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26 October 2018

**Incident On 29 April 2016 At About 1645hrs Along Pasir
Ris Drive 1 Towards Pasir Ris Drive 12, Involving A
Motorcycle FBK 7736H**

**Requested By
Roy & Partners
101 Cecil Street #11-09
Tong Eng Building
Singapore 069533**

Introduction

1. I refer to your request dated 15 October 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).

Background of the Incident

10. On 29 April 2016 at about 1645hrs, Madam Aini Binte Mohamed Noor (herein referred to as "**Madam Aini**") sustained relatively severe bodily injuries whilst riding her motorcycle FBK 7736H (herein referred to as "**Motorcycle**") along Pasir Ris Drive 1 towards Pasir Ris Drive 12. The circumstance leading to Madam Aini sustaining the bodily injuries was unknown as she could not recall what had happened.
11. For this case I was requested to determine: -
 - a) whether the bodily injuries sustained by Madam Aini could have been a result of her being flung forward; or
 - b) whether it was a result of the Motorcycle self-skidded.

Documents Referred to & Methodology

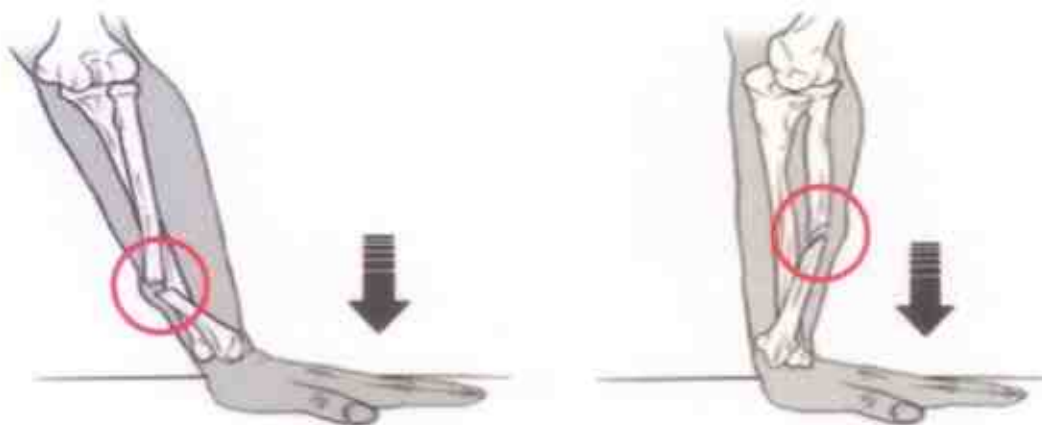
12. The documents provided to me for review and analysis were as follows: -
 - a) Traffic police report T/20160517/2169 lodged by Madam Aini;

- b) Police First Information Report;
 - c) SCDF Ambulance Report;
 - d) Inpatient discharge summary dated 10 May 2016 by Dr. Seah Zeyen of Changi General Hospital;
 - e) Medical report dated 22 November 2017 by Dr. Pravin Thiruchelvam of Changi General Hospital;
 - f) Specialist medical report dated 12 January 2018 by Dr. Low Boon Yong of Changi General Hospital;
 - g) Specialist medical report dated 02 February 2018 by Dr. Lai Juen Bin of Changi General Hospital;
 - h) 46 coloured photographs showing damage to the Motorcycle;
 - i) Repair invoice for the Motorcycle dated 10 February 2017.
13. A visit to the reported place of incident on 23 October 2018 and a review and analysis of the aforesaid documents/information were carried out in preparation of this report.
14. I now set out below my detailed analysis and findings.

Bodily Injuries Sustained by Madam Aini

15. From the various medical reports, Madam Aini had sustained the following bodily injuries: -
- a) fracture of the right radial shaft and ulnar styloid;
 - b) fracture of the left radial shaft and ulnar styloid;
 - c) comminuted fractures of the left fourth and fifth metacarpal bones and dislocation of the left middle finger metacarpal bone;
 - d) soft tissue swelling around the left wrist joint;
 - e) displaced fracture at the right proximal mandibular ramus;

- f) fracture at the left mandible;
 - g) laceration over the left lower lip; and
 - h) Abrasion on both thighs.
16. For the purpose of this report, I had checked on the medical terms used to describe Madam Aini's bodily injuries. These are broadly summarized as follows: -
- a) fracture of the 2 main bones at the left and right forearm, between the elbow and the wrist;
 - b) fracture and dislocation of 3 left fingers;
 - c) swelling around the left wrist;
 - d) fracture of the bones at the left and right jaw area;
 - e) cut at the left lower lip; and
 - f) abrasion on both thighs.
17. Given the fractures to various bones/limbs, it can reasonably be determined that the bodily injuries sustained by Madam Aini was of an impact type injury. Notably, the fracture of the 2 main bones at the left and right forearm was referred to as Galleazi fracture in the various medical reports. Such fracture involves a partial or complete break of one of the main bones (radial shaft) at the forearm, between the wrist and middle portion of the forearm. Fall on an outstretched hand is typically the cause of such fracture. See illustration below.



18. Since both the left and right forearm of Madam Aini was fractured (Galleazi fracture), and considering the typical cause of such fracture, it can be established that Madam Aini had used both her hands to break a fall hence sustaining the Galleazi fracture. Correspondingly, Madam Aini's 3 left fingers were also fractured/dislocated during this break fall.
19. The fracture of the bones at the left and right jaw area, cut at the left lower lip were indications that the lower part of Madam Aini's face had forcefully impacted onto the road surface. This is consistent to the pattern of the grazed/scratched marks that were seen on Madam Aini's helmet visor, where the helmet had grazed against the road surface, forming the marks on the helmet visor. See photo 1 below.



Photo 1 shows Madam Aini's helmet. The grazed/scratched marks seen on Madam Aini's helmet visor are consistent to marks that are formed by the helmet grazing against the road surface.

20. Following the discussions on bodily injuries sustained by Madam Aini, it appears that Madam Aini had fell from a height, tried to break her fall by using both her hands. Momentum then carried her upper body forward where her face contacted onto the ground before she came to a final rest.

Damage to Motorcycle

21. My examination of the photographs showing the damage to the Motorcycle revealed damages that were mainly of grazing nature to the right side of the Motorcycle. Such grazing nature marks are commonly associated with a motorcycle falling and thereafter sliding along the ground. Since the grazing nature marks on the Motorcycle were mainly along its right side, it can then be established that the Motorcycle had fell on its right side and slid along the road surface at the material time.
22. I also note what appears to be a lack of impact damage, like bending, crushing, breaking of body parts seen on the Motorcycle, which would seem to indicate that the Motorcycle was not exposed to an impact from, or onto any object and/or motor vehicle. In other words, the physical damage to the Motorcycle seems to indicate that it had fell on its own See photo 2 – 6 below.



Photo 2 shows marks of grazing nature that was observed on the right side of the Motorcycle, in particular to the right side handle bar and IU cover (circled).



Photo 3 shows marks of grazing nature that was observed on the right side wing mirror of the Motorcycle. The grazing marks are a result of the Motorcycle falling and sliding along the road surface.



Photo 4 shows marks of grazing nature (circled) that was observed on the right side lower cover of the Motorcycle. Again, these grazing marks were a result of the Motorcycle falling and sliding along the road surface.



Photo 5 shows marks of grazing nature that was observed on the exhaust guard, which was on the right of the Motorcycle. Such grazing nature marks are commonly associated to a motorcycle falling and thereafter sliding along the ground.



Photo 6 shows marks of grazing nature that was observed on the right side rear cover of the Motorcycle. From the damage pattern seen on the Motorcycle, it can be established that the Motorcycle had fell on its right side and thereafter slid along the road surface at the material time.

23. In general, the physical damage to the Motorcycle indicates that it had fell on its own without any impact intervention, which may suggest of a self-skid scenario. However, the bodily injuries sustained by Madam Aini, which was discussed earlier, does not appear to correspond to Madam Aini falling with the Motorcycle in a self-skid scenario.

Physical Damage to Motorcycle vs Bodily Injuries Sustained

24. Very often, in a self-skid scenario, the rider will first fall in the same direction as the motorcycle and thereafter either slides along the road surface together with the motorcycle or gets separated from the sliding motorcycle before rolling/tumbling to a rest. Bodily injuries to the rider would tend to be, amongst others, multiple abrasions and/or lacerations to the skin more on the side where the rider had fallen; a result of the rider's body sliding or rolling/tumbling along the road surface.
25. As earlier discussed, Madam Aini's bodily injuries was of an impact type, where she had fell from a height and tried to break her fall by using both her hands. The bodily injuries sustained by Madam Aini hence does not correspond to her falling to her right together with the Motorcycle, that is akin to a self-skid scenario. If falling together with the Motorcycle was not the case, then it would appear to me that Madam Aini was most likely separated from the Motorcycle before the Motorcycle fell on its right.
26. Since Madam Aini was separated from the Motorcycle before it fell, the reasonable means of separation would have been for Madam Aini to be flung forward. This scenario would correspond to the bodily injuries that she had sustained. Upon being flung forward, natural human reaction would be for Madam Aini to break her fall by using both her hands as she comes down from height, leading to the Galleazi fracture injury on both her forearm (refer to paragraph 17 and 18 above). Falling backwards as a means of separation with the Motorcycle was not possibly as this would cause Madam Aini to land on her back, fracturing her ribs and not her forearms.
27. Following the discussions in paragraph 24 to paragraph 26 above, if one was to co-relate the physical damage seen on the Motorcycle with the bodily injuries sustained by Madam Aini, it would be likely that this particular incident was not a self-skid of the Motorcycle incident. Furthermore, there are several other factors, beside the bodily injuries, which also does not support a scenario of the Motorcycle self-skid. Amongst the factors, is the accident location.

Accident Location

28. Given the unclear accident location contained in Madam Aini's Traffic Police Report, I had established the approximate accident location from information contained in the Police First Information Report and the SCDF Ambulance Report. The accident location was established to be along Pasir Ris Drive 1 towards Pasir Ris Drive 12, along the stretch of roadway between Block 425 and Block 547. See Google map below.



Screenshot taken from Google Maps shows the stretch of roadway of Pasir Ris Drive 1 towards Pasir Ris Drive 12, between Block 547 and Block 425 (highlighted by the black arrow).

29. During my visit to this stretch of roadway on 23 October 2018, I had observed that the approximate accident location was a relatively straight road. There was a pedestrian crossing and a bus stop along this stretch of roadway. Other than this, there was nothing along this stretch of roadway which differs from a typical arterial roadway. There is therefore no reasonable reason(s) for the Motorcycle to self-skid along a normal straight stretch of roadway; unlike along a bend or a corner, where a motorcycle may possibly skid if understeered or oversteered.

30. Also, the Motorcycle was a tri-wheel type of motorcycle where there are 2 wheels at the front, such type of motorcycles is more stable when taking a bend, or cornering or even when make left turns or right turns as compared to a motorcycle that has 2 wheels. The general road handling for a tri-wheel motorcycle is more stable, which is another factor that does not seem to suggest that it was possible for the Motorcycle to self-skid at the material time. See photo 7 - 9 below.



Photo 7 shows a frontal view of the Motorcycle, which is a tri-wheel type of motorcycle. Such type of motorcycle is generally more stable in terms of road handling as compared to a 2-wheel motorcycle. This is another factor that does not seem to suggest that it was possible for the Motorcycle to self-skid at the material time, especially when travelling along a straight stretch of roadway.



Photo 8 shows a general view of the stretch of roadway of Pasir Ris Drive 1 towards Pasir Ris Drive 12, between Block 547 (yellow arrow) and Block 425 (red arrow). The stretch of road was observed to be relatively straight.



Photo 9 shows a general view of the stretch of roadway of Pasir Ris Drive 1 towards Pasir Ris Drive 12, nearer to Block 547 (arrowed). The stretch of road was observed to be relatively straight. There appears to be no reasonable reason(s) for the Motorcycle, whilst travelling along this stretch of roadway, to self-skid unlike along a bend or a corner, where a motorcycle may possibly skid if understeered or oversteered.

Flung Forward Scenario

31. Although there was no reasonable reason(s) for the Motorcycle to self-skid along a normal straight stretch of roadway, there are however several possible reasons for a flung forward scenario whilst the Motorcycle was travelling along the straight stretch of roadway.
32. First would be that the Motorcycle had impacted onto the rear portion of another motor vehicle, which would cause Madam Aini to be projected forward due to momentum. In such a scenario, I would expect to see impact damage to the frontal portion of the Motorcycle. The front mudguard, front cover, front headlamp etc would have all been broken as a result of the impact force from such front to rear collision. The front forks of the Motorcycle would have also been bent/shifted inwards due to the direction of impact. However, it was clear that the Motorcycle did not sustain such pattern of damage. Hence the scenario of the Motorcycle colliding into the rear of another motor vehicle at the material time was not possible given the physical damage seen to the Motorcycle.
33. On the other hand, if Madam Aini had applied hard braking (emergency brake) in an accident avoidance situation, then it would have been possible for her to be flung forward without any eventual collision. I note that the braking system of the Motorcycle was of hydraulic pressure type with brake disc at all the wheels. The braking efficiency to the front of the Motorcycle was more efficient as compared to the rear given that there were 2 wheels at the front and 1 wheel at the rear.
34. To put things into perspective, in a 100% braking efficiency, each wheel of the Motorcycle would have approximately 33% of braking efficiency. In total, the front of the Motorcycle would have approximately 66% braking efficiency compared to approximately 33% to the rear. The ability to stop the rotation (moving) of the front wheels would therefore be approximately double ie the front wheels would stop much quicker than the rear wheels. When hard braking, this could result in the rear of the Motorcycle lifting upwards as the front wheels slows and stops faster than the rear wheels, ultimately leading to Madam Aini being flung forward.

35. For clarity, a normal saloon motor car that has 4 wheels has a braking efficiency of 60% frontal and 40% rear. This translate to 30% for each front wheel and 20% for each rear wheel. This gives a more balance braking efficiency. Even with such balance braking efficiency, the front of a saloon motor car will still dip downwards with the rear portion lifted during hard braking, more so a motorcycle. See photo 10 & 11 below.



Photo 10 shows a frontal view of the Motorcycle. The braking system of the Motorcycle was of hydraulic pressure type with brake disc at all the wheels. The front wheels of the Motorcycle will stop rotating faster as compared to the rear wheel given that the frontal wheels are individually fitted with its own brake disc (arrowed).



Photo 11 shows the brake disc (arrowed) at the front right wheel of the Motorcycle. The front left wheel and rear wheel of the Motorcycle were similarly fitted with such brake disc as part of the Motorcycle's braking system.

36. The bodily injuries that Madam Aini had sustained and the physical damage to the Motorcycle, would in fact appear to correspond to a scenario that Madam Aini had indeed applied hard braking action to the Motorcycle in reaction to a situation (hazard), which caused her to be flung forward. The Motorcycle, without an operator, then fell on its right side before sliding along the road surface to a complete rest. Madam Aini upon being flung forward had used both her hands to break her fall as she landed onto the road surface. Momentum carried her upper body forward where her face landed directly on the road surface before she came to a rest.

37. Some possible causes for Madam Aini to apply hard braking action at the material time includes amongst others, sudden hard braking by a motor vehicle that was travelling in front of her, sudden dashing across the roadway by pedestrians, riding behaviour of personal mobility device etc. Generally, it would have been for accident avoidance reason(s) that Madam Aini had to apply hard braking action at the material time.

Conclusion

38. Having reviewed the documents/information for this case, I am of the view that the type of bodily injuries sustained by Madam Aini and the physical damage to the Motorcycle collectively corresponds to a scenario of Madam Aini being flung forward from the Motorcycle rather than a scenario of the Motorcycle self-skid.
39. In all likelihood, Madam Aini had applied hard braking action to the Motorcycle at the material time, which led to her being flung forward. The requirement of a hard braking action along a relatively straight roadway would have been due to accident avoidance reason(s) like for example sudden hard braking by a motor vehicle that was travelling in front of her, sudden dashing across the roadway by pedestrians, riding behaviour of personal mobility device etc.
40. I have rendered these opinions and conclusions after careful evaluation and analysis of the documents provided, based on my education, training and experience. The factual matters stated in this report are, as far as I know, true and I have made all enquiries which I consider appropriate. The opinions stated in this report are genuinely held by me and this report contains reference to all matters I consider significant



Ang Bryan Tani

Senior Technical Investigator

Technical Investigation & Reconstructionist (SAE-A)

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