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A2_1 The Flash: Hero or Villain?

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Abstract

The CW Television Network's show 'The Flash' depicts the titular character rescuing a cyclist from being hit by a car. This paper discusses whether the act of being saved by The Flash is in fact more damaging than being struck by a car. The results suggest that The Flash can be a hero but will have to alter either his speed or his method to lessen the impact on the victim.

Introduction

'The Flash' is an upcoming television show featured on The CW Television Network in America. The show features Barry Allen; a forensic scientist who receives the power of super speed after being struck by lightning in a mysterious storm. Allen then takes on the persona of 'The Flash' in an effort to use his powers for good. An example of this is shown in the trailer [1] where a cyclist is almost struck by a taxi, but is pushed to safety by The Flash. Upon studying the footage, it was postulated that this act occurs at such a speed that the impact may be more damaging than if the cyclist had been hit by the taxi.

Discussion

The first step was to find the ratio of distances travelled by The Flash and the taxi. The vehicle in the footage was identified as being a Ford Crown Victoria; the tyre size for this vehicle was taken as 225/60 with a rim size of 17 inches [2], which equates to a radius of 0.35 metres. Viewing the trailer from the point of collision between the taxi and the cyclist to the point of contact between the cyclist and The Flash (time code 4:09 to 4:10)[1], it can be seen that the wheel undergoes approximately three-quarters of a revolution. The distance travelled by the taxi was then found using

$$x = 2\pi r N,$$

where r is the radius of the tyre and N is the total number of revolutions. This gives a value of 1.65m for the distance, x.

It was estimated from the same footage that The Flash travels 10 metres in this time interval. Therefore, by the direct proportionality between speed and distance, The Flash is travelling 6.07 times faster than the vehicle. By assuming that the taxi is travelling at the speed limit of a built up area i.e. 13.4 ms^{-1} (30 mph), then The Flash is travelling at 81.3 ms^{-1} (182 mph).

In order to now calculate and compare the momenta of The Flash and the taxi the masses of each must be determined. Knowing that the taxi is a Ford Crown Victoria it was possible to find its mass is approximately 2 tonnes [3]. The mass of The Flash was assumed to be 75kg. It was worked out that the momenta of the taxi and The Flash were 26800 kg ms^{-1} and 6097.5 kg ms^{-1} respectively. It is clear to see the momentum of The Flash is much lower than that of the taxi; however, as damage cannot be quantified, it is assumed that a greater pressure rather than simply momentum results in higher likelihood of injury. The pressure that each exerts on the cyclist must therefore be considered.

It was assumed that the time over which this momentum is imparted on the cyclist was the same for both the taxi and The Flash meaning that the pressure would now only be dependent on the contact areas and momenta (in reality the contact time in each collision may differ slightly). In the case of the collision between the taxi and the cyclist it was assumed that the impact would occur between the windscreen and the cyclist's torso and upper legs (approximated to the area of two

torsos). In the case of the collision between the cyclist and The Flash it can be seen from the footage (time code 4:10)[1] that The Flash makes contact with his upper chest (approximated to be the area of one third of a torso). This implies that the contact area in the taxi-cyclist collision is six times larger than in The Flash-cyclist collision.

Knowing the momenta of the taxi and The Flash along with the relative contact areas, Eqn. 1 could be used to calculate the pressure imparted for each collision.

$$p_F = \frac{m_F v_F}{A_F t_F};\ p_t = \frac{m_t v_t}{A_t t_t}, \tag{1}$$

where m is mass, v is velocity, t is time, A is area and p is pressure. The subscripts F and t represent The Flash and the taxi respectively. Knowing that $t_F = t_t$ and $A_t = 6A_F$ an expression for the ratio of the pressures was found in the form,

$$Ratio = \frac{p_F}{p_t} = \frac{6m_F v_F}{m_t v_t}.$$

This was calculated to be 1.36 meaning that The Flash exerts more pressure on the cyclist than the taxi; this implies that The Flash in fact causes greater injury to the cyclist by "saving" him.

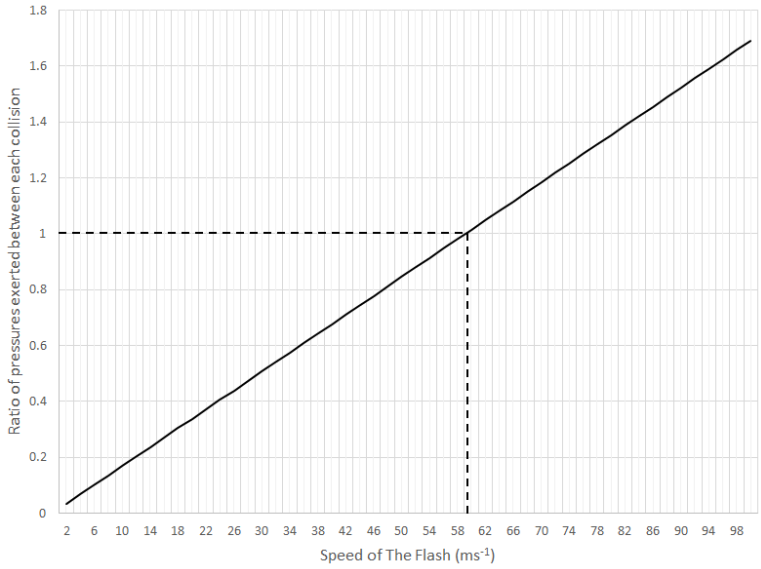

Figure 1: The dashed line represents the speed beyond which The Flash exerts more pressure than the taxi on the cyclist.

Having shown that in this scenario The Flash would have been better off not intervening, the speed at which The Flash could impact the cyclist and do less harm than the taxi was deduced. From Fig. 1 this can be seen to be approximately 58 ms^{-1} (130 mph).

Conclusion

It has been shown that in the scenario depicted in the trailer that The Flash's intended heroic act results in more villainous consequences by injuring the cyclist more than the taxi would have. The Flash's efforts will be serving the greater good if he lowers the speed at which he makes contact. Alternatively, increasing the area over which he makes contact with the cyclist would also lower the pressure and likelihood of injury.

References

[1] https://www.youtube.com/watch?v=Yj0l7iGKh8g accessed on 07/10/2014.

[2] http://www.sizemytires.com/make/ford/crown-victoria accessed on 07/10/2014.

[3] http://www.edmunds.com/ford/crown-victoria/ accessed on 07/10/2014.