Road Safety Foundation

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Getting ahead

Returning Britain to European leadership in road casualty reduction

July 2008

Getting ahead

Foreword

by Lord Dubs of Battersea
Chairman, Road Safety Foundation

Like the public, Parliamentarians tend to talk about road safety almost exclusively in terms of the way we behave on the roads as drivers, pedestrians or cyclists. After all, over 90% of road casualties start with an error.

But to err is human. In rail and air safety it is assumed that even the best trained pilot or driver will make mistakes. The systems that surround the human being are designed to make errors unlikely and to ensure that the consequences of mistakes are not fatal.

On the roads, simple predictable everyday human errors routinely result in a death sentence.

In the last decade, there have been more than 375,000 fatal and serious crashes. Thousands of stretches of road see the same human errors repeated year after year resulting in crashes that kill and maim.

Quite apart from the reservoir of suffering, the cost of road crashes wastes 1.5% of our entire GDP. This amount is, for example, worth more than we spend on primary schools or twice what we spend on GPs.

This policy paper describes how Britain can become the undisputed world leader in road safety. As in all leading countries, we have to act on ALL the components of a safe road system together – behaviour, vehicles, and roads. The government has been tightening traffic law, not least in the enforcement of speed limits. New vehicles have soared in their safety standards from a typical 2-star to 4-star and even 5-star car crash EuroNCAP safety ratings following the introduction of the programme in the 1990s.

As the government prepares its road safety strategy beyond 2010, this report proposes how we can now turn attention to the safety features built into our roads. The paper shows how we can quickly prevent around one-third of total deaths and serious injuries by detailed attention to safe road design alone. Britain can deliver this through a formal systematic '*Safe Road Infrastructure Programme*' which targets the safety deficiencies on our urban roads and particularly on a new programme for the busy 'A' roads outside towns, where so many of our road deaths are concentrated. This programme must be delivered by local authorities but there is an onus on central government to put the enabling framework in place.

A *'Safe Road Infrastructure Programme'* could save 10,000 deaths and serious injuries a year. The total savings in crash costs from the programme would be worth 0.5% of GDP. The programme should win wide support, not just because it saves lives and disabling injuries, but because it is quick, certain, and affordable with an investment return that few, if any other programmes, can match.

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1. The Scale and Cost of Britain's Road Casualties

The end of 2010 will show whether or not both British and European road safety goals for the decade have been met. The British target is for a 40 per cent reduction in annual deaths and serious injuries at the end of the decade compared with the 1994-1998 period. The European target is for a 50 per cent reduction in annual road deaths by the end of the decade compared with the beginning.

The British government is currently beginning a major road safety strategy review and calling for contributions as it looks to define new goals and actions for the period beyond 2010.

In the immediate past decade some 375,000 Britons have been killed and seriously injured on the roads (Transport Statistics Great Britain 2007, DfT 2007). Some 1.5 per cent of entire British GDP is lost annually to road crashes worth £18bn (Highways Economic Note 1, DfT 2007 with GDP and price inflator; Table 1.1. United Kingdom National Accounts, The Blue Book, ONS 2007).

The £18bn estimated cost of road crashes excludes the substantial disruption and economic cost of road accidents. The additional costs on heavily trafficked motorways and 'A' roads are substantial and amount to many billions more. The £18bn economic figure includes the costs to emergency services and health and social care costs, particularly the costs of long term care to those disabled in road crashes (HEN1, 2007). Road crashes are the leading cause of death in young adults and the age profile of road victims is such that they can readily require half a century of care with much reduced quality of life.

In as much as money can ever describe the sudden, violent nature of road crashes, the economic costs also include the cost of pain, grief and suffering as awarded by courts.

2. Britain's Pioneering Role

For much of the 20th century, Britain was an international leader in reducing road casualties. Whilst almost everyone has a view to share on how road deaths can be prevented, Britain's outstanding performance was built on the bedrock of pursuing policies built on research evidence.

In the 1980s, the Department for Transport pioneered the use of targets in Government to mobilise and manage a national effort to reduce road casualties. The essential achievement of a well researched and stretching target to reduce deaths by 33 per cent by the end of the century won deserved praise. This process has been widely copied across Europe and internationally with repeated success and is documented in international best practice (for example, World Report on Road Traffic Injury Prevention, WHO 2004).

3. The Second National Casualty Reduction Target

Britain's second national casualty reduction target, launched at the start of the decade, aimed to reduce deaths and serious injuries by 40 per cent by 2010.

Progress is in the right direction. By mid-decade at end 2005, deaths, which are usually well defined and recorded in most of Europe and used for international comparisons, had however fallen by only 11 per cent at the time of the major European Commission mid-term review of performance across Europe.

The recorded number of seriously injured had numerically fallen in line with the published target, by 33 per cent by end-2006 (Tomorrow's roads – safer for everyone: The second three-year review, DfT 2007), but it is improbable that a sudden and unexpected de-coupling of the rate of deaths and serious injuries has occurred. There are more likely explanations to be found in examining changes in the way crash statistics are reported, classified and recorded. The Road Safety Foundation raised this complex issue with government in the late 1990s and the government is properly researching it (e.g., Road Safety Research Report No. 69, Under-reporting of Road Casualties – Phase 1, www.dft.gov.uk/pgr/roadsafety/research/rsrr/theme5/underreportingofroadcasual.pdf) and increasingly focusing on the number of deaths as the reliable indicator.

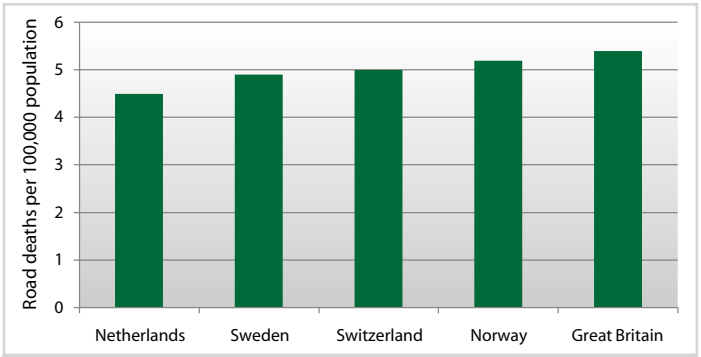
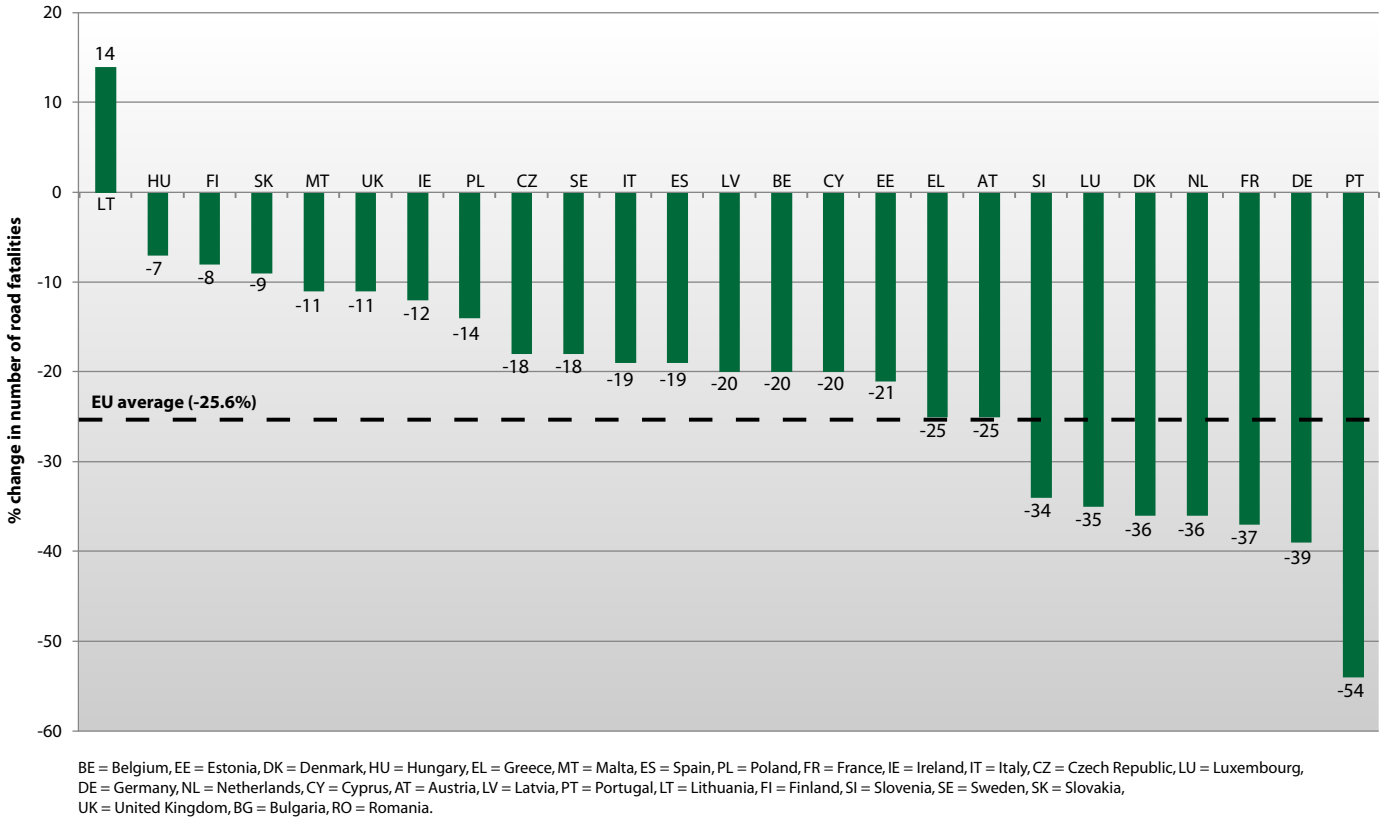


Figure 1. Comparative safety in high performing European countries, 2007



BE = Belgium, EE = Estonia, DK = Denmark, HU = Hungary, EL = Greece, MT = Malta, ES = Spain, PL = Poland, FR = France, IE = Ireland, IT = Italy, CZ = Czech Republic, LU = Luxembourg, DE = Germany, NL = Netherlands, CY = Cyprus, AT = Austria, LV = Latvia, PT = Portugal, LT = Lithuania, FI = Finland, SI = Slovenia, SE = Sweden, SK = Slovakia, UK = United Kingdom, BG = Bulgaria, RO = Romania.

Figure 2. Evolution of road fatalities, 1996 versus 2005

4. Britain's Safety Record in Comparison with other European Countries

In 2001, by the standard measure of deaths per head of population, Britain had the safest roads in Europe. Figure 1 gives the latest figures published in June 2008 by IRTAD (www.internationaltransportforum.org/Press/PDFs/2008-06-09IRTAD.pdf). These figures show Britain ranking behind Netherlands, Sweden, Switzerland and Norway on 2007 data.

At end June 2008, the Department for Transport published the main results for end-2007 which encouragingly showed that British deaths had fallen by some 7 per cent between 2007 and 2006 bringing the UK performance to 5.0 per 100,000 population, the UK's lowest on record for road deaths (Road Casualties in Great Britain: Main Results: 2007, DfT 2008).

Britain's position alongside the Netherlands and Sweden as the top three performers had been a fixture of international benchmarking for many years. However, the EC highlighted in the mid-term review that Britain's rate of improvement in comparison with most other countries was below average in the first half of the decade (Figure 2, CARE Database and EC national publications, 2007; ec.europa.eu/transport/roadsafety_library/care/doc/safetynet/2007/bfs2007_sn-kfv-1-3-mainfigures.pdf).

Britain's disappointing rate of improvement held broadly true whether countries start from a low or high rate of road deaths. If this faster improvement were only by countries with a poor safety record, Britain might have taken comfort that this was an inevitable 'catching up'. However, some of the best countries have also improved quickly. It remains to be seen whether the encouraging 2007 British figures are sustained and whether other countries also sustain their recent improvement.

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5. Britain's Performance in Safe Infrastructure on Main Roads

5.1. Ten Year Analysis (1997-99 to 2004-06)

Since 2002, the Road Safety Foundation has been mapping and tracking the rate of death and serious injury on Britain's main roads and motorways as part of the European Road Assessment Programme (EuroRAP).

The Road Safety Foundation's mapping has illustrated the risks faced by individual road users of being involved in a crash resulting in fatal or serious injuries.

The network on which mapping and tracking has taken place is the primary route network - the motorways and the 'A' roads with green road signs. The network excludes a small length of primary route in urban cores, typically inside the inner ring road of major cities, where allocating crashes to a specific route is not straightforward. The network is approximately 22,000kms long and accounts for around a third of all British road deaths.

The annual Performance Tracking of the change in risk over each of the last 5 years has allowed a robust picture to emerge of the routes that have improved over time and those routes that have stayed persistently higher risk. The Foundation has worked closely with national and local road authorities to build a statistical base of major changes alongside records of the countermeasures adopted by authorities. These show the engineering, enforcement and education measures that have been particularly effective and document the challenges faced in ensuring that Britain's road infrastructure is safe.

For this report, the Foundation has analysed 10 years of data on over 850 separate road sections over the length of the primary route network. The data spans the period 1997 to 2006 and permits identification of where the greatest gains have been made over the decade, and where room for improvement still exists.

Progress is being made and Britain's roads are getting safer. In the period 1997-1999 there were 21,575 fatal and serious crashes resulting in death or serious injury. In 2004-2006, this dropped by one-fifth to 17,345.

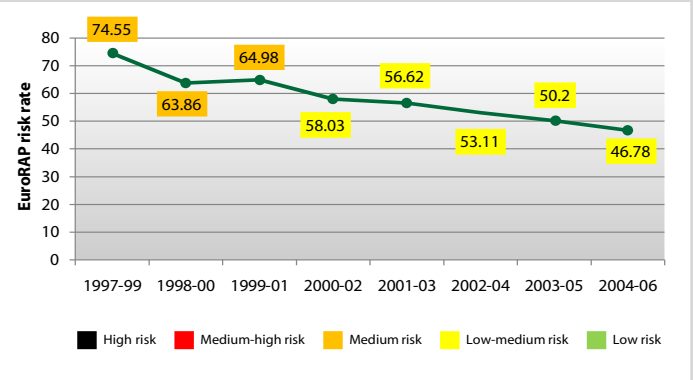

Figure 3. EuroRAP risk over time (number of fatal or serious crashes per bn veh km 1997-99 to 2004-06)

Figure 3 shows how the average risk rate, in terms of the number of fatal and serious accidents per billion vehicle kilometres travelled, has changed over time. Based on rolling three year data, results show an initial unstable period followed by a steady reduction, with an overall shift in average risk of 37 per cent (1997-99 compared with 2004-06) from the medium to the low-medium category.

A comparison of risk distribution across the network in the first and latest data periods reveals a positive shift to the lower risk categories (Figure 4). Road sections rated as high risk (black), medium-high risk (red), and medium risk (orange) fell by 64 per cent, with a concomitant rise of 24 per cent in the two safest risk categories (yellow and green).

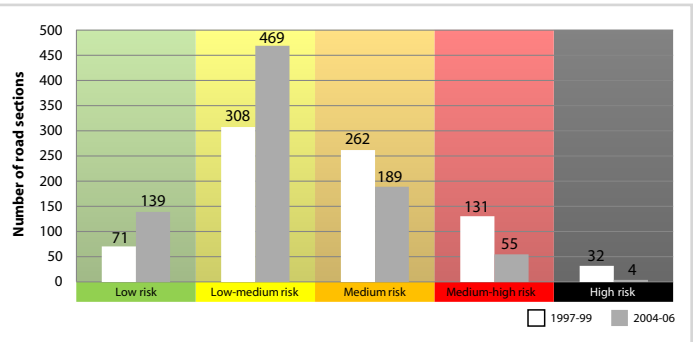

Figure 4. Evolution of risk distribution (1997-99 and 2004-06)

Table 1 splits results by national/regional authority jurisdiction and carriageway type. The greatest overall accident saving has been made on single and mixed (single and dual sections) carriageways under national jurisdiction. Here fatal and serious crashes have fallen by 27 per cent since 1997-99. On dual carriageways, in contrast, these types of crashes have fallen just 9 per

	Number fatal & serious collisions			Risk rate (no. fatal & serious collisions per bn veh km)		
	1997-99	2004-06	% change	1997-99	2004-06	% change
Motorways	3,078	2,647	-14	17.16	11.45	-33
Trunk Duals	1,758	1,604	-9	34.23	23.43	-32
Primary A Duals	2,235	1,661	-26	60.43	34.17	-43
Trunk Mixed & Singles	3,577	2,612	-27	93.90	50.59	-46
Primary Mixed & Singles	10,855	8,763	-19	87.03	61.67	-29

Table 1. Trends by national/regional authority jurisdiction and carriageway type

cent, with motorways showing a reduction of 14 per cent. Over the period 1997-99 to 2004-06 fatal and serious crashes on the trunk road network have fallen by 1,550.

On roads under local authority jurisdiction, fatal and serious crashes have fallen by 2,666, with a 26 per cent reduction on dual carriageways and a 19 per cent reduction on single and mixed carriageways.

However, despite the progress, there are three major issues.

Firstly, comparisons between the first (1997-99) and the latest data period (2004-06) show a 20 per cent reduction in the number of fatal and serious collisions over the last 10 years. This annual fall is low by recent European standards as discussed in section 4.

Secondly, as discussed in section 3, the extent to which the fall in deaths and serious injuries is due to reporting changes and other issues in the recording of serious injuries is unknown. The reliable indicator of progress which can be used to compare progress with other countries – the number of deaths – has fallen by only 3 per cent on the network over the last 6 year period for which fatality figures are available.

Thirdly, it is reasonable to assume that the busy primary route network defined as 'the most satisfactory national routes for through traffic between places of importance', should be managed to the highest standards of safety. The latest results published in 2008 show that there is still progress to be made, as discussed in section 5.2.

5.2. British Results 2008 (2001-03 to 2004-06)

The results of the latest Risk Mapping and Performance Tracking analysis for GB by the Road Safety Foundation were published on 30 June 2008 (see www.eurorap.org/gb2008). This used the latest collision and traffic flow data available, covering the three year period 2004-2006.

Notwithstanding the 18 per cent reduction in the average risk rate in 2004-06 compared with 2001-03, there remains cause for concern.

Despite significant advances in knowledge, engineering practice and road safety countermeasures, 30 per cent of the primary route network failed to rate in the safest two risk categories (low-medium and low risk) that we would expect as the minimum safety level for these strategic roads. Moreover, 24 per cent of motorway sections fell outside of the safest risk band. The full risk map of Britain's motorways and main roads is shown in Figure 5.

Results of Performance Tracking are detailed in Tables 2-4 and show:

- Britain's most improved roads (2001-2003 vs. 2004-2006)
- Britain's persistently higher-risk roads (2001-2003 & 2004-2006)
- Britain's highest risk roads with high numbers of fatal and serious collisions involving motorcyclists (2004-2006)
- Britain's highest risk roads when collisions involving motorcyclists are removed (2004-2006)
- Britain's highest risk road sections in each UK Government Office Region (2004-2006)

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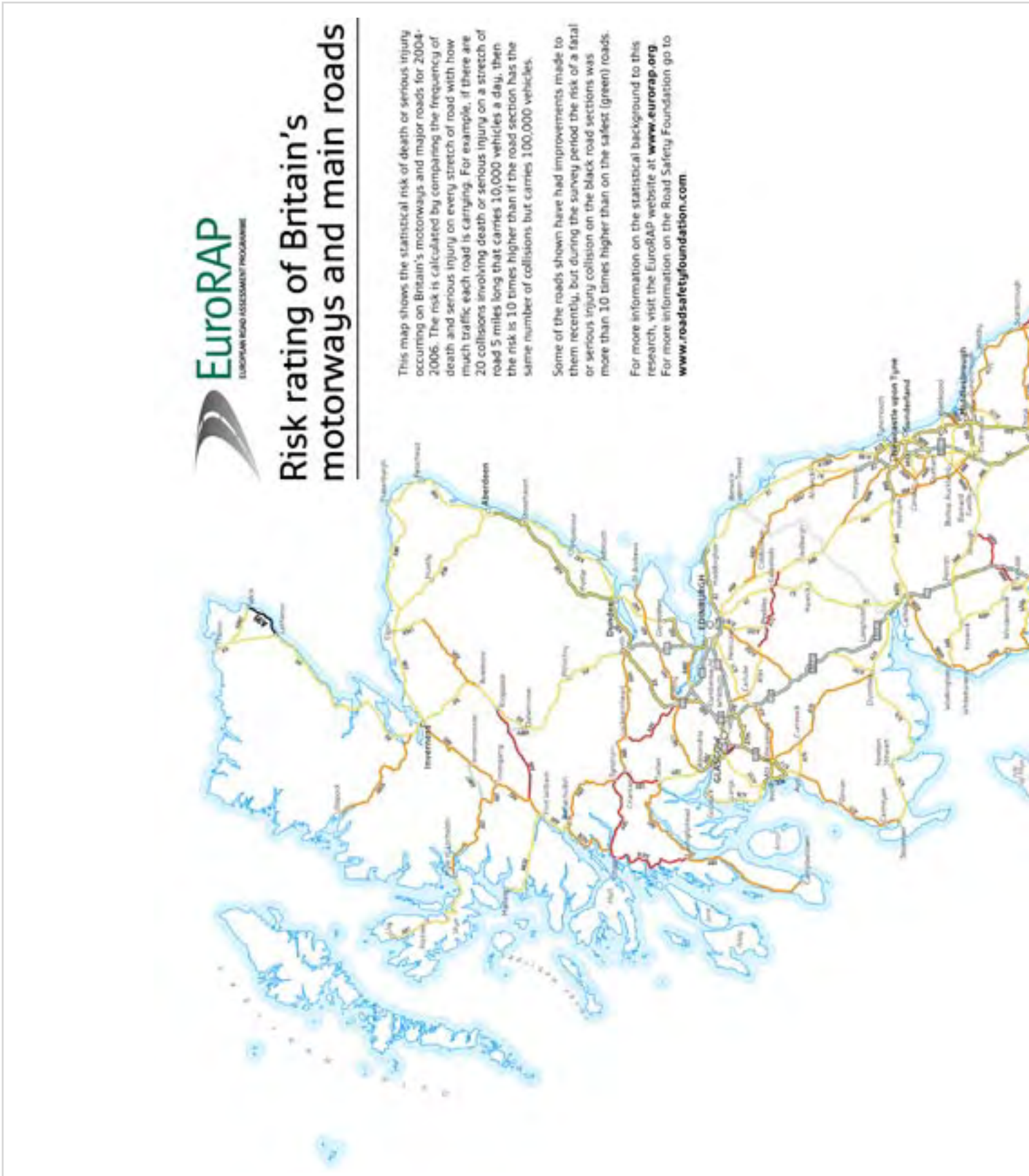

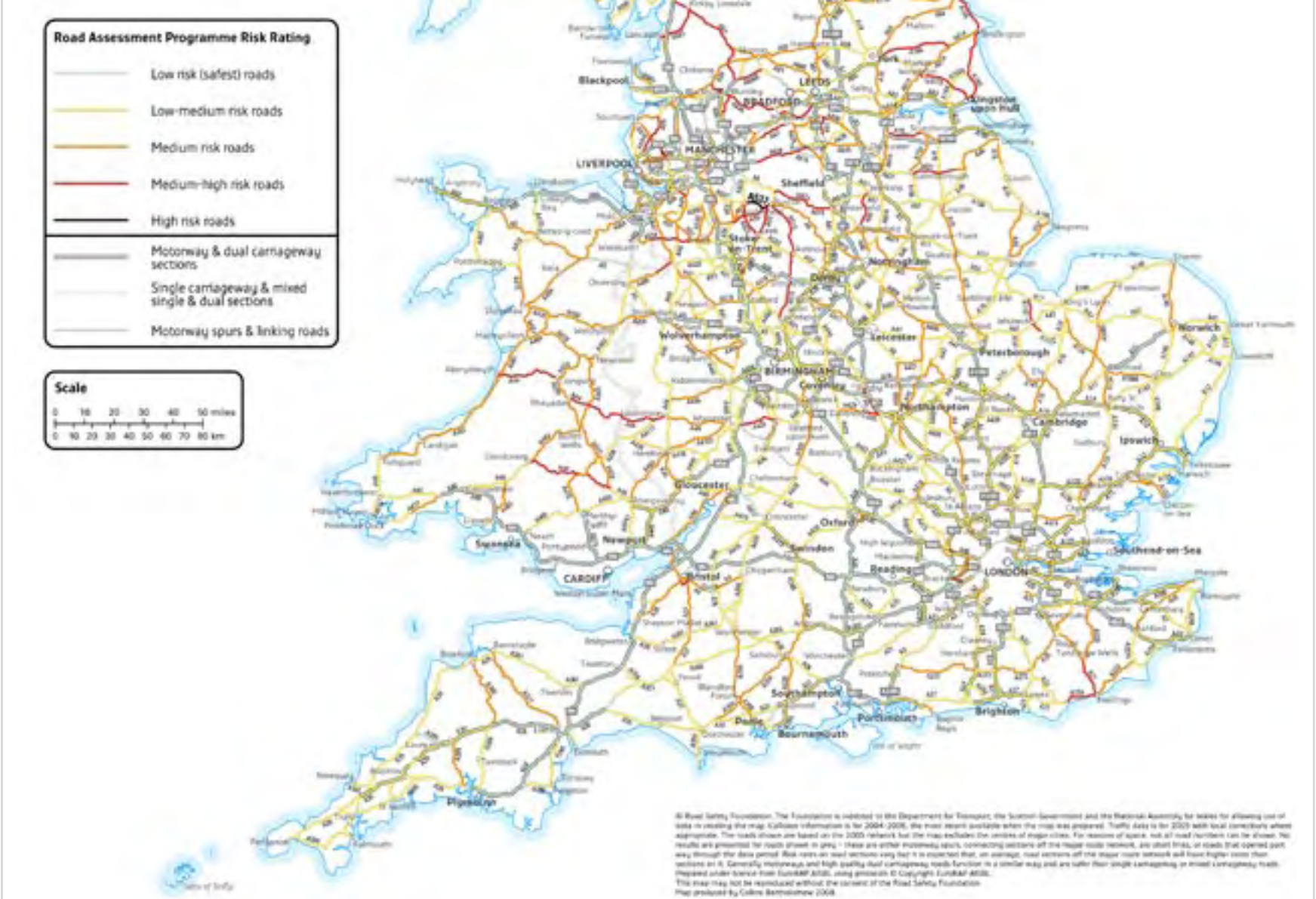

Figure 5. Risk rating of Britain's motorways and main roads (2004-06)

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Road No.	Description	Region/country	km	Road type	No. F&S collisions 2001-03	EuroRAP Risk Rating 2001-03	No. F&S collisions 2004-06	EuroRAP Risk Rating 2004-06	% decrease in no. F&S collisions	Measures implemented include:
A453	A38 - Tamworth	WM	5	Single	8	82.71	1	9.43	-88	Traffic lights, speed limit reduction, village gateway treatment, central islands and improved pedestrian facilities
M6	M6 J16 - J17	NW	10	Motorway	32	28.89	8	6.78	-75	Surfacing, junction improvements, signing
A602	Ware - Stevenage	E	15	Single	28	82.60	8	23.39	-71	Surfacing, markings, advanced warning signs
A120	Puckeridge – Braintree*	E	40	Single	59	64.45	19	20.00	-68	Junction improvements, markings and signing
A8	M8 J6 - J8	Scot	10	Dual	18	28.35	6	8.71	-67	Hard shoulders, junction improvements, continuous central barrier
M4	M4 J1-J3	SE	9	Motorway	20	21.10	7	7.35	-65	Motorcycle access to bus lane, signing, revised speed limit
A249	Maidstone - Sittingbourne	SE	13	Dual	33	69.39	13	26.92	-61	Junction improvements, speed limit reduction, resurfacing, lighting, pedestrian facilities
A53	Shrewsbury - Stoke-on-Trent	WM	48	Single	32	62.41	13	23.95	-59	Bend signing, surfacing, pedestrian crossing facilities
M25	M25 J25 - J26	SE	6	Motorway	22	33.79	9	11.86	-59	Holmesdale Tunnel Refurbishment, parapet upgrades
A605	A14 Thrapston - A1 Peterborough	EM/E	24	Single	31	64.08	13	25.17	-58	Speed limit reduction, roundabouts and junction enhancements, signing and marking, VAS, fixed and mobile cameras
M27	M27 J8 - J12	SE	19	Motorway	37	17.61	16	7.16	-57	Improved signaling, motorcycle-friendly crash barrier improvements, speed limit reduction
A41	Hemel Hempstead - Aylesbury	SE/E	26	Mixed	52	63.88	25	29.15	-52	Completion of Aston Clinton Bypass
A40	St Clears - Fishguard	Wales	56	Single	51	90.78	25	40.80	-51	Markings, speed limit reduction, resurfacing, signing, junction improvements
A47	Norwich - Gt Yarmouth	E	39	Mixed	45	36.73	23	17.13	-49	Speed limit reduction, VAS, resurfacing, signing, edge of carriageway markings and warning lines
A30	Bodmin (A38) - A390*	SW	41	Mixed	37	37.98	19	19.20	-49	Surfacing, markings, reflective road studs, temporary speed limits as part of the Bodmin to Indian Queens major improvement scheme
M11	M11 J8 - J9	E	49	Motorway	58	20.81	31	10.29	-47	Completion of Great Dunmow Bypass, "Keep Your Distance" carriageway chevrons, warning signs
A46	Leicester - Bingham	E	30	Mixed	48	65.21	26	34.74	-46	Junction improvements
M6	M6 J17 - J20	NW	28	Motorway	60	19.09	36	10.74	-40	Signing, "Keep Your Distance" carriageway chevrons, lighting, junction improvements, surfacing

Ranked by percentage reduction in the number of F&S collisions from 2001-03 to 2004-06; significant reduction at the 98% level; section lengths are greater than 5km; minimum number of 6 F&S collisions 2001-03, minimum collision density of 1 F&S/mile 2001-03; EuroRAP risk rating based on the number of F&S collisions/billion vehicle kms travelled: green (low risk), yellow (low-medium risk), orange (medium), red (mediumhigh), black (high); * appeared in 'Britain's most improved roads' list published June 2007; VAS = Vehicle Activated Signs; measures implemented based on road authority responses to pre-publication consultation.

Table 2. Britain's most improved roads (2001-2003 vs. 2004-2006)

Road No.	Description	Region/country	km	Road type	No. F&S collisions 2001-03	EuroRAP Risk Rating 2001-03	No. F&S collisions 2004-06	EuroRAP Risk Rating 2004-06	% change in no. F&S collisions	% contribution of collision types (2004-2006)				
										Junctions	Head-ons	Run-offs	Peds/cyclists	Other
A537	Macclesfield – Buxton	NW/EM	13	Single	22	303.03	21	250.45	-5	19	19	10	5	48
A683	M6 J34 - Kirkby Lonsdale*	NW	24	Single	20	303.03	22	171.14	10	23	23	23	0	32
A61	Barnsley – Wakefield	Y&H	10	Single	18	138.10	22	164.14	22	32	5	23	14	27
A54	Congleton – Buxton*	NW/EM	24	Single	20	195.25	18	161.39	-10	11	44	22	6	17
A84	M9 J10 – Lochearnhead	Scot	44	Single	29	155.95	29	134.10	0	28	21	17	17	17
A5	Daventry - Rugby (A428)*	EM/WM	16	Single	12	112.64	15	127.82	25	33	20	7	7	33
A726	M77 J3 to Paisley*	Scot	7	Mixed	23	153.00	18	120.27	-22	22	6	17	44	11
A570	St Helens - M58 J3	NW	10	Dual	17	113.28	18	118.77	6	33	6	17	28	17
A53	Leek – Buxton*	WM/EM	20	Single	16	151.22	13	118.03	-19	15	15	46	15	8
A671	Burnley - A59 Whalley*	NW	10	Single	24	152.99	18	117.43	-25	22	11	11	44	11
A644	Dewsbury - M62 J25*	Y&H	9	Single	20	120.41	19	115.26	-5	42	11	16	26	5
A1079	Mkt Weighton – Hull*	Y&H	32	Single	65	127.53	62	113.85	-5	40	5	6	47	2
A1101	Outwell (A1122) - Long Sutton (A17)	EM/E	21	Single	24	119.76	25	113.01	4	40	24	0	28	8
A619	Chesterfield – Baslow	EM	15	Single	22	111.98	20	111.97	-9	20	15	10	40	15
A166	York – Driffield*	Y&H	40	Single	37	144.88	29	108.46	-22	31	24	14	3	28
A646	Burnley – Halifax	NW/Y&H	34	Single	46	114.48	45	108.16	-2	36	16	4	33	11
A533	A49 - A56*	NW	5	Single	7	141.03	6	107.21	-14	50	0	50	0	0
A631	Gainsborough - A1103*	EM	24	Single	20	141.03	17	106.16	-15	35	12	41	6	6
A623	Baslow - Chapel-en-le-Frith	EM	22	Single	22	134.64	17	104.63	-23	35	18	24	6	18
A515	Lichfield – Buxton	WM/EM	73	Single	58	126.94	17	103.24	-7	31	28	20	9	11
A65	Long Preston - M6 J36	NW	42	Single	46	130.49	40	102.54	-13	35	38	10	3	15

Ranked by EuroRAP Risk Rating 2004-06; no significant reduction in the number of F&S collisions between data periods; section lengths are greater than 5km; minimum of 6 F&S collisions 2001-03 and 5 2004-06; minimum collision density of 1/mile in both periods; EuroRAP Risk Rating above average of the medium-high (red) category or high risk (black) in both periods; EuroRAP Risk Rating based on the number of F&S collisions/billion vehicle kms travelled; * appeared in 'Britain's consistently higher risk roads' list published June 2007.

Table 3. Britain's persistently higher risk roads (2001-2003 & 2004-2006)

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Road No.	Description	Region/country	km	Road type	No. F&S collisions involving motorcyclists	% of F&S collisions on section	% change in F&S collisions involving motorcyclists (2001-03 vs. 2004-06)	EuroRAP Risk Rating (All vehicles)	Contribution to EuroRAP Risk Rating from motorcyclists	% of motorcycle collisions by collision type				
										Junctions	Head-ons	Run-offs	Peds/cyclists	Other
A537	Macclesfield – Buxton	NW/EM	13	Single	15	71	-25	250.45	178.89	20	20	13	0	47
A683	M6 J34 - Kirkby Lonsdale	NW	24	Single	12	55	-20	171.14	93.35	33	25	8	0	33
A54	Congleton – Buxton	NW/EM	24	Single	8	44	-38	161.39	71.73	13	50	25	0	13
A84	M9 J10 – Lochearnhead	Scot	44	Single	11	38	10	134.10	50.86	9	36	18	18	18
A72	Blyth Bridge – Galashiels	Scot	44	Single	12	41	9	121.29	50.19	25	17	33	0	25
A515	Lichfield – Buxton	WM/EM	73	Single	26	48	24	103.24	49.71	38	23	31	0	8
A166	York – Driffield	Y&H	40	Single	13	45	0	108.46	48.62	31	15	15	0	38
A259	Hastings – Eastbourne	SE	19	Single	17	36	42	120.05	43.42	53	0	6	0	41

Ranked by contribution to total risk from collisions involving motorcyclists 2004-06; no significant reduction in the number of F&S collisions involving all vehicle or motorcyclists only between 2001-03 vs. 2004-06; section lengths are greater than 5km; minimum of 8 F&S collisions involving a motorcyclist 2004-06; minimum collision density (all vehicles) of 1/mile 2004-06; EuroRAP Risk Rating (all vehicles) medium-high (red) or high risk (black) in 2004-06; % total F&S collisions involving motorcyclists >33% 2001-03 and 2004-2006; EuroRAP Risk Rating based on the number of F&S collisions/billion vehicle kms travelled.

Table 3a. Britain's highest risk roads with high numbers of fatal and serious collisions involving motorcyclists (2004-2006)

Road No.	Description	Region/country	km	Road type	No. F&S not involving motorcyclists	% of F&S collisions on section	% change in F&S collisions involving motorcyclists (2001-03 vs. 2004-06)	EuroRAP Risk Rating (All vehicles)	Contribution to EuroRAP Risk Rating from nonmotorcyclists	% of non-motorcycle collisions by collision type				
										Junctions	Head-ons	Run-offs	Peds/cyclists	Other
A61	Barnsley – Wakefield	Y&H	10	Single	17	77	6	164.14	126.84	29	6	29	18	18
A726	M77 J3 to Paisley	Scot	7	Mixed	17	94	-6	120.27	113.59	24	6	18	47	6
A623	Baslow - Chapel-en-le-Frith	EM	22	Single	16	94	7	104.63	98.47	38	19	19	6	19
A619	Chesterfield – Baslow	EM	15	Single	17	85	-6	111.97	95.17	18	12	12	47	12
A1101	Outwell (A1122) - Long Sutton (A17)	EM/E	21	Single	21	84	11	113.01	94.93	29	29	0	33	10
A1079	Mkt Weighton – Hull	Y&H	32	Single	51	82	-6	113.85	93.65	33	6	8	51	2
A570	St Helens - M58 J3	NW	10	Dual	13	72	8	118.77	85.78	23	8	8	38	23
A628	M67 - A616 (Woodhead)	NW/Y&H	24	Single	17	74	-26	106.93	79.03	0	53	12	12	24
A644	Dewsbury - M62 J25	Y&H	9	Single	13	68	-7	115.26	78.86	38	8	23	23	8
A671	Burnley - A59 Whalley	NW	10	Single	12	67	-43	117.43	78.29	8	17	8	67	0
A646	Burnley - Halifax	NW/Y&H	34	Single	30	67	-3	108.16	72.11	27	20	3	43	7

Ranked by contribution to total risk from collisions involving non-motorcyclists 2004-06; no significant reduction in the number of F&S collisions involving all vehicle or non-motorcyclists only between 2001-03 vs. 2004-06; section lengths are greater than 5km; minimum of 8 F&S collisions not involving motorcyclists 2004-06; minimum collision density (all vehicles and non motorcyclists) of 1/mile 2004-06; EuroRAP Risk Rating (all vehicles) medium-high (red) or high risk (black) in both data periods (2001-03 and 2004-06); EuroRAP Risk Rating based on the number of F&S collisions/billion vehicle kms travelled.

Table 3b. Britain's highest risk roads when collisions involving motorcyclists are removed (2004-2006)

Region	Road no.	Description	km	Road type	No. F&S collisions 2004-06	EuroRAP Risk Rating 2004-06
North West	A537	Macclesfield - Buxton	13	Single	21	250.45
Scotland	A99	A9 Latheron - Wick	27	Single	12	209.26
Wales	A495	Whitchurch - Welshampton	12	Single	11	170.31
Yorkshire	A61	Barnsley - Wakefield	10	Single	22	164.14
East Midlands	A5	Daventry - Rugby	16	Single	15	127.82
West Midlands	A53	Leek - Buxton	20	Single	13	118.03
South East	A259	Hastings - Eastbourne	19	Single	47	120.05
South West	A48	Chepstow - Gloucester	44	Single	45	95.89
East	A1065	Swaffham - Fakenham	24	Single	13	93.36
North East	A688	Barnard Castle - A68	17	Single	11	82.80

Ranked by EuroRAP Risk Rating 2004-06; EuroRAP Risk Rating based on the number of F&S collisions/billion vehicle kms travelled: green (low risk), yellow (low-medium risk), orange (medium risk), red (medium-high risk), and black (high risk). Sections listed for the East Midlands and North West span two regions, but are listed under the region where the majority of the length falls.

Table 4. Britain's' highest risk road sections in each UK Government Office Region (2004-2006)

6. Vision Zero, Sustainable Safety and the 'Safe Road System'

6.1. Vision Zero

In 1997, the Swedish Parliament, with all party support, adopted its 'Vision Zero' policy which has since been adopted by many countries worldwide. The policy envisages a future in which no-one is killed or suffers disabling injuries on the roads.

Sweden still maintained short term targets as did Britain. The policy however introduced gradual but radical change in how safety is approached and managed.

In the 'Vision Zero' model, the safety of the road system becomes a shared responsibility between the designers of the system – vehicle manufacturers and road authorities – and the road user.

The rules for the system are that:

1. the designers of the system are always ultimately responsible for the design, operation and use of the road transport system and thereby responsible for the level of safety within the entire system

2. road users are responsible for following the rules for using the road transport system set by the system designers (e.g., wearing seat belts; obeying speed limits)

3. if road users fail to obey these rules due to lack of knowledge, acceptance or ability, or if injuries occur, the system designers are required to take necessary further steps to counteract people being killed or seriously injured

There are strong ethical dimensions to 'Vision Zero'. For example:

- *"Life and health can never be exchanged for other benefits within the society."* In Britain for example, designers trade off safety and capacity in road design.
- *"Whenever someone is killed or seriously injured, necessary steps must be taken to avoid a similar event."* The fatal accident inquiries in Norway, for example, treat a road crash as avoidable as a rail or air crash.

Crucially, 'Vision Zero' introduces a measure of biomechanical tolerance as a parameter of the safety of the system. Put conveniently, it says the human body cannot survive an uncushioned impact of more than 25mph. Therefore the system cannot be permitted to allow these forces since, as in rail and air safety, it is assumed that human beings will always make mistakes. The permitted speed of vehicles becomes specified by how well the vehicle and the road can reduce crash impact and injury severity.

This had profound implications for road and vehicle design.

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The difficult campaign to make fundamental improvements to European standards of vehicle safety took place in the mid-1990s. The European New Car Assessment Programme (EuroNCAP) backed by motoring organisations and the British, Dutch and Swedish governments drove up the typical crash performance of new vehicles for car occupants from 2-star to 4-star and, now, frequently 5-star performance. Vehicles were bought from showrooms and the results of independent crash tests were published. Consumer pressure ensured a new market in safety. Progress on pedestrian safety has been slower and the legislative route is being pursued.

In 1999, European motoring organisations and the British, Swedish and Dutch governments began work on the European Road Assessment Programme (EuroRAP) to tackle the problem of road design. Early work in defining a star rating scale for roads quickly confirmed that motorways were the only group of roads built in a way that systematically seeks to eliminate all the forces that kill at the posted speed limit. The paradox however, that the fastest roads were the safest was short-lived. The new Swedish standard for single carriageways, designed to 'Vision Zero' principles and already adopted by a number of other countries (e.g., Ireland) quickly proved in service to be the safest road type known.

EuroRAP road inspections across Europe quickly confirmed that the roads on which most deaths take place have only 1- and 2-star ratings. Recent work in several countries suggests that the death and serious injury rate doubles with each loss of a star.

As expected, indeed intended, 'Vision Zero' highlighted the key tension. It is inevitable that road deaths will occur when existing roads are used at the current posted speed limit (let alone beyond it or if people are not sober or do not wear seat belts). There become only three ways forward:

1. improve the protection standards of roads
2. lower the speed limits
3. accept a level of risk on roads much higher than any other daily activity

The economically efficient solution is that there should be investment in protection up to the point where it is more efficient to lower the speed limit. For example, in the urban core and residential areas where there are both environmental and safety gains to be had, lower speed limits become an acceptable and rational choice. While in rural areas, longer journeys can destroy the viability of communities and long overdue investment in safety becomes paramount.

Recent developments in Swedish policy are bringing closer the prospect that roads will be inspected for safety as robustly as planes, boats, rail and road vehicles.

The Swedish government is also using the principles behind the EuroRAP Star Rating (the 'Road Protection Score') to guide its review of speed limits.

6.2. Sustainable Safety

There are differences in emphasis between the Dutch 'sustainable safety' and Swedish 'Vision Zero' approach even though the similarities are greater.

The document 'Sustainable Safety: A new approach for road safety in the Netherlands' (www.rws-avv.nl/pls/portal30/docs/1771.PDF: AVV, 2000) introducing principles of the new approach in 2000 said:

> *"'Sustainable Safety' recognises that 90 percent of road accidents are attributable (to a greater and lesser extent) to human error. Consequently sustainable safety realises that the human is the weakest link in the traffic and transport chain. Furthermore, the human does not readily change or adapt and many attempts at influencing road user behaviour have failed or had merely short term effects. The limitations of the human remain evident. Motivation, attention, emotion, observation, prediction, knowledge and skills are all weaknesses that prevent the human from being the ideal traffic participant. All and all the human remains unpredictable and therefore is in itself not sustainable from a road safety perspective."*

The document goes on to describe similar principles of the 'safe road system' adopted in Sweden.

The emphasis of Dutch policy is important in that a goal of Dutch safe road design is to reduce the likelihood that fallible human beings will misread the road. A 'self-explaining road', on which the driver is encouraged to naturally adopt behaviour consistent with design and function, originated in the Netherlands. Self-explaining roads show road users with a clear road layout where

they should be and what they should do to maintain safety. The aim is that different classes of roads should be distinctive, and within each class features such as width of carriageway, road markings, signing, and use of street lighting are consistent throughout the route. Drivers perceive the type of road and instinctively know how to behave. The environment effectively provides a label for the particular type of road and there would thus be less need for separate traffic control devices such as additional traffic signs to regulate traffic behaviour.

Only more recently did Dutch policy makers amend their principles to add the proposition that roads should also be 'forgiving', and be capable of protecting road users in the event of a crash.

It is the combination of Swedish and Dutch policies that gives us the modern safe road design goal of 'self-explaining and forgiving roads' – roads that reduce the likelihood of crashes and provide protection when the inevitable happens.

In March 2008, the Netherlands became the first government to introduce explicitly the concept of an acceptable safety level for roads when the government announced that all 2-star roads, based on the EuroRAP Star Rating system, would be eliminated from the national network.

6.3. The Safe Road System

Other countries have adopted 'Vision Zero' or variants in recent years. Switzerland, a country which has recently been a very high performer, being one example. Further afield, the Australian state of Victoria has been one of the most notable advocates of a 'Vision Zero' variant focusing on the concept of a 'safe road system'.

The British culture has been more pragmatic and finds the idea of a guiding philosophy such as 'Vision Zero' difficult to get to grips with. Indeed, it could be argued that the reason Britain has not got ahead in recent years is more about the need to improve delivery, not philosophy. However, delivery is about the setting of clear goals, obtaining political support and ensuring the financial resources and technical capability to make sure improvement happens. The crucial role of road safety engineering and single carriageway roads, for example, was clearly identified in the last road safety strategy review but not carried through. In contrast the safer cities initiative and urban safety management were both taken forward.

The Dutch and Swedish policy approach has ensured substantial attention to safe road design on all parts of the network and the SUNflower comparative studies which include the UK, Netherlands and Sweden specifically, point to the opportunities Britain has to pay attention to the rural network (SUNflower: A comparative study of the development of road safety in Sweden, the United Kingdom and the Netherlands, Koornstra *et al*., 2002).

A specific disappointment of the last strategy review was the target for the Highways Agency network that was set below the general British 40 per cent reduction target (in turn lower than the European norm). The impact of this was the lack of external incentive on the nation's leading roads agency to initiate stretching programmes to improve safety as a priority and as a model for other smaller authorities.

7. How the Public in Britain, Sweden and the Netherlands see the Safe Road System

One simple way of gauging public understanding of road casualty reduction is simply to ask the same litmus questions in Britain, Netherlands and Sweden.

The results of a recent EuroRAP survey are shown in Figure 6. The public were simply asked in each of the three countries whether investment in safer cars, safer drivers or safer roads would save the most lives in the next 10 years. In all three countries driver behaviour was regarded as most important but in Britain this was the

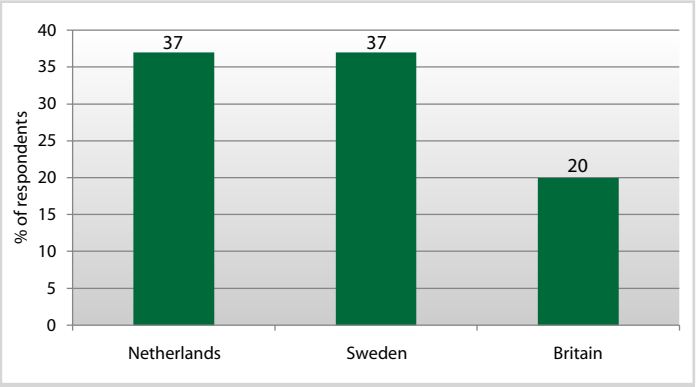

Figure 6. Per cent saying investment in safe roads would save the most lives in the next 10 years

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overwhelming answer. Only 1 in 5 British respondents regarded investment in safe roads as important whilst in the Netherlands and Sweden this was more than 1 in 3.

Results from focus groups in Australia also suggest that without education programmes, public thinking equates the safety of a road with the presence or absence of potholes rather than the presence or absence of roadside hazards and well laid out junctions. Recent radio advertisements have been run simply to convey the message that 'roads are more important than you think' in order to increase public understanding of the high returns possible from safe road infrastructure programmes. In Britain, road user and professional organizations have initiated the *Campaign for Safe Road Design (www.saferoaddesign.com)* in order to increase public awareness and understanding of the crucial role of the road infrastructure in national casualty levels.

8. Worldwide Examples of *Safe Road Infrastructure Programmes*

The International Road Assessment Programme (iRAP) – the umbrella organisation for road assessment programmes globally - has sought to find case studies of well evaluated, large-scale, *Safe Road Infrastructure Programmes* across the world. Although it is a routine finding that safety improvements at individual sites and small programmes deliver very high returns, there are few reported systematic large-scale programmes to upgrade the safety of networks: for example, projects the equivalent size of a routine major road scheme at £25m-£100m.

The Department for Transport has helpfully published the rates of return from all the small safety engineering schemes across England in one year. This English annual programme cost a little over £100m and delivered an estimated average 'first year rate of return' of over 300 per cent (Second Review of the Government's Road Safety Strategy, DfT 2007, www.dft.gov.uk/pgr/roadsafety/strategytargetsperformance/2ndreview/screen). In economic terms, this investment programme - with maintenance - almost certainly had an economic life of around 20 years and paid for itself within the first 20 weeks.

iRAP has collaborated with publishing group UKIP Media and worked with their technical journalists to write up the background to five case studies (available at www.irap.net). A summary of 3 of these case studies is relevant:

- ***Victoria, Australia***. Within an Arrive Alive programme addressing safe drivers, safe vehicles and safe roads, the State of Victoria – with a population of just 5m people - invested £110m between 1999 and 2004 in a safe road infrastructure programme targeting safe junctions and safe roadsides. The results of the first programme led to a commitment to invest the same again between 2004 and 2007. A further commitment has already been made to invest over £300m further. The programme is dubbed a 'grey spot' programme because it is proactive, rather than reactive, to known risks. The State of Victoria is an insurer and receives a large direct financial benefit from lower claims resulting from the investment. (Designs for Life: How an Australian state is dealing with road safety, iRAP 2008).

- ***London.*** *Transport for London* invested a reported £200m over a 6 year period in road safety and estimate the programme has delivered £3.5bn in benefits in the same period. They expect road safety engineering programmes to deliver 100 per cent per annum returns. The Road Safety Unit says the critical success factors are the creation of a programme with political support; the use of data to guide action to where it is effective; and the training of safety engineers to get the job done well. (Safety First: How road authorities in London are reversing the trend, iRAP 2008).

- ***Irish National Roads Authority***. Ireland's national road authority has invested in a systematic safety review across six main regional routes. Although hundreds of sites were involved, the first phase of work cost only £6m and the savings in deaths from this small, quick, programme may be equivalent to nearly 5 per cent of the Irish national casualties. (Republic Enemy: How Ireland's road authorities are confronting bad road design, iRAP 2008).

Each of the three cases summarized were undertaken in a unit around the size of a British government region. All three had special circumstances. In Victoria, there is a direct financial interest in reducing road casualties. In London, the government created a new Mayoral system and generated unusual political leadership. In Ireland, a major period of infrastructure investment has generated both the resources and confidence to act strategically.

The two other articles in this series concern the implementation of programmes of roundabouts which are an important safety countermeasure worldwide and are, for example, beginning to be introduced in the USA and Latin America in numbers (What Goes Around...: How Brazil has rediscovered the merits of the roundabout, iRAP 2008). The French case study records that France has invested in a programme of 30,000 roundabouts over the last 20 years and continues to introduce 1,000 per annum. (Circle of Influence: How France has used roundabouts to cut casualties, iRAP 2008).

9. Delivering a *Safe Road Infrastructure Programme*

9.1. The Business Process

The International Road Assessment Programme (iRAP) has drawn from the knowledge base of leading countries to define a new standard business process to generate and evaluate investment in safe road infrastructure programmes, for use by development banks and finance ministries. Leading developing countries will have their own proprietary national techniques for some of these steps.

The business process identified by iRAP follows the steps shown in Figure 7. Following an analysis of available crash data, a network on which deaths and serious injuries are concentrated, and so suitable for targeting, is defined. This is followed by physical road inspections and analyses to identify where there are shortfalls in the infrastructure. There is then an evaluation of possible countermeasures likely to have high rates of return. A high return programme affordable by the country is then recommended.

The impact of safer road infrastructure is not short term. Once introduced, for example, a roundabout or safety fencing will – with appropriate maintenance – go on delivering the saving of life for at least two decades. The iRAP evaluation is therefore based on whole life costs and whole life benefits over the economic life of improvements. The analysis is presented in exactly the same way as any other major infrastructure investment programme.

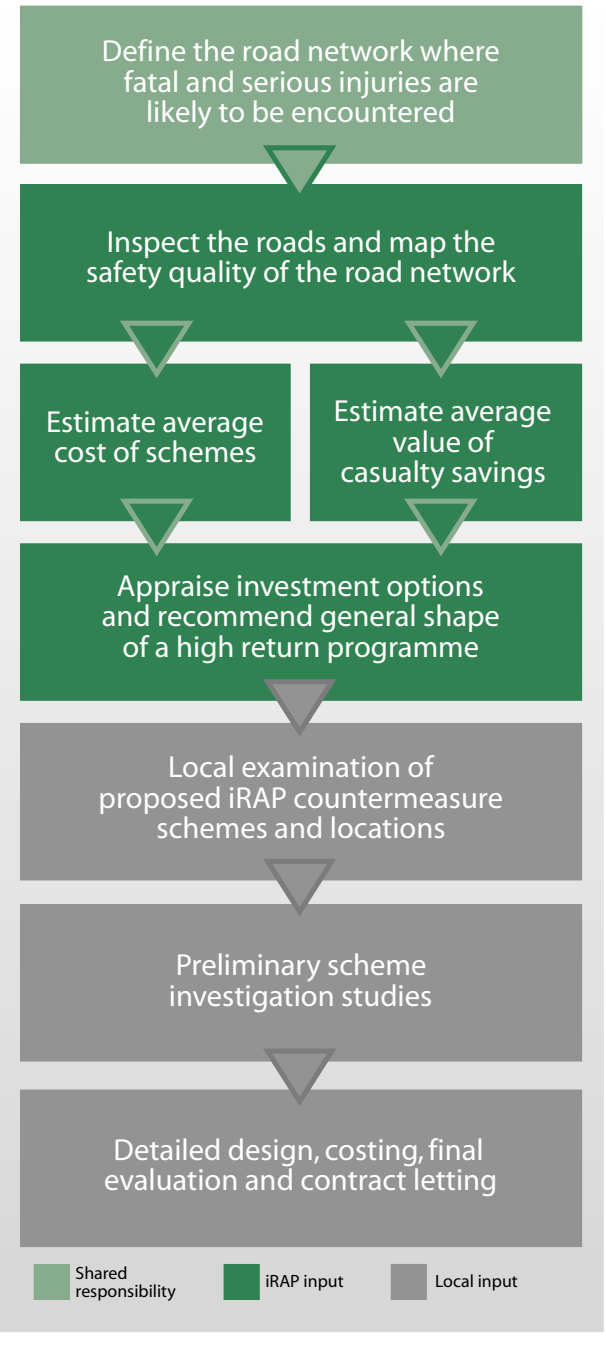

Figure 7. iRAP business process

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9.2. Protocols to Measure Safety

The three main protocols used by RAP programmes cover:

- *Risk Mapping* which presents actual crash rates across the road network measuring the combined performance of road, vehicle and driver together
- *Star Rating* which measures the in-built safety of the infrastructure against the main crash types based on physical road inspections and a 'Road Protection Score'
- *Performance Tracking* which measures the improvement in performance over time

In Britain, Risk Mapping and Performance Tracking has been carried out annually for over 5 years (see section 5). Working with the Highways Agency, the Road Safety Foundation has also recently completed inspection of the entire English trunk road network. This followed a successful pilot which sampled roads of all types in England, Scotland, Wales and Northern Ireland (Star Rating Roads for Safety: UK trials 2006-07, Castle *et al*., 2007 available online at www.eurorap.org/library/pdfs/20071217_UK_RPS_Report.pdf). The Road Safety Foundation was grateful to the IAM Motoring Trust for its financial contribution to this pilot.

9.3. Tools to Generate Countermeasures

In a major investment, iRAP has developed technical tools which follow road inspections for low and middle income countries and piloted these in four countries around the world (Vaccines for Roads: the new iRAP tools and their pilot application, iRAP 2008). These new iRAP tools identify over 50 countermeasure types that could improve the estimated risk level on a road for road users and then search for affordable high return programmes.

There has been positive reaction to the technical advance in the new iRAP tools. British authorities are also among those leading requests for more specific guidance on how to interpret and generate countermeasures once RAP inspections have identified deficits. In Europe, which embraces countries at many stages of economic development and technical fluency, the European Road Assessment Programme (EuroRAP) has said it is sympathetic to work to improve guidance and tools if sufficient authority members support the proposal.

9.4. Evaluation of Safe Road Infrastructure Programmes

One of the iRAP tools undertakes economic evaluation. The Road Safety Foundation has informally discussed the iRAP economic evaluation with Department for Transport economists and it is clear that the method used by iRAP is in line with recommended UK evaluation.

The method currently widely used in the UK for safety engineering schemes is the 'first year rate of return' whose main virtue is that it is simple and allows one safety engineering scheme or option to be quickly compared with another.

However, this simple tool for scheme selection and design of components within a programme is unhelpful in the presentation and evaluation of an important programme as a whole. *Safe Road Infrastructure Programmes* need to be generated, evaluated and compared on the same basis as any other significant competing transport project or any other competing local authority programme. Road safety engineering programmes have been relegated to the discretionary fringes of many authorities in part because the presentation has been piecemeal and unfamiliar.

Road crashes consume 1.5 per cent of GDP and there are some 30,000 deaths and serious injuries annually consuming £18bn. Large targeted *Safe Road Infrastructure Programmes* are an outstanding investment – they can reduce the national burden of road crashes significantly with quick, certain, affordable, high return, high impact, and generally popular programmes.

The promotion of *Safe Road Infrastructure Programmes* is underpinned by the basic statutory requirements of roads legislation to provide safe and efficient highways. Frequently road authorities state in policy documents that their first objective is the safety of roads and, in the absence of an attractive investment option, prioritise other programmes.

A formal *Safe Road Infrastructure Programme* can provide a yardstick of performance. With transparent evaluation, they can be seen to be one of the most attractive social and economic investments in the economy.

9.5. Reactive versus Proactive Programmes

The leading countries, guided by their design philosophies, have become more proactive and less reactive in their approach to safety. Britain still tends to await clusters of accidents at sites rather than search out known high risks for treatment before people are killed and seriously injured, even though the problems inherent in statistically unreliable small short-term clusters are well known.

One of the side effects of using site-specific first year rates of return is that the benefits available from larger proactive programmes that eliminate known high risks across the network are not generated and captured. For example, if collapsible roadside poles were installed to replace rigid poles at 10,000 similar sites, the high returns come from the reduction in many deaths and serious injuries across the programme and over their economic life. If the first year return at every site was required then only the sites that had clusters by chance in the recent past would be treated.

9.6. Procurement of Safe Road Infrastructure Programmes

If the iRAP business process were followed in Britain, a typical 3 year programme size for each government region might fall in the order of £100m-£200m. The programme would typically involve hundreds of kilometres of safety fencing and road treatments and specific measures at hundreds of sites. Implementing programmes at this scale has many advantages:

- it is efficient to engage specialist programme managers
- administrative costs are lower
- project teams and contractors become more proficient
- fewer expert staff are needed
- unit costs are lower
- where relevant, project finance is practical

These procurement efficiencies can be very substantial. The costs per kilometre of installing safety fencing in Sweden over very long lengths appears to be a fraction of the UK price for procuring short lengths such as the 100 metre stretches frequently seen across the network. This appears to arise from more than the normal expected efficiencies from bulk commodity purchase. As contractors gain know-how and confidence they learn methods and invest in equipment to overcome frequently occurring site difficulties.

10. Defining a *Safe Road Infrastructure Programme* for Britain

An effective *Safe Road Infrastructure Programme* means targeting the roads on which deaths are concentrated. Britain's programme logically has two main components:

- A new 'A' road programme
- Continuing the urban safety management programme

While the urban safety management programme has been taken forward, it is the 'A' road programme that now principally requires formal, systematic support.

10.1. The 'A' Road Programme

Approximately two-thirds of road deaths are outside towns, defined by the Department for Transport as settlements of greater than 10,000 population in Road Casualties Great Britain 2006 (DfT, 2007) and are concentrated on busy 'A' roads where it is highly cost efficient to target safe road design countermeasures.

Deaths act as a sound proxy for economic return and almost certainly for the more serious disabling injuries. Estimation of deaths is not statistically reliable at road section level but they can be used to segment the network to define strategy and targets for road types and responsible administrations.

10.2. The Risk Mapping Programme

Many authorities have proprietary methods and analysis to identify roads on which they should take safety action in their area. The EuroRAP system of Risk Mapping has been statistically designed to support national road safety strategies and has been applied in Britain annually for over 5 years (see section 5). Risk Mapping provides an international and common basis of measurement that can be used for assessing priorities, benchmarking and tracking progress in implementing a national safe road infrastructure programme.

Risk Mapping is already applied in Ireland as well as Britain. The Road Safety Foundation has worked with the Irish National Roads Authority and Roads Service in Northern Ireland to prepare a map across Ireland, the

most recent of which was published in May 2008 (EuroRAP 2008: Ireland Results: Risk and star rating of Ireland's major roads, AA Ireland and EuroRAP 2008, available online at www.eurorap.org/library/pdfs/20080519_IRELAND_RESULTS.pdf).

The most frequently seen Risk Mapping is that produced for consumers and shows the risk of death and serious injury for individual road users across the British road network (see AA Atlases 2001-2008, Collins Road Atlases 2009). However, there are a number of additional standard map types which are designed to assist authorities:

- a crash density map
- a map showing a road's performance in comparison with the average for the road type
- a map showing the potential for accident reduction

The mapping system also permits other analysis and presentation of data. For example, in the usRAP programme, a map of the economic losses across the network is becoming increasingly popular with analysts.

The Risk Mapping data currently contains spatial records of all fatal and serious injury accidents since 1997. This network is approximately 22,000kms long and contains the entire primary route network, but excludes roads in the cores of large towns and cities where area rather linear safety analysis is appropriate.

The primary route network contains Britain's most important through routes notated with 'green signs' to reflect that they are of more than local importance. A third of all Britain's road deaths are concentrated on the EuroRAP network.

Local authorities and professional institutions have argued to the Road Safety Foundation that the Risk Mapping results do not include all the major safety management problems with which they have to contend. Local authorities also have concentrated safety problems on 'A' roads other than those on the primary route network alone.

For this paper, the Foundation has analysed the likely number of road deaths that would be added if the Risk Mapping network were extended to cover all 'A' roads including those outside the urban core. Doing so would pick up more than half, and up to 60 per cent, of all road deaths and would mean slightly more than a doubling of the Risk Mapping road network length to approximately 50,000 kms.

If the propositions in this paper are widely supported and further funding can be raised, the Foundation therefore proposes that the GB Risk Mapping network should be extended to all 'A' roads. This can be completed before the end of 2008.

10.3. Britain's Urban Safety Management Programme

The urban safety programme has natural momentum and the trend is firmly towards more livable streets. In recent years, there has been greater understanding of the impact that safe road design can make on urban thoroughfares through, for example, tidying the provision of parking and the establishment of more and safer crossings. Urban speed limits are being more clearly enforced.

The case for adopting countermeasures like 20mph limits in residential areas to make walking and cycling safer and more pleasant has become compelling. TRL research over recent years has established the safety case and new Department for Transport guidelines set out recent changes (Department for Transport Circular Roads 1/06 "New Guidance on Setting Speed Limits", DfT 2006). While there is still much debate over the balance to be struck between mobility and safety, these debates are rightly held and resolved at local level by local people.

London and the six conurbations account for over half of urban road deaths (Road Casualties English Local Authority Tables: 2006, DfT, 2006: www.dft.gov.uk/pgr/statistics/datatablespublications/accidents/casualtieslatables/roadcasualtieslocal06#/) and success will be heavily dependent on progress made in these few authorities. There is room for optimism. The Road Safety Unit at Transport for London received a Prince Michael International Road Safety Award in December 2007 for their leadership and investment which has led to a 40 per cent reduction in deaths and serious injuries in 8 years. The estimated savings from the London programme were described in section 8.

The potential in an urban programme remains very large with over 1,000 deaths a year to be targeted. The synergy between environmental gain and safety gain is very clear. However, because of the high costs of general

amenity improvement programmes, the effectiveness of safety investment can very easily be diluted. Countermeasure programmes from safety budgets must have a strong focus on the locations where known high risks of death and serious injury are concentrated.

With large, effective units such as exists in London, the urban component of a national *Safe Road Infrastructure Programme* should require mainly attention so that the urban safety management programmes of urban authorities:

- receive political attention, not least in ensuring that comparative performance is made transparent on common measures
- best practice is communicated with effective professional working groups
- investment for effective high return programmes is available

10.4. Targets for a Safe Road Infrastructure Programme

Based on a baseline total of 3,000, Table 5 shows the Road Safety Foundation's preliminary estimated distribution of road deaths for the Highways Agency network, all local authority 'A' roads (excluding urban cores) , the urban cores, and all other local authority roads.

The Foundation proposes a target of 40 per cent casualty reduction from a *Safe Road Infrastructure Programme* alone for all roads except:

- the busy Highways Agency mixed network which is highly targetable at 45 per cent
- minor local authority roads which are not easily targetable at 15 per cent

The overall programme would deliver a casualty reduction of one-third.

These estimates are based on the contribution from safer infrastructure alone. The improvements which *improve protection* (e.g., safety fencing, safe run-off areas) will be enhanced further by improvements in seat belt wearing rates.

10.5. The Budget for the Programme

Discussion and papers at the December 2007 EuroRAP conference in London, enabled by the Foundation, revealed the assessment that although the costs of saving a death or serious injury (KSI) would rise from current very low levels, it would remain possible for even highly rated authorities to continue saving a death or serious injury per annum for an investment of just £300,000. This implies a benefit-to-cost ratio well in excess of 10 (or 100 per cent first year rate of return in the assessment terms currently used by road engineers).

		Annual Deaths		Target Reduction	
		number	per cent	number	per cent
Highways Agency					
Motorways & trunk duals		230	8%	92	40%
Mixed network		165	6%	74	45%
	HA Trunk	***395***	*13%*	***166***	*42%*
Local Authorities 'A' Roads					
Primary Duals		80	3%	32	40%
Primary 'A' Roads Mixed		470	16%	188	40%
Non-Primary 'A' Roads		825	28%	330	40%
	LA 'A' Roads	***1,375***	*46%*	***550***	*40%*
LA Urban Cores	*Urban Core*	***730***	*24%*	***292***	*40%*
LA Other	*Other*	***500***	*17%*	***75***	*15%*
	Total	**3,000**	100%	**1,083**	33%

Table 5. Preliminary estimated distribution of road deaths across the British road network and proposed targets

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The returns from saving 10,000 KSI and other crash costs are worth £6bn per annum or 0.5 per cent of GDP. If the target average cost for the programme were £300,000 to achieve one KSI per annum then the total cost to save 10,000 KSI per annum would equate to a one-off investment of £3bn. This programme equates to £425m per annum over 7 years - a budget in reach for a priority programme even within existing roads and transport expenditure.

The present value of the saving would be worth approximately £85bn. Assuming reasonable values for the incremental maintenance cost (i.e. the increase in maintenance cost as a result of having to maintain additional safety fence, road markings, sheltered turning lanes etc.), the present value of the cost of the programme would be £8.5bn. Given the very high returns, the rational approach would be to accelerate the programme to be delivered as quickly as practical. The key issues are clearly more about 'delivery' - mobilizing the programme and addressing institutional barriers and managerial and technical capacity issues.

10.6. Building Partnerships to Find and Deliver High Return Countermeasures

Unlike urban areas, the majority of the network on which deaths are concentrated is not under the management control of a relatively small number of larger authorities. Only the Highways Agency administers a network on which many deaths are concentrated. Although local authorities have no other programme that impacts more on life and death in their area, the practical responsibility for safety programmes often lies in busy technical services departments with many diverse demands in a sector where the specialist safety skills are in short supply.

In building the partnerships required to deliver a national effort to reduce road casualties on 'A' roads there is a need to support the strengths of local authorities without whom no action is possible. In particular, authorities are close to local communities and have sound skills in the delivery of practical schemes. There are also high performing authorities who have a tradition and experience in innovation and application of new techniques.

These skills can be supported by specialist skills training, guidance and tools from the third sector whether professional institutions, charities, or member associations which are not available individually to local authorities. The business process in Figure 7 shows that while authorities need to be able to turn to expert support it is ultimately local authorities who are responsible and accountable for their performance in delivering safe road infrastructure in their areas. It is now possible to measure the safety of roads transparently and this is the public's assurance that the accountability is real.

11. Conclusion

As the government reviews its road safety strategy for the period beyond 2010, this paper has reviewed British performance and how other leading countries are focusing on safe road design. The paper has highlighted that a *Safe Road Infrastructure Programme* needs to be central to the next road safety strategy to return Britain to international leadership in casualty reduction.

In the late 1990s, other leading countries fundamentally reappraised their safety strategies with their 'Vision Zero' and 'sustainable safety' policies. There was recognition that, if the goal is that using the road is to be no more risky than rail, air or any other normal activity in daily life, a strategy based on seeking to squeeze out normal human error will be no more successful in future than it has been in the past. A 'safe road system' means taking action on safe driving, safe vehicles and safe roads together.

The policies of the other leading countries may be too philosophical for British taste. Regardless, the road safety strategy analysis of leading countries, including Britain, has recognised for years that the majority of road casualty savings needs to come from safer road infrastructure. Recent comparative research has pointed to the need for action on British roads outside towns where two-thirds of road deaths are concentrated. The slower rate of British progress may simply reflect less successful delivery rather than less successful philosophy. It is nonetheless undeniable that the leading countries have drawn design inspiration from the challenges of their philosophy, and their engineers have created whole new safer road types and design codes for 'self-explaining' and 'forgiving roads'.

Human errors only kill when the consequences are high energy impacts. Safe road design which provides 'self-explaining roads' that make errors in reading the road unlikely. 'Forgiving roads' provide protection like

pedestrian refuges, sheltered turning bays and safety fencing which prevent an everyday mistake becoming fatal. Routine, predictable deaths and serious injuries should not happen when road users are obeying the rules of the road, high NCAP rated vehicles are involved, and posted speed limits and design are aligned.

This paper contains an analysis using EuroRAP protocols of the safety performance of the green signed British primary route network on which a third of British road deaths take place. This shows that 30 per cent of this most important network does not reach even the safest two EuroRAP risk categories: even a quarter of motorways do not reach the safest safety rating. Local authorities and professional institutions argue that problems are not confined to the primary route network and this EuroRAP analysis needs to be extended to the 'A' road network in order to understand more fully the priorities that need to be managed. The Road Safety Foundation accepts this argument and will seek to extend the analysis.

This paper shows the returns that are possible by reinvigorating the urban safety management programme and initiating a *Safe Road Infrastructure Programme* on the British 'A' road network.

A national *Safe Road Infrastructure Programme* alone - even without initiatives on behaviour and vehicles - could reduce deaths and serious injuries by a third in less than a decade. This reduction of some 10,000 killed and seriously injured annually would be worth 0.5 per cent of GDP, or £6bn annually.

The social and economic rates of return from a *Safe Road Infrastructure Programme* are so high, the costs are so affordable, that the only rational question is how the programme can be mobilised to deliver these savings as quickly as possible. The programme must be delivered by local authorities who have the practical core skills to do the job on the ground. But there is an onus on central government to put in place the right framework to enable the programme. There needs to be partnership with the professional institutions, charities and associations who have specialist skills, tools, knowledge and training which can help guide the national effort and help build the capacity needed to deliver a national *Safe Road Infrastructure Programme.*

About the Road Safety Foundation

Road Safety Foundation

www.roadsafetyfoundation.com

The Road Safety Foundation is a UK charity founded in 1986 to be a permanent legacy of both the first European Road Safety Year and the establishment of Britain's first road safety target for the end of the last century.

Alongside world class leaders in safety, the charity is a vigorous advocate of cutting casualties through simultaneous action on all three components of a safe road system: the driver, the vehicle and the road. Its research has broken ground in each of these.

In the last five years, the charity has focused on the major project of leading the establishment of Road Assessment Programmes in the UK and internationally. In 2002, the Foundation established EuroRAP as a sister European Association to EuroNCAP (which crash tests new cars). Subsequently, Road Assessment Programmes have followed throughout the developed and developing world.

The Foundation is the enabling Member for EuroRAP in the UK and Ireland.

More information on the Foundation is at
www.roadsafetyfoundation.com

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Getting ahead

Returning Britain to European leadership in road casualty reduction

In the last decade there have been 375,000 fatal and serious road crashes. Thousands of stretches of road see the same human errors repeated year after year resulting in crashes that kill and maim. These road crashes waste 1.5% of GDP – more than we spend on primary schools or GPs.

The government is seeking contributions as it reviews Britain's safety strategy beyond 2010. This paper looks at the new road safety policies of leading countries who are now seeking to build safe road systems where death on the roads is no more acceptable than in the air or on rail. These countries are taking simultaneous effective action not just on safer driving and safer vehicles but on safer roads.

Britain has made progress on urban safety but two thirds of British road deaths are now outside major towns. These deaths are concentrated on Britain's 'A' road network which makes it straightforward and affordable to target Britain's high risk locations with modern safety engineering. This paper reviews the astonishing returns which are now being achieved by simple safe road design changes such as sheltered turning lanes, safety fencing and road markings to make roads more 'self-explaining and forgiving'.

This paper shows that it is possible to save 10,000 deaths and serious injuries a year through a national *Safe Road Infrastructure Programme* initiative alone. The total savings in crash costs from the programme would be worth 0.5% of GDP. The programme would be delivered mainly by Britain's local authorities with expert support.

The *Safe Road Infrastructure Programme* proposed needs government commitment and local skills. It would take less than a decade to implement and have one of the highest investment returns in the British economy.

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