


VEHICLE DESIGN and PEDESTRIAN SAFETY

Dominique CESARI
INRETS

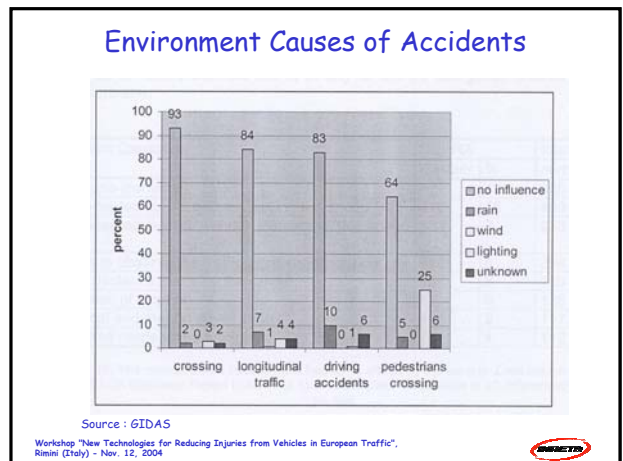
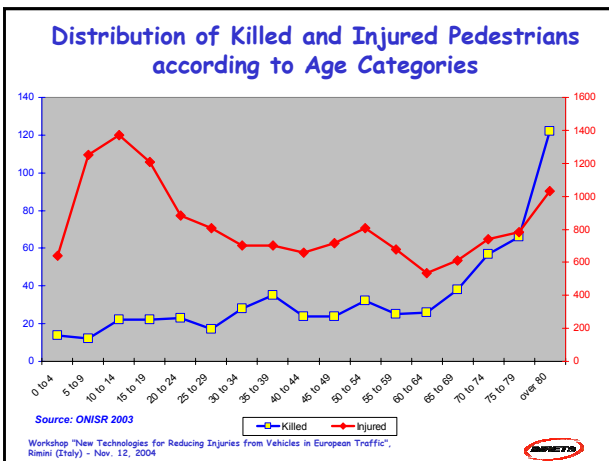
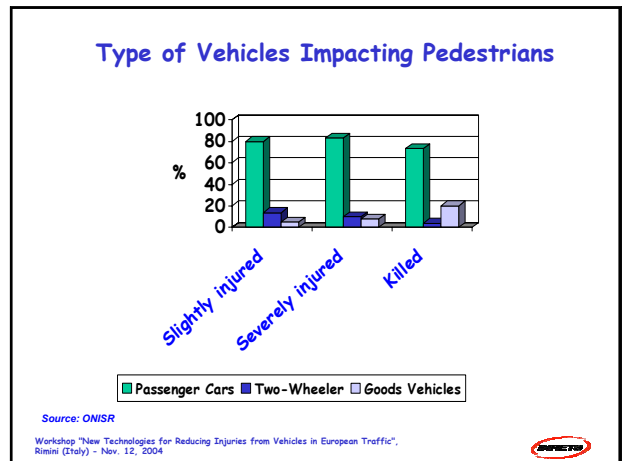
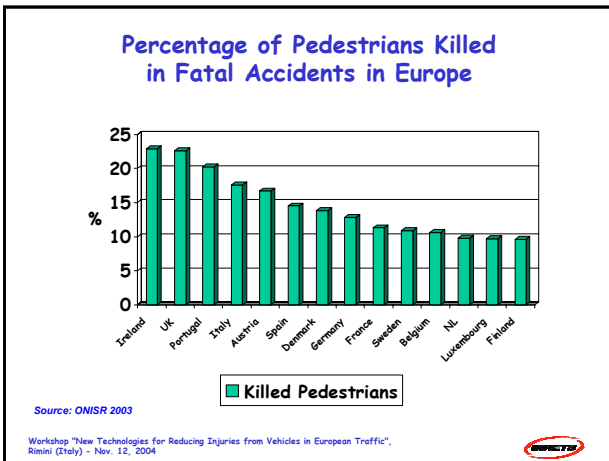
Workshop "New Technologies for Reducing Injuries from Vehicles in European Traffic",
Rimini (Italy) - Nov. 12, 2004



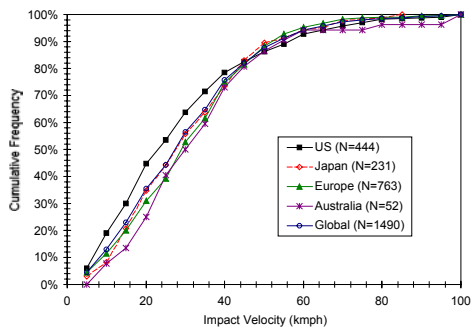
Pedestrian Safety and Car Design

- Main Characteristics of Pedestrian Accidents
- Injury Mechanisms
- Car Design and Pedestrian Protection
 - Pre-crash Issues
 - Crash Protection Improvement
 - Control of Pedestrian Kinematics
- Conclusions

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Vehicle Speed in Pedestrian Accidents (AIS 2+)

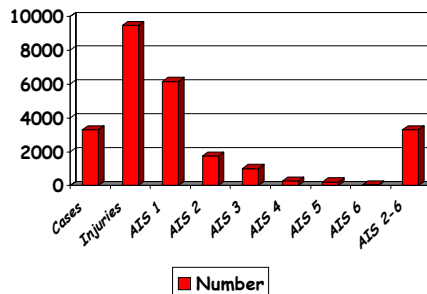


Distribution of impact speeds (Source: IHRA/PS)

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IHRA Pedestrian Accident Data Set Injury Severity Distribution

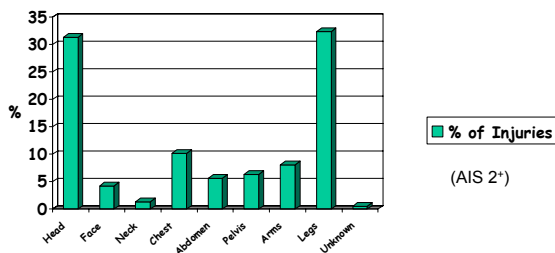


Number

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Injury Distribution according to Body Segments

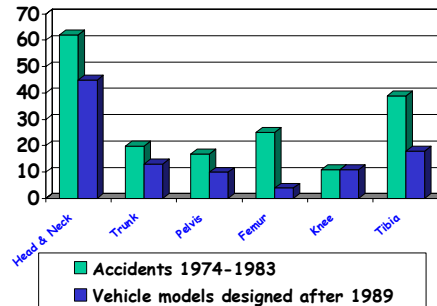


(Source: IHRA/PS)

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Injury Frequency Occurrence according to Vehicle Age

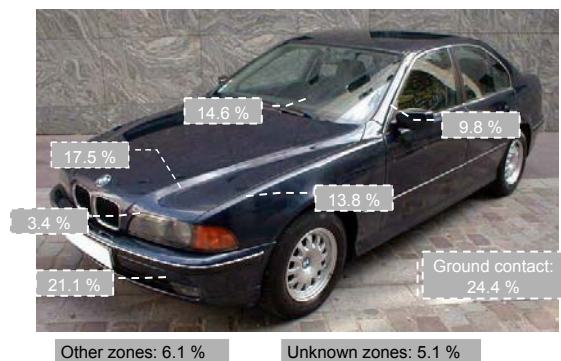


(Source: INRETS/LAB)

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Vehicle Zones Involved in Pedestrian Accidents



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EuroNCAP and EC Directive Tests



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PRE-CRASH ISSUES

- Detection/Visibility
- Braking Optimisation

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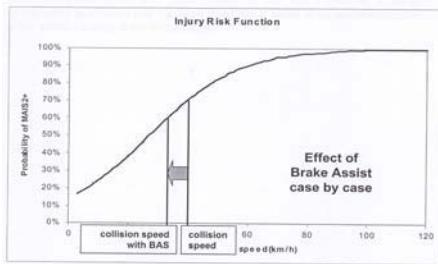
DETECTION/VISIBILITY

- Day Running Light
- Laser Active Night Vision
- Thermal Imaging

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Effect of BAS



- GIDAS data set:
 - 7.9 % of pedestrian collision avoided
 - 11.5 % of AIS 2+ injuries reduced by one AIS value or more

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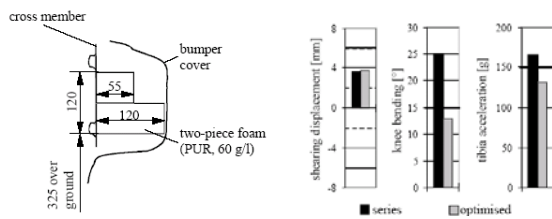
Improvement of Pedestrian Protection

- Leg Protection
 - Low and Compliant Bumper
- Head Injury Protection
 - Bonnet Buckling Structure (Child and Adult)
 - Pop-up Bonnet (Child and Adult)
 - A Pilar Airbags (Adult)
- Kinematic Control
 - Front Airbag (Decrease Head to Bonnet Impact Speed)

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Leg Protection Improvement

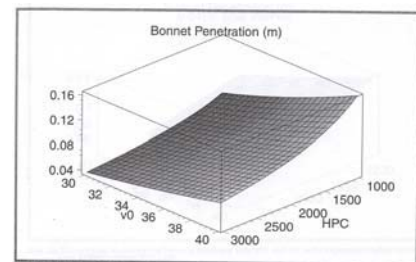


From I. Kalliske et al paper, 17th ESV Conference, Amsterdam, June 2001

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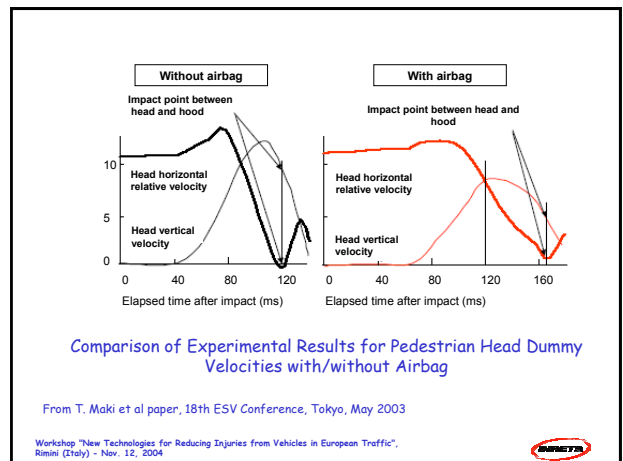
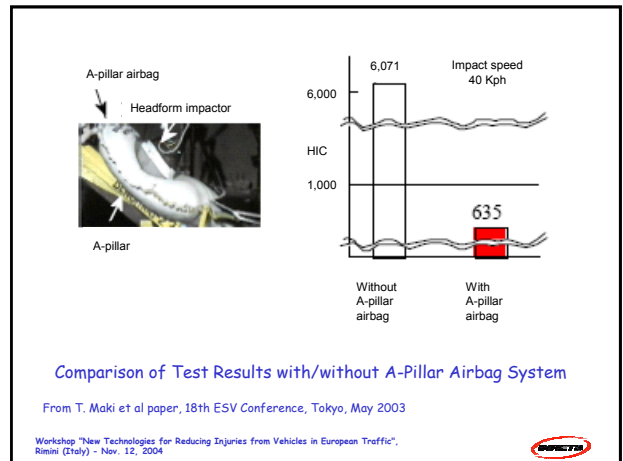
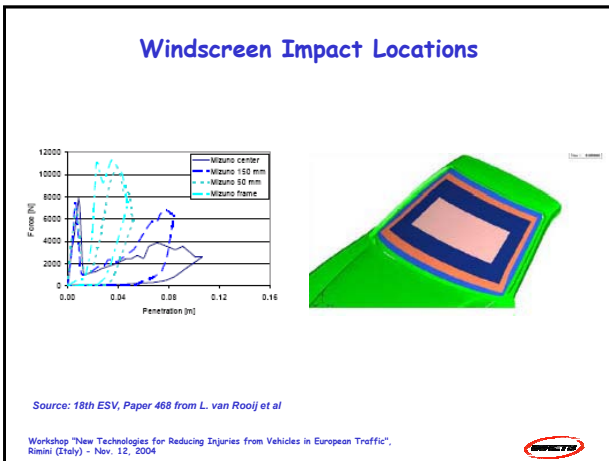
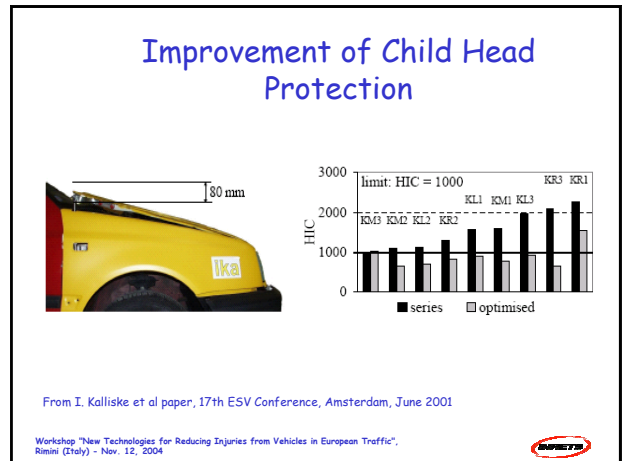
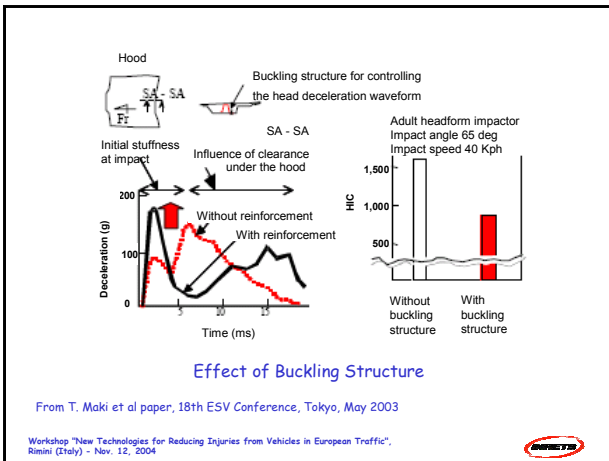


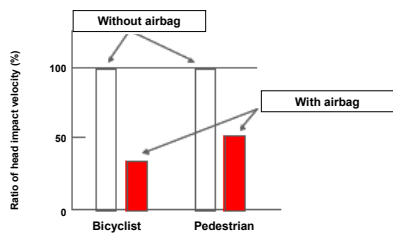
Optimized Bonnet Penetration



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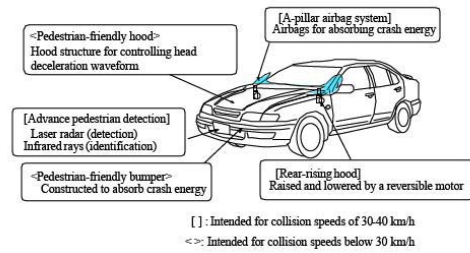




Comparison of Head Impact Velocities against the Hood (experimental)

From T. Maki et al paper, 18th ESV Conference, Tokyo, May 2003

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Pedestrian Protection Technologies incorporated in Nissan ASV II

From T. Maki et al paper, 18th ESV Conference, Tokyo, May 2003

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Conclusions

- On-going Research to improve Pedestrian Perception by Car Drivers
- Automatic Brake Assistance would Provide Shorter Stopping Distance Reducing Car Impact Speed
- Pedestrian Protection can be Improved by Car Design
- Leg Protection is Related to Front Face Stiffness and Shape
- Head Injury Protection Requires Bonnet Deformability (especially for Children) which may be Provided by Bonnet Pop-up
- Windscreen Pillars are Stiff and Head Protection would Require Deployable Systems
- Front Deployable Systems would Help to Control Pedestrian Kinematic Decreasing Head to Bonnet Impact Velocity

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