UTM
UNIVERSITI TEKNOLOGI MALAYSIA

Razak Faculty of Technology and Informatics

Integrated Occupational Safety Health and Environment Management

MRSE 2573

CASE STUDY 2:

"A Study of Road Accidents of Heavy Vehicles in Malaysia"

Lecturer: Dr Shamsul Sarip

Group Members:

Hayad Robleh Jiir	MRS 171066
Logeswaran.M	MRS161098
Jegathesan Vangarasalam	MRS171056
Christopher Julian	MRS161076
Mohd Firdaus Bin Said	MRS181019
Noor Shafiq Bin Nordin	MRS171113
Bobyiga-a Rodney Ndansi	MRS 171065
Mohanad Alsharif	MRS171064

1. Introduction

A commercial vehicle is the backbone of the transportation and logistics industry which drives the vibrant economy of a country. Nevertheless, commercial or heavy vehicle-related accident is drawing serious attention. In 2017 alone, a total of 42, 005 road accidents involving lorry and bus was recorded (Kementerian Pengangkutan Malaysia, 2017).

Figure 1.1: Heavy vehicle road accident

Although bus only 0.9% of total 802 523 vehicle involved in road accident, the number of it causalities are always high due to the number of passengers involved. Fatalities per crash rate equally increases from 36% in 2007, 32.4% 2008, 14% in 2009 and 18.4% in 2010 as stated in MIROS investigation report 2012. In 2012, reporting by MIROS, it's about 21.4 % of bus accident due to mechanical defects and cause an injury. 28.6% of crash causes is due tyre defects and 2.15% due to brake defects.

Table 1. Most Common Critical Causes of Accident (MIROS Investigation Report 2012)

Causes of Accident	Percentage
Regular Occurrence	Percent level
A. Injury	
Crash Compatibility	24.2%
Mechanical defects	21.4%
Use of restraint device	22%
Road side hazard	14.7%
Structure Integrity	23.5%
Substandard crash	23.5%
B. Crash	
Conspicuousness	27.8%
Fatigue	23.6%
Brake defects	2.15%
Risky driving	9.1%
Road defects	19%
Speeding	22.6%
Tyre defects	28.6%

Table 1.1: Most common critical causes of accident

The Malaysian Times reporting 70% of road accident involving motorist is due to mechanical failure of the vehicles, especially the brake system. For heavy vehicles such as buses and lorries occurred because the drives took the matter lightly.

2. Overall statistics of road accidents in Malaysia

As heavy vehicle transportation continues to grow within Malaysia, crash rates among heavy vehicle remain high, and the risk of injury and fatality continues to extend to all road users. Every year more than 6000 people are killed in road accidents in Malaysia. Approximately 1000 of these fatalities are car occupants and motorcyclists, killed in collision involving rigid and articulated type's trucks (Huzaifah, M.M, 2010).

Crash compatibility is one of the main contributing factors that lead to high level of severity in heavy vehicle crashes. The large dimension and heavy mass of these heavy vehicles contribute enormously to the severity of an impact with another vehicle. On top of that, heavy vehicles often travel in lower speed as compared to other vehicles. Thus, this high speed differential between heavy vehicles and the rest of the vehicles may lead to potential rear end collisions. In this type of crashes configuration, conspicuity plays a significant role especially involving night crashes.

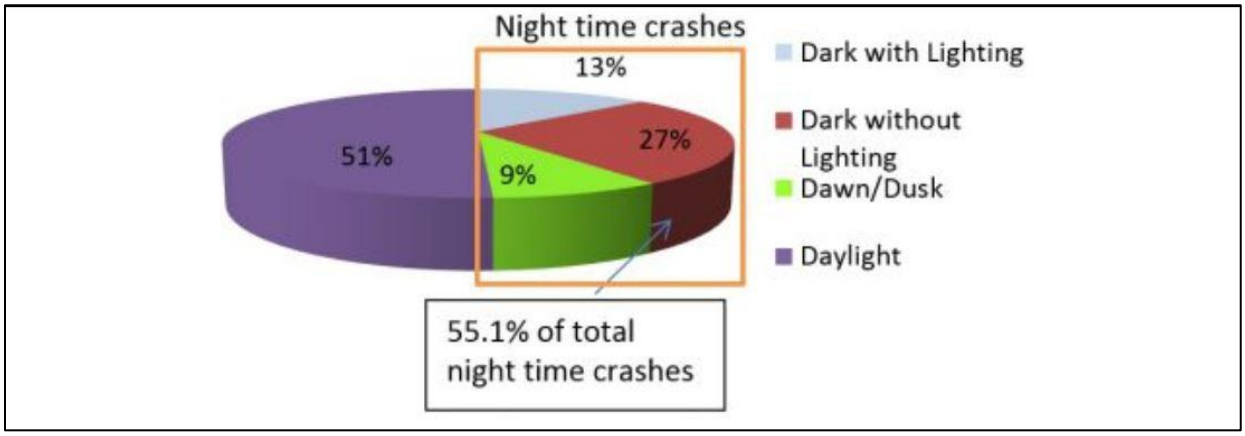


Figure 2.1: HCGV crashes lighting conditions and movement during the rear end collision

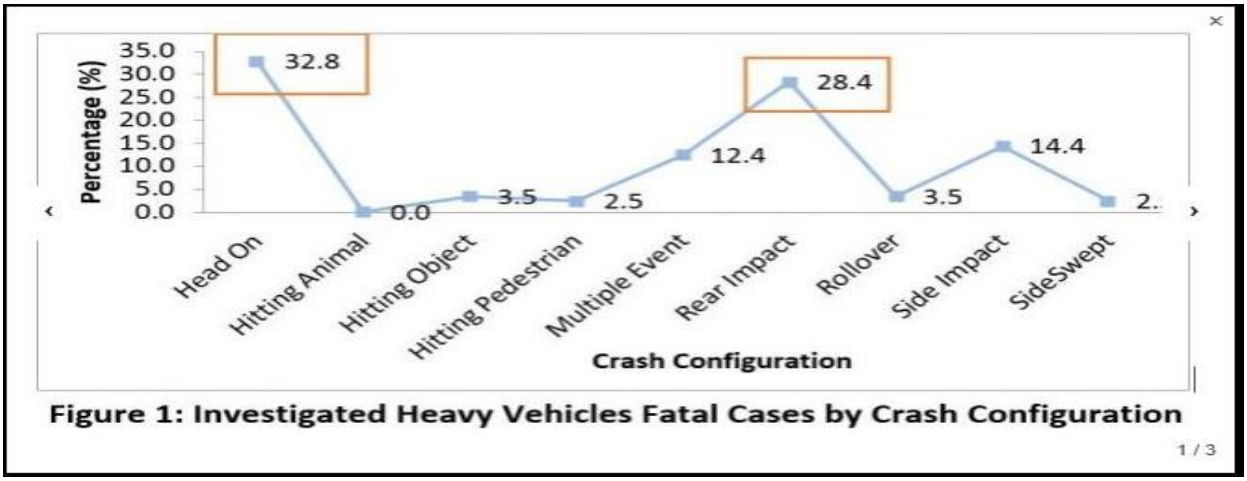


Figure 2.2: Investigated heavy vehicles fatal cases by crash configuration

According to the statistics of Road Accidents in Malaysia 2016 by Royal Malaysian Police (RMP), the totals of road accidents had increased from24,581 cases in 1974 to 328,264 cases in 2017 which reaching more than135% of accident cases over 30 years. The fatalities' count also increased at slower rate, compared to total road accident from 2.303 in 1974 to 6,2000 in 2017.

However, after Malaysian Government has established a 5-year national road safety target to reduce the road accident deaths by 30% by the year2000, the growing trend of road fatalities dropped in 1997. The rapid growth in population, economic development, industrialization and motorization encountered in the country is linked with the increase of road accidents.

From 1974 until 2017, the average of Malaysian population's growth rate has been increased about 5.1% per year with the total road length had also been increased from 11,161 km to 71,814 km which lead to the increase of vehicle ownership from 9.6 persons per vehicle to 1.7 persons per vehicle and the total numbers of registered vehicles also increased to 15,026,660 vehicles from1,090.279 vehicles in 2017.

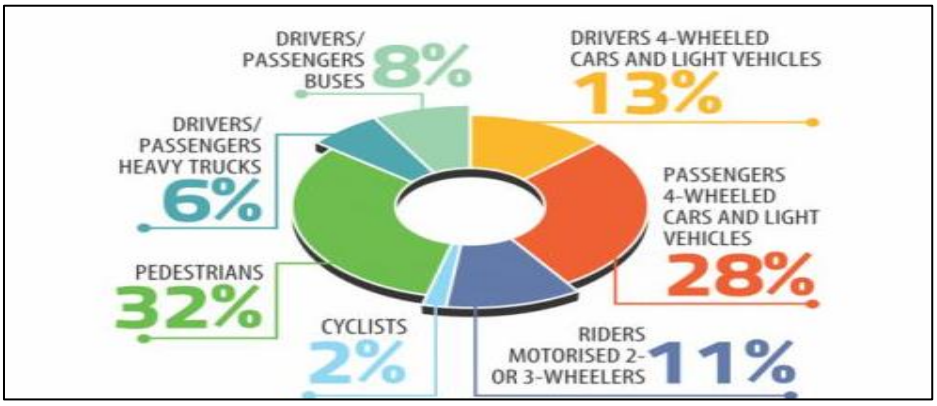


Figure 2.3: Showing the percentage of heavy vehicle

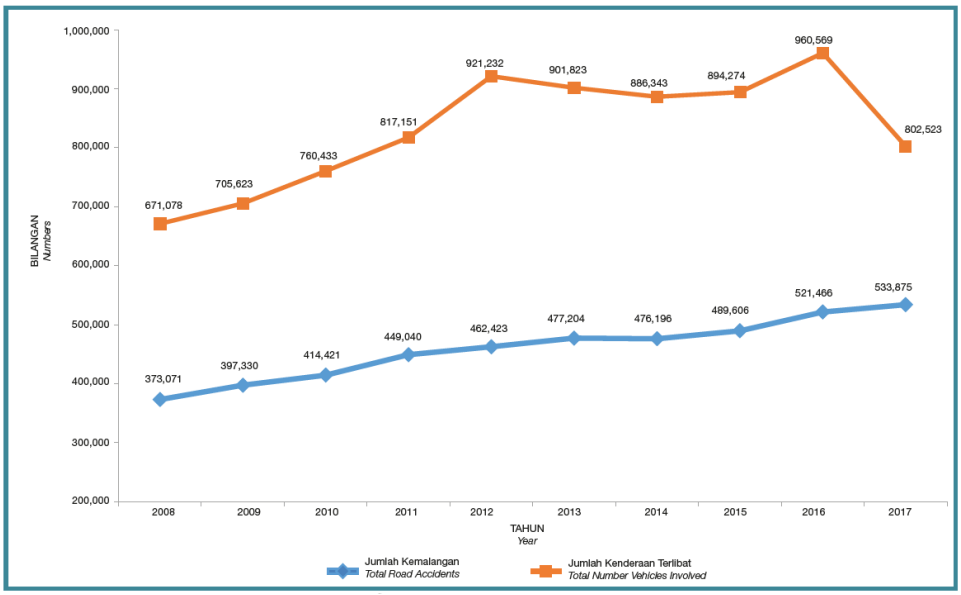


Figure 2.4: showing road accident and how many heavy vehicles involve

Traffic accidents in Malaysia have been increasing from the year 2008 till 2017, with 373071 cases in 2008 and 533875 cases in 2018. The increase of road accidents is in line with the rapid growth in population, economic development, industrialization and motorization encountered by the country since the 1970's. From 2008 till 2017, there is an increase in Malaysian population from 27.1 million in 2008 and 31.6 million in 2017. The highest accident rates are from the state of Selangor, with whopping 154958 accidents.

JADUAL 1.16: JUMLAH KEMALANGAN JALAN RAYA MENGIKUT NEGERI, MALAYSIA, 2008-2017
Table 1.16: Total Road Accidents by States, Malaysia, 2008-2017

NEGERI *State*	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
PERLIS	1,417	1,633	1,548	1,791	1,881	1,895	1,888	1,861	2,062	1,925
KEDAH	16,520	17,701	17,966	19,699	19,935	20,228	20,159	22,016	23,200	23,262
PULAU PINANG	34,049	33,719	34,306	37,158	37,851	39,361	38,747	39,856	42,244	43,007
PERAK	30,539	32,327	32,072	33,506	34,714	35,408	35,131	36,736	38,531	38,587
SELANGOR	100,380	107,429	115,565	128,876	129,106	135,024	137,809	140,957	151,253	154,958
W.P. KUALA LUMPUR	48,671	51,942	53,493	58,795	61,872	64,527	63,535	64,664	68,866	72,940
NEGERI SEMBILAN	17,362	18,369	19,407	21,157	22,146	23,066	23,748	22,939	24,428	24,941
MELAKA	12,105	13,275	14,110	14,720	15,195	16,083	16,375	17,069	18,601	18,771
JOHOR	48,667	51,747	55,381	59,501	62,316	64,600	64,473	67,112	73,116	76,121
PAHANG	15,629	17,068	17,315	19,001	20,554	20,130	19,071	19,635	20,465	20,813
KELANTAN	8,842	9,549	9,707	9,603	9,968	9,748	10,326	9,960	10,544	10,786
TERENGGANU	8,814	10,118	10,106	10,684	10,861	10,996	9,383	10,381	10,793	10,713
SABAH	14,588	15,798	16,192	16,585	17,446	17,438	17,858	17,290	17,298	17,244
SARAWAK	15,488	16,655	17,253	17,964	18,578	18,700	17,693	19,130	20,065	19,807
JUMLAH *Total*	373,071	397,330	414,421	449,040	462,423	477,204	476,196	489,606	521,466	533,875

SUMBER: JABATAN SIASATAN DAN PENGUATKUASAAN TRAFIK, POLIS DIRAJA MALAYSIA (PDRM)
Source: Traffic Investigation and Enforcement Department, Bukit Aman

Increasing trend

Table 2.1: Total road accidents by states, 2008-2017

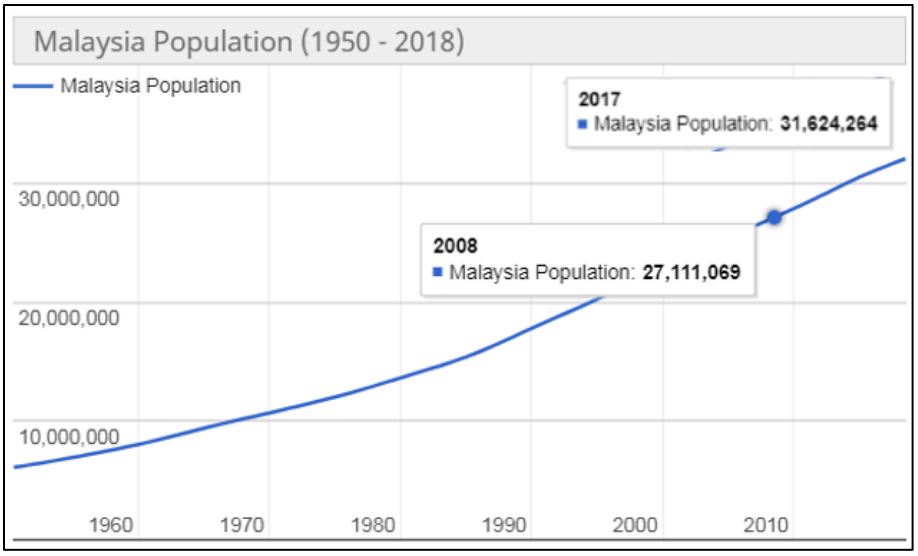


Figure 2.5: Malaysian population from 1950 - 2018

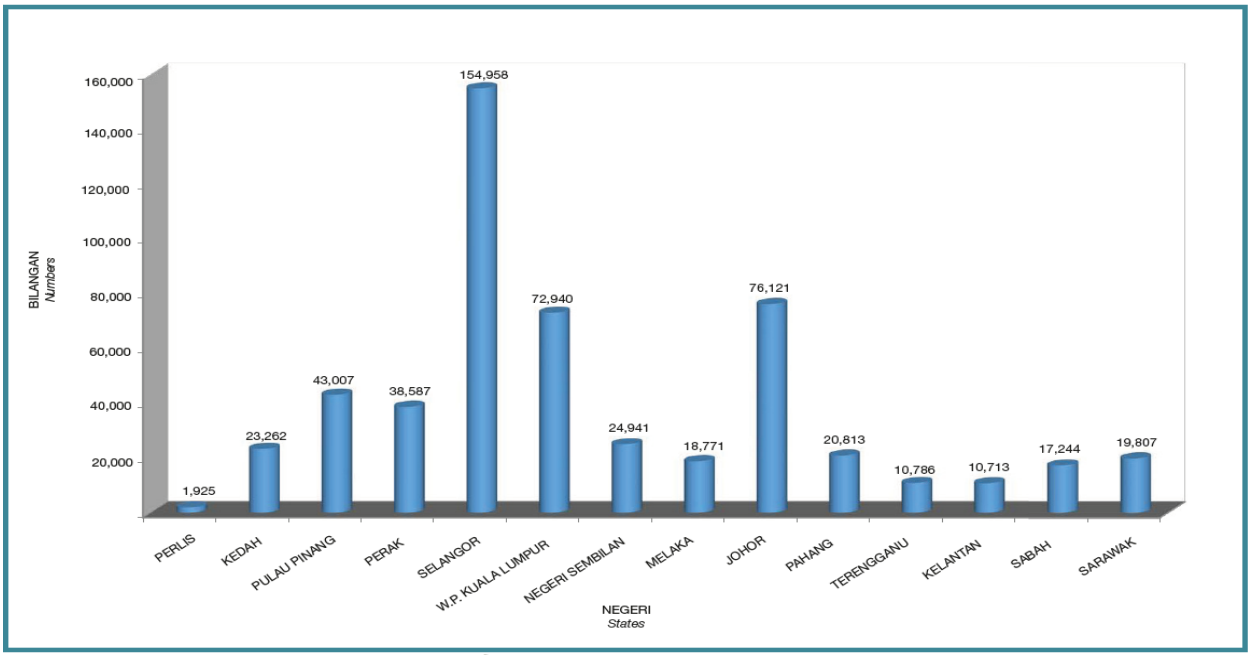


Figure 2.6: Total road accidents by states, 2008-2017

Table 2.2 shows breakdown of total motor vehicles involved in accidents, categorized by types, of which heavy vehicles category consists of 4 types, lorries, buses, vans and four wheel drives. In 2017, heavy vehicles involved in accidents consists a total of 99649 out of a total of 802523 vehicles.

JADUAL 1.17: JUMLAH KENDERAAN YANG TERLIBAT DALAM KEMALANGAN JALAN RAYA MENGIKUT JENIS KENDERAAN, MALAYSIA, 2008-2017
Table 1.17: Total Motor Vehicles Involved in Road Accidents by Type of Vehicle, Malaysia, 2008-2017

TAHUN *Year*	MOTOSIKAL *Motorcycle*	MOTOKAR *Motocar*	VAN *Van*	BAS *Bus*	LORI *Lorry*	PEMACU 4 RODA *Four Wheel Drive*	TEKSI *Taxi*	BASIKAL *Bicycle*	LAIN-LAIN *Others*	JUMLAH *Total*
2008	111,819	435,665	20,392	9,356	48,250	22,793	8,769	2,463	11,571	671,078
2009	113,962	472,307	19,220	9,380	46,724	23,581	8,669	2,486	9,294	705,623
2010	120,156	511,861	18,788	9,580	50,438	25,777	9,899	2,178	11,756	760,433
2011	129,017	546,702	17,916	9,986	53,078	30,828	11,197	2,033	16,394	817,151
2012	130,080	655,813	15,143	10,617	42,158	32,891	11,680	1,310	21,540	921,232
2013	121,700	632,602	17,148	10,123	39,276	52,512	11,651	1,370	15,441	901,823
2014	125,712	617,578	15,041	9,193	37,481	41,464	10,856	1,275	27,743	886,343
2015	123,408	625,758	14,565	8,804	34,942	46,163	9,591	1,119	29,924	894,274
2016	135,181	670,935	14,470	9,462	35,064	48,907	8,399	1,318	36,833	960,569
2017	108,221	564,491	13,347	7,258	34,747	44,297	5,328	787	24,047	802,523

SUMBER: JABATAN SIASATAN DAN PENGUATKUASAAN TRAFIK, POLIS DIRAJA MALAYSIA (PDRM)
Source: Traffic Investigation and Enforcement Department, Bukit Aman

Table 2.2: Total Motor vehicles involved in road accidents by types of vehicles

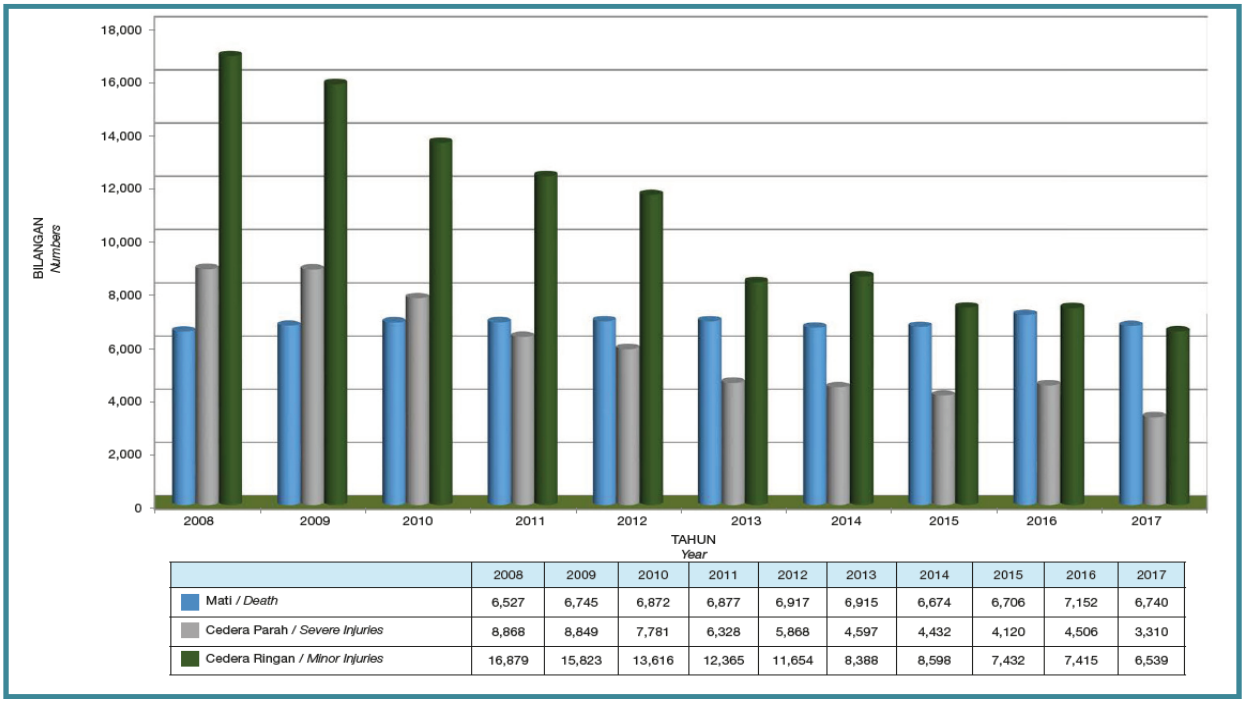
Table 2.3 shows total number of accidents resulting in casualties, serious injury and minor injury. In 2017, there were 6740 deaths, 3310 serious injuries and 6539 minor injuries.

JADUAL 1.19: JUMLAH KECEDERAAN DAN KEMATIAN DISEBABKAN KEMALANGAN JALAN RAYA, MALAYSIA, 2008-2017
Table 1.19: Total Casualties and Damages Caused by Road Accidents, Malaysia, 2008-2017

TAHUN *Year*	JUMLAH KEMALANGAN *Total Number of Accidents*	KECEDERAAN DAN KEMATIAN *Casualties*			
		MATI *Death*	PARAH *Serious*	RINGAN *Minor*	JUMLAH *Total*
2008	373,071	6,527	8,868	16,879	32,274
2009	397,330	6,745	8,849	15,823	31,417
2010	414,421	6,872	7,781	13,616	28,269
2011	449,040	6,877	6,328	12,365	25,570
2012	462,423	6,917	5,868	11,654	24,439
2013	477,204	6,915	4,597	8,388	19,900
2014	476,196	6,674	4,432	8,598	19,704
2015	489,606	6,706	4,120	7,432	18,258
2016	521,466	7,152	4,506	7,415	19,073
2017	533,875	6,740	3,310	6,539	16,589

SUMBER: JABATAN SIASATAN DAN PENGUATKUASAAN TRAFIK, POLIS DIRAJA MALAYSIA (PDRM)
Source: Traffic Investigation and Enforcement Department, Bukit Aman

Table 2.3: Total number of accidents resulting in casualties, serious injury and minor injury



	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Mati / *Death*	6,527	6,745	6,872	6,877	6,917	6,915	6,674	6,706	7,152	6,740
Cedera Parah / *Severe Injuries*	8,868	8,849	7,781	6,328	5,868	4,597	4,432	4,120	4,506	3,310
Cedera Ringan / *Minor Injuries*	16,879	15,823	13,616	12,365	11,654	8,388	8,598	7,432	7,415	6,539

Figure 2.7: Total number of accidents resulting in casualties, serious injury and minor injury

3. Causes of Road Accidents

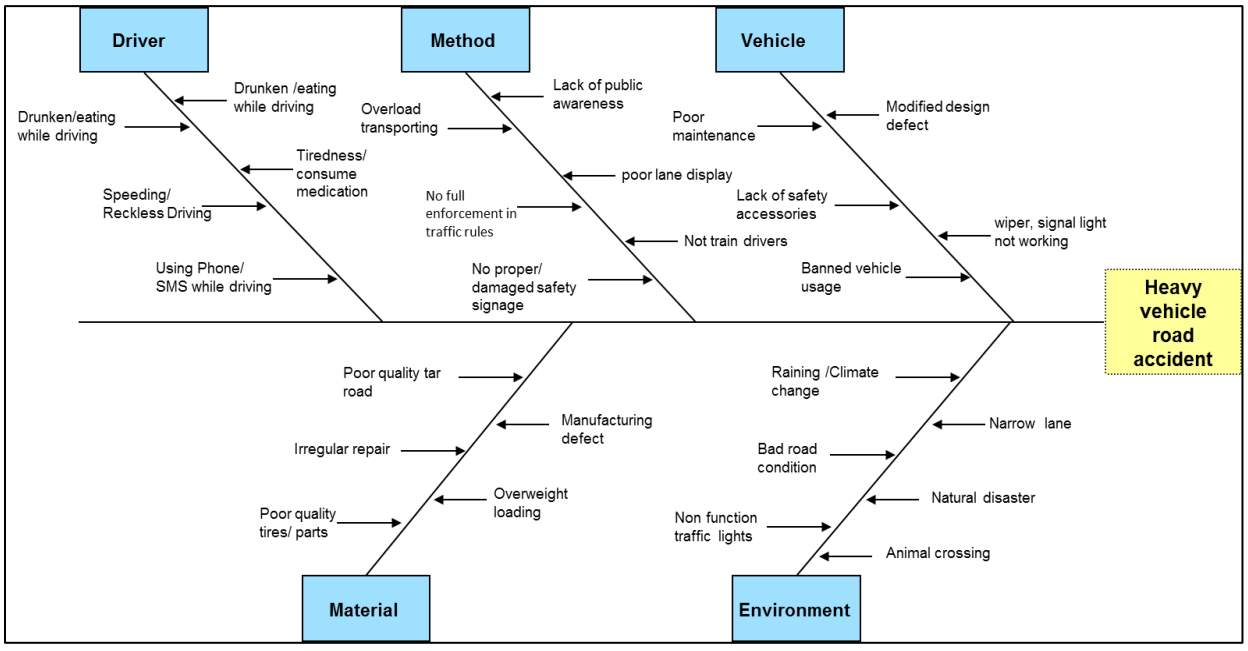


Figure 3.1: Fishbone Diagram of Heavy Vehicle Road Accident

3.1 How Driver Error Causes Heavy Vehicle Involved in Accidents

Unfortunately, most heavy vehicle crashes result from driver error on the part of the heavy vehicle driver. Some of the most common causes are:

- **Driver Fatigue**
  Heavy vehicle drivers aren't supposed to drive long hours, but many do anyway. Sleep deprivation and driver fatigue are some of the top causes of commercial heavy vehicle accidents.

- **Substance Abuse**
  Many heavy vehicle turn to alcohol and drugs to cope with their lifestyle and its demands. Unfortunately, this also leads to deadly crashes despite the laws regulating abuse.

- **Speeding and Reckless Driving**
  Heavy vehicle that speeds or fails to adhere to traffic laws puts other drivers on the road in danger. Many heavy vehicle accidents are caused by excessive speed combined with unsafe lane changes and heavy vehicle following other vehicles too closely.

- **Records Falsification**
  Despite the rules in place governing the heavy vehicle industry and its drivers, some try to circumvent restrictions by falsifying log books or other records. When this happens, both a driver and their company could be liable for a crash.
- **Negligent Hiring**
  When a heavy vehicle driver commits an error behind the wheel that causes a crash, it's natural to ask whether the driver should have been allowed to operate the heavy vehicle in the first place. When a heavy vehicle company hires a driver with a history of moving violations or other indicators that the driver was a high-risk employee, the company may be guilty of negligent hiring

- **In properly Trained Drivers**
  Driving a heavy vehicle takes much more skill and training than driving a passenger car. Heavy vehicle are more complicated to operate and need wider berths to make safe turns and longer stretches of road to come to safe stops. When drivers aren't properly trained in the safe operation of heavy vehicle, collisions may result.

- **Failing to Maintain Proper Lookout**
  Because of their size, heavy vehicle have large blind spots. Heavy vehicle drivers should regularly check their mirrors and be aware of blind spots to make sure they don't hit another vehicle when changing lanes or making turns.

3.2 When Vehicle Errors Cause Heavy Vehicle Accidents

Even a safe and rule-compliant heavy vehicle driver can be involved in a serious and deadly heavy vehicle crash because of vehicle-related errors. This could happen due to:

- **Design Defects**
  If a heavy vehicle wasn't designed properly or has bad parts installed, such as failing breaks or tires, the chances of an accident increase. These designers and manufacturers may also be held liable for resulting damages.

- **Maintenance Errors**
  Failing to maintain a heavy vehicle or doing so improperly can lead to an accident.

- **Cargo Issues**
  There are several ways that cargo can cause a crash. The cargo might be dangerous or mislabeled, leading to a dangerous spill or explosion. Cargo might also be loaded improperly, where incorrect weight distribution can cause a rollover accident.

- **Truck Defects**
  Sometimes a defect in the way a heavy vehicle was designed or manufactured may be the root cause of a serious crash.

3.3 Road Issues That Can Cause Heavy Vehicle Accidents

Other factors that could cause or contribute to a heavy vehicle accident include obstacles in the road. Whether a vehicle is driving recklessly or not, if there are obstacles left in the road, a dangerous or more severe accident could occur. In other cases, a flaw in the road that is due to poor design or maintenance could cause a catastrophic crash. When this happens, the entity responsible for the road's upkeep, which is often a government entity, may become the target of a heavy vehicle accident lawsuit.

3.4 Truck Accidents Can Have Serious Consequences

Heavy vehicle can weigh up to 80,000 pounds. By comparison, most passenger cars on the road weigh around 3,000 or 4,000 pounds and a motorcycle typically weighs less than 1,000 pounds. That's a big difference in size and weight which translates to a massive difference in force in the event of an impact, especially when the heavy vehicle is traveling at highway speeds.

People in passenger cars or SUVs, or who are riding motorcycles, unfortunate enough to collide with heavy vehicle often suffer multiple serious injuries that may include:

- Broken bones
- Lost limbs
- Concussion and other traumatic brain injuries

- Neck and spinal cord injuries
- Back injuries
- Crush injuries
- Paralysis
- Severe burns
- Disfiguring lacerations
- Psychological trauma

It can take years to recover from this kind of crash. Will face significant medical expenses for surgeries, physical therapy, and other treatments. It's also likely to lose time away from work and that's something a lot of people just can't afford these days when many families live paycheck to paycheck. When family member has been seriously injured in a collision with a heavy vehicle or a loved one has been killed in a heavy vehicle accident it's natural to want to hold accountable the driver or heavy vehicle company responsible for the crash.

4. Solution for Road Accidents

4.1 Automatic Accident Detection Mobile Application (ADD)

One of the solution to prevent road accident was introducing a mobile app, Automatic Accident Detection. It is a smart phone app that used to integrate the user and ambulance services with the use of internet to save time and life. This system can report an accident by using the three axis accelerometer (road lane, acceleration or breaking system and road obstructions) to the cloud server that would automatically dispatches the nearest ambulance by processing the GPS coordinates and providing specific route to the certain accident spot. (Jhoyti, 2012)

Figure 4.1 show the flowchart of how the system diagram for the app. The application also help user to call ambulance in fast times. They can just click yes or no if they need an ambulance. Figure 2 show the flow chart of the ADD system. Besides that, the android application used by the ambulance driver assists the driver to reach the location quickly and safely.

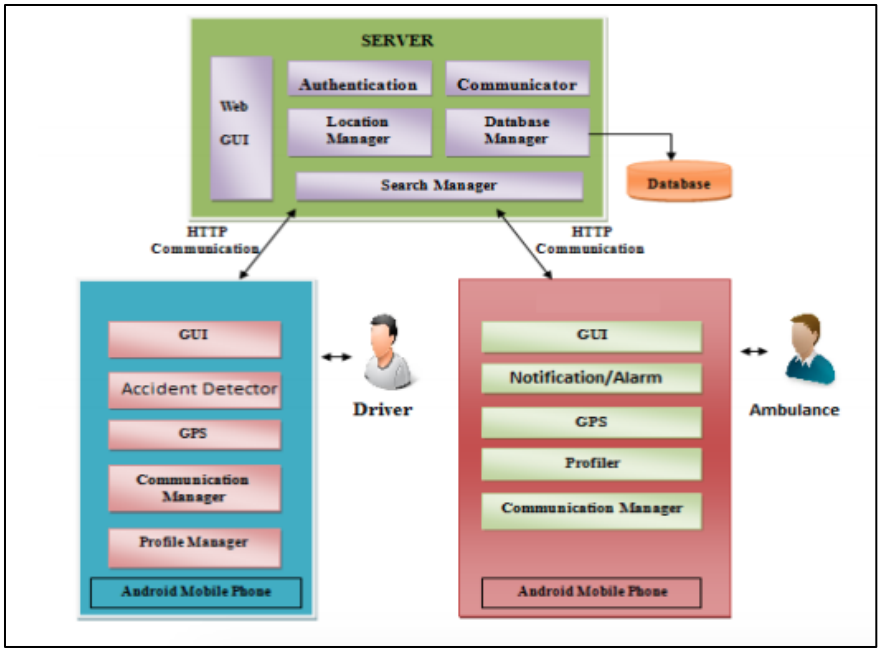


Figure 4.1 System diagram

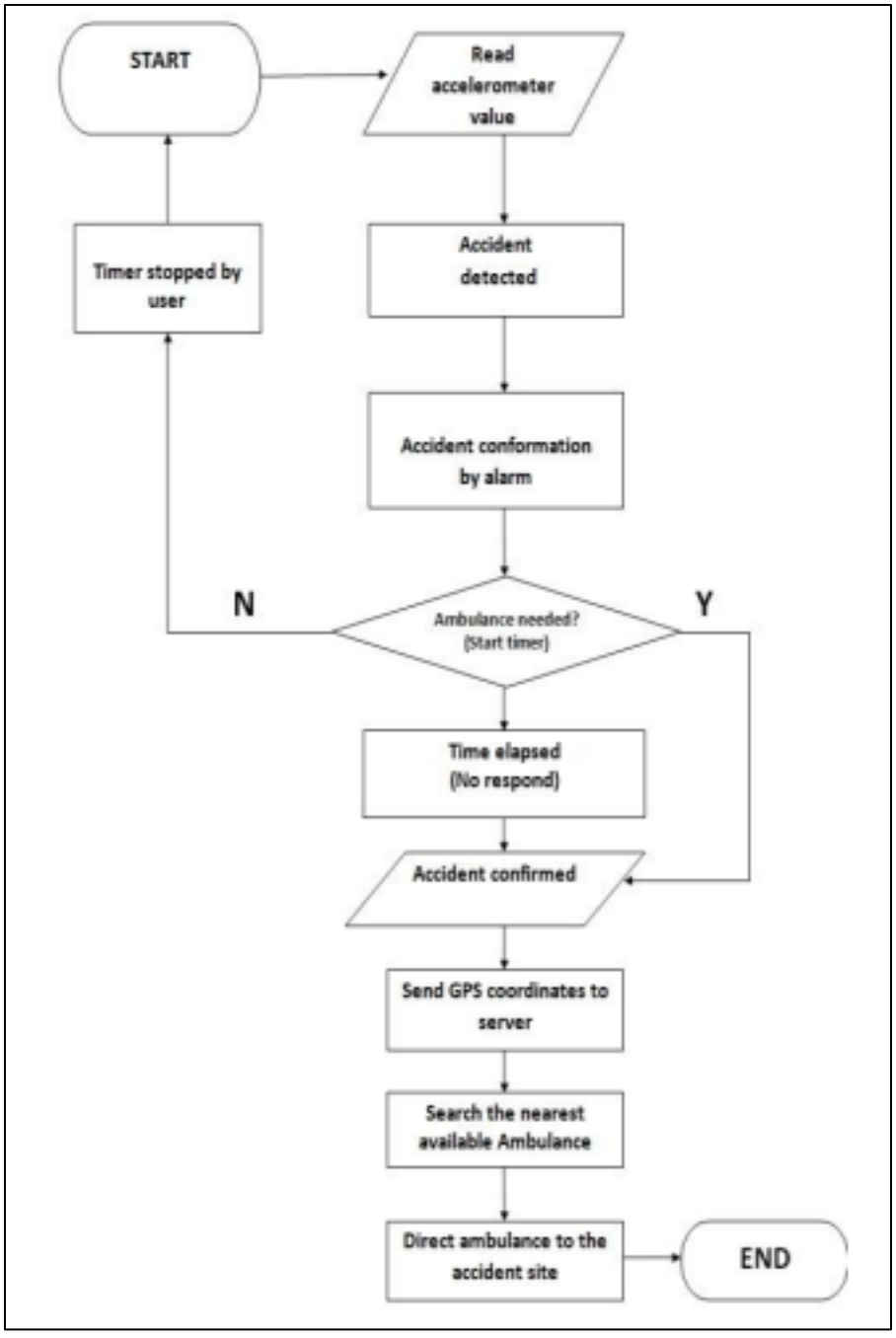


Figure 4.2 flow chart of the AAD application

4.2 Road speed limiter

Excessive speed in driving heavy vehicles has been a social and governmental issue around the world for many years, primarily from the perspective of road safety. (Chu, Li, Wang, Wu & Hu, 2018) With increased engine power and long axle ratio, attainable speeds for trucks are currently much higher than the speed limits on highways and secondary roads in many countries. (Galkin, et al., 2018)

One effective solution to prevent speeding in commercial vehicles is to equip with a road speed limiter system, which restricts maximum road speed to the required speed limit without loss of engine power. This is realized by limiting the required fuel demand according to a set speed limit. The maximum speed limit is set using an electronic control unit.

Information about the current speed of the vehicle is measured with a speed sensor that supplies an electronic speed signal to the control unit. The control unit limits the fuel output in different ways, depending on the fuel injection technology of the engine. In addition to its main function, limiting the maximum speed, the system offers a variable speed limiter as an option. The driver can activate this feature below the maximum speed limit in areas with lower speed limits.

Furthermore, the speed limiter includes additional speed limit inputs to preprogram smaller speed limits than the maximum speed. This functionality can be used to prevent fast driving if any special function in the vehicle is activated. Two different engine technologies used in vehicles require different speed limiter device applications: Mechanical Controlled Engines and Electronically Controlled Engines.

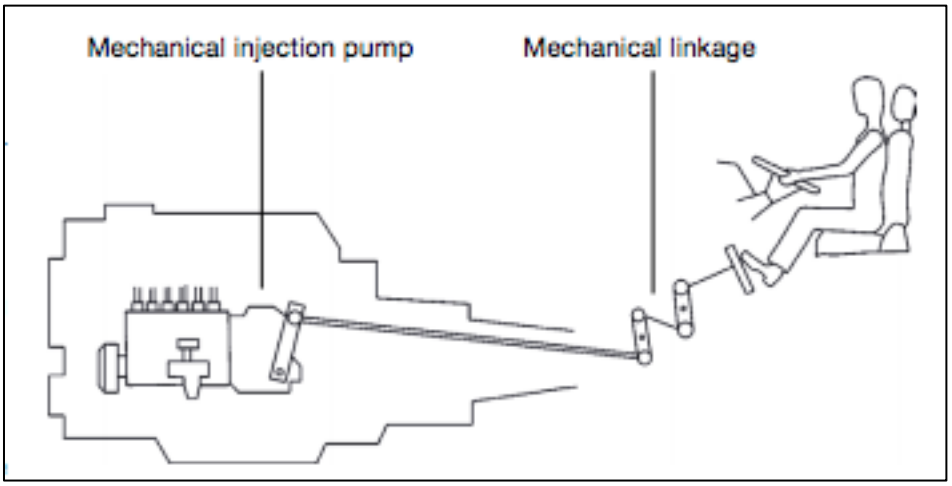


Figure 4.3 Mechanical Control Engines

Engine revs are regulated with a mechanical throttle pedal, which transmits the pedal position mechanically via a throttle cable or rod to the injection pump (or throttle body). The fuel

demand on the injection pump is adjusted via a mechanical injection pump lever or a mechanical throttle plate. To realize a speed limiting system on a mechanically controlled engine, an electromechanical speed limiter is used to decouple the driver's demand from the injection pump in order to limit the maximum speed. In this application, the vehicle must be equipped with a separate speed limiter system.

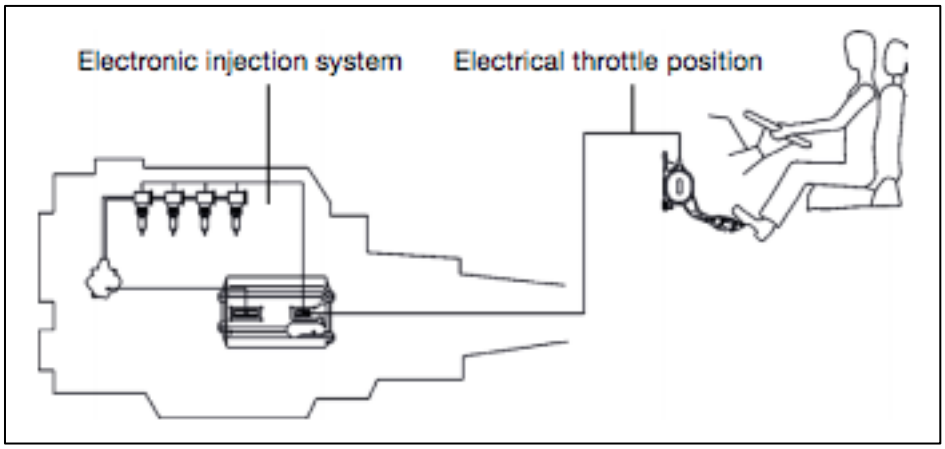


Figure 4.4 Electronic Control Engines

Engine revs are regulated with a mechanical throttle pedal which converts the mechanical pedal position to an electrical signal, and transmits it via an electrical wire to an electronic control unit. The control unit regulates the fuel demand via electronic injection such as electronic diesel control (EDC), a pump line nozzle system (PLD) or common rail direct injection (CDI). In this application, the speed limiter function could be one of numerous functions managed by the engine's or vehicle's electronic control unit.

4.3 Seeing Machines

This solution detects and prevents driver weariness and distraction by giving real-time checking and intercession. It uses a dash-mounted device that uses intelligent sensory technologies that tracks the driver's eye movements and facial designs to detect when the driver is tired or distracted. The machine issues an alarm sound in the cab and it causes the driver's seat to vibrate to get the driver's attention back on the street.

Figure 4.5. Seeing Machines

4.4 iPal wearable technology

iPal is a pair of glasses that tracks eye movements. It has four cameras: two that track your eye movements and two that track the scene in front of you. The iPal can identify tiredness and see distractions. It also measures eyelid openings as a way of detecting driver tiredness. It also alarms the driver through the driver's smart phone using a Bluetooth connection.

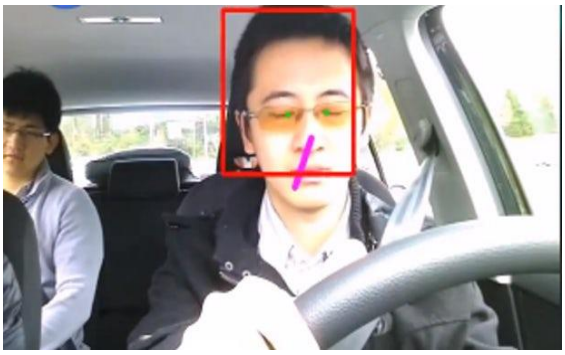


Figure 4.6 iPal technology

4.5 **F-CAM**. Forward Collision Avoidance and Mitigation

Uses radar and sensors to alarm the driver and after that apply the brakes when it senses an impending crash. These systems help avoid crashes or decrease the severity of a crash that's unavoidable. A few interstate security bunches are requesting the NHTSA to require F-CAM systems for buses and commercial trucks over 10,000 pounds. They estimate that this crash avoidance technology might prevent more than 2,500 crashes.

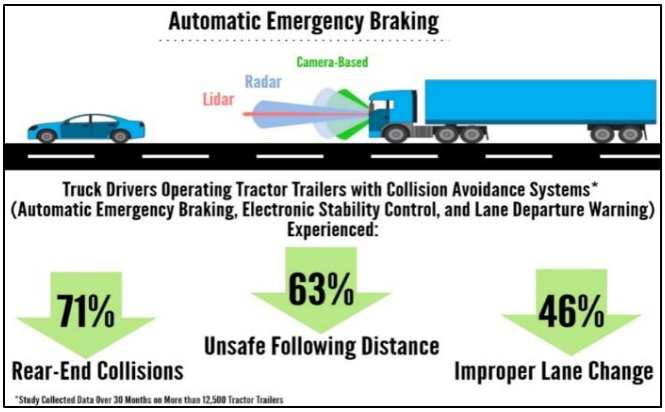


Figure 4.7 F-CAM

4.6 Samsung Safety Truck

Samsung has developed a solution that may make this problem a thing of the past. Samsung developed a technology for trucks that seeks to enrich the lives of people through innovation. Samsung have introduced the Safety Truck. The Safety Truck consists of a wireless camera attached to the front of the truck, which is connected to a video wall made out of four exterior monitors located on the back of the truck. The monitors give drivers behind the truck a view of what is going on ahead, even in the dark of night. This allows drivers to have a better view when deciding whether it is safe to overtake. Another advantage of the Safety Truck is that it may reduce the risk of accidents caused by sudden braking or animals crossing the road. Although it is still in the prototype test, Samsung can confirm that the technology works and that this idea can definitely save the lives of many people.

Figure 4.8 Samsung Safety Truck

4.7 Setting up of model driving training.

Refresher training to drivers of Heavy Motor Vehicle in the unorganized sector.

5. Conclusion

This essentially statistical study highlights the variety of heavy vehicle accidents. It reveals the main tendencies and shows that generally speaking, heavy vehicle accidents are not accountable to heavy vehicles alone. In terms of the road infrastructure itself, it would appear that curves are a subject for further investigations. Due to their nature, road conditions in curves undoubtedly become critical much more rapidly for heavy vehicles than for light vehicles. It can therefore been stated that swerves in curves contribute to accident-prone situations and that the characteristics inherent to heavy vehicles are aggravating factors. It is important to remember that heavy vehicles are not always the cause of accident situations. A heavy vehicle driver may suddenly be faced with another road user who cuts in front of him (or hits the heavy vehicle from behind):

Road user approaching from the opposite direction on a straight section of road and on a wide infrastructure without a central reservation;

- Road user approaching from the opposite direction, in a curve of a narrow road.
- Road user without right of way who cuts in front of a heavy vehicle at a junction or suddenly turns left in front of the heavy vehicle
- Rear collision–stationary heavy vehicle, waiting to turn left. The specificity of heavy vehicles has little impact on this type of accident, other than in terms of passive safety, since their mass explains the severity of injuries.

The three main situations involving road infrastructure which can lead to heavy vehicle accidents are:

- Intentional and risky driver behavior on a road or a stretch of road that is poorly adapted to heavy vehicle traffic.
- Steep downward slopes over a distance greater than 6 km.
- The (often unexpected) presence of an isolated danger zone. This isolated danger zone may be a tight bend after a long straight stretch of road, a curve with a tight radius, a slippery area (due to meteorological conditions or poor skid resistance). When associated with geometry-related constraints and the dynamics of a heavy vehicle, a curve can

therefore rapidly provoke a critical situation for the latter, even if statistics tend to draw more attention to other situations.