MIROS
MALAYSIAN INSTITUTE OF ROAD SAFETY RESEARCH

CRU
CRASH RECONSTRUCTION UNIT

MIROS TRAFFIC CRASH INVESTIGATION

ENGR ISKANDAR BIN ABDUL HAMID

CRASH RECONSTRUCTION UNIT
VEHICLE SAFETY & BIOMECHANICS RESEARCH CENTRE
MALAYSIAN INSTITUTE OF ROAD SAFETY RESEARCH
(MIROS)

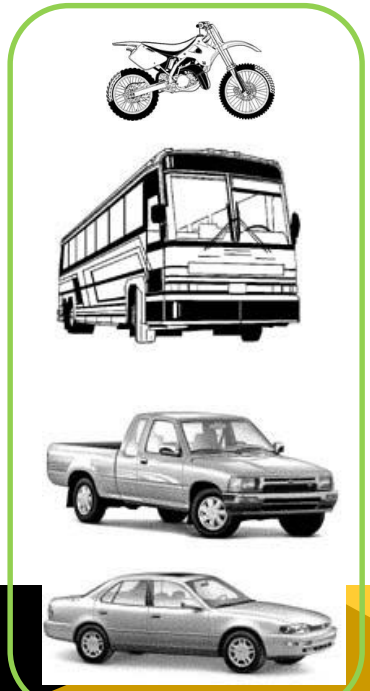
Contents

- Crash Factors
- MIROS Crash Investigation objectives
- SOP
  - Notification
  - Preparation
  - Data Collection
- Improvement Initiatives

Road Crashes

SYSTEM

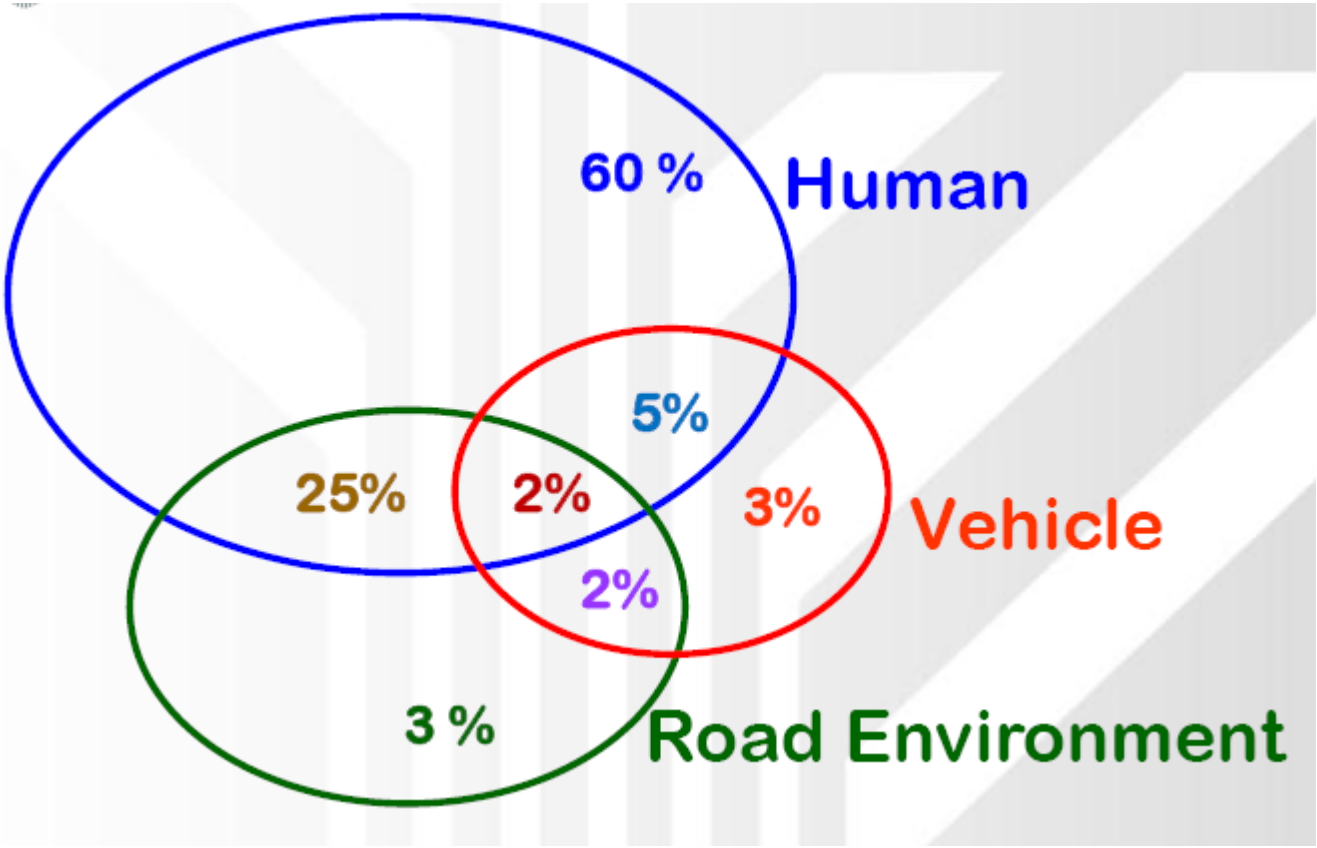
VEHICLES



USERS

ROADS

Crash factors

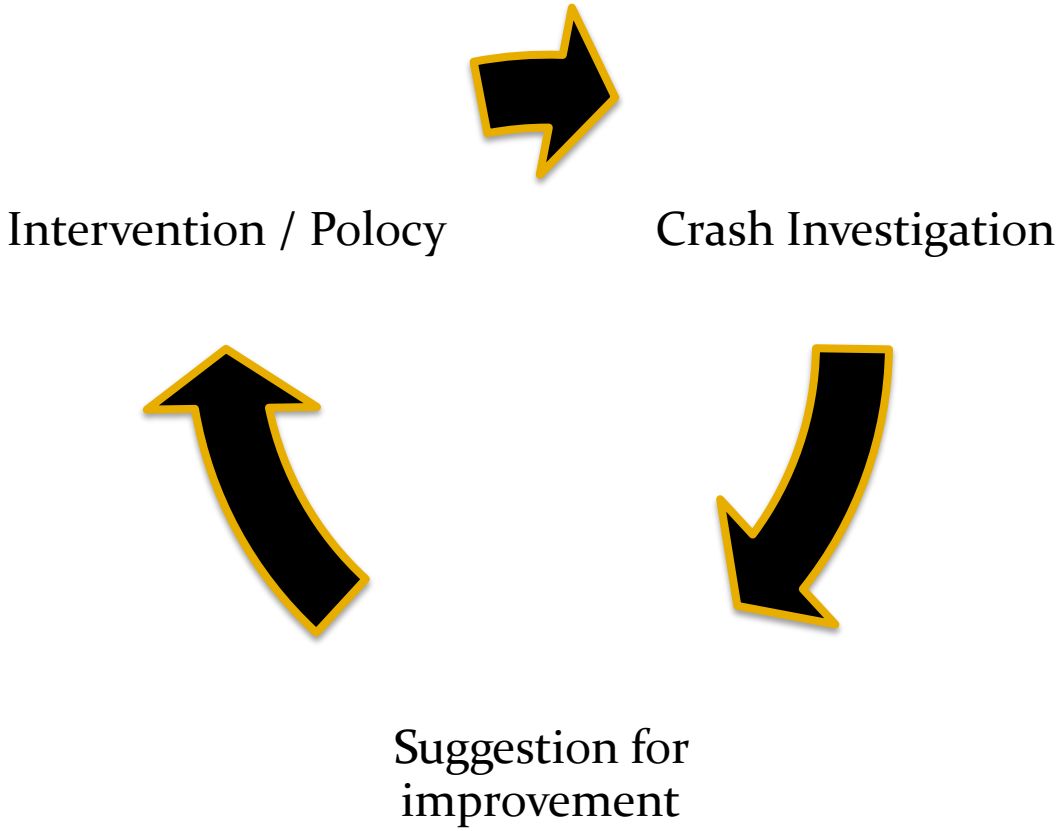


Objektif of In-depth Crash Investigation

- The primary purpose of research based, in-depth crash investigation is to identify in detail as many factors as possible that contribute to crashes and the resulting injuries and, in particular, factors that have not previously been identified.
- The results of these investigations are reported to the federal government, road authorities, the automotive industry and other stakeholders.
- Ultimately, this process can be expected to lead to the development of countermeasures that will prevent the same crash from happening again.

Source: *CASR, 2007*

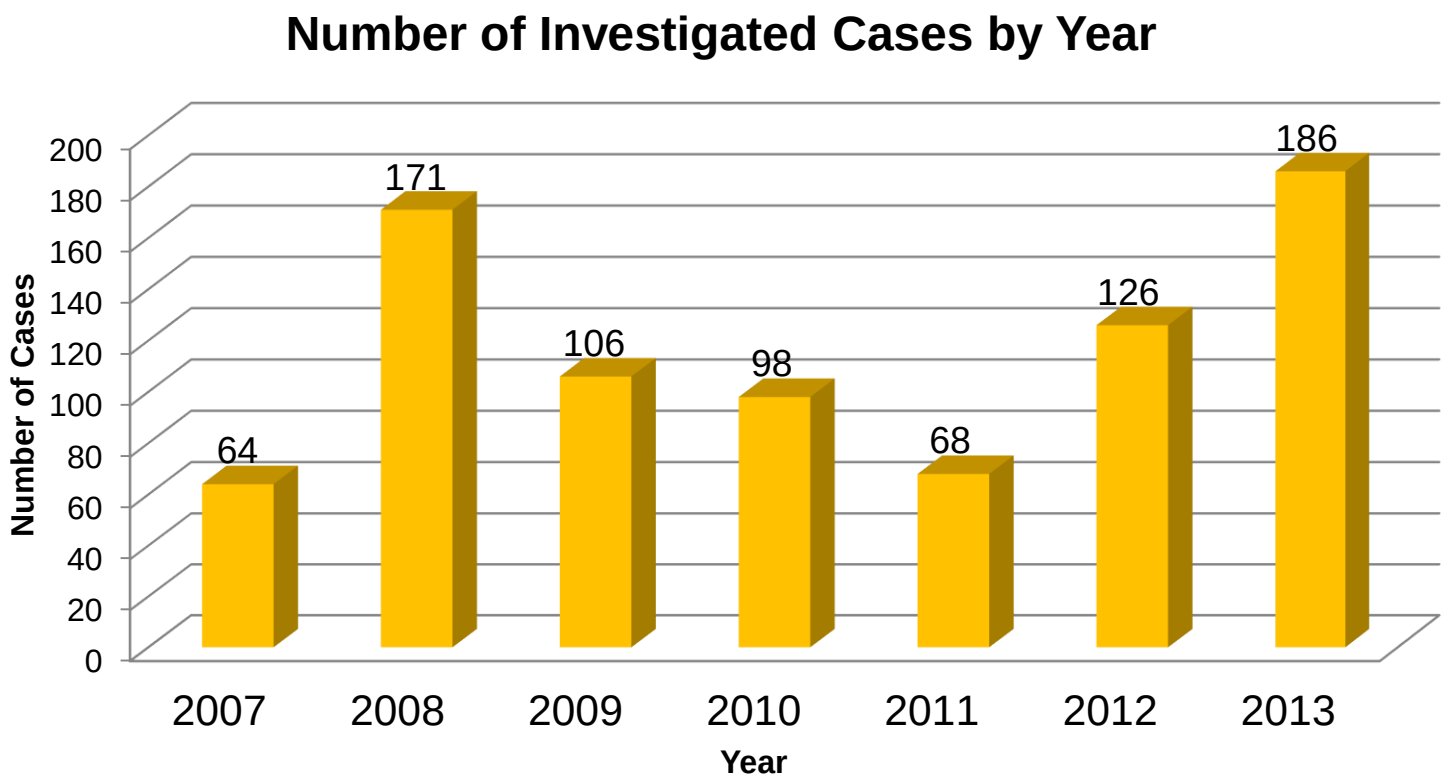
Crash Investigation: Overall picture



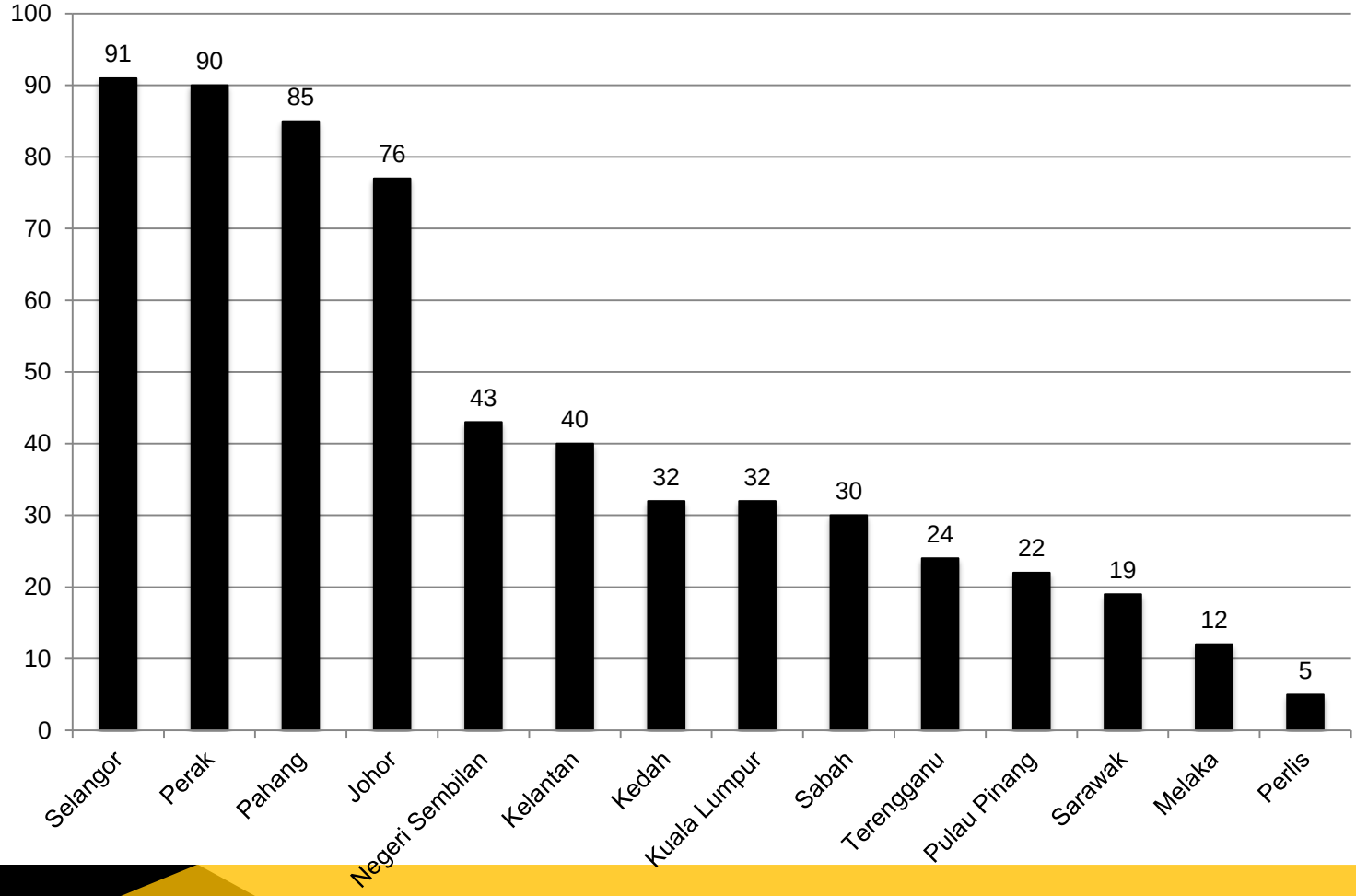
Crash Reconstruction Unit, MIROS

- Investigated cases: > 800 cases (since 2007)
- Catchment area: Malaysia
- Man power:
  - 5 Mechanical Engineers,
  - 1 Biomedical Engineer,
  - 1 Forensic Scientist
  - 1 Materials Engineer
  - 5 Supporting Staffs

Number of cases investigated



Number of cases investigated according to states 2007-2013



Type of Cases

- **Normal**: 3 deaths & above
- **Inquiry**: High number of fatalities, requested by the Ministry
- **Special**: Requested by agencies, car manufacturers, etc
- **Project based**: Motorcycles, Single Vehicle Crash, etc.

Type of Investigation

- **Retrospective** – Need some time to go to crash location e.g. East Malaysia
- **On the spot** – project based e.g. standby at hospital, follow ambulance

Standard Operating Procedure for Retrospective Investigation

1. Notification
2. Preparation
3. Data Collection
4. Data Analysis

MIROS Crash Team Vehicle

Equipment And Tools - Measurement

Equipment And Tools - Photography

Unmanned Aerial Vehicle (UAV)

- Early at-scene arrival, to avoid traffic congestion
- Top view analysis

Data Collection

Primary	Secondary
On-site investigation Inspection of damaged vehicles	Reports and findings from relevant authorities (PDRM, highway authorities, hospitals etc)

Road

- Road design & Environment
- Road geometry
- Road Site Evidence

Vehicles

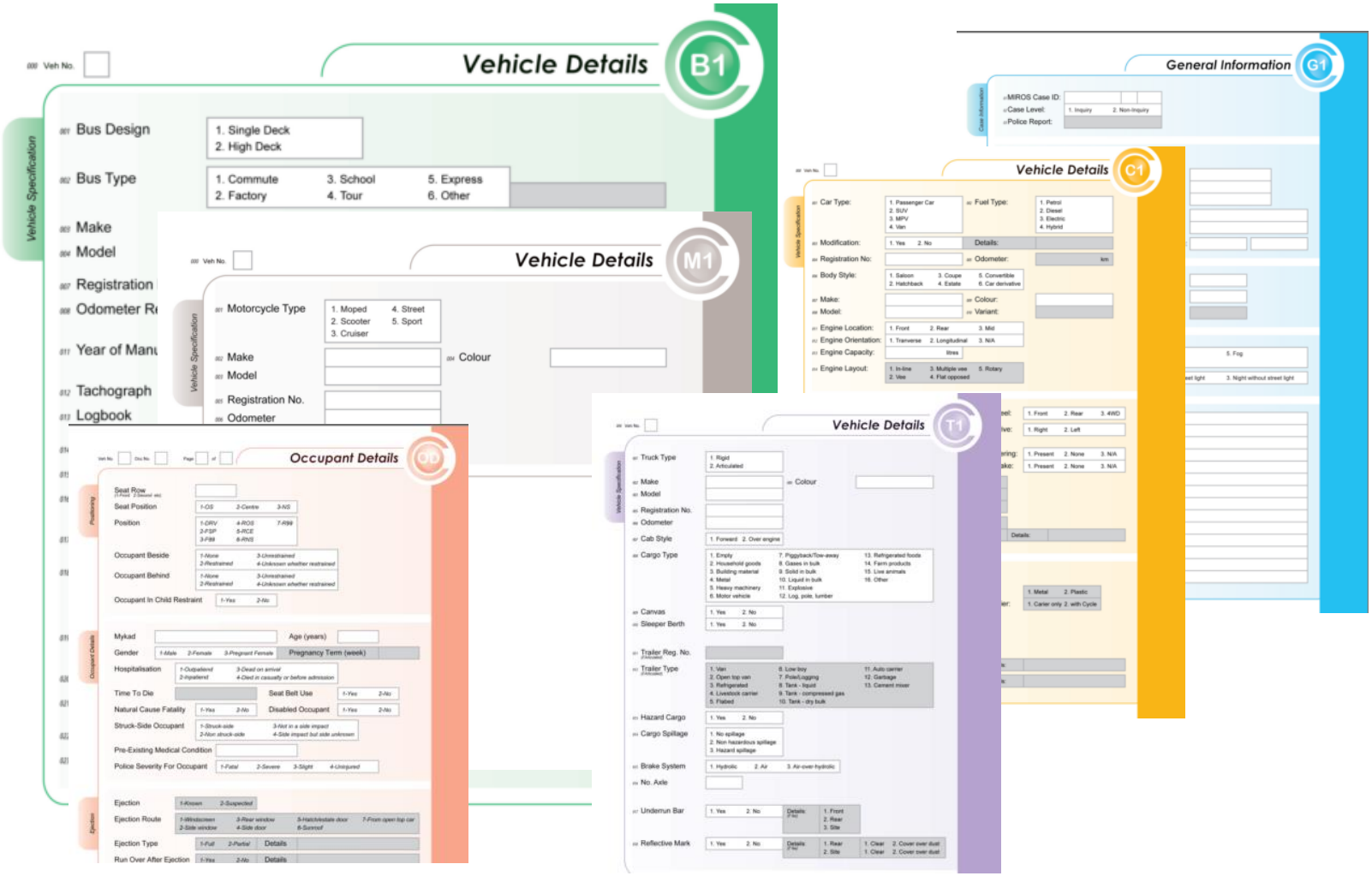
- Vehicle damage
- Restraint System

Occupants

- Injury level
- Injury mechanisme

System

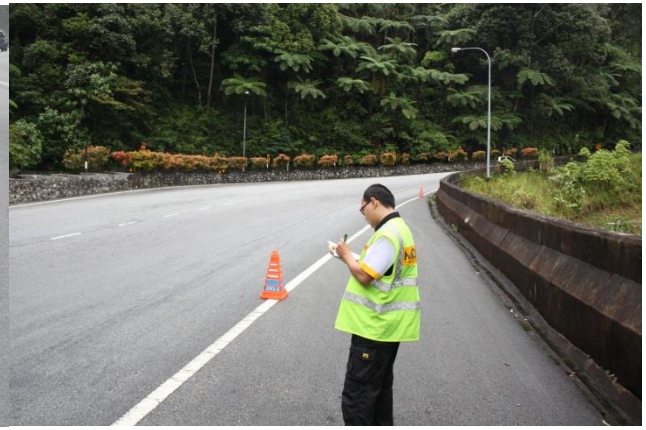
- Trip management
- Driver selection & condition
- Vehicle management



* Adapted from The University of Birmingham & The University of Adelaide Crash Investigation forms

Road Design

Road Geometry

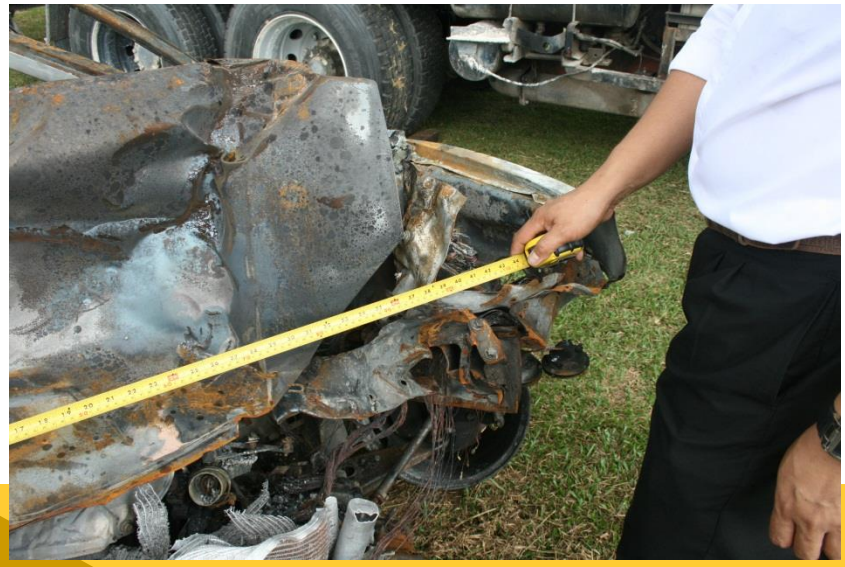


Aerial view (UAV)

Physical Evidences

Vehicle damages

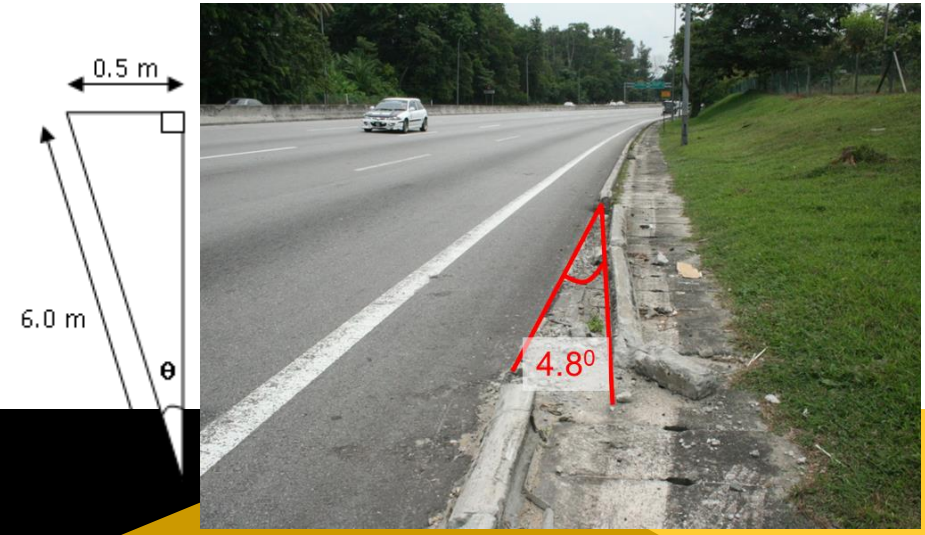
Collision Damage Classification (CDC)=01FYAW6



Restraint System

Crash Location Analysis

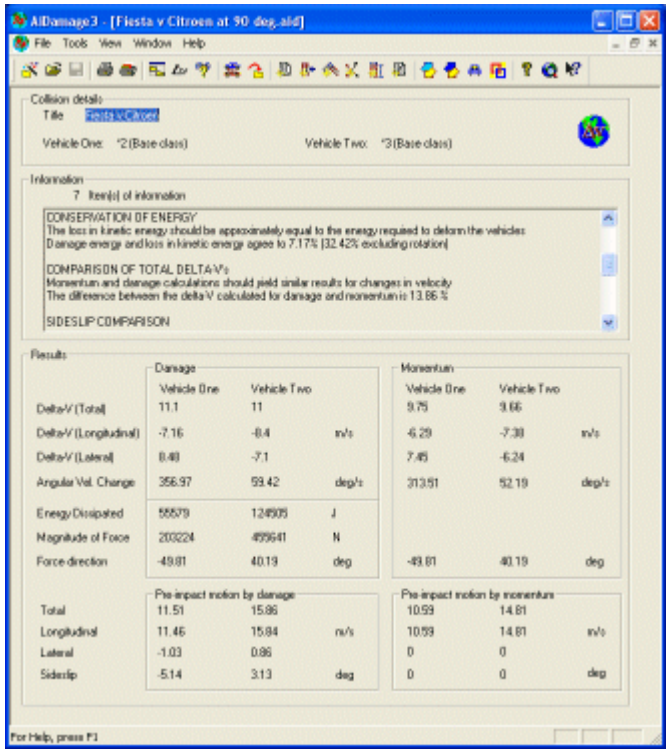
Crash effects



Vehicle damages analysis

Crush Energy Calculation

Crush Measurement (C1 – C6)



Using AIDamage software

Delta-V → Speed

Vehicle damages analysis

CRUSH MEASUREMENT (C1 – C6)

1 2 3 4 5 6 7

Direction of impact

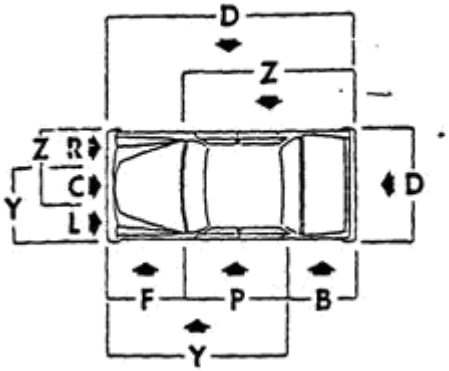
General area of damage

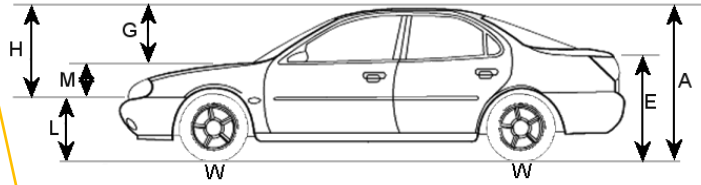
Specific horizontal area

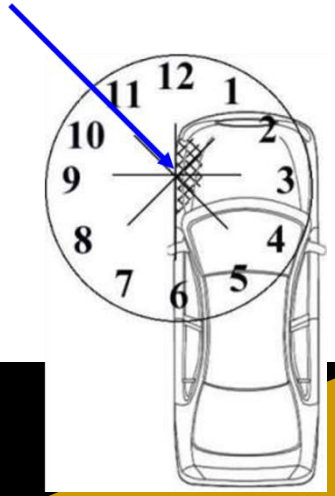
Specific vertical area

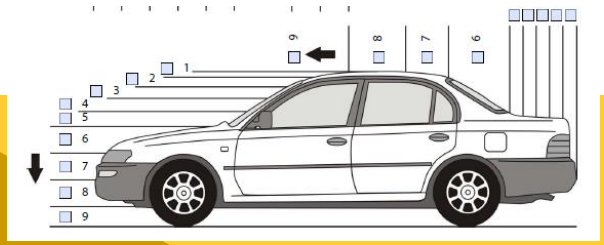
Type of damage distribution

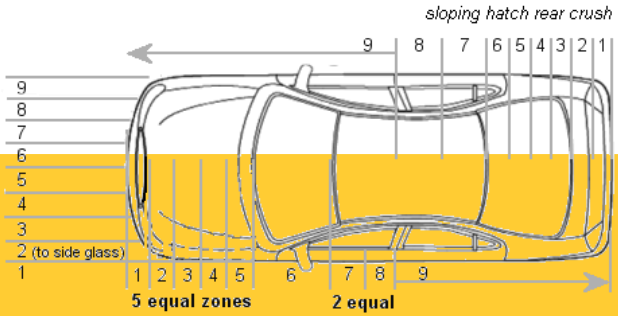
Damage extent











Crash Reconstruction

- Scientific process
- Laws of Physics & Engineering principles
  - Conservation of Momentum & Energy
  - Crash kinematics – changes in mass movement
  - Crash dynamics – how the vehicles collided & its final rest position.

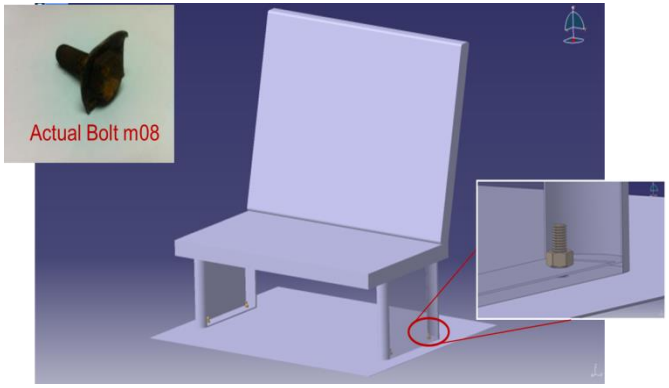
- Overvolume
- Overloading (penumpang / barangan)

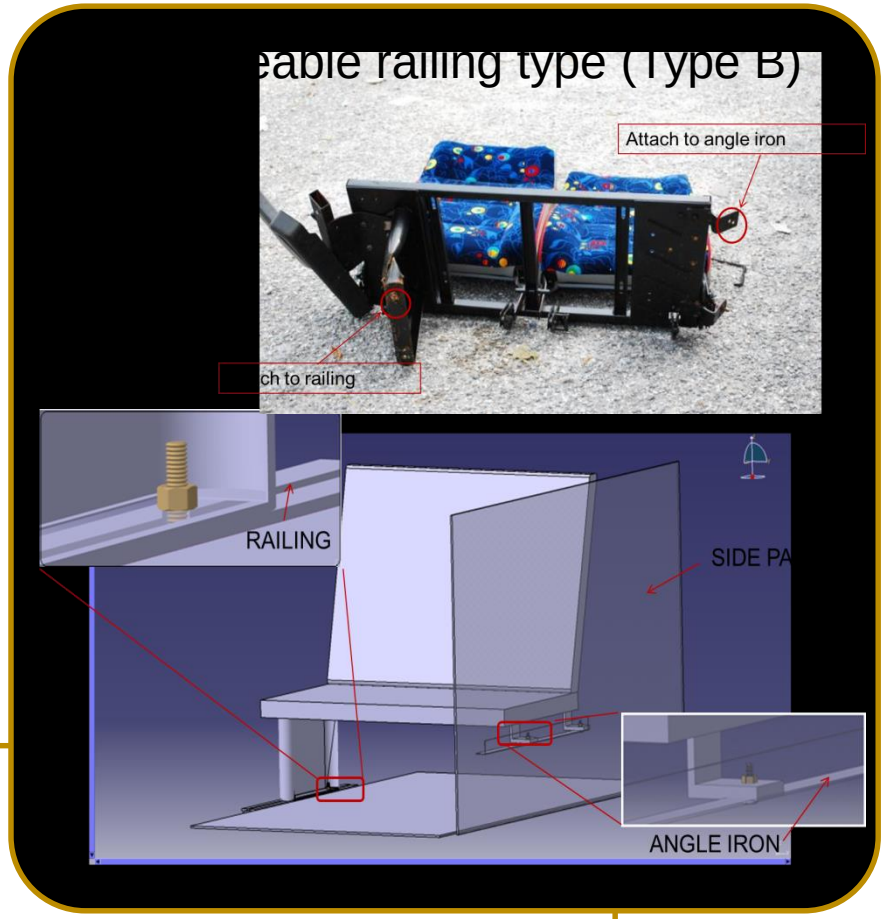
(*Overvolume*)

Overloading- Occupants

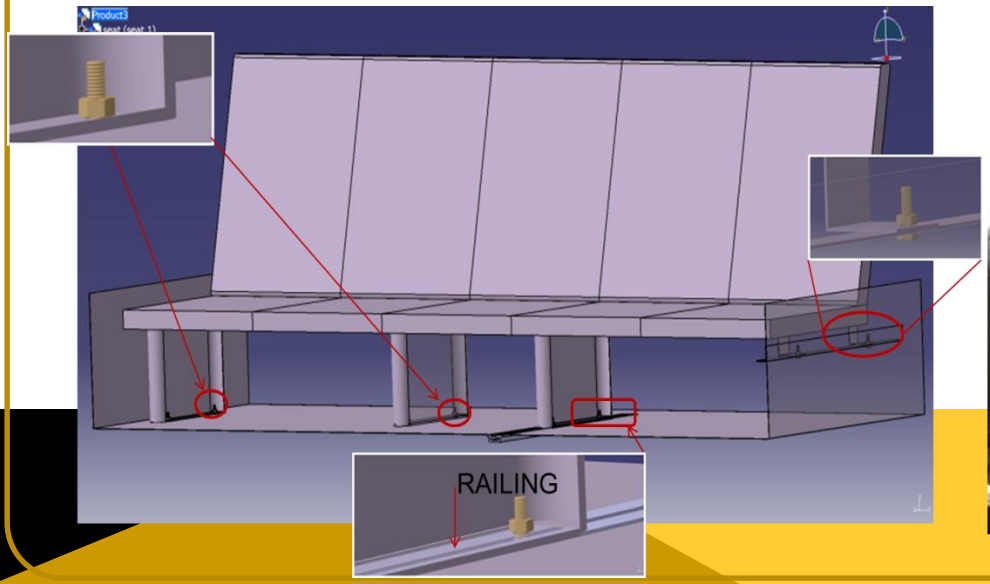
SEAT ANCHORAGES (UN R80 ISSUE)

Fixed type (Type A)

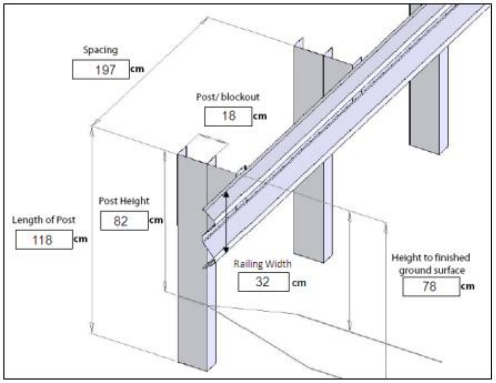


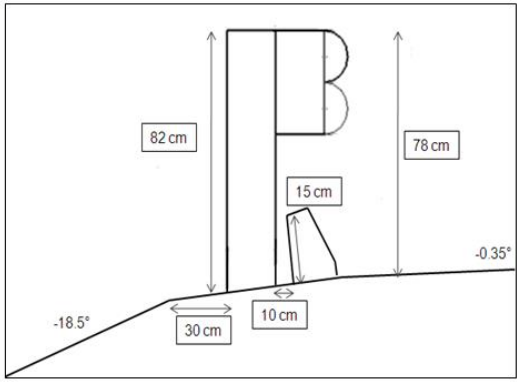


Top on type (Type C) – for last row only



Tyre failure





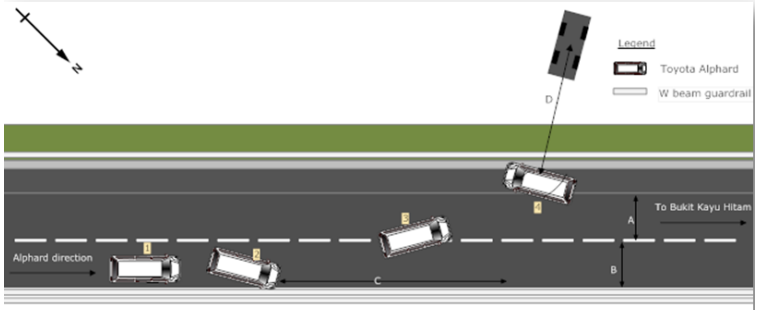
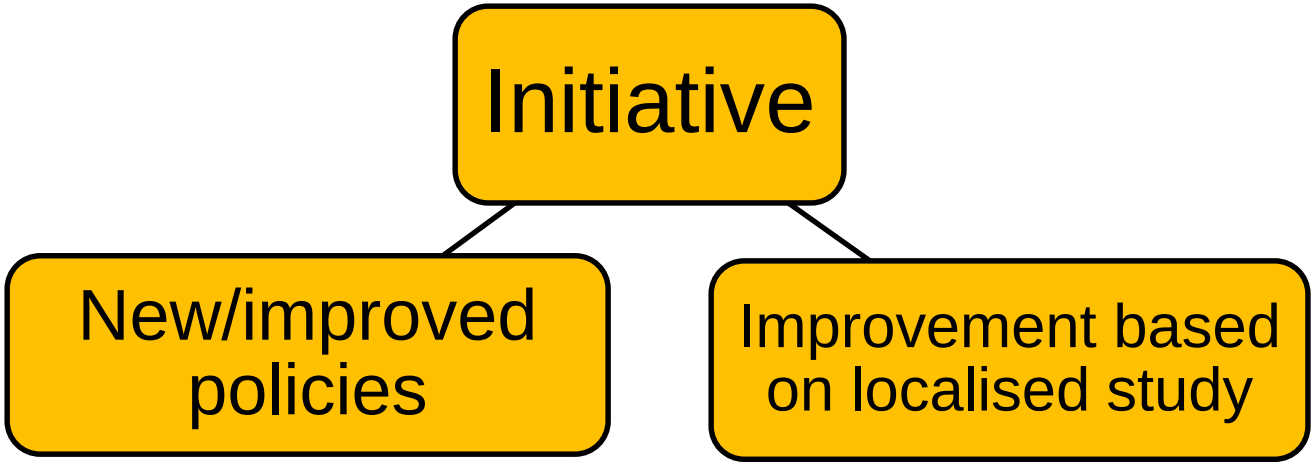


DIAGRAM NOT TO SCALE

Date	22/07/2010
Day	Thursday
Time	1025 hrs
Location	KM 301.9 North-South Expressway
Weather	Fine

Variables	Distance (m)
A	3.5
B	3.5
C	30
D	28

Improvement initiatives

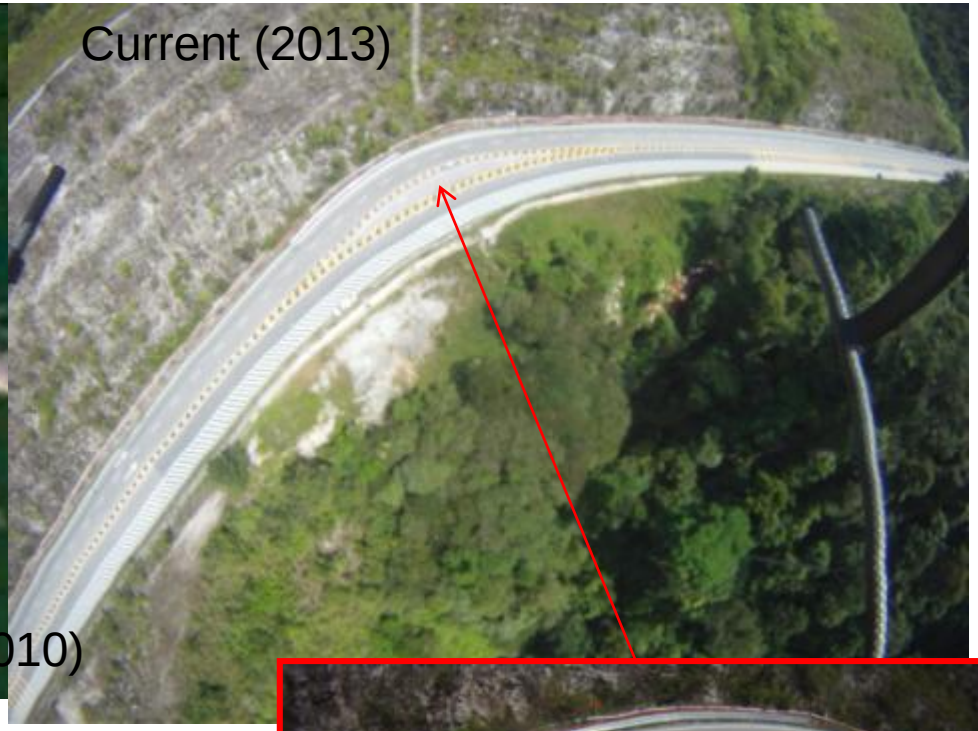


Improvement initiatives (based on Simpang Pulai Case)

- Improvement of sharp curve
- Improvement of space between barriers
- Addition of traffic calming element (*transverse bar*)

Improvement of Sharp curve (Plan View)

Source: Google Map (accessed in Dec 2010)

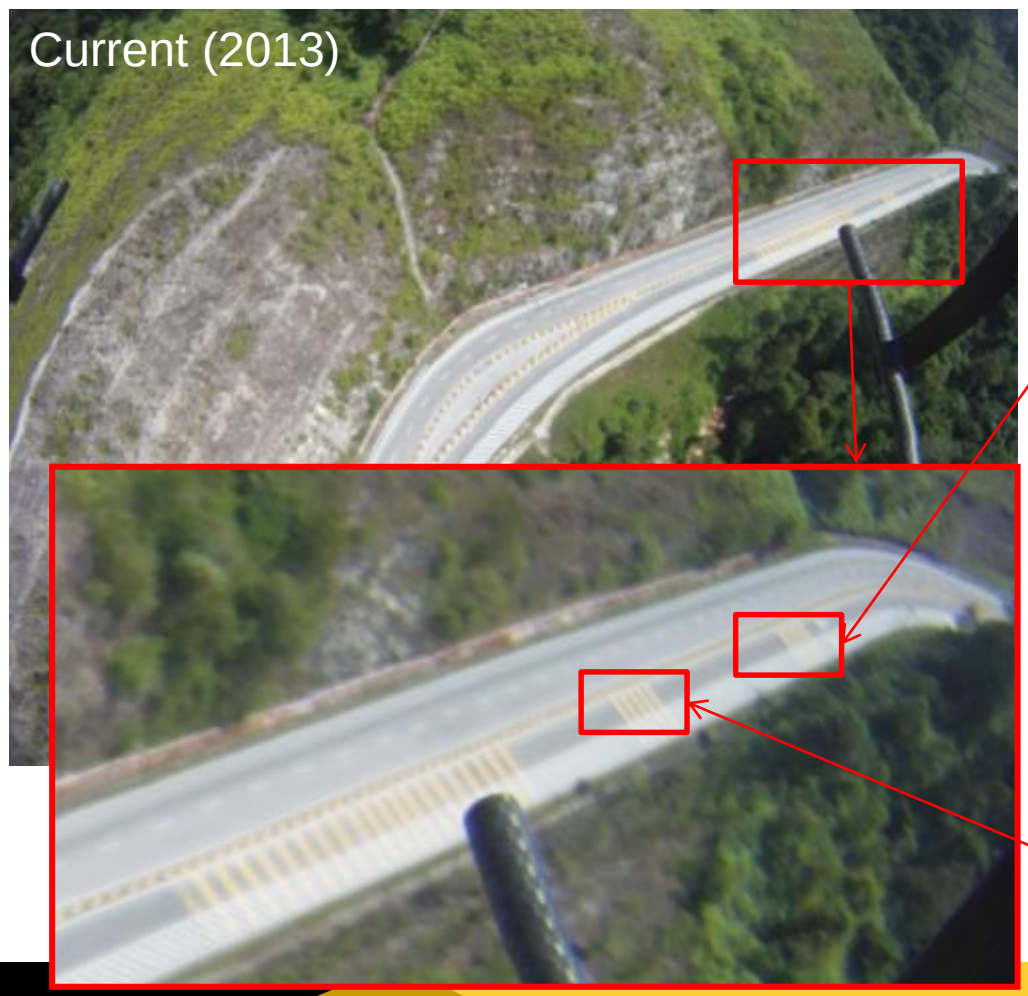


Improvement of space between barriers

Similar to previous barrier location

Addition of barrier – improve downhill curve

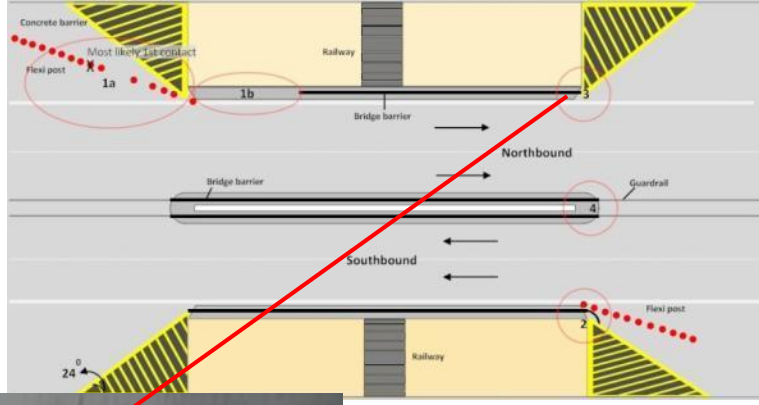
Addition of traffic calming element (*transverse bar*)



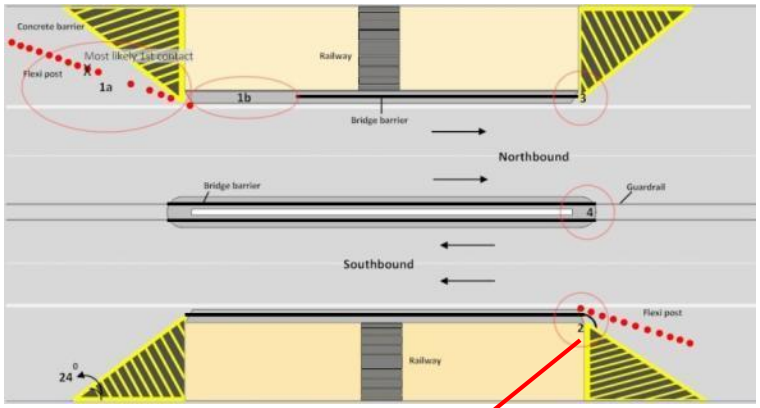
Improvement initiatives

- *End treatment improvement on bridge parapet*

Ending Point of the Damage Bridge



End Treatment



Causing the penetration of the rails into the lower passenger compartment

1. ENHANCING GUARDRAIL STANDARDS FROM TL2 TO TL3-TL6

❖ There is an urgent need to install barriers which can withstand crash energy of test level (TL) 3 and up to level 6 on certain stretches in Malaysian roads.

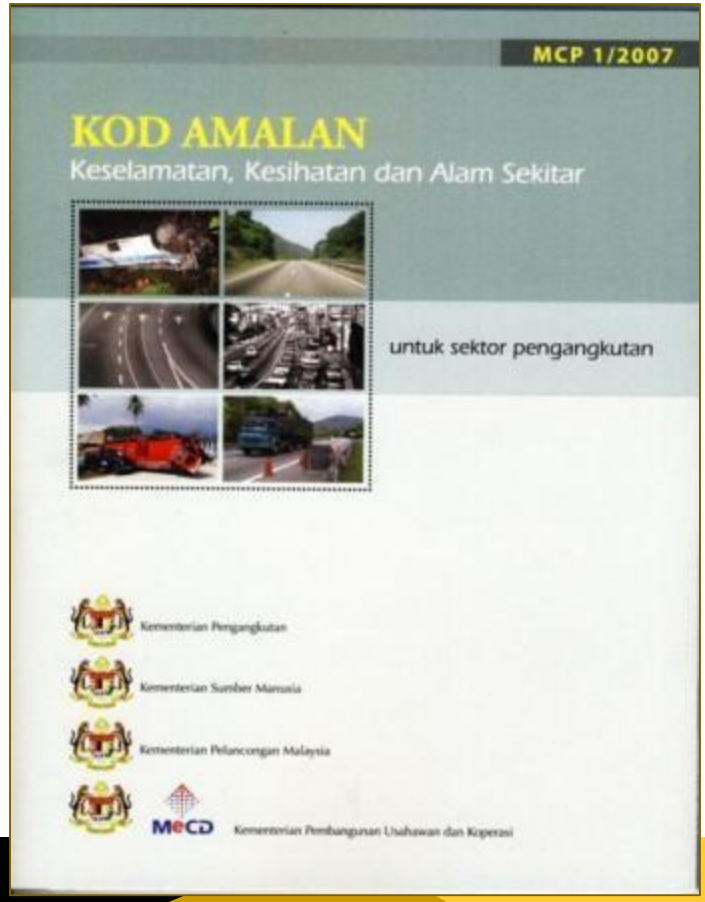
❖ Cabinet made a policy decision requiring related authorities to develop a plan for upgrading the existing guardrail system from TL2 to TL3, 4, 5 or 6, depending on the safety requirements of a particular stretch of the road.

❖ For stretches of roads running alongside a slope and with a history of accidents, an upgrade to TL6 has been made mandatory.

❖ Implementation: Jabatan Kerja Raya (JKR)

Note: *Test Level (TL) is defined as a form of destructive test performed to ensure safe design standards in compatibility with traffic barriers for different automobiles.*

2. CODE OF PRACTICE ON SAFETY, HEALTH AND ENVIRONMENT (SHE) FOR THE TRANSPORT SECTOR



- ❖ Lack of supervision by the company's fleet manager in monitoring the drivers has been seen as a possible contributing factor towards driver negligence when on the road.

- ❖ Interviews with top management of the company also found the non-existence of standard procedures on safety and health for transport activities.

- ❖ Officially published in November 2007 and then endorsed by the Cabinet as a policy decision.

3. IMPLEMENTATION OF REAR SEATBELT USE IN VEHICLES

❖ MIROS Study: 95% of Malaysian cars are fitted with rear seatbelts and 81% of Malaysian road users have access to rear seatbelts.

❖ It is a proven fact that rear seatbelts are 44% effective in reducing fatalities compared to unrestrained back seat occupants.

❖ A 60% compliance to rear seatbelt use is estimated to reduce 63 fatalities a year, and a further reduction in terms of injury severity is expected.

❖ The policy has been enforced on 1st January 2009.

Publication (downloadable through MIROS website):

1. MRR/4/2007: An Assessment of Rear Seatbelt Availability and Accessibility in Malaysia - a Preliminary Study
2. MRR/9/2008: PHASE 1 : Achievements of First 3-Month Advocacy Program - Rear Seatbelt Use : Public Awareness and Practice

4. BUS COMPLIANCE TO UN R66 AND UN R80

❖ Numerous in-depth analytical studies and reconstruction of real world bus crashes by MIROS reveal that many of our buses have frail superstructure design and poor seat design and anchorage.

❖ Cabinet of Malaysia has made a policy decision to incorporate United Nations Economic Commission for Europe (UNECE) guidelines – UN R66 and UN R80 as part of the type approval for new buses effective November 2007.

❖ Implementation: Jabatan Pengangkutan Jalan (JPJ)

Note:
R66 – Uniform Technical Prescriptions Concerning The Approval of Large Passenger Vehicles with regard to The Strength of Their Superstructure.
R80 – Uniform Provisions Concerning The Approval of Seats of Large Passenger Vehicles with regard to The Strength of The Seats and Their Anchorages.

Seminar


MIROS

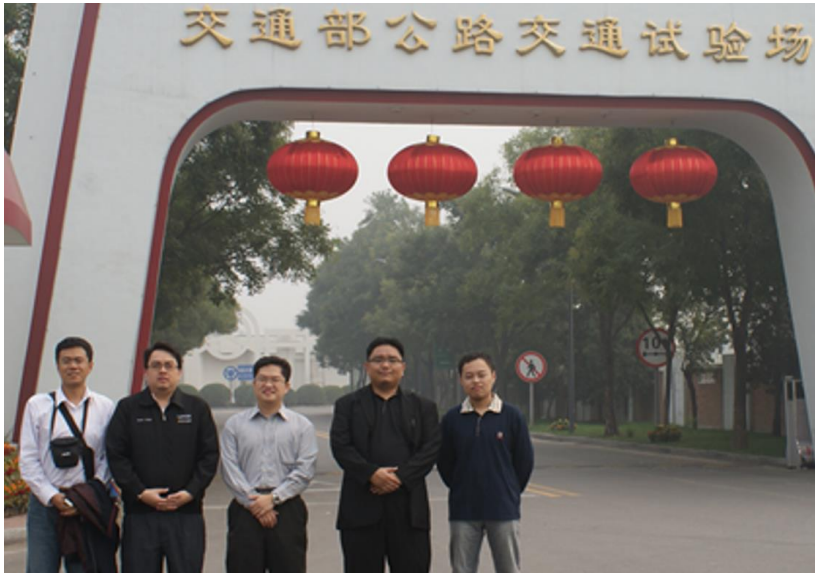

2ND MALAYSIAN WORKSHOP ON CRASH INVESTIGATION
AND INJURY BIOMECHANICS
1 - 2 DECEMBER 2011
at FLAMINGO HOTEL BY THE LAKE, KUALA LUMPUR


RETROSPECTIVE:
RECONSTRUCTION OF REAL-WORLD CRASH USING
ANIMATION

Train The Trainer

Media Coverage

Research Collaboration



Linkages With Authorities

THANK YOU

iskandar@miros.gov.my

cru@miros.gov.my