Future of Automotive Safety

Integrating Safety in Design

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Agenda

- Passive Safety, structure & restraint systems
  - Vehicle Structures
  - Issues of Compatibility
  - Restraints systems
- Pedestrian Protection – Passive & Active
- Pre Crash & Active Safety
  - Testing of Intelligent Safety Systems
Impact legislation formulated through 1990’s
Based on cars of late 80’s early 90’s
Aimed at recreating car to car impacts
Impact barriers are based on 90’s 900kg vehicle, low front end stiffness
Development of vehicle to meet NCAP

EuroNCAP has improved passive safety of cars
Evolution of Car Design

- Main passenger cell now has high integrity to avoid intrusion.
Compatibility

- Alignment of energy absorption
- Distance over which energy is absorbed tends to be the same for all vehicles
- Consequence is a large car is much stiffer than a small car
Compatibility
EEVC WG15– VC-COMPAT

- Integrated set of test procedures to assess a car’s frontal impact protection
  - Address partner and self protection without decreasing current self protection levels
  - Minimum number of procedures
  - Internationally harmonised procedures

- Both full width and offset tests required
  - Full width test to provide high deceleration pulse to assess the occupant’s deceleration and restraint system
  - Offset test to load one side of car for compartment integrity

- Procedures designed so that compatibility can implemented in a stepwise manner
Compatibility - Next Steps

Approach 1
- Full Width Deformable Barrier (FWDB) test
  - Structural interaction
  - High deceleration pulse
- ODB test with EEVC barrier
  - Frontal force levels
  - Compartment integrity

Approach 2
- Full Width Rigid Barrier (FWRB) test
  - High deceleration pulse
- Progressive Deformable Barrier (PDB) test
  - Structural interaction
  - Frontal force matching
  - Compartment integrity

WG 15 Route Map aims for recommendation Nov 2010
Strategies being adopted

- Honda Civic / Accord
Passive Safety
Near Term – Restraint System

Current restraint system made up of:
- Seatbelt
- Seatbelt retractor
- Load limiter
- Airbag (s)
  - 2 – stage
- Contribution from
  - Steering column
  - Knee bolster area
Possible Changes to the Restraint System – Pre Crash Safety

- System is set up for one seating position
- OEM undertake due care for:
  - Range of occupants sizes 95%ile to 5%ile
  - Out of Position e.g. arm on window
- Technology is available to adapt restraint system to the actual position / size / age
  - Move seat
  - Close window
  - Pre load seatbelt
**Directive 2003/102/EC Phase 2 / EuroNCAP Impact Zones**

- **Child Headform**
  - Speed 11.1 m/s (40 kph)
  - Mass 2.5 Kg
  - Kinetic energy 154 J

- **Upper Legform**
  - Kinetic energy range
  - From 200 J to 700 J

- **Adult Headform**
  - Speed 11.1 m/s (40 kph)
  - Mass 4.8 Kg
  - Kinetic energy 295 J

- **Lower Legform**
  - Speed 11.1 m/s (40 kph)
  - Mass 13.4 Kg
  - Kinetic energy 825 J

- **Alternative Upper Leg to Bumper Test for SUV’s**
  - Speed 11.1 m/s
  - Mass 9.5 Kg
  - Energy 585 J

**EuroNCAP Only**
Directive 2003/102/EC Phase 2 / EuroNCAP Impact Zones

Child Headform
- Speed 9.7 m/s (35 kph)
- Mass 3.5 Kg
- Kinetic energy 165 J

Adult Headform
- Speed 9.7 m/s (35 kph)
- Mass 4.8 Kg
- Kinetic energy 213 J

Upper Legform
- Kinetic energy range
  - From 200 J to 700 J

Alternative Upper Leg to Bumper Test for SUV’s
- Speed 11.1 m/s
- Mass 9.5 Kg
- Energy 585J

Monitor only

EuroNCAP Only
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Revised injury criteria

Alternative Upper Leg to Bumper Test for SUV’s
Speed 11.1 m/s
Mass 9.5 Kg
Energy 585J

EuroNCAP Only

Monitor only

Brake Assist

MIRA
Active & Pre Crash Safety – Reducing Probability of Impact

2006 Road Casualties of GB included contributory factors:

- 67% of all accidents involved driver / rider error or reaction
- 34% included going too fast / too close / exceeding speed limit
- 35% included failed to look properly

- These figures are consistent with USA where human error contributed to 90%
Pre Crash Safety Test Method

- Platform to measure / detect VRU in real time, in safety
- Supports Infrared & colour camera systems

Save-U platform 2004
Restraint Mechanisms

- Test vehicle
- Falling weight
- Braking Drum
- Energy absorbers
- Deformed steel bar
To allow accurate post-test data analysis, onboard sensors logged rig velocity and yaw, and “ground truth” information is recorded using an overhead camera.
SAVE-U test with pedestrians crossing
What Facilities are Required? For Active & Pre-Crash Testing

To support these applications and scenarios it is necessary for a Telematics centre to be able to controllably replicate the following environments:

- City
- Motorway
- Trunk Roads
- Free-form area
- Control Centre & Demonstration Suite
MIRA’s Headquarters
Stage 1. City Circuit

Features

- City grid features numerous junctions, islands & traffic calming features
- Parking areas for on-board set-up and data review
- Simulates Line-of-sight and Urban Canyon effects
- Differential GPS positioning
- Support for numerous communications standards
- Flexible power management
Applications and Scenarios

- Time Distance Position based charging
- Intelligent Parking
- Lane Departure Detection/Warning
- Driver Behaviour Studies
- Telematics robustness in poor reception areas
- Product and Technology Demonstrations
- National/International Forums/Events
- Port system - slot allocation
- RO-RO truck parking
- Electronic towbars – ‘platooning’
- ADAS (Advanced Driver Assist Systems)
  - Blind Spot Detection
  - Park/Reverse Assist
  - Adaptive Cruise Control
  - Road edge detection
  - Road Sign Detection
- Speed control
- Security - tracking

- Travel & traveler Information
- Liability Framework - what if it fails
- In-car 'black box' data recorders
- Standards
- Electronic Tolling
- Cooperative Active Safety
  - Collision mitigation
  - Vulnerable road user detection
  - Intersection safety
- eService and vehicle diagnostics
- Navigation Services
- Traffic Management
- Journey Management
- Fleet Management
- Stand-alone/autonomous vehicles/systems
- Intelligent/Variable Message Signs
- Air quality management
Concluding Remarks

Passive Safety
- Structure technology available
  - Agreement needed on compatibility formula
- Restraint system technology is maturing
- Pedestrian issues are understood

Pre-Crash Technology
- Requires safe environment for development
- Each technology can be developed in isolation

Active Safety Technology
- Requires performance standards