NATIONAL CENTER FOR SUSTAINABLE TRANSPORTATION TECHNOLOGY (NCSTT)

Vehicle Safety Status In Indonesia

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ASEAN AUTOMOBILE SAFETY FORUM
AASF 2018

AGENDA

1. NCSTT Introduction
2. WHO Data on global accident
3. Indonesian accident data
4. Accident investigation and resolution
5. Modeling and Validation

NATIONAL CENTER FOR SUSTAINABLE TRANSPORTATION TECHNOLOGY

NCSTT

Sustainable Transport

CCR Sustainable Electric Based Transportation Technology Development

- Funding : USAID / SHERA Program (2017-2021)
- Host: NCSTT ITB - National Center for Sustainable Transportation Technology
- University Partners (Indonesia):
  1. University of Diponegoro (UNDIP)
  2. University of Sriwijaya (UNSRI)
  3. University of Lambung Mangkurat (UNLAM)
  4. Institute Technology Kalimantan (ITK)
  5. State University of Sebelas Maret (UNS)
  6. University of Sam Ratulangi (UNSRAT)
- US Partner: MIT – Cambridge, MA
  1. MIT Profesional Development
  2. MIT Impact and Crashworthiness Laboratory/Battery Consortium

CCR Objective

- Develop an integrated transportation system that can support economic growth in Indonesia
- Acquire and implement advanced technologies for the next generation of electric based transportation within a sustainable innovation ecosystem:
  - Motor & RESS (Reserved Energy Storage System) Technologies
  - Light weight vehicle structures for personal car and urban mass transport (PRT, LRT)
  - Static & dynamic charging infrastructures for vehicle electrification
  - Transit oriented development (TOD)
  - Safety and Crashworthiness of electric based vehicles
  - Implementation policy, standard, and certification

Background

PROBLEM: Un-sustainable Transportation in Indonesia

- High traffic jam, polution, dependence on fossil fuel
- Transportation system in Indonesia cannot support national economic development. In Jakarta → Rp. 31 T (USD 2B) economic losses/ year. NCSTT Study in 2017.

CHALLENGES: Electric Vehicle Revolution in 2025

- Fuel Economy Regulation of 56.5 MPG (Mile Per Gallon) started in 2025
- The electric based transportation will be the solution wrt cost & regulation
- Global electric vehicle proliferation strategy In Indonesia will need to be addressed

OPPORTUNITIES: Indonesian Transport Expansion Plan in 2030

- Indonesian market for passenger vehicles will increase from 1.4 million to 4 million.
- New urban railways system of 3800 km will require 12,000 new passenger coaches will be needed (RIPNAS).

Jakarta

Bandung

Surabaya

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Selection of Technology

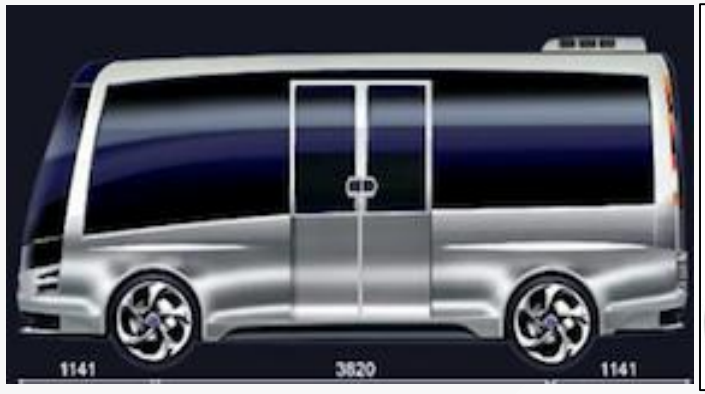
Electric based transportation system is selected due to the fact :

- Current powertrain with combustion engines already reached optimum performance.
- Performance Improvement can only be achhieved by:
  1. Lightweight vehicle technology
  2. Aerodynamic exterior to achieve low coefficient of drag (C_D)
- Transitioning from combustion engine to electric motor:
  1. Hybrid electric/gasoline engine
  2. Extended range electric vehicle (EREV) technology to relieve driver “anxiety” due to limited energy availability of battery
  3. Full electric motor when the charging infrastructure is common

Collaboration and research implementation plan

In order to create focus research innovation, acticities for product innovation priorities in the CCR are:

- **Battery integrity/safety system**
- **Electric bus** for student/faculty shuttle transportation
- **e-Trike:** Electric vehicle for postal delivery
- **Light Rail Transit/LRT** (Kereta Kapsul) for urban transport in Jakarta and Bandung
- infrastructure development, **static/dynamic induction charging system**



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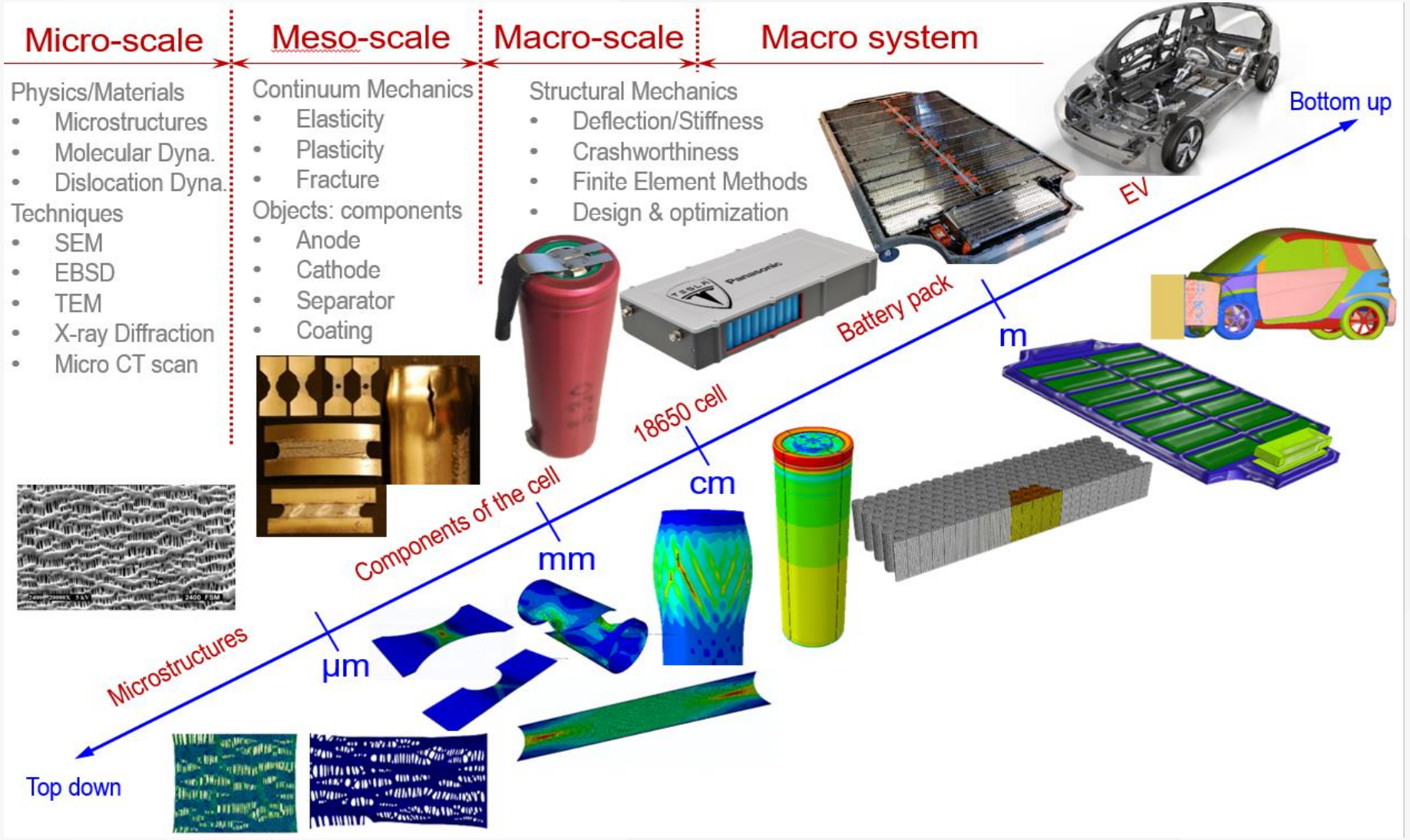
Research Collaboration on Li-Ion Battery – NCSTT-MIT



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Vehicle Safety In Indonesia

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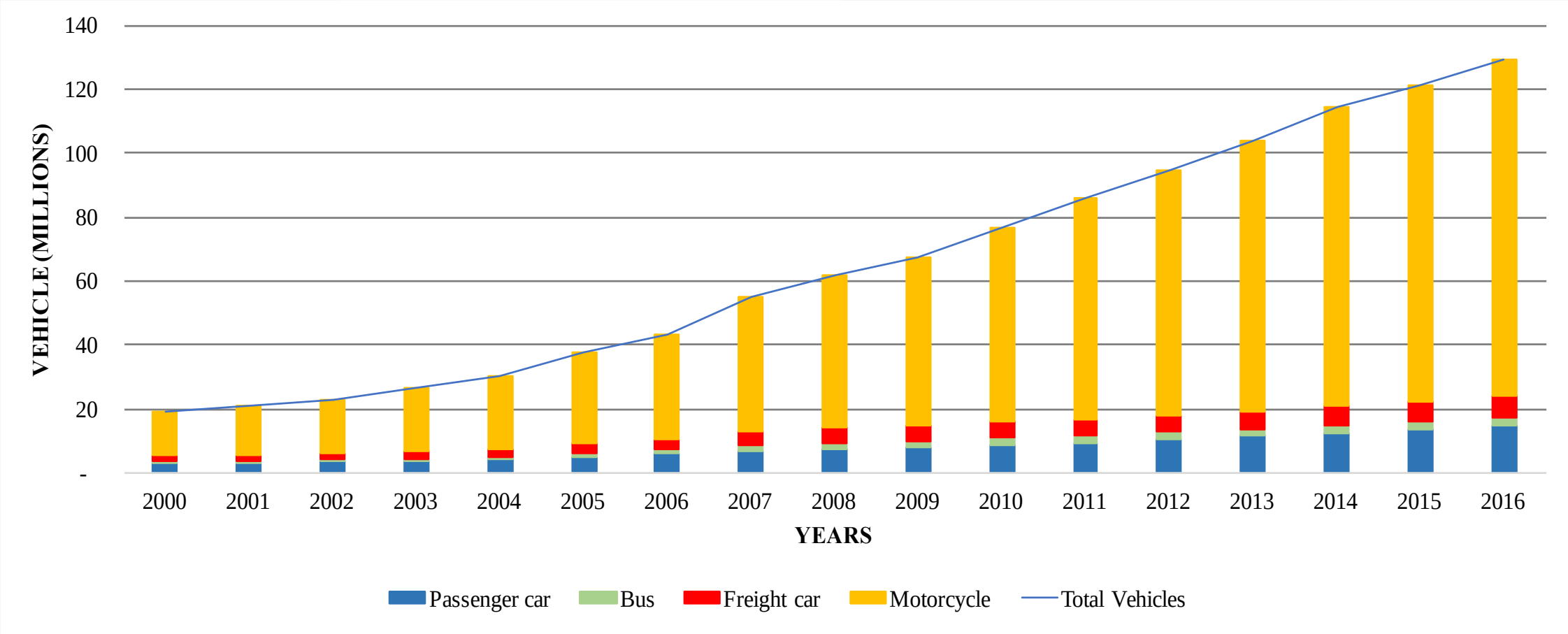
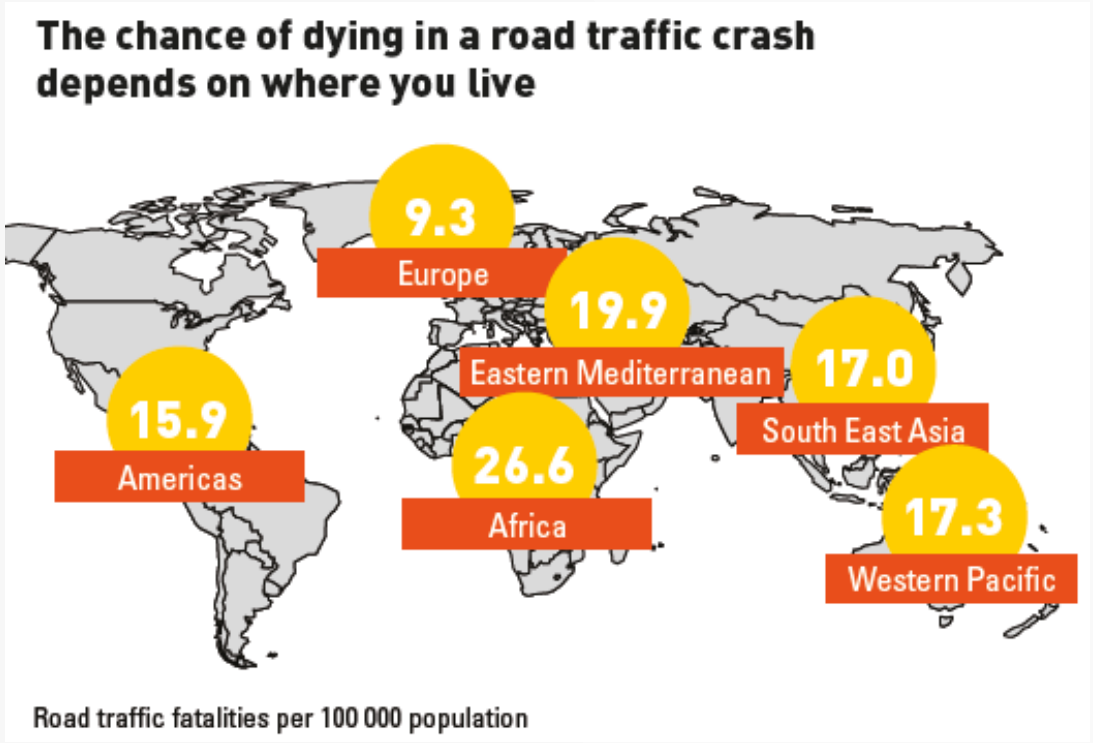
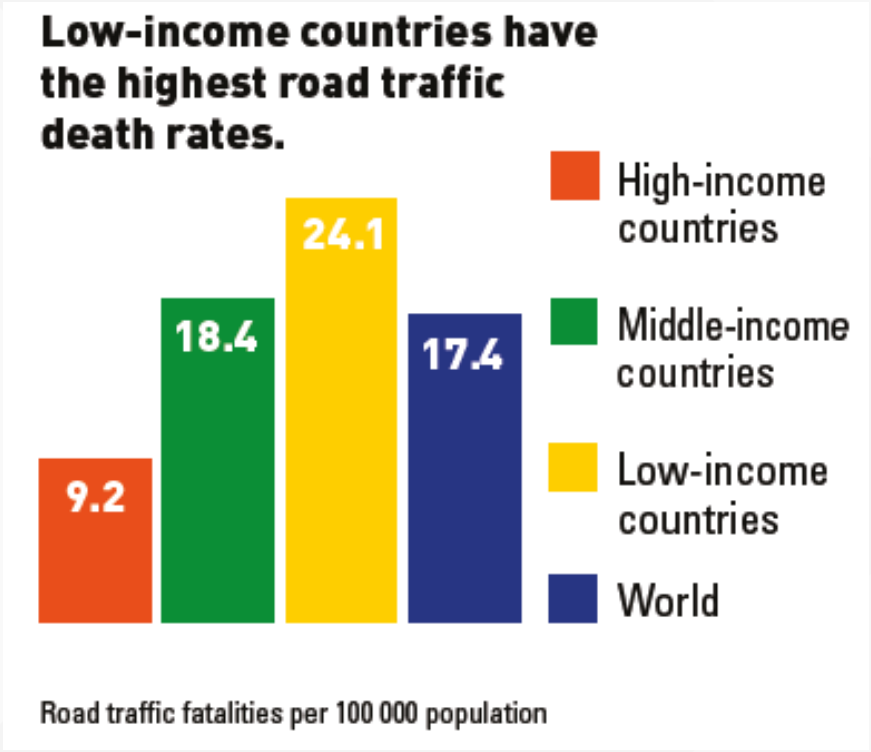
Number of Vehicles in Indonesia



World Traffic Fatalities





Source: WHO - Global status report on road safety 2015

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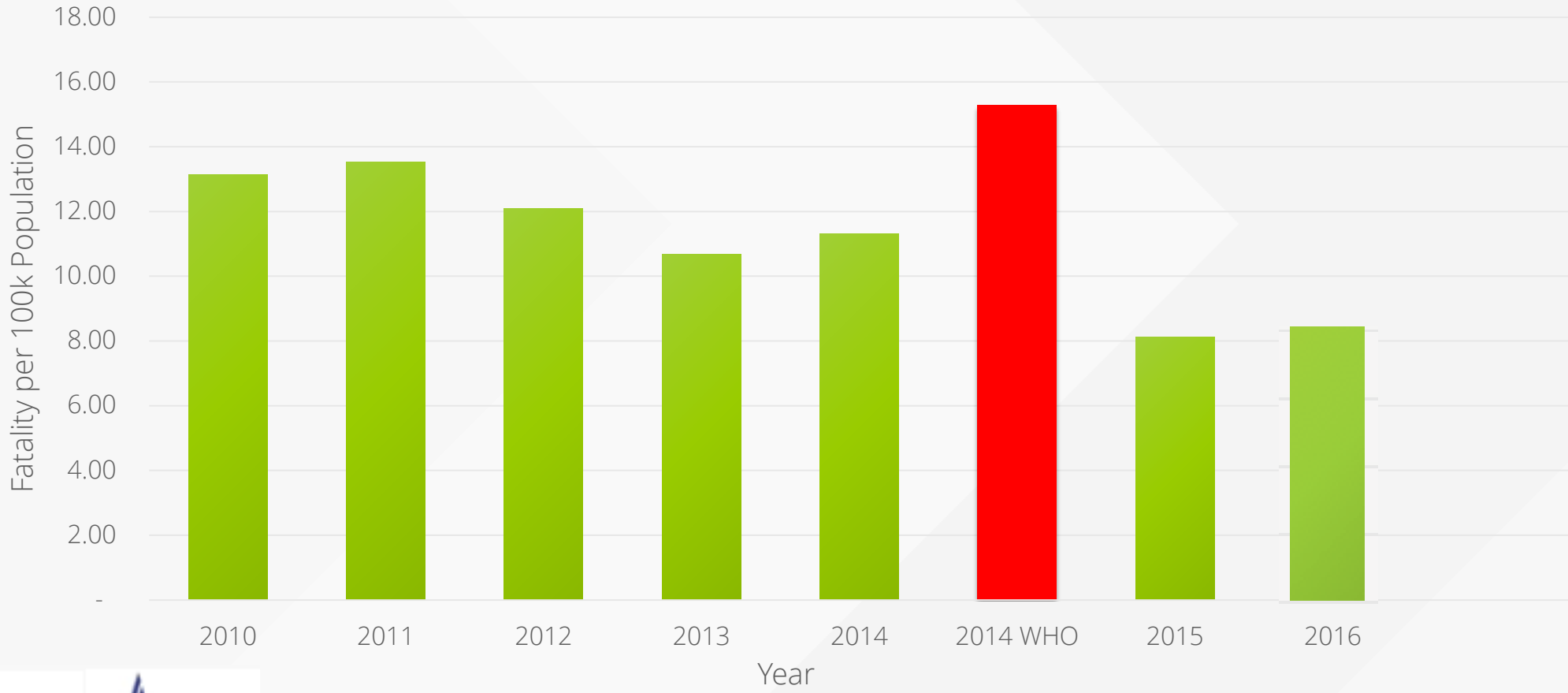
Fatality per 100k Population in Indonesia 2010 – 2016



Source: http://www.korlantas-irsms.info/graph/accidentDa

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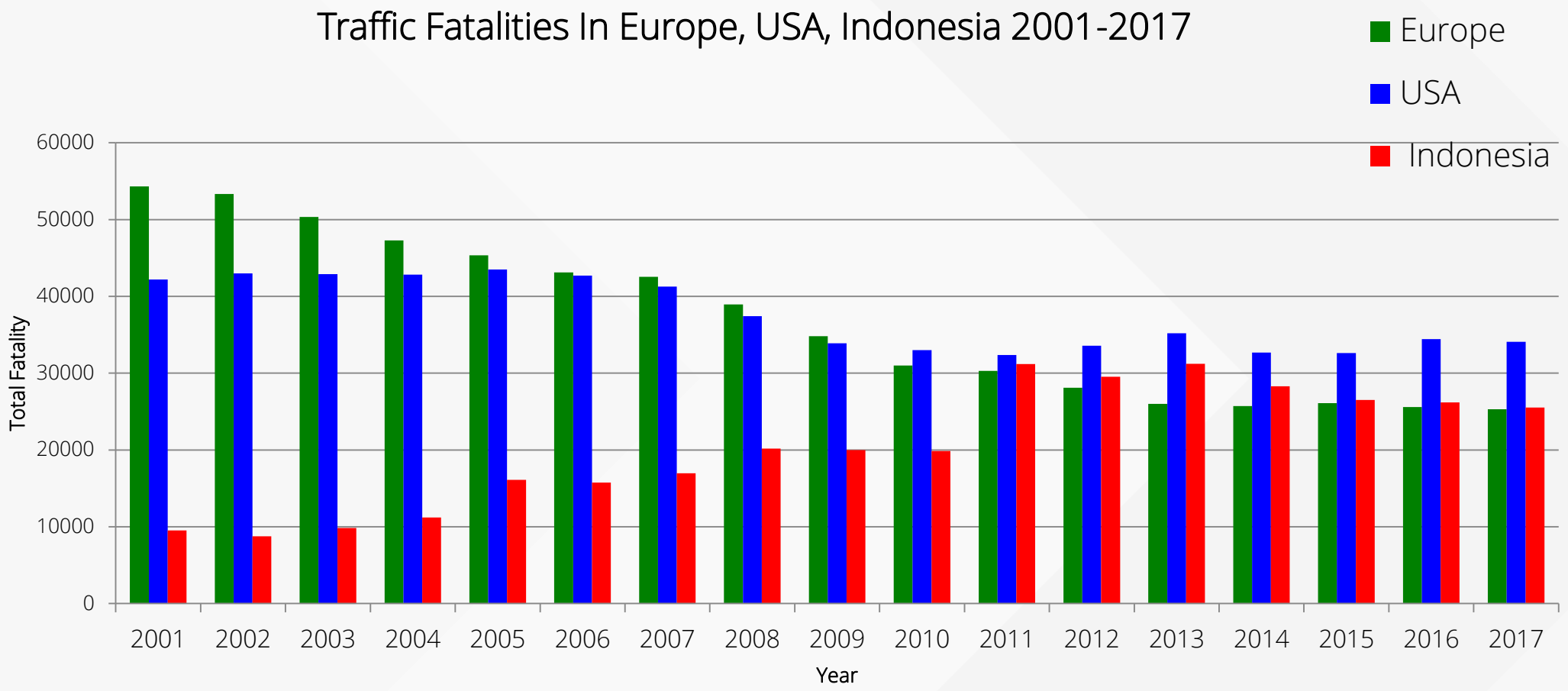
Traffic Fatality: US, EU, Indonesia



- Fatality rate in Indonesian accident increases
- Dramatic reduction in EU, US due to regulation upgrade

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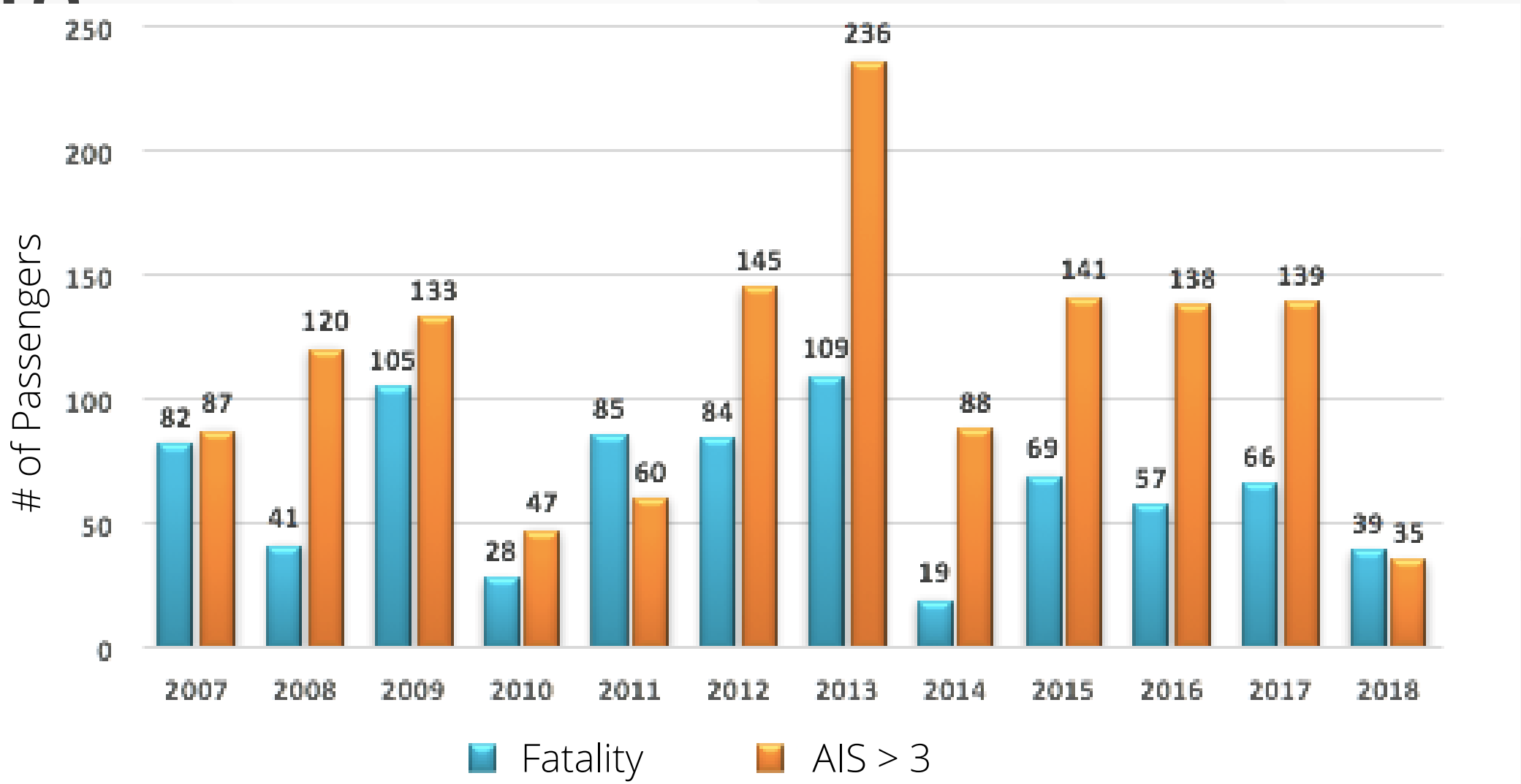
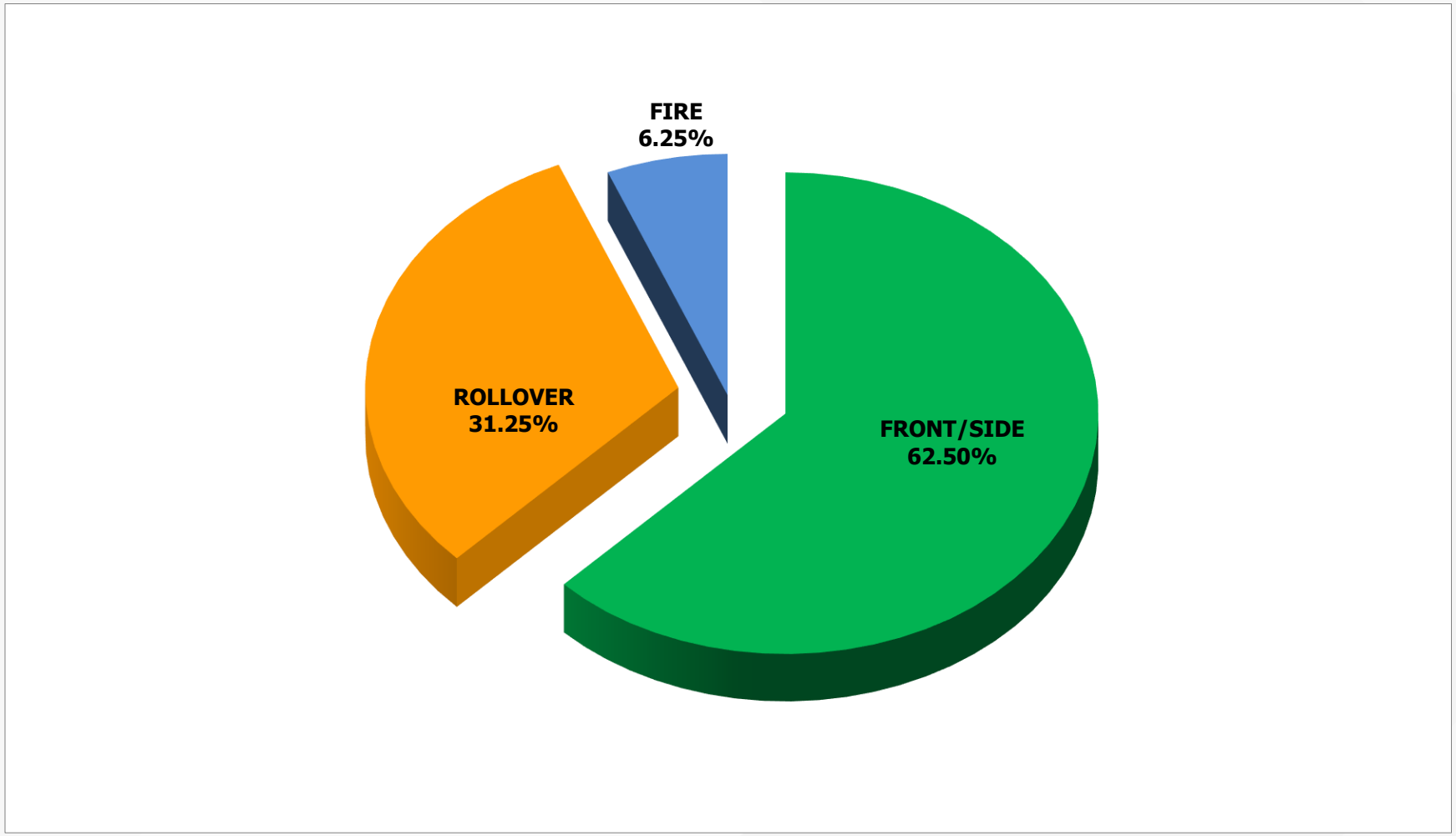
Accident Investigation by KNKT 2007-2018



KNKT INVESTIGATION: Type of Accident



Rollover Accident in Indonesia

.com/baca/artikel/7218/tabrak-truk-bus-terbalik-penumpang-berceceran

Rollover Accident: Bus Rukun Sayur, Palikanci (2015)

Fatality = 11,

Severe Injury (AIS > 3) = 12,

Light Injury (AIS < 3) = 30

http://regional.kompas.com/read/2015/07/14/14451031/Foto-foto.Kecelakaan.Bus.Rukun.Sayur.di.Tol.Palikan

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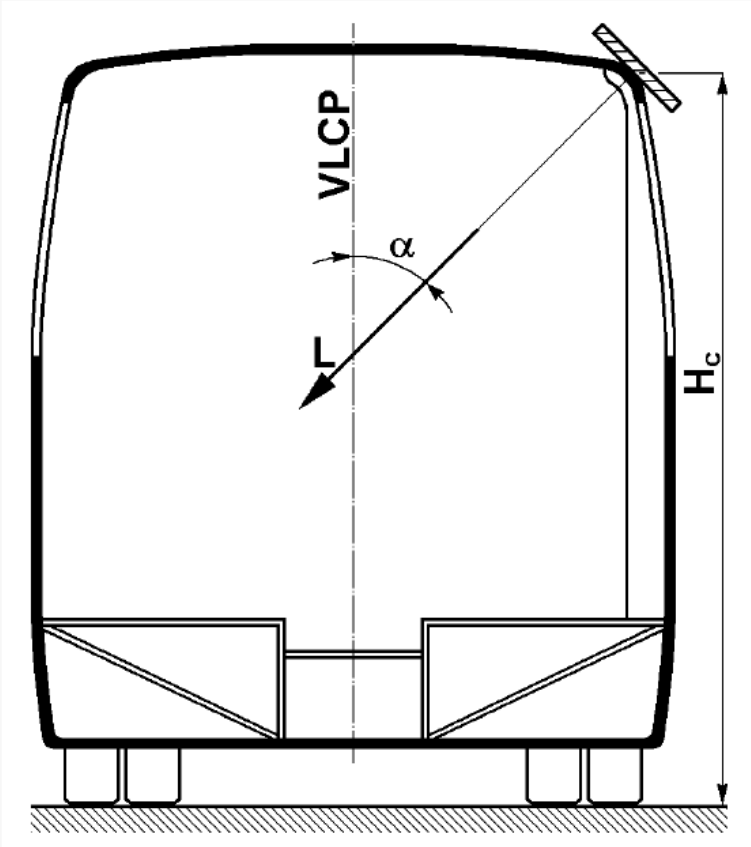
GLOBAL REGULATION ROLLOVER



ROOF CRUSH REQUIREMENTS:

1. **UNECE R66**. (EU): Energy Method

Energy absorbed during deformation up to the residual space > 75% potential energy

$$E_{min} = 0{,}75\ M\ g\ \Delta h$$

2. **FMVSS 216**. (US): Force Method

Reaction force of the rigid platten > 1,5 x GVW prior reaching 127 mm displacement

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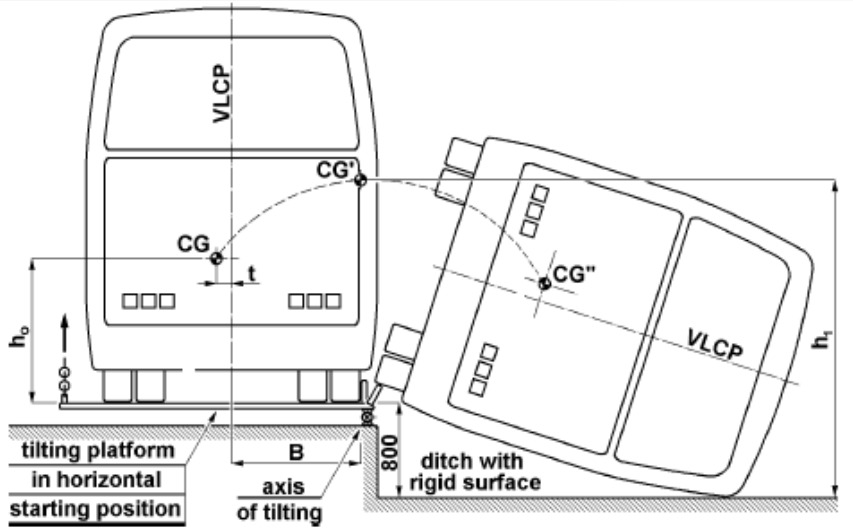
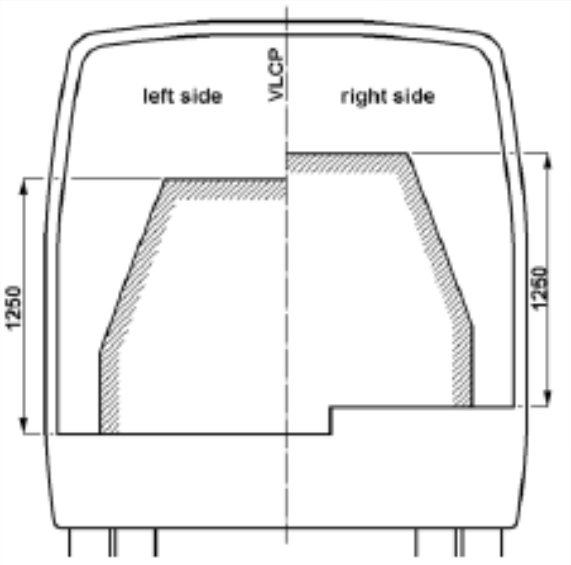
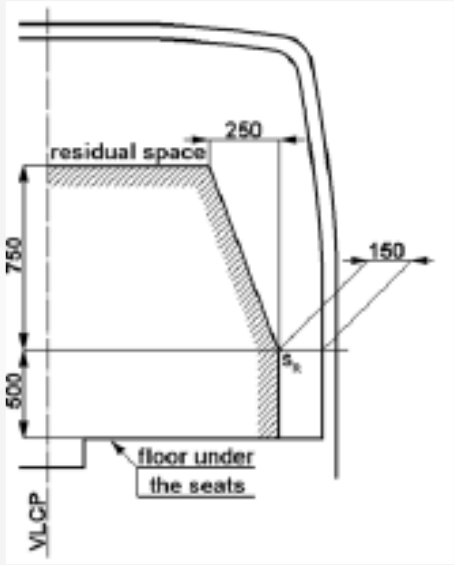
3. UNECE R66: Rollover Bus







REQUIREMENT: Structural intrusion does not exceed the safety zone

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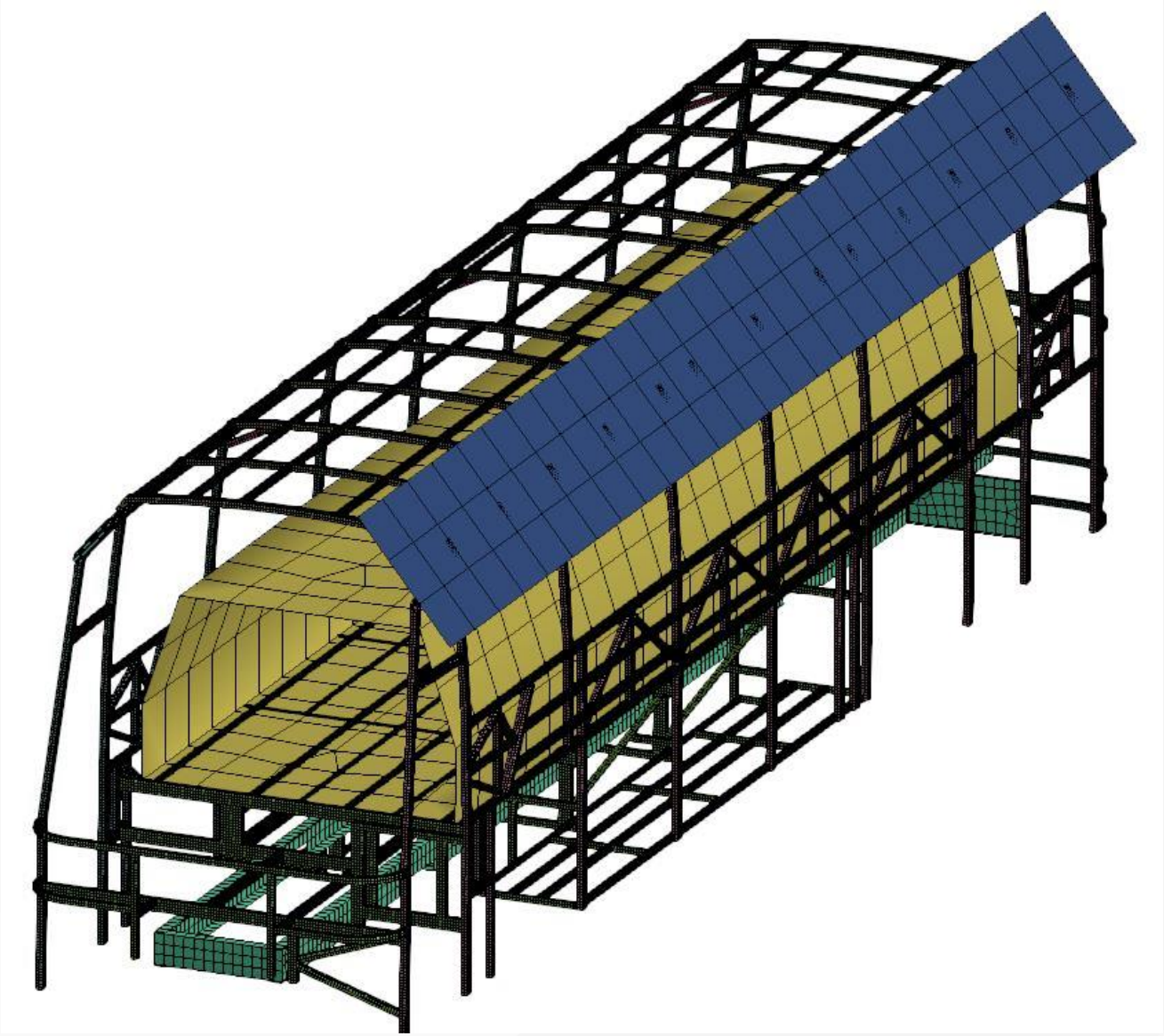
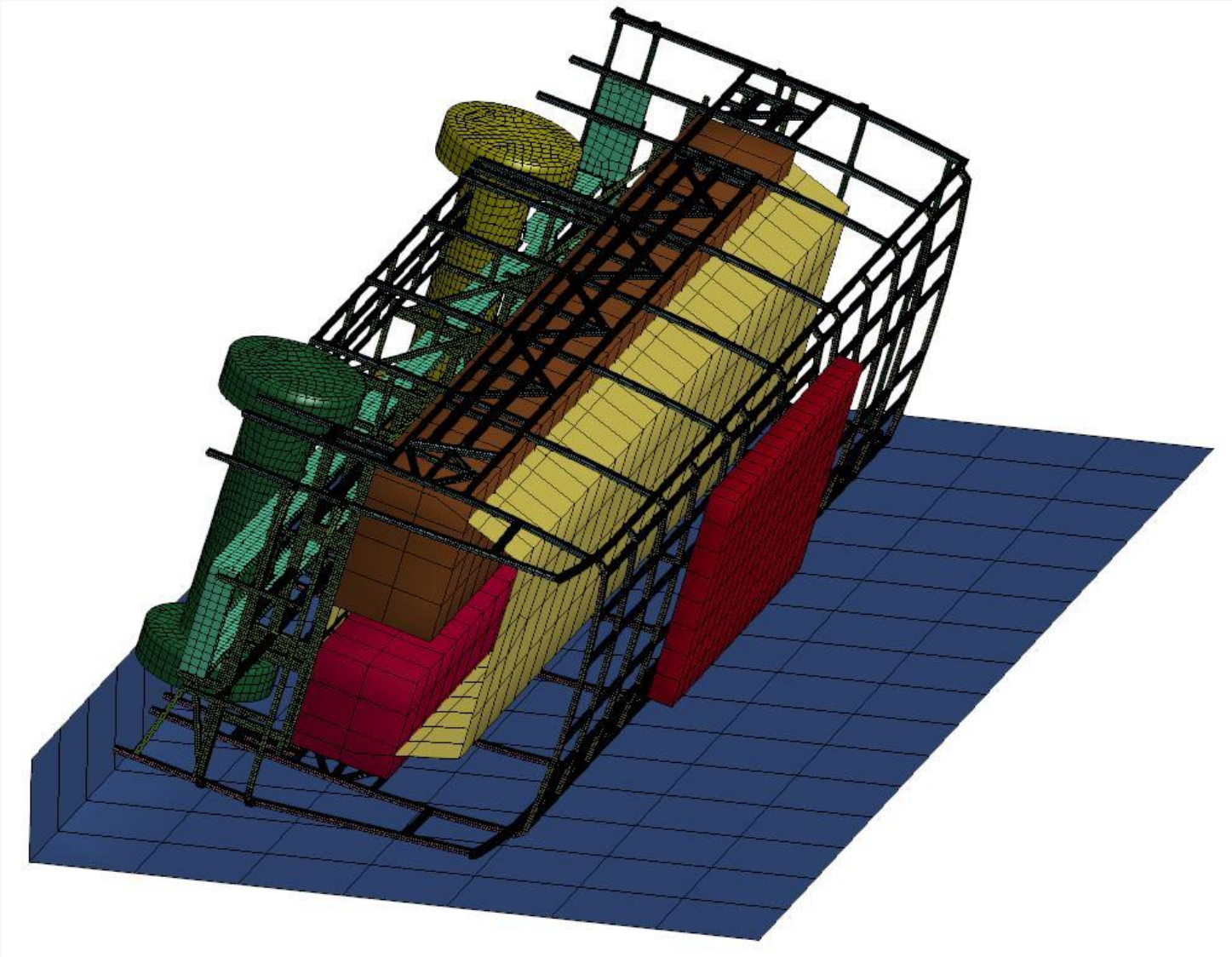
Bus Superstructure Modeling

Courtesy: LAKSANA

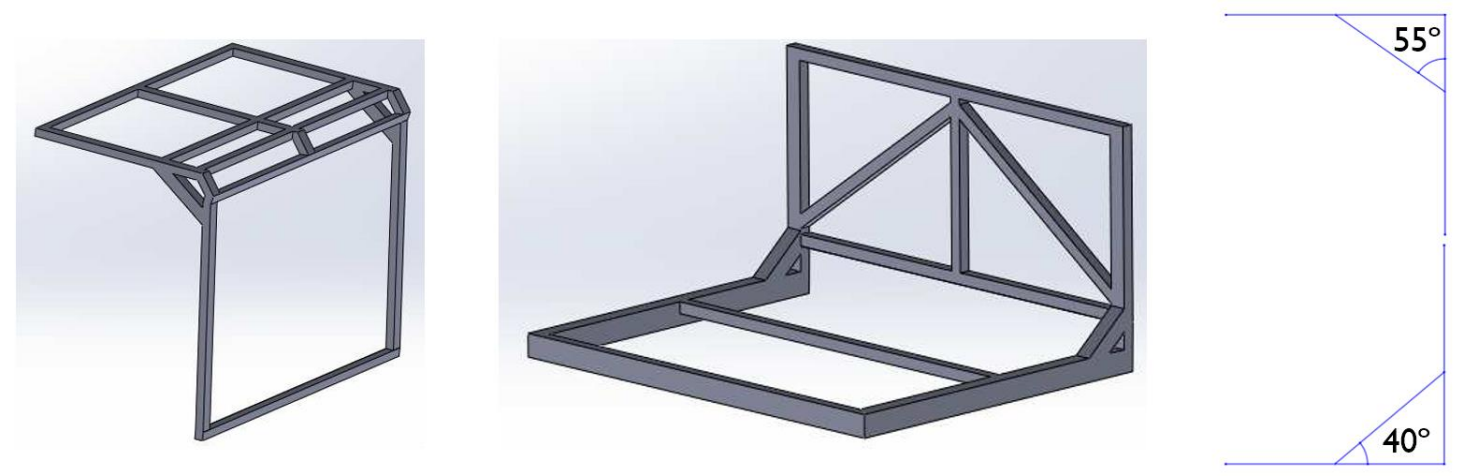
Roof Crush Modeling

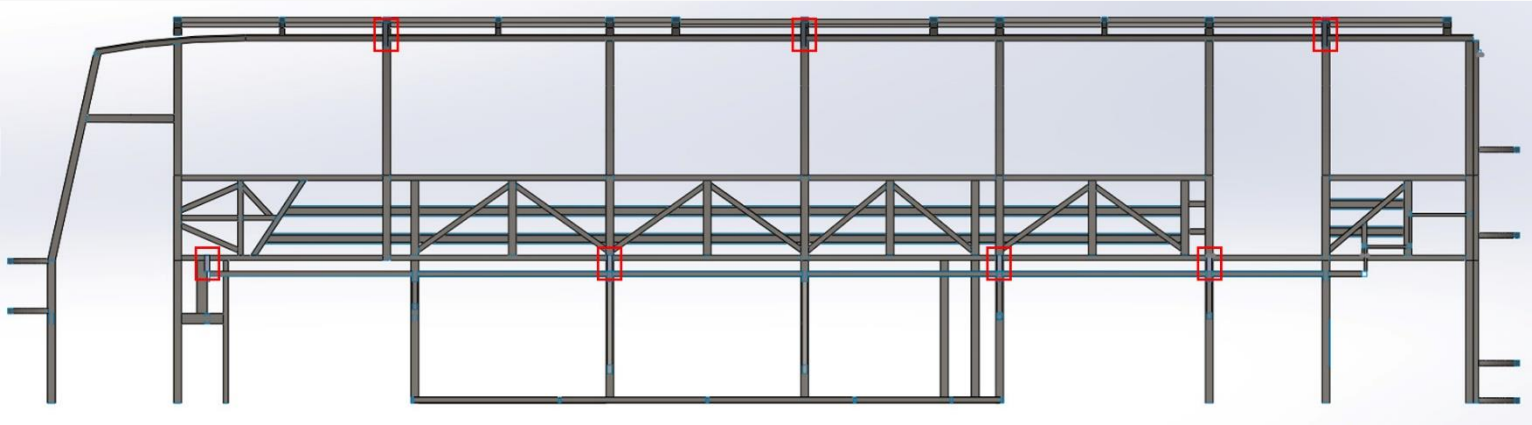


Rollover Modeling



Strategic Reinforcement





1) *Gusset* reinfrocement at the roof-wall-floor joints
2) Optimized *gusset alignment (40-55 deg)*
3) Staggered reinforcement
4) Vertical pillar must be continuous

Numerical Results

	Baseline	With Strategic Reinfrocement
UNECE R66 No Passenger	v	v
UNECE R66 47 Passengers	x	v
UNECE R66 59 Passengers	x	v
FMVSS 216 No Passengers	x	v
FMVSS 216 47 Passengers	x	v
FMVSS 216 59 Passengers	x	v
Rollover 47 Passengers	v	v
Rollover 59 Passengers	x	v

Physical Test – Laksana Bus

- Validated the Numerical Simulation Model

Courtesy: LAKSANA

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THANK YOU

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Introduction

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