# Glass losses for Kia SUVs with panoramic roofs

▶ **Summary**

Previous Highway Loss Data Institute (HLDI) reports have shown that glass claim severities have been increasing over the past five years. This report examines select Kia SUVs to understand the extent to which panoramic roofs may be contributing to this increase, as well as their impact on glass claim frequency and overall losses. Glass claim frequency for vehicles with standard panoramic roofs is 10 percent higher than for vehicles without such roofs available. Glass claim severity is 26 percent higher, and overall losses are 39 percent higher. Among vehicles that may be equipped with optional panoramic roofs, glass claim frequency is 5 percent higher, glass claim severity is 20 percent higher, and overall losses are 26 percent higher than for vehicles without panoramic roofs available. The smaller effect among this group likely reflects the fact that some vehicles likely were not equipped with these roofs.

Estimated differences in glass claim frequency, severity, and overall losses for vehicles with and without glass panoramic roofs
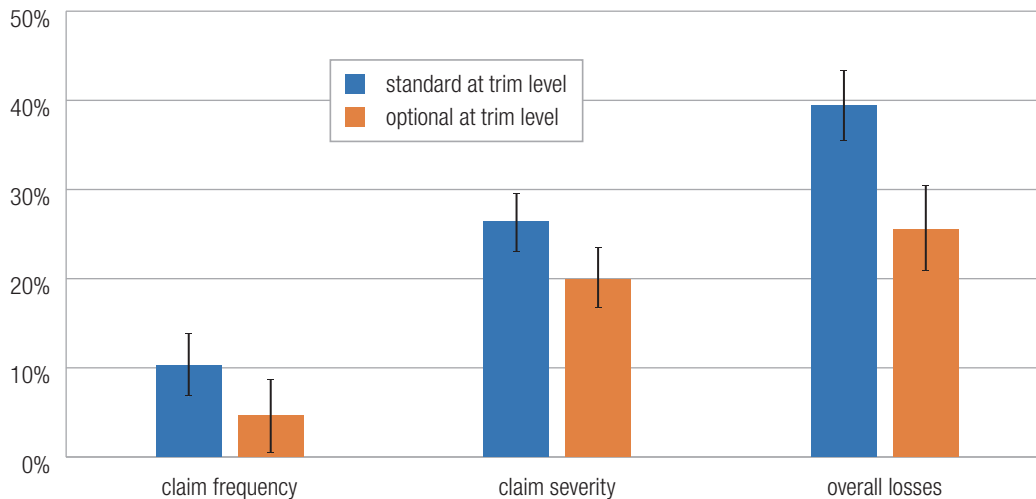
▸ Introduction

Glass claim severities have been increasing over the past five years (HLDI, 2017). **Figure 1** shows glass claim severities by calendar year and vehicle type based on the four most recent model years.

Figure 1: Glass claim severities by calendar year and vehicle type based on four most recent model years
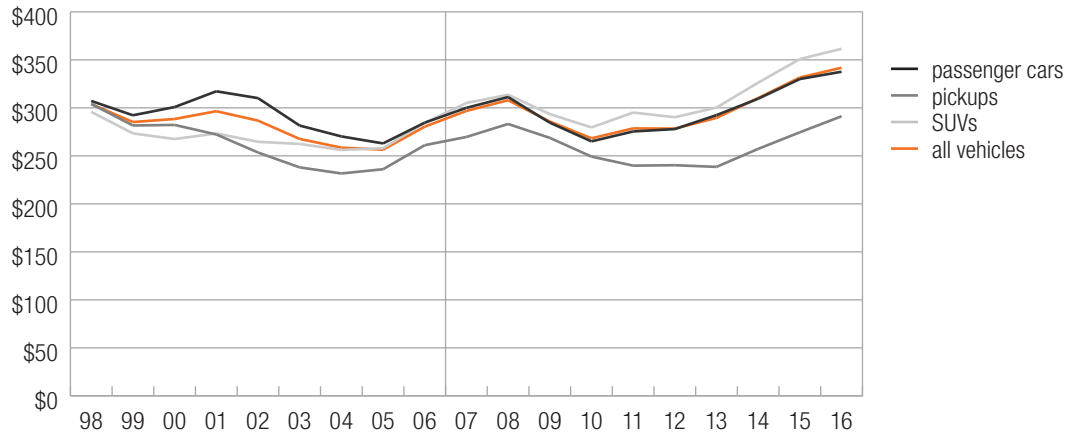
Some vehicles with panoramic roofs have one large glass panel, or multiple glass panels spanning the roof of the vehicle. In some vehicles, these panels open in a manner similar to a traditional sunroof. This report examines select Kia SUVs to understand the extent to which panoramic roofs may be contributing to this increase, as well as their impact on glass claim frequencies, claim severities, and overall losses. The comprehensive glass exposure (measured in insured vehicle years) for the study vehicles by panoramic roof availability are shown in **Table 1**. Exposure is measured in insured vehicle years. An insured vehicle year is one vehicle insured for one year, two vehicles for 6 months, etc.

Table 1: Panoramic roof comprehensive glass exposure	
Panoramic roof availability	**Exposure (insured vehicle years)**
Standard	81,751
Optional	71,371
Not available	380,653

▸ Methods

Vehicles

The vehicles in this study are the 2014-15 Kia Sorento 2WD/4WD and the 2016 Kia Sportage 2WD/4WD. They were selected because panoramic roof availability (standard, optional, or not available) was tied to a VIN-discernible trim level. In addition, these vehicles do not have any Advanced Driver Assistance Systems (ADAS) that use windshield-mounted sensors.

Insurance Data

Automobile insurance covers damage 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 comprehensive coverage. Comprehensive coverage insures against theft or physical damage to insured vehicles that occurs for reasons other than crashes. Glass losses are filed under comprehensive and cover the repair or replacement of vehicle glass due to damage from rocks or other road debris and from other noncollision events.

Statistical Methods

Regression analysis was used to quantify the effect of the panoramic glass roof on glass losses while controlling for other covariates. Covariates included calendar 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, and risk. Based on the model year, make, and series, a single variable called SERIESMY was created for inclusion in the regression model. Statistically, including such a variable is equivalent to including the interaction of model year, make, and series. This variable effectively restricted the estimation of the effect of the glass panoramic roof within model year, make, and series, preventing the confounding of the panoramic roof effect with other vehicle design changes that could occur from model year to model year.

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.

For space reasons, illustrative full regression results on glass claim frequency are shown in the Appendix for the vehicle set with standard, optional, and not available panoramic roofs. To further simplify the presentation here, the exponent of the parameter estimate was calculated, 1 was subtracted, and the result multiplied by 100. The resulting number corresponds to the effect of the covariate on that loss measure. For example, the estimate of the effect of a standard panoramic roof on glass claim frequency was 0.0977; thus vehicles with standard panoramic roofs had 10.3 percent more glass claims than expected $((\exp(0.0977)-1)*100 = 10.3\%)$.

▸ Results

Figure 2 shows the results of the regression analysis on comprehensive glass losses for vehicles with standard or optional glass panoramic roofs compared with the same vehicles without an available glass panoramic roof. The blue bars compare vehicles that have glass panoramic roofs standard at certain trim levels with those that do not have it available. The orange bars compare vehicles that have glass panoramic roofs as an option at certain trim levels with those that do not have it available. The black bars correspond to the 95 percent confidence intervals. Glass claim frequencies, claim severities, and overall losses are significantly higher for both categories of vehicles than vehicles without glass panoramic roofs. For vehicles with the glass panoramic roof standard, glass claim frequency was 10 percent higher, claim severity was 26 percent higher, and overall losses were 39 percent higher. For vehicles with glass panoramic roofs optional, claim frequency was 5 percent higher, claim severity was 20 percent higher, and overall losses were 26 percent higher. All of these results were statistically significant.

Figure 2: Estimated differences in glass claim frequency, severity, and overall losses for vehicles with and without glass panoramic roofs
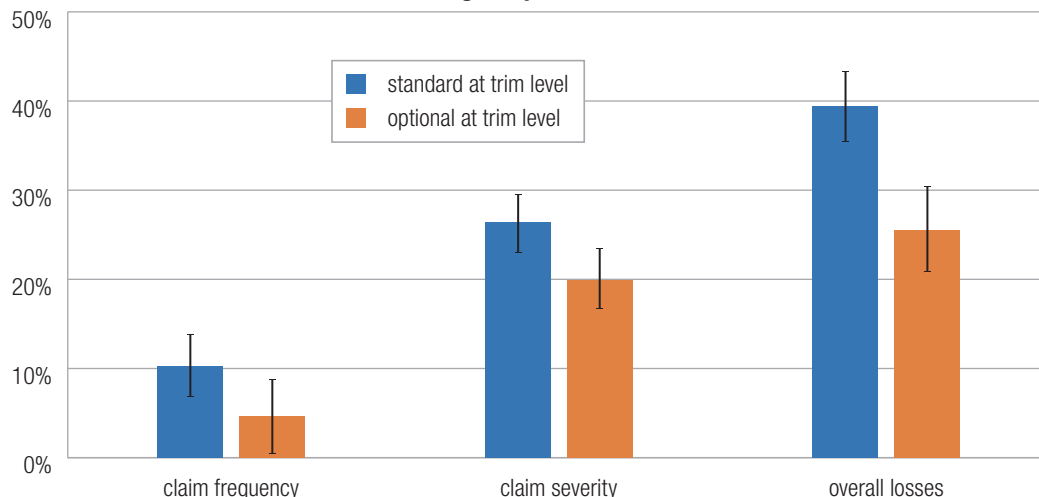
▸ Discussion

Glass losses for vehicles with standard or optional panoramic roofs are significantly higher than vehicles without panoramic roofs. In addition, the increase is greater for vehicles with standard panoramic roofs than vehicles with optional panoramic roofs, which is expected, since not all vehicles with the option actually have it. Panoramic roofs are becoming much more widely available, with one-quarter of midsize SUVs and more than half of midsize luxury SUVs having panoramic roofs available. Over the past few years, glass claim severities have been going up, and panoramic roofs are likely a contributing factor, with the cost to replace these glass roofs running $800-$1,000.

▸ What's Next

This is a preliminary look at glass losses for vehicles with panoramic roofs based on a limited sample of vehicles. As panoramic roofs become more widely available and more data is collected, HLDI will continue to study this on a larger scale.

References

Highway Loss Data Institute. 2017. Glass losses: 2014–16 passenger cars, pickups, SUVs, and vans. *Insurance Report.* G-16. Arlington, VA

▸ Appendix

Appendix: Illustrative regression results - glass claim frequency								
Parameter		Degrees of freedom	Estimate	Effect	Standard error	Wald 95% confidence limits		Chi-square	P-value
Intercept		1	-9.1137		0.0292	-9.1710	-9.0565	97247.10	<0.0001
Rated driver age group	14–24	1	-0.0457	-4.5%	0.0326	-0.1095	0.0181	1.97	0.1601
	65+	1	-0.3093	-26.6%	0.0177	-0.3441	-0.2746	304.08	<0.0001
	Unknown	1	0.1496	16.1%	0.0395	0.0722	0.2270	14.35	0.0002
	25–64	0	0	0	0	0	0		
Risk	Nonstandard	1	-0.2688	-23.6%	0.0360	-0.3394	-0.1982	55.74	<0.0001
	Standard	0	0	0	0	0	0		
State	Alabama	1	-0.0757	-7.3%	0.0559	-0.1852	0.0339	1.83	0.1758
	Alaska	1	0.7413	109.9%	0.0842	0.5764	0.9063	77.57	<0.0001
	Arizona	1	1.3426	282.9%	0.0315	1.2809	1.4042	1821.45	<0.0001
	Arkansas	1	-0.0561	-5.5%	0.0750	-0.2031	0.0909	0.56	0.4546
	California	1	-0.2705	-23.7%	0.0379	-0.3447	-0.1963	51.02	<0.0001
	Colorado	1	0.8381	131.2%	0.0400	0.7596	0.9166	438.14	<0.0001
	Connecticut	1	-0.0706	-6.8%	0.0688	-0.2054	0.0643	1.05	0.3051
	Delaware	1	-0.4629	-37.1%	0.1051	-0.6689	-0.2568	19.39	<0.0001
	Dist of Columbia	1	-0.8725	-58.2%	0.3545	-1.5672	-0.1777	6.06	0.0138
	Florida	1	-0.0662	-6.4%	0.0306	-0.1262	-0.0061	4.67	0.0308
	Georgia	1	-0.4673	-37.3%	0.0416	-0.5488	-0.3859	126.45	<0.0001
	Hawaii	1	-1.1586	-68.6%	0.2511	-1.6507	-0.6665	21.30	<0.0001
	Idaho	1	0.7603	113.9%	0.0751	0.6132	0.9074	102.61	<0.0001
	Illinois	1	-0.7350	-52.0%	0.0499	-0.8329	-0.6372	216.89	<0.0001
	Indiana	1	-0.8388	-56.8%	0.0753	-0.9864	-0.6912	124.10	<0.0001
	Iowa	1	-0.3506	-29.6%	0.0790	-0.5054	-0.1957	19.68	<0.0001
	Kansas	1	-0.1234	-11.6%	0.0734	-0.2672	0.0204	2.83	0.0925
	Kentucky	1	-0.2166	-19.5%	0.0626	-0.3394	-0.0938	11.96	0.0005
	Louisiana	1	0.3370	40.1%	0.0494	0.2402	0.4338	46.53	<0.0001
	Maine	1	-0.3191	-27.3%	0.1024	-0.5197	-0.1185	9.72	0.0018
	Maryland	1	-0.2212	-19.8%	0.0522	-0.3236	-0.1188	17.94	<0.0001
	Massachusetts	1	0.8422	132.1%	0.0448	0.7543	0.9300	352.84	<0.0001
	Michigan	1	0.0495	5.1%	0.0579	-0.0641	0.1630	0.73	0.3933
	Minnesota	1	0.4748	60.8%	0.0409	0.3946	0.5550	134.60	<0.0001
	Mississippi	1	0.2839	32.8%	0.0830	0.1213	0.4466	11.70	0.0006
	Missouri	1	-0.2251	-20.2%	0.0550	-0.3329	-0.1173	16.75	<0.0001
	Montana	1	0.5420	71.9%	0.1259	0.2953	0.7887	18.54	<0.0001
	Nebraska	1	-0.2767	-24.2%	0.1075	-0.4873	-0.0661	6.63	0.01
	Nevada	1	0.0490	5.0%	0.0732	-0.0944	0.1925	0.45	0.5027
	New Hampshire	1	-0.1470	-13.7%	0.0925	-0.3283	0.0343	2.52	0.1121
	New Jersey	1	-0.8061	-55.3%	0.0546	-0.9131	-0.6990	217.82	<0.0001
	New Mexico	1	0.3000	35.0%	0.0817	0.1399	0.4601	13.49	0.0002
	New York	1	0.1019	10.7%	0.0328	0.0376	0.1661	9.67	0.0019
	North Carolina	1	-0.2514	-22.2%	0.0437	-0.3371	-0.1658	33.08	<0.0001

Parameter		Degrees of freedom	Estimate	Effect	Standard error	Wald 95% confidence limits		Chi-square	P-value
	North Dakota	1	0.1239	13.2%	0.1060	-0.0838	0.3317	1.37	0.2422
	Ohio	1	-0.4672	-37.3%	0.0418	-0.5491	-0.3852	124.88	<0.0001
	Oklahoma	1	-0.6955	-50.1%	0.0957	-0.8831	-0.5079	52.79	<0.0001
	Oregon	1	-0.0871	-8.3%	0.0666	-0.2177	0.0434	1.71	0.1908
	Pennsylvania	1	-0.5342	-41.4%	0.0387	-0.6100	-0.4584	190.95	<0.0001
	Rhode Island	1	-0.2323	-20.7%	0.1139	-0.4556	-0.0091	4.16	0.0414
	South Carolina	1	0.5462	72.7%	0.0393	0.4692	0.6232	193.23	<0.0001
	South Dakota	1	0.3110	36.5%	0.1013	0.1124	0.5096	9.42	0.0021
	Tennessee	1	-0.7767	-54.0%	0.0613	-0.8968	-0.6565	160.57	<0.0001
	Utah	1	0.7110	103.6%	0.0609	0.5916	0.8305	136.15	<0.0001
	Vermont	1	0.1733	18.9%	0.1087	-0.0397	0.3864	2.54	0.1109
	Virginia	1	-0.1309	-12.3%	0.0444	-0.2180	-0.0438	8.68	0.0032
	Washington	1	0.2413	27.3%	0.0460	0.1511	0.3316	27.47	<0.0001
	West Virginia	1	-0.6755	-49.1%	0.0660	-0.8048	-0.5462	104.84	<0.0001
	Wisconsin	1	-0.4731	-37.7%	0.0614	-0.5935	-0.3527	59.31	<0.0001
	Wyoming	1	0.2349	26.5%	0.1290	-0.0179	0.4876	3.32	0.0686
	Texas	0	0	0	0	0	0		
Rated driver gender	Male	1	-0.0202	-2.0%	0.0141	-0.0479	0.0074	2.05	0.1519
	Unknown	1	-0.1977	-17.9%	0.0568	-0.3091	-0.0863	12.11	0.0005
	Female	0	0	0	0	0	0		
Rated driver marital status	Single	1	-0.0307	-3.0%	0.0153	-0.0607	-0.0006	4.00	0.0454
	Unknown	1	-0.0156	-1.5%	0.0555	-0.1244	0.0932	0.08	0.7786
	Married	0	0	0	0	0	0		
Deductible range	0	1	0.7144	104.3%	0.0246	0.6663	0.7626	845.26	<0.0001
	1–50	1	0.5862	79.7%	0.0371	0.5134	0.6590	249.20	<0.0001
	51–100	1	0.4226	52.6%	0.0179	0.3876	0.4577	558.41	<0.0001
	101–200	1	0.2681	30.7%	0.0389	0.1918	0.3444	47.43	<0.0001
	201–250	1	0.2330	26.2%	0.0190	0.1958	0.2702	150.73	<0.0001
	501–1,000	1	-0.0889	-8.5%	0.0242	-0.1364	-0.0414	13.44	0.0002
	> 1,000	1	-0.2346	-20.9%	0.1191	-0.4681	-0.0012	3.88	0.0488
	251–500	0	0	0	0	0	0		
Density	<50	1	0.2578	29.4%	0.0257	0.2074	0.3082	100.46	<0.0001
	50–99	1	0.1543	16.7%	0.0245	0.1063	0.2022	39.74	<0.0001
	100–249	1	0.1992	22.0%	0.0214	0.1573	0.241	86.92	<0.0001
	250–499	1	0.2416	27.3%	0.0207	0.2010	0.2822	135.99	<0.0001
	500–999	1	0.0789	8.2%	0.0208	0.0382	0.1195	14.44	0.0001
	1,000+	0	0	0	0	0	0		
Calendar year	2013	1	-0.1451	-13.5%	0.0336	-0.2109	-0.0793	18.67	<0.0001
	2014	1	0.0459	4.7%	0.0187	0.0092	0.0825	6.02	0.0141
	2015	1	0.1018	10.7%	0.0152	0.0721	0.1316	44.93	<0.0001
	2017	1	-0.0772	-7.4%	0.0212	-0.1188	-0.0356	13.24	0.0003
	2016	0	0	0	0	0	0		

Table title: Appendix: Illustrative regression results - glass claim frequency

Parameter		Degrees of freedom	Estimate	Effect	Standard error	Wald 95% confidence limits		Chi-square	P-value
Appendix: Illustrative regression results - glass claim frequency									
Vehicle model year, make, and series	2014 Kia Sorento 4dr 4X4	1	0.0169	1.7%	0.0195	-0.0214	0.0551	0.75	0.3874
	2015 Kia Sorento 4dr 4X2	1	0.0356	3.6%	0.0168	0.0026	0.0686	4.48	0.0343
	2015 Kia Sorento 4dr 4X4	1	0.0677	7.0%	0.0221	0.0244	0.1110	9.41	0.0022
	2016 Kia Sportage 4dr 4X2	1	-0.1622	-15.0%	0.0398	-0.2402	-0.0842	16.62	<0.0001
	2016 Kia Sportage 4dr 4X4	1	-0.2275	-20.3%	0.0411	-0.3081	-0.1469	30.58	<0.0001
	2014 Kia Sorento 4dr 4X2	0	0	0	0	0	0		
Panoramic roof	Standard	1	0.0977	10.3%	0.0168	0.0648	0.1306	33.82	<0.0001
	Optional	1	0.0453	4.6%	0.0195	0.0071	0.0835	5.40	0.0201
	Not available	0	0	0	0	0	0		