Introduction

On Wednesday the 11th of October we went on a physics trip to Thorpe park to look at the ways in which a roller coaster works. This assignment will be looking in particular at the way the roller coaster "stealth" works, by looking at the G forces acting on the ride, the launching system and breaking system.
Stealth is located in "Thorpe Park" in surrey, designed by Werner Stengel and manufactured by Intamin, a company located in Switzerland, Stealth reaches a height of 205 feet and is 1312 feet long. It lasts a duration of 12 seconds and Accelerates 0-80 in 2.3 seconds. It uses a hydraulic launching system, and a magnetic breaking system and the maximum G forces felt by the rider is 4.8.

Intamin:

Intamin AG is a designing and manufacturing company in Wollerau, Switzerland. It is best known for creating thrill rides and roller coasters worldwide. Their first roller coaster installation was the Jr. Gemini, a kids ride at Cedar Point in 1979 and since then they have installed a total of 70 coasters in several countries around the globe.

Having been the first company to design a river rapids ride, freefall experience and the first drop tower, the first company to create a magnetic propulsion system and the Hydraulic Launch system they have earned the reputation of being innovative and creative with their rides.

Launching System:

A hydraulic launch track has a trough running along its centre, a "catch car" that connects to the train for launching travels through this trough. The catch car is connected to a cable loop that runs along the entire length of the launch track, anchored by a pulley wheel at the near end of the track and by the launch motor itself at the far end. The launch motor is located in a small building under the end of the launch track. Only about 2/3 of the length of this type of launch track can be used for launching the train, as the catch car must be stopped after it disengages from the train.

What are G forces?

The term g force or refers to the symbol g, the acceleration due to gravity at the earth's surface
The acceleration due to gravity on the Earth's surface at sea level is equivalent to 1 g which is a non-SI unit of acceleration defined as exactly 9.80665 m/s^2, g-force or g-load is a force-equivalent, equal to 9.80665 N/kg
Positive and negative Gs incur different effects on the body, as you pull positive Gs your weight increases respectively, something of a weight of 10 pounds would increase to 100 if it acquired 10 Gs. Positive Gs work by pushing the blood in your body towards your feet. Whereas negative Gs incurs weightlessness, the effect of negative Gs is to push the blood up into the head. The body can withstand up to 9 Gs without suffering severe consequences but blood vessels in your eyes will start to rupture when you apply as little as 2 to 3 negative Gs.

A person who feels weightless has not lost weight; the force of gravity acting on the person is the same as it always is. The normal force though has a small magnitude at the top of the loop (where the rider often feels weightless) and a large magnitude at the bottom of the loop (where the rider often feels heavy). The normal force is large at the bottom of the loop because in order for the net force to be directed inward, the normal force must be greater than the outward gravity force. At the top of the loop, the gravity force is fixed inward and so, there is no need for a large normal force in order to maintain the circular motion.

There are two types of energy involved in a roller coaster ride. PE, or potential energy is the stored energy of the object. Once the object starts moving, it begins to lose its initial height, which causes a loss in potential energy and gain what is called kinetic energy. Kinetic energy, or KE, is the energy of motion. At all times, if potential or kinetic energy is lost, then its opposite, either potential or kinetic, is gained. The sum of the amounts of these two is called the total mechanical energy and is abbreviated TME. For each point in the roller coaster, the TME is the same even though the PE and KE are different amounts. This is only true, however, if there are no external forces acting on the cars of roller coaster. When the cars are travelling on the track, the force of friction is acting upon the cars between the tracks, and friction is an external force. The force of friction is so small, however, that it is considered negligible. The force of air resistance, also, can be considered negligible because it is so small

centrifugal force is the outward force on a body moving in a curved path around another body it may refer to two different forces which are related to rotation. Both of them are oriented away from the axis of rotation, but the object on which they are exerted differs. Centrifugal forces are also a form of inertia (The tendency of a body to resist acceleration; the tendency of a body at rest to remain at rest or of a body in motion to stay in motion in a straight line unless acted on by an outside force).

Using a reference frame which is fixed relative to the car (a model which those inside the car will often find natural) and while ignoring its rotation, it looks like an external force is pulling the passenger out of the car. This is the fictitious centrifugal force, so called because it is not an actual force exerted by some other object. G forces also occur on jet planes, as these pilots experience g forces above what a normal human body can manage they wear g suits , these work by stopping blood pooling at the lower ends of the body by pumping it upwards using water filled bladders.

G forces on stealth

Stealth breaking system

Stealth uses magnetic breaks which work by having two rows of magnets made of strong Neodymium magnets. Eddy currents are generated in a metal fin, usually made of copper, when it passes through the rows of magnets. This creates a magnetic field which opposes the fins motion and this breaking force is directly proportional to the speed which the fin is moving. This is one of the systems faults although as in theory this means that the fin can never come to a complete stop. For example if the trains speed was 40 it would then be 20, then 10, 5 and so on. To bring the train to a complete stop therefore there is an additional set of fin breaks (rubber tires) that help the train come to a complete stop.

This is considered a safe breaking system as other breaking systems such as fin or skid breaks rely on friction to slow down a train which can be effected by elements such as rain.

INTAMIN

Pioneer of Amusement Rides