The Textile Mills of Lancashire: The Legacy

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Front Cover:
(Top) The weaving shed of Queen Street Mill on the day of its closure, 22 September 2016 (© Anthony Pilling)

(Bottom) The iconic, Grade I-listed, Queen Street Mill, Harle Syke, the last surviving example of an intact steam-powered weaving mill with its original looms in the world (© Historic England)

Back Cover:
The Beer Hall at Holmes Mill, Clitheroe

The Textile Mills of Lancashire

The Legacy

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Contents

Foreword iv

Preface v

1 Introduction 1

2 Lancashire's Early Textile Industry 11

3 Lancashire's Later Textile industry 57

4 The Future 89

5 Glossary 113

6 Notable People mentioned in the Text 117

7 Bibliography and Further Reading 123

8 Mills Referred to in the Text 127

Foreword

Lancashire's cotton spinning and weaving heritage is a source of national pride, as it is an industry that contributed to the North of England becoming the powerhouse for the nation's expansion and prosperity from the dawn of the industrial revolution.

The County's vast textile mills and weaving sheds brought with them unprecedented urban growth, shaping the familiar Lancashire mill towns we see today. The grid pattern of terraced workers' houses and north-light weaving sheds remain evident in the industrial landscape of Pennine Lancashire, where three-quarters of the County's surviving textile mills lie. This book is a valuable insight into the buildings, structures, processes and people that made the industry and the places we know today.

Reusing historic buildings and structures lies at the heart of planning for a sustainable future. We know that understanding, valuing and caring for the past in imaginative ways promotes a sense of belonging, civic pride, and is the foundation stone for effective place-making: but it is not easy to find solutions to new uses in these buildings. The textile mills of Lancashire are a unique reminder of the innovation, entrepreneurship and vitality of the region's distinguished industrial past, a legacy and common inheritance that should be a lasting part of Lancashire's future.

Catherine Dewar
North West Planning Director - Historic England

Preface

Lancashire's historic textile industry holds a particular place in Britain's history. Its success was a direct result of the Industrial Revolution, which resulted in the region blossoming into a leading economic force between the late eighteenth and early twentieth centuries. This was, importantly, essential to Britain's place and dominance as the world's first industrial nation. During this period, Lancashire's textile industry was at the forefront of innovation, adopting both steam power and the factory-based system of production, which in turn greatly shaped the historic character of the region, and left an enduring legacy. Whilst this legacy is still deeply ingrained in Lancashire's consciousness, its most graphic reflection lies in the textile mills, which were established across the historic county, many of which were directly responsible for the formation of the distinctive urban landscapes associated with the region's mill towns. However, since the demise of the textile industry in the second half of the twentieth century, the loss of historic mills, through demolition, decay and fire, has been a cause of increasing concern amongst those who recognise their heritage value, and their importance in providing an enduring sense of place for the residents of the mill towns. This threat has been felt perhaps most keenly in Lancashire, a county in which its history and identity were bound closely to the development of the industry, and this danger has prompted a recognition of the need for urgent action.

This publication represents the culmination of a decade of research on the textile mills of Lancashire by Oxford Archaeology North, born out of two phases of survey funded by Historic England designed to assess the survival of, and threats to, modern Lancashire's historic textile mills. It highlights the historic growth of the region's textile industry, and also the architectural form and evolution of Lancashire's textile mills and ancillary industries, such as bleaching, dyeing, and printing. Importantly, it also aims to show that such buildings can be readily adapted to modern use as viable spaces, which, significantly, allows each settlement actively to retain its 'sense of place'.


Windermere
River Kent
Backbarrow
River Lune
Bowland Fells
Lancaster
River Wyre
River Ribble
Colne
Nelson
Burnley
Amounderness Plain
Kirkham
Preston
Accrington
Blackburn
West Pennine Moors
Darwen
Rossendale Fells
Chorley
River Roch
Rochdale
River Irwell
Bolton
Bury
Ormskirk
River Croal
River Irk
Oldham
Wigan
River Medlock
Leigh
Salford
Ashton-under-Lyne
Manchester
St Helens
Liverpool
Warrington
Stockport
0
50 km
1:750,000
Historic county boundary of Lancashire
Modern county and district boundaries

1 Introduction

Across Lancashire, textile mills form a characteristic and iconic form of historic building that largely emerged during the eighteenth century, and act as a visual testament to the county's industrial past. At a broader level, these mills were an integral element of England's economic development between the late eighteenth and early twentieth centuries and most are a direct product of the factory-based system of production, which characterises this industrial era.

The Geography of the Lancashire Textile Industry

The county of Lancashire, from which the southern and northern parts were split in 1974, is a land of contrasting natural character, formed through a varied geological and topographical arrangement that has shaped its history for thousands of years. The principal geographical features are the uplands of the southern Pennine range, forming the eastern boundary, the low-lying tills and mosses of the Lancashire and Amounderness Plains to the west, and the Irish Sea beyond, which defines the western border. The Pennines include two distinct western spurs, the West Pennine Moors and Rossendale Fells in the south of the county and the Bowland Fells to the north, divided by the broad swathe of the Ribble Valley, which cuts the county in two from north-east to south-west. Both upland areas are composed principally of sandstone grit and are dissected by a series of short, deeply incised valleys formed by the fast-flowing tributaries that feed the major watercourses of the Lune, Ribble and Mersey. The Bowland Fells have been exploited principally for grazing and quarrying, although its streams have also proved suitable for power generation, but it was to the south, in the West Pennine Moors and Rossendale Fells, and more significantly within the river valleys of the Irwell, Medlock, Croal and Roch, now in Greater Manchester, that the textile industry really developed.

Abbey Village, one of the valley settlements to the south of the River Ribble

During the early post-medieval period, the availability of grazing land proved vital to the success of the woollen industry, which led to the growth of market centres in the lowland basin to the south of the fells. This area, defined to the north and east by the Pennines, and to the south by the Mersey Valley, provided a topography that created a high annual rainfall, carried upon the prevailing western winds, and a naturally humid climate. This proved ideal for the manufacture of cotton cloth, which was first produced in Bolton in the early seventeenth century, and rapidly became the dominant textile west of the Pennines. The basin was formed by the confluence of several rivers, creating major trade routes to the east, towards London, and west to the seaport of Liverpool, and it was there, at the confluence of the Irwell and Irk rivers, that the settlements of Manchester and Salford grew to become the vast manufacturing centres of the nineteenth century.

The fells to the north of the basin, with their clean, fresh and abundant water supply, provided by these fast-flowing streams, and the geological composition of the landscape, also attracted the nascent textile-finishing industry, and later supplied the motive power of the early cotton mills, stimulating the growth of Manchester's manufacturing satellite towns, such as Stockport, Bury, Rochdale and Bolton. In the latter years of the eighteenth century, mineral exploitation and in particular the Lancashire coalfields, an area that encompassed much of the county to the south-east of the Ribble Valley, became increasingly important, with towns such as Wigan, St Helens and Warrington providing coal and heavy machinery to the developing steam-powered mills of the urban areas. The region also contains an abundance of stone and a local brick-making industry, which provided the requisite materials employed in the construction of the mills.

The lowlands on the edge of the Pennine scarp create a natural north-south routeway, that has clearly been in use for thousands of years, and the county has several major watercourses, which act as excellent natural routes of communication integral to the success of the early textile industry. These include the Mersey, which formed the historic southern border of Lancashire, with the Cheshire Plains beyond, and the Ribble, which meanders through the Ribble Valley, a wide catchment area for the tributaries emerging from the upland areas to its north and south. Several major textile-manufacturing towns

developed along the southern edge of the valley, which coincided with the northern limits of the coalfield, including Chorley, Blackburn, Accrington, Burnley, Nelson and Colne. These towns would later develop into the heartlands of the cotton-weaving industry, with Chorley being notable for the diversification of its textile-manufacturing base. Preston, at the head of the Ribble estuary, was at the north-western limit of the traditional cotton-manufacturing areas, although textile mills were built in smaller numbers to the north of this, both in the Wyre and around Lancaster. In the north of the county, the major river was the Lune, fed by the Bowland Fells and eastern Cumbria, which emptied into the sea near the port of Lancaster. The Wyre is also significant, reaching the coast at Fleetwood. These areas, forming part of the wider Lancashire and Amounderness Plains, did not benefit from the mineral resources of the south of the county, but proved suitable for the mixed and arable agriculture that sustained the massive population increases of the eighteenth and nineteenth centuries, and to some extent allowed the cultivation of flax to supplement imports from Ireland.

Looking east up the River Ribble from Preston, with Pendle Hill in the distance

Historically, the northern extent of Lancashire lay 'north of the sands', within the Cartmel and Furness Peninsulas (now part of Cumbria), a geographically isolated area of undulating hills and wooded river valleys that give way to the coastal plains bordering the Irish Sea. This area contributed to the ancillary trades, such as bobbin and spindle manufacture, as well as producing iron from its extensive deposits of iron ore, though a few cotton mills were established there in the late eighteenth century, such as at Backbarrow, at the southern end of Windermere.

Lancashire's textile mills

What is a textile mill?

The term 'textile mill' is necessarily broad, used to describe buildings for a wide range of industries concerned with the production of natural fabrics. It covers any structure involved in manufacturing these fabrics, from the processing of the raw material and the spinning of yarn to the weaving of fabric and its bleaching, dyeing, and printing. However, within Lancashire, the majority of surviving textile mills dating from the late eighteenth century onwards were engaged in the production of cotton goods.

For the purposes of this book, 'textile' has been taken to include woollens, flax, silk and cotton, the processing of which formed England's major textile industries from the medieval period to the middle of the last century. Ancillary industries have also been included, specifically those 'mills' concerned with the manufacture of textile equipment, such as spinning machines, looms, spindles, reeds, and bobbins, although the industry also created specialist engineering firms manufacturing steam engines, boilers, iron beams and columns, as well

Above: Swainson, Birley & Co's cotton mill (1826), Preston, demonstrating the rapid increase in the size of the mills

Left: Cheesden Lumb woollen mill, an example of the early, water-powered mills

Tulketh Mill, Preston, built in 1906, dominating its townscape

as gearing and shafting to drive the machinery. The period covered is defined by the survival of standing structures, a very few from as far back as the seventeenth century, to the second quarter of the twentieth century, after which the industry rapidly declined. The working of man-made fibres has not been considered, many of these only having being developed in the twentieth century, although many manufacturers of these reused earlier textile buildings. Indeed, by the mid-twentieth century, the production of man-made fibres dominated the Lancashire textile industry. This led to the establishment of massive textile mills, such as the Courtalds complex in Skelmersdale, once the largest textile-manufacturing site in the world.

The importance of Lancashire's textile mills

The development of the textile industry had a fundamental impact on the economy, population, and architecture of Lancashire, and by the end of the nineteenth century, out of a total population of over four million, over 500,000 were employed by the industry, principally that part connected with the production of cotton goods. Indeed, the historic county of Lancashire then supported the largest cotton industry the world had ever seen.

Rhyddings Mill in Oswaldtwistle, September 2010 (Grade II-listed Building), following a devastating fire

During this time, Manchester had developed into a centre of international importance, recognised as the world's first truly industrial city. In fact, its cotton-spinning mills, which were at their highest number in 1853, and its pre-eminent role as a centre of commerce, earned it the title of 'Cottonopolis' in 1854. At its peak, Lancashire provided the world with over 30% of its cotton goods and accounted for over half the nation's exports. Moreover, in the later eighteenth and nineteenth centuries, the county operated at the cutting edge of technological innovation, its inhabitants being responsible for many of the inventions that led to the exponential growth of an industrial revolution that changed the lives of the majority of the world's population. During this period, the area also benefited from the arrival of several 'immigrant' engineers, especially from Scotland, who brought their skills to Lancashire.

The collapse of the British textile industry from the 1920s has left a legacy of neglected and redundant industrial buildings, increasingly under threat of demolition. These mills, workshops and warehouses represent an important record of the wider changes in society that were taking place in the county and beyond, with developments in engineering, architecture, economics and social organisation being reflected in their form, character, function and changing use over time. As such, they are a crucial part of our understanding

of this period in history and a record of the nation's transition from a feudal society at the beginning of the sixteenth century to the post-industrial world in which we now live.

Given the importance of the textile mill to the character of Lancashire, several programmes of investigation have been instigated to record extant mill buildings, evaluate their survival, research their history and, ultimately, to protect these iconic historic buildings. One of the earliest studies to recognise their importance was carried out by N K Scott in 1952, during his post-graduate research into Preston's textile mills, a valuable survey conducted prior to the redevelopment of many of these sites.

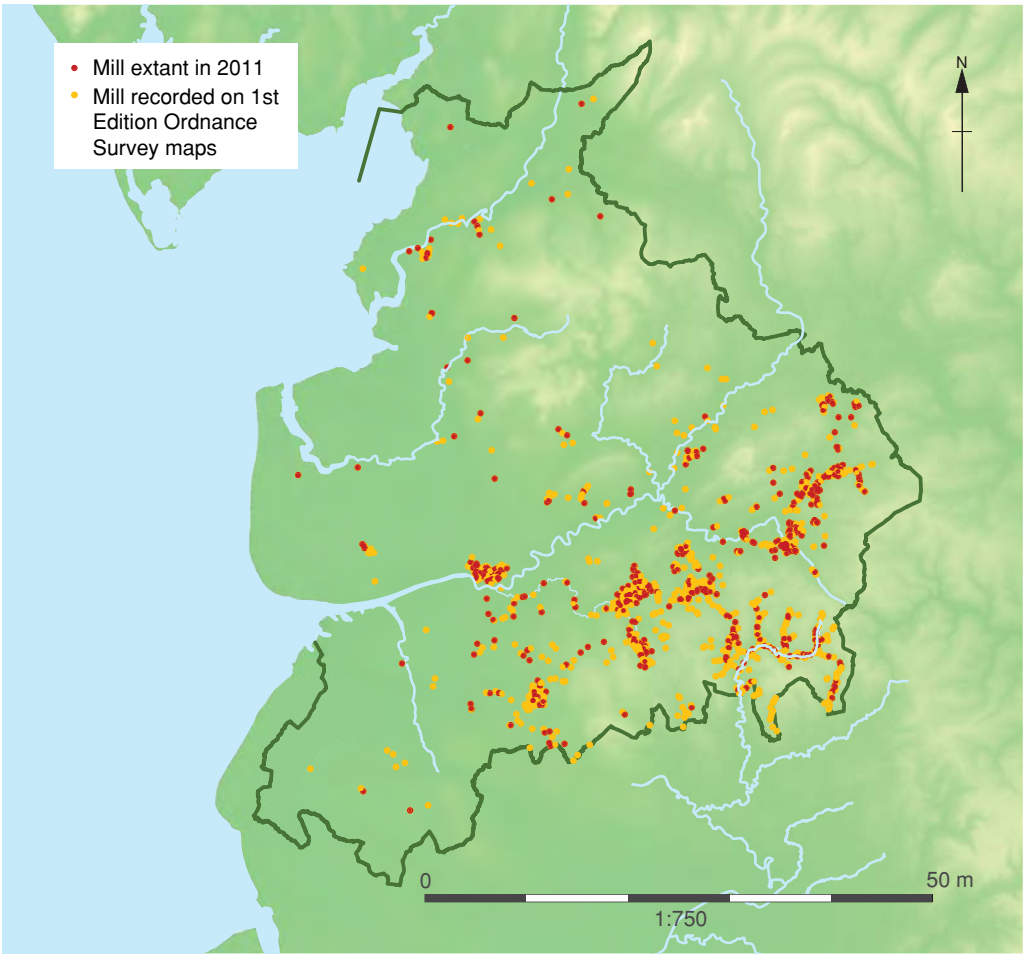
In the 1980s, several wider regional studies were also initiated by the former Royal Commission on the Historical Monuments of England (RCHME). The publication of *Cotton Mills in Greater Manchester*, by Mike Williams and Douglas Farnie, represents the culmination of this research, although the study only surveyed the mills of the metropolitan areas of Greater Manchester. This occurred in tandem with other RCHME surveys of the extant textile mills in West Yorkshire and East Cheshire, both of which received their own publications. In addition, in more recent years, valuable surveys of textile mills in Lancashire have been undertaken at a local level, notably English Heritage's investigation of the textile mills in the borough of Pendle (2000), enhanced by Geoff Shackleton's study of the same area (2006), Chris Aspin's survey of Arkwright-type mills (2003), Colin Dickinson's work on mills in Preston (2002), and James Longworth's study of the cotton mills of Bolton (1987). These studies all provide useful descriptions of the mills and background information on the companies which worked them.

Similarly, the *Industrial Heritage* series of 15 volumes produced by Mike Rothwell since the late 1970s provides detailed information on the textile-manufacturing sites in Hyndburn, Blackburn and Darwen, the Ribble Valley, Padiham, the Nelson, Brierfield and Barrowford areas of Pendle, and the Haslingden, Helmshore and Whitworth areas of Rossendale. Whilst these volumes offer an invaluable resource to any study of the local industrial heritage, the earlier volumes, such as those on Blackburn, Rishton and Great Harwood, which had all

been published in the mid-1980s, contain information on the numerous textile-manufacturing sites that have since been demolished or remodelled. A welcome addition to publications about the Lancashire textile industry is Roger Holden's (2017) work specifically on the weaving mills, examining both the structures and the documentary sources. In addition, Geoff Timmins has extensively recorded and analysed buildings associated with handloom weaving, many of which have been renovated to enhance their domestic accommodation.

Since the early 1990s, following the introduction of various planning guidances designed to protect the historic environment, a plethora of textile mills has also formed the focus of archaeological investigations, which aim to record both upstanding and below-ground remains prior to modern redevelopment. One of the more noteworthy of these studies focused on Murray's Mill, in the Ancoats area of Manchester.

Murrays Mills, Ancoats, recorded in detail prior to conversion to mixed residential and business use



The survival of Lancashire's textiles mills in 2011

More recently, however, Lancashire's textile mills have formed the subject of two phases of survey, focusing on the mills within the modern (post-1974) boundaries of the county. The first of these provided a rapid assessment of surviving mills within this area, which was then followed by a 'Buildings at Risk' assessment of all the surviving sites identified from the initial survey. As part of this work, a detailed survey of a sample of surviving sites was made, accompanied by recommendations for those sites meriting consideration for

statutory designation; the results of this survey have largely informed the choice of textile mills described in this book. A new programme of recording is also being undertaken to re-evaluate the textile mills of Greater Manchester, whilst, nationally, the importance of textile mills is being reaffirmed, with the publication of Historic England's *Textile Mills: Introductions to Heritage Assets*.

2 *The Birth of the Lancashire Textile Industry*

Lancashire's Early Textile Industry

The manufacture of textiles for personal use, using indigenous raw materials, has been carried out in Lancashire for thousands of years. Its development as a commercial industry of any scale is, however, a comparatively recent event and, initially, the production of woollen and linen goods formed the focus of the early Lancashire textile industry. Later, fustian and silk goods began to be manufactured, and cotton, which was to have the most profound impact on the economy, social structure, and architecture of the region.

Initially, the organisation of early textile production lay with an independent textile worker, who produced and sold cloth. During the seventeenth century, a system known as 'putting-out' emerged, whereby textile merchants, based in urban centres, would provide workers with the raw materials to produce cloth, who were paid upon receipt of the finished product. The merchant would then arrange for the finishing of the cloth by specialist fullers and dyers, before its sale at a local market. Within this system, the cloth was normally produced in rural areas, which allowed the merchants and textile workers to bypass restrictions on industrial development, imposed by the town guilds.

'Industry and Idleness': a depiction of handloom weavers in a loomshop

From the late eighteenth century onwards, the putting-out system was replaced by the factory-based system, which was intimately connected with the emergence of Lancashire's cotton industry. This capitalist system was characterised by the acquisition of a centralised building (the factory) and (water- or steam-powered) machinery by an entrepreneur or cooperative, who paid largely unskilled workers to produce a standardised set of products. Such factories could therefore

produce products on a much larger scale than had hitherto been possible, which were significantly lower in cost, and these could be distributed widely through improved transport networks, which also developed in tandem with the factory-based system.

Wool

Spinning and weaving

A small-scale woollen industry appears to have developed in Lancashire by the thirteenth century and, by the late sixteenth century, many rural communities seem to have been supplementing their agricultural income by spinning and weaving woollen cloth in a domestic setting. During this period, the production of cloth was predominant in eastern and central Lancashire, though it was also produced further to the west, in Preston and Wigan. In the latter part of the sixteenth century, the emerging woollen industry was further stimulated by the appearance of a new style of cloth introduced to England by Flemish refugees, which had a worsted warp and a woollen weft. Following its appearance, the production of this 'new' cloth was rapidly adopted by the Lancashire weavers, and by the early seventeenth century its production was focused in the Rochdale, Bury (both now Greater Manchester), and Rossendale areas.

From the late seventeenth century onwards, the production of woollen goods began to dwindle in Lancashire, and from the mid-eighteenth century, this was largely confined to the eastern part of the county. Significantly, though, this period did see the emergence of specialised loomshops that effectively foreshadowed the factory-based system of spinning and weaving. These were two- or three-storey, double-depth workshops, which had rows of multi-light windows on each lateral elevation. The physical and documentary evidence suggests these structures were being built in hamlets, villages and towns specifically to rent out to hand spinners and weavers, up until the mid-nineteenth century, although they were largely superseded following the adoption of the automated power loom within early nineteenth-century textile factories.

Finishing

Once the woollen cloth had been produced, it required finishing, leading to the rise of a fulling industry in parts of Lancashire. This increasingly relied on

Top left: Loomshop at Rawtenstall

Top right: water-powered fulling stocks at Higher Mill, Helmshore, used to pound the woollen cloth to produce a cleaner, thicker cloth with a felt finish

fulling mills, Lancashire's first mechanised textile mills, where, the woollen cloth, produced by the cottage-based industry, was cleansed and degreased, either with potash, dung and urine, or fuller's earth (a naturally occurring magnesium oxide-rich clay). The cloth was then pounded to pump out the dirt and grease, thicken the weave, and produce a felt-like texture. This process was powered by water, using a wheel, harnessed to drive two wooden hammers, or stocks. The hammers would pummel and gather the cloth into narrow folds at the far end of a wooden box, or trough.

Documentary evidence indicates that fulling mills had been constructed in Manchester, Burnley and Colne by the thirteenth century, although others will almost certainly have been in operation, but none survives from this date. Although much later, perhaps the best-preserved fulling mill in the county is Higher Mill at Helmshore (listed Grade II), erected in 1789 on the Ogden Brook by a Lancashire woollen manufacturer called William Turner. The original building was a rectangular three-storey sandstone structure with an integrated waterwheel and associated reservoir which, by 1830, could raise an estimated 50 horse power (hp). The width of the building was limited by the length of its transverse timber floor-beams, making it narrow in proportion to its length. Elsewhere, there is also evidence for the combining of processes within the finishing trades, such as in Burnley where, in 1736, John and Henry Halstead reportedly operated a water-powered fulling mill and dye house at the junction of Calder Vale Road and Padiham Road.

Linen

The production of linen cloth, through the weaving of flax, also formed a small-scale activity during the late medieval period, though by the mid-sixteenth century it was a significant industry, with production occurring in the Manchester area, and perhaps also in Liverpool. In the late sixteenth century, Manchester continued to be a major centre for linen production, used to make smallwares, though by this time production is also known to the north-east (in Blackburn and Burnley), west (in Wigan, Ormskirk and Preston) and east (Oldham and Ashton). Linen production in historic Lancashire expanded in the late seventeenth century, as heavy duties were imposed on imports from the Continent, and through a growing demand for linen by the nascent cotton industry. During this period, Manchester was a leading trading hub, and Warrington (now in Cheshire) emerged as an important centre, particularly in tablewares. In the early part of the eighteenth century, cotton was used in linen cloth, and again Manchester remained dominant, producing cotton-linen smallwares, whilst sailcloth was made at Kirkham, Warrington and Lancaster. By the early nineteenth century, linen production was much reduced and largely restricted to the sailcloth industries on the west coast, and Kirkham and Lancaster, along with Preston, were the regional production centres.

Fustian

Fustian is a strong, twilled cloth, with a linen warp and a cotton weft, that probably began to be manufactured in Lancashire in the early seventeenth century, using both local materials and flax imported from Ireland, Scotland, and Russia, and cotton from the eastern Mediterranean. This formed a coarse and cheap cloth, often used in menswear, and during this period the main areas involved in its production were Bolton, Blackburn, Oldham and Manchester (all now in Greater Manchester). Production of fustians remained a fairly small-scale affair throughout the remainder of the seventeenth century, though there was a growth in manufacture in the earlier part of the eighteenth century, which again was confined to the early fustian-producing centres, along with Wigan, Leigh (both Greater Manchester) and Warrington (now in Cheshire). Some of the reasons for this growth were the presence of a workforce, already skilled in linen weaving, and an emerging mercantile class in Manchester (such as the

Chethams, the Booths, the Wrigleys and the Byroms), who could easily supply the requisite cotton. In addition, the manufacture of fustians during this period was stimulated by a 1721 Act of Parliament, which prohibited the use of printed cotton cloth, the demand for which was replaced by printed fustian. Although, from the late eighteenth century onwards, fustian was largely eclipsed by cotton, its production did continue, albeit much reduced in scale, in the early nineteenth century, within a factory-based context, particularly within the Irwell Valley. This is evidenced by the presence in historic Lancashire of several fustian mills dating to this period, such as the Irwell Mills, Bacup, which were engaged in weaving between 1824 and 1837 under the initial ownership of Hargreaves and Hardman, and later John Holden and James Holt.

Silk

The production of silk yarn and cloth in the region emerged in the mid-seventeenth century and was undertaken in Manchester and Salford, and some surrounding towns, such as Cheadle and Stockport, with an outlying industry developing in north Lancashire, around Lancaster. Although the scale of the industry in this period is difficult to ascertain, production continued to form an important strand of the region's textile industry into the nineteenth century, by the 1840s its labour force being higher than that employed in the production of woollen cloth. Cheshire increasingly became the centre of the industry, particularly the town of Macclesfield.

Silk weaving in a domestic setting, 1895 (© Tower Hamlets Local History Library and Archives)

Cotton

Rise and ascendancy

In the late eighteenth century, the English textile industry was transformed by a shift towards the manufacturing of cotton goods, which rapidly became the mainstay of Lancashire's regional economy throughout the next 150 years. At one level, the rise of the cotton industry in Lancashire was closely linked to the eighteenth-century demand for these goods. In this respect, it was founded on the popularity of cotton cloth, which had emerged during the seventeenth century, when a type of dyed cotton or calico, known as chintz, began to be imported from India. Although the use of chintz was first prohibited by Parliament in 1701 and then later banned in 1721, the repeal of these regulations in 1774 acted as a direct stimulus for Lancashire to produce its own cotton cloth, from imported raw cotton. Up until the 1860s, most of this was obtained from slave plantations in the southern states of America, which resulted in close links between these two areas.

Chintz, a type of dyed cotton or calico imported from India during the late seventeenth century

Eighteenth-century technological advancements relating to the development and powering of textile machinery also provided the correct conditions for the dramatic expansion of the cotton industry. Following the adoption of steam power in the region, the industry had a further advantage, as the Lancashire coalfields could supply cheap sources of fuel. Another factor directly responsible for the growth of Lancashire's cotton industry was the improvement in transport, allowing coal to be conveyed to the major urban centres, raw cotton to be imported, and cotton goods distributed relatively easily. Firstly, these improvements were linked to the development of river navigation, followed by the building of canals. Some of the earliest of these improvements focused on Manchester. Initially, the opening of the Mersey and Irwell Navigation in 1734 created an efficient link between Manchester and the port of Liverpool, enabling waterborne trade to enter into Manchester for the first time. The local network was further improved in 1761 by the opening of the Bridgewater Canal, the region's first true canal. This was

The major canals, coalfields, and geographical features of Lancashire


N
Cartmel Peninsula
River Kent
Furness Peninsula
Kent Estuary
Yorkshire Dales
Lune Valley
River Lune
Morecambe Bay
Bowland Fells
Lancaster
Lune Estuary
Lancaster Canal
Lancashire Valleys
River Ribble
Leeds & Liverpool Canal
River Wyre
Irish Sea
Amounderness Plain
Burnley
Leeds
River Darwen
River Calder
Rochdale Canal
West Pennine Moors
Rossendale Fells
Manchester Pennine Fringe
River Douglas
Douglas Navigation
Lancashire Coal Measures
River Irwell
Manchester Bolton Bury Canal
Huddersfield Narrow Canal
Lancashire Plain
Wigan
River Irk
River Medlock
Southern Pennine Hills
Leeds & Liverpool Canal
Manchester
Ashton Canal
Mersey and Irwell Navigation
Mersey Valley
Liverpool
Manchester Ship Canal
Peak Forest Canal
Bridgewater Canal
River Mersey
Cheshire Plain
Macclesfield Canal
Trent and Mersey Canal
0
50 km
1:750,000
Extent of coalfields
Canal network

built to allow large quantities of coal to be transported from the Duke of Bridgewater's mines at Worsley to the rapidly expanding centres of Manchester and Salford. However, by 1776, it had been lengthened to link Manchester with Runcorn and, in turn, the port of Liverpool, providing Manchester with ready access to sources of raw cotton.

The Bridgewater Canal, opened in 1761, to supply Manchester with a cheap source of coal, here crossing the Mersey and Irwell Navigation, opened in 1734 as a major transport link to Liverpool via Warrington

To the west, in the mid-eighteenth century, the Douglas Navigation connected the pitheads at Wigan to Preston and the Ribble estuary, and trade was further improved by the construction of sections of the Leeds and Liverpool Canal later in the century. In the north-east of the county, this canal connected the coal mines at Burnley with important markets in Yorkshire, while in the north-west, the construction of the Lancaster Canal had also begun, ultimately linking Preston with the limestone areas to the north in the following century. In 1777, the Trent and Mersey Canal also opened, which joined the Bridgewater Canal and formed an important commercial link connecting Lancashire with the industries of the Midlands. Other important canals were the Rochdale Canal, the Ashton Canal and its branch, the Stockport Canal, and the Manchester, Bolton, and Bury Canal. These were all established in the closing decade of the eighteenth century and connected Manchester with other important industrial towns engaged in textile manufacturing.

These combined elements thrust Lancashire's cotton industry into the factory-based system of production, which quickly enabled it to dominate the textile industry. The mid-nineteenth century saw an increasing degree of specialisation within the cotton sector, though this became more pronounced in the latter part of the century.

Manchester and the south-east of the historic county concentrated on the spinning trade, to the south of the West Pennine Moors and Rossendale Fells, while weaving became focused in Pennine Lancashire to the north-east, where many of the traditional handloom weavers had come from. This period also witnessed a significant expansion in the region's transport system, with the birth of the 'Railway Age', after the completion of the Liverpool and Manchester Railway in 1830. After this date, an extensive rail network developed, with routes connecting all of the cotton towns throughout Lancashire with other major British cities and ports. This caused some to expand dramatically.

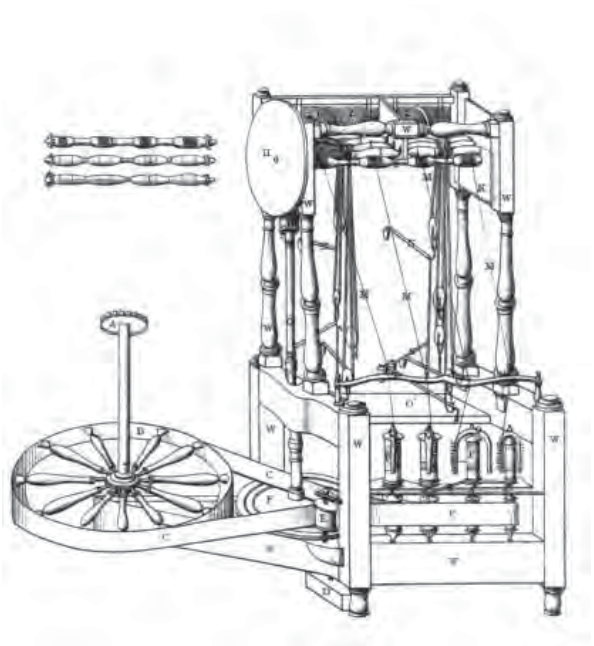
Cotton-spinning mills

In Lancashire, the single mechanised manufactory did not properly appear until the late 1770s, with the introduction into the region of mechanised cotton spinning. Mechanisation in this area of textile production was made possible through several important technological advancements in the textile industry in the eighteenth century. The first of these dates to 1720, when Thomas Lombe applied water power to the silk-throwing process, in Derby on the River Derwent. Significantly, this was undertaken within a five-storey-high, long and narrow building that would form a model for the cotton and woollen mills appearing in Lancashire in the late eighteenth century. This was followed by the invention of the Spinning Jenny by James Hargreaves in 1764, which allowed a single spinner to operate eight spindles simultaneously.

James Hargreaves' Spinning Jenny allowed the spinning of multiple threads at once

In 1769, Preston-born Richard Arkwright took out a patent for a cotton-spinning machine, known as the water frame once he had adapted it to be powered by a waterwheel, and followed this with a carding engine in 1775. He brought these machines together in a purpose-built building at Cromford on the River Derwent, based upon that used by the Lombe brothers, to produce the world's first successful mechanised cotton-spinning factory.

Further improvements followed, with the introduction in 1779 of Samuel Crompton's spinning mule, a machine which made a thinner, stronger thread. This allowed the manufacture of fine cotton goods that could compete with those made in India. Crompton did not patent his machine, making it accessible to all, and in the long term it became the favoured machine amongst fine cotton spinners.



Arkwright's water frame, the first successful powered cotton-spinning machine

Early cotton-spinning mills

Arkwright's development of a water-powered cotton mill was quickly adopted in his home county of Lancashire, many being built on the abundant fast-flowing rivers in the Pennine areas, taking advantage of the humid climate that was believed to be best-suited to the production of cotton goods. The development of steam power in the late eighteenth century gradually transformed the siting of cotton-spinning mills, effectively shifting the industry from the rural river valleys to urban centres, which had an abundance of labour and ready access to coal. In Lancashire, the initial boom in urban steam-powered mills was concentrated on Manchester, where cheap coal had been available since the completion of the Bridgewater Canal in 1761, and also some of its surrounding towns, such as Stockport and Stalybridge. The urban steam-powered mill still required a source of water, but it no longer had to be fast-flowing, and this would have a significant effect upon the morphology of a town. Where there was access to a canal or river, urban mills clustered around their margins, often stimulating residential developments nearby. This was the case in Burnley, for example, where cotton mills lined the banks of the Leeds and Liverpool Canal, while in Preston, where there were only limited opportunities for canal access, mills such as Hanover Street (listed Grade II), erected in 1796, were built with their own reservoirs.

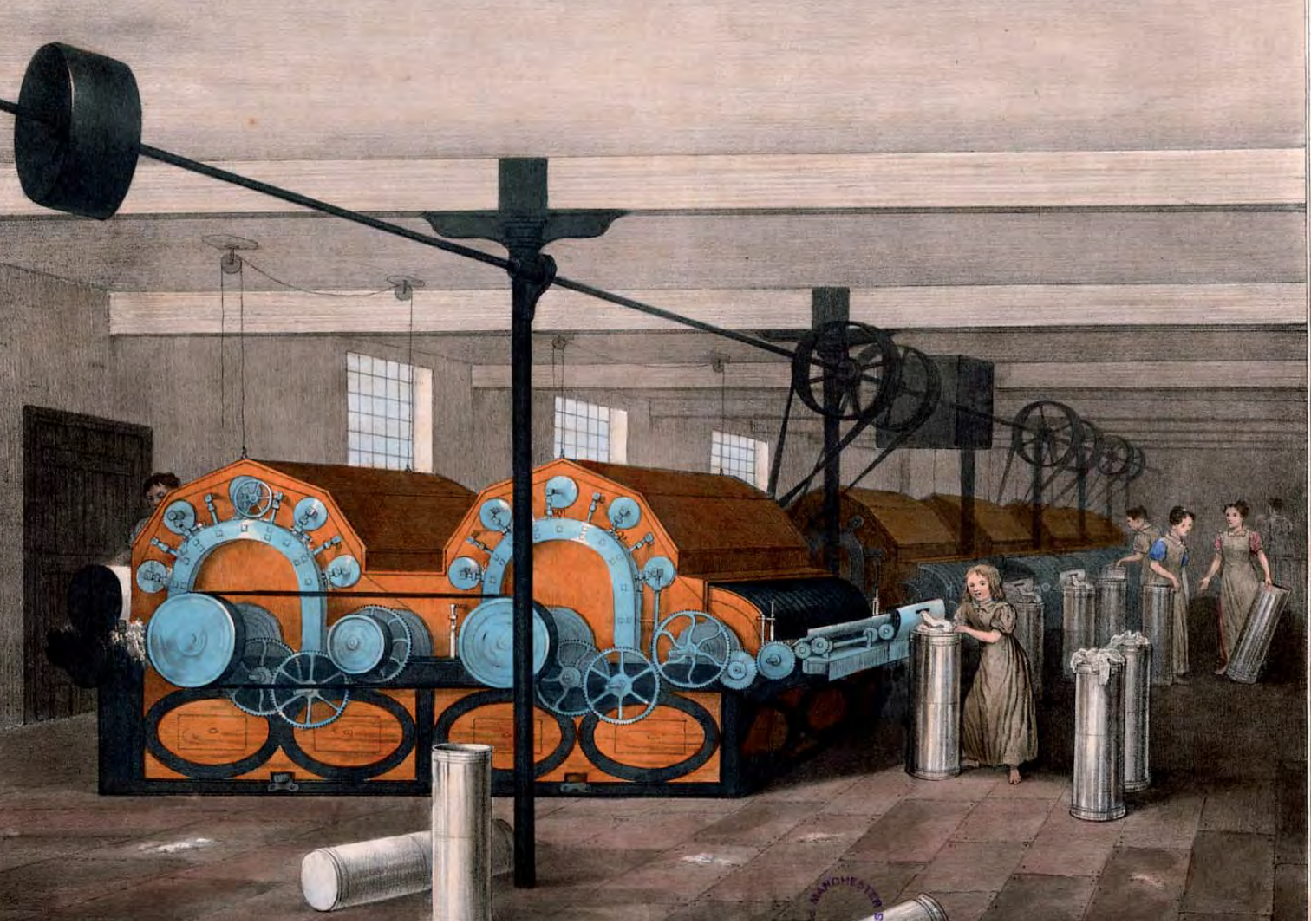
In the more rural districts, such as Rossendale, where water power was available, the use of the waterwheel continued as the principal power source well into the nineteenth century. However, the success of the urban steam-powered mills signalled the beginning of the slow decline of the rural water-powered mill and, with the exception of the finishing trades, led to the relocation of the textile industries to the urban population centres. Thus the steam-powered textile mill undoubtedly made a significant contribution to the massive urban expansion experienced in Lancashire throughout the nineteenth century, and also to the character of the towns that emerged.

Processes

Both water-powered and early steam-powered spinning mills were purely utilitarian buildings and, as such, their architectural form largely reflects the processes which were undertaken within them. Three main processes were required in order to produce cotton yarn. The first of these related to the opening and preparation of the bales of raw cotton. Initially, this was undertaken by hand in separate workshops, where the bales were opened onto a mesh floor and impurities in the cotton were removed, through a process known as willowing or batting, involving beating the cotton with sticks.

Following this process, the cotton fibres were formed into a sheet of wadding (the lap) ready for carding. From the mid-1790s, the beating process was mechanised by using a machine known as a willow, whilst from 1800, machines, termed scutchers, were employed, which both removed impurities and mixed the cotton fibres. These machines comprised a high-speed rotating drum and a fan, which pumped out cotton dust. This was highly flammable and, although initially the scutchers were contained in buildings outside the mill, they were later contained in dedicated fireproof rooms (a blowing room) within the spinning mill, equipped with a ventilation system that extracted the cotton dust.

Carding and the production of the roving was the second process associated with a spinning mill, which used machinery invented in the later eighteenth century. These machines comprised a rotating drum, with wire spikes, contained within a case, which was also lined with spikes. These combed the



Carding engines, removing the dirt and other impurities from the raw cotton to form an untwisted sliver (Barfoot 1840; © Manchester Archives and Local Studies)

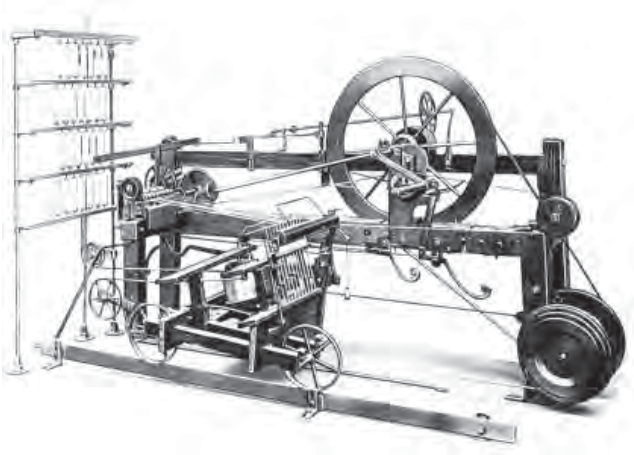
lap to produce a thin sheet of fibre that could then be formed into untwisted slivers. Following this process, the slivers were subjected to draughting (or drafting), using a machine known as a draw frame. This allowed them to be doubled into a single sliver, which might also be doubled again. The resultant sliver was then stretched using draughting rollers and twisted to create the roving, ready for spinning.

The third process occurring within the spinning mill related to mechanised spinning, which took place in the upper storeys. Two different types of spinning machine were used in Lancashire's mills. The first was Arkwright's water frame,

using draughting rollers to stretch and twist the roving into yarn, which was then wound onto a spindle. The benefits of this machine was that it could achieve a continuous output and be operated using relatively unskilled workers. This machine was then adapted in the early nineteenth century, when it was known as a throstle, so that it could be driven by steam power. The ring frame was another adaptation, invented in America during the early nineteenth century, and used in Lancashire textile mills in the late nineteenth century.

The mule, invented by Samuel Crompton in the late eighteenth century, formed the second type of spinning machine. It combined the draughting-roller elements of the water frame with features of the earlier spinning jenny developed by Hargreaves, and along its back it had bobbins, containing the roving, whilst a parallel carriage held the spindles. This carriage was wheeled, and moved away from the bobbins to pull out the roving to produce a finer and stronger yarn than that produced by the water frame. This was then wound onto the spindles when the carriage moved back in towards the bobbins. Steam power was successfully applied to the mule in 1793, representing a major technological advance. Following this application, though, the machine was still only partly powered, and it was not until 1825 that the self-acting mule was patented by Richard Roberts of Manchester, meaning that the whole process could be driven by steam power.

Samuel Crompton's mule was a hybrid of the spinning jenny and water frame, producing a strong thin yarn



During the nineteenth century, several other machines might also have been found in a cotton-spinning mill. These included yarn-winding machines, which transferred the yarn from the spindles onto bobbins, ready for despatch, and yarn-doubling machines, which combined two or more yarns to produce a stronger thread. However, in the mid-nineteenth century, this latter process often occurred in specialised yarn-doubling mills.

Water-powered cotton-spinning mills

The first water-powered cotton-spinning mill in Lancashire was erected in 1777 by Edward Chadwick at Birkacre near Chorley, which he leased to Arkwright himself, who then installed his patented water spinning-frames. The mill was destroyed by machine breakers in 1779, but other water-powered spinning mills were established shortly afterwards, such as Armetriding Mill in Euxton (1784), Clayton Mill in Clayton-le-Woods (1784; now demolished), and Lower Burgh Factory at Plymouth Bridge (1791; now demolished).

These mills were long narrow buildings up to five storeys high, and each storey was provided with regularly spaced windows, to maximise the amount of daylight entering the building. In the Pennine fringe of Lancashire, mills were constructed of stone, whilst handmade brick was used in areas where stone was not readily available. These spinning mills typically housed between 1000 and 2000 spindles, and possessed wooden floors, which were supported by transverse timber beams. The waterwheels powering these mills were situated on either an external side elevation, or were housed internally, and were fed by a system of leats, which often flowed from a reservoir.

Within modern Lancashire, water-powered cotton mills still survive at Salmesbury Bottoms Mill, Hoghton Bottoms Mill, Roach Bridge Mill, and Cleveley Mill near Scorton, although all of these have been subject to considerable remodelling and alterations, with a resultant loss of original fabric. A more complete example is Kirk Mill in Chipping (listed Grade II), which was established in 1785, on the site of a former medieval corn mill, and this appears to typify these types of early water-powered spinning mills. At this site, the original mill was approximately 33ft (10m) wide, and around 69ft (21m) long, with the original waterwheel probably being external to the mill. Internally, the building was sufficiently narrow for unsupported, single large-scantling beams to span the entire floor, suggesting that it was designed as an Arkwright-type mill. Although evidence for many line-shafting positions survives, it is probable that deeply gouged scars to the north of the centre-line of the mill represent the position of the original shaft. Another fine example of a water-powered mill, albeit of a slightly later date, is Lappet Mill at Calder Vale, which was converted subsequently to steam and, latterly, water turbine.

(Top) Kirk Mill, Chipping, after restoration; a well-preserved example of an Arkwright-type cotton-spinning mill erected in 1785. This redundant eighteenth-century mill is being sympathetically repaired and refurbished as a highly-quality hotel by SCPi Bowland Ltd (© Amy Chicken)

(Bottom) A photograph of c 1933 demonstrates how little Kirk Mill has changed in the last 80 years

Steam-powered cotton-spinning mills

Steam-driven pumping engines were initially employed in the 1780s to furnish the waterwheels in the spinning mills with constant and regular supplies of water. However, with the adoption of the rotative steam engine by the cotton-spinning industry, the form of the spinning mill evolved. It generally comprised a large multi-storeyed spinning block, comparable in form to the water-powered spinning-mill, with one or more attached wings, creating a mill that had a U- or L-shaped plan. By the early nineteenth century, many spinning mills were wider than their eighteenth-century predecessors, employing cast-iron columns to support their floors. Larger urban mills, with the same U- or L-shaped plan, appeared in the mid-nineteenth century, following the introduction of the self-acting mule in 1825. These mills were designed to house larger, transversely orientated spinning machines, with Brunswick Mill in Manchester, when first built, being one of the largest examples in historic Lancashire (listed Grade II).

Cast-iron columns were also an integral element of fireproof mills, which first appeared in the 1790s at Ditherington, Shropshire, and Belper, Derbyshire. In historic Lancashire, the earliest examples date to the early nineteenth century, such as those within an extension to the Salford Twist Mill, which was built in 1802 (now demolished). In these types of fireproof mills, the cast-iron pillars supported cast-iron columns, which in turn supported brick-vaulted ceilings. These vaults were covered with sand, ash, blast-furnace waste or rubble, above which a floor composed of stone flags, tiles, or wooden boards was laid. Many early nineteenth-century mills contained a basement, lit by small windows, and an attic, which was sometimes lit by large lunette windows positioned in the gable-end walls. Significantly, many of the windows associated with early mills contained crown glass, composed of a series of hollow globes or bullseyes. One unfortunate consequence of this was that such windows could magnify light and thus could pose a fire risk. Other features associated with early nineteenth-century spinning mills included external stair towers and full-height privy towers.

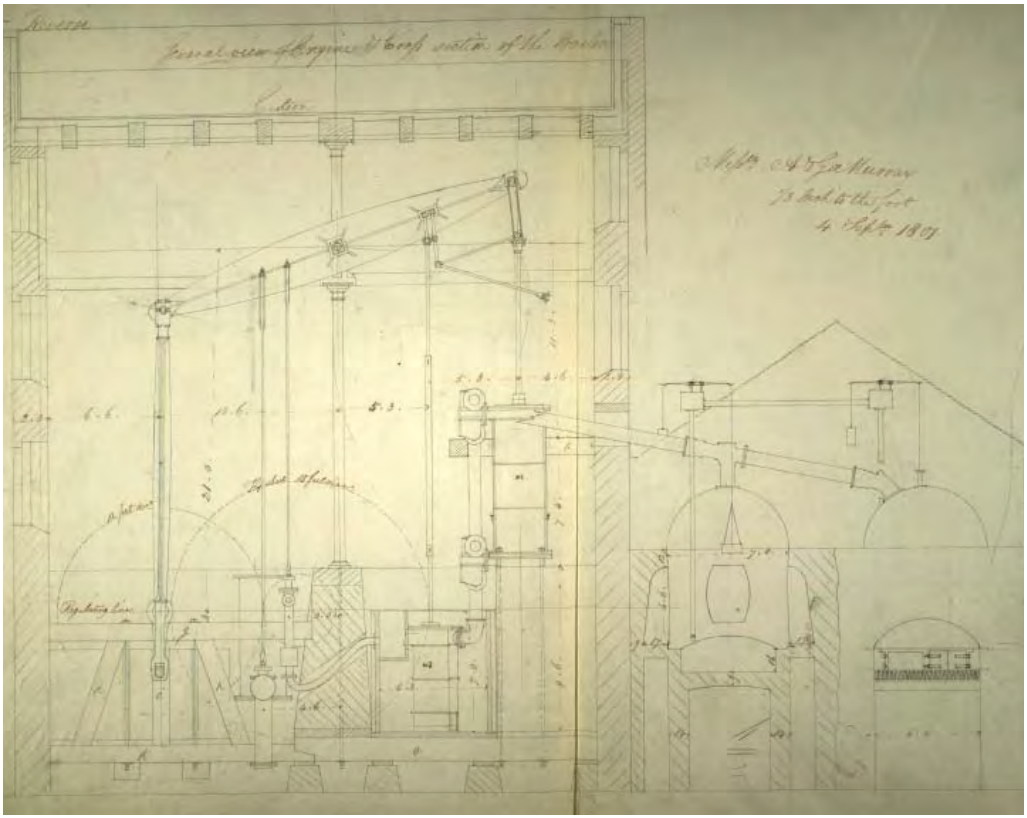
From the late 1790s until the 1870s, the majority of the steam-powered spinning mills were powered by rotative beam engines, consisting of a cylinder, condenser and a working beam, which turned a flywheel. Rotative motion using a beam

Above Left: Cast-iron columns and fireproof single-brick-arch floor construction at Brunswick Mill, built in 1840

Above Right: Lithograph of Brunswick Mill, Manchester, a cotton mill built to a U plan

engine was first made possible following the invention of the crank method by James Pickard in 1780. Pickard patented the crank, restricting its use, and this led to the development of the sun and planet gear method, which was patented by James Watt in 1781, and used in the first Boulton and Watt rotative beam engines. Once Pickard's patent had expired, however, the crank method was employed universally.

These rotative beam engines were built within an engine house placed either within the mill or as an attached building. Engine houses were tall, narrow structures with a characteristic round-headed window set in an end wall and, initially, these both supported the superstructure of the engine, specifically its working beam, and also provided shelter for the engine's cylinder. In the early nineteenth century, cast-iron began to be used in beam-engine design, whereby a working beam was secured by an entablature supported by columns, all using the same material.



Cross-section through engine and boiler houses, showing the beam engine and boiler arrangement (© Library of Birmingham)

The demand for greater power also led to the use of paired beam engines during the early nineteenth century, and then the development of the compound-beam engine, which incorporated an additional high-pressure cylinder into the design. Although compound-engines appeared in the early nineteenth century, their design was perfected and patented by William McNaught in 1845, meaning that these types of engine could be effectively used within textile mills. Importantly, existing single-cylinder beam engines could be modified retrospectively in line with McNaught's design, and hence they were said to have been 'McNaughted'.

Boilers were also required to raise steam to power the engine. In the early spinning mills, low-pressure haystack and wagon boilers were employed,

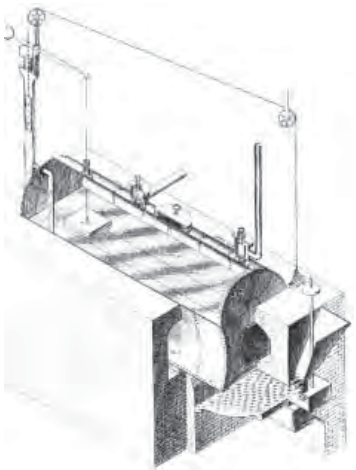
Integrated double, or paired, beam-engine house at Britannia Mill, New Line

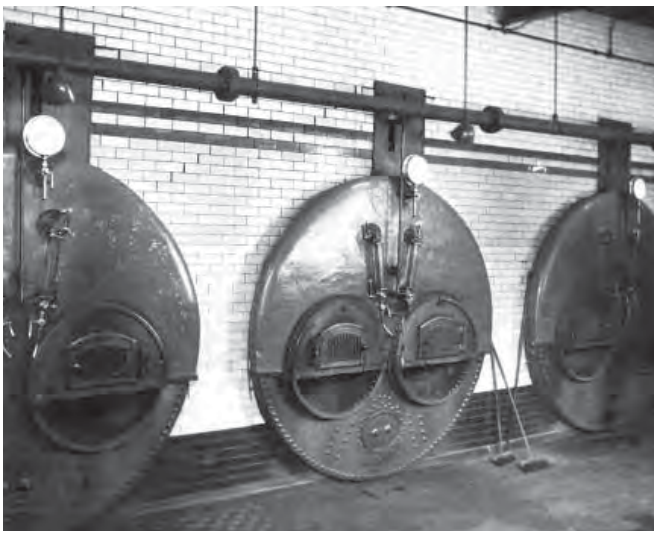
with the latter type contained within a dedicated boiler house, either within the mill or forming an external building. These boilers could produce the steam required to power both pumping engines and also early beam engines. The development of improved beam-engine technology in the early and mid-nineteenth century meant that higher steam pressures were required, and this led to the use of alternative, high-pressure boiler types. The earliest of these was developed in 1812 and was known as the Cornish Boiler, which comprised a long iron cylinder, with a single flue. This design was then further improved, in 1844, with the introduction of the Lancashire Boiler. Again, this was essentially a long iron cylinder, though it possessed two internal flues and corresponding furnaces. These latter boilers were adopted as the 'standard' type in mills from the mid-nineteenth century onwards and they were normally situated either singly or in groups within a large external boiler house. The economiser was another significant mid-nineteenth-century development, which had a significant impact on the

cost of powering a spinning mill. This device formed a nest of cast-iron pipes set into the main flue between the boilers and chimney and, using exhaust gases, it preheated the water that entered the boiler.

Boiler houses also required a large chimney, which is, perhaps, one of the most iconic, and characteristic, features of mills and, more generally, of the townscapes associated with Lancashire's textile industry. The chimney was linked to the boiler via a flue and was designed both to emit the exhaust fumes from the furnaces and also create a draught to aid in the working of these furnaces. Chimneys were very carefully designed structures and their height was dictated by the amount of draught required for the number and pressure of the steam-raising plant. Naturally, higher chimneys also had greater powers of dispersal and emission, compared with lower chimneys, and in urban areas, legislation also dictated a minimum height.

Chimneys associated with the late eighteenth- and early nineteenth-century mills were usually square in section, and tapered towards the top, although some mills in Manchester, such as Brownsfield Mill, also possessed straight-sided cylindrical chimneys, the latter being one of the very few to be encased by





Far left: The Wagon Boiler, so-called because of its shape, powered many of the steam engines built in the first half of the nineteenth century, producing about 0.3 bar of pressure

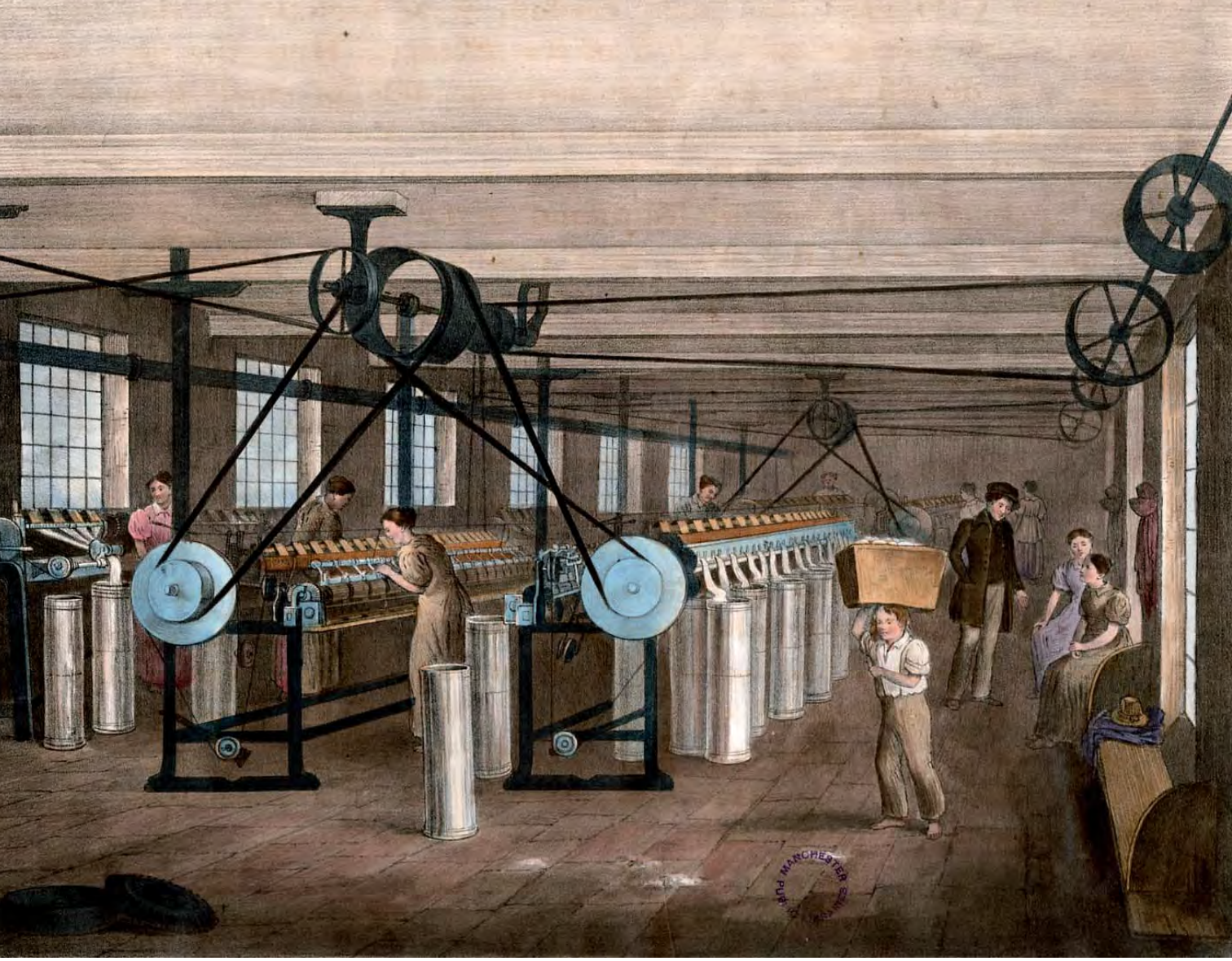
Near left: The Lancashire Boiler was introduced in 1844 and was capable of producing the higher pressures necessary for increasingly powerful engines. It remained the standard form throughout the nineteenth century

the stair tower (listed Grade II*). All were normally attached to, or were within, these early mills. In the mid-nineteenth century, however, higher chimneys appeared, which reflected the demand for more power, and although the earlier chimney types persisted, free-standing octagonal-sectioned chimneys also began to be built.

Inside the spinning mill, the transmission of power from the steam engine to each floor was achieved through the use of an upright, vertical shaft, which in early mills was made of timber, and in later buildings (dating from the 1820s onwards) from cast iron. This shaft was turned by a horizontal 'first motion' shaft, rotated by the flywheel of the beam engine, via the use of a pinion wheel. The vertical shaft tended to be sited either against the end wall of the mill, or an internal dividing wall. The vertical shaft was connected with horizontal line shafts, supported by cast-iron hangers attached to the beams or cast-iron columns. In a small number of early mills, however, the steam engine turned a horizontal drive shaft beneath the ground floor, which, in turn, powered a series of short vertical shafts connected to machinery on the overlying floor. A belt/rope system was used to transfer power from the rotating line shafts to individual machines. With this system, a series of drums positioned along the line shaft was connected by leather belts/ropes to corresponding drums on the machines.

Top Left: Square-section chimney at Britannia Mill, Haslingden, built in 1856

Bottom Left: Round-section chimney at King's Mill, Harle Syke, built in 1912



In addition to engine- and boiler houses, spinning mills were also normally associated with a range of ancillary structures during the earlier part of the nineteenth century. These included warehouses, which were sometimes attached to the wings of the mill, to create an enclosed courtyard, and counting houses and offices. Other ancillary structures included gas retorts, which appeared in the first decade of the nineteenth century. These held gas that was produced on site, which was used for lighting within the spinning mill.

Power system of belts driving drawing frames, typical of an early nineteenth-century spinning mill (Barfoot 1840; © Manchester Archives and Local Studies)

Spital's Moss Mill in Preston, erected in 1796 as a steam-powered cotton-spinning mill. It is one of the earliest of its type in the county

In Lancashire, beyond what is now Greater Manchester, there are several extant early steam-powered cotton-spinning mills. One of these is Spital's Moss Mill in Preston, built in 1796, which by 1797 stood beside the newly constructed Lancaster Canal. The original mill, constructed in the Palladian architectural style, forms a narrow rectangular, four-storeyed building, constructed in red brick with sandstone dressing (listed Grade II). It has a shallow, projecting bay beneath a pediment at the centre of each lateral wall and, although the fenestration has been altered, it appears that each floor had three small, classically proportioned windows in the central bay, and another four on either side. By modern standards, however, Spital's Moss would certainly have been a poorly lit building. The size of the mill's original steam engine is unknown, since the complex was extended in the early nineteenth century. By 1821, though, the buildings were in the possession of Horrockses, Whitehead & Co, which installed 16hp and 18hp steam engines.

Standish Street Mill, Chorley, a cotton mill first erected before 1811, although reputedly rebuilt after a fire in 1829

Another example is Standish Street Mill, in Chorley. This was built by John Goodair in 1811 and, although it was reputedly destroyed by a fire in February 1829, the extant remains may relate to the original early mill. In any event, this forms a well-preserved example of an early nineteenth-century cotton-spinning mill, representing not only the oldest extant textile mill in Chorley, but also one of the oldest steam-powered cotton mills in the county.

The complex comprises a five-storey narrow, brick-built, spinning block, possessing simple architectural embellishment in the form of a projecting central pediment. It has a four-storey engine house against its eastern gable wall, which was later remodelled to form offices. A nine-storey tower was added to the south of the engine house, probably in the late nineteenth or early twentieth century, and housed a water tank above the height of the spinning block, which supplied a sprinkler system. Other elements within this complex

include a three-storey warehouse range to the west, and a detached two-storey, stone-built, structure.

Early room-and-power spinning mills

The so-called room-and-power system developed at the same time as the emergence of the urban steam-powered spinning mill. This system, which seems to have first appeared in Manchester in the late eighteenth century, allowed those companies that could not afford or did not wish to invest in their own premises the option of renting floor space and access to a power source within an existing mill. Room-and-power mills were either purpose-built by speculators attracted by the high rental returns, or in some cases converted from existing mills, but they also allowed fledgling companies wishing to erect their own mills a way of off-setting the cost by renting out part of the building. For instance, the narrow five-storey Bee Hive Mill was built as a multi-occupancy room-and-power mill in the 1820s, as was the seven-storey Brownsfield Mill, both in Ancoats (and both listed Grade II*), the first industrial suburb of Manchester. A number of successful businesses began by renting space in a room-and-power mill, such as Jonathon Pollard, who rented part of a mill on Union Street in Ancoats in 1797 before going on to build his own mill in 1802.

Cotton weaving

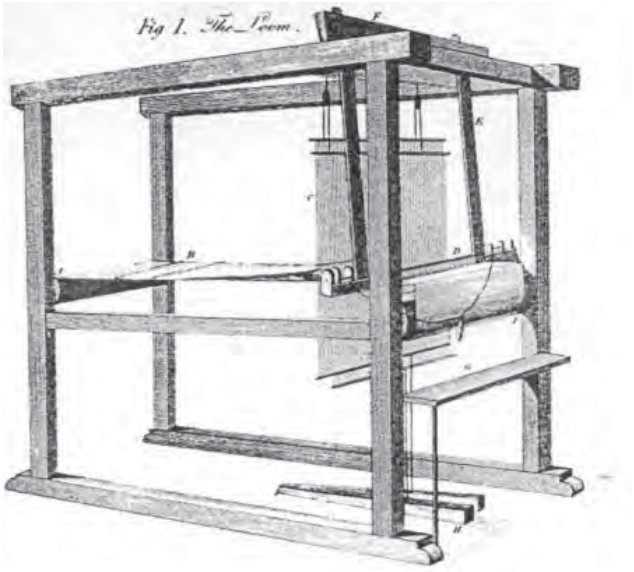
During the eighteenth and nineteenth centuries, the weaving of cloth, whether it was cotton, wool, or other yarn types, followed the same basic principles. First the yarn was prepared for weaving by winding the warp threads onto a beam, which was fitted on to the head of a loom. A size paste (starch mixture) was then applied to the yarn to protect it from abrasion during weaving. The weft was also wound onto bobbins and these were fitted into a shuttle. Following these initial stages of preparation, the loom was set up by passing each warp thread through the eyes of a series of wire healds and, during weaving, the healds rose and fell, creating a space through which the shuttle was passed.

Prior to the nineteenth century, the weaving process was performed on several different types of handlooms, which were often contained in purpose-built loomshops (*page 12*), locally termed weavers' cottages, although from 1734, the process was made easier by the invention of the flying shuttle by John Kay. In

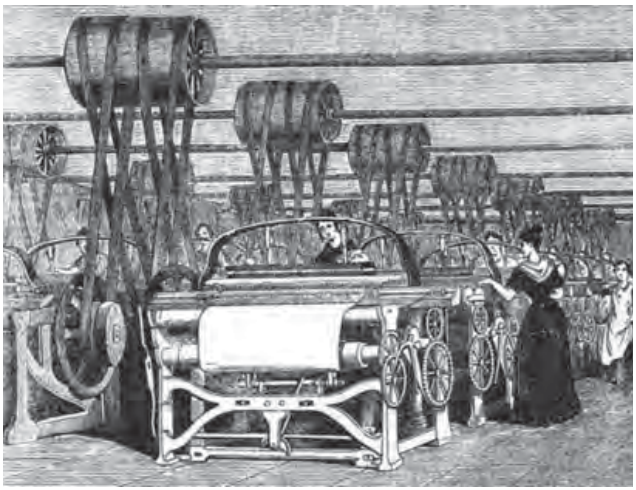
the late eighteenth century, Edmund Cartwright developed the power loom, which was later improved by manufacturers like William Horrocks of Stockport and John Todd of Burnley.

In the 1820s the power loom was further improved by Richard Roberts, who designed a cast-iron machine, which significantly increased the reliability and speed of the weaving process, and this was quickly adopted by the Lancashire textile industry. Naturally, the adoption of the power loom led to the demise of the trade of handloom weaving, wages of 23 shillings a week in 1802-6 having been cut to 8 shillings a week by 1826, by manufacturers trying to protect themselves from the slump of the post-Napoleonic-War years. This was a serious concern in Lancashire where, by 1820, handloom weavers accounted for over 51% of the population in some areas, and averaged 25% across the entire historic county.

Perhaps unsurprisingly, in 1826 protests and rioting broke out in Blackburn and Accrington, leading to the destruction of the power looms at Sykes Mill, Grange Lane, Accrington (now demolished), amongst others. That same year, Fishwick Mill in Preston took the precaution of erecting defences to protect their newly installed looms, although what this entailed is not clear. The plight of the handloom weaver was, however, shortly due to suffer another blow, with the introduction of Bullough and Kenworthy's self-acting Lancashire loom in 1842. This furthered the development of the power loom, and became



Top: Engraving of a handloom, which, despite the invention of the power loom in 1785 by Edmund Cartwright, remained the dominant form of weaving until well into the nineteenth century



Bottom: Richard Roberts' power loom, introduced in the 1820s, represented a significant improvement on previous designs and signalled the reliable mechanisation of all parts of the cotton-manufacturing process

the standard design throughout the remainder of the nineteenth century, leading to the rapid increase in such looms within the industry.

Weaving sheds

In the 1820s, following the introduction of Richard Roberts' power loom, an increasing number of established spinning mills began to incorporate them into existing buildings. At first, power looms were reportedly installed within earlier multi-storey buildings, but it was soon realised that these buildings could not provide the even, natural light which was required by the weaving process. In addition, the heavy loom machinery and the vibrations caused by their operation could cause structural problems and thus they were better suited to single-storey structures. A new form of building, the weaving shed, was developed in response to the specific needs of the industry.

The single-storey weaving shed had a range of advantages over the multi-storey mills for weaving purposes. Firstly, the looms could be placed directly on the ground, reducing the need for expensive structural floor beams. Secondly, a better, more even light was provided to all parts of the floor using a series of repeating bays supported by rows of cast-iron columns, carrying timber trusses, with each bay topped by a glazed saw-tooth-design roof, usually facing north to avoid strong sunlight, which might dry out the woven cloth. This same feature allowed the sheds to be built as wide as required, free from the need to maximise natural light from the windows in the side walls, a design preoccupation of the spinning blocks. The sheds were, however, very land-intensive in comparison to multi-storey blocks, which in the towns added considerably to their construction costs, but this was offset to some degree by their adaptability to irregular plots. In some rare instances, such weaving sheds were incorporated into multi-storeyed buildings. At Brierfield Mill, Brierfield (listed Grade II), this was achieved between 1873 and 1876 by terracing the weaving floors of shed number 2 into the natural slope, while at Victoria Mill, Burnley (also Grade II-listed), the weaving shed of the 1880s was placed over the warehouse.

Weaving sheds were purely utilitarian buildings and thus lacked any architectural embellishment. In terms of their form, those dating to the earlier nineteenth century generally comprised 20ft-wide (6m) spans, with transverse bays of 10ft

North-light roof at Queen Street Mill, Harle Syke, providing an even light suitable for the weaving of cloth

(3m), and the power looms within were powered by steam-engines that were comparable to those associated with earlier nineteenth-century spinning mills. When weaving sheds were constructed adjacent to a spinning mill, power may have been derived from a single large engine house, which powered all the manufacturing processes on the site, though in other instances weaving sheds sometimes had a dedicated steam engine.

Power transmission within the weaving shed was also achieved through similar techniques to those used in spinning mills. However, given that weaving sheds were single-storey, the main drive shaft was positioned horizontally against a side wall. This would then turn a series of line shafts that were attached to the shed's cast-iron supporting columns, with each line

North-light weaving sheds in front of the Grade II-listed Britannia Mill, Haslingden

shaft often powering two rows of looms. One effect of the arrangement of the transmission shafts associated with the power system was that weaving sheds normally required two right-angled walls, though the other walls of the shed could be more eccentric in form.

Integrated spinning and weaving mills

One significant outcome of the uptake of the power loom by the Lancashire cotton industry was the appearance of integrated spinning and weaving mills from the 1820s onwards. In some cases, small weaving sheds were attached

to established spinning mills, as was the case at Chorlton New Mill (listed Grade II), where in 1829 a single-storey weaving shed containing 600 looms was built, powered by a marine-type engine. Another early example is Higherford Mill (listed Grade II), which saw the construction of a weaving shed in 1832, to the south of an existing spinning block; by 1836, it is recorded as housing 74 power looms to weave calico.

The 1820s and 1830s were mainly characterised by the appearance of large purpose-built integrated spinning and weaving mills. These consisted of a multi-storey spinning block, with a rectangular single-storey weaving shed of equal or greater size attached to one side of the mill. The warehouse range and power plant might have been shared between them or, in some cases, a separate engine house might have been erected to power the weaving shed. One early example of this type of integrated mill is Fishwick Mill, which was built in Preston in 1826, whilst another early example was Orrels Mill, erected in Stockport in 1834-5 to the designs of William Fairbairn (now demolished). Following their success, the building of purpose-built integrated mills spread across Lancashire in the mid-nineteenth century, with particular concentrations in Rossendale, Blackburn, Burnley and Preston.

In modern Lancashire, there are several good surviving, or recently demolished, examples of mid-nineteenth-century integrated mills. One is Abbey Mill (listed Grade II), west of Blackburn, which was erected in *c* 1840 by John Park as a five-storey spinning block, with an integrated engine house at the eastern end, a small fire-proof preparation block beyond, and a single-storey weaving shed of five bays attached to the western end of the spinning block. The mill was powered by a vertical beam engine, its position marked by the elongated semi-circular-headed window on the southern elevation, and the now-demolished chimney was of square section and detached from the main structure. The spinning block is twice the width of the Arkwright-type mills of the late eighteenth century and twice as long, reflecting the use of internal cast-iron intermediary columns, which had been introduced in the late 1790s. The north-light roof of the weaving shed (actually facing north-west) appears to be consistent with an early date, being of the 20ft (6m) span typical of the early sheds, and constructed with timber trusses. An additional weaving shed

Abbey Mill, Abbey Village, an early surviving example of an integrated cotton mill erected c 1840, with two phases of weaving sheds (1988; © Historic England)

was later added, with a narrow-span roof, typical of those dating to the later nineteenth century.

A good example of an integrated mill was Reeds Holme Mill, near Rawtenstall, which was established around 1850, and which, prior to its levelling in 2012, contained a series of mid-nineteenth-century mill buildings. These included a three-storey spinning block; a weaving shed; and a stable block, all constructed in local sandstone. The original three-storey spinning block was not fireproofed, and had an internal double-beam engine house. A small boiler house appeared to have been placed transversely at the eastern end of the mill, leading to a large octagonal-section chimney. A small weaving shed also stood opposite the preparatory block of the main mill building and, although this allowed the mill to undertake both spinning and weaving, it appears that during the 1850s the site was principally engaged in cotton spinning.

Reeds Holme Mill, near Rawtenstall, established around 1850 (1988; © Historic England)

Extension work carried out in 1864-7 changed the complex to a fully integrated cotton mill, enlarging it on to the Burnley Road street frontage. The power plant was seemingly remodelled to supply the increased demand for power, with a four-bay boiler house added at the eastern end of the three-storey mill, the existing boiler being replaced by an economiser. The power of the engine may also have been increased by the addition of a high-pressure cylinder; in addition, the stable block appears to have been added to the complex at this time. This had an ornate gateway at its western end, controlling access into the complex from Burnley Road. A third major phase of construction comprised the further expansion of the weaving shed, which included a shallow basement, functioning as a conditioning cellar. The addition of engineering workshops above the eastern end of the weaving shed appears slightly later in date, and represents a subsequent alteration of the integrated textile-mill complex. The site continued to function as a textile mill into the twenty-first century (manufacturing synthentic fabrics), and was latterly occupied by JB Broadley Ltd.

Weaving mills

The purpose-built weaving mill probably emerged at around the same time as the integrated mill, although it was slower to gain popular support. It is uncertain when it was introduced to what is today the county of Lancashire, although early contenders may include Bridge Mills in Edenfield (1820s) or Rake Head Mill in Burnley (1835). By the middle of the century, they began to be built in large numbers, with particular concentrations in Preston, Blackburn, Darwen and Accrington, and in smaller numbers in Rossendale, but it was in the Pennine areas to the north-east, around Burnley, Nelson and Colne, where the regional centre would develop.

Mid-nineteenth-century weaving mills normally comprised a typical single-storey weaving shed, with a saw-tooth roof, along with other ancillary structures. These included a multi-storeyed block, usually two or three floors high, and often fronting the main street on which the mill stood, an engine house, a boiler house, and chimney. The multi-storey block was an important component, usually acting as a warehouse for both spun yarn and woven cloth, housing the yarn-preparation processes, sizing and beaming, and providing office accommodation for the administration of the mill. They frequently joined a single-storey shed to its rear, and the two were usually connected internally to allow beamed warp, weft

Church Kirk Mill, across the Leeds and Liverpool Canal. Sadly, the chimney has been lost since this photograph was taken

bobbins, and woven cloth to be transferred between the two. To the front there were separate entrances for both vehicles and mill operatives, often arranged in a repeated pattern to facilitate multiple occupancy.

Modern Lancashire's earliest intact purpose-built north-light weaving shed may be that at Church Kirk Mill, in Church, where, in 1853, Edmund Kershaw erected a five-bay weaving shed, with an attached three-storey preparation and warehouse block to the east, on the bank of the Leeds and Liverpool Canal. The building was powered by a vertical beam engine at the southern end of the three-storey warehouse range. The boiler house stood to the south of the engine house and the building's chimney was beyond it, overlooking the canal. Internally, the north-light roof trusses were constructed in timber and were carried on rows of cast-iron columns, forming bays of 16 x 10ft (5 x 3m), broadly consistent with other early nineteenth-century weaving sheds.

Union Mill, Sabden, a weaving mill erected in 1856 by Samuel & Richard Harrison, accommodating 208 looms (1988; © Historic England)

Church Kirk Mill appears to be typical of the smaller weaving mills of the 1850s, which accommodated between 200 and 500 looms. Other examples include Britannia Mill in Haslingden (1855; listed Grade II), which retains its original tapered square chimney, Ellenshaw Mill in Darwen (1856), which has the same, although partially demolished, and Union Mill in Sabden (1856), which originally ran just 208 looms. In common with the majority of these mills, it was later extended with the addition of more looms.

Garden Street, a cotton-weaving mill built in 1853-4 by John Carr and originally containing 508 looms. The mill was considerably expanded in the early twentieth century

Another example of a mid-nineteenth-century weaving mill was Garden Street Mill, situated on the northern bank of the River Blakewater in the Bank Top area of Blackburn (demolished in 2015). This was established as a purpose-built weaving factory in 1853-4, representing one of the earliest such mills in Blackburn, and was one of the oldest weaving sheds in Lancashire. The complex was typical of the Blackburn area and comprised two preparation blocks, one dating to the mid-nineteenth century, the other to the twentieth century; a large weaving shed, exhibiting three phases of construction; two phases of engine house; and a boiler house that retained three modified Lancashire Boilers. Significantly, this site illustrated the traditional layout of early mills, and also of local variation within its later phases, with extensions to the weaving shed relating to the evolution of construction techniques over a 50-year period. Moreover, this evolution saw the wide, shallow timber roof of an earlier shed being superseded by narrower, but more open-plan, steel and cast-iron roofs in the later structures. The two preparation blocks also demonstrated the evolution of a local style in Blackburn. For instance,

Cob Wall Works, originally built as a water-powered carding factory, but converted to serve as a bobbin mill in the 1820s, before partial rebuilding in the late nineteenth century. It is a rare example of an intact bobbin and shuttle works in an urban environment

the original mid-nineteenth-century preparation block was of two storeys, typical of those associated with weaving complexes throughout the region, whilst the early twentieth-century addition was only a single storey, but with a much larger footprint. This is typical of weaving mills from the late nineteenth century in the Blackburn area, where single-storey weaving complexes were very much the norm.

Ancillary works: bobbin mills

The growth of Lancashire's textile industry in the nineteenth century also resulted in the rise of numerous ancillary industries. These included large iron foundries and engineering works, which produced the power plant, and the spinning and weaving equipment, and also smaller 'mills', which produced bobbins and spindles, onto which the cotton thread was wound. Although the survival of these early ancillary mills in an original state is rare, and those that do survive date to the late nineteenth century, Cob Wall Works, in Blackburn, is one example of an early bobbin mill. Although this was originally built in *c* 1786 as a water-powered carding factory, by the 1820s Thomas Riley and Son used the mill for bobbin turning. During this time an 8hp engine and a small waterwheel powered the mill, and in 1851 it employed 36 workers. In 1863, the works comprised two bobbin mills, along with engine and boiler houses, drying house, and yard. This site was, however, rebuilt in the late nineteenth century.

An early twentieth-century bleach croft in operation, using chemical bleaching agents

Finishing works

Another important aspect of Lancashire's eighteenth- and nineteenth-century textile industry was the finishing of cloth, including bleaching, dyeing and printing. Bleaching formed an initial process in textile finishing, which freed the cotton, linen, or fustian cloth from impurities, making it ready for printing or dyeing. Prior to the late eighteenth century, the bleaching process was achieved at a bleach croft by first boiling the cloth in alkaline lye, made from wood ash, within a large vat known as a kier. The cloth was then washed in water and steeped in buttermilk, using stone or wooden troughs, before being spread out in an open area where it was exposed to the sun for a fairly prolonged period. Given that bleaching required an adequate supply of fresh water, the bleach crofts were often placed close to a river.

In the late eighteenth century, the process was transformed through the invention of bleaching powder in 1798 by Charles Tennant, and the introduction of mechanisation, which resulted in the emergence of indoor bleachworks. Such works used water or steam power and often comprised a series of single-storey

buildings that housed the apparatus used in the bleaching process. This included dash wheels, which were large cylinders divided into compartments where bundles of cloth were washed. These machines were used at various different stages in the bleaching process to remove impurities, though after 1828, following a design by David Bentley, they were largely replaced by washing machines. A boiling kier and grey-sour cistern would also be used to clean the cloth prior to bleaching, together with chlorine cisterns, used to bleach, and a white-sour cistern that was used to treat the material following bleaching. Other pieces of machinery within the bleachworks included squeezers, mangles and calendars. Apart from buildings employed in the bleaching process, these works often contained a warehouse, and a boiler house and chimney, used to raise the steam required by small high-pressure steam engines, and other processing machinery.

The dyeing process depicted in a nineteenth-century lithograph, showing the heated cisterns and belt-driven mounted rollers used to apply colour to the cloth (Barfoot 1840; © Manchester Archives and Local Studies)

Holme Bleaching Mill, in Rawtenstall, is an extant example of a Lancashire bleach works. Although its origins are unclear, it may date from *c* 1830, and was perhaps part of the fulling and carding operation carried out at the adjacent Holme Mill (now demolished). It functioned as a bleach works throughout the mid-nineteenth century, though by the 1860s it was being used for cotton manufacture. Most of the extant buildings date from the use of the mill as a bleach works, and comprise a range of one- and two-storey stone-built structures, with a row of gables, each with a louvred ventilator, overlooking the River Irwell to the west, and an adjoining two-storey warehouse and office block to the east, beneath a hipped roof. A pair of smaller hipped buildings lie at the southern end of the warehouse range, with three single-storey gabled sheds to the east. These were, at some stage, extended to the south. On the other side of the lane is another single-storey office block, built of brick, with a hipped roof. A weir and reservoir also survive, which supplied the works with fresh water.

Following bleaching, the cloth could be dyed, through the application of coloured matter and a mordant, which fixed the dye in the cloth. Until the mid-nineteenth century, dyes were mostly derived from plants, such as indigo, madder and logwood, cochineal insects, and tropical sea snails. The mordant after the early seventeenth century was alum, which was manufactured from a particular type of shale, largely found in north-east Yorkshire.

Dyeworks

During the eighteenth century, specialist dyeworks appeared across Lancashire, often built adjacent to a river that in turn supplied the large quantities of fresh water required in the dyeing process. Many were initially established close to or within the regional centres of textile production, such as Manchester and Salford. Such works could contain one or more single-storeyed buildings, within which the cloth was dyed in large vats, or becks, containing hot water and the dyeing agent, which were often heated by steam. The cloth for dyeing was wound into a long rope and was immersed in the dye, using a large rotating roller that was mounted above the dyeing vat. Once the cloth had been dyed, it was washed to remove unwanted colourants.

Other buildings within a dyeworks might include those relating to the preparation of the cloth prior to dyeing. These could be a building where the undyed cloth was stored and then dried, one where the surface of the cloth was raised and cut, and a building where the cloth was scoured and washed to remove the size from the cloth. Following dyeing, the cloth was dried. Originally, this was undertaken in an outdoor area, known as a tenter ground, from the tenter hooks on which the cloth was hung; following the introduction of mechanisation, though, tentering machines were used to dry the cloth. Although numerous dyeworks were established across Lancashire, these finishing works rarely survive today. One such company that is still in production is the Pincroft Dyeing and Printing Co in Adlington, though now using 'state of the art' machinery.

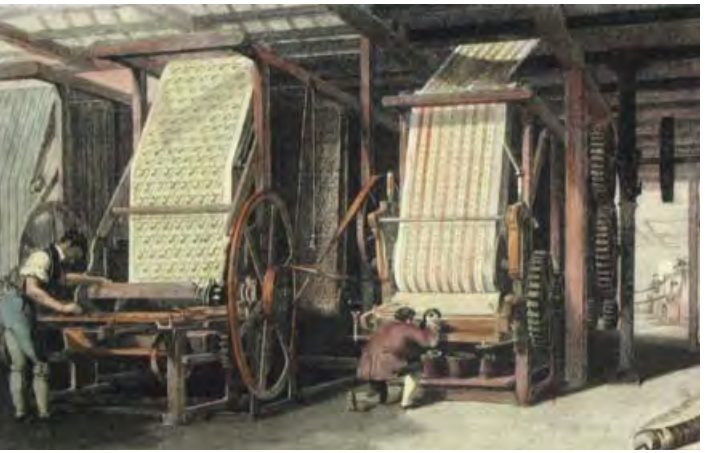
Printing in the early nineteenth century was a laborious task that used carved wooden blocks dipped in dye to produce a repeating pattern

Printing

Printing of cloth, following bleaching and dyeing, formed the third industry associated with textile finishing. Again, this was undertaken in purpose-built industrial works, which often incorporated the other elements of textile finishing and thus contained dyehouses and bleaching works. The ancestry of Lancashire's textile-printing industry lay with the fustian industry (*page 14*) and, during the eighteenth century, several nascent 'factories' emerged, which focused on the printing of fustian and then later cotton cloth. In many respects, the development and achievements of this industry formed the basis for Lancashire's dramatic ascendancy in late eighteenth-century cotton production.

The reason for the success of the county's early printing industry was down to the fact that the region possessed an abundant supply of fresh water, access to cheap labour and land, and an established fustian industry, producing cloth suitable for printing. This made it a viable alternative location to counter the other established English printers, specifically those based in London. The early printing process involved applying dye to the underside of a carefully carved rectangular wooden block, approximately 12in (305mm) in length and 7in (178mm) wide, which was then pressed onto the cloth with a high degree of precision, to form a repeating pattern. The work was time-consuming, monotonous and required a skilled operator to ensure an even pattern was achieved.

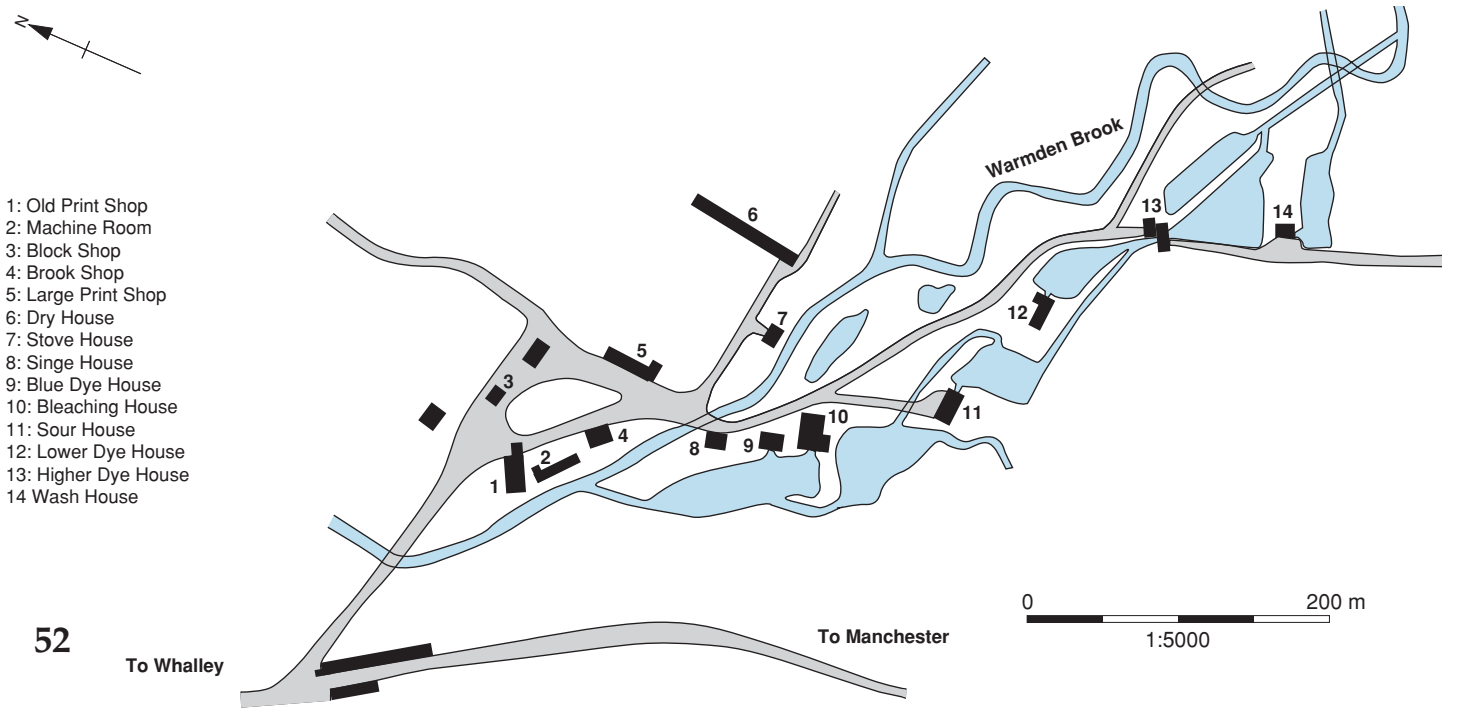
The introduction of mechanised printing using copper rollers considerably increased the speed at which cloth could be printed, but hand-block printing continued where fine detail was required



The Ribble Valley emerged as an early focus of the industry, encouraging the growth of several settlements in the area that would later develop significant textile industries, with purpose-built printworks being constructed in the Preston and Blackburn areas from the 1760s, Darwen from 1777, and Chorley from the early 1780s. The earliest works was established in 1764 by Edmund Clayton at Bamber Bridge, on the River Lostock near Preston, which was well positioned to capitalise on both an adequate water supply and the already well-established textile industry. Shortly afterwards, Robert Peel, who had

been experimenting with the use of carved rollers, opened a printworks at Oswaldtwistle, printing a parsley-leaf design, for which he earned the nickname 'Parsley Peel'. Indeed, the Peel family became one of the most famous names in Lancashire's early cotton industry, and were its founders in Bury, following the establishment of a calico-printing works at Bury Ground in 1773. This formed the first industrial factory in the upper Irwell Valley.

During this period, other printworks were established in Lancashire, at Bannister Hall, and Mosney Works on the River Darwen in Walton-le-Dale, where a fabric known as Blackburn Grey was printed (both now demolished). Moreover, this latter works witnessed in 1783 the first use of engraved copper rollers, which could print up to six colours at a time, and which in time would supersede the hand-printing method. This printing technique was introduced by Thomas Bell and, as a result, the Mosney Works became one of the largest and most important textile concerns in the county, employing between 700 and 1000 people prior to its collapse in 1788. One outcome of the use of copper rollers was that printworks required engravers, who were often housed in separate buildings. Initially, the copper rollers were engraved by hand, though in the early nineteenth century individual dies were engraved, which were then used to stamp the design onto the roller, using a machine.



A plan of Broad Oak Printworks from 1813, showing the dispersed layout of building along the banks of the watercourse

Most early printworks appear to have been composed of rambling accumulations of single-storey structures arranged on the banks of rivers and streams in rural valleys. Such locations were critical to the provision of the clean, fresh fast-flowing water necessary for the process. Few remains of these earliest printwork sites are visible, although the remnants of water-management systems and isolated and fragmentary structures of late eighteenth-century date exist in some places, and the potential for below-ground survival is considerable. This is the case at Catterall, where a two-storey stone structure and the remnants of the leat system from the calico printworks established by 1791 still survive, and also at Broad Oak, the site of an important printworks at Accrington, which was established in 1792.

A plan of the Broad Oak works from 1813 depicts a range of dispersed structures focused along the bank of the river. These include a wash house, two dye houses, sour house, bleaching house, blue dyehouse and singeing house, dry house, stove house, large print house, block shop, machine room, and old print shop. This site was apparently powered by no less than seven waterwheels. After 1816, under the ownership of Hargreaves and Dugdale, the works was expanded, leading to the establishment of new print shops. At this time the works also housed three single-colour machines and 216 tables, and by 1829 steam power had been introduced, with the works containing two 10hp, one 14hp, and a 20hp steam engine within the various processing sheds. Further buildings were constructed during the 1830s and, by 1846, the works employed approximately 850, and housed 12 machines, 300 tables, five steam engines (one 25hp, two 14hp, and two 10hp), although it still also retained water power.

Castle Clough Works, in Hapton, East Lancashire, is a rare surviving example of a mid-nineteenth-century printworks. Although it was constructed in 1792 as a three-storey water-powered spinning block, harnessing the power of the Castle Clough Brook, by the mid-nineteenth century it was operating as a printworks. The extant complex comprises a total of 14 primary and ancillary buildings, which may include dyehouses and bleaching sheds, at least one engine house, a warehouse, a probable drying shed, a gatehouse, a possible stable block and several residential properties, which were probably associated with the mill.

Early textile mills and the development of the surrounding landscape

Castle Clough Printworks, a rare survival of a textile-finishing site that originated in the late eighteenth century (1988; © Historic England)

Whilst many towns were clearly well-established prior to the Industrial Revolution, the impact of the textile industry on the urban landscape of Lancashire is probably more pronounced than within any other county in England. In the major urban centres, during the late eighteenth century, the textile industry initially promoted *ad hoc* urban growth, particularly in terms of the housing that was built for the factory workers. For instance, late eighteenth-century maps of Manchester, notably that compiled by William Green between 1787 and 1794, show that although there was some organisation, in that a broadly rectilinear pattern of development had been laid out to form the industrial suburbs of the town, little thought had been given to how the huge numbers of workers that the new factories could employ were to be housed. During the early and mid-nineteenth century, however, the idea of a grid pattern for these expanding towns, containing terraces of modest dwellings, was developed.

Calder Vale, a fine example of a terraced housing 'colony village' associated with a mill (© Historic England)

In rural areas, during the earlier part of the nineteenth century, rows of terraced housing, broadly based on the local vernacular tradition of single-fronted cottages, were also constructed, near to the mill, forming industrial hamlets of one or several streets. For instance, Abbey Village, Chorley, grew rapidly along the turnpike road between Bolton and Blackburn following the erection of Abbey Mill in *c* 1840, with a row of terraced cottages on the approach to the mill having been built concurrently. Another fine example is the Rossendale village of Irwell Vale, built at the confluence of the Rivers Ogden and Irwell, with three short rows of terraced housing for workers at the already established late eighteenth-century Ewood Bridge Mill, and with an associated halt being added on the later railway line from Bury to Rawtenstall. Within the modern county of Lancashire, the best examples of rural terraced houses associated with a 'factory colony' village are at Calder Vale.

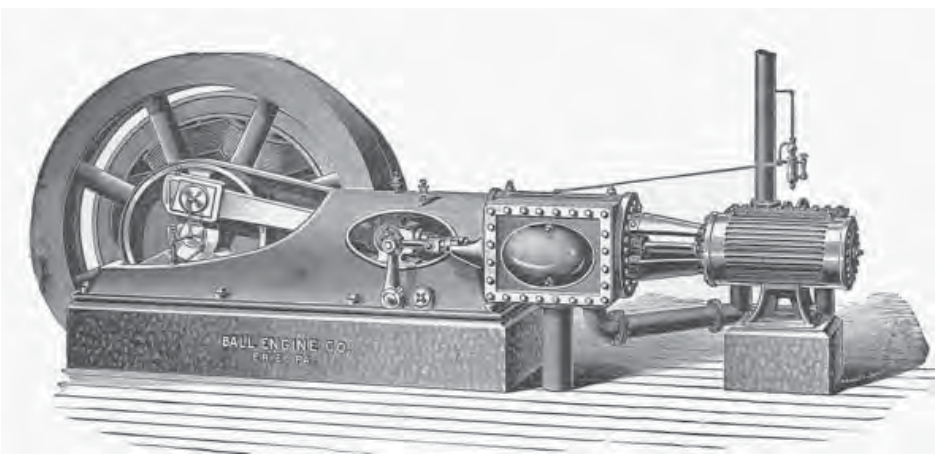
Further up the Irwell Valley, the industrial towns of Rawtenstall, Waterfoot, and Bacup grew around mills placed in the valley bottom, between the existing road and the river, and a railway later built alongside, with rows of terraced houses lining the road, and also perpendicular streets built up the valley sides. Haslingden grew from a small seventeenth-century market town on a hill overlooking the Irwell Valley into a larger town of almost 8000 inhabitants by 1831, mostly involved in the woollen trade, although this was becoming rapidly less dominant by this date. At this time, many people were also employed in the stone-quarrying industry, for which the area became a major centre from the second half of the nineteenth century. This growth demonstrates the far-reaching landscape impact of the textile industry, requiring building materials for its increasingly large buildings, and for the houses of its expanding workforce, which also needed ever-increasing quantities of fuel and food.

3 *The development of cotton-mill technology and mill construction*

Lancashire's Later Textile Industry

In the late nineteenth and early twentieth centuries, various technological advances were made, which were to have a great impact on Lancashire's textile industry and these, in turn, influenced the design of textile mills. Principal amongst these were developments in the powering of mills. The first major advance came in the 1860s with the adoption of the horizontal steam-engine, which became the most common type of engine used in later textile mills. Early horizontal engines possessed a single cylinder, but the majority of the engines used in Lancashire's later textile mills employed high- and low- pressure cylinders arranged in either a tandem-compound style, with cylinders placed in line, or a cross-compound style, with one cylinder positioned on either side of the flywheel. In addition, cross-compound engines were produced in tandem form, with two sets of cylinders positioned on either side of the flywheel, and these became particularly common in late nineteenth- and early twentieth-century mills. During the 1880s, compound engines with vertical cylinders were also introduced, which were more compact, and thus could be installed where space was at a premium.

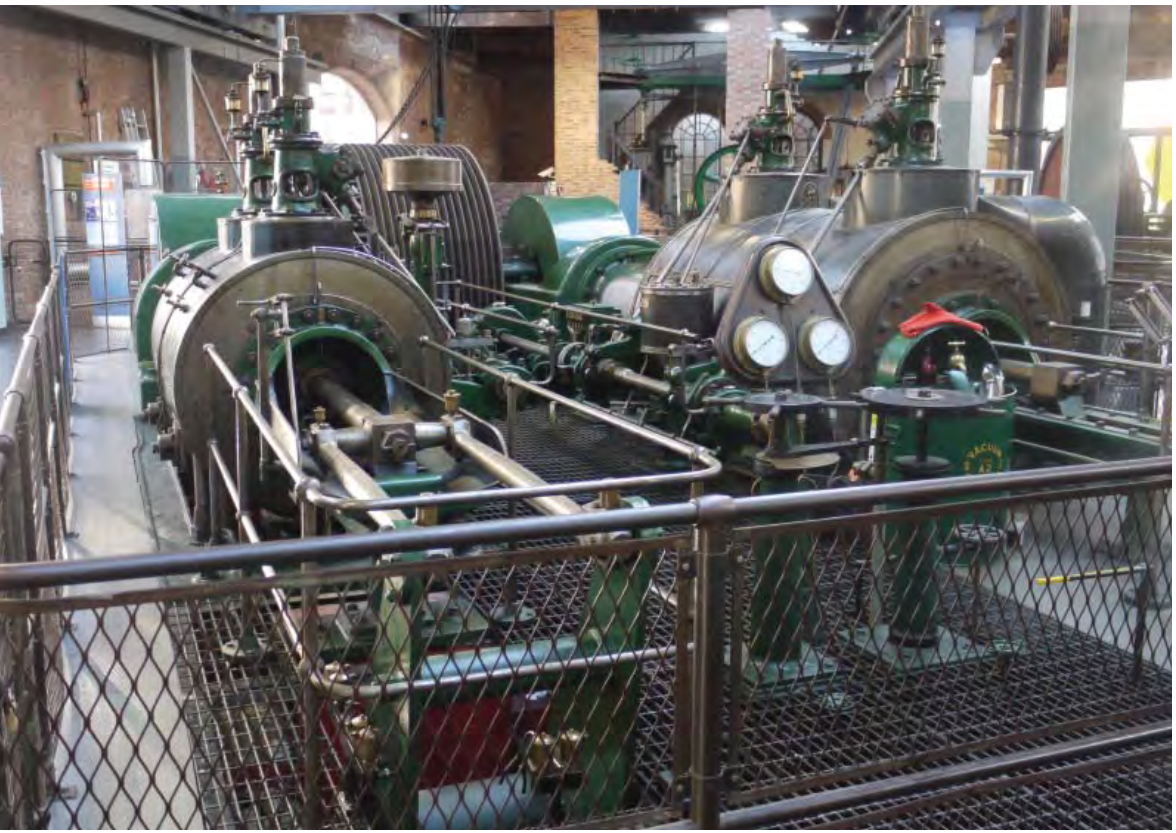
As with beam engines, horizontal engines were contained in dedicated engine houses, their size being dictated by the size of the engine. Generally, during this period, horizontal tandem engines could be housed in a narrow engine house, with a low ceiling, often contained within the mill itself. In contrast,



An 1897 engraving of a tandem-compound horizontal steam engine

cross-compound engines required a wider engine house, and these were normally placed in large external structures, particularly when they were used to power a rope drive.

Lancashire Boilers, which had been developed in the mid-nineteenth century (*pages 29-30*), were generally used to raise the steam required by the horizontal engine. However, from the 1890s, there were significant advances in boiler technology, which allowed higher pressure to be achieved and several derivative-type Lancashire Boilers were employed in textile mills. Chimney design also altered during this period. Although the number of boilers used at a textile mill determined their height, as did, in some cases, early smoke-control laws, such as the Public Health Act of 1875, from the 1860s onwards most chimneys



A cross-compound horizontal engine. This was made in 1926 by W & J Galloway at the Knott Mill Iron Works in Manchester, and was installed in Elm Street Mill, Burnley, a room-and-power weaving mill. This was the last steam engine ever built to power a mill and is now in the Museum of Science and Industry, Manchester

Octagonal chimney base at the Grade II-listed Trafalgar Mill, Burnley

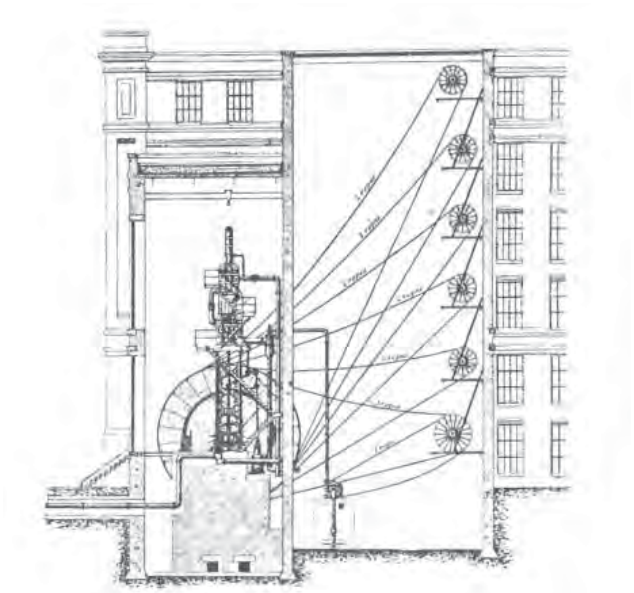
in the larger spinning mills were octagonal and were detached from the mill. Initially, in the 1860s, such chimneys were also constructed on plinths, though this practice became less common as the century progressed. Smaller mills, however, such as those associated with weaving and textile finishing, often used large circular chimneys.

Many of the late nineteenth-century textile mills were also built further away from water sources, which traditionally supplied the boilers and engine condensers. Reservoirs, or lodges, were therefore often used to provide a constant supply to the engine's condenser and the boilers, and were frequently built at a higher level than the boiler houses. Indeed, two interlinked reservoirs are known at some of the larger mills, with one supplying cold water to the engine and the other receiving the hot condensate. Modifications to reservoir design also occurred in the 1890s, when brick walling was used to divide some reservoirs into separate bays. This allowed hot water entering the reservoir to be more efficiently cooled.

Ordnance Survey map of 1909, showing Harle Syke near Burnley. Each mill can be seen to have its own reservoir or lodge (Reproduced by permission of the National Library of Scotland)

Power transmission within textile mills was also developed during the late nineteenth century through the introduction of two new methods to provide the primary power to drive textile machinery, in place of the main shaft (upright or horizontal) that was used before this date. The first of these was the belt drive, a system introduced from America in the 1860s, whereby drums attached to the line shafts were driven by the engine's flywheel via a system of leather belts, these being contained in vertical ducts running through the full height of the multi-storeyed mill. This system was not widely adopted in Lancashire's mills, though.

The rope drive formed the second method of power transmission and this was widely adopted in late nineteenth- and early twentieth-century spinning mills. In principle, this was comparable to the belt drive, though it used a durable form of cotton rope, developed in the mid-1870s, which connected the engine's flywheel with pulleys on the ends of line shafts in multi-storeyed buildings, and with countershafts in weaving sheds. Within this system, a grooved rope drum took the place of the engine's flywheel, which could turn a large number of cotton ropes. This system had many advantages over the older main-shaft power-transmission system, in that a failure of one rope would only disrupt the power to one line shaft, as opposed to the failure of a main shaft,



Cross-section through Dukinfield Mill, Manchester, showing the workings of a rope drive

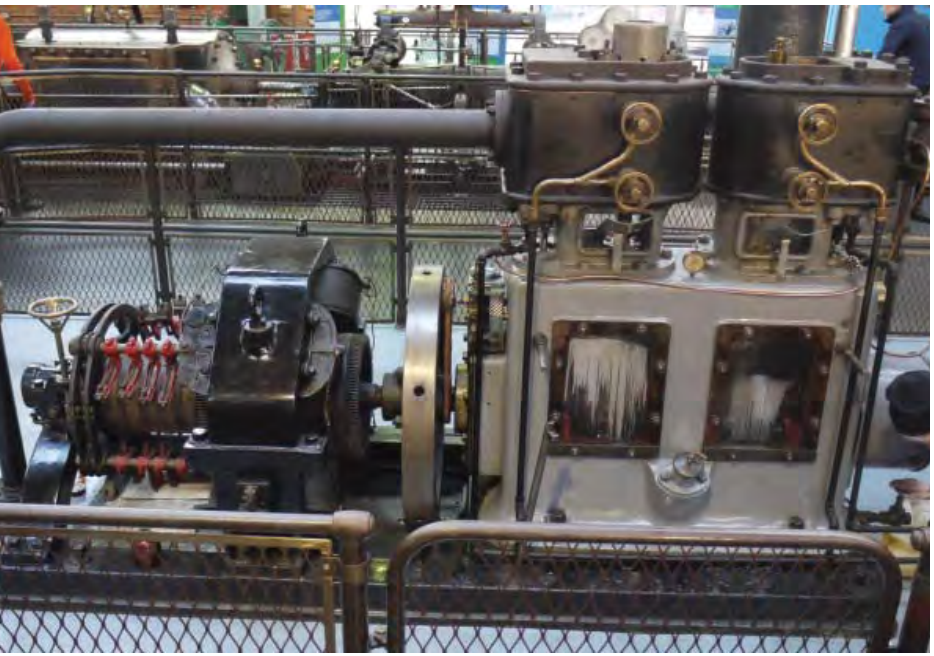
The engine house at Tulketh Mill, Preston, c 1922, showing the cross-compound engine and rope drum at the centre

which would result in the loss of power to all of the line shafts within a mill. The rope-drive system was also cheaper, easier to maintain, and quieter than earlier power-transmission systems.

In the multi-storeyed cotton-spinning mills, the rope drum was connected to a rope race, placed either at the end or in the centre of the mill. This narrow bay extended the full height of the building and contained the pulleys on the end of the line shafts. When a rope drive was used to power a single-storey weaving shed, a rope alley was used, which created a narrow bay along the length of the shed. The rope drum was contained within this alley, usually at its centre, and this turned the pulleys mounted on two adjacent line shafts. Power was then passed on to the other line shafts in the buildings, via a second rope, which connected the pulleys turned by the rope drive with the other line-shaft pulleys.

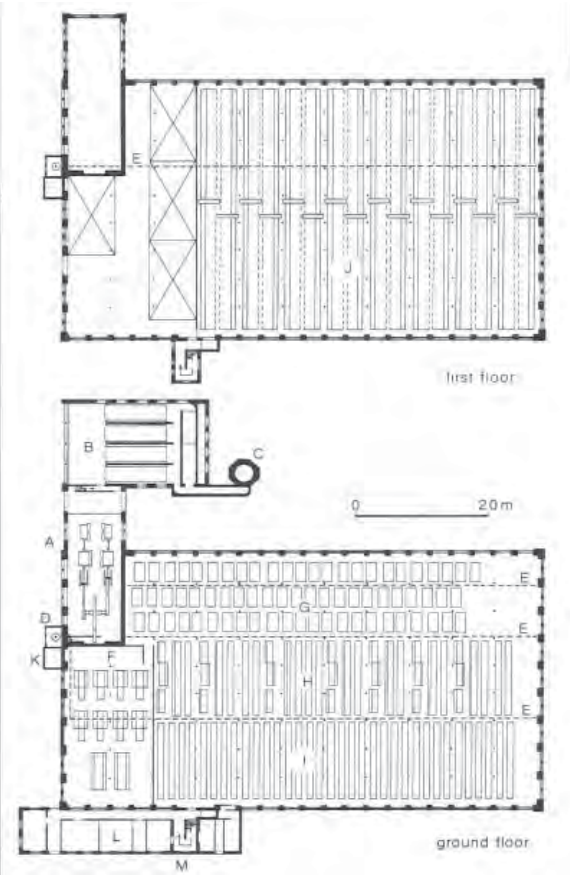
A steam turbine and electrical generator, in the Museum of Science and Industry, Manchester

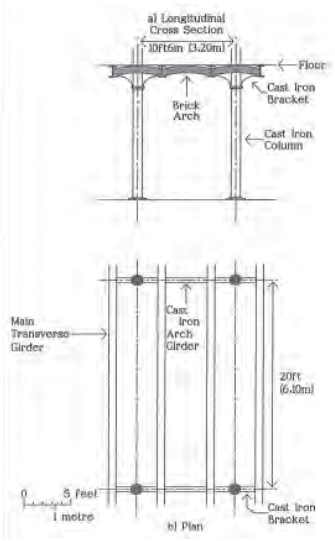
In 1884, a further advancement was made in power systems, following the patenting of a steam turbine and linked electrical generator, which meant the machinery in textile mills could be electrically powered. In Lancashire, the adoption of electricity by mills was slow and, although electrical lighting was used during the late nineteenth century, electricity was not used to power machinery directly until after 1900. During the early twentieth century, electrical power could either be generated at the mill, by the use of a steam turbine, or bought from a public company. The main advantage was that it eliminated the need for extensive steam-power plant and this meant that mills were cheaper to build.



In addition to the development of these power systems, the late nineteenth century is also characterised by the use of new and improved building materials and techniques, which were incorporated into the design, particularly of spinning mills. In this respect, significant advances were made in the structural framing and fire-proofing of multi-storeyed mills, which allowed the construction of wider, better-lit and stronger buildings. During the late nineteenth century, rolled-iron and steel beams became available and some mills therefore used these, carried on cast-iron posts, as supports for their floors. The use of these beams also led to different approaches to framing, whereby the transverse and longitudinal rolled-iron/steel beams supporting the floor were set in a grid-pattern arrangement, with their outer ends supported by the wall, and the intersections supported by cast-iron columns.

Using this technique, a higher proportion of the weight of the floor was transmitted through the cast-iron columns directly to the foundations of the mills, as opposed solely to the external walls, which was the case in earlier structures, where the floors were supported by brick-vaulted ceilings and cast-iron beams and columns. Brick-vaulted ceilings were still employed in late nineteenth-century mills, though their design was improved by using longitudinal or multiple transverse vaulting in each bay. This led to a variety of different vaulting techniques being employed in late nineteenth-century mills, with the vaults being supported by rolled-iron beams.





Top; typical layout of a late nineteenth-century spinning mill, showing the transverse arrangement of preparation machinery on the ground floor and mules on the first floor

Left; Abraham Stott's 1871 patent for a double-brick-arch floor was followed by a series of improvements that led to wider bays, and larger windows (after Holden 1993)

Indeed, one noteworthy example, developed and patented by the Oldham millwright Abraham Henthorn Stott in 1871, used transverse vaults that were supported by rolled-iron beams, which were carried on brackets attached to the sides of cast-iron columns. Importantly, the strengthening of mill floors enabled the widths of the bays within a mill to be increased, allowing more mules to be contained in a single bay, and this also meant the mill could have larger windows.

In the late nineteenth century, concrete also began to be used to strengthen the floors of multi-storeyed mills. Initially, this was used in conjunction with brick-vaulted ceilings, though from the 1880s flat reinforced concrete floors, supported by rolled-iron beams, began to replace brick-vaulted floors. The use of concrete floors further mitigated the load-bearing functions of the mill's external walls, and resulted in the construction of large flat-headed windows.

Concrete floor construction at Daisy Mill, Manchester, a cotton mill dating to the early 1920s

The cast-iron columns and rolled-iron beams in some mills, which were viewed as a fire hazard, were coated in plaster from the 1880s, and automatic sprinkler systems were also introduced, which were supplied by water contained in tanks placed at the top of stair towers. In the early twentieth century, the use of automatic sprinklers led to the appearance of mills with flat roofs, behind parapets, which allowed rainwater to be collected for use in the sprinkler system.

Vine Mill in Oswaldtwistle. The adjoining spinning blocks on the left date from 1875 and 1899, while those to the right date to 1906 and 1914, by which time a flat-roof design predominated (now demolished; 1988; © Historic England)

One final innovation dating to this period, which was to have an influence on the region's weaving industry, was the invention of the Northrop loom. This was a fully automatic power loom, which allowed shuttles to be continuously loaded with thread, whilst another feature was that the loom stopped when a warp thread broke, allowing it to be fixed. This was introduced in 1902 and was manufactured in Blackburn at the British Northrop Loom Co Ltd. The loom proved highly successful, allowing labour costs to be halved, and was exported across the globe. Ironically, its success and uptake in these global markets was one contributing factor that led to the decline of Lancashire's textile industry in the early twentieth century (*page 68*).

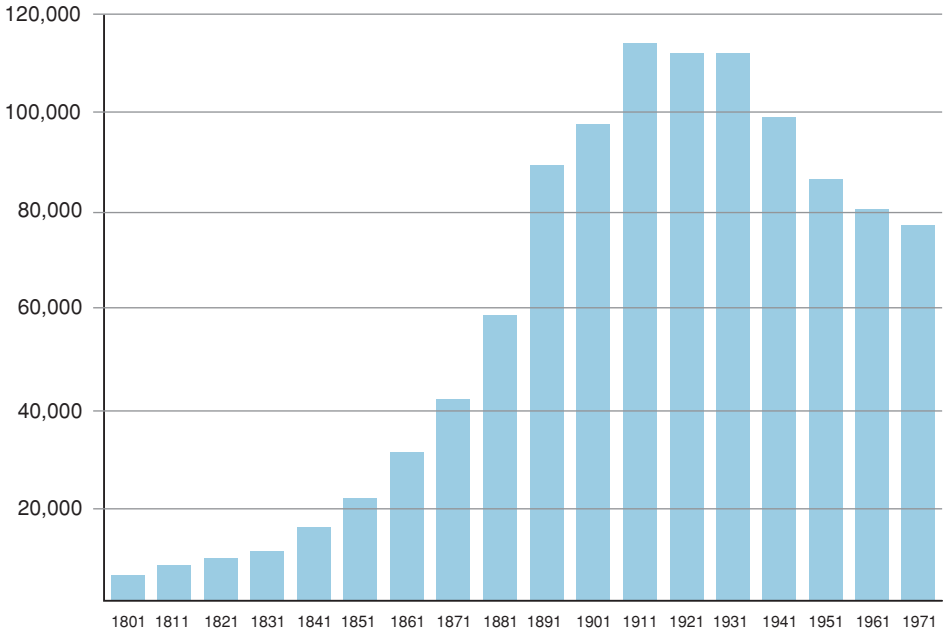
Regional specialism: cotton spinning and weaving

One feature of the late nineteenth century was the construction of fewer integrated mills (*see Chapter 2*) and the rise of specialised cotton production in separate spinning and weaving establishments. During this period, specialised production was viewed as more economically viable and was linked to a late nineteenth-century boom in the cotton industry, and new legislation, which led to the formation of a large number of limited firms (joint-stock companies), such as those in Oldham. In general terms, cotton spinning was concentrated in the south-east of historic Lancashire, whilst weaving was more a feature of Pennine Lancashire. Indeed, by the end of the nineteenth century, Burnley was known as the cotton-weaving capital of the world.

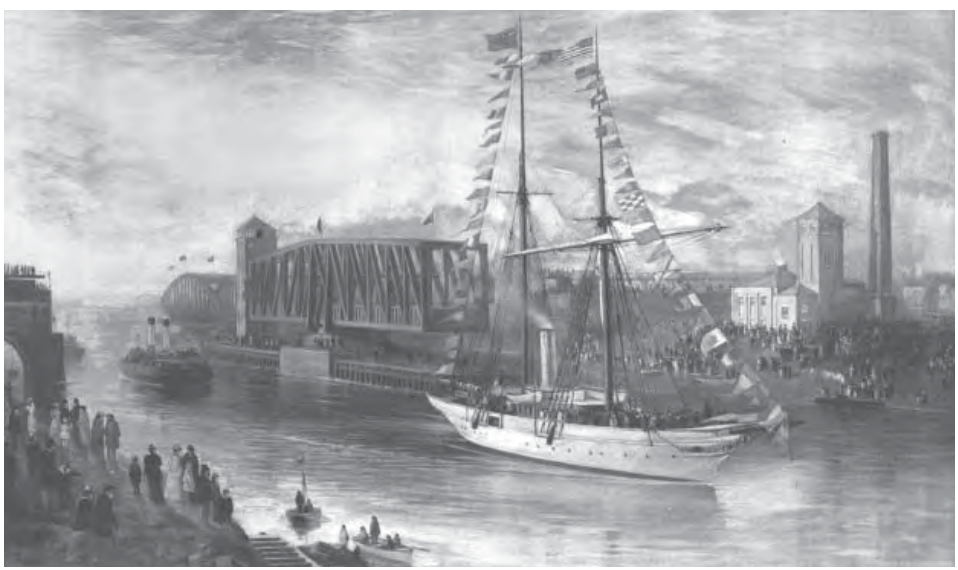
The Cotton Economy

Following the boom of the early nineteenth century, Lancashire endured a period of deep recession in the early 1860s, known as the Cotton Famine, perhaps in part due to over-production, but in the main caused by the disruption of raw cotton imports from the southern states of America, as a result of the American Civil War. Following this, as the industry revived, much of the cotton entering Lancashire was derived from Egypt and India. Ready access to new supplies of raw cotton and to international markets, through the port of Liverpool, combined with technological advancements in mills, resulted in a cotton-producing boom, and by 1871 the British textile industry provided the entire world with 32% of its cotton goods. This boom also resulted in a rapid population expansion in some of the mill towns of the region, particularly the 'new' weaving centres of north-east Lancashire such as Burnley, the population of which doubled in size between 1871 and 1901. The region's cotton economy was further enhanced by the opening of the Manchester Ship Canal in 1894, which provided Lancashire with improved access to both raw materials and international markets. Therefore, by 1914 Lancashire's cotton industry was producing vast amounts of cotton goods, with India, the largest single customer, buying 3000 million yards (2,743,200 metres) of cotton cloth. Following the First World War, Manchester reached its cotton-producing zenith and, by 1920, Lancashire's cotton industry peaked.

Mill workers affected by the Lancashire Cotton Famine



The dramatic growth of Burnley's population is illustrated by this graph, showing the rapid increase in the mid- to late nineteenth century, followed by a decline following the collapse of the weaving industry in the 1920s



The opening of the Manchester Ship Canal in 1894

After 1920, despite cotton remaining Britain's leading export until 1938, the industry declined rapidly, largely through a fall in exports. Countries that had formerly provided lucrative markets, particularly India, developed their own mills, using similar technology, such as the Northrop power loom, whilst Japan captured many former British markets in China and the Far East. The imposition of tariffs by America and Brazil then caused further damage to the export of British cotton goods.

Although a short boom period began in 1945, as a result of shortages caused by the Second World War, after 1952 British cotton textiles faced intense competition from manufacturers in the Far East, which possessed a ready pool of cheap labour. More serious, however, was the widespread manufacture of man-made fibres and, by 1962, 40% of British cloth production was in such fibres. The gradual dominance of synthetic fibres was particularly detrimental to the room-and-power weaving industries of Pennine Lancashire, which during the Second World War had largely focused on, and been economically protected by, the production of cotton uniforms for the military. In consequence, these areas were slow to adapt to the production of synthetic fabrics, and faced a rapid decline following the war. More generally, the British textile industry largely collapsed during the second half of the twentieth century, which in many cases led to the rapid decay, neglect, dereliction and demolition of Lancashire's textile mills.

Mill architects and late nineteenth/early twentieth-century 'Super Mills'

In the spinning sector, the ultimate expressions of regional specialisation within the industry were the 'super mills' of the late nineteenth and early twentieth centuries. These large mills embraced both the technological advancements and new building materials and techniques that appeared at that time and represent the last stage of evolution in the development of Lancashire's spinning mills. During the late nineteenth century, the size and shape of these mills was enhanced, being both longer and wider than earlier spinning mills, though they were still of similar height, possessing between four and six storeys.

In the late nineteenth century, their internal layout also evolved, with internal engines houses being common until the 1880s, whilst external engines,

Bee Hive Mill, Bolton, a cotton-spinning mill built in 1895, with a distinctive stepped profile to accommodate preparation processing at ground-floor level

associated with rope drives, were more common after this date. Prior to the 1880s, many spinning mills also possessed a cross-wall, which separated the main preparation area and spinning rooms from those processes which had a higher fire risk. These cross-walls also contained the power-transmission and ventilation systems, a staircase or hoist, and the sprinkler system. However, with the adoption of the rope drive, cross-walls were built in fewer mills.

Another distinctive feature of late nineteenth-century spinning mills was their stepped profile, which was created by the extension of the ground floor beyond the walls of the upper storeys. These extensions often had saw-toothed roofs, typical of weaving sheds, and they provided space for carding and other preparation processes. Double mills also appeared during this period, which comprised two mills built on either side of a central, shared engine house. In addition to the spinning blocks, the late nineteenth-century super mills contained a range of ancillary features, including a stair tower, office block, engine and boiler houses, chimneys, and sometimes a warehouse. The mills were also normally enclosed by a wall or railings, which could be accessed through an elaborate main gateway.

By the early years of the twentieth century, super mills increased in size and it was not unusual for some to house 100,000 mule spindles or more, and the largest, for instance Pear New Mill, Bredbury (listed Grade II*), established in 1912, accommodated 137,000 spindles. Confidence was such that, in several cases, mills were designed to facilitate the erection at a later date of a second adjoining mill of equal size with a shared power plant, converting it into a double mill, as was the case at Swan Lane Mills 1 and 2, in Bolton (now Greater Manchester; listed Grade II*), which accommodated a combined 210,000 mule spindles upon completion of Mill 2 in 1905.

Pear New Mill, Bredbury, one of the largest mule spinning-mills ever built (Creative Commons Attribution Share-alike licence 2.0 Chris Allen)

Swan Lane Mills, Bolton, the first mill erected in 1902, being followed by a second in 1905, to make a double mill (Williams with Farnie 1992)

Houldsworth's Mill, Stockport, an Italianate mill designed by A H Stott in 1865

Significantly, super mills were a product of specialist firms of architects, which emerged in the middle years of the nineteenth century and dealt with all aspects of the design. One such firm, Stott and Sons, set up by Abraham Henthorn Stott in 1847, was particularly prolific throughout the remainder of the century and on into the twentieth century. Stott and Sons also patented several new methods in the construction of brick-vaulted floors, which allowed the incorporation of larger windows and wider bays. In keeping with the architectural fashion of the day, Stott and Sons favoured Italianate detail in their mills, such as at Houldsworth's Mill, in Stockport (1865; listed Grade II*), where arched window-heads were accompanied by campanile towers topped by hipped roofs over bold projecting corbels. One of the finest examples of the Italianate

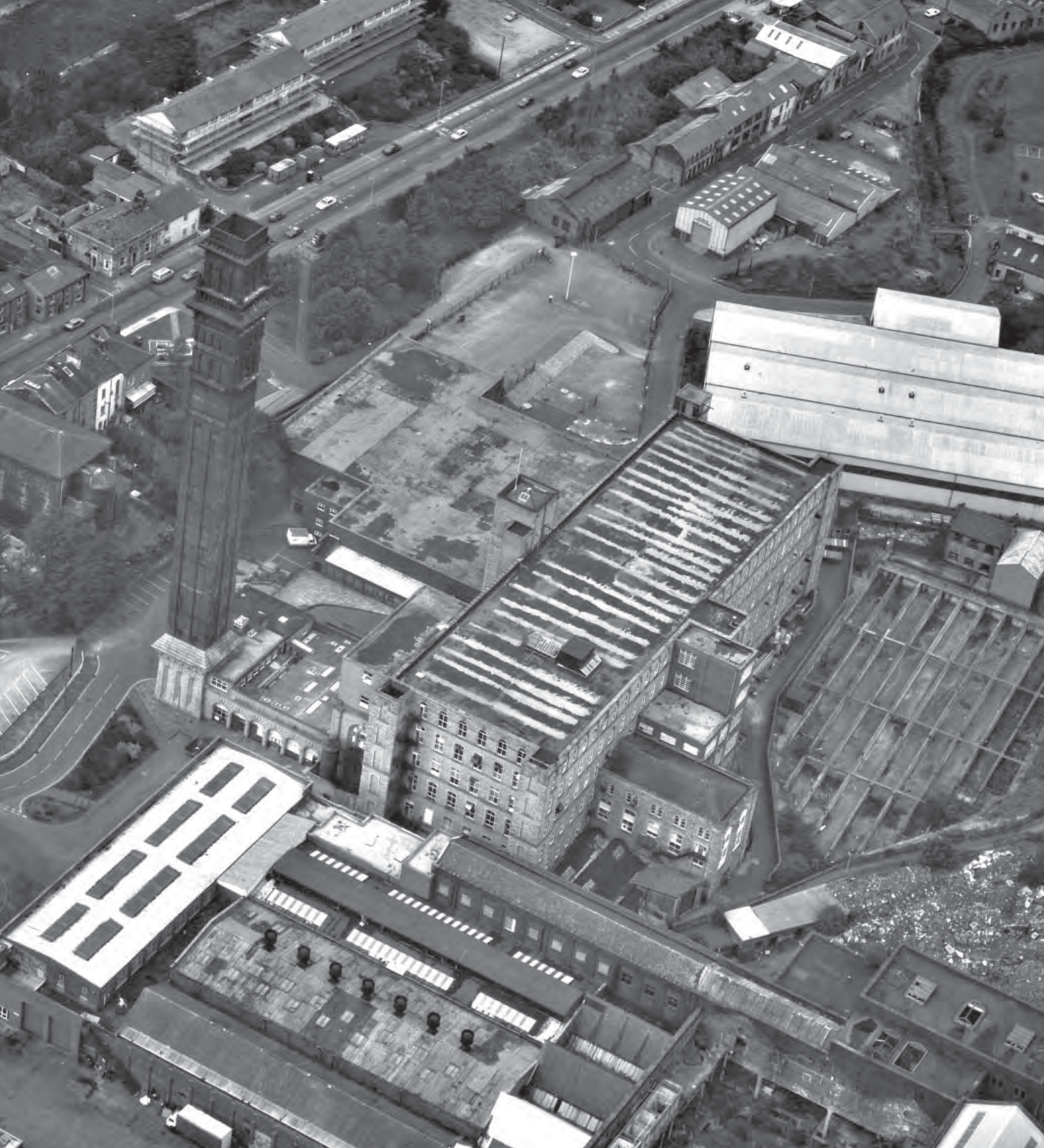
form is preserved at India Mill, Darwen (elements listed Grade II and Grade II*), where, in 1867, the architect Ernest Bates built the mill's enormous chimney in the style of a campanile tower. Philip Sidney Stott, the son of Abraham and owner of an independent practice, was one of the most prolific of the architects, being responsible for the mills that housed 40% of new spindles in Oldham between 1887 and 1914.

Other influential architects of the period included Bradshaw Gass and Hope of Bolton, who may have introduced the use of concrete floors to Lancashire in 1876, at Howe Bridge in Atherton (Greater Manchester; now demolished), and were known for their meticulous use of Italianate detail; Edward Potts, who was reportedly involved in the design of 200 mills; and Fred Dixon of Oldham, whose work can be identified by his use of decorative yellow brickwork on principal elevations, and bold continuous piers between bays, as at Rutland Mill, Shaw (1907; now demolished).

Facing: India Mill, Darwen, with a fine campanile chimney designed by Ernest Bates in the 1860s (Grade II listed; 1988; © Historic England)*

Above: Rutland Mill in Shaw, built in 1907 to the design of Fred Dixon, and featuring his distinctive continuous piers between window bays

Left: Howe Bridge Mill, Atherton, by Bradshaw, Gass and Hope (Creative Commons Attribution Share-alike licence 2.0 Chris Allen)

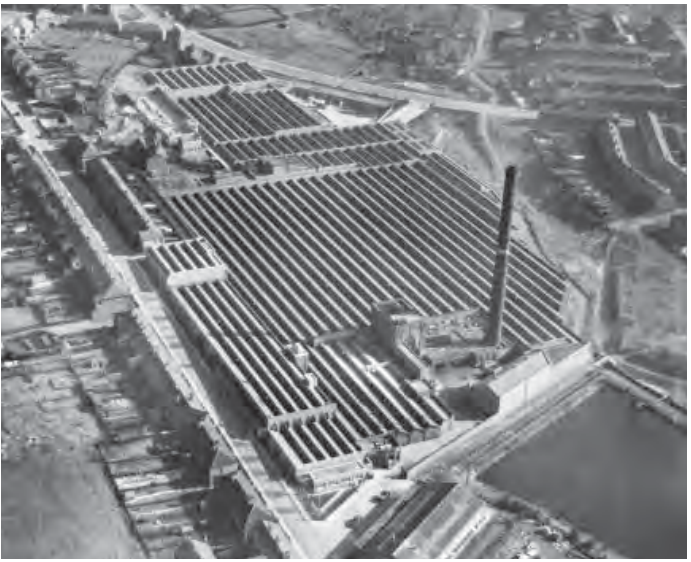


Wesley Street Mill, Bamber Bridge, erected in 1907 by the architects Potts, Son and Henning, the last spinning mill to have been constructed within the modern county boundary

Although the majority of these super mills were constructed in the spinning towns of the south-east, in what is now Greater Manchester, particularly Oldham, a handful can be found in the modern county. In Preston, the four-storey Centenary Mill (listed Grade II), erected in 1895, housed 85,000 spindles in a building approximately 80m long and 40m wide, while at Wesley Street in Bamber Bridge, formerly known as Bamber Bridge Mill, Potts, Son and Henning erected a five-storey spinning block of over 100m in length, housing 135,000 spindles powered by an engine generating 3000hp (1907; now demolished).

At Tulketh, in Preston (1905), Fred Dixon designed a huge five-storey spinning block, with an attached three-storey engine house to the east, detached chimney, and single-storey office block (listed Grade II). The main block measured approximately 107m long by 40m wide and was built in red brick with steel beams, and concrete floors resting on widely spaced cast-iron columns. Dixon employed his favoured yellow-brick detailing over the windows of the spinning block and engine house, and used his characteristic bold full-height

Coppul Ring Mill, Chorley, a Grade II-listed cotton-spinning mill designed by Stott and Sons



Cromer Ring Mill, Middleton, an unusual example of a single-storey spinning mill built in 1903 by Philip Sidney Stott (1988; © Historic England)

piers between the bays. The engine house, main tower and office block attracted the greatest embellishment, including oculus and semi-circular-headed windows, string-courses and, in the case of the office block, sandstone surrounds and a projecting bay window. The mill had a horizontal cross-compound engine which, by 1918, was powering 127,400 mule spindles and 12,600 ring-spinning machines.

These latter machines, producing coarse cloth, were developed from the throstle and enabled continuous spinning, in contrast to mule spinning, which was intermittent. Following the introduction of these machines, ring-spinning mills slowly increased in popularity through the second half of the nineteenth century, though they were never built in large numbers. Due to the greater weight of its machinery and a higher productive capacity, these mills were often built over fewer floors, such as at Coppul Ring Mill in Chorley, built in 1906 by Stott and Sons (listed Grade II), which stood to three storeys and housed 60,000 ring spindles. At Cromer Ring Mill in Middleton (1903), the Oldham architect Philip Sidney Stott designed a single-storey structure to house the same number of ring spindles, using the typical north-light roof design employed so successfully in the weaving sector.

Wesley Street Mill was a Lancashire super mill established as a purpose-built cotton-spinning factory in 1907, creating the largest mill in the South Ribble district. In contrast to earlier mills, it did not occupy a canal-side location, and water required by the steam-power plant was obtained from two

purpose-built lodges. In 2012, prior to its demolition, the extant buildings included a large five-storey spinning block, an attached three-storey engine house, a boiler house, and two further buildings, possibly an economiser house and stables. The buildings were a rare survival of a large Edwardian spinning mill, being in a style more typical of the mills in the satellite towns of Manchester, most notably Oldham, where the mill's architect, Edward Potts, was based. Indeed, only one example of a Potts' mill survives within the modern county, at Cowling Mill, Chorley. It is of brick construction, with concrete and steel floors, a technique pioneered, in part, by Potts in the late nineteenth century, creating a large saving in both weight and cost of construction. The mill also retains an almost intact Mather and Platt integrated sprinkler system, which is again of relatively early date. Both the spinning block and the engine house have excellent examples of architectural embellishment, typical of the period, and both feature prominently in the local landscape, offering a rare reminder of the importance to the region of the textile industry in the early twentieth century.

Cowling Mill, Chorley, built in 1906 by the architect Edward Potts

Elk Mill, Oldham, the last traditional cotton-spinning mill built within the old county boundary of Lancashire

The short period of prosperity and confidence that followed the First World War soon gave way to a depression, and the dubious title of the last cotton-spinning mill erected in Lancashire can be given to Elk Mill, in Oldham (now Greater Manchester), completed in 1926 and housing 107,000 mule spindles, which was demolished in 1998 to make way for a retail park. This large but relatively austere mill was designed by the architects, Arthur Turner and Son, and was driven by a steam turbine that provided the building with electric lighting.

Weaving mills

The design and architecture of dedicated late nineteenth- an early twentieth-century weaving mills was generally comparable to those dating to the earlier part of the nineteenth century, comprising weaving sheds with attached multi-storey preparation blocks, typically spanning the width of the shed. However, during this period, weaving mills were generally larger in size, particularly around Colne, Burnley and Nelson, where sheds of a 1000 looms or more were common. At Hargher Clough Mill in Burnley, for example, which was built in 1881 by John Walmsley, the 22-bay shed accommodated 1704 looms by 1891, while, when Pendle Street Mill in Nelson was completed in 1887, it had 2400 looms and was declared the largest weaving shed in Lancashire, if not the whole world (both demolished since 2012). Even this was dwarfed, however,

The cotton-weaving shed at Hargher Clough Mill, Burnley, accommodating 1704 looms

Facing: Pendle Street Mill, Nelson, built in 1885-7, one of the largest steam-powered weaving sheds in Lancashire, (1988; © Historic England)

by Bankfield Mill in Barnoldswick, which in 1909 was extended to house 3000 looms. Many later weaving sheds also employed steel and cast-iron roofs in their design, which led to the development of narrower, but more open-plan, structures.

The finest surviving example of a late nineteenth-century weaving shed is undoubtedly Queen Street Mill in Harle Syke, a site of international significance (Grade I listed), which was built as a joint-stock company venture, organised by a village co-operative selling 4000 shares issued at £5 each. The mill was built in 1894 and stands within an area of nineteenth- and early twentieth-century mixed industrial and residential development that includes no less than four other contemporary weaving sheds, and preserves a range of structures typifying the late nineteenth-century weaving complex of Pennine Lancashire. It comprises a multi-storey preparation block and warehouse, with an attached engine house, boiler house and detached circular full-height chimney. The power plant is fed from its original adjacent lodge, which still contains water. The weaving shed stands to the rear of the preparation block, and was extended further beyond it within a few years of its original construction.

Queen Street Mill, Harle Syke, built by a village co-operative and run as a room-and-power mill, with the adjecent Grade II-listed King's Mill (© Historic England)

On opening, the mill housed 990 looms, weaving cloth largely used for making shirts. It was closed in 1982 but was then opened as a textile museum, still producing cotton woven on looms original to the complex, powered by a tandem compound-steam engine that was built from parts salvaged from the original 1895 engine. Steam for the engine is supplied by one of two extant Lancashire Boilers, again both forming part of the early twentieth-century complex.

One significant local variant in the layout of weaving mills also appeared in Blackburn and Hyndburn during the early part of the twentieth century, when weaving mills in this area moved towards ranges of single-storey preparation buildings, arranged along the front or sides of the weaving mill. Notable examples include the extensions made in 1905 to the Garden Street Mill complex (*see Chapter 2*), Parkside Mill, erected the following year, and Albert Mill, Rishton, built in 1912 (demolished since 2012). Whilst this represented a more efficient use of warehousing and preparation space, negating the need for hoisting between floor levels, it required a much greater land footprint, and land was readily available on the fringes of the smaller towns of Hyndburn to the east. It is unclear, however, why this style of weaving mills flourished in the larger town of Blackburn, where space was at a far greater premium, but not in the similarly sized nearby towns of Burnley and Chorley.

Room-and-power weaving mills

Another feature of the late nineteenth century, connected with weaving, was the formalisation of room-and-power mills after 1850. This involved the construction of a mill, which was built specifically to let to a series of tenants, who shared the space and power systems of the mill, and was based on a system that had first emerged in Manchester in the late eighteenth century (*see Chapter 2*). The room-and-power system was particularly important for weaving, as in many instances this was undertaken by smaller firms than those engaged in spinning, which could therefore benefit from the use of a shared space in a larger mill complex. Therefore, in Lancashire, many of the room-and-power weaving mills were built by impoverished hand weavers, who between them raised sufficient funding to erect their own mills, and as a result, architecturally these tended to be purely utilitarian in character. This was the case at Black Carr Mill in Trawden, where

Scholefield Mill, Nelson, built in 1906 as a room-and-power weaving mill

the village erected a weaving mill between 1880 and 1882, which proved so successful that it was doubled in size shortly after. Indeed, the room-and-power model became so endemic in the area that, by the 1870s, the majority of weaving mills in Pendle were built in this way, and increasingly those that had not been were converted to such use.

Within modern Lancashire, a good example of a late room-and-power mill is Scholefield Mill, which was erected in 1906-7 by the Scholefield Mill Company Ltd, and formed one of the last large room-and-power mills in Nelson. It is also one of the best surviving examples of a weaving mill in the town. The complex was erected over Walverden Water, a culverted watercourse, fed by Walverden reservoir, which provided water for several mills in the locality. With the exception of the chimney, this large mill complex survives intact, with small textile-related additions made in the first half of the twentieth century. It also retains an unusual coal store, which allowed fuel to be fed from delivery on Brunswick Street, down the natural slope and directly into the automatic boiler feeders. The mill complex comprises a total of five main buildings, with a large 19-bay north-light weaving shed to the north, behind a 40-bay, three-storey preparation and warehouse block to the south. At its western end, the warehouse adjoins a large horizontal-engine house, with the boiler house beyond. An original two-storey office block projects from the eastern end of the preparation block, with a similar addition to the west.

Ancillary mills: sizing works, bobbin mills and heald and reed works

Ancillary mills, producing bobbins for both weaving and spinning, and healds and reeds for the weaving industry, continued to form an important element of Lancashire's textile industry in the late nineteenth and early twentieth centuries. Reeds were used by the weaver to beat the weft inserted by the shuttle and took the form of a smooth, flattened wire held in wooden strips secured by twine. Healds, on the other hand, were a looped wire, or flat metal strip with an eye in the centre, used to move the warp threads (*see Chapter 2*). During this period, dedicated size works also appeared, which undertook some of the processes that were normally confined to preparatory blocks at

weaving mills. Significantly, several extant examples of these ancillary works are present in modern Lancashire.

One of these is Crescent Works, situated on the fringes of Colne, which was established as a purpose-built sizing works in 1926. More generally, this part of Colne became an area of specialism within the borough for the preparation of spun cotton for weaving, with a large sizing works having been built at Boundary Mill to the west, and the Crescent Works replaced an earlier sizing works belonging to Fisher, Ridehalgh and Duckett, who were operating in the nearby Excelsior Laundry by 1923. Significantly, Crescent Works is the only example of this type of mill in Lancashire. The majority of the original buildings survive and, whilst having been remodelled for continued use into the twenty-first century, are in good condition, representing a single phase of construction dating to the late Edwardian period.

The complex comprises a square, single-storey structure, with multi-span northern-light roof, the power plant being partitioned into the south-east corner, and offices in the south-western part, within a stone-faced block above a shallow basement. The power plant comprised a double-bay boiler house, apparently housing only a single boiler, with an electricity sub-station to the rear. In this respect, the complex is a relatively rare survival of a textile mill utilising electrical power. Originally, a tapering, circular brick-built chimney stood to the north of the power plant, within the square footprint of the works, though this was demolished in the mid-/late twentieth century. Elements of the power-transmission system also survive within the works, including line-shaft hanger bolting plates, and a bearing box for the shafting.

Crescent Works, Colne, built in 1926 as a sizing works

Cob Wall Works, Blackburn, was built as a carding mill in the late eighteenth century. Although extensively rebuilt, it retains elements of the earlier buildings

Laburnum Street Heald and Reed Works, Haslingden

In terms of other ancillary works, Cob Wall Works, Blackburn, is a good example of a late nineteenth-century bobbin works, which was functioning as such in the earlier part of the nineteenth century (*see Chapter 2*). Major reconstruction of the works took place between 1877 and 1888, with further additions in 1906, and the buildings that were extant at this site in 2012 formed elements of this later works. These are of two storeys, and mainly of red-brick construction, although they also contain some sandstone elements. One of the buildings, extending along Old Whalley Road, has four gabled bays, with a later extension, and a cast-iron beam to the loading bay reads '19 Kirk & Co 06'. A tapered square-section brick chimney also survives to the rear, presumably adjacent to the power plant, with the former offices housed on the lower floor of the west bay.

Another ancillary works is the Laburnum Street Heald and Reed Works, in Haslingden, which was built in the mid-1870s by James Sharples to serve the local weaving trade. This works comprises a 16-bay, two-storey sandstone structure, with a small warehouse forming a return at its northern end. A four-bay, narrow stone-built and rendered range on the back of the southern end of the building also appears to represent an original two-storey block.

The works could be accessed through two entrances, which are still present within the principal façade of the building. These entrances have plain surrounds, and two loading-bay doors are also preserved in the building's façade. One of these was above the entrance at the northern end of the façade and this still retains a projecting steel hoist-beam, which presumably was a later improvement to an original hoist mechanism. The other loading doorway was also associated with the upper storey of the building and was identified towards the southern end of the façade. In addition, the warehouse was provided with a loading

doorway, and this is associated with an original timber hoist-beam, projecting from an aperture above the doorway, and retaining a pulley wheel.

In 1880, the works was driven by a high-pressure horizontal engine, which was replaced in 1898 when extensions were made. These extensions comprised a three-bay structure abutting the southern end of the earlier building range, constructed of locally produced machine-made brick. In this part of the mill, an adjacent brick-built, single-storey boiler house is also present, with a decorative cast-iron water tank on its roof. Associated with this was a tapering cylindrical brick-built chimney stack, now reduced to roof height, set on a square-section, stone-built base.

Whilst ancillary works, such as the Laburnum Street Heald and Reed Works, are generally unremarkable, and often blend into the rows of adjacent terraced housing, key features, such as chimneys, water tanks, and loading doors, sometimes survive, providing testament to this frequently overlooked element of Lancashire's textile industry. Significantly, they also demonstrate that the swathes of terraces depicted on historical mapping do not solely represent housing for workers in the mills, but included many of the industries that were vital to the success of Lancashire's mills.

Textile finishing

During the late nineteenth and early twentieth centuries, textile finishing continued to form an important element of Lancashire's textile industry. By this date, dedicated bleachworks and printworks existed, the latter often associated with all of the processes (bleaching, dyeing and printing) connected with textile finishing.

Technologically, printworks benefited from advances made in the mid-nineteenth century, which resulted in the appearance of the first synthetic dyes, and also from the widespread adoption of printing machines from the 1860s onwards, though traditional hand printing still formed an integral element of the industry. Synthetic dyes were first discovered in 1856, and at this date related to a single mauve-coloured dye, though subsequently, during

Painting of Broad Oak Printworks, Accrington, c 1827, from beyond the town

the latter part of the nineteenth century, advances in chemical engineering allowed a range of colours to be produced, which also cost less than traditional natural dyes. Within the printworks of the region, synthetic dyes were produced in dedicated laboratories, which became another building associated with these industrial sites.

Although, following the introduction of synthetic dyes, printing was initially a thriving industry in Lancashire, it entered a period of decline in the late 1880s, and many printing firms were forced to close. This was alleviated to some extent by amalgamation, resulting in the establishment of three printing associations, the largest of which was the Calico Printers' Association. Following the First World War, the printing industry once more entered a period of decline, and across Lancashire the number of printworks had fallen dramatically by 1939.

One of the Lancashire printworks that was in operation during this period was the Broad Oak Printworks, in Accrington, which had been established in the late eighteenth century (*see Chapter 2*). At this works, all elements of textile finishing occurred, and it appears that it was little affected by the downturn in the printing industry in the last decade of the nineteenth century. Indeed, probably as a result of selective investment by the Calico Printers' Association, it was expanded during this period and, by 1890, the works employed about 1000 people, possessed 56 separate buildings of various sizes, and contained 32 printing machines. In the early twentieth century, further extensions were made to the works, including the construction of new raising and finishing rooms, along with turbine engine and boiler houses. Further reconstruction occurred after 1920 and, in the early 1930s, several new print shops were built.

Significantly, much of the mid-late nineteenth-century Broad Oak Printworks survived into the present century. This included the main gates into the works, flanked by a single-storey stone-built watch house and a two-storey manager's house, whilst within the works were a brick-built chimney, a stone-built cloth warehouse, dated 1925, single- and two-storey laboratory blocks,

a three-storey shop with round-headed windows, and a range of single-storey sheds. One end of this latter range dates to around 1890 and formed the stentering department, where fabric was stretched and straightened prior to printing, whilst the other end was built in the early twentieth century and functioned as a screen-printing shop. Opposite the stenter house was a detached single-storey dye-house. The interior of the works also contained an early bleach croft and boiler house, probably forming elements of the early nineteenth-century printworks (*see Chapter 2*), next to the turbine engine and boiler house. In addition, above the bleach croft was a series of late nineteenth-century single-storey sheds, which were originally used for bleaching, printing and blue dyeing. Several large reservoirs existed beyond the works, which supplied fresh water, essential for the bleaching and dyeing of cloth, and also required by the plant powering the works. The present condition of the site is unknown.

Textile mills and the development of the surrounding landscapes

During the late nineteenth century, Lancashire's textile mills continued to exert an influence over their surrounding environs, particularly within urban areas. This resulted in townscapes that were characterised by late nineteenth-century terraced housing occupied by mill workers. These streets also contained small industrial premises housing trades associated with the textile industries. In addition, increasingly grand civic structures, schools, public houses, and shops were constructed, and, in the larger towns, like Preston and Blackburn, parks and gardens. Large villas became common on the fringes of the urban centres, with larger country residences constructed in rural areas, giving aristocratic credence to the mill-owning elite. In addition, seaside resorts like Fleetwood, Blackpool, and Southport, which were established in the earlier part of the nineteenth century to entertain the affluent middle class, became increasingly popular with the textile workers of the region, with Morecambe becoming a particular favourite of the Yorkshire textile workers. Following the development of the railway network and improvements in the working conditions at the end of the nineteenth century, these resorts provided a much-needed annual respite from the mill towns.

Holiday-makers at Blackpool c 1894-1910 (© Historic England)

The rapid decline of the textile industry, and the knock-on effect on associated manufacturing and energy industries, formed a not insignificant part of the urban decay of the late twentieth century. One significant outcome was mass unemployment, particularly in the mid-sized cotton towns that had become so reliant on the textile industry, followed in the later part of the twentieth century by the gradual destruction of many of Lancashire's historic textile mills.

Holmes Mill , Clitheroe, prior to renovation

4 *The Significance of Textile Mills*

The Future

In many of Lancashire's towns, the mills dominated the landscape as the largest and most economically important buildings in the area. They were the focus of the daily lives of the population, who worked six days a week and up to 14 hours a day. In the larger towns and cities, the tall chimney stacks of the mills characterised the skyline for generations, testifying to the massive industrial output that helped to transform Britain into the world's first industrial nation. The cotton mill, along with the rows of terraces that housed the workers, became the characteristic Lancashire building types, and by the early twentieth century the cotton industry and the mills that served it had become an integral part of Lancashire society, providing a livelihood for half a million people, with many more dependent upon the income the industry provided. Estimates suggest that in the course of 250 years, over 4000 textile mills and related structures were built in the historic county, helping to shape both the rural and urban environments in which we now live.

Smoking chimneys over Darwen, c 1900 (© Lancashire Telegraph)

The decline of the textile industry in the second quarter of the twentieth century had a catastrophic effect on these buildings. As the industry contracted, redundant buildings were neglected and fell into disrepair, becoming structurally unsafe and unsightly reminders of better economic times. Without a use, many mills became a target for vandalism, theft and arson, ultimately resulting in their demolition, while others were subjected to poorly informed conversion and the consequent erosion of their heritage value.

The buildings that survive are a record of the technological and structural developments that occurred over the course of nearly 250 years. As such, they reflect the ebbs and flows of the economic circumstances in which they were built, the changing methods of production, organisation and power generation, and they demonstrate an evolution in architectural style and form. They are a product of a manufacturing revolution and belong to a period in history that changed the way people thought and lived. In short, they are a fragile and irreplaceable physical manifestation of the rapidly changing society which built and used them.

The demolition of Wesley Street Mill, Bamber Bridge

While this in itself is reason enough to ensure their survival, more recently there has been a growing recognition of the important contribution historic buildings make to their surroundings, giving people a connection to a past way of life and a sense of belonging, or 'sense of place'. Ultimately, this can foster a range of social benefits that include stronger community ties and even increased individual health and well-being. Furthermore, experience demonstrates that historic-building conservation projects can play an important role in stimulating local regeneration, creating job opportunities, improving economic circumstances, and contributing to sustainable environmental policies. These social benefits are now explicitly acknowledged in government planning policy, which recommends that, where possible, heritage assets be preserved and enhanced.

The Threat

Change is an inevitable consequence of a developing society, and the construction of new buildings and innovative architectural forms is a vital part of the development of our towns, with each generation adding its own distinctive forms to their character. However, it is vital that we take a considered approach to the changes made, to ensure a diverse character that does not ignore the benefits gained from the retention of some historic buildings. The figures regarding the loss of buildings concerned with Lancashire's textile industry are sobering. In Greater Manchester, an assessment of the survival rate suggests over half of these buildings had been lost by the end the twentieth century. Within the modern county of Lancashire, a study in 2011-12 shows that of the 1661 recorded sites only 541 remained, meaning that over two-thirds of these buildings have been lost, the majority without any formal record.

Lancashire Mill statistics as of October 2012

Survival:	**1661 recorded sites** **541 survive (32.6%)**
At Risk or Vulnerable:	**158 (29.2%)**
Vacancy:	
Approximate total floor space	**2,254,366 sqm**
Approximate vacant floor space	**473,994 sqm (21%)**

At least as concerning is that this same study identified that, of those buildings that did survive, 29% were considered to be at risk or vulnerable, with a third of these considered to be in a poor or very bad condition. Unsurprisingly, these figures are comparable with calculated vacancy rates, 21% of the available floor space in historic textile mills in modern Lancashire then being unused. It is these buildings in particular that are targeted for theft, vandalism and arson. Since this study was completed, the rate of attrition does not appear to have abated, with the demolition of significant sites, such as Wesley Street Mill in Bamber Bridge, Garden Street in Blackburn, Alliance Works in Preston, Vine Mills in Oswaldtwistle and Roe Lee Mill in Blackburn, which was first badly damaged by an arson attack before its demolition. There are sadly many other examples of demolition which have almost certainly reduced the number of surviving mills to under 500 by now, and while the difficult economic circumstances of the last decade limited the options for the repurposing of mill buildings, they are likely to face a far greater threat from a post-recession economy hungry for available brownfield development land.

Spinning room at Helmshore Museum (Image Copyright David Dixon. This work is licensed under the Creative Commons Attribution-Share Alike 2.0 Generic Licence)

Challenges and Opportunities

Despite the grim outlook, textile mills are suitable for a multitude of purposes. In a small number of cases, some outstanding examples have been converted into museums. Those at Higher Mill and Whitaker's Mill at Helmshore, and the internationally important Queen Street Mill, Harle Syke (Grade I listed), have made a significant contribution to the public's understanding of the industry, although local government spending cuts have left the future of both uncertain. In a handful of cases, mills are still employed in the textile industry, such as at Lappet Mill, Calder Vale, where high-quality head scarfs are made for the Saudi Arabian market, at Britannia Mill at New Line, near Bacup (listed Grade II), which manufactures footwear insoles in man-made textiles, and Tower Mill, Dukinfield, which has now reopened for the spinning of fine yarn. These represent just a fraction of the total number of buildings available, and finding appropriate and sustainable new uses for the remaining buildings often requires a degree of creativity, compromise and co-operation, with a consideration of the wider public benefits and longer-term vision.

The challenges are various and differ from building to building, but there are common themes. The plan form, size and construction of a building can have a significant effect on its suitability for reuse, with irregular plan forms and single-storey structures often proving more difficult to repurpose than the multi-storey spinning blocks and warehouses. This is perhaps best illustrated in cases where a new use has been found for the spinning block but the associated weaving sheds have been demolished (*see Moor Lane Mills below*). There have been several studies that look at the economics of finding sustainable and appropriate new uses for textile mills, both in Lancashire and the surrounding counties, such as the *Northern Lights* study (by Purcell, Miller, Tritton, 2010), *The Economics of Industrial Building Conservation Projects in Pennine Lancashire* (by Heritage Works Buildings Preservation Trust Ltd, 2011), and *Engines of Prosperity* (by Cushman & Wakefield, 2016). These studies include a range of suggestions for sensitive reuse, from residential and office functions to retail, leisure and education facilities.

Centenary Mill, Preston, converted to residential use in 2005

Moor Lane Mills, Lancaster, during conversion, after the demolition of the weaving sheds, c 1989 (© Historic England)

Location also tends to be a prime factor, with many textile mills situated in areas of social deprivation and high unemployment, where property values are low and investment unattractive to potential developers. This problem has been particularly acute in the Pendle area where, exacerbated by the economic downturn since 2008, a weak property market is combined with the predominance of large, redundant single-storey weaving sheds. Where property values are higher, in areas like Manchester, the financial incentive for reuse is that much greater, although, conversely, in some cases this can make it more profitable to demolish the structure and redevelop the site.

The Buildings at Risk survey undertaken in 2012 has helped to identify those areas experiencing the greatest challenges to reuse and, where appropriate, targeted heritage designation should be considered to ensure that buildings are protected from irrevocable decline and ultimately demolition. This study has contributed to this goal, with the listing of seven mills, including Queen Street Mill in Harle Syke (Grade I), Grane Mill, Haslingden (Grade II*), Holmes Mill in Clitheroe (Grade II), Britannia Mill in Haslingden (Grade II), Britannia Mill in New Line (Grade II), King's Mill, Harle Syke (Grade II), and Abbey Mill, Abbey Village (Grade II). This adds significantly to the 47 mills already designated, although it is important to note that the project could only examine a sample of the extant mills, and there were numerous instances where internal inspection of potentially significant buildings was not possible; as a consequence, the possibility remains that other buildings may have the criteria necessary for designation. In some cases where statutory listing is not appropriate, the significance of a building can be acknowledged through the list of locally recognised heritage assets, or as part of a wider industrial conservation area, where it is the overall urban landscape that provides its heritage significance.

In some cases, where no viable use can currently be found for a significant building, it may be appropriate to mothball these, ensuring their survival until such time as the economy offers new opportunities, and in such circumstances published guidance is available from

Historic England. There are, however, increasing numbers of examples of urban regeneration where the derelict textile mill, often standing at the heart of a community, has been seen as an opportunity rather than an eyesore. At Murray's Mills, Ancoats, in Greater Manchester (elements listed Grade II and Grade II*), for instance, urban regeneration was led by the conversion of multi-storey spinning and warehouse blocks to a mix of residential use, office spaces, retail and leisure, using unobtrusive methods informed by prior archaeological investigation.

Brierfield Mill, Brierfield, currently undergoing renovation to mixed use as part of the Northlight *project (© Barnfield Construction)*

Similar principles are being used in Burnley, where the *On the Banks* redevelopment of the Weavers' Triangle hopes to stimulate growth in the area, and at Brierfield, where the *Northlight* project has been granted planning permission for the conversion of Brierfield Mills into new business workspaces, a leisure complex, hotel, conferencing facility, residential apartments and a marina beside the canal. At Brierfield Mills (listed Grade II), a study commissioned by Historic England into the potential to enhance the building's energy efficiency has helped to highlight the inherent sustainability and environmental benefits of retaining and reusing textile-mill buildings on a much wider scale. This builds on the policy that thermal efficiency regulations are more flexible for historic buildings than for new build.

A significant part of the initial funding for the Murray's Mills project came through the Ancoats Buildings Preservation Trust, one of a growing number of not-for-profit organisations, often run by volunteers, that work towards the conservation of historic buildings at risk. Through these organisations, funding in the form of grants and loans is available from the Architectural Heritage Fund and Heritage Lottery Fund, providing badly needed finance for important buildings that would not otherwise be economically viable through traditional

channels. Other successful ventures carried out by Building Preservation Trusts include Lomeshaye Bridge Mill in Nelson (*see below*) and Higherford Mill in Higherford (listed Grade II), which is being converted for use as workshops, an art gallery and an educational resource centre.

Textile-mill conversions that have proven most successful have been those that retained the special character of the mill, whether that be its architectural form, original layout, historic finishes and details associated with the building's use over time, or often a combination of these. In seeking to achieve these goals, current conservation guidance argues for the retention of original spaces, where possible, the minimisation of modern partitions, which should ideally be low-impact, and, where feasible, the exposure of historic internal and external finishes to allow the building to be better understood. A challenge concerning textile mills is the retention of machinery, often relating to the original power and transmission system, features which can occupy valuable space and generally add no immediate financial value for the developer. Where new buildings and services are required, they should be designed sensitively to complement the original structures in a bold and confident industrial style that can be easily distinguished from the original buildings and yet not dominate them.

Similarly, a considered approach needs to be taken to comply with current building regulations and modern expectations of comfort, which allow appropriate solutions to be found that do not compromise the historic character of the building. While improved thermal efficiency is an important aspiration, in some circumstances, where the building is listed or lies within a conservation area, regulations concerning energy efficiency can be relaxed if it is considered that they would have a detrimental effect upon the significance of the building. Other building regulations leave less room for manoeuvre, with the insertion of additional secondary staircases and lifts requiring a careful approach to their design.

Underpinning any successful conservation and reuse project is the completion of a heritage assessment that identifies what is significant about the building. This document can then be used to inform the building's conservation plan and help to identify an appropriate new use for the structure without the loss of its unique special character. Significantly, there are several good examples

of Lancashire mills that have been sympathetically redeveloped for modern-day use, which incorporate these philosophies.

Holmes Mill, Clitheroe: the first phase of a mixed use conversion has been completed

A recent example of mixed reuse is Holmes Mill, which stands at the southern edge of Clitheroe town centre, and is now a Grade II-listed complex. Prior to redevelopment, this site comprised a three-storey spinning mill built in 1823, associated with an integrated beam-engine house, and a second spinning block dating to 1830, which had an attached beam-engine house and single-storey boiler house. Other elements included a modified weaving shed of 1853, an additional boiler and engine house that retained its original cross-compound horizontal steam engine, and another weaving shed, all of which date to 1910/11. Significantly, the steam engine is one of only five *in situ* in modern Lancashire and is in its original unrestored condition. In 2014, the complex became redundant after the closure of the textile business, and several of the buildings were in a poor state of repair, requiring urgent remedial action. The proposed conversion was a privately funded venture undertaken by a developer with experience in the conservation of historic buildings, with the creation of an anticipated 150 jobs. It was also hoped that it would contribute to a growth in the local tourist industry.

The scheme of conversion has been divided into three phases, with the first stage completed in July 2016, and the remainder set for completion in 2017. This initially involved the conversion of the 1830 spinning block, to accommodate a micro-brewery with associated shop, smokehouse and bakery on the ground-floor, a function room at first-floor level, and office space on the floors above, aimed at the creative industries. Repairs included removal of the late cement

render from the exterior, consolidation of the masonry and repointing where necessary, and replacement of like-for-like windows, though with upgraded thermal efficiency. Building regulations required the provision of an additional fire-escape staircase to the north, while internally the first floor was partially removed to allow the installation of brewery equipment on the ground floor. In addition, it was necessary to reposition some cast-iron columns to create practical spaces, and structural improvements were made to enhance inadequate floor strength. The importance of the steam engine has been acknowledged by providing access to the engine house, making it a central attraction within

The Holmes Mill engine house, now part of the pub and restaurant at Bowland Beer Hall, associated with the micro-brewery

the building's new use. The second phase includes the opening of a 31-room hotel, bar and grill with food hall, while phase three will see the original mill renovated to incorporate a gym, urban spa and pool.

At Lomeshaye Bridge Mill, which stands on the banks of the Leeds and Liverpool Canal on the western edge of Nelson, the potential to contribute to the regeneration of the local area was demonstrated through the conversion of the building to office and workshop space. The buildings are not listed, although they are situated within the Whitefield Conservation Area, and parts of the complex probably represent the earliest surviving textile-mill building in Nelson. At the outset of redevelopment, the complex contained the original two-storey steam-powered cotton-spinning mill, built in 1841, which was extended in 1899 with the addition of two extra storeys, and two weaving sheds, one dating to 1877-8, and another dating to 1881-2.

Lomeshaye Bridge Mill, Nelson (© Historic England)

The mill was purchased by the Heritage Trust for the North West in 1998, a Building Preservation Trust that seeks to find new uses for historic buildings at risk, but in 2000 the area was threatened with wide-scale redevelopment that would have seen the demolition of the mill along with 400 associated terraced houses. After a public enquiry, the decision was taken to retain the mill, which would form part of a wider project to regenerate the Whitefield area, including the conservation of the nineteenth-century terraced housing, construction of new-build affordable housing, and the provision of a new school in the area.

Funding for the mill's conservation was not secured until 2014, when a substantial Heritage Lottery grant was obtained and planning permission granted. The Prince of Wales' Regeneration Trust promoted the project as a model of the benefits of heritage-led regeneration and spearheaded efforts to find appropriate and sustainable uses for the building. The first stage of the conversion scheme sought to create a workshop on the ground floor for the Heritage Trust's in-house conservation company, specialising in traditional building skills, with archive

The upper floor of Lomeshaye Bridge Mill has been sensitively repaired, and is awaiting a new use (photograph courtesy of David Morris)

storage on the first and second floors and managed workspace on the third floor. Repairs were made to the roof timbers, slates and external masonry, with new windows installed by the Trust's conservation team that retain the character of the original building while meeting modern standards of thermal efficiency. Where structurally necessary, internal cast-iron columns were replaced and a new central staircase and lift were inserted, with the old industrial lift retained and repaired. The success of the wider scheme in the area has seen house prices rise, confidence in the local area return and the removal of the Whitefield Conservation Area from Historic England's Heritage at Risk register.

Another good example of heritage-led regeneration is Victoria Mill, which is within Burnley's iconic Weavers' Triangle, an area of land known for its concentration of cotton mills on the banks of the Leeds and Liverpool Canal.

Burnley Weavers' Triangle in 1910, with the Leeds and Liverpool Canal flowing through its heart, and Victoria Mill to the south (right)

Burnley Weavers' Triangle today (© Historic England)

The mill is Grade II-listed and belongs to the canal-side conservation area, a part of Burnley recognised as one of the most important historic industrial areas in England. At the time of redevelopment, this complex contained a four-storey spinning block, a preparation block and, unusually, a two-storey weaving shed, all built in the early 1880s, which replaced an earlier spinning block dating to 1854. In addition, the site also contained a seven-storey stair tower, added to the south-western corner of the spinning block in 1889, and a second weaving shed dating to before 1892.

Prior to conversion, the mill had stood empty for several years and was in a very poor state of repair. A private-sector application to promote a mixed-use commercial development had been proposed in 2008, but this had subsequently collapsed and the mill's increasingly fragile condition prompted Burnley Borough Council to acquire it, to protect it against further decay and secure the buildings for future refurbishment. Urgent stabilisation works were carried out to the structure and to secure the buildings from vandalism, making them watertight. This included the underpinning of damaged foundations, the replacement of roofing with temporary coverings, and the securing of access points against intruders.

In 2012, a planning application was submitted to develop the complex as a new University Technical College (UTC), providing training to 14-19 year olds. The mill was transformed into a state-of-the-art teaching facility, retaining as much of the surviving buildings as possible and adapting them to accommodate lecture halls, workshops, science studios, workstations and exhibition space. A bold contemporary glass and timber-clad extension was added to the south to serve as a sports hall, with consideration being given to the scale, massing and use of complementary materials, while internally services were carried in steel ducting to maintain an industrial aesthetic. This major scheme formed the first

Moor Lane Mills North, Lancaster, now used as student accommodation

stage in part of an holistic strategy by Burnley Borough Council in combination with private partners to regenerate the Weavers' Triangle, stimulating the creation of over 4700 jobs in the area, bringing redundant industrial floor-space back into use and encouraging further investment in the area. The college opened in 2013 but is now facing closure as a result of low student numbers. It is hoped, however, that a new training use can be found for what is a state-of-the-art education facility.

The Moor Lane Mills complex, in Lancaster, on the western bank of the Lancaster Canal, represents a further example of the sympathetic redevelopment of Lancashire's nineteenth-century mills. This complex is situated to the north and south of Moor Lane and, at the time of redevelopment, it comprised a six-storey spinning mill to the north dating to 1819, the roof of which was raised in 1830,

Moor Lane Mills South, Lancaster, serving as office space

and a five-storey spinning block on the opposite side of the road, built in 1826. The heritage significance of these buildings was acknowledged by the Grade II listing of the southern mill in 1974 and of the northern mill in 1982.

Both mills stood derelict for a number of years until, in 1987-8, a scheme was proposed for the conversion of the southern mill into office space. Exterior alterations were generally limited and sympathetic to the historic character of the buildings, although, due to its city-centre location, the decision was taken to demolish the weaving sheds that had occupied the southern half of the site, to make room for on-site parking facilities. Internally, the buildings were laid out as open-plan office areas, with some low-impact partitioning, a mixture of modern and original interior finishes, and the provision of additional staircases, lifts and necessary conveniences.

The following year, the northern mill was converted to student accommodation for one of Lancaster's two thriving universities, which included the installation of a new emergency staircase in the north-east corner, the removal of some later additions, the insertion of a new hydraulic lift in the existing lift shaft, and the sub-division of the floors into 93 individual study bedrooms, with a shared kitchen on each floor. The sub-division of the original spaces with modern brick walls has inevitably compromised the interior's historic character to some degree, but this must be offset against the project's success in finding a sustainable new use for the building. In this instance, the limited bay widths between columns and regular fenestration associated with mills of this date have proven suitable for the provision of compact and well-lit individual spaces without the need for the removal of columns.

The northern mill is currently occupied by the University of Cumbria and is a popular location with students, mid-way between the town centre and the campus, while the southern mill was occupied by Reebok International Ltd as office and exhibition space until 2007. The buildings, which are owned by the local council, are now used partly by the NHS and partly by a contracting archaeological organisation.

One of the most successful residential conversions was undertaken at the Grade II-listed Ilex Mill in Rawtenstall, which was built as an integrated cotton mill in 1856 beside the Bacup branch of the Lancashire and Yorkshire Railway. The site, within the Rawtenstall Town Centre Conservation Area, had retained most of its original layout, including its five-storey spinning block with integrated beam-engine house, freestanding octagonal stone chimney, an adjoining warehouse and preparation block of five storeys built to an L-shaped plan, and a narrow three-storey block to the north. An unusual single-storey weaving shed lay at the heart of the complex, built with fireproof brick arches rather than the typical north-light roof, and lit by roof lights set within the brick vaults. Textile manufacturing ended in 1981 and the buildings became redundant from 1985, falling into a state of increasing disrepair. To ensure its survival, Rossendale Borough Council bought the mill with the help of a grant from English Heritage in the mid-1990s, and plans were put forward for its conversion into a town

Ilex Mill, Rawtenstall, a successful residential conversion

hall, but funding did not become available and the buildings were obtained for private development. The complex was bought by a developer with experience in historic building conversion in 2003 and plans were submitted for its conversion into residential accommodation. The project was completed two years later, providing 91 apartments and six rooftop penthouses, while the weaving sheds now serve as secure residents' parking, with a rooftop garden above. While modern finishes and partitions have been applied internally, the external character of the buildings has been preserved, with the retention of the existing fenestration and the sensitive use of appropriate double-glazed windows.

Moscow Mill, aka Oswaldtwistle Mills, prior to the demolition of the second chimney, (© Historic England)

The suitability of weaving sheds for retail use has been demonstrated at the former Moscow Mills in Oswaldtwistle, an integrated mill, originally erected in 1824-5 as a cotton-spinning mill. The spinning mill was enlarged in 1842 and again in 1860, with a separate weaving mill erected to the rear in 1871-2. After a fire in 1898, much of the original spinning block was lost, but the remaining buildings operated as a reed and heald works, textile-beaming mill, and a range of other uses in the early twentieth century. The mill was returned to weaving in 1908 and continued as a textile-manufacturing site until the last decade of the twentieth century. The surviving buildings include a two-storey boiler house/spinning room, the lower portion of the original spinning mill, preparation rooms, weaving shed, office with warehouse over, smithy and mechanics' shop. The 1860s extensions include a two-storey spinning department with attached beam-engine house and integrated boiler house. The site also retains an octagonal brick chimney, although reduced in height, and both of its reservoirs.

After the closure of the mill in the early 1990s, it was converted to use as a retail outlet and has continued to grow since, currently known as Oswaldtwistle Mills. Modern internal finishes accompany low-impact partitions that do not extend to the full height of the north-light shed, retaining a sense of the original layout and ensuring a well-lit interior. It is now occupied by 100 retailers, including five restaurants, an ice-cream parlour, garden centre, homewares shop, aquatics specialist and a craft centre. It also has a textile and heritage museum on the site and a nature trail that makes use of the reservoirs as a wildfowl reserve. The mill provides work for 190 people, with the associated business and conference

Hollin Bank Mill, Brierfield, aka Pendle Village Mill

centre employing over 70 staff indirectly. The outlet attracts 1.5 million visitors every year, offering 120,000 square feet of retail space and providing public access to one of Oswaldtwistle's valuable heritage assets.

A similar scheme has been undertaken at Hollin Bank Mill, Brierfield, which was erected in 1891-3 as a steam-powered room-and-power cotton-weaving mill on the eastern bank of the Leeds and Liverpool Canal. The original buildings included a multi-storey office, preparation block, warehouse, and engine house with associated boiler house and a circular red-brick chimney. The single-storey weaving shed projected from the eastern side of the preparation block and warehouse. Shortly after construction, a significant extension was added to the east, doubling the size of the weaving shed, along with the addition of a three-storey warehouse block further to the east. By the end of the century, the mill accommodated over 2000 looms, operated by several firms. The original warehouse was damaged by fire in 1917 and again in 1924, being rebuilt on both occasions. The mill continued to produce textiles until the 1990s as a manufacturer of surgical bandages, before its closure in 1994.

In 2006, it was converted to retail space as the Pendle Village Mill, housing a range of shops that include furniture and clothing, a gift shop and a tea room, in 80,000 square feet. The conversion included the partial demolition of approximately a quarter of the weaving sheds to create a sunken entrance courtyard, and the modernisation of the interior with the boxing-in of most

of the columns, but the north-light glazing has been retained and has proven suitable for retail lighting. The shopping centre is located immediately off Junction 12 of the M65 motorway, which has helped to make it a successful venture, with parts of the mill still available for expansion.

Conclusion

These examples illustrate the range of possible uses that mills of varying types can be put to if a creative approach is taken to their retention. The ideas are by no means exhaustive, however, and these buildings have been successfully put to many other uses. Some of them are listed or stand within conservation areas, while others have no formal designation, demonstrating that neither circumstance is a barrier to successful development. It is evident in each case that a degree of compromise was required to bring the scheme to completion, but all have retained their historic character to a greater degree. Inevitably, the reuse of historic structures requires some compromise from both the developer and the conservation officer in the local planning authority, and a balance must be struck between providing an appropriate building that meets modern standards and regulations without losing its historic character.

It is only recently that the social benefits associated with the retention and reuse of our historic buildings have begun to be appreciated on a wider scale, and their potential to lead urban-regeneration schemes is gaining a growing recognition. Nevertheless, the rapid rate of loss and the poor condition of many buildings illustrated by this study is a cause for concern, and in many Lancashire towns opportunities for urban regeneration through the reuse of an historic textile mill are dwindling. This study and others like it have sought to identify, evaluate and understand the remaining resource to assist informed decision-making and demonstrate just some of the possibilities for their considered reuse, but further study and a wider appreciation of these buildings is necessary. Indeed, this study could only examine a sample of the remaining mills and there will certainly be mill buildings that, if subjected to the same level of examination, would meet the criteria for designation. Ultimately, it is only by understanding what is significant about our historic textile mills, and then identifying the challenges and solutions to their reuse, that we can hope to retain this important part of our heritage.

In Summary, the most sucessful textile mill conversions:

1 Respect, retain, and celebrate significant architectural, archaeological, and historic details following the recommendations of a prior Conservation Statement;

2 Respect and retain the historic layout of the mill and any open floor plates so far as practicable, allowing former work spaces to continue to be understood and valued;

3 Leave historic floor, ceiling, and wall finishes exposed where possible, minimising areas of internal partitions, corridors, or boarding over historic fabric;

4 Respect and retain significant surviving industrial artefacts, especially elements of the power-generation and transmission system(s) of the textile mills;

5 Adopt a bold and confident 'industrial aesthetic' for the design of new additions, internal interventions and services, whilst allowing the new and old to be read distinctly.

5 Glossary

Batting — Beating **cotton** fibres over a frame, across which were stretched cords. This process, usually undertaken by women, cleaned the **cotton** and allowed for the removal of seeds, which were picked out by hand.

Beaming — After the application of a **sizing** paste, yarn was wound onto a beam in a process known as beaming, ready for use on the weaving loom.

Beck — A large vat used to dye long, continuous lengths of **cloth**.

Bleach croft — A field used to lay out undyed cloth for bleaching in sunlight. Chemical bleaching removed the need for such fields.

Bobbin — A round spool for holding **yarn**, frequently flanged at both ends.

Calendar — A machine composed of a series of rollers through which **cloth** is passed to produce a desired finish.

Calico — A white **cotton cloth** with patterns printed in one or more colours.

Card — A fine but stiff wire brush, used to disentangle fibrous materials preparatory to spinning. The term is also used to mean a **card**ing engine, which combed the fibres mechanically into lengths, laid parallel to form a sliver.

Cloth — Any woven or felted fabric.

Cotton — A soft, white fluffy fibrous material extracted from the cotton plant for spinning into cotton yarn.

Dash wheel — A type of early washing machine used in the bleaching process.

Doubled yarn — Thread doubled and retwisted on a doubling frame.

Draughting/Drafting — Another term used for **Drawing**.

Drawing — Cotton drawn-out and doubled in a drawing frame to straighten the fibres and even out the grist.

Finishing — After **cloth** has been woven, it goes through a series of finishing processes, which can include bleaching, dyeing and printing.

Flax — A fibrous plant from which **linen** is produced.

Flying Shuttle — A device for **weaving cloth** patented by **John Kay** in 1733. It increased the speed at which cloth could be woven by hand.

Fulling — Pounding newly woven woollen **cloth** in an alkaline liquor to absorb natural greases and oils that were added during the **weaving**, and to thicken up the fabric to give a stronger and denser material.

Fustian — A strong twilled **cloth**, with a **linen warp** and a **cotton weft**, the production of which increased steadily in the Manchester area during the early seventeenth century.

Grey sour — In the bleaching process, the grey sour involved the addition of a weak hydrochloric acid as a cleaning agent.

Heald — Part of a **weaving loom** that raises and lowers the **warp** threads.

Horse power — A standard measurement of mechanical power used to compare a machine to the work of a horse.

Kier — A type of metal vat or boiler used in the bleaching or dyeing process.

Lap — Thick sheet of fibres produced from the initial cleaning of raw **cotton**, and processed further in a **card**ing engine.

Linen — A cloth made of **flax** yarn.

Lodge — A reservoir holding and cooling water at a textile mill to supply the steam engine and boilers.

Loom — A machine for the **weaving** of **cloth**.

Lye — An alkaline water produced by adding plant ashes, used to remove natural oils during the bleaching process before the introduction of chemical bleaching.

Mordant — A chemical or mineral agent used to fix dyes in the finishing industry.

Mule — A **cotton-spinning** machine derived from an invention by **Samuel Crompton**, and so-named because it combined the roller-drawing principle of **Arkwright's water-frame** and the carriage-drawing of **Hargreaves' spinning jenny**.

Oculus window — A circular window, often used to embellish the façade of a building.

Reed — Part of a **weaving loom** that keeps the **warp** threads in position and guides the **shuttle** across the **loom**.

Ring frame	A continuous **spinning** machine, which largely displaced **mules** during the twentieth century.
Roving	A thin rope of lightly twisted, substantially parallel fibres, from which **yarn** is spun. Produced on a roving frame.
Scutcher	A machine for opening and cleaning raw **cotton**, reputedly introduced to Manchester by **John Kennedy** in 1808-9.
Self-acting mule	A mule **spinning**-frame which automatically performed drawing, **twist**ing, winding-on, to produce a tube, or cop, of **yarn**. The machine was perfected by **Richard Roberts** in 1830, but was not applied to fine **spinning** until the 1860s.
Shuttle	The case in which the **weft** is carried on the **loom** during **weaving**.
Silk	A fine thread harvested from the cocoon of the silk moth, which is then used to produce a luxurious **cloth**.
Silk Throwing	The **spinning** of several **silk** threads to form a **yarn** strong enough to weave with.
Sizing	The coating of **yarn** in a starchy paste to increase its resistance to abrasion during **weaving**.
Sliver	A thick, soft, untwisted rope of fibre, produced from a **card**ing engine.
Smallwares	A **cloth** that usually comprised a **linen warp** and a **worsted weft**.
Spindle	A revolving rod onto which **yarn** is wound during the **spinning** process.
Spinning	The drawing out and twisting of fibres into a **yarn** strong enough for **weaving**.
Spinning jenny	A hand-operated **spinning** machine invented by **James Hargreaves** in 1767 that allowed the **spinning** of multiple threads.
Tenter	The method used to hang **cloth** for drying and bleaching on a frame. Later tentering was carried out indoors within heated dry houses.
Throstle	A **spinning** machine derived from the **water frame**, but larger and capable of operating at faster speeds.

Twist — **Yarn** intended for use as **warp**.

Warp — **Yarn** which lies lengthwise in the **cloth**.

Water frame — A water-powered **spinning** machine patented by **Richard Arkwright** in 1769. It could be operated by semi-skilled labour and was capable of **spinning** several **yarns** simultaneously. Considered to be the first true factory-based **spinning** machine.

Weaving — The method of making fabric by interlacing threads. Plain weave is a simple, over-under construction giving a flat, even texture, while patterned weaves, such as twill and herringbone, are obtained by differential raising of **warp** threads on the loom.

Weft — **Yarn** intended for the shuttle of a **loom**, which lies cross-wise in the **cloth** and interlaces with the **warp**.

White sour — In the bleaching process, the white sour involved washing the bleached cloth through a diluted solution of sulphuric acid.

Willow — A machine used for the cleaning of raw **wool**, **cotton** or other materials.

Wool — The fine, soft hairy coat of a sheep or similar animal that is used in the production of woollen and **worsted** goods.

Worsted — A fine, strong **yarn** made from **wool** that has been combed and **drafted**.

Yarn — Spun thread.

6 Notable People Mentioned in the Text

Engineers

Richard Arkwright: born in 1732 in Preston, Arkwright was responsible for the invention of mechanised **spinning** in 1769, when he patented his **water frame**. He established the world's first water-powered **cotton** mill at Cromford in Derbyshire in 1771 and went on to patent a **card**ing engine in 1775. He died in 1792.

Thomas Bell: he introduced copper rollers to the printing process in 1783 that, after refinement, allowed the application of up to six colours on each pattern.

David Bentley: he invented a type of washing machine in 1828, known as the **dash wheel**, that was used extensively within the bleaching industry.

James Bullough and William Kenworthy: Bullough (1800-68) and Kenworthy made a series of refinements to **Roberts'** power **loom** that became known as the Lancashire **Loom**. Their design became the industry-standard equipment for the next century.

Edmund Cartwright: born in Nottinghamshire in 1743, Cartwright developed the first power **loom,** which he patented in 1785. Although his original machine was not commercially successful, by the 1820s a series of refinements led to its widespread adoption. He died in 1823.

Samuel Crompton: born in Bolton in 1753, Crompton invented the **spinning** mule in 1779, a hybrid of **Arkwright's water frame** and **Hargreaves' spinning jenny** that allowed the **spinning** of finer and stronger **yarns**. Crompton did not patent the machine but the mule became the standard **spinning** equipment in the industry for the next 150 years. He died in 1827.

William Fairbairn: born in Kelso in 1789, Fairbairn was an influential mill-wright and engineer working in Manchester, responsible for the development of improved construction techniques and more efficient power systems in textile mills. He died in 1874.

James Hargreaves: born in Oswaldtwistle in 1720, he is credited with the invention of the **spinning jenny** in 1764, a hand-operated machine designed for **spinning** several threads at a time. The early machines increased **yarn** output by a factor of eight. He died in 1778.

William Horrocks: a Stockport-based textile manufacturer, Horrrocks was responsible for improvements to the power **loom** in 1803, leading to the introduction of the Horrocks **loom**.

John Kay: born in 1704 in Walmersley, Lancashire, in 1733-4 he patented the flying **shuttle**, a machine that vastly increased the speed at which **cloth** could be hand woven, and enabled the **weaving** of wider **cloth**. He died in *c* 1779.

Thomas Lombe: born in 1685, Lombe took out patents on a number of water-powered machines concerned with the production of **silk**. Along with his brother John, he set up a **silk**-throwing mill in Derbyshire in 1720, which was subsequently used as the model for **Arkwright's cotton** mills in the late eighteenth century. Thomas died in 1739.

Robert Peel: born in 1723 in Oswaldtwistle, Peel established his own printworks in 1764, developing roller-printing techniques. He was famed for his parsley-leaf patterns that earned him the nickname Parsley Peel. Robert died in 1795 but the Peel family went on to make a number of refinements to the mechanised **weaving** and **spinning** industry, and a later Robert Peel was responsible for the repeal of the Corn Laws in 1846, when Prime Minister.

Richard Roberts: born at Llanymynech in 1789, Roberts was responsible for improvements to both **weaving** and **spinning** machinery, refining the design of the **loom** in 1822, and then in 1830 patenting the first successful self-acting **mule**. He died in 1864.

Charles Tennant: born in Alloway in 1768, Tennant was a weaver and later a chemist, who developed a chlorine and lime-bleaching solution in 1798 that significantly reduced the time taken to bleach cloth from months to hours. He died in 1838.

John Todd: a Burnley-based manufacturer of textile equipment, Todd was responsible for improvements to the power **loom** in the early nineteenth century.

Early Manchester and Salford Entrepreneurs

The Booths: a Salford-based family of textile merchants who profited in the emerging textile industry.

The Byroms: an influential Manchester-based family that prospered initially from dealing in **linen** drapery.

The Chethams: a prosperous Manchester-based family of textile merchants, bankers and landowners from the sixteenth to the nineteenth centuries.

The Wrigleys: a Salford-based family of textile merchants who profited in the emerging textile industry.

Mill Owners

Edward Chadwick: erected one of the first water-powered **cotton** mills in Lancashire at Birkacre in 1777, which was leased by **Richard Arkwright** and fitted with his patented **water frames**. The mill was destroyed by machine breakers in 1779.

Edmund Clayton: established Lancashire's first printworks at Bamber Bridge in 1764. He died in 1767.

Fisher, Ridehalgh and Duckett: the partnership built Crescent Works, a tape and **beaming** mill, in Colne in the mid-1920s.

John Goodair: built Standish Street Mill in or before 1811, a **cotton-spinning** factory in Chorley, which he operated until 1824.

John and Henry Halstead: in 1736, the pair ran a water-powered **fulling** mill and dye house at the junction of Calder Vale Road and Padiham Road in Burnley.

Hargreaves and Dugdale: Thomas Hargreaves and Adam Dugdale took over the Broad Oak calico-printing works near Accrington in 1812. Under their direction it became the most important calico printworks in Accrington.

Edmund Kershaw: a publican who erected Church Kirk Mill, in Church, in 1853 for **cotton weaving**.

John Park: built Abbey Mill in Abbey Village as an integrated **cotton** and **weaving** mill in 1840.

Jonathon Pollard: a Manchester-based **cotton** manufacturer, who prospered as a tenant under the room-and-power system, before going on to build his own **cotton-spinning** mill, known as Pollard's Mill, in the Ancoats area, in around 1802.

Thomas Riley and Son: converted Cob Wall Works from a water-powered carding factory to a bobbin mill in the 1820s.

James Sharples: built the Laburnum reed and heald works in Haslingden in the 1870s.

William Turner: Lancashire woollen manufacturer responsible for the construction of the water-powered Higher Mill at Helmshore in 1796.

John Walmsley: Walmsley and his son George were responsible for the erection of Hargher Clough cotton-weaving mill in Burnley in 1881.

Architects

Ernest Bates: architect responsible for the design of a range of building types, including India Mill in Darwen in 1867.

Bradshaw, Gass and Hope: a firm of Bolton-based mill architects founded in 1862 by J J Bradshaw. They are attributed with the introduction of concrete floors to Lancashire in 1876, at Howe Bridge, Atherton.

Fred Dixon: born in 1854, Dixon was an Oldham-based mill architect who established his own practice in 1889. He designed 22 mills in Oldham and often employed yellow brick to decorate their facades. He died in 1935.

Edward Potts: born in 1839, Oldham-based architect Edward Potts is recognised as one of the most prolific and important mill architects of the nineteenth and early twentieth centuries. He was influential in the development of the concrete fireproof-floor design. He died in 1909.

Abraham Henthorn Stott: born in 1822, Stott opened his own architectural practice in Oldham in 1847, specialising in the design of textile mills, and was influential in the development of improved floor designs. He died in 1904.

Stott and Sons: after the retirement of A H Stott, his sons Jesse Stott and A H Stott junior continued the practice under the name of Stott and Sons. The Stotts are recognised as one of the most prolific firms of mill architects of the nineteenth and early twentieth centuries.

Philip Sidney Stott: born in 1858, P S Stott was the son of A H Stott and worked for the family practice for a short time before setting up his own practice in 1883, specialising in the design of cotton mills. His practice was also extremely successful in the latter years of the nineteenth and early years of the twentieth century. He died in 1937.

Arthur Turner and Son: architects responsible for the design of Elk Mill in 1926, the last steam-powered mill to be built in the historic county of Lancashire.

Cartographer

William Green: a cartographer who compiled a large-scale map of Manchester between 1787 and 1794.

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8 Mills referred to in the text

Lancashire Mills

Numbers in the first column are used to note the location on the map on the final page

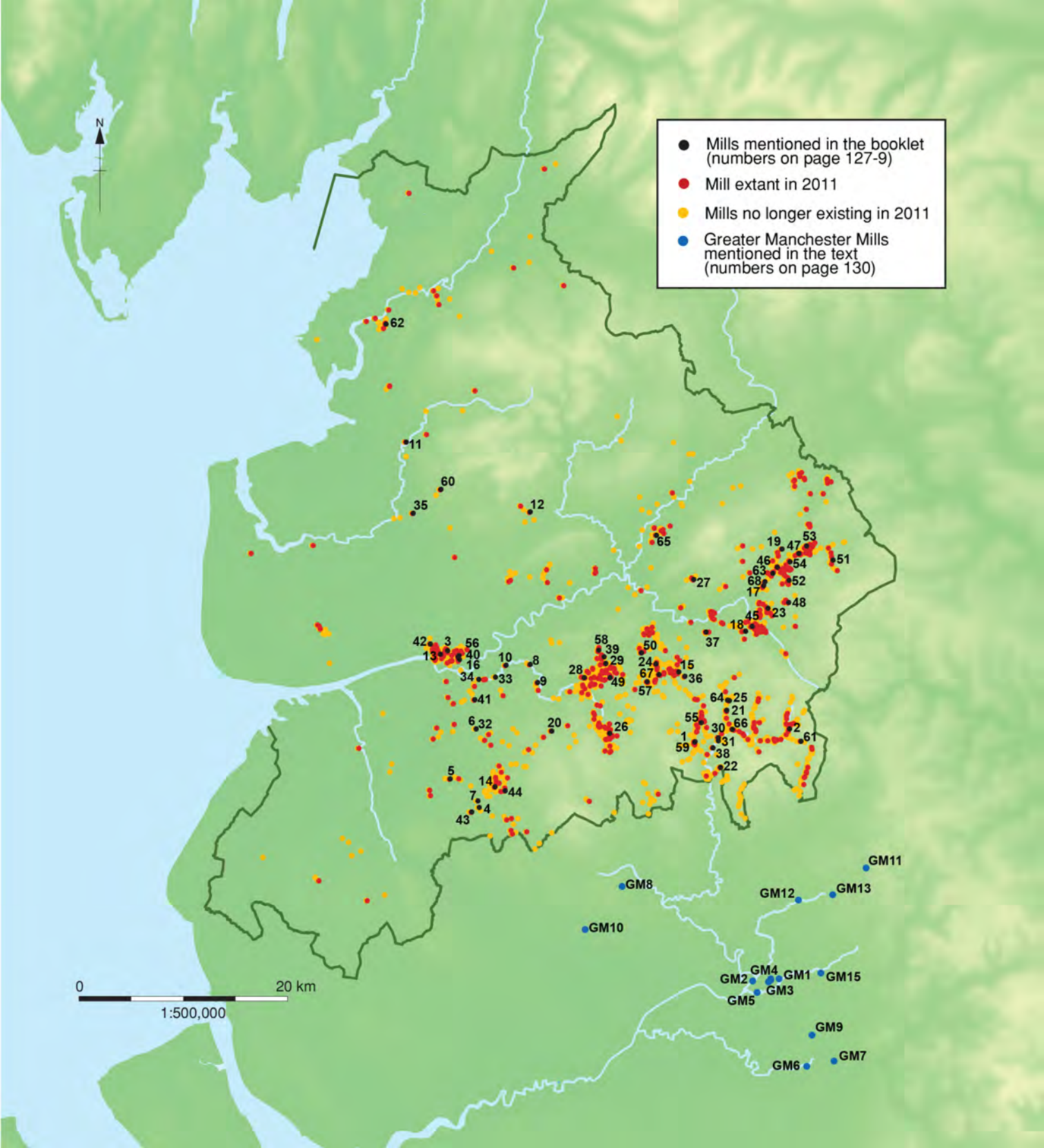
	Name	Location	Survival	Listed	Listing No	Scheduled
1	Higher Mill	Helmshore	Extant	Grade II	185678	Yes
2	Irwell Mill	Bacup	Partially	No		No
3	Hanover Street Mill	Preston	Extant	Grade II	392050	No
4	Birkacre Mill	Chorley	Demolished			
5	Armetriding Mill	Euxton	Extant	No		No
6	Clayton Mill	Clayton-le-Woods	Demolished			
7	Lower Burgh Factory	Chorley	Demolished			
8	Salmesbury Bottoms Mill	Salmesbury	Partially	No		No
9	Hoghton Bottoms Mill	Hoghton Bottoms	Partially	No		No
10	Roach Bridge Mill	Salmesbury	Extant	No		No
11	Cleveley Mill	Scorton	Extant	No		No
12	Kirk Mill	Chipping	Extant	Grade II	1401593	No
13	Spital's Moss Mill	Preston	Extant	Grade II	392104	No
14	Standish Street Mill	Chorley	Extant	No		No
15	Sykes Mill	Accrington	Demolished			
16	Fishwick Mill	Preston	Partially	No		No
17	Brierfield Mill	Brierfield	Extant	Grade II	186209	No
18	Victoria Mill	Burnley	Extant	Grade II	467238	No
19	Higherford Mill	Barrowford	Extant	Grade II	454564	No
20	Abbey Mill	Abbey Village	Extant	Grade II	1433925	No
21	Reeds Holme Mill	Rawtenstall	Demolished			
22	Bridge Mills	Edenfield	Partially	No		No
23	Rake Head Mill	Burnley	Extant	No		No
24	Church Kirk Mill	Church	Extant	No		No
25	Britannia Mill	Haslingden	Extant	Grade II	1428080	No
26	Ellenshaw Mill	Darwen	Extant	No		No
27	Union Mill	Sabden	Extant	No		No
28	Garden Street Mill	Blackburn	Demolished			
29	Cob Wall Works	Blackburn	Extant	No		No
30	Holme Bleaching Mill	Rawtenstall	Extant	No		No
31	Holme Mill	Rawtenstall	Demolished			
32	Bamber Bridge Printworks	Bamber Bridge	Demolished			
33	Bannister Hall Printworks	Walton-le-Dale	Demolished			
34	Mosney Works	Walton-le-Dale	Demolished			
35	Catterall Printworks	Catterall	Partially	No		No
36	Broad Oak Printworks	Accrington	Extant	No		No

	Name	Location	Survival	Listed	Listing No	Scheduled
37	Castle Clough Works	Hapton	Extant	No		No
38	Ewood Bridge Mill	Ewood Bridge	Extant	No		No
39	India Mill	Darwen	Extant	Grade II Grade II*	1072436 1362166	No
40	Centenary Mill	Preston	Extant	Grade II	392105	No
41	Wesley Street Mill	Bamber Bridge	Demolished			
42	Tulketh Mill	Preston	Extant	Grade II	391890	No
43	Coppul Ring Mill	Chorley	Extant	Grade II	357608	No
44	Cowling Mill	Chorley	Extant	No		No
45	Hargher Clough Mill	Burnley	Demolished			
46	Pendle Street Mill	Nelson	Demolished			
47	Bankfield Mill	Barnoldswick	Extant	No		No
48	Queen Street Mill	Harle Syke	Extant	Grade I	1416482	No
49	Parkside Mill	Blackburn	Extant	No		No
50	Albert Mill	Rishton	Demolished			
51	Black Carr Mill	Trawden	Extant	No		No
52	Scholefield Mill	Nelson	Extant	No		No
53	Crescent Works	Colne	Extant	No		No
54	Boundary Mill	Colne	Extant	No		No
55	Laburnam Street Heald and Reed Works	Blackburn	Extant	No		No
56	Alliance Works	Preston	Demolished			
57	Vine Mill	Oswaldtwistle	Partially	No		No
58	Roe Lee Mill	Blackburn	Demolished			
59	Whittaker's Mill	Helmshore	Extant			Yes
60	Lappet Mill	Calder Vale	Extant	No		No
61	Britannia Mill (New Line)	Bacup	Extant	Grade II	1434087	No
62	Moor Lane Mills	Lancaster	Extant	Grade II	383222 383221	No
63	Lomeshaye Bridge Mill	Nelson	Extant	No		No
64	Grane Mill	Haslingden	Extant	Grade II*	1429217	No
65	Holmes Mill	Clitheroe	Extant	Grade II	1413649	No
66	Ilex Mill	Rawtenstall	Extant	Grade II	185727	No
67	Moscow Mills	Oswaldtwistle	Extant	No		No
68	Hollin Bank Mill	Brierfield	Extant	No		No

Greater Manchester Mills

Numbers in the first column are used to note the location on the map on the final page

	Name	Location	Survival	Listed	Listing No
GM1	Brunswick Mill	Manchester	Extant	Grade II	1197807
GM2	Salford Twist Mill	Salford	Demolished		
GM3	Brownsfield Mill	Manchester	Extant	Grade II*	1207994
GM4	Bee Hive Mill	Manchester	Extant	Grade II*	388211
GM5	Chorlton New Mill	Manchester	Extant	Grade II	1197774
GM6	Orrels Mill	Stockport	Demolished		
GM7	Pear New Mill, Bredbury	Stockport	Extant	Grade II*	1240634
GM8	Swan Lane Mills	Bolton	Extant	Grade II*	1388070
GM9	Houldsworth's Mill	Stockport	Extant	Grade II*	1067171
GM10	Howe Bridge Mill	Manchester	Demolished		
GM11	Rutland Mill	Oldham	Demolished		
GM12	Cromer Ring Mill	Rochdale	Extant	No	No
GM13	Elk Mill	Oldham	Demolished		
GM14	Murray's Mills	Manchester	Extant	Grade II Grade II*	1220282 1282961 1270855 1247473 1200821
GM15	Tower Mill	Dukinfield	Extant	Grade II	1268070


Mills mentioned in the booklet (numbers on page 127-9)
Mill extant in 2011
Mills no longer existing in 2011
Greater Manchester Mills mentioned in the text (numbers on page 130)
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GM1
GM2
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The Textile Mills of Lancashire: The Legacy

This booklet details the fascinating history of the textile industry in Lancashire, one of the cradles of the Industrial Revolution, the sites that survive today, and what the future might hold for these iconic buildings.

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