National Heritage Protection Plan

NHPP 4B3: Transport and Communications
4B3.102: Historic Railway Buildings and Structures: Overview of development pressure and review of significance

Volume 1: Overview of Significance and Investment Trends

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Date:	March 2014
Project Number/Document Reference:	Volume 1: Overview of Significance and Investment Trends RPS reference OXF7949

Document Control Grid

Title:	National Heritage Protection Plan, NHPP 4B3: Transport and Communications, 4B3.102: Historic Railway Buildings and Structures: Overview of Development Pressure and Review of Significance Volume 1: Overview of Significance and Investment Trends
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Derivation:	1.0
Origination Date:	17th March 2014
Reviser(s):	Mick Rawlings
Date of Last Revision:	17th March 2014
Version:	1.0
Status:	Draft
Summary of Changes:	N/A
Circulation:	EH
Required Action:	EH to approve
File Name / Location	O:\7949 Historic Railway Buildings and Structures\Oxford Reports\Cultural Heritage\Vol 1 Background, History and Threats 16-03-2014.doc

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1 INTRODUCTION

This report has been prepared in response to a brief provided by English Heritage (EH), under the provisions of the National Heritage Protection Plan (NHPP) for the period 2011-2015, funded under NHPP Activity Plan 4B3 Transport and Communications. It conforms to guidelines provided by English Heritage in their document on the Management of Research Projects in the Historic Environment (MoRPHE) and National Heritage Protection Commissions Programme Guidance for Applicants (release 6).

At a time of increased investment in the railway infrastructure, the project is intended to provide accurate and up to date information for Heritage Protection Department, National Planning and Conservation Department and Designation Department staff together with other English Heritage staff and partner organisations such as the Railway Heritage Trust and the Heritage Railway Association.

Railways are a British invention and their early remains are of international significance. Their subsequent development into an integrated national and international network was a key driver of the Industrial Revolution. Jointly, as highly capitalised joint stock companies and as a monopoly carrier, the railway companies were of immense economic importance. This importance was reflected in their buildings, engineering structures and earthworks, represented in cities and larger towns by imposing stations, hotels and goods warehouses. In smaller communities, the railway station came to be as much a feature of life as the church, the school and the post office. The railway transformed the personal lives of millions and had a profound and pervasive effect on both the urban and rural landscape that remains with us today.

The impacts of Crossrail, the Great Western Main Line electrification, the Network Rail Programme to abolish the vast majority of traditional mechanical signal boxes and High Speed 2 are already being addressed by English Heritage. This report responds to the announcement by Government in 2013 of an additional £4.2 billion to be spent on rail investment on upgrading the existing railway infrastructure.

Due to the scale and visibility of the proposals for electrification and other works, the operational railway network is seen as an especially high profile component of the historic environment. English Heritage needs to act effectively in response to this unprecedented level of change and potential threat. Designation applications for railway buildings and structures are common and an increased understanding of the historic stock is essential in order that English Heritage can respond in a timely and informed manner to them. The proposals for rail investment highlight the need to ensure that the potential impact of them is fully understood as it is likely to have significant resource implications for English Heritage's Designation Department, Heritage Protection Department and National Planning and Conservation Department.

Research Aims and Objectives

This study comes under the English Heritage Corporate Plan 2010-2015 Aim 1 'Identify and protect our most important heritage'.

The study is intended to provide accurate and up to date information for Heritage Protection Department, National Planning and Conservation Department and Designation Department staff, together with other English Heritage staff and partner organisations such as the Railway Heritage Trust and the Heritage Railway Association. The information will assist the relevant EH departments and staff and partner organisations to manage change to the historic environment.

The specific objectives of the project are as follows:

1. Characterise the historic building stock in text, including post-war buildings only where these are of evident significance, and discuss the significance of various asset types. This will in part take the form of an examination of ways in which the railway asset types set out in the Transport Buildings listing selection guide (English Heritage, April 2011) can be assessed on a strategic basis. We require statements of significance on the following asset types:

    - stations and associated buildings and structures
    - railway housing of all types
    - footbridges
    - overbridges and underbridges
    - viaducts
    - tunnel portals
    - water towers
    - engine sheds
    - and other significant railway structures (other than goods sheds and signal boxes).

    Classes of rail-related assets that are excluded include Goods Sheds and Signal Boxes (subject to separate studies) and former railway-owned assets that are more relevant to other thematic studies (notably former railway-owned canals, docks, hotels and engineering workshops. Designated remains of early horse-drawn rail roads, tramroads and plateways, the London Underground network, street tramways, funicular and cliff railways, railed inclined planes on canals, narrow gauge railways and industrial railways that formed only a subsidiary component of much larger industrial enterprises are excluded, unless relevant.

2. Following on from the above, and drawing on published sources as well as personal knowledge and expertise, identify gaps in the designation base and highlight, as far as is realistically possible, any examples which may be worth assessing for Designation (excluding signal boxes and goods sheds which are being investigated by English Heritage). This should take the form of a synthesis in text but not an exhaustive list of candidates for Designation. It is accepted that statements are based on professional judgement and that views on the Designation base can only be as accurate as the available information allows.

4. Provide a national overview of the scale and type of development pressure prevalent at the current time and likely trends over the next five years insofar as it impacts on the historic railway stock and focussing on the Network Rail programme of upgrading. This should also include brief coverage of the threat posed by broader Network Rail programmes such as the Stations upgrading work.

5. Identify those geographic areas of the country where development pressure on the active historic railway will be greatest over the next 5-10 years. The cab video screen grabs are useful in this regard insofar as they show potentially affected assets on lines that will bear the brunt of modernisation.

The ultimate aim is to have a better understanding of the threats to the historic railway in England, of the character and importance of the surviving stock and its designation, to enable the best use of limited resources to be able to protect it.

The geographical scope of the project is England only. The temporal scope covers the period from the opening of the Stockton & darlington railway in 1825 through to the Privatisation of the main line network in 1994.

2 THE SIGNIFICANCE OF RAILWAYS

Railways were arguably the single most important factor in making the Industrial Revolution and all that sprang from it happen. The development of railways and the resulting increase in the speed of traffic was the key factor in allowing growth in the modern sense, sustained economic growth exceeding population growth, to become a reality, indeed to become the normal situation, in a way which it never had before. As is cogently argued by Sally and David Duggan in their book *The Day the World Took Off*, the moment that the first public train set off from Liverpool to Manchester, 11.00a.m. on the 15th September 1830, may fairly be judged as the precise moment that divides the pre-modern world from the modern world. The railway brought modern technology into everyday life in a radically new way and gave birth to new perceptions, new hopes, and new fears. It created, in the words of Wolfgang Schivelbusch, a revolutionary rupture with (all) past forms of experience.i

Only Georgian Britain possessed the precise combination of technical, material, financial and legislative preconditions that were necessary for this seminal event in world history to take place. In 1830 the Turnpike roads of Britain reached the zenith of their efficiency and fame. They were regarded as the fastest and most efficient land transportation network the world had ever seen. The Liverpool to Manchester route was one of the busiest routes anywhere in the world. Within two years of the opening of the Liverpool & Manchester Railway, only one stage coach was left. Nothing before had provided such a dramatic confirmation of change and technical progress as the coming of the railway. It is arguable that nothing has done so to the same extent since. Thus, in India the railway is thought to be as important a legacy of British rule as Parliamentary democracy. In the United States, the first country after England to wholeheartedly embrace the steam railway, the driving of the Golden Spike and the completion of the first transcontinental railroad is regarded as being as seminal to the national story as the first Thanksgiving or the Declaration of Independence.

In economic terms, the railway was the great product of the first phase of the industrial revolution. Railway construction mobilised capital and labour to an extent never witnessed previously. It demanded iron production on an unparalleled scale. This placed additional demands on the coal industry, which itself expanded as new coal reserves and new markets were opened up by the cheap transport the railway provided. Suddenly manufacturing could take place almost anywhere, rather than being restricted to the coalfields. Railways released the full potential of enormous tracts of territory remote from coasts or navigable waterways, both for the exploitation of raw materials and for food production to feed the ever-expanding industrial workforce. Without the railway the scramble for the African interior would have been futile. Without the railway the creation of the United States, Canada, India or the Russian empire would have been impossible.

For the first time in human history travel was freed from the constraints of human and animal muscle power and even the constraints of geography. The plans for the first inter-city trunk railway, the London & Birmingham Railway, deposited with Parliament in 1832 and 1833

show a route constructed through a landscape substantial parts of which were still medieval open fields still farmed in strips. For the majority of people affected, whole lives were lived within a 20-mile radius. Within a single generation private enterprise had constructed a national trunk network of 6890 route miles, making the 1851 Great Exhibition both possible and accessible to the entire national populace. By the 1860s international and transcontinental overland travel was a practical reality.

The railway was seen as the concrete symbol of the unlimited potential of science to improve everyone's lives. The railway demonstrated that human effort could reshape the earth to fit human needs. Because the locomotive's iron wheels placed limitations on traction, railways went through nature in a straight, level line, requiring earthworks on a heroic scale and new forms of engineering technique, particularly with regard to tunnels and, to an even greater extent, bridges. British railway works led the world in size, materials, engineering design and complexity of construction. The skills used were initially those acquired during the construction of the canals and latterly from the training carried out by the Institute of Civil Engineers, formed in 1818. By far the most spectacular of all railway engineering achievements were the viaducts, large bridges and trainshed roofs. They represented completely new architectural forms, independent of the architect and unconnected with local traditions.

With its speed and dominance over natural topography, the railway changed the public perception of space and distance. The railway also brought a new appreciation of the importance of time, arguably the most important change in human consciousness associated with the industrial revolution. In the 1840s, as the British trunk railway network was nearing completion, British railways and the Post Office found it necessary to develop standard, unified time, 'railway time', across the railway network. Initially 'railway time' and local time ran alongside each other, but this was clearly unsatisfactory. In 1880 'railway time' finally became standard time in England. Germany followed suit in 1893. In 1889, the United States was divided into four time zones, which remain unchanged to this day. At first, these time zones were regarded only as a convenience for the use of the railways; in practice they became regional standard time zones.

Standard time was possible only due to the concurrent development of the railway telegraph, first demonstrated by Cooke and Wheatstone on the London & Birmingham Railway in 1838. The development allowed clocks to be synchronised across the country in real time. By the end of 1848 telegraph lines covered over 1,800 miles of Britain's infant railway network, about half the rail lines in service. Within 25 years, 20,000 towns and villages in Britain were connected to 650,000 miles of telegraph wire and 30,000 miles of submarine cable. In 1848 it took around ten weeks to send a message from London to Bombay and get a reply. By 1874 it could be done in four minutes. Railways had an equally profound impact on the development of the universal postal service and national daily newspapers, allowing the transmission of thoughts and ideas in a way never previously possible.

The railway also permitted the development of the modern city, changing the face of the urban landscape as surely as it changed the rural landscape. In 1800 urban areas accounted for 40% of the population of Britain (and 25% of the French and German population). By 1914, urban centres accounted for 80% of the population of Britain (and 60% in Germany, 45% in France). As soon as trunk railways penetrated urban areas, the urban wealthy started to migrate outwards. In most cities the new railway lines were built almost exclusively through working class neighbourhoods, taking advantage of lower property prices and the angst of the elite and the middle classes. In London alone, the railways were responsible for the eviction of almost 120,000 people to make way for the new construction, forcing the working populace outwards and the better-off out further again still. It was no longer necessary for the ordinary man to live close to his place of work. The daily commute to work was born. The world's first modern suburban railway, the Manchester, South Junction & Altringham Railway, opened in 1848. Within 20 years, extensive webs of railways had been built in all British cities, supporting the development of extensive suburban communities. The railway was similarly responsible for the creation of similarly specialised commercial and industrial urban districts. It also changed shopping, by making large retail outlets feasible in large towns and by allowing consumer goods to reach even the remotest communities, in shops or through mail order.

The Victorians had a phrase 'progress comes on iron rails'. For better or for worse, the railway transformed the world in the most fundamental way possible. Developments since, including the motor car, the telephone, aviation, television and the internet have been no more than subsequent incremental advances, none of which could have occurred without the seismic shift in human experience and material culture that the railways produced. The material evidence of railway development thus has clear and universal cultural and historic value. This value was recognised particularly early on in Sweden, where official preservation of railway materiel started well before the end of the 19th Century, the country thus having a better collection of railway locomotives from the middle years of the 19th Century than any other country in the world. More recently this significance has been recognised in India, Austria, Italy and Switzerland through the World Heritage Site designations for the Rhaetian, Semmering and Indian Mountain railways.

In contrast, the country in which the railway was conceived and developed, and from where it was exported worldwide, has struggled with its official recognition of the global importance of its railway heritage. Most famously this was expressed in the failed battle to save the Euston Arch in 1961. Perhaps in part this ambivalent attitude is due to the almost unique popular affection of the British for their railways, which has expressed itself through the 'railwayacs' of the 19th Century and through the railway enthusiasts and train-spotters of the 20th. Even today the Beeching cuts of the 1960s are still felt as a deep trauma on the national psyche. A ride on a steam train to see Santa is as much a part of Christmas as going to church. A ride on a heritage railway as much a part of a family holiday as a day on a beach. This popular enthusiasm has resulted in a phenomenal third-sector railway heritage industry, with a turnover of £84 million, 2,000 paid employees and 18,000 volunteers, carrying 6.8 million passengers annually and contributing an estimated £579 million to the wider economy.ii With its emphasis on nostalgia for the more recent past, this popular enthusiasm has nevertheless

tended to overshadow any more scholarly appreciation of the national and international importance of the nation's built railway heritage. Thus the original pork pie shop in Melton Mowbray is listed at Grade II*, putting it in the top 8% of English buildings, whilst George Stephenson's fine skew bridge at Rainhill, beneath which Rocket first demonstrated the practicability of high speed mechanical traction, is listed at Grade II, putting it somewhere in the top half million. For whatever reason, Britain has no railway World Heritage Site and has more protected telephone boxes than it has listed railway stations, bridges and viaducts combined.

HISTORY AND SIGNIFICANCE OF BRITISH RAILWAYS BY PERIOD

To assist in the understanding of the historic and technical significance of railway structures, it is helpful to establish a broad temporal framework. This is helpful in establishing broad selection criteria, although it needs to be acknowledged that not all types of structure will necessarily fit into any universal chronology. Thus, generally there is a presumption that the older something is, the rarer and more significant it will be, yet various types of structure will have differing chronologies. The year 1940 would be very late for a brick railway bridge, but would be very early indeed for a pre-stressed concrete bridge.

Pre-1830

Non main-line railways (i.e. pre-modern railways) fall largely outside of the scope of this project. They are nevertheless of inherent significance as the precursors of the modern railway. Like main-line railways, early surface railways (as opposed to guided barrow-ways in mines) are a uniquely British phenomenon. First encountered in Nottinghamshire in 1603-4 in the form of Huntigdon Beamont's 'Wollaton Wagonway', they were eventually copied abroad, but all the key developments took place in the United Kingdom and generally in England. These early railways developed almost simultaneously on Tyneside and in Shropshire, most commonly as a device for easing the passage of wheeled cart-loads of coal from the pits to navigable water. Their use spread rapidly in the coalfields, especially in the north-east of England, so that railways had become known as *Newcastle Roads* by the 18th century. The rails were of timber, sometimes surfaced latterly with plates of cast iron, but not made wholly of metal until the second half of the century, when iron rails began to be cast at Coalbrookdale and elsewhere. An evolutionary blind-alley was turned around 1787 by John Curr transferred the flange from the wheel to the rail, initiating the *plateway'*. This system continued in parallel with the *railed way* for several generations. The common feature of both the plateway and the railway (or wagonway) was that the wagons were self-guided and moved by horses, by men, or by the force of gravity, rather than by steam-powered machines.[iii]

The early development of wooden railways is very poorly documented and is still the source of academic debate. Little evidence of the wooden tracks themselves, or the vehicles they carried, has survived. When archaeological evidence does come to light, for example the wooden tracks discovered at Lambton, near Sunderland or more recently at the former Neptune shipyard at Walker, Newcastle, it can still add immeasurably to our scant knowledge. Such remains are thus very significant. The physical structures associated with such early railways, including formations, embankments and bridges, have proved more durable where they were not later rebuilt for steam haulage, although surprisingly few enjoy statutory protection. This is probably because, with a few very notable exceptions (notably the Causey Arch), such wooden railways tended to follow the lie of the land and the earthworks and

structures associated with them consequently tend to be small-scale and relatively unspectacular. Nevertheless, because of subsequent events, any surviving remains should be regarded as being of more than national importance. There would appear to be considerable scope for further protection.

Following the establishment of the English canal network in the 1770s, horse-drawn tramroads with iron rails came to be seen as an alternative to the canal, particularly where water was scarce, or where gradients were steep. This led to the development of the 'hybrid railway', combining the iron railed way with the common-carrier status and engineering technique of the canal. The horse and gravity remained the main sources of traction but, for steeper gradients, steam haulage using ropes and stationary winding engines was increasingly used. A number were built as public utilities, under their own Acts. With consistent gradients, heavier engineering and iron rails, thoughts turned to the carriage of passengers and mechanical propulsion, each step moving the primitive wooden *waggonway* inexorably towards the modern main-line railway. Key dates are:

1758: First railway built under its own Act of Parliament (Middleton Railway, Leeds)

1796: First railway authorised to be built using share capital (Lake Lock Rail Road, South Yorkshire)

1802: First use of a steam locomotive on rails (Coalbrookdale) (1804 at Penydarren)

1803: First public railway authorised under its own Act (Surrey Iron Railway)

1807: First railway authorised to carry passengers (Oystermouth Railway, Swansea)

1808: First passengers hauled by steam (*Catch Me Who Can*, Euston Square)

1812: First sustained commercial application of the steam railway locomotive (Middleton Railway, Leeds)

1825: Completion of the first railway to bring all of the above together (the Stockton & Darlington Railway).

The Stockton & Darlington Railway, whilst seminal, was still not a modern main line railway however. It was essentially a coal-hauling *hybrid railway*. Whilst it used slow and primitive steam locomotives on its flatter eastern end, it used rope haulage at its western end. Passenger traffic was horse-hauled in single carriages. It nevertheless indicated the way forward and established the reputation of its engineer, George Stephenson, as ‘Father of the Railways’.

1830 – c.1840

This period covers the period from the opening of the first steam-hauled, high-speed, inter-city, *main-line* railway between Liverpool and Manchester, through the completion of the Great Western Railway in 1841. It includes the construction of the first long-distance main line railways connecting Liverpool and Manchester to Birmingham and from Birmingham to London. The success of the Liverpool & Manchester Railway set in train the First Railway Mania, which saw the commencement of an embryonic national network, albeit not yet regarded as such. The period saw first export of modern railway technology to the United

States, Belgium, the German states (which rapidly developed largely indigenous railway technologies), and to France, Austria, Russia, Cuba and Canada (which initially did not).

George Stephenson, and his son, Robert, evolved the steam railway locomotive into an instrument capable of much more than hauling freight over short distances, leading George Stephenson to build the Liverpool & Manchester Railway (1826-30) on a heroic scale, with minimal curvature and easy gradients. This railway broke with tradition in that it had a double track (dedicated tracks in either direction) and used mechanical traction throughout. It was subject to public control and, most importantly, was intended from the outset to be both a common carrier of freight, but also for passengers to be a substantial mainstay of traffic. No previous line had fulfilled all these criteria. On it the Stephensons proved that passengers could be safely and profitably carried at speeds far in excess of those of the fastest horse driven coach and that such speeds could easily be sustained in ordinary service.

The operation of the Liverpool & Manchester Railway was an unqualified success. In 1831 the company transported nearly half a million passengers. Profits were almost 50% of receipts and handsome dividends of 10% were achieved and sustained. Within a year rival coach services had been completely annihilated. The first long-distance railway, the Newcastle & Carlisle Railway, had been authorised as a horse-worked railway in 1829, but following the success of the Liverpool & Manchester, a number of modern railways of comparable length to the Liverpool & Manchester were immediately put in hand in Lancashire and Yorkshire, including the Leeds & Selby (incorporated 1830), Manchester Bolton & Bury and Preston & Wigan (both incorporated 1831). The success of these modern railways in turn prompted a succession of Acts for increasingly ambitious trunk lines, referred to as the *First Railway Mania*, culminating in a crash in 1838. These included the following:

1833: London & Birmingham, Grand Junction and London & Greenwich railways

1834: London & Southampton Railway

1835 Great Western Railway and London & Croydon Railway

1836: Birmingham & Gloucester, Manchester & Leeds, Midland Counties, Birmingham & Derby, North Midland, York & North Midland, Great North of England, Northern & Eastern, London & Blackwall Eastern Counties, Bristol & Exeter, Cheltenham & Great Western Union, Taff Vale and South Eastern railways

1837: Manchester & Birmingham, Chester & Birkenhead, Lancaster & Preston, Maryport & Carlisle, Sheffield Ashton-under-Lyne & Manchester, Hull & Selby, Bishop Auckland & Weardale and London & Brighton railways

1838 Edinburgh & Glasgow Railway

The period saw several well-established civil engineers such as John Rennie Jnr and Francis Giles involved on initial surveys and some, notably James Walker, Jesse Hartley and Francis Giles, were involved in the construction of some early lines. Nevertheless the laying out of the longer-distance trunk railways saw the emergence of a new school of highly influential younger engineers, including not only Robert Stephenson, but also Joseph Locke, Isambard Kingdom Brunel and Charles Blacker Vignoles. These men were instrumental in raising civil

engineering to the rank of a highly respected profession and they trained almost all of the many railway engineers who came later.

The period saw the evolution of railway engineering structures such as bridges and viaducts and the evolution of tunnel designs that would not fill with smoke and choke passengers. The particular demands of railways for straight and level formations saw important developments in skew bridges and in the development of the cast-iron level beam bridge. On the Liverpool & Manchester railway the Stephensons had established successful templates for locomotives and carriages, but specialised structures such as track (including track gauge), stations, engine sheds and repair workshops remained experimental and evolved more slowly, often through what proved to be a painful process of trial and error.

Because of the high expectations of investors, capital was easy to obtain. Engineering was often lavish. Engineers, directors and shareholders sometimes differed in their opinions over the application of unnecessary decoration to engineering structures, but the quality of finish was invariably high. Terminal stations were seen as an opportunity for building impressive structures. Towards the close of the period the world's first large all-metal overall roofs were constructed, notably the train sheds at London Euston and at Birmingham. The layout of the stations themselves and the relationship between railway tracks, train shed roofs and station buildings remained unresolved and experimental. Intermediate stations generally remained primitive until circa 1840. The layout of terminal and wayside stations evolved towards something we might recognise today at the very end of the period, largely thanks to Brunel, Tite and Thompson, with attractive permanent buildings and formal platforms.

The development of the 'hybrid railway' did not end with the opening of the Stockton & Darlington Railway, nor even with the completion of the first modern main-line railways. Thus the best preserved hybrid railway, George Stephenson's Bowes Railway, opened in 1826. Robert Stephenson's Canterbury & Whitstable Railway (opened 1830) and the first trans-Pennine railway, the horse- and incline-worked Cromford & High Peak Railway (opened 1831) were both hybrid railways, as were George Stephenson's Stanhope & Tyne and Whitby & Pickering railways (opened 1834 and 1836 respectively). Indeed, such railways continued to be built and extended, particularly in North and South Wales, well into the middle years of the 19th Century. The F(f)estiniog Railway in North Wales (completed in 1836) is probably the best known working example. Such late examples, which have tended to survive relatively well due to the quality of their engineering, are the coelacanths of early railways and are thus highly significant. Protection of remains has tended to be by listing, although parts of the Bowes Railway, the Cromford & High Peak Railway and the upper end of the Stockton & Darlington Railway are scheduled.

Current designation policy is that *most pre- 1840* (railway) *buildings will often be of international significance as being among the earliest railway structures in the world and that great care should be taken in seeking out work of this date because it is often hidden by later alterations and extensions*.[iv] Because of the scale of the national railway-building project, its still experimental nature and its subsequent influence both at home and abroad, it is current

practice that any railway buildings or structures from this period that survive in a reasonably unaltered state will normally merit statutory protection, normally through listing. Even fragmentary remains may well be worthy of designation if their significance is still apparent. High grading would be based on the significance of their design and / or historic importance.

c.1841 – c.1852

This period spans from the opening of the Great Western Railway through to completion of the Great Northern Railway, then the largest built under a single Act (285 miles, with a capital of £5,600,000). In this period the British railway network grew from a series of unconnected lines with an operational mileage of around 1500 miles, to a relatively integrated network of 7,336 route miles at the close of 1852. Passenger journeys rose from 15 million per year at the end of 1841 to 82.8 million.[v] At the end of the period not only had all of the first generation main lines been completed, but further extensions had built to complete the East and West Coast main lines between London and Scotland. London had been put in direct rail communication with Plymouth, Swansea, Holyhead, Glasgow, Edinburgh and Aberdeen. Engineers in the United States in particular, but also in Germany, has started to develop indigenous schools of railway practice that would soon rival that of Britain in terms of international influence. British railway engineering nevertheless remained at the cutting edge, particularly with respect to speed, the development of specialised buildings and civil and mechanical engineering practice. The period thus saw British railway engineers and British capital busy developing railways in France, Spain, Italy, the Netherlands, South America, the West Indies and Egypt.

The period divides readily into has two halves. The first (to c.1844) saw the effective completion of the network of largely unconnected lines authorised during the *First Railway Mania*. This was a relatively orderly process and, once completed, these early main lines returned profits and dividends not dissimilar to those of the Liverpool & Manchester, Grand Junction and London & Birmingham. Constructional technique advanced steadily, but with few revolutionary advances. During the second part of the period (c.1844-1852) the concept of an interconnected network emerged. The inconvenience of *breaks of gauge* led to the *Battle of the Gauges*, whilst various bouts of territorial politics and a series of amalgamations of smaller companies into the first regional or national combines. The first significant railway merger was the formation of the London & North Western Railway in 1844 (uniting the pioneering main lines linking Liverpool, Manchester, Birmingham and London) and the Midland Railway in 1845 (uniting railways linking Bristol, Birmingham, Derby, Nottingham and Sheffield). Despite these amalgamations, constant railway promotion saw the number of independent concerns continue to grow.

Whilst the completion of the railways of the First Mania was a capital and engineering project on a quite unparalleled scale, the period of the *Second Railway Mania* was one of the most remarkable phenomena of the whole period of Britain's industrialisation. Between 1825 and 1835, some 54 railways had been authorised by Parliament, most of them of a local nature.[vi] Once completed and in operation, the success of these led to a speculative frenzy, following a

common pattern: as the price of railway shares increased, more and more money was poured in by banks and by private speculator large and small, until the inevitable collapse occurred. By 1845 over one thousand projected schemes had been put forward. In 1846 alone, no fewer than 272 Acts of Parliament were passed, setting up new railway companies and authorising 4540 miles of new British lines.[vii] This was nearly 50% more than the total mileage completed in Britain in the previous twenty years.

In the peak years 1846-48, over 8,000 miles of new railways were authorised. Whilst a number of these were paper speculations with no hope of ever being built, over 1000 miles of new railways were being opened in Britain each year. Domestic railway investment was roughly half of total national capital investment and the equivalent of about two-thirds of the value of all exports. It entailed a wage bill of £16million for a construction force of 250,000 and by 1850 the railways required a permanent workforce of 60,000.[viii] This was on top of British investment and engineering input into the still slowly developing railway networks in France, Spain, Italy and Canada. Railway construction drove commodity prices, determined the cyclical movement of the economy, and drove the development of metallurgy, structural science and the development of the iron and coal industries. Amalgamations, take-overs, territorial politics and share manipulation became a way of life, producing a new breed of corporate businessmen, including George Hudson and Captain Mark Huish, whose names became national bywords for sharp business practice and deception.

The prodigious demand for wrought iron, particularly for rails, had a dramatic effect on production and capacity, making the material an economic proposition for bridge- and ship-building. As a result, the key technological developments of the period were in structural engineering, including the first major wrought iron bridge and the first great arched train sheds, most notably the Britannia tubular bridge in Wales and the roof of Newcastle station, both completed in 1850. As with the previous SS Great Western (1838), the great contemporary development in iron steamship construction, Brunel's SS Great Britain (1845), was conceived out of the Great Western Railway's ambition to extend its railway service to New York. The period also saw the establishment of what became great railway workshops at new *railway towns* such as Derby, Crewe and Swindon. The ease of raising capital before the bursting of the Mania bubble in 1848 resulted in railways being built lavishly, costs running on average at three times those of Continental or American railways. Tunnels, bridges, stations and even workers' and crossing keepers' cottages were increasingly seen as opportunities to impress the public and to express corporate pride, leading to a profusion of individualistic and decorative designs by a variety of engineers and architects. Probably the key architectural contribution of the railways to national life was the introduction of the Italianate style, which was so closely associated with railway-building that it was initially referred to as the '*railway style'*. The style spread back to Europe and beyond specifically because of the continuing international influence of British railway engineering.

Because of the extraordinary scale of the British railway-building project, its continued experimental nature and influence both at home and abroad, all buildings and structures surviving from this period that survive in a reasonably unaltered state are generally regarded

as meriting statutory designation. Again, current designation policy is that *great care should be taken in seeking out work of this date because it is often hidden by later alterations and extensions*.[ix] Thus, incomplete, fragmentary or damaged remains may still be worthy of designation if their significance remains intact. High grading would be based on a combination of completeness and architectural and / or historic importance.

c.1853 - 1876

Notwithstanding the deflation of the Railway Mania bubble in 1848 and the national depression in the second half of the 1860s triggered by the collapse of the bank Overend & Gurney due specifically to their over-exposure to railway stocks, this period saw railways in Britain continuing their phenomenal growth, with new routes being added at a rate of around 400 new route miles per year. These opened up many marginal rural areas, including Cornwall and the hinterlands of Wales and Scotland. The period saw the rise to prominence of a new generation of more or less scrupulous railway managers running huge and increasingly competitive businesses. As a result, many new lines were highly competitive but ultimately unnecessary routes, built as the emerging combines each competed to tap the more lucrative parts of the country and their sources of traffic. The period closes with the completion of the last truly *heroic* main-line railway, the Midland Railway's trans-Pennine Settle to Carlisle route, completing a third Anglo-Scottish route.

During this period railway traffic soared. Thus between 1853 and 1876, passenger journeys grew from 82.4 million at the end of 1852 to 517 million at the end of 1876.[x] Freight traffic grew at a similar pace as British manufacturing boomed. Two areas of very rapid growth were suburban and leisure traffic, the railways being particularly instrumental in the growth of the suburbs and seaside towns. This huge expansion in traffic, coupled with increased competition and price-cutting, placed an enormous strain on the railway network, with slow trains, poor punctuality and appalling safety standards, despite the gradual introduction of railway signalling from the mid-1850s. Traffic growth generally, and particularly the growth in suburban traffic that the railways themselves had fostered, resulted in a spate of urban railway building, including the world's first underground railway and a number of large new termini and central railway stations which were required to be of increasingly sophisticated design to allow more passengers than ever before to each find their respective trains at the right time. To add to the complexity, social mores and the increased carriage of the poorer classes meant that stations had to achieve greater efficiency whilst providing separate accommodation for three classes of traveller and two sexes, plus refreshment and (often) hotel facilities.

The intense competition of the period, coupled with growth of the larger combines through amalgamation and merger, saw the railways emerge as pioneers of corporate design. The quality of build and the degree of standardisation varied enormously, depending on local circumstances, the prestige or otherwise of traffic being tapped and the particular views of the often autocratic general managers on the importance of design. Thus, the largest of all the concerns, the London & North Western Railway, was noted for its parsimony and reliance on

functional, 'standard' designs wherever possible thanks to the influence of its Chairman, Sir Richard Moon. In contrast, the thrusting Midland Railway under James Alport, was noted for the exceptional design quality of everything it built, particularly as it thrust southward from Leicester to St Pancras and northward, first to Manchester through the Peak District, then over the Pennines to Carlisle via Settle. Other railways (of which there were several hundred, large and small) filled the design spectrum in between. Large glass and iron roofs were an increasingly important element of station design, both at termini and larger stations, important developments being the crescent truss roof (an almost uniquely railway phenomenon) and large transverse ridge-and-furrow roofs (developing Paxton's Crystal palace theme). Prefabricated iron and glass platform canopies started to appear at some lesser stations, the Midland Railway (of which Paxton was a Director) being a particular pioneer in this respect. The railways continued to lead the structural design of metal bridges and viaducts.

During this period American and German railway engineering practice remained on the ascendant. British technology nevertheless remained largely dominant internationally, particularly in the development of railways that initially opened up India, South America, the Antipodes and Scandinavia. A number of internationally important advances occurred in Britain in the design of metal station roofs and bridges. The importance of the railway in suburban development and the development of seaside towns, first in the UK and then abroad, cannot be over emphasised.

Current designation policy is that most railway buildings and structures pre-1860 are significant, but that increasing selectivity is required after about 1860 (see also 1877-1914, below).[xi] Much eclectic design in the best tradition of Victorian architecture was nevertheless commissioned in this period. The emergence of the concept of the corporate house-styles is also of particular interest, given the pioneering nature of railways in this area. Whilst railway buildings and structures after c.1860 tend to be regarded as being increasingly standardised, truly standardised (i.e. identical, template) company designs for stations and other buildings remained relatively rare and good surviving examples of early house-styles are rarer still. Further, despite railway mergers, there remained scores of independent railways and as quickly as railways were absorbed into larger combines, new independent concerns were promoted and constructed, often each with its own distinctive architectural signature. Completeness, rarity and group value will be important considerations for designations at the lower grade, as would be the importance of ensuring the preservation of representative examples of building types and styles, both regionally and by company.

Smaller stations comprising the main station building (sometimes with staff accommodation), waiting shelters and goods shed, survived in vast numbers until the 1960s. Such complete ensembles but nevertheless have suffered grievously since. Timber buildings, especially waiting shelters, are maintenance-heavy and easily vandalised, and have consequently been very susceptible to replacement in recent years and are becoming increasingly rare. All elements of such reasonably complete ensembles, even if otherwise architecturally undistinguished, may well be eligible for listing as they are now so rare. Extra care needs to

be taken to ensure that less obvious ancillary structures such as weighbridges, lamp rooms, goods offices, stables etc. are fairly considered, alongside principal station buildings. [xii]

1877 - 1914

The period from 1877 to the start of the First World War saw British railways reach their zenith in terms of confidence, commercial importance and extent, with the railways attaining complete dominance over UK inland transport. By 1914 long-distance road transport was dead and the canals (many of them now railway-owned) were on their knees. Major topographical obstacles to the growth of the network were overcome, with the building of the Severn Bridge (1879), Seven Tunnel (1886), the Tay Bridge (1878 and 1887) and the Forth Bridge (1890). The last trunk main lines were built, notably the Great Central main line from Sheffield to Marylebone and the Great Western Railways high-speed 'cut-off' lines, which greatly reduced journey times between their main centres of London, Birmingham, South Wales and the West Country. In order to assist the promotion of railways into even the most sparsely populated areas, a series of *Light Railway* Acts were passed, allowing the construction of lightly-laid standard and narrow gauge branch lines with minimal signalling, subject to low speeds limits. With the further infilling of rural gaps, duplication or triplication of rival railways into industrial honeypots and new main line construction, by 1914 the UK rail network had grown to 23,440 miles, with even the smallest and remotest village being no more than 20 miles from the nearest station. By far the majority were considerably closer, whilst a number of relatively insignificant communities could boast not just one railway station, but two.

The only place where the railways faced meaningful competition was in the suburbs, due to street tramways and deep-level tube railways, both of which boomed circa 1900, thanks to rapid advances in electric technology. Trams and tubes had closely-spaced stops and vehicles with rapid acceleration. The railways responded with increased train frequencies and speeds and through their own early electrification schemes in Tyneside (1903), Merseyside (1904), south London (1909) and south-west London (1915). Between the end of 1876 and the end of 1914, British annual railway passenger journeys climbed form 515 million to their highest ever peak of 1.55 billion,[xiii] said at the time to be the equivalent of moving the earth's total population every year.

As well as successfully defending their existing monopoly, British railways extended their activities during this period with extensive dock construction, ferry and hotel ownership, short-distance road haulage and substantial vertical integration, with railway-owned factories producing an ever-increasing proportion of the larger railways' total materiel requirements. By the turn of the 20th Century, the London & North Western Railway claimed to be the largest joint stock company in the world. Despite amalgamations, in 1914 there were still 130 individual railway companies in Great Britain, between them possessing some 23,000 locomotives, nearly 73,000 carriages and 1.4 million goods wagons.[xiv] The railways were carrying over half a billion tons of freight annually and directly employing 643,135 people[xv], making them collectively the largest direct employer of labour. This figure excludes those

employed indirectly (e.g. producing the coal used by the industry) and the tens of thousands employed in the specialised engineering industry supplying British financed railways abroad, particularly those in India, South America and the Antipodes.

In the previous era most railways had enjoyed atrocious public reputations, being crowded, unpunctual, very slow and, worst of all, dangerous. In the late Victorian and Edwardian period, the railways underwent a renaissance. Public demand and the increasingly competitive market saw the speeds and weights of passenger trains increase markedly as bogie carriages with corridor connections, toilets, heating, electric lighting and continuous brakes were introduced, together with Pullman carriages, restaurant cars and sleeping cars. In most cases these improvements were in response to advances made by the Midland Railway, who also pioneered the abolition of second class accommodation and the inclusion of (up-rated) third-class accommodation on all trains, including expresses. Improved freight handling and train speeds saw fresh meat and milk become everyday urban staples and fish (and chips) become a national dish. Individual railways consolidated their improving PR by introducing bright and distinctive liveries for their locomotives and carriages. Previously inadequate and chaotic engine sheds, goods depots and stations were rebuilt on rational lines, stations in larger town and busy junction stations usually being rebuilt with very extensive canopies and / or overall roofs and lavish provision of buildings in up-to-date styles connected by footbridges or subways to large and well provided island platforms, to allow for easy circulation and interchange. At lesser stations platforms were raised and, at many, the railway companies added their own designs of decorative lamp standards, footbridges and platform canopies with fretted valances, completing the characteristic appearance of the classic British railway station.

Posterity has been unkind to the physical legacy of this halcyon period of the British railway. In part this is because the seminal early books on railway architecture were published in the 1950s and 1960s, when even early Victorian architecture was struggling to gain public acceptance of its worth. As a result, whilst the earlier heritage has been relatively widely protected through the designation system, the legacy of this halcyon epoch between the late 1870-s and the First World War has remained relatively more vulnerable to cycles of underinvestment, rationalisation and modernisation. Certainly for most types of structure, most that might once have been described as being standardised are now increasingly rare, particularly so if also substantially intact.

Current designation policy is that ‘increasingly rigorous selection is required for *(railway)* buildings after about 1860: this reflects both the quantity of what remains, and the standardisation of design which was applied to buildings and structures erected along different railway lines. A number of factors should be taken into account when assessing buildings of the latter half of the nineteenth century, which have often undergone considerable replacement... Where possible, a representative sample of structures from each company should be designated if the architecture is distinctive; rarity of survivals by company may be a factor here… Other regional factors may be relevant too – surviving smaller station buildings in urban areas such as Lancashire, Yorkshire, and Tyneside are very thin on the ground due

to the de-staffing of stations and subsequent demolition in the 1970s. As with industrial buildings generally, group value can be a key determinant. Some stations and goods yards need to be assessed as a whole, especially where they demonstrate the phased evolution of the railway system, through alteration and extension. Rarity is, however, an issue which needs to be factored in when assessing more recent railway buildings: attrition rates for some later Victorian railway buildings have been high, and it is not simply a question of 'the older, the better'… Multi-phased stations can be of special interest as well, but judgment will be needed as to the coherence of the ensemble, and the claims of the component elements.[xvi] It is suggested that these criteria are appropriate, but that they be extended to include railway buildings and structures of the pre First War period also.

1915 - 1947

At the outbreak of the Fist World War, the 130 individual British railway companies were brought under immediate central Government control. Over the course of the war, over a third of the 643,000 railway workers enlisted. All but essential maintenance works were largely suspended due to the shortage of labour and because the railway workshops were required for armament production and other war work. By the end of the war the railways were in a decrepit state and chronically short of equipment and money, with the Government in debt to the owners to the tune of £60million simply for the backlog of maintenance. Costs had risen markedly. The railway unions called a national strike for fairer pay and shorter hours in September 1919, to which the Government rapidly capitulated. Nationalisation had been called for by many, but when the Government finally handed back control in August 1921, it was on the basis that the railways would benefit from an end to cut-throat competition and that, as from 1st January 1923, 123 of the 130 companies under Government control would be amalgamated into four large combines, referred to as the 'Big Four': the London Midland & Scottish Railway, the London & North Eastern Railway, the Southern Railway and an enlarged Great Western Railway.

Despite the savings that should have accrued from economies of scale and rationalisation of duplicate facilities, Britain had lost much of its coal export trade and other markets during the war, whilst the release of thousands of cheap war-surplus lorries to underemployed ex-servicemen resulted in the railways facing serious road competition for the first time in ninety years. The General Strike, Wall Street Crash, Great Depression, bus travel and a growing market in long-distance coach travel all further damaged the railways prospects of making much progress before the railways were again taken under Government control for the massive exertions of the Second World War. The railways emerged in a pitiful condition, not only overworked and worn out, but also severely damaged through targeted and untargeted bombing.

Despite the unfavourable climate, the Big Four railway companies made great efforts to recover during the inter-war years. Most publicly this involved the setting new speed records and running fast and fashionable prestige express trains. Facing increasing competition from other forms of transport, the railway closed some 1,300 miles of passenger railway between

1923 and 1939, although much of this remained open for freight. The railway companies diversified into road haulage, bus operation, internal air flight and cross-channel roll-on, roll-off train ferries, the first of which was the Harwich to Zeebrugge train ferry (1924). Modern maritime stations were opened at Dover (started before the war, but opened in 1919) and at Tilbury (1930). Investment in physical infrastructure was generally targeted at reducing costs, particularly in the modernisation of freight handling, which was becoming a loss-making sector due to high wage costs, road competition and the railway's unique common-carrier status, which meant that they could not turn away loss-making loads. All railways introduced modern signalling in the most heavily trafficked urban areas. The Southern Railway invested heavily in suburban and main-line electrification. New stations were few and far between, which is a pity, given the quality of those that were built, for example at Leeds, Holywell, Leamington, Cardiff, on extensions to the London Underground built by the Great Western and London & North Eastern railways and at various points on the Southern Railway. Many other schemes, including the reconstruction of Euston station, were shelved on the outbreak of the Second World War.

Current designation policy for railway structures built between 1915 and 1948 is less well defined than for earlier periods. [xvii] Because of the contributions of Pick and Holden, the inter-war London Underground system is currently better represented than all 'Big Four' railway companies combined. The small number of stations that were built by the ‘Big Four’ main-line railway companies, and the larger number of significant additions to existing stations, were generally of good design however, whether modernist or not. Freight buildings were of lesser architectural interest, but they functioned well and were a significant advance on what went before. As well as protecting the most clearly outstanding stations, the designation system should seek to ensure the preservation of a representative sample of key building types for each of the four main-line companies. Architecture and design quality and / or technical or construction interest, and / or extent of alteration and group value will be key issues.

1948 - The Present

On 1st January 1948 the nationalised British Transport Commission came into existence, taking responsibility for railways, canals and road freight transport in Great Britain. Its main holdings were the networks and assets of the Big Four railway companies, including hotels, ferry services, numerous canals, thirty-two railway-owned ports and the railway's financial interests in various bus companies and shipping lines. It also took over 55 other railway undertakings, the fleets of *private-owner wagons* belonging to industrial concerns for use on the national railway network, the 19 remaining independent canal undertakings, 246 road haulage firms, several bus companies and the London Passenger Transport Board. The Act provided for five Executives to operate services, covering Docks & Inland Waterways, Hotels, London Transport, Railways (including ferries) and Road Transport. The Railway Executive traded as British Railways, divided into six regions for operational purposes. The former railway hotels eventually re-merged with British Railways when the BTC was dissolved in 1962.

Upon nationalisation the British railway network was still substantially undiminished in scale from that of 1914. It route mileage was only slightly reduced and it actually employed slightly more people (641,046).[xviii] Freight traffic had reduced by about a third to 273 million tons,[xix] while passenger traffic had also reduced by roughly a quarter, to 1.14 billion.[xx] Costs had nevertheless grown considerably and there was an enormous backlog of war damage and arrears in renewals and maintenance. Shortages of raw materials and coal added to its problems. Nevertheless, many engine sheds and stations were rebuilt or updated and a number of pre-war modernisation schemes brought to fruition, including the electrification of the trans-Pennine Woodhead route and parts of the East London suburban network. Several suspended pre-war station reconstructions were implemented, although the architectural ambitions of the newly nationalised railway both in revived pre-war schemes and post-war reconstruction tended to reflect the austerity of the age. 3,318 miles (5,340 km) of the most lightly-used branch lines were closed between 1948 and 1962.

In 1955 operating cost exceeded income for the first time ever. To restore the railways to profitability an ambitious Modernisation Plan was launched, with £1.24 billion earmarked for modernising the railway network over a 20 year period. This included huge semi-automated freight marshalling yards, further main-line and suburban electrification and the phased introduction of diesel locomotives and multiple units. Instead losses mounted, from £68 million in 1960 to £87 million in 1961 and £104 million in 1962. These spiralling losses accompanied a brief architectural renaissance, resulting in the now-listed stations at Manchester (London Road), Broxbourne, Harlow and Coventry, all built 1960-62. The experiment was short-lived. The rebuilding of Euston station 1961-69 marked an architectural low. In 1963 a major rationalisation of the rail network began following the publication of *The Reshaping of British Railways* (the infamous *Beeching Report*). On top of the over 3,000 miles closed since nationalisation, the Report recommended the closure of a further 5,000 miles of railway and 2,363 stations. This equated to the loss of 30% of route mileage and 55% of all stations, including many intermediate stops on retained inter-city routes. Concurrently, the national dieselisation programme was rapidly accelerated after 1963, resulting in steam's complete demise in 1968. The Beeching Report also recommended a move away from wagon-load freight to containerisation and block trains, with dramatic effects on freight infrastructure including the brand-new marshalling yards and the scrapping of a third of a million freight wagons. Beeching published a second report *The Development of the Major Railway Trunk Routes* in 1965, setting out his conclusion that of the 7,500 miles of trunk railway, only 3,000 miles *'should be selected for future development'* and invested in. In 1966 plans were unveiled to close and demolish St Pancras station, resulting in a public outcry and the station's listing at Grade I.

Despite promises made to end railway closures by the 1964 Labour government, closures continued. As a result, some lines it had not recommended for closure were subsequently shut down, such as the Woodhead route between Manchester and Sheffield, most of the Oxford–Cambridge route (despite it serving Milton Keynes) and the main line from Edinburgh to Perth. Under Beeching, King's Lynn was to have remained at the centre of routes towards Norwich, Hunstanton and Wisbech, all of which subsequently closed. Further drastic surgery

was proposed in the 1983 Serpell Report, to much public angst, and railway closures really only came to an end with the reprieve of the Settle Carlisle railway in 1989. By 1970 over 6,000 miles of route and 4,000 stations had been closed since Beeching. The process of nationalisation and rationalisation was a deep trauma for large sections of the population. Thousands had lost jobs by which they defined themselves and hundreds of communities had lost a lifeline to the outside world for which they had developed an abiding affection. In the pre-television, austerity world of the 1950s train-spotting had become a way of life for a generation of (mostly) boys. With an increasingly centralised railway, the widespread cuts and the end of steam, part of the national phyche was lost. The result was a deep, popular nostalgia unmatched in any other heritage sector and the birth of a volunteer-led, private-sector railway heritage movement that is unparalleled anywhere else in the world.

The end of the Age of Steam also heralded a change in the name of British Railways to British Rail, a company with a new logo and new corporate identity. Whilst many lines and stations had closed and steam had disappeared in 1968, much of the remaining infrastructure of the Edwardian and Victorian railway remained, albeit in an increasingly decrepit state. Building on the 1955 Modernisation Plan, the new British Rail looked firmly to the future and had a new corporate image to promote. In 1966 electrification of main line routes accelerated with the completion of the Euston to Crewe line. The West Coast Main Line saw a further extension of electric services to the Midlands the following year and eventually to Glasgow in 1974. 100-mph became normal for many Inter-City services. Container freight trains were introduced, as were carriages with air conditioning. The introduction of centralised power signalling systems started the demise of manual signal boxes. In 1984 the electrification of the East Coast Main Line between King's Cross and Edinburgh was announced, completed in July 1991. In 1994 the Channel Tunnel was completed, connecting British mainland rail services with Continental Europe. The same year saw the Privatisation of the railways, with Railtrack taking responsibilities for track, buildings and infrastructure. Railtrack was dissolved in 2002 following a series of fatal accidents, culminating in the Hatfield Rail disaster. Its role was assumed in 2002 by Network Rail, a statutory corporation created as a 'not for dividend' private company, with the taxpayer taking responsibility for Railtrack's debt of £7billion.

Following the creation of British Rail in 1968, 'forward looking' became a something of a corporate mantra. The architectural results of the new corporate image were dismal. From 1964 traditional individual rebuilding projects had been largely abandoned in favour mass-produced solutions using factory-made parts, starting with the CLASP system, used since the 1950s by local authorities for schools and other public buildings, then using the SCOLA (Second Consortium of Local Authorities) system. These pre-fabricated systems were finally abandoned from 1980 when British Rail adopted a new system of brick buildings with apex roofs, resembling a 'chalet' style. A substantially new attitude to architecture and heritage became apparent in 1985, both with the start of the award-winning rebuilding of Liverpool Street station, commencing in 1985 and with British Rail's establishment of the Railway Heritage Trust, to assist the operational railway in its preservation and upkeep of listed buildings and structures, and to facilitate the transfer of non-operational historic buildings and structures to outside bodies willing to undertake their preservation.

No buildings or structures of the early post-nationalisation period (1948-1955) are designated. Buildings and structures tended to reflect both the austerity of the time and the nationalised industry's commitment to improving the working conditions of railwaymen and women. Some substantial additions to bomb-damaged historic structures (e.g. Middlesbrough station) may be significant in their own right, for design quality and historic interest.

The Modernisation Plan period (1955-c.1968) saw the creation of some of the best and most individual stations produced by British Railways. A small selection of the best are already listed. These have escaped the subsequent upgrades that may have now rendered the remainder un-listable, due to the high thresholds for post-war designation. The iconic structures of the Modernisation Plan period are early diesel depots, marshalling yards and associated infrastructure and some very noteworthy bridges (e.g. the rebuilt Chepstow and Grosvenor bridges. Birmingham New Street power signal box (Bicknell and Hamilton, 1967), built shortly before the 'British Rail' corporate re-branding appears to have been the sole successful essay in brutalist design.

Post 1968 the re-branded British Rail produced less and less of any architectural or technical significance, reflecting the railways increasingly secondary importance to the economy and national transport infrastructure. With the exception of a small number of engineering structures that were of a complexity that required external design expertise, it seems unlikely that anything produced in-house between 1968 and privatisation in 1994 would meet the strict criteria for post-war designation.

Generally post 1948, architecture and design quality and / or technical or construction interest, and a combination of lack of alteration and high group value will be key issues.

CURRENT AND FUTURE TRENDS IN INVESTMENT IN THE RAILWAY INFRASTRUCTURE

Organisation and responsibilities in the railway industry

Government responsibility for the railway rests with the Department for Transport [DfT]. The Secretary of State (Patrick McLoughlin) manages overall transport strategy, including economic growth and climate change, transport security and high speed rail. A Minister of State (Baroness Susan Kramer) is responsible for HS2 Phase Two, rail funding and futures including regulation, stations policy and smart ticketing. In respect of other rail topics two Parliamentary Under Secretaries of State deal with operational performance, major projects, fares and ticketing, Rail Delivery Group reform[xxi] and franchising (Stephen Hammond) and freight and logistics and HS2 Phase One (Robert Goodwill). This division is arbitrary and can lead to confusion, while it is notable that relationships with the industry are not listed among the ministers' roles[xxii]. It should also be noted that community rail, light rail and trams, winter resilience, environmental impacts and alternatives to travel have disappeared in the rearrangement of duties following the Government reshuffle in October 2013.

The Department works with 22 'agencies and public bodies'. Of these the Office of Rail Regulation [ORR] is described as a 'non-ministerial department' (see below). Directly Operated Railways (currently the public-sector operator of the East Coast Main Line [ECML], High Speed Two Limited (charged with promoting and planning the proposed new high-speed railway), the British Transport Police Authority and Passenger Focus (the travellers' champion) are 'executive non-departmental public bodies'. London and Continental Railways Ltd [LCR] is a 'public corporation, and the Rail Accident Investigation Branch is classified as 'other'[xxiii]. BRB (Residuary) Ltd (which managed the loose ends left following the demise of the British Railways Board) was abolished on 30 September 2013. Its functions have been dispersed to the Highways Agency (closed alignments), LCR (properties with development potential) and Network Rail (miscellaneous operational land, and accident and war memorials). The Railway Heritage Committee was closed on 30 March2013 and its responsibilities transferred to the Board of Trustees of the Science Museum.

Separation of track and train, or wheel and rail, is a fundamental feature of contemporary organisation of the railway itself. This derives from concepts established by the European Union in furtherance of a conviction that they would promote competition and thereby make the European railways collectively more efficient and able to achieve an increased modal share that would benefit the environment. The policy was primarily directed at international freight traffic, but the principles required a reordering of state corporations that had traditionally been vertically integrated. Strictly, the division was only required in terms of internal arrangements, but in some countries total separation was pursued. Of these Britain was among the most rigorous[xxiv].

By the Railways Act 1993 the infrastructure – the civil engineering, track, signalling and control, stations, power supply and ancillary buildings – passed from the unified British Rail to a new private-sector body, Railtrack. In 2002, after a chequered history, the assets were transferred to Network Rail (NR), a 'not for dividend' company limited by guarantee and without shareholders. This has created the rather strange situation that the railway infrastructure is not 'owned' by anyone and is technically in the private sector while at the same time its now-substantial debt is in practice guaranteed by the Government.

NR has recently devolved management to ten geographic Routes, whose Directors now have extensive responsibilities and are closer to their partners in the Train Operating Companies (TOCs), external stakeholders and local suppliers than when strong control was exercised from the company's headquarters in Milton Keynes. In some cases a formal alliance has been established between the NR Route and the matching TOC, most closely in the case of the Wessex Route and South West Trains where a joint team now manages the South Western main line and suburban territory. Like the Rail Delivery group described below, this is legally a peculiar animal since the franchise holder may change and since other operators run trains over Wessex tracks, but it undoubtedly has advantages in better coordination. Whether, freed from central control, such a body might become more assertive or more careless regarding heritage issues has yet to be seen.

Although the strategic and everyday management of Network Rail rests with the Board of Directors[xxv], as a monopoly holder of rail infrastructure it is tightly regulated by ORR in keeping with the European Union concept of separation, in which such bodies are known as Infrastructure Managers (Ims) or System Operators. ORR describes itself as *'the independent safety and economic regulator for Britain's railways'*[xxvi]. Economic regulation is focussed on continual scrutiny of Network Rail's efficiency and performance, its planning and the setting of its budgets, and supervision of its contracts with the train operating companies to ensure fair and non-discriminatory access.

Train operating companies do just what their name says, but in order to run on Network Rail tracks they must apply for access rights and agree suitable 'paths' in the timetable[xxvii]. They are perceived as 'customers' of NR, which can be a helpful relationship but which can (and does) also lead to tension because the participants have different objectives rather than a common view of the collective railway. Most TOCs hold franchises, as explained below, but there are also a small number of 'open access' companies running passenger trains at their own risk and the freight operating companies [FOCs]. The process of applying for, agreeing and modifying access contracts has become highly formalised and legalistic and has thus introduced rigidity into certain aspects of railway management. Nonetheless, this report is not much concerned with the TOCs, since their involvement in matters concerning buildings is limited (but see below).

With the exception of the tiny number of open-access trains passenger services on Britain's main-line railway are operated under franchise contracts between a TOC and the Government[xxviii]. DfT specifies the service it wants provided for the geographical set of routes

that comprise the franchise and the improvements it wishes to see during the lifetime of the agreement. There follows an open tendering process, although in practice the field is dominated by a small number of large companies, commonly referred to as the 'owning groups'.

Franchising has generated considerable controversy regarding the specificity and length of contracts, the cost and management of the process, the behaviour of the successful bidders and its benefits and disbenefits for passengers and the railway. It has gone through four major and many minor revisions, the most recent following DfT's mishandling of the flagship West Coast Main Line (WCML) franchise which culminated in the suspension of the process, enquiries and a fresh attempt to ensure that the system is correct, fair and transparent. Many observers believe this to be the last chance for it to be demonstrated that it can work for the general good[xxix].

The other players in an industry that now comprises multiple organisations in varying relationships include the owners of the rolling stock (essentially banks), suppliers of a wide range of engineering, technical and support services, contractors for some operating functions such as cleaning and security – and consultants. None of these would normally participate directly in decisions about buildings and other heritage assets, but their interactions with Network Rail and the TOCs could have subtle effects on attitudes toward development. In particular, the engineering firms may influence the approach to matters such as electrification standards, and on the ground they may not exercise the same care as a conservation officer when dealing with an historic structure.

Following a recommendation of the McNulty Review[xxx] a Rail Delivery Group (RDG) was created in order to address the difficulties and inefficiencies that fragmentation of the railway is undoubtedly causing. Its membership covers Network Rail, the owning groups of the TOCs and the main freight operating companies, with observers from DfT and ORR and recently other stakeholders in the industry as associate members (but not Passenger Focus). Although it has a remit to develop strategies RDG has not yet made a distinctive contribution to policy or practice, but it has the potential capability for pushing ideas that might have implications for the infrastructure in areas such as asset management and technological innovation. It is a peculiar body since the TOCs only hold temporary rights to their franchises and have no permanent status, and the Commons Transport Committee rather pointedly recommended that *'the DfT and ORR keep a close eye on the work of the RDG to ensure it acts in the best interests of the farepayer and taxpayer, rather than of established rail interests*[xxxi].

The task of Network Rail

Network Rail has a duty to operate, maintain, renew and enhance the infrastructure of the railway and to provide adequate capacity to meet the reasonable requests for paths by train operators, with whom there is a regular dialogue and a more formal relationship by virtue of NR inputs into franchise specifications. It should be noted however that the governance arrangements and structure of the industry are such that there is no all-embracing master-

plan, and certainly not one embedded in a vision for the future purpose(s) of the railway based, for example, on a radical timetable concept[xxxii]. This has the effect that NR's plans tend to be driven by specific ideas from TOCs and other parties and by its own preoccupation with managing the existing infrastructure, thus creating the risk that projects may not always be well-coordinated with each other[xxxiii] and the certainty that innovative ideas for new infrastructure (HS2 excepted) may not be explored.

In carrying out these duties NR is supervised by ORR. The regulatory tools range from target-setting (such as for the punctuality of trains) through detailed analysis of working practices and benchmarking studies in order to secure greater efficiency, to the overarching system of quinquennial 'Control Periods' that provide the framework for operating and capital programmes and budgets. *In extremis*, ORR can fine NR for a failure to meet its targets or for default on obligations set out in its IM licence.

The present Control Period is the fourth (hence CP4) and will end on 31 March 2014. The fifth period (CP5) will run from 1 April 2014 to 31 March 2019. Some plans are also being made for CP6 and beyond. This report includes some references to schemes in the CP4 plans, but is mostly concerned with the CP5 plans.

ORR and NR are not however the only parties in the Control Period process. Clearly, given the scale of the public funds required for investment and DfT's role in franchising, the Government has a critical input too. The two mechanisms are the High Level Output Statement [HLOS] and the Statement of Funds Available (SoFA) [xxxiv]. The HLOS sets out the Government's specification of the broad pattern of services that it wishes to see provided in the next Period and its understanding of the infrastructure works that will be required to run them, while the SoFA specifies the provisional budget that DfT expects to have available. There then follows a negotiation between ORR and NR regarding a plan for the delivery of these statements, with the possibility that it may be necessary to go back to the Government to modify them in order to identify a workable package of proposals within an acceptable budget.

Relationships between NR and its regulator are sometimes strained. ORR's function necessarily involves a certain amount of second-guessing of NR's analysis, plans and activities, which may irritate those with the immediate responsibility, while ORR may have a more purist view of efficiency standards calculated in the abstract or from benchmarking than the body that actually has to deliver operations and projects in real time in often unfavourable conditions[xxxv]. On several occasions the tension has been sufficient to raise the possibility of legal appeals, but so far this has not happened in respect of any major issue. And currently a further dimension is that the 2012 HLOS contained suggestions for schemes that NR, probably for good reasons, had not expected. ORR's recent criticism that NR is lagging in evaluating these does seem a little unfair (see further on this below).

ORR's issued its 'final determination' on 31 October 2013[xxxvi]. Much of it confirms earlier judgments or consists of esoteric adjustments. For the present purpose the most important features were the decision to substantially increase civil-engineering spending on bridges,

tunnels and coastal and estuarine defences because of concern about the backlog of maintenance and a number of serious failures, and the acceptance that a number of major projects have not yet been developed sufficiently for a firm price to be agreed. This problem is a function of working in quinquennial cycles and will be alleviated by ORR's agreement to deal with them as plans mature during CP5.

The planning process

Initiatives in planning within Network Rail spring from its duty to ensure that the infrastructure has the capability (or qualities) and capacity (or available volume) that operators and potential operators require. The process involves a sequence of documents and background material. In 2009 NR produced in collaboration with the industry at large *Planning Ahead 2009 – Control Period 5 and beyond*, with a further version in 2010. Then in September 2011 there came the Initial Industry Plan [IIP] which, as a preferred programme and outline budget, laid the ground for the CP5 process itself by informing the Government's HLOS and SoFA.

The IIP *'set out how the industry can deliver a more efficient and better value railway and how the railway can play a key role in driving sustainable economic growth [and] examined the key choices and options facing funders in specifying the future outputs of the railway and the level of funding required'*[xxxvii]. They were produced by a Planning Oversight Group and build on the series of Route Utilisation Studies (RUSs) that began in 2006. In March 2012 ORR published its Advice to Ministers on the level of expenditure and efficiency for Network Rail's core operating, maintenance and renewals costs, but this did not consider potential enhancements or their impact on the core network.

In parallel with the Control Period cycle and the programme to refresh the RUSs, NR has begun a Long Term Planning Process. This was approved by ORR in April 2012 and Market Study documents are appearing. ORR intends it to feed into the Periodic Review in 2018[xxxviii].

Once the United Kingdom Government (through DfT) had published its Statement in the summer of 2012 Network Rail produced a series of documents. The first was a summary of the issues and aspirations entitled *A better railway for a better Britain*. Plans were outlined in the *Full strategic business plan for England and Wales*. The *Industry strategic business plan* developed the details, which are further elaborated in Route Plans for each of NR's ten areas. Finally there is a set of technical supporting documents[xxxix].

It has to be said that the volume, complexity, repetition and detail of this material borders on the burdensome. Moreover, that is not the end. The next stage is for it to be scrutinised by ORR. It issued its *Draft determination of Network Rail's outputs and funding for 2014-19* on 12 June 2013. This had 813 pages of close analysis[xl] and was discussed between ORR, NR, DfT and all other industry stakeholders; it was also open for public consultation. ORR announced its final determination on 31 October, following which arrangements for its implementation on 1 April 2014 are being made.

Principal issues for the built environment of the railway

The scale of change

A better railway for a better Britain describes the planning aspiration: '*to turn a once great but decaying part of our nation's heritage into a growth industry with huge potential for the future*'[xli]. The context is that '*railways don't just move people and freight, they also generate and spread prosperity – they can create jobs, open up new markets and, ultimately, support the growth of a new balanced economy*'[xlii]. However, right upfront, NR spells out a central issue, namely that it believes the railway is running close to capacity. Although the seriousness and imminence of capacity constraints is disputed (see further below) it is appropriate for NR to focus on the issue.

It first protects its flank by pointing out that *'Our industry does not lack ambition when it says that you cannot have everything'*: in other words the challenge is real, not imaginary or self-serving. It goes on:

'Network Rail has been trying to get this trade off [between the capacity of the infrastructure and the number of trains and passengers] right for a decade. And as an industry we have become excellent at squeezing every last improvement out of what we have got. But as demand grows, this becomes harder, and in some places impossible. That is why we are investing to deliver a quantum leap in the application of technology – potentially the biggest in 100 years. Intelligent infrastructure is a game changer leading to smarter working, lower costs, improved safety and better reliability. But this requires long-term investment.'[xliii]

Elsewhere[xliv] NR claims that it *'can deliver better value for money to customers and funders if we have the flexibility to make trade-offs at a local level between capacity, performance and cost*. The necessary works represent *'the biggest capacity improvement programme since the Victorian era'* and include:[xlv]

- 170,000 extra commuter seats at peak times by 2019 (this covers both London and major regional cities, and at least in the latter is expected to exceed growth, thereby reducing crowding)
- Rebuilding the line linking Wales and the west of England to London
- 700 more trains a day linking key northern cities
- Modern signalling allowing more trains to run closer together, safely and reliably
- Electrifying far more of the railway (some 3000 track-kilometres).

It is also intended that the railway will carry 30 per cent more freight than it does today and that technical enhancements will ensure that CO_2 emissions per passenger will be cut by 25 per cent. To achieve these ambitions it will be necessary to *'change our company, manage our assets, innovate, create more reliable timetables and work with our partners to deliver a better railway while reducing public subsidy*'[xlvi].

NR reminds readers of its documents that it is responsible for

- 30,000 bridges, embankments and tunnels;
- numerous culverts, coastal and estuary defences and retaining walls; and
- investment in replacements and new infrastructure standing at almost £5bn per year.

The modest-size Anglia Route alone has 7 'major structures', 717 overbridges, 1459 underbridges and viaducts, 116 redundant bridges, 83 footbridges, 632 retaining walls, 15 tunnel bores, 4 tunnel shafts and 28 tunnel portals. The London North East Route has 1095 overbridges, 2631 underbridges, 189 footbridges, 2285 retaining walls, 77 tunnels and 2936 culverts. It notes that the *'average age of bridge structures is 101 years old with 25% over 145 years old (the oldest being 188 years old). The historical nature of the bridge stock has lead [sic] to a wide variety of construction types and materials, including brick/stone arches, cast iron, wrought iron, early steel, modern steel, reinforced/pre-stressed concrete and timber'*. It therefore envisages no less than 1948 'interventions' during CP5, ranging from replacement and strengthening to preventative and minor works[xlvii].

There is concern about the scale of the asset-management programme:

'The majority of our structures and earthworks assets are over a century old. They degrade very slowly which, meaning their longevity, can lead to a perception that the asset is more robust than is actually the case. In the last periodic review, the case was not fully established for our proposed increase in expenditure … we have carried out extensive further analysis of the required activity and expenditure levels. This analysis supports a significant increase in renewals to address the previous under investment. Incidents at Stewarton [collapse of a girder bridge], Pass of Brander [landslide] and River Crane [water-scouring of bridge abutments], whilst not directly related to investment in a single control period, underline the need to significantly increase investment levels above those historically allocated to these assets. They also highlight that we will continue to improve our understanding of the underlying asset condition.'

Key themes

Network Rail's own ten key themes concern safety, reliable infrastructure, reliable timetables, investment, technology, customer focus, people, openness, sustainability and reduced subsidy[xlviii]. Of these the most significant for the present purpose are the connected themes of reliability and technology and the investment needed to realise the concepts.

It is emphasised, as noted above, that the age of railway structures, many of which are carrying greater loads than those for which they were designed and which have not always been properly maintained, is a cause for concern. This predicates systematic asset-management programmes to make them more resilient[xlix]. And underpinning all of NR's activities is the pressure to achieve greater efficiency: although the findings of the McNulty Review[l] have been queried, the mantra that Britain's railway is inefficient by reference to

European comparators has become entrenched and conditions both Government policy and ORR's perspective. The target is an 18% improvement by the end of CP5. Although NR is unconvinced about some of the data it is (genuinely as well as tactfully) committed to seizing opportunities to drive out inefficiencies by pursuing best European practice, preferably in conjunction with other players.

The commitment to sustainability could have profound implications for the heritage of buildings if it is conscientiously implemented, although it is not obvious from the various documents that NR fully appreciates the wide implications of resource constraints, energy scarcity and climate change. NR say that in order to *'deliver a railway fit for the future'* it will

- '*make efficient use of natural resources, innovate with sustainable materials, and reduce, reuse or recycle any waste;*
- *be energy efficient across our infrastructure and operations;*
- *use low carbon energy sources to minimise rail's carbon footprint;*
- *make our network and our operations resilient to future changes in the climate;*
- *enhance the ecological diversity of its land, increasing its economic and social value;*
- *protect land, air and water from pollution and other negative impacts;*
- *improve the accessibility and inclusivity of stations and rail services; and*
- *make a lasting positive contribution to our neighbours and the communities we serve*[ii].

NR also notes that its elderly infrastructure and operations must be adapted to make them more resilient to changes in global weather patterns[iii].

Running through the more detailed documents is the concept of Risk Based Maintenance, also referred to as Reliability Centred Maintenance and Intelligent Infrastructure. Hitherto much of the more routine elements of the works programme has been determined by time-based schedules and in reaction to particular problems. To some extent that is unavoidable, but in future the ability to monitor continuously and remotely the condition of structures and equipment will be exploited in systems that organise, explain and respond to the masses of date generated by the measuring devices. A related objective is to simplify track by removing redundant switches and crossings and local sidings. Although all this is likely to lead to important efficiencies and to a reduction in delays arising from infrastructure failures, the effect will need to be watched carefully from a conservation perspective to avoid it creating a momentum for certain works before the broader implications have been properly considered.

NR's commitment to openness should also be noted on those occasions when the company fails to consult with interested parties or acts unilaterally but insensitively in its management of one of its structures: *'We will become an open and accessible organisation which*

understands, and helps others to understand, the issues shaping the future of the railway[iii]. Likewise the commitment to sustainability: *'By placing sustainability at the heart of everything we do, we will make our business more efficient, protect the value of our assets, and deliver a railway fit for future generations'*.

Current and Future Projects

At the time of the 2011 Budget, Prime Minister David Cameron described the current and proposed investment in the railway infrastructure as '*the biggest modernisation of our railways since the Victoria era'*. At the time, the Government was committed to spending over £34bn is being spent across the network during Control Period 4 (CP4) (2009-2014), with a further £9.4bn to be invested during Control Period 5 (CP5) (20214-2019). This excludes new-build schemes such as HS2. The works include the structural enlargement of key freight routes to take larger containers and the creation of an electrified freight spine to take the largest containers; extensive track and formation enhancements for greater capacity and speed, the rebuilding or improvement of 150 stations, major alterations and improvements to a number of flagship stations (Birmingham New Street, Manchester Piccadilly, Manchester Victoria, London Bridge, Blackfriars, Paddington, Reading, Victoria and Waterloo) and the overhead electrification of an additional 850 route miles of the rail network. This is in addition to routine works such as bridge upgrading and replacement, ongoing works to enclose vulnerable parts of the operational railway network within galvanised palisade fencing and the elimination of the last 800 mechanical and manual signal boxes, the latter to take place between 2014 and 2044 at a cost of some £2bn.

The railway lines to be affected include some of the most historic in Great Britain, and indeed the world. Whilst not a complete list, excluding the Great Western Main Line, the lines proposed for electrification included all or parts of:

- Liverpool & Manchester Railway (1826-30) (electrification now approaching completion)
- Leeds & Selby Railway (1829-34)
- Manchester & Bolton Railway (1831-38)
- London & Southampton Railway (1834-40)
- Preston & Wyre Railway (1835-39)
- Bolton & Preston Railway (1838-41)
- Leeds, Dewsbury and Manchester Railway and Huddersfield and Manchester Railway (1845-48)
- Midland Counties Railway (1836-40)
- North Midland Railway (1836-40)
- Oxford & Rugby Railway (1846-5), and
- Oxford & Birmingham Railway (1848-52).

Planned Investment in Control Period 4 (2009-2014)

Over £34bn was committed across the network for Control Period 4 (CP4), delivering improvements in safety, performance, capacity and availability. This investment includes:

- £8.0bn to enhance the network, including platform lengthening and increasing capacity to enable more and longer trains to run.
- £11.5bn in renewals – replacing older parts of the network (including track, signalling and bridges) with new.
- £9.2bn on day-to-day maintenance and the costs of operating and running the network.

This investment has included:

- the Thameslink Programme, involving major redevelopments at London Bridge, Blackfriars and Farringdon stations;
- the East London Line extension (with Transport for London);
- peak train lengthening on many routes into London and other cities;
- King's Cross station redevelopment (new western concourse, new 12-car platform and better links with London Underground and St Pancras International);
- Redevelopment of Birmingham New Street station;
- Reading station capacity enhancement and redevelopment;
- Significant investment in the main line corridors, including preparing the infrastructure for the introduction of the new Intercity Express trains on the East Coast and Great Western routes and linespeed improvements on London to Sheffield and Manchester to Leeds routes;
- Improvements to at least 150 stations across the network in England and Wales under the 'National Stations Improvement Programme' and accessibility improvements at 100 stations under the 'Access for All' programme;
- Investment to allow freight trains to use the route between Peterborough and Doncaster via Lincoln, thus relieving the East Coast main line;
- Enhanced freight capacity between Ipswich and Peterborough; and
- Creation of a large container diversionary route between Southampton and Basingstoke.

£3.7bn was also set aside during the CP4 delivery period for further investments not funded through the periodic review. This £3.7bn includes:

- Crossrail work at Paddington and other stations east and west of London.
- London 2012 enhancements
- Edinburgh to Glasgow improvements
- Southampton to Nuneaton W10 gauge clearance (for larger containers), involving modification or replacement of some 50 separate structures (i.e. modification or replacement of 1 bridge every 2.74 miles).[liv]

In most cases these projects have been completed.

2010 Northern Hub Project

In addition to the planned CP4 works, in 2010 the Government announced the addition of the 'Northern Hub' project, intended to aid regeneration across the Merseyside and Yorkshire. This initially comprised the modernisation and electrification of the following routes by 2018: [lv]

Overhead electrification: Manchester to the airport: by December 2013

The first phase of work between Manchester and the airport is well underway. Bridges and parapets were modified and upgraded parapets along the route in 2012, with Overhead Line equipment (OLE) installed 2012-13.

Overhead electrification: Manchester to Liverpool, and Huyton to Wigan: by December 2014

Bridges rebuilt or modified and parapets increased on the original Liverpool & Manchester route and between Huyton and Wigan 2011-2012 and four-tracking in the Huyton - Roby area. OLE currently being installed. Completion planned by 2014.

Overhead electrification: Preston to Blackpool: by May 2016

To prepare for electrification Network Rail is currently rebuilding or upgrading bridges and tunnels, whilst carrying out safety improvement work to parapets. 15 bridges need to be modified on this route, including:

- 11 reconstructions
- 3 track lowerings
- 1 bridge removal

This is the only section for which Network Rail has published figures for bridge reconstruction and modification. For the 17-mile route, this represents 1 bridge reconstructed or removed every 1.2 miles. Overhead line equipment on this route will be installed in 2014/15/16.

Overhead electrification: Manchester to Bolton and Preston: by December 2016

Currently at the planning stages. Network Rail propose to start preparatory work on the bridges and tunnels in 2014 and 2015, with a view to installing the overhead line equipment shortly afterwards. The line is programmed to be fully electrified by December 2016.

Overhead electrification: Manchester to Leeds and York via Huddersfield

Funding to electrify the Standedge route from Manchester to Leeds and York was announced in November 2011. Network Rail have been carrying out assessments of the bridges and tunnels between Manchester and Leeds to understand which structures need to be modified for electrification. Network Rail have said that the outcome of this work would be discussed with local authorities and stakeholders. Electrification will be extended to York via Micklefield. Beyond surveys and advanced planning, little physical work has commenced.[lvi]

In Autumn 2011 the Government announced a further £477million of additional investment for the 'Northern Hub' project, jointly funded by Network Rail and the regional passenger transport authorities. The additions include:[lvii]

- Redevelopment of the Grade II Manchester Victoria station, including replacement of 19th-century trainshed overall roof with ETFE 'tent'. The contracts for M&E design work and design of the 'tent' have been let.
- Two new through platforms at Grade II Manchester Piccadilly station, providing more direct train services across the North
- New 'Ordsall Chord' link between Manchester Victoria and Manchester Piccadilly and capacity improvements on the 'Castlefields Corridor' to allow through running across the city. It had been hoped that a route would be selected that would avoid cutting across the throat of the Grade I Manchester Liverpool Road station, but for reasons of cost this option was rejected by Network Rail. The station will thus be was severed from the Grade I River Irwell bridge and the national railway network. The planning application was submitted in September 2013.

Additional tracks and passing loops in the Hope Valley at Dore & Totley, Grindleford and Chinley are also required in order to enhance capacity and improve journey-time. The work at Dore involves the restoration of the second platform on the westbound line, but it is unclear whether platforms will be restored on the Midland Main Line tracks at the same time.

Just before completion of this Report DfT announced[lviii] that the Wigan (North Western) - Westhoughton - Lostock Junction [- Bolton] line is to be added to the Northern Hub electrification scheme in order to *'enable the conversion of the busy Wigan to Manchester Victoria services and Wigan to Manchester Airport services from older Pacer diesel trains to more modern and higher capacity electric trains.'* It is noted that statement referred to *'Wigan (North Western Station)'* (on the electrified West Coast Main Line). The present services run instead to Wigan Wallgate (Grade II), continuing as through trains from and to Southport or Kirkby.

Control Period 5 (CP5) improvements (2014-2019)

NR list the major projects for CP5 as the completion of Thameslink and Crossrail, electrification of the Trans-Pennine route via Huddersfield, the electrification of the Midland Main Line and Great Western Main Line (and probably the Valley Lines in South Wales), the

remaining stages of station redevelopment at Birmingham New Street, Reading (including the new track layout) and London King's Cross, completion of the Northern Hub and North West electrification projects in Lancashire and Yorkshire, a substantial project at London Waterloo (including bringing the former Eurostar platforms back into use and urgent work to remodel the tired track layout in the 'throat'), the introduction of a new fleet of inter-city trains and the Edinburgh to Glasgow Improvements Programme. It is recognised that these large projects will change outputs, ie. train services, fundamentally but that detailed work on the implications remains to be done.

Approximately £5.2bn of funding was initially set aside for infrastructure enhancements for Control Period 5, covering the five financial years from 2014/15 to 2018/19. On top of this, the Government has recently committed a further £4.2bn worth of new rail schemes. In addition to works to committed CP4 schemes continuing into CP5, these project include: [lix]

Midland Main Line Electrification (MML)

This comprises an £800 million 25KV AC overhead electrification and upgrade from Sheffield and Nottingham to Bedford, completing the full electrification of the Midland Main Line out of London St Pancras. Included in the MML project are:

- Kettering – Corby 25 Kv AC overhead electrification;
- Kettering – Corby capacity enhancement (additional double track); and
- Leicester area capacity enhancement (freight/passenger crossing flows);
- Derby station area remodelling in conjunction with renewals;
- Sheffield station area remodelling in conjunction with renewals;
- Substantial structural gauge enhancement from W6A (3.965metres to bridge soffit), possibly to W12 (5.6 metres to soffit height).[lx]

Great Western Main Line (GWML) and Valley Lines Electrification

Bridge and other works are already in hand in advance of the full electrification of the Great Western Main Line from London Paddington to Cardiff Central. NR state[lxi] that *'Proposed expenditure on Great Western electrification has increased by over £300m due to increased scope (including new bridge reconstructions) and the development of an electrification system that meets the requirements of European regulations and those of new trains'*.

Additional electrification is planned for the Thames Valley branches, the South Wales Mail Line from Cardiff to Swansea, the Vale of Glamorgan Line and Welsh 'Valley Lines'. The additional works in England include:

- 25 kv AC overhead electrification of Acton – Willesden,
- 25 kv AC overhead electrification Slough – Windsor,
- 25 kv AC overhead electrification of Maidenhead – Marlow,
- 25 kv AC overhead electrification of Twyford – Henley-on-Thames

Oxford station area capacity enhancement and station enlargement.

Route gauge clearance for new generation passenger trains is also proposed for the West of England Main Line (Bristol - Penzance).

Greater Bristol

In order to facilitate the introduction of the IEP long-distance trains, including four trains/hour between Bristol and London, together with faster and more frequent services on other lines there are proposals for an additional platform at Bristol Parkway, four-tracking of Filton Bank, remodelling of Bristol East Junction, and an additional platform, extra station capacity and a master plan linked to wider urban redevelopment at Bristol Temple Meads. The latter has now emerged as a very ambitious scheme indeed with profound implications for the classic Brunel and Great Western buildings. A Memorandum of Understanding was recently signed between Network Rail, Bristol City Council, West of England Local Enterprise Partnership, Homes and Communities Agency and English Heritage.

East - West Rail

This project will provide additional capacity to accommodate growth in freight and passenger markets by upgrading the Bedford - Bletchley - Bicester - Oxford railway (including reopening Bletchley – Bicester section to passenger traffic and rebuilding the closed Calvert – Bletchley section) to create a direct link between the Midland, West Coast and Great Western Main Lines. The project incorporates the Chiltern Railways scheme to open a new Oxford - London Marylebone route by building a curve between the former London & North Western Line and the former Great Western Birmingham main line at Bicester. At a later stage the promoters (primarily local authorities) hope to recreate the Cambridge - Bedford link, but new alignments will be required in several places due to significant parts of the trackbed having been built on.

The Electric Spine

Possibly less likely to come forward is the creation of a high-capacity 'electric spine'. The concept, announced by the Prime Minister in 2011, is for an electrified freight artery running from Yorkshire and the West Midlands to the South Coast ports, utilising the northern end of the electrified Midland Main Line, then newly electrified lines from Nuneaton and Bedford to Oxford, Reading, Basingstoke and Southampton. If this does go ahead it will include: [lxii]

- Southampton Port – Basingstoke enhancement from 750 DC third rail electrification to 25 kV AC overhead electrification;
- Basingstoke – Reading 25 kV AC overhead electrification;
- Oxford – Banbury - Leamington Spa 25 kv AC overhead electrification;
- Leamington Spa – Coventry capacity enhancement, 25 kV AC overhead electrification and additional double track;
- Coventry – Nuneaton 25 kV AC overhead electrification; [lxiii]

Interestingly, the Electric Spine is downplayed by Network Rail in its most recent Strategic Business Plan. It is described as *'a major north-south rail electrification and capability enhancement to improve regional and national connectivity'*, but, having emphasised the role of the long term planning process, NR rather pointedly explains that some schemes specified in the HLOS had not been identified in the IIP or developed through the industry processes and hence that it had had only *'limited time to understand'* them, most notably *'elements of the electric spine'*[lxiv].

The concept links together the Midland Main Line (MML) electrification, the upgrade of the East - West line (Bedford - Bletchley - Oxford), the Great Western Main Line electrification and conversion of the Basingstoke - Southampton line from third-rail DC to 25kV AC overhead traction in order to create a new freight and passenger corridor. It has elicited surprise in the industry, which had not previously considered the route in these terms. The issues are these:

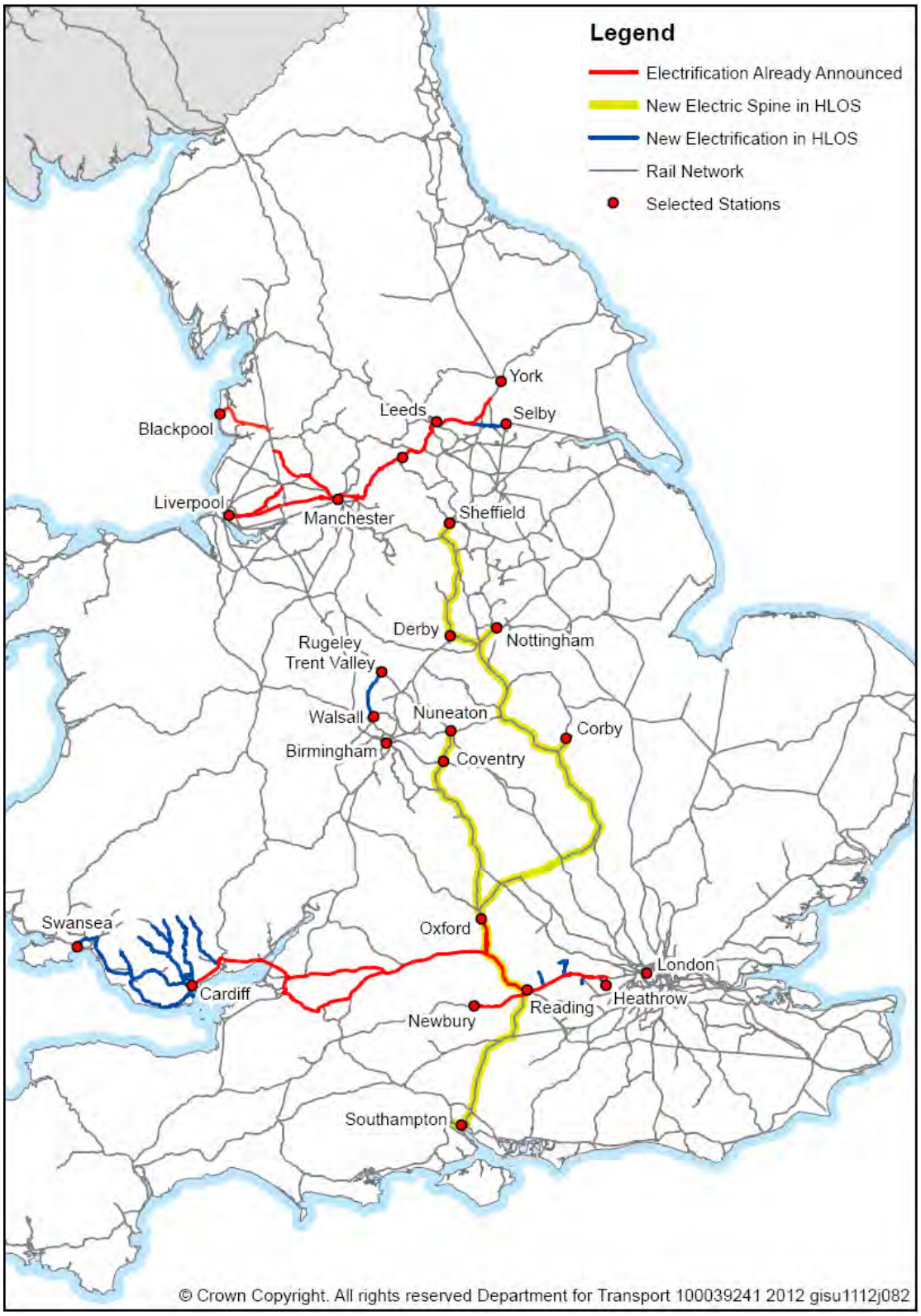
- considerable resources have already been invested in creating capacity for container trains between Southampton, the West Midlands and the WCML, including gauge-enhancement and the diversionary route via Salisbury and Andover, and it is not obvious how much of these flows would benefit from transfer to MML;
- although Southampton will surely retain its status as a major port it will face fierce competition from Felixstowe, possibly Harwich Bathside Bay and certainly the new London Gateway which this spine route cannot do much to moderate;
- the principal passenger route is that via the West Midlands, presently served by CrossCountry, and while the East Midlands connection merits development it is not of the same market-size;
- replacement of diesel trains by electric stock is plainly desirable, but this can only be considered at the network level where gaps elsewhere must be closed before through working can be contemplated;
- the technical case for replacing third-rail electrification is strong in principle but hugely complicated in practice in terms of programming, interaction with fleet renewals and everyday operations, yet this proposal has no such context and is not self-evidently the best place to start; and
- it would be absurd to commit to the spine project unless and until the freight operators guarantee that they will deploy electric rather than diesel locomotives, something that at present they are not willing to do.

While parts of the electric spine scheme may materialise in their own right it seems unlikely that it will do so as a single scheme. Attention should therefore be directed to the parts. In particular, if third-rail conversion does become a serious agenda item it would be desirable to

study the inventory of buildings and equipment specifically associated with that system (but note that little has been heard publicly since the HLOS announcement).

Barnt Green – Bromsgrove Electrification

Also included in the settlement for delivery early in Control Period 5 is the 25kV overhead electrification of four miles of the Birmingham – Bristol main line, from Barnt Green to Bromsgrove. This section is the famous 1-in-37 Lickey Incline, built by the Birmingham & Gloucester Railway (opened 1841). The project involves the replacement of four bridges over the railway (or track lowering beneath them) and the construction of a new station at Bromsgrove.


Legend
Electrification Already Announced
New Electric Spine in HLOS
New Electrification in HLOS
Rail Network
Selected Stations
York
Leeds
Selby
Blackpool
Liverpool
Manchester
Sheffield
Derby
Nottingham
Rugeley
Trent Valley
Walsall
Nuneaton
Corby
Birmingham
Coventry
Swansea
Oxford
London
Cardiff
Heathrow
Reading
Newbury
Southampton
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East Coast Main Line

Introduction of the Intercity Express Programme (IEP) trains on ECML will necessitate infrastructure work at certain locations to accommodate their 260m length and also upgrading of power supplies. The big projects are the new flyovers north of Doncaster and at Hitchin and the reconstruction of Peterborough station to provide additional tracks and platforms and an improved entrance, but no detail of the smaller schemes has yet been published.

West Coast Main Line (WCML)

NR point out that the WCML is *'the busiest mixed traffic railway in Europe'*. There are 12 different operators. *'Fast and slow passenger trains mix with each other and heavy freight trains. Different trains stop at different stations, with different frequency, and other lines join it at regular intervals'*[lxv]. Hence timetabling and real-time management are an enormous problem. It is assumed that *'pricing people off the railway'* is unacceptable[lxvi] and that new capacity will be required. Although the environmental impact will therefore be largely felt in the form of additional tracks on existing or widened formations or even on completely new alignments, it is also likely that structures on the classic lines will be threatened by platform-lengthening, reconstruction of stations or the interpolation of new junctions.

On the WCML the building of a flyover and associated works at Norton Bridge, just north of Stafford, is proceeding through the approvals process. This grade-separation is highly desirable for operational reasons and is unlikely to affect any significant railway heritage. A larger project to bypass Stafford has been considered and could have a greater impact if it were to proceed, especially if it seeks to deal with the capacity problem on the twio-tarck bottleneck through Shugborough Park and tunnel and Colwich Junction (south of Stafford), an area that includes listed structures and a Registered Park[lxvii]. An upgrade of the traction power supply will be required.

Tension between Virgin Trains and Network Rail over the condition of the WCML south of Rugby and frequent operating incidents led to an agreement to study the problems together. The joint report was well received. Some measures, such as improvements in the maintenance regimes for pointwork and overhead electrical equipment, are unlikely to have any visual impact, but action to address trespass and suicide may do so. Sections of line where these often cause disruption are being assessed for the efficacy of more substantial lineside fencing, while barriers on platforms may have some deterrent effect on suicides.

Cross-country

There is a scheme to raise line speeds, reduce journey times, bring performance improvements and increase passenger and freight capacity between Barnt Green (the traditional London Midland / Western Region boundary in the south-western outskirts of Birmingham) and Westerleigh Junction (where the cross-country line through Cheltenham joins the Great Western Main Line east of Bristol Parkway). A similar scheme is in hand for

the 'Oxford Corridor', the line from Birmingham and Coventry to Didcot via Leamington Spa and Oxford.

Strategic Freight Network

The Strategic Freight Network (SFN) was conceived by the Department for Transport in 2007 in order 'to provide a framework for investment and network management to better meet freight requirements'. By reducing conflicts with passenger traffic and creating new capacity it would 'improve the logistical efficiency of the railway and secure … reliability gains to benefit all users'. Detailed analysis identified routes that would be prioritised for clearance for larger gauges, lines that could be reopened and sections that would facilitate diversions (the freight industry attaches particular importance to this since it expects the same all-hours route availability as is normal on the roads). Funds were set aside for SFN works during CP4, and it was envisaged that the programme would continue through CP5. Staging was to be influenced by what could be undertaken as a component of wider projects[lxviii].

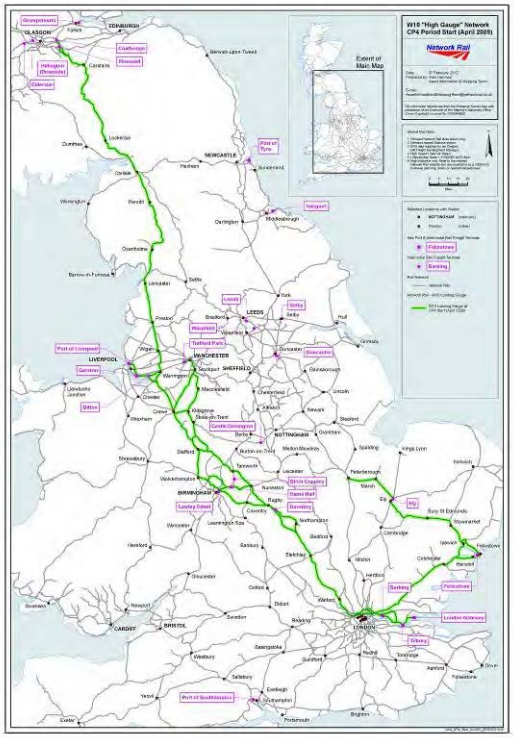
Each of the principal commodities carried by rail was considered. For most bulk flows (coal, oil, steel, construction materials, waste) the requirement would primarily be for additional and sounder paths. In the present context the most significant element would be the provision of capacity for the expected continuing growth in the conveyance of maritime containers and in particular gauge clearance to accommodate the increasing proportion of 9'6" (2.9 m) boxes[lxix]. This intermodal traffic would require the largest normal British gauge, known as W10, to be made available on the principal routes between the container ports and the inland terminals.

The routes identified were the Great Eastern, East Coast, Midland, West Coast and South Western Main Lines, the cross-country route between the Haven Ports, Peterborough, Leicester and Nuneaton, Crewe - Stoke-on-Trent - Derby, and the Southampton - Oxford - West Midlands corridor. The germ of the 'Electric Spine ' concept (see below) can be seen in the proposal to develop the part-abandoned Bedford - Bletchley - Oxford line to provide alternative links with the West Coast and Midland Main Lines. A key diversionary route was to be the Andover loop (Basingstoke – Andover – Salisbury – Romsey – Southampton) to provide an alternative route when the South-Western main line is affected by engineering works. The partially-closed line between Lichfield City, Ryecroft Junction [Walsall], Bescot and Stourbridge Junction was to be safeguarded from development in case extra capacity or a diversionary route were required north of Birmingham.

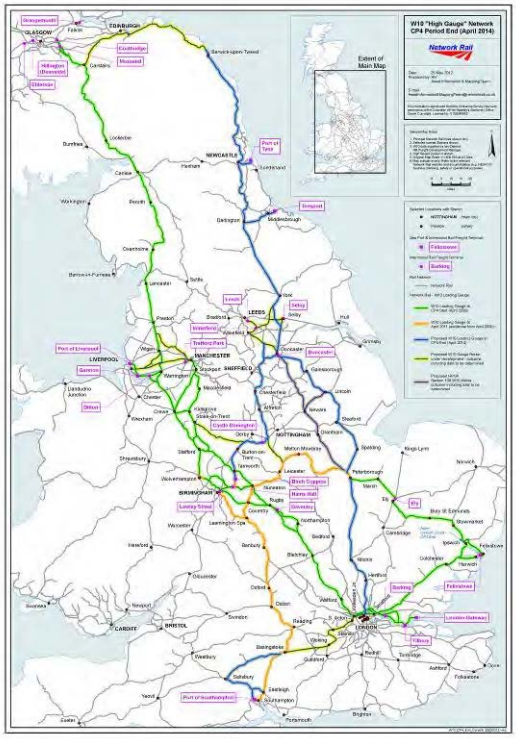
Apart from the 'Continental' gauge (which cannot be achieved on the British network at an acceptable cost, except for some short sections linked to the High Speed 1 Channel Tunnel line) there is one gauge larger than W10, namely W12. On electrified routes, this resulats in bridges being raided from a soffit heightr of just under 4 metres to a soffit height of 5.6 metres. The W12 gauge enables refrigerated containers that are 9'6" high but slightly wider than standard boxes to be conveyed by rail. However the works so far undertaken to implement W12 are too patchy for it to be effectively available for whole routes. The expenditure will therefore only come to fruition when further work is completed, and for that there does not appear to be a systematic plan. It is noted that W12 is the structural gauge

adopted for new bridges on GWML and it is currently proposed that the MML electrification results in the creation of freight corridor to W12 standards throughout. The feasibility of this remains to be established.

The current nation-wide W10 gauge enhancement programme is illustrated in two accompanying charts obtained from Network Rail. They show the position in April 2009 at the start of CP4 and the position as it is expected to be in April 2014, at the end of CP4. It will be seen that a great deal has been or will shortly be accomplished and an effective network is now available for most combinations of port and inland terminal. It is expected that the emphasis in CP5 will shift to better timetabling and where necessary to extending loops to allow longer trains to run. This will clearly have much less impact on structures than the ongoing structural gauge enhancement works.



W10 Freight Network, April 2009



W10 Freight Network, April 2009

The completed additions to the W10 network during CP4 comprise Peterborough - Nuneaton and Southampton - Nuneaton and Birmingham. The East Coast Main Line between Berwick-upon-Tweed and Doncaster, the 'GN&GE Joint Line' between Doncaster and Peterborough and the ECML between there and London will be completed by the end of the period, together with the Teesport - Darlington line (including part of the original Stockton & Darlington Railway) [lxx], South Yorkshire - West Midlands and the Basingstoke – Salisbury – Southampton diversionary route.

Some key connecting projects remain to be completed later, including Carstairs (on the WCML) … Edinburgh … Berwick (without which the northern part of the ECML is of little use),

some sections in West Yorkshire and works in the Manchester / Liverpool area (the latter presumably largely being undertaken during the 'Northern Hub' electrification works), Stoke-on-Trent - Derby and the South Western Main Line between Basingstoke and London, including its links across London. Work on the Doncaster - Peterborough section of the ECML, including Lincoln – Newark, is being planned on the basis of a Section 106 agreement with Hutchison Ports (UK) [HPUK], made when the company was granted planning permission for expansion at the Port of Felixstowe.

Summary Business Plans for each Network Rail Route (Control Period 5)

Each Route has produced a Business Plan which supplements the documents of the national plan[lxxi]. They contain a great deal of detailed material as well as expressing the route manager's corporate ambitions and business-speak messages. As a result they can become tedious to read, especially since some have not been decently edited. All the plans emphasise the growing importance of Remote Condition Monitoring and of the ORBIS programme for more detailed and more efficient asset management.

London North Eastern (LNE)

The LNE Route Plan first notes the ECML CP4 schemes on which work is underway in preparation for the new fleet of IEP trains and the associated recast of the timetable: new flyovers at Doncaster North Chord and at Hitchin, layout and station improvements at Peterborough and on the Alexandra Palace - Finsbury Park section, and work to improve the route via Lincoln so that freight can be transferred from the main line. In CP5 ETCS will be implemented on the south end of ECML and Colton Junction / Selby - Micklefield Junction - Leeds will be electrified as part of the trans-Pennine project (or possibly in advance of it, by autumn 2014 – though this was probably spin since no further announcement has been made). The new Rail Operating Centre at York, one of the 14 planned for the network, is under construction. And there is a commitment to 'improve connectivity and performance', although the Plan merely states that the Route *'will work with the industry to identify the most appropriate interventions'*[lxxii].

During the final year of CP4 gauge rectification works at tunnels and bridges, ranging from track lowering or sluing to complete renewal, will return fifteen sections to their intended gauge. They include Newcastle - Carlisle, Stillington - Ferryhill, Hull - Bridlington, Harrogate - Leeds, Skipton North Junction - Chesterfield, Leeds - Bradford, Milner Royd Junction - Bradford and Barnsley - Sheffield. The reconstruction of Wakefield Westgate station will also be completed: this comprises replacement of the remaining canopies, repair of the Listed buildings on the down side and a new building to replace more modern structures on the up side.

CP5 projects that may have some effect on older infrastructure include further work at Leeds, Doncaster and Sheffield stations and the ambitious scheme to transform Newcastle Central, the Hull to Gilberdyke, South Humberside and Horbury Junction - Barnsley - Meadowhall linespeed improvements, a small project at Marsden for the same end and new freight

capability for the Port of Tyne, Teesport and Immingham. It is possible that improved provision for intermodal freight may lead to plans for a flyover at Werrington Junction north of Peterborough, but its construction could seriously disrupt ECML services. The 'electric spine' scheme did not include three key links in the Sheffield area, namely Doncaster South Yorkshire Junction - Sheffield, South Kirkby Junction - Swinton and the Rotherham - Beighton Junction - Chesterfield freight line, but LNE expects these to be covered in CP6.

East Midlands

The headline scheme is of course the electrification of the Midland Main Line between Sheffield, Derby, Nottingham and Corby and Bedford. This is intended to include structural gauge enhancement (probably to the full W12 gauge) for intermodal freight trains. Other works are expected in order to realise the concept of the 'Electric Spine'. These will mostly be 'capacity interventions' such as realignments, extra tracks and platform lengthening that may incidentally involve historic structures. One particular case is the curve at the Grade II Market Harborough station, easing of which will result in the railway being re-routed to the west of the Listed station building, rather than to the east as at present.

The route has seven major structures 'which are large, unique and require specific management plans': they are Harpers Brook Viaduct, Harringworth Viaduct (Grade II), Mansfield Viaduct, Trent Viaduct (fast lines), Welsh Harp Viaduct the Wichnor Viaducts over the rivers Trent and Tame and the Chiltern Green Viaduct (slow lines). The route has at least two Grade II signal boxes, Sudbury (1885) and Oakham Crossing (1899), which are expected to close in 2015.

London North Western (LNW)

The Route Plan includes a particular emphasis on maintenance of its stock of buildings: *'The large number of buildings provides an opportunity to reduce energy consumption and improve energy efficiency. The route's Accommodation Strategy proposes to rationalise and consolidate properties in order to reduce the number required. The replacement and refurbishment of structural assets across the route will be reviewed prior to expenditure and exploration of opportunities to improve the whole life cycle sustainability of those projects will be considered, e.g. retro-fitment of buildings with energy efficient technology. The route is considering setting minimum specifications for sustainability in its buildings portfolio. The use of the national assessment tool (BREAAM) [sic] will be mandated and the industry recognised carbon calculator will be used to enable carbon output to be measured'*[lxxiii]. It also emphasises that Network Rail *'has a legal obligation to protect the environment within which it operates'* and hence that *'the Route will continue to work alongside the appropriate organisations to ensure ongoing operations, infrastructure maintenance and enhancement activities have minimal impact on the aesthetics of the environment and it surroundings'* and that *'any major projects will automatically have environmental impact assessments'*.

Projects that may affect structures include the Northern Hub works in Greater Manchester; new plaforms and other improvements at Liverpool Lime Street station (Grade II);

modernisation and capacity enhancements at Moorfields in Liverpool and at Birkenhead Hamilton Square station (Grade II); partial doubling of the Redditch branch at Alvechurch; a new station at Kenilworth; the rebuilding of the East - West line between Bedford and Oxford, including the new link with the Chiltern main line at Bicester; and alterations at Watford Junction to accommodate the diversion of Metropolitan Line trains from Watford, London Underground.

No fewer than 56 'complex structures' and 20 major bridges will require attention in CP5 as part of a long term sustainable approach to maintenance. One example is the 49 spans of Whalley Viaduct (Grade II) in order to prevent pier settlement caused by the deterioration of the original timber piles. Certain long timber bridges (presumably in Wales?) will receive accelerated replacement.

Anglia

The scale of the challenge facing the route is evident in a list of the key capacity and capability issues, such as single lines, the mix of different types of train, constricted layouts and lengthy signalling headways, and inadequate space at busy stations. It is however unlikely that many of these can be addressed in CP5, but all have implications for the longer term[lxxiv]. 'Strong passenger growth' is expected, and it is assumed that the number of trains run will increase. Specific infrastructure measures include renewing lineside security fences (primarily to prevent incursions by large animals) and vegetation management to maintain sight lines and to control low-adhesion risks.

The RUS that focussed on Stations identified the need to relieve congestion at London Fenchurch Street (Grade II) (work was brought forward and has now been completed) and probably to intervene in due course at Barking and Tottenham Hale stations. Developments are in hand at Cambridge and Seven Sisters stations in CP4. At Cambridge this is in conjunction with redevelopment around the station with office, retail and residential units. Improvements to the forecourt area and station buildings themselves are being made under Section 106 obligations and include relief for the well-known crowding problem. The works have involved an additional platform, losing Cambridge its status as England's last 'one-sided' main mine station. Alterations for operating purposes are likely at Colchester and Witham stations. London's Liverpool Street station requires regular maintenance due to high passenger volumes and its age, and renewal of the Grade II train shed roof is programmed.

Six bridges between Norwich and London Liverpool Street are due to be replaced, together with ten in the Lea Valley and a number on the Barking to Fenchurch Street line. Bridge strengthening works are planned between South Tottenham and Woodgrange Park. The route between Woodgrange Park Junction and Gospel Oak Junction is to be electrified (that this was ever conditional resulted from an argument over funding). A number of bridges that are known to fall short of modern standards will also need attention, and the condition of many post-war pre-stressed concrete bridges is giving concern. The four swing bridges require constant maintenance.

New stations are to be built at Soham and Lea Bridge. The Kew Branch is to be cleared to W10 structure gauge. Six mechanical signalboxes in the Norwich area will be closed when control passes to the Romford Regional Operating Centre. During CP5 eight carriage washers will be replaced, seven stations and maintenance depots will be relit and rewired and some station canopies will be renewed. The Summary Business Plan states that *'There is a dilapidated Grade II listed engine shed at Clacton on Sea'*, but it is unclear what is meant. The old wooden-roofed engine shed, which is not Listed, was reused as a traction maintenance depot on electrification. It was substantially refurbished with a new roof and new administration block in 2010, at a cost of £1.5million[lxxv].

Western

As befits its history, the plan for the Western Route has a distinctive section on its approach to its built heritage[lxxvi]. It is worth quoting in full (whether the Route always lives up to its aspirations is for others to judge).

'The Western Route's historical and architectural significance is recognised and the teams work closely with English Heritage and other conservation/heritage bodies to make sure sensitive structures are safeguarded. There are nearly 200 listed structures, stations and signal boxes including two of the nation's Grade 1 listed stations, London Paddington and Bristol Temple Meads. It is also responsible for Grade 1 listed structures including Wharncliffe Viaduct near Southall and the Royal Albert Bridge that spans the River Tamar.

Network Rail's 10-year improvement plan includes electrifying part of the route. An example of engagement in heritage resulted in English Heritage launching a consultation on the architectural importance of structures along the Great Western railway in 2012. That work has led to 40 new listings and listing upgrades including Box tunnel and the Maidenhead Railway Bridge. This approach protects sensitive structures whilst major improvement work is delivered. The approach has impressed English Heritage with the evident commitment to respecting the special structures in Western Route's care.

Novel solutions will need to be deployed to enable electrification through these heritage assets and the Western Electrification team are currently developing acceptable solutions in liaison with Heritage bodies.

Through CP5 the Route will continue to refine its approach to further improve its proactive asset management of listed buildings. This will be achieved by ongoing review of the heritage portfolio and prioritising interventions based on condition, significance and heritage status. This will avoid deterioration of historic fabric and allow the maintenance of these important assets in accordance with their heritage status.

Novel approaches and innovations will continue to be deployed such as the replacement of a listed footbridge at Dawlish station with a fibre reinforced polymer replacement moulded with the same detail as the original, including the rivet heads.

By the end of CP4 the Route will have spent £80m on works at Paddington and the Royal Albert Bridge.

Paddington station was built in 1854 with Span 4 added in 1916. The works to Span 4 included major steelwork repairs, scrollwork repairs and replacement, re-glazing and re-lighting. This resulted in winning the 2012 National Heritage award for station environment. Works to refurbish Spans 1-3 in a similar vein are also planned so that by the end of CP4 Paddington station train shed roof will be restored to a condition not seen since the mid twentieth century.

Royal Albert Bridge was completed in 1859. The works being undertaken in CP4 concentrate on the iconic central span and involve major steelwork repairs, including replacing around 50,000 bolts, and repainting of c.18,000 metres square of structure. This will allow it to continue to stand as a testament to the engineering genius of Isambard Kingdom Brunel.

Listed areas are demarked by their curtilage and not all assets within it are necessarily part of the listing. In CP5 the Route is planning major refurbishment of Bristol Temple Meads ahead of electrification. In order to understand and fully categorise the significance of the fabric within the station environs, a conservation statement is currently being developed and consulted with the various heritage bodies. This work is essential to inform and enable proposed enhancement works associated with the 10-year improvement plan including the station master plan and the Western enterprise zone, with Temple Meads at its heart.

Structures works included in the CP5 bid include the 17 approach spans to the Royal Albert Bridge, which will mean that the structure in total is refurbished at the most appropriate time for whole-life asset management. Other works in CP5 target planned preventative maintenance of listed structures safeguarding their condition for now and the future.'

Crossrail requires reconfiguration of the relief lines between Maidenhead and London Paddington, including platform extensions for longer electric trains at Maidenhead, Taplow, Slough, Langley, Iver, West Drayton, Hayes & Harlington, Southall, West Ealing (plus a new bay platform for Greenford services), Acton Main Line and Ealing Broadway. Other works are the redoubling between Kemble and Swindon, the proposed reopening to passenger traffic of the Portishead branch (presently freight only) and the imminent major repairs to Whiteball Tunnel.

Wessex

Some twenty bridge reconstructions of a scale requiring 48-72 hour possessions are likely to be undertaken in CP5. Another acute problem is presented by the long, deep cuttings on the approaches to tunnels where unstable ground may necessitate reducing the slope and removing vegetation (the risks attendant on a derailment and its aftermath at these locations are high). The tunnels at Honiton, Crewkerne and Gillingham are likely to be addressed. Of bridges on the route the structures over the rivers Avon and Stour will need attention, as will

the large bridge over Westminster Bridge Road immediately outside Waterloo (this will be programmed with the reconstruction of the track in the 'throat' of the station).

Like the Kent Route, Wessex notes the large number of lineside buildings (982 in total), the mediocre state of repair of many of them, their criticality to operations and hence the need for systematic overhaul.

Sussex

Rebuilding London Bridge for the enhanced Thameslink service in 2018 is imposing severe operating constraints and hence limiting other works on this Route. Nonetheless current projects include the developer-led replacement of the principal buildings and the addition of an extra platform at Redhill and an extra platform at Gatwick Airport. More substantial schemes are being prepared for CP6 and may include grade-separated junctions and additional tracks to increase the capacity of the Brighton Main Line[lxxvii] and station works to aid passenger flow at Wimbledon and at the Grade II London Victoria (the latter described as 'concourse decongestion').

As with other Routes, Sussex faces the need to attend to major structures. Hooley Cutting near Redhill has required reworking of its slopes, Chelsea River Bridge (the Grade I Cremorne bridge?) a major overhaul and Goat House Bridge at Norwood Junction upgrading to modern standards. In CP5 work on the viaducts at Shoreham (over the Adur) and Thorndell is being planned, as is replacement of timber components on the Arun River Bridge at Pulborough. At least 16 underline bridges will be rebuilt to avert structural problems, and Mitre Bridge carrying the West London Line over the Great Western Main Line also needs attention. The comprehensive refurbishment of the Grade II Brighton station has just been completed, and East Croydon station is being rebuilt to cope with increasing footfall.

Kent

Major works are under way at London Bridge, including the dismantling of the Grade II-listed train shed (to be re-erected in part in Aberystwyth). A new station for Rochester has been received planning consent; this will be on a fresh site, rendering the present station redundant. Other major structures that are expected to need extensive works are the river bridges at Charing Cross (Hungerford) (strengthening), Cannon Street (painting) and Rochester; Southborough Viaduct (response to scouring); and Sevenoaks and Bo-Peep tunnels. The coastal line between Folkestone and Dover passes through or alongside unstable chalk formations, and work may be required on the Abbotscliffe, Shakespeare and Martello Tunnels. Minor works may be undertaken at stations to secure level access.

Approximately 600 operational lineside buildings support the network in Kent, of which many need repair. A number of Southern Railway reinforced concrete footbridges (the 'Exmouth' type) survive, but these are being rapidly replaced; in some cases lifts may be installed. In the longer term alterations to stations could accompany the possible transfer of the Hayes branch to London Underground as an extension of the Bakerloo Line.

Station Improvements

All operational main-line railway stations are owned by Network Rail. The company directly manages 11 major stations in London and the six busiest outside London (and will shortly add Reading). The remainder (some 2500 of them) are leased to the TOC (or principal TOC) serving them. NR therefore has prime responsibility for their managed stations and for capital works at all others, while the TOCs undertake maintenance and minor works under the terms of their contract. In practice a TOC may lead in proposing and supervising an upgrade. The Scottish and Welsh Governments, Transport for London and many other local authorities also become involved in enhancements.

Network Rail operational improvements

Numerous schemes for stations are being developed and implemented. Some will be at least partially rebuilt in order to address particular problems. For example, at Westbury reintroduction of a former platform is being considered in order to provide additional capacity and greater operational flexibility[lxxviii] and at Rochester the only way to provide extra capacity has proved to be to build a new station on a new site (which will also have a better relationship with the town); what will be done with the 1892 building is not yet known although demolition seems likely. To bring it into the electrified Birmingham Cross-City Line Bromsgrove is to have a completely new station and its second platform restored, although here virtually nothing of the original buildings has survived.

The Grade II Manchester Oxford Road station is to be extended, with the new design incorporating the Modernisation Plan entrance. Liverpool Central needs attention as part of the upgrading of the City's Underground network. The task of transforming the fine but neglected Grade II* station at Nottingham is nearly complete, while works at Reading and at the modern but tired Birmingham New Street are well advanced. The Grade II Manchester Victoria station is also in the course of similar work, also involving the loss of its train shed. Schemes to improve circulation may affect historic fabric, as at the Grade II London Fenchurch Street (the original train shed roof was removed some years ago). On the Thameslink and Crossrail routes in London the reconstruction of Stratford and Blackfriars stations has been completed, the new station at Farringdon (Grade II) is taking shape, the low-level platforms at Paddington (Grade I) are in hand, and the major rebuilding of London Bridge has begun – with the loss of some important historic features including the Grade II train shed.

At a number of stations in the conurbations and on busy commuter lines a programme of lengthening platforms is underway and will continue. Increasing the number of coaches per train is a critical tool for alleviating overcrowding and is especially important on the lines running into London Waterloo.

Network Rail is obliged by the Government to maximise its revenues from its land and stations. Retail outlets at the large stations it manages provides a significant (£513 million) and increasing source of income for Network Rail, and the business is presently

outperforming non-rail equivalents. NR expects to continue to enable passengers *'to broaden their purchases beyond the immediate requirements of their journey'*. Rentals from a wide portfolio of other properties are also important. Recent retail projects have included the Waterloo Balcony and Victoria Place. Schemes at Liverpool Street (Grade II), Euston, Paddington (Grade I), Newcastle Central (Grade I) and London Bridge are envisaged. Such projects are only likely to increase.

An emerging trend is for bodies outside the railway to campaign for and sometimes participate in schemes to improve stations. This reflects a greater sense of the station as a gateway for a community and its potential role in place-making. Examples include

- West Yorkshire Metro funding for a new south entrance at Leeds (linked to the modern western footbridge);
- the partnership between Network Rail, Merseyrail and Cheshire West and Chester Council to completely refurbish and bring into community-benefitting use the Grade II listed buildings at Ellesmere Port station and thereby to create a better facility for travellers;
- at Cheltenham Spa (where some NSIP works have already been completed) a plan for two new bay platforms and a glazed concourse added to the historic façade that will be part-funded through the Local Transport Body mechanism by Gloucestershire County Council and Cheltenham Borough Council. The original colonnaded porte cochere at the front was removed in the 1980s, but the Victorian platform canopies will be lost;
- a contribution by Devon County Council to the (much-needed) overhaul of the cramped but classic frontage and forecourt of the Southern Railway's inter-war Exeter Central.

The existing stations at Leeds, Manchester Piccadilly (Grade II), Birmingham New Street, Birmingham Moor Street (Grade II) and London Euston will need major works if HS2 is built, either to accommodate additional platforms or to ensure good links between the classic and HS2 platforms. The proposed HS2 station at Birmingham will have a major impact on the setting of the old Curzon Street station (Grade I).

National Stations Improvement Plan

The National Stations Improvement Plan (NSIP) was a principal component of the strategy for 2009 to 2014 (CP4). It envisaged work to upgrade the facilities, efficiency and appearance of about 150 medium-sized stations in England and Wales, in a coordinated manner and with an average spend on each station of £1.1 million. By implication the largest stations (most of which are those directly managed by NR) have their own specific plans, while a large number of small – and in many cases poorly-used – stations would be left as they are with minimal maintenance. A design guide was produced to highlight the key measures:

- *'customer comfort, security and safety e.g. good standard of seats, good standard of station canopies, adequate CCTV;*
- *customer information and way finding including core station signage, concentrated passenger information and help points and clocks;*
- *customer facilities including customer toilets, retail facilities and customer waiting shelters; and*
- *introduction of modular assets.'*

The list of stations 'being considered' for action is reproduced at the end of this report. Information about the works envisaged or completed at each station appears to be scattered across numerous NR documents and press releases and hence is difficult to assemble. Reasonably enough, there appear to have been adjustments as the Control Period has proceeded, but the picture is not wholly clear. Subsequent annual updates have however given a broad picture of progress, and the 2013 edition contains a list of outstanding schemes, from which the original table has been annotated. It appears that work has been completed or is planned at about 340 stations, but there is no comparable programme in the CP5 agenda for the remaining stations or for further work at those already improved[lxxix].

National Stations Improvement Plan (Control Period 4, to 2014)	
Train Operating Company	**Stations**
Arriva Trains Wales	Bidston, Caldicot, Chester, Frodsham, Helsby, Hereford, Heswall, Ludlow, Nantwich, Neston, Shrewsbury, Wem.
C2C	Basildon, Chalkwell, Chafford Hundred, Limehouse, Ockendon, Shoeburyness, Southend East, Upminster. **Barking**
Chiltern Railways	Aylesbury Town, Gerrards Cross, Leamington Spa, Princes Risborough, Warwick, Wendover. **Bicester North, Banbury, Haddenham & Thame**
East Midlands	Alfreton, Burton on Trent, Derby, Kettering, Leicester, Long Eaton, Loughborough, Skegness. **Spalding, Chesterfield**
First Great Western	Castle Carey [*sic*], Cheltenham Spa, Chippenham, Didcot Parkway, Exeter Central, Exeter St Davids, Gloucester, Newbury, Newton Abbott, Penzance, Slough, Swindon, Truro, Westbury, Weston-super Mare. **Burnham, West Drayton, Plymouth, Southall, Bath Spa, Theale**
First Capital Connect	Bedford, Finsbury Park, Flitwick, Harpenden, Harringey, Hatfield, Hitchin, Kentish Town, Leagrave, Mill Hill Broadway, Potters Bar, Royston, St Albans, Stevenage, Welwyn Garden City, West Hampstead. **Biggleswade**

London Midland	Berkhamsted, Bloxwich, Bloxwich North, Cannock, Hednesford, Kidderminster, Landywood, Milton Keynes Central, Rugeley Town, Tamworth, Telford, University, Watford Junction, Worcester Foregate Street. **Sutton Coldfield, Leighton Buzzard, Snow Hill, Hemel Hempstead, Lichfield Trent Valley, Redditch, Stourbridge**
Merseyrail	Hall Road, Hooton, Kirkdale, Liverpool Central, Ormskirk, Rice Lane, Rock Ferry, Walton, Waterloo. **Maghull, Moreton, Ellesmere Port, Hunts Cross, Bidston, Orrell Park**
[now] East Coast	Berwick-upon-Tweed, Darlington, Grantham, Newark, Peterborough, Retford. Doncaster, Durham, York.
[now] Greater Anglia	Billericay, Bishops Stortford, Brentwood, Mark Tey, Cambridge, Chelmsford, Colchester, Gidea Park, Harold Wood, Ilford, Rayleigh, Romford, Seven Sisters, Southend Victoria, Waltham Cross, Wickford, Witham, Wood Street. **Chingford, Enfield Town, Ipswich**
Northern	Accrington, Altrincham, Blackburn, Bolton, Bradford Interchange, Halifax, Harrogate, Hartlepool, Huyton, Manchester Oxford Road, Manchester Victoria, Mexborough, Rochdale, Skipton, Wakefield Kirkgate. **Blackrod, Bingley, Bradford Forster Square, Shipley, Leyland, Eccles, New Pudsey, Burnley Manchester Road, Guide Bridge, Meadowhall, Worksop**
South West Trains	Andover, Basingstoke, Clapham Junction, Earlsfield, Eastleigh, Fareham, Farnham, Fleet, Fratton, Haslemere, Havant, Hersham, Honiton, Hounslow, New Malden, Putney, Salisbury, Southampton Central, Staines, Surbiton, Twickenham, Vauxhall, Wandsworth Town, Weymouth, Wimbledon, Winchester, Wokingham. **Byfleet & New Haw, Sunningdale, Fleet**
Southeastern	Ashford International, Brixton, Bromley South, Canterbury West, Chatham, Crayford, Dartford, Denmark Hill, Deptford, Dover Priory, Folkestone Central, Gillingham, Gravesend, Lewisham, Margate, Northfleet, Paddock Wood, Rochester, Sevenoaks, Sittingbourne, Strood, Swanley, Tonbridge, Tunbridge Wells, Waterloo East, Woolwich Arsenal. **Orpington, Hastings, Blackheath, Grove Park, Folkestone West**
Southern	Ashtead, Balham, Crystal Palace, East Grinstead, Gipsy Hill, Hassocks, Horsham, Norbury, Norwood Junction [now London Overground], Peckham Rye, Queens Road Peckham, Selhurst, Smitham, Streatham Hill, Uckfield, West Croydon, West Norwood. **Cheam, Leatherhead, Falmer, Chichester, Battersea Park, Sutton, East Croydon**
TransPennine Express	Barrow-in-Furness, Dewsbury, Grimsby, Huddersfield, Middlesbrough, Northallerton, Scarborough, Selby, Stalybridge, Warrington Central. **Birchwood, Hull**
Virgin Trains	Carlisle, Preston, Runcorn, Wigan, Wolverhampton. **Warrington Bank Quay**
The base list is taken from: Network Rail. CP4 Delivery Plan 2009. Enhancements programme: statement of scope, outputs and milestones. March 2009. See www.networkrail.co.uk/aspx/5500.aspx, pp. 14-15.	

*2013 update on the National Stations Improvement Programme. At the time work remained outstanding at the stations underlined. Work on those shown **bold** also remained to be started.*[lxxx]

Access for All

The Access for All Programme is part of the Railways for All strategy, launched in 2006 to address the issues faced by disabled passengers using railway stations in Great Britain. Central to the strategy is the ring-fencing of £370 million funding running through to 2015, for provision of an obstacle free, accessible route to and between platforms at priority stations. This generally includes the modification or replacement of footbridges and the provision of lifts or ramps. The 122 stations in England so far subject to Access for All schemes are identified in Appendix 2.

Bridges

The scale of Network Rail's task in maintaining the railway is illustrated again by the fact that its Western Route alone has 3292 bridges of which two-thirds support the railway and one-third support something crossing over the railway. Their average age is 120 years; 46% are over 145 years old and the oldest was built 180 years ago[lxxxi]. As noted above, the modest-size Anglia Route alone has 7 'major structures', 717 overbridges, 1459 underbridges and viaducts and 116 redundant bridges. The London North East Route has 1095 overbridges, 2631 underbridges and 189 footbridges. The LNE Route Plan notes that the *'average age of bridge structures is 101 years old with 25% over 145 years old (the oldest being 188 years old)'.* It therefore envisages no less than 1948 'interventions' during CP5, ranging from replacement and strengthening to preventative and minor works[lxxxii]. Network Rail envisages no fewer than 56 'complex structures' and 20 major bridges will require attention in CP5 as part of a long term sustainable approach to maintenance. One example is the 49 spans of Whalley Viaduct (Grade II) in order to prevent pier settlement caused by the deterioration of the original timber piles. Certain *'long timber bridges'* (presumably in Wales?) will receive accelerated replacement.

Many bridges, both overbridges and underbridges, require rebuilding or replacement because their condition has deteriorated. This is applying particularly to metal structures, many of which have been ill-maintained for decades. Some railway underbridges have to be reconstructed to bear the stress caused by heavier or faster trains. Electrification and structural gauge enhancement programmes are affecting many hundreds of railway overbridges, which need to be raised or rebuilt (or trackbeds lowered) in order to accommodate large shipping containers and / or 25kV AC overhead electric wiring.

The scale of bridge works for electrification is indicated by the fact that for the Great Western Main Line (GWML) project it will be necessary to rebuild or alter 116 bridges between Maidenhead and Swansea[lxxxiii]. And even relatively modest lines may be affected by infill schemes or those that offer diversionary routes. Examples are Selby - Micklefield Junction (-Leeds), Oxenholme - Windermere (which has been added to the programme in order to eliminate the complications of operating a small diesel outpost[lxxxiv]) and Rugeley Trent Valley - Walsall on which work has already started. A campaign to electrify York - Harrogate - Leeds is being mounted by local authorities, but it may struggle to climb the Network Rail priority list, especially in respect of the York - Harrogate section.

Bridges that are vulnerable to flood damage will receive particular attention, as will the old swing bridges at Hull (Grade II), Goole (Grade II) and Selby. Another category of bridge that may be subjected to rebuilding is that where a high frequency of damage from road vehicles occurs; a rail overbridge near Cannock with historic cast iron face girders has just been rebuilt for this reason[lxxxv]. Some disused bridges may merit attention to eradicate maintenance liabilities. This will normally involve removal or infilling, although the Grade II bridge at the former Derby Friargate (Great Northern) station is the subject of a local campaign to restore and refurbish it.

It should therefore be assumed that the magnitude of the modernisation programme puts almost any railway bridge at risk of demolition or major alteration. Recent practice with electrification works on the Paisley Canal branch in Scotland does however demonstrate that it is possible to greatly reduce the cost of electrification through track lowering the use of short 'neutral' sections of catenary beneath historic bridges (the cost reduced from over £20 million to £9million through retention and other measures). Where it is possible to retain historic bridges on overhead-electrified railways (either through track-lowering, the application of derogations or through 'neutral' sections), a problem remains with bridge parapets, which require raising and the installation of anti-climb copings to comply with (perhaps excessively cautious) guidance[lxxxvi].

Signalling buildings

Fourteen 'state of the art' control centres will replace both the numerous surviving manual-lever boxes and earlier generations of electronic signalling installations. This has benefits in maintenance and in the supervision of train movements[lxxxvii]. The work will include gradual adoption of the European Train Control System (itself part of the European Rail Traffic Management System) which will eliminate lineside signals and replace them with indications to the driver in his cab. This means that every existing building and piece of equipment associated with the current signalling system will become redundant[lxxxviii]. The southern end of the ECML and the GWML will be the first schemes, following the trials on the Cambrian and Hertford Loop Lines. However the programme will probably take until mid-century to complete, and some special-purpose boxes will be retained, for example those controlling swing bridges on the Norfolk Broads.

Each of the Route Plans has a section on the historic significance of these buildings and the agreement with English Heritage on the listing of a selection of them. For example, London North Eastern recognises the 'signal box inheritance' when it refers to the closure of 20 signal boxes and gated level crossings in the course of the upgrade of the GN/GE Joint Line between Doncaster and Peterborough via Lincoln and to 80 more from the transfer of signalling control to the new Operating Centres during CP5. Network Rail now possesses a comprehensive register that describes the historic importance and context of each building[lxxxix].

Level crossings

Level crossings are now the single largest source of risk to the safe operation of trains. That is largely because of the success of warning and protection systems in reducing the number of collisions and derailments. As trains become faster and more frequent level crossings represent both a constraint on capacity and an increasing hazard (the statistical likelihood of an accident increases with the number of conflicting moves, and longer periods of closure to road vehicles provoke frustration and encourage risk-taking). It has therefore become policy that wherever possible crossings will be replaced by bridges or closed and that many of those that remain open will be controlled by advanced equipment and monitored remotely from the new control centres. The programme will be guided by the All Level Crossing Risk Model. The preferred type is designated *Manually Controlled Barrier – Obstacle Detection* [MCB-OD] and relies on electronic scanning of the crossing to ensure that it is clear before a train is authorised to pass. (Technical problems are however causing some delay to their installation.)

Under this programme some 750 crossings will have been closed by April 2014 and many more will follow. A total of 464 will be dealt with in one way or another during CP5, with the aid of a £67 million ring-fenced fund. This implies that every existing building associated with level crossings is likely to become redundant.

Other assets

Other assets which will be the target of substantial programmes include drainage, fencing, electrical supply equipment, maintenance depots, telecommunication facilities and miscellaneous buildings. Improving life-cycle sustainability will be a key objective. Most of these assets are relatively modern and of little conservation interest, but some may merit a watching brief. In certain cases an assemblage of items of railway infrastructure may have historic significance, although it is difficult, outside of preserved railways, to protect them from changes that are required in the course of running a modern railway. A package of energy-saving retrofits to buildings could also occasionally trigger some conservation concern.

There do not appear to be many specific proposals regarding works and depots. The modern Siemens depot at Manchester Ardwick is being prepared for extra workloads following the electrification schemes in the area and at Reading an entirely new depot is nearing completion as part of the GWML electrification – what is left of the old steam depot will presumably be demolished. Similar situations will arise at some other locations. Of the works buildings surviving in railway use the most vulnerable is probably that now owned by Bombardier at Derby, should the company withdraw from the British market if it fails to win sufficient rolling-stock contracts. As far as is known the buildings at Doncaster and Eastleigh are expected to remain in productive use for some time. The future of the railway works at Wolverton (and Springburn in Glasgow) appears to have been secured for the time being following the takeover of the failed Railcare company by Knorr-Bremse.

The miscellaneous assets of the British Rail Residuary Board (such as the Old Dalby test track, bridges and war memorials) have been transferred to Network Rail, whose budget will include a provision of around £2 million per year for their maintenance.

Possible future developments

In August 2013 Patrick McLoughlin announced that he wished to have the electrification of the 10-mile Lakes Line between Oxenholme and Windermere added to the North-West electrification schemes. The project, costed at £16million would eliminate an isolated diesel route and allow electic trains to run through from Manchester and Liverpool.

Just before completion of this Report DfT announced[xc] the setting up of a 'task force' to identify the next generation of schemes to be electrified. The routes to be examined include Leeds – Harrogate - York, Selby - Hull, Sheffield - Leeds, Sheffield - Doncaster, Middlesbrough - ECML, Sheffield - Manchester (via the Hope Valley), Warrington - Chester and Crewe – Chester.

Slowing of growth

Since the mid-1990s rail traffic has grown at a remarkably consistent and sustained pace. It is easy (and too easy for the ideologically committed) to associate this with privatisation, the freedoms of private companies compared with those of a nationalised industry and the introduction of competition within the railway (as distinct from the longstanding and fierce competition from other modes). The story is in fact considerably more complex, and the reasons why the downward trends reversed so decisively are not fully understood.

In the case of freight traffic it is important to distinguish the two principal sectors of the business since aggregating them gives a misleading picture. Movement of coal is primarily a function of the quantity required for electricity generation and of the ever-changing mix of sources, although competition between the rail hauliers and hence some advances in efficiency may have had an effect at the margin. Tonne-kilometres grew by 45% between 1999/2000 and 2012/2013. All other traffic grew by 0.4% (in t-km) over the same period. Within that total the tonnage of containers (predominantly those landed or shipped at container-handling ports) increased faster, by 62%, than that of other commodities, some of which fell sharply, largely as a result of external changes in markets and industrial organisation. In recent years there has been a sharp rise in the movement of domestic containers as retailers and some road hauliers have been attracted to rail in response to growing congestion, a shortage of long-distance lorry-drivers and awareness of environmental issues[xci].

Some of these trends may continue, others may not. It is therefore surprising that rail industry forecasts appear to rely on a single scenario that presumes prolonged strong growth[xcii]. It is recognised that coal will decline rapidly as fossil-fuel power stations are decommissioned, but this is expected to be offset by conveyance of imported biomass, a traffic that is going to present notable logistic challenges. Container traffic on the other hand is forecast to increase dramatically, but this is heavily dependent on trends in world trade. Moreover, a presumption

of growth ignores the possibility of changes in practice and sentiment, for example decisions to reverse outsourcing and bring manufacturing back to Britain, a consumer reaction to the waste inherent in short-life goods and perhaps sharply rising prices caused by factors in Asian economies and resource-scarcity, including the cost of the oil used for transport itself.

In the case of passenger traffic the explanations for recent trends include:

- the availability, at least until 2007, of a great deal of disposable income for discretionary spending among social groups for whom extra travel would be a commonplace;
- frustration over road congestion and a degree of environmental conscience over unnecessary use of cars;
- a rise in the cost of running cars and curbs on the financial benefits of company cars;
- the quality of the rail service connecting many centres with a high proportion of 'knowledge-based' jobs and the ability to use electronic tools on trains that cannot be used in cars;
- a marked decline in the status-enhancing role of cars among young people;
- the growth of employment in London, where commuting other than by rail is almost infeasible; and
- the growth of the service sector, and particularly of financial jobs, in cities such as Edinburgh, Leeds and Manchester, coupled with the renewed popularity of inner-city living (which prompts leisure travel by rail) and the attraction, partly for house-price reasons, of ex-urban residential areas (from which commuting by rail has London characteristics).

This is a formidable list, against which an emphasis on privatisation *per se* looks unconvincing. More importantly, it is not axiomatic that so mixed a set of favourable trends will continue. Some may strengthen, others weaken, other new trends may emerge. Not all NR forecasts are based on what appears to be rather simplistic extrapolation, since some exercises in more sophisticated scenario-painting have been conducted, but a confident expectation of continuing growth pervades most of the planning documents and Government pronouncements.

For both freight and passenger traffic then *it would be wise to assume that the plans are more likely to be adjusted for a weakening of growth than for a faster pace to materialise*. This proposition holds even though the Government is committing unprecedented levels of funding to the railway in the conviction that the economy will benefit and that growth will continue unabated. Precisely which components might be scaled down if circumstances change cannot easily be foreseen, but any which heavily depend on particular flows or types of train should be treated with caution. This position may gain credibility from the most recent

statistics, which suggest that growth in the long-distance and regional markets has been very slight for the last two years and that only the London & South East market is really buoyant[xciii].

A revised understanding of capacity

Definition of the capacity of a railway is notoriously problematic. For a line with a homogeneous fleet of trains and standard running times and stopping patterns, and without junctions, capacity is simply (though even then not exactly) determined by the signalling headway between trains. This is broadly the circumstance on, say, London's Victoria Line, but the effect when those conditions do not apply is shown by the difference between that line's achievement and that of a more complex operation such as the Circle Line. On the main line railway a very varied mix of trains and a very complex geography makes measurement of capacity with any standardised metric almost impossible.

This has not inhibited researchers anxious to find definitions that may assist infrastructure managers who, under the European regime of separated functions, feel the need to measure capacity in order to assist in the allocation of paths and the identification of 'congested' routes that require action of some kind. However such an approach misses two key points. Firstly, it can be argued that the capacity of a railway cannot be determined *a priori*, but that it is a *post hoc* function of the decisions taken in planning a timetable, in other words of the chosen priorities and the relationships between the paths placed on the timing graph (which are themselves a mix of technical and market factors). The second point is that capacity is not of course solely a matter of trains/hour: it must also encompass passengers or tonnes per train.

Network Rail, which is only responsible for the mechanical task of constructing the timetable and not for its commercial specification (which rests with the TOCs and FOCs), sometimes seems to lose sight of the first, while the second is, for similar reasons, barely assessed either by NR or ORR. This is nonetheless strange, given the alleged pressure on capacity: on parts of the network (eg. on the trans-Pennine route between Leeds and Manchester) many trains comprise only a few carriages but the service is frequent. To some extent this is legitimate, since frequency is a key factor affecting modal share, but the issue must be addressed when measures to alleviate congestion are being addressed and the solutions may be expensive.

A related matter is the complex relationship between the number of trains, their speed, the structure of timetables and demand. Reassessment of these factors may lead to some revision of conventional assumptions about the way in which routes are planned and hence in some cases to modification of infrastructure programmes[xciv]. It may also require adjustments to NR's regulatory output targets during the course of a Control Period by means of the change-control mechanism.

It is possible therefore that the question of capacity and the presumption that limits are being reached may be revisited. Again, some scaling back of infrastructure projects – in favour of rolling-stock solutions or timetable revisions – might result, especially if financial pressures to economise are being simultaneously felt. These could become acute if the hitherto-

disregarded issue of the scale of Network Rail's debt comes to the fore, as many in the industry believe its unsustainability will force it to do.

Institutional changes

Network Rail reports[xcv] that it is *'investigating the possibilities of letting an infrastructure concession to manage part of our network while retaining a focus on the network through improvement of our system operator activities'*. This is of uncertain provenance, has not been overtly presented as policy by DfT, is hardly mentioned in the railway press and seems somewhat incompatible with all the effort that has gone into creating a strong, unified organisation. Nonetheless it could happen and needs to be monitored, because a private-sector utility manager, even within the constraints of a time-limited concession, would not necessarily have the same respect for the built infrastructure that NR does at least aspire to.

The Office of National Statistics (ONS) has been asked to look again at the curious status of Network Rail as a company that is neither properly private nor owned by the government and having its debts counted on the public balance sheet. It is generally accepted that this is unsustainable both in governance terms and as a matter of policy in the face of substantial increases in the debt and hence in interest payments. If ONS does decide to declare it a public debt then it is possible that the Department of Transport will be forced to take a more direct role in the management of NR and that greater constraint may be exercised over expenditure, with profound consequences for many of the schemes mentioned in this report. In turn that may trigger a wider review of the structure and purposes of the industry.

The relationship between Network Rail and its regulator

As a monopoly owner and manager of Britain's railway infrastructure Network Rail is supervised by the Office of Rail Regulation. It is perhaps unsurprising that the relationship is sometimes tense. NR has a large, complex and difficult task in managing the system while at the same time coping with unprecedented growth and an inheritance of structures many of which are not in the best of condition. ORR on the other hand has the luxury of detachment, its own sources of expertise, a profound belief in the virtues of independent regulation and a conviction that NR is not as efficient as it could and should be (but note that NR has challenged the relevance or validity of some aspects of ORR's benchmarking studies).

This situation is largely a matter of governance for the railway as a whole, and critics of the structure would like to see it simplified and the inherent process-costs and second-guessing removed. However it is relevant for the present purpose in two respects. First, the immense pressure on NR to become 'more efficient' in everything it does could run the risk of it paying less attention to heritage issues than it should. This may be compounded in some cases by real or bureaucratic concerns about safety, since ORR is also a vigilant and assertive safety regulator. And second, ORR has the final say on NR's expenditure in each Control Period. If it has not been satisfied about the soundness of the economic assessment of specific projects it may withhold approval. The effect of this is that any of the plans outlined in this report could be curtailed.

At the time of the Draft Determination of NR's CP5 plans ORR cast doubts on the scale and cost of both the Northern Hub and the East-West projects. Representations about this were received from both industry and external parties. In the Final Determination ORR have effectively agreed to defer the issue until the projects have been more fully specified in conjunction with NR's train-operating customers and other interests. This approach also covers the Waterloo Throat and Electric Spine schemes[xcvi].

A change of Government and new policies

A General Election is required by Statute to take place in May 2015. Its outcome is particularly difficult to foresee in circumstances of economic uncertainty, highly uneven distribution of the benefits of such growth as there is, volatile public attitudes and the probable occurrence of unexpected dramatic events. That said, a majority Labour Government is at present seen by many commentators as the most likely scenario. If it were to occur it would have significant consequences for Britain's railway.

Labour's transport policy is not yet fully formed (and is prone to the adoption of populist causes in preference to deeper analysis), but it is clear from the many voices criticising the prevailing system of governance and from the strong undercurrent of public support for radical changes that a new Government would be expected to act firmly and quickly. And while most people in the industry are in denial regarding the possibility of another reorganisation (both from understandable concern about transitional effects and from their vested interests) a few are beginning to voice ideas of what would be advantageous. The new Shadow Secretary of State, Mary Creagh, has begun to hint at what she has in mind.

The most important changes would probably be:

- moving from the present regime of franchises, with concessions in particular cases, to an all-concessions regime;
- recreating a national InterCity brand;
- devolving responsibility for letting and managing the concessions to regional bodies and allowing them, plus the Scottish and Welsh Governments, to partner with non-profit organisations instead of being constrained to negotiate with a limited group of private companies and European railways[xcvii];
- limiting the role of the Regulator, possibly by merging ORR into Network Rail; and
- a reform of railway finances and the fares system.

Many campaigners, and if polls and blogs are to be believed many among the general public, would wish to see full reunification – and even to 'Bring Back British Rail'. Labour may however baulk at that (unless a crisis in NR's finances precipitated it), and sympathetic voices in the industry will advise that key objectives can be more effectively met by the changes

mentioned above and by setting the industry a vision of an integrated public service embedded in a clear statement of the inclusive purposes of the state and local grants.

None of the changes would have an immediate or obvious effect on the railway's built environment, but in due course there could be an expanded programme of modernisation – probably spread more evenly around the country – and a vigorous campaign to reopen stations and lines[xcviii]. This could include strong efforts to turn stations into 'community hubs', some of which is happening already: extending the range of activities will imply construction works on the station and in its environs, and in particular the bringing back into active life of presently-disused accommodation (what has been achieved recently at Ellesmere Port is a prime example).

One other sequence of decisions could occur. The Labour Party is equivocal about HS2 and a tense political game is being played over the question of multi-party support for the project. If Labour did decide to withdraw its support and in Government to abandon the proposals in their current form it is likely (and certainly desirable) that this would be followed by a comprehensive study of a wide range of alternative schemes, some of which would probably involve new alignments, albeit for slower speeds. These schemes would be spread across the country and could impinge on many features of the railway environment.

Filling gaps in the network

A weakness in the prevailing planning regime is that it concentrates on renewal and development of the existing network. Some projects to reopen closed lines or stations and occasional new links such as the Ordsall Curve in Manchester as a key element in the Northern Hub are taken forward when a particular study (or a campaign group) identifies them, but there is no systematic analysis of the network with a methodology designed to fit it better to future demands or to facilitate significant changes in the modal split. For example, in planning trans-Pennine electrification no study seems to have been made of the case for a new base tunnel, while the absence of a railway link in the M1 corridor between the East Midlands and the Northampton / Milton Keynes area is a major gap.

Were priorities to change and a different approach to be adopted it is possible that some existing projects might be deemed relatively marginal while more radical schemes became a higher priority. This could alter the relative vulnerability of historic buildings while also introducing new threats arising from a different scale or location of works. In some cases a new line might use parts of abandoned alignments where important buildings survive in non-railway uses.

Sustainability as a priority

The forecasts of continuing growth in rail traffic, both passenger and freight, all essentially assume a 'business as usual' future. Apart from some limited modelling of alternative scenarios in NR's longer-term studies there is little acknowledgement of the possibility of fundamental shifts. This is not of course any different from the assumptions made by many

bodies, especially those close to governments, but that does not make such shifts any less likely. They include:

- weather events that cause the Government to act more firmly on carbon reduction;
- sharp rises in energy and raw-material costs;
- any one of many instabilities in the global economic system becoming acute;
- a reversal in the trend to out-source production; and
- social unrest in response to austerity and inequality.

It is extremely difficult to forecast the effect any of these might have on rail investment, but it can be said that the effect could be considerable. The first two for example could both cut the total volume of travel and increase rail's modal share, with an unclear net outcome and probably differential effects in various sectors of the market. Conversely, bringing production back to Britain in response to rising costs in overseas factories and rising transport costs (and maybe some consumer reaction against short-life goods produced in questionable conditions) could cut the number of imported containers without offering alternative flows (because the new geography would be lorry-dominated). And the impact of unrest is almost impossible to foresee.

The point of this brief section is not to argue that any of these things will necessarily happen but to ensure that when analysing all the programmes for railway projects it is borne in mind that they should not be treated as absolutely fixed just because continual growth has been assumed. They may have to be adjusted for future circumstances.

Conclusions

All in all, excluding HS2, rail infrastructure investment in the period 2009-2019 will total at least £41.4bn. It will include extensive structural gauge enhancements across the system, for the carriage of larger containers between Nuneaton and Southampton, for new diesel trains (West of England main line) and for the installation of overhead line equipment over more than 850 miles of the network.

Alongside the inevitable impacts of other route upgrades, rationalisation, the phasing out of mechanical signalling, the progressive fencing in of the railway system with high palisade fencing and programmes of platform lengthening, station enhancements and accessibility improvement across the country, this does indeed represent the most extensive and rapid change to have occurred to the railway infrastructure since the Victorian era. On the basis of known bridge reconstructions on Crossrail, Preston - Blackpool and the Nuneaton-Southampton freight enhancement (the latter route now requiring further enlargement for electrification) it is likely that at least 400 to 800 overline bridges will be replaced or significantly modified.

RPS

Appendix 1

A review of documents describing plans for development of the railway in England

prepared for English Heritage

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Summary

This review covers the concluding year of Control Period 4 (2009-2014) and all of Control Period 5 (2014-2019). Network Rail and other documents have been trawled for references to physical works of all kinds. The author is familiar with the nature and effects of rail projects and, following an explanation of the institutional context, has attempted to evaluate the probable consequences for every type of historic structure. These are explained by theme. In addition trends over the longer term such as further electrification, concentration of signalling control and enlargement of the loading gauge are outlined, together with factors that may change the setting and underlying assumptions. In some cases where information is publicly available the scale of works is itemised.

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17 December 2013

1 Organisation and responsibilities in the railway industry

1.1 Government responsibility for the railway rests with the Department for Transport [DfT]. The Secretary of State (Patrick McLoughlin) manages overall transport strategy, including economic growth and climate change, transport security and high speed rail. A Minister of State (Baroness Susan Kramer) is responsible for HS2 Phase Two, rail funding and futures including regulation, stations policy and smart ticketing. In respect of other rail topics two Parliamentary Under Secretaries of State deal with operational performance, major projects, fares and ticketing, Rail Delivery Group reform[xcix] and franchising (Stephen Hammond) and freight and logistics and HS2 Phase One (Robert Goodwill). This division is arbitrary and can lead to confusion, while it is notable that relationships with the industry are not listed among the ministers' roles[c]. It should also be noted that community rail, light rail and trams, winter resilience, environmental impacts and alternatives to travel have disappeared in the rearrangement of duties following the Government reshuffle in October 2013.

1.2 The Department works with 22 'agencies and public bodies'. Of these the Office of Rail Regulation [ORR] is described as a 'non-ministerial department' [see ¶1.6]. Directly Operated Railways (currently the public-sector operator of the East Coast Main Line [ECML], High Speed Two Limited (charged with promoting and planning the proposed new high-speed railway), the British Transport Police Authority and Passenger Focus (the travellers' champion) are 'executive non-departmental public bodies'. London and Continental Railways Ltd [LCR] is a 'public corporation, and the Rail Accident Investigation Branch is classified as 'other'[ci]. BRB (Residuary) Ltd (which managed the loose ends left following the demise of the British Railways Board) was abolished on 30 September 2013. Its functions have been dispersed to the Highways Agency (closed alignments), LCR (properties with development potential) and Network Rail (miscellaneous operational land, and accident and war memorials). The Railway Heritage Committee was closed on 30 March2013 and its responsibilities transferred to the Board of Trustees of the Science Museum.

1.3 Separation of track and train, or wheel and rail, is a fundamental feature of contemporary organisation of the railway itself. This derives from concepts established by the European Union in furtherance of a conviction that they would promote competition and thereby make the European railways collectively more efficient and able to achieve an increased modal share that would benefit the environment. The policy was primarily directed at international freight traffic, but the principles required a reordering of state corporations that had traditionally been vertically integrated. Strictly, the division was only required in terms of internal arrangements, but in some countries total separation was pursued. Of these Britain was among the most rigorous[cii].

1.4 By the Railways Act 1993 the infrastructure – the civil engineering, track, signalling and control, stations, power supply and ancillary buildings – passed from the unified British Rail to a new private-sector body, Railtrack. In 2002, after a chequered history, the assets were transferred to Network Rail [NR], a 'not for dividend' company limited by guarantee and without shareholders. This has created the rather strange situation that the railway infrastructure is not 'owned' by anyone and is technically in the private sector while at the same time its now-substantial debt is in practice guaranteed by the Government.

1.5 NR has recently devolved management to ten geographic Routes, whose Directors now have extensive responsibilities and are closer to their partners in the Train Operating Companies [TOCs], external stakeholders and local suppliers than when strong control was exercised from the company's headquarters in Milton Keynes. In some cases a formal alliance has been established between the NR Route and the matching TOC, most closely in the case of the Wessex Route and South West Trains where a joint team now manages the South Western main line and suburban territory. Like the Rail Delivery group described below

[¶1.11] this is legally a peculiar animal since the franchise holder may change and since other operators run trains over Wessex tracks, but it undoubtedly has advantages in better coordination. Whether, freed from central control, such a body might become more assertive or more careless regarding heritage issues has yet to be seen.

1.6 Although the strategic and everyday management of Network Rail rests with the Board of Directors[ciii], as a monopoly holder of rail infrastructure it is tightly regulated by ORR in keeping with the European Union concept of separation, in which such bodies are known as Infrastructure Managers [IMs] or System Operators. ORR describes itself as "the independent safety and economic regulator for Britain's railways"[civ]. Economic regulation is focussed on continual scrutiny of Network Rail's efficiency and performance, its planning and the setting of its budgets, and supervision of its contracts with the train operating companies to ensure fair and non-discriminatory access.

1.7 Train operating companies do just what their name says, but in order to run on Network Rail tracks they must apply for access rights and agree suitable 'paths' in the timetable[cv]. They are perceived as 'customers' of NR, which can be a helpful relationship but which can (and does) also lead to tension because the participants have different objectives rather than a common view of the collective railway. Most TOCs hold franchises, as explained below, but there are also a small number of 'open access' companies running passenger trains at their own risk and the freight operating companies [FOCs]. The process of applying for, agreeing and modifying access contracts has become highly formalised and legalistic and has thus introduced rigidity into certain aspects of railway management. Nonetheless, this report is not much concerned with the TOCs, since their involvement in matters concerning buildings is limited [but see ¶4.3.5].

1.8 With the exception of the tiny number of open-access trains passenger services on Britain's main-line railway are operated under franchise contracts between a TOC and the Government[cvi]. DfT specifies the service it wants provided for the geographical set of routes that comprise the franchise and the improvements it wishes to see during the lifetime of the agreement. There follows an open tendering process, although in practice the field is dominated by a small number of large companies, commonly referred to as the 'owning groups'.

1.9 Franchising has generated considerable controversy regarding the specificity and length of contracts, the cost and management of the process, the behaviour of the successful bidders and its benefits and disbenefits for passengers and the railway. It has gone through four major and many minor revisions, the most recent following DfT's mishandling of the flagship West Coast Main Line [WCML] franchise which culminated in the suspension of the process, enquiries and a fresh attempt to ensure that the system is correct, fair and transparent. Many observers believe this to be the last chance for it to be demonstrated that it can work for the general good[cvii].

1.10 The other players in an industry that now comprises multiple organisations in varying relationships include the owners of the rolling stock (essentially banks), suppliers of a wide range of engineering, technical and support services, contractors for some operating functions such as cleaning and security – and consultants. None of these would normally participate directly in decisions about buildings and other heritage assets, but their interactions with Network Rail and the TOCs could have subtle effects on attitudes toward development. In particular, the engineering firms may influence the approach to matters such as electrification standards, and on the ground they may not exercise the same care as a conservation officer when dealing with an historic structure.

1.11 Following a recommendation of the McNulty Review[cviii] a Rail Delivery Group [RDG] was created in order to address the difficulties and inefficiencies that fragmentation of the

railway is undoubtedly causing. Its membership covers Network Rail, the owning groups of the TOCs and the main freight operating companies, with observers from DfT and ORR and recently other stakeholders in the industry as associate members (but not Passenger Focus). Although it has a remit to develop strategies RDG has not yet made a distinctive contribution to policy or practice, but it has the potential capability for pushing ideas that might have implications for the infrastructure in areas such as asset management and technological innovation. It is a peculiar body since the TOCs only hold temporary rights to their franchises and have no permanent status, and the Commons Transport Committee rather pointedly recommended that "the DfT and ORR keep a close eye on the work of the RDG to ensure it acts in the best interests of the farepayer and taxpayer, rather than of established rail interests"[cix].

2 The task of Network Rail

2.1 Network Rail has a duty to operate, maintain, renew and enhance the infrastructure of the railway and to provide adequate capacity to meet the reasonable requests for paths by train operators, with whom there is a regular dialogue and a more formal relationship by virtue of NR inputs into franchise specifications. It should be noted however that the governance arrangements and structure of the industry are such that there is no all-embracing master-plan, and certainly not one embedded in a vision for the future purpose(s) of the railway based, for example, on a radical timetable concept[cx]. This has the effect that NR's plans tend to be driven by specific ideas from TOCs and other parties and by its own preoccupation with managing the existing infrastructure, thus creating the risk that projects may not always be well-coordinated with each other[cxi] and the certainty that innovative ideas for new infrastructure (HS2 excepted) may not be explored.

2.2 In carrying out these duties NR is supervised by ORR. The regulatory tools range from target-setting (such as for the punctuality of trains) through detailed analysis of working practices and benchmarking studies in order to secure greater efficiency, to the overarching system of quinquennial 'Control Periods' that provide the framework for operating and capital programmes and budgets. *In extremis*, ORR can fine NR for a failure to meet its targets or for default on obligations set out in its IM licence.

2.3 The present Control Period is the fourth [hence CP4] and will end on 31 March 2014. The fifth period [CP5] will run from 1 April 2014 to 31 March 2019. Some plans are also being made for CP6 and beyond. This report includes some references to schemes in the CP4 plans, but is mostly concerned with the CP5 plans.

2.4 ORR and NR are not however the only parties in the Control Period process. Clearly, given the scale of the public funds required for investment and DfT's role in franchising, the Government has a critical input too. The two mechanisms are the High Level Output Statement [HLOS] and the Statement of Funds Available [SoFA] [cxii]. The HLOS sets out the Government's specification of the broad pattern of services that it wishes to see provided in the next Period and its understanding of the infrastructure works that will be required to run them, while the SoFA specifies the provisional budget that DfT expects to have available. There then follows a negotiation between ORR and NR regarding a plan for the delivery of these statements, with the possibility that it may be necessary to go back to the Government to modify them in order to identify a workable package of proposals within an acceptable budget.

2.5 Relationships between NR and its regulator are sometimes strained. ORR's function necessarily involves a certain amount of second-guessing of NR's analysis, plans and activities, which may irritate those with the immediate responsibility, while ORR may have a more purist view of efficiency standards calculated in the abstract or from benchmarking than

the body that actually has to deliver operations and projects in real time in often unfavourable conditions[cxiii]. On several occasions the tension has been sufficient to raise the possibility of legal appeals, but so far this has not happened in respect of any major issue. And currently a further dimension is that the 2012 HLOS contained suggestions for schemes that NR, probably for good reasons, had not expected. ORR's recent criticism that NR is lagging in evaluating these does seem a little unfair [see further on this at ¶4.3.2].

2.6 ORR's issued its 'final determination' on 31 October 2013[cxiv]. Much of it confirms earlier judgments or consists of esoteric adjustments. For the present purpose the most important features were the decision to substantially increase civils spending on bridges, tunnels and coastal and estuarine defences because of concern about the backlog of maintenance and a number of serious failures, and the acceptance that a number of major projects have not yet been developed sufficiently for a firm price to be agreed. This problem is a function of working in quinquennial cycles and will be alleviated by ORR's agreement to deal with them as plans mature during CP5.

3 The planning process

3.1 Initiatives in planning within Network Rail spring from its duty to ensure that the infrastructure has the capability (or qualities) and capacity (or available volume) that operators and potential operators require. The process involves a sequence of documents and background material. In 2009 NR produced in collaboration with the industry at large *Planning Ahead 2009 – Control Period 5 and beyond*, with a further version in 2010. Then in September 2011 there came the Initial Industry Plan [IIP] which, as a preferred programme and outline budget, laid the ground for the CP5 process itself by informing the Government's HLOS and SoFA.

3.2 The IIP "set out how the industry can deliver a more efficient and better value railway and how the railway can play a key role in driving sustainable economic growth [and] examined the key choices and options facing funders in specifying the future outputs of the railway and the level of funding required"[cxv]. They were produced by a Planning Oversight Group and build on the series of Route Utilisation Studies [RUSs] that began in 2006. In March 2012 ORR published its Advice to Ministers on the level of expenditure and efficiency for Network Rail's core operating, maintenance and renewals costs, but this did not consider potential enhancements or their impact on the core network.

3.3 In parallel with the Control Period cycle and the programme to refresh the RUSs, NR has begun a Long Term Planning Process. This was approved by ORR in April 2012 and Market Study documents are appearing. ORR intends it to feed into the Periodic Review in 2018[cxvi].

3.4 Once the United Kingdom Government (through DfT) had published its Statement in the summer of 2012 Network Rail produced a series of documents. The first was a summary of the issues and aspirations entitled *A better railway for a better Britain*. Plans were outlined in the *Full strategic business plan for England and Wales*. The *Industry strategic business plan* developed the details, which are further elaborated in Route Plans for each of NR's ten areas. Finally there is a set of technical supporting documents[cxvii].

3.5 It has to be said that the volume, complexity, repetition and detail of this material borders on the burdensome. Moreover, that is not the end. The next stage is for it to be scrutinised by ORR. It issued its *Draft determination of Network Rail's outputs and funding for 2014-19* on 12 June 2013. This had 813 pages of close analysis[cxviii] and was discussed between ORR, NR, DfT and all other industry stakeholders; it was also open for public consultation. ORR announced its final determination on 31 October, following which arrangements for its implementation on 1 April 2014 are being made.

4 Principal issues for the built environment of the railway

4.1 The scale of change

4.1.1 *A better railway for a better Britain* describes the planning aspiration: "to turn a once great but decaying part of our nation's heritage into a growth industry with huge potential for the future"[cxix]. The context is that "railways don't just move people and freight, they also generate and spread prosperity – they can create jobs, open up new markets and, ultimately, support the growth of a new balanced economy"[cxx]. However, right upfront, NR spells out a central issue, namely that it believes the railway is running close to capacity. Although the seriousness and imminence of capacity constraints is disputed [see further at §5.2] it is appropriate for NR to focus on the issue.

4.1.2 It first protects its flank by pointing out that "Our industry does not lack ambition when it says that you cannot have everything": in other words the challenge is real, not imaginary or self-serving. It goes on:

> "Network Rail has been trying to get this trade off [between the capacity of the infrastructure and the number of trains and passengers] right for a decade. And as an industry we have become excellent at squeezing every last improvement out of what we have got. But as demand grows, this becomes harder, and in some places impossible. That is why we are investing to deliver a quantum leap in the application of technology – potentially the biggest in 100 years. Intelligent infrastructure is a game changer leading to smarter working, lower costs, improved safety and better reliability. But this requires long-term investment."[cxxi]

Elsewhere[cxxii] NR claims that it "can deliver better value for money to customers and funders if we have the flexibility to make trade-offs at a local level between capacity, performance and cost".

4.1.3 The necessary works represent "the biggest capacity improvement programme since the Victorian era" and include[cxxiii]

- 170,000 extra commuter seats at peak times by 2019 [this covers both London and major regional cities, and at least in the latter is expected to exceed growth, thereby reducing crowding]
- Rebuilding the line linking Wales and the west of England to London
- 700 more trains a day linking key northern cities
- Modern signalling allowing more trains to run closer together, safely and reliably
- Electrifying far more of the railway [some 3000 track-kilometres].

It is also intended that the railway will carry 30 per cent more freight than it does today and that technical enhancements will ensure that CO_2 emissions per passenger will be cut by 25 per cent. To achieve these ambitions it will be necessary to "change our company, manage our assets, innovate, create more reliable timetables and work with our partners to deliver a better railway while reducing public subsidy"[cxxiv].

4.1.4 NR reminds readers of its documents that it is responsible for

- 30,000 bridges, embankments and tunnels;
- numerous culverts, coastal and estuary defences and retaining walls; and
- investment in replacements and new infrastructure standing at almost £5bn per year.

The modest-size Anglia Route alone has 7 'major structures', 717 overbridges, 1459 underbridges and viaducts, 116 redundant bridges, 83 footbridges, 632 retaining walls, 15 tunnel bores, 4 tunnel shafts and 28 tunnel portals. The London North East Route has 1095

overbridges, 2631 underbridges, 189 footbridges, 2285 retaining walls, 77 tunnels and 2936 culverts. It notes that the "average age of bridge structures is 101 years old with 25% over 145 years old (the oldest being 188 years old). The historical nature of the bridge stock has lead [*sic*] to a wide variety of construction types and materials, including brick/stone arches, cast iron, wrought iron, early steel, modern steel, reinforced/pre-stressed concrete and timber". It therefore envisages no less than 1948 'interventions' during CP5, ranging from replacement and strengthening to preventative and minor works[cxxv].

4.1.5 There is concern about the scale of the asset-management programme[cxxvi]:

> "The majority of our structures and earthworks assets are over a century old. They degrade very slowly which, meaning their longevity, can lead to a perception that the asset is more robust than is actually the case. In the last periodic review, the case was not fully established for our proposed increase in expenditure … we have carried out extensive further analysis of the required activity and expenditure levels. This analysis supports a significant increase in renewals to address the previous under investment. Incidents at Stewarton [collapse of a girder bridge], Pass of Brander [landslide] and River Crane [water-scouring of bridge abutments], whilst not directly related to investment in a single control period, underline the need to significantly increase investment levels above those historically allocated to these assets. They also highlight that we will continue to improve our understanding of the underlying asset condition."

4.2 Key themes

4.2.1 Network Rail's own ten key themes concern safety, reliable infrastructure, reliable timetables, investment, technology, customer focus, people, openness, sustainability and reduced subsidy[cxxvii]. Of these the most significant for the present purpose are the connected themes of reliability and technology and the investment needed to realise the concepts.

4.2.2 It is emphasised, as noted above [¶4.1.5], that the age of railway structures, many of which are carrying greater loads than those for which they were designed and which have not always been properly maintained, is a cause for concern. This predicates systematic asset-management programmes to make them more resilient[cxxviii]. And underpinning all of NR's activities is the pressure to achieve greater efficiency: although the findings of the McNulty Review[cxxix] have been queried, the mantra that Britain's railway is inefficient by reference to European comparators has become entrenched and conditions both Government policy and ORR's perspective. The target is an 18% improvement by the end of CP5. Although NR is unconvinced about some of the data it is (genuinely as well as tactfully) committed to seizing opportunities to drive out inefficiencies by pursuing best European practice, preferably in conjunction with other players.

4.2.3 The commitment to sustainability could have profound implications for the heritage of buildings if it is conscientiously implemented, although it is not obvious from the various documents that NR fully appreciates the wide implications of resource constraints, energy scarcity and climate change. NR say that in order to "deliver a railway fit for the future" it will

- "make efficient use of natural resources, innovate with sustainable materials, and reduce, reuse or recycle any waste;
- be energy efficient across our infrastructure and operations;
- use low carbon energy sources to minimise rail's carbon footprint;
- make our network and our operations resilient to future changes in the climate;
- enhance the ecological diversity of its land, increasing its economic and social value;
- protect land, air and water from pollution and other negative impacts;
- improve the accessibility and inclusivity of stations and rail services; and

- make a lasting positive contribution to our neighbours and the communities we serve"[cxxx].

NR also notes that its elderly infrastructure and operations must be adapted to make them more resilient to changes in global weather patterns[cxxxi].

4.2.4 Running through the more detailed documents is the concept of Risk Based Maintenance, also referred to as Reliability Centred Maintenance and Intelligent Infrastructure. Hitherto much of the more routine elements of the works programme has been determined by time-based schedules and in reaction to particular problems. To some extent that is unavoidable, but in future the ability to monitor continuously and remotely the condition of structures and equipment will be exploited in systems that organise, explain and respond to the masses of date generated by the measuring devices. A related objective is to simplify track by removing redundant switches and crossings and local sidings. Although all this is likely to lead to important efficiencies and to a reduction in delays arising from infrastructure failures, the effect will need to be watched carefully from a conservation perspective to avoid it creating a momentum for certain works before the broader implications have been properly considered.

4.2.5 NR's commitment to openness should also be noted on those occasions when the company fails to consult with interested parties or acts unilaterally but insensitively in its management of one of its structures: "We will become an open and accessible organisation which understands, and helps others to understand, the issues shaping the future of the railway"[cxxxii]. Likewise the commitment to sustainability: "By placing sustainability at the heart of everything we do, we will make our business more efficient, protect the value of our assets, and deliver a railway fit for future generations".

4.3 Key topics

major projects

4.3.1 NR list the major projects for CP5 as the completion of Thameslink and Crossrail, electrification of the Trans-Pennine, Midland and Great Western Main Lines (and probably the Valley Lines in South Wales), the remaining stages of station redevelopment at Birmingham New Street, Reading (including the new track layout) and London King's Cross, the Northern Hub and North West electrification schemes, a substantial project at London Waterloo (including bringing the former Eurostar platforms back into use and urgent work to remodel the tired track layout in the 'throat'), the introduction of a new fleet of inter-city trains and the Edinburgh to Glasgow Improvements Programme. It is recognised that these large projects will change outputs, ie. train services, fundamentally but that detailed work on the implications remains to be done.

4.3.2 Interestingly, the so-called **'Electric Spine'** is downplayed. It is described as "a major north-south rail electrification and capability enhancement to improve regional and national connectivity", but, having emphasised the role of the long term planning process, NR rather pointedly explains that some schemes specified in the HLOS had not been identified in the IIP or developed through the industry processes and hence that it had had only "limited time to understand" them, most notably "elements of the electric spine"[cxxxiii].

4.3.3 The concept links together the Midland Main Line [MML] electrification, the upgrade of the East West line (Bedford … Bletchley … Oxford), Great Western electrification and conversion of the Basingstoke … Southampton line from third-rail DC to 25kV AC overhead traction in order to create a new freight and passenger corridor. It has elicited surprise in the industry, which had not previously considered the route in these terms. The issues are these:

- considerable resources have already been invested in creating capacity for container trains between Southampton, the West Midlands and the WCML, including gauge-

enhancement and the diversionary route via Salisbury and Andover, and it is not obvious how much of these flows would benefit from transfer to MML;

- although Southampton will surely retain its status as a major port it will face fierce competition from Felixstowe, possibly Harwich Bathside Bay and certainly the new London Gateway which this spine route cannot do much to moderate;
- the principal passenger route is that via the West Midlands, presently served by CrossCountry, and while the East Midlands connection merits development it is not of the same market-size;
- replacement of diesel trains by electric stock is plainly desirable, but this can only be considered at the network level where gaps elsewhere must be closed before through working can be contemplated;
- the technical case for replacing third-rail electrification is strong in principle but hugely complicated in practice in terms of programming, interaction with fleet renewals and everyday operations, yet this proposal has no such context and is not self-evidently the best place to start; and
- it would be absurd to commit to the spine project unless and until the freight operators guarantee that they will deploy electric rather than diesel locomotives, something that at present they are not willing to do.

4.3.4 While parts of the electric spine scheme may materialise in their own right it seems unlikely that it will do so as a single scheme. ***Attention should therefore be directed to the parts. In particular, if third-rail conversion does become a serious agenda item it would be desirable to study the inventory of buildings and equipment specifically associated with that system*** (but note that little has been heard publicly since the HLOS announcement).

Stations

the National Stations Improvement Plan

4.3.5 All stations are owned by Network Rail. The company directly manages 11 major stations in London and the six busiest outside London (and will shortly add Reading). The remainder (some 2500) are leased to the TOC (or principal TOC) serving them. NR therefore has prime responsibility for their managed stations and for capital works at all others, while the TOCs undertake maintenance and minor works under the terms of their contract. In practice a TOC may lead in proposing and supervising an upgrade. The Scottish and Welsh Governments, Transport for London and many other local authorities also become involved in enhancements.

4.3.6 The National Stations Improvement Plan [NSIP] was a principal component of the strategy for 2009 to 2014 (CP4). It envisaged work to upgrade the facilities, efficiency and appearance of about 150 medium-sized stations in England and Wales, in a coordinated manner and with an average spend on each station of £1.1 million. By implication the largest stations (most of which are those directly managed by NR) have their own specific plans, while a large number of small – and in many cases poorly-used – stations would be left as they are with minimal maintenance. A design guide was produced to highlight the key measures:

- "customer comfort, security and safety e.g. good standard of seats, good standard of station canopies, adequate CCTV;
- customer information and way finding including core station signage, concentrated passenger information and help points and clocks;
- customer facilities including customer toilets, retail facilities and customer waiting shelters; and

A introduction of modular assets."

4.3.7 A complementary programme is the 'Access for All' initiative designed to ensure that stations can be easily and conveniently used by everyone, including those with disabilities. Most of the works are quite modest, and the appearance of the buildings may well be improved by the associated tidying up of minor features that have accreted over the years (the classic 1930s Southern Railway buildings at Horsham are a good example).

4.3.8 The list of stations 'being considered' for action is reproduced at the end of this report. Information about the works envisaged or completed at each station appears to be scattered across numerous NR documents and press releases and hence is difficult to assemble. Reasonably enough, there appear to have been adjustments as the Control Period has proceeded, but the picture is not wholly clear. Subsequent annual updates have however given a broad picture of progress, and the 2013 edition contains a list of outstanding schemes, from which the original table has been annotated. It appears that work has been completed or is planned at about 340 stations, but there is no comparable programme in the CP5 agenda for the remaining stations or for further work at those already improved[cxxxiv].

other station schemes

4.3.9 Numerous other schemes for stations are being developed and implemented. Some will be at least partially rebuilt in order to address particular problems. For example, at Westbury reintroduction of a former platform is being considered in order to provide additional capacity and greater operational flexibility[cxxxv] and at Rochester the only way to provide extra capacity has proved to be to build a new station on a new site (which will also have a better relationship with the town); what will be done with the 1892 building is not yet known. To bring it into the electrified Birmingham Cross-City Line Bromsgrove is to have a completely new station and its second platform restored, although here virtually nothing of the original buildings has survived.

4.3.10 Manchester Oxford Road is to be extended, but the new design will incorporate the distinguished (though somewhat shabby) Modernisation Plan entrance. Liverpool Central needs attention as part of the upgrading of the City's Underground network. The task of transforming the fine but neglected station at Nottingham is nearly complete, while works at Reading and at the modern but tired Birmingham New Street are well advanced. Schemes to improve circulation may affect historic fabric, as at London Fenchurch Street (the original trainshed roof was removed some time ago). On the Thameslink and Crossrail routes in London the reconstruction of Stratford and Blackfriars has been completed, the new station at Farringdon is taking shape, the low-level platforms at Paddington are in hand, and the major rebuilding of London Bridge has begun – with the loss of important historic features.

4.3.11 At a number of stations in the conurbations and on busy commuter lines a programme of lengthening platforms is underway and will continue. Increasing the number of coaches per train is a critical tool for alleviating overcrowding and is especially important on the lines running into London Waterloo. Most of this work is unlikely to involve older buildings, but it could do so at a few locations where they happen to lie off the ends of existing platforms. As noted above, schemes to provide step-free access to platforms may also affect the appearance of stations.

4.3.12 Retailing at the large stations it manages provides a significant (£513 million) source of income for Network Rail, and the business is presently outperforming non-rail equivalents. Rentals from a wide portfolio of other properties are also important. Recent projects have included the Waterloo Balcony and Victoria Place, and NR expects to continue to enable passengers "to broaden their purchases beyond the immediate requirements of their journey". Schemes at Liverpool Street, Euston, Paddington and London Bridge are envisaged, as well refurbishments elsewhere.

4.3.13 An emerging trend is for bodies outside the railway to campaign for and sometimes participate in schemes to improve stations. This reflects a greater sense of the station as a gateway for a community and its potential role in place-making. Examples include

- West Yorkshire Metro funding for a new south entrance at Leeds (linked to the modern western footbridge);
- the partnership between Network Rail, Merseyrail and Cheshire West and Chester Council to completely refurbish and bring into community-benefitting use the Grade II listed buildings at Ellesmere Port and thereby to create a better facility for travellers;
- at Cheltenham Spa (where some NSIP works have already been completed) a plan for two new bay platforms and a glazed concourse added to the historic façade that will be part-funded through the Local Transport Body mechanism by Gloucestershire County Council and Cheltenham Borough Council (though the original colonnade at the front was removed in the 1980s and some Victorian platform canopies will now be lost); and
- a contribution by Devon County Council to the (much-needed) overhaul of the cramped but classic frontage and forecourt of the Southern Railway's inter-war Exeter Central.

4.3.14 The existing stations at Leeds, Manchester Piccadilly, Birmingham New Street, Birmingham Moor Street and London Euston will need major works if HS2 is built, either to accommodate additional platforms or to ensure good links between the classic and HS2 platforms.

Bridges

4.3.15 The scale of Network Rail's task in maintaining the railway is illustrated again by the fact that its Western Route alone has 3292 bridges of which two-thirds support the railway and one-third something over the railway. Their average age is 120 years; 46% are over 145 years old and the oldest was built 180 years ago[cxxxvi].

4.3.16 Some bridges, both overbridges and underbridges, require rebuilding or replacement because their condition has deteriorated. Some railway underbridges have to be reconstructed to bear the stress caused by heavier or faster trains, and many railway overbridges need raising, or trackbeds lowering, in order safely to accommodate overhead electric wiring providing AC power to trains at 25kV. And innovative designs may simplify future maintenance. ***It should therefore be assumed that the magnitude of the modernisation programme puts almost any railway bridge at risk of demolition or major alteration***. Recent practice with electrification works on the Paisley Canal line does however demonstrate that it is possible to mitigate the consequences for historic bridges, although a problem remains with insensitive treatment of parapets to accord with (perhaps excessively cautious) safety regulations[cxxxvii].

4.3.17 The scale of bridge works for electrification is indicated by the fact that for the Great Western Main Line [GWML] project it will be necessary to rebuild or alter 116 bridges between Maidenhead and Swansea[cxxxviii]. And even relatively modest lines may be affected by infill schemes or those that offer diversionary routes. Examples are Selby … Micklefield Junction (… Leeds), Oxenholme … Windermere (which has been added to the programme in order to eliminate the complications of operating a small diesel outpost[cxxxix]) and Rugeley Trent Valley … Walsall on which work has already started. A campaign to electrify York … Harrogate … Leeds is being mounted by local authorities, but it may struggle to climb the Network Rail priority list, especially in respect of the York … Harrogate section.

4.3.18 Bridges that are vulnerable to flood damage will receive particular attention, as will the old swing bridges at Hull, Goole and Selby. Another category of bridge that may be subjected to rebuilding is that where a high frequency of damage from road vehicles occurs; one near Cannock is currently being rebuilt[cxl]. Some disused bridges may merit attention: one at the

former Derby Friargate (Great Northern) station is the subject of a local campaign to retain and refurbish it.

Signalling buildings

4.3.19 Fourteen 'state of the art' control centres will replace both the numerous surviving manual-lever boxes and earlier generations of electronic signalling installations. This has benefits in maintenance and in the supervision of train movements[cxli]. The work will include gradual adoption of the European Train Control System (itself part of the European Rail Traffic Management System) which will eliminate lineside signals and replace them with indications to the driver in his cab. ***This means that every existing building and piece of equipment associated with the current signalling system will become redundant***[cxlii]. The southern end of the ECML and the GWML will be the first schemes, following the trials on the Cambrian and Hertford Loop Lines. However the programme will probably take until mid-century to complete, and some special-purpose boxes will be retained, for example those controlling swing bridges on The Broads.

4.3.20 Each of the Route Plans has a section on the historic significance of these buildings and the agreement with English Heritage on the listing of a selection of them. For example, London North Eastern recognises the "signal box inheritance" when it refers to the closure of 20 signal boxes and gated level crossings in the course of the upgrade of the GN/GE Joint Line between Doncaster and Peterborough via Lincoln and to 80 more from the transfer of signalling control to the new Operating Centres during CP5. The Route has a strategy based on a comprehensive register that describes the historic importance and context of each building[cxliii].

Level crossings

4.3.21 Level crossings are now the single largest source of risk to the safe operation of trains. That is largely because of the success of warning and protection systems in reducing the number of collisions and derailments. As trains become faster and more frequent level crossings represent both a constraint on capacity and an increasing hazard (the statistical likelihood of an accident increases with the number of conflicting moves, and longer periods of closure to road vehicles provoke frustration and encourage risk-taking). It has therefore become policy that wherever possible crossings will be replaced by bridges or closed and that many of those that remain open will be controlled by advanced equipment and monitored remotely from the new control centres. The programme will be guided by the All Level Crossing Risk Model. The preferred type is designated *Manually Controlled Barrier – Obstacle Detection* [MCB-OD] and relies on electronic scanning of the crossing to ensure that it is clear before a train is authorised to pass. (Technical problems are however causing some delay to their installation.)

4.3.22 Under this programme some 750 crossings will have been closed by April 2014 and many more will follow. A total of 464 will be dealt with in one way or another during CP5, with the aid of a £67 million ring-fenced fund. ***This implies that every existing building associated with level crossings is likely to become redundant***.

Other assets

4.3.23 Other assets which will be the target of substantial programmes include drainage, fencing, electrical supply equipment, maintenance depots, telecommunication facilities and miscellaneous buildings. Improving life-cycle sustainability will be a key objective. Most of these assets are relatively modern and of little conservation interest, but some may merit a watching brief. In certain cases an assemblage of items of railway infrastructure may have historic significance, although it is difficult, outside of preserved railways, to protect them from

changes that are required in the course of running a modern railway. A package of energy-saving retrofits to buildings could also occasionally trigger some conservation concern.

4.3.24 There do not appear to be many specific proposals regarding works and depots. The modern Siemens depot at Manchester Ardwick is being prepared for extra workloads following the electrification schemes in the area and at Reading an entirely new depot is nearing completion as part of the GWML electrification – what is left of the old steam depot will presumably be demolished. Similar situations will arise at some other locations. Of the works buildings surviving in railway use the most vulnerable is probably that now owned by Bombardier at Derby, should the company withdraw from the British market if it fails to win sufficient rolling-stock contracts. As far as is known the buildings at Doncaster and Eastleigh are expected to remain in productive use, and the future of those at Wolverton (and Springburn in Glasgow) has been secured by the takeover of the failed Railcare company by Knorr-Bremse.

4.3.25 The miscellaneous assets of the British Rail Residuary Board (such as the Old Dalby test track, bridges and war memorials) have been transferred to Network Rail, whose budget will include a provision of around £2 million per year for their maintenance.

4.4 Key routes

4.4.1 Lists and diagrams of projects indicate that they will be spread right across the network, but a number of programmes and schemes stand out. The priorities are driven by the principles set out in the Eddington Transport Study, namely that the critical networks (ie. those supporting economic growth) are "urban areas and their catchments, key inter-urban corridors and connections to international gateways, both passenger and freight"[cxliv].

East Coast, West Coast and Brighton Main Lines

4.4.2 Introduction of the Intercity Express Programme [IEP] trains on ECML will necessitate infrastructure work at certain locations to accommodate their 260m length and also upgrading of power supplies. The big projects are the new flyovers north of Doncaster and at Hitchin and the reconstruction of Peterborough station to provide additional tracks and platforms and an improved entrance, but no detail of the smaller schemes has yet been published.

4.4.3 NR point out that the WCML is "the busiest mixed traffic railway in Europe. There are 12 different operators. Fast and slow passenger trains mix with each other and heavy freight trains. Different trains stop at different stations, with different frequency, and other lines join it at regular intervals"[cxlv]. Hence timetabling and real-time management are an enormous problem. Similarly, the Brighton line [BML] is running close to capacity in the peaks. It is assumed that "pricing people off the railway" is unacceptable[cxlvi] and that new capacity will be required. Although the environmental impact will therefore be largely felt in the form of controversial new alignments, as with HS2, ***it is always possible that structures on the classic lines will be threatened by platform-lengthening, reconstruction of stations or the interpolation of new junctions***.

4.4.4 On the WCML the building of a flyover and associated works at Norton Bridge, just north of Stafford, is proceeding through the approvals process. This grade-separation is highly desirable for operational reasons and is unlikely to affect any significant buildings. A larger project to bypass Stafford has been considered and could have a greater impact if it were to proceed, especially if it seeks to deal with the capacity problem through Shugborough Tunnel and Colwich Junction (south of Stafford), an area that includes listed structures and landscapes and an Area of Outstanding Natural Beauty[cxlvii]. An upgrade of the traction power supply will be required.

4.4.5 Tension between Virgin Trains and Network Rail over the condition of the WCML south of Rugby and frequent operating incidents led to an agreement to study the problems

together. The joint report was well received. Some measures, such as improvements in the maintenance regimes for pointwork and overhead electrical equipment, are unlikely to have any visual impact, but action to address trespass and suicide may do so. Sections of line where these often cause disruption are being assessed for the efficacy of more substantial fencing, while barriers on platforms may have some deterrent effect on suicides. The fencing is difficult to argue against, although it may not be very attractive, but the appearance of the barriers, and their inconvenience to staff and to the majority of travellers, must be offset against a possibly rather limited effect.

Northern Hub

4.4.6 This project is designed to upgrade services with enhanced speeds and frequencies across a swath of northern England in order to boost the regional economy. It is centred on the comprehensive rebuilding of Manchester Victoria station, the construction of the Ordsall Curve that will enable the re-routeing of certain services and two new through platforms at Piccadilly. Associated works are envisaged at Newcastle Central, Leeds, Sheffield and elsewhere. Although this is the most high-profile project the step-change in connectivity is expected to be matched elsewhere in the country.

4.4.7 It includes electrification of the trans-Pennine York … Leeds … Stalybridge … Manchester Victoria … [Chat Moss] … Liverpool Lime Street route, Blackpool … Preston, Preston to Manchester via Bolton and Wigan … Liverpool. Stalybridge … Manchester Piccadilly will also be electrified, but the current Manchester … Liverpool route via Warrington Central will not be dealt with for the time being. Four-tracking in the Huyton … Roby area and passing loops in the Hope Valley at Dore & Totley, Grindleford and Chinley will also be required in order to enhance capacity and improve journey-time (that at Dore involves the restoration of the second platform on the westbound line, but it is unclear whether platforms will be restored on the Midland Main Line tracks at the same time). Additional electrification may follow: Hull to Leeds and Doncaster is one such project, to prevent Hull being marginalised as a diesel-operated backwater.

Cross-country

4.4.8 There is a scheme to raise line speeds, reduce journey times, bring performance improvements and increase passenger and freight capacity between Barnt Green (the traditional London Midland / Western Region boundary in the south-western outskirts of Birmingham) and Westerleigh Junction (where the cross-country line through Cheltenham joins the Great Western Main Line east of Bristol Parkway). A similar scheme is in hand for the 'Oxford Corridor', the line from Birmingham and Coventry to Didcot via Leamington Spa and Oxford.

East West Rail

4.4.9 This project will provide additional capacity to accommodate growth in freight and passenger markets by reopening the Bedford … Bletchley … Bicester … Oxford railway to create a direct link between the Midland, West Coast and Great Western Main Lines. There may be historic structures both on the open but lightly-trafficked sections and on the sections abandoned many years ago. The project incorporates the Chiltern Railways scheme to open a new Oxford … London Marylebone route by building a curve between the former London & North Western Line and the former Great Western Birmingham main line at Bicester. At a later stage the promoters (primarily local authorities) hope to recreate the Cambridge … Bedford link, but new alignments will be required because significant parts of the trackbed have been built on.

Great Western Main Line

4.4.10 NR state[cxlviii] that "Proposed expenditure on Great Western electrification has increased by over £300m due to increased scope (including new bridge reconstructions) and the development of an electrification system that meets the requirements of European regulations and those of new trains".

Greater Bristol

4.4.11 In order to facilitate the introduction of the IEP long-distance trains, including four trains/hour between Bristol and London, together with faster and more frequent services on other lines there are proposals for an additional platform at Bristol Parkway, four-tracking of Filton Bank, remodelling of Bristol East Junction, and an additional platform, extra station capacity and a master plan linked to wider urban redevelopment at Bristol Temple Meads. The latter has now emerged as a very ambitious scheme indeed with profound implications for the classic Brunel and Great Western buildings. A Memorandum of Understanding was recently signed between Network Rail, Bristol City Council, West of England Local Enterprise Partnership, Homes and Communities Agency and English Heritage.

4.5 Strategic Freight Network

4.5.1 The Strategic Freight Network [SFN] was conceived by the Department for Transport in 2007 in order "to provide a framework for investment and network management to better meet freight requirements". By reducing conflicts with passenger traffic and creating new capacity it would "improve the logistical efficiency of the railway and secure … reliability gains to benefit all users". Detailed analysis identified routes that would be prioritised for clearance for larger gauges, lines that could be reopened and sections that would facilitate diversions (the freight industry attaches particular importance to this since it expects the same '24/7' availability as is normal on the roads). Funds were set aside for SFN works during CP4, and it was envisaged that the programme would continue through CP5. Staging was to be influenced by what could be undertaken as a component of wider projects[cxlix].

4.5.2 Each of the principal commodities carried by rail was considered. For most bulk flows (coal, oil, steel, construction materials, waste) the requirement would primarily be for additional and sounder paths. In the present context the most significant element would be the provision of capacity for the expected continuing growth in the conveyance of maritime containers and in particular gauge clearance to accommodate the increasing proportion of 9'6" (2.9 m) boxes[cl]. This intermodal traffic would require the largest normal British gauge, known as W10, to be made available on the principal routes between the container ports and the inland terminals.

4.5.3 The routes identified were the Great Eastern, East Coast, Midland, West Coast and South Western Main Lines, the cross-country route between the Haven Ports, Peterborough, Leicester and Nuneaton, Crewe … Stoke-on-Trent … Derby, and the Southampton … Oxford … West Midlands corridor. The germ of the 'electric spine ' concept [see ¶4.3.2-4] can be seen in the proposal to develop the part-abandoned Bedford … Bletchley … Oxford line to provide alternative links with the West Coast and Midland Main Lines. A key diversionary route was to be the Laverstock Curve near Salisbury to enable Southampton trains to run via Andover when the Eastleigh route is closed. The partially-closed line between Lichfield City, Ryecroft Junction [Walsall], Bescot and Stourbridge Junction was to be safeguarded from development in case extra capacity or a diversionary route were required north of Birmingham.

4.5.4 Apart from the 'Continental' gauge (which cannot be achieved on the British network at an acceptable cost, except for some short sections linked to the High Speed 1 Channel Tunnel line) there is one gauge larger than W10, namely W12. This enables refrigerated containers that are 9'6" high but slightly wider than standard boxes to be conveyed by rail. However the works so far undertaken to implement W12 are too patchy for it to be effectively

available for whole routes. The expenditure will therefore only come to fruition when further work is completed, and for that there does not appear to be a systematic plan.

4.5.5 The W10 gauge enhancement programme is illustrated in two accompanying charts obtained from Network Rail. They show the position in April 2009 at the start of CP4 and the position as it is expected to be in April 2014, at the end of CP4. It will be seen that a great deal has been or will shortly be accomplished and an effective network is now available for most combinations of port and inland terminal. It is expected that the emphasis in CP5 will shift to better timetabling and where necessary to extending loops to allow longer trains to run. This will have much less impact on structures than the gauge works.

4.5.6 The completed additions to the W10 network during CP4 comprise Peterborough … Nuneaton and Southampton … Nuneaton and Birmingham. The East Coast Main Line between Berwick-upon-Tweed and Doncaster, the 'Joint Line' between Doncaster and Peterborough and the ECML between there and London will be completed by the end of the period, together with the Teesport … Darlington line[cli], South Yorkshire … West Midlands and the Laverstock diversionary route.

4.5.7 Some key connecting projects remain to be completed later, including Carstairs (on the WCML) … Edinburgh … Berwick (without which the northern part of the ECML is of little use), some sections in West Yorkshire and the Manchester- Liverpool area (the latter probably undertaken during the electrification works), Stoke-on-Trent … Derby and the South Western Main Line between Basingstoke and London, including its links across London. Work on the Doncaster … Peterborough section of the ECML including Lincoln … Newark is being planned on the basis of a Section 106 agreement with Hutchison Ports (UK) [HPUK] made when the company was granted planning permission for expansion at the Port of Felixstowe.

4.6 Summary Business Plans for each Network Rail Route

4.6.1 Each Route has produced a Business Plan which supplements the documents of the national plan[clii]. They contain a great deal of detailed material as well as expressing the route manager's corporate ambitions and business-speak messages. As a result they can become tedious to read, especially since some have not been decently edited. All the plans emphasise the growing importance of Remote Condition Monitoring and of the ORBIS programme for more detailed and more efficient asset management.

London North Eastern [LNE]

4.6.2 The LNE Route Plan first notes the ECML CP4 schemes on which work is underway in preparation for the new fleet of IEP trains and the associated recast of the timetable: new flyovers at Doncaster North Chord and at Hitchin, layout and station improvements at Peterborough and on the Alexandra Palace … Finsbury Park section, and work to improve the route via Lincoln so that freight can be transferred from the main line. In CP5 ETCS will be implemented on the south end of ECML and Colton Junction / Selby … Micklefield Junction … Leeds will be electrified as part of the trans-Pennine project (or possibly in advance of it, by autumn 2014 – though this was probably spin since no further announcement has been made). The new Rail Operating Centre at York, one of the 14 planned for the network, is under construction. And there is a commitment to "improve connectivity and performance", although the Plan merely states that the Route "will work with the industry to identify the most appropriate interventions"[cliii].

4.6.3 During the final year of CP4 gauge rectification works at tunnels and bridges, ranging from track lowering or sluing to complete renewal, will return fifteen sections to their intended gauge. They include Newcastle … Carlisle, Stillington … Ferryhill, Hull … Bridlington, Harrogate … Leeds, Skipton North Junction… Chesterfield, Leeds … Bradford, Milner Royd

Junction … Bradford and Barnsley … Sheffield. The reconstruction of Wakefield Westgate station will also be completed: this comprises repair of the older buildings on the down side and a new building to replace the unworthy modern structures on the up side.

4.6.4 CP5 projects that may have some effect on older infrastructure include further work at Leeds, Doncaster and Sheffield stations and the ambitious scheme to transform Newcastle Central, the Hull to Gilberdyke, South Humberside and Horbury Junction … Barnsley … Meadowhall linespeed improvements, a small project at Marsden for the same end and new freight capability for the Port of Tyne, Teesport and Immingham. It is possible that improved provision for intermodal freight may lead to plans for a flyover at Werrington Junction north of Peterborough, but its construction could seriously disrupt ECML services. The 'electric spine' scheme did not include three key links in the Sheffield area, namely Doncaster South Yorkshire Junction … Sheffield, South Kirkby Junction … Swinton and the Rotherham … Beighton Junction … Chesterfield freight line, but LNE expects these to be covered in CP6.

East Midlands

4.6.5 The Midland Main Line will be electrified between Sheffield, Derby, Nottingham and Corby and Bedford. This will probably include gauge clearance to W10/W12 for intermodal freight trains. Other works are expected in order to realise the concept of the 'Electric Spine'. These will mostly be 'capacity interventions' such as realignments, extra tracks and platform lengthening that may incidentally involve historic structures. One particular case is the curve at Market Harborough, easing of which may seriously affect the distinctive station building.

4.6.6 The route has seven major structures "which are large, unique and require specific management plans": they are Harpers Brook, Harringworth Viaduct, Mansfield Viaduct, Trent Viaduct (fast lines), Welsh Harp Viaduct the Wichnor Viaducts over the rivers Trent and Tame and the Chiltern Green Viaduct (slow lines). It also has two Grade 2 listed signal boxes, Sudbury (1885) and Oakham Crossing (1899) that are expected to close in 2015.

London North Western [LNW]

4.6.7 The Route Plan includes a particular emphasis on maintenance of its stock of buildings: "The large number of buildings provides an opportunity to reduce energy consumption and improve energy efficiency. The route's Accommodation Strategy proposes to rationalise and consolidate properties in order to reduce the number required. The replacement and refurbishment of structural assets across the route will be reviewed prior to expenditure and exploration of opportunities to improve the whole life cycle sustainability of those projects will be considered, e.g. retro-fitment of buildings with energy efficient technology. The route is considering setting minimum specifications for sustainability in its buildings portfolio. The use of the national assessment tool (BREAAM) [*sic*] will be mandated and the industry recognised carbon calculator will be used to enable carbon output to be measured"[cliv]. It also emphasises that Network Rail "has a legal obligation to protect the environment within which it operates" and hence that "the Route will continue to work alongside the appropriate organisations to ensure ongoing operations, infrastructure maintenance and enhancement activities have minimal impact on the aesthetics of the environment and it surroundings" and that "any major projects will automatically have environmental impact assessments".

4.6.8 Projects that may affect structures include the Northern Hub works in Greater Manchester; possible improvements at Liverpool Lime Street; modernisation and capacity enhancements at Moorfields in Liverpool and at Birkenhead Hamilton Square; partial doubling of the Redditch branch at Alvechurch; the new station at Kenilworth; the rebuilding of the East <> West line between Bedford and Oxford, including the new link with the Chiltern main line at Bicester; and alterations at Watford Junction to accommodate the diversion of Metropolitan Line trains from Watford, London Underground.

4.6.9 No fewer than 56 'complex structures' and 20 major bridges will require attention in CP5 as part of a long term sustainable approach to maintenance. One example is the 49 spans of Whalley Viaduct in order to prevent pier settlement caused by the deterioration of the original timber piles. Certain long timber bridges will receive accelerated replacement.

Anglia

4.6.10 The scale of the challenge facing the route is evident in a list of the key capacity and capability issues, such as single lines, the mix of different types of train, constricted layouts and lengthy signalling headways, and inadequate space at busy stations. It is however unlikely that many of these can be addressed in CP5, but all have implications for the longer term[clv]. "Strong passenger growth" is expected, and it is assumed that the number of trains run will increase. Specific infrastructure measures include renewing lineside security fences (primarily to prevent incursions by large animals) and vegetation management to maintain sight lines and to control low-adhesion risks.

4.6.11 The RUS that focussed on Stations identified the need to relieve congestion at London Fenchurch Street (work was brought forward and has now been completed) and probably to intervene in due course at Barking and Tottenham Hale. Developments are in hand at Cambridge and Seven Sisters in CP4. At Cambridge this is in conjunction with redevelopment around the station with office, retail and residential units. Improvements to the forecourt area and station buildings themselves are being made under Section 106 obligations and include relief for the well-known crowding problem. Alterations for operating purposes are likely at Colchester and Witham. London Liverpool Street requires regular maintenance due to high passenger volumes and its age, and renewal of the train shed is programmed.

4.6.12 Six bridges between Norwich and London Liverpool Street are due to be replaced, together with ten in the Lea Valley and a number on the Barking to Fenchurch Street line. Bridge strengthening works are planned between South Tottenham and Woodgrange Park, and the line between Woodgrange Park Junction and Gospel Oak Junction is to be electrified (that this was conditional resulted from an argument over funding). A number of bridges that are known to fall short of modern standards will also need attention, and the condition of many pre-stressed concrete bridges is giving concern. The four swing bridges require constant maintenance.

4.6.13 New stations are to be built at Soham and Lea Bridge. The Kew Branch is to be cleared to W10 structure gauge. Six mechanical signalboxes in the Norwich area will be closed when control passes to the Romford Regional Operating Centre. There is a dilapidated Grade II listed engine shed at Clacton on Sea[clvi]. During CP5 eight carriage washers will be replaced, seven stations and maintenance depots will be relit and rewired and some station canopies will be renewed.

Western

4.6.14 As befits its history the plan for the Western Route has a distinctive section on its approach to its built heritage[clvii]. It is worth quoting in full (whether the Route always lives up to its aspirations is for others to judge).

> "The Western Route's historical and architectural significance is recognised and the teams work closely with English Heritage and other conservation/heritage bodies to make sure sensitive structures are safeguarded. There are nearly 200 listed structures, stations and signal boxes including two of the nation's Grade 1 listed stations, London Paddington and Bristol Temple Meads. It is also responsible for Grade 1 listed structures including Wharncliffe Viaduct near Southall and the Royal Albert Bridge that spans the River Tamar.

"Network Rail's 10-year improvement plan includes electrifying part of the route. An example of engagement in heritage resulted in English Heritage launching a consultation on the architectural importance of structures along the Great Western railway in 2012. That work has led to 40 new listings and listing upgrades including Box tunnel and the Maidenhead Railway Bridge. This approach protects sensitive structures whilst major improvement work is delivered. The approach has impressed English Heritage with the evident commitment to respecting the special structures in Western Route's care.

"Novel solutions will need to be deployed to enable electrification through these heritage assets and the Western Electrification team are currently developing acceptable solutions in liaison with Heritage bodies.

"Through CP5 the Route will continue to refine its approach to further improve its proactive asset management of listed buildings. This will be achieved by ongoing review of the heritage portfolio and prioritising interventions based on condition, significance and heritage status. This will avoid deterioration of historic fabric and allow the maintenance of these important assets in accordance with their heritage status.

"Novel approaches and innovations will continue to be deployed such as the replacement of a listed footbridge at Dawlish station with a fibre reinforced polymer replacement moulded with the same detail as the original, including the rivet heads.

"By the end of CP4 the Route will have spent £80m on works at Paddington and the Royal Albert Bridge.

"Paddington station was built in 1854 with Span 4 added in 1916. The works to Span 4 included major steelwork repairs, scrollwork repairs and replacement, re-glazing and re-lighting. This resulted in winning the 2012 National Heritage award for station environment. Works to refurbish Spans 1-3 in a similar vein are also planned so that by the end of CP4 Paddington station train shed roof will be restored to a condition not seen since the mid twentieth century.

"Royal Albert Bridge was completed in 1859. The works being undertaken in CP4 concentrate on the iconic central span and involve major steelwork repairs, including replacing around 50,000 bolts, and repainting of c.18,000 metres square of structure. This will allow it to continue to stand as a testament to the engineering genius of Isambard Kingdom Brunel.

"Listed areas are demarked by their curtilage and not all assets within it are necessarily part of the listing. In CP5 the Route is planning major refurbishment of Bristol Temple Meads ahead of electrification. In order to understand and fully categorise the significance of the fabric within the station environs, a conservation statement is currently being developed and consulted with the various heritage bodies. This work is essential to inform and enable proposed enhancement works associated with the 10-year improvement plan including the station master plan and the Western enterprise zone, with Temple Meads at its heart.

"Structures works included in the CP5 bid include the 17 approach spans to the Royal Albert Bridge, which will mean that the structure in total is refurbished at the most appropriate time for whole-life asset management. Other works in CP5 target planned preventative maintenance of listed structures safeguarding their condition for now and the future."

4.6.15 Crossrail requires reconfiguration of the relief lines between Maidenhead and London Paddington, including platform extensions for longer electric trains at Maidenhead, Taplow, Slough, Langley, Iver, West Drayton, Hayes & Harlington, Southall, West Ealing (plus a new

bay platform for Greenford services), Acton Main Line and Ealing Broadway. Other works are the redoubling between Kemble and Swindon, the proposed reopening to passenger traffic of the Portishead branch (presently freight only) and the imminent major repairs to Whiteball Tunnel.

Wessex

4.6.16 Some twenty bridge reconstructions of a scale requiring 48-72 hour possessions are likely to be undertaken in CP5. Another acute problem is presented by the long, deep cuttings on the approaches to tunnels where unstable ground may necessitate reducing the slope and removing vegetation (the risks attendant on a derailment and its aftermath at these locations are high). Those at Honiton, Crewkerne and Gillingham are likely to be addressed. Of bridges on the route the 'wheel-timbered' structures over the rivers Avon and Stour will need attention, as will the large bridge over Westminster Bridge Road immediately outside Waterloo (this will be programmed with the reconstruction of the track in the 'throat' of the station).

4.6.17 Like the Kent Route Wessex notes the large number of lineside buildings (982), the mediocre state of repair of many of them, their criticality to operations and hence the need for systematic overhaul. Most will probably have little historic or aesthetic significance, but a few may and others are of generic styles which may justify listing of some good examples.

Sussex

4.6.18 Rebuilding London Bridge for the enhanced Thameslink service in 2018 is imposing severe operating constraints and hence limiting other works on this Route. Nonetheless current projects include the developer-led replacement of the principal buildings at Redhill and the addition of an extra platform, and the extra platform at Gatwick Airport in order both to provide additional space for passengers and to remove some routeing conflicts north of the station. More substantial schemes are being prepared for CP6 and may include grade-separated junctions and additional tracks to increase the capacity of the Brighton Main Line[clviii] and station works to aid passenger flow at Wimbledon and London Victoria (the latter is described as 'concourse decongestion').

4.6.19 As with other Routes, Sussex faces the need to attend to major structures. Hooley Cutting near Redhill has required reworking of its slopes, Chelsea River Bridge a major overhaul and Goat House Bridge at Norwood Junction upgrading to modern standards. In CP5 work on the viaducts at Shoreham (over the Adur) and Thorndell is being planned, as is replacement of timber components on the Arun River Bridge at Pulborough. At least 16 underline bridges will be rebuilt to avert structural problems, and Mitre Bridge carrying the West London Line over the Great Western Main Line also needs attention. The comprehensive refurbishment of Brighton station has just been completed, and East Croydon is being rebuilt to cope with increasing footfall.

Kent

4.6.20 Major works are under way at London Bridge. A new station for Rochester has been approved; this will be on a fresh site and presumably the original building will be redundant. Other major structures that are expected to need extensive works are the river bridges at Charing Cross (Hungerford) (strengthening), Cannon Street (painting) and Rochester; Southborough Viaduct (response to scouring); and Sevenoaks and Bo-Peep tunnels. The coastal line between Folkestone and Dover passes through or alongside unstable chalk formations, and work may be required on the Abbotscliffe, Shakespeare and Martello Tunnels. Minor works may be undertaken at stations to secure level access.

4.6.21 Approximately 600 operational lineside buildings support the network in Kent, of which many need repair. A number of concrete footbridges (the 'Exmouth' type) survive but are being rapidly replaced; in some cases lifts may be installed. In the longer term alterations to stations could accompany the possible transfer of the Hayes branch to London Underground as an extension of the Bakerloo Line.

5 Possible future developments

5.1 Slowing of growth

5.1.1 Since the mid-1990s rail traffic has grown at a remarkably consistent and sustained pace. It is easy (and too easy for the ideologically committed) to associate this with privatisation, the freedoms of private companies compared with those of a nationalised industry and the introduction of competition within the railway (as distinct from the longstanding and fierce competition from other modes). The story is in fact considerably more complex, and the reasons why the downward trends reversed so decisively are not fully understood.

5.1.2 In the case of freight traffic it is important to distinguish the two principal sectors of the business since aggregating them gives a misleading picture. Movement of coal is primarily a function of the quantity required for electricity generation and of the ever-changing mix of sources, although competition between the rail hauliers and hence some advances in efficiency may have had an effect at the margin. Tonne-kilometres grew by 45% between 1999/2000 and 2012/2013. All other traffic grew by 0.4% (in t-km) over the same period. Within that total the tonnage of containers (predominantly those landed or shipped at container-handling ports) increased faster, by 62%, than that of other commodities, some of which fell sharply, largely as a result of external changes in markets and industrial organisation. In recent years there has been a sharp rise in the movement of domestic containers as retailers and some road hauliers have been attracted to rail in response to growing congestion, a shortage of long-distance lorry-drivers and awareness of environmental issues[clix].

5.1.3 Some of these trends may continue, others may not. It is therefore surprising that rail industry forecasts appear to rely on a single scenario that presumes prolonged strong growth[clx]. It is recognised that coal will decline rapidly as fossil-fuel power stations are decommissioned, but this is expected to be offset by conveyance of imported biomass, a traffic that is going to present notable logistic challenges. Container traffic on the other hand is forecast to increase dramatically, but this is heavily dependent on trends in world trade. Moreover, a presumption of growth ignores the possibility of changes in practice and sentiment, for example decisions to reverse outsourcing and bring manufacturing back to Britain, a consumer reaction to the waste inherent in short-life goods and perhaps sharply rising prices caused by factors in Asian economies and resource-scarcity, including the cost of the oil used for transport itself.

5.1.4 In the case of passenger traffic the explanations for recent trends include

- the availability, at least until 2007, of a great deal of disposable income for discretionary spending among social groups for whom extra travel would be a commonplace;
- exasperation with road congestion and a degree of environmental conscience over unnecessary use of cars;
- a rise in the cost of running cars and curbs on the financial benefits of company cars;
- the quality of the rail service connecting many centres with a high proportion of 'knowledge-based' jobs and the ability to use electronic tools on trains that cannot be used in cars;

- a marked decline in the status-enhancing role of cars among young people;
- the growth of employment in London, where commuting other than by rail is almost infeasible; and
- the growth of the service sector, and particularly of financial jobs, in cities such as Edinburgh, Leeds and Manchester, coupled with the renewed popularity of inner-city living (which prompts leisure travel by rail) and the attraction, partly for house-price reasons, of ex-urban residential areas (from which commuting by rail has London characteristics).

5.1.5 This is a formidable list, against which an emphasis on privatisation *per se* looks unconvincing. More importantly, it is not axiomatic that so mixed a set of favourable trends will continue. Some may strengthen, others weaken, other new trends may emerge. Not all NR forecasts are based on what appears to be rather simplistic extrapolation, since some exercises in more sophisticated scenario-painting have been conducted, but a confident expectation of continuing growth pervades most of the planning documents and Government pronouncements.

5.1.6 For both freight and passenger traffic then ***it would be wise to assume that the plans are more likely to be adjusted for a weakening of growth than for a faster pace to materialise***. This proposition holds even though the Government is committing unprecedented levels of funding to the railway in the conviction that the economy will benefit and that growth will continue unabated. Precisely which components might be scaled down if circumstances change cannot easily be foreseen, but any which heavily depend on particular flows or types of train should be treated with caution. This position may gain credibility from the most recent statistics, which suggest that growth in the long-distance and regional markets has been very slight for the last two years and that only the London & South East market is really buoyant[clxi].

5.2 A revised understanding of capacity

5.2.1 Definition of the capacity of a railway is notoriously problematic. For a line with a homogeneous fleet of trains and standard running times and stopping patterns, and without junctions, capacity is simply (though even then not exactly) determined by the signalling headway between trains. This is broadly the circumstance on, say, London's Victoria Line, but the effect when those conditions do not apply is shown by the difference between that line's achievement and that of a more complex operation such as the Circle Line. On the main line railway a very varied mix of trains and a very complex geography makes measurement of capacity with any standardised metric almost impossible.

5.2.2 This has not inhibited researchers anxious to find definitions that may assist infrastructure managers who, under the European regime of separated functions, feel the need to measure capacity in order to assist in the allocation of paths and the identification of 'congested' routes that require action of some kind. However such an approach misses two key points. Firstly, it can be argued that the capacity of a railway cannot be determined *a priori*, but that it is a *post hoc* function of the decisions taken in planning a timetable, in other words of the chosen priorities and the relationships between the paths placed on the timing graph (which are themselves a mix of technical and market factors). The second point is that capacity is not of course solely a matter of trains/hour: it must also encompass passengers or tonnes per train.

5.2.3 Network Rail, which is only responsible for the mechanical task of constructing the timetable and not for its commercial specification (which rests with the TOCs and FOCs), sometimes seems to lose sight of the first, while the second is, for similar reasons, barely assessed either by NR or ORR. This is nonetheless strange, given the alleged pressure on capacity: on parts of the network (eg. on the trans-Pennine route between Leeds and Manchester) many trains comprise only a few carriages but the service is frequent. To some

extent this is legitimate, since frequency is a key factor affecting modal share, but the issue must be addressed when measures to alleviate congestion are being addressed and the solutions may be expensive.

5.2.4 A related matter is the complex relationship between the number of trains, their speed, the structure of timetables and demand. Reassessment of these factors may lead to some revision of conventional assumptions about the way in which routes are planned and hence in some cases to modification of infrastructure programmes[clxii]. It may also require adjustments to NR's regulatory output targets during the course of a Control Period by means of the change-control mechanism.

5.2.5 ***It is possible therefore that the question of capacity and the presumption that limits are being reached may be revisited***. Again, some scaling back of infrastructure projects – in favour of rolling-stock solutions or timetable revisions – might result, especially if financial pressures to economise are being simultaneously felt. These could become acute if the hitherto-disregarded issue of the scale of Network Rail's debt comes to the fore, as many in the industry believe its unsustainability will force it to do.

5.3 Institutional changes

5.3.1 Network Rail reports[clxiii] that it is "investigating the possibilities of letting **an infrastructure concession** to manage part of our network while retaining a focus on the network through improvement of our system operator activities". This is of uncertain provenance, has not been overtly presented as policy by DfT, is hardly mentioned in the railway press and seems somewhat incompatible with all the effort that has gone into creating a strong, unified organisation. ***Nonetheless it could happen and needs to be monitored, because a private-sector utility manager, even within the constraints of a time-limited concession, would not necessarily have the same respect for the built infrastructure that NR does at least aspire to.***

5.3.2 The Office of National Statistics [ONS] has been asked to look again at the curious status of Network Rail as a company that is neither properly private nor owned by the government and having its debts counted on the public balance sheet. It is generally accepted that this is unsustainable both in governance terms and as a matter of policy in the face of substantial increases in the debt and hence in interest payments. If ONS does decide to declare it a public debt then it is possible that the Department of Transport will be forced to take a more direct role in the management of NR and that greater constraint may be exercised over expenditure, with profound consequences for many of the schemes mentioned in this report. In turn that may trigger a wider review of the structure and purposes of the industry.

5.4 The relationship between Network Rail and its regulator

5.4.1 As a monopoly owner and manager of Britain's railway infrastructure Network Rail is supervised by the Office of Rail Regulation. It is perhaps unsurprising that the relationship is sometimes tense. NR has a large, complex and difficult task in managing the system while at the same time coping with unprecedented growth and an inheritance of structures many of which are not in the best of condition. ORR on the other hand has the luxury of detachment, its own sources of expertise, a profound belief in the virtues of independent regulation and a conviction that NR is not as efficient as it could and should be (but note that NR has challenged the relevance or validity of some aspects of ORR's benchmarking studies).

5.4.2 This situation is largely a matter of governance for the railway as a whole, and critics of the structure would like to see it simplified and the inherent process-costs and second-guessing removed. However it is relevant for the present purpose in two respects. First, the immense pressure on NR to become 'more efficient' in everything it does could run the risk of

it paying less attention to heritage issues than it should. This may be compounded in some cases by real or bureaucratic concerns about safety, since ORR is also a vigilant and assertive safety regulator. And second, ORR has the final say on NR's expenditure in each Control Period. If it has not been satisfied about the soundness of the economic assessment of specific projects it may withhold approval. The effect of this is that any of the plans outlined in this report could be curtailed.

5.4.3 At the time of the Draft Determination of NR's CP5 plans ORR cast doubts on the scale and cost of both the Northern Hub and the East-West projects. Representations about this were received from both industry and external parties. In the Final Determination ORR have effectively agreed to defer the issue until the projects have been more fully specified in conjunction with NR's train-operating customers and other interests. This approach also covers the Waterloo Throat and Electric Spine schemes[clxiv].

5.5 A change of Government and new policies

5.5.1 A General Election is required by Statute to take place in May 2015. Its outcome is particularly difficult to foresee in circumstances of economic uncertainty, highly uneven distribution of the benefits of such growth as there is, volatile public attitudes and the probable occurrence of unexpected dramatic events. That said, a majority Labour Government is at present seen by many commentators as the most likely scenario. If it were to occur it would have significant consequences for Britain's railway.

5.5.2 Labour's transport policy is not yet fully formed (and is prone to the adoption of populist causes in preference to deeper analysis), but it is clear from the many voices criticising the prevailing system of governance and from the strong undercurrent of public support for radical changes that a new Government would be expected to act firmly and quickly. And while most people in the industry are in denial regarding the possibility of another reorganisation (both from understandable concern about transitional effects and from their vested interests) a few are beginning to voice ideas of what would be advantageous. The new Shadow Secretary of State, Mary Creagh, has begun to hint at what she has in mind.

5.5.3 The most important changes would probably be:

- moving from the present regime of franchises, with concessions in particular cases, to an all-concessions regime;
- recreating a national InterCity brand;
- devolving responsibility for letting and managing the concessions to regional bodies and allowing them, plus the Scottish and Welsh Governments, to partner with non-profit organisations instead of being constrained to negotiate with a limited group of private companies and European railways[clxv];
- limiting the role of the Regulator, possibly by merging ORR into Network Rail; and
- a reform of railway finances and the fares system.

Many campaigners, and if polls and blogs are to be believed many among the general public, would wish to see full reunification – and even to 'Bring Back British Rail'. Labour may however baulk at that (unless a crisis in NR's finances precipitated it), and sympathetic voices in the industry will advise that key objectives can be more effectively met by the changes mentioned above and by setting the industry a vision of an integrated public service embedded in a clear statement of the inclusive purposes of the state and local grants.

5.5.4 None of the changes would have an immediate or obvious effect on the railway's built environment, but in due course there could be an expanded programme of modernisation – probably spread more evenly around the country – and a vigorous campaign to reopen stations and lines[clxvi]. This could include strong efforts to turn stations into 'community hubs',

some of which is happening already: extending the range of activities will imply construction works on the station and in its environs, and in particular the bringing back into active life of presently-disused accommodation (what has been achieved recently at Ellesmere Port is a prime example).

5.5.5 One other sequence of decisions could occur. The Labour Party is equivocal about HS2 and a tense political game is being played over the question of multi-party support for the project. If Labour did decide to withdraw its support and in Government to abandon the proposals in their current form it is likely (and certainly desirable) that this would be followed by a comprehensive study of a wide range of alternative schemes, some of which would probably involve new alignments, albeit for slower speeds. These schemes would be spread across the country and could impinge on many features of the railway environment.

5.6 Filling gaps in the network

5.6.1 A weakness in the prevailing planning regime is that it concentrates on renewal and development of the existing network. Some projects to reopen closed lines or stations and occasional new links such as the Ordsall Curve in Manchester as a key element in the Northern Hub are taken forward when a particular study (or a campaign group) identifies them, but there is no systematic analysis of the network with a methodology designed to fit it better to future demands or to facilitate significant changes in the modal split. For example, in planning trans-Pennine electrification no study seems to have been made of the case for a new base tunnel, while the absence of a railway link in the M1 corridor between the East Midlands and the Northampton + Milton Keynes area is a major gap.

5.6.2 Were priorities to change and a different approach to be adopted it is possible that some existing projects might be deemed relatively marginal while more radical schemes became a higher priority. This could alter the relative vulnerability of historic buildings while also introducing new threats arising from a different scale or location of works. In some cases a new line might use parts of abandoned alignments where important buildings survive in non-railway uses.

5.7 Sustainability as a priority

5.7.1 The forecasts of continuing growth in rail traffic, both passenger and freight, all essentially assume a 'business as usual' future. Apart from some limited modelling of alternative scenarios in NR's longer-term studies there is little acknowledgement of the possibility of fundamental shifts. This is not of course any different from the assumptions made by many bodies, especially those close to governments, but that does not make such shifts any less likely. They include:

- weather events that cause the Government to act more firmly on carbon reduction;
- sharp rises in energy and raw-material costs;
- any one of many instabilities in the global economic system becoming acute;
- a reversal in the trend to out-source production; and
- social unrest in response to austerity and inequality.

5.7.2 It is extremely difficult to forecast the effect any of these might have on rail investment, but it can be said that the effect could be considerable. The first two for example could both cut the total volume of travel and increase rail's modal share, with an unclear net outcome and probably differential effects in various sectors of the market. Conversely, bringing production back to Britain in response to rising costs in overseas factories and rising transport costs (and maybe some consumer reaction against short-life goods produced in questionable conditions) could cut the number of imported containers without offering

alternative flows (because the new geography would be lorry-dominated). And the impact of unrest is almost impossible to foresee.

5.7.3 The point of this brief section is not to argue that any of these things will necessarily happen but to ensure that when analysing all the programmes for railway projects it is borne in mind that they should not be treated as absolutely fixed just because continual growth has been assumed. They may have to be adjusted for future circumstances.

5.8 Addendum

5.8.1 Just before completion of this Report DfT announced[clxvii] that the Wigan … Westhoughton … Lostock Junction [… Bolton] line is to be added to the Lancashire electrification scheme in order to "enable the conversion of the busy Wigan to Manchester Victoria services and Wigan to Manchester Airport services from older Pacer diesel trains to more modern and higher capacity electric trains." The statement referred to Wigan (North Western Station), but the present services run via Wigan Wallgate as through trains from and to Southport or Kirkby. It is therefore unclear what is envisaged, since severance at Wigan and continuing diesel operation west thereof would probably not be popular. At the very least a rebuilding to improve the link between the two adjacent but separate stations might have to be considered.

5.8.2 The same announcement described the setting up of a 'task force' to identify the next generation of schemes to be electrified. The routes to be examined include Leeds ... Harrogate ... York, Selby ... Hull, Sheffield ... Leeds, Sheffield ... Doncaster, Middlesbrough … ECML, Sheffield ... Manchester via the Hope Valley, Warrington... Chester and Crewe ... Chester (some of these are mentioned elsewhere in this Report).

National Stations Improvement Plan	
Train Operating Company	Stations
Arriva Trains Wales	Abercynon, Abergavenny, Aberystwyth, Bangor, Barry Dock, Bidston, Caldicot, Cardiff Central, Cardiff Queen Street, Carmarthen, Chester, Dinas Powys, Dinas Rhondda, Frodsham, Haverfordwest, Helsby, Hereford, Heswall, Llanbradach, Llandudno Town, Llanelli, Llwynypia, Ludlow, Milford Haven, Nantwich, Neston, Penrhiwceiber, Pontypool & New Inn, Pontypridd, Port Talbot Parkway, Porthmadog, Pyle, Quakers Yard, Rhyl, Severn Tunnel, Shrewsbury, Swansea, Ton Pentre, Trefforest, Ty Glas, Wem, Whitland, Ystrad Rhondda.
C2C	Basildon, Chalkwell, Chafford Hundred, Limehouse, Ockendon, Shoeburyness, Southend East, Upminster. **Barking**
Chiltern Railways	Aylesbury Town, Gerrards Cross, Leamington Spa, Princes Risborough, Warwick, Wendover. **Bicester North, Banbury, Haddenham & Thame**
East Midlands	Alfreton, Burton on Trent, Derby, Kettering, Leicester, Long Eaton, Loughborough, Skegness. **Spalding, Chesterfield**
First Great Western	Castle Carey [*sic*], Cheltenham Spa, Chippenham, Didcot Parkway, Exeter Central, Exeter St Davids, Gloucester, Newbury, Newton Abbott, Penzance, Slough, Swindon, Truro, Westbury, Weston-super Mare. **Burnham, West Drayton, Plymouth, Southall, Bath Spa, Theale**

First Capital Connect	Bedford, Finsbury Park, Flitwick, Harpenden, Harringey, Hatfield, Hitchin, Kentish Town, Leagrave, Mill Hill Broadway, Potters Bar, Royston, St Albans, Stevenage, Welwyn Garden City, West Hampstead. **Biggleswade**
London Midland	Berkhamsted, Bloxwich, Bloxwich North, Cannock, Hednesford, Kidderminster, Landywood, Milton Keynes Central, Rugeley Town, Tamworth, Telford, University, Watford Junction, Worcester Foregate Street. **Sutton Coldfield, Leighton Buzzard, Snow Hill, Hemel Hempstead, Lichfield Trent Valley, Redditch, Stourbridge**
Merseyrail	Hall Road, Hooton, Kirkdale, Liverpool Central, Ormskirk, Rice Lane, Rock Ferry, Walton, Waterloo. **Maghull, Moreton, Ellesmere Port, Hunts Cross, Bidston, Orrell Park**
[now] East Coast	Berwick-upon-Tweed, Darlington, Grantham, Newark, Peterborough, Retford. Doncaster, Durham, York.
[now] Greater Anglia	Billericay, Bishops Stortford, Brentwood, Mark Tey, Cambridge, Chelmsford, Colchester, Gidea Park, Harold Wood, Ilford, Rayleigh, Romford, Seven Sisters, Southend Victoria, Waltham Cross, Wickford, Witham, Wood Street. **Chingford, Enfield Town, Ipswich**
Northern	Accrington, Altrincham, Blackburn, Bolton, Bradford Interchange, Halifax, Harrogate, Hartlepool, Huyton, Manchester Oxford Road, Manchester Victoria, Mexborough, Rochdale, Skipton, Wakefield Kirkgate. **Blackrod, Bingley, Bradford Forster Square, Shipley, Leyland, Eccles, New Pudsey, Burnley Manchester Road, Guide Bridge, Meadowhall, Worksop**
South West Trains	Andover, Basingstoke, Clapham Junction, Earlsfield, Eastleigh, Fareham, Farnham, Fleet, Fratton, Haslemere, Havant, Hersham, Honiton, Hounslow, New Malden, Putney, Salisbury, Southampton Central, Staines, Surbiton, Twickenham, Vauxhall, Wandsworth Town, Weymouth, Wimbledon, Winchester, Wokingham. **Byfleet & New Haw, Sunningdale, Fleet**
Southeastern	Ashford International, Brixton, Bromley South, Canterbury West, Chatham, Crayford, Dartford, Denmark Hill, Deptford, Dover Priory, Folkestone Central, Gillingham, Gravesend, Lewisham, Margate, Northfleet, Paddock Wood, Rochester, Sevenoaks, Sittingbourne, Strood, Swanley, Tonbridge, Tunbridge Wells, Waterloo East, Woolwich Arsenal. **Orpington, , Hastings, Blackheath,**
Southern	Ashtead, Balham, Crystal Palace, East Grinstead, Gipsy Hill, Hassocks, Horsham, Norbury, Norwood Junction [now London Overground], Peckham Rye, Queens Road Peckham, Selhurst, Smitham, Streatham Hill, Uckfield, West Croydon, West Norwood. **Cheam, Leatherhead, Falmer, Chichester, Battersea Park, Sutton, East Croydon**
TransPennine Express	Barrow-in-Furness, Dewsbury, Grimsby, Huddersfield, Middlesbrough, Northallerton, Scarborough, Selby, Stalybridge, Warrington Central. **Birchwood, Hull**
Virgin Trains	Carlisle, Preston, Runcorn, Wigan, Wolverhampton. **Warrington Bank Quay**

The base list is taken from: Network Rail. CP4 Delivery Plan 2009. Enhancements programme: statement of scope, outputs and milestones. March 2009. See www.networkrail.co.uk/aspx/5500.aspx, pp. 14-15.

A 2013 update shows that work was outstanding at the stations underlined and that those added in bold also remained to be completed. See http://www.networkrail.co.uk/WorkArea/DownloadAsset.aspx?id=30064785772, pp. 18-21.

Notes and references

The hyperlinks were checked on 16 December 2013 but cannot be guaranteed to function.

APPENDIX 2 ACCESS IMPROVEMENTS UNDER ACCESS FOR ALL (ENGLAND ONLY)

Alfreton Parkway
Specific improvements under discussion.
None
2013/2014
LAST UPDATED
2 November 2012
Alnmouth
Installation of 2 lifts to the existing bridge plus significant additional station works including the removal of barrow crossing.
In progress
Winter 2012
LAST UPDATED
7 November 2012
Audley End
Footbridge and 2 lifts. Platform and overhead wires upgrades.
Completed
March 2010
LAST UPDATED
1 March 2012
Barrow-in-Furness
Installation of new lifts into subway and other station improvements.
Completed
Autumn 2009
LAST UPDATED
1 June 2012
Berkhamsted
Installation of new footbridge with three new lifts.
Future planned
Autumn 2013
LAST UPDATED
1 June 2012
Billericay
Specific improvements under discussion.
None
2013/2014
LAST UPDATED
2 November 2012
Bingley
Two lifts added onto existing footbridge at the station.
Future planned
2012/2013
LAST UPDATED
31 October 2012
Blackburn
Lift from subway to platform.
Completed
2011/2012

LAST UPDATED
4 September 2012

Blackheath

One lift available for public use at the station.
Completed
Summer 2011
LAST UPDATED
9 September 2012

Brentwood

Three lifts to be built onto footbridge at station.
Future planned
2012/2013
LAST UPDATED
9 September 2012

Brockenhurst

New footbridge and three lifts at the end of the platforms
Future planned
2014/2015
LAST UPDATED
9 September 2012

Brockley

One lift added to footbridge and tactile platforms at the station.
Future planned
2012/2013
LAST UPDATED
31 October 2012

Bromley South

Two lifts available for public use at the station.
Completed
Autumn 2012
LAST UPDATED
31 October 2012

Burnham (Buckinghamshire)

One lift from subway to platform to be built at the station.
Future planned
2013/2014
LAST UPDATED
9 September 2012

Camden Road

Two lifts at the station.
Completed
Summer 2012
LAST UPDATED
31 October 2012

Canterbury West

Two lifts and footbridge at the station.
Completed
Winter 2010
LAST UPDATED
31 October 2012

Carlisle

Two lifts built into subway at the station.
Future planned
2013/2014

LAST UPDATED
31 October 2012
Chadwell Heath
Three lifts and new footbridge at the station.
Completed
Summer 2012
LAST UPDATED
9 September 2012
Cheadle Hulme
Three lifts and footbridge
Completed
Summer 2011
LAST UPDATED
9 September 2012
Chippenham
Two lifts and public right of way bridge at the station.
Future planned
2013/2014
LAST UPDATED
1 March 2012
Clapham Junction
Nine lifts to all platforms and links to platforms 11/12 and 15/16.
Completed
Spring 2011
LAST UPDATED
9 September 2012
Clapham Junction (Grant Road)
Lift for public use at the Grant Road end of the station.
Completed
Summer 2012
LAST UPDATED
2 November 2012
Denmark Hill
Three lifts to all platforms and a bridge.
In progress
Winter 2013
LAST UPDATED
9 September 2012
Dorking
Two lifts to platforms with a footbridge.
Completed
Spring 2011
LAST UPDATED
9 September 2012
Earlsfield
Two lifts from ground level to all platforms at the station.
Behind schedule
Winter 2012
LAST UPDATED
9 September 2012
Elstree & Borehamwood
Three lifts for public use at the station.
Future planned
2012/2013

LAST UPDATED
31 October 2012
Fareham
Footbridge and two lifts from entrance to platform
Completed
Spring 2009
LAST UPDATED
1 March 2012
Farnborough (Main)
Two lifts from entrance to platform and footbridge.
Completed
Autumn 2011
LAST UPDATED
9 September 2012
Fazakerley
Two lifts added to footbridge providing step free route from entrance to platforms.
Completed
Spring 2009
LAST UPDATED
9 September 2012
Finsbury Park
Lifts from underground areas of station.
Future planned
2013/2014
LAST UPDATED
1 March 2012
Fleet
Footbridge and two lifts to station platforms.
Future planned
2013/2014
LAST UPDATED
1 March 2012
Forest Hill
Footbridge and two lifts to platforms at station.
Completed
Spring 2010
LAST UPDATED
9 September 2012
Fratton
Footbridge and two lifts to platforms at the station.
Completed
Summer 2009
LAST UPDATED
9 September 2012
Gloucester
Footbridge and two lifts to platforms at the station.
In progress
Autumn 2012
LAST UPDATED
9 September 2012
Godalming
Specific improvements currently under discussion.
None
2013/2014

LAST UPDATED
2 November 2012
Gospel Oak
Two lifts and raised ramps at the station.
Completed
Summer 2012
LAST UPDATED
1 March 2012
Gravesend
To build two lifts and footbridge at the station.
Future planned
Spring 2013
LAST UPDATED
19 September 2012
Grimsby Town
Footbridge and two lifts to platforms at the station.
Completed
Summer 2012
LAST UPDATED
9 September 2012
Grove Park
Three lifts with footbridge to platforms at the station.
Future planned
2013/2014
LAST UPDATED
9 September 2012
Hackney Central
Two lifts added to footbridge at the station.
Completed
Summer 2012
LAST UPDATED
2 November 2012
Harpenden
Three lifts and footbridge to all platforms. Longer platforms and new ticket gates.
In progress
Spring 2013
LAST UPDATED
1 March 2012
Hassocks
Two lifts to be built in the subway at the station.
Future planned
2013/2014
LAST UPDATED
31 October 2012
Hatfield
Two lifts to be built onto footbridge at the station.
Future planned
2012/2013
LAST UPDATED
31 October 2012
Headstone Lane
Specific improvements under discussion.
None
2013/2014

LAST UPDATED
2 November 2012
Hemel Hempstead
Three lifts available for use in the subway at the station.
Future planned
2013/2014
LAST UPDATED
31 October 2012
Henley-in-Arden
Two lifts to be built onto footbridge at the station.
Future planned
2013/2014
LAST UPDATED
31 October 2012
Hereford
Two lifts to be built at the station.
Future planned
2013/2014
LAST UPDATED
1 March 2012
Highbury & Islington (GN & City Line)
One lift available for public use at the station.
Completed
Autumn 2010
LAST UPDATED
19 September 2012
Hitchin
Two lifts available for public use in the subway at the station.
Future planned
2013/2014
LAST UPDATED
31 October 2012
Hither Green
Study currently underway looking at providing step-free access at station.
None
2013/2014
LAST UPDATED
2 November 2012
Honor Oak Park
Two lifts added to footbridge at the station.
Future planned
2013/2014
LAST UPDATED
31 October 2012
Hooton
Three lifts and footbridge to all platforms.
Completed
Spring 2011
LAST UPDATED
1 March 2012
Huntingdon
Footbridge with two lifts and stairs to all platforms.
Completed
Summer 2012

LAST UPDATED
19 September 2012
Ipswich
Two lifts attached to footbridge.
Completed
Summer 2011
LAST UPDATED
19 September 2012
Kew Gardens
Two lifts added to footbridge and platform upgrade at the station.
Future planned
2013/2014
LAST UPDATED
19 September 2012
Laindon
Two lifts and footbridge for public use at the station.
In progress
Autumn 2012
LAST UPDATED
31 October 2012
Lawrence Hill
Specific improvements under discussion.
None
2013/2014
LAST UPDATED
2 November 2012
Leighton Buzzard
Second footbridge with three lifts and stairs at the station.
Future planned
2012/2013
LAST UPDATED
1 March 2012
Leominster
Two lifts added to footbridge at the station.
Completed
Autumn 2012
LAST UPDATED
1 March 2012
Letchworth Garden City
Two lifts to be built into the existing lift shafts at the station. Proposed ideas are under consideration.
Future planned
2013/2014
LAST UPDATED
19 September 2012
Leyland
Specific improvements under discussion.
None
2013/2014
LAST UPDATED
2 November 2012
Limehouse
One lift up to platform at the station.
Future planned

2012/2013
LAST UPDATED
2 November 2012
Littleborough
Two ramps to platforms at station.
Completed
Spring 2012
LAST UPDATED
19 September 2012
Long Eaton
Two lifts to platforms at the station.
Completed
Summer 2012
LAST UPDATED
20 September 2012
Loughborough
Two lifts added to footbridge and platform improvements.
Completed
Spring 2012
LAST UPDATED
20 September 2012
Luton
Proposed idea is three lifts built at the station.
Future planned
2013/2014
LAST UPDATED
2 November 2012
Manchester Oxford Road
Two lifts to and from subway at station.
Future planned
2013/2014
LAST UPDATED
20 September 2012
Manchester Victoria
One lift to be built for public use at the station and other accessible improvements.
Future planned
2013/2014
LAST UPDATED
2 November 2012
Market Harborough
Specific improvements under discussion.
None
2013/2014
LAST UPDATED
2 November 2012
Marple
Two lifts and footbridge access to all platforms.
Completed
Summer 2012
LAST UPDATED
20 September 2012
Metrocentre (Gateshead)
Proposed idea for two lifts added to footbridge at the station.
Future planned

2013/2014
LAST UPDATED
20 September 2012
Middlesbrough
Two lifts to and from the subway and platform improvements.
Completed
Spring 2010
LAST UPDATED
20 September 2012
Morpeth
None
2012/2013
LAST UPDATED
2 November 2012
New Cross
Two lifts and footbridge to platforms at the station.
Future planned
2013/2014
LAST UPDATED
20 September 2012
New Cross Gate
Walkway with three lifts and stairs.
Future planned
2013/2014
LAST UPDATED
20 September 2012
New Eltham
Two lifts and footbridge at the station.
Future planned
2012/2013
LAST UPDATED
2 November 2012
New Malden
Lifts built into subway for platforms one and four at the station.
Future planned
2013/2014
LAST UPDATED
2 November 2012
Northfield
Two lifts into subway providing access to platforms and street.
In progress
Autumn 2012
LAST UPDATED
20 September 2012
Orrell Park
Two lifts and footbridge at the station.
Future planned
2013/2014
LAST UPDATED
2 November 2012
Peckham Rye
Study currently underway looking at step-free access at the station.
None
2013/2014

LAST UPDATED
2 November 2012
Peterborough
Three lifts, platform tactiles, CCTV and lighting at the station.
Future planned
2012/2013
LAST UPDATED
2 November 2012
Pitsea
Footbridge with three lifts to provide step free access to platforms from the entrance.
Completed
Summer 2012
LAST UPDATED
20 September 2012
Preston Park
Specific improvements under discussion.
None
2013/2014
LAST UPDATED
2 November 2012
Putney
Three lifts to platforms and platform upgrades at the station.
Future planned
Winter 2014
LAST UPDATED
28 September 2012
Rotherham Central
Two lifts for public use at the station.
Completed
Spring 2012
LAST UPDATED
2 November 2012
Selly Oak
Two lifts added to the existing footbridge at station.
In progress
Autumn 2012
LAST UPDATED
28 September 2012
Shipley
Four lifts attached to new footbridge and old footbridge refurbished.
Completed
Summer 2009
LAST UPDATED
28 September 2012
Shirley
New footbridge and lifts at the north end of the station.
Future planned
2013/2014
LAST UPDATED
2 November 2012
Sittingbourne
Two lifts and platform upgrade improvements.
Completed
Spring 2012

LAST UPDATED
31 October 2012
Slough
Three lifts and footbridge across three platforms at the station.
Completed
Summer 2012
LAST UPDATED
2 November 2012
St Erth
Discussions of the design progressing for the station.
Future planned
2013/2014
LAST UPDATED
2 November 2012
Staines
Two lifts added to footbridge.
Completed
Spring 2011
LAST UPDATED
31 October 2012
Stalybridge
One lift in the subway at the station.
Future planned
2012/2013
LAST UPDATED
2 November 2012
Streatham Common
Two lifts added to footbridge.
Completed
Spring 2010
LAST UPDATED
31 October 2012
Strood
Two lifts added to new bridge, short ramp and extended platforms at the station.
Future planned
2013/2014
LAST UPDATED
31 October 2012
Sutton Coldfield
Two lifts added to footbridge and refurbished canopies/shelters.
Station improvements opened by Rt Hon Andrew Mitchell MP.
Completed
Winter 2011
LAST UPDATED
31 October 2012
Swanley
Two lifts and refurbished footbridge.
Completed
Summer 2012
LAST UPDATED
31 October 2012
Thornton Heath
Three lifts added to footbridge and platform improvements.
Future planned

Winter 2012
LAST UPDATED
31 October 2012

Tilbury Town
Two lifts added to footbridge at the station. Also, new ramp to ticket office.
Completed
Summer 2012
LAST UPDATED
2 November 2012

Tottenham Hale
Two lifts and footbridge at the station.
Future planned
2012/2013
LAST UPDATED
2 November 2012

Twickenham
Future planned
2013/2014
LAST UPDATED
31 October 2012

Vauxhall
Four lifts in the subway at the station.
Behind schedule
Winter 2012
LAST UPDATED
31 October 2012

Walthamstow Central
Small upgrades at the station including signage and ramp improvements.
Completed
Spring 2012
LAST UPDATED
2 November 2012

Waterloo (Merseyside)
None
Summer 2011
LAST UPDATED
31 October 2012

Wellingborough
Two lifts and footbridge at the station.
Completed
Summer 2011
LAST UPDATED
2 November 2012

Wembley Central
Two lifts and stair lift to platform five at the station.
Completed
Summer 2012
LAST UPDATED
2 November 2012

West Hampstead Thameslink
Three lifts and footbridge at the station.
Completed
Spring 2011
LAST UPDATED

31 October 2012
Winchester
Specific designs under discussion.
Future planned
2012/2013
LAST UPDATED
2 November 2012
Worcester Park
New bridge and two lifts at the station.
Future planned
2013/2014
LAST UPDATED
2 November 2012
Worcester Shrub Hill
Likely to be two lifts added to bridge at station. Discussions are on-going for the design.
Future planned
2013/2014
LAST UPDATED
31 October 2012
Wrexham General
One lift and footbridge at the station.
Completed
Winter 2011
LAST UPDATED
31 October 2012[clxviii]

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[v] Rail transport in Great Britain http://en.wikipedia.org/wiki/File:GBR_rail_passenegers_by_year.gif (accessed 4/11/2013)

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[xiii] Rail transport in Great Britain http://en.wikipedia.org/wiki/File:GBR_rail_passenegers_by_year.gif (accessed 4/11/2013)

[xiv] A brief history of Britain's railways – early times to the 21st century http://www.teachingzone.org/railway/pdf/history.pdf (accessed 4/11/2013)

[xv] Munby, D.L., 1978, *Inland Transport Statistics Great Britain 1900-1970*, 83 and 46-47

[xvi] EH Transport Buildings Selection Guide (May 2011) http://www.english-heritage.org.uk/caring/listing/criteria-for-protection/selection-guidelines/

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[xviii] Munby, D.L., 1978, *Inland Transport Statistics Great Britain 1900-1970*, 48

[xix] Munby, D.L., 1978, *Inland Transport Statistics Great Britain 1900-1970*, 84

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[xxix] Not least the Commons Transport Select Committee: see House of Commons Transport Committee (2013). Rail 2020, Seventh Report of the Session 2012-13 [HC 329-1], ¶51-65. http://www.publications.parliament.uk/pa/cm201213/cmselect/cmtran/329/32902.htm.

[xxx] Realising the Potential of GB Rail – Report of the Rail Value for Money Study, May 2011. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/4203/realising-the-potential-of-gb-rail-summary.pdf.

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[xli] Network Rail (2013). A better railway for a better Britain. Introductory text. See http://www.networkrail.co.uk/searchresult.aspx?q=better railway better Britain.

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[xlvii] London North Eastern Route Plan, pp.61-62.

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[l] See endnote 10. For NR's own reservations see Strategic Business Plan, p.56.

[li] Op. cit., p.19, edited.

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[liii] Op. cit., p.29. "The public needs to be part of the debate about the future of the railway. Building on the report, Our Railway's Future, we will transform the way Network Rail communicates with the public."

[liv] Summary Control Period 4 Delivery Plan 2009, Network Rail

[lv] http://www.networkrail.co.uk/North_West_electrification.aspx

[lvi] http://www.networkrail.co.uk/North_West_electrification.aspx

[lvii] http://www.networkrail.co.uk/aspx/6474.aspx

[lviii] See https://www.gov.uk/government/news/road-and-rail-projects-to-boost-local-and-regional-transport--2.

[lix] http://assets.dft.gov.uk/publications/hlos-2012/illustrative-options.pdf

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[lxi] Strategic Business Plan for England & Wales, p.48.

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[lxxx] See http://www.networkrail.co.uk/WorkArea/DownloadAsset.aspx?id=30064785772, pp. 18-21.

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[xciii] See http://dataportal.orr.gov.uk/displayreport/report/html/bb0104d6-b195-4a98-89c8-f10db8a2e9a8.

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