

**FIXED-SITE AMUSEMENT RIDE INJURY SURVEY, 2012 UPDATE**

**Prepared for  
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## Preface

This report presents the results of work done by the National Safety Council, Research and Statistical Services Group, under contract to the International Association of Amusement Parks and Attractions. It includes estimates by the Council for calendar years 2003 through 2012. The Council's work is an extension of, but independent of, the estimates made for 2001-2002 by Heiden Associates, which are included here for reference and reported more fully in the June/July 2003 issue of *Injury Insights* (Heiden & McGonegal, 2003).

### **FIXED-SITE AMUSEMENT RIDE INJURY SURVEY, 2012 UPDATE**

Since 2001 the International Association of Amusement Parks and Attractions (IAAPA) has sponsored an annual survey to collect and analyze ride, attendance, and patron injury data from facilities that operate fixed-site amusement rides. The IAAPA survey was undertaken to gain perspective on fixed-site amusement ride injuries in the United States. The surveys include amusement and theme parks, tourist attractions, and family entertainment centers. The results of these surveys are presented below.

Facilities were asked to report attendance and ridership as well as the number of patron injuries. Separate attendance-based and ridership-based analyses were performed and are shown in Table 2. Updated attendance and ridership estimates were made using data from parks that reported attendance and/or ridership for 2012. This method differs from the one used from 2007-2011 that used the overall percentage changes in attendance and/or ridership for all parks reporting for both the current and prior year and makes use of all of the 2012 data reported. The resulting attendance estimate for 2012 was somewhat higher using the current method, while the ridership estimate was lower. Because the new method allows for the inclusion of data from all responding parks instead of a subset of parks, the 2012 estimates are more representative of the universe of all parks and thus provide an enhanced level of injury estimate accuracy.

To be consistent with the estimates previously reported for 2001-2002, the summary of results is shown in Table 1. Estimated attendance in 2012 was up 9% from 2011 and estimated ridership was down 11%. The 11% decrease in the ridership estimate is the result of the new estimate method and reflects the likely over estimate in ridership in previous years. For comparison purposes, a secondary analysis using consistent estimate methods showed a 9% increase in ridership from 2011 to 2012 (consistent with attendance estimates).

**Table 1. Summary of Results**

Year	Estimated Number of Facilities w/Rides in the U.S.	Estimated Annual Attendance (millions)	Estimated Annual Ridership (billions)	Estimated Annual Number of Ride-Related Injuries	Injuries per Million Attendance
2001-2002	459	302.9	---	2,486	8.2
2003*	403	300.4	1.95	2,044	7.0
2004	403	300.0	1.81	1,637	5.2
2005	398	300.4	1.82	1,783	5.2
2006	395	291.7	1.76	1,797	6.6
2007	395	292.1	1.78	1,664	4.6
2008	422	291.2	1.70	1,523	4.7
2009	398	278.4	1.69	1,181	4.4
2010	386	290.1	1.70	1,299	4.4
2011	383	297.4	1.69	1,204	4.3
2012	373	324.1	1.51	1,424	4.6

Source: 2001-2002, Heiden & McGonegal (2003). 2003-2012, National Safety Council estimates based on fixed-site amusement ride injury surveys.

\*Changes in the estimating method beginning with 2003 affect comparability with the 2001-2002 survey.

Not all facilities were able to report both attendance and ridership and therefore there were differences in the selection of facilities used in each analysis. Table 2 presents the attendance-based estimates of ride related injuries compared to ridership-based estimates of ride related injuries for the period 2003-2012. The difference between the

two injury estimates has varied from as little as 11 in 2004 to as much as 355 in 2007. In 2012, the attendance-based injury estimate of 1,424 exceeded the ridership-based estimate by 77 injuries.

The distributions of injuries by ride type and injury severity for 2012 obtained from the ridership-based estimates were similar to the distributions obtained from the attendance-based estimates for total injuries, serious injuries, and other injuries. The largest portion of injuries for both sets of estimates took place on family and adult rides, followed by roller coasters and children’s rides. However, the portion of injuries by injury severity for children’s rides was uniformly higher in the attendance-based analysis compared to the ridership-based analysis, while the reverse was true for roller coasters. The portion of injuries by injury severity on family and adult rides for “other injuries” and “total injuries” was higher in the attendance-based analysis compared to the ridership-based analysis, while for serious injuries the portion of injuries was slightly higher in the ridership-based analysis.

**Table 2. Attendance-Based vs. Ridership-Based Injury Estimates, 2003-2012**

Year	Attendance-Based		Ridership-Based		Difference between attendance-based and ridership-based injury count
	Estimated Annual Number of Ride-Related Injuries	Injuries per Million Attendance	Estimated Annual Number of Ride-Related Injuries	Injuries per Million Patron-Rides	
2003	2,044	7.0	1,954	1.0	+90
2004	1,637	5.2	1,648	0.9	-11
2005	1,783	5.2	1,713	0.9	+70
2006	1,797	6.6	1,546	0.9	+251
2007	1,664	4.6	1,309	0.7	+355
2008	1,523	4.7	1,343	0.8	+180
2009	1,181	4.4	1,086	0.6	+95
2010	1,299	4.4	1,207	0.7	+92
2011	1,204	4.3	1,415	0.8	-211
2012	1,424	4.6	1,347	0.9	+77

Source: National Safety Council estimates based on annual fixed-site amusement ride injury surveys.

Ridership and attendance-based injury estimates again show divergent trends in 2012:

Attendance-based:

- The estimated injury total and the injury rate per million attendees were each up in 2012 compared to 2011 (1,424 vs. 1,204 injuries and 4.63 vs. 4.25 injuries per million attendees, respectively).
- Compared to 2003, both the estimated number of injuries and the injury rate per million attendees in 2012 were down—by 30% and 34%, respectively.

Ridership-based:

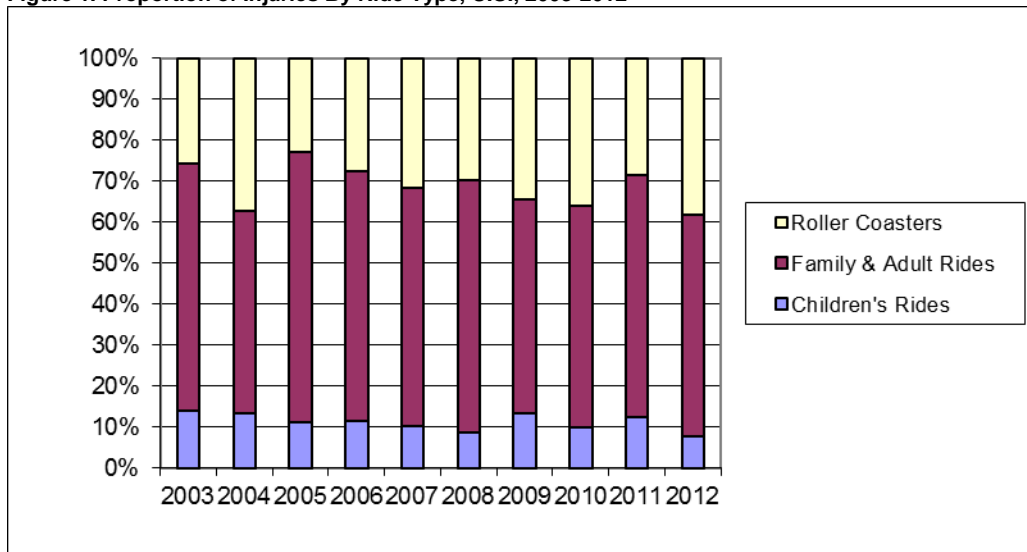
- The estimated injury total was down 5% in 2012 compared to 2011 (1,347 vs. 1,415 injuries), while the injury rate per million patron-rides was up 6% (0.89 vs. 0.84)
- Compared to 2003, both the estimated number of injuries and the injury rate per million patron-rides in 2011 were down—by 31% and 10%, respectively.

The primary factors underlying the difference between the attendance and ridership-based estimates were differences in the data reported by small parks and family entertainment centers (FECs). In the attendance-based analysis, small parks reported a 30% higher attendance figure than for the previous year while also reporting higher injury totals, while FECs reported a 59% higher attendance figure and injury totals over double those of the previous year. These increases in attendance and injuries resulted in higher injury rates and therefore higher injury estimates for total, serious injury, and other reportable injuries for small parks and FECs. Conversely, in the ridership-based analysis, the much lower injury estimates for small parks resulting from an 82% increase in ridership combined with similar injury totals was not quite offset by the higher injury estimates produced by slightly lower ridership combined with higher injury totals in the case of large parks and increased ridership combined with higher injury totals for both attractions and FECs, resulting in the 5% decline in the number injuries. The pattern of results just described was observed whether using the new or previous estimation method.

Ridership-based rates are perhaps a more appropriate measure of exposure to risk than attendance-based rates because injuries on rides are the outcome of interest. Parks with similar attendance may have much different ridership numbers because of differences in the number and kinds of amusement rides provided. **The results discussed in the remainder of the report are based on the ridership analysis, which is shown in Table 3.**

As shown in Figure 1, about 54% of the injuries in 2012 occurred on family and adult rides compared to 59% in 2011, 54% in 2009, and 52% in 2009. The overall number of injuries on family and adult rides in 2012 was down 13% compared to 2011. The number of injuries on children’s rides decreased from 175 in 2011 to 104 in 2012, with the overall proportion of injuries on children’s rides decreasing 38% -- from 12.4% to 7.7%. Roller coasters accounted for 38.2% of the injuries in 2012, up from 28.6% in 2011. Unlike the decreases observed for children’s and family and adult rides, the overall number of injuries on roller coasters increased 27.2% from 2011 to 2012.

**Figure 1. Proportion of Injuries By Ride Type, U.S., 2003-2012**



Source: National Safety Council estimates based on annual fixed-site amusement ride injury surveys.

In 2012, the injury rate per million patron-rides was 0.8 for family and adult rides, 1.5 for roller coasters, and 0.50 for children’s rides. The difference between the injury rate for children’s rides and family and adult rides is statistically significant, as is the difference between the injury rate for family and adult rides and roller coasters and the difference between the injury rate for children’s rides and roller coasters.

About 6.8% of the injuries were reported to be “serious,” meaning an injury resulting in immediate admission and hospitalization in excess of 24 hours for purposes other than medical observation. The remaining 93.2% were reportable injuries that were other than serious. The proportion of injuries that were serious in 2012 was up 58% from the proportion in 2011 and was the highest since 2006. The rate of serious injuries per million patron-rides was 0.06 in 2012—up 50% from 0.04 in 2011 and also the highest since 2006.

**Table 3. Summary of Estimated Fixed-Site Amusement Ride-Related Injuries, U.S., 2003-2012 (based on ridership)**

Year	Characteristic	Injuries by Ride Type				Injuries by Severity		
		Total	Children's Rides	Family and Adult Rides	Roller Coasters	Total	Serious Injuries	Other Reportable Injuries
2003	Estimated Number of Injuries	1,954	277	1,173	504	1,954	106	1,848
	Percent	100.0%	14.2	60.1	25.8	100.0%	5.4	94.6
	Injuries per Million Patron-rides	1.0	1.2	1.0	1.0	1.0	0.1	1.0
2004	Estimated Number of Injuries	1,648	219	806	613	1,648	132	1,516
	Percent	100.0%	13.3	49.5	37.2	100.0%	8.0	92.0
	Injuries per Million Patron-rides	0.9	1.0	0.8	1.2	0.9	0.1	0.8
2005	Estimated Number of Injuries	1,713	192	1,131	390	1,713	132	1,582
	Percent	100.0%	11.2	66.0	22.8	100.0%	7.7	92.3
	Injuries per Million Patron-rides	0.9	0.8	1.0	0.9	0.9	0.1	0.9
2006	Estimated Number of Injuries	1,546	177	943	426	1,546	135	1,411
	Percent	100.0%	11.4	61.0	27.6	100.0%	8.7	91.3
	Injuries per Million Patron-rides	0.9	0.7	0.9	1.0	0.9	0.1	0.8
2007	Estimated Number of Injuries	1,309	134	759	416	1,309	35	1,274
	Percent	100.0%	10.2	58.0	31.8	100.0%	2.7	97.3
	Injuries per Million Patron-rides	0.7	0.5	0.7	0.9	0.7	0.02	0.7
2008	Estimated Number of Injuries	1,343	117	827	399	1,343	80	1,264
	Percent	100.0%	8.7	61.5	29.7	100.0%	5.9	94.1
	Injuries per Million Patron-rides	0.8	0.6	0.8	1.0	0.8	0.05	0.7
2009	Estimated Number of Injuries	1,086	145	565	375	1,086	65	1,021
	Percent	100.0%	13.4	52.1	34.5	100.0%	6.0	94.0
	Injuries per Million Patron-rides	0.6	0.6	0.5	0.9	0.6	0.04	0.6
2010	Estimated Number of Injuries	1,207	122	652	433	1,207	59	1,148
	Percent	100.0%	10.1	54.0	35.9	100.0%	4.9	95.1
	Injuries per Million Patron-rides	0.7	0.5	0.6	1.0	0.7	0.03	0.7
2011	Estimated Number of Injuries	1,415	175	836	405	1,415	61	1,355
	Percent	100.0%	12.3	59.0	28.6	100.0%	4.3	95.7
	Injuries per Million Patron-rides	0.8	1.0	0.8	1.0	0.8	0.04	0.8
2012	Estimated Number of Injuries	1,347	104	728	515	1,347	91	1,256
	Percent	100.0%	7.7	54.1	38.2	100.0%	6.8	93.2
	Injuries per Million Patron-rides	0.9	0.5	0.8	1.5	0.9	0.06	0.8

Source: National Safety Council estimates based on annual fixed-site amusement ride injury surveys.

Note: Totals may not equal sum of parts due to rounding.

### Survey Response

Of the 373 eligible facilities with rides in 2011, a total of 175 provided some or all of the data requested (39 provided attendance data only, 21 provided ridership data only, 106 provided both attendance and ridership data, and 9 provided injury data only). The respondents used in the analyses represented about 67.6% of the estimated total annual attendance and 77.0% of the estimated total rides taken at all facilities.

The table below summarizes the number of facilities whose data were used for the attendance-based and ridership-based estimates from 2004-2012. It was impractical to find a single set of facilities that reported all data (attendance, ridership, and injuries) for all years as that would have reduced the reliability of the estimates.

Year	Number of facilities used for injury estimates	
	Attendance-based	Ridership-based
2004	124	99
2005	117	90
2006	124	97
2007	125	104
2008	153	134
2009	113	105
2010	104	96
2011	117	100
2012	143	126

#### 2003-2012 Methodology

The National Safety Council conducted the survey using a master list of amusement/theme parks, family entertainment centers, and tourist attractions thought to have fixed-site rides. The master list was prepared in consultation with IAAPA and Amusement Industry Consulting, Inc. The survey consisted of a notification letter, a package of reporting information mailed one week later, a follow-up postcard mailed one week after the reporting package, and a final follow-up postcard mailed at the end of the response period. In 2012, two subsequent follow-ups to all nonrespondents were conducted via e-mail. After the mailings and electronic follow-up, IAAPA volunteers made follow-up telephone calls and sent e-mails to IAAPA member facilities. Injury rates based on the reporting facilities were used to estimate national totals. (See also “Survey Response” above.)

#### 2001-2002 Methodology

In 2001 and 2002 IAAPA mailed survey questionnaires to members previously identified as having fixed-site amusement rides. IAAPA retained Heiden Associates, Washington, DC, to analyze the survey results. Using the IAAPA survey results and other data, Heiden Associates estimated the number of U.S. facilities with one or more fixed-site amusement rides and the injury totals and rates.

#### References

Heiden, E.J., & McGonegal, S. (2003). 2001-2002 fixed-site amusement ride injury survey analysis. *Injury Insights*, June/July 2003.