UTM
UNIVERSITI TEKNOLOGI MALAYSIA

MRSE 2573
INTEGRATED OCCUPATIONAL, SAFETY AND HEALTH MANAGEMENT

70% OF ROAD ACCIDENT IN MALAYSIA ARE DUE TO BRAKE FAILURE

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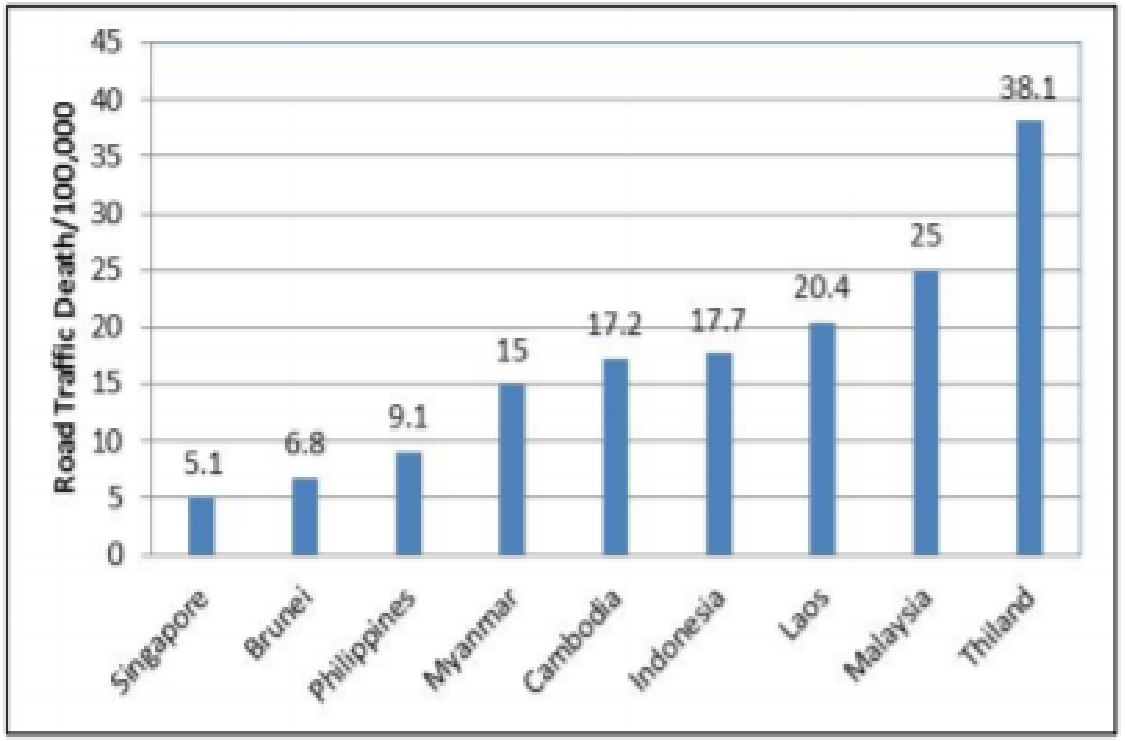
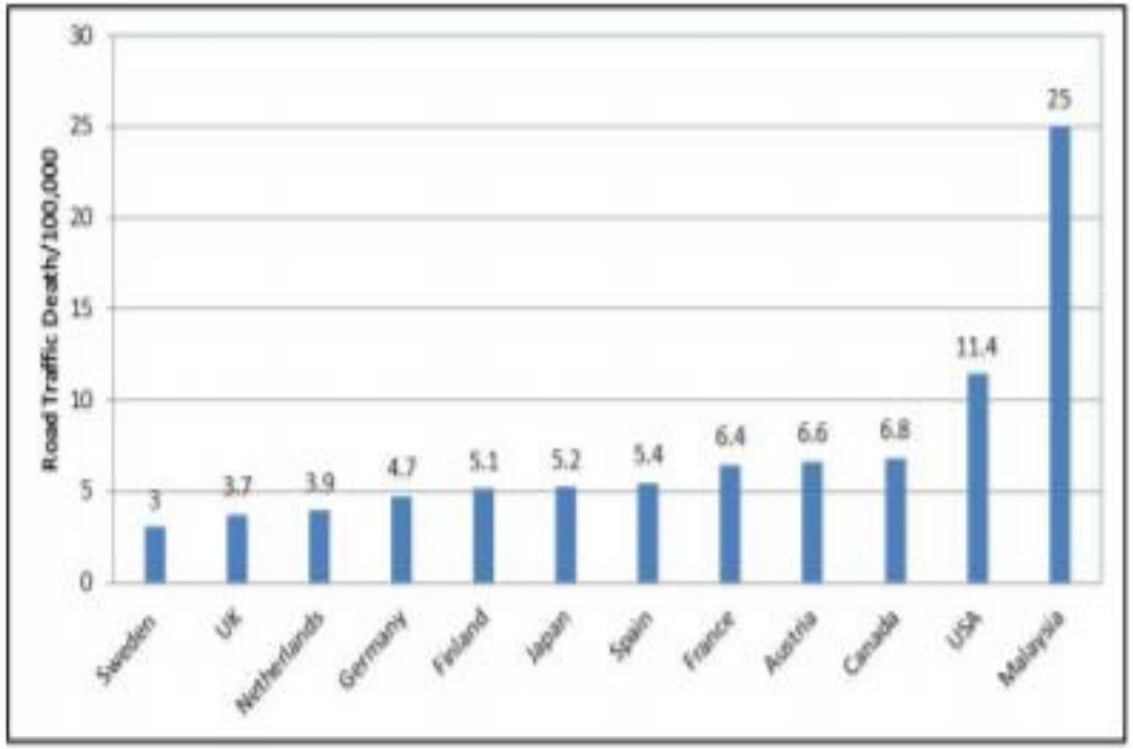
INTRODUCTION





Graph 1: Fatality Rate of Countries in Asia

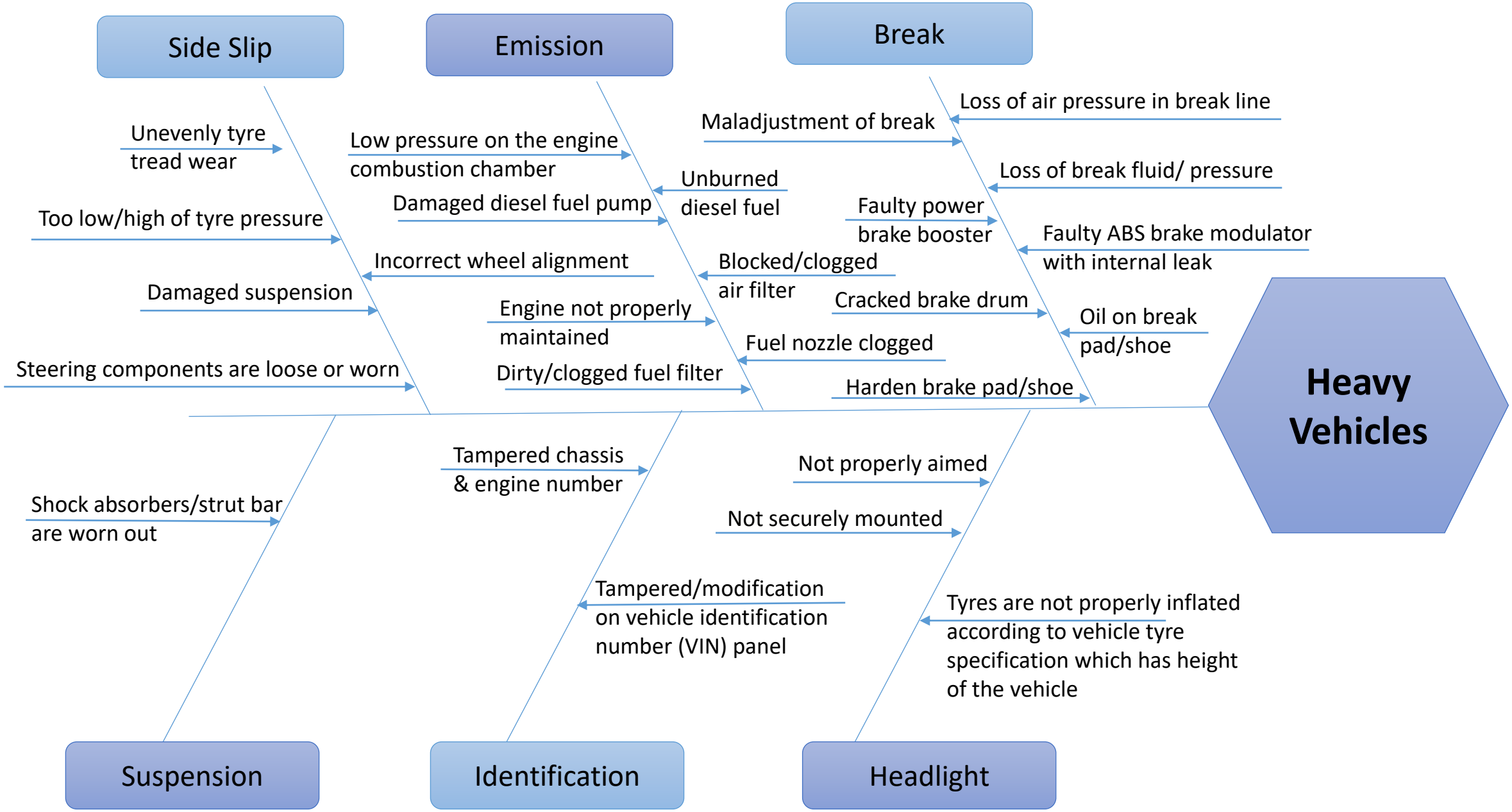
Graph 2: Fatality Rate Comparing Malaysia to other Developed Countries.

Table 1: Percentage of Type of Vehicles Involved in Accidents in Malaysia.

Year	% of Registered Vehicels Involved in Accidents				
	PRIVATE VEHICLES	PRIVATE MOTORCYCLES	LORRIES/ VANS	BUSES	TAXIS
2004	6.44%	1.51%	8.42%	22.12%	10.94%
2005	5.85%	1.39%	7.62%	15.06%	10.49%
2006	5.93%	1.40%	7.80%	16.19%	11.01%
2007	5.77%	1.41%	7.92%	16.52%	12.12%
2008	5.01%	1.22%	4.91%	29.57%	8.90%
2009	5.58%	1.28%	7.06%	14.17%	11.00%
2010	5.68%	1.28%	7.20%	13.95%	11.83%
2011	5.65%	1.30%	7.14%	13.94%	12.47%
2012	6.37%	1.23%	6.84%	14.49%	12.58%
2013	6.11%	1.11%	6.48%	16.28%	11.83%
Average=	5.84%	1.31%	7.14%	17.23%	11.32%

Table 2: Statistics on the Cause of Accidents Among Heavy Vehicles in Malaysia. (Brake defect sits on the highest percentage in terms of faultiness of car)

Factors	00.01–6.00	6.01-9.00	9.01-12.00	12.01-14.00	14.01-16.00	16.01-20.00	20.01-24.00
A. Injury							
Crash Compatibility	6.4%	19.1%	14.6%	15.2%	13.3%	13.9%	18.2%
Mechanical defects/others	4.1%	5.3%	4.2%	1.5%	3.3%	2.8%	6.8%
Use of restraint device	6.4%	3.2%	11.5%	7.6%	8.3%	13.9%	10.2%
Roadside hazard	5.3%	7.4%	3.1%	6.1%	6.7%	2.8%	3.4%
Structure Integrity	3.5%	3.2%	2.1%	3.1%	3.3%	0%	2.3%
Superstructure	0.6%	2.1%	0%	0%	1.7%	0%	1.1%
B. Crash							
Conspicuousness	2.9%	1.1%	3.1%	4.5%	1.7%	0%	1.1%
Fatigue	19.3%	9.6%	4.2%	10.6%	6.7%	1.9%	4.5%
Brake defects	2.3%	3.2%	4.2%	3%	3.3%	7.4%	2.3%
Overloading	1.8%	0%	4.2%	1.5%	3.3%	2.8%	0%
Risky driving	10.5%	14.9%	19.8%	22.7%	20%	0.9%	22.7%
Road defects	4.1%	4.3%	5.2%	3.5%	6.7%	9.3%	4.5%
Speeding	13.5%	10.6%	17.7%	6.1%	11.7%	6.5%	13.6%
Tyre defects	1.8%	1.1%	2.1%	4.5%	3.3%	0.9%	2.3%


Side Slip
Emission
Break
Unevenly tyre tread wear
Too low/high of tyre pressure
Damaged suspension
Steering components are loose or worn
Low pressure on the engine combustion chamber
Damaged diesel fuel pump
Incorrect wheel alignment
Engine not properly maintained
Dirty/clogged fuel filter
Unburned diesel fuel
Blocked/clogged air filter
Fuel nozzle clogged
Maladjustment of break
Faulty power brake booster
Cracked brake drum
Harden brake pad/shoe
Loss of air pressure in break line
Loss of break fluid/ pressure
Faulty ABS brake modulator with internal leak
Oil on break pad/shoe
Heavy Vehicles
Shock absorbers/strut bar are worn out
Tampered chassis & engine number
Tampered/modification on vehicle identification number (VIN) panel
Not properly aimed
Not securely mounted
Tyres are not properly inflated according to vehicle tyre specification which has height of the vehicle
Suspension
Identification
Headlight

SYSTEM OF SAFETY

1. Design And Engineering
2. Maintenance & Inspection
3. Mitigation System
4. Warming Devices
5. Training And Procedure
6. Personal Protective Factors

1. Design and Engineering

Proposed solution for safety improvement on heavy vehicle (Truck)

Solution from vehicle manufacturing:

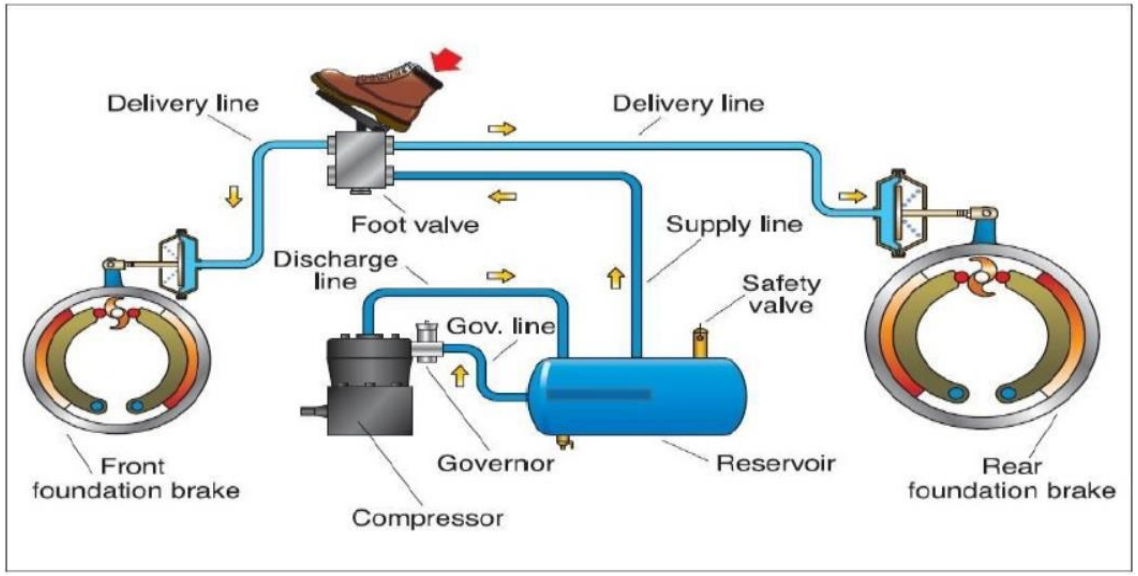
- Brake condition (sensors) monitoring system to provide early warning. (*Internal system*)
- ***Pre-collision*** warning based on *Data processed* from various sensors input installed on truck. (*Internal system*)
- Driver monitor sensor to alert driver under tired condition to take a rest. (*Human factor*)
- ***Auto Speed check*** feature to limit/slow down truck when sensor detect wheel slip/spins. (*Vehicle handling*)
- Intelligent lighting to prevent obstruction to other road user/ provide warning during danger situation detected by on-truck sensor. (*External signal*)
- ***Tire-pressure monitoring*** capability to limit speed until pressure is recovered. (Internal system)

Solution from government body:

- Tracking of vehicle ***accident history***/occurrence for monitoring/prediction of future occurrence/ shut down.
- Introduce strict ***annually check*** on truck especially on braking functional check.

In-depth breakdown understanding of a Truck Air Brake System

Air Brake System are found on almost all commercial Track in today's modern practice. Below are 10 safety feature that can be found on a modern Truck Air-Brake system.



10 safety feature on Truck Air-brake:		
1	Air Tanks (Reservoirs)	Design to hold for up to 12 full brake applications even when compressor fails.
2	On-Way Check Valves	Prevent air from bleeding out. Air only moves forward in system.
3	Dual Air Brake Systems	Separate into 2 sub system to prevent total failure. Steer axles vs rest of the areas.
4	Air Compressor	Design with high safety factor to cover beside Brake and all another accessories.
5	Pressure Protection Valve	Shut off air to other accessories and direct air into brakes when pressure drops.
6	Low Air Warning	Audio & Visual notification turn On when detect brake pressure drop below 60lbs.
7	Sound	Loud audio noticeable to driver during even minor leak happens
8	Spring Brakes	Spring released to engage braking during pressure drop under 20 ~ 45 psi
9	Tractor Protection System	Automatic shut off air to trailer to protect truck air during detection of air loss.
10	Automatic Slack Adjuster	Transition from manual slack adjuster design to automatic for improved reliability.

2 .Maintenance & Inspection

No	Cause	Maintenance & Inspection
1	Brake	• Conduct checking every 6 month of brake fluid/pressure and air pressure in the brake line • Enhance the quality of ABS Brake modulator to ensure internal leak free • Restricted of annual checking at governance body for brake pad standard thickness
2	Emission	• Compulsory additive added based on scale too ensure burned diesel completion • Monthly personal inspection for fair filter, fuel filter and fuel nozzle • Every 3 months checking on engine camshaft
3	Side Slip	• Use good quality of rubber for tires to enhance the gripping with road • Regular check up on the wheel alignment and tyre pressure. • Alert on the suspension based on mileage of truck travelling
4	Suspension	• Change shock absorber/strut bar in every 5 years or 200,000km, whichever come first based on necessity.
5	Identification	• Chassis number/ engine number must be clear, distinct, untampered and is the same number as printed on vehicle registration Card/ vehicle ownership card
6	Headlight	• Headlight have to be tilt properly at securely mounted and properly aimed • Tyre has to be properly inflated according to tyre specification to ensure height of the vehicle is adjust correctly.

3.Mitigation System

1. Collision Mitigation

- Audible & visual warnings and active braking on stationary vehicles that could be a possible obstruction in their lane.
- Vehicle collision audible & visual warnings that alert drivers to developing rear-end collisions
- Haptic warning provides short brake pulse which causes drivers to respond faster to imminent rear-end collisions
- “Always on” at speeds above 15 mph even when cruise control is not set
- Applies up to 50% of the vehicle’s braking power to help avoid or mitigate an impending collision.

2. Adaptive Cruise With Active Braking

- Assists in maintaining a 3.6 seconds interval between driver’s vehicle and the vehicle ahead
- Makes cruise control a more useful tool in various traffic conditions
- Allows for an enhanced driving experience in various traffic conditions
- Reduces driver fatigue in congested traffic

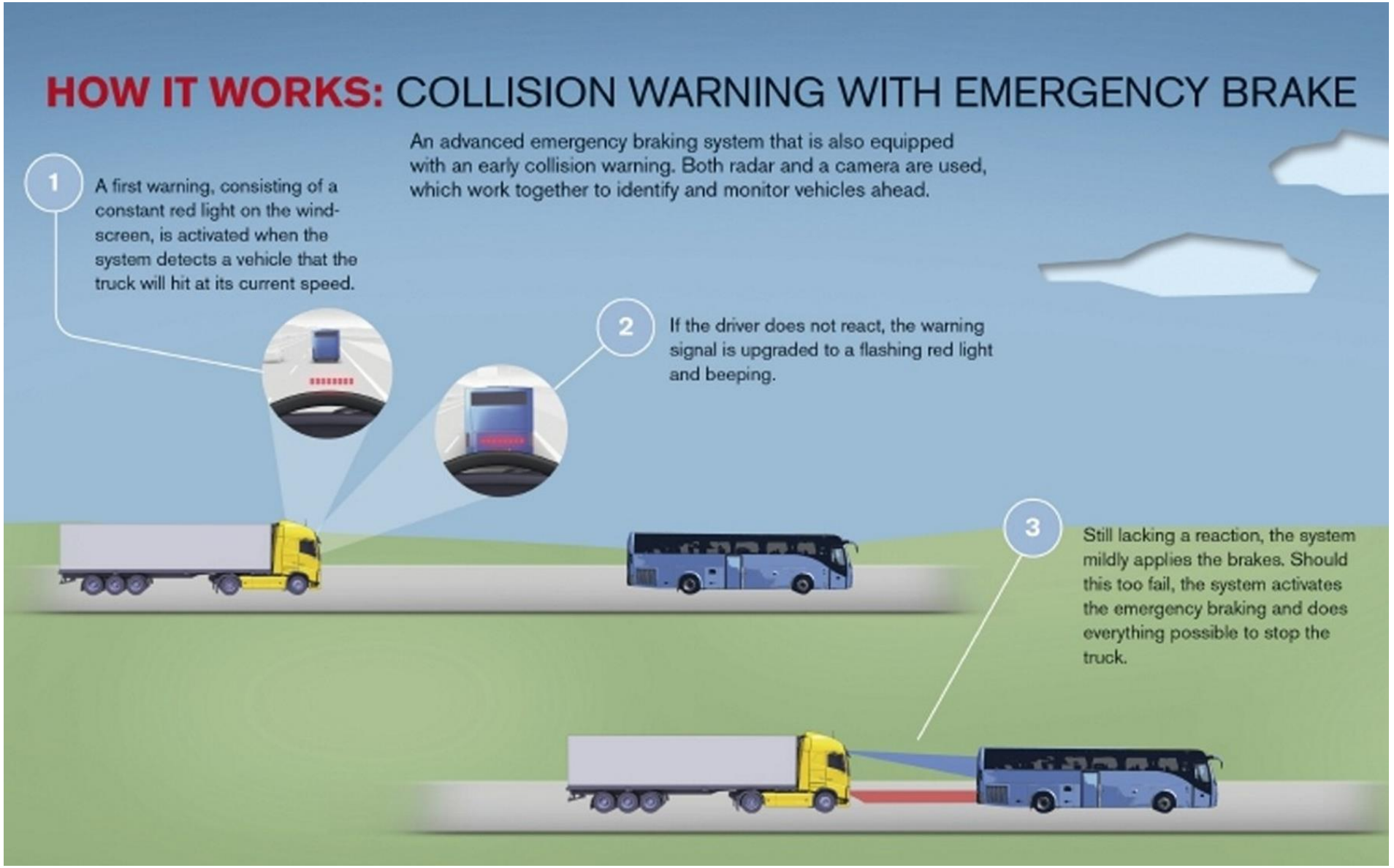
THE MITIGATION SYSTEM

Bendix® Wingman® Fusion™

The integration of camera, radar and brakes that advances commercial vehicle driver assistance technology to a new level of performance in North America

THE MITIGATION SYSTEM

VOLVO TRUCKS COLLISION WARNING WITH EMERGENCY BRAKE



5.THE WARNING SYSTEM

Root Cause / Hazard : Winding and Steep Road which leads to overturned.
Solution : Road signage to alert the truck driver on the road condition.

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Solution : Road signage to alert the truck driver on the road condition.

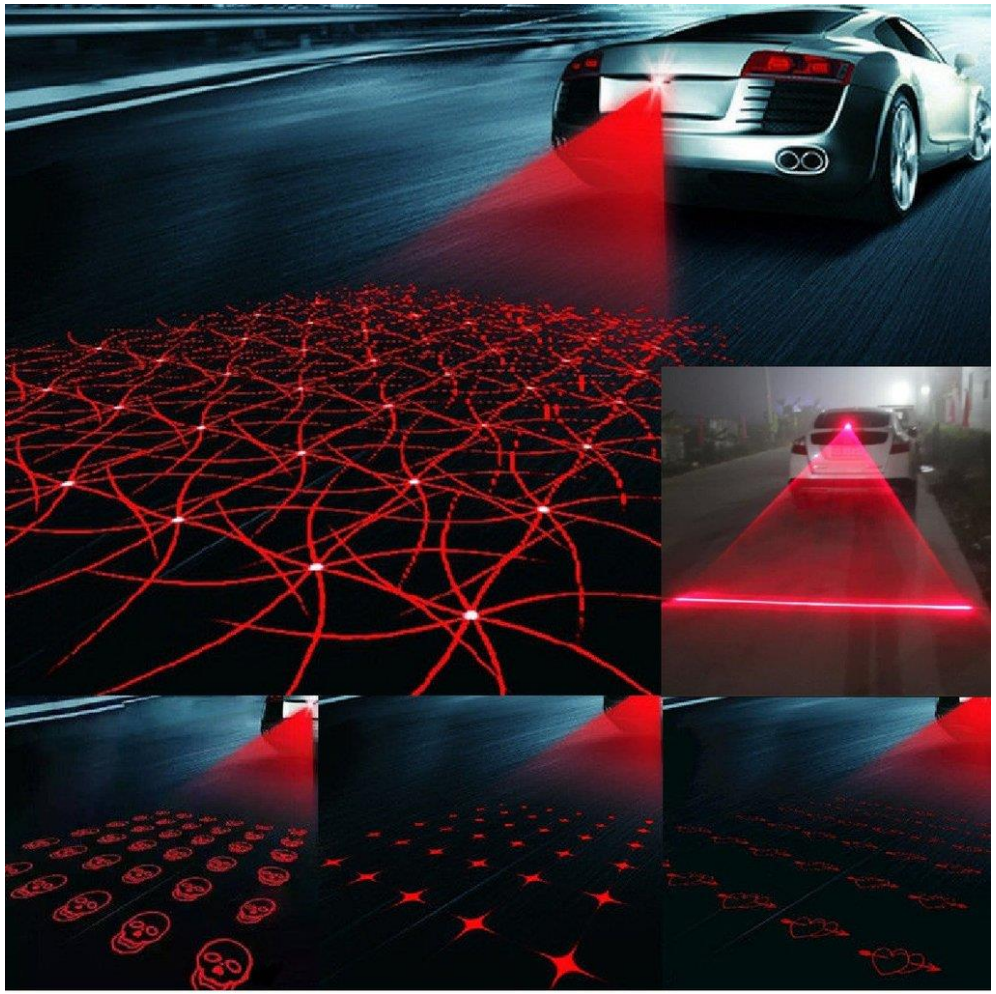
THE WARNING SYSTEM

Root Cause / Hazard : Emergency Breaking which make the car behind unable to brake on time.

Solution : Long LED Light across the truck rear which easy for the behind card to notice the braking from afar.

THE WARNING SYSTEM

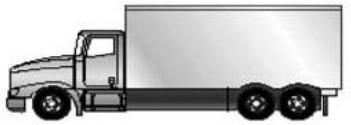
Root Cause / Hazard : Emergency Breaking which make the car behind unable to brake on time.
Solution : LED Projection light which more effective as it appear on the road with respective safe distance



HEAVY VEHICLE FORMULA

For timed interval following distance

- 1 second required for each 10 feet of vehicle length at speeds under 40 MPH
- Above 40 MPH use same formula, then add 1 second for the additional speed

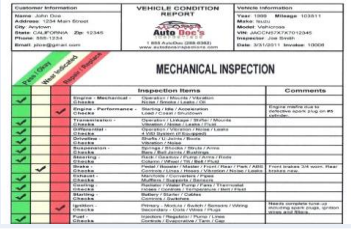


40 foot truck (under 40 MPH) = 4 seconds

50 foot truck (above 40 MPH) = 6 seconds

60 foot truck (under 40 MPH) = 6 seconds

5. Training and Procedure of Trucks / Heavy Vehicle Repair and Maintenance

Focus Area	Items	Training Procedure
Personnel Skill Level 	Knowledge Competency	1. Technical & mechanical **knowledge** to read **specifications, tolerances & measurement** **2.** **Skill to use measurement devices**, calipers, micrometers, diagnostic devices & computers systems
	Planning & Organizing in Work Place	**1.** **Plan, prioritize task** and work requirement to ensure that task are completed in positive outcome **2.** **5S practice** in the work place to prevent mix up of different of disk brake, right brake fluid. Ensure area are free of dust & fibre material
Repair and Maintenance 	Run Test Diagnostic Fault Detection	**1.** **Run test** diagnostic system to ensure **critical brake system** are in working condition ▪ Air brake pressure ▪ Disk brake thickness ▪ Brake fluid heating point ▪ ABS & Traction control syste, ▪ Sensor and wiring harness 2. Any **system fault,** data, Repair and part replacement are recorded to **document the history** maintenance of the vehicle
Documentation & Reporting 	Final Inspection Test Run Preventive Maintenance	**1.** **Final Inspection** is required to ensure all checklist and maintenance repair are completed 2. All Tools, faulty parts are **disposed** of and work area are cleaned **3.** **Testing of** brake vehicle must complete with testing of emergency brake, braking performance, air pressure & brake timing 4. Time, parts & personnel who worked on the vehicle are **documented and sign off** **5.** **Driver consent** to the repair work completion and **sign off** for vehicle acceptance & PM Tag on vehicle are updated

6.PERSONAL PROTECTIVE FACTORS

Three root causes to brake failure:

1. Owner's negligence
2. Faulty servicing
3. Faulty installation

Faulty Servicing
Overlooking problematic part

Owner's Negligence

- Improper usage of brakes
- Not changing brake fluid
- Not sending car for servicing

Faulty Installation
Hydraulic lines not attached properly

HOW TO KNOW OF FAULTY BRAKES?

1. Grinding or squeaking noise
2. Difficulty in stopping car
3. Car veers to one side

WHAT TO DO WHEN IT HAPPENS?

1. Stay calm
2. If practical, maneuver car to side of road
3. Remove foot from accelerator
4. Once slowed down, put in neutral
5. Apply handbrake

Thank You