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Your Ref: TP/IP/06189/2018  
Our Ref : CI/TPD18008063/D

01 June 2018

**Road Traffic Accident On 27 January 2018 At About  
1347hrs Along Yishun Avenue 7 Before Yishun Avenue  
2, Near Lamppost 31, Involving A Motor Car SJH 4639X  
And A Male Pedestrian**

**Requested By  
General Investigation Team A  
Traffic Police Department  
Singapore Police Force  
10 Ubi Avenue 3  
Singapore 408865**

## Introduction

1. I refer to your request dated 03 April 2018.
2. By way of introduction, I set out below a brief description of my professional qualifications and professional work experiences.
3. I am a Senior Technical Investigator and certified Accident Reconstructionist with LKK Auto Consultants Pte Ltd. I have been carrying out assessments, valuations, inspections and technical investigations of motor vehicles involved in, among other things, accident since 2007. I have also carried out accident reconstruction basing on the laws of dynamics and physics by applying mathematical equations with technique competencies aligned with international standards, ensuring proper cause analysis. Some of my clients include the Singapore Police Force, NTUC Income Insurance Co-Operative Limited, AIG Asia Pacific Insurance Pte Ltd, AXA Insurance Singapore Pte Ltd, Cycle & Carriage Industries Pte Ltd and Performance Motors Limited amongst others. I also have experience in providing analysis and commentaries on damages and faults of motor vehicles.
4. I have given oral evidence as an expert witness in both the State Court and High Court, for both the prosecution and the defence for criminal proceedings and also for both the plaintiff and the defendant in civil proceedings. For instance, in MC Suit 17701/2010/Q, I acted as an expert witness in proceedings which involved among other things, a claim by an owner of a Mercedes sedan against the dealer for allegedly carrying out negligent works on the Mercedes sedan; in Suit 760/2011, I was asked by the dealer to provide my expert opinion on whether a brand new BMW sedan sold to a customer was defective. I have also been jointly appointed by both a car dealer and a car owner to provide my expert opinion as to whether the transmission of a brand new car was defective.
5. My testimony as an expert witness for accident reconstruction and speed analysis cases involving criminal proceedings for the prosecution include amongst others, MAC 2350-51/2011, an accident involving four motor cars and a motorcycle resulting in the death of the motorcyclist; DAC 039421-2011, a motor car and motorcycle accident resulting in the death of the motorcyclist; MAC 3935/12, a motor lorry and pedal bicycle accident resulting in the death of the cyclist.

6. Cases where I have been engaged by an accused person include amongst others, DAC 60889-90/10, a motorcycle and motor car accident resulting in the death of the pillion rider; DAC 049130-2013 & DAC 049131-2013, self-accident involving a SMRT bus resulting in the death of one of its passengers.
7. I have also carried out numerous line of sight simulation, in close replication of an accident scenario, to determine a driver's view and sighting capability.
8. I hold a certificate in Technical Accident Investigation and Reconstruction from the Society of Automotive Engineers Australasia and a National ITE Certificate (Intermediate) in Automotive Technology (Light Vehicle) from the Institute of Technical Education. I have also attended training and passed a practical examination on correct repair methods, safe and cost-effective assessment of damaged motor vehicles (Thatcham Escribe System).
9. I am an affiliate member of the Society of Automotive Engineers Australasia; an affiliate member of the Institute of Automotive Engineer Assessors (UK); an associate member with the Society of Operations Engineers (UK).
10. For this particular case, I was requested to determine the approximate speed of the motor car SJH 4639X (herein referred to as "**Motor Car**") which was involved in the captioned accident.
11. A visit to the post-accident location on 17 April 2018 and a review of the documents/data listed below were carried out in preparation of this report.

## **Documents**

12. I had reviewed the following documents that were made available to me: -
  - a) Copy of the Police sketch plan;
  - b) Copy of the Police sketch plan with the pedestrian's estimated point of collision;
  - c) 26 coloured photographs of the accident scene taken by the Police;
  - d) Copy of the Police Vehicle Damage Report of the Motor Car;
  - e) Copy of the Police Vehicle Mechanical Inspection Report of the Motor Car.

13. I now set out below my detailed analysis with respect to the approximate speed of the Motor Car at the material time of accident.

### **Speed Analysis**

14. For this particular case, the type of trajectory of the pedestrian upon impact from the Motor Car was of a wrap trajectory type, where the impact to the pedestrian was below his centre of mass. This is normally 55% of a person's height.
15. Such type of trajectory would typically involve the person being thrown up into the air and/or rotated onto the front bonnet and/or front windscreen of the motor car before falling/sliding off the front bonnet of the motor car onto the road surface and sliding/rolling/tumbling to a final rest.
16. The damage to the front bonnet and front windscreen of the Motor Car, as seen from the Police accident scene photographs, are damages that correspond to such type of trajectory.
17. In a wrap trajectory, the approximate speed of the Motor Car at the time when it had struck the pedestrian can be determined by taking into consideration the throw distance of the pedestrian upon the collision impact. This throw distance is the total horizontal distance from the point of impact between the Motor Car and the pedestrian to the final rest location of the pedestrian.
18. For this particular case, the approximate location of the point of impact between the Motor Car and the pedestrian was identified by the pedestrian during investigations carried out by the Police. Basing on the Police sketch plan with the pedestrian's estimated point of collision, I note that the pedestrian was struck on the centre lane of the 3-lane roadway. The distance of the point of collision to lamppost 31 was measured and recorded by the Police to be 29.9m in the Police sketch plan with the pedestrian point of collision..
19. The final rest location of the pedestrian was at the location marked with placard B in the Police accident scene photographs. This was where blood stains were found on the road surface. This location was measured by the Police, and recorded in the Police sketch plan to be 11m before lamppost 31.

20. The total throw distance of the pedestrian can then be established by considering the measured distance of the approximate location of the point of impact to lamppost 31 and the measured distance from the blood stains to lamppost 31. By using lamppost 31 as reference, the total throw distance was 18.9m (29.9m less 11m). This 18.9m was verified by me when I had visited the post-accident location on 17 April 2018 as the general surroundings and road features at the time of my visit were unchanged to those that were depicted in the Police accident scene photographs
21. Basing on the relationship between pedestrian projection speed and motor car pre-impact speed, a throw distance of 18.9m produces a pedestrian projection speed range of 47kmph to 56kmph. The speed of the Motor Car at the time when it had struck the pedestrian was therefore approximately 47kmph to 56kmph. See calculations set out below.
22. By applying Searles Equation of Motion (Projection Velocity of Pedestrian),

Where:

$V_{\min}$  – Minimum vehicle velocity (Minimum vehicle speed)

$V_{\max}$  – Maximum vehicle velocity (Maximum vehicle speed)

$d_t$  – Total throw distance (18.9m)

$\mu$  – Co-efficient of friction of Pedestrian (recommended 0.66 for asphalt road on dry surface) ----- [1]

$g$  – Gravity (9.81m/s)

The minimum speed of the Motor Car at the point of impact with the pedestrian was approximately: -

$$\text{Minimum Velocity, } V_{\min} = \sqrt{\frac{2\mu g d_t}{1 + \mu^2}} \text{ ----- [1]}$$

$$\sqrt{\frac{2 \times 0.66 \times 9.81 \times 18.9}{1 + (0.66 \times 0.66)}}$$

$$\sqrt{\frac{244.739}{1.435}}$$

$$\sqrt{170.549}$$

$$V_{\min} = 13.059\text{m/s}$$

$$\text{Speed} = 47\text{kmph} (13.059 \times 3.6)$$

The maximum speed of the Motor Car at the point of impact with the pedestrian was approximately: -

$$\text{Maximum Velocity, } V_{\max} = \sqrt{2\mu g d_t} \quad \text{----- [1]}$$

$$\sqrt{2 \times 0.66 \times 9.81 \times 18.9}$$

$$\sqrt{244.739}$$

$$V_{\max} = 15.644\text{m/s}$$

$$\text{Speed} = 56\text{kmph} (15.644 \times 3.6)$$

## Conclusion

23. Having reviewed the documents/data for this particular case, the speed of the Motor Car when it had struck the pedestrian was approximately 47kmph to 56kmph.

### Ang Bryan Tani

*Senior Technical Investigator*

*Technical Investigation & Reconstructionist (SAE-A)*

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## Reference:

- [1] **Technical Accident Investigation & Reconstruction Course, Society of Automotive Engineers, Australasia. Chapter 13, Pedestrians Impact with Motor Cars.**