



Honda Accord collision avoidance features

This is the third look at the collision avoidance features on the Honda Accord. The Honda Accord is a popular passenger car and is one of the best-selling vehicles in America. With many Honda Accords on the road, equipping them with a crash prevention system that works could potentially have a large and beneficial impact on insurance losses. Interestingly, Honda has equipped most of the Accords with a camera-based front crash prevention system while one Honda Accord trim is equipped with a radar-based one.

This Highway Loss Data Institute (HLDI) report updates two prior analyses of Honda Accord collision avoidance features. Forward Collision Warning (FCW) paired with Lane Departure Warning (LDW) is on most Honda Accord trims as well as the Crosstour and uses a single camera mounted behind the windshield for sensing. The Honda Accord four-door Touring trim is studied for the first time in this bulletin and is equipped with FCW, LDW and Adaptive Cruise Control (ACC). This system utilizes a radar unit mounted in the front grille, similar to most other forward collision warning systems studied by HLDI. Despite similar FCW function, these systems are evaluated separately. LaneWatch, a passenger-side blind spot information system, utilizes a camera mounted on the passenger-side mirror and is available on some of the studied vehicles.

There is nearly twice as much exposure in this study as in the prior one. All of the estimates in this study are within the confidence bounds of the prior study. The updated results for the FCW/LDW system continue to be associated with reductions in claim frequency for all five coverage types examined. With this update the insurance losses for FCW/LDW are now more in line with results from previously evaluated FCW systems. The Honda Accord Touring trim with the radar-based FCW/ACC system has much less exposure but the magnitude of the property damage liability and bodily injury liability benefits are similar to the camera-based FCW/LDW system. The claim frequency benefits for the radar-based system are slightly larger than the camera system but the confidence bounds overlap. Alternative analysis for the camera-based system using data from 2012 model year vehicles to control for differences in trim levels yields similar results. This is an indication that the benefits for the camera-based system can be attributed to the feature and not variability associated with the trim level.

The camera-based system resulted in a decline in collision claim severity while the radar based Touring system resulted in a significant increase. This is in line with previous HLDI findings and the increased claim severity is likely associated with the replacement cost of the radar units in crashes not avoided.

The updated claim frequency loss results for LaneWatch continue to be favorable. The Accord Touring trim is also equipped with LaneWatch and is evaluated for the first time. Results for all vehicles equipped with LaneWatch were consistent with expectations. IncurSION into an occupied adjacent lane would be expected to result in a two-vehicle crash that would lead to a PDL claim against the encroaching driver. The estimated reductions in PDL claims is much larger than the reductions estimated for collision claims. This is consistent with the fact that the reductions in collision claims from such crashes would be diluted by the many single-vehicle crashes that result in collision claims and are unaffected by the LaneWatch system. However, alternative analysis using data from 2012 model year vehicles to control for differences in trim levels indicates an increase in claim frequency for the system. At this point the LaneWatch results should be viewed as preliminary.

Change in claim frequencies by collision avoidance feature, initial vs. updated results

Vehicle damage coverage type	Forward Collision Warning & Lane Departure Warning			Forward Collision Warning, Lane Departure Warning & Adaptive Cruise Control
	April 2014	September 2014	Current	Current
Collision	-3.8%	-3.6%	-1.7%	2.0%
Property damage liability	-14.0%	-9.9%	-11.7%	-15.8%
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Injury coverage type	April 2014	September 2014	Current	Current
Bodily injury liability	-39.5%	-29.2%	-26.8%	-39.4%
Medical payment	-27.3%	-29.7%	-22.3%	-25.7%
Personal injury protection	-10.7%	-16.8%	-6.3%	10.4%

Introduction

This Highway Loss Data Institute (HLDI) bulletin provides an updated look at the effects of available Honda Accord collision avoidance systems on insurance losses. Earlier HLDI studies found encouraging results (HLDI, 2014a, 2014b). Prior HLDI results indicate these systems are having some benefit. This HLDI bulletin updates prior analyses with significantly more exposure and adds a separate analysis for the Honda Accord Touring trim. The features included in this analysis are as follows:

Forward Collision Warning (FCW) uses a camera system located behind the windshield to assess the risk of a collision with leading traffic. The warning system has three driver-selectable range settings. When a potential crash is detected, lights flash in the heads-up display, the FCW indicator blinks, and there is continuous beeping. The system is active only at speeds more than 10 mph and can be deactivated by the driver. At each ignition cycle, the system defaults to the previous on/off setting. Vehicles with FCW also have Lane Departure Warning.

Lane Departure Warning (LDW) utilizes the same camera as forward collision warning to also identify traffic lane markings. Audio and visual warnings will indicate if the vehicle path deviates from the intended lane. The system is functional at speeds between 40 and 90 mph but does not warn if the turn signal is on or the movement is determined to be sufficiently sudden as to be evasive. The system can be deactivated by the driver. At each ignition cycle, the system defaults to the previous on/off setting.

Adaptive Cruise Control (ACC) uses radar sensors mounted in the front bumper to monitor traffic ahead and maintain the driver's selected following distance. As traffic conditions dictate, the system employs braking force to maintain the set following distance. Adaptive cruise control is available at speeds over 10 mph. Forward Collision Warning remains active even when adaptive cruise control is turned off.

LaneWatch is Honda's term for a passenger-side-only blind spot monitor. A camera mounted behind the external passenger side rearview mirror monitors the passenger side of the vehicle and displays an 80-degree field of view on the console-mounted information screen when the turn signal indicator is activated. Reference lines are also provided to indicate proximity. Both the turn signal indicator and reference lines are driver-controllable settings and can be deactivated. An upcoming navigation system maneuver can also be given priority over the LaneWatch display. LaneWatch can be deactivated by the driver. At each ignition cycle, it will default to the previous on/off setting.

All of the vehicles in this study were equipped with rear cameras. As there are no vehicles without this feature, their effectiveness cannot be evaluated in this analysis. The vehicles in this analysis may also have been equipped with optional rear parking sensors. This feature was not controlled for in the analysis, as the availability of rear parking sensors on a vehicle was not discernible from the vehicle identification number (VIN).

► Method

Vehicles

Several trim levels are offered on the vehicles included in this study. Trim levels are bundles of vehicle options such as interior materials, engines, and comfort, convenience, and safety features. For example, the Honda Accord EX-L V6 is equipped with a 6-cylinder motor, leather seats, and several collision avoidance technologies. The less expensive LX is equipped with cloth seats, a 4-cylinder motor, and no collision avoidance technologies. For the Honda vehicles included in this study, the trim levels can be determined in the first 10 positions of the VIN. The collision avoidance features in this study are either standard or not available at the trim level. Consequently, by knowing the trim level, the presence of the collision avoidance features is known. LaneWatch and the combination of FCW and LDW are offered as standard equipment on several 2013–14 Honda Accord models (trims). LaneWatch and the combination of FCW, LDW, and ACC are offered on the Touring trim of the four-door Honda Accord. Honda Accord vehicles without these features served as the control vehicles in the analysis. **Table 1** lists total exposure, measured in insured vehicle years, and the exposure of each feature as a percentage of total exposure. Also included in **Table 1** is the exposure from the two prior reports.

Table 1: Feature exposure by vehicle series

Make	Series	Model year range	Forward Collision Warning (includes Lane Departure Warning)	Forward Collision Warning (includes Lane Departure Warning and Adaptive Cruise Control)	LaneWatch	Total exposure	September report exposure	April report exposure
Honda	Accord 2dr	2013–14	67%		67%	56,381	29,915	15,183
Honda	Accord 4dr	2013–14	38%		49%	569,785	283,665	157,309
Honda	Accord 4dr Touring	2013–14		100%	100%	11,662	-	-
Honda	Accord Crosstour 4dr	2013–14	70%		77%	10,767	5,750	2,408
Honda	Accord Crosstour 4dr 4WD	2013–14	100%		100%	8,671	4,474	1,968

Insurance Data

Automobile insurance covers damages to vehicles and property as well as injuries to people involved in crashes. Different insurance coverages pay for vehicle damage versus injuries, and different coverages may apply depending on who is at fault. The current study is based on property damage liability, collision, bodily injury liability, personal injury protection, and medical payment coverages. Exposure is measured in insured vehicle years. An insured vehicle year is one vehicle insured for 1 year, two vehicles for 6 months, etc.

Because different crash avoidance features may affect different types of insurance coverage, it can be important to understand how coverages vary among the states and how this affects inclusion in the analyses. Collision coverage insures against vehicle damage to an at-fault driver's vehicle sustained in a crash with an object or other vehicle; this coverage is common to all 50 states. Property damage liability (PDL) coverage insures against vehicle damage that at-fault drivers cause to other people's vehicle and property in crashes; this coverage exists in all states except Michigan, where vehicle damage is covered on a no-fault basis (each insured vehicle pays for its own damage in a crash, regardless of who is at fault).

Coverage of injuries is more complex. Bodily injury (BI) liability coverage insures against medical, hospital, and other expenses for injuries that at-fault drivers inflict on occupants of other vehicles or others on the road; although motorists in most states may have BI coverage, this information is analyzed only in states where the at-fault driver has first obligation to pay for injuries (33 states with traditional tort insurance systems). Medical payment (MedPay) coverage, also sold in the 33 states with traditional tort insurance systems, covers injuries to insured drivers and the passengers in their vehicles, but not injuries to people in other vehicles involved in the crash. Seventeen other states employ no-fault injury systems (personal injury protection coverage, or PIP) that pay up to a specified amount for injuries to occupants of involved-insured vehicles, regardless of who is at fault in a collision. The District of Columbia has a hybrid insurance system for injuries and is excluded from the injury analysis.

Statistical methods

Regression analysis was used to quantify the effect of each vehicle feature while controlling for other covariates. The covariates included calendar year, model year, garaging state, vehicle density (number of registered vehicles per square mile), rated driver age group, rated driver gender, rated driver marital status, deductible range (collision coverage only), and risk. For each safety feature studied, a variable was included.

Claim frequency was modeled using a Poisson distribution, whereas claim severity (average loss payment per claim) was modeled using a Gamma distribution. Both models used a logarithmic link function. Estimates for overall losses were derived from the claim frequency and claim severity models. Estimates for frequency, severity, and overall losses are presented for collision and property damage liability. For PIP, BI, and MedPay, three frequency estimates are presented. The first frequency is the frequency for all claims, including those that already have been paid and those for which money has been set aside for possible payment in the future, known as claims with reserves. The other two frequencies include only paid claims separated into low- and high-severity ranges. Note that the percentage of all injury claims for the Honda Accord that were paid by the date of analysis varies by coverage: 71.7 percent for PIP, 54.0 percent for BI, and 57.7 percent for MedPay. The low-severity range was <\$1,000 for PIP and MedPay, <\$5,000 for BI; high severity covered all loss payments greater than that.

A separate regression was performed for each insurance loss measure for a total of 15 regressions (5 coverages x 3 loss measures each). For space reasons, only the estimates for the individual crash avoidance features are shown on the following pages. To illustrate the analyses, however, **Appendix A** contains full model results for Honda Accord collision claim frequencies. To further simplify the presentation here, the exponent of the parameter estimate was calculated, 1 was subtracted, and the resultant multiplied by 100. The resulting number corresponds to the effect of the feature on that loss measure. For example, the estimate of the effect of Forward Collision Warning (including Lane Departure Warning) on PDL claim frequency was -0.0166; thus, vehicles with the feature had 1.7 percent fewer collision claims than without FCW/LDW (($\exp(-0.0166)-1$)*100=-1.7).

► Results

Results for Honda Accord's Forward Collision Warning System including Lane Departure Warning are summarized in **Table 2**. The lower and upper bounds represent the 95 percent confidence limits for the estimates. For vehicle damage losses, the frequency and severity of claims as well as overall losses are down. Half of the reductions are significant (indicated in bold in the table).

For the injury-related coverage types, bodily injury liability and medical payment claim frequencies for paid and unpaid claims show significant reductions. Among paid claims, claim frequency shows a benefit with half of the estimates being significant.

Table 2: Change in insurance losses for Forward Collision Warning and Lane Departure Warning

Vehicle damage coverage type	Lower bound	FREQUENCY	Upper bound	Lower bound	SEVERITY	Upper bound	Lower bound	OVERALL LOSSES	Upper bound
Collision	-4.7%	-1.7%	1.5%	-\$300	-\$145	\$17	-\$35	-\$18	\$0
Property damage liability	-16.2%	-11.7%	-6.9%	-\$215	-\$66	\$91	-\$20	-\$13	-\$7
Injury coverage type	Lower bound	FREQUENCY	Upper bound	Lower bound	LOW SEVERITY FREQUENCY	Upper bound	Lower bound	HIGH SEVERITY FREQUENCY	Upper bound
Bodily injury liability	-37.9%	-26.8%	-13.8%	-49.6%	-32.1%	-8.6%	-54.6%	-36.7%	-11.7%
Medical payment	-32.5%	-22.3%	-10.6%	-48.7%	-24.0%	12.7%	-36.9%	-22.0%	-3.5%
Personal injury protection	-16.1%	-6.3%	4.7%	-25.2%	-4.1%	23.0%	-17.9%	-4.3%	11.6%

Results for Honda Accord's LaneWatch system are summarized in **Table 3**. Again, the lower and upper bounds represent the 95 percent confidence limits for the estimates. Reductions in claim frequency are estimated for both first- and third-party vehicle damage coverages. Both collision and property damage liability claim frequency reductions are statistically significant. Losses per insured vehicle year (overall losses) declined significantly under both property damage liability and collision coverage.

Under injury coverages, the frequency of claims is lower for all three coverages. The 12.7 percent reduction under personal injury protection is statistically significant. Among paid claims, there is a significant reduction in high severity PIP claims, yet no clear pattern emerges.

Table 3: Change in insurance losses for LaneWatch

Vehicle damage coverage type	Lower bound	FREQUENCY	Upper bound	Lower bound	SEVERITY	Upper bound	Lower bound	OVERALL LOSSES	Upper bound
	Collision	-7.9%	-5.0%	-2.0%	-\$215	-\$60	\$101	-\$40	-\$24
Property damage liability	-13.2%	-8.8%	-4.0%	-\$119	\$28	\$183	-\$14	-\$8	-\$1

Injury coverage type	Lower bound	FREQUENCY	Upper bound	Lower bound	LOW SEVERITY FREQUENCY	Upper bound	Lower bound	HIGH SEVERITY FREQUENCY	Upper bound
	Bodily injury liability	-19.4%	-6.0%	9.5%	-26.1%	-2.5%	28.6%	-32.0%	-7.4%
Medical payment	-15.6%	-3.5%	10.3%	-23.8%	11.4%	62.8%	-30.4%	-14.9%	4.1%
Personal injury protection	-21.4%	-12.7%	-3.0%	-15.3%	7.8%	37.1%	-29.6%	-18.6%	-5.8%

Table 4 shows the differences in the claim frequency estimates between the initial results published in April 2014, September 2014, and the updated results included in this report. The updated results for the combined FCW/LDW system continue to show frequency benefits for all coverage types. The PDL claim frequency reduction remains significant, although the size of the effect is between the two prior estimates. All three injury coverages continue to show reductions in claim frequency. The effect consistently dropped for bodily injury liability across the three studies. The previous frequency estimate for personal injury protection was statistically significant, while the updated estimate is no longer significant. The benefits of LaneWatch under collision has increased over the three reports and is now statistically significant. The frequency reduction under property damage liability is significant and similar to the initial estimate. The frequency reductions under the injury-related coverages remain similar to the September 2014 estimates. However, the estimate for personal injury protection is the only statistically significant estimate.

Table 4: Change in claim frequencies by collision avoidance feature, initial vs. updated results

Vehicle damage coverage type	Forward Collision Warning & Lane Departure Warning			LaneWatch		
	April 2014	September 2014	Current	April 2014	September 2014	Current
Collision	-3.8%	-3.6%	-1.7%	-2.5%	-2.6%	-5.0%
Property damage liability	-14.0%	-9.9%	-11.7%	-7.8%	-12.5%	-8.8%

Injury coverage type	April 2014	September 2014	Current	April 2014 report	September 2014	Current
	Bodily injury liability	-39.5%	-29.2%	-26.8%	7.9%	-5.2%
Medical payment	-27.3%	-29.7%	-22.3%	-11.1%	-8.6%	-3.5%
Personal injury protection	-10.7%	-16.8%	-6.3%	-15.8%	-13.1%	-12.7%

Honda Accord Touring:

Results for Honda Accord Touring's Forward Collision Warning System including Lane Departure Warning and Adaptive Cruise Control are summarized in **Table 5**. The lower and upper bounds represent the 95 percent confidence limits for the estimates. For property damage liability, claim frequency and overall losses are down. Under collision coverage, the Touring trim showed an increase in claim frequency, claim severity, and overall losses with severity and overall losses being significant.

For the injury-related coverage types, bodily injury liability and medical payment claim frequencies for paid and unpaid claims show reductions. Among paid claims, claim frequency also shows a benefit under bodily injury liability and medical payment.

Table 5: Change in insurance losses for Forward Collision Warning, Lane Departure Warning and Adaptive Cruise Control

Vehicle damage coverage type	Lower bound	FREQUENCY	Upper bound	Lower bound	SEVERITY	Upper bound	Lower bound	OVERALL LOSSES	Upper bound
Collision	-5.0%	2.0%	9.6%	\$129	\$522	\$949	\$9	\$53	\$102
Property damage liability	-25.8%	-15.8%	-4.4%	-\$211	\$162	\$587	-\$25	-\$11	\$6
Injury coverage type	Lower bound	FREQUENCY	Upper bound	Lower bound	LOW SEVERITY FREQUENCY	Upper bound	Lower bound	HIGH SEVERITY FREQUENCY	Upper bound
Bodily injury liability	-60.7%	-39.4%	-6.6%	-62.8%	-24.9%	51.6%	-94.9%	-79.0%	-13.6%
Medical payment	-46.5%	-25.7%	3.0%	-80.1%	-43.6%	59.8%	-43.9%	-11.3%	40.3%
Personal injury protection	-14.3%	10.4%	42.2%	-38.2%	11.4%	100.5%	-26.8%	4.8%	50.1%

Results for Honda Accord Touring's LaneWatch system are summarized in **Table 6**. Again, the lower and upper bounds represent the 95 percent confidence limits for the estimates. Reductions in claim frequency are estimated for both first- and third-party vehicle damage coverages. Collision and property damage liability claim frequency reductions are statistically significant. Losses per insured vehicle year (overall losses) declined significantly under these two coverage types.

Under injury coverages, the frequency of claims is lower for all three coverages. The 13.4 percent reduction under personal injury protection is statistically significant. Among paid claims, larger reductions are seen for higher severity claims.

Table 6: Change in insurance losses for Honda Accord Touring LaneWatch

Vehicle damage coverage type	Lower bound	FREQUENCY	Upper bound	Lower bound	SEVERITY	Upper bound	Lower bound	OVERALL LOSSES	Upper bound
Collision	-7.7%	-4.8%	-1.8%	-\$232	-\$78	\$83	-\$41	-\$24	-\$7
Property damage liability	-13.3%	-8.8%	-4.1%	-\$111	\$38	\$194	-\$14	-\$8	-\$1
Injury coverage type	Lower bound	FREQUENCY	Upper bound	Lower bound	LOW SEVERITY FREQUENCY	Upper bound	Lower bound	HIGH SEVERITY FREQUENCY	Upper bound
Bodily injury liability	-19.9%	-6.6%	8.9%	-26.3%	-2.7%	28.5%	-32.7%	-8.3%	25.1%
Medical payment	-15.5%	-3.4%	10.6%	-23.8%	11.7%	63.6%	-30.4%	-14.8%	4.3%
Personal injury protection	-22.1%	-13.4%	-3.8%	-16.0%	7.0%	36.3%	-30.7%	-19.7%	-7.1%

Comparison results:

Table 7 shows the differences in the claim frequency estimates for the Honda Accord/Crosstour and Honda Accord Touring. The results for the FCW/LDW (ACC on Touring) system show minimal, if any, benefit under collision coverage across the vehicle series. However, under property damage liability, claim frequency is reduced significantly. Under injury coverages, reductions are seen across all vehicle series and coverages, with the exception of personal injury protection claim frequency for the Honda Accord Touring. Several of the reductions are significant.

Table 7 also shows the differences in the claim frequency estimates for LaneWatch for the Honda Accord/Crosstour and Honda Accord Touring. The estimated reductions in claim frequency for both of these vehicles are nearly identical across all coverage types. This may in part be due to the control populations being identical. Significant reductions are seen for both vehicles under collision, property damage liability, and personal injury protection.

Table 7: Change in claim frequencies by collision avoidance feature and vehicle series				
Vehicle damage coverage types	Collision Mitigation Warning & Lane Departure Warning (ACC on Touring)		LaneWatch	
	Honda Accord/Crosstour	Honda Accord Touring	Honda Accord/Crosstour	Honda Accord Touring
Collision	-1.7%	2.0%	-5.0%	-4.8%
Property damage liability	-11.7%	-15.8%	-8.8%	-8.8%
Injury coverage types	Honda Accord/Crosstour	Honda Accord Touring	Honda Accord/Crosstour	Honda Accord Touring
Bodily injury liability	-26.8%	-39.4%	-6.0%	-6.6%
Medical payments	-22.3%	-25.7%	-3.5%	-3.4%
Personal injury protection	-6.3%	10.4%	-12.7%	-13.4%

► **Discussion**

The loss results for the systems included in this study continue to be favorable and fall within the bounds of the prior study. However, some of the point estimates have changed. While just a year has passed from the initial study, the exposure available for analysis has more than doubled for the Honda Accord and Crosstour. The increase in exposure has resulted from both the sale of additional vehicles and the additional time insured for the vehicles included in the previous study. The results for the combined FCW/LDW system are in-line with prior findings for comparable systems. The frequency benefits are within the confidence bounds of the estimates in the previous study, and fairly similar to the prior bulletin. The frequency estimates for LaneWatch continue to indicate reductions, and three of the estimates are statistically significant.

Forward collision warning systems are designed to prevent or mitigate front-to-rear crashes, which typically result in PDL and BI claims if injury in the struck vehicle occurs. The updated FCW/LDW system continues to be associated with reductions in claim frequency for all five coverage types examined. With this update the insurance losses are now more in line with results from previously evaluated systems. The Honda Accord Touring trim with the radar-based FCW/LDW/ACC system has much less exposure but the magnitude of the property damage liability and bodily injury liability benefits are similar to the camera-based FCW/LDW system. The claim frequency benefits for the radar-based system are slightly larger than the camera system but the confidence bounds overlap. The camera-based system resulted in a decline in collision claim severity while the radar-based Touring system resulted in a significant increase. This is in line with previous HLDI findings and the increased claim severity is likely associated with the replacement cost of the radar units in crashes not avoided.

The analysis of Honda's LaneWatch, a passenger-side blind spot detection system, showed a reduction in claims, with significant effects for collision, PDL and PIP. None of the estimates from the April 2014 report were significant, and the BI estimate suggested an increase in claims. Effects of LaneWatch are patterned as expected. Incursion into an occupied adjacent lane would be expected to result in a two-vehicle crash that would lead to a property damage liability claim against the encroaching driver. The PDL estimates for the Accord/Crosstour and Accord Touring are identical and statistically significant, and the estimated reduction in property damage liability claims is much larger than the reduction estimated for collision claims. This is consistent with the fact that the reductions in collision claims from such crashes would be diluted by the many single-vehicle crashes that result in collision claims and are unaffected by the LaneWatch system.

As previously mentioned, the collision avoidance systems are tied to the vehicle trim levels. In order to be confident that the measured differences were attributable to the collision avoidance features and not the trim levels, a supplemental analysis was conducted including loss data for model year 2012 Honda Accord vehicles. While the Honda Accord was redesigned in 2013, the trim levels in 2012-14 were comparable. The inclusion of loss data for the 2012 model year, in which no crash avoidance features were present, allowed the supplemental analysis to include the vehicle trim level in addition to the control variables used in the primary analysis. Thus, the supplemental analysis assumes that loss differences attributable to the different trim levels were the same in both model years. The summary results of the supplemental analysis are included in **Appendix B**, and the full regression analysis results for collision claim frequencies are shown in **Appendix C**. The supplemental results for the combination FCW/LDW system is consistent with the supplemental analysis from the prior 2014 bulletin. This analysis indicates larger benefits for the FCW/LDW system yet all of the estimated effects are within the confidence bounds of the main analysis presented in this report. Due to the similarity of the two analyses for FCW/LDW and uncertainty about the applicability of 2012 model trim level differences to the redesigned 2013-14 models, the analysis presented in the results section of this bulletin is expected to be the better predictor of the effects on losses of that system. The supplemental estimates for the LaneWatch system are showing increased claim frequencies. However, while the results in the main portion of this bulletin are indicating reductions, the alternative analyses suggest that LaneWatch results should be viewed as preliminary. Similar analysis could not be conducted for the Touring trim as the 2013 model year (included in this analysis) was the first year that trim was available.

► Limitations

There are limitations to the data used in this analysis. At the time of a crash, the status of a feature is not known. The features in this study can be deactivated by the driver, and there is no way to know how many of the drivers in these vehicles turned off a system prior to the crash. However, surveys conducted by the Insurance Institute for Highway Safety indicate that large majorities of drivers with these types of systems leave them on. If a significant number of drivers do turn these features off, any reported reductions may actually be underestimates of the true effectiveness of these systems.

Additionally, the data supplied to HLDI does not include detailed crash information. Information on point of impact and the vehicle's transmission status is not available. The technologies in this report target certain crash types. For example, LaneWatch is designed to prevent sideswipe-type collisions. All collisions, regardless of the ability of a feature to mitigate or prevent the crash, are included in the analysis.

References

- Highway Loss Data Institute. 2014a. Honda Accord collision avoidance features: initial results. *Loss Bulletin* Vol. 31, No. 2. Arlington, VA.
- Highway Loss Data Institute. 2014b. Honda Accord collision avoidance features: an update. *Loss Bulletin* Vol. 31,

► **Appendix A**

Appendix A: Illustrative regression results — collision frequency									
Parameter		Degrees of freedom	Estimate	Effect	Standard error	Wald 95% confidence limits		Chi-square	P-value
Intercept		1	-8.9446		0.3053	-9.5430	-8.3462	858.29	<0.0001
Calendar year	2012	1	-0.5214	-40.6%	0.0480	-0.6155	-0.4272	117.84	<0.0001
	2013	1	-0.0216	-2.1%	0.0101	-0.0413	-0.0018	4.58	0.0324
	2014	0	0	0	0	0	0		
Vehicle model year and series	2013 Accord 2dr	1	0.1824	20.0%	0.1009	-0.0155	0.3802	3.26	0.0708
	2014 Accord 2dr	1	0.2399	27.1%	0.1043	0.0356	0.4443	5.29	0.0214
	2013 Accord 4dr	1	0.0666	6.9%	0.1000	-0.1294	0.2626	0.44	0.5052
	2014 Accord 4dr	1	0.0544	5.6%	0.1002	-0.1419	0.2508	0.30	0.5868
	2013 Accord Crosstour 4dr 2WD	1	0.0136	1.4%	0.1071	-0.1962	0.2234	0.02	0.8988
	2014 Accord Crosstour 4dr 2WD	1	0.1495	16.1%	0.1424	-0.1295	0.4286	1.10	0.2936
	2013 Accord Crosstour 4dr 4WD	1	0.0623	6.4%	0.1087	-0.1507	0.2753	0.33	0.5664
	2014 Accord Crosstour 4dr 4WD	0	0	0	0	0	0		
Rated driver age group	14–24	1	0.2828	32.7%	0.0198	0.2440	0.3217	203.59	<0.0001
	25–29	1	0.1870	20.6%	0.0177	0.1523	0.2217	111.57	<0.0001
	30–39	1	0.0592	6.1%	0.0151	0.0297	0.0887	15.45	<0.0001
	50–59	1	-0.0615	-6.0%	0.0154	-0.0916	-0.0313	15.97	<0.0001
	60–64	1	-0.0804	-7.7%	0.0198	-0.1192	-0.0416	16.50	<0.0001
	65–69	1	-0.0239	-2.4%	0.0203	-0.0637	0.0159	1.39	0.2390
	70+	1	0.1025	10.8%	0.0173	0.0687	0.1363	35.27	<0.0001
	Unknown	1	0.0264	2.7%	0.0239	-0.0205	0.0734	1.22	0.2696
	40–49	0	0	0	0	0	0		
Rated driver gender	Male	1	-0.0593	-5.8%	0.0103	-0.0795	-0.0392	33.26	<0.0001
	Unknown	1	-0.1820	-16.6%	0.0378	-0.2560	-0.1080	23.22	<0.0001
	Female	0	0	0	0	0	0		
Rated driver marital status	Single	1	0.1951	21.5%	0.0113	0.1729	0.2173	296.01	<0.0001
	Unknown	1	0.2132	23.8%	0.0377	0.1393	0.2871	31.99	<0.0001
	Married	0	0	0	0	0	0		
Risk	Nonstandard	1	0.2345	26.4%	0.0191	0.1970	0.2720	150.55	<0.0001
	Standard	0	0	0	0	0	0		
State	Alabama	1	0.0657	6.8%	0.2915	-0.5057	0.6371	0.05	0.8217
	Arizona	1	0.1059	11.2%	0.2909	-0.4642	0.6761	0.13	0.7157
	Arkansas	1	0.1342	14.4%	0.2957	-0.4453	0.7137	0.21	0.6499
	California	1	0.4291	53.6%	0.2890	-0.1374	0.9956	2.20	0.1377
	Colorado	1	0.1659	18.0%	0.2927	-0.4077	0.7395	0.32	0.5708
	Connecticut	1	0.0499	5.1%	0.2916	-0.5215	0.6214	0.03	0.8640
	Delaware	1	0.1750	19.1%	0.2969	-0.4069	0.7569	0.35	0.5556
	District of Columbia	1	0.6259	87.0%	0.3006	0.0366	1.2151	4.33	0.0374
	Florida	1	-0.0813	-7.8%	0.2894	-0.6484	0.4859	0.08	0.7788

Appendix A: Illustrative regression results — collision frequency

Parameter	Degrees of freedom	Estimate	Effect	Standard error	Wald 95% confidence limits		Chi-square	P-value
Georgia	1	0.0505	5.2%	0.2900	-0.5178	0.6189	0.03	0.8616
Hawaii	1	0.3911	47.9%	0.2967	-0.1903	0.9726	1.74	0.1874
Idaho	1	-0.1660	-15.3%	0.3142	-0.7818	0.4499	0.28	0.5973
Illinois	1	0.1203	12.8%	0.2899	-0.4479	0.6884	0.17	0.6782
Indiana	1	0.0158	1.6%	0.2919	-0.5564	0.5880	0.00	0.9568
Iowa	1	0.0578	6.0%	0.2988	-0.5278	0.6435	0.04	0.8465
Kansas	1	0.1013	10.7%	0.2957	-0.4784	0.6809	0.12	0.7320
Kentucky	1	-0.1134	-10.7%	0.2946	-0.6909	0.4641	0.15	0.7004
Louisiana	1	0.3580	43.0%	0.2902	-0.2108	0.9269	1.52	0.2174
Maine	1	-0.0334	-3.3%	0.3135	-0.6478	0.5811	0.01	0.9153
Maryland	1	0.2398	27.1%	0.2898	-0.3282	0.8078	0.68	0.4079
Massachusetts	1	0.2468	28.0%	0.2912	-0.3239	0.8175	0.72	0.3966
Michigan	1	0.5284	69.6%	0.2914	-0.0428	1.0996	3.29	0.0698
Minnesota	1	0.0760	7.9%	0.2925	-0.4973	0.6493	0.07	0.7951
Mississippi	1	0.2545	29.0%	0.2930	-0.3198	0.8287	0.75	0.3852
Missouri	1	-0.0412	-4.0%	0.2926	-0.6147	0.5322	0.02	0.8879
Montana	1	-0.3104	-26.7%	0.3434	-0.9835	0.3627	0.82	0.3661
Nebraska	1	-0.0526	-5.1%	0.3023	-0.6452	0.5400	0.03	0.8619
Nevada	1	0.0313	3.2%	0.2950	-0.5469	0.6095	0.01	0.9155
New Hampshire	1	0.2675	30.7%	0.2956	-0.3118	0.8468	0.82	0.3655
New Jersey	1	0.1492	16.1%	0.2894	-0.4180	0.7164	0.27	0.6062
New Mexico	1	0.1848	20.3%	0.2980	-0.3992	0.7688	0.38	0.5351
New York	1	0.4253	53.0%	0.2891	-0.1414	0.9920	2.16	0.1413
North Carolina	1	-0.1526	-14.2%	0.2901	-0.7212	0.4159	0.28	0.5988
North Dakota	1	0.3131	36.8%	0.3173	-0.3089	0.9350	0.97	0.3238
Ohio	1	-0.0269	-2.7%	0.2899	-0.5951	0.5412	0.01	0.9260
Oklahoma	1	0.0885	9.3%	0.2934	-0.4866	0.6636	0.09	0.7629
Oregon	1	0.1019	10.7%	0.2938	-0.4739	0.6776	0.12	0.7287
Pennsylvania	1	0.2840	32.8%	0.2896	-0.2835	0.8515	0.96	0.3267
Rhode Island	1	0.3252	38.4%	0.2950	-0.2531	0.9034	1.21	0.2704
South Carolina	1	-0.0180	-1.8%	0.2911	-0.5886	0.5526	0.00	0.9506
South Dakota	1	0.0106	1.1%	0.3265	-0.6294	0.6505	0.00	0.9742
Tennessee	1	-0.0187	-1.9%	0.2911	-0.5894	0.5519	0.00	0.9487
Texas	1	0.1180	12.5%	0.2893	-0.4489	0.6849	0.17	0.6834
Utah	1	0.0067	0.7%	0.2974	-0.5762	0.5896	0.00	0.9819
Vermont	1	0.2581	29.4%	0.3128	-0.3550	0.8712	0.68	0.4093
Virginia	1	0.1924	21.2%	0.2897	-0.3754	0.7602	0.44	0.5066
Washington	1	0.1385	14.9%	0.2912	-0.4323	0.7093	0.23	0.6344
West Virginia	1	-0.1814	-16.6%	0.3045	-0.7782	0.4154	0.35	0.5514
Wisconsin	1	0.1010	10.6%	0.2926	-0.4725	0.6744	0.12	0.7300
Wyoming	1	0.0046	0.5%	0.3590	-0.6991	0.7083	0.00	0.9897
Alaska	0	0	0	0	0	0		
Deductible range								
0–250	1	0.4899	63.2%	0.0159	0.4588	0.5211	950.88	<0.0001
1,001+	1	-0.4176	-34.1%	0.0980	-0.6095	-0.2256	18.17	<0.0001

Appendix A: Illustrative regression results — collision frequency

Parameter	Degrees of freedom	Estimate	Effect	Standard error	Wald 95% confidence limits	Chi-square	P-value		
Registered vehicle density	251–500	1	0.2833	32.8%	0.0137	0.2563	0.3102	424.91	<0.0001
	501–1,000	0	0	0	0	0	0		
	0–99	1	-0.2570	-22.7%	0.0173	-0.2909	-0.2230	219.70	<0.0001
	100–499	1	-0.1729	-15.9%	0.0112	-0.1949	-0.1509	237.22	<0.0001
	500+	0	0	0	0	0	0		
Forward collision warning & lane departure warning	1	-0.0166	-1.6%	0.0163	-0.0485	0.0152	1.05	0.3061	
LaneWatch	1	-0.0514	-5.0%	0.0157	-0.0822	-0.0206	10.71	0.0011	

► Appendix B: Analysis results included model years 2012–14, accounting for vehicle series and model level loss differences

Change in insurance losses for Forward Collision Warning and Lane Departure Warning

Vehicle damage coverage type	Lower bound	FREQUENCY	Upper bound	Lower bound	SEVERITY	Upper bound	Lower bound	OVERALL LOSSES	Upper bound
Collision	-10.4%	-6.1%	-1.7%	-\$253	-\$32	\$202	-\$44	-\$23	\$0
Property damage liability	-18.9%	-12.8%	-6.2%	-\$337	-\$142	\$68	-\$26	-\$18	-\$8

Injury coverage type	Lower bound	FREQUENCY	Upper bound	Lower bound	LOW SEVERITY FREQUENCY	Upper bound	Lower bound	HIGH SEVERITY FREQUENCY	Upper bound
Bodily injury liability	-39.4%	-24.7%	-6.4%	-46.8%	-22.3%	13.4%	-52.4%	-27.8%	9.5%
Medical payment	-30.0%	-14.8%	3.7%	-45.8%	-6.0%	63.1%	-37.7%	-16.8%	11.3%
Personal injury protection	-12.7%	1.7%	18.4%	-23.1%	8.4%	52.8%	-11.6%	8.6%	33.5%

Change in insurance losses for LaneWatch

Vehicle damage coverage type	Lower bound	FREQUENCY	Upper bound	Lower bound	SEVERITY	Upper bound	Lower bound	OVERALL LOSSES	Upper bound
Collision	-2.6%	1.9%	6.5%	-\$251	-\$38	\$187	-\$19	\$3	\$27
Property damage liability	1.0%	8.3%	16.1%	-\$200	-\$4	\$205	-\$2	\$9	\$20

Injury coverage type	Lower bound	FREQUENCY	Upper bound	Lower bound	LOW SEVERITY FREQUENCY	Upper bound	Lower bound	HIGH SEVERITY FREQUENCY	Upper bound
Bodily injury liability	-9.3%	11.3%	36.5%	-30.7%	-1.1%	41.1%	-30.2%	3.2%	52.6%
Medical payment	-9.2%	9.5%	32.0%	-31.2%	16.3%	96.5%	-22.2%	2.5%	35.0%

Personal injury protection	-15.8%	-2.8%	12.3%	-17.8%	14.0%	57.9%	-27.2%	-11.6%	7.4%
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► Appendix C

Illustrative regression results for secondary analysis — collision frequency									
Parameter		Degrees of freedom	Estimate	Effect	Standard error	Wald 95% confidence limits		Chi-square	P-value
Intercept		1	-8.6458		0.1813	-9.0012	-8.2904	2273.60	<0.0001
Calendar year	2011	1	-0.3303	-28.1%	0.0426	-0.4138	-0.2468	60.15	<0.0001
	2012	1	-0.0462	-4.5%	0.0106	-0.0670	-0.0254	18.97	<0.0001
	2013	1	-0.0012	-0.1%	0.0071	-0.0151	0.0127	0.03	0.8642
	2014	0	0	0	0	0	0		
Model year	2012	1	-0.1026	-9.8%	0.0117	-0.1255	-0.0798	77.45	<0.0001
	2013	1	-0.0101	-1.0%	0.0102	-0.0301	0.0100	0.97	0.3259
	2014	0	0	0	0	0	0		
Vehicle series and trim	Accord 2dr EX	1	0.1000	10.5%	0.0325	0.0362	0.1637	9.44	0.0021
	Accord 2dr EX-L	1	0.1181	12.5%	0.0272	0.0648	0.1714	18.89	<0.0001
	Accord 2dr EX-L V6	1	0.1129	12.0%	0.0263	0.0613	0.1645	18.37	<0.0001
	Accord 2dr LX-S	1	0.1538	16.6%	0.0280	0.0989	0.2088	30.08	<0.0001
	Accord 4dr EX	1	-0.0833	-8.0%	0.0262	-0.1347	-0.0320	10.11	0.0015
	Accord 4dr EX-L	1	-0.0372	-3.7%	0.0225	-0.0813	0.0069	2.73	0.0985
	Accord 4dr EX-L V6	1	-0.0689	-6.7%	0.0230	-0.1140	-0.0238	8.97	0.0027
	Accord 4dr LX	1	-0.0076	-0.8%	0.0221	-0.0509	0.0357	0.12	0.7295
	Accord 4dr Sport	1	-0.0168	-1.7%	0.0224	-0.0607	0.0271	0.56	0.4527
	Accord Crosstour 4dr 2WD EX	1	-0.0799	-7.7%	0.0411	-0.1604	0.0007	3.78	0.0520
	Accord Crosstour 4dr 2WD EX-L	1	0.0081	0.8%	0.0400	-0.0703	0.0865	0.04	0.8388
	Accord Crosstour 4dr 2WD EX-L V6	1	0.0381	3.9%	0.0379	-0.0362	0.1125	1.01	0.3150
	Accord Crosstour 4dr 4WD EX-L V6	0	0	0	0	0	0		
Rated driver age group	14–20	1	0.3128	36.7%	0.0210	0.2717	0.3539	222.41	<0.0001
	21–24	1	0.3240	38.3%	0.0145	0.2956	0.3524	499.60	<0.0001
	25–39	1	0.1315	14.1%	0.0078	0.1161	0.1468	281.43	<0.0001
	65+	1	0.0799	8.3%	0.0091	0.0622	0.0977	77.83	<0.0001
	Unknown	1	0.0759	7.9%	0.0159	0.0447	0.1072	22.72	<0.0001
	40–64	0	0	0	0	0	0		
Rated driver gender	Male	1	-0.0467	-4.6%	0.0073	-0.0610	-0.0324	41.10	<0.0001
	Unknown	1	-0.2267	-20.3%	0.0235	-0.2728	-0.1805	92.81	<0.0001
	Female	0	0	0	0	0	0		
Rated driver marital status	Single	1	0.1992	22.0%	0.0079	0.1837	0.2147	634.16	<0.0001
	Unknown	1	0.2548	29.0%	0.0234	0.2088	0.3007	118.16	<0.0001
	Married	0	0	0	0	0	0		
Risk	Nonstandard	1	0.2253	25.3%	0.0119	0.2020	0.2487	356.69	<0.0001
	Standard	0	0	0	0	0	0		
State	Alabama	1	-0.1463	-13.6%	0.1818	-0.5026	0.2100	0.65	0.4210

Illustrative regression results for secondary analysis — collision frequency

Parameter	Degrees of freedom	Estimate	Effect	Standard error	Wald 95% confidence limits		Chi-square	P-value
Arizona	1	-0.1130	-10.7%	0.1814	-0.4686	0.2426	0.39	0.5335
Arkansas	1	-0.0308	-3.0%	0.1849	-0.3931	0.3315	0.03	0.8678
California	1	0.1873	20.6%	0.1799	-0.1653	0.5399	1.08	0.2978
Colorado	1	-0.0733	-7.1%	0.1828	-0.4316	0.2850	0.16	0.6884
Connecticut	1	-0.1235	-11.6%	0.1817	-0.4795	0.2326	0.46	0.4967
Delaware	1	-0.0244	-2.4%	0.1860	-0.3889	0.3402	0.02	0.8958
District of Columbia	1	0.4012	49.4%	0.1891	0.0307	0.7718	4.50	0.0338
Florida	1	-0.3042	-26.2%	0.1801	-0.6573	0.0488	2.85	0.0912
Georgia	1	-0.1965	-17.8%	0.1806	-0.5505	0.1575	1.18	0.2767
Hawaii	1	0.1351	14.5%	0.1875	-0.2324	0.5026	0.52	0.4711
Idaho	1	-0.3885	-32.2%	0.2017	-0.7837	0.0068	3.71	0.0540
Illinois	1	-0.1079	-10.2%	0.1805	-0.4618	0.2459	0.36	0.5499
Indiana	1	-0.2025	-18.3%	0.1821	-0.5594	0.1543	1.24	0.2660
Iowa	1	-0.1530	-14.2%	0.1876	-0.5208	0.2148	0.66	0.4149
Kansas	1	-0.2380	-21.2%	0.1862	-0.6030	0.1270	1.63	0.2012
Kentucky	1	-0.2837	-24.7%	0.1839	-0.6441	0.0768	2.38	0.1229
Louisiana	1	0.1056	11.1%	0.1810	-0.2491	0.4603	0.34	0.5596
Maine	1	-0.1495	-13.9%	0.1974	-0.5365	0.2374	0.57	0.4489
Maryland	1	0.0188	1.9%	0.1805	-0.3351	0.3726	0.01	0.9172
Massachusetts	1	-0.0153	-1.5%	0.1813	-0.3708	0.3401	0.01	0.9326
Michigan	1	0.2768	31.9%	0.1817	-0.0793	0.6329	2.32	0.1276
Minnesota	1	-0.2185	-19.6%	0.1827	-0.5765	0.1395	1.43	0.2317
Mississippi	1	-0.0540	-5.3%	0.1834	-0.4135	0.3054	0.09	0.7683
Missouri	1	-0.2798	-24.4%	0.1827	-0.6378	0.0782	2.35	0.1256
Montana	1	-0.1695	-15.6%	0.2087	-0.5786	0.2396	0.66	0.4167
Nebraska	1	-0.2986	-25.8%	0.1902	-0.6714	0.0742	2.46	0.1165
Nevada	1	-0.1340	-12.5%	0.1846	-0.4959	0.2278	0.53	0.4679
New Hampshire	1	0.1242	13.2%	0.1842	-0.2369	0.4853	0.45	0.5004
New Jersey	1	-0.0869	-8.3%	0.1802	-0.4400	0.2662	0.23	0.6294
New Mexico	1	-0.0849	-8.1%	0.1880	-0.4534	0.2837	0.20	0.6518
New York	1	0.1375	14.7%	0.1800	-0.2153	0.4902	0.58	0.4450
North Carolina	1	-0.3662	-30.7%	0.1807	-0.7204	-0.0120	4.11	0.0427
North Dakota	1	-0.0569	-5.5%	0.2060	-0.4606	0.3468	0.08	0.7822
Ohio	1	-0.2856	-24.8%	0.1805	-0.6395	0.0682	2.50	0.1136
Oklahoma	1	-0.1918	-17.5%	0.1837	-0.5519	0.1683	1.09	0.2965
Oregon	1	-0.1363	-12.7%	0.1841	-0.4970	0.2245	0.55	0.4591
Pennsylvania	1	0.0374	3.8%	0.1803	-0.3160	0.3907	0.04	0.8359
Rhode Island	1	0.0949	10.0%	0.1844	-0.2665	0.4563	0.26	0.6068
South Carolina	1	-0.2895	-25.1%	0.1816	-0.6455	0.0665	2.54	0.1109
South Dakota	1	-0.2071	-18.7%	0.2080	-0.6147	0.2005	0.99	0.3194
Tennessee	1	-0.2253	-20.2%	0.1814	-0.5809	0.1304	1.54	0.2144
Texas	1	-0.1206	-11.4%	0.1801	-0.4736	0.2323	0.45	0.5029
Utah	1	-0.2277	-20.4%	0.1870	-0.5942	0.1388	1.48	0.2234
Vermont	1	-0.0354	-3.5%	0.1999	-0.4272	0.3564	0.03	0.8594

Illustrative regression results for secondary analysis — collision frequency

Parameter	Degrees of freedom	Estimate	Effect	Standard error	Wald 95% confidence limits		Chi-square	P-value
Virginia	1	-0.0811	-7.8%	0.1805	-0.4348	0.2727	0.20	0.6532
Washington	1	-0.1332	-12.5%	0.1819	-0.4898	0.2234	0.54	0.4641
West Virginia	1	-0.2894	-25.1%	0.1908	-0.6633	0.0846	2.30	0.1294
Wisconsin	1	-0.1811	-16.6%	0.1827	-0.5391	0.1770	0.98	0.3216
Wyoming	1	-0.1172	-11.1%	0.2287	-0.5655	0.3312	0.26	0.6085
Alaska	0	0	0	0	0	0		
Deductible range								
0–250	1	0.4788	61.4%	0.0111	0.4570	0.5007	1848.29	<0.0001
1,001+	1	-0.4950	-39.0%	0.0753	-0.6426	-0.3475	43.27	<0.0001
251–500	1	0.2564	29.2%	0.0096	0.2376	0.2752	712.36	<0.0001
501–1,000	0	0	0	0	0	0		
Registered vehicle density								
0–99	1	-0.2623	-23.1%	0.0125	-0.2868	-0.2378	439.50	<0.0001
100–499	1	-0.1790	-16.4%	0.0080	-0.1947	-0.1634	502.45	<0.0001
500+	0	0	0	0	0	0		
Forward Collision Warning & Lane Departure Warning	1	-0.0633	-6.1%	0.0237	-0.1097	-0.0169	7.14	0.0075
LaneWatch	1	0.0184	1.9%	0.0228	-0.0262	0.0631	0.65	0.4185



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