Seatbelts Essay, Research Paper

When travelling at slow speeds in your car the wearing of a seatbelt has little effect of your body when you brake. So why is it important to wear your seat belt?

A driver or passenger travelling in a car is moving at the same speed as the car. If the car suddenly stops, the body of the rider inside will keep moving forward at the same speed. This demonstrates inertia. The tendency of a moving object to keep moving, or of a stationary object to remain at rest. Basically Newtons first law; that a body stationary or moving with constant velocity will want to continue to do so, unless acted on by a force.

Lets understand what is happening here. First drive along in your car at 60 km/h on a backstreet with no traffic, then brake gently and slowly. You will notice that the seat belt doesn?t really do much to hold your body. Now do the same again but this time break as quickly and sharply as you can. Your body will be thrown forwards with great force, and your seatbelt will be literally holding you in place.

Now your body was what is commonly referred to as being “thrown forwards”, however this is not the case. Your body was actually not slowing down much at all and your velocity relative to the car initially was much greater. The car began to slow down due to breaking and your body in accordance with Newtons First law wanted to continue to move at the original constant velocity. Now if your seat belt was not there to provide an opposing force, to your momentum and inertia, by holding you from going forwards, you very likely would have been thrown into the dash or steering wheel.

Lets look at this mathematically.

m= your mass in kilograms for this purposes 70kg

V= final velocity 0 m/s

U= initial velocity 60 km/h or 16.6 m/s straight line

S= distance taken to stop 42 m

t= 3.8

a= -4.368 m/s/s

Now your momentum at 60km/h is P=MU

So P= 70kg\*16.6m/s

P=1162 Kg m/s

Impulse I=MU/t

I=70\*16.6/3.8

I=305N

So your body will weigh about 610kg when you are breaking hard, a force it is difficult for any person to withstand.

Now in the context of a head on accident at around 60km/hr the force exerted on your body is greatly increased. In the event of such an accident it will take the car approximately 0.4 seconds to stop. This gives an acceleration of ?41.5m/s/s. This means the impulse on your body would be equal to:

I=MU/t

I=70\*16.6/0.4

I=2905N

So your body would weigh around 300kg.

With this amount of inertial force it is impossible for anyone not wearing a seatbelt to stay in his or her seat. They will either be thrown forwards into the dash or steering wheel, with a force that is capable of crushing skulls or rib cages. Even worse they could be thrown through the windscreen hitting external objects, such as telegraph poles or oncoming cars.

Those with their seatbelts on may suffer small abrasions and haematomas (bruising.) But this is a small price to pay to be able to walk away from a serious crash.

But the seat belt is slack when I put it on, how can it possible protect me?

An inertia-reel seat belt works on the same principle as Newtons First law. Its mechanism includes a pendulum, which hangs vertically under ordinary driving conditions. If the car should suddenly stop, however, it swings forward, and a locking lever resting on the pendulum is released. The lever engages a toothed ratchet that locks the shaft around which the belt is wound. The locked seat belt then prevents the body from being flung forward. When the seat belt is fastened, it winds out from the reel against slight tension from a spring. This keeps it taut during normal travelling, but allows enough free movement for a driver to reach forward as necessary. If the driver tugs on the belt abruptly while winding it out, the locking mechanism will engage and stop the action of the spring. Slackening the belt releases the spring and the locking lever.

So next time you go for a “drive” it is imperative you put your seat belt on to prevent your inertial mass from “driving” you into the windscreen.