Automotive Safety and Assessment Program

KMUTNB Automotive Test Track at Prachinburi Campus
Automotive Engineering program has launched in 2005 with support from IKA at RWTH Aachen. By that time we adopted all subjects from RWTH Aachen. Until 2012 the focus research area was moved towards safety aspect of vehicles. Automotive Engineering curriculum was changed by adding some specific subjects that related to vehicle safety and assessment into the master program. The name of the program has changed to Automotive Safety and Assessment Engineering Program.
Integrated Safety System

Collison

Active Safety
- Accident warning & avoidance

Recognition judgment
- Break Assist ESC/ABS

Pre-Collision Safety
- Evasive action
- Pre-crashed system
- Pre-crashed break assistant AEB

Passive Safety
- Injury mechanisms

Rescue
- Crashworthiness structure
- Pedestrian mitigation system

Simulated test field
- Crash test Computer simulation

ASAE-research focus
ASAE-research focus

Automotive Safety and Assessment Engineering
ASAE members
Course offers

### International Master Program at TGGS

- **Degree awarded:** Master of Engineering (M.Eng.)
- **Program duration:** two years | **Language of instruction:** English

<table>
<thead>
<tr>
<th>Semester</th>
<th>Coursework</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Core courses and elective courses (total 5 courses)</td>
<td>15 credits (30 ECTS credits)</td>
</tr>
<tr>
<td>2.</td>
<td>Core courses and elective courses (total 5 courses)</td>
<td>15 credits (30 ECTS credits)</td>
</tr>
<tr>
<td>3.</td>
<td>Industrial internship (at least 18 weeks)</td>
<td>4 credits (30 ECTS credits)</td>
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<tr>
<td>4.</td>
<td>Master thesis (6 months)</td>
<td>12 credits (30 ECTS credits)</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>46 credits (120 ECTS credits)</strong></td>
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</table>

### International Doctoral Program at TGGS

- **Degree awarded:** Doctor of Engineering (D.Eng.)
- **Program duration:** three years | **Language of instruction:** English

<table>
<thead>
<tr>
<th>Semester 1-6</th>
<th>Dissertation (Research work only)</th>
<th>9 credits/semester</th>
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<tbody>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>54 credits</td>
</tr>
</tbody>
</table>

Mechanical and Automotive Engineering combine curriculum of ASAE and MESD programs.
Core courses of ASAE

- Vehicle Fundamentals and Manufacturing Process
- Vehicle Standard and Regulation
- Crash and Part Assessment
- Human Body Simulation
MAE curriculum

ASAE branch

Semester 1
- Automotive Engineering Fundamentals
- Introduction to Automotive Safety
- Finite Element Methods
- Advanced Fluid Mechanics
- Elective Course

Semester 2
- Fundamentals of Vehicle & Component Assessments
- Standards & Regulations for Automotive Engineering
- Vehicle crash and human body model simulations
- Structural Design and Manufacturing Process of Motor Vehicle
- Computational Fluid Dynamics

Semester 3
- Industrial Internship

Semester 4
- Master Thesis
Block Lecture

- Block Lectures by Professors from RWTH Aachen University
  - Learn the advanced knowledge from German professors

Professor Markert: Human body model

Professor Biemann: Acoustic engineering (NVH)

Dr. Brezing and Dr. Bland: Structural design and machine design process

Prof. Schroeder: Advanced fluid mechanics

Prof. Meinke: Computational fluid dynamics
Invited Guest Block Lecture

Accident reconstruction special lectures and workshop
by Prof. H. Steffan from TU Graz, Austria-May 2015
Invited Guest Block Lecture

TGGS-ASAE SPECIAL TALK ON

From accident studies to vehicle safety research and regulations

by Dr. Dominique Cesari

Emeritus senior researcher
The French Institute of Science and Technology for transport, development and networks (IFSTTAR)
Former EEVC chairman
Visiting Professor at Tongji University, China

Date: 18 March 2016
Time: 9:30-12:00
Venue: TGGS building

Please email julialuc.c.es@ifsttar.org for registration

special talk on "From accident studies to vehicle safety research and regulations" by Dr. Dominique Cesari from IFSTTAR

Block lecture "impact biomechanics/occupant, pedestrian and child safety by Dr. Cesari from IFSTTAR
Industrial Internships

- **Industrial Project-based Internships**
  - Internship at qualified companies for 4 months
    - GIF-Gesellschaft Für Industrieforschung mbH, Germany
    - ACTS GmbH & Co KG, Germany
    - MIROS, Malaysia
    - NSK LTD, Japan
    - Kyowa Electronics and Instruments, Japan
    - Ford Motor Thailand
    - Bosch Automotive Thailand
    - ZF Lemford Thailand
    - BMW Thailand
    - NHK Ltd (seat) Thailand
    - Autoliv Thailand
Opportunities for Internships and Master thesis in Germany for excellent students

Students year 2013 and 2014 are doing Master theses at RWTH Aachen, Germany
ASAE-research focus
Research Activities

• Bus crashworthiness
• Development of rollover test rig (ECE R66) and
• Frontal impact pendulum (R29)
• Bus chassis design and development
• Rear end underrun protection

• Break test evaluation and AEB
• Driving head kinematic analysis under frontal offset collision during rebound phase
• Optimal design for student-mover vehicle safety
• Fatal Injury Analysis of Occupants for Pickup Vehicle Offset-frontal Collision

• Study of motorcycle grip force on braking distance
• MC rider brake behaviour
• Motorcycle crash test, component test and simulations
• Child helmet and child seat design for safety
• MC component test and evaluation

• Analysis of Vehicle to pedestrian collision using finite element human model (Car, bus, van, pickup)
• Design and development of pedestrian friendly vehicle front structure
• Develop testing protocol for evaluating bus front end design
Research Activities

Field data collection and analysis / Accidental investigation and reconstruction

Analysis of Brake behaviour of Thai motorcycle riders

- Identify the brake distance with following parameters
  - C.G. & Weight
  - Speed
  - Road Friction & Tire
  - Driver foot brake force & Reaction Time
- Educate pickup drivers to understand the brake distances through Sub-district Administrative Organization

Accidental investigation and reconstruction

Vehicle brake evaluation and analysis
ABS, BA, ESC, PCS, AEB

Automotive Safety and Assessment Engineering
Research Activities

Analysis of Brake behaviour of Thai motorcycle riders

- 38% of Samples
- 21% of Samples

- Hand Brake Pattern
- High and gradually decrease pattern
- Stable pattern with equal grasp opening
Research Activities

Passive safety - crashworthiness

Development of UNECE standard Tests (R66 & R29) for Large Vehicle

Implementation of UNECE test regulation for bus

Bus crashworthiness design

Design of underrun protection for large truck
UNECE-R66 rollover test equipment developed by ASAE-RC
UNECE-R29 impact test equipment developed by ASAE-RC
Head starting to rebound at $t = 141$ msec.

Head hitting B-pillar $t = 240$ msec.
Development of motorcycle finite element model for crash simulation
Objective

• Study Injury mechanism of children from seat position

• Develop child seat for MC in Thailand
Research Activities

Motorcycle crash tests with Child pillion on board
- sitting in front of rider
- sitting behind rider

Collaborate with MIROS Crash test lab in Malaysia
Experimental Test Motorcycle with Child Rider in Back pillion

Experimental Test Motorcycle with Child Rider in front pillion
Finite element study kinematics and injury mechanisms of motorcyclists and pillion passengers
Application of Human body model in vehicle safety

Study effects of pre-collision factors on pedestrian kinematics and injury mechanisms

Finite element analysis of a modified bumper structure with aluminium foam for minimization of pedestrian injury
Research Activities

Maximum bending moment

- Car velocity: 40 km/h, impact angle: 90°
- Bus velocity: 20 km/h, impact angle: 90°

40 ms, strain 1.3
30 ms, stress 179 MPa
Possibility to develop pedestrian-friendly front structure of the vehicles

Feasibility trial: use aluminium foam

Comparison of knee and head response

<table>
<thead>
<tr>
<th></th>
<th>Standard front end</th>
<th>Modified front end</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIC</td>
<td>1296</td>
<td>952.7</td>
</tr>
<tr>
<td>Resultant moment</td>
<td>214.960 Nm</td>
<td>184 Nm</td>
</tr>
<tr>
<td>Angle</td>
<td>30</td>
<td>21</td>
</tr>
<tr>
<td>Resultant force (N)</td>
<td>4922.3</td>
<td>2850.4</td>
</tr>
</tbody>
</table>
Design & innovation

Develop testing protocol for evaluating bus front end design - PhD thesis

Objective

- Study currently front end buses affecting on pedestrian injury
- Develop testing protocol for evaluating bus front end design e.g. shape and material

ASAE developed the head form
Research Activities

The Effects of Active Muscle Contraction into Pedestrian Kinematics and Injury during Vehicle-Pedestrian Collision –collaborated with RWTH Aachen

THUMS Model with skeletal muscle

<table>
<thead>
<tr>
<th>Muscle Name</th>
<th>Picture Reference</th>
<th>THUMS Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lateral Head Gastrocnemius</td>
<td>![Image]</td>
<td>![Image]</td>
</tr>
<tr>
<td>Medial Head Gastrocnemius</td>
<td>![Image]</td>
<td>![Image]</td>
</tr>
</tbody>
</table>

As the purpose of this thesis research, there were total 48 active FE model muscles of in lower extremity that have been inserted.
Effects of active muscle contraction on whiplash injury-collaborate with RWTH Aachen
Both professors of ASAE program are ASEAN NCAP technical committee members and auditors. ASAE program hosted several activities of ASEAN NCAP in Thailand for example the 6th manufacturing meeting, media coaching and ASEAN Automobile Safety Forum.
NCAP: A Global Perspective on Automotive Safety in the UN Decade of Action

Presentation by
David Ward
Secretary General
Global New Car Assessment Programme

ASEAN NCAP GRAND PRIX AWARDS 2014
Automobile Safety Forum
Kuching, Sarawak
August 27th 2014

ASEAN NCAP's Road Map 2015 ~ 2020 & Strategic Planning

27th August 2014
ASEAN Automobile Safety Forum 001/2014
Kuching, Sarawak

Road Safety Situation in Thailand
Assoc. Prof. Dr. Julaluk Carmai
Assoc. Prof. Dr. Saiprasit Koetniyom
Automotive Engineering Program, TGGS
King Mongkut’s University of Technology North Bangkok

ASEAN Automobile Safety Forum
27 August 2014
Kuching, Malaysia

Representation of Thailand accident situation in ASEAN Automotive Safety Forum in Kuching Grand Prix Award and Seminar: 27 Aug 2014

As such other activities...
TOYOTA-KMUTNB Vehicle Safety Seminar is arranged bi-annually. ASAE research Centre has a strong collaboration with Toyota on vehicle safety research and activities.

The first TOYOTA-KMUTNB Vehicle Safety seminar in August 2014 with the Chief Safety Technology Officer as a keynote speaker.

The second TOYOTA-KMUTNB Vehicle Safety seminar in March 2016 with the Project General Manager, advance CAE division keynote speaker.
ASAE other activities

• Seminar & Workshop for Product Standard Testing of Automotive brake system TISI. 1466−2551:22 April 2015

FOR: Passenger Car, Pickup, Van & Bus

At National Science Technology and Innovation Policy Office (ECE Regulation No. 13)
@ Prachinburi Campus (ECE Regulation No.13) FOR: Passenger Car, Pickup, Van & Bus

Automotive Safety and Assessment Engineering
Engineering Dynamics and vehicle fundamentals lectures to use in accident reconstruction and a workshop on evaluation of tyre conditions: Central Institute Forensic Science (CFSI) on 16-17 Dec
Transmission Assessment of Chevrolet Cruz for court evidence
Fuel consumption testing for 200 customers one day
6 tested cars-industry testing service

Driving pattern:
No cycle:
Average speed: ≥ 55 km/hr

Extra Urban Driving Cycle
4 Cycles ≈ 10 Km

ECE R83: Driving Cycle
Part 1 Four city cycle:
Part 2 Extra Urban Driving Cycle:
Part 1+ Part 2:

Length 1.013 km@ 195 s: Average speed 18.7 km/hr
Length 6.955 km@ 400 s: Average speed 56.9 km/hr
Length 11.007 km: 1220 s: Average speed 32.5 km/hr
Accident Reconstruction as support event for Court
Mazda Fuel Consumption Test; 2011/ 2015
Investigation of Vehicle Speed for police evident

(t_3) = 5.0 วินาที
(t_2) = 0.5 วินาที
(t_1) = 0 วินาที
Thank you for your attention

Automotive Safety Assessment Engineering Program
Visit our website: http://ae.tggs.kmutnb.ac.th/
Facebook: https://www.facebook.com/groups/ASAE.TGGS/

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Email: Julaluk.c.ae@tggs-Bangkok.org