



Auto  
Consultants  
Pte Ltd

Company Registration No. 199607198R

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Your Ref: YM 8972C  
Our Ref : CI/TP18016255/D

20 September 2018

**Mechanical Condition Report Of Motor Lorry YM 8972C,  
Involved In An Accident On 06 November 2012**

**Requested By  
Tan Chong Industrial Machinery (Pte) Ltd  
23 Jalan Buroh  
Singapore 619479**

## **A. Introduction & Background Information**

1. I refer to your request dated 28 June 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 case, I was requested by Tan Chong Industrial Machinery (Pte) Ltd (herein referred to as "**TCIM**") to provide my comments and opinions pertaining to the mechanical condition of a motor lorry YM 8972C (herein referred to as "**Motor Lorry**") that was involved in an accident with 3 pedestrians at the junction of Clementi Avenue 6 by Clementi Loop on 06 November 2012.
11. Because of the accident, I am instructed that TCIM faces a third-party action brought by the driver of the Motor Lorry (herein referred to as "**Driver**") and employer, Havi Logistics (Singapore) Pte Ltd who are both Defendants in DC Suit Nos. 848/2014 and 3272/2015 ("the actions"). The Plaintiffs are an injured pedestrian and the next of kin of a deceased pedestrian respectively. The Defendants are seeking an indemnity or contribution of liability from TCIM on the ground that the accident was solely caused by or substantially contributed by the negligence of TCIM.

12. The Defendant's defence, amongst other things, is that the Motor Lorry's brakes were ineffective at the material time and that TCIM was negligent in failing to ensure the roadworthiness of the Motor Lorry as it was last serviced by TCIM on 5 November 2012, one day before the accident.
13. The Driver was subsequently charged in Court for causing the death of the deceased pedestrian and causing grievous hurt to the other pedestrian by driving at an unsafe speed and with inefficient brakes. I am further instructed that the Driver engaged Mr Kelvin Koay of Koays Consulting Pte Ltd, who inspected the Motor Lorry after the accident, and thereafter testified at the criminal trial. Mr. Tan Jiat Shee, Senior Automotive Engineer with STA Vehicle Inspection and Mr Lim Chwee Hai, TSO Grade 2 from Automotive Engineering & Management Division, Police Logistics Department, also inspected the Motor Lorry after the accident and both gave evidence on behalf of the Prosecution.
14. The reports of Mr Kelvin Koay, Mr Tan Jiat Shee and Mr Lim Chwee Hai were produced in Court during the course of the criminal trial. I am now requested to peruse these reports and thereafter provide my comment(s) and opinion(s) on whether the brake system of the Motor Lorry was indeed ineffective, had failed and/or malfunctioned at the material time of accident.

#### **B. Documents Referred To & Methodology**

15. The following documents were reviewed and considered in the preparation of this report: -
  - a) Specialist Inspection Report dated 07 December 2012 by Koays Consulting Pte Ltd, including annexes enclosed in the report (herein referred to as "**Koays Report**");
  - b) Mechanical Inspection and Assessment of Accident Vehicle Report by STA Vehicle Inspection, including photographs enclosed in the report (herein referred to as "**STA First Report**");
  - c) Clarification Report by STA Vehicle Inspection dated 23 January 2014, including annexes enclosed in the report (herein referred to as "**STA Second Report**");

- d) Police Accident Damaged Vehicle Inspection Report by Automotive Engineering & Management Division, Police Logistics Department (herein referred to as "**Police Logistics Department Report**").

- 16. I did not have an opportunity to carry out a physical inspection of the Motor Lorry. For the purpose of this report, I had instead relied on the photographs, information, records etc contained in Koay's Report, STA First Report, STA Second Report and Police Logistics Department Report (herein collectively referred to as "**Reports**") for analysis.

### C. Summary Of Conclusion

- 17. It is my opinion that the brake system of the Motor Lorry was in serviceable condition at the material time of accident; and/or at the time when TCIM returned the Motor Lorry to Havi Logistics (Singapore) Pte Ltd on 05 November 2012. Apart from the claim by the Driver that the brakes were ineffective, there was no other substantial and/or objective evidence to suggest the same.
- 18. I now set out below the details of how I arrived at my opinion.

### D. Mileage Of The Motor Lorry

- 19. The Motor Lorry broke down and was towed to TCIM on 04 November 2012. The flywheel, clutch disc and bearing were replaced. At this time, the Motor Lorry was also serviced. The engine oil, oil filter and fuel filter were replaced. The Motor Lorry was driven back to Havi Logistics (Singapore) Pte Ltd on 05 November 2012 by TCIM. From the job card J1092348 of TCIM for these activities, the mileage of the Motor Lorry was recorded to be 99,235km. This was also the last time that work was done on the Motor Lorry by TCIM prior to the accident.
- 20. The mileage recorded of the Motor Lorry in paragraph 3.4 page 4 of Koays Report, was indicated as 99,495km. This was on 23 November 2012 after it was released by Traffic Police Department. I am instructed that the Motor Lorry was towed from Traffic Police Department to TCIM where the inspection of the Motor Lorry, as stated in Koays Report, was carried out. I am also instructed that the mileage of the Motor Lorry will continue to move during towing, depending on whether the engine was switched on or whether the rear wheels were off ground during towing.

21. Considering the need to preserve the condition of the Motor Lorry for Police investigations, the Motor Lorry would have also been towed from the accident scene to Traffic Police pound after the accident. An estimated mileage that the Motor Lorry would have recorded whilst being towed from the accident scene to Traffic Police pound and subsequently to TCIM is about 24km and 33.6km respectively (gathered from Google Maps).
22. Taking into account the estimated total mileage during the 2 towing journeys, it can be established that the Motor Lorry was driven for at least 202.4km (99,495km less 99,235km less 24km less 33.6km) between the time that it left TCIM on 05 November 2012 to the time of accident on 06 November 2012. Koays Report did not account for this 202.4km driven distance of the Motor Lorry.
23. The Motor Lorry was driven for 202.4km without any complaint of braking problem. Neither was the Motor Lorry involved in any accident(s) during this same period, which had included the 3.99km distance that it was driven from the office of Havi Logistics (Singapore) Pte Ltd, at Pandan Loop, to the accident junction. This 3.99km distance was indicated in the tracking report of the Motor Lorry, shown in page 32 of Koays Report. In general, the driven distance of the Motor Lorry for 202.4km without encountering any braking issue(s) was not accounted for in Koay's Report.

#### **E. Braking Pattern Of Motor Lorry**

24. The tracking report of the Motor Lorry had amongst other things showed the location and travelling speed of the Motor Lorry for a total time of 40mins, including 5mins after the accident. As seen from this report, the Motor Lorry had started the journey from the office of Havi Logistics (Singapore) Pte Ltd. In paragraph 3.42 page 17 of Koays Report, it was stated that: *"Driver had applied brakes frequently under heavy traffic condition and this had likely caused overheating of the brakes, which were aggravated if the brakes were out of adjustment. Evidence of overheating of the brake drums were found during the inspection of the Motor Lorry".*

25. The information from the tracking report seems to indicate that there was no frequent braking of the Motor Lorry during the journey leading up to the accident location. This can be established by looking at the reduction of the travelling speed of the Motor Lorry. In total, there were 5 occasions of speed reduction with 3 occasions being reduced to 0kmph, with the third occasion being after the accident. The other 2 occasions being at the start of the journey with once at Havi Logistics (Singapore) Pte Ltd and the second at the roadway just outside. The evidence that the Motor Lorry was able to come to a complete stop on 2 occasions (speed reduced to 0kmph) prior to the accident does not seem to suggest that there was braking problem to the Motor Lorry.
26. The application of brakes for a minimum of 3 occasions to a maximum of 5 occasions during the journey, with 2 being at the start of the journey, cannot be considered to be a frequent braking pattern. The braking pattern of the Motor Lorry gathered from the tracking report showed a pattern that was: on and off brake application with time gaps in between these applications. Such pattern would not cause the brakes to overheat given that there was a cooling down period between the next application, as compared to a pattern where there is heavy/hard braking applied for a constant continued period like on a race track.
27. Furthermore, the last speed reduction prior to the accident was from 29kmph to 6kmph, which was about 2.55km away from the accident location. The brakes of the Motor Lorry would have cooled down when it was travelling this 2.55km. Hence, referring to the tracking report, if the Driver had applied the brakes at the timing 18:26 to 18:27 when the speed of the Motor Lorry was reduced from 58kmph to 0kmph, the brakes would not have been in an overheated condition to have been ineffective, had failed and/or malfunctioned.

#### **F. Brake Test Result Vs Actual Operational Behaviour**

28. A roller brake test was carried out on the Motor Lorry on 23 November 2012. This was after it was released by Traffic Police Department. At the time of the test, the Motor Lorry was in the same physical condition as at after the accident. The test result shown in page 34 of Koays Report was an overall fail of the Motor Lorry's brake system. The cause of this was the efficiency of the rear brakes, where a 19% was recorded.

29. For such roller brake test, the measurement of the brake force/efficiency is through a machine where the wheels of the vehicle sit on a roller (simulating movement of the vehicle) and thereafter the brake pedal of the vehicle is depressed when instructed to by the machine. I note that there was a single test result in Koays Report, indicating that there was only one test conducted on the Motor Lorry. Koay's Report did not seem to account for any possible error of the readings captured by the machine given that there was direct human intervention ie depressing of brake pedal. For example, if the brake pedal was not depressed fully or at a wrong timing, the readings captured would be lesser as the brakes did not achieve full efficiency. At minimum, a second test should have been carried out to ensure the accuracy of the result for the first test, regardless of whether the result of the first test was pass or fail.
30. The accuracy of the roller brake test result is further questionable as it contradicts the actual operational behaviour of the Motor Lorry's brake system immediately before the test and immediately after the test. In paragraph 3.29 page 13 of Koays Report, it was stated that *"on the way to the inspection centre for the roller brake test, the brake system of the Motor Lorry was tested"*. I am instructed that the Motor Lorry was driven to the inspection centre and thereafter driven back to TCIM after the roller brake test was completed, and during both journeys, the brakes of the Motor Lorry had to be applied by the driver due to traffic condition, and in all applications, the brakes were in normal working condition. The journey from TCIM to the inspection centre and back to TCIM was approximately 3.4km and 5.0km respectively (gathered from Google Maps).
31. The inspection of the Motor Lorry stated in STA's Report and Police Logistics Department Report were both static inspection without any driving of the Motor Lorry and/or dismantling and/or replacing of any parts. The first driving of the Motor Lorry after the accident would therefore be on 23 November 2012 during the drive from TCIM to the inspection centre for a roller brake test, refer to paragraph 3.26 page 13 of Koays Report. I am instructed that there was no dismantling and/or replacing of parts before this drive. It was also not stated in Koay's Report that any work was done to the Motor Lorry before the drive to the inspection centre.

32. Given that the braking system of the Motor Lorry had been untouched since the accident, if indeed there was an issue(s) with the Motor Lorry's braking system at the time of accident, I would expect the issue(s) to be still present when the Motor Lorry was driven for the very first time after the accident. However, this was not the case as the Motor Lorry's braking system was operating normally during the journey to the inspection centre from TCIM. Mr Calvin Koay, who sat on the Motor Lorry during this journey did not state that he felt any ineffectiveness, issue(s) etc to the Motor Lorry's braking system, as none of these were mentioned in Koay's Report.

#### **G. Maintenance History Of The Motor Lorry**

33. A summary of the maintenance history of the Motor Lorry for the period 28 November 2011 to 5 November 2012 was annexed in page 28 to page 31 of Koays Report. During this period, there were several activities that involved the braking system of the Motor Lorry, these were similarly mentioned in paragraph 3.10 page 9 of Koays Report. The recorded information from the maintenance history, would suggest to me that the brake system of the Motor Lorry was regularly maintained and serviced. This includes an overhaul of the rear brakes on 21 September 2012 by TCIM, about 1 and a half month before this accident. The front brakes of the Motor Lorry were also overhauled on 01 March 2012.
34. I further note that there were 2 records of "brake not effective". This was on 16 April 2012 and 09 July 2012. I am instructed that the 2 records of "brake not effective" were brought up by Havi Logistics (Singapore) Pte Ltd. From these records, Havi Logistics (Singapore) Pte Ltd did not highlight and/or raised any issue(s) regarding the braking system of the Motor Lorry on 04 November 2012 or thereabouts, when the Motor Lorry was last at TCIM before the accident.

35. The records also show that on 05 November 2012, before returning the Motor Lorry, a brake test was conducted on the Motor Lorry. I am instructed that this test had involved driving the Motor Lorry within the premise of TCIM and applying the brake. This test, although relatively short and at low speed, would involve checks on the brake system operationally. Any abnormality, like too much free play on the brake pedal, leakage of air, abnormal sounds during braking etc can be detected through such test. An experienced mechanic would and should be able to detect whether there was any operational abnormality to the braking system, more so if the mechanic is from TCIM, who are the local specialist in Nissan UD heavy commercial vehicles like the Motor Lorry.
36. Furthermore, the Motor Lorry was driven back to Havi Logistics (Singapore) Pte Ltd upon the completion of repairs and servicing on 05 November 2012. This drive was approximately 6.3km (gathered from Google Maps). The Motor Lorry was driven by a designated driver, who was and still is, in the employment of TCIM. Having driven many types of heavy commercial vehicles like the Motor Lorry, this person can be considered to be reasonably experienced in the handling of such type of vehicles. In this aspect, it would therefore not be unreasonable to say that the braking system of the Motor Lorry was in fact operationally tested twice by 2 persons on 2 different occasions. And on both these 2 occasions, the experienced mechanic and the experienced driver did not encounter any abnormality to the operational behaviour of the Motor Lorry's braking system.

#### **H. Condition Of Rear Brake Drums**

37. The marks seen on the rear brake drums of the Motor Lorry were commented to be "cracks" in paragraph 3.32 page 13 of Koay's Report, STA First Report, STA Second Report and Police Logistics Department Report did not contain photographs showing the inside of the brake drums as their inspection was a static inspection and did not involve any dismantling. Without the benefit of physically inspecting the rear brake drums of the Motor Lorry, I cannot say for sure that the marks in the photographs shown in page 14, page 15 and page 16 of Koays Report are "cracks" caused by overheating or caused by other reason(s) instead.

38. I did however manage to check the front brake drums and rear brake drums of several heavy commercial vehicles, similar to that of the Motor Lorry, which frequently carries heavy load. Although not common, the same type of marks, referred to as "cracks" in Koays Report, were seen on several of the heavy commercial vehicles that I had inspected. For the purpose of this report, 2 different types of heavy commercial vehicles with the same type of marks on the brake drums are discussed in the below paragraphs, one of which is an exact same model as the Motor Lorry.
39. The first heavy commercial vehicle, which was an exact same model as the Motor Lorry (herein referred to as "**Exemplar Vehicle 1**"), was found with the same type of marks on its rear left brake drum and front left brake drum. The marks were found around the entire circumference of the aforesaid brake drums. It was then driven to STA Inspection Centre for a roller brake test. To ensure the accuracy of the result, there were 2 tests carried out. For both tests, the Exemplar Vehicle 1 had recorded an overall passed for its braking system. See photo 1 – 9 below.



**Photo 1** shows a general view of Exemplar Vehicle 1, which was an exact same model as the Motor Lorry. The rear left brake drums were removed for my checks on the condition of the brake drums.



**Photo 2** shows a general view of the removed rear left brake drum of Exemplar Vehicle 1. I had found the same type of marks, which were referred to as "cracks" in Koays Report. These marks were observed to be around the entire circumference of the brake drum.



**Photo 3** shows a close-up view of the same type of marks that were referred to as "cracks" in Koays Report (refer to the photographs seen in page 14 to page 16 of Koays Report). These marks were found on the rear left brake drum of Exemplar Vehicle 1.



Photo 4 shows the front left brake drum of Exemplar Vehicle 1, removed for checks on the condition of the front left brake drum. Exemplar Vehicle 1 was an exact same model as the Motor Lorry.



Photo 5 shows a general view of the removed front left brake drum of Exemplar Vehicle 1. I had found the same type of marks, which were referred to as "cracks" in Koays Report. These marks were observed to be around the entire circumference of the brake drum.



Photo 6 shows a close-up view of the same type of marks that were referred to as "cracks" in Koays Report (refer to the photographs seen in page 14 to page 16 of Koays Report). These marks were found on the front left brake drum of Exemplar Vehicle 1.



Photo 7 shows Exemplar Vehicle 1 going through the roller brake test at STA Inspection Centre with the brake drums condition as seen in photograph 3 and photograph 6 above. There were 2 tests carried out to ensure the accuracy of the result.



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## VEHICLE INSPECTION FORM

VEHICLE NO. <b>YM6023E</b>	MILEAGE <b>421529</b>	REF NO. <b>LQ180914041</b>
TYPE OF INSPECTION <b>Self-Request First Inspection</b>	DATE OF REGISTRATION <b>01/03/2007</b>	MOTOR NO. <b>0</b>
DATE OF INSPECTION <b>14/09/2018</b>	BRAKES <b>P</b>	ENGINE NO. <b>J08ELUB10133</b>
MAKE OF VEHICLE <b>NISSAN</b>	W(Kg) L(Kg) R(Kg) S(%) T(%) D(%)	CHASSIS NO. <b>PKC37BN00020</b>
OVERALL RESULT <b>Passed</b> (arrowed)	1a 3,184 817 937 38 0.6 1.1 1p 0 0 0 0 0.0 0.0 2a 4,300 1,200 1,351 42 0.5 1.1 2p 0 812 1,013 43 4.4 0.0	DIESEL SMOKE <b>SOUND LEVEL</b>
EMISSION TEST		HEADLIGHT
TAXI METER	SPEEDOMETER	SPEED LIMITER
		SPEED WARNING DEVICE
TEST CERTIFICATE		
		
ABOVE CARRIAGE INSPECTION (P-PASS M-MARGINAL F-FAIL)		

Photo 8 shows the result of the first roller brake test that was carried out to Exemplar Vehicle 1 at STA Inspection Centre. An overall passed (arrowed) was recorded for the braking system of Exemplar Vehicle 1.



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## VEHICLE INSPECTION FORM

VEHICLE NO. <b>YM6023E</b>	MILEAGE <b>421530</b>	REF NO. <b>LQ180914042</b>
TYPE OF INSPECTION <b>Self-Request First Inspection</b>	DATE OF REGISTRATION <b>01/03/2007</b>	MOTOR NO. <b>0</b>
DATE OF INSPECTION <b>14/09/2018</b>	BRAKES <b>P</b>	ENGINE NO. <b>J08ELUB10133</b>
MAKE OF VEHICLE <b>NISSAN</b>	W(Kg) L(Kg) R(Kg) S(%) T(%) D(%)	CHASSIS NO. <b>PKC37BN00020</b>
OVERALL RESULT <b>Passed</b> (arrowed)	1a 3,188 894 937 40 1.3 1.3 1p 0 0 0 0 0.0 0.0 2a 4,318 1,170 1,307 37 3.1 1.8 2p 0 1,013 1,078 40 1.3 0.0	DIESEL SMOKE <b>SOUND LEVEL</b>
EMISSION TEST		HEADLIGHT
TAXI METER	SPEEDOMETER	SPEED LIMITER
		SPEED WARNING DEVICE
TEST CERTIFICATE		
		
ABOVE CARRIAGE INSPECTION (P-PASS M-MARGINAL F-FAIL)		

Photo 9 shows the result of the second roller brake test that was carried out to Exemplar Vehicle 1 at STA Inspection Centre. An overall passed (arrowed) was again recorded for the braking system of Exemplar Vehicle 1.

40. The second heavy commercial vehicle was a Nissan model prime mover that was fitted with a full air-brake system (herein referred to as "Exemplar Vehicle 2"), which was the same type of brake system that was fitted on the Motor Lorry. Again, the same type of marks as seen in the photographs shown in page 14, page 15 and page 16 of Koays Report, were also seen on the rear left brake drum, rear right brake drum and front right brake drum of Exemplar Vehicle 2. The marks were found around the entire circumference of the aforesaid brake drums. Similar to Exemplar Vehicle 1, it was driven to STA Inspection Centre for a roller brake test. To ensure the accuracy of the result, there were again 2 tests carried out.
41. Exemplar Vehicle 2 had recorded an overall passed for the first test but had recorded an overall failed for the second test. I note from the result of the second test that the brake force for the front right wheel was significantly lesser than its front left wheel. This creates an imbalance brake force to the front wheels of Exemplar Vehicle 2. In the event of heavy/hard braking, it may be possible for Exemplar Vehicle 2 to veer/swerve to the side where the brake force is higher, hence a failed result was recorded for the second test. Notably, in the same test, I note that the brake efficiency for the front brakes of Exemplar Vehicle 2 was able to achieve 53%, which is above the 50% legal requirement.
42. Since there was a passed and a failed result for Exemplar Vehicle 2, I had requested TCIM to check on the front brakes of Exemplar Vehicle 2 and to rectify the imbalance brake issue. A third roller brake test was subsequently carried out where an overall passed was recorded. The work carried out by TCIM for the front brakes of Exemplar Vehicle 2 before the third roller brake test was adjusting and servicing of the front brakes. There was no replacement of any part(s) for the front brake, in particular the brake drums and/or brake linings. In other words, the brake drums with marks referred to as "crack" in Koays Report, were fitted on Exemplar Vehicle 2 when it recorded an overall pass during the third roller brake test. From these observations, it can be established that the failed result recorded for the second roller brake test was not due to and/or related to the marks seen on the brake drums of Exemplar Vehicle 2. See photo 10 – 22 below.



Photo 10 shows a general view of Exemplar Vehicle 2, a Nissan model prime mover that was fitted with a full air-brake system, the same type that was fitted on the Motor Lorry. The rear left brake drums were removed for my checks on the condition of the brake drums.



Photo 11 shows a general view of the removed rear left brake drum of Exemplar Vehicle 2. I had found the same type of marks, which were referred to as "cracks" in Koays Report. These marks were observed to be around the entire circumference of the rear left brake drum.



Photo 12 shows a close-up view of the same type of marks that were referred to as "cracks" in Koays Report (refer to the photographs seen in page 14 to page 16 of Koays Report). These marks were found on the rear left brake drum of Exemplar Vehicle 2.



Photo 13 shows a general view of Exemplar Vehicle 2 with its rear right brake drums removed for my checks on the condition of the brake drums.



Photo 14 shows a general view of the removed rear right brake drum of Exemplar Vehicle 2. I had found the same type of marks, which were referred to as "cracks" in Koays Report. These marks were observed to be around the entire circumference of the brake drum.



Photo 15 shows a close-up view of the same type of marks that were referred to as "cracks" in Koays Report (refer to the photographs seen in page 14 to page 16 of Koays Report). These marks were found on the rear right brake drum of Exemplar Vehicle 2.



**Photo 16** shows a general view of Exemplar Vehicle 2 with its front right brake drums removed for my checks on the condition of the brake drums.



**Photo 17** shows a close-up view of the same type of marks that were referred to as "cracks" in Koays Report (refer to the photographs seen in page 14 to page 16 of Koays Report). These marks were found on the front right brake drum of Exemplar Vehicle 2.



Photo 18 shows Exemplar Vehicle 2 going through the roller brake test at STA Inspection Centre with the brake drums condition as seen in photograph 12, photograph 15 and photograph 17 above.



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## VEHICLE INSPECTION FORM

VEHICLE NO <b>XD1924T</b>		MILEAGE <b>610014</b>		REF NO <b>LQ180914043</b>																																				
TYPE OF INSPECTION <b>Self-Request First Inspection</b>		DATE OF REGISTRATION <b>15/10/2007</b>		MOTOR NO <b>0</b>																																				
DATE OF INSPECTION <b>01/14/09/2018</b>		BRAKES		ENGINE NO <b>GE13334083B</b>																																				
MAKE OF VEHICLE <b>NISSAN</b>		<table border="1"> <thead> <tr> <th></th> <th>W(Kg)</th> <th>L(Kg)</th> <th>R(Kg)</th> <th>R(N)</th> <th>L(N)</th> <th>R(N)</th> </tr> </thead> <tbody> <tr> <td>1s</td> <td>4,004</td> <td>1,574</td> <td>1,300</td> <td>42</td> <td>4.6</td> <td>1.6</td> </tr> <tr> <td>1p</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0.0</td> <td>0.0</td> </tr> <tr> <td>2s</td> <td>1,307</td> <td>798</td> <td>155</td> <td>41</td> <td>2.0</td> <td>1.6</td> </tr> <tr> <td>2p</td> <td>0</td> <td>000</td> <td>748</td> <td>43</td> <td>2.3</td> <td>0.0</td> </tr> </tbody> </table>			W(Kg)	L(Kg)	R(Kg)	R(N)	L(N)	R(N)	1s	4,004	1,574	1,300	42	4.6	1.6	1p	0	0	0	0	0.0	0.0	2s	1,307	798	155	41	2.0	1.6	2p	0	000	748	43	2.3	0.0	CHASSIS NO <b>GKB4CLB00156</b>	
	W(Kg)	L(Kg)	R(Kg)	R(N)	L(N)	R(N)																																		
1s	4,004	1,574	1,300	42	4.6	1.6																																		
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2s	1,307	798	155	41	2.0	1.6																																		
2p	0	000	748	43	2.3	0.0																																		
OVERALL RESULT <b>Passed</b> (arrowed)		SIDE SLIP		DIESEL SMOKE																																				
EMISSION TEST				SOUND LEVEL																																				
TAXI METER		SPEEDOMETER		HEADLIGHT																																				
SPEED LIMITER		SPEED WARNING DEVICE		TEST CERTIFICATE NO																																				
<p>ABOVE CARRIAGE INSPECTION (P-PASS N-MARGINAL F-FAIL)</p> 																																								

Photo 19 shows the result of the first roller brake test that was carried out to Exemplar Vehicle 2 at STA Inspection Centre. An overall passed (arrowed) was recorded for the braking system of Exemplar Vehicle 2.



Auto  
Consultants  
Pte Ltd

Company Registration No. 199607198R

51 UBI AVE 1, #01-25 PAYA UBI INDUSTRIAL PARK, SINGAPORE 408933 TEL : (065) 62563561 FAX : (065) 67414108



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GST Regn No: SUT-005288-2

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249 Jalan Besar Lay  
Singapore 10527  
Tel : (65) 6261 6178  
Fax : (65) 6261 2201

## VEHICLE INSPECTION FORM

VEHICLE NO. <b>XD1924Y</b>		MILEAGE <b>61001.3</b>		REF NO. <b>LQ18091404</b>																																				
TYPE OF INSPECTION <b>Self-Request First Inspection</b>		DATE OF REGISTRATION <b>15/10/2007</b>		MOTOR NO. <b>0</b>																																				
DATE OF INSPECTION <b>14/09/2018</b>		BRAKES		ENGINE NO. <b>GE133340838</b>																																				
MAKE OF VEHICLE <b>NISSAN</b>		<table border="1"> <thead> <tr> <th></th> <th>W(kg)</th> <th>L(kg)</th> <th>R(kg)</th> <th>R(%)</th> <th>L(%)</th> <th>D(%)</th> </tr> </thead> <tbody> <tr> <td>1a</td> <td>4,890</td> <td>1,496</td> <td>999</td> <td>30</td> <td>10.6</td> <td>1.7</td> </tr> <tr> <td>1p</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0.0</td> <td>0.0</td> </tr> <tr> <td>2a</td> <td>2,308</td> <td>799</td> <td>739</td> <td>64</td> <td>2.3</td> <td>1.3</td> </tr> <tr> <td>2p</td> <td>0</td> <td>821</td> <td>730</td> <td>43</td> <td>1.6</td> <td>0.8</td> </tr> </tbody> </table>			W(kg)	L(kg)	R(kg)	R(%)	L(%)	D(%)	1a	4,890	1,496	999	30	10.6	1.7	1p	0	0	0	0	0.0	0.0	2a	2,308	799	739	64	2.3	1.3	2p	0	821	730	43	1.6	0.8	CHASSIS NO. <b>GKB4CL800136</b>	
	W(kg)	L(kg)	R(kg)	R(%)	L(%)	D(%)																																		
1a	4,890	1,496	999	30	10.6	1.7																																		
1p	0	0	0	0	0.0	0.0																																		
2a	2,308	799	739	64	2.3	1.3																																		
2p	0	821	730	43	1.6	0.8																																		
OVERALL RESULT <b>Failed</b>		SIDE SLIP		DIESEL SMOKE																																				
EMISSION TEST				SOUND LEVEL																																				
TAXI METER		SPEEDOMETER		SPEED LIMITER																																				
				SPEED WARNING DEVICE																																				
				TEST CERTIFICATE NO.																																				
																																								
ABOVE CARRIAGE INSPECTION (P-PASS M-MARGINAL F-FAIL)																																								

Photo 20 shows the result of the second roller brake test that was carried out to Exemplar Vehicle 2 at STA Inspection Centre. An overall failed (circled) was recorded for the braking system of Exemplar Vehicle 2. This was due to imbalance brake force, where the front right brake force was significantly lesser than the front left brake force (red arrow). The efficiency of the front brakes was however noted to be above the 50% legal requirement (blue arrow).



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## VEHICLE INSPECTION FORM

VEHICLE NO. <b>XD1924Y</b>		MILEAGE <b>610064</b>		REF NO. <b>LQ180917059</b>																																				
TYPE OF INSPECTION <b>Self-Request First Inspection</b>		DATE OF REGISTRATION <b>15/10/2007</b>		MOTOR NO. <b>0</b>																																				
DATE OF INSPECTION <b>17/09/2018</b>		BRAKES		ENGINE NO. <b>GE133340838</b>																																				
MAKE OF VEHICLE <b>NISSAN</b>		<table border="1"> <thead> <tr> <th></th> <th>W(kg)</th> <th>L(kg)</th> <th>R(kg)</th> <th>R(%)</th> <th>L(%)</th> <th>D(%)</th> </tr> </thead> <tbody> <tr> <td>1a</td> <td>4,748</td> <td>1,887</td> <td>1,304</td> <td>23</td> <td>3.1</td> <td>1.6</td> </tr> <tr> <td>1p</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0.0</td> <td>0.0</td> </tr> <tr> <td>2a</td> <td>2,424</td> <td>807</td> <td>730</td> <td>64</td> <td>2.6</td> <td>1.2</td> </tr> <tr> <td>2p</td> <td>0</td> <td>798</td> <td>693</td> <td>60</td> <td>3.1</td> <td>0.8</td> </tr> </tbody> </table>			W(kg)	L(kg)	R(kg)	R(%)	L(%)	D(%)	1a	4,748	1,887	1,304	23	3.1	1.6	1p	0	0	0	0	0.0	0.0	2a	2,424	807	730	64	2.6	1.2	2p	0	798	693	60	3.1	0.8	CHASSIS NO. <b>GKB4CL800136</b>	
	W(kg)	L(kg)	R(kg)	R(%)	L(%)	D(%)																																		
1a	4,748	1,887	1,304	23	3.1	1.6																																		
1p	0	0	0	0	0.0	0.0																																		
2a	2,424	807	730	64	2.6	1.2																																		
2p	0	798	693	60	3.1	0.8																																		
OVERALL RESULT <b>Passed</b>		SIDE SLIP		DIESEL SMOKE																																				
EMISSION TEST				SOUND LEVEL																																				
TAXI METER		SPEEDOMETER		SPEED LIMITER																																				
				SPEED WARNING DEVICE																																				
				TEST CERTIFICATE NO.																																				
																																								
ABOVE CARRIAGE INSPECTION (P-PASS M-MARGINAL F-FAIL)																																								

Photo 21 shows the result of the third roller brake test that was carried out to Exemplar Vehicle 2 at STA Inspection Centre after the front brakes were adjusted and serviced due to the imbalance brake force for the front brakes. Exemplar Vehicle 2 recorded an overall passed (arrowed) for its braking system at the third roller brake test without any replacement of part(s) for the front brake.

TAN CHONG INTERNATIONAL		Tan Chong Industrial Machinery (Pte) Ltd		陳唱工業機械(私人)有限公司	
www.tanchong.com		23 Jalan Buroh Singapore 619479		Service Dept Tel : 6703 8757 Service Dept Fax : 6266 3862	
<b>DELIVERY ORDER</b>					
TO :	FPS GLOBAL LOGISTICS PTE LTD	DATE IN :	17-09-2018		
ADDRESS :	BLK 511 KAMPONG BAHRU ROAD #03-03 KEPPEL SINGAPORE 099447	DATE OF COMPL :			
CONTACT PERSON :		GST REGN No. :	M2-0036354-0		
CONTACT NUMBER :	82401800	TIME IN :	13:37		
PAYMENT TERMS :	30 DAYS	JOB NUMBER :	BRJ0002747		
EGN. NUMBER :	XD190AY	MILEAGE :			
TOEHL :	GRB4CLB9H8	TECHNICIAN :			
CHASSIS NUMBER :	GRB4CLB-00156	REFERENCE :			
ENGINE NUMBER :	GE13-324063R	STAFF :	ALFRED LEE		
QUOTATION	YES / NO	EXPECTED TIME OF COMPLETION	SERVICE ADVISOR		
ITEM	JOB CODE	DESCRIPTION			
	L T-8R-0995-09900	TO SERVICE & ADJUST FRONT BRAKE			

Photo 22 shows the job card for Exemplar Vehicle 2 before it was sent to STA Inspection Centre for a third roller brake test. The job description was carried out due to the imbalance brake force for the front brakes of Exemplar Vehicle 2 that was recorded during the second roller brake test.

43. Having checked the front and rear brake drums of several heavy commercial vehicles similar to that of the Motor Lorry, it would appear to me that the marks referred to as "cracks", and seen in the photographs shown in page 14, page 15 and page 16 of Koays Report, are marks that can commonly be found on the brake drums of heavy commercial vehicles. Basing on the results of the roller brake tests at STA Inspection Centre, heavy commercial vehicles with such marks on their brake drums would still have an efficient braking system.

#### I. Condition Of Rear Tyres

44. The 4 rear tyres of the Motor Lorry were indicated to be worn and below the legal requirement in STA First Report. The remaining tread measurements for the rear right tyres and rear left tyres were indicated as 0.5mm for both sides (refer to paragraph 3 of STA First Report). In Koays Report, the measurement for the tread depth of the rear tyres was indicated as 1mm (refer to paragraph 3.7 page 4 of Koays Report). Police Logistics Department Report on the other hand, had indicated measurements of between 3mm to 6mm for the 4 rear tyres of the Motor Lorry (refer to paragraph 7 of Police Logistics Department Report).

45. The different measurements given for the remaining tread depth of the Motor Lorry's rear tyres could be due to several reasons like the type of equipment used to measure, how the measurement was carried out or whether based purely on visual estimation etc.
46. At the time of accident, the weather was fine and road surface was dry. Frictional grip or traction between the road surface and the Motor Lorry's rear tyres would not have been affected by the condition of the rear tyres. There was still sufficient rubber compound to create frictional resistance between the rear tyres and the road surface when the brakes are applied. The condition of the rear tyres, whether worn till below the legal requirement or otherwise, was not a contributing factor to the accident.

#### **L. Conclusion & Duty**

47. Several factors that were discussed in this report, when collectively considered, lead me to believe that the brake system of the Motor Lorry was in serviceable condition at the material time of accident; and/or at the time when TCIM returned the Motor Lorry to Havi Logistics (Singapore) Pte Ltd on 05 November 2012. These factors are: -
  - a) from the time that the Motor Lorry returned to Havi Logistics (Singapore) Pte Ltd, after leaving TCIM on 05 November 2012, it was driven for 202.4km without encountering any braking issue(s);
  - b) the Motor Lorry's braking system was operationally tested twice before it was returned to Havi Logistics (Singapore) Pte Ltd on 05 November 2012. The tests were by 2 persons who can reasonably be considered to be experienced in handling heavy commercial vehicles like the Motor Lorry. Both did not encounter any abnormality to the operational behaviour of the Motor Lorry's braking system;
  - c) there was no frequent braking of the Motor Lorry during the journey leading up to the accident that could have rendered the brakes to be in an overheated condition to have been ineffective, had failed and/or malfunctioned;
  - d) the Motor Lorry's braking system was operating normally during the first drive of the Motor Lorry on 23 November 2012, when it was still in its same condition since the accident;

- e) possible error of the readings captured during the roller brake test on 23 November 2012 was not accounted for, especially so when the result contradicts the actual operational behaviour of the Motor Lorry's braking system;
- f) the brake system of the Motor Lorry was regularly maintained with the rear brakes overhauled about 1 and a half month before this accident and front brakes overhauled about 8 months before this accident;
- g) marks on the brake drums, which were commented to be "cracks" that were caused by overheating, are in fact marks that can commonly be found on the brake drums of heavy commercial vehicles like the Motor Lorry;
- h) heavy commercial vehicles with such marks on their brake drums would still have an efficient braking system;
- i) the condition of the Motor Lorry's rear tyres, whether worn till below the legal requirement or otherwise, was not a contributing factor to accident.

48. 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 the report are, as far as I know, true and I have made all enquiries which I consider appropriate.

49. The opinions stated in this report are genuinely held by me and the report contains reference to all matters I consider significant. I understand and acknowledge my duty to the Court and believe I have complied with that duty.



**Ang Bryan Tani**

Senior Technical Investigator

Technical Investigation & Reconstruction (SAE-A)

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