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Frictional Coefficients and their Influence on Planetary Rotation

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Abstract

The world population has grown considerably in the last 100 years, and because of that vehicle production is at an all time high. Much "research" has been performed regarding the environmental impact of these vehicles. Unfortunately the area of friction has remained virtually unexamined, perhaps dangerously so. This study inspects the correlation between friction and the rotation of the Earth and comes to a surprising and frightening conclusion: we are at most a year away from the end of the world.

Introduction

For thousands of years, the world has depended on the wheel to get us through our daily life. Wheels have been gaining in popularity since their invention in prehistoric times (Hart, 1985, 1988). At present, practically every facet of life is dependent on the use of wheels. However, with this reliance comes a greater danger than the world has ever faced.

Wheels use the principle of friction to propel a vehicle in a fixed direction. The advent of vulcanized rubber has created a wheel capable of generating more friction than any wheel in history. Newton's third law states that for every action there is an equal and opposite reaction. This means that to balance the direction of movement of the vehicle, there is an equally strong force along the ground in the opposite direction. Since vehicles are moving faster than ever, the equal and opposite force is getting stronger than ever. Add to this an increasing number of vehicles traversing the globe, and we are on the brink of a disaster of Dante's Peakian proportions.

In theory, if enough vehicles travel in the same direction at the same time, a state of critical mass will be reached. At this point one of the following three things could occur. If too many vehicles are moving against the Earth's rotation, the combined friction resulting from all of those wheels could potentially cause the rotation of the Earth to speed up, thereby breaking us free of gravity and throwing us into space, not unlike a colony of ants resting on an active yo-yo. In contrast, if too many vehicles were to move with the Earth's rotation, the friction might slow, and possibly stop, the rotation, leading to gyroscopic distress. This would cause the relative stability of the Earth to be compromised and would bring a cease to the procession of night and day. Thirdly, if too many vehicles move north or south, the friction could cause the earth to tilt on its axis, thereby flipping the seasons. The effect of this on bird migration and seasonal novelty production alone would be catastrophic.

This study, commissioned by forward thinking APSO science-minded professional Rev. Paulo Robvolli (Italy), Director-General of the Sixth APSO Working Group on Rotation, Friction and Centripetal/Centrifugal Forces, will attempt to determine where the greatest danger lies, what vehicles pose the greatest threat, and how long we have until disaster strikes.

Method

Testing this theory proved to be a difficult prospect. The cost and difficulty of measuring the actual rotation of the earth, coupled with the need for an immediate and accurate answer, necessitated an innovative approach to the problem. The resulting experiment is both simple and deep in theoretical underpinnings. The force generated by one average wheel will be calculated on a variety of surfaces. Then, by determining the number of wheels in the world, a simple calculation will provide the total possible force exerted by all the wheels in the world. After this, directed by the modern principle of subtraction, it is a simple matter to determine how many wheels need to be moving at the same time to effect the rotation of the earth.

To determine the average force from one wheel, four vehicles were tested and the average of the four was used (Strømmen, 2003). These vehicles were: a remote-controlled dune buggy, a standard 18-speed mountain bike, a suped-up 1982 Honda Civic, and a regulation monster truck named "Missy." Subjects were required to start from a complete stop on a variety of materials. Force along the ground (in kg•km/h), and displacement of the material (in cubic centimetres) were measured and divided by the number of wheels. Results are summarized in tables 1 and 2.

Results

Results fall into two categories: loose materials and solid materials. Loose materials (gravel, topsoil, etc.) showed the greatest displacement, and the

Table 1. Force Generated by One Wheel

	Dune Buggy	Mountain Bike	Honda Civic	Missy
Concrete	*12.34*	*5.6*	*46.87*	*65.99*
Salt Flats	*10.55*	*10.68*	*48.88*	*50.36*
Topsoil	*4.67*	*3.22*	*20.45*	*26.88*
Gravel	*4.25*	*2.10*	*16.23*	*28.44*

Unit: kg•km/h

Table 2. Displacement of Materials

	Dune Buggy	Mountain Bike	Honda Civic	Missy
Concrete	*0*	*0*	*0*	*0*
Salt Flats	*1*	*1*	*3*	*5*
Topsoil	*15*	*20*	*45*	*70*
Gravel	*12*	*8*	*50*	*65*

Unit: cm^3

lowest force. They will slide along the earth as there is little attachment between the material and the earth itself. This functions as a natural defence mechanism for the earth, protecting it from natural enemies such as wind and water. Clearly loose materials provide a buffer between the wheels and the earth, reducing the danger of effecting rotation considerably.

More dangerous by far are solid materials. Concrete showed no measurable displacement and the greatest amount of force. There is no other option but to conclude that this easily represents the greatest threat to our continued survival. Concrete roads are firmly fastened to the earth and topical forces exerted on that concrete will be transferred through the concrete to the Earth itself. This means that all of the force from the wheel is actually acting on the earth and not on the material.

As a reliable estimate there are 13.2 billion wheels in the world. This is based on the fact that there is one four-wheeled vehicle for every person in the world (Smythe, 1954). This will not yield an accurate world wheel count however, as certain anomalies must be accounted for. We must subtract the number of motorcycles, add the number of semis, and then add the number of service vehicles to arrive at the final result (formula 1). Therefore, as there are 6.3 billion people in the world, motorcycles have 2 wheels, semis have 18, and miscellaneous service vehicles average out to 5 wheels each, following formula 1 through gives us the result of 13.2 billion wheels in the world. All we need to do then is examine the average force from one wheel (table 1) and then

Formula 1. Calculation of the Total Number of Wheels in the World

$$TW = 4TP - 2M + 18S + 5O$$

Formula 2. Calculation of Daily Driving Time per Person

$$DT = 24 - h_S - h_E + h_O$$

extrapolate to 13.2 billion wheels.

Of course not all of these wheels will be moving at the same time. Indeed, this fact is the only reason that the coming disaster has not already happened. Current sleep research indicates that people sleep an average of seven hours out of every twenty-four (Fred, 2003). This leaves 17 hours of the day in which a vehicle may be operated. By subtracting time spent eating (ignoring drive-through meals), and adjusting for other factors we are left with a total of 6 hours per day of driving time (formula 2).

Thus, there are 6 hours of every day in which wheels will be operated. This means that at any given time, one-fourth of all the wheels in the world (3.3 billion) will be moving. Research shows that it takes a phenomenal amount of force to affect the rotation of something as large as the Earth (Various Science Fiction Movies, 1945–1986). By rough estimate this number is 100 billion kg•km/h. If we multiply the average force generated by one wheel by the number of wheels moving on the Earth at any given time we arrive at 105.6 billion kg•km/h. Clearly the only thing saving us from disaster is the fact that not all vehicles travel in the same direction at the same time. Unfortunately, calculating the probability that 3 billion wheels will travel in the same direction is beyond the scope of this experiment.

Conclusions

The results of this study are frightening to say the least. Clearly we are teetering on the brink of disaster. I can only hope that this message reaches the appropriate authorities in time. At the current pace, disaster could strike as early as January 2004, and is inevitable by June 2005.

Despite this chilling vision of things to come, there is some hope. There are steps which can be taken to stave off destruction, but they must be taken immediately. In short, we need to reduce the number of wheels on the roads. As shown above, we are already on the brink of disaster. Reducing the number of wheels on the road will have a clear and immediate impact on the only number that matters: the probability of destruction. The automotive industry is historically slow to adopt change (History, all years), but a shift in design towards tracked vehicles (not tested here) would likely yield a dramatic improvement in the situation.

As well as reducing the number of

wheels, the rate of urbanization needs to be slowed, if not stopped entirely. As proven in this study, gravel roads provide a buffer between the wheel and the earth. Urbanization is leading to more and more paved roads, which increases the danger exponentially. If we return to only gravel roads, the force being generated by the current number of wheels will drop dramatically. This means that it will require more vehicles travelling in the same direction to affect a change. Critics will argue that this may result in more accidents (Critics, 2005), however I believe this is a small price to pay for our continued existence here on Earth.

References

Critics. (2005). Europe.

Smythe, Q. (1954). *Fun Facts*. Dublin Ireland: Blarney Press.

Fred. (2003). 214 43rd St. East.

Hart, J. (1985). *B.C. Big Wheel*. New York, NY: Ballantine Books.

Hart, J. (1988). *B.C. Rides Again*. New York, NY: Ballantine Books.

History. (All Years). United States.

Strømmen, J. (2003). *The rule of three: A technical application of the new math*. Saskatoon, Canada: The Sciencist.

Various Science Fiction Movies (1945 – 1986). Hollywood, CA.