active due to heavy rain although I was not sure the radar was self cleaning.
93: The first time I got an imminent threat warning for passing a car merging out of my lane I was confused.

24. Please describe any specific situation when the alert came on too soon:

32: When cars turned in front of me
37: 1) When a larfe truck was along side or was turning to the right of the car. 2) Going over a dip in the road
38: Objects on side of vehicle
42: Only in regard to construction barrels and other large obstructions. But this was inconsistent also, so one cannot hook (mentally) signals w/reliably same actual conditions.
43: Guard rails, signage, merging traffic.
44: cars turning ahead
53: False alarms
54: Most non vehicular alerts (sign, past, ped.overpass)(overpasses on rural freeways)
55: If driving to fast
56: One time the alert came on about 30 feet away from the vehicle in front
60: I was driving on the freeway and the car was about 3 cars length and I received a the third alert (big yellow car)
61: One time I had just decreased the gap, to two, but it came on way ahead (refers to the small green car icon)
70: It was early every time. It happened today, just before I turned on to Huron Parkway.
77: Only the green alert came on to soon.
79: But if the weather conditions were rainy or icy would the alert still give enough time to stop? (N/A not too soon but at inappropriate times)

83: A few times it came on for no apparent reason but that was not a serious problem—when that happened the symbol was always small and soon disappeared.
85: As preciously stated when a car ahead of me was completing a turn and I felt I was not that close to them.
87: Only if I had set it to come on too soon.
92: Around Curves

Please describe any specific situation when the alert came on too late:
31: If you had the setting wrong
38: rear end situations
41: Sometimes it seemed like I was going a little fast and too close to a car and the alert did not come on.
45: If I'm looking at the dash to see why I'm being warned I don't have time to stop a crash.
47: The false alarms went on immediately no green or yellow. (On a few occasions I approached a vehicle rapidly and hit the brakes before I got an alarm)
48: In general I felt by the time the alert sounded or the visual appeared it would almost be too late.
51: As stated for my taste the warning could have come somewhat sooner although that might have been a bit more annoying.? (The visual icons would have been more annoying.)
52: (At higher speeds)
57: That was my biggest concern. I always would have to brake before the warning came.
58: Other vehicle would change lanes and get in front of me when I did not feel they had enough space to do so. Alert did not come on right away.
60: I was less than one cars length and I didn't set an alert
64: Cars ahead at a dead stop.
67: It may not have been too late, but it was after my foot was already headed (?) to the brake.
68: Usually I had applied the break before the alert sounded/flashed
72: Cars would slow to turn, be out of my way, and the alerts would still sound.
75: When car 1 move to a new lane, but there was a car in front of car 1.
80: There was once when I felt the system should have alerted me. A car cut in front of me on the freeway. But it, the system, did not respond.
81: Please see previous bus description (Q19)
82: On freeway speeds
83: Don't remember anything specific.
86: Vehicles entering interstate off of steep ramps (I-696 and M-10)
87: When I had set it to come on too late
89: None come to mind, in general it sometimes seemed late
90: The car came out in front of me and then the signal went off.
91: When the speed I was approaching another moving vehicle was close to the same speed.

92: When the number were to low
95: I felt the FCW signal did not give the driven sufficient time to make necessary adjustments to successfully avoid an accident on a consistent basis.

25. Please describe any specific situation (s), if any, when you found the FCW alert to be useful in warning you about a potential rear-end collision.

34: I was slowly approaching a vehicle, and was a bit distracted with something else that I was doing and I got too close to the other car. The warning alerted me.
35: In one instance, a car cut across in front of mine when I'd briefly taken my eye off the road on a city street; as the audio alert actuated, I immediately hit the brake.
37: When either cars entered the lane too quickly or too close.
41: When driving on the freeway at a high rate of speed.
50: Car cut short in front of me
52: It would be useful when the diver is preoccupied—which is probably why most accidents occur—fiddling with automatic buttons that aren't working as expected—etc.
53: When someone turned @ the last second
56: I looked away from the cars in front of me and traffic was slowing down
58: It would warn me that I might not be at a safe distance from car in front of me to stop quickly.
66: It was very useful when I potentially could have rear-ended the car in front of me on the cooks M-59 over pass. (see question 4)
70: I never found them useful
71: Unexpected right turn by preceding vehicle.
73: While going up hill and a slow truck was ahead
76: The change grabbed your attention if you were looking elsewhere.
77: I looked away from the road once and it went off I did need to break.
82: Useful when distracted or no alert
83: Cars turning right out of my lane.
85: When the traffic was slowing down ahead of me.
86: When distracted by passengers.
88: Snow storm heading up north
92: When other cars are right in front of you.
93: When I got an alert for coming up on a car stopped at a stop light.

41. Can you suggest any changes or modifications to the FCW system that might improve it?

31: Move the display to the right more and be able to turn system off or on.
33: tied in with accelerator
(car slows down automatically when a driver receives an alert.)
37: Audio option with alert might be more helpful to being alert. (audio feedback (voice) before an imminent alert. "You are closer than you've chosen")
38: Rear end sensitivity should be increased.

40: (Get the audio working! has potential to be a great system. A lot of people don't pay attention to the road today.)

41: That the imminent alert did not go off when passing cars, so much.

42: More reliability. Too many seedless gaps. The very best thing (and NOT brought up yet) is seeing your actual speed posted in line of view.

43: more audio or perhaps spoken interruption-less visual cues.

44: The false alerts were the only bothersome feature; I think you begin to ignore this feature on the car unless the auditory alert is enabled.

45: Make it talk instead of beep

46: It does not seem to pick up motorcycles very well, esp. after dark.

47: Adjustable volume on alert, more false alarm filtering (repeated identical stationary alerts)

48: Move the visual indicator location.

49: Reduce alarms to stationary objects in curves

50: A wider radar vision across the front

51: Adjustable distance when audio warning sounds. (adjust the timing of the imminent alert).

52: Other than being distracted—I would consider it valuable in adverse weather conditions—I would improve the radar system—getting a warning about the radar in heavy rain isn't very encouraging.

53: Have the audio alert come on just a little bit earlier or have it adjustable.

54: Eliminate false alarms.

56: For the driver of the vehicle to be able to turn the system on or off at their convenience.

57: 1. I would only have the car icon appear when your vehicle is approaching the need to stop (Largest size). 2. I would have the imminent warning occur sooner. (A single stage alert before imminent, one amber only)

60: I think that FCW and the ACC should be combined into one feature. In FCW if you are too close the car should slow down. That would make it better. Logos should not be displayed on windshield, sometimes they distract you from what's in front of you causing a possible collision.

63: Since the HUD display is at the front of the vehicle, your attention is already in the same zone as any possible forward collisions. To capture drivers attention, who might be distracted, need a different method to alert—possible audio (ie "40 feet to impact", "30 feet to impact", etc) Audible alerts need to be louder and take into account road & vehicle noise.

64: (audio tone) Ding as the orange car becomes larger

65: I think the visual warning is a distraction and do not think any modification can change that. The auditory alert was a little un-nerving to me when it would go off—I think there are too many things that can make it go off with traffic as heavy as it is everywhere now. I prefer to focus and concentrate on the road and there are enough everyday distractions—I'm looking to eliminate distractions rather than adding any.

66: Control over visual/audio settings. Volume of audio alerts. Ability to turn FCW on/off.

68: Provide the alert earlier

70: Prune away unnecessary icons (one cautionary & imminent), narrow the range (width) of it's radar response, keep it working below 25mph, make it disableable, have it did (?) in close parking.
71: Active vehicle image at any speed and even if brakes are applied. No audible.
72: --Less false readings --signs, cars, turning, etc.
73: None, I really enjoyed using it
74: No visual warning until an imminent threat was detected
76: To have the radar on a swivel that turns as the car turns
77: Change it so the green light does not come on too soon; be able to use at lower speeds.
79: Comment: Regardless of how irritating the alerts were or were not if it helps to prevent one accident it is worth it!
81: I don't fell the 3-car distance wave length to be safe. I would only drive at setting 6 and feel safe.
83: Maybe have it start at 20 mph for around town driving.
84: Fix the false warning alerts and change visual alert to 5 or 6 step bar scale.
86: Brighter colors for icons on heads-up display-use brighter primary colors.
88: Radio turning back on when alert goes off.
89: A dashboard display in addition to HUD for very bright conditions when HUD is difficult to see.
90: Green isn't such a great color. Sometimes it blend, but blue would probably be worse.
92: Have a better color, it was great for night, or make to change to any color. (orange during bright sunny day was difficult to see)
93: The warning icon should only flash on to indicate what it senses not stay on the screen. Cautionary alerts are a critique of my driving. If you don't follow safe parameters for following the icons remain.
94: I feel that when you truly need this system the reaction time from the time you hear the alarm until you need to react to avoid a collision, is to short.
95: Modify FCW to accommodate objects that falsely signal an imminent collision may occur. Also, modify FCW to signal sooner when vehicles are traveling at the same or near the same speed to give rear driver enough time to make adjustments when necessary.

ACC

1. **Please describe situations or conditions that made you feel uncomfortable when using ACC**

32: When the car in front of me moved out of my lane the car did not speed up and made me nerves (nervous)
35: On I-94 this a.m. for no reason the brakes suddenly actuated.
37: 1) Higher speeds (75+) 2) Heavy Rain
38: Coming up on another vehicle.
39: Need greater acceleration for passing
41: When the car would slow down for merging traffic

42: When lanes merged and I felt I should decrease speed I could not rely on ACC.
43: Acceleration of cruise control wasn't quick enough.
46: Sometimes it seemed to bring me to close to an ahead car, even with its gap at 6.
47: Changing lanes after braking acceleration was to slow.
52: At speeds over ~45 MPH it began feeling less responsive—began to influence my overall comfort.
55: That it may not stop me
57: When a car in front would brake, ACC responded later than I would like, and then would have to brake too firmly (not smoothly)
59: Once merging onto an expressway when congested the speed would change too much. .
60: Sometimes it would brake very suddenly causing me to jerk.
63: Medium density traffic, the "lead" space ACC maintains isn't practical (the gap was pretty long; dropping back in the gap)
64: Heavy fast traffic on the freeway
66: Heavy traffic on highway. Maim concern: Someone following too close behind me when another car changes into my lane causing the ACC to decrease speed rapidly. I was concerned about the car behind me not slowing down quickly enough (Note: this isn't referencing an actual event; it's hypothetical, but a concern)
67: When I would change lanes to pass, after slowing down for the vehicle in front of me, the ACC took too long to increase my speed. As a result I tended to hold up approaching vehicles.
68: When first using it, it took awhile not to automatically apply the break. After I got used to it, it was OK.
70: It breaks too hard, & at inappropriate times. It seems to make people driving behind me irritated (me too)
71: Learning curve to rely on ACC
72: Braking was jerky at times
73: As traffic got congested on freeway
76: When it gunned the gas to get back to a set speed.
77: When the car would slow down to much to the point where I could not merge into the next lane of traffic w/out making them brake also.
79: The braking system made me nervous (letting the car brake for you was a little nerve racking)
82: Heavy traffic, fast traffic, snow.
83: When car would aggressively brake or accelerate at expressway speeds. I was concerned with impact it might have on other drivers.
85: Nervous that the system wouldn't slow down/adjust tot eh speeds of other vehicles.
86: You need to disengage it when passing in moderate traffic. It "feels" as if the system is fighting your attempt to manual control.
87: Feeling unsure it would slow down behind slow cars/trucks
88: Heavy merging traffic.

89: Poor weather conditions
92: When other car change lane faster or around curves
95: When larger vehicles were traveling ahead and the ACC would break more forcefully when approaching.
96: The ACC brakes the car to much, over reacting.

2. Please describe situations or conditions that made you feel unsafe when using ACC

32: When it slowed down or speed up too fast
37: 1) Higher speeds 2) curves
38: Braking too harshly
41: I felt the car made kind of a sudden stop for merging traffic.
42: On M14 when motorists are rushing to/from work and there's merging lanes because of construction. Also highway construction, closed lanes and curves in the road with trucks beside you.
46: Just to close sometimes
47: Lane change
52: At speeds over ~45 MPH I found myself not trusting it (didn't brake quickly enough.)
54: System braking (the degree of braking was more than I would have applied if braking manually)
55: May slow down to fast for person behind me
57: See above
65: I felt somewhat worried that it would not work to slow down. My foot was on the brake ready to slow down. Maybe if I used it more there would be less apprehension.
66: see question 1. Note: I was just as comfortable using ACC as conventional CC, however, question1 describes a situation that would make me feel very unsafe using ACC. If I anticipated this situation I immediately turned off ACC.
67: I was concerned about forgetting to brake at an exit ramp. Because, with a slower vehicle in front of me on the Xway, my speed was already slow enough. Then with the exit ramp clear, I could accelerate to the pre-set speed. Only started to happen once, but I was concerned about it.
68: Difficult in trusting the system.
70: Tried to accelerate into a motorbike; (different scenario) decelerated strongly as I was changing lanes
76: When it started to gun back to set speed and another car would get back in the way.
77: When it was foggy out it would brake.
79: I worried about rear end collision from the car behind me.
80: In certain situations I found myself not waiting for the system to react. I would brake before the system.
82: If highway went into a curve, heavy traffic.
83: See Q1, (felt very safe: " After I got used to it"
85: Having the car brake on its own was very unusual feeling.

86: In fast traffic the system slows the vehicle down so rapidly that rear end crash seems a possibility.
87: Some answer as above
88: Brake slamming when car cuts in front.
90: When trying to change lanes after following someone slower than me.
92: When the speed take off after a slow car (leaves the lane)
94: The acc isn't food when driving behind a slower vehicle and getting on an exit ramp (because of unexpected accel), nor is it good for heavy traffic situations (its response to other vehicles in this situation was not intuitive)
95: None that I can think of right now.
96: It overreacts and made me feel like I was not in control.

4. While driving using ACC, please tell us the number of times, if ever, you came close to experiencing a rear-end collision? _____
If so, please describe the conditions under which it occurred:

42: The one time on M14 with merging traffic and we came dangerously close to a SUV ahead with no deceleration or warning occurring. (Another was on M14 when I approached the car ahead rather fast and no warning was signaled.)
46: just driving, sometimes slow, (35-45mph)
52: Speeds over 50-60 MPH I did Not feel comfortable relying on it. Passengers became very uncomfortable at higher speeds.
57: None, but I did have to intervene several times to prevent an unsafe situation.
58: I was accelerating while in ACC when another car cut in front of me-no warning signaled me.
61: Car cut in front of me on the freeway.
70: ACC tried to accelerate into a motorcycle
72: --Didn't slow fast enough (car in front) –Didn't accelerate fast enough & a car tuned into my lane (in back) and almost hit me.
74: A car entering the freeway at a slow pace in front of me. Maximum braking by ACC was not enough.
82: Slow down in traffic where it could not stop fast enough.
83: Traffic stoppage in Florida keys turned in alert and possibly helped avoid accident. (FCW alert in ACC. Car was braking)
87: Was talking to a friend about other things in the car and not paying enough attention. (Received a "driver control required" message)
94: I never had a situation that caused the alarm to go off but there were several times I felt I had to break as I was to close to the car in front of me.

5. Please describe any difficulties you had when using ACC

34: Having enough distance between myself and the car ahead to set the control at the speed I wanted.
37: See question 1 and 2
39: Maybe the speed up when passing
42: Taking my eyes off the road to adjust gaps or find the desired button. This became easier with practice, but it still is distracting.
47: Disengage using the brake pedal seemed delayed.

52: Began to not trust it for braking
55: Trying to keep safe distance
61: Sometimes if the car ahead speed dropped suddenly then mine did too. Cars in back of me would move to another lane. Especially if I had ACC set to more than 3 spaces. If I didn't have ACC on, I might no have braked so hard at that distance.
64: Cars cutting into the space I left when on the 6 setting
65: It seemed to be somewhat jerky w/some slow downs and re-accelerations. Also, you would move to the passing lane & it seemed to hesitate before accelerating & then take off like a jet.
66: See question 1. Also, heavy traffic conditions
67: See #2. Also, I wasn't always able to predict or understand the timing & rate or deceleration when I approached a slower vehicle.
68: Trust, when setting at legal highway speed (I-75) most cars were passing me.
70: It would sometimes brake as soon as I released the gas pedal
74: The 1 MPH increase/decrease button sometimes skipped numbers ex: 72-74-76
77: Just that it would slow down to much when it adapted to the car in font of me.
86: The system doesn't "feel" smooth as a conventional cruise control.
87: I would need more time to get used to it. Weather conditions did not permit me to test it more thoroughly.
88: Resuming set speed after braking. (Resume didn't work; would not return to set speed)
90: The changing lanes thing. Following a truck that was passing a truck was not very fun either.
92: Most other cars are driving faster than the speed limit, when they are going around you like lighting.
94: I think that where the adjustment on the steering wheel is should be the scan of seek button on the radio. Several times I instinctively pushed up on the adjustment button thinking I was going to change the radio dial (seems like the button would be better placed right-hand side of wheel, furthest in position.)

6. Please describe any difficulties you had adjusting the following distance

42: The problem is in the beginning of use—at relatively high speeds one is learning–on-the-job.
43: Hard to translate blocks and gaps into actual footage while driving.
48: With all the controls on the steering wheel locating the buttons easily.
52: Occasionally forgot Gap vs Warn-
53: No difficulties. It took a little while to fins the right setting
63: I must have forgotten that I could adjust the gap. Never did and don't know how.
67: exc. See #5
70: does not respond while accelerating whether automatically or manually (does not refer to gap. Didn't have problem adjusting the gap)

73: My nails are too long. They make applying pressure a little difficult. (buttons)

11. Were there ever situations when the ACC system operated in a manner that you would not have predicted or was opposite of what you expected? If so, please explain.

32: Only when I first used it
35: Only 1 other than mentioned on #1 item
41: Only for merging traffic. I feel the car stops too suddenly.
42: The incident described on question #4
44: On occasion, I thought the car would slow a little sooner and accelerate a little faster.
46: Got to close sometimes otherwise just as explained.
52: Higher speeds-didn't brake quickly enough
56: It functioned exactly how I expected it to.
65: -No, but the hesitation before accelerating & somewhat jerky motion seemed exaggerated.
67: With the cruise speed at 75, I approached a truck that was going 60. It took longer than I thought it should have (gap=4) then the slowdown dropped me back several car lengths from the pong where the slowdown got serious.
70: It would apply the brakes and then accelerate, instead of gently allowing itself to decelerate into a safe driving gap.
72: Sometimes engaged too late
77: Once it started to slow down when nothing was infront of me and traffic was behind me. It also slowed down when I was driving in a fog.
80: Going from my answer in questions #2, I realized you had to trust the system in order to take full advantage of it.
82: Sometimes it seemed to slow down the car when car ahead would pull away, change lanes, or just whenever.
83: Once. Car failed to accelerate after moving into a passing lane to pass a truck. The car kept coasting to <10mph below my set speed.
86: Acceleration or resuming set speed is slower than anticipated.
95: ACC would decelerate to speed of vehicles in right lane while I was passing in left lane as both car were traveling on a corner. This happened more so when both cars were moving on a corner that turned to the left.

12. Were there ever situations when you did not understand the ACC information displayed? If so, please explain

42: I found it alarming when speed went above the setting, only 1 more mile than set, but this can be disconcerting when one is NOT controlling and it is high speed.
43: Only relating to understanding spatial footage/distances.

Can you suggest any changes or modifications to the ACC system that might improve it?

- 33: tied in to FCW (see comments made in FCW modifications)

- 37: Audio to relate to visual (referring to FCW)
- 39: Quicker passing response
- 41: That the breaking for merging traffic be a little more gentle and not such a sudden jerk.
- 42: fewer gap choices
- 43: Again, prefer an audio system (would like to have verbal input for set speed, would like a series of beeps to indicate deceleration)
- 44: A smoother transition when pulling out and passing
- 45: Make it recover more quickly when it has to brake hard.
- 46: Detect cars a little sooner (at further distance) motorcycles; brake a little sooner.
- 47: Smooth out the decal to brake transition speed up the eccelration on lane change.
- 48: Remove the "GAP" option and set the distance thereby eliminating additional options when using ACC.
- 52: More rapid response at higher speeds
- 53: More gap settings
- 54: Slower decceleration rate when approaching slower cars.
- 56: ACC System works exceptionally well
- 57: Sometimes the acceleration is too fast (when a car is in front of you) Respond sooner to a car braking or slowing quickly brake more smoothly.
- 60: The car should brake and speed up gradually.
- 63: Resolve conflict bet. driver acceleration and ACC deceleration (i.e. disengage if gas pedal is applied)
- 65: less hesitation before accelerating after moving into passing lane. More fluid motion—kind of jerky.
- See question 30 (q. 30: I would be more comfortable if car could detect the distance between the car behind and adjust deceleration accordingly)
- 68: Faster acceleration for passing requiring set speed.
- 70: Tune the radar response, make deceleration to braking transitions more intelligent/smoother to mimic a good driver (one who rarely has to brake on the highway)
- 72: Accel/Decel and braking jerkiness
- 74: Need one bar less sensitive adjustment (A "zero" bar), I only used the 2 bar setting. 6 is way too sensitive.
- 75: The acclertation of the ACC should be one mile at a time. For example: If I have the ACC set at 70 MPH. The ACC want ta accelerate back it try to jump from 55 to 70 instead of climbing from 55 to 70 MPH.
- 76: Have another control to adjust the acceleration speed.
- 77: If I had the option to turn it off or on (conventional vs. ACC) I would recommend it. It would be nice to have for long road trips. It shouldn't slow down so much sometimes. It was hard to change lanes comfortably when it did that.)
- 78: To respond when you approach a stopped car
- 79: Provide an option of ACC or CC

- 83: Make it somewhat adjustable to drivers preference regarding acceleration and braking.
- 86: Refine braking and acceleration timing—refine disengagement—when you hit acceleration the system should disengage.
- 89: Smoother transition slowing and accelerating, sometimes seemed overcompensating.
- 92: When it speed up or down it was uncomfortable.
- 94: The thing I feel makes it most unsafe is the very thing your trying to achieve. There is no way of knowing where a car moves out of the way, that your going onto an exit ramp, and when you car automatically accelerates going into the corner instead of decelerates it can cause accidents.
- 95: Adjust ACC so vehicle does not adapt speed to vehicles in another lane while traveling around a corner. Reduce the level of deceleration behind large trucks.
- 96: The system needs more refinement so the braking isn't so harsh; it has to be intertwined w/FCW; coasting before hard braking.

Participant Handling

1. **What could researchers have done differently to improve your understanding of the FCW system and how it operated?**

   37: Check up witht the driver after the first 5 days by cell phone
   42: TIME and hands-on the most useful teachers.
   43: translated blocks/gaps into footage/mileage
   44: Nothing, you have to experience the feature to really understand it.
   46: Nothing-it was explained in detail.
   48: Explained the "GAP" in terms of distance
   52: The instructions were fine
   60: Researchers made it very clear for me to understand how to use features (I didn't need additional instructions)
   63: Maybe a telephone call on day 7 or 8 to see if there are ???s
   70: They did well
   79: Nothing, the training was extensive and very helpful
   80: There wasn't anything that could or should have been done differently.
   84: Nothing, everything was explained in an excellent manner
   86: Nothing, very detailed (burn a DVD!!!)
   88: Measurement for spaces-like 1 car length- 2 car length
   89: Emphasize that is a warning only and not a braking system—except when ACC is operating.
   90: It was hard to do examples on the road and at first I felt unsafe. Perhaps either a driving course with another car or a simulator would work.
   94: The researcher did an excellent job. I did not encounter one situation that I didn't expect.
   95: The researchers did a great job of explaining this product to me. I was very understanding of the system and how it works.

2. **What could researchers have done differently to improve your understanding of the ACC system and how it operated?**
   - 37: Check with driver with quick phone call
   - 44: Nothing, you have to experience the feature to really understand it.
   - 48: Explained the “GAP” in terms of distance
   - 53: Give an approximate distance w/settings
   - 59: All my questions were answered one I watched the video it explained everything very well.
   - 70: They did a darn good job.
   - 77: Both the FCW and ACC were clearly explained and easy to understand how to use.
   - 79: Nothing-The training was excellent
   - 80: There wasn’t anything that should have been done differently
   - 84: Nothing, everything was explained in an excellent manner.
   - 86: Nothing, very detailed (burn a DVD!!!)
   - 91: Watched training video more than once (for question number 3)
   - 94: Same as above (Q1)
   - 95: Again, my understanding of the ACC system was good.

Additional FCW questions

4. **If you would have turned off the FCW system how long into your experience would you have kept the FCW system on?**
   - 32: 7-8 days
   - 34: One week on. I probably would have turned the system off while driving on the highway at a faster speed, and turned it on again while driving thorough city traffic.
   - 44: 2 ½ weeks but turned back on heavy arterial traffic.
   - 45: Around 3 or 4 days
   - 48: week to 10 days
   - 55: 1 week
   - 60: After 1st week I would have tuned system off.
   - 63: A week
   - 65: I may have turned it off and then tried it again in different driving situations.
   - 66: He wouldn’t have turned it off while driving for the ACAS project. If he owned it, he would turn off FCW in specific situations (eg when he is on a date, with his parents).
   - 68: 2 weeks
   - 70: a few days
   - 72: 2 weeks
   - 74: 2 days
   - 75: 3 week window
   - 81: 2 weeks

- 84: for 3/4 of time it was activated.
- 90: Two ½ weeks
- 93: 7 days
- 94: 3-4 weeks, assuming it was his car.
- 95: 2 or 3 weeks

6. What about the alert makes it annoying? Is it the characteristics of the tone or the visual alerts?

- 32: Loudness. It scared me
- 34: the visual alerts flashing
- 35: did not fin the alert annoying
- 36: not annoying
- 39: Loudness of the tone
- 40: alerts not annoying
- 41: The alert itself was not annoying
- 42: Loudness
- 43: size of the flashing icon and the red/amber combination
- 44: The alert is disruptive. I know I need to brake I don't need a distraction. The visual was worse than the audio. (I know this)
- 45: Audio component—too startling; I would lose my focus it scared me.
- 47: Audio is too high, full screen "red" is overwhelming
- 48: They were too late and I was already reacting.
- 49: Loudness
- 50: Not at all annoying
- 51: The amber icon was too big and in my face
- 52: Visual icons—when received when there was no imminent danger
- 53: Did not find them annoying., Alert was fine; didn't make his ears ring; he is slightly hard of hearing.
- 55: Visual-not at all annoying. Audio- only slightly annoying—didn't last too long.
- 56: High pitched noise
- 57: Only slightly annoying because they were not needed. System was designed well, it just didn't come on at the right time.
- 58: Only when it would go off when there was nothing to be concerned about.
- 59: Cautionary visual alerts-not a big deal but the increasing size of the cautionary alerts.
- 60: Visual icons are big and bright. Auditory alert was fine.
- 61: The beep was at a comfortable level. When I should go off, it wasn't annoying. If it shouldn't be going off, it was annoying.
- 62: Not annoying
- 63: The alerts themselves were not annoying the judgment part was—suggesting something is wrong.
- 64: Didn't find the alerts at all annoying

- 65: Audio—I didn't feel there was a danger and I wasn't expecting it to come on. It startled me.
- 66: Cautionary alerts—only slightly annoying and somewhat distracting.
- 67: He didn't find them to be annoying.
- 69: Only slightly annoying. The audio alert was startling.
- 70: The alerts were happening when I didn't think that they were necessary.
- 72: When it happened
- 74: If the alerts were necessary then they weren't annoying
- 75: Changing of the visual alerts from green to amber and back.
- 76: Didn't find the alert annoying
- 77: Didn't find it annoying
- 81: I was never in a situation when I thought the alert was warranted. Scared me when it went off falsely.
- 82: Somewhat like fingernails on a blackboard.
- 84: Tolerable
- 85: Only slightly annoying—the surprise and the flashing.
- 87: not annoying
- 88: Only slightly; the flashing made it annoying.
- 89: Found the audio alert "only slightly" annoying because I wasn't used to it. When I had passengers in the car they would wonder what it was.
- 90: Annoying—audio. Annoying tone that grated on the ear.
- 91: Only slightly annoying—when it was a situation in which I was moving away from a potential crash.
- 92: Only slightly annoying—first time, it jumped out
- 93: Somewhat annoying—It's the <u>constant</u> display of the icons
- 95: Found the alerts to be tolerable
- 96: Only slightly annoying when the alarm was false

7. At any point during the last 3 weeks did you use your own vehicle? If so, when and what were the circumstances.

- 32: Just Saturday night—I went out and wasn't sure if I would be able to drive home and I didn't want anyone else driving the car
- 35: hauling with a pickup truck
- 37: Once, she doesn't remember why/ Possibly t o carry things to school.
- 39: Just some short trips to the stores used to buy gas for his lawn mower. Replaced gas grill tank
- 40: needed truck to pick up some things
- 42: yes. Drove my car to have it repaired.
- 43: Once. During the power outage the Buick had no gas she drove her car
- 44: Not often get some car repairs. Gas.
- 47: Yes. Hauling things w/truck. My wife picked me up in her car.
- 51: Twice. My daughter's car seat was in my car and I didn't want to change it. Swapping cars w/her husband.
- 52: Once. Hauling dirt.

- 53: Yes. 6-7 times Working around the house; hauling thing in his truck.
- 54: Yes. 3-4 times. Tools and equipment in my van that I needed for work.
- 55: Yes. Leather seats were too cold; New brakes on his truck, he wanted to drive it and used it for side jobs.
- 56: Couple days. For my work.
- 57: A couple of times I used our van. I have a family of six.
- 59: Weekend when we had to get her a new car because of system problems.
- 62: Used my wife's car to run to the bank and put air in her tire.
- 63: Yes, I went to Toledo with a friend and I wanted to share the driving.
- 64: Dropped off car last night at UMTRI Drove minivan home from repair shop.
- 65: Yes. When I drove to Wayne State, I felt more comfortable driving my car. One day for shopping.
- 66: Yes, 6 times. I drove to UM game and knew I would have beer. I missed driving my car.
- 68: Yes, I went to Canada
- 71: Moving a step ladder; not enough room in Buick
- 72: Yes, went to Canada
- 74: Pickup a picture frame that wouldn't fit in the Buick
- 75: Her vehicle was at UMTRI
- 79: Yes, once. Went to get a Christmas tree.
- 81: Yes. Once. Went to a Rose Bowl party and knew that I would have something to drink.
- 82: Yes. Just to drive it around for a few hours so it wouldn't be sitting around for a month.
- 84: Yes. Not enough room in the car.
- 85: Once. Needed a 4 wheel drive vehicle to get to the house we're building.
- 86: Yes. To go to Home Depot.
- 87: Yes. One day when the weather was really bad and I had a Dr.'s appt and didn't want to risk harming the Buick.
- 88: Yes. My car was parked behind the Buick. Drove SUV because I was made at my husband and if I had the SUV, he couldn't go anywhere.
- 96: Only to keep my battery charged. I took my own car when I went to a party and knew that I would have a few drinks.

8. How much experimentation did you do with the FCW system trying to provoke forward collision warnings? When would you say you had experienced the system enough that you stopped experimenting?

- 32: very little
- 34: no experimenting
- 35: no experimentation
- 36: none
- 39: some. 4-5 times
- 40: tried to provoke alerts, but couldn't get an imminent working. (He felt the system wasn't working.)

- 42: A little with my son in IN (Indiana), just a little.
- 45: a lot of playing with it weeks 2-3. Last week, just drove it.
- 47: A little
- 48: with parked cars
- 50: Tried but couldn't get an alert
- 52: At the beginning, more so. 1 time/day provoked an alert at higher speeds.
- 53: didn't do it.

- 54: Did not try to provoke alerts
- 55: A little. He provoked the vast majority of them. End of second week of FCW.
- 56: 3X the first day. After the first day.
- 57: First few days, six times. After software was updated, a couple of times. Didn't get imminents, had to brake before he got an imminent.
- 58: Quite a bit but didn't get any scared my passengers!! 2 weeks experimented
- 59: None
- 61: 4x-only got alerts twice. After the first week.
- 62: A couple of times right after the system activated. Three days.
- 63: Maybe once or twice—Third or fourth day.
- 64: Didn't experiment w/provoking alerts
- 65: I did some. Tried to show my daughter's friends. Tried to show my kids. Within first week, I stopped experimenting.
- 66: A little. Didn't push it. Within 2-3 days, I stopped experimenting.
- 67: Some. I am very conscious of tail-gating. I tried to provoke alerts but stopped very short of a risk of collision. (When did you stop?) Two weeks into it.
- 68: A couple of times. Couldn't do it, I had to brake. After the second week.
- 69: 5-10 times. Stopped experimenting after 2 weeks.
- 70: First few times I tried it. I couldn't provoke an alert-stopped experimenting after second day.
- 71: Within the first week of FCW being active
- 72: Did not really experiment
- 73: Experimented a little throughout whole test
- 74: 4-5 times. After 2 days.
- 75: 7-8 times. When she was alone in the car or w/someone she had already demo'd the car to.
- 76: Once or twice
- 77: A couple of times when it was first activated. After 2-3 times.
- 78: Never stopped experimenting with the system.
- 79: Didn't experiment
- 80: Just once. After the first week.
- 81: Quite a bit the first week. Stopped experimenting after the 2nd week.

- 82: A little. I won't say I completely stopped. After a couple of days I got comfortable with it.
- 84: In the first wee, 50% of the time. I kept experimenting until yesterday. The experimenting slowed down because I found some comfort zones.
- 85: I didn't provoke it at all.
- 86: 3-4 times. More experimentation occurred at the end of the study.
- 87: Id did try to drive up behind cars to see if it was working stopped by the first week.
- 89: In the first few days I did it quite often if I had a passenger in the ca I would show them. After 3 days he stopped experimenting.
- 91: He was searching to find out how close or how fast of an approach he needed to provoke an alert. He did a fair bit of experimenting stopped experimenting during the second week.
- 92: A good bit. By the third day of the second week, she stopped experimenting.
- 93: A little bit. Four days into the FCW experience he stopped experimenting.
- 95: Initially, quite often. As time went one, I did it every so often. 2-21/5 weeks I stopped experimenting.
- 96: I didn't toy with it.

APPENDIX P

MULTIFACTOR ANALYSIS
PERCENTILE OF FOLLOWING TIME
AT 1-SECOND HEADWAY TIME MARGIN

MULTIFACTOR ANALYSIS: PERCENTILE OF FOLLOWING TIME AT 1-SECOND HEADWAY TIME MARGIN

General Linear Model

Within-Subjects Factors

Measure: MEASURE_1

LIGHT	ACAS	Dependent Variable
1	1	L_ACAS
	2	L_NOACAS
2	1	D_ACAS
	2	D_NOACAS

Between-Subjects Factors

		Value Label	N
GENDER	1	F	30
	2	M	30
AgeCat	1	Young	22
	2	Middle	20
	3	Old	18
Season	1	Summer/fall	26
	2	Fall/winter	34

Tests of Within-Subjects Effects

Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
LIGHT	Sphericity Assumed	.447	1	.447	77.121	.000	.616
	Greenhouse-Geisser	.447	1.000	.447	77.121	.000	.616
	Huynh-Feldt	.447	1.000	.447	77.121	.000	.616
	Lower-bound	.447	1.000	.447	77.121	.000	.616
LIGHT * GENDER	Sphericity Assumed	.002	1	.002	.294	.590	.006
	Greenhouse-Geisser	.002	1.000	.002	.294	.590	.006
	Huynh-Feldt	.002	1.000	.002	.294	.590	.006
	Lower-bound	.002	1.000	.002	.294	.590	.006

Continued: Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
LIGHT * AGE_CAT	Sphericity Assumed	.002	2	.001	.170	.844	.007
	Greenhouse-Geisser	.002	2.000	.001	.170	.844	.007
	Huynh-Feldt	.002	2.000	.001	.170	.844	.007
	Lower-bound	.002	2.000	.001	.170	.844	.007
LIGHT * SEASON	Sphericity Assumed	5.718E-05	1	5.718E-05	.010	.921	.000
	Greenhouse-Geisser	5.718E-05	1.000	5.718E-05	.010	.921	.000
	Huynh-Feldt	5.718E-05	1.000	5.718E-05	.010	.921	.000
	Lower-bound	5.718E-05	1.000	5.718E-05	.010	.921	.000
LIGHT * GENDER * AGE_CAT	Sphericity Assumed	.003	2	.002	.278	.759	.011
	Greenhouse-Geisser	.003	2.000	.002	.278	.759	.011
	Huynh-Feldt	.003	2.000	.002	.278	.759	.011
	Lower-bound	.003	2.000	.002	.278	.759	.011
LIGHT * GENDER * SEASON	Sphericity Assumed	.009	1	.009	1.540	.221	.031
	Greenhouse-Geisser	.009	1.000	.009	1.540	.221	.031
	Huynh-Feldt	.009	1.000	.009	1.540	.221	.031
	Lower-bound	.009	1.000	.009	1.540	.221	.031
LIGHT * AGE_CAT * SEASON	Sphericity Assumed	.014	2	.007	1.188	.314	.047
	Greenhouse-Geisser	.014	2.000	.007	1.188	.314	.047
	Huynh-Feldt	.014	2.000	.007	1.188	.314	.047
	Lower-bound	.014	2.000	.007	1.188	.314	.047
LIGHT * GENDER * AGE_CAT * SEASON	Sphericity Assumed	.021	2	.010	1.777	.180	.069
	Greenhouse-Geisser	.021	2.000	.010	1.777	.180	.069
	Huynh-Feldt	.021	2.000	.010	1.777	.180	.069
	Lower-bound	.021	2.000	.010	1.777	.180	.069
Error(LIGHT)	Sphericity Assumed	.279	48	.006			
	Greenhouse-Geisser	.279	48.000	.006			
	Huynh-Feldt	.279	48.000	.006			
	Lower-bound	.279	48.000	.006			
ACAS	Sphericity Assumed	.020	1	.020	1.855	.180	.037
	Greenhouse-Geisser	.020	1.000	.020	1.855	.180	.037
	Huynh-Feldt	.020	1.000	.020	1.855	.180	.037
	Lower-bound	.020	1.000	.020	1.855	.180	.037

Continued: Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
ACAS * GENDER	Sphericity Assumed	.016	1	.016	1.458	.233	.029
	Greenhouse-Geisser	.016	1.000	.016	1.458	.233	.029
	Huynh-Feldt	.016	1.000	.016	1.458	.233	.029
	Lower-bound	.016	1.000	.016	1.458	.233	.029
ACAS * AGE_CAT	Sphericity Assumed	.022	2	.011	.997	.376	.040
	Greenhouse-Geisser	.022	2.000	.011	.997	.376	.040
	Huynh-Feldt	.022	2.000	.011	.997	.376	.040
	Lower-bound	.022	2.000	.011	.997	.376	.040
ACAS * SEASON	Sphericity Assumed	.017	1	.017	1.532	.222	.031
	Greenhouse-Geisser	.017	1.000	.017	1.532	.222	.031
	Huynh-Feldt	.017	1.000	.017	1.532	.222	.031
	Lower-bound	.017	1.000	.017	1.532	.222	.031
ACAS * GENDER * AGE_CAT	Sphericity Assumed	.017	2	.008	.762	.472	.031
	Greenhouse-Geisser	.017	2.000	.008	.762	.472	.031
	Huynh-Feldt	.017	2.000	.008	.762	.472	.031
	Lower-bound	.017	2.000	.008	.762	.472	.031
ACAS * GENDER * SEASON	Sphericity Assumed	1.232E-05	1	1.232E-05	.001	.973	.000
	Greenhouse-Geisser	1.232E-05	1.000	1.232E-05	.001	.973	.000
	Huynh-Feldt	1.232E-05	1.000	1.232E-05	.001	.973	.000
	Lower-bound	1.232E-05	1.000	1.232E-05	.001	.973	.000
ACAS * AGE_CAT * SEASON	Sphericity Assumed	.048	2	.024	2.195	.122	.084
	Greenhouse-Geisser	.048	2.000	.024	2.195	.122	.084
	Huynh-Feldt	.048	2.000	.024	2.195	.122	.084
	Lower-bound	.048	2.000	.024	2.195	.122	.084
ACAS * GENDER * AGE_CAT * SEASON	Sphericity Assumed	.027	2	.013	1.226	.302	.049
	Greenhouse-Geisser	.027	2.000	.013	1.226	.302	.049
	Huynh-Feldt	.027	2.000	.013	1.226	.302	.049
	Lower-bound	.027	2.000	.013	1.226	.302	.049

Continued: Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Error(ACAS)	Sphericity Assumed	.527	48	.011			
	Greenhouse-Geisser	.527	48.000	.011			
	Huynh-Feldt	.527	48.000	.011			
	Lower-bound	.527	48.000	.011			
LIGHT * ACAS	Sphericity Assumed	.060	1	.060	11.366	.001	.191
	Greenhouse-Geisser	.060	1.000	.060	11.366	.001	.191
	Huynh-Feldt	.060	1.000	.060	11.366	.001	.191
	Lower-bound	.060	1.000	.060	11.366	.001	.191
LIGHT * ACAS * GENDER	Sphericity Assumed	.002	1	.002	.355	.554	.007
	Greenhouse-Geisser	.002	1.000	.002	.355	.554	.007
	Huynh-Feldt	.002	1.000	.002	.355	.554	.007
	Lower-bound	.002	1.000	.002	.355	.554	.007
LIGHT * ACAS * AGE_CAT	Sphericity Assumed	.000	2	.000	.028	.972	.001
	Greenhouse-Geisser	.000	2.000	.000	.028	.972	.001
	Huynh-Feldt	.000	2.000	.000	.028	.972	.001
	Lower-bound	.000	2.000	.000	.028	.972	.001
LIGHT * ACAS * SEASON	Sphericity Assumed	.014	1	.014	2.655	.110	.052
	Greenhouse-Geisser	.014	1.000	.014	2.655	.110	.052
	Huynh-Feldt	.014	1.000	.014	2.655	.110	.052
	Lower-bound	.014	1.000	.014	2.655	.110	.052
LIGHT * ACAS * GENDER * AGE_CAT	Sphericity Assumed	.022	2	.011	2.068	.138	.079
	Greenhouse-Geisser	.022	2.000	.011	2.068	.138	.079
	Huynh-Feldt	.022	2.000	.011	2.068	.138	.079
	Lower-bound	.022	2.000	.011	2.068	.138	.079
LIGHT * ACAS * GENDER * SEASON	Sphericity Assumed	.023	1	.023	4.327	.043	.083
	Greenhouse-Geisser	.023	1.000	.023	4.327	.043	.083
	Huynh-Feldt	.023	1.000	.023	4.327	.043	.083
	Lower-bound	.023	1.000	.023	4.327	.043	.083
LIGHT * ACAS * AGE_CAT * SEASON	Sphericity Assumed	.011	2	.006	1.074	.350	.043
	Greenhouse-Geisser	.011	2.000	.006	1.074	.350	.043
	Huynh-Feldt	.011	2.000	.006	1.074	.350	.043
	Lower-bound	.011	2.000	.006	1.074	.350	.043

Continued: Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
LIGHT * ACAS * GENDER * AGE_CAT * SEASON	Sphericity Assumed	.012	2	.006	1.089	.345	.043
	Greenhouse-Geisser	.012	2.000	.006	1.089	.345	.043
	Huynh-Feldt	.012	2.000	.006	1.089	.345	.043
	Lower-bound	.012	2.000	.006	1.089	.345	.043
Error(LIGHT*ACAS)	Sphericity Assumed	.254	48	.005			
	Greenhouse-Geisser	.254	48.000	.005			
	Huynh-Feldt	.254	48.000	.005			
	Lower-bound	.254	48.000	.005			

Tests of Between-Subjects Effects

Measure: MEASURE_1

Transformed Variable: Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Intercept	14.520	1	14.520	203.246	.000	.809
GENDER	.061	1	.061	.860	.358	.018
AGE_CAT	1.309	2	.654	9.158	.000	.276
SEASON	.191	1	.191	2.670	.109	.053
GENDER * AGE_CAT	.213	2	.106	1.490	.236	.058
GENDER * SEASON	.016	1	.016	.223	.639	.005
AGE_CAT * SEASON	.090	2	.045	.628	.538	.026
GENDER * AGE_CAT * SEASON	.319	2	.160	2.234	.118	.085
Error	3.429	48	.071			

Estimated Marginal Means

1. LIGHT

Estimates

Measure: MEASURE_1

LIGHT	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
1	.300	.020	.259	.340
2	.210	.017	.176	.244

Pairwise Comparisons

Measure: MEASURE_1

(I) LIGHT	(J) LIGHT	Mean Difference (I-J)	Std. Error	Sig.(a)	95% Confidence Interval for Difference(a)	
					Lower Bound	Upper Bound
1	2	.089(*)	.010	.000	.069	.110
2	1	-.089(*)	.010	.000	-.110	-.069

Based on estimated marginal means

* The mean difference is significant at the .05 level.

a Adjustment for multiple comparisons: Bonferroni.

Multivariate Tests

	Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Pillai's trace	.616	77.121(a)	1.000	48.000	.000	.616
Wilks' lambda	.384	77.121(a)	1.000	48.000	.000	.616
Hotelling's trace	1.607	77.121(a)	1.000	48.000	.000	.616
Roy's largest root	1.607	77.121(a)	1.000	48.000	.000	.616

Each F tests the multivariate effect of LIGHT. These tests are based on the linearly independent pairwise comparisons among the estimated marginal means.

a Exact statistic

2. ACAS

Estimates

Measure: MEASURE_1

ACAS	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
1	.245	.018	.210	.281
2	.264	.021	.223	.306

Pairwise Comparisons

Measure: MEASURE_1

(I) ACAS	(J) ACAS	Mean Difference (I-J)	Std. Error	Sig.(a)	95% Confidence Interval for Difference(a)	
					Lower Bound	Upper Bound
1	2	-.019	.014	.180	-.047	.009
2	1	.019	.014	.180	-.009	.047

Based on estimated marginal means

a Adjustment for multiple comparisons: Bonferroni.

Multivariate Tests

	Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Pillai's trace	.037	1.855(a)	1.000	48.000	.180	.037
Wilks' lambda	.963	1.855(a)	1.000	48.000	.180	.037
Hotelling's trace	.039	1.855(a)	1.000	48.000	.180	.037
Roy's largest root	.039	1.855(a)	1.000	48.000	.180	.037

Each F tests the multivariate effect of ACAS. These tests are based on the linearly independent pairwise comparisons among the estimated marginal means.

a Exact statistic

3. LIGHT * ACAS

Measure: MEASURE_1

LIGHT	ACAS	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
1	1	.274	.020	.233	.314
	2	.326	.023	.280	.371
2	1	.217	.018	.181	.253
	2	.203	.021	.162	.245

4. AgeCat

Estimates

Measure: MEASURE_1

AgeCat	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Young	.335	.029	.276	.393
Middle	.282	.030	.221	.343
Old	.148	.033	.081	.215

Pairwise Comparisons

Measure: MEASURE_1

(I) AgeCat	(J) AgeCat	Mean Difference (I-J)	Std. Error	Sig.(a)	95% Confidence Interval for Difference(a)	
					Lower Bound	Upper Bound
Young	Middle	.052	.042	.652	-.052	.156
	Old	.187(*)	.044	.000	.077	.297
Middle	Young	-.052	.042	.652	-.156	.052
	Old	.134(*)	.045	.013	.023	.246
Old	Young	-.187(*)	.044	.000	-.297	-.077
	Middle	-.134(*)	.045	.013	-.246	-.023

Based on estimated marginal means

* The mean difference is significant at the .05 level.

a Adjustment for multiple comparisons: Bonferroni.

Univariate Tests

Measure: MEASURE_1

	Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Contrast	.327	2	.164	9.158	.000	.276
Error	.857	48	.018			

The F tests the effect of AgeCat. This test is based on the linearly independent pairwise comparisons among the estimated marginal means.

5. AgeCat * LIGHT * ACAS

Measure: MEASURE_1

AgeCat	LIGHT	ACAS	Mean	Std. Error	95% Confidence Interval	
					Lower Bound	Upper Bound
Young	1	1	.348	.033	.281	.414
		2	.403	.037	.328	.478
	2	1	.297	.029	.239	.355
		2	.291	.034	.223	.359
Middle	1	1	.290	.034	.221	.359
		2	.367	.039	.289	.444
	2	1	.234	.030	.173	.294
		2	.239	.035	.168	.309
Old	1	1	.184	.038	.107	.260
		2	.207	.043	.121	.293
	2	1	.120	.033	.054	.187
		2	.080	.039	.003	.158

APPENDIX Q

DATA FIELDS IN FOT DATABASE TABLES

Data Fields in FOT database tables

AccBraking

Field	Data Type	Description	Units
Driver	tinyint	Driver number 1- 255	none
Trip	smallint	Trip number	none
Time	int	Time in centiseconds since das started	csec
AccDecelRequested	real	Acc decel requested	g's

Bytes

Field	Data Type	Description	Units
Driver	tinyint	Driver number 1- 255	none
Trip	smallint	Trip number	none
Time	int	Time in centiseconds since das started	csec
ChannelId	smallint	Source channel	none
Value	tinyint	Discrete transition value for the channel	none

Data

Field	Data Type	Description	Units
Driver	tinyint	Driver number 1- 255	none
Trip	smallint	Trip number	none
Time	int	Time in centiseconds since das started	csec
Throttle	real	Throttle opening	%
Steer	smallint	Steering wheel angle	deg
YawRate	real	Yaw rate	deg/sec
AbsSpeed	real	Vehicle speed from abs	m/sec
Latitude	float	Latitude from gps	deg
Longitude	float	Longitude from gps	deg
NumberOfSats	tinyint	Number of sattelites from Gps	none
GpsHeading	real	Gps heading	deg
Brake	tinyint	Brake active	none
CIPVRange	real	Range to cosest in-path vehicle	m
CIPVRangeRate	real	Range rate of closest in-path vehicle	m/sec
CIPVAzimuth	real	Centroid of closest in-path vehicle	deg
FcwAlertLevel	tinyint	DVI alert level	none
FcwTargetId	tinyint	FCW target Id from gmr1	none
Sensitivity	tinyint	FCW sensitivity	none
CIPV	tinyint	Closest in-path vehicle target id	none
CIPS	tinyint	Closest in-path stationary target id	none
C0	real	C0 from data fusion	1/m
C1	real	C1 from data fusion	1/m2
C2	real	C2 from data fusion	1/m2
NearConf	tinyint	Near-range geometry confidence	none
FarConf	tinyint	Far-range geometry confidence	none
NearValidity	tinyint	Near-range validity distance	m
FarValidity	tinyint	Far-range validity distance	m
LaneGeoSource	tinyint	Lane geometry source bitmap	none
RadarIndex	int	Extended radar scan index	none
ThreatIndex	int	Extended threat scan index	none

Field	Data Type	Description	Units
TargetIndex	int	Extended target selection scan index	none
FcwTargetType	tinyint	Fcw target type	none
FcwRange	real	DVI target range	m
FcwRangeRate	real	Range rate of dvi target	m/sec
FcwAzimuth	real	Centroid of dvi target	deg
Distance	real	Trip distance	m
FcwSubAlgorithm	tinyint	Fcw sub algorithm	none
AxFiltered	real	Filtered longitudinal acceleration	m/sec2
AutoBrake	tinyint	Automated braking	none
Engaged	tinyint	Acc/Ccc active from direct wire	none
FcwActive	tinyint	Fcw active	none
Vp	real	Velocity of CIPV	m/sec
SystemHealth	tinyint	ACAS system health	none
TransSpeed	real	Speed from transmission	m/sec
GapSetting	tinyint	Acc Gap Setting	none
CIPVStage	tinyint	Stage of closest in-path vehicle	none
FcwStage	tinyint	Stage of Fcw object	none

DFTh

Field	Data Type	Description	Units
Driver	tinyint	Driver number 1- 255	none
Trip	smallint	Trip number	none
Time	int	Time in centiseconds since das started	csec
ThreatIndexRaw	int	Threat assessment scan index	none
LaneOffset	real	Host offset from lane center - positive = right	m
HeadingInLane	real	Vehicle heading angle in lane - positive = going right	deg
LaneWidth	real	Lane width	m
LaneOffsetConf	tinyint	Lane offset confidence	none
HeadingConf	tinyint	Heading in lane confidence	none
LaneWidthConf	tinyint	Lane width confidence	none
NhtsaAlertLevel	tinyint	NHTSA algorithm alert level	none
NhtsaTargetId	tinyint	NHTSA algoritm target id	none
DVICounter	int	DVI sequence counter	none
FusionCounter	int	Fusion sequence counter	none
HUDSpeed	tinyint	HUD vehicle speed	mph
HUDVehicleIcon	tinyint	HUD vehicle icon	none
ShowNeedsService	tinyint	Show Needs Service Soon	none

Doubles

Field	Data Type	Description	Units
Driver	tinyint	Driver number 1- 255	none
Trip	smallint	Trip number	none
Time	int	Time in centiseconds since das started	csec
ChannelId	smallint	NULL	NULL
Value	float	NULL	NULL

Floats

Field	Data Type	Description	Units
Driver	tinyint	Driver number 1- 255	none
Trip	smallint	Trip number	none
Time	int	Time in centiseconds since das started	csec
ChannelId	smallint	Source channel	none
Value	real	Transition value for the channel	none

Map

Field	Data Type	Description	Units
Driver	tinyint	Driver number 1- 255	none
Trip	smallint	Trip number	none
Time	int	Time in centiseconds since das started	csec
mapcounter	int	Map sequence counter	none

Sensor

Field	Data Type	Description	Units
Driver	tinyint	Driver number 1- 255	none
Trip	smallint	Trip number	none
Time	int	Time in centiseconds since das started	csec
BatteryVoltage	real	Battery voltage	volts
Ay	real	Lateral acceleration, positive right	m/sec2
Ax	real	Longitudinall acceleration, positive forward	m/sec2
GpsSpeed	real	Speed from gps	m/sec
Az	real	Vertical acceleration, positive down	m/sec2
VDot	real	Delta vehicle speed	m/sec2
ExtendedBrake	tinyint	Extended brake switch	none
AccDetect	tinyint	Acc detect vehicle ahead	none
SensorCounter	int	Sensor sequence number	none
GpsWeek	int	Gps week from sensor	none
GpsTime	int	Gps millisecs in week from sensor	msec
SensorAtoDHealth	tinyint	Sensor a/d and direct i/o health	none
Class2Health	tinyint	Class 2 health	none
RadarHealth	tinyint	Radar health	none
AccelerometerHealth	tinyint	Accelerometer health	none
GpsHealth	tinyint	Gps health	none
YawRateHealth	tinyint	Yaw Rate health	none
FusionHealth	tinyint	Fusion health	none
TargetHealth	tinyint	Target selection health	none
ThreatHealth	tinyint	Threat health	none
MapINSHealth	tinyint	Map INS health	none
MapMatchHealth	tinyint	Map matching health	none
MapDataHealth	tinyint	Map database health	none
VisionHealth	tinyint	Vision health	none
SceneHealth	tinyint	Scene health	none

STVRc

Field	Data Type	Description	Units
Driver	tinyint	Driver number 1- 255	none
Trip	smallint	Trip number	none
Time	int	Time in centiseconds since das started	csec
TargetIndexRaw	int	Target selection scan index	none

Summary

Field	Data Type	Description	Units
driver	tinyint	Driver number 1- 255	none
trip	smallint	Trip number	none
Vehicle	tinyint	Vehicle number 0-13	none
TripStart	float	Absolute starttime in access format	none
Odometer	float	Odometer reading	m
Distance	real	Trip distance	m
AcasDisabled	tinyint	Acas disabled (i.e. true 1st week)	none
StartTime	int	First time for test	csec
EndTime	int	Last time for test	csec
WarmStart	tinyint	True if das running on ignition	none
sensorversion	tinyint	Sensor module software version	none
systemversion	tinyint	ACAS system version	none

Targets

Field	Data Type	Description	Units
Driver	tinyint	Driver number 1- 255	none
Trip	smallint	Trip number	none
Radarindex	int	Extended radar scan index	none
Time	int	Time in centiseconds since das started	csec
Target	tinyint	Target identifier	none
Range	real	Distance to target	m
Rdot	real	Range rate	m/sec
Azimuth	real	Angle to target in horizontal plane	deg
Xloc	real	Lateral offset of target	m
XlocRate	real	Change in lateral offset	m/sec
Acceleration	real	Acceleration of target	m/sec2
Movable	tinyint	Indicates whether target is moving	none
Stationary	tinyint	Indicates whether target is stationary	none
Bridge	tinyint	Fusion bridge flag	none
Stage	tinyint	NULL	NULL

APPENDIX R

VARIOUS PIVOT TABLE RESULTS ON EXPOSURE

Exposure by Age Group and Gender

Algorithm C

		Age Group			
Gender		*20-30*	*40-50*	*60-70*	*Total*
F	*Hours*	347	334	403	1085
	Miles	15511	15145	18937	49593
M	*Hours*	350	378	398	1125
	Miles	16224	16172	19003	51399
Total Hours		697	713	801	2210
Total Miles		31735	31317	37940	100992

All Algorithms

		Age Group			
Gender	*Data*	*20-30*	*40-50*	*60-70*	*Total*
F	*Hours*	555	483	504	1543
	Miles	23925	20999	23126	68050
M	*Hours*	474	454	567	1496
	Miles	22432	19087	27223	68741
Total Hours		1030	938	1071	3039
Total Miles		46357	40085	50349	136791

Road Class vs. Control Mode

Algorithm C

		Control Mode				
Road Class		*ACC*	*CCC*	*MANACAS*	*MANBAS*	*Total*
Freeway	*Hours*	202	40	210	99	551
	Miles	14478	2873	13064	6361	36777
Ramp	*Hours*	2	0	24	9	35
	Miles	103	14	958	330	1404
Surface Roads	*Hours*	59	10	709	258	1037
	Miles	3149	520	23673	8559	35901
Unknown	*Hours*	158	18	312	83	571
	Miles	10765	1296	11608	2774	26443
Unpaved	*Hours*	0	0	12	4	17
	Miles	2	0	350	115	467
Total Hours		420	69	1268	453	2210
Total Miles		28497	4703	49652	18139	100992

All Algorithms

		Control Mode				
Road Class		*ACC*	*CCC*	*MANACAS*	*MANBAS*	*Total*
Freeway	*Hours*	274	50	281	128	733
	Miles	19719	3570	17552	8091	48932
Ramp	*Hours*	2	0	32	11	46
	Miles	141	16	1276	437	1869
Surface Roads	*Hours*	93	17	1001	358	1469
	Miles	4973	933	33229	11836	50970
Unknown	*Hours*	193	24	432	118	766
	Miles	13270	1662	15587	3821	34340
Unpaved	*Hours*	0	0	19	6	25
	Miles	8	2	513	156	680
Total Hours		562	91	1765	620	3039
Total Miles		38112	6182	68157	24340	136791

Road Class by Age Group

Algorithm C

		Age Group			
Road Class	Data	20-30	40-50	60-70	Total
Freeway	Hours	206	177	168	551
	Miles	13986	11519	11273	36777
Ramp	Hours	14	11	9	35
	Miles	588	475	341	1404
Surface Roads	Hours	352	379	306	1037
	Miles	12244	13034	10623	35901
Unknown	Hours	117	139	315	571
	Miles	4721	6115	15606	26443
Unpaved	Hours	8	5	4	17
	Miles	196	174	97	467
Total Hours		697	713	801	2210
Total Miles		31735	31317	37940	100992

All Algorithms

		Age Group			
Road Class	Data	20-30	40-50	60-70	Total
Freeway	Hours	289	220	224	733
	Miles	19336	14484	15113	48932
Ramp	Hours	20	14	12	46
	Miles	828	592	449	1869
Surface Roads	Hours	530	527	411	1469
	Miles	18357	18018	14595	50970
Unknown	Hours	181	167	418	766
	Miles	7570	6740	20029	34340
Unpaved	Hours	10	9	6	25
	Miles	266	251	163	680
Total Hours		1030	938	1071	3039
Total Miles		46357	40085	50349	136791

Speed Range Miles by Age Group

Algorithm C

Miles	*Age Group*			
Speed Range	*20-30*	*40-50*	*60-70*	*Total*
Lowspeed (<25.7 mph)	2066	2153	2150	6370
Midspeed (25.7-54.8 mph)	10979	12319	10807	34105
Highspeed (>54.8 mph)	18690	16845	24982	60517
Total	31735	31317	37940	100992

All Algorithms

Miles	*Age Group*			
Speed Range	*20-30*	*40-50*	*60-70*	*Total*
Lowspeed	3167	3012	2943	9121
Midspeed	16403	16653	14845	47901
Highspeed	26787	20421	32561	79769
Total	46357	40085	50349	136791

Fcw Sensitivity by Algorithm

Miles	*Sensitivity*						
Algorithm	*1*	*2*	*3*	*4*	*5*	*6*	*Total*
A	2774	1154	1368	1723	1304	4793	13117
B	499	2456	2176	2013	363	3854	11361
C	11329	8731	14191	10578	6418	18484	69735
Total	14603	12340	17734	14314	8086	27131	94212

Fcw Sensitivity by Age Group

Algorithm C

Miles	*Sensitivity*						
Age Group	*1*	*2*	*3*	*4*	*5*	*6*	*Total*
20-30	5598	4284	5433	1773	242	3835	21166
40-50	4609	3737	3291	2948	1881	5127	21595
60-70	1122	710	5467	5857	4295	9522	26974
Total	11329	8731	14191	10578	6418	18484	69735

All Algorithms

Miles	*Sensitivity*						
Age Group	*1*	*2*	*3*	*4*	*5*	*6*	*Total*
20-30	8066	6778	6819	3264	442	5637	31006
40-50	5081	4176	3982	3907	2822	7555	27526
60-70	1456	1386	6934	7143	4822	13938	35680
Total	14603	12340	17734	14314	8086	27131	94212

Control Mode by Driver (miles)

Driver	*ACC*	*CCC*	*MANACAS*	*MANBAS*	*Total*
1	120	10	891	333	1354
2	383	4	827	202	1416
3	32	1	246	98	376
4	82	50	932	296	1361
5	488	58	667	169	1382
6	173	1	1002	465	1641
7	424	130	413	250	1217
8	9	0	1171	689	1869
9	827	146	1007	351	2332
10	77	45	292	119	533
11	514	292	543	266	1616
12	403	0	579	72	1054
13	330	3	325	137	794
14	296	83	423	169	970
15	825	2	804	304	1934
16	464	40	302	88	894
17	301	120	510	288	1218
18	1052	13	1110	140	2315
19	225	25	333	55	638
20	918	65	612	124	1719
21	203	19	475	76	773
22	62	13	1075	229	1380
23	12	3	419	73	508
24	255	31	278	134	698
25	329	0	459	40	828
26	196	286	654	236	1372
27	436	29	778	311	1554
28	46	0	355	180	581
29	27	10	400	184	622
30	105	0	622	123	851
31	588	76	1046	642	2352
32	46	0	1215	341	1602
33	106	390	240	522	1259
34	92	6	2830	787	3714
35	479	38	673	144	1334
36	354	76	525	249	1204
37	1032	8	1545	98	2683
38	841	132	1488	347	2809
39	1002	49	634	157	1843
40	234	32	661	194	1122
41	16	0	882	335	1234
42	277	14	722	148	1161
43	55	30	237	106	428
44	648	45	1788	275	2756
45	672	81	609	192	1554
46	508	0	761	623	1892
47	382	43	900	148	1472
48	282	46	1179	486	1993

Driver	ACC	CCC	MANACAS	MANBAS	Total
49	145	2	749	206	1102
50	2303	106	1049	319	3776
51	76	0	844	261	1180
52	755	103	395	182	1434
53	56	1	379	196	631
54	493	117	576	222	1408
55	37	0	491	205	733
56	30	0	954	430	1414
57	1006	0	877	680	2563
58	623	9	1047	198	1877
59	251	14	876	325	1467
60	71	0	770	238	1079
61	154	18	950	271	1393
62	954	339	789	317	2398
63	82	49	309	148	588
64	2121	158	549	218	3046
65	301	41	924	239	1504
66	40	15	609	307	971
67	150	10	700	193	1053
68	127	126	479	280	1011
69	95	130	470	262	957
70	1361	0	984	504	2849
71	1188	206	511	140	2046
72	258	0	315	138	711
73	1274	40	241	197	1752
74	869	188	645	263	1965
75	203	0	581	296	1081
76	332	267	965	295	1859
77	210	62	1119	350	1741
78	204	102	226	128	661
79	26	7	701	134	868
80	389	0	936	276	1601
81	46	124	549	238	958
82	582	34	847	242	1704
83	1227	700	771	444	3142
84	125	33	778	347	1282
85	202	33	779	288	1302
86	357	27	845	171	1400
87	83	27	238	163	511
88	111	55	382	115	662
89	258	191	593	295	1337
90	192	46	253	277	767
91	198	107	1220	307	1832
92		0	291	91	382
93	211	55	239	276	781
94	639	23	1130	357	2149
95	422	65	537	171	1196
96	48	4	257	143	452
Total	38112	6182	68157	24340	136791

ACC Gap Settings by Driver (miles; ACC active only)

Driver	*1*	*2*	*3*	*4*	*5*	*6*	*Total*
1	0	99	0	0	10	11	120
2	280	39	12	44	3	5	383
3	1	4	2	7	12	5	32
4	0	0	0	0	63	19	82
5	120	9	313	27	10	10	488
6	134	39	0	0	0	1	173
7	0	0	0	0	0	424	424
8	0	0	0	0	0	9	9
9	0	0	0	0	0	827	827
10	0	0	0	0	0	77	77
11	0	20	119	80	254	42	514
12	0	0	0	349	0	54	403
13	0	0	42	92	129	66	330
14	179	26	55	2	0	33	296
15	746	5	70	2	0	2	825
16	123	0	154	22	0	164	464
17	0	0	0	142	0	159	301
18	950	55	43	2	1	1	1052
19	0	0	0	0	0	225	225
20	0	0	833	20	16	50	918
21	12	0	131	46	0	14	203
22	0	0	0	0	0	62	62
23	0	0	1	0	8	3	12
24	7	14	155	65	1	14	255
25	0	0	0	0	0	329	329
26	0	0	0	89	0	107	196
27	0	0	136	100	159	40	436
28	10	0	0	0	0	36	46
29	0	0	3	0	0	24	27
30	44	0	0	0	0	61	105
31	560	6	14	0	0	7	588
32	0	0	14	0	0	32	46
33	0	0	0	0	0	106	106
34	91	0	0	0	0	1	92
35	74	381	11	7	0	6	479
36	0	0	352	1	0	0	354
37	0	0	889	75	0	68	1032
38	542	0	157	0	0	141	841
39	86	133	366	66	34	317	1002
40	0	2	51	2	0	179	234
41	0	0	0	0	0	16	16
42	195	80	3	0	0	0	277
43	0	40	0	14	0	1	55
44	647	0	0	0	0	1	648
45	229	100	242	19	58	25	672
46	0	18	478	11	0	1	508
47	2	20	273	81	0	5	382
48	163	115	1	0	0	3	282

Driver	1	2	3	4	5	6	Total
49	0	35	99	0	0	10	145
50	0	0	0	0	0	2303	2303
51	0	51	5	1	0	18	76
52	145	18	56	0	0	535	755
53	24	5	14	3	9	1	56
54	329	12	107	26	16	3	493
55	23	4	2	2	0	6	37
56	0	29	0	0	0	1	30
57	1	625	131	113	91	45	1006
58	0	0	84	22	42	475	623
59	248	0	4	0	0	0	251
60	0	26	24	1	5	15	71
61	0	25	113	0	15	0	154
62	0	3	852	50	2	46	954
63	0	0	13	35	0	34	82
64	0	0	1136	845	95	46	2121
65	300	0	0	0	0	1	301
66	0	4	6	0	0	30	40
67	0	1	1	35	14	99	150
68	0	0	18	8	86	15	127
69	0	0	0	89	0	6	95
70	1178	56	98	19	0	9	1361
71	801	198	21	146	0	22	1188
72	23	79	55	75	0	26	258
73	0	7	502	667	60	38	1274
74	851	3	7	2	1	5	869
75	194	0	7	1	0	1	203
76	127	183	6	14	0	2	332
77	191	11	5	2	0	0	210
78	0	2	7	25	6	164	204
79	0	0	0	0	0	26	26
80	325	45	2	0	16	1	389
81	0	0	31	15	0	0	46
82	0	0	0	0	29	552	582
83	0	0	7	1075	2	143	1227
84	0	0	0	15	0	110	125
85	0	0	0	183	0	19	202
86	26	45	97	63	41	85	357
87	0	0	0	0	0	83	83
88	0	0	0	110	0	1	111
89	0	0	0	61	81	116	258
90	0	0	21	143	0	28	192
91	0	24	159	15	0	0	198
93	188	4	6	0	0	12	211
94	30	366	117	47	2	76	639
95	359	20	10	14	1	18	422
96	0	0	13	0	0	34	48
Total	10564	3084	8757	5290	1370	9047	38112

APPENDIX S

DRIVER BEHAVIOR QUESTIONNAIRE

The questionnaire below requires you to judge the frequency of your own driving errors and violations. For each item you are asked to indicate *how often*, if at all, this kind of thing has happened to you. Base your judgements on what you remember of your own driving over the past year.

Please indicate your judgements by circling the response that best describes your behavior.

Lapses

Mean: .56214 A: .55 B: .74 C: .44
Standard Deviation: .404773 A: .422 B: .382 C: .377

	Never	Hardly Ever	Occasionally	Quite Often	Frequently	Nearly All The Time
1. Attempt to drive away from traffic lights in the wrong gear. Mean: **.06 A: .00 B: .13 C: .05** Standard Deviation: **.240 A: .000 B: .352 C: .224**	0	1	2	3	4	5
5. Forget where you left your car in a parking lot. Mean: **1.04 A: 1.27 B: 1.00 C: .90** Standard Deviation: **.789 A: .799 B: .679 C: .852**	0	1	2	3	4	5
6. Turned on one thing, such as your headlights, when you meant to switch on something else, such as the windshield wipers. Mean: **.68 A: .60 B: .80 C: .65** Standard Deviation: **.741 A: .632 B: .862 C: .745**	0	1	2	3	4	5
7. Realize that you have no clear recollection of the road along which you have just been traveling. Mean: **.68 A: .73 B: .93 C: .45** Standard Deviation: **.768 A: .704 B: .884 C: .686**	0	1	2	3	4	5
11. Misread the signs and turn the wrong direction on a one-way street. Mean: **.32 A: .40 B: .33 C: .25** Standard Deviation: **.551 A: .632 B: .488 C: .550**	0	1	2	3	4	5
18. Hit something when backing up that you had not previously seen. Mean: **.32 A: .40 B: .40 C: .20** Standard Deviation: **.551 A: .632 B: .507 C: .523**	0	1	2	3	4	5
19. Intending to drive to destination A, you 'wake up' to find yourself on a road to destination B, perhaps because destination B is a more common destination. Mean: **.65 A: .47 B: 1.14 C: .45** Standard Deviation: **.751 A: .640 B: .864 C: .605**	0	1	2	3	4	5
20. Get into the wrong lane approaching an intersection. Mean: **.74 A: .53 B: 1.20 C: .55** Standard Deviation: **.828 A: .743 B: 1.014 C: .605**	0	1	2	3	4	5

Errors

Mean: .32250 A: .30 B: .43 C: .26
Standard Deviation: .352732 A: .374 B: .425 C: .264

	Never	Hardly Ever	Occasionally	Quite Often	Frequently	Nearly All The Time
4. Attempt to pass someone that you hadn't noticed to be making a left turn. Mean: **.38 A: .27 B: .47 C: .40** Standard Deviation: **.667 A: .594 B: .743 C: .681**	0	1	2	3	4	5
9. Fail to notice that pedestrians are crossing when turning onto a side street from a main road. Mean: **.38 A: .47 B: .53 C: .20** Standard Deviation: **.567 A: .640 B: .640 C: .410**	0	1	2	3	4	5
13. When turning right, nearly hit a bicyclist who is riding along side of you. Mean: **.08 A: .00 B: .13 C: .10** Standard Deviation: **.274 A: .000 B: .352 C: .308**	0	1	2	3	4	5
14. Attempting to turn onto a main road, you pay such close attention to traffic on the road you are entering that you nearly hit the car in front of you that is also waiting to turn. Mean: **.24 A: .27 B: .33 C: .15** Standard Deviation: **.517 A: .594 B: .617 C: .366**	0	1	2	3	4	5
17. Underestimate the speed of an oncoming vehicle when attempting to pass a vehicle in your own lane. Mean: **.42 A: .27 B: .60 C: .40** Standard Deviation: **.575 A: .458 B: .737 C: .503**	0	1	2	3	4	5
21. Miss "Yield" signs, and narrowly avoid colliding with traffic having the right of way. Mean: **.22 A: .20 B: .33 C: .15** Standard Deviation: **.465 A: .414 B: .617 C: .366**	0	1	2	3	4	5
22. Fail to check your rearview mirror before pulling out, changing lanes, etc. Mean: **.38 A: .40 B: .53 C: .25** Standard Deviation: **.567 A: .632 B: .640 C: .444**	0	1	2	3	4	5
24. Brake to quickly on a slippery road, or steer the wrong way into a skid Mean: **.48 A: .53 B: .53 C: .40** Standard Deviation: **.544 A: .640 B: .516 C: .503**	0	1	2	3	4	5

Violations

Mean: .51429 A: .48 B: .57 C: .50

Standard Deviation: .438031 A: .450 B: .389 C: .480

2. Become impatient with a slow driver in the fast lane and pass on the right. Mean: **1.27 A: 1.21 B: 1.40 C: 1.20** Standard Deviation: **1.056 A:1.051 B: .986 C:1.152**	0	1	2	3	4	5
3. Drive especially close to a car in front as a signal to the driver to go faster or get out of the way. Mean: **.60 A: .67 B: .47 C: .65** Standard Deviation: **.756 A: .816 B: .640 C: .813**	0	1	2	3	4	5
8. Cross an intersection knowing that the traffic lights have already changed from yellow to red. Mean: **.60 A: .47 B: .73 C: .60** Standard Deviation: **.756 A: .640 B: .961 C: .681**	0	1	2	3	4	5
10. Angered by another driver's behavior, you caught up to them with the intention of giving him/her "a piece of your mind." Mean: **.40 A: .40 B: .33 C: .45** Standard Deviation: **.639 A: .828 B: .617 C: .510**	0	1	2	3	4	5
12. Disregard the speed limits late at night or early in the morning. Mean: **1.00 A: .87 B: 1.33 C: .85** Standard Deviation: **.990 A: .834 B: 1.175 C: .933**	0	1	2	3	4	5
15. Drive even though you realize you might be over the legal blood alcohol limit. Mean: **.02 A: .07 B: .00 C: .00** Standard Deviation: **.143 A: .258 B: .000 C: .000**	0	1	2	3	4	5
16. Have an aversion to a particular class of road user, and indicate your hostility by whatever means you can. Mean: **.12 A: .07 B: .13 C: .15** Standard Deviation: **.328 A: .258 B: .352 C: .366**	0	1	2	3	4	5
23. Get involved in unofficial 'races' with other drivers. Mean: **.10 A: .20 B: .13 C: .00** Standard Deviation: **.303 A: .414 B: .352 C: .000**	0	1	2	3	4	5

APPENDIX T

DRIVER STYLE QUESTIONNAIRE

Driving Style Questionnaires

Two questionnaires regarding your style of driving and driving habits are presented below. Please complete these questionnaires to the best of your ability. You may skip any questions you feel uncomfortable answering. It is important to note that you have already been qualified to participate in this study. Therefore, your responses to these questions will not affect your receiving a vehicle today.

Please answer all of the questions below by checking one of the boxes provided.

Very Infrequently — Very Frequently

Calmness
Mean: 4.1733 A: 4.2000 B: 4.1556 C: 4.1667
Standard Deviation: .53976 A: .57459 B: .33014 C: .65338

1. Sometimes when driving, things happen very quickly. Do you remain calm in such situations? □ □ □ □ □ □
   Mean: **4.34 A: 4.73 B: 4.27 C: 4.10** Standard Deviation: **1.002 A: .458 B: .961 C: 1.252**

---

8. Do you become flustered when faced with sudden dangers while driving? □ □ □ □ □ □
   Mean: **.86 A: .80 B: .93 C: .85** Standard Deviation: **.670 A: .676 B: .704 C: .671**

---

15. Is your driving affected by pressure from other motorists? □ □ □ □ □ □
   Mean: **.96 A: 1.33 B: .87 C: .75** Standard Deviation: **1.068 A: 1.447 B: .516 C: 1.020**

Planning
Mean: 3.5500 A: 3.2333 B: 3.4667 C: 3.8500
Standard Deviation: 1.08914 A: .99762 B: .99043 C: 1.19318

2. Do you plan long journeys in advance, including places to stop and rest? □ □ □ □ □ □
   Mean: **2.96 A: 2.47 B: 2.53 C: 3.65** Standard Deviation: **1.511 A: 1.506 B: 1.407 C: 1.387**

---

9. How often do you set out on an unfamiliar trip without first looking at a map? □ □ □ □ □ □
   Mean: **.86 A: 1.00 B: .60 C: .95** Standard Deviation: **1.229 A: 1.134 B: .986 C: 1.468**

Very Infrequently — Very Frequently

Social Resistance
Mean: 2.1600 A: 1.5667 B: 2.9000 C: 2.0500
Standard Deviation: 1.22241 A: .84233 B: 1.22766 C: 1.22367

3. Do you dislike people giving you advice about your driving? □ □ □ □ □ □

Mean: **1.76 A: 1.47 B: 2.47 C: 1.45** Standard Deviation: **1.153 A: .640 B: 1.302 C: 1.146**

---

10. Are you happy to get advice from people about your driving? □ □ □ □ □ □

Mean: **2.44 A: 3.33 B: 1.67 C: 2.35** Standard Deviation: **1.567 A: 1.345 B: 1.397 C: 1.565**

Speed
Mean: 1.6867 A: 1.7333 B: 2.0667 C: 1.3667
Standard Deviation: .94619 A: .75803 B: 1.14226 C: .83701

4. Do you exceed the 70 mph speed limit on the expressway? □ □ □ □ □ □

Mean: **2.10 A: 2.33 B: 2.27 C: 1.80** Standard Deviation: **1.344 A: 1.496 B: 1.486 C: 1.105**

---

6. Do you exceed the speed limit on surface streets in urban areas? □ □ □ □ □ □

Mean: **1.08 A: 1.00 B: 1.60 C: .75** Standard Deviation: **.922 A: .655 B: 1.121C: .786**

---

13. Do you drive fast? □ □ □ □ □ □

Mean: **1.88 A: 1.87 B: 2.33 C: 1.55** Standard Deviation: **1.189 A: 1.187 B: 1.397 C: .945**

Deviance
Mean: .8100 A: .8667 B: .8667 C: .7250
Standard Deviation: .74155 A: .91548 B: .66726 C: .67814

5. Do you ever drive through a traffic light after it has turned to red? □ □ □ □ □ □

Mean: **.42 A: .40 B: .40 C: .45** Standard Deviation: **.673 A: .737B: .632 C: .686**

---

14. Do you pass other vehicles on the right, given the opportunity? □ □ □ □ □ □

Mean: **1.20 A: 1.33 B: 1.33 C: 1.00** Standard Deviation: **1.050 A: 1.234 B: 1.113 C: .858**

	Very Infrequently					Very Frequently
Focus Mean: 3.0133 A: 3.1778 B: 3.0222 C: 2.8833 Standard Deviation: .55923 A: .41532 B: .56997 C: .63315						
7. Do you ignore passengers urging you to lower your speed? Mean: **.38 A: .20 B: .73 C: .25** Standard Deviation: **.602 A: .414 B: .704 C: .550**	☐	☐	☐	☐	☐	☐
11. Do you drive cautiously? Mean: **4.64 A: 4.87 B: 4.47 C: 4.60** Standard Deviation: **.663 A: .352 B: .834 C: .681**	☐	☐	☐	☐	☐	☐
12. Do you find it easy to ignore distractions while driving? Mean: **4.02 A: 4.47 B: 3.87 C: 3.80** Standard Deviation: **1.253 A: .915 B: 1.187 C: 1.473**	☐	☐	☐	☐	☐	☐

APPENDIX U

PHOTO ANECDOTES OF THROTTLE-OVERRIDE, REVERSE CUT-IN, AND FLYING PASS INCIDENTS

PHOTO ANECDOTES OF THROTTLE-OVERRIDE AND REVERSE CUT-IN INCIDENTS

This appendix contains example of specific incidents of throttle-override, reverse cut-in, and flying-pass maneuvers that were associated with headway intrusions considered significant while under ACC control.

Examples of Throttle Override into a Headway Intrusion

Shown in Figure Z.1 is the ACAS database viewer screen representing the moment of maximum intrusion (44 sec) into the conflict window for a driver whose ACC had been adjusted for Th=2.0 seconds. The incident clearly occurs on a freeway, with the driver occupying the left-most lane and with a passenger vehicle serving as the CIPV. Since the set speed value is 73 mph, but the vehicle is currently traveling at 76 mph, it is clear that the throttle override has not only induced a headway that lies in the conflict window but has also caused the speed to go above the value of the set speed. A review of the forward video from this driver's continuing relationship with the indicated target vehicle shows that the host driver appears to be operating rather aggressively, trying to pass. Presumably, then, the throttle override tactic was associated with that intent.

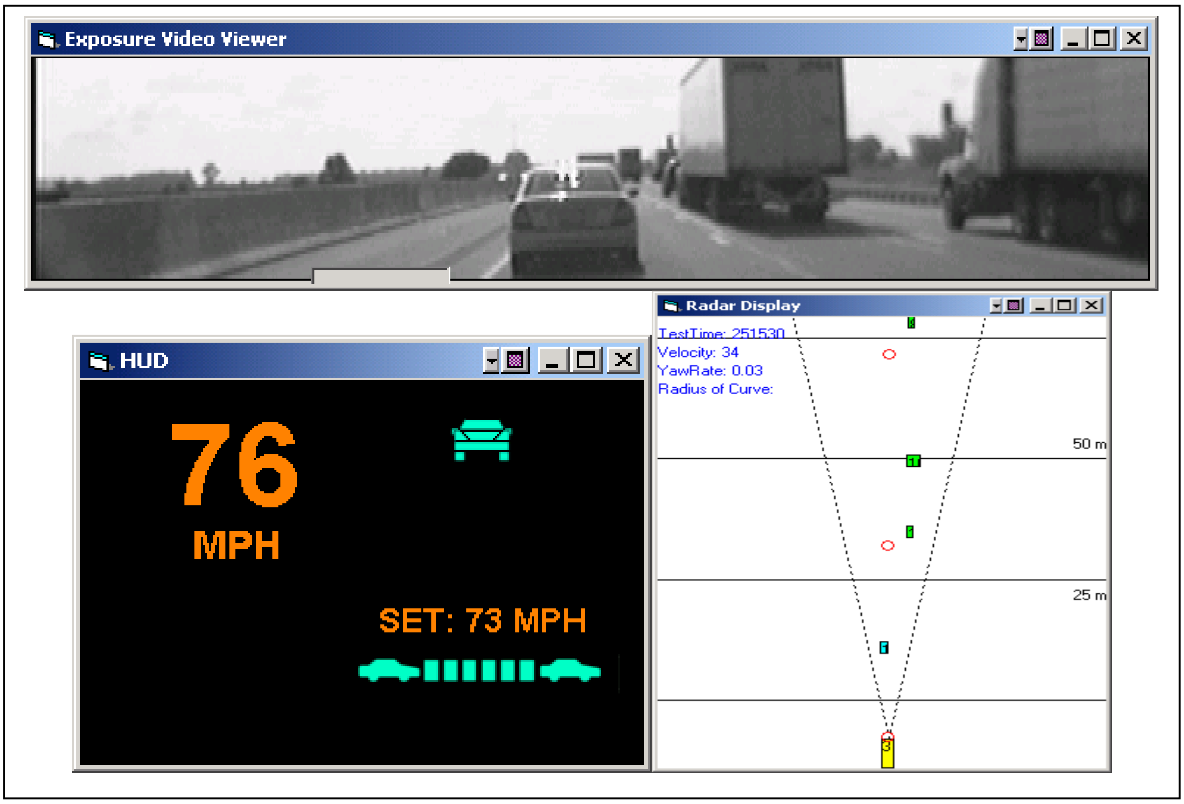


Figure Z.1 Throttle Override Conflict for the moment at which $(Htm/Th)_{min}$ = 0.22; Htm_{min} = 0.44 s; Th = 2.0 s

Shown in Figure Z.2 is the viewer screen representing the moment of maximum intrusion into the conflict window for a case in which Th has been adjusted to 1.0 seconds and Vset is adjusted to its maximum possible value, 80mph. This incident also occurs on a freeway, with the driver occupying the left-most lane behind a passenger van. The throttle override has caused the headway time to reach the very low value of 0.28 seconds. Review of the video shows that the host driver soon passed the van and may have also been seeking to shrink the headway space so as to prevent a cut-in by vehicles to the side.

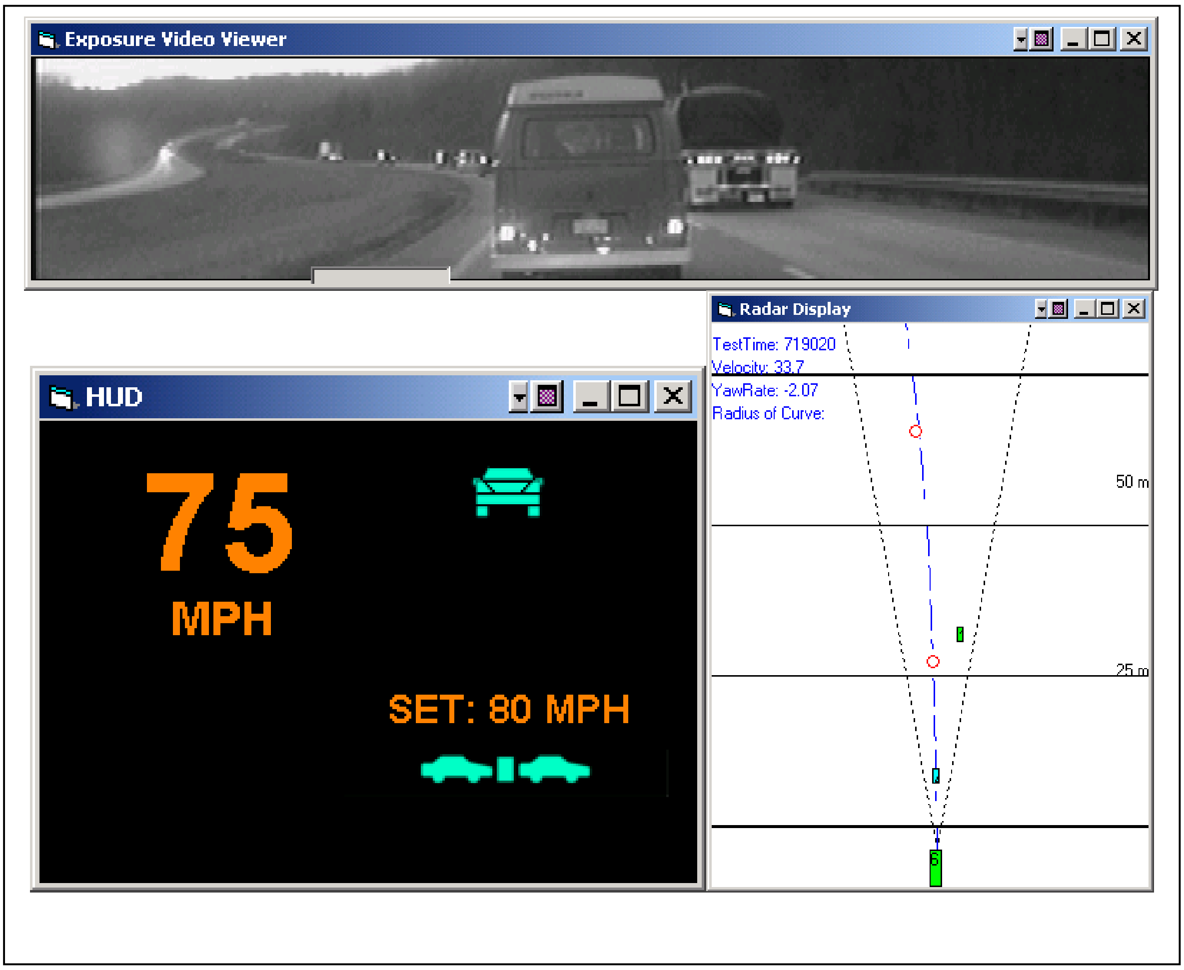


Figure Z.2 Throttle Override Conflict for the moment at which $(Htm/Th)_{min} = 0.28$; $Htm_{min} = 0.28$ s; Th = 1.0 s

Examples of Reverse Cut-In

Figure Z.3 presents the video-viewer screen for the sequence in which a reverse cut-in conflict is induced when the host driver moves into the right lane at 67 mph as a prelude to exiting the freeway. A slower-moving vehicle is encountered in the exit lane, such that the host has slowed to 58 mph within the subsequent 6-second interval, employing ACC autobraking up to a peak of 2.22 m/s^2. It is notable that the ACC set speed shows a value of 80 mph and that the ACC gap setting is 1.0 seconds (i.e., single bar between the vehicle icons on the display.) This case represents the second-highest deceleration level achieved among all 82 episodes of reverse cut-in conflict that were examined here.

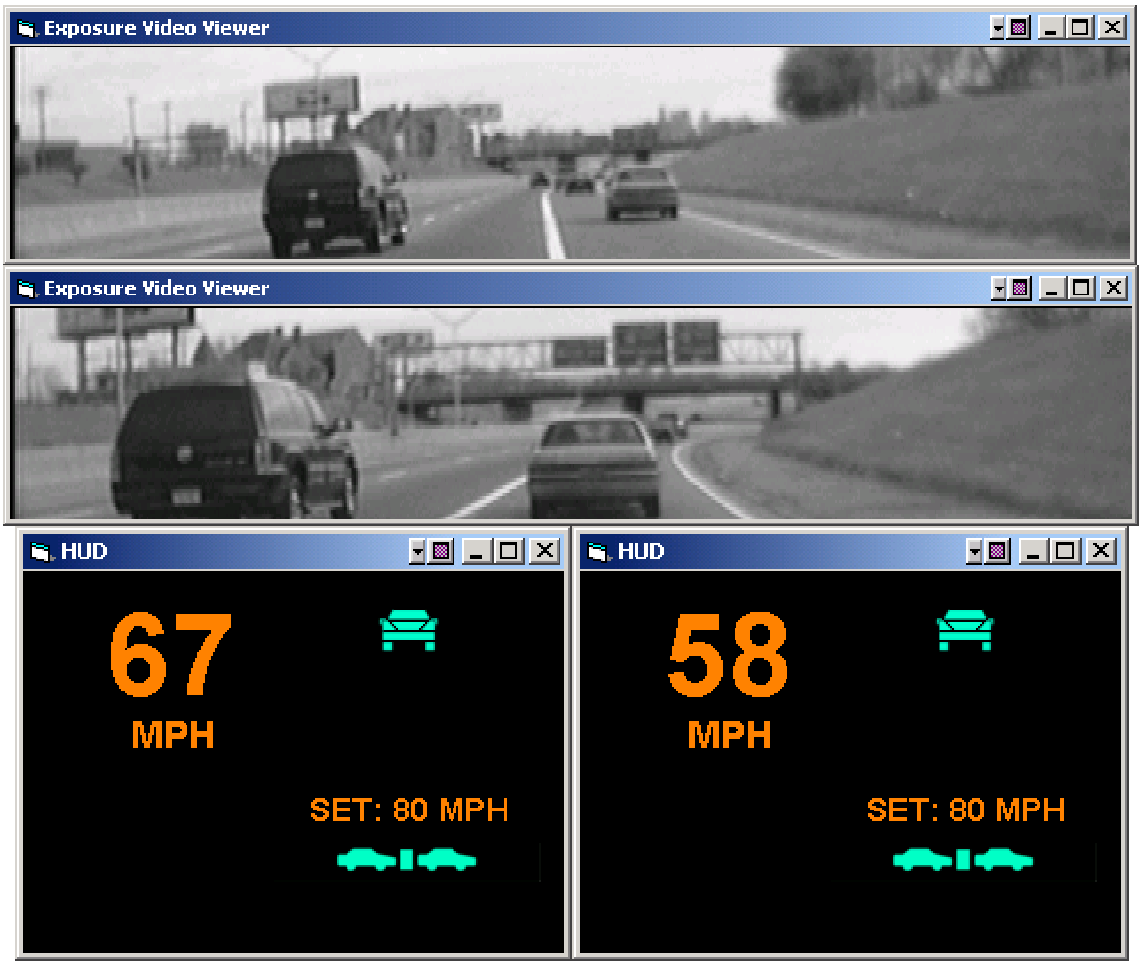


Figure Z.3 Example episode in which ACC-engaged host encounters conflict during a reverse cut-in sequence by changing lanes to exit behind a slower moving vehicle

Shown in Figure Z.4, a vehicle encounters a reverse cut-in conflict while changing lanes during a simultaneous throttle-override application. Clearly, the throttle override was necessary for the host to achieve the initial speed of 79 mph (indicated at the left) while the ACC set speed values reads only 72 mph. An autobrake deceleration that peaked at 2.02 m/s^2 was then needed to manage the conflict and bring the host vehicle down to the 71-mph speed indicated in the right display window.

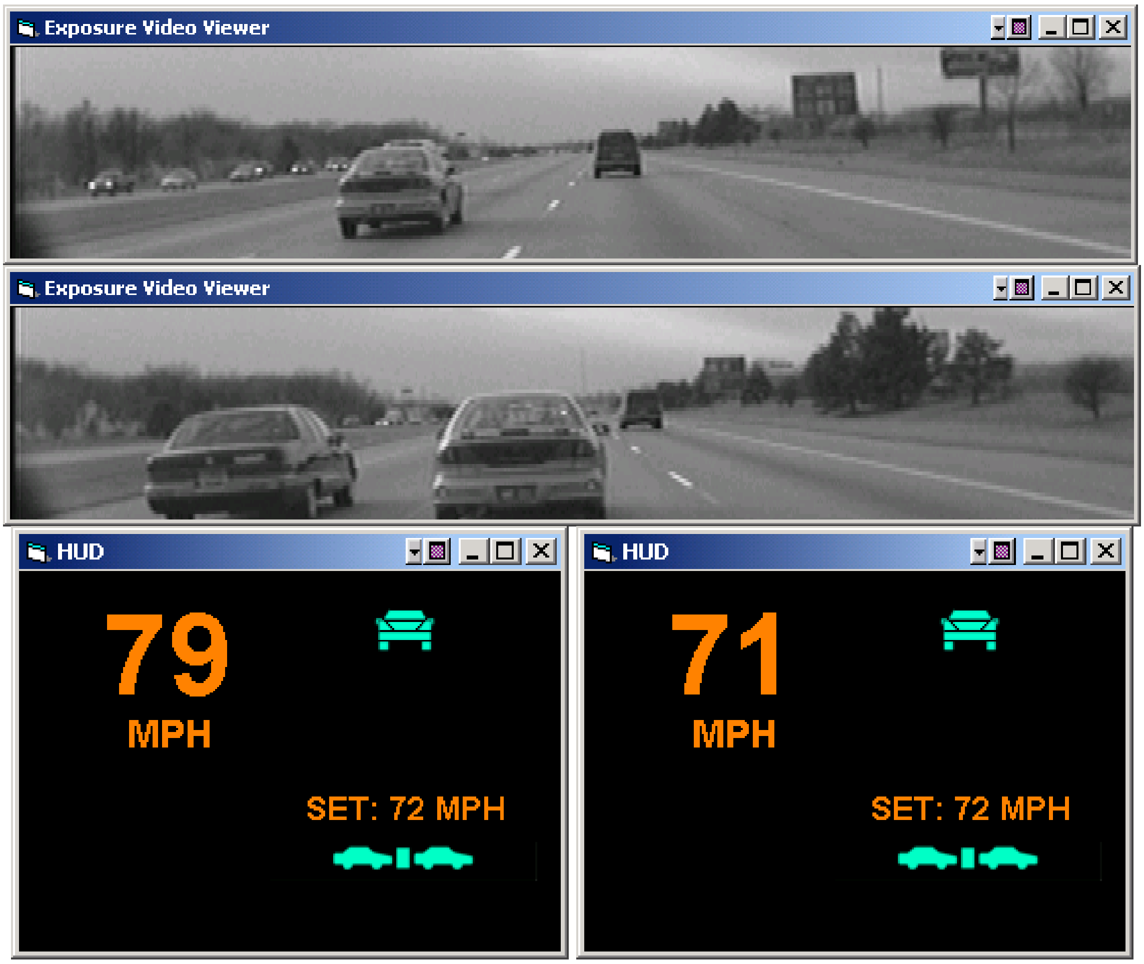


Figure Z.4 Example of a combined throttle override and lane change that cultivates an ACC reverse cut-in conflict with the vehicle in the center of the lower video screen

Shown in Figure Z.5 is the case of a reverse cut-in conflict that arises when the host vehicle and the conflicting target vehicle both move abruptly into what had previously been a vacant lane in between the two of them. Over the next six seconds of the conflict development, the host loses only 3 mph, from 69 to 66 mph, but still generates a peak autobraking deceleration of 1.2 m/s^2 due to the combination of a short headway when the conflict began, plus an ACC gap selection of 1.4 seconds (as seen in the three spacing bars displayed between the car icons.)

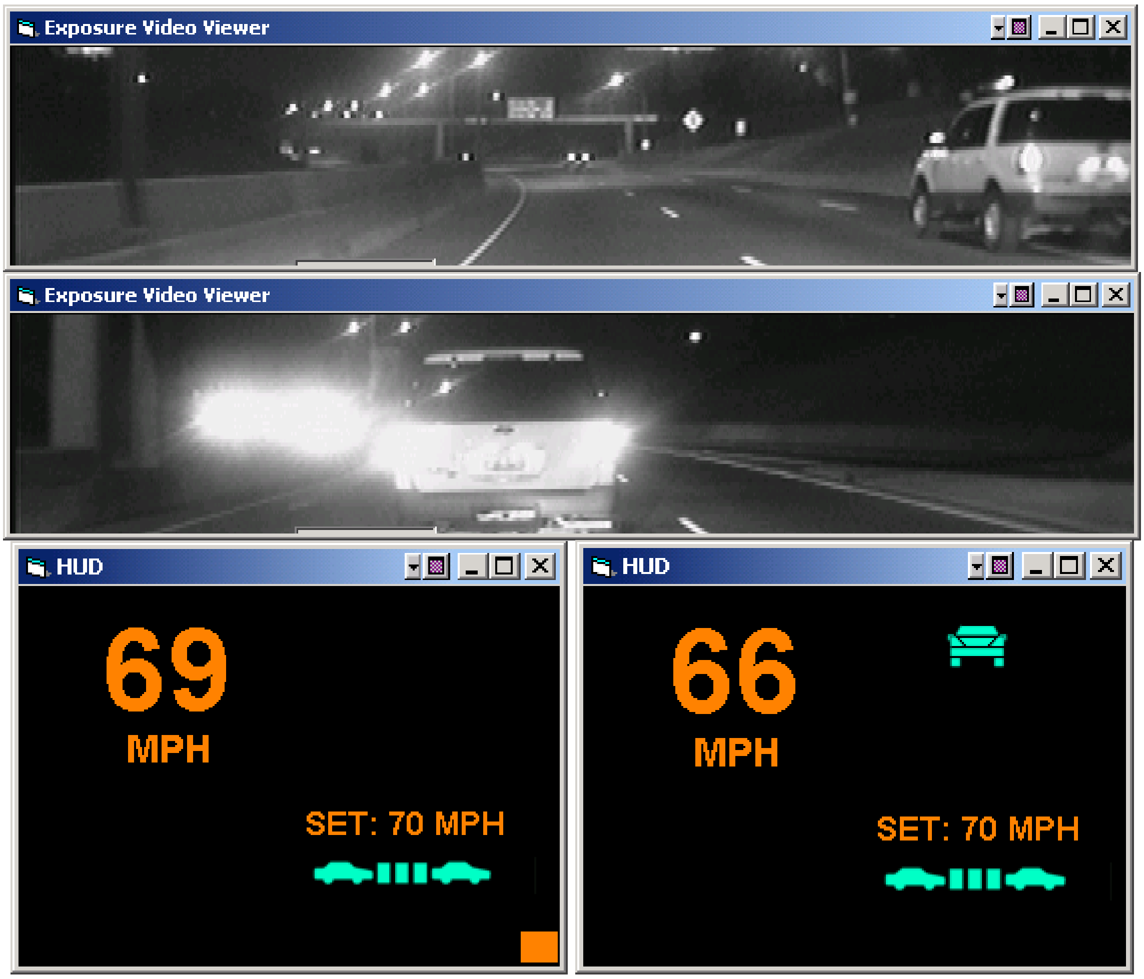


Figure Z.5 Example case of ACC reverse cut-in conflict involving simultaneous lane changes by both the host vehicle and another vehicle

Figure Z.6 presents the relatively benign case in which the host vehicle cuts-out to arrive behind a vehicle that is traveling at very nearly the same speed as the host, but the reverse cut-in range in substantially inside of that which corresponds to the ACC gap setting (2 bars on the display or 1.2 seconds of intended headway gap in this case.) Given that the range-rate is small, the level of autobraking deceleration is quite modest peaking at 0.6 m/s^2. Thus, this case represents a very common situation in which the reverse cut-in maneuver is executed with minimal conflict and only a brief snubbing of the host vehicle's speed is needed for its resolution. The deceleration response serves to drift the host vehicle slowly back into registration with its gap setting.

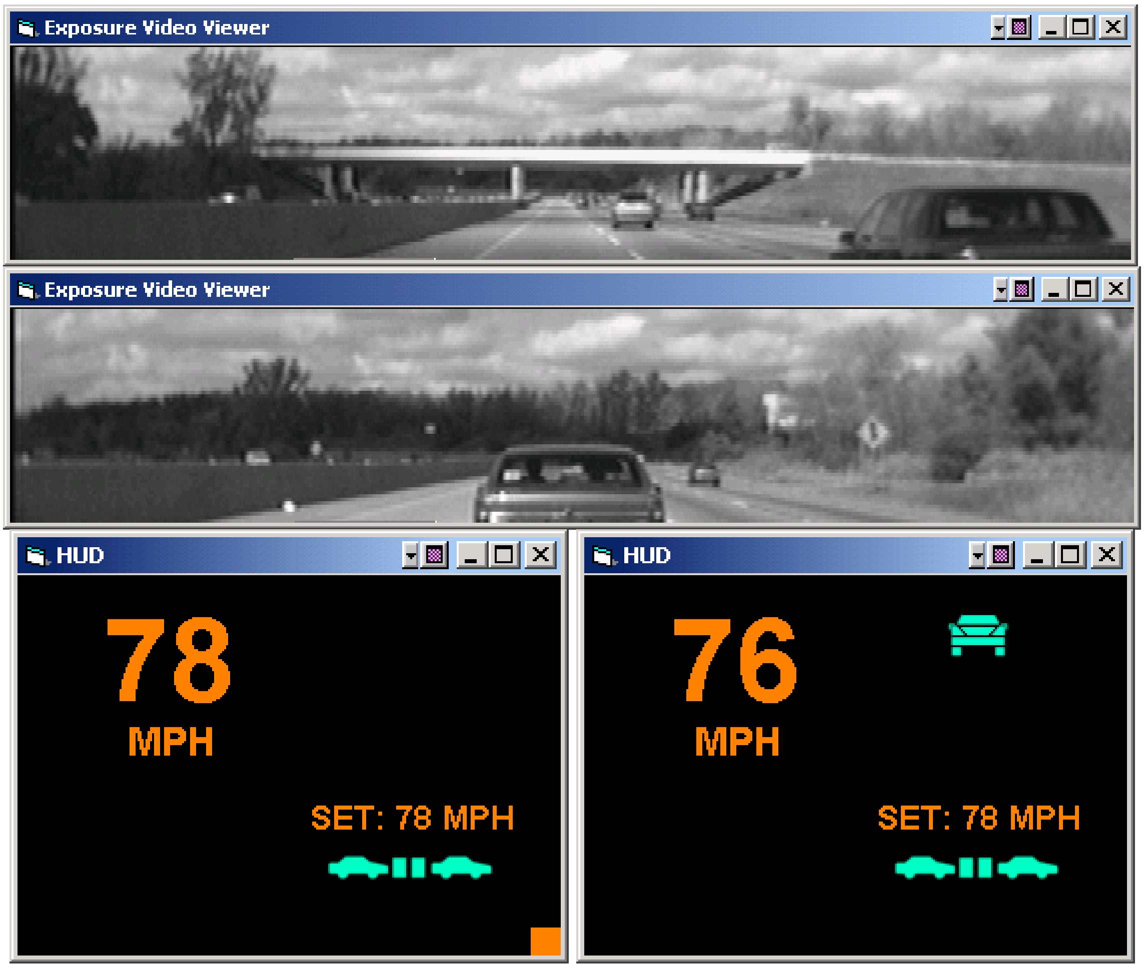


Figure Z.6 Example of an ACC reverse cut-in maneuver that arrives at relatively close range, but minimal overtaking speed behind another vehicle

Examples of Flying Pass

Shown in Figure Z.7 is an illustrative example of a flying-pass event under ManBase control. The driver is traveling at 62 mph while overtaking a preceding vehicle that is traveling approximately 10 mph slower in the center lane of a freeway. The range to the preceding vehicle at the time of lane transition was 10.4 meters, i.e., at the very short extreme of all range values seen in a maneuver of this kind. Similarly, the TTC value of 2.25 seconds was the lowest of all times-to-collision in any flying-pass maneuver. A DA peak of –0.9 m/s^2 was measured based primarily upon the range and range-rate values, with a minimal deceleration disturbance (i.e., Vpdot) on the part of the preceding vehicle.

The top video frame from the scene camera shows the approach phase of the maneuver while the next-lower frame from that camera corresponds approximately with the moment of the lane transition, for which the numerical values of the listed variables were reported in the figure title. The bottom frame shows the moment at which the host vehicle has arrived fully within the left lane. The face video shows the driver looking directly out the side window at the moment of lane transition, presumably confirming the availability of the gap that is about to be taken in the adjacent lane.

Figure Z.7. Illustration of a flying pass in the ManBase mode of control

Shown in Figure Z.8 is an illustrative set of video frames for a flying-pass event that occurred during ACC engagement. This particular sequence represents the highest (most-negative) value of DA that was observed during a flying-pass event during the FOT with ACC engagement. The driver is traveling at 66 mph while overtaking a preceding vehicle that is traveling approximately 16 mph slower in the center lane of a freeway. The range to the preceding vehicle at the time of lane transition was at 45 meters, i.e., within a very common regime for conducting a flying pass under ACC engagement. Noting that the heads-up display showed that the ACC gap setting had been adjusted to the 3-bar position, or 1.4 seconds of headway time, the 45 meter distance is almost exactly the steady-state headway under ACC control. But, the range-rate value of -7 m/s is on the high (most-negative) end of the distribution for flying passes with ACC engaged, indicating that this sequence began from a strongly-transient approach condition (which is, after all, an essential pre-requisite for a flying-pass maneuver, as defined in this report.)

Figure Z.8. Illustration of a flying pass with ACC engaged

The peculiar aspect of this particular sequence lies in the fact that the preceding vehicle is braking at approximately 0.12 g's at the time that the flying pass is being executed by the host driver. Thus, the DA value (which incorporates the deceleration level of the preceding vehicle) registers a somewhat more negative value of $-1.7\ m/s^2$. In the sequence of the video clip, the top and center frames from the scene camera both show brake lamps illuminated on the preceding, white pickup truck. In the bottom frame, with the lane change having been completed, it would appear that the white pickup truck is no longer braking.

The face video shows the driver looking in the nominal direction of the left-side mirror at the moment of lane transition, presumably confirming the availability of the gap that is about to be taken in the adjacent lane.

DOT HS 809 901
August 2005

U.S. Department
of Transportation
National Highway
Traffic Safety
Administration

www.nhtsa.dot.gov
nhtsa
people saving people