
The Influence Of Roads On Improving Safety Using Lane Support Technologies

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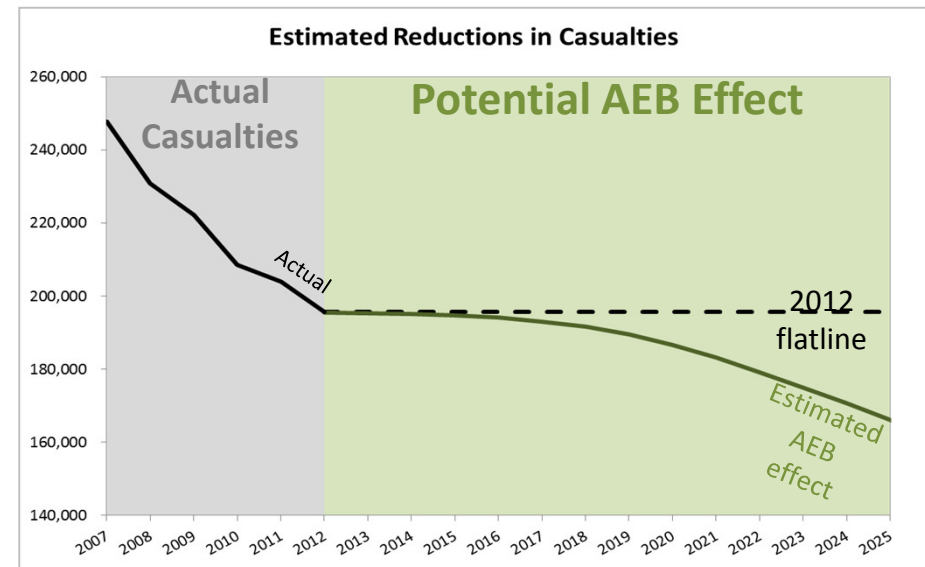
20th May 2014



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Research

ADAS Testing

AEB Just the Beginning.....

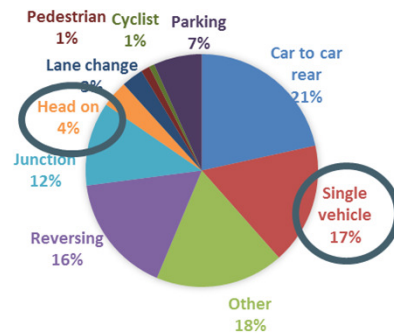


UK Safety Research

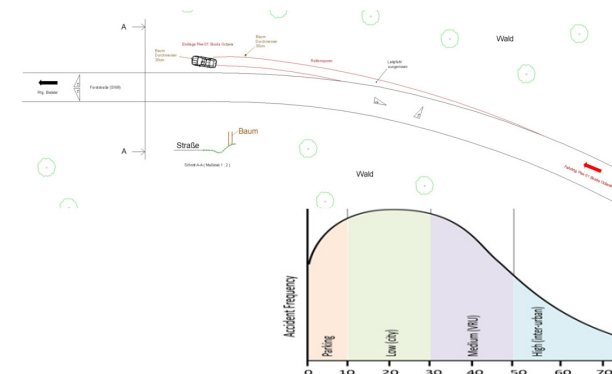
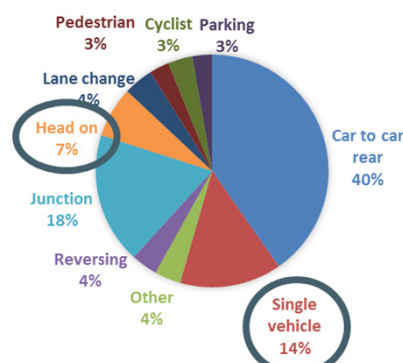
Run-off Road Crashes

- Single vehicle and head-on collisions – 20% of damage and PI claims frequency

Damage



Personal Injury

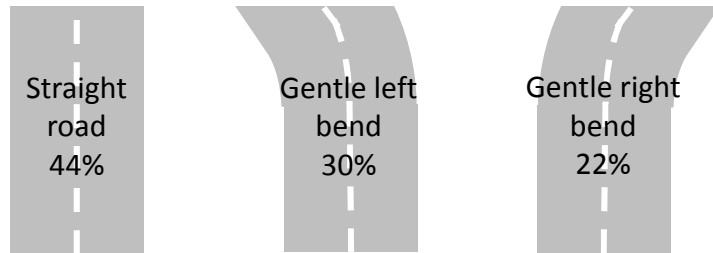


Claim Type	Estimated Damage and PI Claims Value 2012 (£Million)	%	0-10	10-30	30-50	50+
			Parking	Low	Medium	High
Car to car rear	£2,450	33%		£1,550	£550	£350
Junction	£1,150	15%			£750	£400
Single vehicle	£1,150	15%	£400	£350	£250	£150
Reversing	£700	9%	£700			
Head on	£400	5%			£100	£350
Parking	£350	5%	£350			
VRU	£350	5%		£100	£250	
Lane change	£250	3%			£50	£200
Other	£750	10%	£250	£200	£150	£100
Total	£7.55bn	100%	£1.7bn	£2.2bn	£2.1bn	£1.55bn

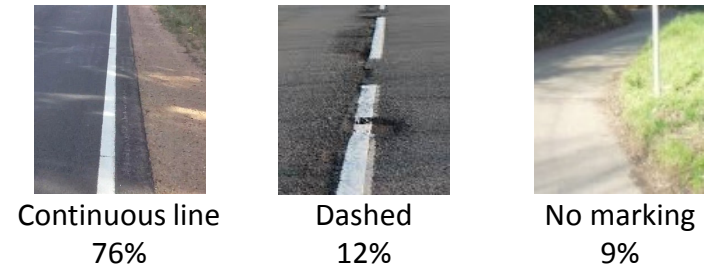
German Real World Data

Run-off Road Crashes: German data (GIDAS)

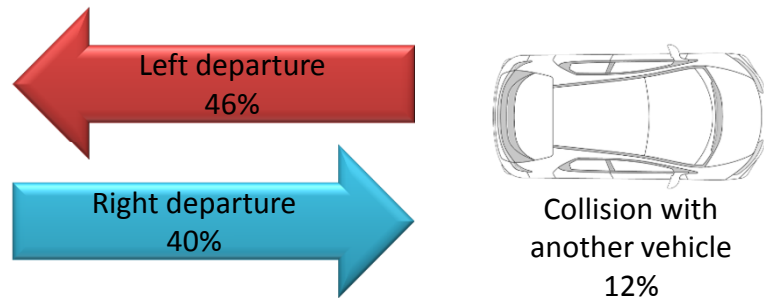
Road Shape



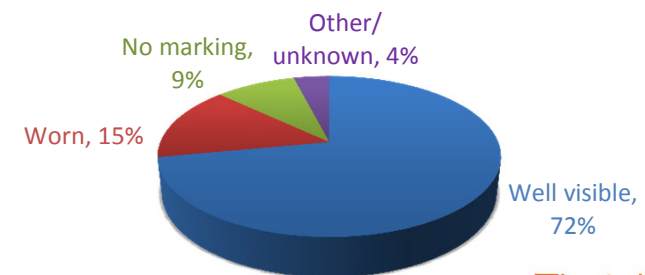
Line Marking



Collision



Line Visibility



German Real World Data

Run-off Road Crashes: German data (GIDAS)

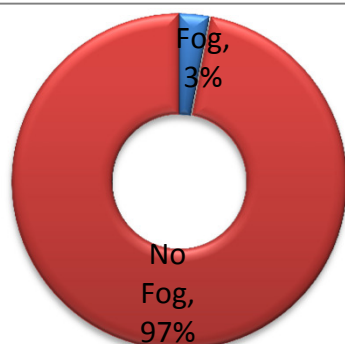
Speeds & Causes

- Higher speeds 60-80km/h+
- Causation factors
 - Inattention, drowsiness, failure to apply sufficient steering

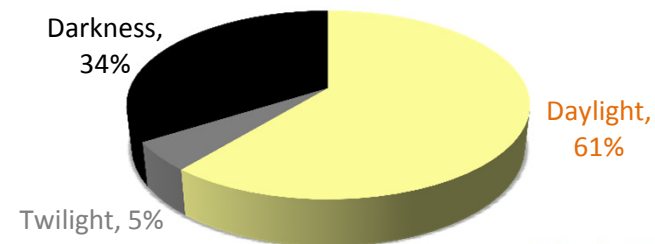
Road Condition



Fog



Light



Roads That Cars Can Read

Euro NCAP & Euro RAP



“Lane markings are the rails for the self-steering car”

“Road markings on Europe’s roads should adopt a memorable ‘150 x 150’ standard defining their width and how much light they must reflect back”

ACEA definition of factors affecting operation & performance of systems:

High	Medium	Low
<ul style="list-style-type: none">• Road surface condition (wet, ice etc)• Worn out markings• Multiple confusing road markings• Old road markings not completely obscured even if blacked out	<ul style="list-style-type: none">• Road gradient• Road curvature• Boundaries between multiple lanes	<ul style="list-style-type: none">• Lane width (too narrow, too wide)• Visibility (eg fog)

Run Off Road Technologies

Sensors and Functionality

- Lane Departure Warning – Mono Camera
 - Warns the driver of lane excursion
- Lane Keep Assist – Stereo Camera
 - Warns the driver of lane excursion and uses EPAS to steer the car back into lane
- Run Off Road Protection (AES) - Camera Radar Fusion
 - Warns the driver of lane excursion and uses EPAS to steer the car back into lane.
 - In critical situations (across lane into head on traffic) uses ESC to rapidly steer car



EPAS = Electronic Power Assisted Steering; ESC = Electronic Stability Control

Run Off Road Technologies

Lane Detection Algorithms

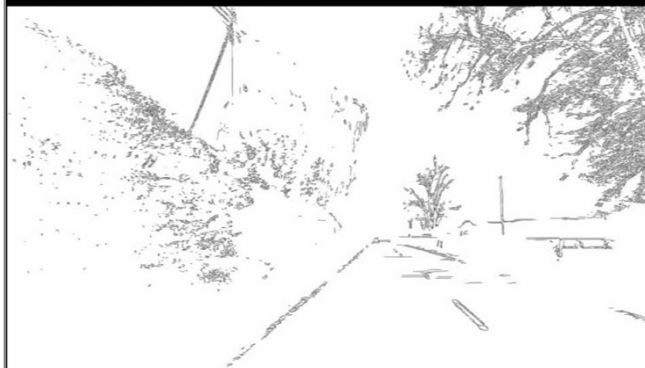
1) Driver's view



2) Camera view



3) Edge detection algorithm



4) Driver's view with detected lanes



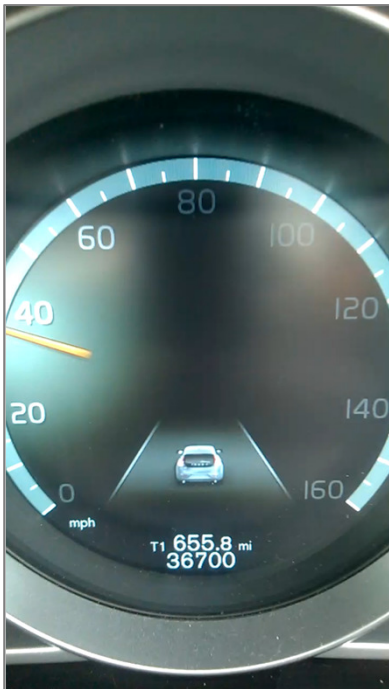
Image processing is example only; not OEM system output

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Research

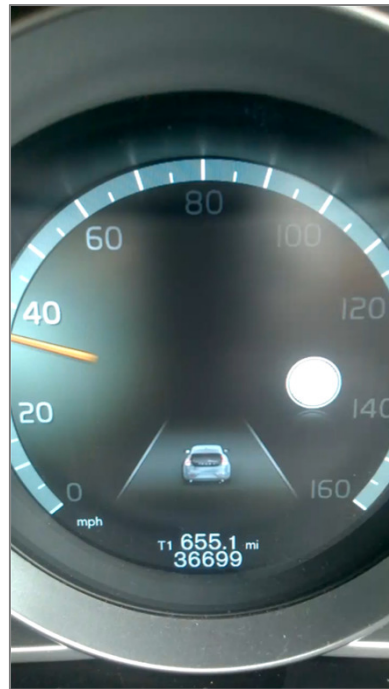
Run Off Road Technologies

Lane Keep Assist System HMI

Markings both sides



Right marking only

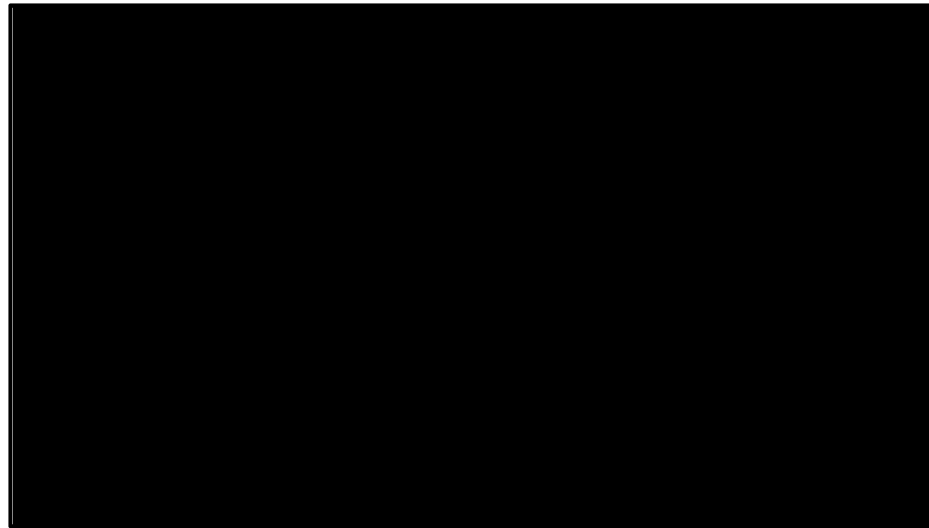
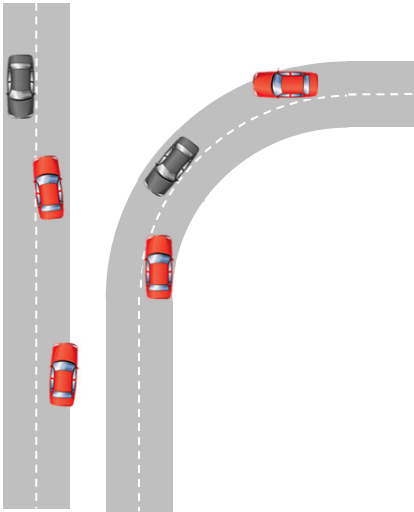


- Lane marking acquired
 - Volvo – grey to white
 - Mercedes – grey to green
- LKA system activated
 - Volvo – green to red
 - Steering wheel vibrated



Run Off Road Technologies

Lane Control Systems

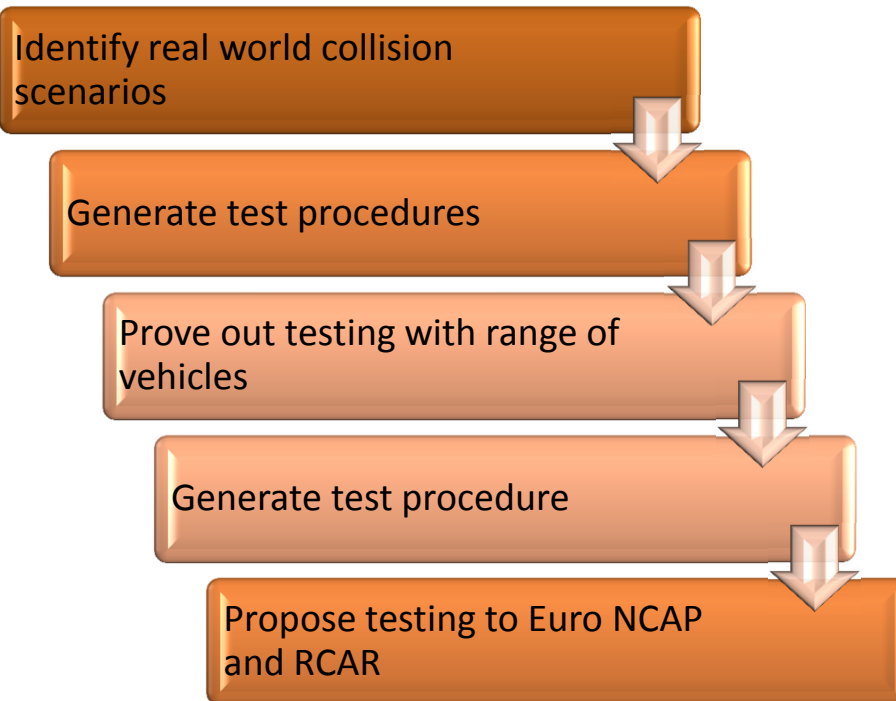


- Sophisticated lane guidance systems already in production
 - Mercedes E class, Infiniti Q50, Subaru Levorg...
 - Interpret and react to solid and dashed markings, overtaking and oncoming traffic etc.
- 2015 Volvo XC90 to preview advanced Run-Off-Road system

Testing AES

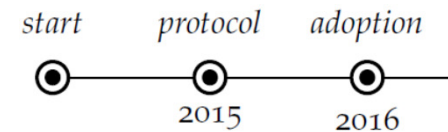
Testing Development and Stakeholders

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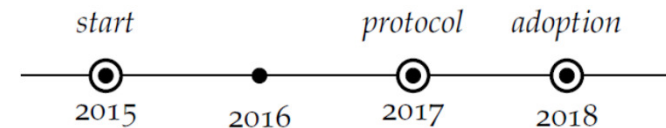


Euro NCAP

- Lane Keep Assist protocol

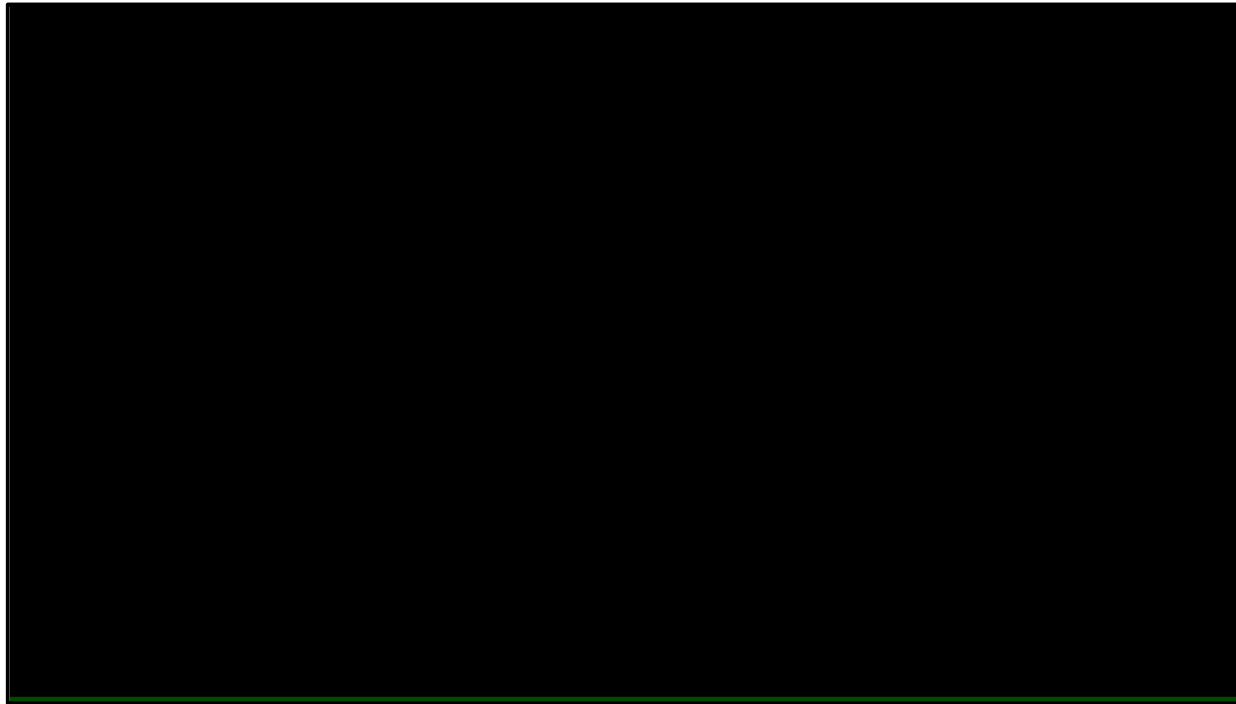


- Lateral Support Systems (AES)
 - Crash into fixed object, critical lane change manoeuvres, narrow offset head-on collisions



Future Testing

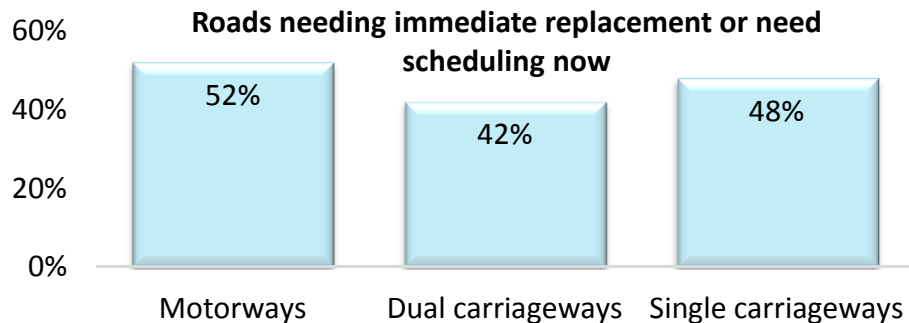
3D test target will allow testing for different collision scenarios



UK Roads

Conclusions

- **Road Safety Markings Association:**
 - ‘Lifelines’ survey of road markings, nearly 4,000 km of England’s roads
- 47% of markings on all roads need replacing immediately or need scheduling for replacement now



- Only 17% of markings on all roads are excellent

Conclusions

- **Run off road crashes are frequent and costly to society**
- **Systems on vehicles can help drivers to avoid errors**
- **Road markings have a role to support those systems**
- **EuroNCAP devising test procedures to encourage AES**