Issue 65: Winter 2010

A BULLETIN OF THE HISTORIC ENVIRONMENT

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Conservation bulletin

Inherited Infrastructure

Historic infrastructure is the heritage we rarely think about, but its legacy is everywhere. As well as adding value to our lives today it has the potential to teach us vital lessons for the future.

The Grade II* Bennerley Viaduct is on English Heritage's Buildings at Risk Register, but with the help of Sustrans could soon have a new life as part of the National Cycle Network. © Sustrans

ENGLISH HERITAGE

Facing the Future

These are challenging times for us all, but English Heritage is confident that our shared past can play a vital part in building a better future.

Like many organisations across the public sector, English Heritage has to make very significant cuts. The grant we get from government will be reduced by 32% over the next four years. We are fortunate that we can generate income to supplement our grant, but a cut of this scale clearly requires us to re-examine what we do and why.

Being more efficient and reducing our administration and management will only take us so far. It is inevitable that some of the cuts we have to make will affect the services we provide to the public, to owners and developers and to heritage professionals and enthusiasts. In the painful business of working out where cuts will be least damaging we have adopted the principle of protecting those activities we do which no one else can, or will, do.

We know that our advice to owners and local authorities on planning cases is highly valued and we have therefore decided to protect this area of our work from cuts. This is all the more important as every day we hear of further cuts to local authority conservation services. We will also protect, and if we can, strengthen, our designation work as this is a fundamental part of England's system of heritage protection. We also have a unique responsibility to look after the national collection of sites and monuments that we care for on behalf of the public, so we will also protect our conservation and maintenance budgets.

This of course means cutting harder elsewhere. Regrettably, we will be reducing our grants and we are discussing with other organisations how this can be done to reduce the impact on the historic environment. However we recognise that some of our grants support work that no other organisations fund. We will therefore continue, as close as we can to current levels, our grants for private owners, for research, for national heritage organisations and to avoid losing heritage at risk.

These are tough times but it is important that we remain positive and continue to demonstrate the value of our heritage – its contribution to our national and local economies and its role in our national purpose and identity. We in English Heritage are confident that heritage is part of the solution and part of our future.

Simon Thurley
Chief Executive, English Heritage

Conservation Bulletin is published twice a year by English Heritage and circulated free of charge to more than 10,000 conservation specialists, opinion-formers and decision-makers. Its purpose is to communicate new ideas and advice to everyone concerned with the understanding, management and public enjoyment of England's rich and diverse historic environment.

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Editorial: *Inherited Infrastructure*

Without infrastructure society could not function, but it is easily overlooked and we ignore its lessons at our peril.

Most dictionaries agree that the English language managed perfectly well without the word infrastructure until 1927. This now seems extraordinary. Today the word is widely used and readily understood to signify all the underpinning networks through which requirements are moved so that society, or a specific venture, can function. Roads, sewers, airports for a country. Camps, bridgeheads, supply chains for the military. Information for both.

In the latter context, the word has been vigorously embraced by the world of modern communications to the degree that many a first definition of infrastructure would reference electronic communication and data management.

This edition of *Conservation Bulletin* is intended to give a longer timeframe to our understanding of infrastructure. Prehistoric tracks, Roman roads, the earliest vestiges of industry are well known and often designated assets. More recent infrastructure has been widely reviled – electricity pylons – or greatly admired – the Gateshead Millennium Bridge.

The great achievements of the past, like Bazalgette's London sewers, are perceived as casting a baleful light on today's lesser, slower projects. Whether that is fair or not, society certainly needs to understand how to emulate those transformative schemes while protecting and reusing the best of the past and accepting that some infrastructure was designed for and can only sustain a brief lifespan. English Heritage will want to ensure that well-understood significance informs decisions about the protection of historic infrastructure and that lessons can be learnt about the successful provision of future infrastructure.

Public attention has recently been drawn to the country's biggest peace-time construction project – the National Grid – something on which all depend, few notice and even fewer comprehend. We are not yet certain what this century's equivalent will be, nor do we know how existing infrastructure systems will grow, shrink or change. Even in times badged as austere, infrastructure provision moves apace; Crossrail is once again underway after its funding was questioned; good broadband access around the country is being pressed forward. National infrastructure is still to be treated as a special case, deserving a rapid decision-making process. *Conservation Bulletin 65* hopes to cast the light of better understanding on that debate through informed comment and scholarship.

Chris Smith
Planning and Development Director (West), English Heritage

The infrastructure of civic life: Battersea Power Station and gasholder stand sentinel over a 21st-century petrol station. While Sir Giles Gilbert Scott's power station is listed Grade II*, the contemporary gasholder was granted immunity from listing in 2009, thus freeing the site for redevelopment.

Attitudes to Infrastructure

The way people perceive infrastructure changes from generation to generation – sometimes as a threat, sometimes for its beauty.

The English have often expressed great ambivalence about infrastructure. Neil Cossons (below) reminds us that the railways that Wordsworth reviled also gave us wonders like the Ribblehead Viaduct .The CPRE long campaigned, with measured optimism, for beautiful infrastructure but came eventually to question simplistic assumptions, bullishly promoted, about need (pp 7–9). Alan Baxter notes (pp 9–11) that great engineers once led projects to acclaimed success but that mid-20th-century urban roads – also led by engineers – proved destructive and merely utilitarian. His call for a wave of critical engineering analysis to underpin new infrastructure is answered in part by Chris Wilkinson's description of iconic engineering, much of it very recent, which taps a public willingness to admire and wonder (pp 11–13). In closing this section, Roger Bowdler shows how designation gives formal expression to society's attitudes to the value of historic infrastructure and thus structures the debate as to how change should be managed (pp 13–15).

Historic infrastructure

Sir Neil Cossons
Chairman of English Heritage 2000–2007

Wordsworth hated infrastructure. 'Is then no nook of English ground secure from rash assault?' ran his celebrated sonnet on the projected Kendal and Windermere railway in 1844. His concern was the little town of Bowness. But in the event, of course, the railway stopped short of the lakeside, frustrated not by Wordsworth but by the property interests of local landowners.

This little interlude encapsulates the issues of today's debate; public good versus private gain, the aesthetic versus the utilitarian, the nation's needs versus local interest, rural versus urban, the past versus the future. It also set the scene for some of the attitudes about beauty and the quality of place that we have absorbed into our culture as a given. From it has grown the adversarial manner in which much of the debate on the historic environment is conducted. And it raises questions about the motives and credibility of people and organisations who are passionate in their opposition to the new but unable to quantify their defence of the old.

William Cowper, Thomas Carlyle, John Ruskin, William Morris – all found common ground in their grief at the works of industrial man. The rural was cherished, the urban decried; in Cowper's words, 'God made the country, and man made the town', the presumption being that the former had made rather a good job, the latter an awful mess. The tide of literary and artistic opinion for a century and more applauded the natural and condemned the havoc and degradation of the new industrial towns and landscapes.

The influence of these early protesters was more profound than we might at first imagine for they established not only the framework of values that we place on the landscape today, but from their sentiments sprang the first moves towards its protection. In the treasured setting of this newly defined England the romantic ruin had its place and from the 1880s was protected under the new Ancient Monuments legislation. This was the milieu in which the National Trust was founded, antiquarianism flourished, folk-life studies were born, and the bucolic rural scene came to epitomise in jigsaw and on chocolate box all that was English. Those with an interest in conserving what we value in the historic landscape are all too easily tarred with the brush of nostalgic recidivism and berated for trying to rekindle some mythic arcadian past.

The Blue Vein tollhouse near Bath in 1935.

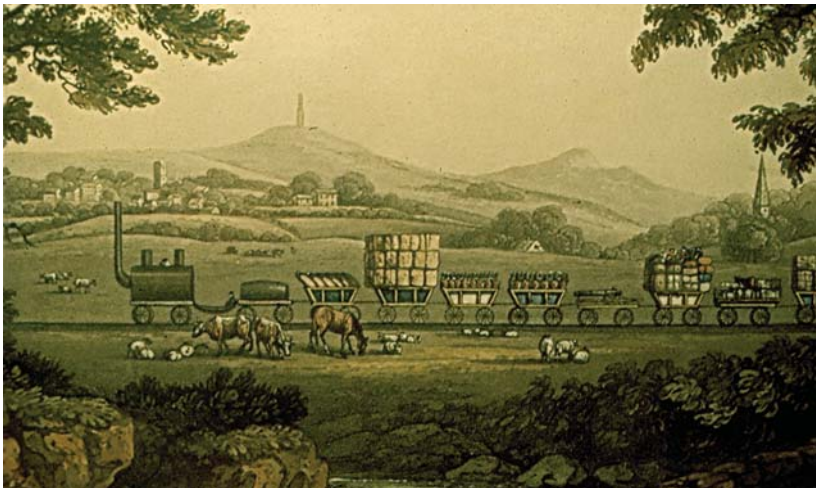
(photo: Arthur Cossons)

Pontcysyllte Aqueduct on the Llangollen Canal, now a World Heritage Site. The restoration of much of Britain's 5,500km inland waterway system is an extraordinary tribute to the power of voluntarism. © Neil Cossons

Today the dilemma is magnified further as we now recognise that much of that 18th and 19th-century infrastructure is itself valued heritage. Some of it represents the birth of a new world order, reflecting Britain's emergence as the first industrial nation. Indeed, the earliest nationwide infrastructure, Roman roads, had no equal until the canal-building boom of the late 18th century. The earthworks of the canals were the largest since the Iron Age. But, by their nature, canals were not unduly intrusive in the landscape. They usually followed contours and their motive power – men and horses – reflected the prevailing practice of the day. Yet now the canal system boasts more listed buildings than any other part of the nation's infrastructure and two of its greatest engineering monuments – the aqueducts at Pontcysyllte and Chirk on the Llangollen Canal – form the central spectacle of a World Heritage Site. Furthermore, its network of some 5,500km of inland navigation has been the subject of one of the largest heritage-led regeneration projects in the world, an extraordinary tribute to the power of voluntarism.

There had, of course, been earlier nationwide infrastructure in the form of turnpike roads, but toll roads were in the main improvements of existing rights of way and the evidence of their survival is not so much in the network itself as in the milestones and tollhouses that punctuated it. Tollhouses are an endangered species, their settings making them often unsuitable as dwellings in the face of modern traffic and susceptible to demolition for road widening. Milestones, on the other hand, are well loved and documented and many have been restored through the efforts of the Milestone Society.

It was the coming of the steam railway, however, that changed the nature and tempo of infrastructure expansion. Railways were the first form of widespread, and very visible, infrastructure and their construction established the idea of travel as a universal and affordable right. They demonstrated for the first time, too, that managed, networked systems were an essential prerequisite of a modern and successful nation. But what eventually became the nation's railway network was not conceived to a coherent plan. It grew from numerous individual



An 1825 impression of what a proposed – but never built – Liverpool & Birmingham Rail Road might have looked like. The Georgian artist had clearly never seen a real steam train but saw the railway as an acceptable adornment in the landscape.
© Author's collection

initiatives, largely unregulated and developed at astonishing speed once the marriage of iron rails and the steam locomotive had been proved an unqualified success. Between 1833 and 1835 lines were authorised to link London with Birmingham, Bristol and Southampton; in 1836 alone 28 new railway companies were formed and by 1844 2,236 route miles had been built, equivalent to today's motorway mileage. By the early 1850s that had tripled, affording Plymouth, Swansea, Holyhead, Glasgow and Aberdeen direct routes to London. The mileage peaked in 1926 at 20,267; today it is about half that, equivalent in size and broadly in shape to the railway network of the mid-1860s.

Throughout the 19th century the opening of a new railway was the cause of celebration; and even in the 1960s railway closures were treated like bereavements. By then much of the real estate of the railway – its great engineering structures and buildings – was already taking its place in the pantheon of the nation's heritage. It was the loss of the Euston Arch in 1962, ostensibly to make way for a new terminus, that galvanised the disparate voices of conservation into coherent protest. Less than a decade later St Pancras, thought to be a lost cause as a station with a future, was listed Grade I, and stands now as the largest and most dazzling example of heritage-led regeneration in the country. Paradoxically, its reopening in 2007, as the terminus for Eurostar, coincided with the announcement of the demolition of the 1967 Euston and the launch of a campaign to rebuild Hardwick's Doric propylæum as part of the new terminus.

The triumph of St Pancras also highlights the paradox of the line that links it to the Channel Tunnel, one of the most hotly contested infrastructure developments to date. Whereas the 19th-century railway is now seen as an adornment in the historic landscape – Ribblehead Viaduct, Brunel's works between Paddington and Temple Meads Bristol, the crossing of the Tamar at Saltash – its 21st-century successor was greeted with fierce opposition, such that tunnelling was the only solution. Today, it is the infrastructure debate as no other that challenges the motives and credentials of those who seek to protect the qualities of the nation's historic environment – that, and the fact that our views evolve and mature over time: yesterday's eyesore is tomorrow's monument. The great cooling towers that dominate the Trent valley are already approaching the end of their lives; history tells us that when the time comes the defence of these great temples to the carbon age, now mellowed by time and familiarity, will be fought with the same passion that secured the gasholders at St Pancras and led to the listing of the Post Office Tower and Jodrell Bank.

Clearly, the infrastructure debate is a fractured one. There are two obvious weaknesses. First, in a material age, those who object to new infrastructure rarely refuse to enjoy its benefits. How many who hate power lines across great landscape deny themselves the use of electricity? It is also worth reminding ourselves that William Morris could indulge his anti-industrial sentiments endowed as he was with an inheritance from his father, on his coming of age in 1855, of shares in Devon Great Consols, the largest copper and arsenic mine in the world.

Second, while those who promote new infrastructure might detail the advantages it will deliver, those who seek to protect the historic environment

The great cooling towers of Rugeley B, Staffordshire, a 1000 megawatt power station built in 1970. Some of Britain's coal-fired stations are nearing the end of their useful lives, but will they be allowed to survive as the heritage of the future?

are rarely able to deploy clear and unequivocal counter-arguments. Unlike a rare species of plant, with its habitat and the nature of its protection as part of the web of life defined by tight scientific criteria, the historic environment has become little more than a combat zone for the trading of unsubstantiated opinions. This is where landscape characterisation – specific, detailed, discriminating, quantifiable – needs to come into its own. And, in that almost all new infrastructure enjoys public subsidy, there is a profound illogicality in one public good being put up as a cockshy for another. Wind farms are a prime example, made the more contentious by conservation interests themselves divided between those who defend landscape from despoliation and others whose priority is carbon-free energy irrespective of the visual consequences. If the public arena matters, then a sensible and thoughtful society would resolve these divergences at the outset, when specifying the requirements, rather than letting the quality of place take its chance through divisive debate.

Perhaps we should have listened to Wordsworth a little more carefully. He understood that it is places that matter – human habitats – more than the individual buildings and monuments that populate them. Placing a clear and comprehensible value on the web of history should enable us to define the power of place as an antidote to the power of expediency.

England and the Octopus revisited

Oliver Hilliam, Judith Rosten and Neil Sinden
Campaign to Protect Rural England

Despite the emphasis on preservation in its original name – the Campaign for the Preservation of Rural England – CPRE has never been about simply preventing change. Sir Patrick Abercrombie, one of its founders, believed that 'rural planning' – the counterpart to town planning – was intended to 'achieve a balance between existing features – natural and historic – and new growth'. It was these principles that shaped the work of many of the early 'preservationists', as the post-war tentacles – the roads and electricity lines of Clough Williams Ellis's *England and the Octopus* (1928) – began to spread in earnest across the countryside. Rural planning was not intended to block the economic growth that was universally supported for post-war recovery. Without a coherent planning system, however, it was feared that roads, electricity and associated infrastructure could needlessly destroy the countryside.

With electricity lines and roads increasingly spreading outwards from town centres in the 1920s in an *ad-hoc* fashion, it made sense to think strategically to create a national network. This was intended both to stimulate the economy and improve the access of rural areas to the fruits of industry and convenience of electricity. At this time CPRE acknowledged 'a great desire for the speeding-up of all measures necessary for the

Things of beauty or a blot on the countryside? For more than 60 years CPRE has campaigned for sensitive solutions to the vital transmission of energy across England's cherished landscapes.
© CPRE

creation of a first-rate National system of roads' but argued that something had to shape the unstoppable pressure of development.

To mitigate the impacts of transport infrastructure, CPRE, with its unique mix of expertise in the fields of planning, landscape and architecture, performed an official advisory role to government. It urged officials to understand the relationship 'of a road and the nature of the countryside through which it passes'. Its 'Roads Beautification' campaign accepted that this relationship need not be negative. It was felt that, carefully routed and designed, motorways would actually enhance the landscape.

When the Trunk Road Act 1937 paved the way for a nationally planned network there was wide support for this principle. By the time initial plans for the motorway network reached the drawing board in 1955, CPRE had three seats on the official Advisory Committee on the Landscape Treatment of Roads. But its effectiveness was limited. The committee was often consulted only after major decisions on alignment had been taken, which, for example, denied it the opportunity to ensure that the M1 ran around rather than straight through Charnwood Forest. It was able, however, to influence the route of the M6 and ensure that the M4 avoided the Berkshire Downs.

There was a marked shift in the charity's policy on major roads from 1970. CPRE ceased simply seeking to mitigate their impact, and began challenging the need for them and their tendency to encourage more traffic. By the early 1990s, the anti-road movement became a two-pronged campaign of policy evidence combined with on-site demonstrations by advocates of direct action. In response to this growing pressure and to questions about the sustainability of continued infrastructure expansion, the government decided to cut road programmes substantially.

The evolution of campaigns on road infrastructure during the 20th century was mirrored in the approach to the expansion of energy infrastructure. Initially, the beauty of well-planned lines of pylons in the landscape was recognised, but at the same time it was recommended that some should be buried underground 'through commons, playing fields, National Trust properties and areas of great beauty'. Matters came to a head in 1951 when the High Court overturned an appeal against an intrusive line in the Malvern Hills. Faced with resistance to underground burial because of its cost, CPRE reluctantly shifted its position to campaigning for 'least bad' route options. Along the way it learnt that being too close to government seemed to lessen its effectiveness, advice being easier to ignore than outright opposition. Despite this, some underground burial was secured, for example at the highest point of the Malverns and on Holy Island. Persistent lobbying also strengthened the law to ensure that CPRE was notified of all overhead line proposals, and public inquiries were held in all disputed cases. In the 1970s, as with roads, CPRE began to question the need for major new

Once an alien presence in the countryside, the red telephone box became one of the best-loved pieces of infrastructure in the English landscape.

infrastructure, calling for greater energy efficiency and decentralisation of supply. In the face of a new wave of investment, we continue to campaign today for a 'smart grid' that minimises landscape impacts.

While pressure for new national infrastructure generally proved irresistible, there were some less obvious successes. In the late 1930s, CPRE was asked to advise on reducing the impact of the surge of new military infrastructure such as hangars, munitions factories and aerodromes. Serious attention was given to the matter, going as far as cladding RAF hangars in Wiltshire with local stone to blend in with the local vernacular architecture.

Conservationists did not always get it right. Responding to consultations on the first wave of telecommunications infrastructure in 1933, CPRE recommended that Sir Giles Scott's telephone boxes be painted dull green in the countryside, as the proposed red frames were considered 'very unsuitable in rural districts'. Now red telephone boxes are considered an iconic part of our heritage and have been the subject of campaigns for their retention. There is an important lesson here. While new infrastructure will impact on the countryside, and while we must continue to do what we can to minimise damage, it will eventually become part of the scene. In future years some of its constructions may well be regarded with fondness for an aesthetic value that we cannot yet recognise. We have also learnt, though, that legal provisions and finance need to be put in place to enable unloved, redundant infrastructure to be removed where appropriate.

We now face a new wave of infrastructure development. Following pressure from CPRE and others the controversial Infrastructure Planning Commission (IPC), created to take decisions on nationally significant development out of the hands of ministers, now faces abolition as the coalition government seeks to replace it with 'an efficient and democratically accountable system'. It will once more fall to environmentalists to ensure that questions of need are properly explored and the implications for landscape and heritage fully considered as part of the decision-making process.

Ultimately, infrastructure will tell future generations the story of our age. And it may not be an entirely positive story. In *Real England: The Battle Against the Bland* (2009), Paul Kingsnorth asks of the Bluewater shopping mall: 'If the world ended today – if this place were covered in ash for a thousand years and then excavated by some future civilisation – what would it say about who we were?'

Infrastructure – now and in the future

Alan Baxter
Senior Partner, Alan Baxter & Associates

In the last generation there has been a serious lack of public and political interest in infrastructure. The many strands of it were beyond the green baize door – the unseen servants. We only grumbled when our power supply was cut or our streets dug up yet again for the repair of crumbling sewers or burst water pipes. But at last we have woken up to the danger our society faces from serious failure and breakdown; how a lack of care and investment is threatening the reliable services on which our nation depends.

A highly intelligent study on a *National Infrastructure for the 21st Century* (Council for Science and Technology, June 2009) and HM Treasury's *Strategy for National Infrastructure* (March 2010) respond well to a recent Institution of Consulting Engineers' annual State of the Nation survey, with its damning critiques of our security of power supplies and of endless muddles and inefficiencies in many areas like local transport. This autumn the government published a much-needed National Infrastructure Plan. But where are the visionary Telfords and Brunels to rise to the new challenges of the 21st century?

In the immediate post-war period Britain responded well to the huge task of reconstruction and the creation of national infrastructure. The CEGB's national electricity grid and the Ministry of Transport's motorway network have served us well, but they were the creations of single-minded engineers. Where we failed was when our single-mindedness to build inner-city ring roads that allowed cars to move faster caused us simultaneously to damage the quality and life of the very towns they were intended to serve. Today this kind of silo mentality is even more dangerous, as the increasing interdependency of the different strands of infrastructure is matched by their ever-more significant impact on the economic, cultural and social life of our towns and countryside. So the Brunels and Telfords of the 21st century must be cultured sociologists and urbanists as well as technically brilliant engineers. The dominance of our silo mentality must be overturned.

Undoing the damage created by the heavy infrastructure of ring roads is very difficult, if not impossible – Birmingham has cut down some of its throttling elevated ring road and Ashford has turned its harsh one-way racetrack ring road into a softer two-way street. But, like much of the Roman

Through intelligent engineering, Ashford has turned its harsh one-way racetrack ring road into a softer two-way street that meets the needs of pedestrians as well as drivers. © Alan Baxter Associates

network of roads, the footprint of major roads is there for the long term. Buildings may come and go without trace but heavy civil engineering involving deep basements, roads and railways has a far longer life, so we must get it right for future generations.

In our highly developed country we also have a new situation to face. For more than a century services within our towns and cities have been buried in an *ad-hoc* way under the streets and pavements and are often poorly charted. In some urban areas, especially in London, this below-ground space is already filled with a labyrinth of tunnels for the Underground railway network as well as major sewers and other vital arteries. This makes the task of threading new tunnels through the cat's cradle of existing ones challenging and expensive. It also reminds us that we may well be reaching a saturation point in how we use subterranean space in city centres. The superstructure of buildings may come and go, but deep basements, tunnels and sewers become a kind of permanent man-made geology as well as being the vital arteries upon which the life of a city depends.

What, therefore, are the significant changes that we need to be thinking about? Our desire and need to move around freely will not diminish, given our growing population. An expansion of the existing facilities for travel will in turn create new challenges, especially in relation to major national infrastructure projects like High Speed 2. The route and design of this proposed new railway between London and the Midlands and North West of England will generate much debate, but even more important is its potential impact on our wonderful countryside. Just as significant, though still largely un-debated, are the environmental implications of the new high-voltage power lines that will be needed to deliver electricity from vital new offshore wind farms and rebuilt power stations to our centres of population. Nor have we yet come to terms with how we better integrate into our lives the siting and the connectivity of airports, the use of which continues to expand rapidly whether we like it or not.

The previous generation's disdain for cities has given way to a new enjoyment of their cultural and human values. The clutter created by the dominance of the car is beginning to be tidied up in a few places – much of the signage littering roads in towns and the countryside is unnecessary and a recent Traffic Signs Policy Review commissioned by the DfT and English Heritage is spearheading its removal. As well as receiving major publicity in the national press it has received strong backing from central government. One can only hope that the initiative will eventually be seen as part of a much wider 21st-century approach to our environment, both built and natural, that insists on a proper understanding of the value of what we have inherited from the past and of allowing it to contribute to a better future. This is not easy and it will need a different breed of professional who can cross boundaries and make things happen. Put bluntly, it is about tidying up the muddle left from our previous irresponsible lack of care about how we use our public spaces.

Technology changes at different speeds. Sometimes it involves sudden rapid jumps, such as the revolution in communications that has occurred in the last decade through the roll-out of broadband. Sometimes it changes remarkably slowly, as in the case of transport. Cars built today have evolved

For too long a proliferation of ugly and unnecessary road signage has debased the quality of our built environment. Finding more civilised solutions will need a new breed of engineers prepared to work as cultured sociologists and urbanists.

very gradually over the last half-century and are not yet radically different from their 1960 ancestors. However, it now seems likely that they will become at least partly reliant on electricity, which will in turn create new infrastructural requirements to keep them fuelled. In the near future we will also become increasingly dependent on local power generation from ground-source heat pumps and combined heat-and-power stations, which will create their own demands for new below-ground distribution networks.

From now on the overwhelming need to drastically reduce our carbon footprint will affect everything we build and replace, and especially our infrastructure. Until now, though, our progress has been slow. As members of the public most of us have little grasp of what that infrastructure is actually about and why it matters so much to our civilisation. If we want to create a better and more sustainable environment for ourselves and our children we urgently need the public to apply the same high intelligence that created a beneficial climate of building and landscape conservation to the poorly understood infrastructure on which we all rely.

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Infrastructure as cultural icon

Chris Wilkinson
Director, Wilkinson Eyre Architects and Commissioner, English Heritage

The term 'iconic landmark' has acquired a similar status to the 'A-list celebrity' – a subject that can be referred to at any time and be sure to attract popular appeal. It is the architectural equivalent to the film star or supermodel, only with a longer shelf life, and its role is to provide the symbolic representation of a place or region. The Eiffel Tower, for instance, offers the memorable image of Paris and the Sydney Opera House does the same for Sydney, and possibly for the whole of Australia.

It is not entirely a new idea, however. It relates back to the concept for the 'Seven Wonders of the Ancient World' and the fierce competition about which cultural monuments should be included. While the Great Pyramid of Giza would definitely make the list, it was not always assumed that the Great Wall of China and the Taj Mahal would follow suit.

Modern engineering feats from earlier times, such as the Panama Canal and the Golden Gate Bridge, have been long been recognised as among the 'Seven Wonders of the Industrial World' but today that list would have to be greatly expanded to include the many incredible technical achievements of the last few years that would qualify as cultural icons.

It is clear, therefore, that the concept of Man pitting his wits against the challenges of Nature has popular appeal and there is a genuine desire to celebrate great engineering achievements. This includes major infrastructure projects, such as the Great Western Railway, which was partly opened in 1838, reached Bridgwater in 1841 and was later extended on to Penzance. This incredible feat of engineering included some of the most remarkable railway tunnels, bridges and viaducts achieved up to that time, earning it the popular title 'God's Wonderful Railway'.

The iconic status of the GWR was enhanced by the narrative describing the incredible achievements of its brilliantly talented young engineer, Isambard Kingdom Brunel. He was only 27 years old at the time he was appointed Chief Engineer of the Great Western Railway and his vision was to provide a link from London Paddington to New York via the GWR to Bristol and a transfer to the *Great Eastern* steamship for the journey across the North Atlantic. He successfully achieved this extraordinary ambition, but not without

Brunel's Clifton Suspension Bridge: a masterpiece of Victorian engineering and a much-loved cultural icon.

considerable difficulties, including a major dispute about the gauge of the railway.

This new-found freedom to travel considerable distances at speed brought with it popular romantic associations, as conveyed in J M W Turner's painting *Rain, Steam and Speed*. The devastating effect on the rural landscape was largely accepted, in a way almost unimaginable today. New infrastructure does inevitably impose on its context and this is why it has to be designed to high standards. People seem to be more sympathetic towards infrastructure projects in the landscape than buildings, however, and it is interesting how often bridges achieve iconic status in the eyes of the public.

For example, the Iron Bridge at Coalbrookdale, built across the River Severn in 1779 with a span of 30m and incorporating innovative materials and technology, made a strong visual intervention in a picturesque landscape and yet was almost universally accepted and revered. At the time of its construction, it became a popular subject for artists and writers. Two views painted by the local artist William Williams were exhibited at the Royal Academy in 1778 before the bridge had even been completed, and engravings by the London artist, Michael Angelo Rooker, became so popular that they went into a second edition. The bridge became a favoured tourist destination in the late 18th century as a spectacle of modern engineering and it is still popular today as a symbol of the Industrial Revolution.

Half a century later, it was the incredible engineering achievement of Thomas Telford's Menai Suspension Bridge, linking Anglesey to the Welsh mainland and completed in 1826, that captured people's hearts. With a span of 168m, this elegant bridge was the largest ever attempted up to that time. It stood more than 30m above the river, with massive chains hanging in a graceful curve from the soaring brick towers. Similarly, Brunel's Clifton Suspension Bridge, opened in 1864 with a span of 214m and a height of 84m above low-water level, became a much-loved cultural icon and it's not hard to understand why. The structural forces that are clearly expressed in these bridges can be understood as part of the engineering, in synergy with the natural surroundings.

In a less picturesque way, the more brutal structure of the Forth Bridge, designed by Sir John Fowler and Sir Benjamin Baker and opened in 1890, is still widely appreciated and is described in the Collins *Encyclopedia of Scotland* as 'the one immediately and internationally recognised Scottish Landmark'. Its 2.5-km length uses more than 65,000 tonnes of steel to cross the wide stretch of water with two main spans of 521m, two side spans of 207m and 15 smaller approach spans. The three huge cantilever tower structures which support the main spans make a dramatic silhouette on the skyline and although not beautiful in the conventional sense, earn their status as a cultural icon.

It is not just historic structures that qualify for iconic status, however; there are modern structures, particularly bridges, which have also achieved popular acclaim.

The Gateshead Millennium Bridge, for instance, completed in 2000, was almost instantly adopted by the locals as an icon. It won the coveted RIBA Stirling Prize for the architects, Wilkinson Eyre,

The new Gateshead Millennium Bridge is the latest in a sequence of historic Tyne bridges – powerful engineering structures that create a profound sense of place.
© Wilkinson Eyre

and engineers, Gifford, and has been featured on a 1st-class stamp as well as a one-pound coin. The success of this elegant rotating structure owes much to its context – the sequence of historic Tyne bridges that together make an exciting composition for industrial archaeologists and bridge lovers as well as the general public. The comparatively lightweight new arched structure is thus seen against the impressive background of the Tyne Bridge (1928), William Armstrong's Swing Bridge (1876) and finally Robert Stephenson's High Level Bridge (1849). Together, these bridges seem to fill the gorge with powerful engineering structures that create a strong identity and sense of place that has great popular appeal.

More recently, the Millau Viaduct in the Tarn Valley in France, by the British architect Norman Foster with the French engineers Eiffel, has succeeded in capturing people's imagination on an international scale. The seven tall, beautifully elegant concrete pylons support the road bridge deck up to 270m above the river; a delicate cable-stayed structure that appears as sculpture in the landscape. Once again, the dialogue between nature and sophisticated engineering has earned popular acclaim and iconic status.

The heritage values of inherited infrastructure

Roger Bowdler
Head of Designation, English Heritage

Infrastructure, and its updating, matters greatly. Just how much is shown by a particularly awful tragedy, which befell four children at the Bull Inn, at Bottesford, in Leicestershire, on 30 April 1831. The loose floor over the privy on which they were dancing 'gave way and the whole of them went down with it, and all were suffocated in the soil before any help could be obtained' (*The Times*, 10 May 1831). Episodes like this remind us how much we owe to the 19th-century creation of a skein of infrastructure across England. Certainly, this is an achievement warranting celebration. But what warrants retention? How should we choose?

Today's cutting-edge facility becomes tomorrow's outmoded lumber. Nuclear power stations reach the end of their safely productive lives; bridges become too weak for modern vehicles, and runways too short for jets; gas pipes replace gasometers; Victorian cemeteries get filled up. Change and replacement are inescapable: they are the very stuff of history, and the inconvenience we encounter is one of the prices one pays for living

Speke Airport, Liverpool: the modernist 1930s hangar building, listed Grade II* but made redundant by the dawning of the jet age, has been given a new lease of life as a health spa.
Mike Williams © English Heritage

in an old country. Heritage values have to compete with the imperative for modernisation: petrifying sites is seldom an option.

How we assign protection, therefore, is a sensitive issue. Consider the case of the Great Western Railway. Upgrading key railway lines is a priority in terms of transport policy, and one few would dare to challenge. Can it be reconciled with the retention of existing railway structures? Recently, the heritage minister John Penrose agreed to de-list the Westbury Lane railway bridge at Purley-on-Thames, West Berkshire. Initially listed in 2009 as part of Brunel's heroic 1840 line, this overbridge had been effectively doubled in width in 1891, thus altering its configuration – and in the minister's view this alteration undermined the claims to special interest and thus it was removed from the list. Other bridges of course remain designated, and the planning system works with this recognition of special interest to permit appropriate or essential alterations.

Designation is a celebration of special interest or national importance; in practice, there is very little real difference between the terms. Standard of design; technological importance; innovativeness; influence; earliness of date; completeness; group value; historical associations: these are the most frequently encountered concepts employed in assessing infrastructure candidates for designation. The family of heritage values that is presented in *Conservation Principles* (English Heritage 2007) is becoming increasingly familiar: *evidential*, *historical*, *aesthetic* and *communal*. Infrastructure provides us with *evidence* into past lives; it opens a window onto our understanding of the past; it frequently possesses a beauty; and its legacy structures tell eloquent tales about the shaping of communities, and their shared daily experience. When articulating special interest, however, one needs to go into greater detail in unpacking the claims being made. A canalside cottage will have different significances to Battersea Power Station. The heritage values of *Conservation Principles* help us ask the right range of questions, but we need to go further in each individual case in shaping the arguments for and against protection.

In an age of openness, it is vital to make public the frameworks within which recommendations are formed. One important aspect of Heritage Protection Reform was the creation of selection guides, outlining our approaches to the selection of assets for designation. Available from our website since March 2007, these guides – 20 for listing buildings, with others on scheduling and the registers of historic parks and gardens and battlefields in preparation – outline our approaches and indicate the sort of questions we ask of designation candidates. Where there is reluctance to countenance statutory protection – as with electricity pylons or nuclear power stations – we say so. In the past, there was a preference for listing signal boxes on preserved railway lines rather than mainline ones – this

The listing of the early Victorian Braithwaite Viaduct in 2003 was initially criticised as a blow to East London transport, but now the atmospheric arches lie at the very heart of a regeneration scheme for the area.
Derek Kendall © English Heritage

too is articulated. Scheduling, which protects carefully selected exemplar sites, can pick and choose its candidates: listing asks a blunter question as to whether special interest is present or not (irrespective of its consequences), and leaves the mitigation of protection to the planning process.

Constructive conservation is the means of averting head-on collisions between protection and progress. Take Speke Airport: Liverpool's sleek tribute to 1930s 'air-mindedness', and Britain's finest civil aviation ensemble, was designed for propeller-driven aircraft with relatively short runway needs. The arrival in the 1950s of the jet airliner rendered the inter-war flying field inadequate: Liverpool John Lennon Airport is now located in new premises a mile away, leaving the old terminus and its hangars – listed Grade II* – in need of new purposes. These have been found: the terminus, substantially enlarged, is now a hotel, and the hangars house a gym and a call centre; redundant infrastructure lives into the future, as full recognition of its architectural and historic importance ensures its re-invention.

Or consider Bishopsgate Goodsyard, on the edge of London's Spitalfields: the listing of the 1839 Braithwaite Viaduct in 2003 was initially criticised as a blow to East London transport, but now the atmospheric arches lie at the very heart of the proposals to create a new and vibrant hub. Staunchly championing the claims to special interest is one of English Heritage's core missions: inevitably this involves some steadiness of nerve in the face of demands for modernisation, and resistance to delay. Understanding the value of inherited infrastructure has never been more relevant. Providing clarity and certainty as to its claims is to be a priority for the new National Heritage Protection Plan (see p41). ■

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Change Past

Infrastructure is built to serve the needs of its day. Its reminds us that change is the constant condition of our evolving society.

The historic environment cannot avoid change – indeed without change much will not survive. Infrastructure is often designed for very particular purposes and thus subject to radical change. The coast, Peter Murphy points out (below), is one place where change can be beyond our control and even the greatest achievements may pass. John Schofield's statement (pp 24–5) of the ubiquity of military infrastructure shows just how often we have changed our landscape in preparing for war. Chris Smith argues (pp 18–19) that change must come to the ring roads which met a utilitarian need but damaged the towns they were meant to serve. John Minnis and Kathryn Morrison see, outside those ring roads, a country where the car has led a radically new phase in urban (or exurban) morphology (pp 19–21). Stephen Brindle's picture of the economic fecundity of Georgian Britain (pp 21–3) shows a society embracing and driving change in a way we no longer find familiar but which perhaps points to the need for society, challenged by climate and demographic circumstances, to embrace change once more.

Coastal management infrastructure

Peter Murphy
Coastal Strategy Officer, English Heritage

Coastal infrastructure has always been designed to manage economic and environmental risk. Risk management and adaptation are now fundamental principles of government policy for the coast (Defra 2010) but, well into the 20th century, reclaimed land and sea defences were still regarded by many people as permanent and irreversible (Murphy 2009, 181–3). In fact, land-claim has involved phases of expansion and retreat over almost two millennia. There is certainly nothing new about adapting to changing circumstances.

Stephen Rippon (2000) has distinguished three types of lowland coastal land use in England in the Roman and medieval periods: *exploitation*, *modification* and *transformation*. The first two involved making use of coastal resources, either without any significant impact on the environment, or by emplacing localised drainage systems. *Transformation* necessitated large-scale infrastructure construction: sea walls, counter-walls, drainage ditches and sluices. It was, in Rippon's words, a high-risk, high-cost but high-return strategy, because reclaimed land was exceptionally productive in terms of agriculture.

Much of England's 9000-mile (14,500km) coastline is protected by some form of sea defence, especially in the south and east. Sea walls are by far our largest archaeological earthworks. They are not generally seen as being ancient structures, however, because many still serve the function for which they were originally constructed: their earliest phases are often concealed by later enlargements and concrete or rock armouring. Others have been superseded by later defences further seawards and now survive as earthworks within drained farmland. Dating sea-banks is difficult. Medieval and later documentary sources make reference to them, though frequently in the context of maintenance and repair; the depiction of banks on the earliest estate and OS maps merely gives a *terminus ante quem*; and very few have been excavated and dated by means of associated artefacts or scientific dating techniques.

Plainly, however, the sea walls were not of one build. Sea walls more or less certainly of Roman date are known, or suspected, from the Solway Firth, East Anglian Fenlands, East Kent, Somerset and the Severn Estuary. Land-claim during the Roman period in the Severn Estuary has been inferred from several lines of evidence, in particular the surface elevation of reclaimed land, and the presence of surface scatters of Roman pottery, which imply settlement or manuring of fields. Given the undoubted capacity of Roman engineers to undertake reclamation projects, the slim

A relict sea-bank in drained marshland in the Ribble estuary in Lancashire. Undated earthwork banks of this type are widespread in coastal marshlands.

This mid-19th century brick-tower drainage pump at Horsey, Norfolk, was reconstructed in 1897 and again in 1912.
© Peter Murphy

and debatable evidence for Roman land-claim in England seems surprising. The most likely explanation is that there was no widespread pressure to undertake such costly projects: areas of uncleared woodland and heathland, which could have been converted to farmland more easily if needed, still survived in the landscape of *Britannia*. The abandonment of coastal marshland between the 3rd and 5th centuries AD resulted from a range of factors: marine transgression, economic change, political insecurity and large-scale population movements were probably all involved (Rippon 2000, 138–51).

By the Middle Saxon period there was a renewed expansion of farming on to the northern silt fens of East Anglia, based on cultivation of salt-tolerant crops such as barley. This was a hazardous flood-prone environment before construction of the late-Saxon fenland Sea-Bank, but the benefits plainly outweighed the risks. In North Kent, charters suggest that post-Roman embankment may have begun as early as the 8th century, and there is documentary evidence for maintenance of sea walls from the 13th century onwards in the Thames estuary. Areas of salt marsh and mudflat were converted to agricultural production in many parts of the country during the middle ages. From the 1280s to the mid-15th century there were frequent breaches of flood banks, during an exceptionally stormy climatic phase.

Some of the best known 17th-century drainage and reclamation schemes are associated with Dutch engineers: most famously Cornelius Vermuyden who, in the 1650s, directed drainage of some 38,500 hectares in the Great Level of Norfolk and Cambridgeshire, funded by a company of 'Adventurers' led by the Earl of Bedford. Some 1450 hectares on Canvey Island were also claimed by Dutch contractors, many of whom subsequently settled on the island. Pumped drainage was widely adopted from this time onwards and many historic structures – from wind pumps to steam-engine houses – still survive, for example on Halvergate Marshes, Norfolk, and in the Fens.

Coastal defences along eroding cliff and dune coastlines were a later development. In 1809, for example, Trinity House undertook works to protect the twin towers of St Mary's, Reculver, which were significant day marks for navigation. Throughout the 19th and 20th centuries individuals and local authorities defended vulnerable stretches of coast, the largest-scale projects occurring in the aftermath of the catastrophic storm surge of 1953.

In recent decades there has been a fundamental reappraisal of coastal management, and the role of the Environment Agency has expanded. The obligations imposed by EU Directives to protect and enhance coastal wildlife habitat, the increasing cost of defence works and, above all, the need to develop a coastline that will be sustainable in the face of 21st-century climate change mean that absolute 'defence' for every single coastal location can no longer be assured – if it ever was. Protection of major settlements and industrial and communications infrastructure will be necessary, but elsewhere land will be lost. The outcome of the current round of Shoreline Management Plan reviews will be the definition of stretches of coast where

A British Museum excavation of a Lower Palaeolithic site behind failing sea defences at Happisburgh, Norfolk, June 2010. The Shoreline Management Plan policy here is 'no active intervention'.
© Peter Murphy

existing unsustainable defences will not be maintained (the 'no active intervention' option), or where new defence lines, further landward, are most appropriate ('managed realignment'). This will result in the loss of historic assets by erosion or permanent flooding and plainly will pose management challenges for English Heritage.

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Ring roads

Chris Smith

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One of the worst experiences of most historic towns in England can be had standing on the edge of the ring road. It is not difficult to understand how this came to be. The need for infrastructure to stop the city being choked by the ever-growing number of car movements across the centre was paramount. The technical solution existed in the mind of traffic engineers and on any number of visionary plans. It was an orbital road that picked up traffic on all the primary radial routes into and out of town and kept it away from the centre, until it was allowed in at the point nearest to its objective, where car parks were to be constructed.

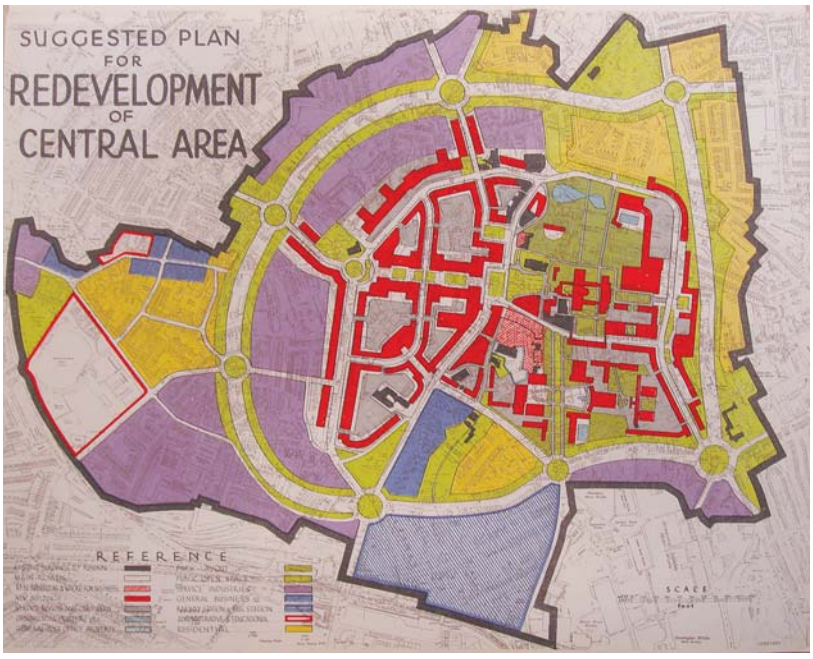
Few of the plans took any account of the existing fabric into which the new road would have to be fitted. Major monuments were generally avoided but apart from that the road went where the road had to go, aided by compulsory powers given to councils to make sure that the engineers' solution could happen. Little thought was given to the relationship of the ring road to other modes of transport, with the common result that the railway station was outside the ring road and a traveller's experience of arrival was characterised by battling through ring-road paraphernalia and subways with little idea of where the town centre was to be found.

Since the parcels of land adjacent to most ring roads were space left over after highway design, rather than part of a comprehensive design, the new routes then went on to be graced with haphazard, low-value development, or none at all. Unsurprisingly the ring roads became among the most used, but least admired of all infrastructure. Even those who believed that a better ring road was essential to the success of the town rarely got their way since improvements proved difficult. Often the settlement had been sold the ring road as the correct but expensive solution; demands for still more money were correspondingly unwelcome. At the same time, the damage to the urban fabric caused by the roads was generating resistance to further change. So even the ring-road enthusiasts found themselves fuming in traffic jams.

When eventually the car-led hegemony lost its grip on planning committees and developers, proposals to unpick, downgrade or even remove parts of the ring road arose. Often they were promoted with the same vigour as the original. In Birmingham the ring road was characterised as the concrete collar, weighing down the centre; expensive plans were drawn up and executed to remove the ring road at Masshouse Roundabout and likewise the massive barrier to connection between the city centre and Eastside.

However, this kind of intervention is still the exception rather than the rule. Further round the Birmingham ring road, the need for better connection between the centre and the Mailbox shopping and recreation centre was met by a striking upgrade of the area below the motorway bridge – with bright illumination, improved pavements and multi-coloured glowing globes.

The main reason removal is so rare is expense.



Donald Gibson's 1945 plan for the redevelopment of Coventry shows the ring road as an at-grade dual carriageway with roundabouts. By the time construction began in 1959 it had been transformed into an urban motorway. It was finally completed in 1974.

Coventry's ring road was designed to allow views to outlying areas, particularly the parks. Half a century later, repairing these connections would make a great deal more sense than removing part of the road.

When CABE and the English Heritage Urban Panel visited Plymouth, where wartime damage and engineers' licence had combined to produce one of the blankest sheets on which a correspondingly complete and thoroughgoing ring road could be built, members noted that the road was of such a scale and so solidly engineered that it would have to be accepted as a given.

Even in places where the physical objects are not so grand or solid, this is most likely to be the appropriate solution. Coventry's ring road is remarkable for the quality of its engineering, which took explicit account of the need for views through the ring road to outlying areas, particularly the parks, and the panel's view was that repairing these connections would make a great deal more sense than removing part of the road.

Many ring roads follow the line of medieval city walls and European experience, as at Avignon and Lucca, shows that this can result in high-quality townscape that accommodates the need to keep the cars out of the centre. In England, of course, the walls have sadly mainly gone. However, the survival of pieces of wall at Norwich does offer a certain dignity to the road, while at Northampton the road follows the line of the lost wall and thus leaves a legible memory. It is not difficult to imagine this ring road slowly upgraded by tree planting, reduction of highway clutter and traffic calming to become a pleasant place.

'Ring road', as a term, evokes the irredeemably unlikeable, but we still need the infrastructure to keep cars from the centre – indeed our society is getting more demanding about the need for a car-free centre. So it may be that, in an age where mighty heroic investment is unlikely, we will remake and rename the ring roads as parks, boulevards and gardens and come to appreciate that this expensive if crudely inserted infrastructure can become a multi-purpose asset for the future.

Creating exurbia: an infrastructure for 'The Great Car Economy'

John Minnis and Kathryn Morrison
Senior Architectural Investigators, English Heritage

In the 1980s, Margaret Thatcher famously declared that nothing could stop 'the great car economy'. How true. In the ensuing years society has become so heavily dependent on the motor car that the layout of our towns and cities has been rearranged to suit those with four wheels. In fact, urban centres have been turned inside out, as retailers, leisure facilities and businesses have, one by one, relocated to edge-of-town and out-of-town locations. The resulting landscape, on the periphery of established settlements, can be called 'exurbia'. Town centres might battle back, with markets and Morris dancers, but there is no denying the transformative effect of the car over the last 30 years.

Just how the car became such a radical agent of change is the central theme of English Heritage's Car Project, which examines the impact of the car on both urban and rural landscapes. In addition, it traces the evolution of building types that grew up with the car, from domestic garages to motorway service areas.

The motor car has always been a mass of contradictions. Promising freedom, it has imposed severe restrictions on the movements of pedestrians. As an object of pleasure, it has killed and maimed. Presented as a hygienic alternative to the horse, it has generated much of the world's pollution. These contradictions continue. At a time when politicians emphasise the need to cut carbon emissions, to preserve stocks of fossil fuels, and to reclaim streets for pedestrians, other forces have led people to undertake more and more journeys by car. Drivers face high parking and congestion charges, soaring fuel prices and road taxes, but still they drive. Just why do motorists put up with this treatment? The answer is as simple as the solution is difficult. The impact of the motor car on England has been so profound that most people would be unable to lead their lives without it. Settlements, workplaces, shops and entertainments have become so dispersed that car-use is the only way the current infrastructure can function. Outside major towns and cities, public transport is often no longer a realistic option for many people.

The car has changed the world, slowly but surely. Between the wars, our urban streets began to bristle with traffic controls, while bypasses cut swathes through the surrounding countryside. The comprehensive redevelopment that followed the Second

Cambridge Science Park, bounded by the A14, the A1309 and a disused railway, now the route of the guided busway, on the north side of Cambridge. This development was built from the 1970s onwards on land belonging to Trinity College.

World War included new road schemes – with underpasses and flyovers, footbridges and subways – that wreaked havoc with urban fabric, while motorways made great distances seem trivial. But urban geography was, by and large, untouched, and town centres continued to fulfil their traditional roles. Only in the last 30 years have essential functions shifted out of town, creating a new landscape with its own infrastructure. While the car is the essential element that made this possible, exurbia does not relate just to the car. It embraces a system of distribution based on road haulage, which has linked up with developments in computing to create a new science of logistics.

Whereas previous urban, suburban or rural developments had obvious continuity with an earlier pre-motor age, the landscape of exurbia is independent of traditional urban centres. You might live in a housing estate on the edge of a conurbation, approached from a trunk road or ring road. From this estate, you might drive to work in an out-of-town business park, and carry out all your shop-ping and banking in a series of superstores, garden centres, retail parks, outlet villages or regional malls, without setting foot in the town centre. Entertainment can be found in a complex that includes, typically, a multiplex cinema, bowling alley and gym. Restaurants, fast-food outlets and budget hotels form an integral part of this landscape, and the business traveller can now shun the town centre. Even the car, itself, can be bought, fuelled, serviced and sold outside the town. What stands out is the uniformity of these out-of-town landscapes: everywhere the same chains, with their unrelenting house-styles. Local diversity is almost non-existent – in fact, there is often no distinctive sense of place whatsoever.

One reason exurbia continues to expand is the availability of cheap land with unlimited free parking in simple-to-use surface car parks. While driving to an out-of-town shopping centre is straightforward and convenient, town centres promise frustratingly slow road systems, awkward multi-storey car parks, and high parking charges. Thus more and more businesses opt to relocate out of town; their customers follow willingly, and the process becomes self-perpetuating.

Another explanation for the preference of out-of-town facilities is their very anonymity. In their cars, people occupy private spaces, free from the possibility of intrusion by those they might not wish to meet. This luxury vanishes on the top deck of a bus, a means of transport on which non-drivers – the young, the old, the infirm and the poor – are concentrated. The car is not wholly to blame for the desertion of the town: technological change has reduced the need to step outside the front door by providing internet/telephone banking, on-line shopping, home-working and even social networking.

Exurbia is not necessarily such a bad thing. Its infrastructure of roads, car parks and big sheds suits

Shopping and eating out with free parking all around in a retail park on the south side of King's Lynn, Norfolk – an homogenised way of living that shuns the diversity of the traditional town centre.

the way many live now. Our modern lifestyles – as we discovered in the 1960s and 1970s – could not be squeezed with ease or dignity into an infrastructure designed for a car-less society. The pressure on traditional centres was such that the growth of exurbia was probably inevitable, if we were to salvage at least part of the urban architectural heritage for future generations.

Environmentalists present a strong case that our modern lifestyle is not sustainable, and that the present level of carbon emissions cannot be allowed to continue. However, their proposals often fail to acknowledge the nature of the infrastructure that supports the way we live now. If we reduce car-use, then the infrastructure created for our car-based culture will need to give way to a new infrastructure, as yet unimagined, but designed for different modes of transportation, within a different geographical framework. Will it be possible to achieve this? Will people be willing to make the sacrifices it would demand? Indeed, is it too late to reverse the fundamental changes wrought by the car? These are the big questions we must all grapple with in the years to come.

For further information see www.english-heritage.org.uk/professional/research/buildings/the-car-project

Georgian culture and the birth of railways

Stephen Brindle
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'Today we have had a lark of a very high order', the diarist Thomas Creevey wrote to his daughter on 14 November 1829. He, and a house-party staying with Lord Sefton at Croxteth Hall near Liverpool, had been for a ride behind the 'Loco Motive machine' on George Stephenson's nearly-complete Liverpool & Manchester Railway, and travelled at an appalling 23 miles an hour:

> … the quickest motion is to me frightful: it is really flying, and it is impossible to divest yourself of the notion of instant death to all upon the least accident happening.

In the early 1830s, history itself seemed to be speeding up: by the time Creevey died in February 1838 Stephenson, with his son Robert and a close-knit group of associates, had almost completed railways that linked the Liverpool & Manchester to Birmingham and Birmingham to London: a national network was fast developing.

Today, we tend to think of infrastructure as something that is directed from the top (ie central government) down, or spreads from the centre (ie London) outwards, but this is not how things happened in Georgian England. Theirs was the ultimate low-tax economy, where the state only accounted for perhaps 10 per cent of GDP. The merchants and gentry, struggling along their muddy, ill-maintained roads, knew that if anything was going to be done about them, they would have to do it for themselves.

The result was turnpike roads. Local parishes, tasked with the maintenance of the highways, were simply not up to it. From 1663 onwards, local magistrates could apply for an Act of Parliament to levy tolls, to maintain them. In 1707, the first independent turnpike trust was formed. The clergy, merchants and gentry of an area would form a trust, obtain an Act to cover a stretch of maybe 20 miles of highway, appoint officers, set up a toll-gate – and apply the proceeds to improvements. By 1750, 150 trusts had been set up; by 1825 there were more than 1,000, maintaining around 18,000 miles of roads. The network grew organically as

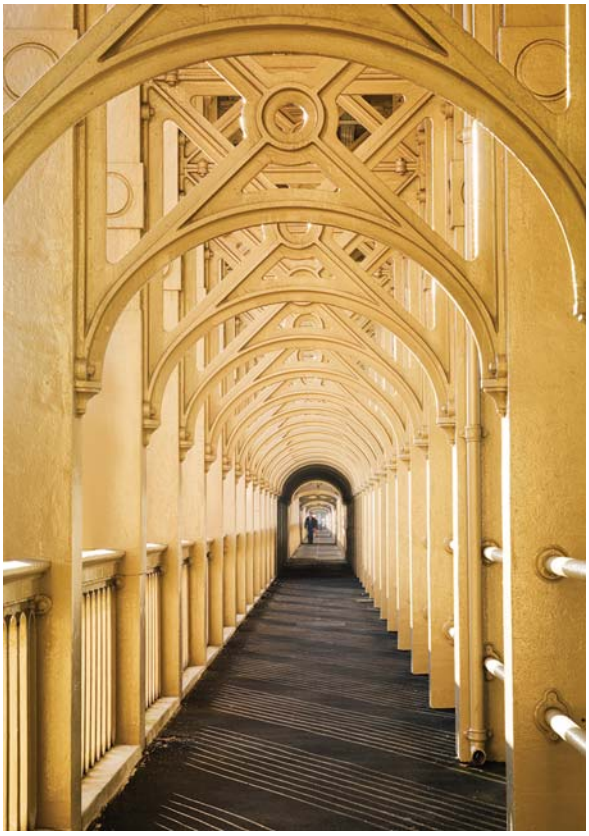
trusts gradually adopted and remade stretches of the main routes that radiated from London and linked town to town.

From the 1780s a new system of mail-coaches grew in the same voluntaristic way, with contractors bidding for the right to carry the royal mail. Rival coach operators were set up, and the competitiveness of the coachmen on some of the great routes became a thing of legend. As Thomas Telford, John Loudon McAdam and their generation developed the roads further, so speeds went up, from an average of 5–6 mph to 9–10 mph.

From the 1760s, the canals began to appear, starting with the Duke of Bridgwater's in Lancashire. The duke built it at his own expense to get coal from his mines at Worsley to Manchester more cheaply: when it opened the price of coal in Manchester halved, demand soared, and by 1800 his canal, which had cost £250,000 to build, was generating profits of £100,000 a year. Canal-building, like road-building, encouraged a culture of accurate surveying, as well as the development of contractors, capable of huge feats of earth-moving. By 1820, England and Wales had 3,691 miles of canals, a heavy-goods network to parallel its roads network.

Meanwhile, Georgian enterprise had already developed the idea of running wagons on rails: in hundreds of collieries, mines and ironworks, engineers knew that a horse could pull five or six times as much in a wagon running on rails, as in an ordinary cart. One breakthrough was the invention of self-acting planes (a full wagon goes down pulling an empty one up) in 1798. The engineers were already using steam-engines to keep their mines dry, and a further step was the application of steam power to inclined planes shortly after. Then around 1800 the first steam locomotives appeared, their main inventor being the self-taught Cornish genius Richard Trevithick. Critical developments in engine-power were made by another self-educated genius, George Stephenson, the chief engineer at Killingworth colliery in Durham, with his *Blücher* in 1814. Thus by the 1820s, Georgian England had a road network, a canal network, the skills in surveying and engineering to design them, the legal, financial and contractual models for getting them built – and a functioning model for the application of steam-power to wagons running on rails. All had been done by private initiative, and almost all of it originated in the provinces, not in London. No other country was anywhere close.

Edward Pease, a Quaker banker from Darlington, was the original motivating force behind the world's first public railway, the Stockton & Darlington. Promoted in 1818 and designed by Stephenson, more than three-quarters of its £120,000 cost was raised locally. Even before it opened in 1824, other and much richer men were becoming seriously interested. Since 1798, people in Liverpool had been thinking about a horse-drawn tramway to link their port to its hinterland around Manchester. A railway company was set up in 1822, but this was



The High Level Bridge between Newcastle-upon-Tyne and Gateshead was designed and built by Robert Stephenson in 1845–9. Recently the subject of a major programme of repair it remains one of the glories of Tyneside and a masterpiece of infrastructure engineering. James O Davies © English Heritage

Thomas Roscoe's engraving of Euston Arch in 1838: grand gateway to the London & Birmingham railway and a tragically lost symbol of the visionary ambitions of provincial Georgian entrepreneurs. Source: Wikimedia Commons

an altogether bigger proposition: their first attempt to get a bill through parliament failed, but the second one passed in 1826. Almost the whole estimated cost of £1,250,000 was raised in Liverpool. Merchants around the country were electrified by the thought: as early as 1824, attempts were being made in Birmingham and Bristol to set up railway companies.

The sums involved were huge, and the proposition seemed terrifyingly speculative. The Birmingham merchants could not raise the money for a railway to the Mersey, so they went to Liverpool for help. The result was the Grand Junction Railway Company, to build a line from Warrington to Birmingham. By the time the Liverpool & Manchester Railway opened on 15 September 1830, the 'Liverpool Party' had a large share of the London & Birmingham Railway, too. Both the Grand Junction and the London & Birmingham secured Acts of Parliament in 1832.

A revolution was being unleashed, and armies of navvies let loose on an unsuspecting countryside. It is sobering, when travelling by train, to reflect that the huge cuttings and embankments were all, every last foot, dug by men with picks, and shovels and wheelbarrows, assisted only by horses, carts and (occasionally) gunpowder. The speed with which it all happened is hardly less astonishing: when the London & Birmingham line opened in September 1838 it was possible to travel from Liverpool to London in about 10 hours. It had cost £5,500,000, over twice its estimate, but the first railways were profitable from the outset: the Liverpool & Manchester, Grand Junction, and London & Birmingham companies regularly returned dividends of 10%. It was remarkable, too, how little of the initiative had come from London: the first, critical generation of railways was born and financed in Durham, Northumberland and Lancashire.

In the 18th century, the fertile soil of provincial Georgian Britain had given birth to a series of local revolutions: ceramics in Staffordshire, iron-working in Shropshire and South Wales, tin-mining in Cornwall, cotton-spinning in Lancashire, and so on. As the country's infrastructure grew like an organism, the pace of change quickened. There were dreadful privations for the poor in all this, but the opening of the railways generated a step-change. The creation of a national market linked these revolutions together and made them into a self-sustaining process: sustained economic growth exceeding population growth, the Holy Grail of modern economists and politicians, had arrived for the first time in history. Railways, a uniquely British phenomenon, were set to transform Britain, and the rest of the world.

In 1830 a beautiful 21-year-old actress, Fanny Kemble, was appearing in Liverpool. On 25 August she was invited for a ride on the Liverpool & Manchester line, then due to open in a few weeks, and rode on the footplate of the engine with bluff, craggy, 49-year-old George Stephenson himself. The *Rocket* reached its top speed of 35 miles an hour, faster than a bird can fly: no one in history had ever travelled this fast before but, as she wrote to a friend:

> When I closed my eyes the sensation of flying was quite delightful, and strange beyond description; yet strange as it was, I had a perfect sense of security, and not the slightest fear.

She was, she wrote, 'most horribly in love' with George Stephenson.

Fanny Kemble, by Thomas Sully, 1834 (detail). After riding with George Stephenson on the footplate of the *Rocket* a few weeks before the official opening of the Liverpool & Manchester, the celebrated young actress declared: 'When I closed my eyes the sensation of flying was quite delightful, and strange beyond description.'
Source: Wikimedia Commons/White House Historical Association

The ubiquity of militarised landscape

John Schofield
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Travel anywhere in the UK, and across much of Europe for that matter, and we encounter the traces of militarism. From Roman forts to medieval castles, from First World War battlefields to Cold War installations, the monuments and memorials to recent conflict are ubiquitous. They may not always be obvious, either for reasons of unfamiliar architecture or their invisibility within modern development, but they remain, none the less, in place and in memory.

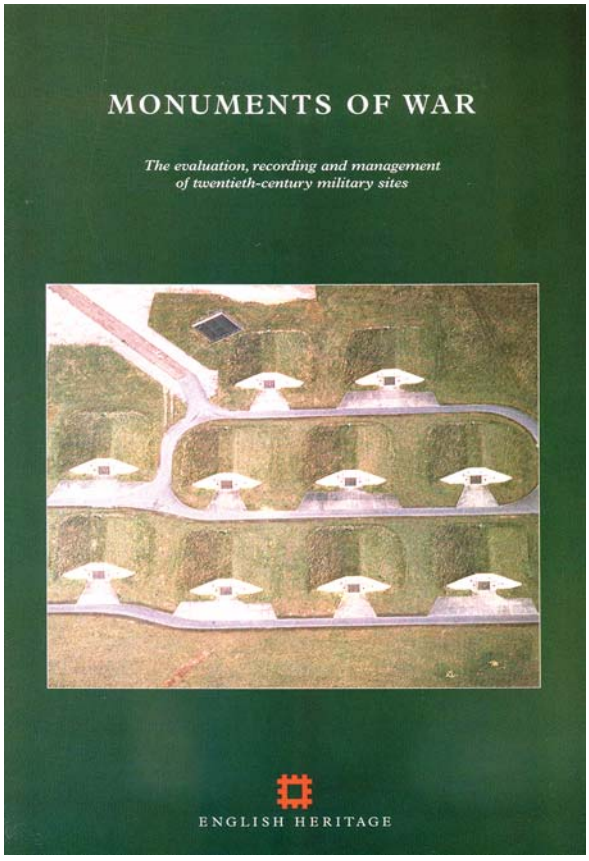
Monuments of War

In 1997 English Heritage marked its comprehensive investigation of 20th-century fortifications in England with a seminar at the Society of Antiquaries of London – Monuments of War. In the publication of its proceedings (English Heritage 1998) I noted how 'not everything can or should be preserved and that the best examples, or those most characteristic of an area or subject, which sometimes reflect the local and the commonplace, should be given priority'. I concluded by stating that the subject, and this initiative, had strong support and that 'a firm foundation existed from which to build in the new millennium'.

At the end of the first decade of that 'new millennium' we can reflect on progress. It is interesting to note the use of that word 'characteristic' in my earlier comments, as much of the later work on 20th-century defences is character based. Characterisation studies were completed for Corsham (Wiltshire) and Coltishall (Norfolk), among others, to inform future management needs. Following the exemplary studies of Colin Dobinson, based on documentary sources held in the National Archives, other national studies were completed, for prisoner-of-war and army camps for example – studies we referred to as 'thematic characterisation'. At one time it was rare to find 20th-century defence sites on Sites and Monuments Records, but now they are as much a part of their new iteration (Historic Environment Records) as the earlier prehistoric and Roman sites that were once a more acceptable part of our cultural heritage. So there is ubiquity in the record as there is in the landscape.

Cold War

The *Monuments of War* publication contained an early report on the Cold War project, then being



RAF Fylingdales, North Yorkshire. The nationally famous 'golf-balls' housing Britain's Ballistic Missile Early Warning System were demolished in 1994, when they became surplus to defence needs. Would the same happen today?

RAF Neatishead, Norfolk, scheduled Type 84 radar. This is the last high-powered radar system from the Cold War era in the United Kingdom; as with any historic structure its continued survival will require a long-term commitment to its maintenance.

undertaken by RCHME, alongside short reports on the emerging significance and public interest in Orford Ness and, in the US, the Nevada Test Site. In his article about the Cold War study, Roger J C Thomas described how the 'range and complexity of Cold War architecture encountered, and the rapid loss of structures and equipment, emphasise the urgent need for the current analytical work', again to inform conservation and management needs. That urgency remains as significant sites are still under threat of development. Times have changed however, and one wonders what would happen to the Fylingdales 'golf-balls' (protecting the Ballistic Missile Early Warning System) if they were threatened with removal today. As has been recognised within some of English Heritage's characterisation projects, there are places where the Cold War is everywhere (contradicting the view that it was a placeless war). One feels the presence of the Cold War still in parts of East Anglia for example, and around former airbases where influence remains, either in military architecture, or the housing built to support military personnel or in people's stories and memories. The Cold War has also become immensely popular, with a strong presence in screen and print media, and reflected in English Heritage's *Cold War* book (Cocroft and Thomas 2004) has now had its fourth print run. Some of the Cold War's key sites remain, not necessarily for all to see as many are still in use and off-limits, but they remain none the less as traces of the recent past. The Cold War Royal Observer Corps 'bunker' at Acomb (York) is an example of what can be done.

Defence lines

Monuments of War also made reference to the Defence of Britain project, in a contribution from the late Andrew Saunders, and one by Colin Dobinson who presented for the first time a map displaying the complexity of Second World War defence lines derived from documentary records. Following the completion of the Defence of Britain Project we wondered what to do with all the data, specifically in terms of heritage protection. The response was twofold: first to identify examples by type, in order to ensure that whatever selection was made of sites for protection, it was at least representative of national and regional diversity. Second, there was a desire to ensure that legible and coherent defence landscapes were both recognised and – hopefully – appropriately managed. For this, William Foot (previously of Defence of Britain) was commissioned to conduct a study of the best-preserved, most complete, most legible defence landscapes as revealed by the Defence of Britain Project data. The Project had demonstrated how widespread and ubiquitous these sites were; the Defence Areas project demonstrated that survival of coherent defence landscapes was equally widespread, with examples from urban, peri-urban and rural settings. The published report (Foot 2006 and now accessible online via the Archaeology Data Service) contains the details, with maps and location information. As Richard Holmes said in the Foreword to William Foot's book, the 'landscape is given added meaning by these defences'.

Landscape

Of all the many English Heritage projects conducted under the broad umbrella of recent defence heritage, these projects emphasise the ubiquity of defence structures. Of course the network is wider still, incorporating extant examples within many classes of buildings and monuments not referred to here, but that merely emphasises further the point: that defence structures are not mere places; they are best viewed as components of a wider militarised landscape, one of extraordinary scope and diversity, and one heavily laden with memories and meaning.

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Change Future

Understanding the growth and decline of past infrastructure can help us to better manage the infrastructure of the present and future.

We cannot see the future and speculation is always at the mercy of events. In this section we attempt to draw some conclusions about future changes bearing on infrastructure. Keith Falconer's overview of the ports (pp below) is one of repeated, thoroughgoing change sweeping away most of what went before. Designation seems the only guarantor of much recognisable survival in future. Anne Locke looks forward to a world after 'peak-car' in which we confront re-use of the mighty motorways (pp 28–9). Roger J Thomas shows us (pp 30–1) that continuous change to the largely temporary infrastructure of war makes it perhaps the most evanescent infrastructure of all – only by intervention based on good understanding and societal consensus as to value will any survive. Jen Heathcote turns to the fundamental importance of the out-of-sight and out-of-mind water systems and their vulnerability to change, when the product they deliver is essential for life (pp 31–2). Finally Wayne Cocroft describes a nuclear infrastructure, which undoubtedly has a very, very long future, which we must learn to manage (pp 33–4).

Ports and harbours – a transient, fragile resource

Keith Falconer
Head of Industrial Archaeology, English Heritage

> Few things in the world of redundant industry are quite so vast, solid and impressive as docks and their related works. (Jackson 1983)

Harbours and ports as points of entry, transhipment, break-in-bulk and trade have throughout historical trading times been examples of infrastructure *par excellence*. They have had to respond and adapt, with varying degrees of success, to political circumstance, to every economic trend and to every technological and operational advance. They have thus left an infrastructure legacy which is of great historical significance but extremely vulnerable to change.

A minimum of history

The development of the seaborne trade through English ports from medieval times to the mid-17th century, though dominated by London, was very susceptible to geo-political factors and restrictions such as the Hanseatic League. When the Antwerp-focused wool trade and the wider Baltic trade flourished, so did the ports typically situated close to the mouths of rivers around the east and southern coasts. But when the export of raw wool declined or wars intervened (sometimes exacerbated by coastal erosion), prominent ports such as York, Norwich, Lincoln, Kings Lynn, Boston, Ipswich, Chester and Southampton declined, some, such as Sandwich, to extinction.

There had been nothing very sophisticated about their facilities – wooden quays, mud flats where ships would beach and a scattering of warehouses. Even the Port of London with its Legal Quay and Custom House had little infrastructure other than a treadmill crane, and was served by lighters from ships moored in the river. In the 17th century changes in ship technology, shifts in the focus of trade to across the Atlantic and beyond, the creation of trading monopolies and the Navigation Acts of 1651 and 1660 (which largely limited carrying to English vessels) all had a profound effect on England's harbours and ports and their infrastructure.

King George V Dry Dock, Southampton (1931–3). Timely action in the face of redevelopment secured the future of this rare survival from the heyday of the transatlantic-liner era. Designed for the repair of the largest ocean liners, this reinforced concrete graving dock was the largest civil engineering work undertaken at any British port in the inter-war period, and remained the world's longest dry dock for almost 30 years. © English Heritage

This manifested itself in the following century in the revival of ports such as Bristol and Hull and the rise of new ports such as Liverpool and Whitehaven. It also led to increasing differentiation in types of harbours and infrastructure that can be crudely summarised as follows:

- unimproved wharves with only elementary handling equipment – hundreds have been noted in the current Coastal Zone surveys
- river ports such as Exeter and Gloucester with improved controlled connection to the sea and later canal ports such as Goole and Stourport notable for their transhipment facilities
- harbours and bays protected by piers around most of the coastline – some with comparatively ancient piers, such as the South Pier at Penzance and the Cobb at Lyme Regis
- harbours of refuge with huge engineered piers on busy exposed sections of coast, such as Scarborough and Ramsgate, but with few handling facilities
- ports with commercial impounded docks. Liverpool was the pioneer, then Hull and Bristol and belatedly, but spectacularly, in the next century, London, with its introduction of enclosed dock systems. With the huge increase in size of ships most major ports had to follow suit. It is at these impounded dock ports that greatly improved infrastructure was required and distinctive dockland areas came into being
- entry and ferry ports such as Dover. These witnessed resurgence in the last two centuries catering first for rail traffic and later road vehicles with some, such as Southampton, further specialising in cruise passengers
- specialist ports handling only a limited type of cargo such as coal, timber, fish, chemicals and oil, with specialised handling and storage facilities such as the Ice Factory at Grimsby and the Billingham phosphate silos.

The rise and decline of docklands

The golden age of English ports lasted only some two centuries – from the adoption of wet docks systems towards the end of the 18th century until the advent of trans-Atlantic containerisation in 1965. However, throughout the period, the trend for ever-larger vessels constantly rendered existing docks inadequate – with the consequent relegation of older docks to concentration on sailing ships and coastal trade. Thus in the first third of the 20th century, when typical ship sizes trebled, many of the historic docks, and particularly those surrounded by multi-storey warehouses, became increasingly redundant. The latter part of the period also saw the ascendency of the transit shed, which culminated in the introduction of massive concrete-framed sheds post-1900.

Containerisation, with its emphasis on deep-water quays, rapid handling and vast areas of hard standing, was to spell the doom of all these traditional docks. Thus the opening of Liverpool's Seaforth Dock in 1971 coincided with the closure of the historic South Docks.

Dover Harbour, Kent. One of the earliest and most important harbours, Dover enjoyed a remarkable rebirth in the 19th and 20th centuries. Admiralty Pier survives as the only executed component of an ambitious scheme for a large national harbour. These historically and constructionally significant components, which still safeguard cross-channel traffic, were listed in 2009 following threatened redevelopment.

Informed change

From the heritage point of view the redevelopment of docks in the major ports has been of very varied success. Some of the differences can be put down to the degree of understanding and valuing of the resource at the decision-making level. Thus in Liverpool state-sponsored surveys and publications were influential in the retention of the cream of the historic features in the South Docks and informed the inscription of Liverpool's historic waterfront as a World Heritage Site. In London, by contrast, most of the historic warehouses and equipment around the London Docks and St Katherine Dock, valued only by the heritage sector, were swept away. Only eleventh-hour designations rescued the Floating Harbour in Bristol from being floored over for a road system, but in Hull the finest warehouse was demolished for an abortive road widening before the docks were belatedly recognised as the civic asset they now are.

The redevelopment of ports is not easy. Typically docks have internal circulation systems which, with obstructive cranes, swing bridges, rail tracks, hydraulic pipe systems and a multitude of large and small sheds, are problematic for the preferred car-based residential and leisure conversions. The response has been to sweep away many of the features that make dockland so distinctive. Thus the humble transit shed is now very much an endangered species and even when in captivity, such as those that house Bristol's industrial museum, is still vulnerable to architects' fashionable whims. Other facilities such as graving docks, dockside cranes and passenger terminals are equally threatened. It takes imagination, informed by detailed recording and assessment, to make a success of dockland regeneration but a visit to Liverpool's Albert Dock demonstrates that it is well worth the effort.

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New uses for old motorways?

Anne Locke

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Successive transport networks – canals, rail, roads and aviation – have both promoted and responded to the country's economic growth. The idea of one era's transport infrastructure being eventually supplemented or eclipsed by another faster, higher-capacity network is a strong one. We have become accustomed to the idea of finding new uses for disused canals and redundant railway lines. But could parts of our road network ever fall out of use?

Some transport policy thinkers are questioning the assumption of ever-increasing demand for transport. The new coalition government took the novel step of giving Transport Minister Norman Baker responsibility for looking at alternatives to travel. Professor Phil Goodwin of the University of the West of England is researching the 'peak car' concept: that, like rail use after 1918 and bus and tram use after 1950, the upwards trend in car travel since the 1960s could – against all previous expectations – stall and go into decline. Recent National Travel Survey results do indeed suggest that, while commercial traffic continues to grow slowly, private car journeys and mileage reached a plateau in the early 1990s and started to turn down in the early 2000s. Trends including more people living in urban centres, improved public transport choices, younger people using cars less, the growth of the internet and a strong move away from driving in London have been put forward as possible underlying causes (Goodwin 2010).

'Spaghetti Junction' or Gravelly Hill Interchange, near Birmingham: what would happen to this massive structure if the motorways themselves went out of use?

Taking a speculative look into the future, it is conceivable that parts of the motorway network could become redundant. They might have been to serve out-dated purposes like car-based commuting, or fuel costs might have reduced demand to a point where maintenance and policing were no longer viable. Motorways could thus become potential heritage assets in search of a new role. Under English Heritage's Conservation Principles, the aim would then be to recognise and reinforce their historic significance, while accommodating the changes necessary to make sure that people could continue to use and enjoy them.

Assuming that the content of today's internet has survived, assessing the significance of a motorway would be enormously assisted by the amount of information now available online. The Motorway Archive Trust, set up by those involved in building the network, has collected first-hand accounts and much previously unpublished material. Possibly no other field of contemporary archaeology has been so well documented.

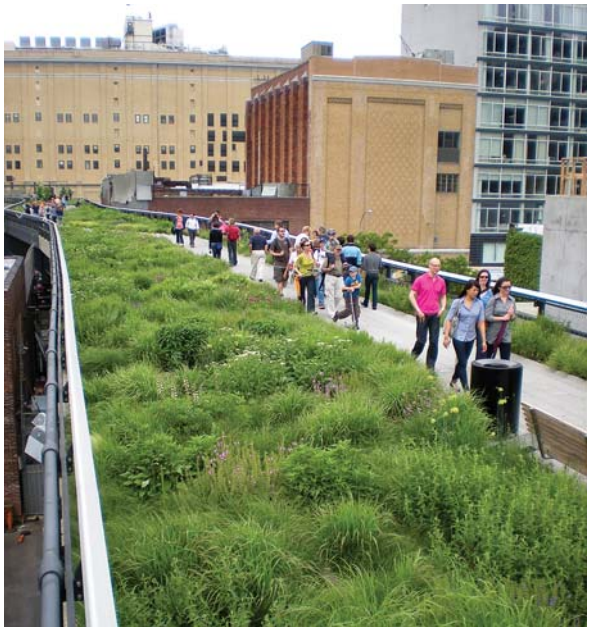
Ensuring continued use would be more challenging. Motorway foundations are up to 1.5m thick, but without active use and vegetation clearance weeds will become established in 5 to 10 years. An abandoned motorway could within a few decades turn into an impenetrable thicket used only by wildlife.

Earlier proposals to deal with traffic growth in London included the Ringway project, shelved in the 1970s, which would have created three concentric orbital roads. Only the outer one – now known as the M25 – was ever built. Ringway 2, running through the South London suburbs, would have been connected to Brighton by the M23. Part of the link, a never-used section of the M23 in Surrey, was constructed in the early 1970s and is now heavily overgrown with encroaching scrub and trees.

Some commentators have imagined stretches of motorway being kept open by enthusiasts, driving cherished vehicles from past eras: this was even the subject of BBC News Online's 2006 April Fool feature about Britain's quietest motorway, headlined 'M45 to be listed as heritage road' (Moran 2009). Alternatively motorways might become high-capacity public-transport corridors for some future transit system, or more of a leisure facility, reclaimed for walking, cycling and recreation, in the same way as our redundant railway lines and canals.

Until the 1960s, remote settlements in the Germany's North Frisian islands relied on hand- or pedal-powered *draisines* (railway trolleys) for transport, with sails for wind assistance (Hidden Europe 2006). Human and wind power might likewise provide recreational use for redundant stretches of motorway. Precedents include the access events for pedestrians and cyclists frequently organised before the official opening of motorways; the recently opened Tempelhof Park in Berlin where cyclists, skateboarders, kite flyers and in-line skaters range across the runways of the now-closed historic airport; and cycle time trials, a distinctive UK activity where cyclists take advantage of the smooth surfaces and gentle gradients of non-motorway dual carriageways and bypasses to pursue personal bests and speed records. Disused motorways would provide the space for human-powered vehicles on a grander scale, perhaps with solar or wind assistance, or for launching and landing personal flying machines. As enthusiasts for bungee jumping from bridges show, human ingenuity in exploiting infrastructure for new physical challenges knows few limits.

In Manhattan, a section of redundant elevated railway once used for freight has been converted to the popular High Line linear park. Could redundant motorways find similar new uses nearer home? © Andrew McIlwraith 2010



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The infrastructure of war

Roger J C Thomas
Military Support Officer, English Heritage

'Military infrastructure' is very difficult to define, because the armed forces have themselves used the phrase in a multiplicity of ways. This reflects the fact that the armed forces are in practice microcosms of society as a whole – all types of civil infrastructure can be found within the military estate alongside the more obvious warlike structures; a world within a world. The definition has therefore to be all encompassing and can be applied to virtually all buildings, structures and complexes built by or for the military in support of their duty to provide national defence, or offence.

Although the use of the term 'infrastructure' is relatively new, the principle has certainly existed as a concept ever since the Romans built their military fortifications, roads, ports, depots and signalling towers. When the Normans seized England from the Anglo-Saxons, they capitalised upon a pre-existing transport system largely based upon the Roman network, which any motorist driving along the A1 continues to benefit from to this very day. Whatever the political, strategic and tactical reasons for war, technology has always been the main driver for the development of new weapons, together with the associated industrial processes and supply systems. The Tudor period thus witnessed the establishment of dockyards and an ordnance industry based around the manufacture of hand guns, artillery and gunpowder.

During the 18th century the organisations of the 'state' and the national ambitions of 'empire' became progressively well defined. In response there was a rapid growth of private and state-owned military infrastructure at such sites as the Royal Arsenal at Woolwich and the Royal Powder Mills at Waltham Abbey. This expansion continued throughout the 19th century, but it was the Great War of 1914–18 that precipitated an exponential growth of infrastructure, which included Royal Naval propellant factories and armament depots, Royal machine-gun factories, national trench warfare filling factories, Royal ordnance factories, Royal aircraft factories and Admiralty oil depots.

The end of the Great War at first brought about a massive retrenchment in military spending and with a few exceptions, most factories, army camps and aerodromes were abandoned. The growth of Nazi Germany during the 1930s, however, caused the process of contraction to slow down and eventually be reversed. In the closing years of the decade Neville Chamberlain's government was criticised in the press and by Winston Churchill for not enlarging the armed forces quickly enough. In reality they had no option because the infrastructure needed for such rapid enlargement simply did not exist. On the contrary, they should be given credit for having the foresight to embark upon the largest peace-time programme of military infrastructure building ever to have taken place in this country, one that saw the construction of hundreds of new aerodromes, barracks, ordnance factories and depots, chemical weapons factories, fuel stores, underground munitions depots, anti-aircraft batteries, gunnery schools, 'Chain Home' radar stations and industrial air raid shelters – the list just goes on and on.

The outbreak of the Second World War only served to accelerate and expand the whole process with yet further types of structure being added to the already immense list. It should also be remembered that many other industrial concerns can also be considered as 'military infrastructure'. The Second World War was a 'total war' in which the whole civilian economy supported the war effort, and the boundaries between what was military and civilian began to blur. No community, no matter how remote, was immune; rural parts of the country saw the establishment of Women's Land Army hostels, flax factories and saw mills, while large areas of land were taken up for military training areas and airfields. It should also be remembered that as more and more men were called up

39 Base Workshop, Bicester, 3.7-inch heavy anti-aircraft gun overhaul and repair section. The outbreak of the Second World War saw a huge investment in defence infrastructure of every kind.

Former 'Operation Bolero' Romney huts at Norton Fitzwarren in Somerset, a decaying reminder of the huge network of construction projects carried out in preparation for the Allied invasion of Europe in 1944.
© Roger J C Thomas

for war duties, women stepped into their shoes to keep the wheels of industry turning.

The arrival of large numbers of American servicemen was anticipated by a substantial infrastructure building project code-named Operation Bolero. Together with the preparations for D-Day – Operations Neptune and Overlord – these schemes brought about yet another rash of new camps, depots, training areas, tank ranges, hospitals and embarkation hards. As soon as the war was over vast numbers of sites were rapidly abandoned, or were given temporary uses, such as the American military hospitals that became displaced-persons hostels. In contrast to the aftermath of Great War, however, many other sites were retained on a 'care-and-maintenance' basis in response to concerns in the West over the intentions of the new Soviet Bloc. As these fears grew, and we entered the Nuclear Age, a renewed period of construction began that only came to a close with the fall of the Berlin Wall in 1989.

Builders: It's a Race Against Time: a contemporary advertisement that sums up the immense effort that took place to build Britain's wartime infrastructure.

Because the sites and buildings that constitute military infrastructure are frequently the first to be abandoned and placed on disposal lists, this means they are also the most vulnerable. Their important wartime role is too easily forgotten and their utilitarian appearance further handicaps recognition of their historical significance. In addition, their frequent return to the original landowner has meant that most have gone into low-grade usage where they have received minimum of maintenance. Given their original construction from low-quality wartime 'utility' materials they quickly become time expired and extremely difficult to permanently repair.

Many of the more extensive complexes are also now classified as 'brownfield' sites, which inevitably increases their vulnerability to total destruction and redevelopment. It is nevertheless imperative that representative examples of these structures are retained for future generations to appreciate, whether by preservation or adaptive re-use. Today, this process has tentatively begun, with the scheduling and listing of a number of sites including the inter-war sound dishes at Great Stones, Kent, and the American Bolero hospital at Fremington, Devon. Guided walks at the mustard-gas factory at Rhydymwyn near Mold in North Wales are gaining popularity, and the flax factory at Easingwold, North Yorkshire, has been given a new lease of life as a graphic design and printing works. ■

Water supply, distribution and discharge

Jen Heathcote
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In 1858, the 'Great Stink' of London caused the Houses of Parliament to become so smelly that members demanded action be taken. The solution, designed by Sir Joseph Bazalgette, comprised 133km of underground sewers and three pumping stations – Abbey Mills, Deptford and Crossness – discharging waste into the Thames and creating a network that continues, in part, to serve the capital.

While the Victorians provided the network for sewage disposal, London's water-supply system has much earlier origins. For example, the Great Conduit constructed in the 13th century brought water from a spring at Tyburn to Cheapside (the remains of the cistern lie beneath No. 1 Poultry). Later, the New River canal, constructed between 1608 and 1613 and still in partial use today, brought fresh water from springs 60km away in Hertfordshire. Prior to this water in London was largely won from the Thames, and as the river also served as the discharge for foul water, serious contamination was likely. Despite this, the city's growing population made high-volume river abstraction unavoidable and waterwheels were built beneath London Bridge in the late 16th century to lift water: the originals were destroyed by the Great Fire, but replacements continued to operate until the early 19th century.

The need to separate the water-supply system from the effluent system so as to limit pollution and aid sanitation in urban centres had been recognised by the Romans. Covered street drains and underground sewerage networks are known from forts and towns, including Corbridge in Northumberland and York, as well as supply systems comprising pipes, conduits, aqueducts and cisterns in cities such as Lincoln and Exeter. The stone-built sewerage network of Lincoln was one of the most advanced in Roman Britain. The main sewer was 1.5m high

and 1.2m wide, had smaller sewers running off to serve public buildings and houses, with manholes at street level to allow access for cleaning and repair. While evidence of the corresponding supply system has been recovered in the form of lead pipework, the stone header-tank and an aqueduct, how water was brought 20m uphill from Roaring Meg, the most likely spring-source, remains an enigma.

The legacy of post-medieval water infrastructure is threefold: legislative, technological and architectural. The legislative framework for the modern water and sewerage industries of England was established in the mid-19th century to reduce water-borne epidemics such as cholera and keep the expanding urban population healthy and productive. In the early 18th century steam-driven pumping stations began to improve the efficiency of the earlier gravity-fed systems for river-water abstraction, drainage and sewage disposal. These began as private enterprises but the 1848 Public Health Act led to many being adopted by local authorities and the water industry rapidly became one of the most municipalised in England. By 1900 60% of local authorities were running their own waterworks, the core components of which, particularly the covered reservoirs and water towers, are familiar landmarks in many towns, although increasingly under pressure from development as many are now redundant.

The significance of this legacy is still unclear and much that remains is neglected. One notable exception is the Eastney pumping station in Portsmouth, now a museum. Another is Bazalgette's Crossness station in London, which has been restored and opened to the public with the aid of grants from English Heritage and Heritage Lottery Fund. More usually, redundant engines have been removed from their housings and the structures abandoned. In the early 1970s, plans for large-scale reorganisation of the water industry prompted a national thematic survey of steam pumping engines and the time has perhaps come for us to reappraise our understanding of those that remain and consider appropriate levels of mitigation and protection.

Eastney sewage pumping station: the 1887 engine house is one of the most complete in the country, with original James Watt beam engines. © Andrew Whitmarsh

The same drivers that led to the development Victorian sewerage system – a rapidly increasing urban population demanding good water, clean air and effective drainage – have led to radical new plans, such as the 6km Lee Tunnel in East London. This has been designed to increase capacity and prevent contamination of London's rivers when the Victorian sewer network is overloaded during periods of high rainfall – a growing problem around the country as flood events become more common.

The challenge for the historic environment sector is to decide what we most value about this Victorian architectural and technological legacy, how we can best protect the little that remains and if or how we should record an invisible, below-ground inheritance that was once at the vanguard of European civic development.

In Exeter, underground passages built in the 14th and 15th centuries brought spring-water into the town through buried pipework. © Mike Alsford

Taming the atom

Wayne Cocroft
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During the immediate post-war period the taming of the atom was seen as a means of maintaining Britain's global political status and improving her economic position, as well as providing the country with a reliable and clean energy source. It is more than 50 years since the pioneering Calder Hall nuclear power station, followed by the Magnox fleet and later Advanced Cooled Reactors (AGRs), began to supply electricity to the National Grid. At the outset many of these stations had an estimated economic life of 20 to 30 years. Although many exceeded this prediction, most of the Magnox stations are either being decommissioned or will shortly reach the end of viable operation, and within the decade most of the later AGRs will also come to the end of their time.

Design

The forms of the early nuclear stations reflected many of the emerging trends in contemporary industrial design and construction techniques. The reactor and turbine hall buildings were carried on huge reinforced concrete footings, and the concrete reactor shields reached up for many storeys. In contrast to the previous generation of monumental brick-clad conventional power stations, the nuclear stations made greater use of prefabricated elements and were clad in concrete, pressed metal or asbestos-sheet panels. To give lightness to the structures increasing use was made of large glass panels, which gave elements of the stations a transparent quality, while at night their internal lights emitted an eerie glow across previously pitch-black landscapes. In a country where wartime camouflage still covered many factories, the new atomic installations also brought brightness with plant, doors and other details picked out in colour in contrast to their otherwise plain surfaces.

Oldbury, Gloucestershire, illustrating the compact design of one of the last Magnox stations. The lead architect was Maurice Webb, and Geoffrey Allan Jellicoe advised on the landscape design.

NMR OP04695

Landscape

For practical reasons remote coastal sites were preferred for the nuclear stations and great care was taken by leading architects to blend these huge structures into their landscapes. In considering the design of a station the prominence of the reactor building is determined by the engineering considerations of enclosing the reactor within a thick containment vessel, and the height above this required for the fuel-handling machinery. To reduce the visual impact of the ancillary buildings on the skyline they were usually accommodated in structures a couple of storeys in height. The appearance of the stations was further ameliorated by careful attention to cladding materials, and around the perimeter the use of mounds and tree cover.

In comparison to coal-fired power stations of similar power output, nuclear power stations occupy a small ground footprint. One consequence of their relatively remote locations is the necessity for high-voltage transmission lines to connect them to the grid and areas of high demand. In some instances, running the transmission wires in underground tunnels to join at some distance with the pylon line was used to break the visual connection in the vicinity of the station. Less obvious impacts of nuclear power stations on their landscapes were caused by the needs to move heavy plant and construction materials, resulting in improvements to the local infrastructure such as harbours, bridges and roads. More transient effects were the requirements for temporary work camps and accommodation for the construction teams. After completion, a typical power station might employ up to 400 people, which usually required the provision of housing schemes and enlarged schools.

Decommissioning

Nuclear power stations presently supply about 16% of the country's electricity needs. As an early entrant into nuclear-power generation the United Kingdom faces one of the most demanding decommissioning programmes. Most of the civil nuclear research sites and early power stations are owned by the Nuclear Decommissioning Authority, which is

tasked with releasing the land for alternative uses. Sellafield, Cumbria, is the largest nuclear site in Europe and home to one of the most complex decommissioning projects in the world. Its historic character has been one of constant change, a feature that will define this site for at least the next century, when under present plans it will be restored to an open brownfield site. Elsewhere, the reduced hulks of the current fleet of reactors are likely to remain a feature of the landscape for many decades. Initially, most sites will be stripped of their non-radioactive components and the reactor buildings will be reduced in size and re-clad to become radioactive material stores. This will allow most of the low-level radiation to be lost through natural decay, allowing for safer, more economic demolition and disposal. These early nuclear facilities also represent an important technological heritage, and in some places, such as Dounreay, Caithness, a heritage strategy is being devised to sit alongside the decommissioning project.

New build

Many of the factors that led to the choice of sites in earlier decades are still valid today, and it is likely that many of the proposed new stations will sit alongside the relics of the first atomic age. To date 8 possible locations for new stations have been identified and two types of pressurised water reactors are being assessed, both with a design life of more than 50 years. A criticism that has been levelled at the earlier Magnox programme was its lack of standardisation. One benefit, however, was that it allowed architects and landscape designers to carefully consider how each of these huge structures might be merged into their local settings. This is a crucial lesson from Britain's first nuclear power programme, and any new stations offer the opportunity for the best contemporary industrial design to create distinctive technological landscapes that may endure beyond the end of this century.

In the 1960s the distinctive Windscale Advanced Gas-Cooled Reactor, Cumbria, symbolised high-tech Britain and the country's independent solution to reactor technology.

Sellafield, Cumbria: difficult and inaccessible heritage, it represents one of the most complex decommissioning challenges in the world.

Serving New Purposes

Redundant infrastructure need not be worthless infrastructure: sometimes it can serve society in new and creative ways.

Canals, railway lines, signal boxes and a rather special bridge – all, by their survival exemplify the durability of infrastructure and fertility of the human imagination in establishing new uses. John Yates on canals (below) and Martyn Brunt on railway lines (pp 36–8) remind us of the vital role played by committed supporting communities. Local understanding by relatively small groups of the value of elements of a greater whole can be combined to establish an effective force for re-use. John Minnis shows that even a very particular building type can survive (pp 38–9) and Heather Sebire describes an example of that rare, but nationally inevitable moment when something is deemed so important that it is adopted as a monument in state care (pp 39–40). Infrastructure has a way of supporting our lives, meeting our needs and slipping, semi-consciously, into our awareness in a more subtle way than statement buildings. Our responses too take longer but, in many cases, we care more than we knew and we act to ensure that infrastructure is not lost. As canals and railway lines show, this often proves prudent as and when a new need is identified.

Canals: third sector for a third age?

John Yates
Historic Building Inspector, English Heritage

England's canal network has survived through a classic period of 'conservation by neglect'. Perhaps 'conservation by minimal investment' would be fairer to the memory of its 19th- and early 20th-century owners – predominantly railway companies – who had kept it on life support until the dawn of the leisure age.

The inland waterways network comprises navigable rivers (principally the Thames, Severn, Mersey and Trent systems) linked across the watersheds by canals dug from the 1760s onwards. These early canals were privately financed, and by 1789 England had the world's first national industrial-transport network, centred on the western midlands. From the 1830s the railways creamed off further capital and new traffic, and most of the network faded into obscurity as local niche transport and as a freight feeder for the railways. By the 1940s the midland canals were still trading, but losing branches as industry reshaped, while many southern waterways were fading away.

This was the phase of picturesque decay. Soon authors and artists began to discover this slower, smaller, gentler world threading secretly through England: its most effective publicist was undoubtedly L T C Rolt, with his lyrical and observant travelogue, *Narrow Boat*, published in 1944. A movement was born, led by the newly founded Inland Waterways Association, to 'save the waterways'. The new enthusiasts were often as much driven by conservatism as conservation, supporting canal transport to preserve the boating families' way of life, but they did support leisure use, especially pleasure boating. Almost all the network was nationalised in 1948, into a succession of public bodies known as 'British Waterways' (BW), which initially oversaw a managed decline. After two decades of campaigning, the 1968 Transport Act gave BW a remit to develop leisure use of most of the network. Some canals were soon being designated as conservation areas.

Picturesque decay does not last for long and the canals soon joined the new age of motorised leisure and property development. BW had inherited a big property portfolio, much by then post-industrial, on which it started a series of partnerships for large and high-profile urban redevelopment schemes, followed in the 1980s by regeneration partnerships. Few were conservation-led – indeed the industrial canal townscape was almost wiped out – but they acted as large-scale enabling developments for the waterways network. They also changed the

A threatened industrial canal townscape at Wordsley, Stourbridge, West Midlands. The disused Stuart Crystal glassworks flank the canalside, with the repaired Red House Glass Cone behind.

Bumblehole Lock, Wombourne, Staffs. The lock itself is authentic through careful repair and reinstatement; the lock cottage is authentic through minimal investment.

market perception of canals, which now typically lift adjoining land values by 20%.

Current issues for the canals focus on use, ownership and resources. A pleasure-boating boom has brought local environmental-capacity issues and a demand for new rural marinas. This is now emerging as a planning issue, as a big marina on agricultural land will seldom accord with rural development policies. However, pleasure boating may well have peaked (although it has recently spawned an informal live-aboard culture) and there is probably greater public benefit in increasing and enhancing the 'quiet enjoyment' users – walkers and cyclists – and expanding their demographic range.

Ownership is back in the political arena, with a proposal for BW's 3500km of waterways to combine with the Environment Agency's 1000km (River Thames and East Anglia) and be passed to a new third sector body. Bridging the funding gap through volunteering does stretch credibility, but there may be a new 'water grid' role – and income – to develop as climate change desiccates the south of England.

Resources are becoming critical, as BW has a shrinking grant from Defra, and a sharp reduction in property income, resulting in a £30m annual maintenance shortfall, and that is beginning to show. On a small scale, most routine maintenance is now outsourced, with a 'reactive maintenance' policy of not repairing things until they fail. (Best conservation practice would, of course, be 'a stitch in time'.) On a larger scale, this lack of routine maintenance and supervision risks major infrastructure failure, as wilder weather beats ever harder on vulnerable historic engineering. On any scale, the significance of this very special historic place is still under threat.

Turning railways into cycleways

Martyn Brunt
National Cycle Network Development Manager, Sustrans

The 16 lattice-work spans of Bennerley Viaduct (see cover photo) have crossed the border between Nottinghamshire and Derbyshire since 1876. More than 440m long and over 18m high, Bennerley has towered over the River Erewash since it was built to serve the rich coalfields of the region as part of the Great Northern Railway Extension. As one of only two wrought-iron viaducts left standing in the UK, it is a Grade II* listed structure, but has stood forlorn and disused since the railway was closed in the 1960s: it is currently on English Heritage's 'At Risk' register. However, plans are afoot to bring this imposing structure back to life – only this time it could be the whir of bicycle wheels rather than the rattle of trains that echoes across the Erewash valley.

Bennerley is owned by Sustrans, the sustainable transport charity responsible for the 20,300-km National Cycle Network (NCN), which is the primary example of community-managed sustainability infrastructure in the UK. Sustrans has a long history of breathing new life into former transport corridors by converting them into traffic-free paths for walking and cycling. The charity originally came into being when founder John Grimshaw and some fellow cycling enthusiasts, frustrated at the lack of provision for bikes in Bristol, leased some land from British Rail in 1979 and started building a cycle route between Bath and Bitton, following the track of the old Midland Railway. That route grew over the years to become the 23-km Bristol to Bath Railway Path, which today is one of Britain's most-well-used traffic-free routes.

The Grade II Hewenden viaduct is one of two spectacular Victorian railway viaducts that are being incorporated in the Great Northern Trail, a new cycleway providing access to the Bronte country of West Yorkshire. © Sustrans

This was by no means the first cycle route in the UK to use a disused railway line – the Manifold Railway Path in the southern Peak district, created in the 1930s, and the High Peak and Tissington Trail were already in active service. But Bristol to Bath proved to be significant because it was a city-to-city route for people to use for commuter and utility journeys as well as for leisure – a catalyst for persuading politicians about the value of converting old railway lines into traffic-free transport corridors.

Enjoying the Granite Way, an 18-km cycleway between Okehampton and Lydford that forms just part the National Cycleways Devon Coast to Coast route.
© Sustrans

It was also the start of an extensive programme of reviving hundreds of miles of disused railways as living transport corridors that continues to this day, transforming public assets into beacons of public benefit. As a result of Dr Beeching's landmark report in 1963, some 16,000km of track in England and Wales were closed. Because of their wide profiles, gentle gradients, well-built track-beds and use of historic bridges, tunnels and viaducts, Sustrans quickly identified the potential of hundreds of miles of old railways for conversion into cycling and walking paths. It therefore began working with partners such as the Countryside Commission, British Railways Board (Residuary), Railway Paths Ltd and local authorities to acquire lines surplus to the needs of the operational railway and convert them into traffic-free routes for people.

Among the earliest completed routes were the old railway lines between York and Selby, Derby and Melbourne (taking in the beautiful Trent Viaduct) and Consett and Sunderland (the latter trail is part of the iconic Sea to Sea route). Today routes such as the Camel Trail in Cornwall, the Phoenix Trail from Thame to Princes Risborough, the Fallowfield Loop in Manchester, the Liverpool Loop Line, the Tarka Trail extending more than 48km between Braunton and Meeth in Devon or the Spen Valley Greenway from Dewsbury to Bradford in Yorkshire all use former railway lines to provide wonderful green corridors running through urban areas into beautiful countryside, and attract literally millions of visitors every year.

Inevitably there is more to bringing former railways to life than clearing an overgrown route and putting down a surface. As well as securing funding and gaining the support communities, Sustrans tries to ensure the routes retain their essential historic character while adapting them to practical new uses. In some cases this means adding artworks to help to turn them into destinations in their own right. The Bristol to Bath Railway Path, for example, features a variety of sculptures as well as access to working steam engines at the old train station at Bitton. The Spen Valley Greenway is home to a flock of Swaledale Sheep constructed from recycled industrial metal, while the York to Selby route features a scale model of the Solar System spread out along 10 kilometres of the trail.

In other cases it means restoring iconic structures to their former glory and giving them back their purpose – carrying people. Magnificent landmarks such as the Cullingworth and Hewenden viaducts near Bradford, or the mile-long Combe Down tunnel near Bath are being opened up as

part of the ongoing development of the NCN, allowing people for the first time free and easy access to structures that have dominated their landscapes.

Of course old railway lines are not the only former transport networks to now carry cycle paths. More than 1000km of the NCN run along canal towpaths, and during coming years we hope to add hundreds more. However, it is disused railways that have played the pivotal role in establishing the country's first network of cycling and walking routes, and will do for many years to come.

Back at Bennerley, Sustrans is embarking on a feasibility study to look at how the viaduct could come to life as a traffic-free route between the communities of Awsworth and Ilkeston and as part of a longer leisure ride that takes people all the way from Nottingham to Derby. The study is the first step in a long process, but it could be the beginning of the next chapter in the imposing viaduct's long history of being an important link and landmark for the people of the region – and the end of its 50-year wait to carry people once again.

Visit www.sustrans.org.uk for more details and NCN routes near you.

The signal box – a great survivor

John Minnis
Senior Architectural Investigator, English Heritage

Signal boxes are among the most distinctive building types associated with railway infrastructure, combining form and function in a highly satisfying way. While the majority of mechanical signal boxes combine the elements of large windows, a ground-floor locking room, an outside staircase and balcony, the number of variations around these themes is considerable. Once to be found at almost every railway station and junction and at many level crossings, 60 years ago they numbered more than 10,000. Despite advances in signalling technology, a surprising number of traditional signal boxes survive, some of them approaching 140 years old.

Some 498 mechanical signal boxes continue in use with Network Rail but as predominantly timber structures they need regular repair and repainting. Sliding sash windows more than 100 years old may be draughty, and this has led in many

Repainted in the traditional green and cream colour scheme of the London & North Eastern Railway, this 19th-century signal box at Littleport in Cambridgeshire continues to serve a useful purpose while retaining all of its original character.
Steve Cole © English Heritage

instances to their replacement in uPVC. As the window area of a signal box is so large the replacement of small paned sashes by large frames filled with sheet glass has a very significant effect on the appearance and character of the building.

Littleport Signal Box, built in 1882 on the main line between Ely and King's Lynn, shows how an unlisted railway structure can be treated sympathetically. It was repainted in 2009 in a traditional green and cream colour scheme as used by the London & North Eastern Railway in the inter-war years. This colour scheme and the retention of the original sliding sash windows give the building a sparkle and provide an object lesson in how a 19th-century industrial building can enter into its third century of use for its original purpose. The refurbishment is part of a programme undertaken by the Network Rail Operations Manager, Ely, and carried out by the contractors, May Gurney, under which 14 boxes have been renovated: one of them, Bury St Edmunds, won a National Railway Heritage Award in 2006.

In the UK 124 signal boxes are listed. However, their subsequent management poses distinct problems. Their location – in many cases next to a working railway with 100-mph-trains running within a few feet of them – means that, once redundant, alternative *in-situ* uses for them are very difficult to find. They are often isolated on railway land with no road access, which can make them easy targets for vandalism if left unoccupied. The problem is illustrated by the Grade II-listed St Albans South, which stood derelict for many years after closure in 1979, until its recent opening as a signalling museum by the St Albans Signal Box Preservation Trust.

In addition to those in active use with Network Rail, more than 300 further boxes survive, either out of use, preserved or re-used. Often largely of timber construction, some are relatively portable and many have been moved to new sites. A number have been re-used for their original purpose on preserved railways while others fulfil an alternative use. One has been turned into a hide on a nature reserve at Lewes, while others on closed lines have been turned into homes, such as that at the former royal station at Wolferton, Norfolk, or into summerhouses, such as Haugh Crossing near Wooler, Northumberland.

So, whether in service on the national rail network, or fulfilling an alternative use, a goodly number of these intrinsically attractive buildings will continue to be a part of the landscape for the future.

Celebrating Ironbridge: grime or shine?

Heather Sebire
Territory Properties Curator, English Heritage

English Heritage has in its guardianship one of the most iconic and revolutionary monuments to the Industrial Revolution, the Ironbridge at Coalbrookdale in Shropshire. Spanning the River Severn, this magnificent structure was the world's first cast-iron bridge, built between 1777 and 1781 to the designs of Thomas Pritchard and financed by the ironmaster, Abraham Darby. Darby's Quaker grandfather first used coke to smelt iron in the Forest of Dean and then later at Coalbrookdale. The industry flourished but expansion was hampered by the lack of a bridge over the Severn, which had to be single-span to allow for barge traffic to pass underneath. The bridge was constructed with 378 tons of cold-blast iron, spans 100 feet 6 inches (30m) and cost more than £6,000 to build. On the two outer ribs are engraved the words: 'This Bridge was cast at Coalbrookdale and erected in the year MDCCLXXIX'. In the 1920s, concerns about the stability of the bridge nearly led to its replacement by a concrete structure further upriver. In 1934 it was closed to vehicular traffic, and in the 1970s a concrete strut was built on the riverbed beneath the bridge to brace the abutments, which had moved almost half a metre towards each other by 1969.

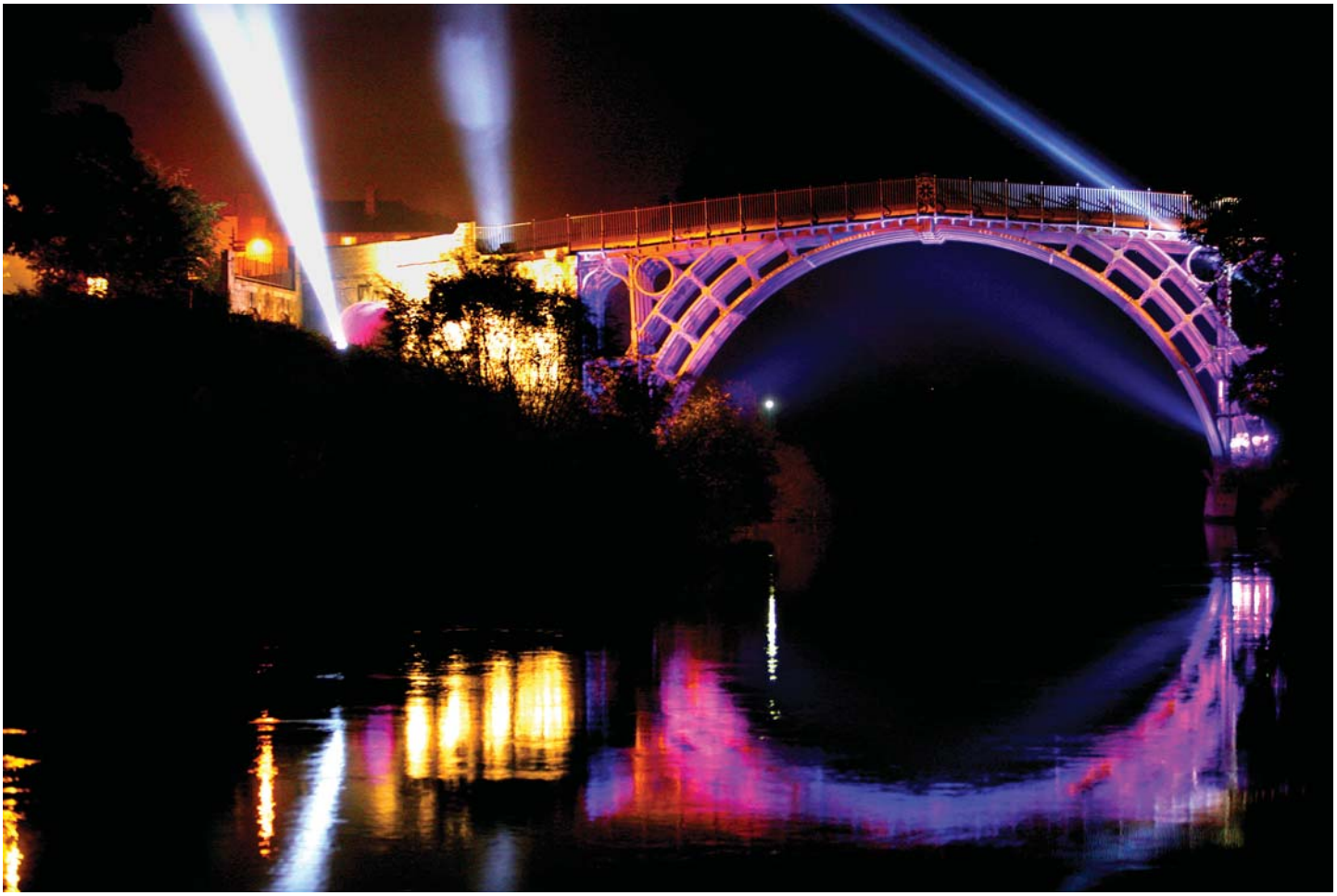
The bridge in use

The bridge was used by ever-increasing volumes of traffic (initially carts and coaches, but more recently motor vehicles) until 1934, when it was closed and designated an Ancient Monument. Massive strengthening works were later undertaken, and English Heritage still continues to monitor and survey the bridge, which is very expensive to maintain.

The entire wooded gorge in which the bridge sits is now known as 'Ironbridge' and has been designated a World Heritage Site. Currently there are more than 10 museums and sites dedicated to the story of the industrial developments in Shropshire, all overshadowed by the giant cooling towers of the present Eon electricity works, a symbol of more recent infrastructure. Interestingly these outstanding examples of infrastructure are themselves being considered for listing as historic buildings.

The bridge today

The tranquillity of the gorge gives little indication now of the dark industrial landscape that would



In September 2008 Thomas Pritchard's iconic Ironbridge was the backdrop to a spectacular sound and light show designed to kick start a four-year celebration of culture and creativity across the West Midlands, as part of the London 2012 Cultural Olympiad.

have surrounded it in the late 18th and early 19th centuries. In the 1780s and 1790s the bridge was seen as a great symbol of the Industrial Revolution, portraying an optimistic view of industry as the provider of work and wealth for all. It would have stood amid the heat, dust and grime of coal-mines and iron and steel works. Today, the bridge's graceful structure is in danger of being appreciated more for its aesthetics than the major achievement of its builders. Early illustrations show that shops and houses grew up around the northern abutment soon after the bridge was completed, but these were finally demolished in the 1950s. The frontage of some cellars has been retained on the west side of the abutment, and the surrounding area has been landscaped with flowerbeds and brick retaining walls.

Some would argue that this great symbol of industry has now been 'prettied up', giving a false impression of a clean rural setting. Although English Heritage's main consideration has to be the conservation and maintenance of the bridge we are also concerned about its presentation. Are we guilty of romanticising the dark grime of the Ironbridge gorge in its heyday? Or should we let the engineering glory of the bridge shine through? Hopefully we can have a compromise.

In 2008, to mark the start of Britain's four-year Cultural Olympiad, the Ironbridge was the subject of a spectacular sound-and-light show that highlighted its role as a contemporary tourist attraction, a symbol of past industrial heritage and an outstanding example of historic infrastructure. On a normal day the structure of the bridge speaks for itself but one-off events like the Cultural Olympiad can also help the public to appreciate the beauty and significance of this great icon of engineering.

News from English Heritage

National Heritage Protection Plan

The National Heritage Protection Plan (NHPP) is the new framework for bringing together work by English Heritage and other partners within the sector to protect the historic environment. It will allow us to re-align and apply the full range of our expertise and resources towards protection activities carried out directly by English Heritage or towards supporting others in their own protection of what is valued and significant.

The draft plan has recently been published on the English Heritage website (**www.english-heritage.org.uk/nhpp**) and further input is sought before it comes into play in April 2010. The plan covers a four-year period and it will be reviewed annually to ensure it is responsive to new and emerging threats and issues.

The NHPP represents an important re-focusing of English Heritage's activity. It will guide the delivery of a significant part of the organisation's work including designation, research, planning casework and grant activity. With the significant cut to our funding, and that of other public sector bodies, it is proving to be an essential tool in the allocation of our very scarce resources.

We believe that the NHPP will encourage a new culture of partnership working in the historic environment. This could take the form of shared objectives, aligned activities and, where possible, pooling of resources to achieve more in combination than the sum of the separate parts. Inevitably, we have focused initially on the English Heritage part of the plan, but we hope that as we start to deliver new projects, we can find more and more common ground with other organisations to work collectively to maximise the protection we can all offer to the whole of the historic environment.

An important theme to the plan is the greater engagement by local communities in its delivery. Much of this will be through intermediary organisations who have strong local links and can ensure that the necessary understanding and protection is delivered by informed local opinion.

Over the next few months, English Heritage will be discussing the plan and its roll-out with our many partners; although it is now nearing its final form, there is still scope to improve it. To that end, a Review Board of external stakeholders is being set up and views are being sought from all interested parties on how best the priorities can be delivered. Do please look at the plan on our website and give us your views.

Edward Impey
Director of Heritage Protection and Planning

The National Heritage Protection Plan recognises the very high value that the general public put on churches and other places of worship. They are often seen as being right at the heart of the community. MT Steward © English Heritage

Heritage Counts

Heritage Counts 2010 was published in October. This year the focus was on exploring the economic importance of heritage, especially in relation to historic environment, regeneration and tourism. The year 2009 was a record one for many visitor attractions with more than 51 million visits to heritage sites. Overall, heritage tourism in the UK is worth £7.4 billion to the UK economy and supports employment for 195,000 people; its attractions provide local firms with business opportunities and people with jobs.

Heritage Counts also explored the economic benefits of historic environment regeneration. One key finding is that heritage-led projects delivered £1.6 in additional economic activity for every £1 of public sector investment over a 10-year period. Another is that one in four businesses cite the historic environment as a factor in deciding where to locate. To download the national and regional reports, including the Heritage Counts indicators and a summary of the key policy updates for the year, please visit www.heritagecounts.org.uk
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Women's History project launch

English Heritage and London Metropolitan University have launched 'Visible in Stone: Women's history through buildings 1850–1950' (**www.english-heritage.org.uk/visibleinstone**). This interactive product allows visitors to read about the fascinating history of women's engagement with the built environment and also add their stories and photos to the project's Flickr, Facebook and Twitter links.

This is the first time that the information on this subject has been brought together in one place and it has involved digging into the archives at The National Monuments Record, the Women's Library and the TUC Library Collection to find material not seen for a century. Architecture is not usually a subject associated with women, but this research throws a new light on a rich history hidden in bricks and mortar.

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Pillars of the community: the transfer of local authority heritage assets

As the pressure to identify savings continues, local authorities are considering how the transfer of heritage assets to community-based organisations can help to focus the energies of the local community and at the same time provide secure futures for the assets themselves. However, transfers of this kind are not without their challenges, which is why English Heritage and partners from the heritage sector and the Development Trust Association's Asset Transfer Unit have developed new guidance outlining what is involved, both from the local authority and community perspective. Accompanied by case studies, it provides advice and checklists based on practical experience, while also directing readers to further information. The guidance can be downloaded from www.helm.org.uk and a summary is also available in hard copy.

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National Heritage Champions Conference

Local authorities not only own and maintain large parts of our heritage, but they also play a key role in ensuring that it is conserved and enhanced as part of their planning responsibilities. Heritage Champions make up a network of experienced and interested councillors nominated by their authorities to help realise the potential of their local historic environments.

On 15 November Baroness Andrews, Chair of English Heritage, hosted the National Heritage Champions Conference at the Foundling Museum in central London. Further information on this productive day and feedback on the talks given by its wide range of speakers will be made available on the HELM website (**www.helm.org.uk**)

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CASE

Over the summer, the Culture and Sport Evidence Board (CASE) published a wealth of new material on the value of participation in the historic environment. This included new research, which explored the drivers of participation. It found that watching TV heritage programmes, visiting sites as a child and access to transport were all positively linked to the likelihood of adults visiting heritage sites. This information will be used by heritage organisations in the future to deliver programmes to increase participation. Other research products include a database of studies related to the historic environment, the use of innovative wellbeing methodologies to demonstrate a link between visiting historic houses and increased wellbeing, and an interactive model to predict the likely outcome of different policy initiatives. For more information please visit www.culture.gov.uk/case

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The Day Nursery (1937), one of the incorporated facilities of the Kensal House 'urban village' designed by Elizabeth Denby and Maxwell Fry and now listed Grade II*. There was also a canteen, laundry and community centre.

World Heritage committee meeting in Brasilia

The UNESCO World Heritage Committee met in Brasilia from 25 July to 3 August. As well as discussing conservation problems at more than 160 existing World Heritage properties it considered new nominations to the World Heritage List (WHL), 21 of which were added, bringing the overall total to 911 sites.

The principal UK nomination under consideration was Darwin's Landscape. The proposed site consists of Down House and its garden, Darwin's home for 40 years, and the landscape of the Down and Cudham valleys in which he carried out the research that led to the development of the theory of evolution. The quality of the documentation prepared by the London Borough of Bromley was commended by all, but after a long debate the Committee deferred the nomination to some future date because of concerns that its values were too intangible. They also agreed that the question of including this type of scientific heritage on the World Heritage List should be discussed at next year's meeting.

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Planning reform

The coalition government proposals for planning reform are moving forward rapidly with a significant shift towards greater local discretion, a reduction in central policy and guidance, and an overall desire to see less regulation at all levels.

A single National Planning Policy Statement could reduce the amount of specific national policy relating to the historic environment. It is likely to include a presumption in favour of sustainable development and it will be important that this recognises local context, distinctiveness and awareness of the value of heritage.

The value-led approach to heritage sits naturally within the localism agenda but some heritage assets have value which extends beyond community and is of national interest. It will be important that the government's proposed new Community Right to Build responds to both the local and national dimension of the historic environment.

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Setting

In July English Heritage issued a consultation on 'The Setting of Heritage Assets: English Heritage Guidance'. The draft guidance is intended to support implementation of Planning Policy Statement 5: Planning for the Historic Environment and its supporting Historic Environment Planning Practice Guide, published in March 2010, which include the government's policies and high-level guidance on setting and the historic environment. The draft consultation paper discusses the definition of setting, the contribution it makes to the significance of heritage assets and broad approaches to assessing the implication of changes within setting. The consultation closed on 26 November and English Heritage intends to issue finalised guidance during 2011.

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The National Monuments Record
News and Events

English Heritage Archives catalogue online

The launch of this website in March 2010 means that, for the first time, it is possible to search, free-of-charge, catalogues describing more than 1 million of the photographs and documents held in English Heritage's archive in Swindon.

Initial feedback has been very positive. Users have told us they have found the site quick and easy to use and they like being able to search so much information from home or work instead of having to make a written enquiry or visit. Other users have mentioned how easy it is to order copies and find it useful that they can save information about items they may wish to order as they look through the catalogue.

This is still a new website and we are planning to improve it following initial feedback, so please have a look and let us know what you think by completing the online feedback form.

Images of the London to Folkestone arterial road widening

This album of 25 prints was purchased at auction in September 2008. It was presumably created by the contractor and is a comparatively rare record of the countryside being changed after the First World War to accommodate the motor car.

The original road was hardly more than a rural lane and the album graphically illustrates how it was transformed to become an 'arterial road', part of the modern A20. The photographs show the methods of work as well as the effects on Wrotham, where no attempt was made to create a buffer zone between traffic and people. Much of the earth is still being moved by hand, though temporary tracks prove that steam excavation equipment was being used for major cuttings.

Banister Walton steel-frame album

This album of photographs by Stewart Bale of Liverpool documents a series of steel-framed structures by Banister Walton & Co Ltd, Constructional Engineers. The company was based in Trafford Park, Manchester, with

The recently acquired Banister Walton album includes 10 large-format prints illustrating the steel-frame construction of the Manchester Reference Library *c* 1934.

Below: Widening the Farningham–Wrotham road in Kent, 1922–3: before and after views near Peckham Wood Corner, looking east.

offices in London. The album, purchased in 2010, contains 49 prints, mostly taken between 1932 and 1934. These show the construction of the Manchester Reference Library, the Geological Museum in London, large factories in Banbury and Dagenham, the Telephone House in Birmingham and Beale's department store in Bournemouth. The album was almost certainly created by Banister Walton to show to future clients. The photographs are unusual in showing only the steel frames with hardly any completed elevations. The album also contains copies of endorsement letters from clients, including the Office of Works.

Britain From Above

The Heritage Lottery Fund has agreed a grant of £1.7m to help English Heritage and the Royal Commissions on the Ancient and Historical Monuments for Scotland and Wales undertake the Britain From Above project. Over the next four years we will conserve and catalogue 95,000 of the oldest and most valuable photographs in the historic Aerofilms collection, and will make these important images freely available online.

The Aerofilms collection, acquired in 2007, is a unique archive of more than 1 million aerial photographs, taken between 1919 and 2006, showing the changing face of Britain during the 20th century. It includes the largest and most significant body of aerial coverage of Britain taken before 1939.

The Britain from Above project will be based in Swindon at the National Monuments Record, the public archive of English Heritage. For free email updates on progress contact aerofilms@english-heritage.org.uk

Historic infrastructure recorded in the newly acquired Aerofilms collection: the Manchester Ship Canal, 25 May 1947.

NMR Services

The NMR is the public archive of English Heritage, holding more than 10 million photographs, plans, drawings, reports, records and publications, covering England's archaeology, architecture, social and local history.
Find out more online at:
www.english-heritage.org.uk/nmr
Or contact: Enquiries & Research Services, NMR, Kemble Drive, Swindon SN2 2GZ
Tel: 01793 414600, fax: 01793 414606 or email: nmrinfo@english-heritage.org.uk

English Heritage Archives
www.englishheritagearchives.org.uk
Descriptions of more than 1 million historical photographs and documents

Heritage Gateway
www.heritagegateway.org.uk
National and local records for England's historic places

Viewfinder
www.english-heritage.org.uk/viewfinder
Historic photographs of England

Images of England
www.imagesofengland.org.uk
Contemporary colour photographs of England's listed buildings from the turn of the 21st century

PastScape
www.pastscape.org.uk
England's archaeological and architectural heritage

Heritage Explorer
www.heritageexplorer.org.uk
Images for learning, resources for teachers

The following ***Designated Datasets*** held by English Heritage are available for download via the English Heritage website, **www.english-heritage.org.uk**. The data are suitable for use in a Geographic Information System:

- Listed buildings
- Scheduled monuments
- Registered parks and gardens
- Registered battlefields
- World Heritage Sites
- Protected wreck sites

Legal Developments

Where does heritage protection begin and end?

Mike Harlow, *Legal Director, English Heritage*

Most people do not have a problem accepting that their freedoms are curtailed through the planning system in the interests of the majority, whether they share those interests or not. What owners and developers always want, and fairly so, is as much clarity as possible on what the constraints are. When it comes to heritage protection this must start with knowing *where* the constraints are.

Most designated heritage assets (scheduled monuments, registered parks and gardens, conservation areas and the like) are defined by a redline boundary. Finding it is about to get a whole lot easier. The Heritage List for England is going online in early 2011. It will provide free access to all national designations on one site. Bring your area up on a map and you will be able to see the national designations in and around it.

But sadly for clarity's sake protection does not switch off at the redline boundary. First, listing protects not just the principal building, but also any attached and curtilage buildings. This is an unhelpful aspect in itself that we can only start to cure with legislation.

Secondly, all heritage assets (designated or not) have a setting that is also protected to a degree. This is defined in words as: 'The surroundings in which a heritage asset is experienced. Its extent is not fixed and may change as the asset and its surroundings evolve' (PPS 5). It is therefore not possible to draw round the setting on a map. This may seem vexing, but some help is at hand. Unlike its predecessors, the PPS Practice Guide tackles what it is about a setting that is likely to make a contribution to the heritage asset and what therefore needs consideration. This advice is to be augmented in the spring by English Heritage guidance on setting.

Apart from the national designations, there are conservation areas (mapped and usually available through the council's website) and 'non-designated heritage assets', defined in PPS 5 as including buildings and sites on local heritage lists. This latter category presents problems as even if there is a local list, and there often is not, the list is not exhaustive. A building or site may be a non-designated heritage asset without anyone yet knowing it.

According to PPS 5 the difference between a non-designated heritage asset and just another building or site is that a heritage asset has been 'identified [by the council] as having a degree of [heritage] significance meriting consideration in planning decisions'. But what does that mean? My garden gnome may be of heritage significance to me, but is that a heritage asset? (It's not, before you start panicking.)

The sane and simple answer lies in reminding ourselves of what the planning system is for and recognising that we already know a heritage building or site when we see one.

The overriding aim of the planning system since the 1990s has been to achieve sustainable development, defined by the World Commission on Environment and Development in 1987 as development that 'meets the needs of the present without compromising the ability of future generations to meet their own needs'. On that basis planning should protect heritage sites if they are 'needed' by our society or future generations. Enjoying our heritage is a need. It's not as basic as food and shelter, but it provides education, a sense of continuity and identity, beauty and a means of association with past lives and events, among other things.

So the objective of sustainable development (and therefore of the planning system) would be served if the planning authority identified buildings and sites in its area that it believes will hold a clear heritage value to a section of society (not an individual) and future generations.

If that feels unsatisfyingly theoretical, then there is the very large body of existing designated assets to draw on for inspiration as to the sorts of things we as a society usually value. A building that is not in a conservation area, but if it were would be described as a positive contributor, is an obvious candidate. Undesignated archaeological sites have long been protected under one of PPS 5's predecessors, PPG 16. We have settled into a comfortable, yet unwritten, common sense of what those sites are.

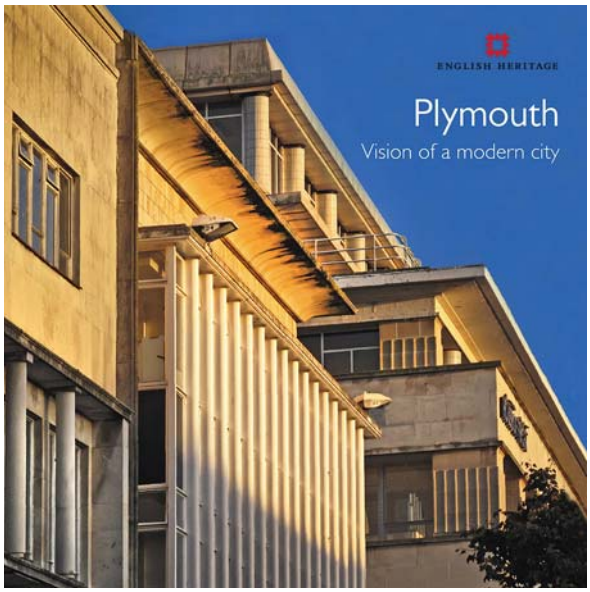
Of course, none of that is as reassuring as a boundary on a map. So it would be ideal if local authorities went about auditing their local heritage stock and wrote or updated their local list. English Heritage is also preparing a 'how-to' guide to l ocal listing, which is due out early next year for consultation. In the meantime, to be inspired by some good work in progress I recommend a visit to Bassetlaw District Council's website and their draft criteria for a local list (**www.bassetlaw.gov.uk** and search for 'non-designated heritage assets'). ■

To be updated on changes to law, policy and decisions affecting heritage you can now follow 'EHLegalDirector' on Twitter.

New Publications from English Heritage

Plymouth: Vision of a modern city

Lynn Pearson



Post-war reconstruction offered unparalleled opportunities to the developing profession of urban planners to cast off the constraints imposed by historic infrastructure and produce a new vision of urban living – one expressed in rationally designed city centres linked to suburban precincts and with modern integrated transport systems. Plymouth is the foremost English example of post-war reconstruction on the grand scale, laid out to the designs of the most influential urban planner of the day, Sir Patrick Abercrombie.

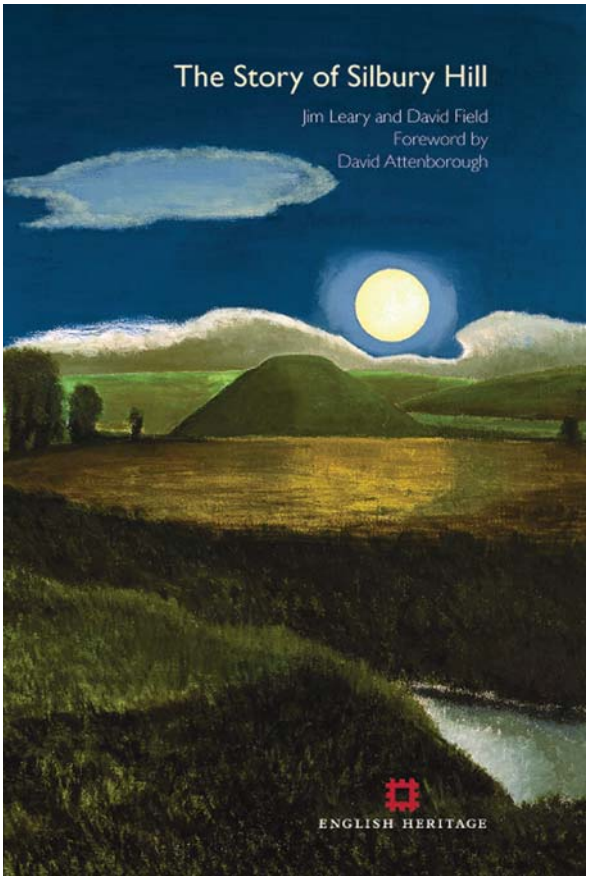
As well as explaining the overall scheme for the central area and suburbs of the renewed city this new volume in the Informed Conservation series describes the landscape forms and architectural styles employed in its civic, commercial and residential areas. The significance of what was achieved in Plymouth is assessed by comparison with British and European examples of contemporary planning.

Today, urban regeneration programmes pose a threat to the legacy of the post-war reconstruction period and the listing of post-war buildings is often contentious and contested. Present-day plans for renewal in Plymouth therefore contribute to the current debate about the buildings and landscapes of the post-war era..

PUBLICATION DATE: January 2011
PRICE: £9.99
ISBN: 978 1 84802 050 4
Paperback, 96pp; 80 illus

The Story of Silbury

Jim Leary and David Field
With a Foreword by David Attenborough



Written by two people with unrivalled information from the recent work and knowledge of Silbury Hill and combining scholarly research, readable narrative and vivid new reconstruction drawings, this book sets out the archaeological story of the monument from early antiquarian days to the collapse on the summit in 2000 that led to the opening of the hill's famous tunnel in 2007 to much media fanfare For the first time the results of the most recent work are set out in detail, describing early activity on the site, the origins of the monument and the construction techniques used.

The book also describes how the monument was seen and used by later Roman and medieval communities, and its final chapter discusses Silbury's power and spirituality for today's locals, visitors, New Agers and Druids alike.

PUBLICATION DATE: October 2010
PRICE: £14.99
ISBN: 978 1 84802 046 7
Paperback, 224pp; 100 illus

English Garden Cities: An introduction

Mervyn Miller

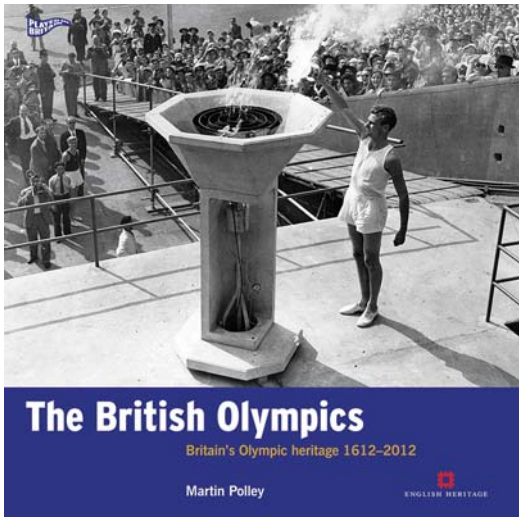
The Garden City Movement provided a radical new model for the design and layout of housing and set standards of international significance for the 20th century. Garden City ideas informed both inter-war housing policy and New Town planning after the Second World War. Present-day sustainable development and eco-settlements have their roots in the Garden City Movement.

Written by the leading authority in the field, this book tells the story of a major development in England's urban and planning history and provides a timely popular survey of the achievements of the Garden City Movement and the challenge of change.

PUBLICATION DATE: December 2010
PRICE: £9.99
ISBN: 978 1 84802 051 1
Paperback, 96pp; 100 illus

The British Olympics: Britain's Olympic Heritage 1612–2012

Martin Polley



The Olympic Games originated in ancient Greece before being triumphantly reborn in 1896. Less well known is how an assortment of British writers, romantics and sportsmen helped nurture that revival. Our nation's fascination with all things Olympian has helped shape the Games of today and allowed London to become in 2012 the first city ever to stage a third modern Olympiad.

Leading the reader on a marathon journey, *The British Olympics* is a vital and entertaining source for anyone with an interest in the Games, in sport, and in the wider narrative of Britain's social and cultural heritage.

PUBLICATION DATE: April 2011
PRICE: £14.99
ISBN: 978 1 84802 058 0
Paperback, 188pp; 90 illus

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