The Impact of Motoring

Part 2 - Social

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http://green.autoblog.com/2013/05/30/biofore-concept-car-is-a-plant-laden-sustainable-ride/

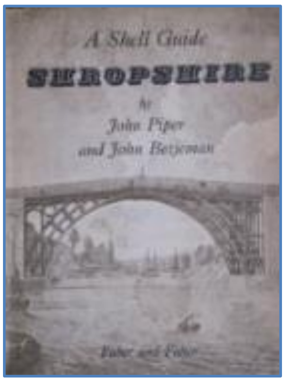
Contents of Part 2

Part 2 - Social

It is surely not an exaggeration to claim that the impact of motoring on the world we inhabit must rank as one of the most far-reaching influences ever introduced by mankind to our planet? The specific invention of the car is, of course, only a small part of the story. The requirements for fossil fuels, the industry and infrastructure to enable the car to function, the social and health benefits (and hazards), some of the changes to the natural world and challenges being faced in the 21st century owe their existence to the rise of motoring. They would merit a book in their own right. In this section, just a few of these influences are presented.

Part 2 - Social — Popular Motoring

Mass production in the USA, mainland Europe and the UK in the early 20th century took the car from the realm of a rich man's (and it was usually a man) pastime to an affordable commodity. More specifically in the UK, the Austin Seven, launched in 1922, revived the fortunes of the Austin Motor Company. During its 17-year production run, it was in competition with the Morris Minor of its day and Model Y Ford, with all striving to offer the "£100 car" to the rapidly expanding motoring public.



Between the World Wars, spurred on by that competition during the 1930s to deliver the "£100 car", motoring for leisure became increasingly popular. Again, in the 1950s, as the availability of new cars in the home market increased following the immediate post-WWII "Export or Die" campaign, a further impetus was given to the number of cars on British roads. Along with this transformation of the domestic tourism and leisure business came the need for maps, road atlases and touring guides. One of the iconic guides of the period 1934 to 1984 was the Shell County Guide. Over the 50-year span that these guides were in print, they had just two editors, John Betjeman and John Piper, both of whom made frequent contributions to the contents of the guides.

Rapidly rising numbers of cars at the start of the 20th century required an associated motor repair industry. Trade directories of the time show blacksmiths turning their skills to motor engineering. Organisations set up to address political issues, such as the repeal the Red Flag Acts, developed in to mobile rescue and recovery organisations.

Finally, as maps give way to satellite navigation for many motorists, this section on the Social impact of motoring concludes with a review of the satnav topic and a look forward to the next evolutionary steps in the technologies that help us find our way around our ever increasingly busy roads.

Why is the Austin Seven so significant?

The Austin Seven revived the fortunes of the Austin Motor Company, added a new small car to their product range and provided the 1920s motorist with an affordable (£165 but as low as £105 in 1934[1]) 4/5 seater car in a design that endured for 17 years. It is over 90 years since its creation and around 7,000 are still in existence.

Introduction

Good King Wenceslas went out, in his Austin Seven,
bumped into a Morris Eight, and landed up in heaven.

This is just one of hundreds of jokes about what is possibly our favourite car of all times. Yes, the Mini was iconic and was built in greater numbers, around 1.6 million against about 290,000[2] Austin Sevens built between 1922 and 1939, but the original little car found its way into the hearts and minds of the British working man and woman for very sound reasons.

For the first time in history, it gave an opportunity for the ordinary working man to purchase a simple, small, but perfectly practical vehicle in which he, his wife, and two or three children could ride in comparative comfort and safety, come rain or shine. The previous option of a motor bike and sidecar had meant being unable to hold a conversation, getting wet and cold, and coping with the inherent instability of a three wheeled vehicle. There were some light 'cyclecars' available but these were not always well designed and never became that popular.

So how did the Austin Seven come to be? Was it a product of market research and a vast development team assessing marketing needs? Not really. It was more the case of one man with a vision and a desire to get his company out of receivership, a brilliant young engineer, and a billiard table!

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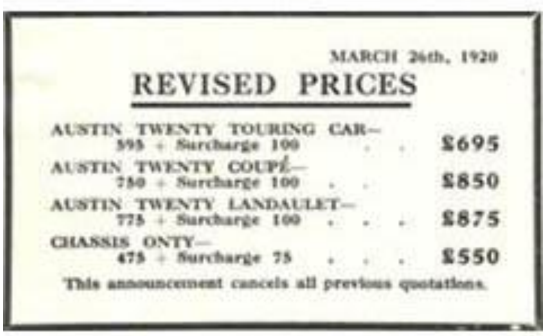
[1] The Motor, 3rd Oct 1933

[2] It is estimated that 290,904 Austin Sevens were manufactured. If you include those made overseas and chassis provided to other manufacturers, the figure goes up to about 416,000

In 1922, the brief post First World War boom had evaporated and the beginning of a depression was on the horizon. The huge Austin factory at Longbridge, south of Birmingham, was one of many in trouble. In fact, it went into receivership in April 1921, having gone from employing 22,000 people in 1919 to just 8,000 in 1922. So it was not surprising, therefore, that the board initially refused the Managing Director Sir Herbert Austin (later Lord Austin: 1866-1941) any funds for the development of a new small car, as they feared that the additional expenditure could result in the demise of the Austin factory.



At the time, the factory had cut their model range to just one car, the large and expensive, 3.6 litre Austin Twenty; to try and achieve economies of scale as Ford had with their very successful Manchester-built Model 'T'. Sir Herbert Austin wanted to produce a small car as an alternative to the motorbike and sidecar, and to the rather limited 'cyclecars' of the day.

The design

The great success of the Austin Seven was due to it being a very well designed car, made of high quality materials, but scaled down.

There were several influences to its design. The engine itself owed much to the Austin 20, but with a two-bearing crankshaft, supported by a ball bearing and a roller bearing mounted together at the front, and a large roller bearing race at the rear. A four cylinder Belgian FN Type 'A' motorcycle had a similar arrangement. Originally, the capacity was 696cc, but this was changed to 747cc after the first hundred cars.

The chassis was a very simple 'A' frame, of top hat section, with a transverse front spring (like the Model T Ford) and two rear quarter elliptic springs clamped into the open ends of the chassis rails. An American 'Grey' truck in use at the Austin works had a similar arrangement and may well have been an inspiration. The French 1920 Peugeot Quadrilette may also have provided some ideas.

Having been refused the necessary finances by the directors, Sir Herbert Austin decided to do it anyway, and enlisted the services of a talented designer, Stanley Edge (1903-1989), who was at the time only 18 years old, and a draughtsman at the factory.

Maybe because of the personal investment made by Sir Herbert Austin in the design and development of the Austin Seven, he was later successful in negotiating a two guinea (£2.10) royalty on every Austin Seven sold and did eventually get approval for the development funds he wanted.

Sir Herbert drew up the initial design concept on the billiard table at his home in Lickey Grange, near the factory, and he and Stanley Edge worked there to complete the design.

AUSTIN SEVEN REVISED PRICES

Effective from August 13th, 1935

RUBY SALOON -	£125
RUBY FIXED HEAD SALOON	£118
PEARL CABRIOLET -	£128
OPEN ROAD TOURER	£112
TWO-SEATER	£102 . 10 . 0
NIPPY SPORTS -	£142

Prices are at Works.

NOTE—The Two-Seater is now available with new radiator.

The first prototype emerged in July 1922, and the production version was released at the London Motor Show in November 1922. The car cost £165, though this was later reduced to £110 in 1932 (around £6,000 in today's money), to try to compete with the very basic, open Morris Minor, which cost just £100.

It was however, the £100 1936 Ford Model 'Y' that had the greatest effect on sales, and was said to have contributed to the eventual demise of the Austin Seven.

Road Fund Tax (Vehicle Excise Duty) for the Austin Seven cost just £8 a year, as opposed to £22 for the Austin Twenty. This low rate, (which was based on the rate of £1 per RAC horsepower) was another reason for the popularity of the Austin Seven

The car had an aluminium body on a wooden frame, conventional for the time, a three-speed crash (i.e. no synchromesh) gearbox and narrow beaded-edge tyres on 19-inch rims. The tyre type changed to wired-on/well type in 1925.

A non-removable starting handle was provided and a manual pull starter, like a lawn mower, was originally fitted but this was changed to an electric starter mounted inside the car in 1925. The owner was advised to use the electric starter only when the engine was warm.

The car had magneto ignition, with manual advance/retard timing adjustment on the steering wheel.

A pram-type hood was fitted and kept out most of the weather for most of the time. The shape of the hood was later changed to give more headroom for rear passengers.

It was economical to run, and could cruise at 45-50 miles per hour, though the speed reduced dramatically if an uphill slope was encountered. Having said that, the Austin Seven could usually climb any hill using its low first gear, or in extreme circumstances, its even lower reverse gear.

The Austin Seven was marketed as being equally suitable for men or women drivers.

Advertising aimed at the female driver

Sales of the Austin Seven increased steadily from about 2,000 in 1923 to a maximum of 26,000 a year in 1929. Though there were many improvements over the years, the basic design of the car did not change much and many parts remained interchangeable throughout the production run, particularly the basic chassis layout.

The biggest change occurred on the 13th August 1935, when the Austin Ruby was announced. This was a major updating of appearance, with a pressed steel radiator grille and more curved lines to the bodywork. It is said that Lord Austin was reluctant to change the radiator grille but acknowledged the old rectangular shape was becoming old fashioned.

From June 1936, the engine had three main bearings and the gearbox had synchromesh on second, third and top gears. Wheel size dropped from 19 to 17 inch and engine power was increased to 16.5 bhp on the New Ruby.

Variants

There must have been hundreds of variants of the Austin Seven, for in addition to their own standard models, specials, sports versions, military cars and racing models, they sold rolling chassis assemblies to other car and van manufacturers and engines to firms like Reliant of Tamworth for their three-wheeler vans and cars.

The Austin Seven was manufactured under licence in many countries, including:

- Australia (Holden)
- France (Lucien Rosengart)
- Germany (Willys Overland and the Dixi, made by BMW)
- Japan (Datsun/Nissan)
- USA (American Austin, Bantam)

The firm of Thomas Startin made vans with aluminium bodies on an ash frame, using the Austin Seven chassis and many firms made their own sports style cars, many of them very attractive.

One particularly elegant saloon car variation was the Swallow, made by the Swallow Sidecar Company, which was headed by William Lyons. This was launched in 1928 and had a split windscreen, luxurious upholstery, a distinctive chrome radiator shell and two marine type ventilators on the scuttle. The Swallow Sidecar Company went on to manufacture the magnificent SS100 sports car from 1933 but in 1939 changed its name due to the political situation in Germany. The name they chose was Jaguar.

The Austin Seven lent itself to home conversions, and once cheaper second hand cars became available, many were converted into sports, trials or utility vehicles.

What's an Austin Seven like to drive?

It was said it was easy to drive badly but hard to drive well. The following personal reflections are based on the author's experience of driving a 1930 AE Series Chummy.

Space – Not as cramped as it looks. The Austin Seven can accommodate two very comfortably built adults in the front and three small children on the bench back seat. However, very tall adults may have problems getting in and out. Needless to say, Austin Sevens were regularly overloaded. One or more adults regularly carried in the back would cause the rear of the tourer body to droop over time, as earlier cars did not have adequate support in this area. This was no longer a problem by the time the Ruby was introduced: it was a full four-seater.

Starting **–**The Austin Seven, even though it only has a six volt electrical system, will normally start using the electric starter, though its not a bad idea to give the manual starting handle a few turns if the vehicle has been standing for some days, to get the oil circulating.

Noise – The engine is fairly quiet if it is in good condition and is not really noticeable above the noise made by the gearbox, particularly the earlier 'crash' (no synchromesh) gearbox, which had straight cut gears. The differential also gives out a whine to a greater or lesser extent depending on how worn it is. Couple that with wind noise and the noise from overtaking traffic and earplugs become a serious consideration for the open touring cars.

Handling – one of the affectionate names for the Austin Seven is 'the road dinghy'. This stems from the way it reacts to undulations in the road, which causes the length of one of the rear springs to increase as the car goes over a bump, giving a degree of uninvited and unexpected rear wheel steering. If the driver over-compensates for this, the car can wander a bit. Once you get used to this little quirk, however, and relax, driving becomes great fun and a straight line can be maintained fairly easily.

Brakes – It pays to anticipate with Austin Seven brakes. The front and rear brakes were not coupled until 1930, so cars had quite good rear braking operated by the handbrake and an indifferent footbrake that operated on the front wheels only. Both brakes were cable operated and the single front cable exerted its force at 45 degrees, which reduced the efficiency and caused the braking effort to increase as the steering wheel was turned. Front brakes themselves were not commonplace in 1922, so this quirk would have been be overlooked by many.

With careful adjustment and regular maintenance, the front brakes can be made to lock if required, so in spite of the design, the modern VOSA test (MOT) is not usually a problem. The Semi-Girling braking system used on later cars, was more effective, and offered individual adjusters on the brake backplates.

Lighting – Early cars had CAV lamps mounted at the side of the windscreen. The problem with these was that the beam did not project far beyond the front of the car, so they could best be described as position indicators rather than headlights. There was also a warning in the early handbooks not to clean the electric light reflectors with brick dust! Later headlamps were mounted at the front of the car, and gave a much improved beam.

Spares – There are still about 7,000 Austin Sevens left. So many were built that most spares are still available from specialist dealers or clubs. Some parts, like early carburettors and body panels, are becoming more difficult to find, but overall the situation is still amazingly good, with a wide range of new components being made in the UK and abroad.

Fun – The Austin Seven is, above all, tremendous fun to drive. It seems to make people smile when they see one on the road, and other drivers will often give a cheery wave or toot on overtaking you, even if you have inadvertently held them up!

Bibliography

These books are packed with useful information, and though not always in print, are worth tracking down. The many Austin Seven clubs also have invaluable websites, and can answer individual questions. You do not have to be an owner to join a club!

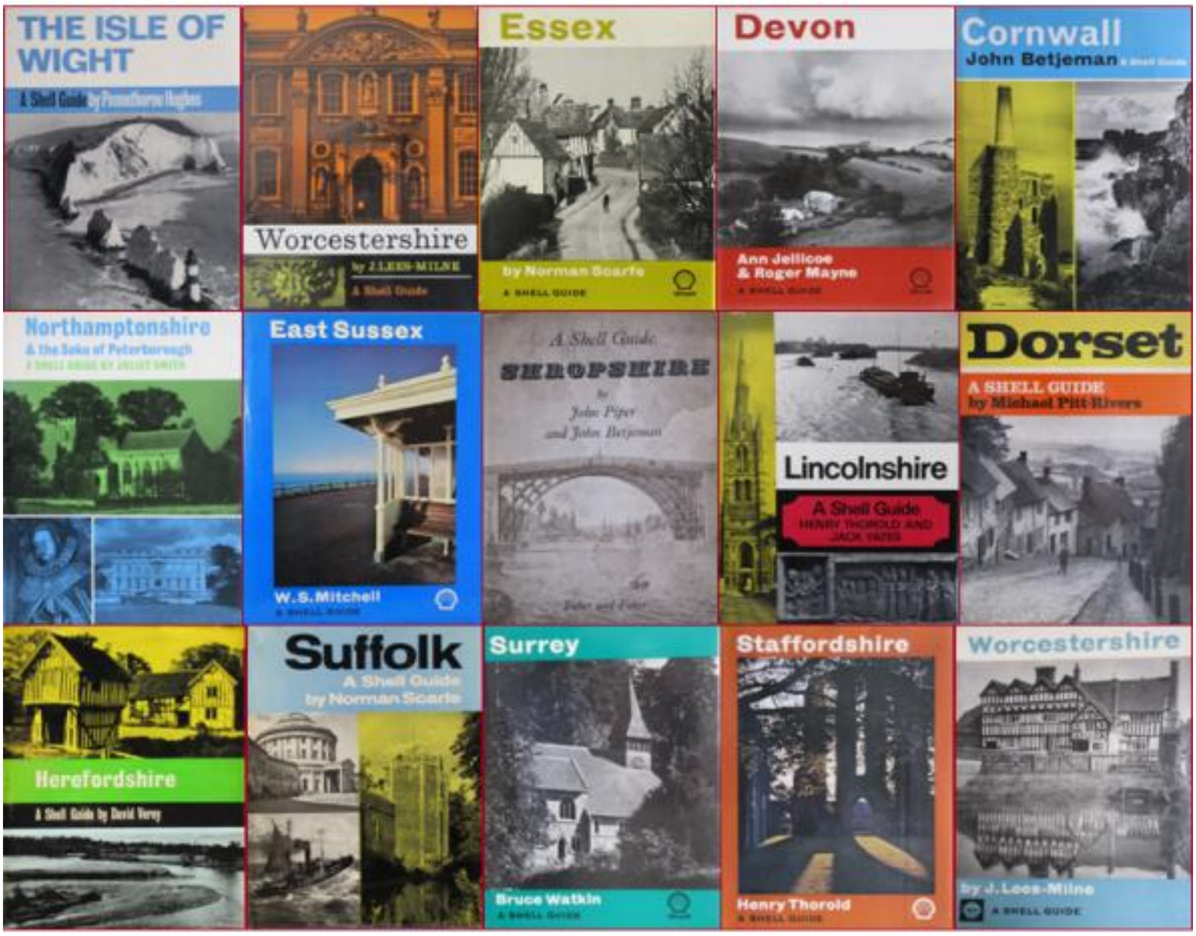
- "The Austin Seven", R J Wyatt, David and Charles
- "The Austin Seven", Jonathan Wood, Shire Publications
- "The Austin Seven Source Book", Bryan Purves, Haynes

This short chapter has left out far more information than it contains, and has had to make many generalised statements. If this annoys the reader, please accept the author's apologies.

Picture Captions and Credits

Page 6: Image taken at 2011 Royal International Air Tattoo
Page 6: 200 miles (and 7 hours travelling) in an Austin Seven Ruby for the annual holiday!
Page 7: Lord Herbert Austin:
http://www.birminghamstories.co.uk/story_page.php?id=5&type=fo&page=2&now=0
Page 8: Austin 20 Price List:
http://www.birmingham.gov.uk/cs/Satellite?c=Page&childpagename=Lib-Central-Information-Services%2FPageLayout&cid=1223092632571&pagename=BCC%2FCommon%2FWrapper%2FWrapper
Page 8: Stanley Edge: http://www.birminghamstories.co.uk/story_page.php?id=5&type=fo&page=5&now=140
Page 9: Advertising aimed at the female driver: property of the Cotswold Motoring Museum & Toy Collection
Page 10: Austin Seven AE Series Chummy 1930

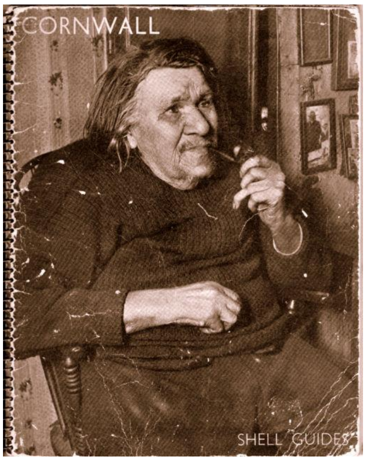
Why were the Shell Guides so influential?
This chapter on The Shell Guides provides an outline of the range, writing style and social significance of this popular series of travel guides to England, Scotland and Wales. The chapter also attempts to justify their presence in the Cotswold Motoring Museum's list of the ten most significant objects in the history of UK motoring.

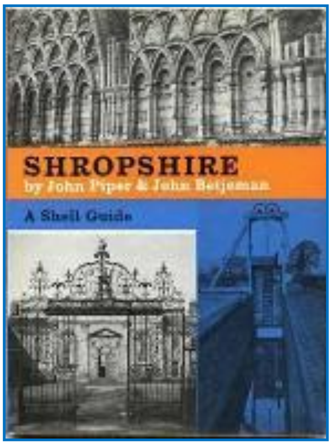


Introduction
In preparing this chapter on the Shell Guides, it very soon became clear that there are two principle sources of reference. One is a 2010 book entitled "A Shell Eye on England"[3] and the other, a user-friendly, detailed website, dedicated to the history and chronology of Shell Guides over their 50-year lifetime. Between them, they would seem to cover all that anyone could reasonably want to know about the Shell Guides. So, either this was going to be a very short chapter, basically listing two references or it would have to follow a different route. Given the inclusion of the Shell Guides in the Cotswold Motoring Museum's exhibition on "A History of Motoring in 10 Objects", the emphasis of this chapter is therefore on arguing the case for their inclusion in that exhibition and in the process, providing an overview of the guides and their history.

[3] By David Heathcote, published by Libri Publishing

The first Shell Guide (to Cornwall) was written by John Betjeman and was published in 1934. Betjeman co-authored and edited some of the subsequent guides and, along with John Piper, remained general editor of all the Shell guides until 1967. Thereafter Piper continued in the role of editor until publication ceased in 1984. By the outbreak of World War II, thirteen Shell Guides had been published. The first of the post-war titles was the 1951 Shropshire guide shown in the centre of the title page to this chapter, jointly written by Betjeman and Piper. The series went on to cover 30 English counties, 4 areas of Wales, the Isle of Wight and the West Coast of Scotland: several in more than one edition.





Images of two editions of the Shell Guide to Worcestershire are also on the title page. The first edition, published in 1964, shows an image of the Guildhall in the centre of Worcester. By the time the second edition was published in 1968, the dust jacket photograph had been changed to a Grade II listed building; the black and white farmhouse at Middle Bean Hall Farm in Bradley Green, near Feckenham. As mentioned above, the central image on the title page shows the first edition of the Shell Guide to Shropshire, this 68-page guide reproduces a Victorian engraving of Ironbridge on the dust jacket. The re-issued guide, shown to the left and published in 1963, includes a photograph of Wenlock Priory. This guide went to a second edition in 1973 with Michael Moulder as a contributing author.

All the guides were sponsored by Shell as a means of promoting their brand and motoring products but were written by different authors. At the time of writing the first Cornwall guide, John Betjeman was writing for the Architectural Review. Perhaps not surprisingly, friends and colleagues associated with the Architectural Review became authors of the early guides, and this is reflected in their architectural emphasis. With the involvement of John Piper from 1937, the guides evolved with an increasing role for photographs and line drawings with new authors providing a shift in the balance of content. Perhaps reflecting the end user role, out on the road or in planning a holiday, the number of pages devoted to the gazetteer increased as the guides progressed.

To expand from a single guide of Cornwall in 1934 to a series of 36 guides, in print until 1984, indicates that they must have found a niche in the market of 1930s to 1980s motoring. The remainder of this chapter investigates how that niche may have arisen and why the Shell Guide filled it so effectively.

Why are the Shell Guides in "A History of Motoring in 10 Objects"?

Is it the numbers?

Department for Transport statistics enable us to quantify the increase in the popularity of motoring during the years that the Shell Guides were available. In 1930, there were approximately 1 million licensed, private cars on the roads of the UK. By 1939, this figure had increased to around 2 million and by 1984, the final year in which the guides were produced, the corresponding number was 16 million. It is clear that, with the exception of the war years, there must have been a ready and increasing market for publications relating to the leisure use of the car. Indeed, when we consider later in this chapter the typical content of the guides, we will see that the first guides were aimed at the holiday market. The very first guide, written by John Betjeman, was devoted to Cornwall: a county that he knew from boyhood holidays and whose attractions (particularly architectural) he was keen to share with his readers.

Thirty-six areas are covered by the guides. These are mostly individual counties but also some wider and more specific areas are described; namely the West Coast of Scotland, South West Wales, Mid-Western Wales, Mid-Wales, North Wales and the Isle of Wight. Over their lifetime, many guides were re-issued. In trying to estimate – at least to an order of magnitude – the number of guides sold, the figures from Chris Mawson's website provide a good starting point. A typical number of bound copies for each guide produced was about 4,000 to 5,000 with around 50% sold. If we assume that, on average, each guide made it to a second edition, then an indication of sales over their 50 year lifetime is between 100,000 and 200,000.

Above: Middle Bean Hall as it is today. Image used on the Worcestershire Guide, Second Issue, 1968

Below: Brockhampton Court as it is today. Image used on the Herefordshire Guide, First Issue, 1955

Original images are visible on the title page

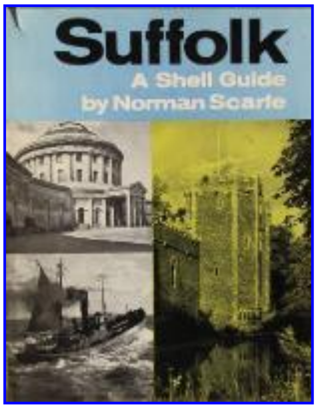
By way of comparison, in this Internet age, for a guide or manual to achieve a place in the Sunday Times top ten list of bestsellers, it has to sell around 100,000 to 200,000 copies but this is frequently achieved in a year or so. Therefore, for the Shell guides, we are not looking at vast numbers of sales. Indeed, Chris Mawson's research in the Shell archives shows that at several points in the 50-year history of the guides, Shell were concerned at the poor financial return on their investment. It appears that the guides survived, as a part of the Shell marketing strategy, in spite of making very little financial profit.

The Shell Guide was not the only choice available to the aspiring holidaymaker and explorer. After the Second World War, the County Books Series published by Robert Hale Ltd in the late 1940s and 1950s were potential competitors to the Shell Guides. Competition from the 1950s onwards was provided by the Pevsner Architectural Guides. These were more numerous than the Shell Guides and outlasted them in print. The first was published in 1951 and the last in 1974, the original series covered the architecture of English buildings in 46 county books and they are still in print today: indeed the series is being expanded and re-issued. The Nikolaus Pevsner guides to the buildings of England follow the detailed gazetteer format that helped to make the Shell Guides particularly suitable for the motorist setting out to explore a county, village by village and town by town.

Is it the content?

The content of the post-war guides and revisions of the pre-war guides followed a similar pattern. Typically, an introductory section would cover one or more specific aspects of the county such as its geography, geology, history, churches, art, architecture, antiquities, regional accents, planning and even early closing days. The bulk of each guide comprised the gazetteer. The 'social effect' of the Shell Guide is often mentioned as a driving force behind their longevity: a motivator to persuade motorists to explore their county and to gain the maximum benefit from motoring holidays. In this context, the gazetteer format was ideal and, at 9" by 7", the physical size of the guides was well suited to travelling in the car glove box. Those guides that went to a second and subsequent edition, generally expanded because of an extended gazetteer. Between the second (1966) and third edition (1976) of the Shell Guide to Suffolk, the gazetteer expanded from 93 pages to 147.

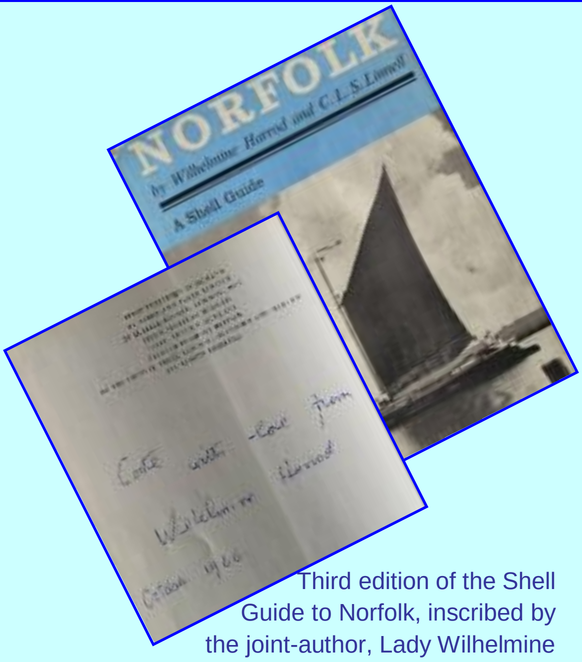
Betjeman and Piper sought authors for their expertise, whether that was in art, conservation and architecture or literature. Consequently, the guides, in spite of a uniformity of layout, are also very individualistic. Heathcote suggests that in adopting the gazetteer format, with brief entries for each location, the limited space would not allow the author to dwell on any negative aspects. However, the down side of a gazetteer approach, unless it is highly selective, is that it will include those locations that a tourist may prefer to avoid rather than to visit. (Arguably, still a worthwhile function of a guide!). Even with limited space to describe the town of Haverhill



in Suffolk, the author, Norman Scarfe, could find space to write, "1955 agreement with GLC to expand to 10,000, then to 18,500, now to 30,000. Why stop at 30,000? … 'The answer is in the character of Haverhill'. A frivolous answer". Whilst the neighbouring village of Kedington merits the complimentary entry, "Church amongst the first a visitor to Suffolk should see. Here, almost more than anywhere in England, crossing the threshold is like stepping back at least two centuries …". Whilst presenting a county with a 'warts and all' description is certainly useful for the tourist, there is clearly scope to offend the local population. This is a characteristic of many of the guides. The 1935 publication of the Shell Guide to Derbyshire showed "the unpleasant side of Derbyshire" alongside a scene of rural tranquillity. Guides to Worcestershire and Mid-Wales also caused some local embarrassment as outlined below.

Is it the authors?

For both John Betjeman and John Piper, initial involvement with the Shell Guides occurred early on in their careers. Both became widely recognised for their literature, artistic and creative skills and it would be difficult to argue that their involvement with the guides was anything but an early stepping-stone to greater things.



Third edition of the Shell Guide to Norfolk, inscribed by the joint-author, Lady Wilhelmine Margaret Eve Harrod (known as Billa) (1911-2005) to her friend Lady Dorothy Heber-Percy nee Lygon (known as Coote) (1912-2001)

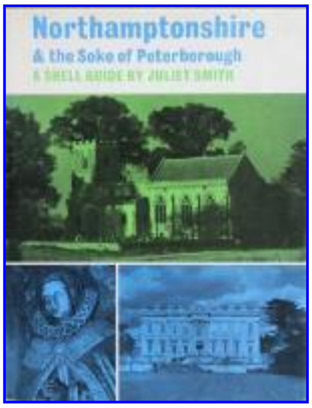
C L S Linnell, joint author of the Norfolk guide was a clergyman with several publications on church architecture to his credit; both within and beyond Norfolk. His co-author, Wilhelmine Harrod, went on to write at length about churches in Norfolk and their conservation. Norman Scarfe, author of the Suffolk, Cambridgeshire and Essex guides, wrote extensively about the history of East Anglia as well as contributing to works on modern history. David Verey wrote the Herefordshire guide and revised the Gloucestershire guide. He wrote extensively about Gloucestershire and Cotswold churches and contributed to the Pevsner series. Author of the Shell Guide to Worcestershire was James Lees-Milne, an architectural historian and native of the county. He was also architectural advisor to the National Trust and was not afraid of speaking his mind. According to the research of Chris Mawson, on seeing the finished draft, Betjeman wrote [to Lees-Milne] congratulating him for the "affection and delicious grumpiness" he had shown. Certainly, Lees-Milne had a trait of describing places in a manner that suggested a set of non-negotiable facts rather than (a very well informed) opinion. For example, “a sort of hill-slope Bournemouth without any sea” was his description of Great Malvern, “… contributes to the general disfigurement of the country”, “Lenchwick is a village of no interest.”, etc.

Much more detail on the authors is available in the two references cited in the introduction but the brief résumé above demonstrates that Betjeman and Piper were able to attract authors of the highest quality to produce the guides. John Piper’s photographs appear throughout the series and his black and white drawings (particularly of church interiors) are found in the immediate post-war guides.

Is it the sponsor?

From the perspective of the 1930s motorist, the guides provided a convenient source of local information on a county-by-county, town-by-town and village-by-village basis. However, the guides were sponsored by Shell (providing very little profit for the company) and the reason for this sponsorship was novel, far-sighted, apparently philanthropic but ultimately commercially motivated. From very early in the era of the internal combustion engine, certainly before World War One, Shell had used art as a means of promoting their brand and hence their products: much as the railway companies had done in the early 20th century. Examples of postcards and posters can be seen in various collections and a display is featured at the National Trust’s Upton House and Gardens. Many of the artists commissioned by Shell to produce advertising posters went on to become famous in British contemporary art. For example, Paul Nash (also author of the Shell Guide to Dorset), John Piper (co-author of the Shropshire guide and general editor), Vanessa Bell, Ben Nicholson and Graham Sutherland.

Whilst there was no reticence to use blatant advertising signage at the point of sale, such as that shown in the many enamelled signs at the Cotswold Motoring Museum, the posters of the 1930s were subtly clever in promoting the Shell brand by associating it with an enviable lifestyle. At the outset, it appears that the guides were viewed in a similar fashion. Yes, they fulfilled the basic role of increasing brand awareness in a highly competitive market for petrol but they also sought to fuel the aspiration of the 1930s young motorist to “traffic-free, rolling roads” (Shell Guide to Derbyshire 1935), “deserted, tree-lined byways” (Shell Guide to Devon 1935) and a sense of being ‘at one’ with nature.



Not all publicity is good publicity however: in any linkage of a brand to a product, there are hazards! In particular, when the author of the Shell guide was an expert in their field and accustomed to directly airing their views. The Mid-Wales guide, published in November 1960, included a reference to Llandrindod Wells and a suggestion that it did nothing but rain in the town. Unsurprisingly, this upset the people of Llandrindod Wells who retaliated with the threat to boycott Shell petrol! James Lees-Milne, an architectural advisor to the National Trust, wrote the Shell guide to Worcestershire. As noted above, this author wrote in a very direct, uncompromising style. He refers to the city of Worcester as “repeatedly sacked by Romans, Danes, Saxons, Welsh and Roundheads” but was prevented from adding "…. [and is] being sacked today by its own corporation". A reference to post war redevelopment of the city centre. A similar issue arose over comments by the author of the Shell Guide to Northamptonshire, Juliet Smith, who made derogatory remarks about the Norwich Union building in Peterborough. As sponsor of a guide intended to promote goodwill for Shell, it is not surprising that in both the Worcestershire and Northamptonshire cases, the final editorial decisions were made by Shell.

In the later guides, for example the 1975 reprint of Norman Scarfe’s guide to Essex, the following disclaimer appears “While the author is here expressing his personal views, Shell-Mex and B.P. is pleased to be associated with this book”. The same author’s 1976 work on Suffolk appears to distance Shell somewhat further by the disclaimer “Although sponsoring this book, Shell U.K. Ltd would point out that the author is expressing his own views”.

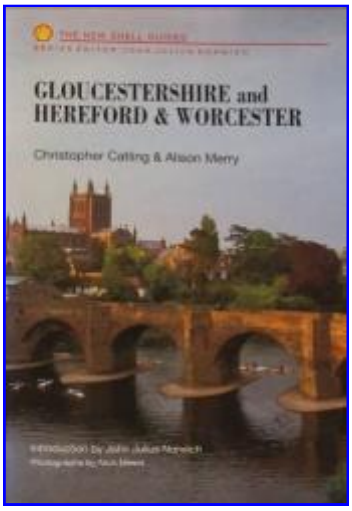
Conclusion

These adverts from The Motor in the 1930s and 1950s show fuel sales were extremely competitive.

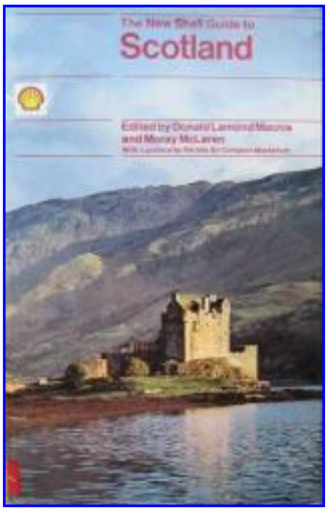
Shell used artwork and the guides to increase awareness of the brand and to associate the product with the finer aspirations of motoring

So, does this justify the inclusion of the Shell guides in "A History of Motoring in 10 Objects"? In reality, maybe it is a combination of all of these factors, plus the fortune of good timing. The guides appeared in their first edition at a time when motoring was becoming affordable to the mass market and again in the revival of motoring following the austerity and rationing of vital materials and fuel during WWII. To have survived for 50 years in multiple editions and re-prints under the direction of just two, like-minded general editors at a time when motoring was changing in scale, taste and affordability is a great achievement. Their longevity alone has been spectacular. Even though out of print, they are today still sought after as a unique description of county life and architecture. In 2008, to see how relevant the Shell Guide to Herefordshire is today, fifty years after publication, a light-hearted test was reported in the Guardian. In terms of change over the last 50 years, Herefordshire was probably a good choice for the experiment but the conclusion was that they can be "…enjoyed by any generation".

Even after Shell ceased supporting the John Betjeman / John Piper guides, they continued to endorse (with the usual disclaimer) further guides. There was a series of Shilling Guides, available even before the demise of the County Guides and also a series of New Shell Guides covering England, Ireland, Scotland, Wales and Britain, each published as a single guide during the 1960s and 70s. The New Shell Guides of the 1980s and 1990s tended to cover



larger areas than their predecessors: for example Gloucestershire, Hereford and Worcester[4] were covered in a single volume. Whilst perhaps more convenient for the motoring tourist, the architectural content was noticeably less than in the original Shell Guides, the gazetteer format was retained and the colour photography produced a greater visual impact. Chris Mawson's comment on the New Shell guides is as follows:



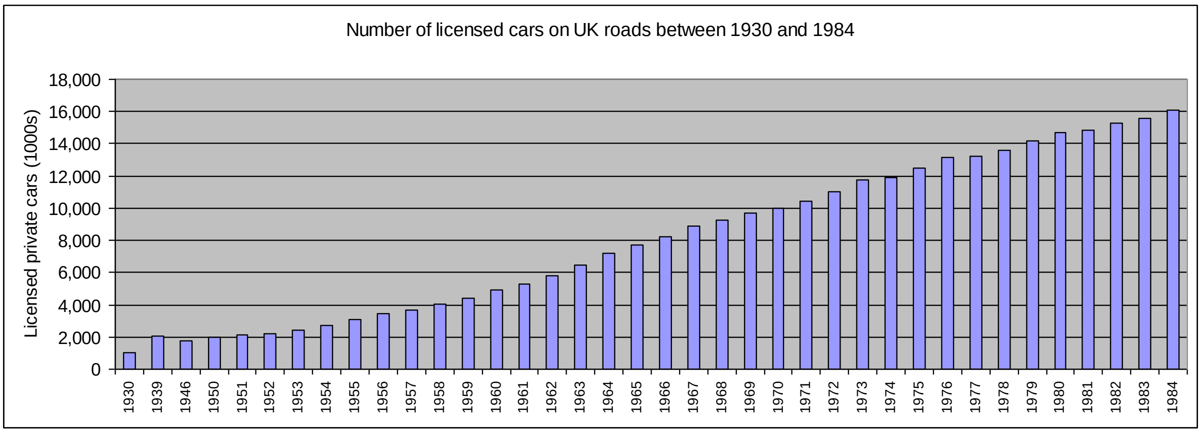
"*An 'official' attempt to revive the format came in the late 1980s when publishers Michael Joseph introduced the 'New Shell Guides' under the general editorship of John Julius Norwich. Rather than reproduce the county-by-county format, these new guides covered regions such as 'The North-East of England' and 'Devon Cornwall and the Scillies'. In tackling larger areas, the guides could only cover the more interesting or obvious places, like many a selective guide before. Perhaps as a result of this, the series faltered and within a few years, all the published volumes were out of print.*"

The original Shell County Guides still make fascinating reading and provide a unique record of Britain in the twentieth century. They are also a lasting tribute to John Betjeman and John Piper who oversaw the entire series throughout their 50 years in print and, in the opinion of the Cotswold Motoring Museum, deserve their place in the top 10 items in "A History of Motoring".

[4] Between 1974 and 1998, Herefordshire and Worcestershire formed a single administrative county

Annex A: Licensed cars on UK roads between 1930 and 1984

The earlier text quotes the number of licensed, private cars on UK roads over the period covered by the production of the Shell guides. These figures, along with those shown in more detail below, are derived from the Department for Transport website.



Annex B: Shell exhibits at the Cotswold Motoring Museum

The Cotswold Motoring Museum and Toy Collection has an abundant display of items that cover the main business of the Shell Oil Company: namely oil and petrol. You may like to see how many of these 16 items you can spot during your visit.

Further information

In addition to the references and links above, Shell Guides are (or have in the recent past been) the subject of exhibitions at:

The Museum of Domestic Design and Architecture (MoDA)
The National Motor Museum Trust
The National Trust property of Upton House

Picture Captions

Page 12: Montage of Shell Guide covers
Page 13: Cornwall by John Betjeman, 1964
Page 13: Shropshire by John Piper and John Betjeman, 1963
Page 13: Enamel advertising sign at Cotswold Motoring Museum, Bourton-on-the-Water
Page 14: Middle Bean Hall, Worcestershire and Brockhampton Court, Herefordshire
Page 15: Suffolk by Norman Scarfe, 1966
Page 16: Norfolk by Wilhelmine Harrod and C L S Linnell, 1966
Page 17: Enamel advertising sign at Cotswold Motoring Museum, Bourton-on-the-Water
Page 17: Northamptonshire and the Soke of Peterborough by Juliet Smith, 1968
Page 18: Copied from 1930s and 1950s copies of The Motor held at the Cotswold Motoring Museum, Bourton-on-the-Water
Page 19: Gloucestershire and Hereford & Worcester by Christopher Catling & Alison Merry, 1990
Page 19: Scotland edited by Donald Lamond Macnie from an original edited by Moray McLaren, 1977
Page 20: Montage of Shell related items on display at the Cotswold Motoring Museum, Bourton-on-the-Water

Introduction

In the subsequent chapter on "Responsibilities of Ownership", the environmental implications of retaining or replacing our cars are discussed. If the retain or replace decision is made solely from an environmental point of view, then the decision may be swayed by the 'unseen' atmospheric CO_2 contribution during the vehicle manufacture, transportation and disposal as well as the emissions during a lifetime of use. If however the attraction of a modern, efficient, reliable car (and the added attraction of a financial discount offered by a highly competitive new car marketplace) proves too tempting, then what can owners expect from those to whom our new vehicles are entrusted? When those new vehicles leave the showroom, they should be at their optimum performance. Engines and other moving parts may need to 'bed in' for the first few hundred miles but wear, spurious rattles and corrosion should not exist. As mileage increases, even with regular servicing, faults will develop – some slowly, some suddenly – accidents will occur and at some point, that new pride and joy will come to need the services of a repair organisation.

An evolution of the blacksmith's skills

The observation by a Scottish clergyman and author, writing an early 20th century account of his town, Maybole, that "blacksmiths had practically disappeared but were replaced by motor engineers, and taxi hirers", could have been true of any town in the UK. The early era of cars required many of the skills associated with the trades of the blacksmith, wheelwright and coachbuilder. The pictures above, showing wheels and semi-elliptical leaf springs from the London to York Royal Mail coach and a French-built 1895 Panhard and Levassor, (both in the London Science Museum) illustrate the point. With oil or acetylene lighting and no battery, the magneto–based ignition system was often the only electrical component of the car.

1896 marked the first London to Brighton car run. A contemporary description mentions "…. the moment pioneer motorists set off from London to Brighton ….. each contraption shaking (as one observer noted) 'like a blancmange at a dance-supper' …..”[5]. This event was to celebrate the repeal of the Red Flag Act: the legislation that required a man carrying a red flag to walk in front of the new-fangled 'road locomotive' to warn of its presence. It was also around this time that the first British-built cars were appearing. It is known that in the summer of 1897, Major General Montgomery of Winchester ordered a Daimler car and thus became the first member of the public in the United Kingdom to own a British-built motor car.

[5] "The Motoring Century: The Story of the Royal Automobile Club" by Piers Brendon, Bloomsbury, 1997

However, the Santler brothers in Malvern, Worcestershire hold the British record for producing the first surviving petrol-engine car when, in 1894, they fitted a single cylinder petrol engine to a previously gas powered car. Although Santler continued to build cars until 1922, unlike Daimler, Santler never appeared to have planned to enter into volume production[6].

The decade following 1896 saw spectacular growth in the number of European and US car manufacturers. By 1905, there were 221[7] UK Motor Manufacturers, the majority in the Coventry area, and along with the growth in the number of motor vehicles came the need to maintain these vehicles.

Trade directories for the town of Malvern (home of the Santler Brothers) show that in 1907, there were 4 blacksmiths and only two motor engineers (one of which was Morgan and Co) but by 1922 there were still 4 blacksmiths but now 10 garages and 10 motor engineers (including Morgan Motor Company Ltd and Santler and Co) [8].

In Bourton-on-the-Water, Gloucestershire, the directories of the day[9] tell a similar story. In 1906, commercial activities relating to road transport included two blacksmiths, a cycle maker and wheelwright. In 1927, one blacksmith and the cycle maker remained but now there was a taxi business and four motor engineers. One was John William

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[6] According to Dr R A Sutton in his publication "Malvernia: The origins and History of the First Motor Car built by Charles and Walter Santler", the brothers were much better at the technical rather than commercial side of their business.

[7] "The Motor Industry of Britain Centenary Book 1896 to 1996", SMMT

[8] Stevens Annual Business Directories for 1907 and 1922

[9] Kelly's Directories for Gloucestershire 1906 and 1927

(Jack) Lake, described as a "motor engineer and cycle repairer", whose garage exhibit is now a major feature in the Cotswold Motoring Museum.

The years of volume production

Some of the repairs that these early garages were called upon to perform would be familiar to today's motorist. Road conditions prior to the First World War were generally poor and wheel and tyre problems would have been common. Twenty years later, servicing schedules were still much more intensive than would be acceptable today. 1000-mile service intervals were common with the grease gun being applied to moving parts of the suspension, chassis, steering, drive train and brakes. Oil level checks for gearbox, rear axle, steering box and fluid checks for the lever-arm shock absorbers would typically be part of the 1000-mile service. After the first 500-mile engine oil change, oil changes were typically every 3000 miles, although 1,000 miles was the interval recommend by some manufacturers, with gearbox and rear axle oil changes every 10,000 miles. It was common for vehicles to require a 'de-coke' (decarbonise) every 10,000 miles. (Modern fuel additives, better lubricants and more complete combustion fortunately today render this procedure much less common). A letter to the Editor of Autocar in 1935, extolling the performance of a 10hp Lanchester, states: "My car has covered 23,000 miles in the 15 months or so that I have had it. During that time it has been decarbonised twice only, at about the 2,000 miles mark and at the 17,000 miles mark …..". There was clearly a market for accessories to address the 'de-coke' problem as seen by this 1931 Decarbo advertisement in Autocar.

There were also unusual and innovative electro-mechanical features whose control functions are now largely implemented using electronics. For example, the Morris Oxford (1956–1959) employed an optional 'Manumatic' transmission. This removed the need for any manual clutch operation during a gear change. The action of the driver gripping the gear lever operated a switch and solenoid, which in turn activated a vacuum-operated clutch and matched the rotational speed of the engine and gearbox before re-engaging the clutch.

Whilst replacement parts were generally vehicle-specific, the concept of all-makes servicing by a garage was common right up to the 1960s. Manufacturers would supply franchised dealerships with various pullers, jigs and other tools specific to their products but a well-equipped, independent garage would be able to tackle most jobs on most low and mid-range makes of vehicle. In 1938, Kennings introduced an 8-minute service and valet for any make of car. National chains, including Kennings and Henleys incorporated specialist services such as engine tuning (eg Crypton, Sun) and lubrication (eg Castrol, Tecalemit) for all makes at major service intervals.

The time-travelling technician

What would be the greatest differences that a 'time-travelling' roadside or garage technician from the 1950s would notice if they were parachuted into a franchised dealership of the 21st century? Firstly, they would probably marvel at the build quality and functionality incorporated in the average family saloon and, as discussed in the "Responsibilities of Ownership" chapter, the value for money that the car represented when compared with its 1950s counterpart. They would notice that some mechanical aspects of servicing remain (eg tyres, coolant checks, oil changes, brake shoe/pad replacement) and that some are much simpler (eg far fewer fluid checks and lubrication points) in comparison with the '50s. In addition, some practises such as re-treading tyres, decarbonising pistons and cylinder head, have virtually disappeared. Instead, the understanding of electronic controls, sensors and diagnostics, driven in part by tighter legislation on the emission of particulates and environmentally harmful gases - implemented through sensors never feasible in the '50s - has become an essential skill for the technician.

Either within or outside of the franchised dealership, the growth of specialist services and suppliers, such as Electronic Control Unit (ECU) re-programming, windscreen, tyre, clutch, brake, audio and air conditioning specialists, would seem unfamiliar; as would the sophistication of the logistics supply chain providing 'just-in-time' parts to the dealership. New materials (eg long-life lubricants, asbestos-free clutch and brake linings) and treatment of waste (eg disposal of old batteries, used engine oil, old electrical – and now electronic - circuitry containing lead solder) would show a revolution in the industry's concern for the welfare of employees and for the environment. No longer is it acceptable to leave old batteries outside the workshop in the certain knowledge that they would disappear overnight!

Picture Captions and Credits

Page 22: The Blacksmith's shop at the Cotswold Motoring Museum, Bourton-on-the-Water
Page 22: Comparison of wheel and suspension from a London to York coach and an 1895 Panhard and Levassor car: both on display in the London Science Museum
Page 22: Acetylene lamp on Alldays and Onions 1911 Victoria, Cotswold Motor Museum, Bourton-on-the-Water
Page 23: Santler Dog Cart Copyright Christie's Images
Page 23: Montage of car manufacturer badges
Page 23: Jack Lake garage sign, Cotswold Motor Museum, Bourton-on-the-Water
Page 23: Print of Jack Lake Garage, Bourton-on-the-Water
Page 24: Advertisement for Decarbo, Autocar, 8 May 1931
Page 24: Sun 1120 Electronic Engine Tester, Cotswold Motor Museum, Bourton-on-the-Water
Page 24: Crypton Diagnostic Centre, Cotswold Motor Museum, Bourton-on-the-Water

Introduction

The UK's two earliest roadside rescue and recovery organisations were both founded over 100 years ago: earlier than any vehicle today on display in the Cotswold Motor Museum. RAC can trace its origins back to that first London to Brighton run in 1896 and the rival AA was set up in 1905. The remit of the AA's 'road scouts' was, initially, to warn members of speed traps and other forms of 'police harassment'. Indeed, well into the 20th century, failure of an AA motorcycle patrol to salute a car bearing an AA badge was understood by the driver as an indication that they may be about to enter a police speed trap.

Given the increasing reliability of modern vehicles, it may seem that the need for roadside rescue organisations such as AA, Britannia Rescue, Green Flag, Mondial, RAC and so on would decrease. However, the increasing complexity of modern vehicles, the reduction in our ability and willingness to tackle car repairs ourselves and the problems still associated with vehicles as age and mileage increase has ensured that many millions of UK motorists have some form of roadside breakdown insurance. In many instances, drivers may have multiple cover: for example, through the vehicle manufacturer's scheme, bundled with a 'premium' bank account, with car insurance, as a benefit of belonging to a car club or, the clear majority (61% according to a 2008 J D Power survey), as an independent purchase through direct membership of a roadside organisation.

In June 2013 there were 29.08 million licensed cars in the UK and, typically, each year roadside rescue organisations receive over 8 million calls for assistance. In 2011, the AA, RAC and Green Flag attended 3.5 million, 2.56 million and 1 million breakdowns respectively.

The distribution of these 8 million calls over a 12-month period is far from uniform. The first frosty morning of the year, the first day back at work after the Christmas and New Year break, the first Saturday of the school summer holiday, abnormal weather; these are all occasions that cause peaks in demand. By comparison, mid-morning on a sunny, mid-week spring day may barely register on the same scale. Predicting demand, and hence staffing levels in call centres and amongst the roadside technicians, is an exercise that all roadside organisations have to address. Historical data is clearly important, as are weather forecasts and special event information. Consequences of a forecast for service demand may result in staff operating split shifts, for example coinciding with morning and evening rush hours, and requires flexibility on the part of all staff.

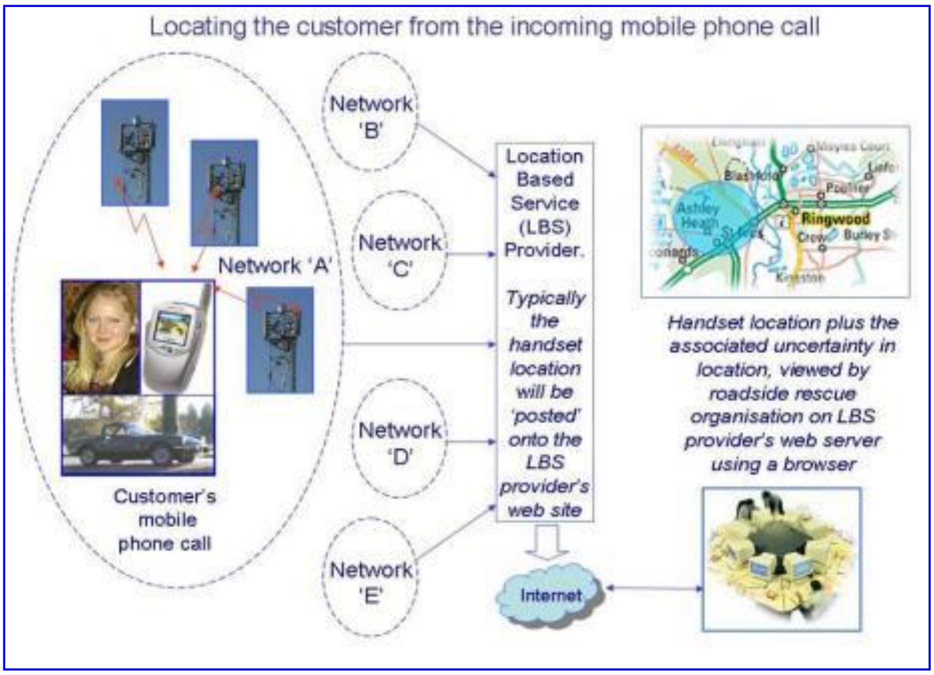
Specific processes will vary from one rescue organisation to another but the following basic steps will be common to most and represent best practice.

Dialogue with the customer

The sequence of events that follow a roadside breakdown usually starts with a phone call to the rescue organisation. Call centre staff are trained to recognise that the customer may be anxious. Not only has their vehicle broken down or been involved in an accident but also they may be more worried about how this will affect the remainder of their day than the immediate re-mobilisation of the vehicle. (39% of RAC patrols have had to deliver a customer to a major event eg a wedding and 2% have delivered a baby!)

Location

Having established the caller's entitlement to service, it is necessary to determine their location. The call handler's IT system, which is likely to feature both a mapping and a text and gazetteer interface, should be able to work with a range of location details that a customer may be able to provide. For example, road names, district, road numbers, motorway junctions, motorway marker posts, landmarks ie garages, pubs, points of interest etc. If this is insufficient to determine a location unambiguously, then there are some more technical options available. A customer calling from a landline may automatically provide the number of the calling line and this may either trigger a location from a database held by the rescue organisation or, as a minimum, the area code that will give an approximate geographic area. Even when an organisation has regional centres, there will be occasions when a single centre takes calls at a national level, so even a crude initial location can speed up the subsequent dialogue.



With mobile phone ownership at 93% of the UK population and 61% of adults having a smartphone, it is not surprising that over 80% of calls for assistance from a motorway originate from a mobile phone. Although the ability to locate a phone within the operator's network is an intrinsic feature of digital networks, it is only relatively recently that this feature has been commercially exploited. Typically, a roadside rescue organisation will enter into a contract with a Location

Based Service (LBS) provider and this LBS provider will manage the interface with the five[10] physical phone networks in the UK. Location of the handset uses the fact that, although the handset communicates via a single cell phone base station, the signal from the handset is received by other base stations within the network. Using the time difference of arrival of the signal at three or more of these base stations, an unambiguous area can be determined that includes the handset location. The size of this area can vary in radius from as little as 100m to 2km, with the final precision dependent upon the relative position of network base stations in the area of the breakdown. The increasing trend to incorporate a GPS receiver in the smartphone will improve the location accuracy to a few tens of metres: always assuming the roadside organisation's IT system is able to exploit this feature of the phone.

Consent of the customer will always be sought by the roadside service organisation before a request is sent to the LBS provider to attempt to locate the handset.

The symptom

The symptom as described by the customer to the call handler will have a major influence on subsequent decisions. Of the UK organisations, AA and RAC employ their own dedicated roadside technicians, referred to as patrols. In addition, some organisations operate branded services for their corporate motor manufacturer customers. There is no point in sending a patrol to a customer who has described a catastrophic problem that will require recovery of the vehicle, possibly using specialist lifting and towing equipment. On the other hand, the customer may only be able to describe the symptom in quite basic terms: "won't start", "cut out", "running roughly", etc. In these circumstances, insight to the underlying fault can sometimes be gained by smart, system-led questions from the call handler. The national databases of roadside organisations quickly reveal patterns of faults with vehicles. This is especially valuable to motor manufacturers following a new vehicle launch but it is also valuable in scripting the smart questions that a call handler may use in a dialogue with the customer. In a small percentage of breakdowns, the smart question and answer routine may result in a recommendation to the customers to try to resolve the problem themselves. An unusual warning light eg low screen washer fluid as shown here, will not prevent the vehicle being driven to a garage so the customer's journey can continue without risk. More frequently however, the outcome of the dialogue results in the optimum resources (eg a motorcycle patrol, a patrol with a vehicle having some towing capability, a flatbed recovery vehicle, a specialist locksmith, a taxi etc) being despatched.

Driver and passenger safety

Customer anxiety can be heightened by the realisation that the roadside, and in particular the hard shoulder of a motorway, is a very dangerous place. Although motorways themselves are the safest roads in the UK, some 250 people every year are killed or injured on the hard shoulder. Once details of the customer's location and problem have been gathered, the call handler should offer guidance on safety to the customer whilst he or she awaits rescue. Recognising the danger of the roadside environment, the SURVIVE Group (Safe Use of Roadside Verges In Vehicular Emergencies) whose members include Association of Chief Police officers, the Highways Agency, Vehicle and Operator Services Agency and representatives of roadside service organisations, was established in 1998. Their aim is to improve the safety of those who work on the road network as well as the travelling public.

[10] The five physical networks in UK are: '3', O_2, the merged Orange and T-Mobile networks (EE) and Vodafone

Patrol attendance

For those organisations with their own patrol force, typically 90% of calls for assistance will result in the attendance of a patrol. In 2008, the industry average for fixing the fault with the customer's vehicle at the roadside, reported by J D Power, was 76% although organisations with their own dedicated patrol force today typically achieve 80%.

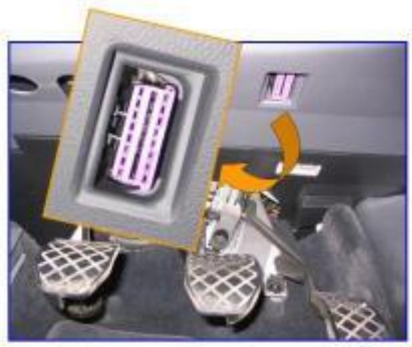
One reason that fix-rates remain so high, even as vehicle complexity increases and access to the engine bay decreases, is that the main reasons for calling a breakdown organisation are dominated by 'low-technology' faults. The hierarchy of faults includes:

- problems with the vehicle battery – especially in cold weather
- wheel and tyre problems – locking wheel nuts and large, heavy wheels are a deterrent to customer DIY
- electrical and mechanical engine problems
- road traffic accidents
- lockout - where the customer has locked the vehicle ignition keys in the boot or interior
- mis-fuelling ie diesel in a petrol vehicle and vice versa.

The number of replacement parts that can be carried in the roadside technician's vehicle is clearly finite and would typically be restricted to common types of battery, small quantities of fuel, lubricants, generic electrical repair items etc. If a roadside organisation is providing a branded service for a specific vehicle manufacturer, then clearly the parts and diagnostic tools carried will be much more focused on that manufacturer's vehicles. Equipment carried will include basic tools, jacking, towing and recovery equipment as well as test equipment. Repair and parts information, at one time paper-based, is now typically stored on the technician's PC.

Diagnostics

Until the advent of the digital data bus within a vehicle, electrical test equipment carried by a roadside technician would have included little more than a multi-meter and current clamp. Modern vehicles contain multiple 'data buses' associated with engine management, safety, braking, suspension, entertainment etc. Access to data is provided via a standardised interface to which a roadside or garage technician will connect their scan tool and PC. EU standards, derived from legislation on vehicle emissions and diagnostics, require the physical and electrical properties of this interface connector and some of the data accessible via the socket, to be common on all vehicles sold in the EU. A technician's ability to read and interpret the diagnostic fault codes presented at this connector is becoming an ever-increasing requirement to maintain high fix-rates.



The roadside technician arrives on the scene of a breakdown knowing about the symptom gleaned from the call handler's dialogue with the customer and possibly enhanced through a direct call to the customer whilst en-route. Following attendance at the breakdown the technician will understand the fault or faults that gave rise to that symptom. Ideally, this fault information will be coded, along with confirmed vehicle details such as the specific model, engine capacity etc, and fed back to the rescue organisation's database to refine the smart, system-led questions that form the starting point of the interaction with the customer.

Competition

Roadside service is a highly competitive market and new entrants regularly appear. As such, it is also a well-surveyed market and J D Power, the consumer organisation Which and UK Institute of Customer Service produce regular reports of roadside recovery service.

Picture Captions and Credits

Page 26: 1903 Cadillac at the end of the 2003 London to Brighton run
Page 26: Old AA box from Bourton-on-the-Water, now in the Cotswold Motor Museum, Bourton-on-the-Water
Page 27: Customer phone call to roadside rescue organisation
Page 27: Roadside rescue organisation call centre, courtesy of RAC Motoring Services
Page 28: Low screen washer fluid level warning indicator
Page 29: Britannia Rescue roadside technician
Page 29: Diagnostic connector J1962 specification. Mandatory on all cars sold in EU

Part 2 - Social | Mapping

Introduction

The next two chapters attempt to summarise some of the ways in which technology, from maps to satnav, helps us to understand our location and guide us along our intended route.

Maps and coordinate systems

A personal, spatial knowledge of our homes and workplaces, our roads, subways, buildings, utilities, railways, rivers, coasts, seabed and airspace underlies every aspect of our day-to-day life: albeit not necessarily at the forefront of our consciousness. The concepts of communicating a position on the Earth, in three dimensions, and distance and direction via a drawing, do not seem to be the most intuitive concepts for human beings to have evolved. However, the evidence exists of portable maps from ages prior to agricultural settlements, when man was still a hunter-gatherer, and these could have made the difference between the survival or extinction of tribes and civilisations.

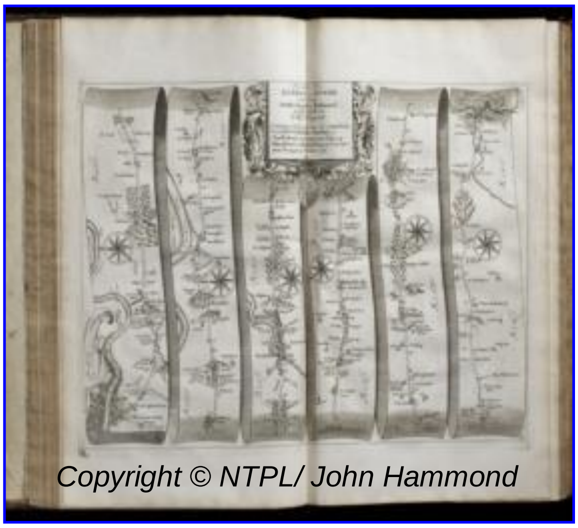
> Women of the Tubu tribe in southern Libya steer their caravans of camels and trek for days across the Sahara just to buy salt and dates at market. For water on the journey, they must find small wells: miss them and they die.
>
> These women use inherited skills to navigate by ‘dead reckoning’. They measure their distance along the route by the number of sand ridges that they pass – no small task when the wind re-shapes the desert sands – and elapsed days. Their direction (heading) is checked by the stars. Their aiming point is a well no more than one square metre in area.

Paper maps

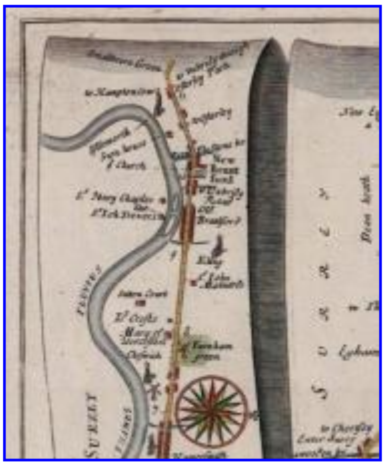
Etchings on stone from 14,000 years ago have been found in the Spanish Pyrenees and are believed to represent the earliest maps.

Biblical stories, Chinese records of solar eclipses 4000 years ago and the orientation of ancient Egyptian tombs and temples from 2500BC are all evidence that humans have used their astronomical knowledge to understand their own location and orientation. Possibly the earliest known city map is of the Turkish city of Catal Hoyuk and is 6200 years old.

Old UK maps, (eg Mappa Mundi) from the 13th century onwards are often considered to be works of art, as well as works of science. The 1660 John Speed map of Cardiff, shown here and now held in the University of Wales, is an example of the artistic quality and detail of early maps.



John Ogilby (1600-1676) ended his varied career by producing maps. He produced the first British road atlas (left) in 1675 and was the first to use a statute mile of 1760 yards. For specific journeys, he created ribbon maps of many routes across England and Wales. These were based on a series of 'ribbons' of road, typically 70 miles in length, covering specific journeys. A sample of Hampshire mapping by Ogilby, from his Lands End to London ribbon map, is shown on the right.



In many ways these ribbon maps resemble the route books, typically produced by RAC and AA for members' routes in the 1960 to 1990 period; before web-based routing was available. The concept of herringbone or fishbone maps, used in motor sport, also follows the ribbon map idea. In these maps, the straight line from bottom to top (or left to right) of the navigator's instruction sheet represents the direct line from start to finish of the journey with missed junctions along the route shown as lines branching off the straight line.

The maps we use today have their origins in war. The Board of Ordnance commissioned maps of the Scottish Highlands in 1747 and following more than half a century of intense mapping by a few brilliant pioneers, the first Ordnance Survey map[11] of part of Kent was displayed to the public in 1801.

Mapping coordinate systems

If our holiday or rally route instructions start with a map grid reference or a latitude and longitude, then it is easy to believe that this will unambiguously define the location of the start of the journey. Unfortunately, this is not the case since it will depend upon the coordinate system from which the latitude and longitude are derived. From the point of view of a motorist in the UK, the most likely situation when this will be encountered is in the use of a GPS satellite navigation receiver (GPS is discussed in the Satnav chapter of this book) and a large-scale Ordnance Survey (OS) map.

[11] "Map of a Nation: a Biography of the Ordnance Survey" by Rachel Hewitt, Granta.

The problem arises from the fact that the mathematical description of the shape of the Earth – a slightly squashed sphere – varies from one coordinate system to another and historically has been optimised for the region of the globe to which the coordinate system refers. For UK, the coordinate system used is OSGB36 (Ordnance Survey Great Britain 1936). For GPS, a global satellite system, the coordinate system is WGS84 (World Geographic Survey 1984). A latitude and longitude read from an OS map, based on OSGB36, could be a few hundred metres different from one read from a GPS receiver set to the WGS84 coordinate system. A significant error for anyone on foot or driving. A webpage to calculate transformations between these coordinate systems is provided by the OS. The above 200m square of map has been reproduced from the OS website to illustrate two points with the same latitude and longitude but in two different coordinate systems.

> The extent to which our native language determines how we express the concept of location and directions is discussed in "Through the Language Glass: How Words Colour Your World" by Guy Deutscher (Heinemann). In English, we often describe a journey using 'ego-centric coordinates' based on the speaker's position (left, right, forwards, backwards) and also using geographical coordinates (north, south, east, west). One particular Aboriginal language does not use 'ego-centric coordinates' – there are no words for left or right - but relies solely on points of the compass. A native speaker may describe Long John Silver as missing his north-westerly leg, depending on the orientation of the TV on which he is watching Treasure Island. This requires the speaker to always understand the direction of north in order to express himself.

Errors can occur in transferring or 'projecting' locations from a spherical surface (the Earth) on to a two-dimensional plan (the map); however, this is moving beyond the scope of this chapter. An excellent introduction to coordinate systems and map projections has been produced for those wishing to take the topic further.

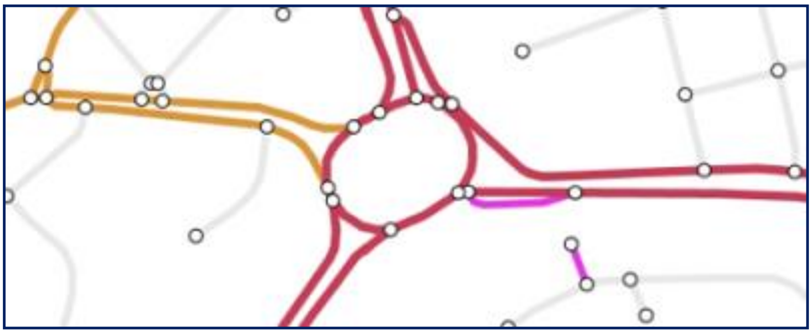
Digital Maps

The first significant move away from using paper or film as the basis of a map display occurred in the 1980s with the capture of electronically scanned images of a paper map stored on video discs: typically the size of dinner plates. Reading these images from a disc player, or bank of disc players, allowed the computer controlling the players to superimpose simple overlays on the map display, for example, to aid planning and logistics processes. Manipulation of the maps, such as pan and zoom, was limited by the original selection of the scanned maps. Although rather basic by today's standards, this move to electronic mapping also marked the start of the now widespread, GIS (Geographic Information System) market: more on this later.

When we use digital mapping today, we are accessing a database comprising segments of the road network (links) and intersection points of these links (nodes). A digital data set of the UK typically comprises 6 million links and nodes. Associated with each link is a range of attributes that include the type of road (motorway, A-road etc), road name, number, locality name etc and a unique identifier. If the data set is to be used for route planning, then additional data is required (sometimes referred to as Drive Restriction Information – DRI) which identifies one-way streets, banned turns etc. In practice, when roads are surveyed to collect the DRI data, a lot of additional information may be gathered, such as height, width, weight restrictions, speed limits, images of roadside signs, lane markings and so on. If the data set is to be used for in-vehicle navigation or logistics, then such information can add to the saleability of the end product. If traffic information is to be used in conjunction with the map data, then the unique link identifier will enable a cross reference to the location codes used with the traffic information. Again, more on traffic information and location codes is provided in the chapter on Reducing Usage.

Two global organisations that are major gatherers and resellers of digital map data are Navteq and Tom Tom (formerly Tele Atlas): they frequently work in collaboration with national mapping agencies such as the Ordnance Survey in UK.

An overview of two data sets provided by the OS, Asset Manager and Traffic Manager, can be found at this link. The sample shown here is from the OS MasterMap® data set and shows typical spatial information available in that data set.



Conclusion

Two primary markets exist for digital mapping data; these are the GIS and vehicle navigation markets.

Users of Geographic Information Systems (GIS) are typically central and local government, the utilities – gas, electricity, water, telecommunications – the emergency services and vehicle fleet operators. Suppliers such as ESRI, MapInfo, Intergraph and many others will typically use digital mapping data to develop a GIS for their end customer.

The proliferation of portable, in-vehicle satellite navigation devices and the addition of mapping to smart phones and tablets has produced a surge in the requirement for digital map data. In the UK, the first area to be digitally mapped for use in satellite navigation systems was within the M25 motorway (1994). Coverage rapidly spread to other major cities and within a few years to the entire UK road network. A similar situation occurred in other Western European countries and today a portable satnav covering all roads in Western Europe can be purchased for less than £100.

Picture Captions and Credits

Page 31: John Speed map of Cardiff, University of Wales
http://upload.wikimedia.org/wikipedia/commons/5/58/John_Speed%27s_map_of_Cardiff_1610.jpg
Page 32: John Ogilby map, Lands End to London
http://www.geog.port.ac.uk/webmap/hantsmap/hantsmap/ogilby/og25smaf.htm
Page 32: John Ogilby atlas at Scotney Castle, Copyright © NTPL/ John Hammond
Page 32: The error introduced by inappropriate choice of coordinate system
http://www.ordnancesurvey.co.uk/docs/support/guide-coordinate-systems-great-britain.pdf
Page 34: Ordnance Survey OS MasterMap® sample
http://www.ordnancesurvey.co.uk/oswebsite/products/os-mastermap/itn-layer/index.html

Lost without your satnav?

In 2012, over 1000 visitors to the Cotswold Motoring Museum and Toy Collection voted the satnav as the 10th item in the "History of Motoring in 10 Objects" exhibition. Those of us who regularly use a satnav soon become dependent on the device. This chapter provides a brief look at what lies behind that colourful screen and those concise instructions.

The option of adding a satellite navigation device to your vehicle first became viable in the UK in the early 1990s. It was then that satellite constellations were becoming sufficiently populated to provide 24-hour coverage and significant areas of the UK, initially within the M25, were covered by digital mapping. Before looking at the benefits that a modern-day satnav can bring, a brief look at how the essential parts of a satnav system came about is explored.

Life (long) before satnav

In July 1714, Parliament passed the Longitude Act. The purpose of this act was to provide a safe means of determining the position of a ship at sea and was in response to a tragic loss of over 2000 lives off the Scilly Isles in 1707. The financial reward offered by the act produced great advances in both astronomical navigation and in precision timekeepers.

Some 10,000 years earlier, as Britain warmed and the glaciers retreated northwards, our hunter-gatherer ancestors must have faced similar, life-threatening issues around knowing their location on land. With their only reward being the prospect of their own survival, they would have measured time in terms of days walked and orientation with reference to the sun, moon and stars. A successful return to hunting grounds, following animal tracks between places of human shelter and animal grazing, would be an adequate reward for their navigational skills.

By comparison, becoming lost on a day out with the family to a safari park may seem of little consequence but, based on a survey by the RAC Foundation, becoming lost, along with congestion and various traits of driver behaviour, is rated as one of the most stressful aspects of driving today.

Directional guidance, through roadside signs conveying distance and direction, has been in existence since the time of the Roman Empire. Marble shafts about 2m high and at 1 mile spacing were used as markers or milestones along Roman roads. In 1698, an English law required each parish to place guideposts at its crossroads pointing out directions to adjacent villages and towns. The development of toll roads and the postal services in the 18th century led to great improvements in signposting with some signs even including travel times to the next location[12].

So, nothing is completely new – modern variable message signs around the motorway and trunk road network frequently provide an indication of traffic congestion by telling drivers what they really want to know; namely the time, as well as the distance, to their destination. Time of arrival at our chosen destination and distance to go are also typically displayed on the screen of a modern in-car satellite navigation (satnav) device.

The 'Points of Interest' databases on the portable satnav or the route-planning website are providing a similar function to those marble, Roman marker posts and parish guideposts, pointing out the nearest inn (hotel), blacksmith (garage) or fuel.

This chapter summarises some of the ways in which technology, from digital maps to satellite location, helps us to understand our location and guide us along our intended route and how dynamic information on road traffic conditions can be used to make our journeys less stressful and more environmentally friendly.

How does satnav work?

In addition to routing software and satnav hardware, such as the touch-screen, there are two essential requirements for a portable or vehicle-based satnav system to operate. These are:

- A digital map database covering the area in which the car is travelling
- A means of determining the location of the car

Digital maps

The principles of this topic have been covered in the earlier chapter on Mapping. The concept of the digital map comprising a database of links and nodes each with associated attributes such as one-way street, speed limit (impedance), banned turns, no entry and so on is essential to the operation of the satnav device. The concept of the unique 'link identifier' is a requirement of the satnav's digital map database if dynamic traffic information is to be incorporated in a route calculation. This is because congestion on a link in the database will be quantified as an increase in the link impedance and may result in a route calculation offering a longer distance but reduced journey time. Today, most satnav products offered for sale in the UK will include, as a minimum a database of the UK and the Republic of Ireland, in many cases all of Western Europe will be included and in some cases North America as well.

[12] "Ways of the World – A History of the World's Roads and of the Vehicles That Used Them" by M G Lay

Location Technology

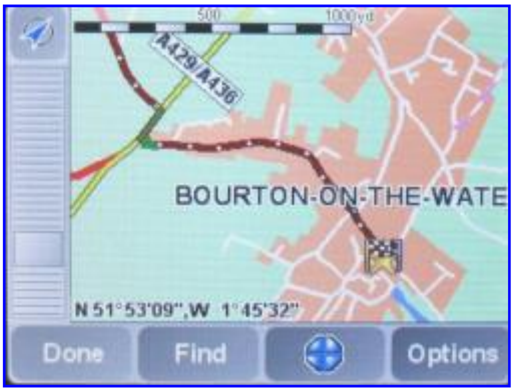
Terrestrial radio frequency (RF) location systems, with varying levels of coverage, precision and configuration have been in existence since World War II and today's mobile phone location technology operates on exactly the same principles. Satellite location systems for wildlife tracking and safety applications have been operational since the 1970s. Today, the most common satellite system configuration is one in which the satellites transmit a RF signal that is picked up by a portable receiver. Using the time difference of arrival of signals from three or more satellites, an unambiguous location of the receiver can be determined. If four satellites or more are 'in view' of the receiver then height above sea-level can also be found. The system of greatest relevance to the motorist (plus walker, cyclist, explorer, surveyor, mariner, aviator, etc) is the Global Positioning System (GPS).

The GPS network is a US Department of Defence (DoD) system designed for military use. However, from the outset, it was expected that the greatest number of users would be civilian. The network comprises 24 active satellites in orbits approximately 20,000km above Earth. Because this is lower than the 36,000km geostationary orbit, used by the majority of communication satellites, the period of each GPS satellite's orbit is around 12 hours. This means that a receiver on Earth 'sees' a continuously varying set of satellites from which it calculates its position. Each satellite transmits data about its own position in orbit. Hence, by measuring the time at which the signal is received and knowing the satellite position, a receiver can calculate its range from the satellite. Receivers are multi-channel; this means that, for example, a 6-channel receiver can receive signals from up to six satellites simultaneously. So, in this example, up to six simultaneous range measurements from up to six satellites can be used to uniquely calculate the location of the receiver. Each GPS satellite carries a very accurate atomic clock and these clocks are synchronised throughout the network. The receiver, by contrast, has a relatively cheap (and hence inaccurate) clock so rather than measuring the absolute time of arrival of a signal from each satellite, it measures the Time Difference Of Arrival (TDOA) between the signals. All locations with an equal TDOA between two satellites lie on a hyperbola. Using a second pair of satellites, all points of equal TDOA lie on another hyperbola. The point where these two hyperbolae intersect is the location of the receiver. This link provides more background to TDOA and hyperbolic navigation for those keen to read more.

There are many sources available on the internet to find a description of GPS. One thorough description is provided by Trimble; a manufacturer of GPS receiving equipment since the early 1980s.

The satnav

We have now introduced the two key components of a satnav device for the motorist: digital mapping and the GPS satellite system. Portable satellite navigation devices, such as those manufactured by Tom Tom, Garmin, Navigon, etc embody a GPS receiver, digital map database for the area covered by the product and various 'points-of-interest' databases, with the user interface via a colour touch-screen. Route calculation between user-defined points is performed by routing software. Some satnavs include a component that senses changes in



heading of the vehicle. The GPS receiver determines the location of the vehicle to within 10 to 15 metres and the track produced as the vehicle starts to move is matched with the road map data for the area. Map data, such as the OS MasterMap® product mentioned above, have an accuracy of carriageway centre line to within 2m and it is this 'map-matched' location that is displayed on the satnav screen. Where a heading sensor is incorporated, this is able to continue to update the display when satellite coverage is lost, for example in a tunnel, under an extensive tree canopy or in urban, high-rise areas.

Whilst the majority of satnav equipment is portable, most vehicle manufacturers provide satnav as an option with a new vehicle. This tighter integration with the car data networks can provide some performance advantages. In addition to the heading sensor, speed information can be used to assist in updating the car's position when satellite signals are temporarily lost. Also, during manufacture, the GPS antenna can be integrated with radio and mobile phone antennas on an unobstructed part of the car body giving the best possible GPS reception. Typically, the navigation display touch-screen would also act as the interface with other vehicle functions such as the audio system, climate control and parking sensors.

The user interface on most satnav systems, portable or built-in, is not always the easiest for a driver to master; especially if the car or system is unfamiliar. Recognising this limitation, as well as the difficulty of finding space in the passenger compartment to accommodate a satnav screen, Smartnav started life as a system where the minimum user interface was a single button (a screen is now a standard feature) and the route calculation is performed in a control centre. Requesting guidance initiates a call to a control centre and the driver describes their destination to the call handler. The route is downloaded to the car and replayed as a set of audio and visual prompts as the journey progresses. Apart from the simple user interface, this configuration allows the control centre to always use the latest maps and to include the latest traffic information in the route calculation. Changes in the traffic conditions during the journey that may alter the recommended route are downloaded to the car as appropriate.

Traffic Information - summary

The gathering, distribution and use of traffic information are covered in the Reducing Usage chapter. The following brief summary is specifically in the context of satnav.

One widely used and standardised method of coding traffic congestion data into a form that is useful for an end user has been through the development of RDS-TMC: Radio Data System-Traffic Message Channel. RDS-TMC is a defined coding process for an event (ie congestion and its cause; ice, snow, accident, etc), expected duration and its location. Assuming the originator of the traffic message and the end user (ie the driver), use the same coding and decoding process, the RDS-TMC broadcast just needs to transmit a simple code to convey details of a traffic event. A radio receiver in the satnav de-codes the incoming data in order to reconstruct the original message. For this to work reliably the RDS-TMC receiver must always have an up-to-date copy of the code database. In a satnav, this would be on the memory medium (CD, DVD, RAM, HDD) which stores the map database. One big advantage of RDS-TMC is that it is language independent. UK drivers travelling through mainland Europe can continue to receive traffic information in English from RDS-TMC broadcasts in the countries through which they are travelling. The traffic 'event' may be described in text on a vehicle display or, used to update the satnav's recommended route.

The information is delivered to the satnav device via FM or digital broadcast or via a mobile phone network. The effect of congestion on map database links along the planned route is to increase the impedance of those links so the satnav will conclude that a faster journey is possible through a change of route and, either automatically or with a prompt from the driver, will calculate a new route.

The future

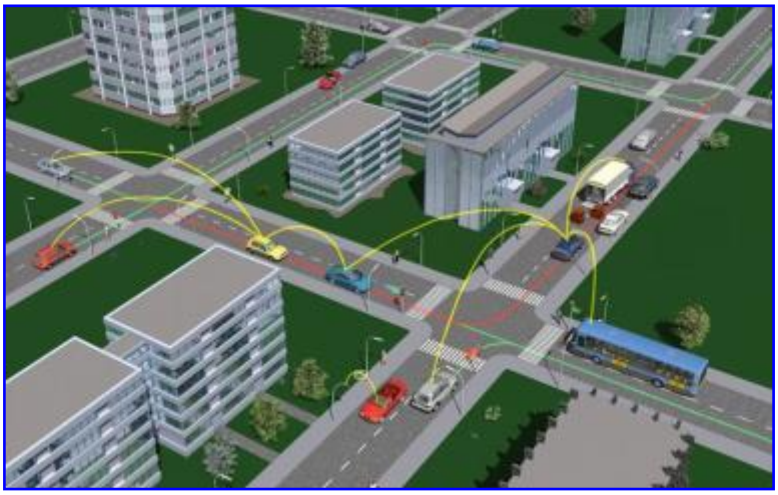
With ever-advancing technology in space, in the car and in the satnav itself, one thing is certain; over the next decade major changes to today's satnav will occur.

In space

Even in this brief review, we should note that GPS will not always be the only option for a global navigation satellite system. When GPS was first declared operational, the location accuracy was deliberately degraded by a feature known as Selective Availability (SA) that resulted in an accuracy of around 100m. The US administration under President Clinton, switched off SA (it has remained off ever since) and accuracy for the civilian user is now around 10m to 15m. Unease at the ownership and control of such a strategic asset as GPS by the US DoD and an anticipation of the technological and commercial spin-off from developing and running a European system has resulted in the EU development of Galileo. This will be a 30 satellite constellation in similar orbits to GPS. Following two 'proof-of-concept' satellites, a further two operational satellites were launched in 2011 with two more in 2012. It is likely that, in 10 years time, the majority of portable satnavs that we use in our cars and phones will use either Galileo or a combination of both GPS and Galileo.

The former Soviet system, Glonass, is being refreshed and China and India have both started to implement regional satellite navigation systems: at least one of which (the Chinese BeiDou-2) will to be expanded to global coverage. By the time Galileo reaches full operational capability by 2020, competition from other systems could be a real threat to its commercial future.

In the car



In the provision of driver aids to navigation and congestion avoidance, the dependence of in-car equipment on an external satellite (and terrestrial) infrastructure has been a recurring theme. One significant addition to that infrastructure over the next decade is likely to be car-to-car communication. A European consortium has been established to develop a standard for inter-vehicle and vehicle to roadside communications. The car-to-car communication will be based on current Wi-Fi standards with a maximum single hop range of 500m to 1000m. Applications will allow advance warning of hazards to be rapidly communicated to traffic near an incident. This may simply be an alert that a nearby vehicle has suddenly reduced speed or, as in this picture, avoidance of a potential delay. The two cars at the left of the picture have received a warning of an incident involving the white bus to the right of the picture. This prompts the satnav in both of the cars to re-route the driver along the green route, around the incident, rather than their originally planned red route.

Legislation will be another force for change. The European Commission has produced a proposal to encourage EU member states to move faster on rolling out the infrastructure for Emergency Call (E-Call). E-Call enables vehicles involved in road traffic accidents to send out an automated alert that is received and recognised by emergency services across the continent. Using GPS or Galileo for location, the alert would be initiated manually, by impact sensors in the vehicle or by deployment of the airbag, and the ensuing data transmission from the vehicle, via an embedded mobile phone module, would contain information about the vehicle itself eg Vehicle Identification Number (VIN), as well as location details. Once it becomes the norm for a vehicle to contain a GPS or Galileo receiver, then the opportunity arises for vehicle manufacturers or third parties to offer other driver services such as routing, traffic information, remote diagnostics or weather reports. Also, under those circumstances, implementation of traffic management schemes, possibly including road-pricing, would become technically and economically feasible.

Increasingly drivers, especially newly qualified drivers, are finding the cost of insuring their car is becoming a barrier to independent motoring. One premium-reducing measure, offered by some insurance companies, entails fitting a ‘black box’. Vehicle parameters (speed, acceleration, cornering, braking etc), vehicle location and time of day are inputs to the calculation of the insurance premium giving the driver direct, personal control over their premium and helping it to remain affordable.

The satnav device

The stand-alone, dedicated satnav is already in fierce competition with alternative, more versatile hardware. As early as 2009, this competition was foreseen. One market research organisation predicted that:

“ ….. *by 2014, usage of navigation-enabled smart-phones will rise to 305 million units, exceeding the 128 million PNDs* [Portable Navigation Devices] *that will be around by then*”.

In fact by the start of 2014, there were 1.4 billion Smartphones in use worldwide and 47% of drivers have downloaded a mapping (not necessarily *navigation*) application. Meanwhile, the number of PNDs, worldwide, is estimated to plateau at around 51 million by 2015. It is clear where this trend is heading. The increasing inclusion of GPS receivers in smartphones, improved displays and battery life and the availability of on-board navigation applications from such well-known names as Tom Tom and Garmin that run on Apple, Android and Windows smartphones explain the trend.

The arrival in 2013 of the ‘web-enabled’ car may mean that even the smart-phone will no longer be the preferred option for viewing navigation guidance when in the car. A short-range radio link, for example Bluetooth, between the smart phone and the browser application sitting behind the in-car, colour touch screen is likely to provide a safer, more practical user interface. The image shown here is of the MyFord Touch: displayed at the 2010 Consumer Electronics Show in Las Vegas. At the 2014 CES, Apple and Google were demonstrating the in-car interaction with the phone for navigation and convenience controls (such as climate control and audio) through their work with Audi, Hyundai and other manufacturers. Finally, for this brief glimpse into the future, Ford, Hyundai and Mercedes-Benz are working with Google on delivering navigation guidance to Google Glass: *wearable* satnav may be the future?

Conclusion

Just as some drivers find using maps to be difficult, so some of us are not naturally ‘at home’ with devices such as satnav. However, it may not be too long before the satnav unit becomes as ubiquitous as the car radio [13] and offers congestion-free directions in response to spoken destinations such as “School”, “Tesco”, “Motor Museum”, “Aunt Jane”, etc. At this point the technology is likely to benefit the majority of our car journeys and we would truly become lost without our satnav.

(Or, you could encourage your 2-year old rear seat navigator!)

[13] and this may be assisted by forthcoming EU legislation on Emergency-Call (E-Call) and the increased uptake of Pay As You Drive, ‘black box’ insurance

Picture Captions and Credits

Page 35: TomTom portable satnav
Page 35: Sign at the Cotswold Motoring Museum, Bourton-on-the-water
Page 36: Variable Message Sign
http://webarchive.nationalarchives.gov.uk/20120801131740/http:/www.highways.gov.uk/knowledge/334.aspx
Page 36: Signs at the Cotswold Motoring Museum, Bourton-on-the-Water
Page 37: GPS satellite image © USAF Research Laboratory
Page 38: TomTom portable satnav
Page 38: Original Equipment Manufacture satnav in Jaguar X-Type
Page 38: Smartnav activation button © Trafficmaster
Page 39: Galileo image © European Space Agency
Page 40: Car to Car graphic from: http://www.car-to-car.org/
Page 41: Nokia Lumia Smartphone with Windows Phone 8 operating system running a satnav application
Page 41: The Ford MyTouch System

Introduction

Consider the definition of a 'responsible' car owner. What ideas does this conjure up? Driving at an appropriate speed for the road conditions? Complying with mandatory signage? Showing courtesy to other road users? Not 'tailgating'? Not hogging the centre lane of a 3-lane carriageway? Probably all these things. There are however, other aspects of motoring where 'responsible' choices need to be made. In selecting our car from the showroom or the used car lot there are choices, some of which have environmental as well as budgetary impact. For example, our choice of fuel – petrol, diesel, gas, electric - the fuel consumption and hence levels of pollutants and CO_2 emissions of our new or a used car with, for a new car, the one-off environmental impact associated with manufacture and shipping. These may all seem like secondary considerations in comparison with the cost, performance, seating and load capacity, aesthetics and comfort but they are not always mutually incompatible.

Statistics from the Society of Motor Manufacturers and Traders show a new car trend towards smaller, lower emission vehicles. To some extent, this may be driven by economic factors but it is a fortunate coincidence that this also has the effect of reducing CO_2 emissions from the domestic transport sector.

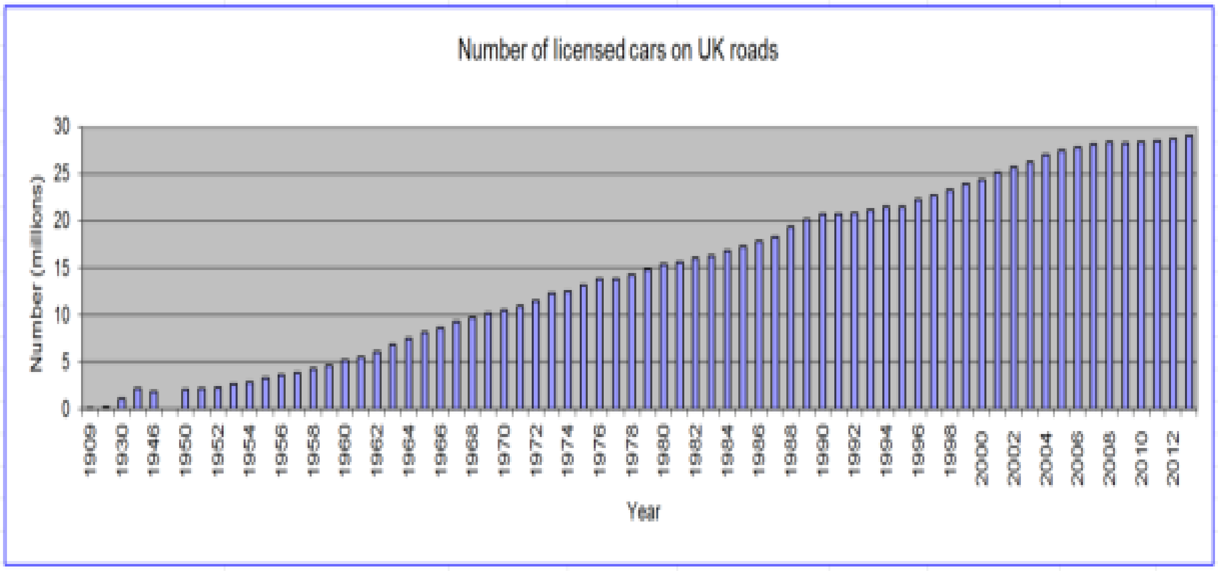
This chapter on Responsibility of Ownership considers the average life of a car and how it can be increased. Drawing on conclusions from the chapter on Air Pollution[14], the chapter also summarises the environmental implications of replacing an ageing car with a newer, lower emission car and concludes with hints, gathered from a number of recognised expert sources, on keeping our cars running efficiently and reliably.

The global environmental impact of motoring manifests itself in many ways and such a broad topic can be addressed from many perspectives. This chapter is largely constrained to UK national trends in car ownership.

Average age of cars

In June 1994, there were 21.03 million cars on the UK roads and the average age was 6.7 years. Over nineteen years later, by the end of 2013, there were 29.14 million cars on the roads and the average age was 7.9 years. In other words, the overall effect of improvements in vehicle manufacturing and servicing, economic factors such as the cost of insurance, vehicle purchase price, the second-hand market prices, maintenance, cost of fuel and changes in taxation have neither greatly changed the age mix of cars on our roads nor reversed the incessant increase in numbers. Against this background, the 2009/10 government car scrappage scheme replaced 400,000 cars of over 10-years old on UK roads. Although

[14] From Part One of this book - Environmental



the new cars met the latest emission standards and should be more reliable than those they replace, the environmental impact of the scheme was not universally supported.

Environmental effects of production, use and scrappage

One of the earliest attempts to quantify the whole-life carbon footprint of a car was undertaken by the Lappeenranta University of Technology, Finland in 2006 when they addressed the carbon dioxide (CO_2) emissions for an average 2004 European light vehicle[15] over its life.

The chapter on Air Pollution showed that the CO_2 associated with the production of a new vehicle represents a significant proportion of its lifetime release of CO_2. Depending on the source of raw materials for the car, the transportation of those raw materials, the transportation of the completed car, the age of the production process, sources of energy used in production and the allowance for end-of-life scrappage, then the incremental lifetime CO_2, over and above that associated with simply driving the car, has been estimated to range from just 15% to over 55%.

ERTICO[16] state that “Fuel consumption during vehicle operation ….. contributes around 60% of the life-cycle greenhouse gas emissions of a passenger car”: this leaves 40% as the production and scrappage overhead.

A further rule of thumb links the value of the car to its carbon footprint through an equivalence of 720kg of CO_2 or equivalent for every £1000 value of the car, giving a £24,000 car a 17 tonne CO_2 overhead in the production and scrappage process.

For electric vehicles, a Low Carbon Vehicle Partnership report provides a good source of reference on the CO_2 contribution during production. Ozzie Zehner, a University of California professor, writing of “Green Illusions” contributes a more controversial opinion but again, much depends upon the assumptions made. For electric cars, with batteries re-charged from the UK grid with its current mix of coal, oil, gas, nuclear and renewables, the *lifetime* CO_2 will most likely be less than for the equivalent internal combustion engine powered car but the percentage of CO_2 produced during manufacture is likely to be higher.

[15] Assumptions: kerb weight 1290kg, travelling 8440 miles per year, fuel consumption of 38.7mpg. Data used is an average for new vehicles sold in 2004 and is based on >14 million cars and 1.8 million vans and pick-ups
[16] An EU organisation devoted to Intelligent Transport Systems

A similar conclusion is reached in the Low Carbon Vehicle Partnership report that observes, with the trend to hybrid electric, plug-in hybrid electric and pure electric vehicles:

"The vehicle's embedded CO_2 from production and disposal is becoming a greater portion of the life cycle CO_2 emissions"

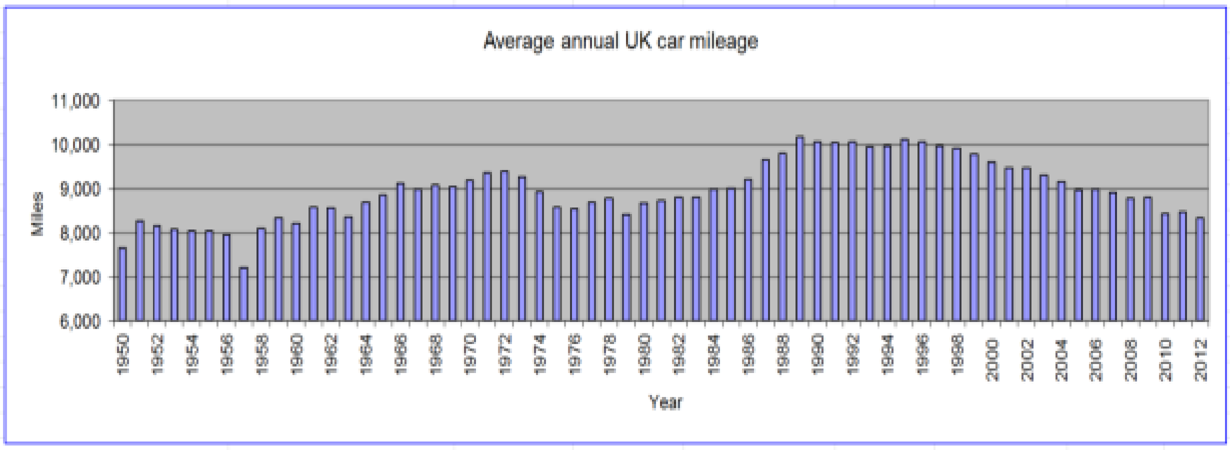
Samples of manufacturer's figures support this conclusion. Comparing a VW Passat Estate B6 (diesel 2 litre, un-laden weight 1510kg) with a Toyota Prius Hatchback (1.8 litre VVTi V, unladen weight 1420kg), shows 19%, 80% and 1% respectively as production, use and scrappage figures for the Passat and 26%, 71% and 3% for the Prius over a 150,000 km lifetime.

Average annual car mileage

In considering the environmental impact of car ownership on CO_2 emissions (and indeed all vehicle emissions[17]), it is not just the number of cars on the road and the average CO_2 produced per car, but also usage that affects the total emissions impact.

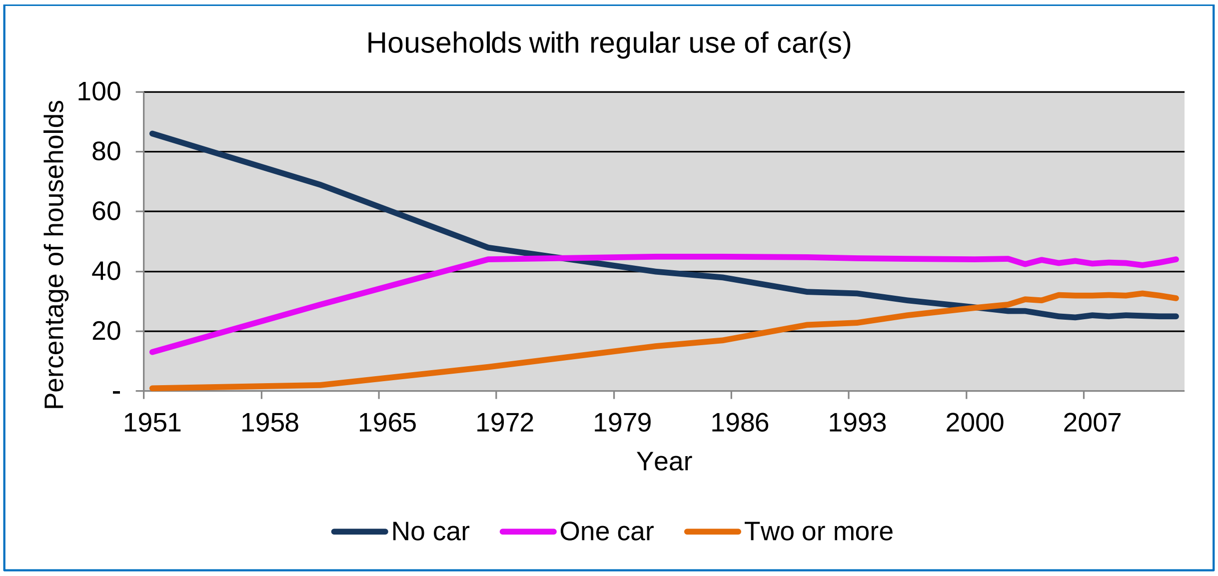
Whilst the *number* of licensed cars on UK roads has increased, almost without exception, year by year, the average *usage* has fluctuated. Using data from the Department for Transport, annual averages can be calculated from the annual total mileage for all cars and the number of licensed cars. The results from 1950 to 2012 are shown below.

Interestingly, there appears to have been a decline since the mid-1990s. However, the pattern of car ownership has also changed over that period. Again using Department for Transport figures, the proportion of UK households owning one car reached around 45% in late 1960s and has remained at that level ever since. However, the proportion of households with access to two or more cars has increased steadily since the same time and now accounts for 33% of UK households.



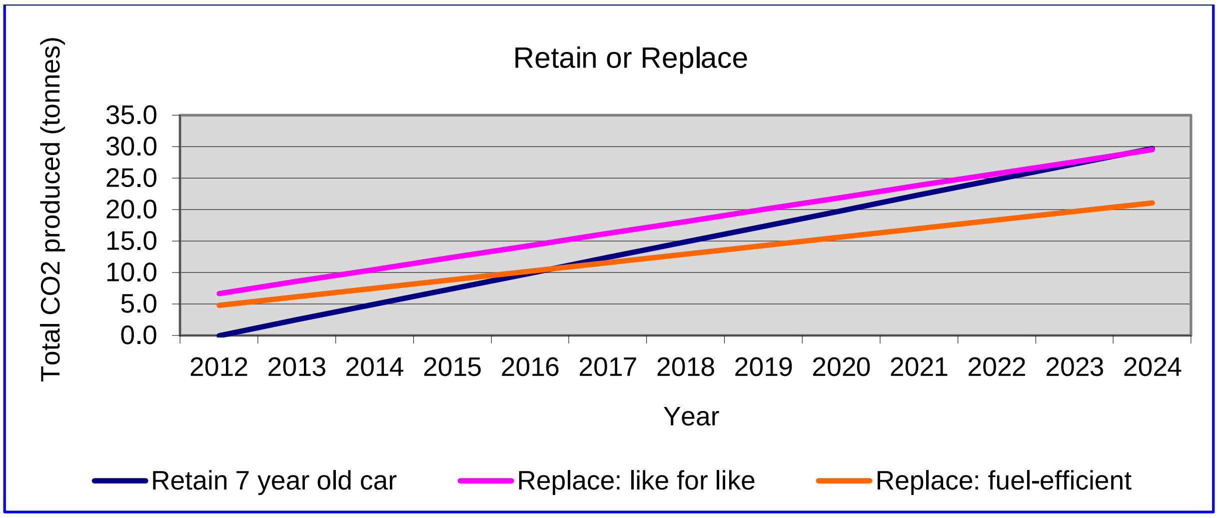
Multiple car ownership may explain the decrease in average annual mileage per car as households spread their journeys between more than one car.

[17] See chapter on Air Pollution



Replace or retain

An illustration of the effect of replacing a 7-year old car with an *equivalent* modern car or a modern, fuel-efficient 2012 car was presented in the Air Pollution chapter. For convenience, the graphic is reproduced here.



This analysis showed that going for a like-for-like replacement that was 7 years newer, it would take over 10 years to justify the decision just in terms of the CO_2 released. On the other hand, a small, efficient modern car replacing one of average emissions performance from 7 years ago, covering high annual mileage, would provide an emissions benefit within the following few years.

But is this the whole story? Availability of raw materials is becoming an increasingly significant factor, especially as the value of electronic components in a modern car continues to increase.

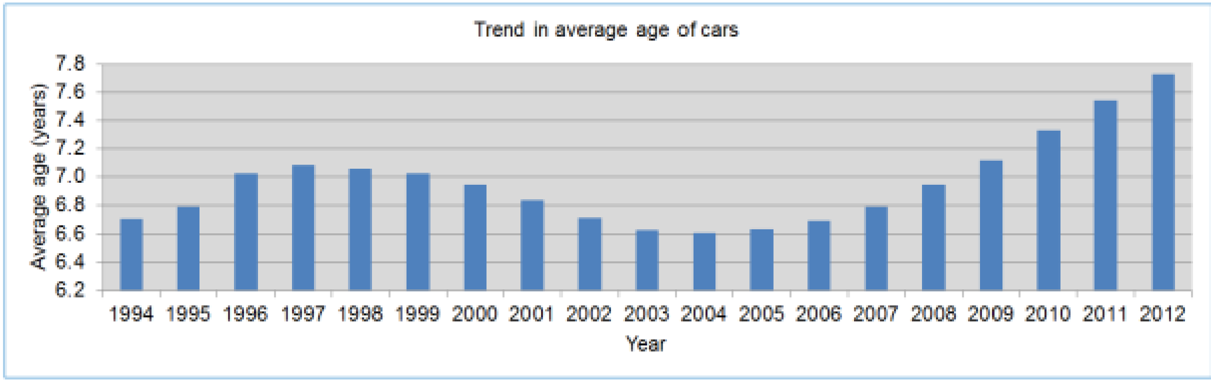
A recent ACEA report draws attention to the future limited availability of lithium if the projected global increase in electric vehicle numbers materialises. Lithium is a key battery component of modern batteries in the consumer electronics, power generation and automotive sectors.

Powerful magnets used in the traction motors of electric vehicles, make use of neodymium, one of the 'rare-earth' elements in the periodic table. Currently 97% of rare earth supply is within China which presents a possible geopolitical issue around availability. A survey by PWC revealed that 73% of automotive manufacturers "perceived mineral and metal scarcity as a pressing issue for the company".

Where retaining a car is not a possibility as it really has reached the end of its economic life, then reuse and recycling are areas where the automotive industry has developed considerable expertise. Within Europe, the End of Life Vehicle Directive was adopted in 2000 and the EU are currently looking to increase target percentages for 2015. These new targets would see 85% of material recycled. One estimate for the US industry is already at 86% of recycled material.

Age mix

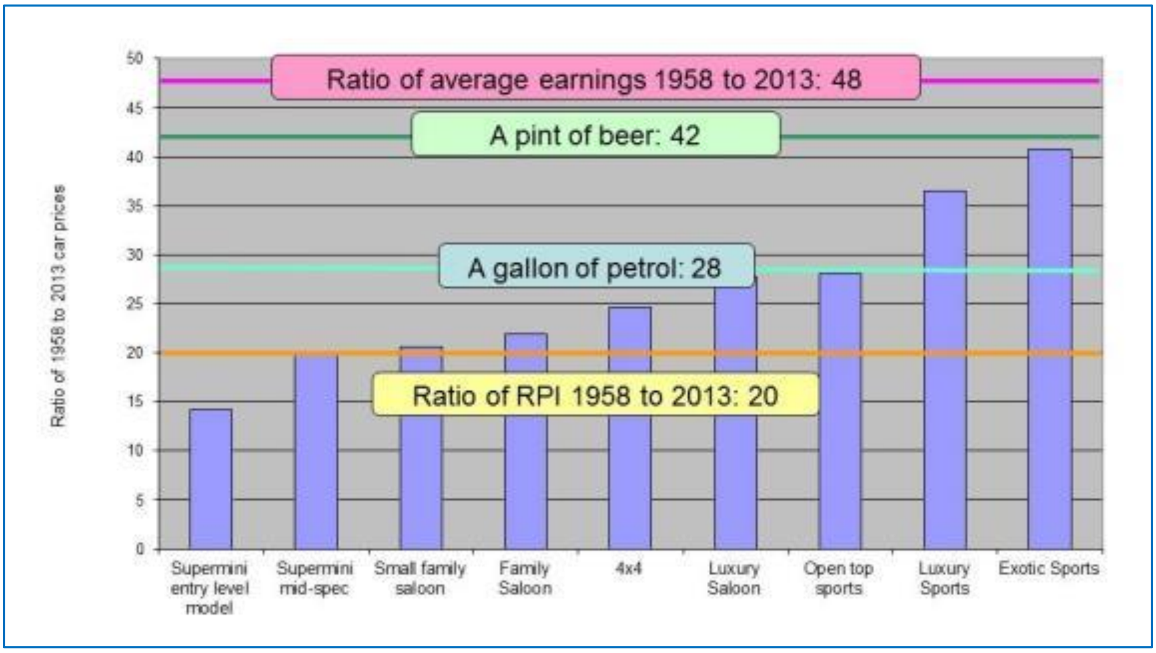
During the period 1994 to the present, data on the age of cars on the road is available from the Department for Transport website. The graph below shows that in the mid-1990s, and again since 2004, there has been an increase in the average age of registered cars: including the period of the scrappage scheme. This coincides with an increase in multiple car ownership within households (hence lower mileage per car) and improvements in build quality for the low and mid-range makes within the mass car market.



Cost of ownership

A 17-year old, newly qualified driver today faces a likely insurance premium on their new car, which may be significantly more than the cost of the car. The cost of fuel seems to move just one way (upwards!) and garage repair bills usually run into at least three figures. We think car ownership is expensive, yet, as we have seen, the number of cars on the road increases year after year. How do the costs of ownership today compare with those of over 50 years ago and how do they compare with the average family income?

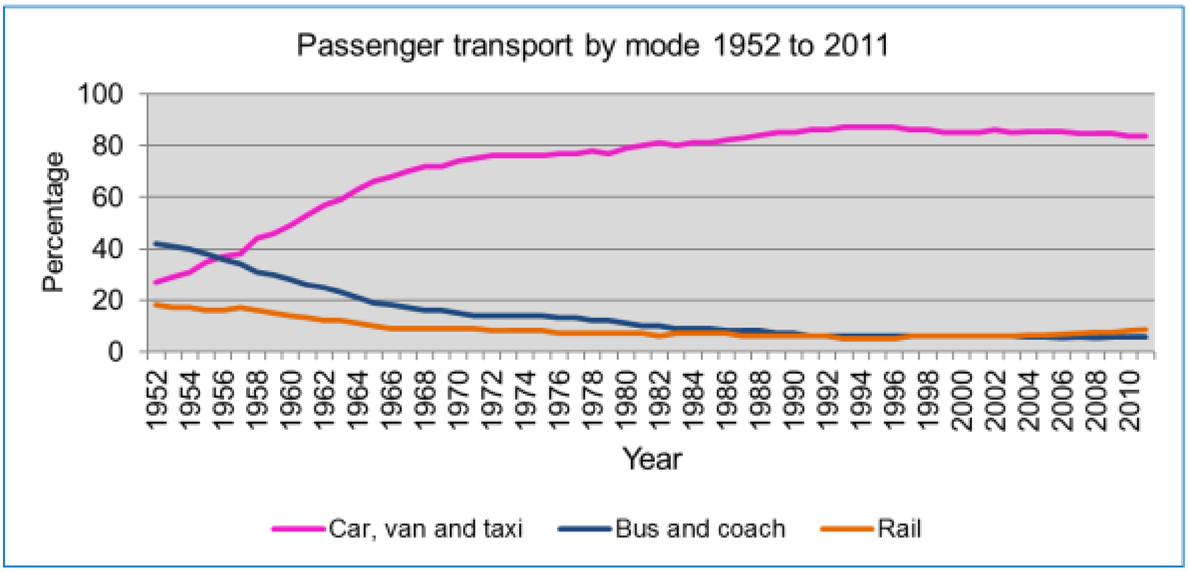
In 1958, average gross earnings were £514. Average gross earnings in 2013 (based on male and female, full time employment) are £24,866 ie an increase of 48 times. Over the same period, the Retail Price Index (RPI) has increased by 20 times. Comparing car prices with our increased purchasing power and increased RPI over this time requires a comparison of roughly equivalent types of car from 1958 and 2013. The specific contents of each generic category of car are shown in the Annex to this chapter and the results are displayed graphically in the chart below. For comparison, the relative increase in the cost of a pint of beer (42 times) and a gallon of petrol (28 times) over the 55 year period are also shown.



Whilst this chart does not include other costs such as insurance and maintenance, it is clear, that in terms of purchasing a new car, virtually all categories of car will take a lower proportion of our hard-earned cash than they would have done in 1958.

The public transport alternative

Whilst this chapter is predominantly about the implications of car ownership since the dawn of motoring history, it is worth a brief reminder that cars are not the only transport option available to travellers. We may read of new railway rolling stock and new bus and coach services but, whether for reasons of convenience, economics or simply lack of alternatives, as the following Department of Transport figures show, the car (van or taxi) is still the dominant mode of transport for most of us. [NB: In the chart below, percentage is the percentage of miles travelled].



Classic cars

Although the average age of cars on UK roads maybe just under 8 years, there are groups of vehicles that are never likely to go near the scrap yard. These are 'classic' cars. The definition of an historic vehicle, from the point of view of Vehicle Exercise Duty (VED) exemption, used to mean any vehicle manufactured before the 1st January 1973 but from April 2014, the critical date became 1st January 1974 and rolling out by a year at the beginning of every April. The term 'classic' however is widely applied to a broader range of cars. Currently, there are over 307,000 vehicles exempt from VED. Keeping older cars on the road serves an historical purpose but also, as illustrated above, an environmental purpose. Classic cars, by definition are long-life vehicles, which tend to be well maintained and cover low annual mileages. Hence, from an environmental point of view, there is a strong argument for maintaining a car well beyond the average life of 7.9 years.

The economics of modern vehicle ownership and maintenance however, do not encourage this approach.

Because of the strong base of owners clubs catering for specific marques, it is easier than may be imagined for an individual to own and run a classic car from the 1950s, 60s and 70s. The Federation of British Historic Vehicle Clubs (FBHVC) has almost 500 affiliated clubs and is a good starting point to search for a relevant club. Parts availability for popular vehicles is generally good. For the Herald-based Triumphs ie Herald, Vitesse, Spitfire and GT6, (part of the Triumph model range covered by the TSSC) most parts, including body panels, are widely available. Some clubs, such as the Stag Owners Club are active in the remanufacture of tooling and spare parts. Technical advice, detailed car specifications and Buyers Guide are all features of the MG Owners Club and the Octagon Car Club. Insurance for the popular classics is generally affordable and given the low annual mileages typical of classic cars, can often cost much less than a modern vehicle[18].

DIY servicing

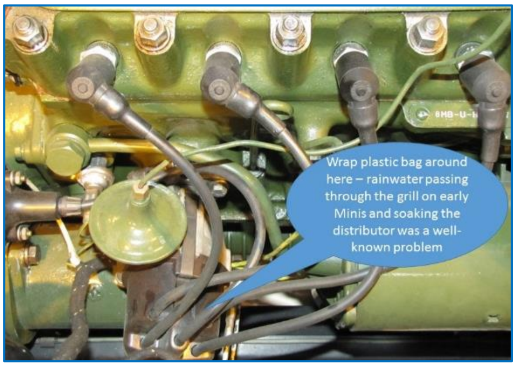
A number of factors have caused the reduction in DIY servicing of modern cars. To adjust engine performance, it was straightforward on mainstream cars up to the mid-1980s to balance the fuel / air mixture at the carburettor(s), to set valve tappets, spark plug gaps and ignition timing. These functions effectively still take place in a modern vehicle but are now performed by software within Electronic Control Units (ECUs) that regulate mixture and timing according to the output of sensors monitoring air and coolant temperatures, throttle and crank positions, exhaust gas properties and other parameters. Not an easy option for DIY.

[18] The FBHVC estimates the annual benefit to the UK economy from Classic Car ownership to be worth £4.3billion

Some DIY tasks have been designed out of a modern vehicle. Lubrication is generally confined to engine oil changes at intervals up to 20,000 miles and improved materials and tighter manufacturing tolerances have largely removed the need for the grease gun.

Yet some tasks, formerly widely undertaken by the DIY enthusiast, such as replacing worn brake linings, coolant hoses or serpentine belts (‘fan’ belts) still tend to be left to garage servicing. Some are more complex (such as the rather extreme example shown here) than they would have been on a 1970s car but maybe this trend also reflects the current economics of car ownership, or changing driver demographics or perhaps it is related to a reduced confidence and familiarity with the cars that we drive?

Daily and weekly tasks that a car driver is expected to undertake still remain. Car Mechanics magazine from December 1962 contains 50 tips to help “Cut Costs”. Some of these reflect driver behaviour and would still be sensible today. For example, weekly checking of tyre pressures and adjusting pressures to match the load being carried, avoiding scuffing tyres and light use of the throttle. Other examples such as replacing “sagging valve springs” and “adjusting toe-in” are tasks only for today’s enthusiast. Also mentioned in the same edition of the magazine was an article on “Preparing your car for winter”: still an important task. Checking battery condition, the strength of coolant / antifreeze mixture, screen washer fluid are all good advice but nowadays we take for granted the fact that our modern vehicles will not need a rubber glove “ …. cut to fit the distributor to keep out the damp” - even assuming we could find a distributor!



Increasing the life of our vehicles

So are there things we can do to keep our cars running reliably for longer, to extend their roadworthy life and reduce the environmental impact of car ownership? Some key messages on Maintenance, Reliability and Fuel Economy, taken from the websites of five organisations with, literally, centuries of experience between them (AA, Britannia Rescue, Green Flag, Institute of Advanced Motorists and RAC) have been merged into the following sections.

Tyres

- Correct tyre pressures are essential to ensure maximum tyre life, good vehicle handling and good fuel economy. Over time, tyres will naturally lose some air. Check tyre pressures regularly and before long journeys. Under-inflated tyres create more rolling resistance and so use more fuel. Tyres under-inflated by 7 psi (0.5 bar) waste half a gallon of fuel per tank. (They are also illegal in the UK). Refer to the handbook, as pressures will normally have to be increased for heavier loads.
- Examine tyres for signs of uneven wear and for any cuts or small nicks in the sides of the tyres. Uneven wear may be an indication of suspension or steering alignment problems.

- Check the tread depth - a minimum of 1.6mm over at least three-quarters of the tread width is the current legal requirement, but they should be replaced long before this depth is reached.
- Don't forget the spare wheel.

Maintenance and reliability tips

- Have the car serviced regularly (according to the manufacturer's schedule) to maintain engine efficiency and optimum fuel consumption.
- Check the engine oil and coolant levels regularly and before long journeys.
- Ensure the correct specification of engine oil is used to top up the level (refer to the handbook).
- Most modern cars have plastic coolant reservoirs to help check the level. In an older car, when the engine is cold, remove the radiator cap to check the coolant level. Top up as necessary, and include antifreeze in the mixture, in winter and summer: it helps protect against overheating, as well as frost damage. It is important that the correct strength antifreeze and water mix is used.
- Check and top up the windscreen washer bottle, and include an additive to tackle grease and squashed flies in summer or icy conditions in winter. It is an offence to drive with an empty windscreen washer.
- If the car does not have a sealed-for-life battery, check the electrolyte level in the cells and top up with distilled water as necessary.
- Be alert for any sign of change. If, for example, the engine seems to be running a little less smoothly, the brakes seem less positive than usual, or the steering feels vaguely odd, don't dismiss it as imagination. Trust your instinct, and investigate the reason, or seek advice.
- One in 5 cars over 3 years old has faulty lights and would fail a MoT. So, before a long journey, check and clean both the headlights and indicator clusters.
- If hot water is poured onto an icy windscreen it may shatter. So, always carry a can of de-icer and a scraper. The de-icer will also free up frozen door locks and petrol filler locks.
- Check front and rear fog lights: remember these should only be used when visibility is reduced to around 100 metres and switched off when visibility improves.
- Brake lights can be checked unaided by seeing if they illuminate a wall, garage door or window.
- Test the horn.
- Number plates should be clearly visible from the front and rear.
- Make sure the brakes are in good working order and have them serviced regularly.
- Check that both front and rear wiper blades are not worn or damaged. If they are leaving smears across your windscreen, it is time for new blades. Split, cracked or perished wiper blades will lead to a MoT test failure as well as being dangerous.
- Clean the windows, inside and out, and wipe the lamp lenses and door mirrors.
- If a light suddenly appears on the dashboard, don't ever ignore it. Treat it as a danger sign and investigate.

Red – danger. Stop and check. A red light means potentially serious trouble. Do not drive the car.

Orange – caution. Shows something requiring urgent attention, such as low fuel, low oil level or low engine coolant.

Green – reminder. Indicators flashing, for example. A memory jogger, not a problem.

- Give the car a good wash and polish to guard against the bodywork ageing.
- Watch for the first signs of rust forming, and treat it before it gets worse. Look for any signs of water leaks that could trigger corrosion.

Fuel saving tips

- Don't carry unnecessary loads - the car was designed to be as aerodynamic as possible, so remove any unused roof rack or roof box. An empty car will use less fuel than one with an unnecessary heavy load in the boot.
- Don't get lost – plan unfamiliar journeys to reduce the chance of getting lost – try web-based route planners or consider a satnav if justified by regular use of unfamiliar routes. Check the traffic news before leaving home.
- Travel at off-peak times if possible - being stuck in traffic jams uses a lot of fuel. Not having to keep stopping and starting is also better for stress levels.
- Combine short trips – cold starts are inefficient so it pays to combine multiple short trips.
- Consider alternatives – if it's a short journey (a couple of miles or so) consider walking or cycling rather than taking the car – fuel consumption is worse when the engine is cold and pollution will be greater until the emissions control system gets up to normal temperature.
- Leave promptly – don't start the engine until you're ready to go. This avoids fuel wastage due to unnecessary idling and ensures that the engine warms up as quickly as possible. (In winter months, scrape ice rather than leave the car idling for a long period to warm up).
- Easy does it – drive smoothly, accelerate gently and read the road ahead to avoid unnecessary braking.
- Decelerate smoothly – when you have to slow down or to stop, decelerate smoothly by releasing the accelerator in time, leaving the car in gear.
- Rolling – if you can keep the car moving all the time, so much the better. Stopping then starting again uses more fuel than keeping rolling.
- Change up earlier – change gear as soon as possible without labouring the engine. Try changing up at an engine speed of around 2000 rpm in a diesel car or around 2500 rpm in a petrol car. This can make such a difference to fuel consumption that all cars in the future are likely to be fitted with Gear Shift Indicators that light a lamp on the dashboard to indicate the most efficient gear change points.
- Cut down on the air-con – air conditioning increases fuel consumption at low speeds, but at higher speeds the effects are less noticeable. So if it's a hot day it's more economical to open the windows and sunroof around town and save the air conditioning for high speed driving. Don't leave air-con on all the time but you should run it at least once a week throughout the year to maintain the system in good condition.
- Turn it off – any electrical load increases fuel consumption, so turn off your heated rear windscreen, heated seats, demister blowers and headlights, when you don't need them.
- Stick to the limits – drive at or within the speed limit – the faster you go the greater the fuel consumption and the greater the pollution. According to the Department for Transport driving at 70mph uses up to 9% more fuel than at 60mph and up to 15% more than at 50mph. Cruising at 80mph can use up to 25% more fuel than at 70mph.
- Don't idle – if you do get caught in a queue avoid wasting fuel by turning the engine off if it looks like you could be waiting for more than a few minutes.
- Consider taking advanced driving lessons - just a few tweaks to your driving style could really make a big difference to how efficiently you drive.

Several of the website links above also have useful tips on Trouble Shooting and Safety: both prior to a journey, on the journey and in the event of breakdown. These have been excluded from this chapter as they are out of scope of the document but are nevertheless worth browsing.

1958 Make / Model Autocar 12 December 1958	1958 price inc Purchase Tax (50%)	Generic category	Average price of Generic category	2013 Make / Model	2013 on the road price	Generic category	Average price of Generic category	Ratio 2013 to 1958
Ford Anglia	£571	Basic Mini	£588	Ford Ka	£8,795	Supermini entry level model	£8,348	14
Austin A35	£569			Fiat Panda	£8,945			
Fiat 500	£556			Fiat 500	£10,010			
Citroen 2CV	£598			Citroen C1 VT	£6,995			
Standard Eight	£646			Hyundai i20	£6,995			
Morris Minor Traveller de luxe1000	£734	Top of range of basic model	£696	Mini One Clubman	£14,570	Supermini mid-spec	£13,733	20
Ford Prefect de luxe	£658			Ford Fiesta Zetec - 1.4, 5-door, man	£12,895			
Morgan Plus 4	£968	Open top sports	£1,018	Morgan Plus 4 2 litre	£32,735	Open top sports	£28,615	28
Triumph TR3	£1,049			BMW Z4 2 litre	£27,615			
Lotus seven	£1,036			Caterham 7 Roadsport 175	£25,495			
Hillman Minx de luxe	£794	Small family saloon	£803	Ford Focus - Edge 1.6 5-door man	£16,200	Small family saloon	£16,565	21
Vauxhall Victor Super	£781			VW Golf Match	£16,495			
Morris Cowley	£834			Mazda 3 1.6 5-door Tamura	£17,000			
Sunbeam Rapier (1500 twin carb)	£1,043	Family Saloon	£1,019	BMW 3i8i ES	£23,185	Family Saloon	£22,264	22
Standard Vanguard	£1,043			Audi A4 1.8 TFSI saloon	£23,960			
Ford Zephyr	£916			Ford Mondeo Edge 1.6 5-door man	£20,495			
Vauxhall Cresta II	£1,073			Vauxhall Insignia 4 door saloon	£21,415			
Jaguar XK150 (convertible)	£1,793	Luxury Sports	£1,793	Jaguar XK 5.0L Coupe	£65,465	Luxury Sports	£65,465	37
Jaguar Mk IX (3.8litre 6 cyl)	£2,162	Luxury Saloon	£2,042	Jaguar XJ 3 litre 6 cyl diesel	£56,865	Luxury Saloon	£56,580	28
Rover 3 litre automatic	£1,921			Audi A8 diesel saloon SE Exec 2wd	£56,295			
Aston Martin DB4 (3.67litre DOHC)	£3,976	Exotic Sports	£3,976	Aston Martin DBS 5.9litre V12	£162,000	Exotic Sports	£162,000	41
Land Rover	£960	Utility	£960	Landrover Freelander 2	£23,705	4x4	£23,705	25

Annex: Comparison of generic car categories from 1958 and 2013

Generic category	Ratio
Supermini entry level model	14
Supermini mid-spec	20
Small family saloon	21
Family Saloon	22
4x4	25
Luxury Saloon	28
Open top sports	28
Luxury Sports	37
Exotic Sports	41

Picture Captions and Credits

Page 49: Morris Mini Minor, Cotswold Motor Museum, Bourton-on-the-Water
Page 49: 1972 Triumph Stag
Page 49: 1950s DIY magazines on car maintenance
Page 50: Serpentine belts on a Jaguar V12 engine
Page 50: December 1962 Car Mechanics
Page 50: Morris Mini showing the area vulnerable to rainwater passing through the radiator grill

The Cotswold Motoring Museum and Toy Collection is not just about cars. Toys that our parents and grandparents played with as children, everyday artefacts from the Victorian and Edwardian era plus an insight into the social history of the village of Bourton-on-the-Water and much more can be found in the Old Mill, alongside the River Windrush.