

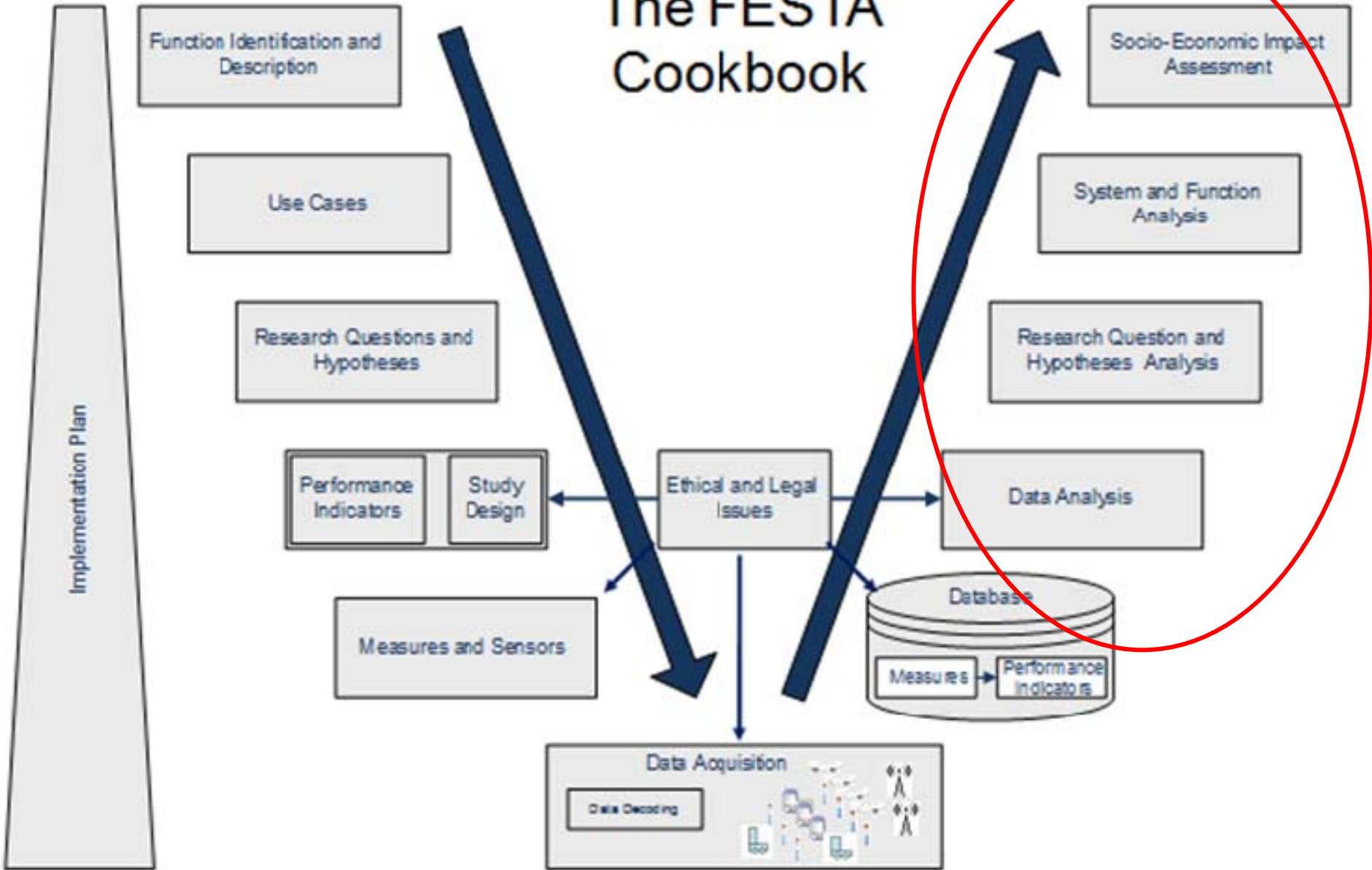
Making data meaningful: the use of time and space in FOT analysis

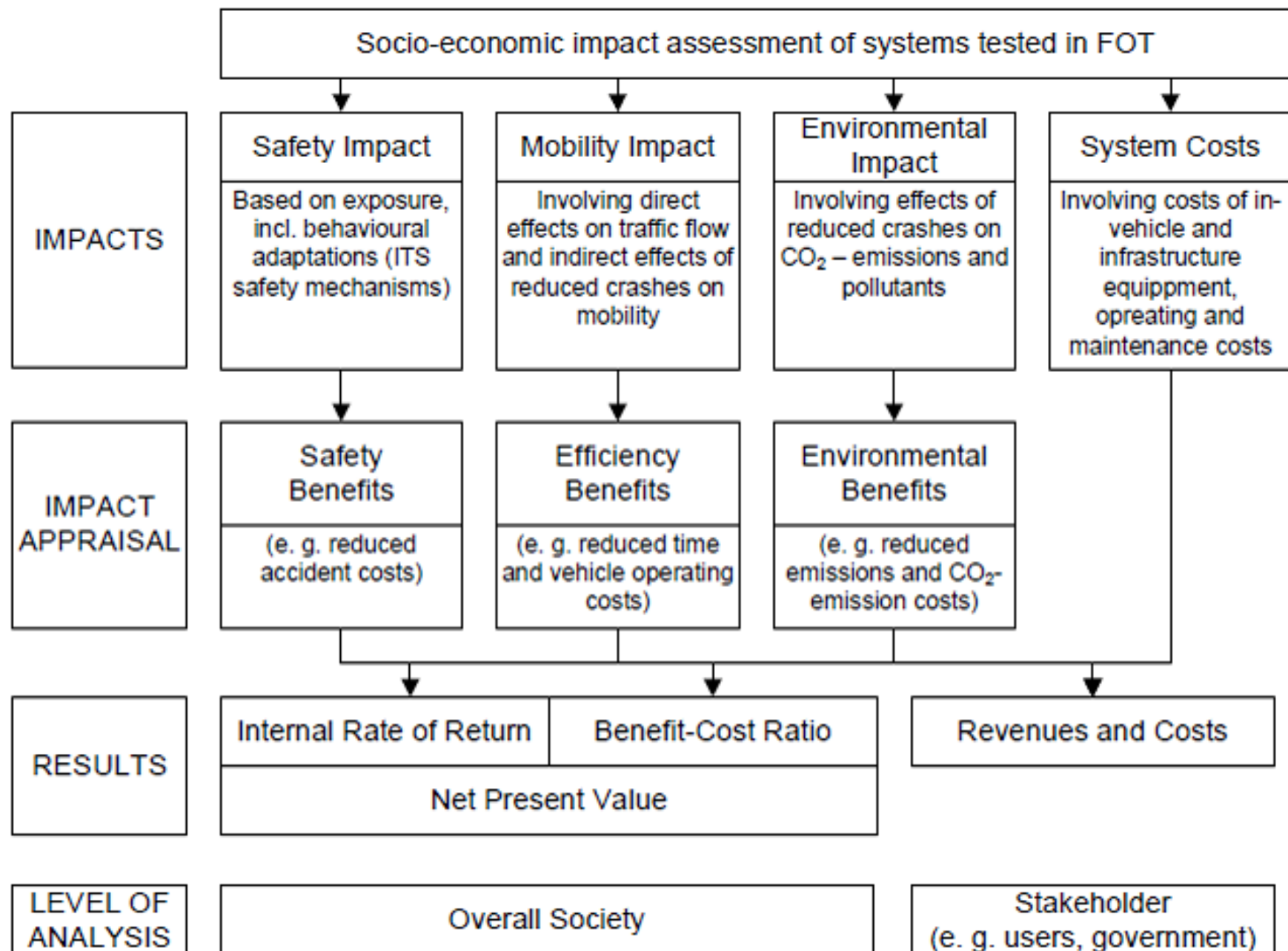
Frank Lai
Institute for Transport Studies
University of Leeds

Analysis of FOT data

- Got the data and populated into a gigantic database – now what?
- Raw data: hundreds of columns and millions of rows of data – these barely tell anything
- The need to convert the raw data into something meaningful – scaling up!
- So we'd like to cook the raw ingredients into some delicious dishes!!

The FESTA Cookbook





Characteristics of FOT data

- Large volume of data
- High resolution, i.e. 1Hz, 10Hz, 60Hz etc
- Data patterns vary according to the interactions among:
 - Driver: gender, experience, personality etc.
 - Vehicle: types of system and configuration
 - Environment: types of road, time of day etc.

Getting data ready for analysis

- Data reduction needs to accommodate the requirements of analysis plan
- Continuous variables are inherently recorded based on time frames; e.g. 1 Hz, 10 Hz, 60 Hz etc
- But data could also be presented based on distance – does this offer something different?

Today's set meal

- Example data from the ISA-UK FOT
- Brainstorming in small groups
- How I cooked the dishes

ISA-UK FOT

Overview

- Field trials
 - ✓ 20 passenger cars
 - ✓ A 7.5 tons truck
 - ✓ A 650 cc motorcycle
- Simulator trials for overtaking scenarios



ISA-UK FOT HMI

The system is turned on by default upon ignition, but the driver can override the system temporarily



ISA-UK FOT

The car fleet and data

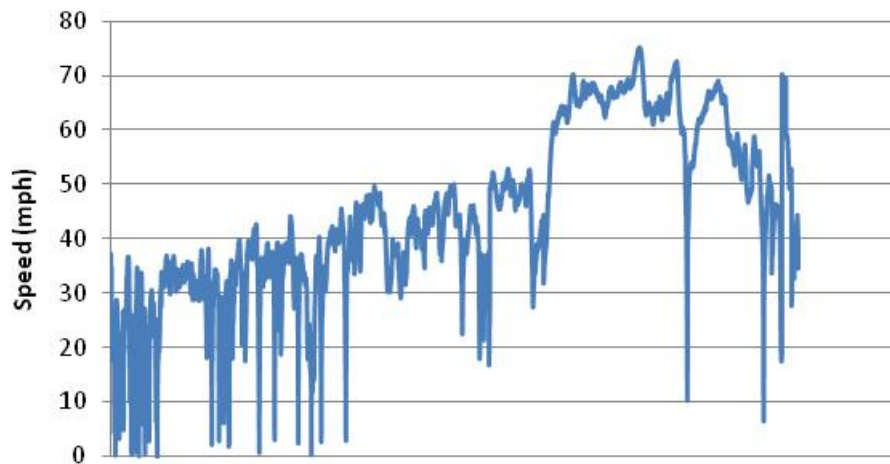
- A fleet of 20 identical cars
- 80 participants. Each of them had the car for 6 months.
- Data were logged at 10 Hz.
- The database contains driving data of 12,119 person-day and 429,487 miles (691,192 km).



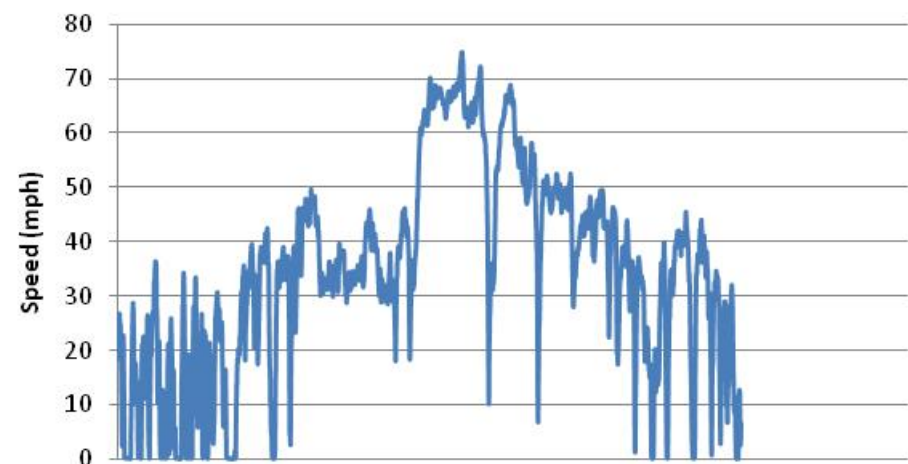
ISA-UK FOT

Speed profiles of a single trip

5 metres

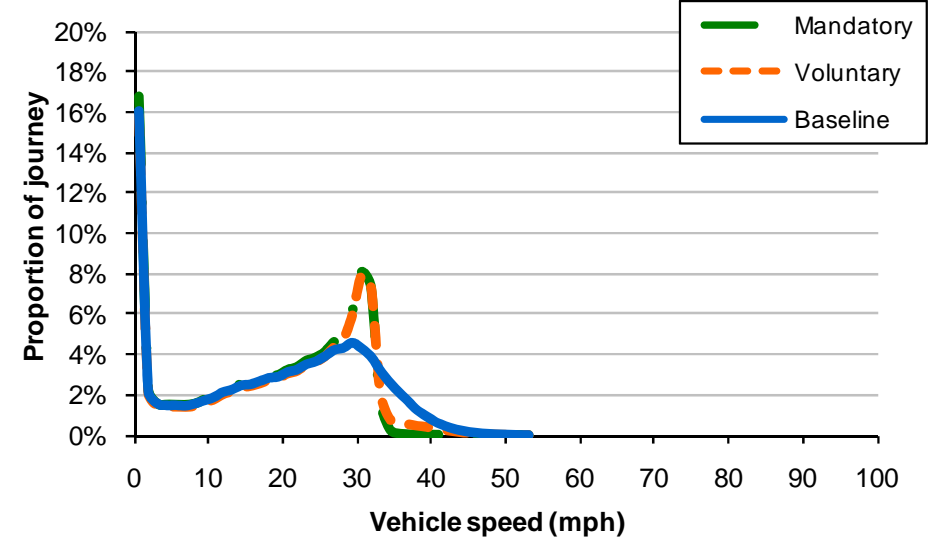
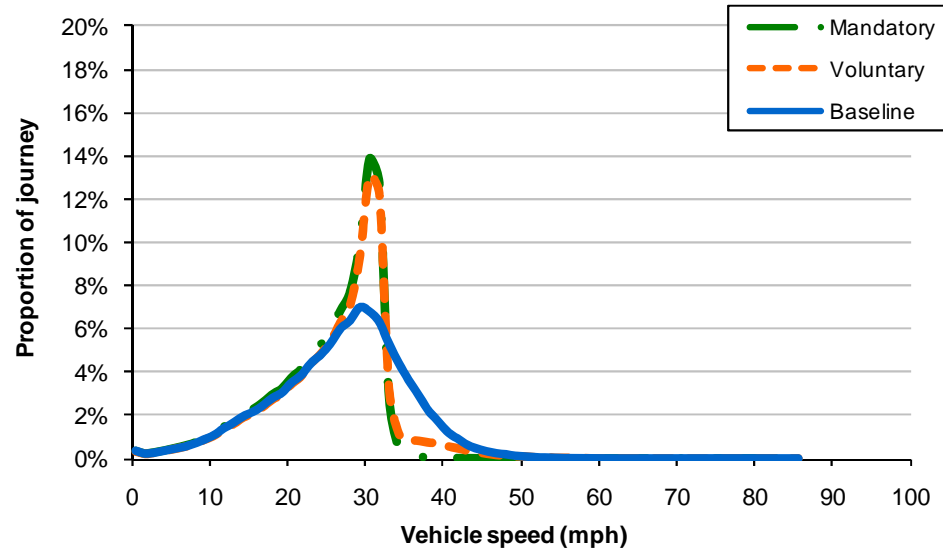


1 Hz



ISA-UK FOT

Aggregated speed profiles



	Baseline	Voluntary	Mandatory
85th	34.83	31.70	31.17
Mean	26.70	25.97	24.93

	Baseline	Voluntary	Mandatory
85th	31.58	30.70	30.23
Mean	18.71	18.57	17.80

Brainstorming

- Group discussions [20 min]
- Brief presentation by each group [5 min]
- General discussion [5 min]

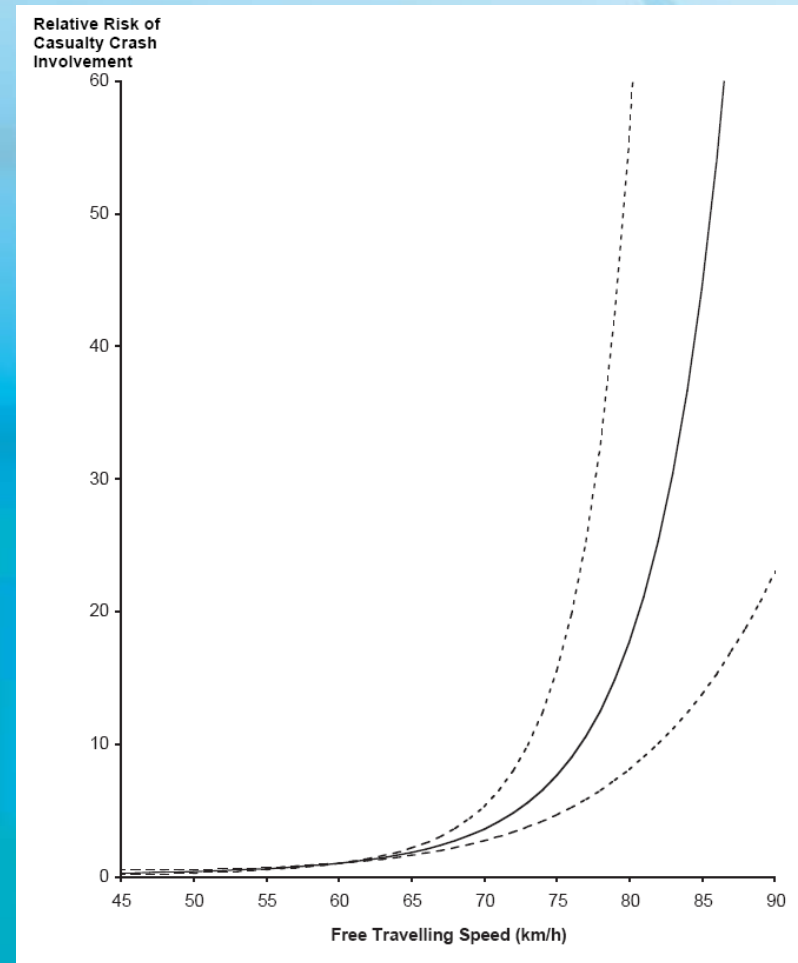
The effect of changes in vehicle speeds was analysed in two ways:

- Safety – distance based data
- CO₂ emission – time based data

ISA-UK data

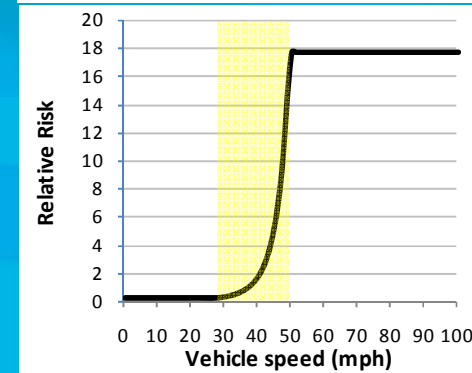
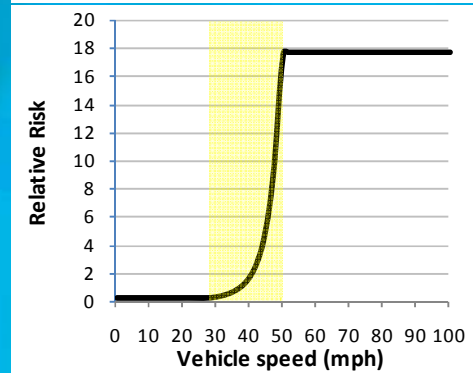
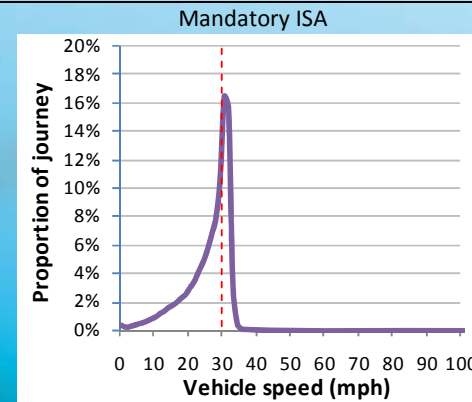
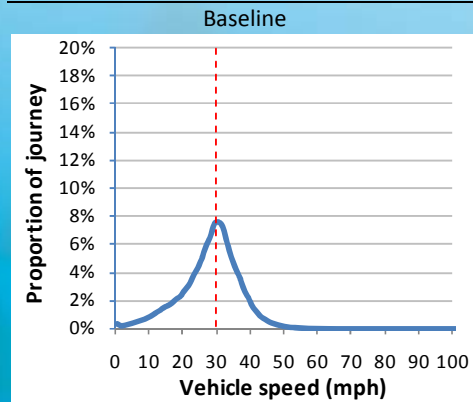
Implications for accident reduction

- Based on relationships between speed and crash risk (Kloeden et al, 2001; 2002)
- Different formulae for urban and rural roads



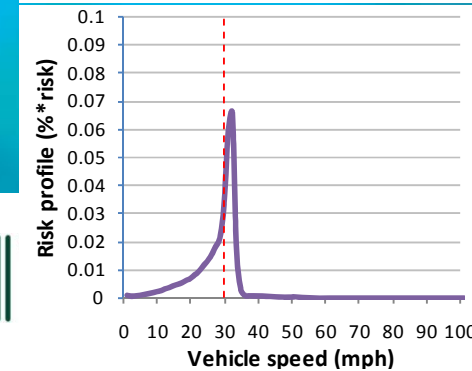
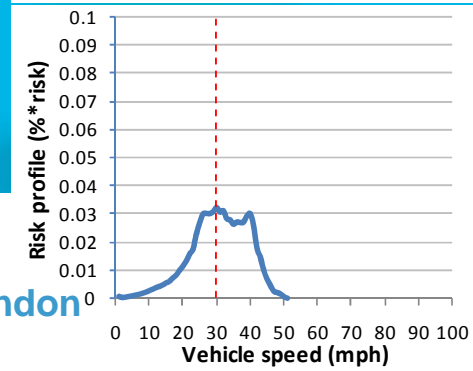
ISA-UK data

Estimation of accident reduction



Area under curve = 0.71

Area under curve = 0.33



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ISA-UK data

Accident reduction by system and road types



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Predicted accident reduction ratios by ISA variants and road types

Road Type	ISA Variant	Speed Limit					
		20 mph	30 mph	40 mph	50 mph	60 mph	70 mph
Unclassified roads	Advisory	0.95	0.98	0.97	0.98	1.00	–
	Voluntary	0.99	0.80	0.53	0.91	0.96	–
	Mandatory	0.38	0.59	0.39	0.91	0.96	–
B roads	Advisory	0.88	0.98	0.96	0.88	0.93	–
	Voluntary	0.70	0.76	0.69	0.85	0.88	–
	Mandatory	0.57	0.59	0.52	0.82	0.87	–
A roads	Advisory	–	0.98	0.98	0.87	0.89	0.97
	Voluntary	–	0.90	0.73	0.84	0.81	0.96
	Mandatory	–	0.46	0.42	0.73	0.77	0.87
Motorways	Advisory	–	–	0.98	0.84	–	0.92
	Voluntary	–	–	0.74	0.95	–	0.86
	Mandatory	–	–	0.32	0.66	–	0.75

ISA-UK data

The effect of market penetration

Predicted percentage of injury accidents saved with ISA

Penetration	Advisory	Voluntary	Mandatory
20%	0.5%	2.4%	5.8%
40%	1.1%	4.8%	11.6%
60%	1.6%	7.2%	17.3%
80%	2.2%	9.6%	23.1%
100%	2.7%	12.0%	28.9%

ISA-UK data

Implications for CO₂ emission

Two analysis approaches:

- Generalised Additive Modelling (GAM) – a statistical modelling technique
- Speed-emissions curves – a more traditional approach. Also the primary means of calculating road vehicle emissions in the UK

ISA-UK data

Effect on CO₂ emission

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

Unit: g/km

Let's get married...

Cost Benefit Analysis

COSTS

- Infrastructure costs
- in-vehicle costs

BENEFITS

- Savings from accident reduction
- Savings from emission reduction
- Fuel savings

Implementation Scenario	BCR
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Market Driven	3.4
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Authority Driven	7.4
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Conclusions

- How data could be used depends on the requirements of the intended analysis
- Time and distance based data are applicable in different ways but are complementary to each other.

Thank you for your attention!



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More information or want to cooperate?

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