The 4th International Safer Roads Conference
Cheltenham, UK, 18 - 21 May 2014

Safe vehicle transport - the roles of collision avoidance and real time data acquisition

Andrew Miller

Chief Technical Officer

Thatcham Research

Thatcham

Thatcham: the UK motor insurers automotive research centre

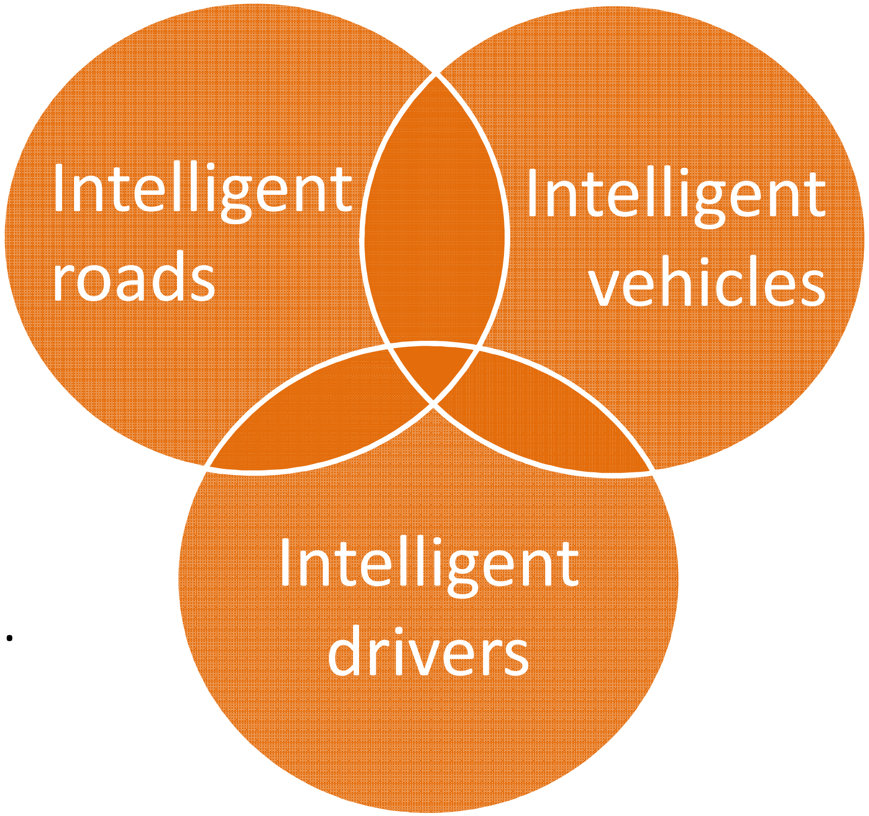
- Not-for-profit research company established for over 44 years
- Financially supported by the majority of UK Motor Insurers
- Backed by the Association of British Insurers and Lloyds Market Association
- Experts in vehicle safety, security, damage and repair

The ‘intelligent’ vehicle

Intelligent Road Safety

New opportunities in embedded intelligence

- Intelligence embedded into Roads
    - Physical and telematics capabilities
- Intelligence embedded into vehicles
    - ‘Awareness’ and telematics capabilities
- Intelligence embedded into drivers?
    - A challenge for policy makers…..



Telematics – toward the 'Intelligent' Vehicle

The future Intelligent vehicle – a very disruptive development

BUT:

- **RIGHT NOW: Humans still currently drive better, it's illegal, we don't know where liability for crashes will lie, we will REALLY need global standards for international vehicle travel, system security will have to be bullet-proof**
- **In short – we not ready for it**
- **Best guess for a car for sale: 2025 – best guess for 100% new car availability: 2040-45: best guess on 90%+ vehicle fleet: 2065**

DON'T PANIC

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On the road to autonomous cars

The Insurance industry – a major enabling actor is ready to play its part

Insurer perspectives

- Potentially life-saving technology
- Insurers look forward to playing a proactive role in shaping what is to come

Challenges and opportunities:

- Insurers expect liability issues to settled in law
- Insurers can provide product liability insurance
- Insurers can provide cover for new risks:
    - Car under partial human control
    - Car under no human control

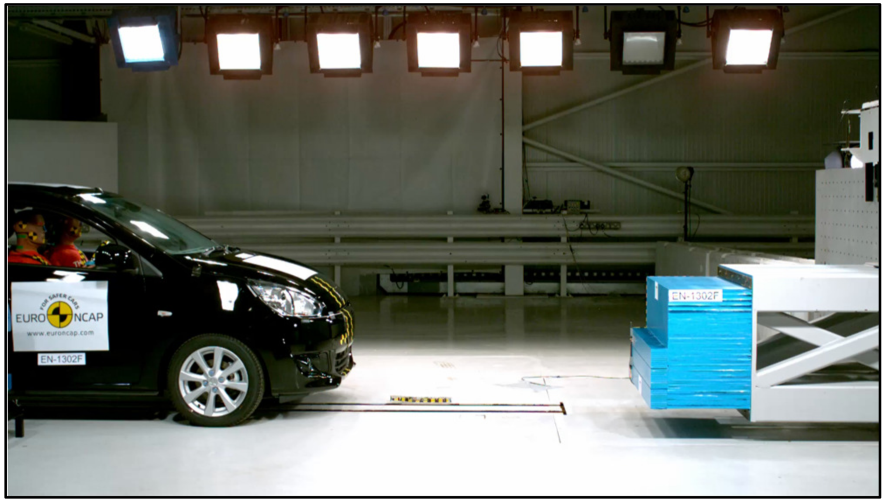
ABI

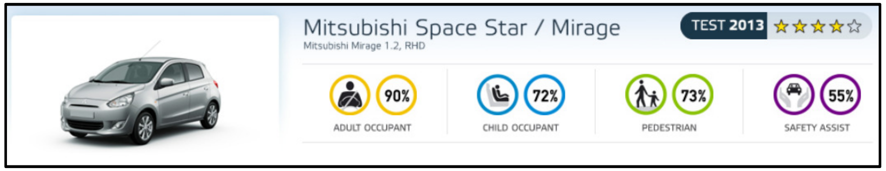
LLOYD'S MARKET ASSOCIATION

What is happening now

We have achieved a great deal already

Passive safety – improving the ‘passive’ protection for occupants





Crash Test @ 50 km/h

Pre Euro NCAP vehicle

Crash Test @ 64 km/h

Modern vehicle

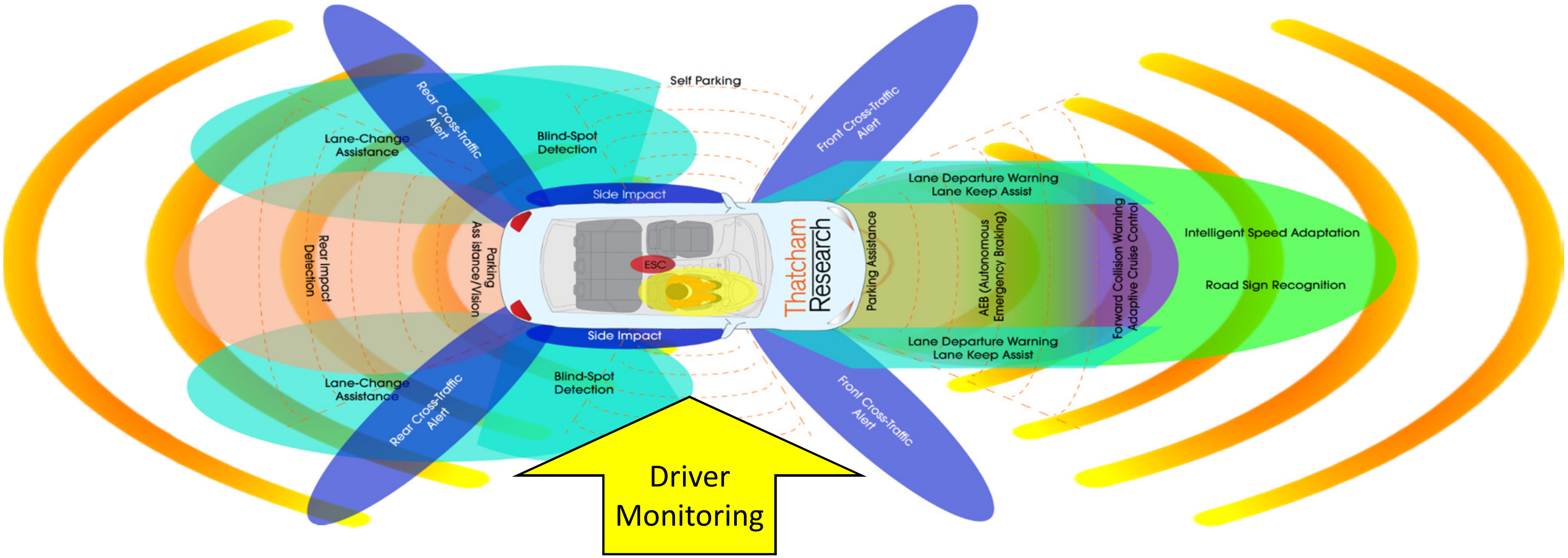
Moving from Passive Safety to Active Safety

Active Safety vehicle technology – stopping the crash happening in the first place

Driver Protection	**Driver Assistance**	**Semi autonomous**	**Driverless cars**
Safety Cell Seat Belts Pre-Tensioners Airbags Load Limiters	ABS Forward Collision Warning Blind Spot monitoring Lane Departure Warning	ESC – Electronic Stability Control **Autonomous Emergency Braking (AEB)** Lane Keep Assist (Lane Guidance) Adaptive Cruise Control Queue Assist	Fully autonomous, navigation, acceleration, braking, steering Platooning V2V and V2i
			
PASSIVE SAFETY Protection in the event of a Crash	ACTIVE SAFETY Mitigating or avoiding the Crash		

Monitoring the environment AND the driver

Monitoring the environment AND the driver?



- The vehicle will be capable of data capture and communication – monitoring itself, the driver and its environment
- So what are the steps toward this:

ADAS

Advanced Driver Assistance Systems (ADAS)

ADAS

- ESC is an established life saver
- Other ADAS systems show potential
- ESC saves lives; an ESC equipped vehicle is 25% less likely to be involved in a serious or fatal crash in the UK

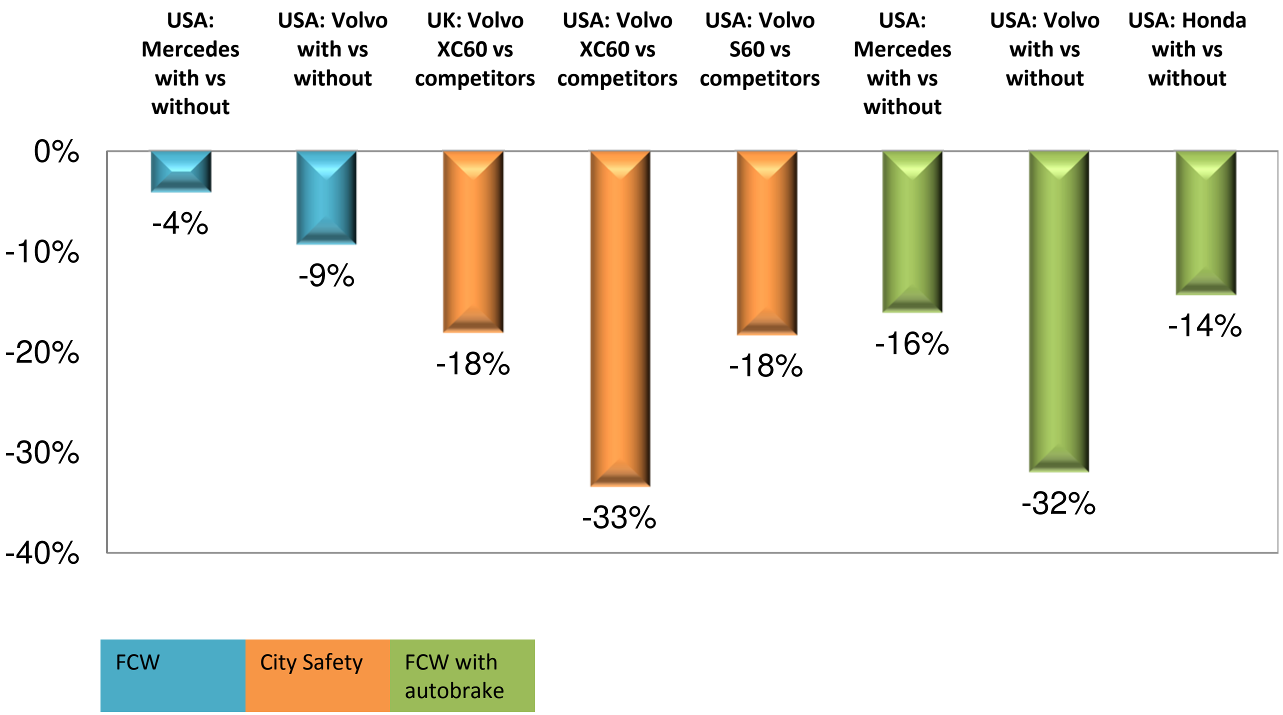
The first real step - AEB

Autonomous Emergency Braking (AEB)

- Brakes the car automatically, if the driver has failed to respond
- Reduces the occurrence of low speed accidents by around 20%
- Most effective at lower speeds where more than 75% of accidents occur

The first real step - AEB

Autonomous Emergency Braking (AEB)



Report available at: www.thatcham.org/AEB

The first real step - AEB

Test procedure development

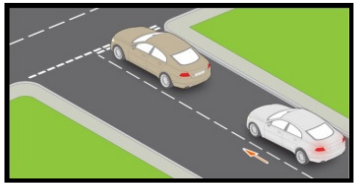
Procedures developed from real world data

Unique in-depth study commissioned by Thatcham investigating real world crashes and their causation factors to formulate realistic test scenarios that drive AEB functionalities

Aim for 4-6 clusters

≥75% of cases

	Clusters							
	1	**2**	**3**	**4**	**5**	**6**	**7–18**	**Total**
Cluster representativeness (%)								
Slight	30	19	13	12	8	5	13	100
Serious	21	10	12	30	9	4	14	100
Fatal	21	0	0	53	0	11	16	100
Total	30	18	13	13	8	5	14	100
Accident severity								
Slight	3249	2025	1401	1293	890	523	1463	10844
Serious	69	32	41	100	28	12	47	329
Fatal	4	0	0	10	0	2	3	19
Total	3322	2057	1442	1403	918	537	1513	11192
Speed limit (mph)								
10-30	1966	1199	932	364	541	235	827	6064
40-50	582	355	236	190	171	117	274	1925
60-70	774	503	274	849	206	185	412	3203
Total	3322	2057	1442	1403	918	537	1513	11192
Junction detail								
Not at junction	1162	679	85	1403	0	363	633	4325
Roundabout	513	528	140	0	257	174	283	1895
Junction	1647	850	1217	0	661	0	597	4972
Total	3322	2057	1442	1403	918	537	1513	11192
Light conditions								
Daylight	2973	1932	1264	1007	747	359	518	8800
Darkness	349	125	178	396	171	178	995	2392
Total	3322	2057	1442	1403	918	537	1513	11192
Weather conditions								
Fine	3040	1983	1227	1096	840	0	833	9019
Not fine	282	74	215	307	78	537	680	2173
Total	3322	2057	1442	1403	918	537	1513	11192
Vehicle A manoeuvre (striking vehicle)								
Going ahead	3312	0	1225	1403	888	537	515	7880
Stopping, starting, held-up	0	2057	162	0	24	0	735	2978
Turning	10	0	55	0	6	0	263	334
Total	3322	2057	1442	1403	918	537	1513	11192
Vehicle B manoeuvre (struck vehicle)								
Going ahead	0	72	0	1403	918	46	145	2584
Stopping, starting, held-up	3322	1985	0	0	0	491	1088	6886
Turning	0	0	1442	0	0	0	280	1722
Total	3322	2057	1442	1403	918	537	1513	11192
Vehicle directions								
Following	3223	2007	463	1386	869	525	1326	9799
Diverging	63	28	909	8	21	5	124	1158
Converging	36	22	70	9	28	7	63	235
Total	3322	2057	1442	1403	918	537	1513	11192



- 75% crashes under 20mph
- 26% of insurance crashes are longitudinal

Example: Cluster 1

- 30% of cases
- Lower speeds
- At junction
- Daylight
- Fine weather
- Veh A going ahead
- Veh B stop/starting
- Following traffic

Report available at: www.thatcham.org/AEB

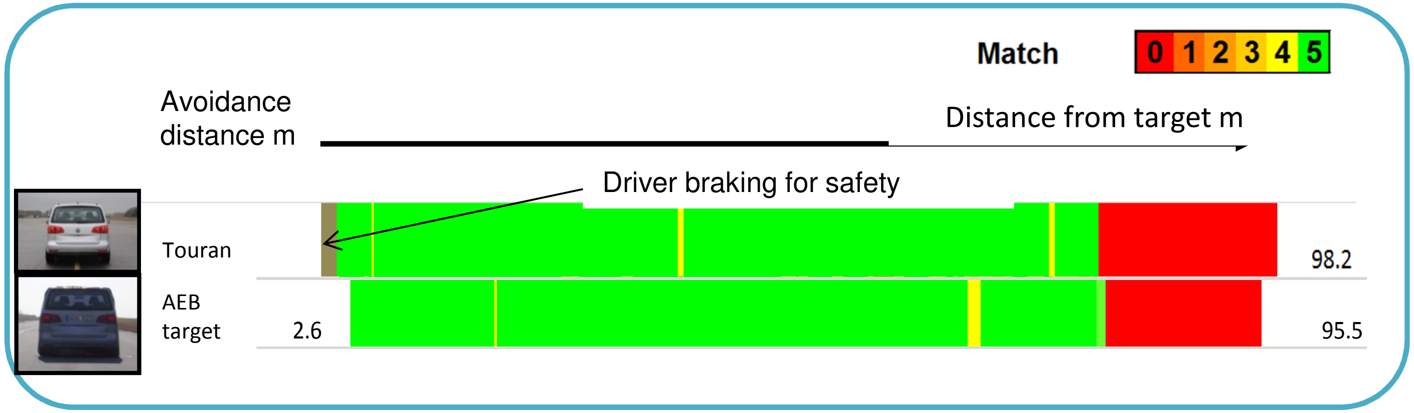
The 'City' AEB test

CITY – target development – verification testing

The ‘City’ AEB test

CITY – target development – verification testing

- Assessment with Volvo V60
  - Camera and radar fusion system
- Target attributes correlate strongly with those of real vehicle for RADAR and vision based sensor systems
- Reflective elements added in typically highly reflective areas (light clusters and number plate) for LIDAR sensor performance



The ‘City’ AEB test

CITY – target development – test equipment

- Tests performed with driving robots controlling vehicle
  - Consistent and repeatable steering and accelerator inputs replicating inattentive driver giving tight control of approach speed and target alignment
  - Precise timing and control for FCW braking input

  - Antony Best Dynamics (ABD)
    - Steer robot (SR)
    - Combined accelerator and brake robot (CBAR)
  - Oxford Technical Solutions (OxTS)
    - RT3002 motion packs
    - RT Range system (relative motion)
  - Thatcham warning recognition system

Euro CAP 'City' AEB test

AEB test scenarios

Car-to-Car Rear (CCR)		Car-to-Pedestrian CP	
	**CITY** Lead Vehicle Stopped <50km/h		CP1 Unobscured nearside walking pedestrian
	**INTER-URBAN** Lead Vehicle Stopped 30-80km/h		CP2 Obscured walking nearside pedestrian
	**INTER-URBAN** Slower Lead Vehicle Target 20km/h Test 30-80km/h		CP3 Unobscured farside pedestrian
	**INTER-URBAN** Lead Vehicle Decelerating 50km/h		

The ‘City’ AEB test

CITY test performance

The 'City' AEB test

CITY test performance

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The 'City' AEB test

INTERURBAN test scenarios

Stationary

Moving

Braking

- Precondition: AEB and/or FCW operate up to at least 80km/h

The 'City' AEB test

INTERURBAN test performance

The ‘City’ AEB test

INTERURBAN test performance

MOVING

The ‘City’ AEB test

INTERURBAN test performance

BRAKING

The ‘City’ AEB test

INTERURBAN test performance

Activation

- AEB system default ON at start of every journey

Forward Collision Warning (FCW)

- Loud and clear

The ‘City’ AEB test

INTERURBAN HMI Points

Activation	Supplementary Warning for FCW	Reversible pre-tensioning of belt (pre-crash phase)
Points awarded if deactivation NOT possible with a single button push	e.g. head-up display, brake jerk, other haptic feedback	Belt is pre-tensioned if critical crash situation detected
2 points	1 point	1 point
		

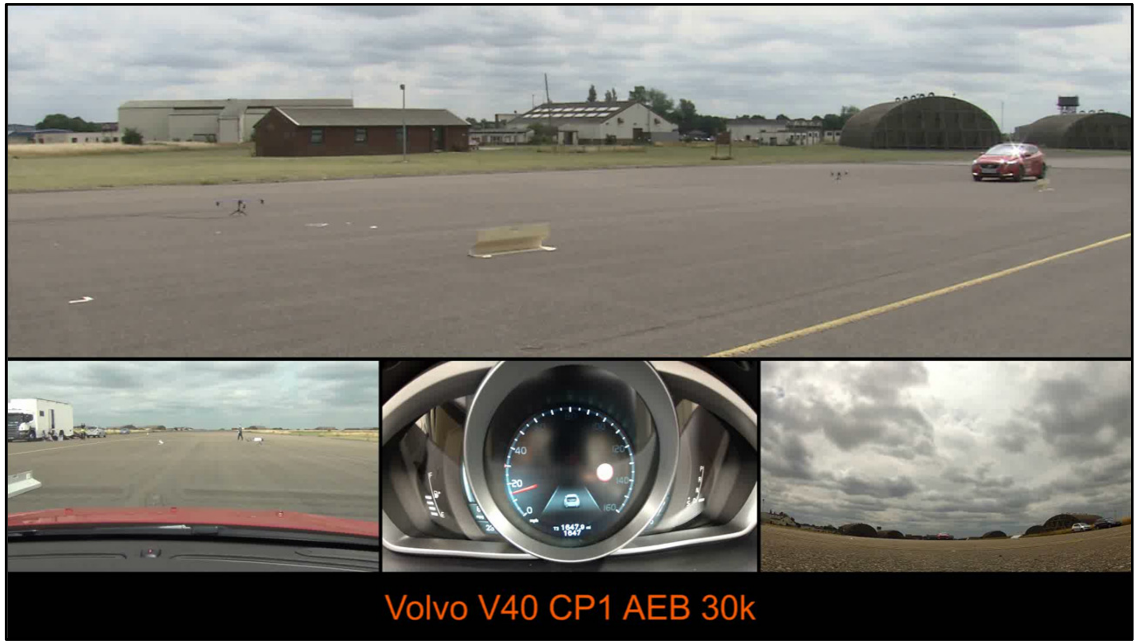
The ‘City’ AEB test

Pedestrian test scenarios

	Far side	Near side	
PEDESTRIAN	Adult	Adult	Child
PEDESTRIAN	8km/h	5km/h	5km/h
PEDESTRIAN	50% (central)	25% & 75%	50% (central)
VUT	20-60km/h	20-60km/h	20-60km/h

AEB Pedestrian

AEB Systems – Pedestrian Detection – Volvo V40 30km/h



- Cameras and Radar in Fusion
- Cameras B+W 640x480
- Require Contrast to differentiate pedestrian from surroundings
- Lighting conditions influence performance

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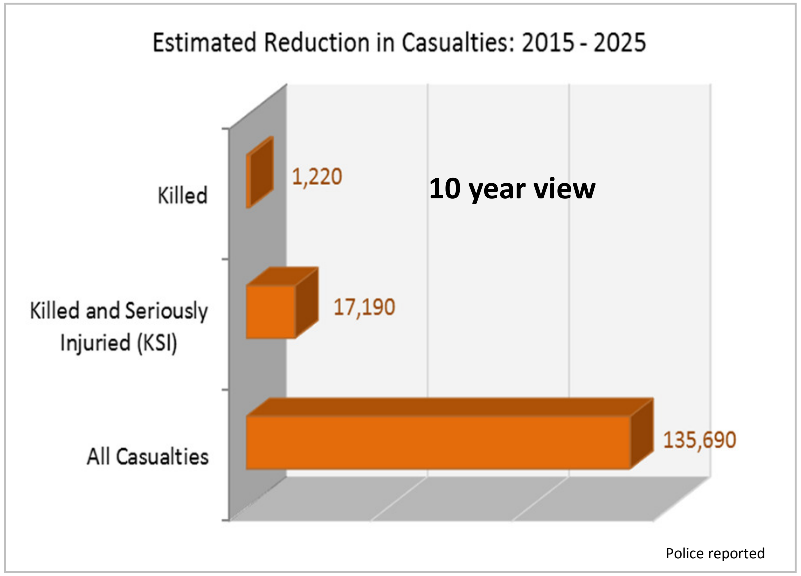
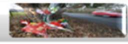
Thatcham's 'Stop the Crash' Campaign

UK Roads: 1,754 fatalities in 2012 (DfT)



In the first 3 years alone this will mean 60 fewer fatalities and 760 fewer serious casualties reported to the Police

 Fatalities and injuries

 Medical and NHS costs

 Emergency services costs and workload

 Congestion

 Lost output

 Insurance costs

 Human costs of pain, suffering to casualties and families

 Infrastructure costs for roads and repairs

Total costs of the average injury crash are approximately £90,000 Source : Government & Insurance data

- UK insurers award lower Group Ratings to vehicles with these technologies
- Call on UK Government to incentivise the fitment of these AEB technologies
- Planned consumer awareness campaign

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Future collision avoidance technology

AEB Side crashes

Junction AEB: Can stop severe crashes that occur at junctions

- Augmenting AEB Low Speed – extending the functionality of auto-brake
- A high priority for future Euro NCAP Strategy
- High severity and high cost crashes
- Will require the further development of test procedures

Expected launch of Junction Assist in 2015

Run-off Road crashes

Run-off Road Crashes – UK insurance statistics

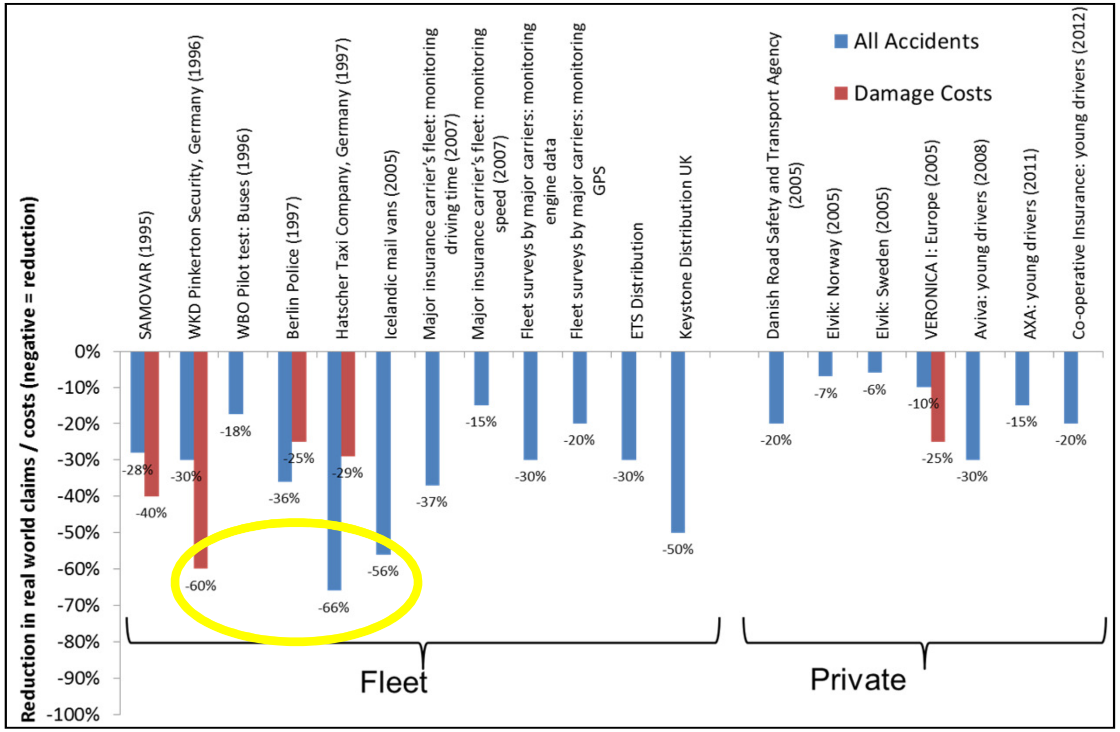
- 44% straight road, 30% gentle left bend, 22% gentle right bend
- 46% left departure, 40% right departure, 12% collision with other vehicle
- **76% continuous white line, 12% dashed, 9% no marking**
- **72% lines well visible, 15% worn, 9% no marking**
- 55% dry, 34% wet, 11% ice/snow
- 61% daylight, 5% twilight, 34% darkness
- 97% no fog
- Higher speeds 60-80km/h+
- Causation factors
  - Inattention, drowsiness, failure to apply sufficient steering

More from Matthew Avery, Thatcham Research's Research Director in his paper today

Communications, telematics and safety

Monitoring changes behaviour

Driver monitoring – an effective behaviour modifier



- Fleet and private use of Event Data Recorders
- Significant changes in behaviour seen
- Typical 20-30% reduction in claims costs
- Fleet savings quite incredible……

Telematics – Thatcham and ABI

Framework for best-practice and market development

Thatcham and ABI objective:

"A stable and competitive telematics market that improves outcomes for consumers, and maximises the potential that is offered by the new technology."

Thatcham and ABI activities:

- ABI: Good Practice Guide
- Thatcham: Minimum Technical Standards

& market owned and influential underwriting data standards provider 'Polaris':

- Minimum Data Standards for UBI

AEB Front crashes

eCall, EDR and challenges for implementation

- eCall is designed to trigger on SRS deployment, but airbag deployments are very rarely triggered (only 4% of insurance cases, excluding write-offs)
- eCall Vehicle based EDR will **only record airbag deployment events**
- Minimum performance standards are required and being developed for broader EDR and telematics communication

Harmonised eCall European Pilot

Minimum Technical Standard: ‘Device agnostic’

Designed to create pro-competitive technical development

Device Type

Aftermarket

Mobile Phone

OEM

Data transfer

Telematics

Physical download

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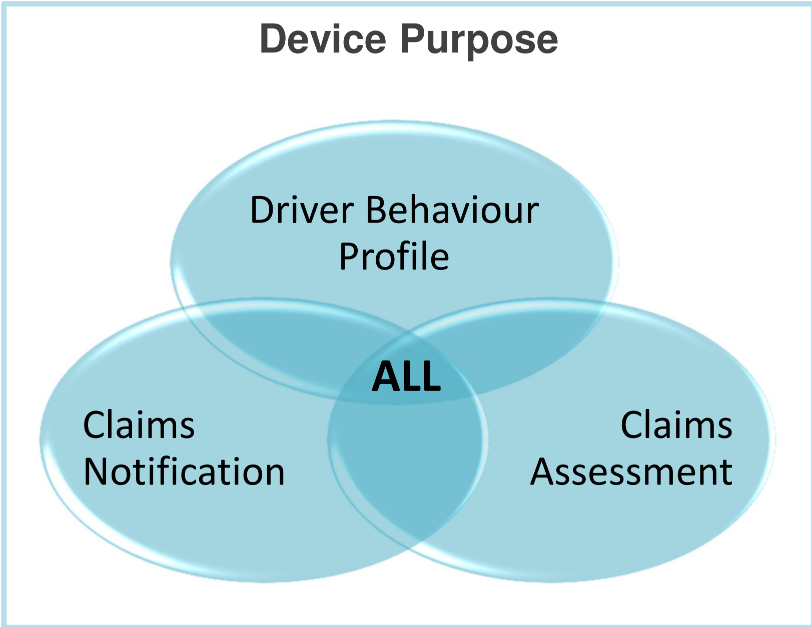
Minimum technical standard

Designed to create pro-competitive technical development

- Common data format
- Not design restrictive
- Open for future developments
- Minimum requirements
- More data elements, or higher specification is encouraged

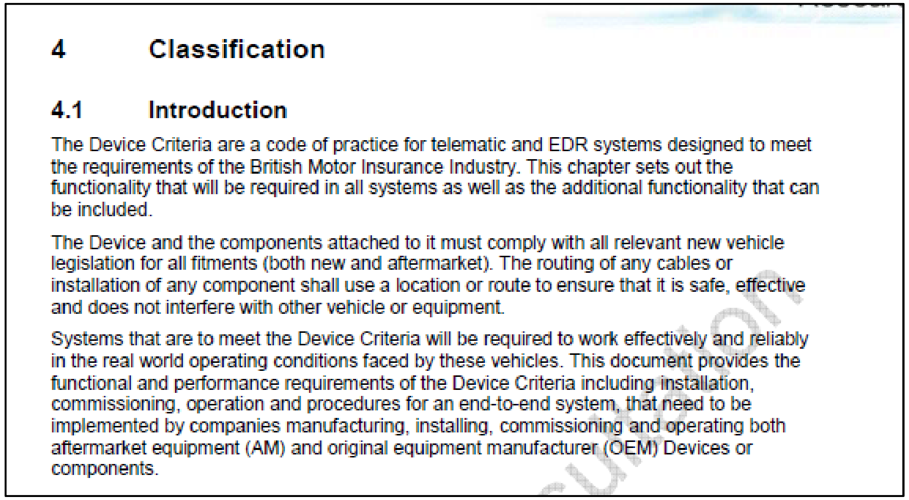


Minimum technical standard

Designed to create pro-competitive technical development

Criteria:

- A code of practice for telematics and EDR systems
- Sets out functionality that is required and which additional functionality will be allowed
- Sets out requirements for reliability through functional and performance requirements, including installation, commissioning, operation
- Applies to the end-to-end system



4 Classification

4.1 Introduction

The Device Criteria are a code of practice for telematic and EDR systems designed to meet the requirements of the British Motor Insurance Industry. This chapter sets out the functionality that will be required in all systems as well as the additional functionality that can be included.

The Device and the components attached to it must comply with all relevant new vehicle legislation for all fitments (both new and aftermarket). The routing of any cables or installation of any component shall use a location or route to ensure that it is safe, effective and does not interfere with other vehicle or equipment.

Systems that are to meet the Device Criteria will be required to work effectively and reliably in the real world operating conditions faced by these vehicles. This document provides the functional and performance requirements of the Device Criteria including installation, commissioning, operation and procedures for an end-to-end system, that need to be implemented by companies manufacturing, installing, commissioning and operating both aftermarket equipment (AM) and original equipment manufacturer (OEM) Devices or components.

ABI Good practice guide

Designed to create pro-competitive technical development

Context:

The Big Picture

- Great potential for data use
- No sharing of data without consent or court order

Rationale

- Need for compliance with the law (DPA 1998) and regulators
- Need to create trust
- Insurer Duty of Care

ABI Good practice guide

Compliance – DPA issues

- Data is Personal – gives the right to access it
- More data is collected
- Consent is required
- New data means more interest from customers
- Data is an attractive resource to third parties
- Responsibilities vary depending on product

ABI Good practice guide

Compliance – Guidelines

- Understanding and consent – including for named drivers
- Data collection after policy termination
- Accurate and necessary data
- Security of data
- Access to data for the individual
- Access to data for third parties
- Access to data for the authorities

ABI Good practice guide

Access to data by authorities

- Personal Telematics Data is not shared with the authorities without appropriate permissions (either from the data subject or by a court order).
- Only information specifically relevant to the court order or data request, or agreed to by the data subject(s) should be released to the authorities.
- Possible exceptions for fraud detection/prevention.

ABI Good practice guide

Trust

- Increasing wariness about the use of personal data
- Scepticism about monitoring and tracking is a major commercial challenge
- Compliance will influence take-up of products and therefore the pool of data available as a resource
- Good practice guide provides a clear ‘line in the sand’

ABI Good practice guide

Duty of care

Open questions about the role of insurers in preventing bad driving and accidents:

- Insurers typically are taking action, but are they compelled to do so?
- On what grounds can a decision be taken?

Proactive data release:

- Could this establish a duty of care?
- Would this make ongoing provision of telematics products difficult?

ABI Good practice guide

Summary

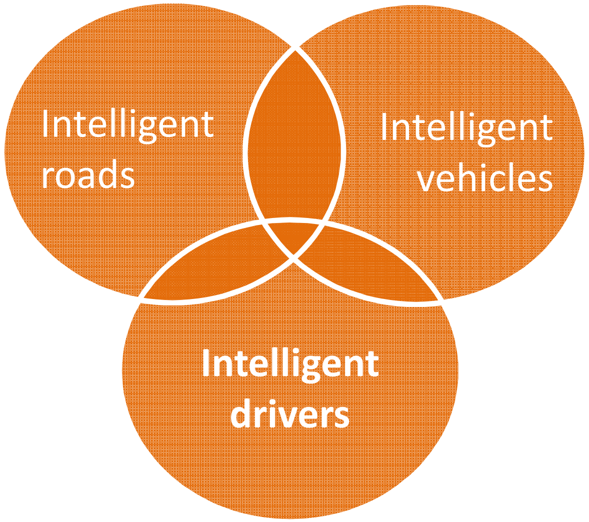
- Potentially large road safety benefits through better incentives.
- Rich source of data if accessed appropriately.
- Important for the proper protocols to be followed.

The guide can be found at:
https://www.abi.org.uk/Insurance-and-savings/Topics-and-issues/Pay-how-you-drive-motor-insurance

Vehicles - an effective road safety development arena

Overall Summary

- The intelligent transport system holds real promise to provide significant increases in safety
- Autonomous vehicles, with or without a supporting infrastructure will hold challenges for our whole society
- AEB is entering the fleet now and will significantly reduce frontal crashes
- New Pedestrian AEB will counter the global epidemic of VRU deaths and serious injuries
- New technologies such as Road departure avoidance / Lane departure warning and Lane keep assistance will require intelligent roads
- The communications revolution, providing telematics capabilities may provide some driver behaviour effects
- The future is on-board environment monitoring – building the 'intelligent' car.
- As to monitoring and making the 'intelligent' driver – we'll see.



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Appendix 1: Rate of AEB fitment

Key assumptions for proposed Government Incentive:

- Average cost of optional AEB system £1298; for modelling assumed as **£1,000**
  - Skoda Citigo, safety pack £180
  - Ford Kuga, Active City Stop £900
  - Volvo, driver support pack £1900
    (ACC, Queue Assist, Lane Keep, Driver Alert, Active High Beam, Road Sign Info Display, BLIS, Cross Traffic Alert)
- Scheme offering a £500 incentive will have 50% take up
- Scheme will increase AEB fitment but not volume of new cars sold

Appendix 2: UK societal benefit model

Holistic Accident Cost	Description	Source	Average Cost per accident
Lost Output	Loss of earnings; non-wage payments; consumption of goods & services	DEPARTMENT for TRANSPORT (2013) Reported Road Casualties Great Britain 2012. London, The Stationery Office.	£13,429 (PI only)
Medical & Ambulance	Ambulance & hospital treatment costs	DEPARTMENT for TRANSPORT (2013) Reported Road Casualties Great Britain 2012. London, The Stationery Office	£3,364 (PI only)
Human Costs	Pain, grief & suffering to casualty, family & friends; loss of enjoyment of life for fatalities	DEPARTMENT for TRANSPORT (2013) Reported Road Casualties Great Britain 2012. London, The Stationery Office	£51,370 (PI only)
Police Costs	Police costs	DEPARTMENT for TRANSPORT (2013) Reported Road Casualties Great Britain 2012. London, The Stationery Office	£530 Damage £958 PI
Insurance Costs	Claim payments including legal costs	ASSOCIATION of BRITISH INSURERS (2012), Annual Motor Statistics. London	£1,615 Damage £13,565 PI
Congestion Costs	Loss of journey time reliability	TRANSPORT FOR LONDON (2012) *	£191 Damage £5,000 PI
Total	**Damage** **PI**		**£2,335** **£87,686**

*TRANSPORT FOR LONDON (2012) An assessment of the direct and indirect economic costs of idling during heavy road traffic congestion to households in the UK, France and Germany. London.
TRANSPORT FOR LONDON (2013) Roads task force thematic analysis. London.
VDI/VDE Innovation + Technik GmbH (2005) Exploratory Study on the potential socio-economic impact of the introduction of Intelligent Safety Systems in Road Vehicles; SEiSS final report. Brussels, European Commission.