

# Lower speeds and Intelligent Speed Adaptation: what do they deliver for safety and CO<sub>2</sub>?

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# The evidence base: two projects



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## ISA-UK (2000-2006)

**isa-uk**  
*Intelligent Speed adaptation*

Final Report  
June 2008

Oliver Carsten, Mark Fowkes, Frank Lai, Kathryn Chorlton,  
Samantha Jamson, Fergus Tate and Bob Simpkin

Project Partners:  
The University of Leeds and MIRA Ltd

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Project Funded by the  
Transport Technology and Standards Division  
Department for Transport



## CfIT ISA (2007-2008)

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Speed Limit Adherence and its Effect  
on Road Safety and Climate Change

Final Report

Oliver Carsten, Frank Lai, Kathryn Chorlton, Paul  
Goodman, David Carslaw and Stephane Hess

October 2008

Project Funded by the  
Commission for Integrated Transport  
and the Motorists' Forum

ITS

- ***Advisory ISA:***  
Informs the driver of the speed limit and warns the driver when the limit is being exceeded (= enhanced SatNav)
- ***Voluntary (or Overridable) ISA:***  
The information on speed limit is linked to the vehicle's engine management system and perhaps additionally to the braking system — the system comes on with the vehicle ignition, but it may be overridden by the driver at will
- ***Mandatory ISA:***  
Works like Voluntary ISA, but without the option to override

# Our vehicles



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- Voluntary system that limited speed to the prevailing limit (no acceleration beyond limit)
- Drivers could override at will
- Vibration on throttle pedal to prevent over-throttling



# Some of our fleet in the ISA-UK project



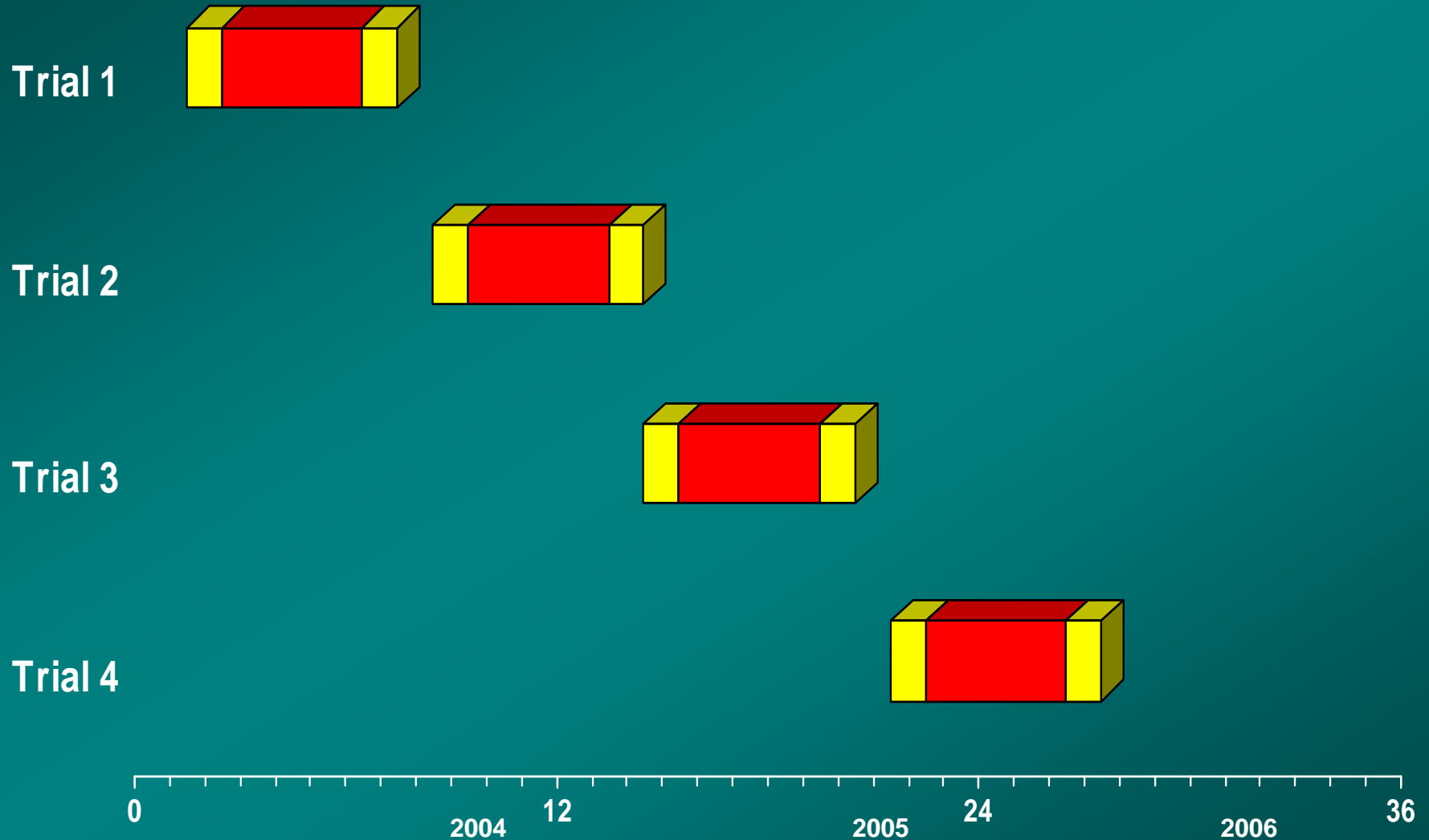
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# Field trial timings



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# The ISA field trials database



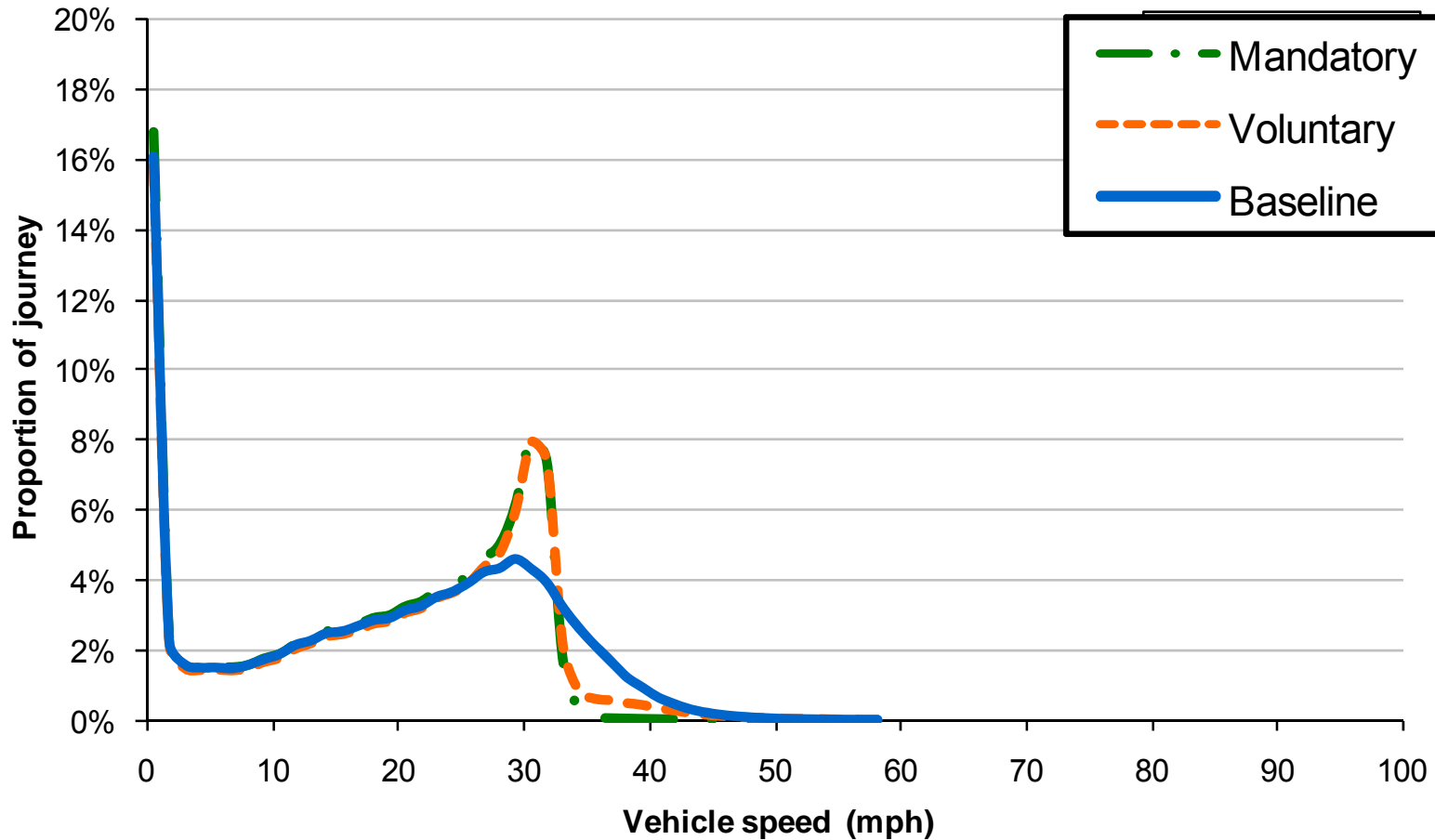
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- Driving by 79 drivers over 6 months
  - 1 month without ISA (baseline)
  - 4 months with Voluntary ISA
  - 1 month with ISA again off
- Total mileage: 429,487
  - With speed limit information: 354,592
  - For ISA active phase: 218,790
  - All at 10Hz

# Speed profile by time on 30 mph roads



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# Safety

## “Recipe”:

- Predict traffic growth (DfT advice)
- Predict accident trends without ISA
- Predict **additional safety impact** of ISA (via *observed* change in speed patterns)
  - **Depends on ISA type and road type**
- Analyse costs and benefits over 60 years from 2010
- Scenario-based approach

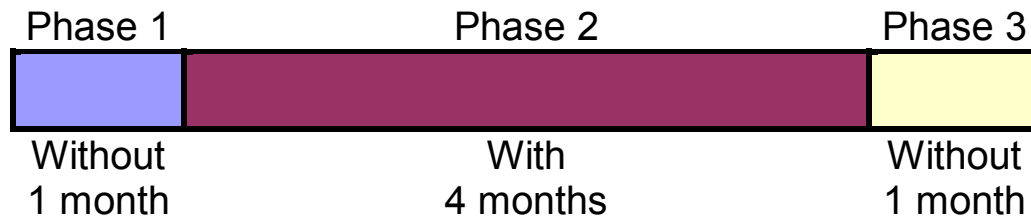


- Based on models from the literature of relationships between speed and crash risk (e.g. Kloeden et al., 2001, 2002)
- These models have been calculated from real-world data
- *They are not drawn from the police reported contributory factors for accidents*

# Use of data from ISA field trials to provide speed profiles



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**Baseline:** data collected from Phase 1 (i.e. no ISA)

**Voluntary ISA:** data collected from Phase 2 (i.e. the ISA system was overridable)

**“Mandatory” ISA:** data collected from Phase 2 excluding when ISA was overridden

# Estimated impact of Advisory ISA on speed



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- Obtained from:

Shift from Baseline (no ISA) to Voluntary ISA

x

Adjustment factor from LAVIA trial in France, i.e.

LAVIA Advisory speed reduction

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LAVIA Voluntary speed reduction

# Predicted risk reduction by type of ISA



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## Reduction in Injury Accidents with ISA

ISA Variant	Overall Reduction
Advisory ISA	-2.7%
Voluntary (Overridable) ISA	-12.0%
Mandatory (Non-Overridable) ISA	-28.9%



# Emissions

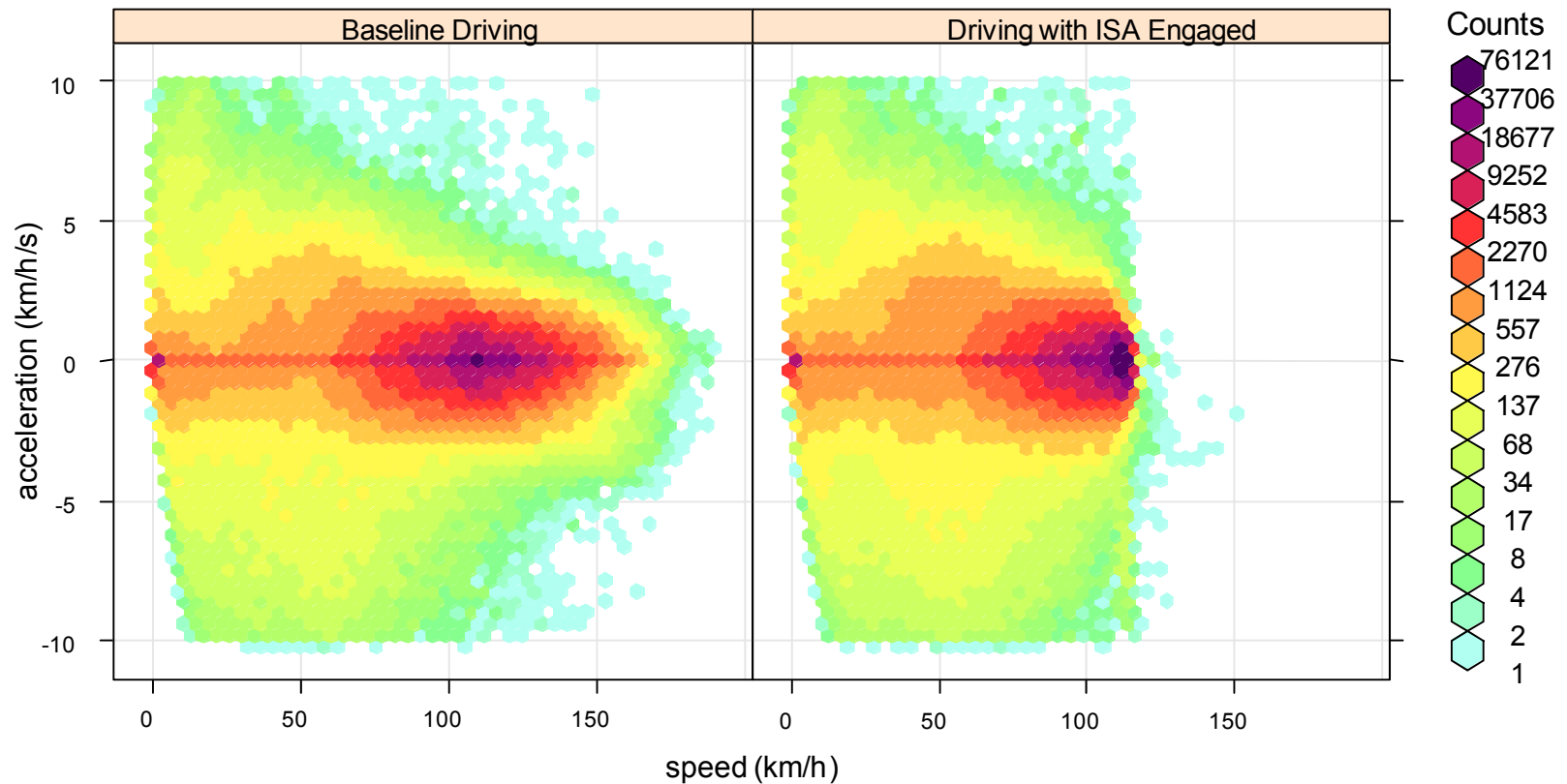


Done two ways:

1. With detailed second-by-second GAMs models
2. With more aggregated speed-emissions curves



## Driving on 70 mph roads



# CO<sub>2</sub> emissions from UK field trial speed profiles



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## GAMs modelling

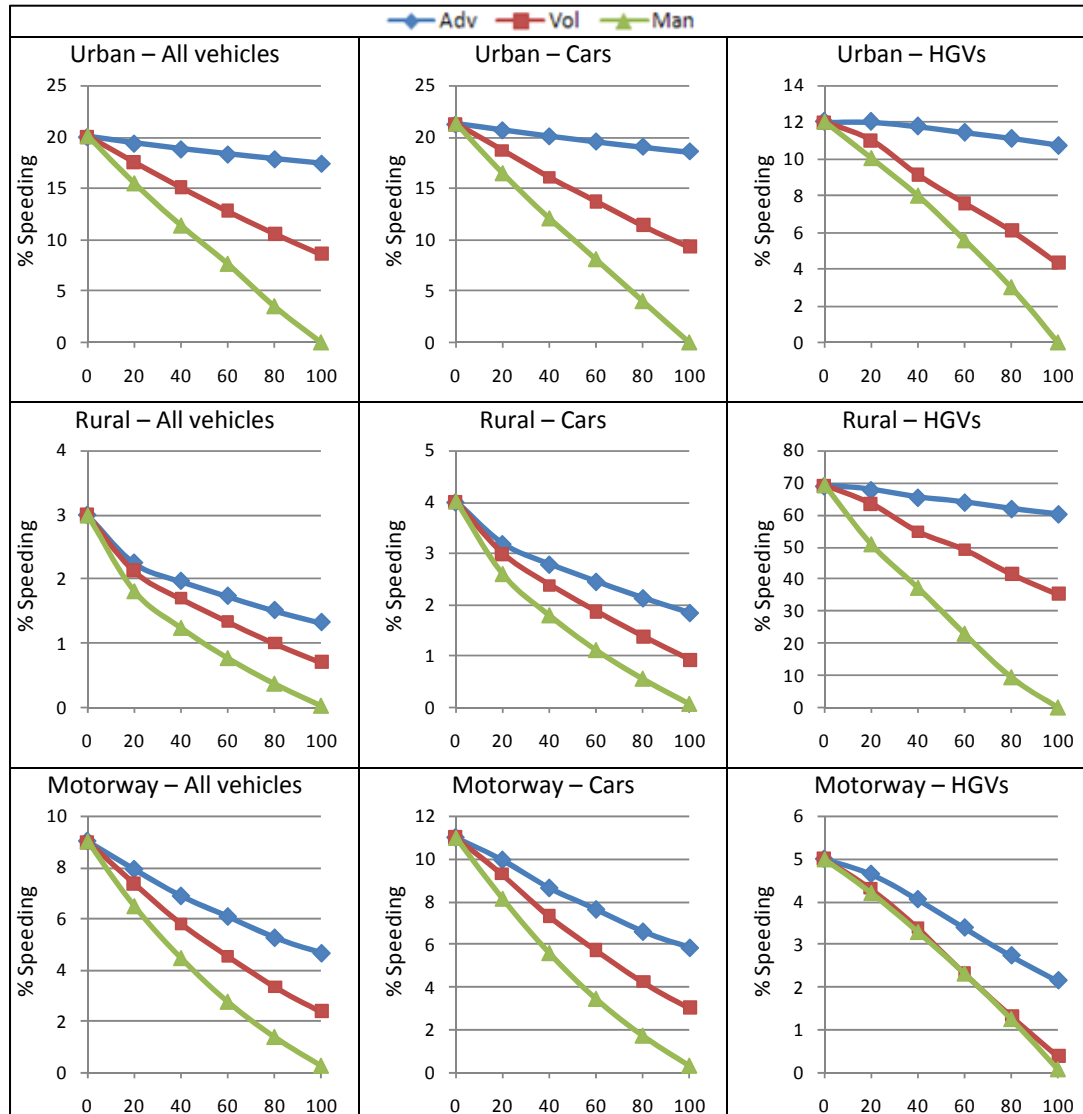
Speed Limit (mph)	Change with Voluntary ISA	Change with Mandatory ISA
20	0.0%	+0.1%
30	-0.4%	-0.4%
40	-1.2%	-1.2%
60	+0.3%	+0.3%
70	-3.4%	-5.8%

## Speed-emissions curves

Speed Limit (mph)	Change with Mandatory ISA
30	+2.8%
40	+2.8%
60	+0.4%
70	-4.2%

- 4 networks:
  1. Rural – A614
  2. Urban – Sheffield S10
  3. Urban – Sheffield Sheaf Valley
  4. Motorway – A1(M) near Gateshead
- AIMSUN micro-simulation model modified to cater for Voluntary ISA
- ***For emissions, used speed-emissions curves***

# Critical mass effect?



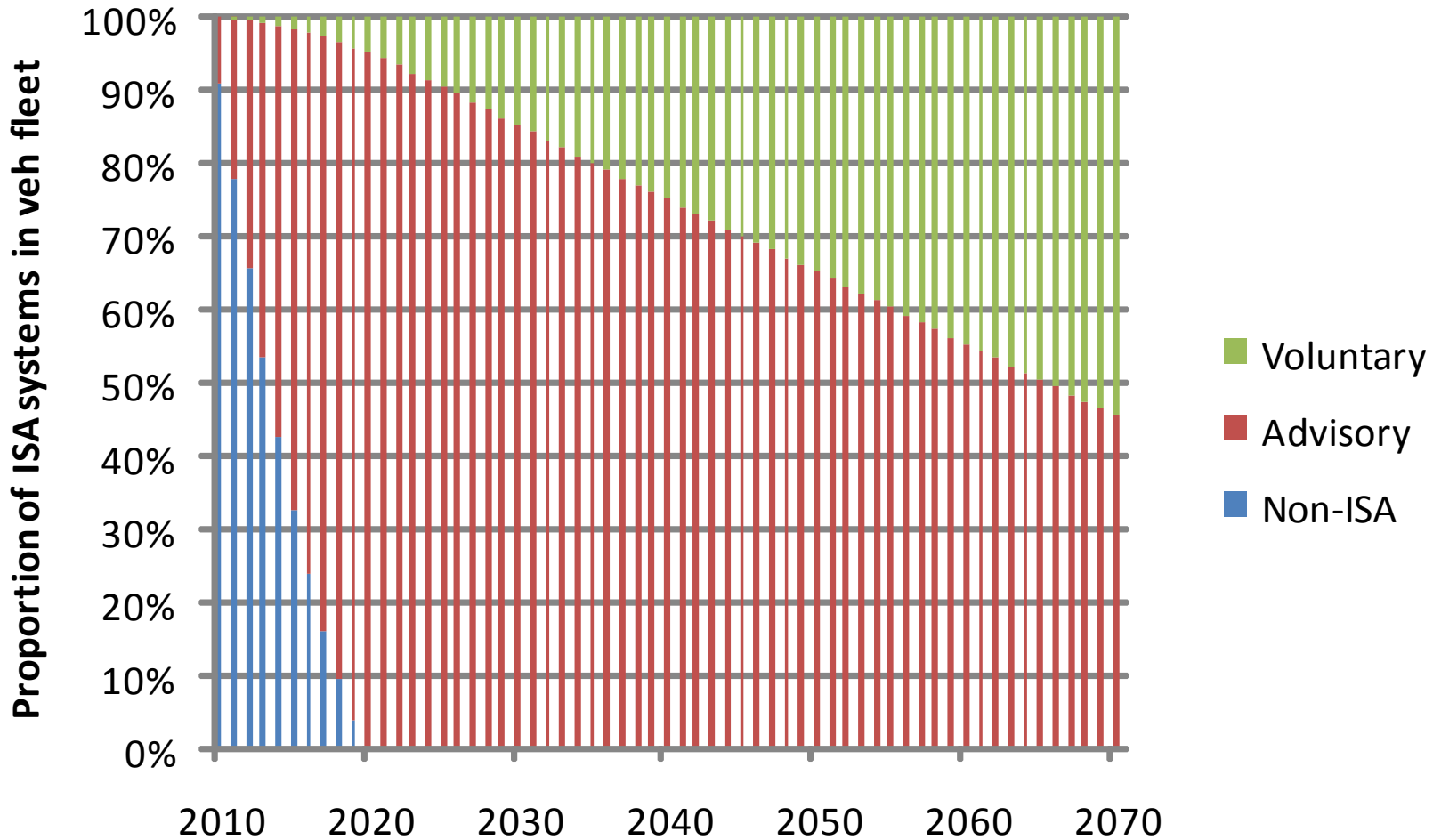


# The future(s)

# Predicted ISA penetration under the Market Driven scenario



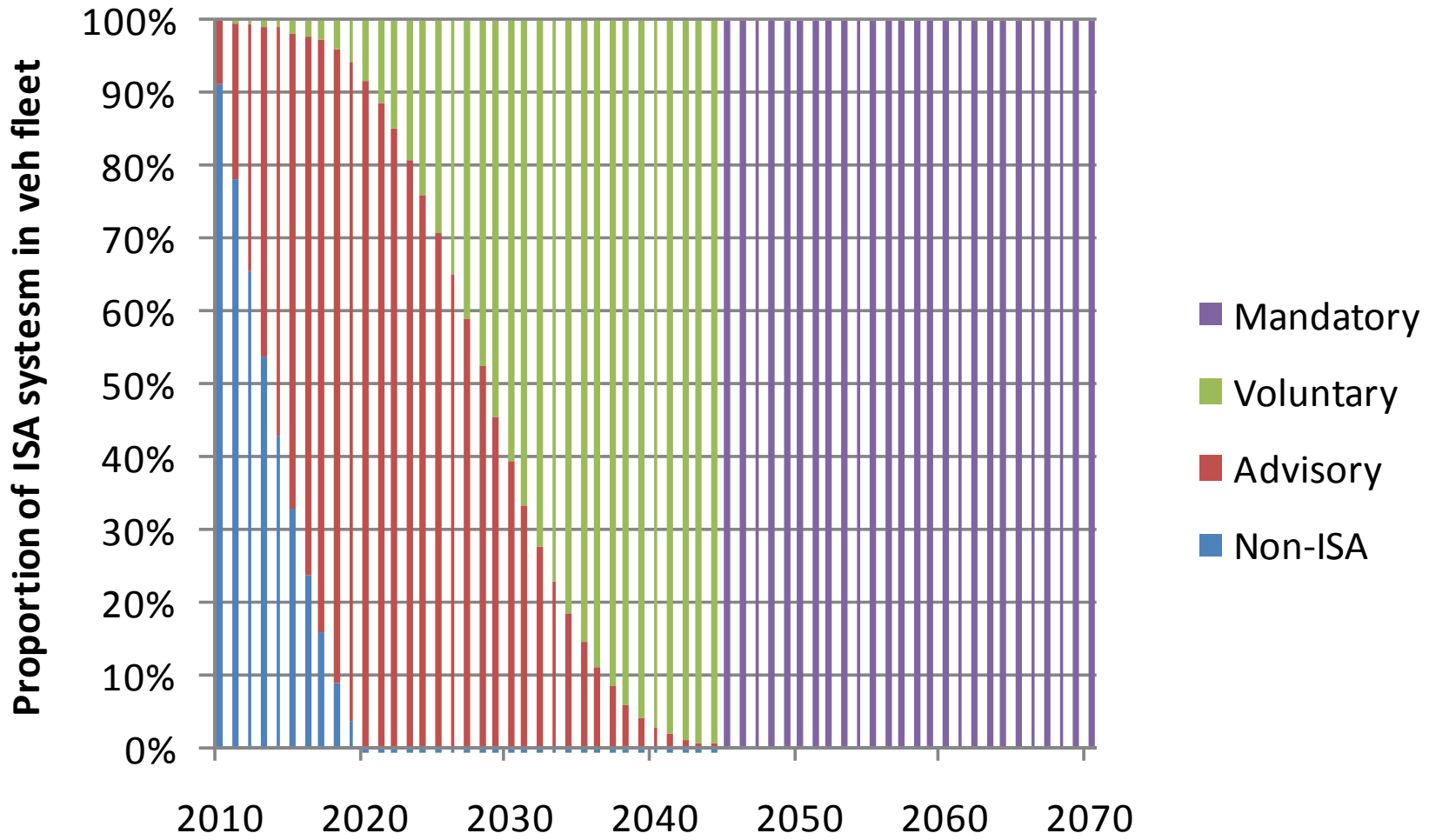
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# Predicted ISA penetration under the Authority Driven scenario



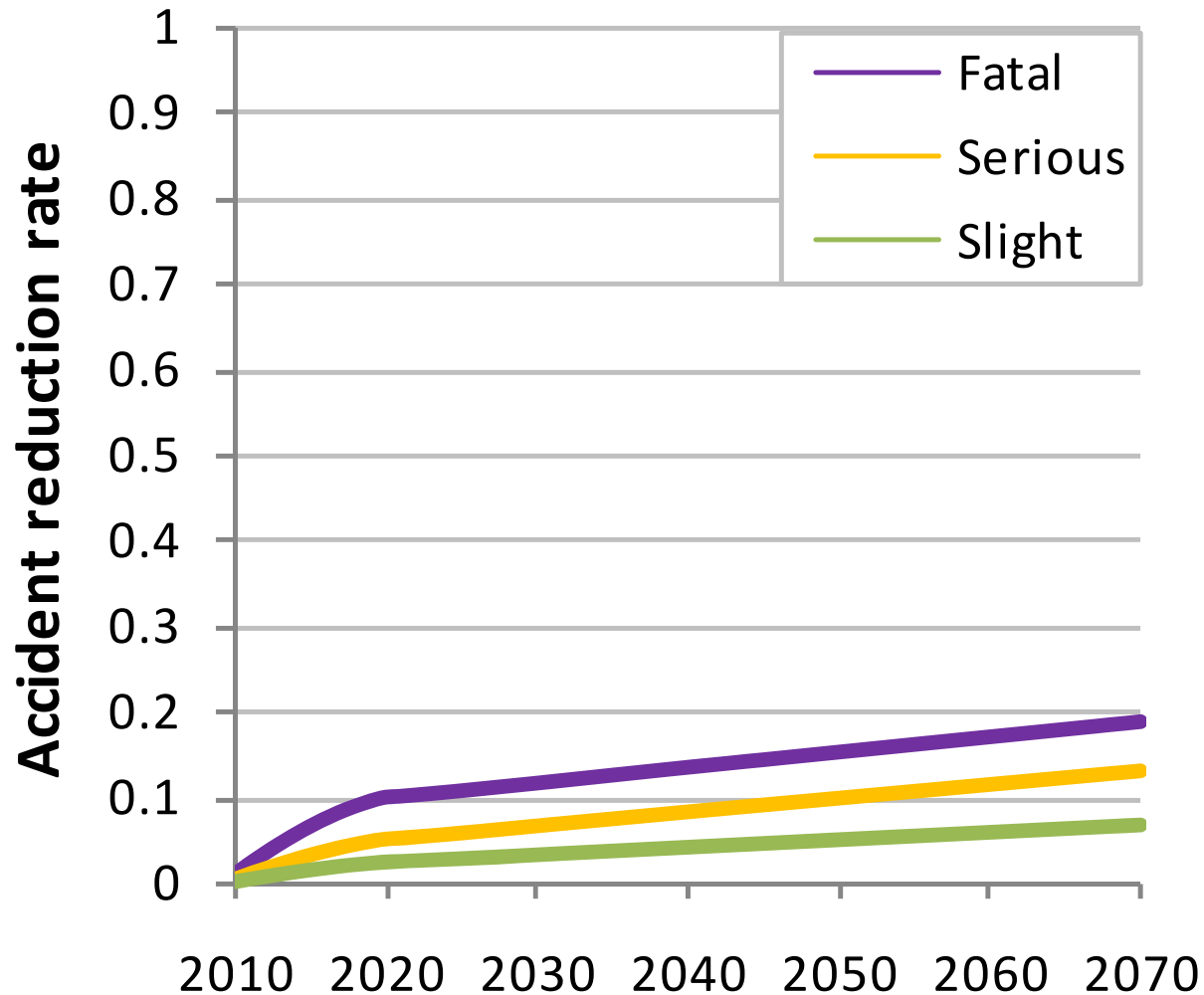
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# Crash reduction over time for Market Driven ISA



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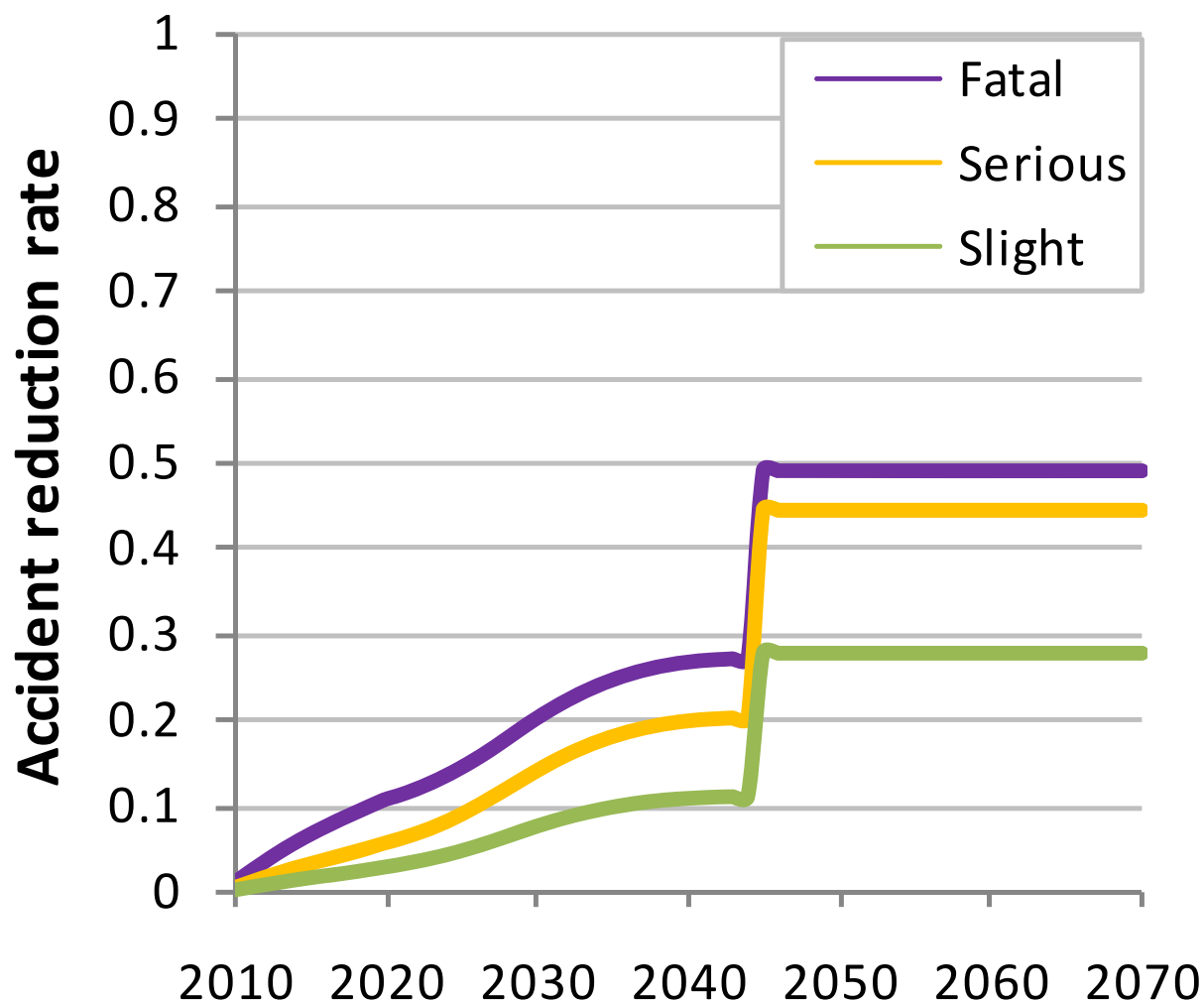




# Crash reduction over time for Authority Driven ISA



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## Crashes Saved 2010 to 2070

	Slight Crashes	Serious Crashes	Fatal Crashes
Market Driven	4%	8%	13%
Authority Driven	15%	25%	30%

## Savings in emissions and fuel 2010 to 2070

	<b>CO<sub>2</sub></b> <b>(tonnes x 10<sup>6</sup>)</b>	<b>Fuel</b> <b>(litres x 10<sup>6</sup>)</b>
Market Driven	4.139	6,460
Authority Driven	16.303	25.436

# Source of ISA benefits over 60-year period



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Implementation Scenario	ISA Benefits (£1m)				% Due to Accident Savings
	Fuel	CO <sub>2</sub>	Accidents	TOTAL	
Market Driven	£446	£196	£32,808	£33,450	98%
Authority Driven	£1,740	£773	£85,122	£87,636	97%

# Do the benefits outweigh the costs?



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- Benefit to cost ratios (accidents + fuel + CO<sub>2</sub>):
  - Market Driven scenario 3.4
  - Authority Driven scenario 7.4

- The safety benefits of ISA are very considerable
- The harder the push for ISA and the “stronger” the system, the greater the benefits
- The environmental benefits of ISA are real
  - There may be benefits on roads other than 70 mph roads
- In cost-benefit terms the environmental impact is much less than the safety impact
- Much of the potential of ISA, e.g. to replace traditional and costly traffic calming, was not counted



Thank you for your attention!  
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*Kipper Williams*

