

Avonside Ironworks, Bristol

John Cattell

Avonside Ironworks was an important mid-Victorian engine works established in 1837 by the engineer and proprietor of the Newark Foundry in Bath, Henry Stothert. A survey of the remaining buildings, which were unlisted and lay within the Bristol Urban Development Corporation area, was carried out by the Emergency Recording section of the Royal Commission on the Historical Monuments of England immediately prior to the clearance of the site in 1996. At that time the complex consisted of a long, two-storeyed erecting shop of c1837 with rubble walls and brick dressings, together with rubble and brick buildings of various dates which had been added to the western and northern sides of this original range. Other buildings dating from around 1860 survived to the north west and north east of the erecting shop.

Located in the St Philips area of Bristol immediately north of the Floating Harbour, the works produced locomotives and stationary engines for companies such as the Great Western Railway, as well as marine condensing engines, boats and other structures. From the early 1880s most of the site was used for paper manufacture, a usage which continued until recently.

The architectural development of the site was particularly difficult to unravel owing to alterations and rebuilding works associated with various changes in ownership and function. In addition to the erecting shop aligned approximately north east-south west (described here as north-south), were two smaller, parallel, ranges to the east, probably a boiler shop and smiths' shop, respectively, and separate buildings fronting Avon Street. By 1855 the northern end of the erecting shop was doubled in width and an unusual tensioning system employed to strengthen the arcade plate was inserted on the line of the original west wall. At the same time this area was reroofed with substantial queen-post trusses, and a three-storey range was constructed at its southern end cutting the erecting shop range in half. Also by 1855 the gap between the boiler shop and smiths' shop was infilled to form a single large range. By 1881 two new shops had been erected in the area to the north west of the erecting shop. Most of the east (boiler shop) range was demolished between 1884-1896.

The economic history of the works has been chronicled by Rolt (1964), Torrens (1978) and Davis, Harvey and Press (1988), and there seems little point going over this ground again. What follows, therefore, is an attempt to relate the physical development of the site and the functions of the various buildings to the fluctuating fortunes of the company. This is preceded by a description of the principal buildings at the time of site clearance.

History

The works were established in 1837 under the name of Henry Stothert & Co., presumably with an eye to building locomotives for the GWR, the construction of the railway having been approved by Act of Parliament in 1835. The western terminus, Temple Meads, was to be built immediately to the south of the works on the other side of the Floating Harbour. Initially, therefore, raw materials would have been transported to the site by water.

In early 1840 Stothert entered into partnership with Edward Slaughter who had worked as an assistant to Brunel at the Bristol end of the GWR, a connection that was to prove very important for the new partnership. Slaughter was taken on to manage the Bristol Works and see to the completion of new orders there, leaving Stothert free to concentrate on the Newark Foundry and his other interests. The new Bristol company operated under the name Stothert, Slaughter & Co. Two *Firefly* class broad gauge locomotives, *Arrow* and *Dart* were built by Stothert at the Bristol factory in 1840 to work the newly-opened Bristol-Bath section of the GWR. This order was followed by another from the GWR for six, smaller, "Sun" class locomotives. These were built during the second half of 1841. The business continued to expand and in June 1842 Stothert and Slaughter were paid £900 for the supply of 'fixed engines' at Swindon.¹ These were a pair of large, low pressure, engines which powered machinery in the fitting shop, the erecting shop and smiths' shops at the GWR's principal locomotive repair works.

The site on which the Avonside Ironworks was to be built in 1837 is shown on a map by Plumley and Ashmead of 1828 as consisting of a partially cultivated field bounded to the south west by Avon Street and to the north west by Little Avon Street. The latter led north-east off Avon Street at right angles and was a continuation of a lane connecting the Floating Harbour with Avon Street. To the north-east of Little Avon Street was an area of workers' housing, probably associated with Cooksons Bottle Works and other glass-making companies located in the strip of land between the Floating Harbour and Avon Street. On the other side of Little Avon Street was a building on the corner with Avon Street, possibly a public house, and further to the north east, two terraces of cottages. Stothert's works were to be built immediately to the rear (south east) of these cottages in the north-western two-thirds of the empty field. At the north-eastern end of the site was a Jews' Burial Ground, which still exists.

What is assumed to be the original layout of the works is shown in the title map of 1842 for the parish of St Philip and Jacob (fig 1). The site was bounded along its eastern side by a branch line of the Bristol & Gloucester Railway which ran across the field shown on the Plumley and Ashmead map cutting off the south-eastern third of the field.² This line ran from Temple Meads under the Great

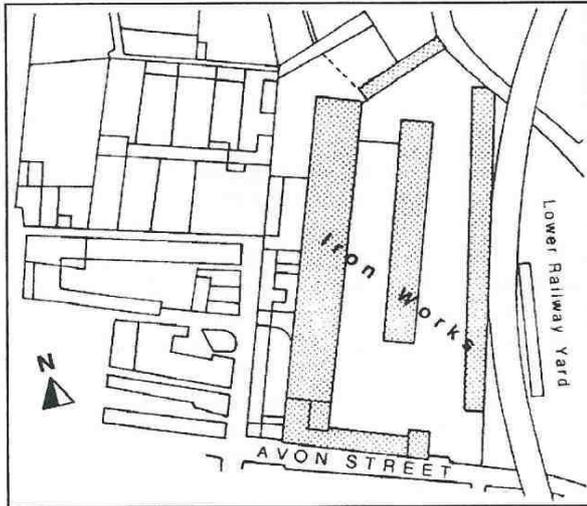


Fig 1 Extract from the tithe map for the Parish of St Philip and Jacob showing the Avonside Ironworks, 1842.

Western Railway before connecting with the main Bristol & Gloucester line north-east of the works site. In 1842 the area of the original field to the east of the branch line along with a tiny triangular piece of land adjoining Avon Street on the west side of the line was leased from the Bristol & Gloucester Railway Co by the Bristol & Birmingham Railway Co and used as a coal yard.

The works covered an area of 3 acres 6 roods and consisted of a long, at least partially two-storey range running north-south parallel to Little Avon Street. At its southern end it was abutted by a narrower range extending in an easterly direction along part of Avon Street. Further to the east, running parallel to the main north-south range was a smaller, narrower shop, and further still to the east, bordering the railway line, was a long, very narrow range.

The tithe map gives no clue as to the functions of the various buildings. However, based on comparisons with other engine-making and repair facilities of the time, there would have been an erecting shop, a fitting shop, a boiler shop and a smiths' shop containing smiths' hearths, as well as a beam-engine house and associated boiler to provide drive for the works machinery. The ground floor of the large shop nearest Little Avon Street was probably used for erecting, and the floor above, for fitting and turning. The middle shop may have been used as a boiler shop (this building was referred to as the boiler shop on a plan of 1881 in the Bristol Record Office), and the long thin range bordering the branch line was probably used as smiths' shops. The latter were usually housed in long thin ranges containing hearths in a linear arrangement.

A little more information about the works is contained in the diary of Edward Snell, a young relative of Henry Stothert's from Barnstaple who had completed his apprenticeship as an engineer at the Newark Foundry in Bath before arriving in Bristol on 21 May 1842 to take up employment with Stothert and Slaughter as a

draughtsman. Snell referred to the factory as the Avonside Iron Works. He met with Slaughter who, not being able to employ him as a draughtsman, put him to work in the erecting shop at a wage of 20/- per week. Snell describes being shown '...into a long shop with a locomotive engine & tender in it...'. This was almost certainly the long shop nearest Little Avon Street. Slaughter ran what was in Snell's view a tyrannical regime imposing severe fines on the workmen for the most minor of misdemeanours, including walking into the engine house, and putting a jar of coffee on the boiler to warm. After the friendly atmosphere he was used to at the Newark Foundry at Bath, Snell found it impossible to work at such an authoritarian establishment and he left just over three weeks later. Although severe by today's standards, Slaughter's managerial rule was probably not unusual for the time, a fact borne out by its description by Henry Stothert's son, John Lum Stothert as '...strict but admirable...'.³ Indeed it seems likely that Slaughter's tight management style and business acumen contributed considerably to the success of the works in the early years.

Major orders continued to flow in during the 1840s, including 14 locomotives for the London, Brighton and South Coast Railway from 1846-1848, and 10 passenger locomotives and eight goods engines built for the Bristol & Exeter Railway in 1849.⁴ The passenger trains were scaled-down versions of Daniel Gooch's *Iron Duke* class 4-2-2 tender engines. Stothert and Slaughter had also contracted to run trains on the newly-opened Bristol & Gloucester Railway in 1844, providing the locomotives, rolling stock and the various repair shops, carriage sheds and engine works, etc needed for the working of the line. It is thought that approximately 340 locomotives were produced for British and foreign companies at the Avonside Ironworks by 1856.⁵

Along with stationary engines such as that built to power the Swindon Works of the GWR, Stothert and Slaughter also manufactured small ships and marine engines. In 1844 the Company built two iron screw steamers to operate between Bristol and Newport in Gwent. According to Torrens these were probably the first screw-propelled vessels specially built for commercial trading in Bristol.⁶ In 1849 Slaughter patented a combined propeller engine, a type of marine condensing engine that was manufactured at the Avonside works. In 1852 Stothert and Slaughter established a separate ship building facility in Bristol by taking over the floating dock at the Hotwells.⁷ The dockyard enabled the company to manufacture much larger vessels and to considerably expand its business in this area. From 1854 the Hotwells operation was run by G.K. Stothert and E.T. Fripp.

The first major expansion of the Avonside Ironworks probably took place in the 1840s, possibly as early as 1844 to coincide with the large order from the Bristol & Gloucester Railway Co. This first phase of expansion was certainly completed by 1855, the date of a detailed 1 in to 50 ft (1:600) plan of the area by George Ashmead showing the works (fig 2). By comparing the Ashmead

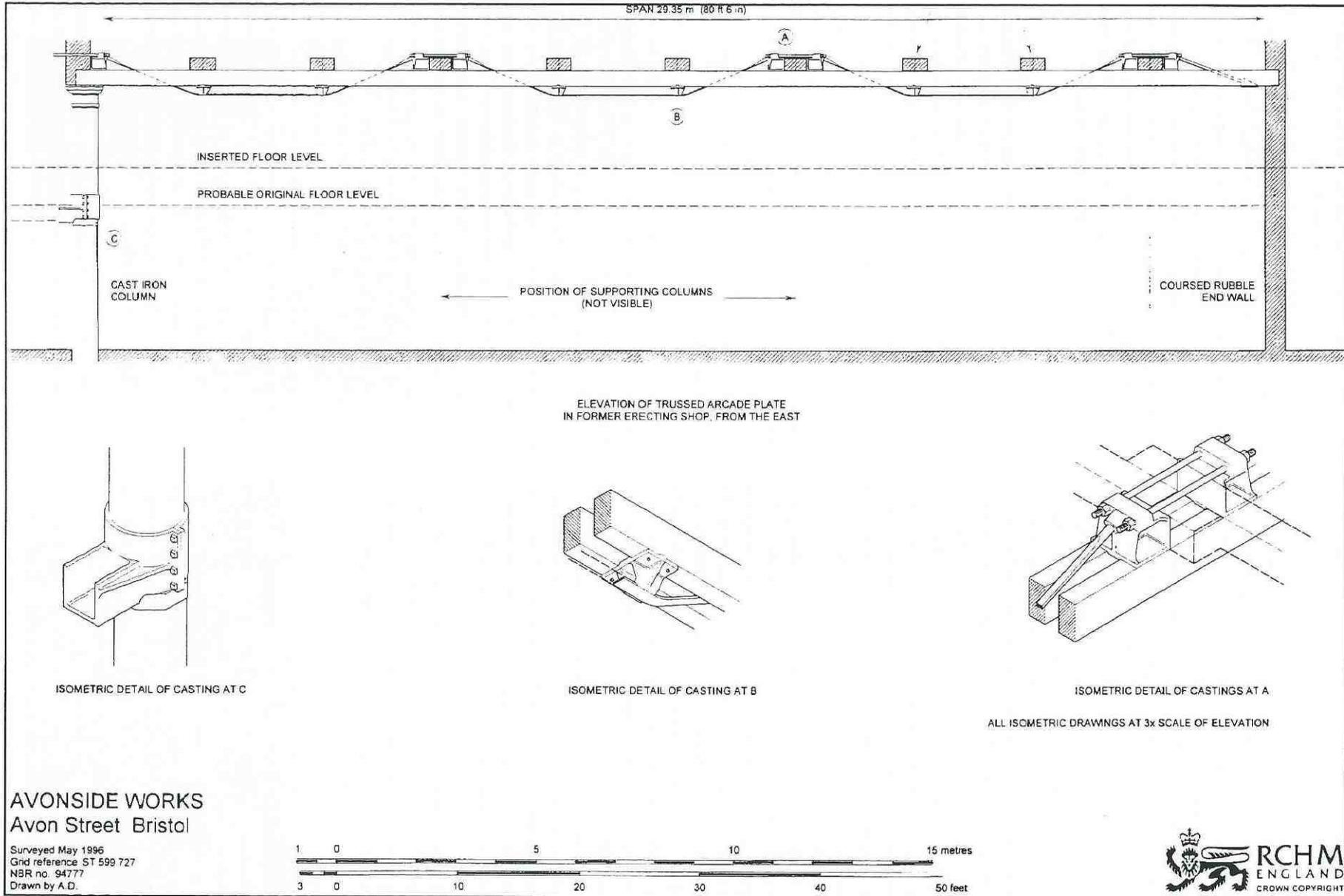


Fig 3 Elevation of the trussed arcade plate in the former erecting shop, from the east, and isometric details

map with the 1842 tithe map and by taking into account the physical evidence in the surviving buildings, it is possible to obtain a fairly clear impression of developments.

There appears to have been a need for more erecting space to supplement that which existed on the ground floor in the long west shop. The solution to this involved widening the northern half of the original erecting shop in a westerly direction. The new west wall of the widened shop was constructed on the pier-and-panel principle similar to that employed by Brunel at the Swindon Works in 1841-2. The extended west section, which was the same width as the original, was unfloored allowing for the erection of large engines, and possibly small ships as well as the installation of an overhead travelling crane. In order to allow for machinery and engines to be moved from the old part of the erecting shop to the extended section it was necessary to remove the original west wall and possibly the first floor of the erecting shop and replace it by an arcade supported on cast-iron columns. The number of columns was limited to three in order to cause minimum disruption to the floor space. This created the problem of how to support an arcade plate of approximately 30 m in length and two parallel sections of roof on just three columns without the arcade plate sagging in the unsupported areas between them. The solution was to tension the arcade plate along its length in order to hold it rigid. Every third series of beam ends for the two roofs was set between cast-iron boxes which were joined by hand forged rods that could be tightened by means of doing up bolts on the outside of each box. From each box rods which were partly hand-forged passed over and under the arcade plate along its length. By tightening the bolts along its length the arcade plate could be held in tension. Beam ends of trusses between those held between the boxes simply sat on top of the arcade plate. The whole arrangement, which amounted to an ingenious solution to a local engineering problem, is shown in fig 3.

At the same time as the arcade was created the roof in the northern section of the original two-storey erecting/fitting shop range was removed and the two sections, the new and the old, were each reroofed with identical and substantial wooden queen-post roofs of 11 m span. These new roofs were structurally integrated with the tensioned arcade plate and are quite clearly part of the same phase of alterations. Probably also part of this phase was the construction of a three-storey, rubble-stone range across the southern end of the arcaded section of the erecting shop at right angles. This probably contained a beam engine and boilers replacing an earlier engine house, the original location of which is unknown. The new engine house and boilers would have provided the additional power required by the major expansion of the works.

The 1855 Ashmead plan shows that by that time the putative boiler shop range had been extended to the north and widened on its eastern side to incorporate the smiths' shops bordering the branch line. The boiler shop must have been at least two storeys in height as it was

connected at first floor level to the upper floor of the erecting shop by means of a wide bridge. Also by 1855 there had been some widening of the original erecting shop range north of the arcaded area. Other alterations included the remodelling of the eastern end of the range fronting Avon Street and the construction of a small rectangular building, possibly a grinding house, in the yard to the south of the three-storey range between the erecting shop and the office and cottages adjoining Little Avon Street.⁸ It is not known whether all of these alterations were carried out at the same time as the widening and reroofing of the northern part of the erecting shop range and the construction of the new engine house or whether they were completed over several years prior to 1855.

The business continued to grow throughout the 1850s and '60s, and in 1856, with the entry of Henry Gruning into the partnership, the company became Slaughter, Gruning & Co. Henry Stothert had retired in 1852 but John Lum Stothert retained a financial interest in the Avonside works.⁹ In 1864 the company became known as the Avonside Engine Co Ltd. A large number of locomotives was produced during these years, and there were many orders from other countries.¹⁰ The increase in foreign orders brought about largely as a result of Slaughter's efforts was vital to offset domestic competition from railway companies who were building up their own locomotive manufacturing facilities at the expense of private manufacturers like Avonside.

Ashmead's map of 1855 was revised in 1874 (fig 4) and a comparison of the two reveals relatively few changes over the intervening period. There was in fact little room left on the original site for expansion. However by 1874 a field at the end of Little Avon Street in the area to the north-west of the works had been purchased by the company and what was probably a machine shop had been erected across the northern end of the new plot. This shop was a tall building with top lighting. This method of lighting was necessary since four square-shaped buildings of differing heights and uncertain function were built against the southern wall of the new shop and the north and west gable walls were blind. A turntable allowed for bogies to be taken into the machine shop via a wide doorway near its south-west corner. This new building may have been complete by 1861 as in that year Slaughter informed Gooch that he now had improved facilities for making goods engines.¹¹ The 1874 map reveals that there was an intention to build a shop extending out from the erecting shop at right angles across the southern third of the new plot, in preparation for which four cottages at the northern end of Avonside terrace had been demolished.

The 1874 map also shows that there had been some rebuilding of the small shops in the wedge-shaped part of the site between the the new machine shop and the Jewish Burial Ground. The only other alteration of note involved the extension of the boiler shop into the point of land formed by the intersection of the extended burial ground



Fig 2 Part of Ashmead's map of 1855, original scale 1:600, showing the Avonside Ironworks site (reproduced with the kind permission of the Bristol Record Office).

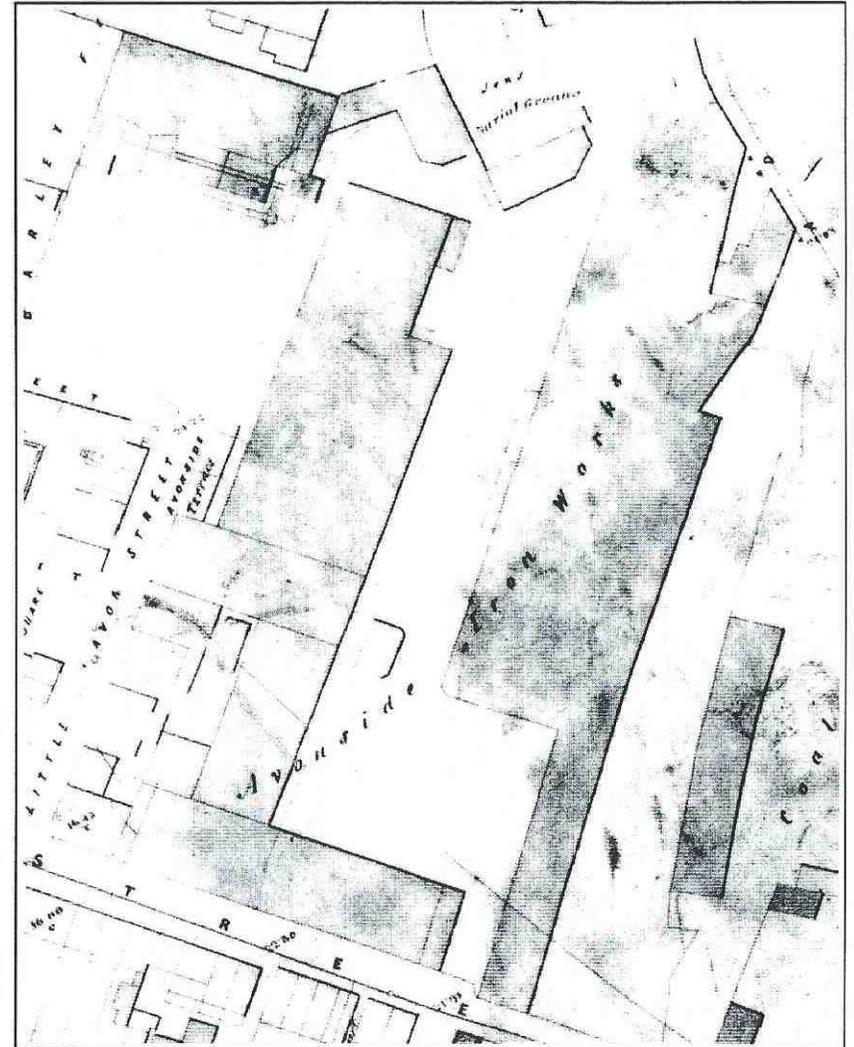


Fig 4 Part of Ashmead's map of 1874, original scale 1:600, showing the Avonside Ironworks site (reproduced with the kind permission of the Bristol Record Office).

with Barton Road at the north east of the site.

Slaughter was forced to retire as managing director in 1874 owing to ill-health, and by the end of the decade a recession in the railway manufacturing industry proved too much for the company despite a late surge in foreign orders. The company went into liquidation in 1881 and the site was sold to the paper manufacturer John Mardon. In the following year the machinery, patterns and spares¹² were purchased by the rival Bristol engine maker. Edwin Walker of Fox, Walker & Co who leased the northern part of the site and built smaller locomotives in reduced quantities. The new company was named the Avonside Engine Co.

However, earlier, in 1881, a number of large foreign orders had necessitated some expansion for in January of that year plans for the extension to the erecting shop first mooted in 1874 were sent to Bristol City Council for approval by the old company. The new erecting shop would appear to have been built shortly afterwards - it was certainly in existence by the time of the survey for the First Edition 1:500 OS plan in 1884. It was subsequently demolished and rebuilt.

The new erecting shop was a tall brick structure with full-height arched windows along its side walls. According to a drawn section accompanying the planning application it was to have a convex, corrugated-iron roof with light metal trusses. However, a Goad Fire Insurance plan of 1896 (fig 5) shows the building having a more traditional type of pitched roof with a central louvred clerestory. By that time the building had been converted to a two-and-one-half-storey paper warehouse and it is possible that the walls were heightened and a new roof provided as part of the change in use.

The 1881 plan shows that the new erecting shop was provided with two pits running the length of the side walls between which was a section of track which continued through the double width old erecting shop to 20 ft and 12 ft turntables positioned immediately outside the east wall of the latter. Thus, it was possible to take locomotives or their component parts from the yard between the boiler and erecting shops through to the new erecting shop. The site plan accompanying the 1881 application is helpful in that it provides more detailed information about some of the other buildings that was not readily available from a study of earlier block plans. We learn, for example, that the buildings -probably single storey- attached to the northern end of the old erecting shop contained three smaller shops, each approximately square in plan, that the part of the original erecting shop on the south side of the transverse three-storey range was in use as a boring mill, and that the range fronting Avon Street had been

extended to the north by approximately double its original width to form a marine shop.

The 1:500 OS plan surveyed in 1884 shows that there had been few changes to the buildings, the main alterations being the demolition of the range of buildings attached to the northern end of the double-width erecting shop, and their rebuilding on a reduced scale in plan, further extension of the wedge-shaped building attached to the east end of the pre-1874 machine shop, and the construction of what appear to have been boilers and a chimney in the yard to the south of the three-storey transverse range in the centre of the original erecting shop. A new shop had also been built on the north side of the entrance to this yard in the place of cottages.

Between Walker's occupation of the northern part in 1882 and the completion of the Goad plan in 1896 the site underwent an extensive transformation. The Avonside Engine Works is shown having retreated to occupy the pre-1874 machine shop and the small shops attached to its southern side on part of the former Barley Field, along with the wedge-shaped building at its eastern end, and a new tank and packing shop built against the northern wall of the 1881 new erecting shop. The tank shop was of the same proportions as the latter and had a roof made up

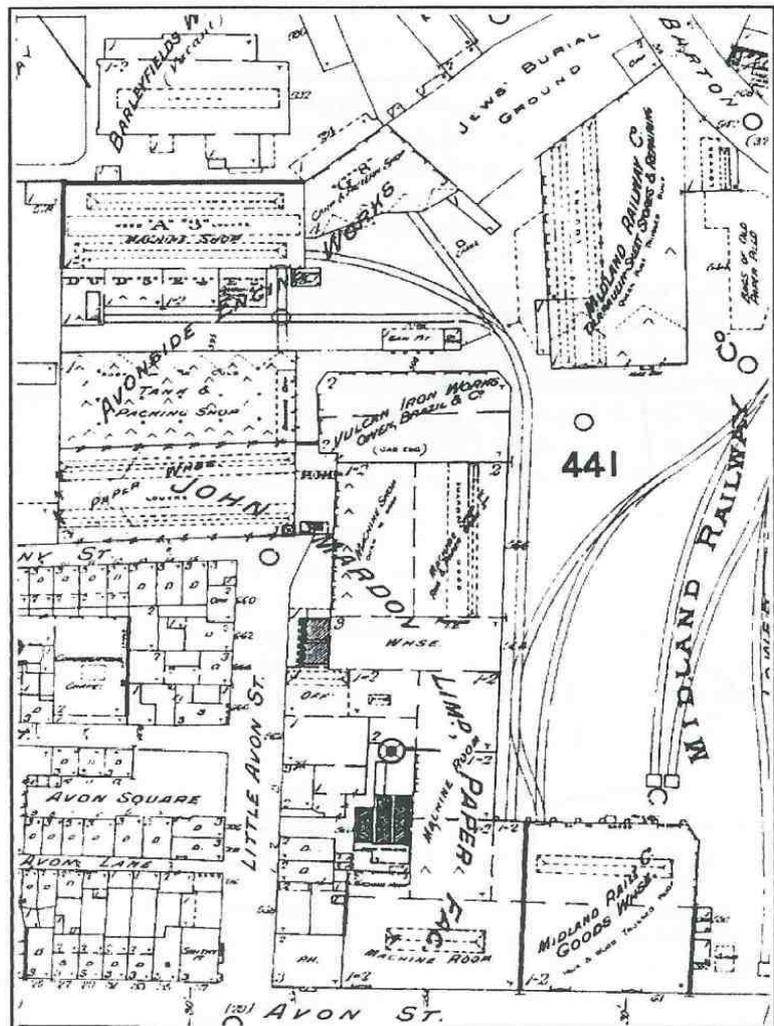


Fig 5 Goad Fire Insurance Plan, 1896

of small transverse gables supported on iron columns. With just three shops of very modest size the output of the works must have been minuscule and it seems likely that the company worked on engines partly constructed on other sites.

The new erecting shop and nearly all of the original erecting shop range were by that time owned and operated by the paper manufacturer John Mardon Ltd. The upper floor of the northern part of the original erecting shop range was used as a rag and paper store and part of the three-storey former engine house converted to a warehouse. Two boilers, which may pre-date the conversion of the building to a warehouse, are shown attached to the west end of the latter. The double boiler in the yard to the south of the warehouse was extended to help provide the extra amount of steam required for paper making. The engine associated with this boiler was probably located on its southern side as there are cast-iron plates, bolts and grease stains in this area. Also, the upper floor of the part of the original erecting shop range to the south of the warehouse was stripped out to form one large machine shop open to the roof, although, again, this stripping out may have occurred at an earlier date.

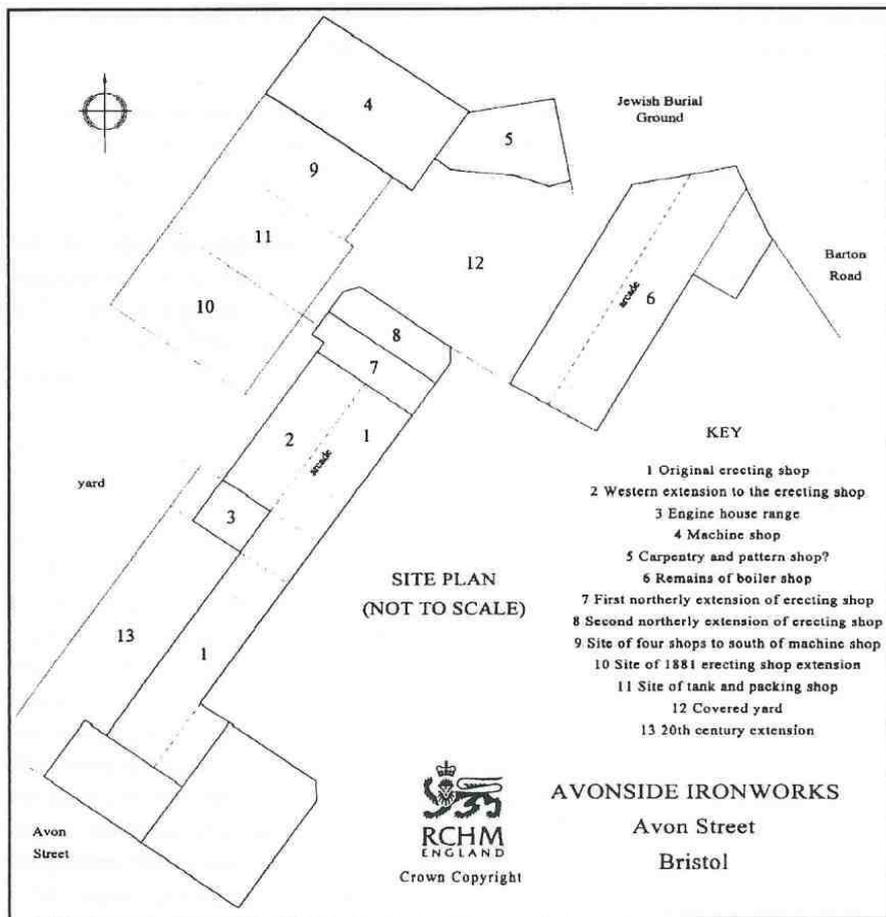
A third company, Owen, Brazil & Co's Vulcan Iron Works, a small gas engineering works, occupied two parallel, two-storey, ranges built across the end of the double-width former erecting shop range. The more southerly of the two may have been a remodelling of the range built in the same position between 1874 and 1884.

Also by 1896 the whole eastern half of the site was sold or leased to the Midland Railway Company.¹³ It demolished the large range incorporating the original boiler and smiths' shops and built new tarpaulin-sheet stores and a repairing shed in the area formerly occupied by the northern part of the original range. It is likely that some parts of the earlier building were incorporated in the later ranges (see below). The Midland Railway Company also took over the former marine shop adjoining Avon Street, using it as a goods warehouse. This part of the building was described on the Goad plan as having an 'iron and wood trussed roof'

The Avonside Engine Works continued to operate from its base at the north-western corner of the site until 1905 when it moved its operations to a new works at Filwood Road, Fishponds. The company continued in business there until 1934 when it went into liquidation.¹⁴ The goodwill, drawings and patterns were subsequently purchased by the Hunslet Engine Company. The greater part of the St Philips site became known as the Avonside Paper Mills, and paper bags and corrugated cardboard continued to be made there until the 1970s. The last occupant of the site was West House Transport who used it as a vehicle depot.

Description

In this section, the structures are keyed to a block plan (fig 6) by an emboldened number in brackets.



Phase 1: c.1837-8

In 1996 the only surviving fabric associated with the first phase was the greater part of the east wall of the long west (erecting shop) range (1) and part of the west wall of this range south of the three-storey engine house. These sections of wall were made of blue-grey lias random rubble and were extensively patched with stones of various types, brick and concrete block. Originally this range had two storeys. The evidence for this was visible at the southern end of the east wall where there were the remains of a wide arched door at ground level and an identical opening above it at first-floor height. The surrounds of these doorways were formed of large, squared and dressed, blocks of yellow and pink-coloured stone. It is not clear how the upper opening was accessed as there were no indications of the former presence of a hoist or a ramp in this position. The walls of the erecting shop range had been so heavily patched that it was virtually impossible to

Fig 6 Site plan, April 1996 (not to scale)



Partially rebuilt remains of the extended boiler shop range, from the south [BB96/5274 Crown Copyright, RCHME]

distinguish the positions of the original windows. However, it appears that there were originally windows at both levels, each having shallow arches made up of two rows of red-brick headers and brick sills.

Inside the northern end of the range, embedded in the east wall, were stone corbels set 330cm above ground level. These supported the ends of the original first-floor beams. The stub ends of these beams, or possibly those of a slightly later phase, projected out from later brick piers on the west side of the range. The western ends of these beams would originally have been supported on similar corbels or been embedded in the original west wall which was removed possibly along with the first floor to create the arcade during the second phase of alterations. In the twentieth century an upper floor was re-inserted at a level approximately one metre above that of the original.

Phase 2: 1842-1854

The widened northern third of the original erecting shop (2), the inserted arcade and the queen-post roofs associated with this phase survived *in situ*. Part of the pier-and-panel west wall of the western extension to the erecting shop was visible from the entrance yard. The northern part of this wall survived behind later additions. This western extension built prior to 1855 was of the same height as the original erecting shop but open to the roof. It was lit by tall windows, possibly contained within wooden panels placed between the stone piers. These panels had been largely replaced by brick infill except in

the north-east corner of the yard where a multi-paned section of glazing was visible.

The queen-post roofs were supported on the masonry side walls and the central arcade plate. The beam ends at the east end of the original range began to fail at a fairly early stage and were supported by inserted storey posts. Some of the beam ends supported on the arcade plate had also rotted and a steel girder had been inserted in recent years close to the east side of the plate to help support them. The ends of the tie beams and principals were held in position by iron straps. At the bottom of the straps were castings formerly housing tie-rods. These were suspended under the soffit of each beam and provided lateral tensioning, fully integrated with that along the trussed arcade plate. To either side of the battered queen posts were iron straps which, passing under the tie, extended up to an iron casting housing the top end of the post, and the ends of the straining beams and principals. Wooden pads were placed between the queen-post straps and the soffits of the tie-beam to prevent any damage to the latter. This system of strapping was intended to prevent the tie-beams sagging across the 11m span of each truss. Originally, the centre of each straining beam supported a king-post with a king-rod running down its centre which was bolted on the soffit of the beam. This arrangement survived in the roof to the west of the arcade plate. There were principals of smaller scantling above the straining beam with tenoned purlins. A continuous timber-framed clerestory was created in the same position east of the arcade plate,

but the presence of holes in the soffits at the centre of the straining beams was evidence of the former existence of king-posts in this position. The clerestory over the east range must therefore have been a later addition.

East of the arcade plate a partition had been inserted fairly recently under one of the trusses that bisected the area between the three-storey transverse range and the position of the original north gable-end wall. South of this central partition the trusses had been cut away and the masonry east wall replaced with brickwork at first floor level. Modern angle-iron trusses supported the roof in this area but the stub ends of the wooden tie-beams and the arcade plate arrangement survived.

The original first floor in the northern half of the east range may have been removed with the widening of the erecting shop prior to 1855. This would have been a logical step as larger locomotives and other structures could then have been erected in this part of the range. However, the stub ends of the girding beam on the line of the arcade, and the remains of the joists, may have formed part of the original first floor. The beam and joist ends may simply have been cut back and slotted into castings affixed to the cast-iron columns inserted to carry the arcade. One of these columns and a casting to carry the end of the girding beam was visible at the point where the arcade intersects with the three-storey cross range (see detail of casting at C in fig 3). Another possibility is that the first floor was removed and then reinserted in 1880 or earlier before being removed again. The brickwork around the cast-iron columns supporting the arcade is thought to date from after January 1881, as the ground plan of that date appears not to show the brick piers. The ends of the girding and tie-beams had been truncated to respect the inserted brickwork therefore the original first floor or slightly later reinserted floor must have been removed after 1881.

The three-storey range (3) built across the southern end of the northern half of the erecting shop range probably formed part of phase 2. Originally it ran across the full width of the widened erecting shop; its east gable wall was aligned with the main east wall of the 1837-8 erecting shop range and its west gable wall with the pier-and-panel section (see the 1855 Ashrhead plan). The external wall of the south side of the western half of the three-storey range survived in 1996. It was of random lias rubble construction and had four windows at first- and second-floor levels, all with brick headers. These had all been blocked up. The easternmost window at first floor-level had been cut down to form a taking-in door before being blocked. There was a wide, shallow-arched doorway, subsequently blocked, in the centre of the western half of the range at ground-floor level. This had dressed-stone surrounds and was almost certainly an original opening. It would have provided access to the beam engine, probably originally housed in the western half of the range, from the yard to the south. There were later doorways, also blocked, on either side of the central opening. These were probably windows that had

subsequently been cut down. Near the west end of the southern elevation between the the ground and first floors was a narrow opening (now blocked) with surrounds of dressed limestone which probably allowed for the provision of a belt drive to a small workshop formerly in this position.

The north and west walls of the western half of the three-storey range were also visible at ground level. The north wall had been much altered by the insertion of large square openings which had subsequently been bricked up. The reason for these openings is unknown, however it is possible that they were created to allow shafting to pass through the wall between the putative engine house and the western erecting shop extension. The west wall originally had two, low, arched openings which presumably allowed for the connection of the boilers on the west side of the wall with the engine house. These openings, one of which was still visible from inside the range, had dressed stone surrounds similar to those of the doorway on the south side of the range. This would suggest they were an original feature and that the boilers that existed on the west side of the gable wall were contemporary with the range itself. There were flat-arched openings of the same width with stone dressings, above the arched ones. These appeared to be coeval with the openings below.

There is evidence to suggest that at second-floor level the eastern half of the engine-house range oversailed the erecting shop range of c1837. The oversailing second-floor walling over the eastern section had been removed with the construction in recent years of a roof running north-south at a lower level. The truncated east end at second-floor level was clad with corrugated-iron sheets. Below the oversail the ground and first floors ran across the western half of the three-storey range on their original north-south alignment. The tensioned arcade plate seems to have continued on the same alignment across the middle of the cross range to intersect at the point at which the south wall of the range met the original west wall of the erecting shop (see fig 3). There was a masonry pier at this point that probably supported the southern end of the arcade plate. The southern end of the girding beam, below, may have been embedded into the pier also.

Phase 3: 1855-1874

The machine shop (4) built during this period on pan of the field at the north-west corner of the site survived, although in much-altered form. The roof was in its original state and consisted of a narrow wooden louvre running the length of the apex and continuous skylights lower down the slope of the roof to either side. The roof was carried on metal trusses with I-section principals and angle-iron queen-posts and struts. The bottom ends of the latter were attached to elaborate cylindrical castings. Into these castings were bolted the ends of single wrought-iron tie-rods connecting with the wall plate. Two rods ran between the castings, in the area between the queen-posts. Additional diagonal rods ran from the castings to the apex.

Heavily patched east wall of the original erecting shop. The gabled roof behind the range closest to the camera near the centre of the picture is part of the engine house cross range. [BB96/5273 - Crown Copyright, RCHME]



Queen-post trussed roof over the northern end of the c1837 erecting shop range. The scarred section of wall on the left of the picture marks the position of the original gable end wall. [BB96/5241 - Crown Copyright, RCHME]



South wall of the engine house cross range showing its intersection with a partially rebuilt section of the west wall [BB96/5263 - Crown Copyright, RCHME]

Also during this period three small buildings between the machine shop and the Jewish Burial Ground were linked together and extended to form a V-shaped range (5) of unknown function. By 1884 the arms of the V had been infilled giving the building an even more unusual plan. The building remained in this form at the time of survey. It was a three-storey lias rubble structure with red brick dressings and roof consisting of wooden queen-post trusses orientated at various angles. The presence of what was probably an original taking-in door and hoist at first-floor level on the north-western elevation suggests that there was an entrance to the site from that direction or that the Barleyfields Works in this area were in some way connected with Avonside. In 1896 the building was described as a carpentry and pattern shop.

The first and second floors in the western half of the three-storey engine house were probably inserted in the 1860s or 1870s. On the south side of the range some or the ends of substantial wooden beams supporting the first floor were embedded into the wall very close to the original window heads. Sections of iron beams were inserted into the masonry under the beam ends to provide extra support. If, as is likely, a beam engine(s) originally occupied this space it would probably have extended in height through the equivalent of two floors, providing further support for the argument that the floor was inserted at a later stage. Furthermore, cast-iron columns supporting the first-floor beams in the middle of the ground floor were inscribed 'G K Stothert & Co'. They were made at the Hotwells factory and must have dated from after c1865 when the company there began trading under that name.

The original engine seems to have been replaced by a horizontal one, possibly a horizontal compound engine of the type made by the Avonside Engine Company Ltd from at least 1877. Stone blocks on which a horizontal engine sat survived at the south-west corner of the range.

The second floor was quite clearly an insertion, as the beam ends along the north wall were not embedded in the wall but rest on free-standing cast-iron columns positioned close to the wall. These columns were possibly reused from elsewhere, and had to be modified to fit into their new position.

Phase 4: 1874-1896

The eastern range (putative boiler shop) was extended in a north-easterly direction prior to 1874, and between 1884 and 1896 all of the range was demolished. with the exception, possibly, of the northern end (6). The 1896 plan shows a range used by the Midland Railway Co for 'tarpaulin sheet stores and repairing' covering much of the space formerly occupied by the northern third of the earlier building. This Midland building consisted of three parallel ranges arranged north east-south west. The western and north-western walls, along with the north-eastern and truncated eastern walls of the later building were on the same footprint as the 1855-1874 extension to the earlier range. These walls were largely of rubble with

brick lintels and headers and seem to have been part of the pre-1874 phase. The southern elevation and the section of wall to the south of the original, truncated, easternmost range, were constructed between 1884-1896 and were in brick.

The roofs of at least two of the three ranges were consistent with a date of before 1874 (it was not possible to view the roof of the truncated easternmost range). The middle range had wooden queen-post trusses of c1860 date with similar castings at the tops of the queen-posts to those utilised in the pre-1855 roofs over the northern part of the erecting shop. Wrought-iron rods were used to provide extra strengthening instead of cast-iron strapping. This part of the original extension pre-dated the west range which had a slightly later type of roof similar in form and materials to that used in the pre-1874 machine shop, but without the angle-iron queen-posts. Also, on the line of the arcade between the middle and west ranges there were two surviving sections of rubble walling, indicating that the arcade was inserted in the place of an external wall and that the western range was therefore a later addition. Between the middle range and the remains of the eastern range, representing perhaps another phase in the extension of the putative boiler shop, were the remnants of a trussed arcade plate supported on cast-iron columns similar to that inserted in the erecting shop.

The only other buildings surviving from this period were the two, two-storey extensions built at the northern end of the widened erecting shop. The earliest of these (7), which may have been an adaptation of a pre-1884 single-storey building in the same position, was built against the masonry north gable ends of the parallel ranges forming the widened erecting shop and in line with them. The east wall was made up of two brick sections, subsequently rendered, with, blocked, full-height windows to either side of a weatherboarded panel containing glazing. The tall windows may suggest that the extension was originally open to the roof. However, by 1896 it incorporated two storeys. The roof consisted of two hipped sections each incorporating a single composite truss with a wrought-iron tie-rod, king-rod and timber struts. The gable wall between the erecting shop range and the extension was removed and replaced by two angle-iron trusses. The surviving original gable at the north end of the western extension to the erecting shop was of rubble construction and it originally had a large brick-dressed circular opening (subsequently blocked) near the apex. A second northerly extension (8) was added to the first prior to 1896. It was orientated at right angles to the earlier extension and was roofed with machine-sawn king-post trusses.

Phase 5: Post-1896 alterations

The use of much of the site for paper making from the early 1880s engendered many alterations to the buildings and only the most important changes are described here. The machine shop at the north-western corner of the site

was floored at some stage after 1896 (possibly after 1904 when the Avonside works were moved to another site) and a high ground-floor space created for manufacturing. The low first-floor space was probably used for storage of light-weight materials. The inserted floor was carried on slender cast-iron columns. About one third of the way up each column were flanges, presumably to take staging associated with the paper-making process. The four small shops attached to the southern wall of the machine shop were demolished and replaced by a large two-storey shop (9). Large arched openings were cut into the south wall of the machine shop to allow goods to be moved between the two ranges. To the south of this the 1881 erecting shop extension was demolished and replaced (10). The tank and packing shop (11) on the north side of this also appears to have been rebuilt. Also, the yard to the east of this range of buildings, bounded by the carpentry and pattern shop, the Jews Burial Ground, the Midland Railway Co sheds and the extensions to the erecting shop, was roofed over with metal trusses in the twentieth century (12).

A concrete first floor was inserted in recent years in the widened northern section of the erecting shop to form a high ground-floor space and modern offices were built above this. The northern end walls of the erecting shop were removed at ground-floor level to incorporate the space originally forming part of the two extensions made prior to 1896. South of the three-storey (engine house) range, the original erecting shop had its first floor removed and its roof replaced by angle-iron trusses resting on inserted brick corbels.

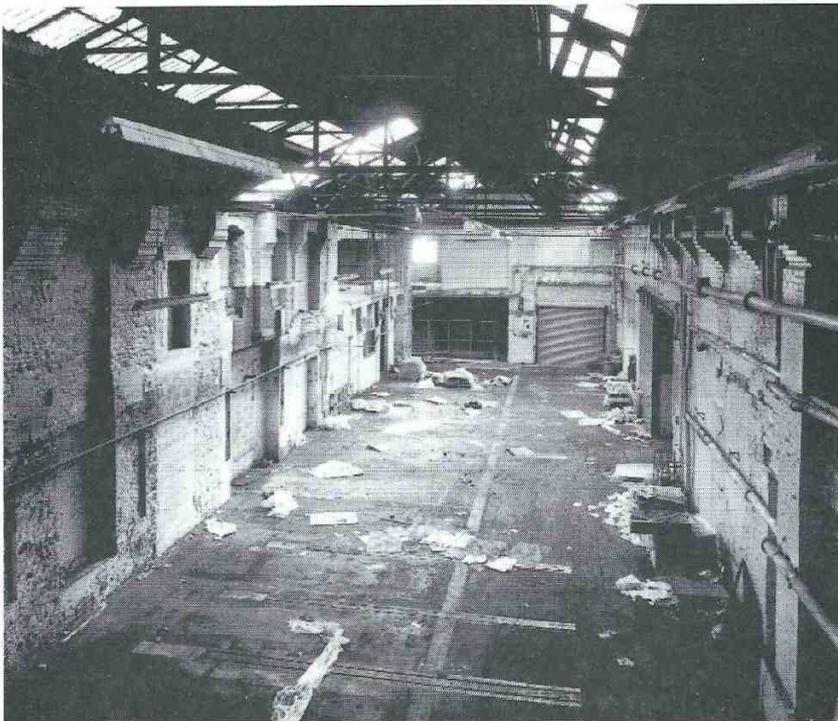
Acknowledgements

The author and editor wish to thank the following colleagues in RCHE for their assistance: Alan Stoyel and Keith Falconer

(with investigation), Peter Williams and James Davies (for site and record photography) and Andy Donald (for the elevational drawing). They are also grateful to Paul Stephens and Mike Chapman for their assistance in the preparation of this article for publication, and to the Bristol Record Office for their permission to reproduce parts of the 1855 and 1874 Ashmead maps.

References

- 1 Cattell, J. and Falconer, K., *Swindon: the Legacy of a Railway Town* (1995) 27.
- 2 This line was built by the Bristol & Gloucestershire Railway (incorporated in 1828) and opened on 6th August 1835. It ran from Bristol (Cuckold's Pill) to Westerleigh (Coal-Pit Heath). The company changed its name to the Bristol & Gloucester Railway in 1839.
- 3 Davis, P, Harvey, C. and Press, J. 1988, 'Locomotive Building in Bristol in the Age of Steam, 1837-1958'. in *Studies in the Business History of Bristol*, Harvey, C.E. and Press, J., ed. (Bristol, 1988) 112.
- 4 Torrens, H., *The evolution of a Family Firm: Stothert and Pitt of Bath* (Bath, 1978) 39.
- 5 Lowe, J.W., *British Steam Locomotive Builders* (Cambridge, 1975) 621.
- 6 Torrens, note 4, 43.
- 7 *Ibid*, 44.
- 8 Ashlar gate piers possibly marking the position of an entrance to this yard from Little Avon Street survived at the time of survey.
- 9 Torrens, note 4, 40.
- 10 Rolt, L.T.C., *A Hunslet Hundred* (Newton Abbot, 1964) provides more information on foreign orders.
- 11 Davis, note 3, 114.
- 12 *Ibid*, 127.
- 13 The Midland Railway absorbed the Bristol & Gloucester Railway in 1846.
- 14 Rolt, note 10, 115.



General view of the southern section of the original erecting shop from the former engine house cross range [BB96/5263 - Crown Copyright, RCHME]