Changing speed limits: Implications for road safety

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Speed and accidents

Simple physics

The relationship

- With an impact speed of 50mph, the likelihood of death for the car occupants is about 20 times that for an impact at 20mph (IIHS, 1987)
- Common Rule of Thumb*:

1% increase in mean speed =

2% increase in injury accidents rate

3% increase in severe accident rate

4% increase in fatal accident rate

- Variable depending on road type, speed variability and environment (Elvik et al., 2004)

* Nilsson (1990); Aarts & van Shagen (2006)

The purpose of speed limits

- **To Enhance Safety**

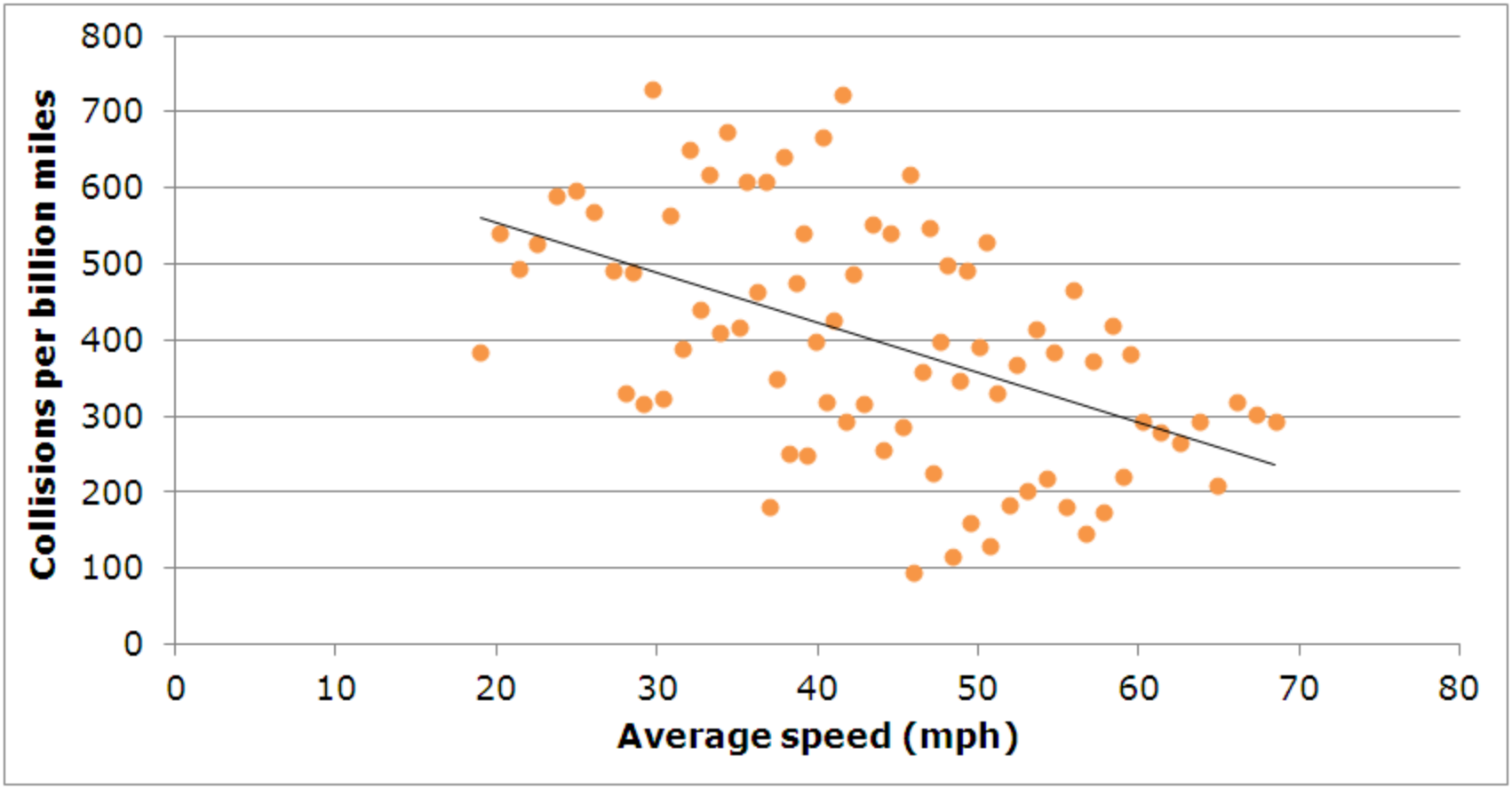
  The primary purpose of speed limits is to enhance safety by reducing the risks imposed by drivers' speed choices. The aim is to reduce disparities in speeds and reduce the potential for vehicle conflicts.

- **The Basis for Enforcement**

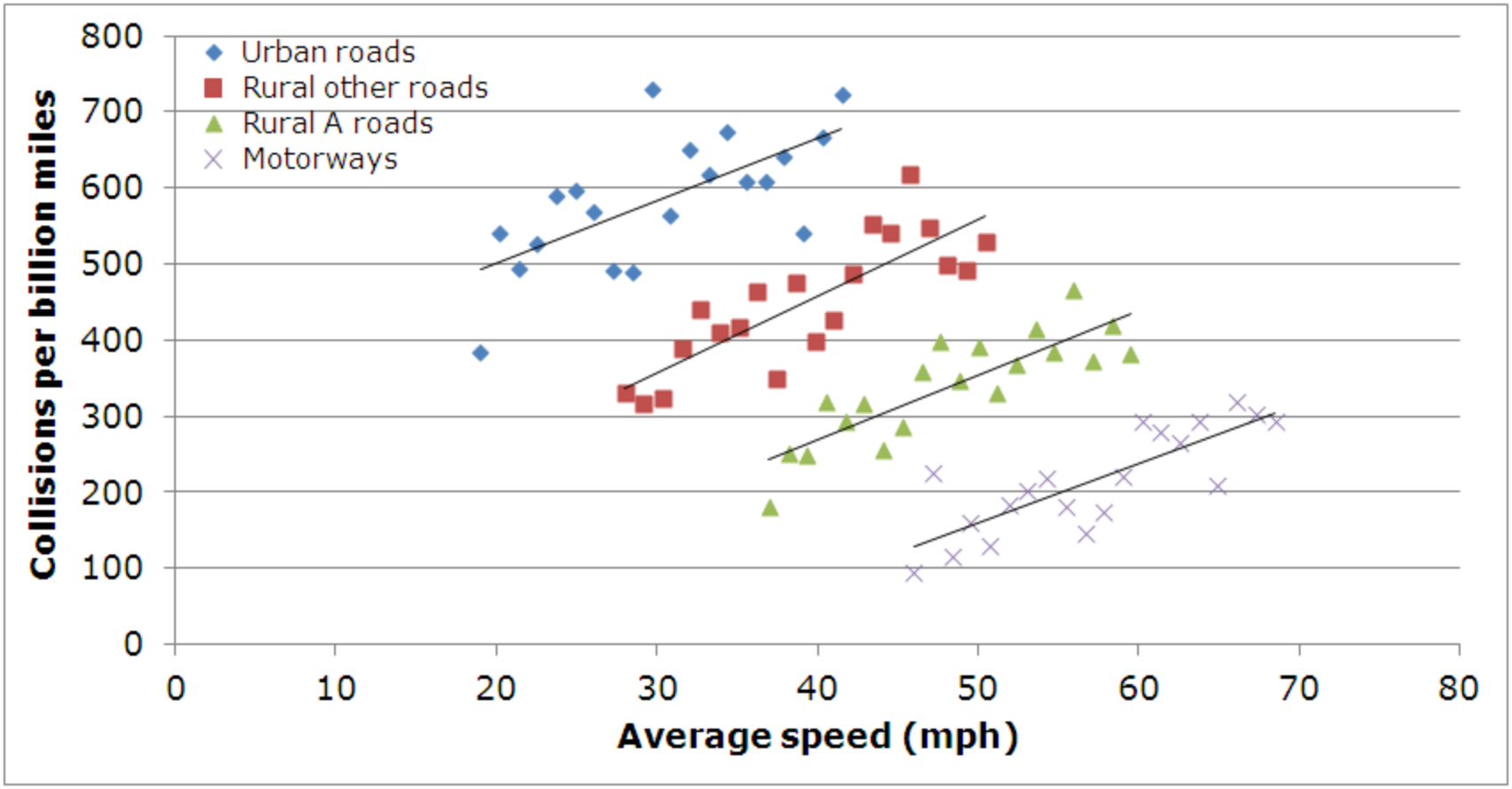
  A related function of speed limits is to provide the basis for enforcement and sanctions for those who drive at speeds excessive for conditions and endanger others.

- "**Speed limits should be evidence-led and self-explaining** and seek to reinforce people's assessment of what is a safe speed to travel. They should encourage self-compliance. Speed limits should be seen by drivers as the maximum rather than a target speed." DfT (2012)

Relationship between average speed and collision rate



Relationship between average speed and collision rate



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A summary of the evidence on the costs and benefits of speed limit reduction

Lawton, Charman, Kinnear, Ainge et al., (2012)

"Reducing a speed limit alone typically results in a change in average speed of as little as a quarter of the change in speed limit"

Evaluation for the Edinburgh Centre for Carbon Innovation, p2

What stops drivers driving faster?

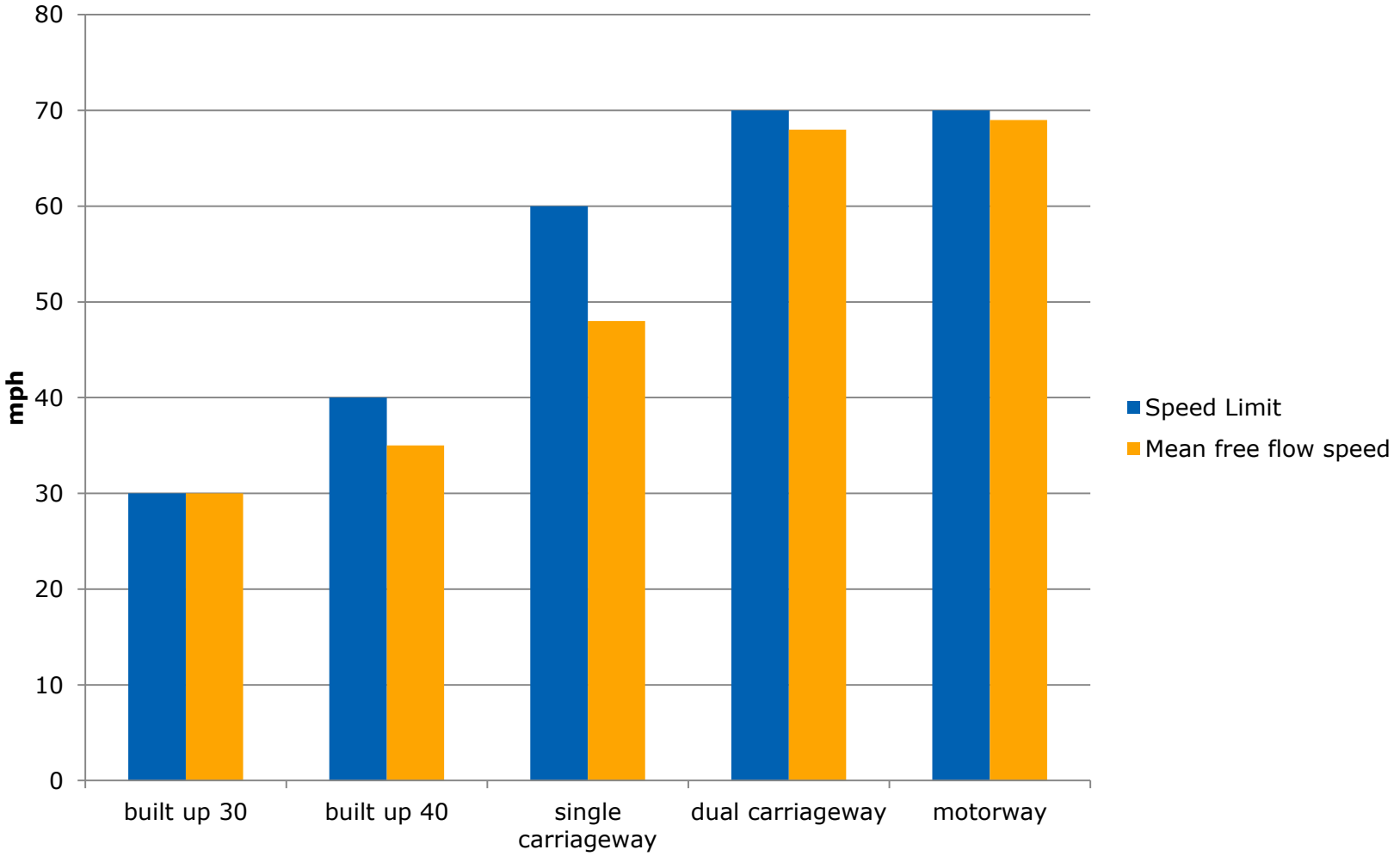
HUSSAR (2008): Quantitative and Qualitative reports

...because the driving task would feel more risky
...because the car would feel uncomfortable
...because of social pressure from passengers and other vehicles
...because an offence might be committed

"And again it was on the motorway, nobody else about, did it [high speed] for a couple of minutes, stopped whenever there was anything looking like it was getting too close. Just a bit too much sensory input for me, and a little bit too quick, even though feels like an empty road, it doesn't feel comfy"

"I think your body knows you're outside your comfort zone. It just registers something and you say 'back again' instantly, to whatever speed you're comfortable"

Free Flow Speeds 2011 – Mean speeds



Percentage of cars exceeding the speed limit

DfT Free Flow Speeds
http://www.dft.gov.uk/statistics/series/speeds/

	Built up 30 mph	Built up 40 mph	Single carriage-way 60 mph	Dual carriage-way 70 mph	Motor-way 70 mph
2011	47%	23%	8%	41%	49%
2001	65%	25%	9%	51%	55%

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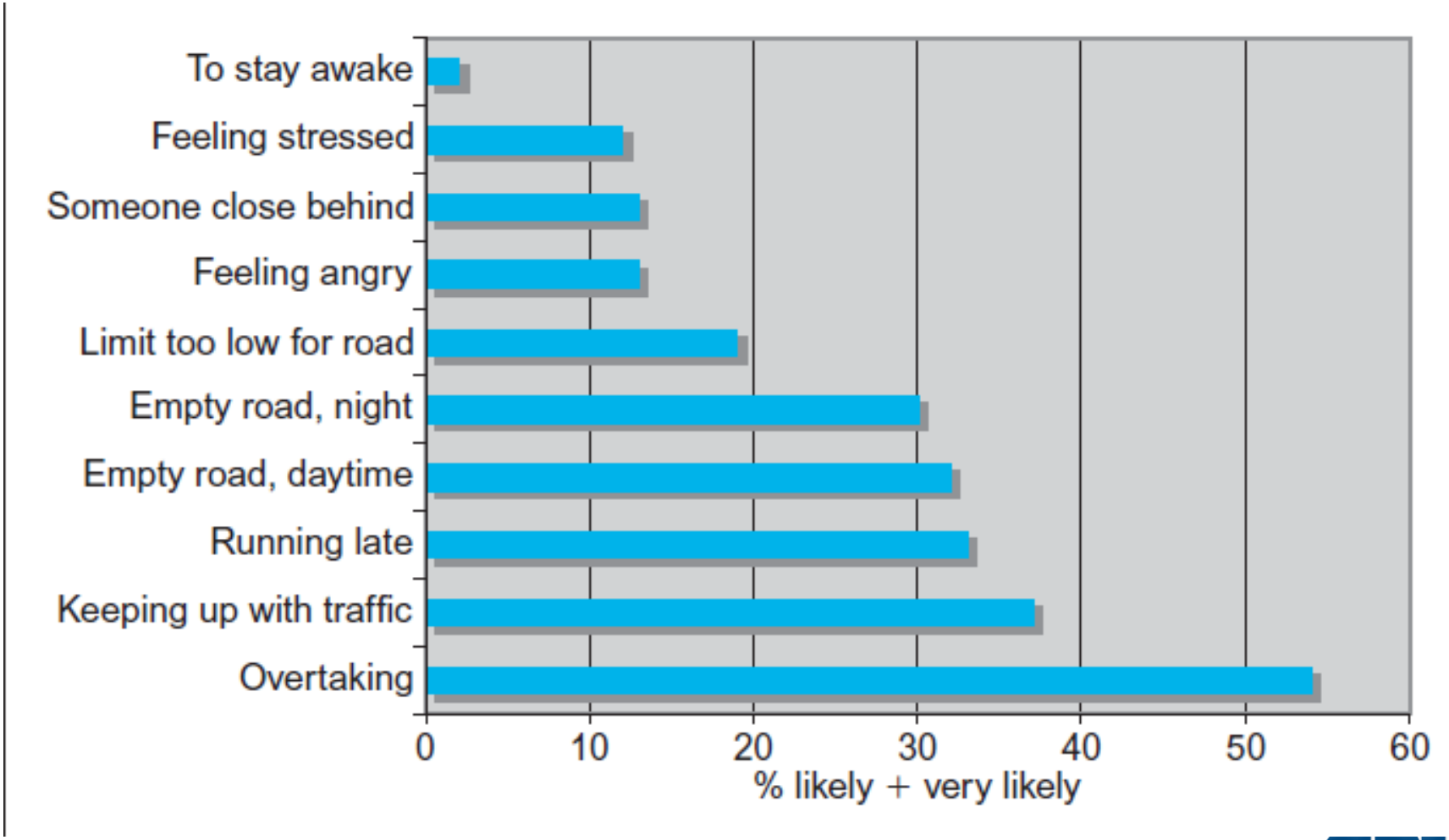
HUSSAR (2008) Speeder types

	Compliant	Moderate	Excessive
% of respondents	52%	33%	14%
Relationship with speed limits	Largely speed limit compliant	Regularly speed moderately but hardly ever excessively	Regularly speed over 10mph over the speed limit
Opportunistic	28%	78%	93%
Reactive	2%	8%	34%
Both reasons	2%	7%	33%
Male	48%	56%	85%
Age	Mainly older	⟷	Mainly younger

Reasons for speeding

HUSSAR (2008)



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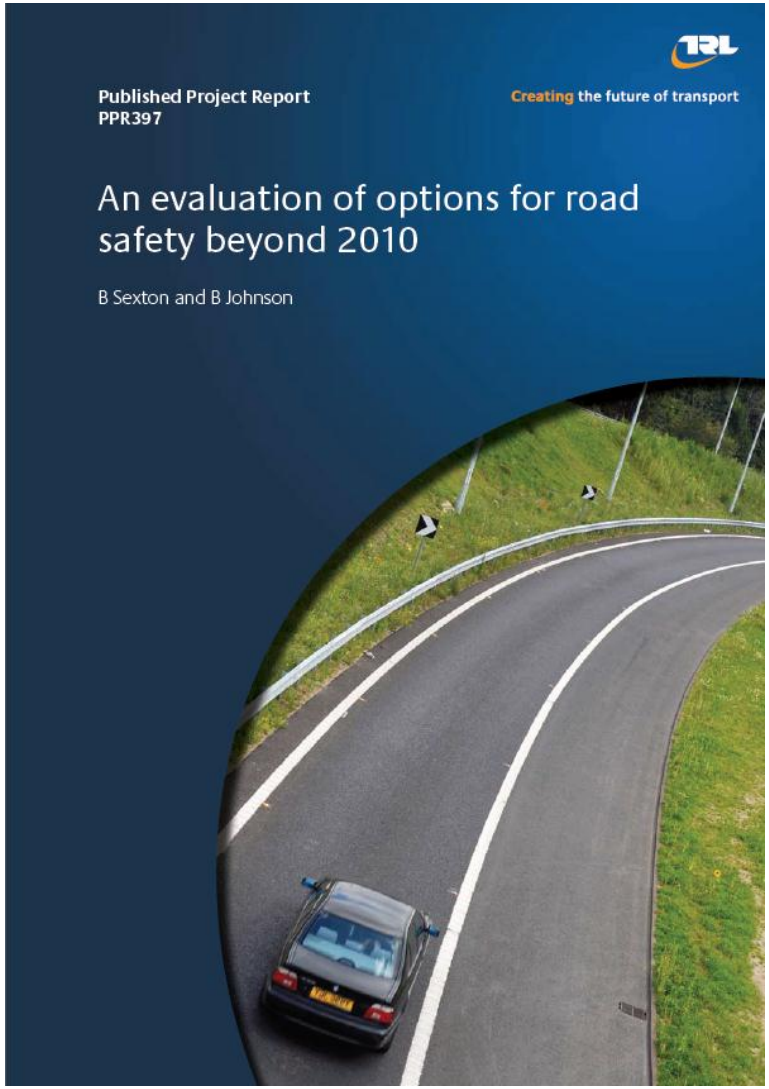
Road safety options beyond 2010



Background

- 2008 – 2009
- Development of post 2010 road safety strategy
- Selection and prioritisation of future activity
- DfT Steering Group
- Options identified for further investigation
- Lots of unavoidable assumptions required

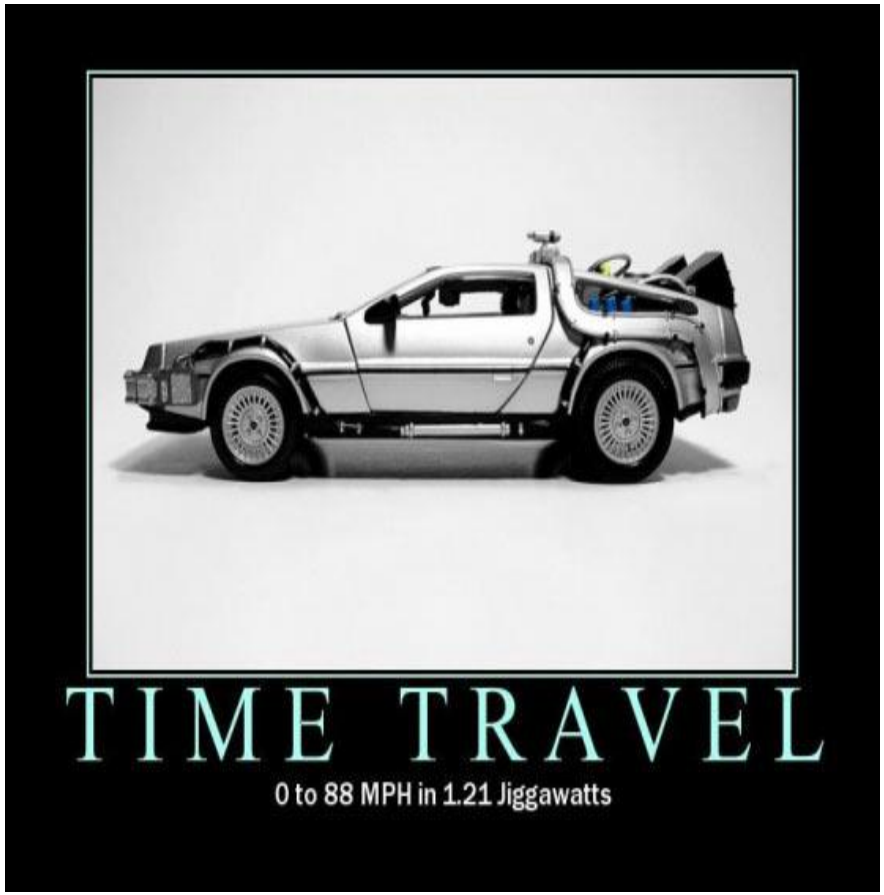
Research and politics

What was said

"Increasing the speed limit on motorways from 70 to 80 miles per hour for cars, light vans and motorcycles could provide hundreds of millions of pounds of benefits for the economy..."

DfT Press Release, 03/10/2011

The justification



What was said

Vehicles (and roads) have got safer since the current speed limit was set in 1965.
Safety is not the only consideration – there are hundreds of millions of pounds per year to be had from savings in travel time.
As 49% of motorists break the speed limit – it would 'restore moral legitimacy of the system'.

DfT Press Release, 03/10/2011

Increase the motorway speed limit to 80mph and improve compliance using average speed cameras

Costs and assumptions

- Large scale media campaign required
- Some sign replacement required
- Significant installation cost
- Maintenance & ongoing administration
- Increase in fuel duty
- All other vehicle speed restrictions remain in place (e.g. HGVs)
- Achieves full compliance
- 2.4mph increase in average speed

Impact on road users

- 18 additional lives lost per year
- 64 more serious injuries
- 363 more slight injuries
- Emissions increase (2% CO_2; 2% NO_x)
- Fuel consumption increase (2%)
- Decrease in journey time (4.1 minutes per hour)
- Net financial benefit of £1,251m over 10 years

NB journey time calculation does not include those currently exceeding 70mph as it is an illegal benefit

Motorway speed limits and carbon emissions

Life-cycle carbon in 2020	130kph (80mph)	100kph (62mph)
change vs REF* (MtCO2e pa)	+1.3%	-2.7%
change vs REF* (% over total)	+0.7%	-2.1%

*Current emissions from passenger cars in the UK = 70 MtCO2 per annum (DECC 2010)

UKERC

Anable, J. & Brand, C. (2011) UKERC Policy Brief: Speed limits and carbon emissions

TRL

Reduce the national motorway speed limit to 60mph and improve compliance using average speed cameras

Costs and assumptions

- Large scale media campaign required
- Some sign replacement required
- Significant installation cost
- Maintenance & ongoing administration
- Reduction in fuel duty
- All other vehicle speed restrictions remain in place (e.g. HGVs)
- Achieves full compliance

Impact on road users

- 94 lives saved per year
- 371 fewer serious injuries
- 2,376 fewer slight injuries
- Significant emission reductions (7% CO_2; 10% NO_x)
- Fuel consumption decrease (7%)
- Increase in journey time (6.8 mins per hour)
- Net loss of £7,577m over 10 years

Maintain the national motorway speed limit at 70mph and improve compliance using average speed cameras

Costs and assumptions

- Large scale media campaign required
- Significant installation cost
- Maintenance & ongoing administration
- Reduction in fuel duty
- All other vehicle speed restrictions remain in place (e.g. HGVs)
- Achieves full compliance

Impact on road users

- 37 lives saved per year
- 138 fewer serious injuries
- 817 fewer slight injuries
- Emission reductions (3% CO_2; 4% NO_x)
- Fuel consumption reduction (3%)
- Increase in journey time (3 minutes per hour)
- Net financial benefit of £1,251m over 10 years

NB journey time savings not included in financial calculation as excess speed is currently an illegal benefit

Reducing the national speed limit on single carriageway roads from 60mph to 50mph

Costs and assumptions

- Large scale media campaign required
- Cost of installing new signs and replacing others where necessary
- All other vehicle speed restrictions remain in place (e.g. HGVs)

Impact on road users

- 260 lives saved per year
- 1,045 fewer serious injuries
- 3,011 fewer slight injuries
- Slight emission reductions
- Slight fuel consumption decrease
- Increase in journey time (4%)
- Net financial loss of £149m over 10 years

Reducing the speed limit on more residential roads from 30mph to 20mph in certain metropolitan areas

Costs and assumptions

- Areas included: London, Manchester, Merseyside, South Yorkshire, Tyne and Wear, West Midlands, West Yorkshire, Strathclyde and Edinburgh
- 12% of suitable roads were already 20mph
- Impact on journey time assumed to be 5% and not included in calculations
- Costs include signage and media campaign

Impact on road users

- 38-84 lives saved per year
- 593-1,384 fewer serious injuries
- 5191-12,112 fewer slight injuries
- Slight emission increase
- Slight increase in fuel consumption
- Increase in journey time
- Net financial benefit of £578-2,202m over 10 years

Reducing the speed limit on residential roads from 30mph to 20mph

Evaluation and support

- Significant casualty reductions have been reported, for example:
  - 57% (Webster & Layfield, 2003);
  - 60% (Webster & Mackie, 1996);
  - 42% (Grundy et al., 2009)
  - 25% (SWOV, 2012)
- Reduction in traffic volume, noise and emissions leads to an increase in mobility and quality of life (SWOV, 2012; BMA, 2012)
- Increase in walking and cycling (WHO, 2006)

But...

- 20mph speed limits need to be introduced concurrently with traffic calming and/or enforcement to be effective (DfT, 2012)
- Most effective in areas where mean speed far exceeds 20mph (Burns et al., 2001)

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Differential Speed Limits

Speed limits on derestricted single carriageway roads in non built-up areas

Vehicle Type	Speed Limit (mph)
Cars & motorcycles (including car-derived vans up to 2 tonnes maximum laden weight)	**60**
Cars towing caravans or trailers (including car-derived vans and motorcycles)	**50**
Buses, coaches and minibuses (not exceeding 12 metres in overall length)	**50**
Goods vehicles (not exceeding 7.5 tonnes maximum laden weight)	**50**
Goods vehicles (exceeding 7.5 tonnes maximum laden weight)	**40**

Differential Speed Limits

Why have DSLs for HGVs?

For	Against
▪ Greater mass increases energy and momentum = longer braking distances ▪ Take longer to slow down ▪ Cause more damage and involved in more serious crashes ▪ DSLs help to offset these differences ▪ Empirical evidence hasn't been found to support arguments against ▪ Absence of evidence isn't the same as evidence of absence	▪ More interactions, more overtaking ▪ Frustration leading to risky overtaking? ▪ Higher seating position promotes earlier anticipation of on-road events? ▪ DSLs therefore not required and / or actually increase risk ▪ Empirical evidence hasn't been found to support arguments for ▪ Absence of evidence isn't the same as evidence of absence

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Summary

- There is a simple relationship between speed, accident rate and accident severity
- Driver speed choice is influenced by many factors which include their disposition to comply with speed limits
- The relationship between speed limits and accidents is mediated by the simple relationship between speed and accidents but is complicated by factors such as:
  - Driver types
  - Speed variation
  - Vehicle types
  - Emission regulations
  - Journey time
  - Communities and health
- "The cheapest intervention, and the one with large co-benefits, is speed reduction" (BMA , 2012, p26)

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Thank you

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