Rod King of 20's Plenty makes great play of Newton's Laws of Motion, but unfortunately does not understand them

.

Following are extracts from a current thread (7th January 2013) on http://www.roadsafetygb.org.uk/

a/ from me

After driving 1m miles and 12 years studying road casualty policies and statistics I agree throughout with Eric and see nothing from the pro-20mph side to persuade me otherwise.

As an engineer, I find it worrying that those who think they understand physics in fact don't - the reference to momentum varying exponentially with speed and (Rod King, DriveTech, and others) who think that it is kinetic energy (which does rise as the square of speed) that results in much worse damage at speed. Nonsense - what matters is the change of momentum of the person hit, and the forces involved: A 40mph Escort welded to the front of a 2,000tonne train would causes the same injury to a pedestrian as would the car alone, because in both cases the pedestrian is accelerated suddenly to 40mph. Massively greater kinetic energy has nothing to do with it.
Idris Francis Petersfield
Like | Dislike

b/ From Rod King

As an engineer (BSc Automobile Engineering) I am afraid that Idris makes the wrong case regarding momentum being the critical factor in collisions. **It is the total energy that is dissipated that is key**. His extreme case of a 40mph car hitting a pedestrian proves nothing as both car alone and car plus train would likely kill the pedestrian. If you add on the speed effecting the ability of participants to avoid collisions then speed plays an exponential role in contributing to total casualties.

But why not reference a more academic report and see the implication of "kinetic energy" in crash and casualty severity http://www.monash.edu.au/miri/research/reports/muarc229.pdf
Rod King, Cheshire
Like | Dislike

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c/ From me

Mr King, : sorry, you are still wrong. As words have not persuaded try numbers:

a/ 1 tonne Escort hits 0.07 tonne pedestrian at 40mph.

Pedestrian on 1.07 tonne combination is then at speed X such that momentum is unchanged (Newton) i.e. (1.07 * X) = (1 * 40) units so X = 40/1.07 = 37.4mph.

b/ 1 tonne Escort on 2,000 tonne train hits 0.07 tonne pedestrian at 40mph.

Pedestrian on 2,001.07 tonne combination is then at speed Y such that (2,001.07 * X) = (2001 * 40), Y = 40 * 2001/2001.07 = 39.986mph

c/ 1 tonne Escort hits 0.07 tonne pedestrian at 60mph.

Pedestrian on 1.07 tonne combination is then at speed X such that momentum is unchanged (Newton) i.e. (1.07 * X) = (1 * 60) units so X = 40/1.07 = 56.1mph.

In b/ kinetic energy of vehicle is **40,000% (4m)** times greater but acceleration of pedestrian is only **7%** greater.

In c/ kinetic energy of vehicle is **225%** greater, acceleration of pedestrian is **50%** greater.

Demonstrating that what matters is the speed **of impact, the change of speed and momentum, not the kinetic energy of the vehicle prior to impact.**

END QUOTES

(slightly edited to tidy it up)

As Mr. King claims to be a graduate engineer, I summarise my CV:

1997 State Scholarship in Pure and Applied Mathematics and Physics

1998 1st Year Honorary Scholarship

1960 1st Class Honours B.Sc. in Electrical Engineering, with IEE Prize for Wales.

1960-62 Research at University of Cambridge Engineering Laboratory

19963-65 Circuit design engineer Leo Computers

1964 - 1994 All aspects of running my own electronics company, including a Queens' Award for Export Achievement in 1992. If I had made mistakes like Mr. King's my company would have gone bust in short order.

1966 Early retirement.

2000 to date Many thousands of unpaid hours studying road accident and casualty data, reports and policies. end

 Idris

Thank you for presenting your calculations on momentum.

It seems to me that the approach you have taken is to reference an "extreme" example regarding the laws of conservation of momentum and then extropolate (sic) this down to a "normal" situation.

However, I don't think you must have read my post where I pointed to kinetic energy rather than momentum as being the major factor in casualty severity. I also gave a reference to an academic paper supporting this. Was this helpful or should it be dismissed as incorrect?
Rod King, Cheshire, 20's Plenty for Us

Like | Dislike

To Rod King. As you fail to understand my point, I will try again.

My figures show (vehicles being much heavier than people) pedestrians are accelerated (very rapidly) almost to vehicle speed, little different whether 15 or 3,000 times heavier. Similar arithmetic is given [2.3.5] in the Report you mentioned.

That vehicle kinetic energy 4 million times greater increases impact forces only 7% confirms it is speed of vehicles that matters, not their kinetic energy.

Degree of injury depends on FORCES (not energy) needed to accelerate, has nothing to do with the kinetic energy of vehicle before impact.

Energy is of course used when forces are applied over distances, but the energy needed to kill is utterly trivial compared to that of moving vehicles.

The report highlights energy transfer to pedestrians but fails to recognise that most becomes kinetic energy of the pedestrian, in itself no more a problem than yours or mine at 70mph.

continued on http://www.fightbackwithfacts.com/20s-plenty/

(above slightly edited to tidy up)

(this is the continuation)

Having skimmed through the Report in question my comments are these

For all the apparently learned people involved, and for all their undoubted good intentions, it seems to be yet another offering from a Department of the Bleedin' Obvious - I have not yet come across any part of the analysis that would be new to anyone having a basic understanding of physics.

That might however be unfair, in that all the analysis might be relevant as a basis for drawing conclusions about what should be done to reduce casualties - as I said, good intentions. Though trying to dissuade people from driving and towards public transport might be a step too far!

That said, the Report does seem to me to be **badly written in at least one respect, in the way it constantly refers to "energy"** - and indeed this may help explain Rod King's confusion over the matter.

Of course **energy is needed to cause physical injury** - but a knife or a razor can kill with hardly any energy, but a cushion would need a great deal of physical force.

For that reason **we need to assess such things on the basis of what really matters, not what is relatively incidental** - in other words that it is **force, torque, strain, compression, stretching, abrasion etc that causes the problems not the energy needed to apply them**. Still less the kinetic energy of the vehicle prior to impact, what Rod King seizes on as the be-all and end-all of crashes.

I hope to find time to read the Report more thoroughly, but have other pressing matters at present

08 Jan 2013

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at this point received a comment by email from a very experienced Canadian road safety researcher with whom I often compare notes, Al Gullon. He wrote to agree with my concern that those who advocated policies on the basis flawed understanding of the physics and numbers risk deluding themselves and misleading others:

"Idris is BANG! on. (pardon the pun) Mr. King is making a gross error on the physics of a crash

back to the RSGB thread:

Idris
I am still awaiting your response to the paper on kinetic energy being a factor in road casualties. Here is another one http://ec.europa.eu/transport/road_safety/specialist/knowledge/pdf/speeding.pdf

This confirms the use of kinetic energy. It also references Swedish research saying that "a change in average speed of 1km/h will result in a change in accident numbers of 4% for a 50km/h road. This result has been confirmed by many before and after studies of different speed reduction measures. This relationship is used by other Scandinavian countries and by Australian and Dutch safety engineers."

Here is another paper - "Speed and road accidents – an evaluation of the power model" http://www.trg.dk/elvik/740-2004.pdf One conclusion is:-

"There is a strong statistical relationship between speed and road safety. When the mean speed of traffic is reduced, the number of accidents and the severity of injuries will almost always go down.

I would suggest that readers should look at both of these documents.
Rod King, Cheshire, 20's Plenty for Us

My next responses below were not allowed

Rod - an earlier reply failed to appear, see www.fightbackwithfacts.com/20s-plenty-errors/, and also: .

As the figures I provided showing that even 4m times greater kinetic energy relates only to 7% greater impact (Monash uses the same momentum principle at 2.3.5) have not persuaded you, try this:

If you weigh X and are hit at (say) 40 mph by a vehicle weighing Y you very rapidly find yourself moving at a speed S determined [conservation of momentum] by $(X + Y) * S = (40 * Y)$,

i.e.

$S = (40 * Y) / (X + Y.)$

As Y, the weight of the vehicle becomes greater and greater, $Y / (X+Y)$ tends ever closer to 1, as S does to 40 but never quite reaches it. However vast the kinetic energy prior to the crash, it makes no difference, you still suffer a 40mph change of speed and the forces involved.

Idris

Rod - If you think (it is far from clear) it is kinetic energy (KE) transferred on impact that matters, that's a different can of worms:

KE transferred to pedestrian comprises that needed to accelerate him to his new speed, plus energy lost in non-elastic deformation.

Severity of injury does NOT relate to that change in KE, but to the "g" forces that accelerate him. They in turn depend heavily on the resilience of the elements involved, as Monash confirm. Given sufficient resilience it is entirely possible, as we all know, to accelerate anyone to 40, 500 or 2000 mph without the slightest injury.

In collisions, resilience of the pedestrian and vehicle will vary all over the place and it is neither possible nor sensible to use KE as a lead parameter in these circumstances, as Monash and others mistakenly seem to do. Force, not energy causes injury, and force arises from momentum, not energy.

Idris

Rod - If you think (it is far from clear) that it is KE dissipated in the collision that matters, that is another can of worms again.

A well designed front end of a car - an easily deformable bonnet can absorb much the energy of a pedestrian impact. That energy is lost as heat, and therefore lost to the still moving vehicle/pedestrian combination resulting in (slightly) lower combined speed and hence (slightly) less speed increase for the pedestrian.

In addition the easy compressibility of the bonnet gives more time for the pedestrian to be accelerated up to speed and hence lower forces and less severe injury.

A more rigid bonnet will however result in less energy being absorbed by it, but greater injury due to higher "g" forces.

The high variability of these factors means that there cannot be a meaningful relationship between KE dissipated and injury severity.

 Idris

Thank you for elaborating your anecdote.

However, I trust that you will agree that peer-reviewed academic papers are a better basis for road danger reduction than anecdotes.
Rod King, Cheshire, 20's Plenty for Us

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nor was my response below allowed

Rod - Responses on physics sent early a.m. not appeared. Finding out why (on my web site).

12 years' experience makes me deeply suspicious of Peer Review: .

Often used to advance views of clique, club, establishment or paymasters while blocking inconvenient opinions. Notorious example - Climate-Gate's leaked emails exposing Global Warming fantasists doing precisely that. Unacceptable.

Much analysis of road safety issues is so seriously flawed it would not have got past competent, truly independent reviewers, yet protests are ignored because faces/CV's/ opinions don't fit - old boy.

One commentator admitting no analytical ability said he assesses reports on CV's, not content!

Author of prize-winning but seriously incompetent camera report wrote he assumes anything by civil servants is correct. So why bother? Fee perhaps? I have often proved them wrong by assuming wrong until proven right (watch this space!), the only sensible scientific approach.

Question everything, then judge.

After I contacted the editor he allowed this final comment from me on this subject - on re-reading it I think it as clear an explanation of what happens and what matters as I could hope to write:

I am not allowed here space to answer all Rod King's points (I do on my web site) but because safety needs to be based on proper understanding of collisions, I must point out that:

When objects collide it is FORCE, not energy, that changes velocities and momentum (Newton's principles of action and reaction, conservation of momentum and energy).

Momentum is proportional to velocity, hence so are forces, not exponentially or as the square of speed.

It is these forces, not energy, that cause deformation and injury, while shapes and resilience determine low forces/acceleration or high.

Anyone hit by a vehicle (inherently much heavier) accelerates almost to prior vehicle speed, even huge further increases in vehicle weight make little difference to acceleration or injurious forces.

Similarly the amount of energy transferred to pedestrians is determined by his change of speed, not remotely by the prior kinetic energy of the vehicle.
Idris Francis Petersfield