



## **UK Trial Survey**

### **to establish Road Protection Scores for the UK**

### **Final Report**

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## Background

Within the European Road Assessment EuroRAP The AA Motoring Trust (AAMT) and the Highways Agency (HA) will apply the Road Protection Score RPS to UK roads. TRL has been commissioned to manage the two year project. ADAC has been contracted to conduct the road test in the UK.

The RPS has been developed within EuroRAP to measure "how the road protects the driver once an accident occurs". It therefore addresses the issue of forgiving road design leaving out the various aspects of probability and accident causation.

Details about the methodology of the RPS are available from EuroRAP (see literature).

The roads within this test have been defined by TRL, AAMT and HA. All roads are part of the UK EuroRAP network taking into account motorways and A-roads only. The roads differ in terms of road layout (motorway, dual, single carriageway) and type of risk as defined in EuroRAP.

## Methodology and Equipment

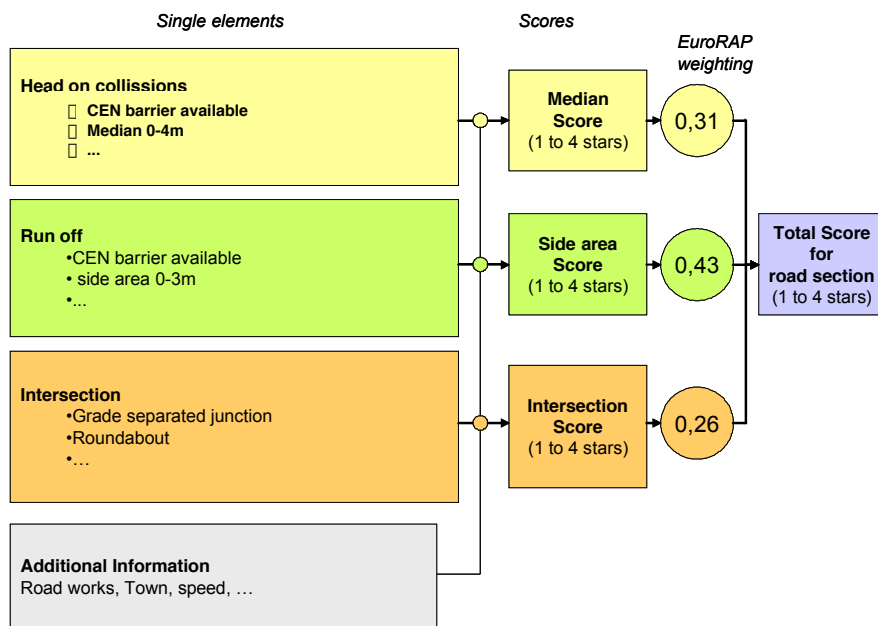
For the road test it has been agreed that the same equipment as in Germany has to be used. Some changes have been introduced to the digitising tablet to include additional UK specific features.

The Road Protection Score RPS shows how the road infrastructure protects the driver from being severely injured or killed once an accident occurs. It is assuming that drivers will make mistakes which could lead to accidents. The main task of the Road Protection Score RPS is to test whether the road helps the driver "to survive" once the accident has occurred.

The inspected road infrastructure covers the aspects of front collision, run-off and intersections.

As in all tests some prerequisites have been defined to abstract the problem: On behalf of the driver we assume that the driver uses the seat belt, drives a safe car, is sober and drives within the speed limit. The road is maintained properly (including signing, marking and drainage) and has a skid resistance within the necessary boundaries. The following graph shows the general test methodology of the current Road Protection Score RPS.

An extended Road Protection Score RPS is currently developed. Beside the aspect of "road protection" the extended Road Protection Score RPS should also contain the aspect of "probability of an accident". But before the extended RPS can be used for the inspections the extended RPS has to be implemented in the software routines.



*Fig. 1: General methodology of the current EuroRAP Road Protection Score RPS*

Every road side feature, which contributes to the RPS, is geographically referenced and written to an Access database. Using a risk matrix a routine calculates the scoring for each of the main types of accidents (head-on, run-off, intersection). Multiplied with an average European weighting factor the three scorings for head-on, run-off and intersection protection are summed to a total score for the road section. These weights take into account the percentage of the likelihood of the specific accident type on average on European roads.



*Fig. 2: ADAC car used for inspections*

The technology used has been developed by the Swedish National Road Administration SNRA and is being used since several years in Sweden. For the use within EuroRAP the soft- and hardware has been further developed by SWECO to

meet the needs of a Pan-European road inspection. Although differences between countries exist, the general idea of protective or “forgiving” road design is common in all countries.

During an inspection the inspector records road side features via digitising tablet (Fig. 3 and 4). The position of the feature is recorded automatically by motor electronic and translated into a geographic co-ordinate in the road map. The system uses a common road map from NavTech. The preparation of FIKS data based on the available UK GIS data has been done by SWECO and delivered to ADAC.



Fig. 3: Overlay of digitising tablet used for RPS inspections in UK

For the UK road test more road side features than for the current RPS necessary were recorded, so it is also possible to calculate the extended RPS with the inspected data.



*Fig. 4: Inspector using digitising tablet*

All geographically referenced attributes are written to an Access database where a routine - developed by SWECO - calculates the scoring for each of the main types of accidents (head-on, run-off, intersection). Multiplied with an average European weighting factor the three scorings for head-on, run-off and intersection protection are summed to a total score for the road section.



*Fig. 5: Presentation of inspection data using ArcGIS from ESRI*

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The length of the sections is depending on the road network or is defined by the length of the section between two junctions on the motorway. The sections are rated with stars – from 1 star (low protection level) to 4 stars (high protection level).

Within the UK the sections have been defined by TRL, AAMT, HA and SWECO according to the EuroRAP network used for risk mapping.

In addition to the inspections by recording the road features via digitising tablet all the roads were filmed continuously by video cameras. One camera is installed on top of the Mercedes Vito, a second camera is installed inside the car (see Fig. 6 and 7).



Fig. 6: Outside camera installed on top of the Mercedes Vito



Fig. 7: Inside camera (below rear-view mirror) and monitor for displaying video pictures.

## Test site

The test site for the road test UK contains about 6.500 km of roads. So for the inspections about 13.000 km (both directions) of roads where inspected. The roads within this road test have been defined by TRL, AAMT and HA. All roads are part of

the UK EuroRAP network taking into account motorways and A-roads only. The roads differ in terms of road layout (motorway, dual, single carriageway) and type of risk as defined in EuroRAP risk mapping.

The following Fig. 8 and 9 show the inspected roads in England, Wales, Scotland and Northern Ireland. The roads have been inspected between 19 October and 22 December 2006. A list of the inspected roads can be found in the annex.

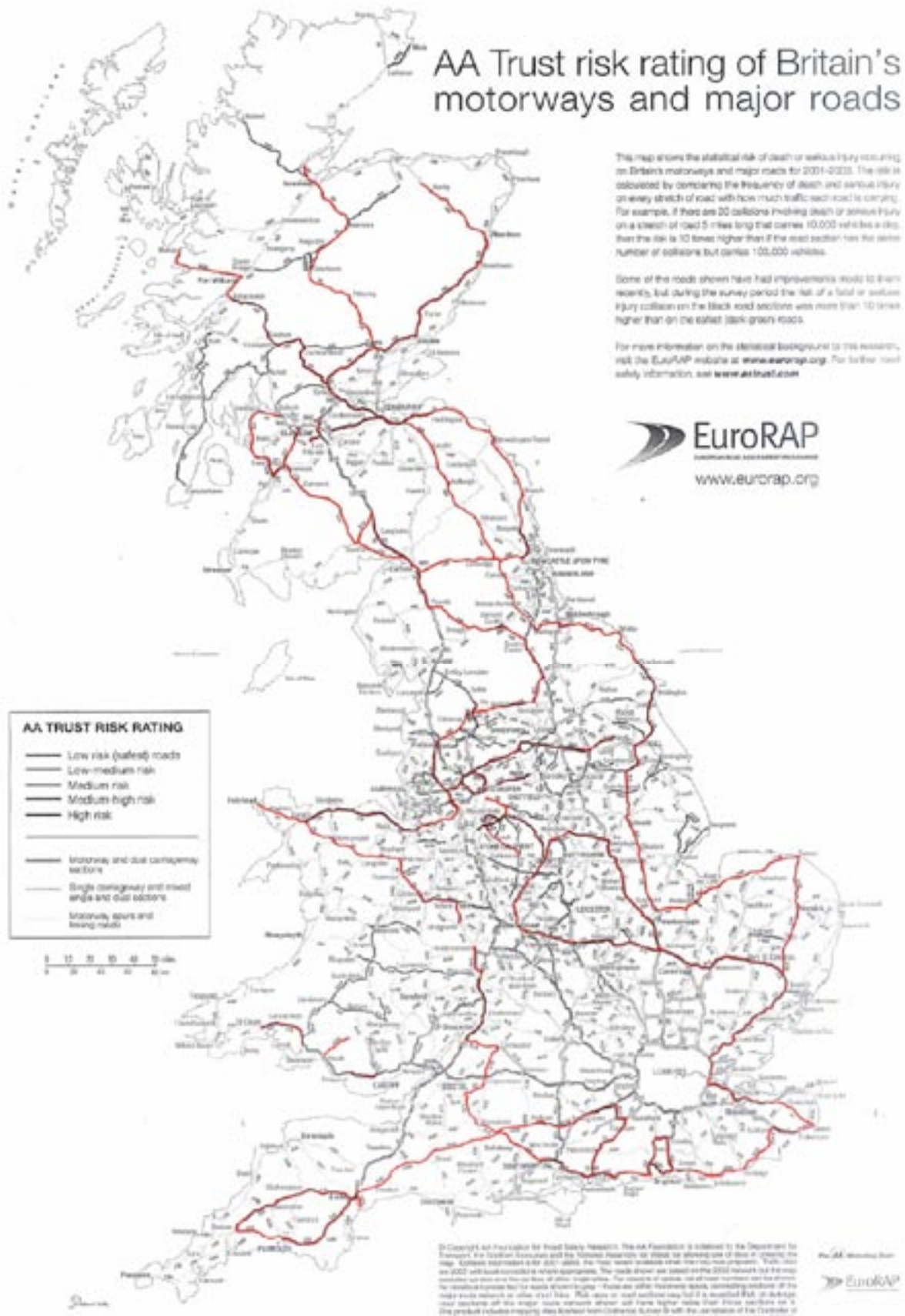


Fig. 8: Roads inspected in England, Wales and Scotland



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## Results

*The results are based on inspections conducted between 19 October and 22 December 2006. The map data has been provided by TRL and processed by SWECO. The FIKS system had to be used "as it is". For the data processing to ArcGIS format available applications from SWECO had to be used. The data is presented with ArcGIS version 9.1 or higher.*

*Only some results are part of this report. More data is available on CD-ROM.*

***Methodological differences in assembling the data mean that some values here differ by up to a few per cent compared with reporting of this survey elsewhere.***

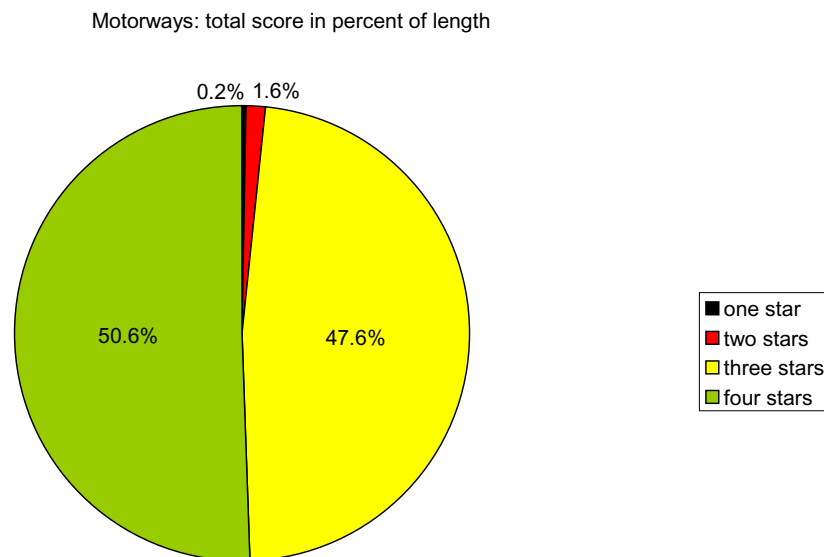


Figure 10a – Overall scores per road type

**A-Roads: total score in percent**

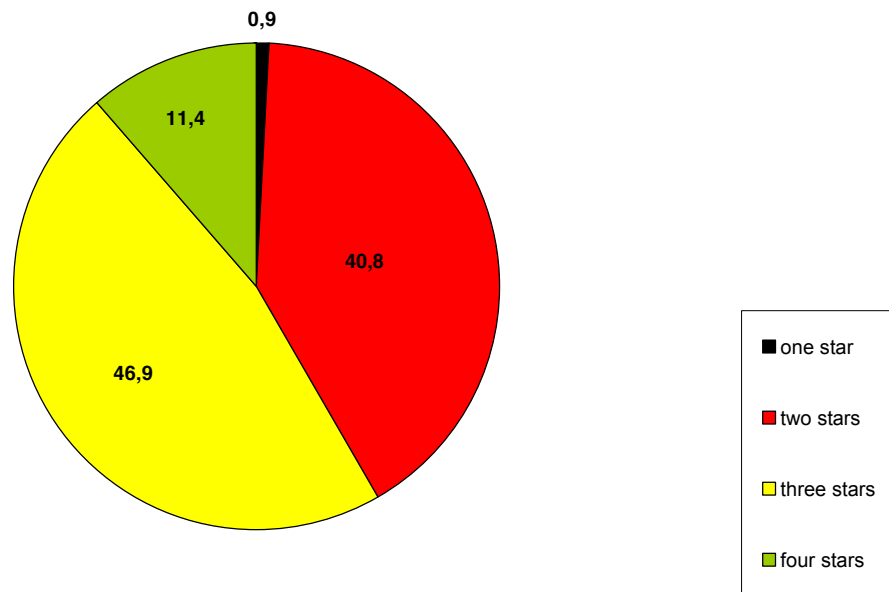
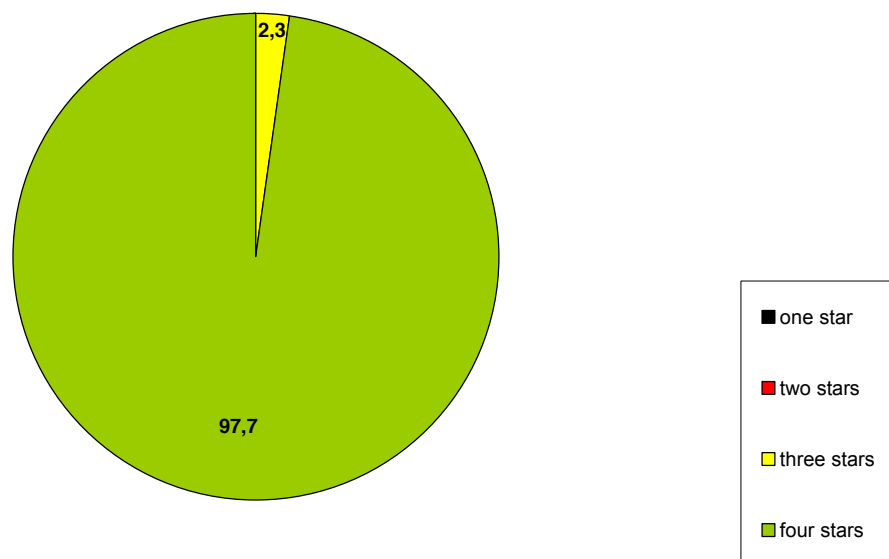


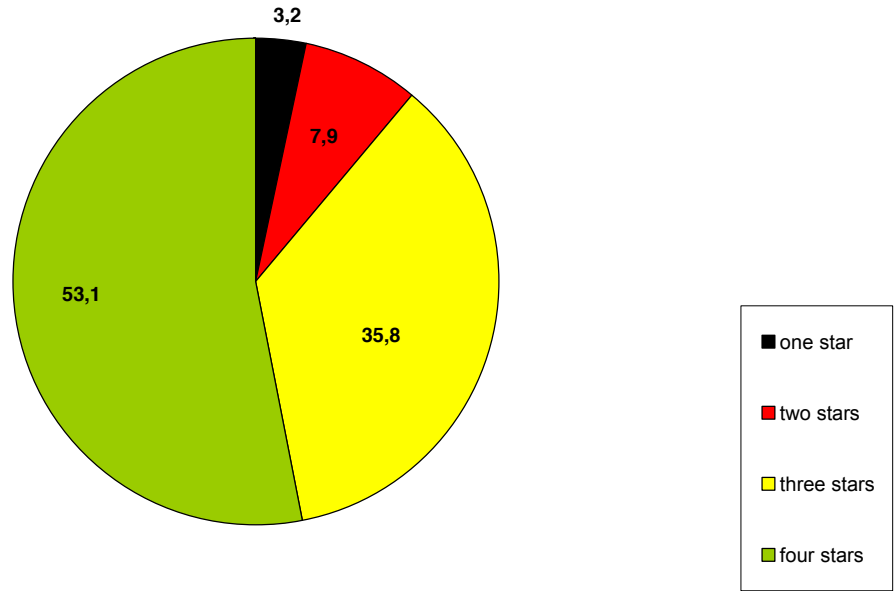
Figure 10b – Overall scores per road type

Due to the junction design 98% of the motorways receive 4 stars for intersection scoring. A-Roads differ in intersection scoring due to junction layout and speed limits on roads.

**Motorway: intersection score in percent**



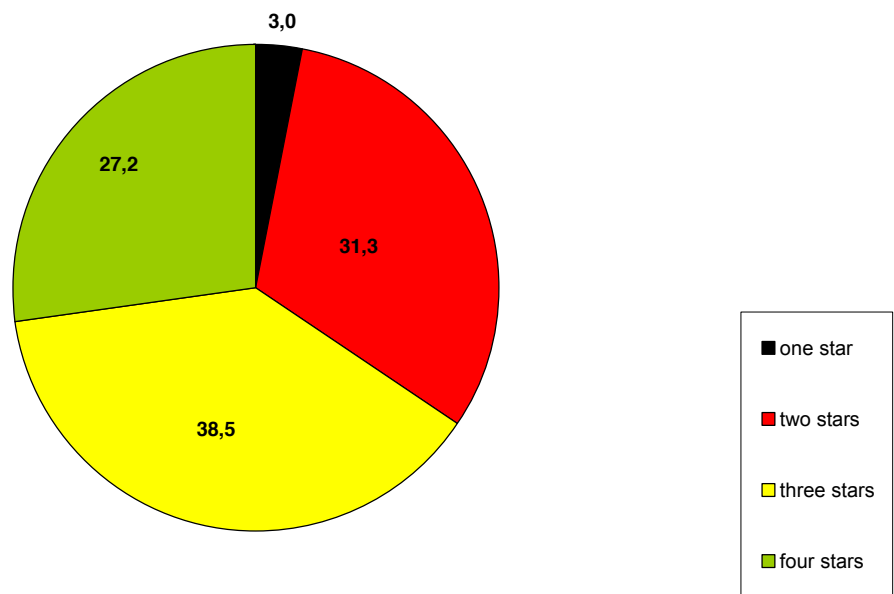
**A-Roads: intersection score in percent**



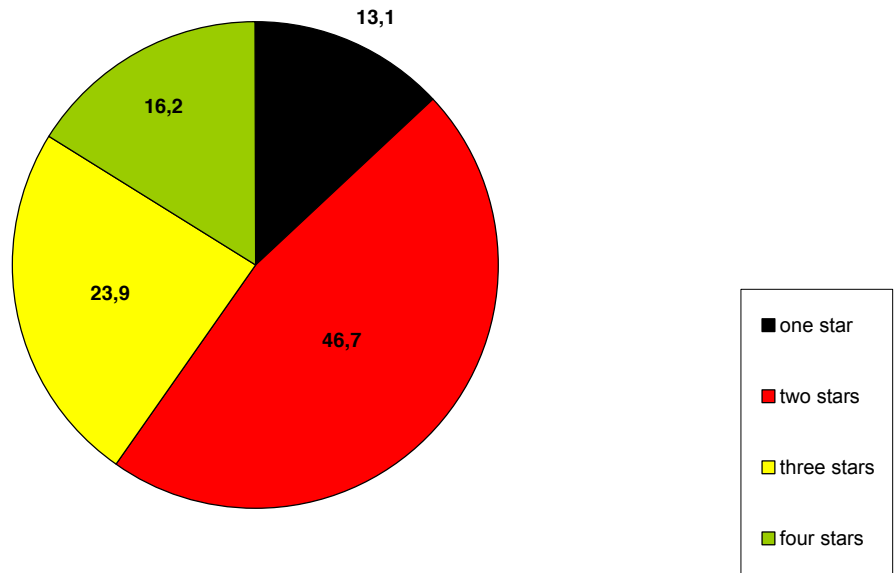
**Fig. 11: Intersection scores per road type**

The side scores also show differences by road type.

**Motorway: side score left in percent**



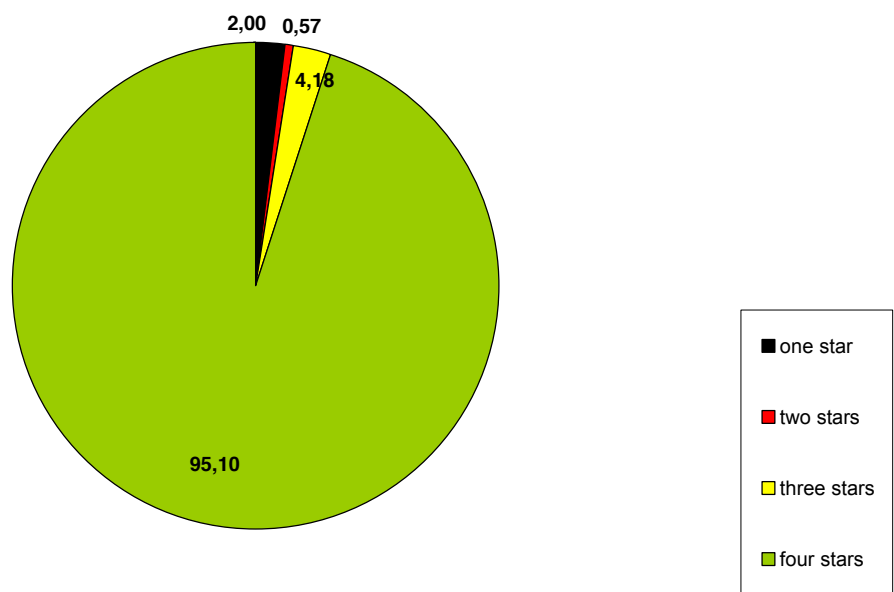
**A-Roads: side score left in percent**



**Fig. 12: Side scores per road type**

The median scores also show differences by road type.

**Motorway: median score in percent**



A-Roads: median score in percent

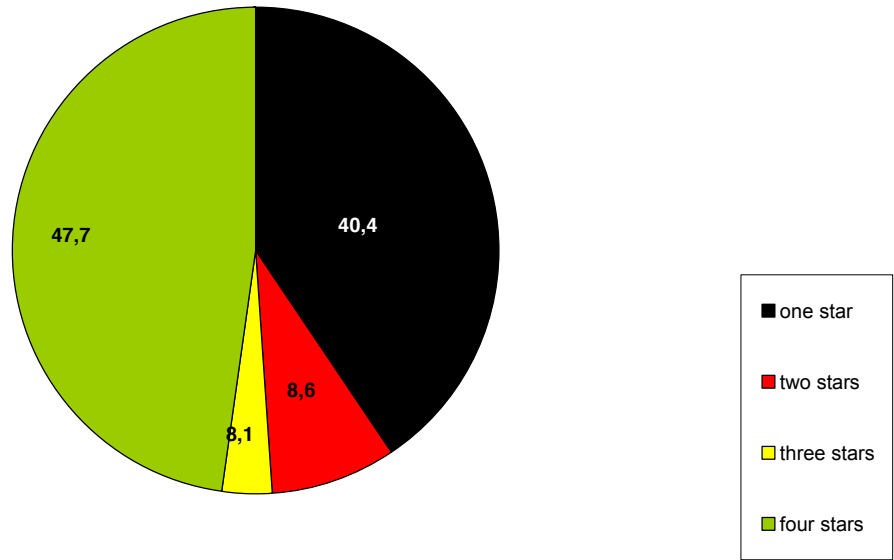


Fig. 13: Median scores per road type

## Links Surveyed

Route Planning GB				
Road	Description	single km	dual km	motorway km
A20	Dover-Folkestone		13.96	
M20	Folkestone-Ashford M20 J10			18.99
A2070	Ashford-St Mary's Bay (Brenzett)	17.71		
A259	St Mary's Bay-Hastings	30.87		
A259	Hastings - Eastbourne	18.61		
A27	Eastbourne - Lewes	25		
A27	Lewes-Hove		19	
A23	Hove-Crawley		26	
A 264/A24	Crawley-Washington		34	
A283	Washington-Shoreham by-Sea	13		
A283	Shoreham by-Sea-Washington	13		
A24	Washington-Worthing		9	
A27	Worthing-Havant		49	
A3, A3(M)	Havant-Guildford		58	
A31	Guildford-Farnham		10	
A331	Farnham-M3 J4		11	
M3	M3 J4-J 8			35
A303	M3 J8-"Stonehenge"	7	53	
A303	"Stonehenge"-M3 J8	7	53	
M3	M3 J8-M3 J4			35
A331	M3 J4-Farnham		11	
A31	Farnham-Guildford		10	
A3, A3(M)	Guildford-Havant		58	
A27	Havant- M27 J2			45
A36	M 27 J2-"Stonehenge" (A303)	42		
A36	"Stonehenge"(A303)-Bath	45		
A4	Bath-Chippenham	46		
A429	Chippenham-Cirencester	33		
A419	Cirencester-Stroud	19		
A419	Stroud-M5 J13	8		
M5A/499	M5 J13-M5 Kidderminster			74
M5/A449	Kidderminster-M5 J13			74
A419	M5 J13-Stroud	8		
A419	Stroud-Cirencester	19		
A417	Cirencester-A420	29		
A417	A420-Wantage	11		
A417	Wantage-A329	22		
A329	A329-A4130	6		
A329	A4130-A329Goring	6		
A329	A329Goring-Purley	7		
A329	Purley-A329Goring	7		
A417	A329-Wantage	22		
A417	Wantage-A420	11		

A4361	Swindon-Beckhampton	18		
A361	Beckhampton-Devizes	18		
A360	Devizes-A303	26		
A360	A303-Devizes	26		
A361	Devizes-Beckhampton	18		
A4	Beckhampton-Chippenham	14		
A4	Chippenham-Beckhampton	14		
A4	Beckhampton-Marlborough	7		
A345	Marlborough-A303	32		
A345	A303-Marlborough	32		
A4	Marlborough-Thatchham	20		
A4	Thatchham-A4/A340	9		
A340	A4/A340-Basingstoke	18		
A340	Basingstoke-A4/A340	18		
A4	A4/A340-M4J12	4		
A4	ReadingM4J12-A404(M)	9		
A404(M)/ A404	A404(M)-A321	8		
A321	A321/4130-A4	6		
A321	A4-A321/4130	6		
A404	A321-A404(M)	8		
A4	A404(M)-M4J12	13		
A4	M4J12-Beckhampton	43		
A4361	Beckhampton-Swindon/NorthWroughton	27		
A361	Swindon-Banbury	61		
A4260	Banbury-Oxford	27		
A4074	Oxford-A329	17		
A329	A4074-M40	14		
A329	M40-A4074	14		
A4074	A329/A4074-Mapledurham	15		
A4074	Mapledurham-Oxford	32		
A4260	Oxford-Banbury	27		
A361	Banbury-Swindon	61		
A417	A417/420-Cirencester	29		
A429	Cirencester-M4 J17	33		
M4	M4 J32-M4 J35 = Teilstück			25
A465	M4 J42-Glyn-Neath		20	
A465	Glyn-Neath-M4 J42		20	
A48/A40	M4 J48-St.Clears		39	5
A48/A40	St. Clears-M4 J48		39	5
M4	M4 J35- M4 J32 = Teilstück			25
A350/A4	M4 J17-Bath	34		
A 36	Bath - "Stonehenge"	45		
A303	"Stonehenge"- Honiton	52	52	
A30	Honiton - M5 J29		21	
M5	M5 J29-M5 J31			9
A30	M5 J31-"Bodmin"		103	
A38	"Bodmin"-M5 J31	30	85	
A38	M5 J31-"Bodmin"	30	85	

A30	“Bodmin”-M5 J31		103	
M5	M5 J31-M5 J30			6
A376	M5 J30-Exmouth	18		
A376	Exmouth-M5 J30	18		
M5	M5 J30-M5 J29			3
A30	M5 J29-Honiton		21	
A303/A30	Honiton-Stonehenge			
A36	Stonehenge - M27 J2			-
M27/A27	M27 J2-Worthing	28	91	
A24/A264	Worthing-Crawley		43	
A23	Crawley-Hove		26	
A27	Hove-Hastings	33	24	
A 259	Hastings-Folkestone	60		
M20	Folkestone-Dover		14	
A2	Dover-M2 J7		36	
M2	M2 J7-M2 J1			31
A2, M25, A12, A282	M2 J1-Chelmsford		46	13
A12	Chelmsford-Colchester (A12/A131)		27	
A12/A14	Colchester (A12/A131)-Ipswich		32	
A14	Ipswich-Chippenham		84	
A14	Chippenham-Huntingdon		55	
A14	Huntingdon-Thrapston		27	
A14	Thrapston-A6116		3	
A14	A6116-M1 J19		41	
M6	M1 J19 - M6 J6			42
A38	M6-Derby		45	
A6	Derby-Buxton	53		
A6	Buxton-Maple	20		
A6	Maple-Buxton	20		
A537/ A53	Buxton-Macclesfield	19		
A523	Macclesfield-Bosley	6		
A54	Bosley-Congleton	7		
A54	Congleton-Bosley	7		
A523	Bosley-Ashbourne	24		
A523	Ashbourne-Bosley	24		
A54	Bosley-Buxton	17		
A54	Buxton-Bosley	17		
A523	Bosley-Macclesfield	6		
A54/A537	Macclesfield-Buxton	19		
A6,A52	Buxton-Derby	53		
A38,A60	Derby-Mansfield	10	26	
A617	Mansfield-Newark on-Trent	24	5	
A1	Newark on-Trent-A1J17		55	
A1	A1 J17-Huntingdon		6	19
A1	Huntingdon-A1 J17		6	19
A1	A1 J17-Newark on-Trent		55	
A617	Newark on-Trent-Mansfield	24	5	

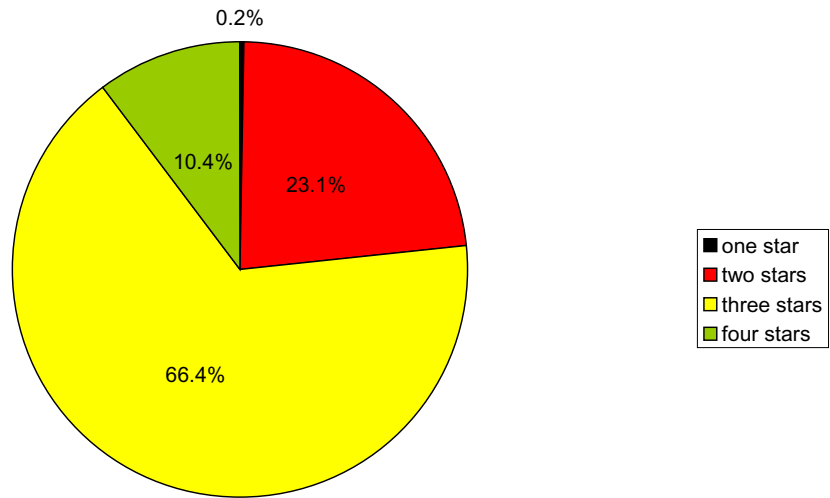
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A38	Derby-A 38/M6		45	
A38	A-38/M6-M6 J9			5
M6	M6 J9-M6 J19			42
A14	M6 J19-Huntingdon		75	
A14	Huntingdon-Chippenham		55	
A14	Chippenham-NeedhamMarket		65	
A140	NeedhamMarket-Norwich	61		
A140	Norwich-Cromer	39		
A149	Cromer-Kings`Lynn	69		
A47	King`sLynn-Petersborough	35	15	
A15	Petersborough-Lincoln	80		
A15 / M180	Lincoln-Hull	39	29	11
A165/ A63	Hull-Bridlington	47		
A165	Bridlington-Scarborough	27		
A171	Scarborough-Whitby	35		
A171	Whitby-Middlesbrough	39		
A66/A172/A66	Middlesbrough-Darlington		30	
A68/A69	Darlington-NewcastleA1		49	
A1	NewcastleA1-Ashington		29	
A1	Ashington-A698	93		
A1	A698-Edinburgh A720	35	58	
A1	Edinburgh A720-A698	35	58	
A1	A698-Ashington	93		
A1	Ashington-Newcastle		29	
A69	Newcastle-Corbridge		19	
A69	Corbridge-A68		5	
A68	A68-St.Boswells	88		
A68	St.Boswells-Edinburgh A720	5	48	
A720/A8	Edinburgh 720-M9 J1a		16	8
M9	M9 J1a-M9 J11			54
A9	M9 J11-Luncarty		54	
A9	Luncarty-Kingussie	95		
A9	Kingussie-Inverness	42	20	
A9	Inverness-MurryFirth	5		
A9	MurryFirth-Inverness	5		
A9	Inverness-Kingussie	42	20	
A9	Kingussie-Perth	113	10	
A90	Perth-Dundee		37	5
A90	Dundee-Aberdeen		87	
A96	Aberdeen-Huntly	41	20	
A96	Huntly-Keith	18		
A96	Keith-Huntly	18		
A96	Huntly-Aberdeen	41	20	
A90	Aberdeen-Dundee		87	
A90	Dundee-Perth		37	
A9	Perth - Sterling	-		
A84	Stirling - Locheranhead	-		

A85	Locheranhead-Crianlarich	26		
A82	Crianlarich-Balachulish	63		
A82	Ballachulish-A830	21		
A830	A830-Mallaig	88		
A830	Mallaig-A830	88		
A82	A830-Balachulish	21		
A82	Ballachulish-Crianlarich	63		
A85	Crianlarich-Locheranhead	26		
A84	Locheranhead-Stirling	45		
M9	StirlingM9 J10-Edinburgh M9 J2			56
M8	M8 J2-M8 J6			36
M73	M73 J2-M73 J3			6
M73	M73 J3-M73 J2			6
M73/ M74/ A725	M73 J2-EastKilbride		19	
M73/ M74/ A725	EastKilbride-M8 J2		19	
M8	M8 J6-M8 J2			36
A720	M8 J2-A 68			21
A68	A68-Corbridge	143		
A69/A689	Corbridge-Carlisle J44	65		
A74	M6 J44-M74 J15			60
A701	A74J15-Dumfries	30		
A701	Dumfries-A74J15	30		
A74	M74 J15-Gretna Green			49
A75	Gretna Green-Dumfries	42		
A76	Dumfries-Kilmarnock	91		
A77	Kilmarnock-Glasgow M8 J20	10	10	12
A77	Glasgow M74 J20-Kilmarnock	10	10	12
A77	Kilmarnock-KreuzungmitA78		11	
A78/A8	A78-bis KreuzungmitM8	22	23	
A78/A8	KreuzungmitM8-A78/A77	22	23	
A77	A78/A77-Kilmarnock		11	
A76	Kilmarnock-Thornhill	68		
A76	Thornhill-Dumfries	23		
E18	Larne-M2 J5	38		-
M2	M2 J5-Belfast M2 J1		17	-
E01	BelfastJ1-Hillsborough J7	12	13	
E01	HillsboroughJ7-Newry	41		
E01	Newry-Hillsborough	41		
M1	Hillsborough-Ballygawley	25	40	
A4	Ballgawley-Aughnacloy	6		
A4	Aughnacloy-Ballgawley	6		
A4	Ballgawley-Enniskillen	46		
A4	Enniskillen-Grenze	25		
A4	Grenze-Enniskillen	25		
A4	Enniskillen-Ballgawley	46		
A5	Ballgawley-Strabane	64		

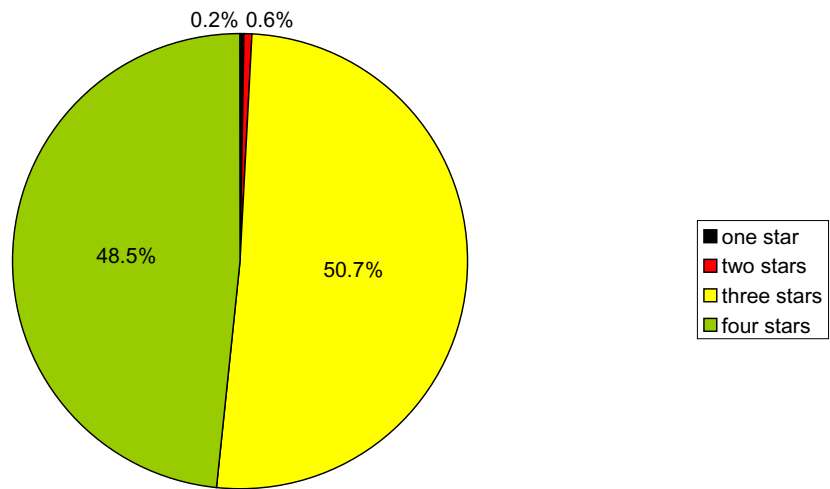
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A5	Londonderry-Strabane	23		
A5	Strabane-Omagh	38		
A5	Omagh-Ballygawley	26		
A4	Ballagwey-Eglisli	21		
M1	Eglisli-Hillsborough		45	
E 01	Hillsborough-Belfast	12	13	
M2	Belfast-M22 J3		32	
A6	M22 J3-Londonderry	80		
A2	Londonderry-Limavady	24		
A37	Limavady-Coleraine	19		
A2	Coleraine-Antrim	65		
A2	Antrim-Coleraine	65		
A 37	Coleraine-Limavady	19		
A2	Limavady-Londonderry	24		
A238	A238-Grenze	5		
A238	Grenze-A238	5		
A6	Londonderry-M22J3	80		
M22/M2	M22J3-M2J6		12	
M2	M2J6-M2J5	8		
E01	M2 J5-M1 J9	24		
E01	M1 J9-M2 J5	24		
E18	M2 J5-Larne	38		
A75	Dumfries-Gretna Green	42		
A74	Gretna Green-(M6) J44			11
M6	M74 J44-Penrith			26
A66	Penrith-A66/A1	44	37	
A1	A66/A1-A61		57	28
A61	A61- Harrogate	24		
A59	Harrogate-Skipton	37		
A59	Skipton-Preston	47		
A682	Gisburn-Long Preston	16		
A682	Long Preston-Gisburn	16		
A682	Gisburn-M65J13	13		
A682	M65J13-Gisburn	13		
M6	M6 Preston-M6/M62			40
M62	M6/M62-M62J12			13
M60	M62 J12-M62 J18			45
M60	M62J18-M62J12			45
M62	M62 J12-M62 J18 - J27			57
M62	M62 J27-M62 J29			18
M62	M62 J29-M62 J38			63
M62	M62 J38-M62 J18			127
M60	M62 J18-M60 J27			26
A628	M60 J27-A628/M67	11		
A628	A628/M67-Stocksbridge	26		
A628	Stocksbridge-A628/M67	26		
A628	A628/M67-M60J27	11		

M60	M60 J27 - J12	-	-	-
M60	M60 J12 - J27	-	-	-
MM62/M6	M62 J12 -M6 J19			31
A556/A54/A51	M6 J19-M53 J12	34		
A55	M53 J12-Bangor		102	
A55	Bangor-Holyhead		39	
A55	Holyhead-Bangor		39	
A5	Bangor-A458 Shrewsbury	126		
A5	A458Shrewsbury-M54 J7		22	
M54	M54 J7-M54 J5			5
A442	M54 J5-Bridgnorth	18	13	
A442	Bridgnorth-M54 J5	18	13	
M54	M54 J5-M54 J7			5
A5	M54 J7-A458		22	
A5	A458-Bangor	126		
A55	Bangor-M53 J12		102	
A556/A54/A51	M53 J12-M6 J19	34		
M6	M6 J19-Preston			58
A59	Preston-Skipton	47		
A59	Skipton-Harrogate	37		
A61	Harrogate-A61/A1	24		
A1	A61/A1-A66/A1		57	28
A66	A66/A1-Penrith	44	37	
M6	Penrith-Carlisle M6 J43	26		
M6	Carlisle M6 J43-M6 J44			6
A689/A69	M6 J44-Corbridge	70		
A68	Corbridge-Darlington	72		
A66	Darlington-Middlesbrough		30	
A66	Middlesbrough-Whitby	39		
A171	Whitby-Scarborough	35		
A165	Scarborough-Bridlington	27		
A165	Bridlington-Hull	47		
A15	Hull-Lincoln	39	29	11
A15	Lincoln-Petersborough	80		
A47	Petersborough-King's Lynn	35	15	
A148	King's Lynn-Cromer	69		
A140	Cromer-Norwich	39		
A140	Norwich-Needham Market	61		
A14	Needham Market-Ipswich		19	
A14	Ipswich-Colchester		24	
A12	Colchester-Chelmsford		41	
A12	Chelmsford-M25 J28		28	
M25	M25 J28-M25 J2		10	13
A2	M25 J2-Dover		56	39

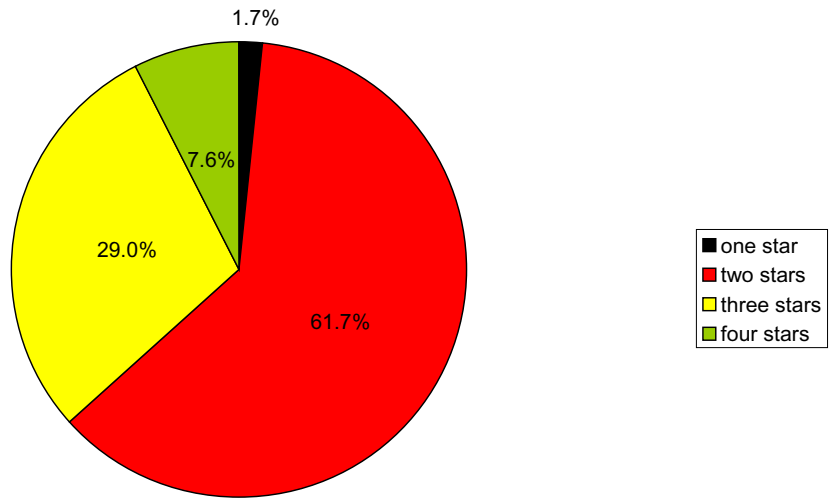
English Trunk A-roads: total score in percent of length



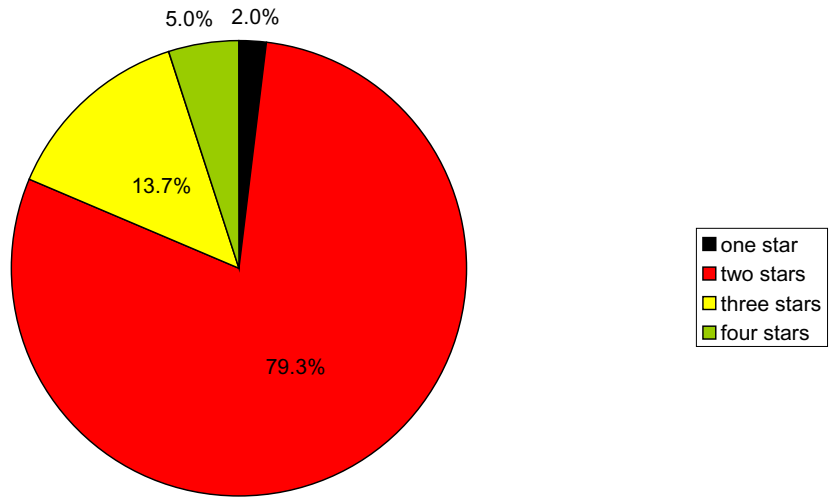
English Trunk Motorways: total score in percent



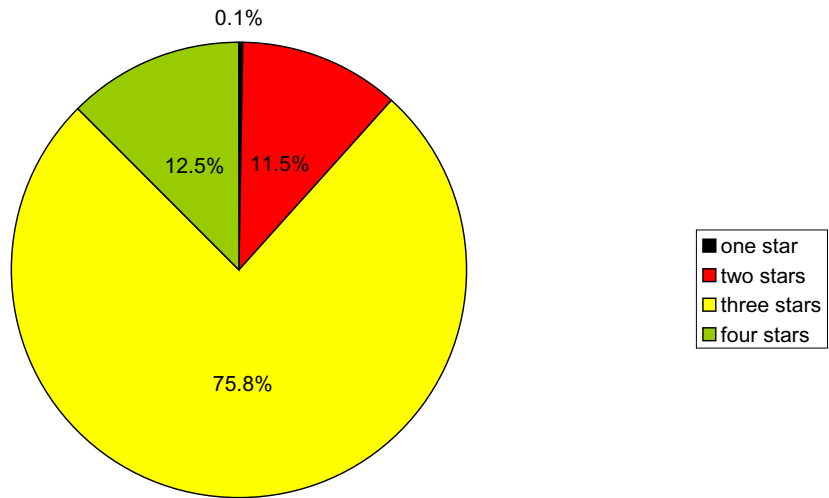
English Non-Trunk A-roads: total score in percent of length



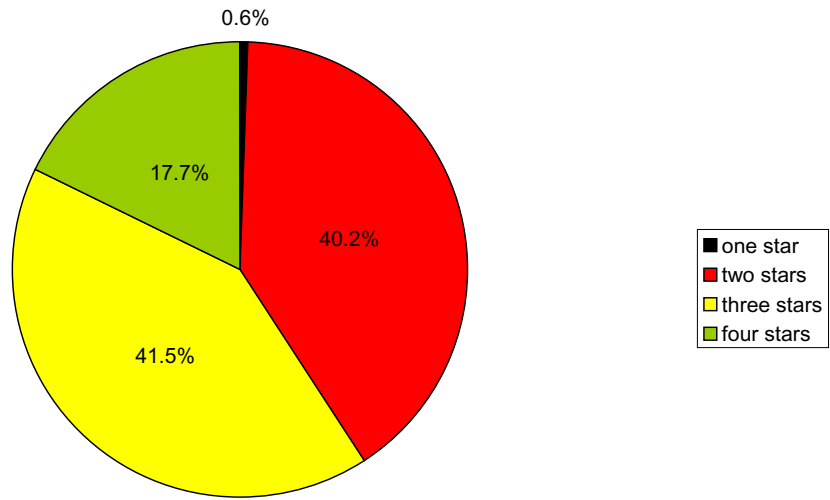
Northern Ireland A-roads: total score in percent of length



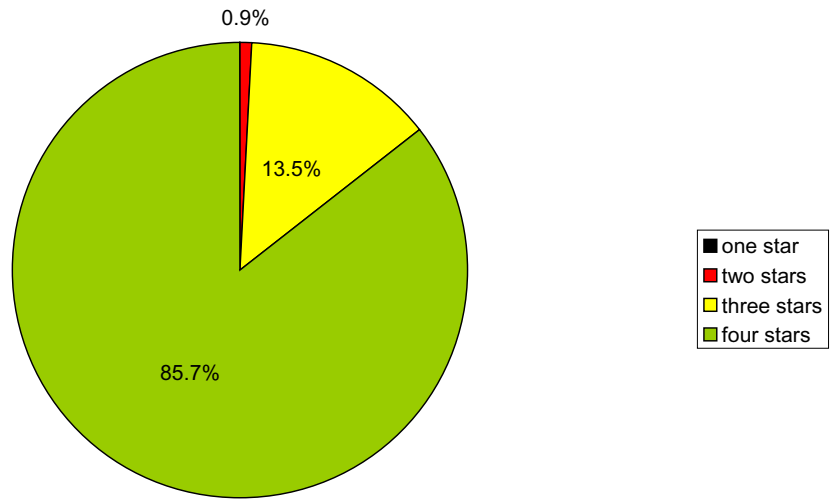
Northern Ireland Motorways: total score in percent of length



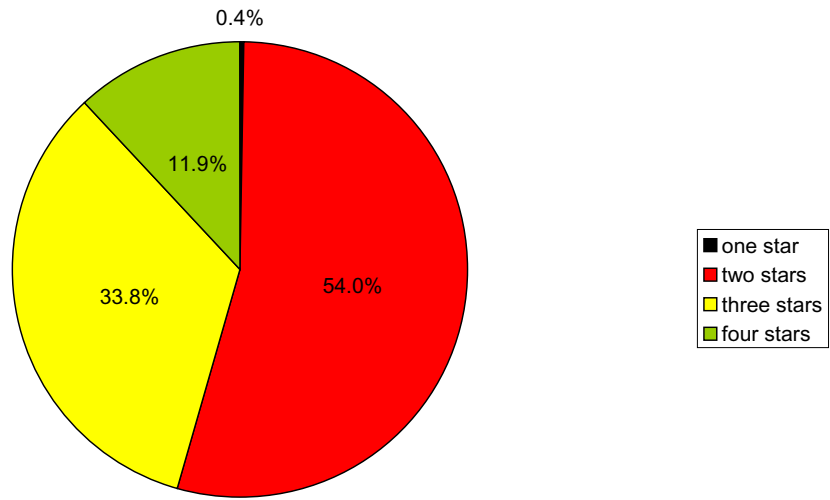
Scotland A-roads: total score in percent of length



Scotland Motorways: total score in percent of length



Wales A-roads: total score in percent of length



Wales Motorway: total score in percent of length

