**Are Amusement Park Rides Safe?**

by Lisa Fritscher, Demand Media



Despite the headlines, most amusement park rides are relatively safe.

Amusement park ride accidents create headlines around the world. When someone is injured or killed at an amusement park, it shatters our sense of safety and makes us wonder whether we could be next, but in fact the chance of an accident is quite low. According to the International Association of Amusement Parks and Attractions' (IAAPA) yearly safety reports, 1.7 billion rides in the United States resulted in 1,343 injuries in 2008, of which 80 required overnight hospitalization. While amusement park rides are generally safe, understanding the types of risks involved can further lower your odds of an accident.

**Mechanical Operations**

Amusement park rides are governed by both state law and industry standards. Since 1978, the American Society for Testing and Materials (ASTM) has issued formal international standards for amusement rides through its F-24 Committee. Ride inspection and maintenance schedules, the design of ride restraints and even height requirements are among the topics addressed. Mechanical failures are rare, thanks to the intense inspections that rides undergo. Nonetheless, if a ride looks rickety or unstable, or if any part of your seat seems loose or broken, skip the ride.

**Ride Operators**

Most modern thrill rides are built with fail-safe technology, making it impossible to launch the ride unless all safety restraints are properly fastened and the track ahead is clear. Older and smaller rides, however, might depend on the operator’s visual inspection. Ride operators also have access to emergency stops for most rides in the event that something goes wrong. Keep an eye on the ride operators as you wait in line, and skip the ride if they seem inattentive or uncaring.

**Height and Weight Considerations**

Most high-velocity rides carry a minimum height requirement. Never try to sneak your child onto a ride for which he does not meet the requirement, since he might be too small for the restraints to work effectively. Even if everyone in your group meets the height requirement, improper seating can increase your risks. Pay close attention to boarding signs. Some attractions require smaller guests to sit toward the inside to prevent being squashed by a larger guest during turns or spins. Smaller riders are more prone to sliding around on a seat and potentially ending up in a dangerous position. Riders who are particularly tall or heavy might not quite “fit” in the seat, making them more difficult to restrain. Check everyone’s restraints for comfort and fit.

**Rider Physical Condition**

Most roller coasters and thrill rides carry standard boilerplate warnings about heart, back and neck conditions. These “one size fits all” warnings help minimize liability for the park but do little to help visitors make an informed decision on what to ride. In general, you should be in good health and feeling good when you take on a thrill ride. If you suffer from any medical condition, talk with your doctor before your trip. He can help you decide whether specific rides are right for you.

**Rider Behavior**

Many amusement park accidents are caused by intentional or unintentional rider behavior. Small children might panic and try to get off a moving ride. Some teens get caught up in horseplay or competition and try to climb between ride cars. Some adults become worried about their children’s reactions and remove their own restraints to try to get to a scared child. Pay attention to signage and verbal instructions from the ride operator. Keep your feet on the floor, face forward with your head back against the headrest and stay fully seated. Brace yourself with your hands. Tie back long hair and place loose items in a locker.

**Freefall (ride)**

From Wikipedia, the free encyclopedia

The Freefall is an amusement ride developed by Giovanola and marketed throughout the world by Swiss company, Intamin. Two generations of this ride were developed. First generation Freefall rides can be identified by the angled supports at the base of the lift tower. Second generation Freefall rides had a more streamlined tower structure. It was a common ride at major amusement parks until the 1990s, when the Drop Tower was developed. Since then, Freefalls have been disappearing from the midways, to be replaced by newer-technology rides. Riders are required to be 42 inches (107 cm) tall or more.

On an original 1st generation Freefall, the car carries 4 people. The car loads in the station. Once it does, the cars move backwards to the rear of the ride. Then, the car is carried to the top of the lift structure. Once there, the car slides forward and hangs over the drop track. The car is released after a few seconds. At the bottom of the tower, the car pulls out of the dive - it is now horizontal, and riders are facing the sky. The car slows as it rolls through the brake run, and then stops near the end. Following this, the car moves backwards, and a mechanism swings the car down. At this point, the ride car is at a 45 degree angle, and the riders are traveling in reverse. Then, the car slides to the station (below the brake run) and stops for loading.

**Accidents**

**Illinois**

In 1984, an accident occurred on "The Edge", a Freefall ride at Six Flags Great America in Gurnee, Illinois. A supporting cable snapped, and the mechanism's anti-rollback devices failed to stop the car from plummeting to the bottom of the tower. Contrary to public belief and rumour, it did not crash down on top of another car and no one was killed in the accident. Four teens were treated at a local hospital and released. To prevent this type of accident from recurring, Intamin doubled the number of anti-rollbacks on the tower and the ride programming was changed so that a car did not enter the elevator shaft until the previous car has completed its descent from the tower. This change slightly lowered the ride's capacity.

The Edge re-opened after having been refitted, but the stigma associated with the accident caused ridership to be low. It closed after the following year and was relocated to Rocky Point Amusement Park, where it received the generic Freefall name, before going to Geauga Lake under the name "Mr. Hyde's Nasty Fall" with a new control system. The ride was dismantled in 2006. Parts from it were then sent to Cedar Point and used to maintain Demon Drop.

**Kentucky**

In 1995, Kentucky Kingdom opened the very first Intamin 2nd generation freefall, called Hellevator. In 2007, the ride was renamed Superman: Tower Of Power, but was dismantled in 2008 after a broken cable caused a girl's feet to be amputated the previous year.

**Popularity loss**

The Superman: Tower of Power at Six Flags St. Louis is not the ill-fated tower from Kentucky. It was relocated to St. Louis from Six Flags Astroworld in Houston after that park closed.

In 1996, Paramount's Great America opened the Drop Zone Stunt Tower. It was about twice the size of the park's first generation Freefall (also named "The Edge", but not to be confused with the Edge not famous for the accident), which had been removed after the 1995 season. In 2008, Great America changed the name of Drop Zone to Drop Tower.

By the late 90's, the classic freefall rides were being substituted for larger, higher-capacity alternatives. These include the Intamin Giant Drop (2nd generation), Gyro Drop (3rd generation), and the S&S Power series of compressed-air tower rides.

Currently, Demon Drop at Dorney Park & Wildwater Kingdom, Torre do Terror, at Beto Carrero World, Brazil, Hollywood Tower, at Movie Studios Park, Italy, and those at Toshimean and Central Park in Japan are the only remaining Intamin first generation Freefall rides in operation. In December 2006, Six Flags Great Adventure and Six Flags Over Georgia dismantled their respective first generation Freefall rides. In September 2007, Six Flags Over Texas announced and began dismantling their first generation Freefall, Wildcatter. February 2008 saw the dismantling of the original Freefall from Six Flags Magic Mountain.

In 2004, Loudoun Castle theme park in Scotland applied for planning permission to build an Intamin Freefall. The planning permission took too long to be granted, however, and the park sold the ride in order to have a new attraction open for the 2005 season. Ironically, Loudoun's new ride for 2007 was an S&S Power Double Shot tower drop ride.

At the end of the 2009 season, Cedar Point removed their first generation freefall ride, Demon Drop. The ride was originally supposed to be moved to Knott's Berry Farm for the 2010 season, but the ride ended up at Dorney Park instead with the same name.

**g-force**

The term g-force is technically incorrect **as it is a measure of acceleration**, not force. While acceleration is a vector quantity, g-forces are often expressed as a scalar, with positive g-forces pointing upward (indicating upward acceleration), and negative g-forces pointing downward. Thus, a g-force is a vector acceleration. It is an acceleration that must be produced by a mechanical force, and cannot be produced by simple gravitation. Objects acted upon by only by gravitation, experience (or "feel") no g-force, and are weightless.

Objects allowed to free-fall in an inertial trajectory under the influence of gravitation-only, feel no g-force. This is demonstrated by the "zero-g" conditions inside a freely-falling elevator falling toward the Earth's center (in vacuum), or (to good approximation) conditions inside a spacecraft in Earth orbit. These are examples of coordinate acceleration (a change in velocity) without proper acceleration. Since the g-force felt is always a measure of proper acceleration (which, in these cases, is zero, even though the objects are freely changing velocity due to gravity) all of these conditions of free-fall produce no g-force. The experience of no g-force (zero-g), however it is produced, is synonymous with weightlessness.

*g-force = amount of acceleration / 9.8 --- (1g = 9.8m/s2)*

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| **Example** | **g-force\*** |
| The gyro rotors in [Gravity Probe B](http://en.wikipedia.org/wiki/Gravity_Probe_B) and the free-floatingproof masses in the TRIAD I navigation satellite[[19]](http://en.wikipedia.org/wiki/G-force#cite_note-18) | 0 g |
| A ride in the [Vomit Comet](http://en.wikipedia.org/wiki/Vomit_Comet) | [≈](http://en.wikipedia.org/wiki/Approximation#Mathematics) 0 g |
| Standing on the Moon at its equator | 0.1654 g |
| Standing on the Earth at sea level–standard | 1 g |
| [Saturn V](http://en.wikipedia.org/wiki/Saturn_V) moon rocket just after launch | 1.14 g |
| [Bugatti Veyron](http://en.wikipedia.org/wiki/Bugatti_Veyron) from 0 to 100 km/h in 2.4 s | 1.55 g† |
| [Space Shuttle](http://en.wikipedia.org/wiki/Space_Shuttle), maximum during launch and reentry | 3 g |
| High-g roller coasters/[[8]](http://en.wikipedia.org/wiki/G-force#cite_note-BBB-7):340 | 3.5–6.3 g |
| [Top Fuel](http://en.wikipedia.org/wiki/Top_Fuel) [drag racing](http://en.wikipedia.org/wiki/Drag_racing) world record of 4.4 s over 1/4 mile | 4.2 g |
| World War One Aircraft [Sopwith Pup](http://en.wikipedia.org/wiki/Sopwith_Pup%22%20%5Co%20%22Sopwith%20Pup)[Sopwith Triplane](http://en.wikipedia.org/wiki/Sopwith_Triplane)[Fokker D.VII](http://en.wikipedia.org/wiki/Fokker_D.VII)[Fokker Dr.1](http://en.wikipedia.org/wiki/Fokker_Dr.1)[SPAD S.VII](http://en.wikipedia.org/wiki/SPAD_S.VII)[SPAD S.XIII](http://en.wikipedia.org/wiki/SPAD_S.XIII)[Nieuport 17](http://en.wikipedia.org/wiki/Nieuport_17) in a steep dive or back or front looping. | 4.5-7 g |
| [Formula One car](http://en.wikipedia.org/wiki/Formula_One_car), maximum under heavy braking | 5+ g |
| [Formula One car](http://en.wikipedia.org/wiki/Formula_One_car), peak lateral in turns [[20]](http://en.wikipedia.org/wiki/G-force#cite_note-19) | 5–6 g |
| Standard, full aerobatics certified [glider](http://en.wikipedia.org/wiki/Glider_aircraft) | +7/-5 g |
| [Apollo 16](http://en.wikipedia.org/wiki/Apollo_16) on reentry[[21]](http://en.wikipedia.org/wiki/G-force#cite_note-20) | 7.19 g |
| Typical max. turn in an aerobatic plane or fighter jet | 9–12 g |
| [Maximum for human on a rocket sled](http://en.wikipedia.org/wiki/John_Stapp#Works_on_effects_of_deceleration) | 46.2 g |
| Death or serious injury likely | [>](http://en.wikipedia.org/wiki/Inequality_%28mathematics%29) 25 g |
| [Sprint missile](http://en.wikipedia.org/wiki/Sprint_%28missile%29) | 100 g |
| Brief human exposure survived in crash[[16]](http://en.wikipedia.org/wiki/G-force#cite_note-nhtsa.dot.gov-15) | > 100 g |
| Shock capability of mechanical wrist watches[[22]](http://en.wikipedia.org/wiki/G-force#cite_note-21) | > 5,000 g |
| Current [formula one engines](http://en.wikipedia.org/wiki/Formula_one_engines), maximum piston acceleration [[23]](http://en.wikipedia.org/wiki/G-force#cite_note-22) | 8,600 g |
| Rating of electronics built into military artillery shells[[24]](http://en.wikipedia.org/wiki/G-force#cite_note-23) | 15,500 g |
| [9 × 19 Parabellum](http://en.wikipedia.org/wiki/9x19mm_Parabellum) handgun bullet (average along the length of the barrel)[[25]](http://en.wikipedia.org/wiki/G-force#cite_note-24) | 31,000 g |
| 9 × 19 Parabellum handgun bullet, peak[[26]](http://en.wikipedia.org/wiki/G-force#cite_note-25) | 190,000 g |
| Mean acceleration of a proton in the [Large Hadron Collider](http://en.wikipedia.org/wiki/Large_Hadron_Collider)[[27]](http://en.wikipedia.org/wiki/G-force#cite_note-26) | 190,000,000 g |
| Acceleration from a [Wakefield plasma accelerator](http://en.wikipedia.org/wiki/Wakefield_plasma_accelerator)[[28]](http://en.wikipedia.org/wiki/G-force#cite_note-27) | 8.9×1020 g |

**Human tolerance of g-force**

John Stapp was subjected to 15 g for 0.6 second and a peak of 22 g during a 19 March 1954 rocket sled test. He would eventually survive a peak of more than 46 g, with more than 25 g for 1.1 sec.[6]

Human tolerances depend on the magnitude of the g-force, the length of time it is applied, the direction it acts, the location of application, and the posture of the body.

The human body is flexible and deformable, particularly the softer tissues. A hard slap on the face may briefly impose hundreds of g locally but not produce any real damage; a constant 16 g for a minute, however, may be deadly. When vibration is experienced, relatively low peak g levels can be severely damaging if they are at the resonance frequency of organs and connective tissues. To some degree, g-tolerance can be trainable, and there is also considerable variation in innate ability between individuals. In addition, some illnesses, particularly cardiovascular problems, reduce g-tolerance.

**Vertical axis g-force**

Aircraft pilots (in particular) exert g-forces along the axis aligned with the spine. This causes significant variation in blood pressure along the length of the subject's body, which limits the maximum g-forces that can be tolerated.

Positive, or "upward" g, drives blood downward to the feet of a seated or standing person (more naturally, the feet and body may be seen as being driven by the upward force of the floor and seat, upward around the blood). Resistance to positive g varies. A typical person can handle about 5 g (49 m/s²) before losing consciousness ("G-LOC"), but through the combination of special g-suits and efforts to strain muscles—both of which act to force blood back into the brain—modern pilots can typically handle a sustained 9 g (88 m/s²) (see High-G training)[citation needed].

In aircraft particularly, vertical g-forces are often positive (force blood towards the feet and away from the head); this causes problems with the eyes and brain in particular. As positive vertical g-force is progressively increased (such as in a centrifuge) the following symptoms may be experienced:

* **Grey-out**, where the vision loses hue, easily reversible on levelling out.
* **Tunnel vision**, where peripheral vision is progressively lost.
* **Blackout**, a loss of vision while consciousness is maintained, caused by a lack of blood to the head.
* **G-LOC** a loss of consciousness ("LOC" stands for "Loss Of Consciousness").
* **Death**, if g-forces are not quickly reduced, death can occur.

Resistance to "negative" or "downward" g, which drives blood to the head, is much lower. This limit is typically in the −2 to −3 g (about −20 m/s² to −30 m/s²) range. This condition is sometimes referred to as red out where vision is literally reddened[11] due to expansion of the capillaries in the eye.[12] Negative g is generally unpleasant and can cause damage. Blood vessels in the eyes or brain may swell or burst under the increased blood pressure, resulting in degraded sight or even blindness.

**Horizontal axis g-force**

The human body is better at surviving g-forces that are perpendicular to the spine. In general when the acceleration is forwards (subject essentially lying on their back, colloquially known as "eyeballs in"[13]) a much higher tolerance is shown than when the acceleration is backwards (lying on their front, "eyeballs out") since blood vessels in the retina appear more sensitive in the latter direction.

Early experiments showed that untrained humans were able to tolerate 17 g eyeballs-in (compared to 12 g eyeballs-out) for several minutes without loss of consciousness or apparent long-term harm.[14] The record for peak experimental horizontal g-force tolerance is held by acceleration pioneer John Stapp, in a series of rocket sled deceleration experiments culminating in a late 1954 test in which he was clocked in a little over a second from a land speed of Mach 0.9. He survived a peak "eyeballs-out" force of 46.2 times the force of gravity, and more than 25 g for 1.1 sec, proving that the human body is capable of this. Stapp lived another 45 years to age 89, but suffered lifelong damage to his vision from this last test.[15]