West Yorkshire Archaeology Advisory Service

RESEARCH AGENDA

INDUSTRIAL ARCHAEOLOGY

by Helen Gomersall

This document is one of a series designed to enable our stakeholders and all those affected by our advice and recommendations to understand the basis on which we have taken a particular view in specific cases. It is also a means by which others can check that our recommendations are justifiable in terms of the current understanding of West Yorkshire s Historic Environment, and are being consistently applied.

As the document is based upon current information, it is anticipated that future discoveries and reassessments will lead to modifications. If any readers wish to comment on the content, the Advisory Service will be glad to take their views into account when developing further versions. Please contact:

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West Yorkshire Joint Services

1. INTRODUCTION[1]

1.1 This paper is intended to give a brief overview of the current state of the publicly-accessible resource available for the study of Industrial Archaeology within West Yorkshire (that portion of the old West Riding which formed a Metropolitan County Council between 1972 and 1986), and to frame suggestions for further lines of directed research in the area. Within this context, the definition of Industrial Archaeology is based on the current practice of the West Yorkshire Archaeology Service Advisory Service. Industrial Archaeology is therefore defined as the study of the physical remains of all aspects of anthropogenic activity for the period 1700-1950, with an emphasis on the development and use of technology and manufacture. For the years 1900-1950, attention has been concentrated almost exclusively on the physical evidence of redundant technological processes. Military remains and their associated industries and ecclesiastical remains are currently excluded from the classification, although these are dealt with as separate subject categories in the West Yorkshire Historic Environment Record. Purely historical information (including business and social histories) which does not inform an understanding of the development and function of the physical remains has been taken to lie outside the scope of the current study.

2. THE INDUSTRIAL HISTORY OF WEST YORKSHIRE

2.1 Modern West Yorkshire is roughly divided into three geological zones. The north and west of the region lies on an upland area of millstone grit, the south- central zone is overlain by coal measures, and the eastern third is comprised of a thick layer of Magnesian limestone. There is a corresponding drop in levels across the area, from the high western slopes of the Pennines to the eastern lowlands which gradually merge with the Vale of York. The region is cut from west to east by the principal river valleys of the Wharfe, Aire and Calder, the last two of which merge and eventually join the Humber estuary below Goole.

2.2 The majority of the land in the region throughout the Medieval and immediately Post-medieval period had belonged to a small number of large estates, administered at a distance. These relatively lax tenurial arrangements appear to have encouraged local tenants to begin to exploit the land for their own benefit rather than for that of the landlord. A form of partible inheritance sprang up which reduced individual holdings to a level insufficient to allow tenants to subsist wholly on the proceeds of farming. At the same time, absentee landlords appear to have encouraged the speculative development of industry as a way both of increasing rents and encouraging industrious tenants to remain on the land.

[1] Authoritative and detailed analyses of the development and nature of Industrial Archaeology can be found in Cossons, N (ed), 2000 Perspectives on Industrial Archaeology and in Palmer, M. and Neaverson, P., 1▮▮9 Industrial Archaeology – Principles and Practice .

2.3 At the beginning of the 18th century, this part of the former West Riding had the appearance of being largely agrarian, but was in fact possessed of substantial mixed economy. In the west, this mixed economy comprised a combination of pastoral farming and textile manufacture. The rise of textile production as the local industry of choice was based on the quantity and quality of the locally available resources – local wool, an abundance of soft water for the washing of both wool and cloth, and of water-power for the mechanised finishing processes. Initially, cloth manufacture was carried out by a large number of individuals for their own benefit. Latterly, with the rise of small groups of large-scale entrepreneurs employing outworkers to produce cloth in quantity for sale in bulk, there was influx of imported raw materials. The balance between farming and manufacture in some areas of the Calder valley was particularly skewed towards textile production. The scale of local production encouraged the formation of 'public water-powered mills to full cloth – these mills were privately owned, and provided a public service to anyone able to pay. During the course of the century, local retail markets or 'Piece Halls became commonplace in the major towns – one of the largest constructed being the Piece Hall at Halifax, a secure site built in 1779 to display and market the wares of more than 300 individual merchants. Domestic textile production had a profound effect on the local building style, producing a distinct variety of housing with well-lit loft space to accommodate one or more looms. These buildings were constructed exclusively of local gritstone, and the upsurge in construction produced a corresponding increase in quarrying activity with profound consequences for the local landscape.

2.4 To the east of the region, the mixed economy comprised a combination of arable farming with activities such as small-scale mining and iron manufacture. Here, too, the choice of industry was at least partly attributable to the available resources. The south-eastern portion of the county contained many local surface seams of coal, which had long been exploited for domestic fuel. The area also contained an abundance of wood for charcoal, and of ironstone associated with the available coal seams. Initially, the painfully slow system of land-transport handicapped the exploitation of local resources. Roads were bad in the summer and almost impassable in the winter, restricting the supply of coal and iron produced largely to local markets. However, a burgeoning national demand for coal at the end of the 17th century encouraged local entrepreneurs to finance a series of attempts to improve the regions waterways to facilitate export. The initial success of the Aire and Calder Navigation, opening Leeds and Wakefield to the Humber Estuary in 1702/03, established that the principle was sound and laid the foundation for later canal ventures in the area. The opening of the Navigation had a profound effect on the producers of coal in the area, whose product was not subject to the same duties paid by 'sea coal from the Northeast, and therefore proved very competitive to markets served by other waterways which opened onto the Humber.

2.5 The introduction of a navigable waterway to the East Coast also opened up markets for textiles and other local produce. New markets in turn stimulated local production. As demand increased, pinch-points began to appear in the manufacturing processes. These bottlenecks prompted the development of

technological solutions to sustain and increase production levels. In textile manufacture in the 1700s, problems appeared at the wool treatment and spinning stages – hand production was incapable of providing sufficient thread to supply the demands of burgeoning numbers of weavers. Powered techniques to produce thread in bulk were developed in Derbyshire in the late 18th century. These were first applied to the tough vegetable fibres of cotton and flax, but were gradually perfected for use in the wool textile industry. The machines were quickly adopted by the manufacturers of West Yorkshire.

2.6 Initially, the existing public mills provided this new powered service in conjunction with the cloth finishing already being carried out on site. Gradually, however, there was an increase in the number of mills being run by local manufacturers who clubbed together to finance such ventures. By the beginning of the 19th century, individual textile manufacturers had begun to finance and build their own mills.

2.7 In the coal and iron producing areas to the east of the sub-region, the shallower and more easily accessible seams had begun to be worked out. Deeper seams were inaccessible to traditional working techniques, with problems of ventilation and drainage becoming gradually more acute as seams reached 100ft and more in depth. Here, too, technological developments nationally began to speed up production and render extraction more efficient. The introduction first of directed ventilation, and then of ventilation furnaces in the late 18th century, increased fresh-air flow in the deepest pits. The introduction of pumps powered first by waterwheels and then by the atmospheric steam engine from the 1710s provided a solution to the worst problems of drainage.

2.8 The development of the steam engine was to have a dramatic effect on other manufactures in addition to coal production. As production increased in the textile industry, the banks of upland rivers and streams became increasingly crowded, and available water-power sources became increasingly overstretched. Mine pumping engines were initially used to recycle water back over mill-dams to continue the running of waterwheels in times of low water. The introduction of rotary motion to steam engines in the 1780s permitted the direct application of steam power to textile production. In the West Yorkshire region, the wide availability of suitable local coal encouraged the introduction of mills where there had not previously been sufficient water power to site them. Textile production began to come down out of the uplands and into the centres of population in the valley bottom.

2.9 Increased mechanisation resulted in an increased demand for both textile machinery and for steam engines. There was a corresponding take-off in the engineering trade. Small-scale engine-building and machine-building were common in the Leeds area by the end of the 18th century. The first purpose-built engineering works in the area was established as the firm of Fenton, Murray and Wood at Water Lane in south Leeds in 1796. The premises later became known as the Round Foundry after a circular workshop on the site. Matthew Murray, the firm s founder, did pioneering work in the fields of structural ironwork, stationary and locomotive steam engines, and machine-tool manufacture. During its effective life (1790s to 1840s), the firm was responsible for training large numbers of mechanical engineers who worked both regionally and nationally.

2.10 Although the presence of the Aire and Calder Navigation permitted the importation of high-quality Baltic iron, local iron production became an increasing factor in the engineering industry. In particular, the presence of coal with a low sulphur content and iron ore with a low phosphorus content made the area immediately to the south of Bradford ideal for the exploitation of developments in the technology of iron-founding introduced in Shropshire in the 1760s. By 1800, southern Bradford had become a major centre for coke-fired iron production.

2.11 As at the beginning of the 18th century, increasing demand and improvements in production stimulated improvements in the local transportation network. Initially, these improvements were seen in the improvement of existing waterways and in the development of new ones. By the 1770, the Calder and Hebble navigation had linked the northern Pennines to the Humber Estuary. During the course of the late 1700s, the Rochdale (begun 1765, completed 1804), Huddersfield Narrow (1794 to 1811) and Leeds and Liverpool (1770 to 1816) canals linked the west coast (especially the port of Liverpool) to the Pennines and central West Yorkshire. By 1802, the Barnsley Canal had linked the area s central and southern coalfields to the Humber Estuary. It must be borne in mind that the majority of the waterways took more than fifteen years to build, and work was completed in stages. The benefit of the system was therefore felt by the local economy long before the official opening day. The effect of this new transport network was especially marked in Bradford, for much of its existence a small settlement at the bottom of a steep valley. The town was relatively isolated until the introduction of a branch from the Leeds and Liverpool Canal in 1772.

2.12 The period of major waterway construction also saw substantial road improvement in the region. Between 1740 and 1830, almost 70 turnpike roads were constructed across West Yorkshire. These roads were predominantly funded by local manufacturers and, although frequently improvements of existing routes of Medieval or even Roman origin, occasionally followed completely new courses. By 1780, all the major towns in West Yorkshire were linked by modern turnpikes, and the roads continued out of the area to all points of the compass.

2.13 The mid-18th century also encompassed the introduction of railed transport in the region. In common with the coal-producing areas of Tyne and Wear, transport of this low-value, high bulk commodity from the area of production to its area of delivery or of further shipping was by waggon along wooden (and later, iron) waggonways. Substantial waggonway systems developed in the areas around Wakefield and Leeds, with traffic from the collieries to land-sale points or to staithes along the river. Haulage along these routes was initially by horse power or by inclined plane. Experimentation at the Middleton Collieries to the south of Leeds resulted in the introduction of steam locomotive haulage, by engines developed in conjunction with Matthew Murray. The engines of the Middleton Railway operated until the 1850s, and represented the first economic use of locomotive haulage in the world.

2.14 The middle years of the 19th century saw a continuation of the trends established by 1830. Within the region s industries, production techniques continued to improve and production volume to increase. There was a corresponding

intensification in dependence on external markets and on raw materials from external sources.

2.15 Within the textile industry, powered mechanical techniques for fibre preparation, spinning and finally weaving were introduced first in cotton, then in worsted and woollen cloth, then in recovered fibres. The number and types of mills in West Yorkshire correspondingly mushroomed. Ultimately there were nearly two thousand individual mills in the region, with tens of thousands of associated buildings. Area specialisms within the region included worsted cloth in Bradford, flax spinning in Leeds, and production of blankets in the Heavy Woollen district of Ossett, Dewsbury and Batley. This last district also pioneered the processing of recovered fibres from wool waste or cloth rags (shoddy and mungo) and their reuse to augment imported wool stock in the region s weaving industry. The industry was badly hit by depression in the 1860s/70s, partly due to a drop in the availability of raw materials, and to increased competition from abroad. The economic downturn forced adaptation and diversification on the region s textile manufacturers. For example, many of Bradford s worsted manufacturers turned to wool spinning – a move which ensured prosperity to the area until the beginning of the 20th century.

2.16 The growth of the textile industry was accompanied by massive growth in those industries designed to build and supply textile mills. Engineering works developed in large numbers in the towns of Bradford, Keighley and Leeds. The prosperity of the industry was not, however, solely dependent on textile machines. Local engineering works ranged from small workshops producing a single type of machine or machine tool, to works providing steam engines (both locomotive and stationary), to very large firms producing everything from structural ironwork to steam engines to textile machinery. Local specialisms included structural ironwork and locomotives in Leeds, and wire (for carding equipment and to meet the increasing demand in cable toward the end of the century) in Cleckheaton and Halifax.

2.17 The needs of the textile industry also produced a corresponding growth in the manufacture of dyes, sizes, bleaches and other chemicals for treating and finishing cloth. Bleach works and small dyeworks at the beginning of the 19th century provided the basis of a flourishing chemical industry in the late 19th and early 20th centuries. Production was particularly concentrated in the Huddersfield area and along the Colne Valley.

2.18 Increases in population naturally resulted in an increasing requirement for food. West Yorkshire in the 19th century was a centre of the milling, malting and brewing industries. Improvements in flour production (the introduction of steam power, and the introduction of roller milling in 1880s) contributed to a concentration of mills at the region s wharves, near the point of grain delivery. Improvements in brewing technology led to a similar concentration of maltings. Cattle markets in Leeds and Wakefield, in addition to providing meat for the growing urban population, also provided hides to a nationally important leather industry centred in Leeds. In common with most of country, tanning had started as small-scale production, well-distributed over centres of population. The mid-19th century saw gradual concentration of production in areas where raw materials

were most readily available – the local ports which supplied the regional meat market. A combination of good transport and readily accessible hides with soft water from local boreholes led to a focusing of production in Leeds. Over the period 1850-1900, the scale and efficiency of production increased in response to the demand from shoe manufacturers and commercial belting factories.

2.19 Substantial increases in production and population resulted in a corresponding inclination to urbanisation. The tendency of the developing transport network to follow the easy routes along valley bottoms led to a concentration of population and industry in the lowlands and the gradual introduction of ribbon development between the major towns. The scope of the canal network had been effectively defined by 1830, with the introduction of a branch from the Calder and Hebble to Halifax. However, technical improvements to the existing canals and navigations (particularly to the Aire and Calder) continued throughout the course of the 19th century. The first elements of a main-line rail were introduced to the region in 1834, with the construction of the Leeds to Selby Railway. Rail connections had been established with the majority of the major national centres by the late 1840s, and rail coverage continued to improve throughout the century, to form a dense regional network by 1900.

2.20 Population growth also led to a requirement for new forms of cheap housing, resulting in a boom in the construction of terraced housing and a particular concentration on the construction of the more space-efficient forms such as back- to-back and through-by-light terraces. In the west of the county, the housing boom encouraged further expansion in the local quarries. In the east, the housing requirement spurred the growth of brick manufacture for local consumption. Brickyards were often to be found in association with local collieries, due to the close contiguity of coal and suitable clay earths. A number of mechanised improvements to the practice of brick manufacture were introduced in mid-century in the Wakefield area. The first use in Britain of the Hoffmann kiln, an improved continental kiln type which came to dominate the industry, appears to have been in Wakefield in the 1860s.

2.23 Glass and pottery manufacture came to dominate the production of the Castleford and Knottingley areas, due to the availability of local raw materials and the convenient proximity of the Aire and Calder Navigation. By the end of the 19th century, Castleford was the single largest producer of glass bottles in Britain.

2.24 The need for reliable night-working in the wake of new production demands led to the exploitation of new artificial light sources. The first use of gas lighting in a mill building in Britain was at Lodge s Mill in Sowerby Bridge in 1805. The private production of coal gas for industrial use soon became common. Gas works providing a public supply had been introduced by 1810; the first gas plant at Leeds was soon followed by installations at Wakefield and Halifax. Public gas supply was commonplace in most areas by the 1840s.

2.25 Urbanisation brought a need for improved sanitation and a reliable hygienic water supply. The earliest modern urban water supply in the county was introduced in Leeds in 1842; water was brought into the town from a reservoir at

Eccup via an aqueduct to a storage reservoir at Woodhouse Moor. Reservoirs began to be constructed in the Pennine uplands in the 1850s, with complexes such as Silsden reservoir and the associated 8-mile-long Barden Aqueduct designed to bring fresh water into the now heavily polluted factory towns.

2.26 The period up to the beginning of the First World War saw continuing improvements in power provision, both in factories and in municipal supply. In the small number of mills where waterpower had been retained, waterwheels were increasingly replaced by the more efficient turbines. The first public power station to supply electricity in the region was established at Whitehall Road in Leeds in 1892. Municipal provision of electricity had become common by 1910. Small local power stations were sometimes combined with other services, as at Heckmondwike, where the generating station of 1901 supplied hot water to the adjacent municipal baths. Electricity provision by local councils both was stimulated by and contributed to the rise of the electric tram as a common form of urban transport in the region.

2.27 By the middle of the 19th century, much of the area s hastily constructed inner-city housing was proving inadequate in terms both of overcrowding and of basic health requirements. The issue had been addressed privately by some employers, most noticeably at the purpose-built mill towns of Saltaire near Shipley and Akroyden near Halifax. Bye-laws introduced by local councils to maintain a minimum housing quality became common in the 1860s/70s, although the effectiveness and application of the regulations varied widely. In particular, legislation intended to curb the worst disadvantages of back-to-back housing was circumvented so often and so easily that construction of the form was finally subjected to a national ban in 1909. The rise of council-built housing in the region, which was to become overidingly common after the Second World War, was begun by the construction of ten houses in Leeds in 1900.

2.28 The demand for coal continued to increase throughout the course of the late 19th and early 20th centuries. There was a corresponding continuation of improvements in the technology needed to provide deeper, better drained, better ventilated mines. The introduction of bulk-ripping machinery and continuous conveyors at the coalface further improved production rates. By the end of the 19th century, there were nearly one hundred individual coal mines in West Yorkshire, mostly concentrated in the east of the county, and ranging in size from a single pit head and shaft to large collieries composed of a number of smaller pits. The period immediately prior to the First World War also saw the completion of the region s railway network, with every town of any size having an effective rail link

2.29 By beginning of 20th century, in addition to the large-scale specialist industries of the region, a good spread of small-scale industries had sprung up throughout the county. Production was increasingly varied - West Yorkshire manufacturers supplied everything from artificial manure to motorcars, and a list of local products for the 1890s would run into hundreds of items. Some regional specialities still survived in some fields, such as locomotive production in Leeds and woollen yarn in Bradford. Increasingly, however, traditional manufacturers began to branch out into new products, with engineering firms in Bradford, Batley, Cleckheaton and Keighley producing automobiles, motorcycles, airplanes

and washing machines for the new consumer market.

3. THE RESOURCE – DOCUMENTARY EVIDENCE

3.1 The documentary evidence which is available to inform the study of Industrial Archaeology is of great variety and substantial potential. However, it is important to understand that this resource is far from comprehensive and can be misleading in detail. It is therefore vital in the study of any industry or site to make use of the whole range of material available.

3.2 The most obvious and readily available evidence is that provided by contemporary maps and plans. In West Yorkshire, the first useful edition of the Ordnance Survey is that surveyed in the 1840s at 6 inches to 1 mile. These maps give a good overview of the condition of the county at that period, and can be used to identify the nature and extent of sites with reasonable accuracy. In densely populated areas, they can be supplemented with the OS 5 feet to 1 mile town plans of the same period.

3.3 The second OS edition, surveyed from the 1880s, provides another good snapshot of the area at the end of the century – although it is unfortunate that the gap between the two editions has meant that there is little cartographic evidence for development within the county during the crucial third quarter of 19th century. What evidence for this period is available is provided by printed maps from other publishers of the period, such as those used as illustrations in town guides or trades directories. This category of map must, however, be treated with some caution due to the highly derivative and occasionally apparently delusional nature of the mapping. A similar unfortunate gap occurs between the latest phase of second edition mapping (1900/1910s) and the next survey revision of the late 1930s – again, the lacuna covers a crucial period in the development of the county.

3.4 A series of geological maps published at 6 inches to 1 mile by the Ordnance Survey in the 1930s not only provides a wide range of information on extractive activity of that date, but also accurately identifies areas of earlier activity. It is even, to a certain extent, possible to form predictive models for the identification of mining features not otherwise visible in the landscape or the record based on the information which these maps supply on the nature, extent and depth of the coal and ironstone seams.

3.5 For industrial and commercial buildings within the area s town centres, the maps issued by C.E. Goad to identify the nature of building stock for insurance purposes from the 1880s until the present can provide detail on a variety of subjects, including building material, form, and even floor-by-floor information on use and occupancy. Development related plans ('Building Plans) deposited from the 1840s onward in order to fulfil the terms of local planning legislation can also be used to track and interpret site development. Surviving plans are generally available from the 1870s onwards. Even applications for minor alterations may prove a source of useful information, since a larger portion of site than strictly necessary was often mapped in the supporting documentation. Large numbers of Building Plans were unfortunately scrapped during local government reorganisation in the 1970s, but

good coverage is still available for a number of areas.

3.6 Published trades and postal directories became available from late 18th century, although content and geographical coverage were initially patchy. These grew more substantial and better organised over the course of the 19th century. In urban areas, street-by-street directories are available from last quarter of the century. As directory entries are essentially nothing but address listings, it can be difficult to identify individual sites, particularly in earlier editions. However, these publications can be of considerable use for tracking the occupancy of sites over the course of the 19th and 20th centuries, and may shed light on the development of individual building complexes.

3.7 The engraved depictions of sites frequently found on company letterheads, and occasionally with directory listings, can also be of help in assigning building date and use and in tracking site development. However, since these engravings are basically advertisements, extreme caution should be applied to their use as they are more likely than not to represent an exaggerated view of the size and splendor of the buildings being depicted. The only exceptions to this rule of thumb appear to have been the engravings produced by the Cooperative Wholesale Service for their annual review, which experience suggests are models of veracity.

3.8 Enquiries by central and local government can also prove to be valuable sources of information. Census returns (particularly the published syntheses) can provide extensive detail on the nature and extent of particular industrial activities and their related workforce within a given area. Parliamentary investigations into factory conditions and the implications of child labour in first half of 19th century resulted in depositions being obtained from a large number of mine and mill owners as well as from individual members of the workforce. These contemporary views of industry contain a range of detail on everyday operation at named sites, as does the evidence gathered by the Royal Commissions into flooding and river pollution which took place in the 1850s and 1860s. Newspaper reports, inquest records and the reports of enquiries into accidents can also provide information of site layout and operation at a given period.

3.9 Company records tend naturally to be strongly biased towards commercial information, but clues to site use and development can be gleaned from some archives sources. For example, company minute books of the later 19th century can be a useful, if laborious, tool when attempting to establish building sequence.

3.10 Many of the sources detailed above are essentially published information and are available for consultation at a range of university and local history libraries. Those sources which are original material are more likely, however, to be found in the care of a site s owner or in one of a number of public and private archives which contain information of relevance to a study of Industrial Archaeology in West Yorkshire. These include The National Archives (with particular reference to the activities of the railway companies), British Waterways, and the remnant British Coal Board archive. Some original source material is held in the collections of the Armley Mills Industrial Museum in Leeds. The largest publicly accessible private archive in West Yorkshire is the John Goodchild

Local History Study Centre, housed on the premises of Wakefield Public Library. There is currently no published handlist available for the collection, but the archive is open to the public by appointment.

3.12 The primary source for documentary information within the area, however, is the West Yorkshire Archive Service. It has offices in Leeds, Wakefield, Huddersfield, Halifax and Bradford, and holds a number of relevant documents, including the Local Authority building plans. For historical reasons, the Archive Service's collections are mostly the result of the accident of deposit rather than active acquisition, and as a result, the document range varies widely. A number of local industries are either poorly represented or completely unrepresented in the available records.

3.13 For many industries, however, the holdings are extensive. The following is a brief overview of the types of data listed for a selection of individual industries.

- Extractive industry – for quarries, the Archive Service holds plans, measurements and business records for a number of individual quarries dating from early 19th to the mid-20th centuries . For coal mines, a variety of records are held, including a small number of colliery plans (often to be found in miscellaneous material deposited by solicitors or engineering firms), and leases and accounts related to a large number of small collieries in operation during the first half of the 20th century. A particularly large amount of material is available which relates to the coalmines of the extensive Shibden Hall estates, and to the Brandling Estate s Middleton Collieries, respectively of interest to an understanding of the development of mining and transport at the beginning of the 19th century.

- Major manufacture - for textile manufacture, the Archive Service holds the company records of large number of mills and works (primarily relating to the late19th/early 20th century). For engineering, the Archive Service holds company records for over 150 firms, large and small, over the whole of the county (largely third quarter of the 19th century or later). These records include the archives relating to a number of large or particularly significant companies, such as Prince, Smith of Keighley, and Kirkstall Forge. The number of company accounts relating to original foundries or ironworks is small, but again includes records relating to firms or sites of particular historical significance such as Pollitt and Wigzell of Sowerby Bridge, Kirkstall Forge and the Low Moor ironworks.

- Minor manufacture – a small number of company accounts, largely relating to the late 19th and early 20th centuries, are held for a few other types of manufacture, including brickworks, tanneries, glassworks (centred on Castleford and Knottingley), chemical works, printworks and confectioners. The brewing industry is particularly well represented in the archive, which holds records for some 20 brewers of varying sizes, including Tetleys Brewery in Leeds.

- Utilities - the roots of utility provision in local government have resulted in good deposition of early material for local gas, water and sewage works;

electricity generation is less well represented.

- Transport - records are particularly numerous and relatively early. For roads, the archives contain papers relating to the establishment and maintenance of a number of the major turnpike roads. For canals, some original or early records for all of the undertakings appear to be held. In particular, the archives contain relevant quarter session records, including deposited plans, and the plans and books of reference for establishment of the Leeds and Liverpool Canal and the Aire and Calder Navigation. For the railways, the archives contain original records (including some plans and sections) for a variety of major and minor lines.

3.14 The West Yorkshire Archive Service also holds the archives of archaeological recording exercises carried out on a selection of buildings within West Yorkshire prior to demolition or alteration.

4. THE RESOURCE - PHYSICAL EVIDENCE

4.1 PRIVATELY HELD DATA-SETS

The study of industrial and technological history has been popular with a number of both unpaid and professional local historians for at least three decades. Large quantities of material on the industrial archaeology of West Yorkshire are believed to have been amassed in private collections and in the personal knowledge of specialists. In the late 1990s the Association for Industrial Archaeology s IRIS (Index Record for Industrial Sites) programme enjoyed some success with getting this private archive into the public domain, with the contributions made by members of the Halifax Antiquarian Society to the County Sites and Monuments Record being particularly noteworthy. However, the majority of the privately-held information on the Industrial Archaeology of the county remains by its very nature unquantifiable and inaccessible.

4.2 THE WEST YORKSHIRE HISTORIC ENVIRONMENT RECORD (HER)

The HER is the only publicly maintained archive which contains substantial data on the physical development and condition of sites of interest to a study of the Industrial Archaeology of West Yorkshire. The data-set currently contains over 10,000 records, of which about 15% relate to sites of the industrial period. The majority of the enhancement which has taken place in the HER over the last ten years has been as an offshoot of industry-specific research projects, and this is reflected in the balance of the records. Almost one quarter of the records in the data-set relate to the textile industry, a result of a major project undertaken jointly by the RCHME and the County Archaeology Unit in the mid-1980s, or to the tanning industry, the subject of an in-house study carried out in the mid-1990s.

4.2.1 The remaining classes of industrial site in the county are less well-served by the record. The number of records held for the majority of site-types is very small in relation to the number of examples which probably originally existed in the county, but the record is particularly sparse in relation to the extractive industries, to the engineering industry, and to small specialist workshops. In addition, the records for the majority of site-types contain little beyond place-name, site-type,

and locational information – for most, even the extent of the area of interest requires confirmation as the first step in using or enhancing the record.

4.3 EXTRACTIVE INDUSTRIES

- Sand and gravel – <5 (total no. of records) \100% (% of records comprising location information only)

No detailed recording work has yet been undertaken in the county on this site type. Priority should be given to identifying a selection of surviving sites in the alluvial plain of the confluence of the Rivers Aire and Calder, with particular reference to the area in the immediate vicinity of Pontefract and Knottingley.

- Quarries (sandstone and limestone) – <40\30%

No detailed recording work has yet been undertaken on this site type. A substantial proportion of the available records comprise incidental mentions in relation to other site-types (e.g. a quarry noted on an aerial photograph of adjacent cropmarks). Of the records which contain descriptive detail, however, a number record the presence of late 19th/early 20th-century equipment such as cranes, saws and working sheds – sites with surviving equipment are particularly common in the upland areas immediately to the north and west of Halifax and Huddersfield, where small-scale quarrying for dimension stone continues within a number of earlier quarries. Information with regard to dozens of small quarries on the millstone grit will have been lost as a result of the expansion of these sites in the late 19th and 20th centuries. Priority should therefore be given to identifying surviving sites where working had ceased by the 1880s. This is a high priority, as sites of this type are particularly vulnerable both to legitimate landfill and illegal tipping.

- Coal – <80\70%

The majority of the records relate to small bell-pit fields or to individual bell-pits. However, the remaining records represent a good range with regard to both date and type of working, although information currently held is largely confined to the detail of surface morphology and arrangement. Sites identified range from the late 18th to the early 20th centuries in date, and drift-mining, shallow surface working and deep mining are all identifiable in the record (although drift-mining is the least well-represented). The majority of the sites for which there are surviving structural remains which pre-date 1900 are probably represented in the Record, and the majority of this sub-set are scheduled.

As a result of NCB policy at the time of major pit-closures in the late 1980s, no intact 20th-century pit-head not in operation survives. The late 19th-century buildings at Caphouse Colliery (now the premises of the National Coal Mining Museum for England) comprise the best-preserved structural remains in the county. However, other significant sites include the vestiges of a small mine at Catherine Slack near Halifax, evidenced by the platform which formerly supported a small horse-operated winch which comprised the coal face-to-surface haulage for the pit, and the surface remains of a 1830s ventilation furnace at nearby Southowram. These sites are Scheduled.

The best-preserved remains of shallow surface workings survive on the uplands at Baildon Moor. Here, an expanse of common moorland preserves the remains of over 200 bell-pits and shaft mouths exhibiting distinct groupings and morphological differences which may relate to variations in working method and period of operation, and which may hold evidence valuable to an interpretation of the development of mining methods in the region.

A small number of surviving pit-heads have been subject to archaeological recording, including watching briefs where no upstanding structural remains survive. Little work has been done on the recording and analysis of below-ground remains (a reflection of a national reluctance to address the problem due to health and safety issues and difficulty of recording material exposed during opencast operations), although a small number of limited watching briefs have been carried out on opencast to the south and east of the county. The Advisory Service is aware of artefacts that have been retrieved from earlier opencast working in the county (including a near-complete wooden sledge), and the potential for the survival of dateable archives in sites of this type should be taken into consideration.

- Ironstone – <10\90%

No detailed recording work has yet been undertaken in the county on this site type. The morphology for small-scale ironstone extraction is exactly the same as for shallow coal mining, as the two minerals are related geologically. The most significant post-Medieval/early Industrial workings which survive in the county are located to the south-east of the village of Emley, and are Scheduled.

4.4 MANUFACTURING INDUSTRIES

- Brickworks/fireclay works – <120\90%

Many records are based on place-name evidence alone. The remainder give detail of surviving kilns or working areas, the majority of which date from the early 20th century. There are no known surviving 19th-century brick-kilns in the county. Geophysical survey followed by trial-trenching at Colton, near Leeds, has established a distinctive magnetometer signal for brick clamps which should aid in the identification of other sites. Archaeological survey has also taken place prior to the demolition of a late 19th-century Hoffman kiln near Morley. Technical histories of brick production prior to about 1870 are largely based on a single technical manual of the period, and on a small number of surviving and excavated examples from elsewhere in the country. Particular attention should be given to identifying sites with a potential for good below-ground remains which may preserve evidence for the kiln type most typically in use in the region prior to the introduction of the Hoffman kiln.

- Glassworks – <20\20%

No detailed recording work has yet been undertaken in the county on this site type. A reasonable level of information is held on the business histories of those sites which have been identified within the Castleford and Knottingley areas, but no systematic data collection has been done for elsewhere in the county. There is a particular lacuna with regard to south Leeds, where a small number of 19th- century window-glass works are known to have been located. No work has as yet been done on the identification of potential sites for early, wood-ash based glassworking.

Although the footprint of the glassworks for which there are records has been identified, fieldwork is required to identify building survival – of which there are, as yet, no positively identified examples. The area of the earliest glass cone to be built in Castleford, dating from 1832, is located on open ground and it may survive archaeologically. Priority should be given to identifying sites the operation of which brackets the introduction of significant technological change such as the introduction of mechanised bottle production in the mid-19th century.

- Potteries – <55 records\90%

A small number of potteries survive within the Bradford/Halifax area. However, the sites with the best potential for above-ground physical survival of early works appear to be clustered around Castleford, Knottingley and Ferrybridge, where the industry has survived until relatively recently. As with glassworks, a reasonable level of information on business histories is held in the HER. No kilns or associated hovels are known to survive. However, recent investigations and photographic recording within the premises of the Ferrybridge Potteries revealed the survival of a small range of early 19th-century buildings, the ground floors of which had been used as clay dumps and the upper floors abandoned. This suggests that complexes which continued in use until the present day have good potential for survival of original moulding and throwing shops at the fringes of more modern areas of production, especially where output has declined in recent years. Recent work in Staffordshire has established the potential for the below- ground remains of 18th and 19th-century kilns to both pose and answer questions about technological development in the trade. The possibility of open- area excavation on the sites of some of the south Leeds potteries should be carefully considered during the course of development.

- Limekilns – < 50\100%

No detailed recording work has yet been undertaken in the county on this site type. Many of these are based on place-name evidence and may be early post-medieval. The remainder are sites which appear on the OS mapping of the 1840s. The majority of the kiln sites are located in areas where the solid geology is primarily millstone grit, and are therefore likely to have been small-scale agricultural kilns. There are no known above-ground survivals in the county, a fact which increases the importance of any below-ground remains which can be precisely located.

- Ironworks/foundries– <20\ most records contain detail of site structure and condition.

There are surviving structural remains on the majority of these sites, but no systematic work has been done to identify early or technologically significant structures. Some recording of structures has taken place prior to demolition – notably at Banks Foundry in Sowerby Bridge, which was also the subject of a post-demolition Watching Brief. A watching brief has also been conducted at Low Moor Ironworks near Bradford, in an attempt to identify remnants of the 19th- century mineral railway which once served the site. The size, extended layout and longevity of a number of the sites (e.g. Low Moor ironworks; Kirkstall Forge) suggest good potential for below-ground survival as a result of site extension or rationalisation.

Given the small number of known sites with surviving early remains, below-ground investigation must be a priority. Sites to the south-east of Bradford should be examined with a view to identifying evidence for the technological development of the coke-fired blast furnace at the end of the 18th century. For sites with early origins and a long operational history such as Kirkstall Forge, particular attention should be given to identifying upstanding 18th and 19th-century remains which may have been masked by later development, and relating these buildings to the below-ground archaeological evidence.

- Engineering works - <20\75%

Systematic identification has been done for this site-type in parts of Leeds and Halifax only. Local knowledge suggests the likelihood of good survival (particularly of small-scale works) in Keighley and the outlying parts of Leeds. Substantial archaeological recording prior to demolition and redevelopment has taken place at the Round Foundry in Leeds (an internationally significant engineering works of the late 18th century) and at Stanningley Ironworks in Pudsey (the last 19th-century specialist bridgeworks to survive nationally).

- Textile mills and ancillary site types – A published gazetteer (Yorkshire Textile Mills – see Appendix 1: Bibliography) lists the locational information for approximately 1500 mill and dyeworks sites.

More detailed records are contained in the HER for some 300 mills and related site types. Sites represented vary from early and relatively undocumented complexes such as Carr Mills in Leeds (an early 19th-century mill of innovative structural type) to well-documented, middle-period sites such as Batley Carr Mills, Dewsbury (a typical mid-19th-century woollen mill with good physical survival, which demonstrates a number of technological transitions) to atypical but iconic sites such as Saltaire Mills (an large worsted mill of the 1850s, set in an extensive area of related workers housing and now designated as a World Heritage Site). Substantial archaeological recording has taken place on textile mills and textile-related sites (including dyeworks) prior to demolition or refurbishment.

Dyeworks form approximately 5% of the documented textile-related sites. Most of the relevant records contain locational information only. A small number of dye works have been recorded archaeologically prior to demolition, but the sample is currently insufficient to document the range of site-size or technologies typical in the industry.

Above-ground survival of the structural remains for the textile industry is so extensive that the sites of demolished mills should not be treated as a priority except in very exceptional circumstances. However, care should be taken to identify and consider the significance of associated landscape features of both surviving and demolished mills. Water supply and delivery systems associated with water-powered mills survive well in the landscape, but structural detail (e.g. of sluice systems and dam structure) is under-documented. Tenter fields (for the drying and stretching of fulled cloth) were ubiquitous in the early 19th century, but the locations of fewer than 25 examples are documented in the HER, and only one of these is recorded as having any degree of physical survival.

- Chemical works/bleachworks - <25\99%

The record has mainly been obtained from OS data of the 1840s. No detailed recording work has yet been undertaken on this site type. Many small chemical works in urban contexts (e.g. northern Huddersfield) do not survive well because they have been replaced by larger works of later date on the same site. Rural sites out of use by the mid-20th century (such as Weetwood paper mill, a water- powered bleachworks and dyeworks of the mid-19th century on the fringes of the Meanwood valley) are more likely to have below-ground survival and should form a priority for investigation.

- Tanneries - <160\60%

This site type is well-represented in the HER, especially for industrial-scale tanneries in Leeds (for which detailed information is held on the 16 surviving sites). The majority of the data held for the remainder of the county is based on place-name evidence. Few tannery complexes appear to survive as upstanding buildings, but the nature of tannery operations means that there is good potential for the survival of below-ground remains where cartographic or place-name evidence exists. A small number of complexes (the Meanwood Tannery in Chapel Allerton; White Lee Tannery in Mytholmroyd) have been subjected to detailed archaeological recording prior to development.

- Paper mills - <10\100%

No detailed recording work has yet been undertaken on this site type. Modern topographical information (from OS map sources) is available for most of the sites which feature on the HER but no real data on survival exists in the Record.

- Water-powered mills (misc) - <5\10%

The records for Thwaite Mills (an 18th-century putty mill near Leeds which has been converted to museum use) and a late 19th-century sawmill at Addingham recently subject to archaeological recording prior to development are the most complete in this class.

- Small factories for the manufacture of miscellaneous goods (clothing; soap; matches; postcards) - <20\90%

The majority of these records relate to clothing factories within a one-mile radius of Leeds city centre, one of which was recorded in detail prior to refurbishment. A number of large print works survive near Leeds city centre, of which one (the Electric Press building) has been recorded archaeologically. Further work should be done with trades directories and the historic map coverage to identify the range of small manufacturing industry across the county with a view to identifying local specialisms (if possible).

4.5 FOOD TECHNOLOGIES

- Corn Milling - <130\90%

Some documentation is held on most of these sites, because the majority are water mills of medieval origin and the HER coverage is believed to be good for that period. Surviving corn mills of purely 18th to 19th-century date are less well documented. A number of small Industrial period mills survived until recently as feed mills (Sam s Mill in Lidget Green, Bradford; Burley Mills at Burley in

Wharfedale), but the number of sites is dwindling rapidly and the identification, recording and possible statutory protection of unconverted sites is an urgent priority. A small number of tower windmills survive in the county and all of these are to some degree recorded in the HER. Large-scale, 19th- and early 20th-century commercial milling is little documented, although records for a small number of sites (the Halifax Co-operative Society Mill near Halifax town centre, Allinson s Flour Mill in Castleford) are held in the HER and survive well as structures. More work could usefully be done on the large-scale transition to roller-milling in the 1880s. A small number of late 18th and early 19th-century mills (e.g. at Mill Green, Holbeck) are recorded which have the potential to preserve below-ground remains relevant to the early use of steam engines to recycle water to a wheel, as demonstrated at the King s Mill, Leeds. Recording has taken place on a small number of corn mills, including one which preserved evidence of the transition to roller-milling.

- Malting - <20\25%

Compared to the numbers formerly present in the landscape, this site-type is very poorly represented in the Record. Maltings are particularly vulnerable to demolition due to low ceiling heights, which render conversion problematic. Where records exist in the HER, they have usually been made as a result of notification to the Advisory Service of impending development. Good examples of 19th-century commercial-scale malting survive in Pontefract, Elland, south Leeds, and Wakefield (although the Elland example, once the largest and best-preserved in the Record, has recently suffered significant demolition). An industrial-scale floor maltings survives in use on the south side of Castleford. Small-scale village or farm maltings are rare survivals in the record. A small number of maltings have been recorded archaeologically prior to alteration, including a good example with intact kiln at Guiseley.

- Breweries - <10\50%

Very few examples of traditional or tower breweries are known to survive in the county, and the record held is probably an accurate reflection of the level of survival. Taylor s Brewery in Keighley is the sole survivor in active use. Kirkstall Brewery in Leeds was recorded archaeologically prior to its conversion to housing. A small number of brewhouses attached to pubs survive, most notably at the Cardigan Arms in Leeds and the Puzzle Hall Inn in Sowerby Bridge. In addition, a few examples of stone brewing vats (Yorkshire Squares) survive out of context where the related brewery has been demolished or converted; the most notable survival is the remains of three Yorkshire Squares preserved adjacent to outbuildings near High Green Owlers above Marsden. Preservation in situ or by record is a priority for all surviving brewery remains

- Bakeries/confectionery factories - <5\25%

No detailed recording work has yet been undertaken on this site type, although some work has been done on the subject by staff at the Calderdale Museums Service. Large-scale commercial bakeries are poorly represented in the HER. Records for confectioners are concentrated in Halifax due to the significance of sweet-manufacture to the local economy at the end of the 19th century. Further work needs to be done to establish the extent of survival on individual sites. Similarly, record enhancement is required in Pontefract to systematically identify and record

the surviving remains of the liquorice industry. Work has recently taken place on recording a 19th/early 20th-century liqourice factory in the town. Particular care should be taken to identify sites which may exemplify changes in scale or technological change in the industry.

- Commercial farming – a small number of model farms are recorded without detail.

The Advisory Service has put a greater emphasis on the recording of historic agricultural buildings in recent years, and a small number of full-scale building records and some 30 photographic records for this site-type have been deposited in the HER since January 2001. The evidence for specialist farming of crops such as rhubarb or liquorice is still present in the landscape but is poorly recorded in the HER (although a set of rhubarb sheds in Outwood have been the subject of detailed archaeological recording prior to demolition). Surviving evidence for woodland management, osier production and similar small-scale rural industries is also not well represented in the Record. Further work should be done with the historic map coverage to identify the range of specialist farming activity across the county.

4.6 INFRASTRUCTURE

- Electricity generation – 31\50%

Only one power station survives in use in the county, at Ferrybridge. This station includes the Listed remains of the earliest power hall on the site (1926). Other sites in the Record include the well-preserved remains of a refuse-burning (destructor) station at Stansfield, Todmorden which dates from the early 20th century, and the remains of the municipal power station at Heckmondwike where boiler-water, used to power the steam turbines, was recycled through the adjacent town wash-house and swimming baths. Many of the earlier stations were intended to supply municipal tram systems, and a small number of stations and depots survive. Detailed recording has taken place on a few of these sites prior to demolition. The HER has been systematically enhanced for this site type, and the Record accurately reflects the level of survival. Priority should be given to ensuring the preservation either in situ or by record of all upstanding remains which predate the Second World War.

- Gasworks - <10. This site type was the subject of systematic HER enhancement, and there is some level of information on site detail and extent of survival for all records.

The production of coal gas is an entirely redundant technology. The site type is very poorly represented in the landscape due to recent demolitions, and the record is probably an accurate reflection of the level of survival. With one exception, all extant sites are municipal gasworks; only one (Pudsey) survives in a good approximation of its original condition. One site for the private generation of coal gas at a textile mill survives at Shaw Lodge Mills, Halifax, and the site is a Scheduled Ancient Monument. No detailed recording work has yet been undertaken in the county on this site type. Priority should be given to ensuring the

preservation either in situ or by record of all upstanding remains which predate the introduction of natural gas in the 1960s.

- Sewage works – 3/site detail and extent of survival is documented for all records

Sites most likely to survive are small works in rural areas, such as those at Oxenhope and at Eastbrook near Todmorden. No detailed recording work has yet been undertaken on this site type. The surviving sites visible on current mapping are poorly represented in the HER, which needs to be enhanced for examples which pre-date the mid-20th century and preserve an approximation of their original form. Particular care should be taken to identify sites which may exemplify changes in scale or technological change in the process.

- Water treatment works – 6/site detail and extent of survival is documented for all records.

A small number of sites have been added to the Record as a result of notification to the Advisory Service of impending development. These latter have been subject to archaeological recording prior to alteration. The record was systematically enhanced for surviving sites in Bradford District, but other sites relating to Pennine reservoirs survive and need to be added to the HER. Particular care should be taken to identify sites which may exemplify changes in scale or technological change in the water-treatment process.

- Reservoirs - <40\75%

A substantial number of reservoirs which were constructed for municipal water-supply survive in the western half of the county, and a number continue to employ original spillways, overflows and dam structure. No detailed recording work has yet been undertaken on this site type. The holdings of the HER are probably reasonably representative, although little detail in available with regard to form, date and surviving features.

The site of a navvy camp associated with the construction of Widdop reservoir is recorded, and there is good potential for the survival of other examples in upland areas. Aqueducts associated with reservoirs also survive and are noted in the Record (including the Barden aqueduct of the 1850s, with related survey tower, and the Seven Arches at Adel, associated with other works by the Leeds Waterworks Company in the early 1840s). The sites of seven water towers of technological or historical interest are also recorded. Priority should be given to ensuring the preservation either in situ or by record of all upstanding remains which predate the Second World War.

4.7 TRANSPORT

- Road - <50\70%

Little unified material relating to the features or development of the road network in West Yorkshire is held in the Record. No detailed recording work has yet been undertaken in the county on this site type. General information is held on some packhorse and turnpike road locations, without much detail on routes or historical background (although much of this information with regard to turnpikes could be

supplied by an examination of the First Edition OS mapping of the 1840s).

The majority of the records relate to features associated with the routes – a few relate to toll houses and gates, but the majority record the position of bridges (the majority of the records relating to packhorse tracks take this form). Most of the recorded bridges are early to mid-19th century, and of interest because of association with a named architect or engineer. Three iron footbridges pre-dating 1820 are recorded at Walton near Wakefield, Newlay near Leeds, and Sowerby Bridge near Halifax, and the site of an iron footbridge of the 1760s is recorded at Kirklees Hall, near Huddersfield. A small number of 18th to 19th-century bridges have been subject to archaeological recording in recent years. Priority should be given to identifying the exact routes of all surviving packhorse tracks and turnpikes, with particular reference to the survival of associated remains or surfacing.

- Canal - <70\10%

Substantial detail is held for individual features along the course of the canals, but the record is weak for the structure and course of the waterways, and for detail on location and character of individual locks which may have archaeological potential. There is a good level of preservation for some lengths of each of the canals and waterways in the county, and there is potential for the survival of 18th-century locks as buried archaeology on stretches of the Aire and Calder Navigation, the Calder and Hebble Navigation, and the Barnsley Canal which have historically become isolated from the main course of the waterway. Staircase locks of the 1770s survive on the Leeds and Liverpool Canal at Bingley and Newlay.

Distinct from the canals established by the larger companies, small private canals and basins serving a colliery (Stanley near Wakefield), a mine and foundry (Gomersal) and a mill (Halifax) appear to survive as buried archaeology. Well-preserved warehousing and canal basins continue to exist at a number of sites, including Marsden and Huddersfield (Huddersfield Narrow Canal), Bingley and Shipley (Leeds and Liverpool Canal), Sowerby Bridge (Rochdale Canal and the Calder and Hebble Navigation) and Stanley Ferry (Aire and Calder Navigation). The remains of an early 19th-century boat yard serving the Aire and Calder Navigation are to be found at Stanley. Late 18th and early 19th-century canal offices survive at Leeds, Stanley and Wakefield, with a good 19th-century example on the New Cut at Castleford. An extensive landscape related to the construction of the Huddersfield Narrow Canal in the 1770s, including the remains of a navvy camp, survives on the uplands of Standedge Moor above Marsden. Detailed recording has taken place on a small number of canal sites and waterway sites prior to modernisation or development, including work that has been carried out to identify the nature and extent of early 19th-century boat-building in Knottingley.

- Railways (Mineral) – <20\50%

Except for occasional stretches of track serving individual works, the site-type is mostly represented in the Record by lines running from coal pits to the nearest form of long-distance transport (canal or mainline railway) or by coal/ironstone supply lines to ironworks. As in the case of roads, the routes of the principal waggonways in the county are not comprehensively plotted within the HER, but can be traced from the OS First Edition mapping. The best-documented waggonway in the HER

(comprising coal pits, the line itself and the staithes which it supplied) is the 18th-century Middleton Railway to the south of Leeds, nationally significant for its early use of steam. Most of the course of the line has potential for below-ground survival, and the remains of the steam-era coal staithes in south Leeds were recorded archaeologically prior to their removal. A stone-built tunnel and viaduct at Flockton, near Wakefield, are postulated potentially to date from the mid-18th century and may represent the earliest upstanding civil engineering associated with railways in the county. Some 19th to 20th-century colliery lines may also merit preservation by record.

- Railways (Mainline) - <45\90%

The records in the HER which relate to this site type predominantly document prominent civil engineering (bridges and viaducts), railway termini, or special-use sites. Individual lines and standard passenger or goods stations are not well documented. Some guidance to probable surviving sites could be supplied from OS mapping of the late 19th century, but modernisation and maintenance have made substantial inroads on historic structures and infrastructure in the county.

A cast-iron overbridge of the 1830s survives over the line of the Leeds and Selby at Barwick in Elmet. There is a maintenance yard of the 1840s (including roundhouse and workshops) related to the Leeds and Thirsk Railway extant at Leeds which has been the subject of archaeological recording prior to conversion. A hydraulic lift tower related to a now-vanished goods station also survives to the rear of the present Leeds City Station. Small goods yards with warehouses are rare, but a substantial example (complete with hydraulic accumulator tower) is to be found to the north of Huddersfield Station. Archaeological recording has taken place on the large goods shed and hydraulic lift in this yard. A small number of coal drops survive in good condition in Calderdale and Bradford. Priority should be given to the identification of surviving early features, with a particular view to the preservation in situ of material predating the 20th century.

4.8 SOCIAL

- Commercial properties - <10\90%

This site type is very poorly represented in the record, relative to the probable level of physical survival. The record includes a small number of offices and a larger number of specialist market halls, including 18th-century cloth halls at Halifax and Leeds. A number of small 19th-century shops with related housing have been recorded in Huddersfield town centre prior to demolition. All surviving 19th-century commercial properties will have undergone a degree of alteration; priority should be given to identifying examples which survive relatively unaltered.

- Housing - <200\70%

This site type has been the subject of specific enhancement and analysis with regard to workers housing, and a substantial amount of archaeological recording of representative examples has taken place. The housing group for which detail is held includes a small number of settlements or terraces which have been purpose-built to house the employees of a particular business – these include Saltaire (associated with Salt s worsted mill), and New Sharlston (a well- preserved 19th-century pit village). Little work has been done on the housing of the middle

class, a substantial number of examples of which survive in the landscape, although a record is held for an atypical example at Whitwood, where a terrace, pub and miner s institute designed by CFA Voysey survive.

- Schools - <15\10%

A small number of mid- to late19th-century schools have been recorded archaeologically after closure and prior to conversion to housing. Data-collection should focus on identifying a selection of sites which predate the First World War, with a view to recording examples across a range of dates and sizes. Particular attention should be given to the physical arrangements reflecting changes in the mechanics of teaching, which in turn reflect changes in educational philosophy over the course of the century.

- Hospitals - <10\70%

This site type has been the subject of comprehensive data collection by the RCHME, and a selection of information on all sites in West Yorkshire is held by the NMR. The records held by the HER focus on those hospitals which had their origins as lunatic asylums or workhouse hospitals. A small number of hospitals have been subject to archaeological recording prior to conversion to housing, and an effort has been made to focus on ancillary features such as the late19th-century laundry at St James Hospital Leeds, which in addition to being of interest for the development of the hospital, typified industrial-scale commercial laundries of the period.

- Theatres/Cinemas -<15\75%

Cinemas which predate the commercial boom in construction of the site type in the 1930s survive well in the landscape. Most small communities or neighbourhoods in the county appear to have had an associated cinema, a number of which have survived relatively intact due to change of use to warehousing, open-plan/low rent retail or bingo halls. A number of cinemas have been recorded archaeologically prior to demolition or conversion, including a Co- operative Society cinema of the 1930s at Horbury and a neighbourhood cinema of the 1910s in Knottingley. Theatres survive less well, but recording has taken place on a small variety theatre of the 1910s in South Elmsall, interesting as a late example of the form.

In addition, a small number of recording exercises have been carried out on 19th-century police stations and late 19th to early 20th-century fire stations in the region, prior to development.

5. THE POTENTIAL OF THE RESOURCE AND THE DIRECTION OF FUTURE WORK

5.1 In Archaeology of Yorkshire, David Cranstone has pointed to the general poverty of the available data-set, and singled out 'the identification and preservation of field evidence as the first priority in the study of Industrial Archaeology in the region. This viewpoint is strongly endorsed by the Advisory Service. In our present state of knowledge, it is currently impracticable to attempt to establish a meaningful and comprehensive research strategy. This is not to say, however, that our

existing understanding of the resource is so flawed that it is impossible to know where to begin. A number of broad priorities in terms of data collection can be identified which, if pursued, will facilitate the formulation of directed lines of research intended to answer more specific questions about the nature and development of society and technology in Industrial West Yorkshire.

5.2 By the second half of the 19th century, a wide variety of minor industries and a relatively smaller number of major industries were based in West Yorkshire. Judged on the basis of whether or not the archaeological remains of these industries are nationally important, most of the minor manufactures are probably better represented in other parts of the country. For example, nail-making in Silsden is insignificant when compared with the industry in the Black Country, and the scale of lead mining in West Yorkshire was paltry compared to that taking place in North Yorkshire. This is also the case for a small number of the major industries. The manufacture of pottery, a major industry in the east of the county in the 18th and 19th centuries, is better represented both by standing structures and by below-ground archaeology in Staffordshire. Similarly, although Castleford was the national centre of glass bottle manufacture in the late 19th century, the archaeology of that industry is better represented in Merseyside or the West Midlands.

5.3 For the majority of industries present in the West Yorkshire sub-region, study should therefore focus on the identification of the scale of the industry and the preservation in situ or by record of a number of typical sites. Data-collection should focus on identifying a selection of sites, with a view to recording examples across a range of dates and sizes. In the interests of contributing to a national overview, priority should be given to recording sites which bracket the key dates of technological change within the industry in question.

5.4 There are a number of major industries, however, for which early examples or major concentrations of sites are to be found in West Yorkshire. For almost all of these industries, where technical histories are available they are usually document-based rather than site-based, and founded on models drawn from regional practise elsewhere in the UK. The archaeological resource in West Yorkshire has the potential to revise or even rewrite the national overview of a number of industries, including coal mining, textile manufacture, engineering, leather production, the manufacture of architectural ceramics, and the early stages of development of the national transport network. It is for these site-types, therefore, that the formulation of a framework of directed research should have the highest priority. For coal mining and textile manufacture, the Industrial Monuments Protection Programme (MPP) has already produced effective paradigms for research, but most most of these industries still await analysis by MPP. It is nevertheless possible to suggest tentative research strategies (or at least, priorities for data collection) for the topics listed below -

- Coal

The industry has been the subject of several detailed economic histories and a few technical histories - the latter largely concentrating on developments in the coalfields of Shropshire, of South Wales and of the Northumberland/Durham region and extrapolating national conclusions from this data. Because the nature of coal seams varies widely from area to area, the methods of

drainage/haulage/ventilation etc. adopted to deal with them at different periods also varied widely. A study of the application and uptake of technology within the Yorkshire coalfield has the potential to add considerably to a national overview of the development of the industry. Ancillary questions relate to the associated transport infrastructure (little is known about the technical aspects of the Yorkshire contribution to the development of railed transport in the 17th and early 18th centuries) and to treatment works (more information is needed about the development of coking technology in this region). Priority should be given to obtaining evidence for a range of typical colliery structures over the whole of the working life of the coalfield. Every available opportunity should be taken for the archaeological investigation and recording of surviving underground workings where these are threatened by opencast or other development. In light of the unexpected survival of a well-preserved wooden waggonway at Lambton 'D pit in Sunderland, particular attention should be given to the area surrounding pit heads – especially the footprints of later spoil heaps which may be targeted for re-working or land reclamation – in order to identify possible surviving evidence for the form and extent of early waggonways in the region.

- Textiles

The surviving mills are of special importance not only for the development of the textile industry, but as exemplars of development in structural and power technologies through the course of the 18th, 19th and early 20th centuries. Particular care must be taken in any recording or development-related strategies to assign an appropriate weight to all parts of the site, since ancillary or architecturally insignificant features may form important survivals within the context of the whole of the site (e.g. sheds for mechanised wool-combing within a worsted mill of the 1840s, such as at Douglas Mills in Bradford). Machinery related to power-generation and transmission does not survive well (only a handful of water-wheels – one of which is in a corn mill - and three steam engines are known to survive in the county), so the physical evidence for power surviving within the structural fabric is of particular significance, especially in those mills which date from periods of technological transition. Hydro-electric schemes related to mill power survive poorly within the record (only one example, at Oats Royd Mill Luddenden, is currently documented), and it is worth noting that the evidence for these may survive some distance from the main mill buildings. Ancillary questions here include the need to explore the development of the modern chemical industry from its beginnings as an adjunct to the textile industry; the West Yorkshire material is well-suited to such a study.

- Engineering

Comparatively little survey work has been undertaken on this site type anywhere in Britain, and no technical history has yet been published which provides an adequate synthesis of even the available material. Leeds, Keighley, and Marsden have good potential to illuminate the early development of light engineering works (manufacturing machine tools and textile machinery). Otley was a nationally-important centre of printing-press production throughout the second half of the 19th century. Leeds was a major centre of locomotive production which was not led by the Railway companies, and has the potential to complement and balance the information gained from recent thorough studies of company works at Swindon and Derby. Leeds also presents a unique resource for a study

of the development of engineering related to the production of machines for the leather industry. Large-scale works on historic sites are almost uniformly redundant for their original use, and are likely to be considered prime sites for housing development, making this one of the most vulnerable of the industrial site types in the county. Priority should therefore be given to the identification and classification of works of this type, with a particular view to the potential for statutory protection.

- Tanning

No useful published technical or economic histories exist for this industry, apart from a brief study of the introduction of mechanisation (based on documentary sources) and an overview of the surviving tanneries in Leeds. As one of the very few centres of production which both survived the changes of the early 1800s and prospered after them, West Yorkshire represents a prime resource for documenting and explaining the development of the British leather industry. Priority should be given to identifying a selection of sites across the region with a good potential for below-ground survival, with a view to recording examples across a range of dates and sizes. Within the Leeds conurbation, priority should be given to ensuring the preservation either in situ or by record of all known upstanding remains.

- Transport:

Canals - most popular and much specialist study of Britain s waterways tend to focus on social history ('life on the canal) or paraphernalia (narrow boats and tinware) rather than on the basic infrastructure. Substantial business and administrative histories of the canal network have been produced, but very little has been done on the early physical form and subsequent development of the system as built (as opposed to 'as planned). West Yorkshire has good potential to illuminate and illustrate the development of navigable waterways and canals. Priority should be given to the identification of surviving early features, or of features which illustrate particular phases of technological change, with a particular view to the potential for statutory protection.

Railways - the technical development from the wooden waggonway to iron plate and edged lines is at present imperfectly understood and based on a small number of spot finds and excavated examples. Recent academic work in this subject has been dominated by studies of development in Wales and in the North East of England, and the waggonways of West Yorkshire have the potential to add to the debate on the development of this crucial technology. In the first instance, priority should be given to identifying the exact routes of all waggonways marked on the OS First Edition 6 inch mapping which have the potential to survive as below-ground archaeology. The need to identify possible survivals below existing colliery spoil has already been noted.

6. CONCLUSION

6.1 Physical survival of the resource for the study of Industrial Archaeology in the county is patchy, and the extant remains are under increasing threat. There is good potential for preservation of the below-ground remains of early sites in the upland areas, where survival is promoted by the implementation of greenbelt restrictions under the local Development Plans. The majority of the sites of interest, however, are located in the urban zone in the lowland areas or along valley bottoms.

6.2 The current policy of encouraging development of brownfield sites in urban areas is having a major impact with regard to the long-term survival of industrial remains in West Yorkshire. In the relatively rare instances where industrial complexes are Listed or fall within the boundaries of a Conservation Area, the principles outlined in Planning Policy Guidance Note 15 can be applied to ensure the proper recording of any affected elements prior to demolition or alteration. Furthermore, since the mid-1990s the Advisory Service has encouraged the Local Planning Authorities within the region to apply the principles of PPG 16 to planning applications which impact on unlisted buildings of archaeological interest. In the majority of instances, this approach has been well-received, and a large number of structures both listed and unlisted have been subject to recording prior to the loss of archaeological information. Since 1993 the Advisory service has issued nearly 200 detailed specifications for the investigation and recording of industrial buildings and sites affected by planning applications.

ANNOTATED BIBLIOGRAPHY

For the sake of brevity, an attempt has been made to confine this bibliography to material which is of most direct relevance to an identification, interpretation and understanding of the physical remains of the industrial period in West Yorkshire. Unfortunately, as a result, some early 20th-century business histories and a number of excellent sources pertinent to a wider understanding of the industrial and social history of the region have had to be omitted from the list below.

Particular mention should be made of the work of John Goodchild, who has published a range of studies on the capitalisation, history and development of a number of local colliery companies and their associated transport network. In addition, thanks to the private efforts of a small group of dedicated local historians, well-researched local histories are available on most of West Yorkshire s towns and villages. Most notably, the series 'Aspects of _ , published by Wharncliffe Books of Barnsley, offers an excellent selection of essays on a variety of major urban centres, including Bradford, Leeds and Huddersfield, some of which are peripherally relevant to an understanding of the development of local industries.

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