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Hampshire Industrial Archaeology Society

Journal



No. 10

2002

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Cover photo: Harbour Board Office & Floating Dock, Southampton
'Majestic', launched 1914 by Blohm & Voss, Hamburg as the 'Bismarck' for Hamburg-America Line, remained uncompleted during WWI. Completion recommenced in 1919 under British supervision but considerably delayed by fire. Handed over to White Star Line in 1921 and completed in March 1922, was the largest ship in the world at that time. Renamed 'Majestic', maiden voyage was May 10 1922 Southampton to New York. Withdrawn 1936.
(Sologlaze Series/7109: E A Sweetman & Sons, Tunbridge Wells)

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HIAS Publications ..... inside back cover

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The Contributors

Dr Edwin Course
Dr Course is the founder of the Southampton University Industrial Archaeology Group and one of the original members of the Twyford Waterworks Trust. It is his work as archivist at Twyford that brought him into contact with the work of Baldwin Latham.

David Ebert and Steven Trick
Dave Ebert and Steve Trick were studying for their Masters degrees in Archaeology at Southampton University and, in 1998 as part of their course, conducted a geophysical survey of the site of the former Highfield Tramway Depot which was in the grounds of the university's Avenue Campus. Both are now studying for their doctorates – Steve at Cardiff University and Dave in Canada.

Martin Gregory
Martin Gregory's interest in the history of steam and the steam engine goes back over 40 years. It has led him to research and build models of many varieties of steam plant. He has been a member of SUIAG/HIAS for over 30 years and also works on the history of Stirling Engines and Sewing Machines.

Jeff Pain
Jeff Pain has been a member of the IA group since the early days in the 1960s. He was born in Southampton and, apart from wartime, has always lived and worked in the area. Educated at Taunton's School, he followed his father into the shipping world, being employed in Freight, Passenger and Ship Agency disciplines. Later, when these spheres collapsed, he spent the last 20 years or so with Pirelli, first at Southampton and, when that closed, at Eastleigh. His main interests have always been in transport covering ships, railways and aircraft, with road interest limited to trams and buses.

Ray Riley
Ray Riley's interest in industrial archaeology derived from his doctorate on Belgian coalmining. He has taught the subject for over 30 years at Portsmouth University and has published articles on a range of topics including Portsmouth dockyard, Portsmouth corn milling, Lódz (Poland) textile mills, and Upper Silesian coalmines. He is currently Associate Director of the Institute of Maritime and Heritage Studies, Portsmouth University.

Hampshire Industrial Archaeology Society

(formerly Southampton University Industrial Archaeology Group)

Journal

Editorial and Acknowledgements

Welcome to the tenth edition of our *Journal*. The year 2001-2002 has seen many changes. The Southampton University Industrial Archaeology Group has become the Hampshire Industrial Archaeology Society and has moved to a new home away from Southampton University. The journal has become the *Hampshire Industrial Archaeology Society Journal* though continuity has been maintained by making this volume ten in the existing series. The *Journal* was started by Dr. Edwin Course in 1992 and it is to him, as founder editor from 1992 to 2001, that its high reputation is due. We welcome his continued involvement in writing for it. The *Journal* now has a new editor in Martin Gregory who has been a frequent contributor to previous volumes. Its continued success depends on the work of members of the Society.

This year's contributions all relate to Hampshire and all but one are written by members. Professor Ray Riley's article compares Portsmouth where he lives and works with Liverpool where he grew up. The article on the Tram Depot in Highfield Road illustrates how quickly a structure, known to many of the older members of the Society, can disappear and become the subject of a modern archaeology project for students at Southampton University. It shows the use of modern techniques in searching for remains from a mere thirty years ago. Jeff Pain's article on the floating dock used in Southampton docks in the 1920s and 1930s shows what a wealth of information can be derived from commercial postcards of the period. Dr. Edwin Course's article on Baldwin Latham researches a well known water engineer of a century ago whilst Martin Gregory reviews the pumping equipment of the period.

We thank all who have contributed to compiling this edition of the Journal. In particular we thank Angela Smith for the expert design and typesetting of this volume. Acknowledgements and thanks for the provision of illustrations are made as follows:-
Philip Brannon's *Picture of Southampton* [pub. 1850] (Fig 4b); David Ebert/Steven Trick (Figs 14, 16 – 18); Dr Edwin Course (Fig 32); Martin Gregory (Figs 33 – 38, 40 – 50); Ordnance Survey (Figs 4a, 5, 7, 13, 15, 19); Jeff Pain (front cover, Figs 20 – 32); Ray Riley (Figs 1, 2); Angela Smith (figs 3, 12); Nigel Smith collection (Figs 6a, 6b, 8 – 11); Tony Yoward (Fig 39).

Martin Gregory
April 2002

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Naval and Commercial Port Infrastructure : Portsmouth and Liverpool Compared

Introduction

It's not until you travel to another place, be it town or country, that you realise the distinctiveness of one's own environment. As a boy growing up in Liverpool I'd never seen armies of people wearing clogs until I ventured to Wigan collecting bus tickets, nor had I cast eyes upon vast red brick cotton mills prior to visits to Manchester to sneak into the LNER depot at Gorton. And a really distant trip to Huddersfield revealed grim millstone grit woollen mills punctuating the Colne valley all the way from the Standedge tunnel eastwards. We didn't have these things in Liverpool, and I began to realise that outside the docks there were hardly any factories at all – Meccano, Hornby and Everton Toffee were some of the exceptions. For years I had assumed that all cities had a similar structure: the suburban middle classes commuting to offices in the centre, the working classes walking to the docks from their nearby homes. (It seems to have escaped me that not all cities were ports). Support for this neat dichotomy was to be found in the occupations of friends' fathers: marine insurance, shipping, forwarding, merchant navy, Mersey Docks and Harbour Board, transport, although one did sell sports goods, which somehow seemed not quite right; my own father made his little pile importing hides. Association with manufacture simply did not occur.

Years later I came to live in another port, Portsmouth, but looked in vain for the equivalent of the Liver Building and the Cunard offices, the well known features of the Liverpool landscape, while the middle classes seemed curiously restricted to a small area in the centre of Southsea. Mansions set in grounds, spacious parks with ornamental lakes fringed by 10-bedroom houses, a redbrick university funded by local entrepreneurs: these did not exist. But reassuringly, there were the thousands of working class houses from which issued shipwrights on bikes en route to the Dockyard. And as in Liverpool, of factories outside the yard (discounting those on the new industrial estates) there was no sight. For a time it was sufficient explanation that one was a commercial port fired by private enterprise, and the other a naval port controlled by Whitehall bureaucracy and political whim. However, this didn't really get to grips with the processes involved, an understanding of which might explain more fully the differences and similarities between the two ports. One way of achieving this, it seemed to me, was to disaggregate port employment into various sectors – five were recognised – and to compare the impact of each in the two ports. This is not to say that each sector operated separately, rather there was interaction between all; as Jackson remarks 'no merchant is an island' (Milne, 2000, 12). The exercise could have been undertaken for a variety of time periods, at least prior to the 1960s when Liverpool went into sharp decline, but the 19th century was selected on the grounds that it was during this time that both Liverpool and, to a certain extent, Portsmouth achieved their pre-eminence.

1. The Commercial Office Sector

Included under this head are the shipping companies, shipbrokers, forwarding agents, warehousing companies, stevedoring firms, ships' surveyors, ships' chandlers and provision agents, insurance firms, banks, import/export undertakings, commodity exchanges, consular services, trade associations and travel agencies. The great majority of these activities were carried out by small firms; Cottrell (1981) found that in 1825 there were 1,346 firms in this sector in Liverpool, a figure which had risen to 2,874 by the late 1850s. Milne (2000, 127) shows that of the 40 leading trading firms between 1855 and 1870, only six were capitalised at £100,000 and above, while 17 were worth from £1,000 to £10,000. The significance of these figures is that the large number of enterprises help to explain the emergence of a middle class, for each firm would have had an owner or a board of directors deriving a profit from the operation. By the end of the century there were a number of large shipping companies in place, all of whose directors lived in some style. Such companies included Bibby, Brocklebank, Cunard, Elder Dempster, Ellerman, Furness Withy, Harrison, Alfred Holt, and White Star. Mountfield (1965) lists the trade associations, many of whose names reflected the direction of Liverpool's traffic: the American Chamber of Commerce, the East India and China Association, the African Association, the Cotton Brokers Association, and the Corn Trade Association. As early as 1871 there were 17,400 clerks, largely employed in the maritime business district, residing in rather humbler circumstances than their employers, but in dwellings much superior to those of the dock labourers. They were what came to be called the lower middle class.

By comparison, Portsmouth's commercial office sector was modest, not only because of the difference in size of the two ports, but also because Portsmouth's commercial port was tiny. Most, if not all the activities noted above, were certainly to be found in Portsmouth, but their scale may be appreciated from the small size of the Camber and Flathouse quays that represented the commercial port. Shipping companies did exist, but in contrast with the might of Liverpool, their fleet was restricted to a few sailing barges. Portsmouth's strength lay in naval operations, which meant that all the necessary office functions were internalised within the Navy

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Board, and after 1832, the Admiralty. True, there were highly paid managerial civil servants in the Dockyard, but they were few in number, while in any case the bulk of the senior administrators were based in London. Set against this background, the almost total absence of large houses inhabited by the wealthy becomes explicable.

2. Public Sector Employment

Treated here are the port authority, including dock construction and maintenance, tugs, ferries, pilots, customs and excise and dock police. Until 1858 the Liverpool port authority was administered by the Corporation, which used profits to build the still impressive civic centre including St George's Hall (1840), quite apart from recruiting Jesse Hartley to construct the Albert Dock and a string of others along the shoreline of the Mersey. So many were the complaints of excess profits through high port dues (I K Brunel representing the GWR roundly criticised the Corporation's policy) that in 1858 the Mersey Docks and Harbour Board (MDHB), a public Company with investors, was created. Thereafter the MDHB is strictly part of the commercial office sector, and so large does it become that in 1907 its new office building is the first of the three well known Pier Head landmarks, the others being the Liver Building (1911) and the Cunard Building (1916). Since most of the activities mentioned at the head of this section were controlled by the MDHB, they did not generate profits as such, but it should be pointed out that the senior management of the Board's five divisions (docks, traffic, finance, marine and pilotage) were well remunerated, contributing to middle class affluence.

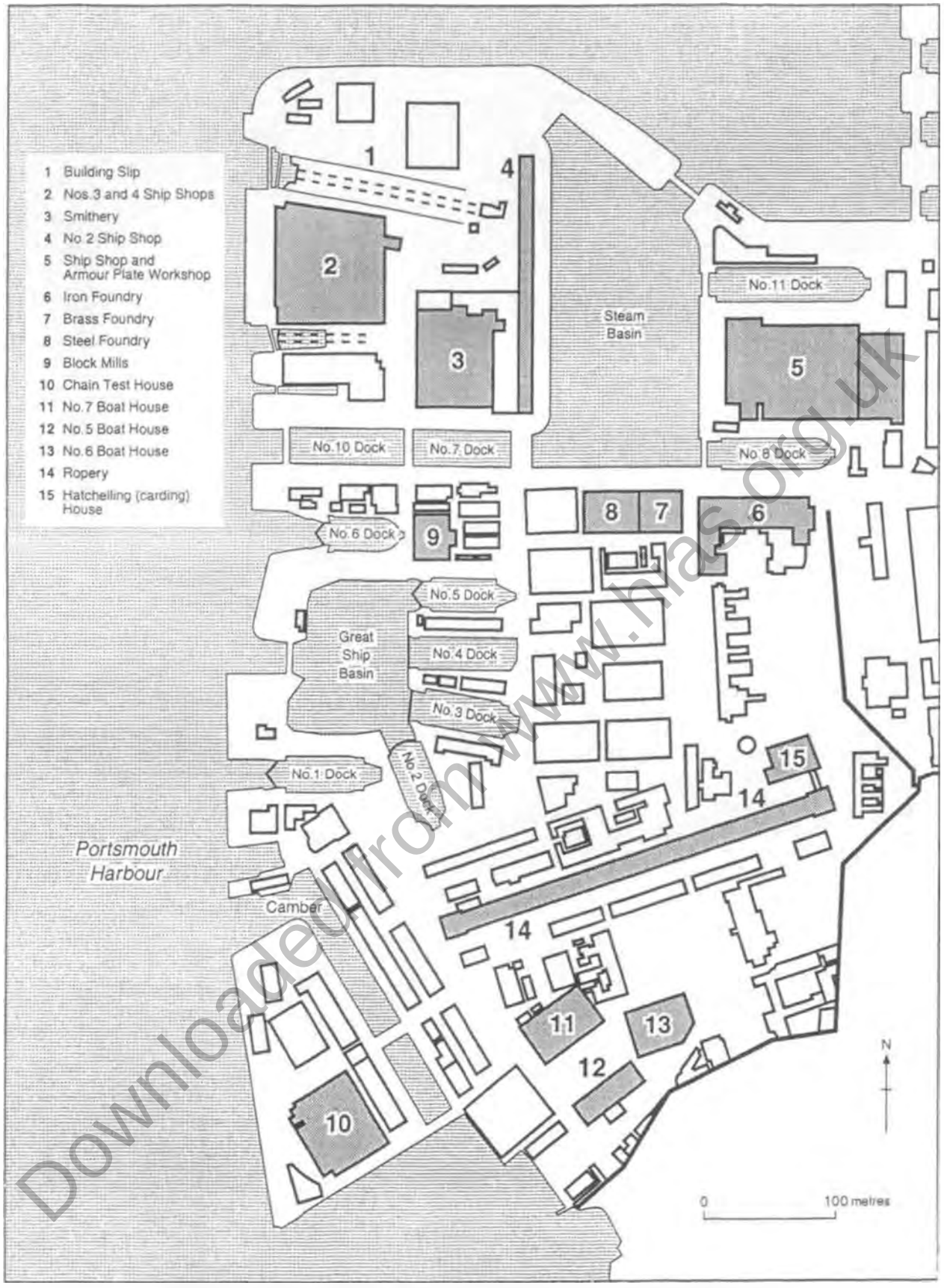
Not surprisingly, given the size of Portsmouth's commercial port, the role of the borough as port authority was muted, and even the construction of the Camber dry dock in 1863 hardly added to the administrative machine. Effectively the port authority was the Navy, operating through the Queen's Harbourmaster, who, apart from day to day matters, consistently denied commercial interests the opportunity to locate on the shoreline. Once again local decisions were underpinned by the Admiralty in London. The design work on the buildings erected for the steam navy was internalised – No.6 Boathouse (1845), the Chain Test House (1845), No.2 Shipshop (1848), the Smithery (1852) and the Iron Foundry (1854), together with the Steam Basin itself (1848), were all planned by Royal Engineer officers (see Figure 1). Risk profit filtering into the Portsmouth economy seems to have been restricted to that generated by Benjamin Bramble, a local contractor, using convict labour. Even the bricks used were fired on site from clay dug from the basin. Subsequent extension work was designed by Admiralty engineers, while the contractors were not local; only labourers' wages were spent in Portsmouth.

3. Labour

By the term 'labour' is meant the dock workers, together with ships' crews. (Dockyard workers are classified under maritime industries). The dock labour force constituted the second great employment sector in Liverpool, employing 19,594 people in 1901. The casual labour system was employed, recruitment being on a daily, or twice daily basis at stands on the dockside between 6.45 - 7am and 12.45 - 1pm. Men were taken on according to their physical strength, contacts and backhanders; wages were low, amounting to about 4/- (20p) a week in 1901, although most men were able only to secure work three days a week. To put this into context, labourers in Alexander Stephen's yard on the Clyde were being paid 15/- (75p) in 1870 (Slaven, 1980,119). That wages could be maintained at this level was because of the number of Irish immigrants who were glad of any income, and the multiplicity of employers, making strike action ineffective. Thus far it has been argued that the nature of activities in Liverpool was conducive to the accumulation of wealth (but not in Portsmouth). Paradoxical though it may seem, the low wages paid to dock labour did generate income, for they enabled handling charges to be very competitive, thereby assisting the profitability of firms, in the best capitalist tradition. Dock labourers lived in conditions of squalor, helping the middle classes to live otherwise. Ships' crews fared better than dock labourers, while officers' salaries placed them among the middle class; the great liner captains were very well rewarded, although few in number. The trend initiated by Alfred Holt on their routes to the Far East of employing Chinese crewmen at low wages had the same effect as the casual labour system in the docks.

The insignificance of Portsmouth's commercial port rendered the dock workers' contribution to the economy of little importance; there were unskilled labourers in the Dockyard, but they were part of the naval shipbuilding industry, considered below. Ships' crews in Portsmouth were almost entirely naval, and during the rearmament era they grew substantially, comprising 12,000 in 1911. Wages might have been guaranteed, but for much of the century there was no provision for the support of sailors' wives, many of whom were left penniless during their husbands' long tours of duty abroad. Some became outworkers in the dress industry, in particular corset manufacture, which from the 1860s became organised on a factory basis, but whose owners never achieved the ostentatious affluence of so many Liverpool entrepreneurs (Riley, 1981). Naval officers constituted the core of the middle class suburb of Southsea, where Thomas Owen built houses specifically designed to appeal to this element of society. A study of the heads of household in Owen's 200 houses in 1851 showed that 47% were serving or retired naval and military officers (Riley, 1980). They may have been impeccably mannered and socially well connected, but they were not numerous and did not enjoy the income levels of the leading Liverpool businessmen.

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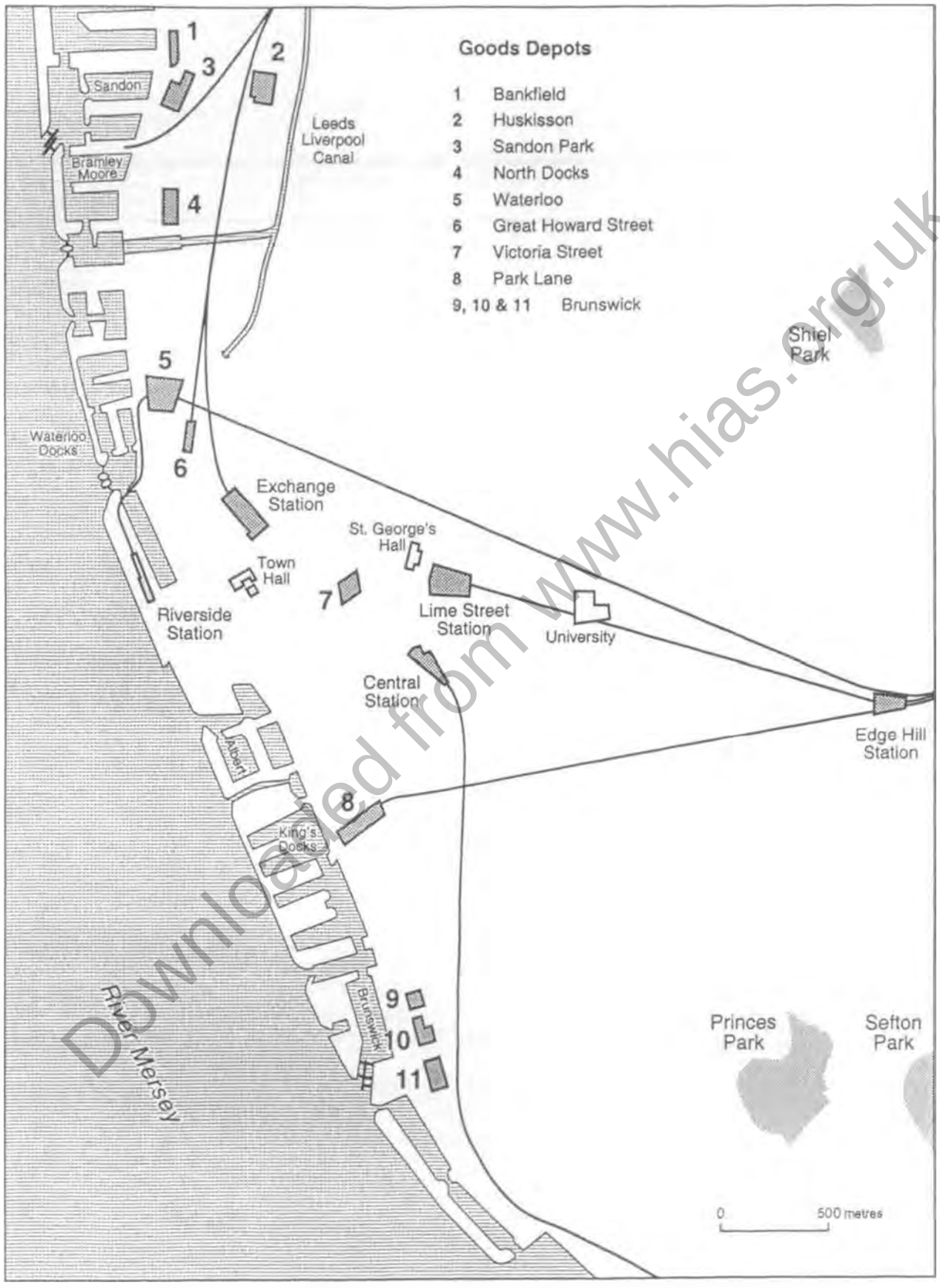
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Figure 1: Some 19th Century Factories in Portsmouth Dockyard

4. Maritime Industries

Compared with the world renowned yards of the Clyde and Tyne, it was something of an oddity that shipbuilding never became an important activity on Merseyside. There was an early reliance on North American vessels during the sail era – one Liverpool shipowner, Rankin, had his own building yard in the Maritime Provinces (Cottrell, 1981) – and as the century wore on such yards as did exist were forced to close as a result of the Corporation/MD1-113's policy of devoting the entire river bank to dock construction. The last builder on

the Liverpool side of the river, Royden, went out of business in 1899. The great survivor was Laird who switched his operations to the west bank at Birkenhead in 1824, the firm amalgamating with the Sheffield steelmaker Cammell in 1903. Shipbuilding might have been muted, and profit restricted, but the land immediately behind the docks was intensively used for engineering and port processing industries: saw milling,



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Figure 2: Central Docks and Railway Links in Liverpool, c.1900

jute working, corn milling using the new roller technology from the 1870s (Riley and Yoward, 2001), sugar refining – Tate and Lyle established their factory in 1872 – the manufacture of cattle cake and edible fats from the 1880s, and soap manufacture pioneered by Lever Brothers in 1889. These were profitable activities, generating substantial income for the region.

By contrast, shipbuilding and repair were central to Portsmouth, just as much as port processing was not. Commercial yards did exist in Portsmouth, but they were minuscule enterprises such as Bevis who built sailing barges, the still small Vosper in Old Portsmouth, and Cramptons who were credited with launching the largest vessel outside the Dockyard, the *Dahlia* of 386 tons in 1878. Naval construction and repair were the very *raison d'etre* of Portsmouth and much has been written about the enormous size of the naval yards, not only in Britain, but also in Spain, France, the Netherlands and Sweden, in the 18th and 19th centuries. It was not unusual for such yards to be employing 4,000 men during the Napoleonic period, at a time when factories elsewhere might have had a workforce of 100 - 200 at most. By the end of the 19th century some 15,000 were working in the Dockyard. But the naval yards were not within the market system; the notion of profit did not exist, causing them not to spawn a middle class based on successful trading. Furthermore, the naval yards followed a policy of self-sufficiency as a means of quality control and cost saving, reducing to a minimum the number of outside private sector contractors. During the sail navy period, timber, hemp, ships' stores such as tallow, iron and copper for sheathing might have been purchased on the market, but the processing was effected inside the Dockyard, giving rise to hemp and rope spinning, sailmaking, pulley block making, iron founding, copper rolling, and saw milling. In the same way metal plates, engines and boilers were bought in for the steam navy, but much of the final work was carried out in the yard. Mention has been made above of the expansion of the factories built between 1845-54 with the advent of steam propulsion: later additions were a new ship shop in 1867, and in 1905 The Factory, at the time said to be the largest covered area in the world. In similar fashion the manufacture of provisions was undertaken within the system, corn milling, bread and biscuit making, brewing, and the salting of meat all being carried out in Portsmouth, and after 1832 at the Royal Clarence Yard at Gosport. Until 1894 even troopships were victualled from this source. One can only conjecture what difference it would have made to Portsmouth's economy and class structure had all these activities been in private hands.

As for port processing industries, it may be speculated that some might have been expected to emerge, but the Admiralty refused to grant permission on the grounds that ships supplying such establishments would interfere unduly with the movement of naval vessels.

5. The Transport Sector

Ports are synonymous with ships, docks and warehouses, but all too often land-side links are overlooked. Indeed the early dock builders gave little thought to landward movement, and even Jesse Hartley at Liverpool made no such explicit initial provision at his Albert Dock, everything being focused on unloading of ships and transfer to surrounding warehouses. Road traffic congestion in and round the docks was by all accounts monumental. The Leeds-Liverpool canal did make a land-side approach, but other canals such as the St Helens, Bridgewater, Trent and Mersey and the Shropshire Union all used the Mersey to gain access to the docks. In the railway era there was a scramble to tap what was a lucrative freight traffic, the LNWR, GWR, Midland, Great Central, Lancashire and Yorkshire and the East Lancashire Railway all building lines and depots (see Figure 2). In 1895 a new station, Liverpool Riverside, was opened on the docks to facilitate liner passenger traffic. Liner passengers could always stay overnight at the Lime Street railway hotel, or the grand Adelphi Hotel, completed in 1913. Each of these generated managerial and clerical jobs. Portsmouth, on the other hand, barely benefited from railway port traffic. Railway branches were run into the Dockyard in 1849 and 1876, but internal traffic on the 25 miles of track was undertaken by the Dockyard railway. No rail link was ever laid down to the old port at the Camber. When the Joint Committee of the LSWR and LBSCR proposed an extension from Portsmouth Town station, the Board of Ordnance ruled it 'entirely inadmissible' since the line would have breached the fortifications. If anything, it was passenger services connecting with the Isle of Wight, rather than freight movement, which were more valuable to the town.

Conclusion

The examination of port employment by sector undoubtedly confirms the original view that the economic and social fortunes of Liverpool and Portsmouth in the 19th century hinged on the presence, or absence, of market competition. At the same time the division contributes to the understanding of the process of capital formation. The method demonstrates just how all pervading an influence was government control in Portsmouth, restricting conspicuous wealth to a few brewing families – Brickwoods being the best known – and how the competitive environment in Liverpool encouraged the emergence of a host of small firms, and a few large ones, bringing substantial rewards to the successful along the way.

Ray Riley

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Highfield Tram Depot, Southampton

In 1998 David Ebert and Steven Trick were studying for their Masters Degree at Southampton University and, as part of this, carried out a geophysical survey on the nearby site of the former Southampton Tramways permanent way depot in Highfield Road. A copy of the finished booklet was sent to Tram 57 Project in appreciation for help with the depot's history. The original treatise was devoted more to their survey and its findings than to the historical background of the depot, although the latter was well covered. However, for the purpose of the HIAS Journal, I carried out further research on the depot and have added extra information while, at the same time, reducing the survey results. Any reader who would be interested in seeing the full results, which involve several diagrams and tables not included with this version, is welcome to borrow the original copy from me. *(Angela Smith)*

Introduction

The empty field in Highfield Road adjacent to the Crawford Building at the Avenue Campus of the University of Southampton held a structure which was identified by the local residents as "the tramshed" at the time of the acquisition of Taunton's School by the University for development in the current Avenue Campus. At the time of this development, in 1996, all buildings on that plot of land had been demolished. The aim of this project was to determine, by use of geophysical survey techniques, the possible location of any building remains which may still exist under the lawn of the plot of land.

Historical Background

Southampton Tramways Company

When the railway from London to Southampton was built in the late 1830s, the need for some sort of transportation became obvious in the growing town, especially to the operators of hotels and public houses. A system of private horse-drawn omnibus carriers arose to fulfil this demand, creating a network covering the town centre as well as the neighbourhoods of Bitterne, Portswood, Millbrook and Shirley. Competiton between the various operators was fierce.

This situation persisted to the mid-1870s when the Southampton Corporation noted that the town was beginning to fall behind many others in the provision of public transporation. There had been an earlier attempt by the British and Foreign Tramway Company to establish a tram company in Southampton, but it had met with fierce opposition from merchants on Above Bar and High Street. In 1876 the Southampton Tramways Company (STC) was established and charged with the construction of a public horse tramway system. The STC was delayed in the track construction as there was a debate as to whether trams should be permitted to use Above Bar and High Street. Once that debate was resolved, the construction of the tram rails began in the summer of 1878. The Government Inspector, Major-General Hutchinson, gave approval to the system on May 3, 1879, and operation of the first route began on May 5.

The centre of operations for the STC was Portswood Depot, which was located at the site of the current bus depot in Portswood Road, and there was also a depot established in Carlisle Road, Shirley. These two depots had several components, but the main ones were the stables for the horses and the tramcar sheds. Portswood depot had stables for about 85 working horses and Shirley depot for 60 horses. Stables for a further 12 more horses were situated behind the Bitterne Park Hotel. Each tram was drawn by a team of 2 horses, which could pull a tram for four to six hours per day. Therefore, each tram on the road needed 8 horses per day dedicated to its operation.

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The horse tramway system was never extended farther north than its terminus in The Avenue at the junction with Alma Road. The Tramways Company purchased some horse buses in 1887 which were put on the Floating Bridge to Common via Terminus Station and St Mary's Road route. The buses and their horses were accommodated in rented buildings – off The Avenue in a lane which later became Highfield Road – that were soon purchased and rebuilt. The First Edition Ordnance Survey 1:2500 map (Figure 4a) shows the site in the mid 1860s (area numbered 1752). Figure 4b is a map drawn by Philip Brannon about 1850 which indicates the same large building south of Highfield Cottage annotated *'Malt Ho'*, so it is possible that the brick building put into use as the stable block may have been converted from a malt house. The depot had stables for 24 horses, a blacksmith's shop and space for storing the horse buses. Soon there was also an hourly bus from Commercial Road Junction to Bitterne Park.

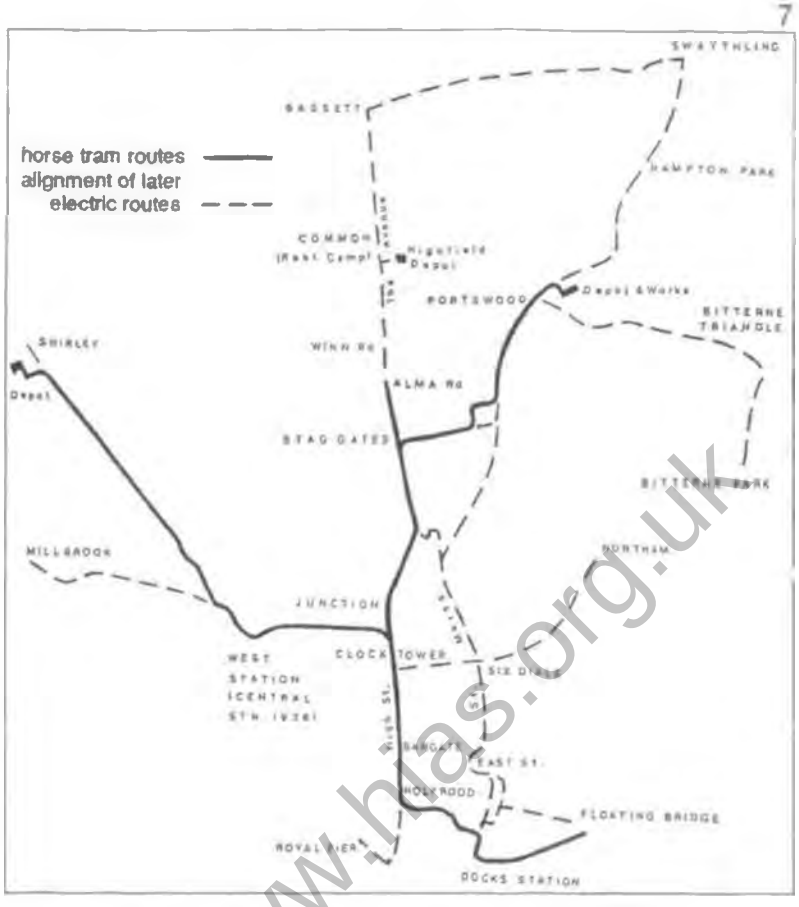


Figure 3: Map of Southampton tramways highlighting the horse tramway system c. 1895 ***(based on maps by the late Major H T G Lourdes-Cresswell, 1975)***





Figure 4a (left):
Enlarged extract from Ordnance Survey First Edition 1:2500, Hampshire Sheet LXV.3, surveyed 1865/66

Figure 4b (above):
Enlarged extract from Philip Brannon's map of Southampton c.1850

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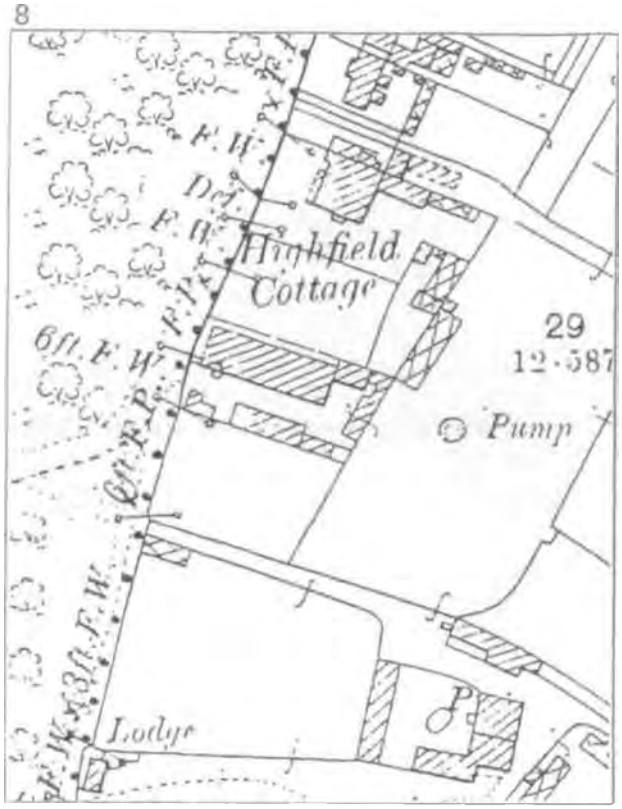


Figure 5: Detail of the Highfield horse tram depot from Ordnance Survey Second Edition 1:2500, Hampshire Sheet LXV.3, revised 1895

The operation of the STC was popular with the general public, offering for the first time a quick, inexpensive and efficient way of getting from the growing suburbs to the town centre. But it was unpopular with the Southampton Corporation due to disagreements about track and road maintenance. The track itself was badly designed, using steel T-rail held in cast iron chairs which was intended to carry steam trams. From 1889 modern 6" girder rail began to be laid for new loops, and between 1894 and 1897 much of the network was relaid with girder rail.

The Highfield depot is not shown in any pictures from this period of its life. This fact is not surprising when the paucity of pictures of later periods is taken into consideration. However, in the map of routes shown in Fig. 3, its placement off The Avenue is clearly indicated, and Figure 5 shows detail of the depot in 1895. When this layout is compared with the earlier Ordnance Survey map in Figure 4a, the building structure looks almost the same.

Southampton Corporation Tramways

Southampton Corporation purchased the Southampton Electric Light and Power Company in 1896 – thus taking responsibility for the provisioning of electricity for the town – in the same year that it decided to take over the Tramways Company. The Corporation finally compulsorily purchased the STC on June 30 1898 and created the Southampton Corporation Tramways (SCT) in order to manage the operations of the town's tramways. The takeover was made with the view of converting the horse tram routes to electric, so that the newly acquired electricity generating station could be used to full capacity during the day. Although the first electrified section was opened on 22 January 1900, work continued until 1901 on conversion and extension of the tram system, so horse-drawn trams ran alongside the new electric trams until the full conversion was complete. Despite the fact that the STC had renewed its tracks only a few years previously, the rails were not appropriate for the new electric trams and work had to be undertaken to modernise the system. While conversion took place the horse buses kept the services going but, once the electric trams were running, both the horse buses and horse trams were taken out of service. By the end of 1900 there were two electric routes in operation – Shirley to the Docks Railway Station and Portswood to the Docks Railway Station via Stag Gates.

As the Corporation took over all of the STC, it also had possession of the three depots. Portswood depot continued to serve as the focus of the operations, containing sheds for the cars and maintenance facilities such as body and machine shops. In later years it manufactured cars for its own use. Shirley depot also continued to serve SCT as a depot as it had in the past. It had facilities for tram storage and rudimentary repair facilities.

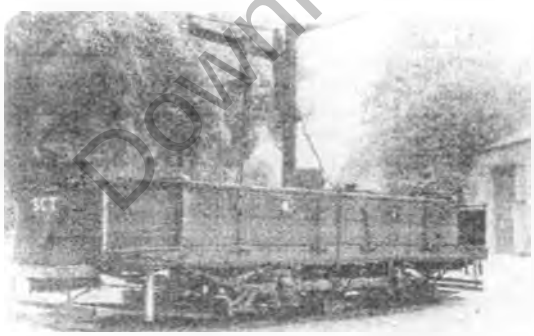


Figure 6a (above): Freight Wagon 2 at Highfield Depot in 1946 ***(C L Belcher)***

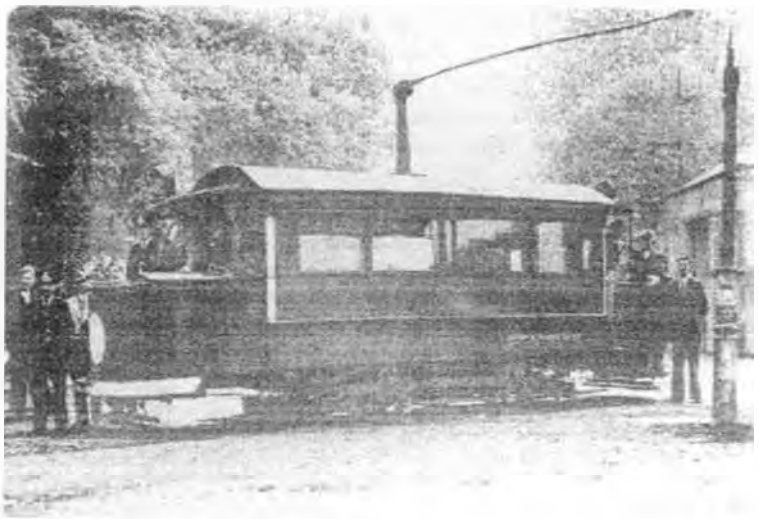


Figure 6b (right): Welding Car, 1946. This tram was originally open-top knifeboard Milnes 22 of 1901, converted in 1928 to replace an earlier welding car ***(D Conrad)***

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The Highfield Depot

Highfield depot continued to play a rôle in the history of the SCT. The depot was relatively small, especially in comparison to the nearby Portswood depot. At best, it would have been able to hold only a few tramcars. The 1907 Corporation Minutes indicate that one building was in use as a temporary paint shop. The depot was connected to the tram system in 1903 after The Avenue route had been extended northwards to the "Common" terminus: tenders went out for the construction of the permanent way for the Highfield extension in March 1903 and for the sole plates in May, so it can be assumed that the track was laid during that summer. In 1915 the Common terminus was renamed "Rest Camp", since a large army camp was present here during the First World War, and remained as such until 1921 when a further extension northwards in The Avenue was laid. So, the depot received a new lease of life as a permanent way facility, serving as the maintenance centre for the SCT, with two permanent way cars. One covered car was fitted with welding equipment and an open wagon carried setts, blocks, etc, and was also fitted with a crane and rail-height carborundum blocks between the wheels for scrubbing corrugations from the rails. The two cars are shown in Figure 6.

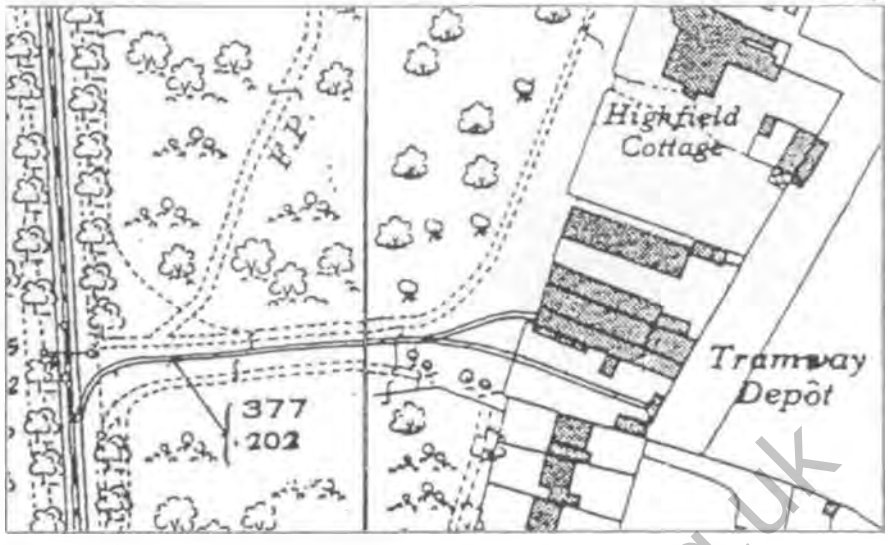


Figure 7: Enlarged extract from Ordnance Survey 1:2500 map, Hampshire Sheet LXV.3 of 1940

Three new covered bays were built about 1903, one of which was rail-connected and accommodated these cars. The adjoining yard, also with rail access, was used for general storage of materials for maintenance (*e.g.* rails, carborundum blocks, granite setts and wood blocks). The 1940 Ordnance Survey 1:2500 map (Figure 7) shows a complex of buildings at the Highfield depot. There was a single track coming from The Avenue along Highfield Road which branched in front of the depot. Comparison with the 1895 map shows that the large, former stable, building was retained, but it was not rail-connected. This was occasionally used to house a tower wagon (for overhead line maintenance) and a small truck. The small building in the south-east corner was the blacksmith's shop. The three bays were wooden-framed with corrugated iron cladding. Apart from the one which accommodated the two permanent way trams, there were also storage facilities and a messroom for the staff. An inspection prior to demolition of the three bays in 1969 revealed that some vertical supports were made from former horse tram rail.



Figure 8: The Highfield depot exterior in June 1948 *(TMS Collection)*

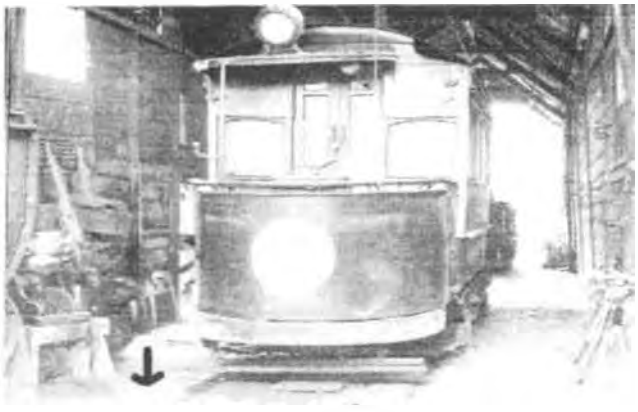


Figure 9: Interior view of Highfield depot, February 1949 *(A F Cook)*

In examining the picture of the exterior of the depot, as shown in Figure 8, one can see a structure with a gabled roof to the right of tram 108. The presence of the track indicates that this building is the southern of the three bays, adjacent to the maintenance yard, shown on the Ordnance Survey map. The interior of the same building can be seen in Figure 9, as indicated by the presence of tracks which only ran into this bay. The photo

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Figure 10: View of depot in 1948 *(A J Watkins)*

shows a wooden structure, clad with corrugated iron, with a cobble or brick floor. The cobble floor, as indicated by the arrow, is interesting, as there are places where similar cobbles can be seen through the grass close to Highfield Road. Figure 10 is a deserted view of the depot taken in 1949 and shows the track dividing. The arrow indicates a tree that can still be seen today at that location. This tree has been used to help place the results of this survey on the 1931 Ordnance Survey map.

It is interesting to read the May 1941 inventory of the Plant and Machinery held at Highfield Depot: 2 pitch boilers, welding car, welding plant (in building), freight wagon with 2 rail scrubbers, 2 concrete mixers, 2 air compressors, 4 rail carriers, a forge, 2 bench vices, a grindstone, Thermit welding drier and stone crusher. The two air compressors were the most valuable with an insurable value of £1000. During WWII some ARP items were kept at the depot including 3 chairs, 3 macintoshes, 12 blankets, 3 pillows, 3 mattresses, 1 axe, 1 crowbar, 2 buckets, 3 stirrup pumps and 3 helmets.

Although there had been plans in the late 1930s to abandon the trams in favour of buses, the war meant that the system struggled on until the end of 1949. The route to Bitterne was the first to close in May 1948 and track uplifting commenced on that route a year later, with work being carried out by staff from the permanent way depot and Borough Engineers Department. The tracks in The Avenue from Burgess Road to Northlands Road (south end of The Common) were lifted July to September 1949, thus cutting off rail access to Highfield depot. The rails, granite setts, wood blocks, trolley wire and overhead fittings made of brass, phosphor bronze, etc, were stored at Highfield and Portswood depots until sold for scrap. The two permanent way cars were sold to scrap dealer A F Harris of Belmont Road in November 1949 for £60. Some of the redundant plant at Highfield depot, most of which was described as *'of considerable age and can generally be regarded as scrap'*, was disposed of in December 1949, with Mr Harris taking the last items in February 1950, including the forge and other equipment from the blacksmith's shop. The last track uplifting in September 1950 involved the 3 depots, with 78 yards of track being recorded as removed at Highfield depot.

Even before the last of the tram system was closed on December 31 1949, part of the Highfield depot – the brick-built former stables at the northern end of the site, as the operational area would still be in use by the trams – had already been leased to a local mineral water bottling company, *Stranger's*, in early 1949. An additional area was included on June 1st 1949. *Stranger's* had to carry out *'very necessary repair work'* before the property could be put to its intended use, for which a rise in rent was deferred to 29th September. In February 1950 further accommodation was added:- *'We are now in a position to release a further portion of Highfield Depot and Messrs. Stranger's have intimated their desire to rent an additional shed on the south-west side of their existing letting, together with a yard and a small shed at the rear of the shed already let, the total area being approximately 185 sq. yards.'*[1]

Once all the track uplifting had been completed in October 1950 and Highfield depot was no longer needed for storage, another section to the south-west of the area already used was let to *Stranger's*:- *'This comprises a covered bay, a messroom and blacksmith's shop. In view of the cost to which Messrs. Stranger's will be put to make good the extensive dilapidation of the shed and to make up the floor to its proper level, the Valuer suggests that the rent for this added portion should remain at £50 until 29th September 1952.'*[2]



Figure 11: Depot in 1969 prior to demolition of the four covered bays *(L N Smith)*

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As well as taking over the existing buildings, *Stranger's* filled in the gap between the brick building and the northernmost of the 3 bays with a pitched, corrugated iron roof, as seen in the 1969 view taken just prior to demolition of the 4 bays (Figure 11). *Stranger's* gave up their lease in 1967 when the Corporation was prepared to grant only a further two years' extension and required certain repairs to be done, which the company found unacceptable, so the premises were vacated and eventually became dilapidated.



Figure 12: Old Tauntonians clubhouse in January 2000. The former blacksmith's shop is the brick building on the right

In 1969 the Transport Committee planned to transfer the old depot to the Education Committee for an extension to the adjacent Taunton's School playing fields. It was said that thousands of bottle stoppers littered the site, along with broken glass from the windows. Behind the old depot was a little copse and behind that a high wall separating the place from the school fields. The copse had become a dumping ground for rubbish. Most of the buildings were demolished later that year. All that remained were the large brick building at the northern end, which was then used for storage by the Southern Science & Technology Forum, and the brick blacksmith's shop. The latter was taken over by the Old Tauntonians Social Club and wooden extensions were later added. This complex was still in situ – albeit in a very derelict condition – in January 2000 when the photograph (Figure 12) was taken, although at the time there were plans to demolish that building. The large brick, former stable, building survived a further 10 years. By 1980 it was claimed that it had been allowed to fall into a poor state of repair and appearance, and it was proposed that it should be demolished as part of a development scheme at Taunton's School. By this time someone had written 'TRAM SHED' in large white letters on the wooden doors.

Professor Champion, of the Department of Archaeology at the University of Southampton and a local resident, recalled a structure on the area in question, described as a long and low building with a single gable roof, brick walls and a wooden door on the Highfield Road side. This wooden door was used for locals to post notices and flyers until its demolition in 1996. The building was identified as being adjacent to the biology block, which still stands at the Avenue Campus. It was thought possible that this building could be one of the outer buildings in the tramshed complex, as shown on the OS map in Figure 7. When Professor Champion was shown a photograph of the tramshed exterior, he confirmed that the gabled structure shown in Figure 8 was not the building that he recalled. Another possibility is that the building was not in the tram depot at all, but part of the Highfield Cooking Centre, built between the depot and Taunton's School in the area which was previously Highfield Cottage (Figure 13).



Figure 13: Enlarged extract from Ordnance Survey 1:2500 maps SU4114, dated 1967, and SU4214, dated 1966

Conclusion

The Highfield tram depot proved to be an interesting subject to research. As part of the urban industrial landscape, the depot was something that became part of the local residents' cognitive landscape of their neighbourhood, but seemingly at a subconscious level. This can be demonstrated by the fact that many people who saw the project underway indicated that they remembered the building which stood on that field. However, when pressed for a description of the building most people had only a fuzzy recollection of the actual appearance of it.

This phenomenon provided an interesting challenge in researching the history of the depot. Often buildings become a part of our image of the area which exist at a subconscious level and, when alterations are made to the physical landscape, similar changes are incorporated to this cognitive landscape. Therefore, it is often hard to recall something that seems quite familiar even after only a short time.

The Survey

The survey baseline was set using the brick wall on one end and the final post of a chain-link fence on the other (Figure 14). These points were chosen in the hope that the baseline could then be transferred to the OS map easily. The baseline was then laid out using sighting rods and the previously established points. Three alternative surveying techniques were made available for the project – magnetometry, resistivity and magnetic

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susceptibility. Before deciding which technique should be deployed, a number of factors were taken into consideration. All techniques have their strengths and weaknesses, and the suitability of each to the project in hand was assessed.





Figure 14 (above): Survey baseline
Figure 15 (right): Ordnance Survey 1:2500 map of 1940 overlaid on map of c1995

Resistivity

Resistivity was thought to be the most suitable method for our purposes. The goal of the project was to find buried evidence of a now-demolished structure, perhaps in the form of wall foundations, and this technique is known to be successful in locating such evidence. There may, however, be some problems – the remains of a semi-demolished concrete path, several iron manhole covers with the possibility of metal pipes associated with these covers beneath the ground's surface, and a number of mature trees growing in the survey area. Finally, much of the western half of the survey area was waterlogged and boggy with different vegetation cover from the rest of the site. It was thought that this area may show up as a low resistance zone on the plot, possibly masking underlying archaeology.

Magnetometry

The area to be surveyed was a grass verge in the corner of the Avenue Campus car park, along one edge of which was a line of parking bays, and on another was a road with an adjacent bay for taxis. A large metallic object such as a car could greatly affect a sensitive device such as a magnetometer. It was therefore recognised that the part of the survey area adjacent to the parking bays might be unsurveyable. There were also several lamp posts along the edge of the survey area incorporating metal in their structure.

An initial inspection of the site revealed that there was much building debris scattered about, including fragments of masonry and lengths of thick iron wire. The overall impression was one of a landscaped grass verge on the edge of a recently developed site. This conclusion was true in this case since the Avenue Campus in its current form was only operational from 1996. This building debris may therefore cause considerable interference and mask underlying structural information. For example there were many fragments of brick littering the surface, and the remnant magnetic moments of these may show up as magnetic anomalies.

As already mentioned, there were several manhole covers on the surface. These were magnetic hazards along with the pipes leading from beneath them. There may, of course, have been other service pipes beneath the surface leading to the college buildings of which we had no surface indication.

Magnetic Susceptibility

The limited depth attainable by this technique was the prime influence in our consideration. It was feared that on a site such as ours the soil had most likely been redeposited from another location and subsequently levelled, in order to produce a flat grassy verge. Any readings obtained with the magnetic susceptibility meter may therefore represent soil from another location. Any significant susceptibility of soil *in situ* may be at a depth beyond the sensitivity of the device.

Conclusion

It was concluded that resistivity was the most appropriate technique in this case, since it has been proven in locating buried wall foundations. A limited scale magnetometry survey would also be undertaken.

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Details of survey

A grid size of 10m x 10m was chosen. This size meant around 7 grids had the potential to be surveyed in their entirety, the remainder being partial grids. For the resistivity survey, a Geoscan RM15 resistivity meter was used, with a 0.5m probe separation, in the twin-probe configuration. The probe separation of 0.5m is suitable for the location of buried wall foundations up to a depth of around 2m. For the magnetometer survey, a Geoscan FM36 fluxgate gradiometer was used. For both techniques, a traverse and sample interval of 0.5m was chosen. This interval gives good resolution on the final plot.

The grass-covered plot that comprised the project area was surveyed in its entirety, but excluded a narrow strip along the western edge where many saplings had recently been planted. The whole area was surveyed since the time was available, and also because it was thought that the southern edge of the grassy plot may coincide with the outer wall of a structure that may have previously stood on this site. This information came from the 1931 OS map.

Survey Results



Figure 16: Resistivity results (white = low resistance)

Resistivity

The results of the resistivity survey are shown in Figure 16. It can be seen that there are a number of 'hard' edges. These seem to suggest an alignment parallel to the long sides of the survey area, i.e. in a WNW-ESE direction. An area of low resistance dominates the western corner of the plot. In amongst this lighter area, there can be seen faint darker lines, on a similar alignment to the feature mentioned above, i.e. WNW-ESE. The border between this area of low resistance and the surrounding areas of higher resistance is very clearly represented on the plot.

Interpretation of Resistivity Survey

Looking at the resistance plot, there appears to be evidence of structural remains buried beneath the surface. Interestingly, these are represented as low-resistance areas. It may be worthy of note that these largely coincide with the waterlogged, boggy part of the survey area. However, these low resistance features continue into areas where the ground is much drier and firmer, and here they border relatively high-resistance zones of high contrast on the plot. The interpretation is therefore that these low-resistance features are not the result of waterlogged ground, but instead represent the robbed-out foundation of at least one building subsequently filled with silty, low-resistance material.

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In apparent contrast to this interpretation, the surveyors noticed that this part of the survey was characterised by a uniform, hard surface just below the topsoil which the probes of the resistivity meter refused to penetrate. It may be that the hard underground surface noticed by the surveyors represents an old ground surface, perhaps of the tramshed. On the western edge of the grass verge, on the far side of the chain-link fence and therefore beyond our survey, there remain areas of brick flooring. These are very similar in appearance to the floor depicted in historic photographs of the tramshed interior. It is suspected that further surfaces of these bricks remain beneath the survey area, and this is what was preventing probe penetration. Parts of the survey area were boggy and also characterised by different vegetation from the majority of the grass verge. These areas may be correlated with the underground surfaces since it is unlikely that water collecting on the surface was able to easily dissipate through the sub-surface brick flooring. These areas are represented as low resistance on the resistivity plot, due to the high water content. A problem with this simple explanation is that adjacent, drier areas of ground appear as similarly low resistance areas on the plot. This discrepancy is hard to explain, but it may simply be that the brick flooring here is lower down out of the reach of the probes, creating an area of poor drainage.



Figure 17: Magnetometer grids overlaid on resistivity survey

Magnetometry

Rather than survey the entire area, as had been done with resistivity, it was decided to concentrate on a central block of whole grids. It proved to be a very noisy site with the sensitivity of the device having to be reset. The resulting plot showed bands of magnetic anomalies on similar alignments to evidence from the resistance plot. Indeed, linear features in one plot seem to match up almost seamlessly with the other. These anomalies could therefore represent the foundations, perhaps of brick, of a now demolished structure. In some places, where the anomaly appears wider than the evidence suggested by the resistance plot, this could be the result of magnetic material that accumulated against the outside walls of the structure when it was still standing.

Combining the evidence

The data gathered by the survey can be collated with old maps from the periods when the Southampton trams were in daily use. The resistivity survey data was overlaid on an OS map from 1931, as can be seen to the right.



Figure 18: Resistivity survey overlaid on 1931 OS map

In the image shown in Figure 18, two tramlines can be seen coming in from the left from The Avenue and are heading for the Highfield tram depot. One of the tramlines heads for a small building to the south. The other tramline heads for the southern end of our survey area.

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The lines on the Ordnance Survey map showing through the overlaid resistance plot show the outlines of buildings. Just how many buildings are represented here is uncertain, but we considered them to be at least two sheds. They can be seen to share the same alignment as many features on the geophysical plot. We considered the low resistance features shown to be the remains of the Highfield Tramway Depot.

Many people stopped to talk to us while we were carrying out the survey. They claim to remember a building standing on the ground where we were working. When quizzed about its appearance most could not offer any details. However, one person remembered it as a low, stone walled building. This description does not fit with the gabled tram shed depicted in Figure 8. Therefore, it is likely that the building people remember is not in fact the tram shed, but another building to the north, that now probably lies under the road to the north of the survey area.

Apart from some of the original brick flooring that can still be seen at the entrance to the Avenue Campus car park, all that remains today of the Highfield Tramway Depot is archaeology.

Conclusion

The survey of the plot of land adjacent to the Avenue Campus of the University of Southampton reveals three important lessons. The survey recovered the remains of a large structure which, when correlated with historical information, clearly is the tram depot buildings which existed in one form or another from the late 1800s to 1980. The lessons involved with this survey revolve around the use of historical sources in geophysical survey and the use of contemporary recollection.

It is clear that this geophysical survey has discovered the remains of a rather substantial structure. However, it is only through a survey of the historical sources that a complete interpretation of the structural remains could be done. Historical sources can be of great value in the interpretation of geophysical survey results.

Although most of the tram depot was destroyed in 1969, its memory remained in the minds of local people. This memory appears to have merged with the remaining buildings associated with the tramshed, until they eventually came to represent the same thing.

However, the use of the historical sources is far from being uncomplicated. By reviewing the photographic evidence of the area, it is relatively easy to predict where the structural remains should be. But one would expect to find high resistance features, not the low resistance anomalies which were identified. Therefore, it is important to remember that the photographic evidence has limitations in predicting the geophysical response.

This project has shown that residents of any given neighbourhood build a mental image of that area. As a neighbourhood changes, this mental image is updated to include the new information. As time passes, the reliability of this image cannot be depended on, but should be considered as a cognitive landscape. Cognitive landscapes are a method of classifying and interactive with one's surroundings. However, this project has demonstrated that contemporary recollections cannot be relied upon to record the industrial heritage of a region, as these cognitive landscapes can be in error or easily influenced by modern changes.

The Highfield tramway depot may or may not be a crucial part of the urban, industrial heritage of the Highfield area, but it is clear that the project has played an important role in renewing the understanding of the evolution of this neighbourhood.

by David Ebert and Steven Trick
with additional historical information by Angela Smith

Acknowledgements

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The Southampton Floating Dry-dock

This article was conceived as a vehicle to illustrate the historical information available to Industrial Archaeology through the medium of postcards. The Southampton dry-dock is particularly well covered by the postcard trade.

There has always been a requirement to have access to the hulls of ships for repair, and until recently (with the increasing use of special paints) for cleaning to remove the marine growths that seriously affected performance. The simplest method was to position the ship over an area of hard standing at high tide. At low tide it was left out of the water for any work to be carried out, though this would of course be interrupted regularly by future high tides!

An improvement to this idea was to position the ship on a frame (later with wheels) which could be hauled up away from the water so that any work was not affected by the tides. Obviously there were practical limits to the size and weight of ship for which this could be used, so fixed dry-docks with canal-type lock gates were developed. In Southampton the provision of such facilities was a condition of the P & O and Royal Mail Companies transferring their fleets to use the dock basins opened in 1842, in conjunction with the arrival of the new railway connection to London.

The first dry-dock (No. 1) in Southampton was opened in 1846, No. 2 in 1847, No. 3 in 1854 and, as the docks extended, No. 4 in 1879, No. 5 in 1895 and No. 6 in 1905. The later ones were built larger to accommodate the increase over the years in the size of passenger liners. As built, No. 6 dry-dock measured 875ft in length by 90ft in width. However, the trio of White Star liners – *Olympic* (1911), *Titanic* (1912) and *Britannic* (1915) – were slightly too large for comfort so, between 1911 and 1913, the walls were cut back to widen the dock and entrance. In the event only the *Olympic* was to avail itself of this facility. The *Titanic* collided with an iceberg (1912) and sank on her maiden voyage. The *Britannic* did not enter passenger service but was requisitioned as a Hospital Ship in the First World War and was sunk by a mine (1916) in the Adriatic.

After the First World War, when the Germans had to hand over their three largest passenger vessels to the Allies as reparations, Great Britain received two and the USA one. The Cunard Company received the *Imperator* which was renamed *Berengaria* and the White Star Line the *Bismarck* which became the *Majestic*. Unfortunately for No. 6 dry-dock, these liners were around 900ft long and 100ft wide. After a notch was cut out of the end of the dock to accommodate the overhang of the bow, the Berengaria would go in but it was a very tight fit. So the provision of larger dry-docking accommodation was required.

At this stage there was no room in the existing docks for another dry-dock and further extension of No. 6 was not a practical option. Although new docks were under consideration, with possible sites being investigated which would have room to accommodate another larger dry-dock, this development was still several years away.

The London & South Western Railway Company who owned the docks decided, as cover, to order a suitable floating dock. This would be moored off 50 Berth which could continue to be used as a tender berth, so that it did not restrict any existing facilities. A tender was, in effect, a large tug with passenger accommodation. The *Calshot*, presently under preservation in Southampton Docks, is a local example. Tenders serviced vessels calling in Cowes Roads. This saved time and cost when there was no cargo and fewer than about 250 passengers (though this figure could be flexible).

The floating dock was ordered on the 13th October 1922 at a cost of £380,000 from Sir W G Armstrong Whitworth & Co Ltd on the Tyne. It was built in seven sections, five at their High Walker Yard (Naval Yard) and two at their Low Walker Yard (ex Mitchell Yard). The first unit was laid down on November 15th 1922 and the sections were launched between March 22nd 1923 and February 7th 1924 with an assembly completion date of April 14th 1924.

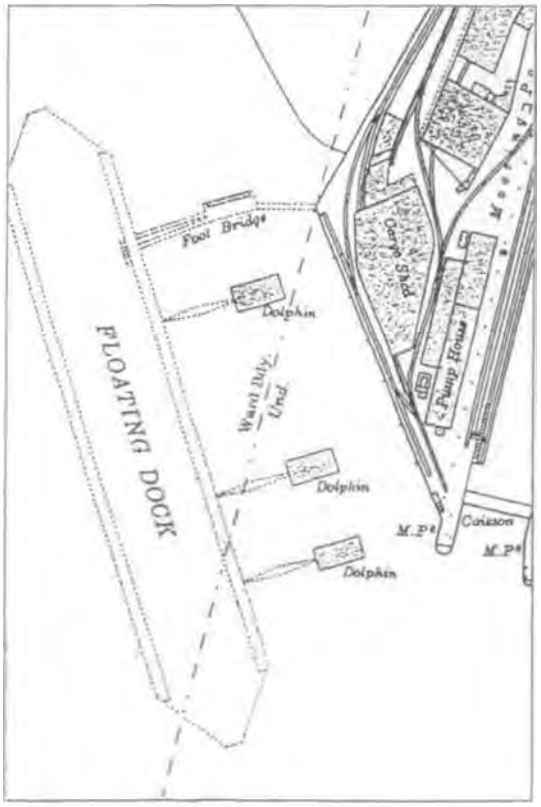


Figure 19: The Southampton floating dry-dock off 50 berth in the 'Old' (Eastern) Docks as shown on the Ordnance Survey 1:2500 map, Hampshire Sheet LXV.15 of 1931

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The basic statistics were:-

Overall length		960 ft
Overall width		170 ft
Internal width		134 ft
Height		64 ft above waterline (empty)
Draft		6 ft (empty)
Weight		18 800 ton
Side Walls,	length	756 ft
	width at base	18 ft
	width at top	12 ft

This gave a nominal capacity to accommodate vessels up to 60 000 displacement ton, with a keel length of some 900 ft, a breadth of 130 ft and a draft of 38 ft.

The watertight sections which could hold 80 000 ton of water were served by 14 centrifugal pumps which took four hours to complete a maximum capacity lift. A flying gangway or swing bridge gave pedestrian access from one wall of the dock to the other.

The mooring position off 50 berth had been dredged to give a depth of 62 feet at low water. This entailed the removal of 1 000 000 ton of spoil (or 2 000 000 ton according to another account!). As there was some silting over time she was moved at least once for further dredging to take place.



Figure 20: (Advertising card for the Crete Shipping Co Ltd) "Ocean tug *Creteboom* on tow of largest pontoon in the world". It claims a time of 3 days 13 hours for the voyage from the Tyne to Southampton. The company used vessels made out of reinforced concrete which had some limited success at the time. The *Creteboom* is still afloat in Ireland.

The dock left the Tyne on April 17th 1924 in the tow of seven tugs, the *George V, Hendon, Plover, Marsdon, Joffre, Great Emperor* and *Creteboom* (the last had a concrete hull and was one of several built at Shoreham after the First World War). Arrival at Southampton was four days later on the 21st April.

Digressing slightly, the Southern Railway Docks and Marine Manager, Major Gilbert Szlumper, wrote about the new dock in the November 1923 issue of the *'White Star Magazine'*. He stated that it will be composed of seven sections which are normally connected together. However, each section is capable of being disconnected from the remaining sections and docked for cleaning or repair. (As far as I am aware this facility was never used in Southampton, but it does possibly explain how her final journey came to be made in two sections). He goes on to mention that the 14 pumps each had its own house on the top deck, all under the telephonic control of the Dock Master in the valve house. Also that two electric cranes will travel on either side from end to end of the structure. (In practice, the cranes were not permanently in position but were borrowed from a quay that was not busy and positioned by the floating crane which had, in any case, to be used for lifts exceeding 5 ton). Continuing, he added that the dock will be held in position by means of four steel lattice mooring booms each 110 ft long, attached at the shore ends to four reinforced concrete dolphins. The booms are hinged at either end so that the dock's movements up or down are not impeded by the tide or during operation. Each boom is capable of taking a push or pull load of 250 ton which allows for a wind pressure on the structure of up to 1000 ton.

The opening ceremony was performed by The Prince of Wales (later King Edward VIII, then Duke of Windsor) on the 27th June 1924. He arrived by train at 10.55am at Southampton West station. Travelling in an open Buick car, he went via the floating bridge to the Supermarine Works and the Imperial Airways base, and

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thence to 50 Berth where, after inspection of the dry-dock, he operated the lever to commence the submergence. The party adjourned to the *Aquitania* for lunch. Afterwards he boarded the Southern Railway paddle steamer *Duchess of Fife* which sailed through the now submerged dock ceremonially breaking a tape across the entrance and so formally opening the dock. Shortly afterwards the Union Castle liner *Arundel Castle* was towed into the dock to be raised high and dry for photographs. However, this was only a demonstration as next morning she was returned to her normal berth.



Figure 21: The *Arundel Castle*, the first ship in the floating dock as a demonstrator at its opening by the Prince of Wales

The Prince of Wales had not finished with Southampton. During the afternoon he laid a wreath at the Cenotaph, visited the TOC H Hostel 'Talbot House' in Bassett, the University Campus in Highfield and the Royal South Hants Hospital, before taking tea in the Royal Pier pavilion.



Figure 22: (F.G.O.Stuart/2178) *Bremen* is believed to be the only foreign vessel to have used the dock. She used it twice in 1929, first in July before her maiden voyage and again in November. This was because her sister ship *Europa* was using the only available dock in Germany at the time.

A few years later the decision on the extension of the docks was made. They would be built to the west by in-filling the bay between the Royal Pier and Millbrook. The new dry-dock at the Millbrook end would be the largest in the world at that time, and would be capable of taking the new Cunard liner then being built on the Clyde by John Brown & Co as project No. 534 (later to be named the *Queen Mary*). In addition there was space for another dock should this be required.

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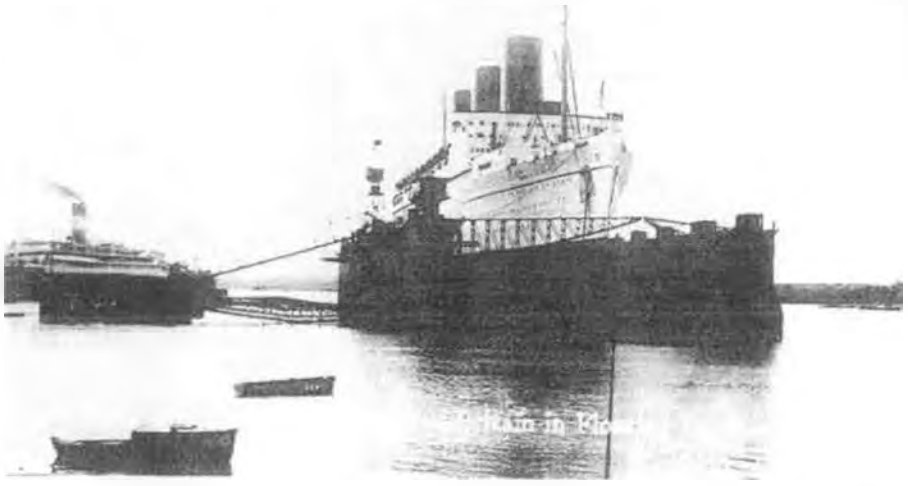


Figure 23: (anonymous) *Empress of Britain*, flagship of the Canadian Pacific Line. Maiden voyage 1931, torpedoed and sunk 1940



Figure 24: (F.G.O.Stuart/2153) *Aquitania*, Cunard Line. Maiden voyage 1914, survived two World Wars and when withdrawn in 1949 was the last of the four-funnelled liners.



Figure 25: (F.G.O.Stuart/2168) *Berengaria*, Cunard Line. Maiden voyage for Hamburg America Line as *Imperator* 1913. First voyage with Cunard Line 1920, still as *Imperator*, renamed *Berengaria* in 1921. Withdrawn 1938 after a fire in New York. The building on the left is the offices of the Southampton Harbour Board with the Town Quay on the right. The 50 yards or so in between had public access and was a favourite spot to take photographs.

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Figure 26:
(F.G.O.Stuart/2152)
Berengaria (see 25 for details)
Note the girders visible either side of the dock wall. These were for centring the vessel to ensure correct positioning on the keel blocks when raised out of the water.

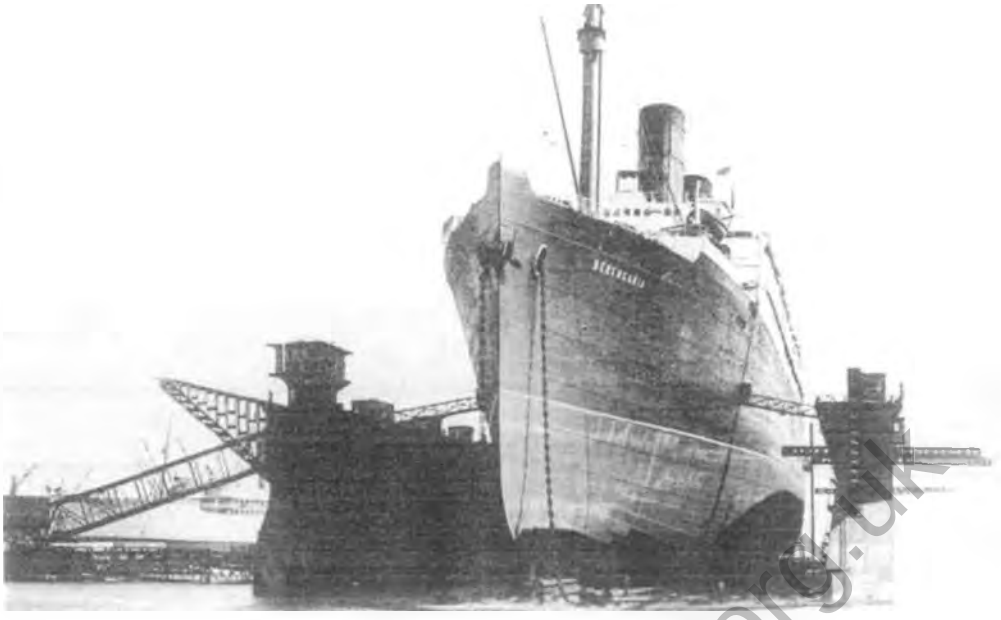


Figure 27:
(J.Salmon Ltd/9752)
Majestic (see caption to front cover photo).
A somewhat unusual rear view





Figure 28: (Anonymous, dated 8/8/1929) During this period the Southern Railway ran excursions to Southampton docks, which usually included a visit to an ocean going liner (the *Aquitania* in this instance) and the floating dock, where an enterprising photographer took orders for his handiwork.

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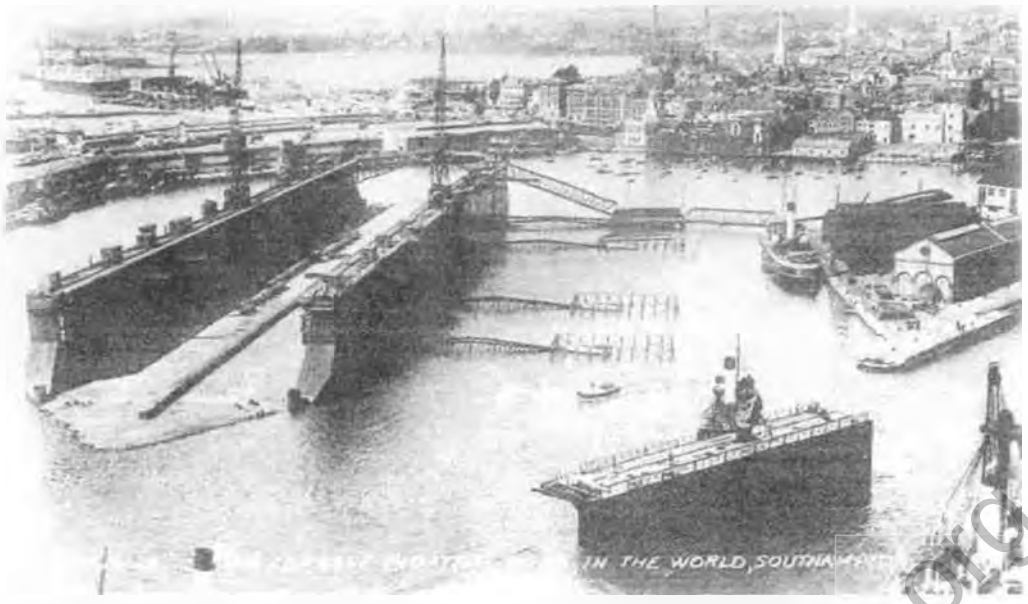


Figure 29: (Valentines/221815 J.V.) The dock is empty but the photo is full of interest. An aerial view probably taken from the floating crane. Note the keel blocks on the bottom of the dock: the centre line remained in position but the side ones were adjusted to suit the dimensions of the incoming vessel. Bottom right, a tug is moving the caisson for No. 7 dry-dock which had been under repair in No. 6 dry-dock (its entrance being on the right) back to the far end of the New Docks. Above this, a tender is on berth 50. Top left, a vessel is on 101 berth in the New Docks. Behind and across the top one can see the bay which was drained and filled to become an industrial estate, and is now full of hotels, leisure outlets and of course shopping plazas.

Figure 30:
(Anonymous)
Majestic.
In spite of caption this view is probably taken from the dock in its submerged position. The two lead tugs (there is another right, off picture) will go right through between the side walls with the ship in tow.



This new dry-dock was opened on 26th July 1933 by King George V. It was known officially as No. 7, though colloquially known as K.G.V. or K.G.5. dry-dock. Once open, the floating dock was more or less out of a job and 1934 was her last year in regular use in Southampton.

During her time at Southampton she hosted the largest British liners starting with the *Olympic* on 12th July 1924 and including the *Aquitania, Berengaria, Mauretania, Majestic, Homeric, Empress of Britain, Asturias* and the *Bergenland.* It appears that only one foreign-flagged vessel used the dock. This was the German *Bremen* which used it twice in 1929, first on July 1st/3rd before her maiden voyage and again on November 27th for attention which lasted for four days. This came about as the only suitable dock in Germany was at that time occupied by the *Europa* (the *Bremen's* sister ship) which was under repair having caught fire and suffered extensive damage whilst fitting out.

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The map in the 1936 Southampton Dock Guide does not show her in position, or indeed the mooring bases off Berth 50 (which at the time of writing are still there, having found use during the late 1940s and early '50s to secure pontoons for BOAC and later Aquila Airways flying boats). Although deleted from the list of available dry-dock facilities she remained in position until after World War Two started.

Bought by the Admiralty on 23rd August 1939, she was used while still at Southampton for repairs to the Monitor *HMS Erebus*. Once this was completed, arrangements were made for transfer to Portsmouth. So early in the morning of February 24th 1940 she left under tow arriving at her new home at 12.45pm on the same day. Numbered AFD 11, she was adapted to accommodate the battleships *Nelson, Rodney* and those of the *King George V* class. During the war she was used to repair smaller dry-docks and also for construction of Phoenix units for Mulberry Harbour used after D-Day.

By the late fifties she was redundant again and was sold for £610 000 to the Rotterdam Dry-dock Company, leaving Portsmouth on May 14th 1959 under tow by the tugs *Elbe, Schelde* and *Tasman Zee*. She arrived at Rotterdam on May 17th. Whilst there she was known as No. 10 the *Prins Bernhard* Dock.

However, in April 1983 this company went out of business and the dock was purchased by the shipbreakers Frans Rijsdijk of Hendrick-ido-Ambacht on 28th December 1983, In the following year it was sold on to Foreign Operations Brasil BV.

For transfer to Brazil it was split into two sections and loaded onto the submersible barges *Giant 1*, and *Sublift Pacific*, leaving Rotterdam on December 17th 1984, under tow by the tug *Smit Houston*. Unfortunately in heavy weather some 200 miles off the Spanish coast the barge carrying the rear section broke adrift and was washed ashore near Corunna: the other section was taken into Vigo. After inspection it was decided that the rear section and the barge carrying it were not recoverable. Together with the other section in Vigo they were purchased for scrap and dismantled.

Jeff Pain

Notes

I must thank Angela Smith and Bert Moody for information which has assisted in the preparation of this article. The illustrations are from Postcards in the author's collection.

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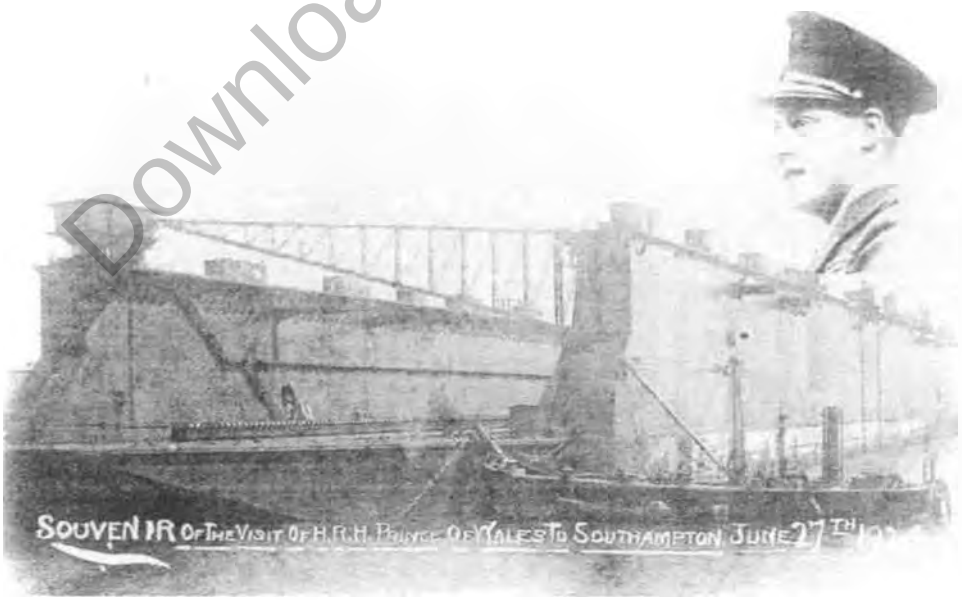


Figure 31: (Anonymous) View of the empty dock with the Prince of Wales' head to commemorate the official opening on 27th June, 1924

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Baldwin Latham and Twyford Waterworks

Over the years many people have left their mark on Twyford Waterworks. However, there is one man who perhaps left more than anybody else. Baldwin Latham, who was the Consulting Engineer of the South Hants Water Company, selected the site and supervised the works until his replacement at the end of 1908.

He was born in Nantwich, Cheshire, in 1836, the son of an architect and surveyor. After attending Nantwich Grammar School, he began a three year apprenticeship at the age of fifteen with the firm of Douglas, contractors of Chester. At the end of his time he went to work in his father's office and remained there until 1860, when he was 24. His first appointment was as Surveyor of the small city of Ely in the Fen country. He was Engineer and Surveyor to the Croydon Local Board from 1863 until 1871 and remained closely associated with Croydon until his death in 1917. He came to specialise in clear water supply and foul water disposal, the vital importance of which came to be appreciated during his lifetime. Whereas the names of the foremost railway engineers such as Brunel and Stephenson are well remembered, water supply was less dramatic than rail travel and sewage disposal received even less public acclaim. Few names are well known – James Lemon and Frederick Bramwell and, of course, Joseph Bazalgette are perhaps the best known. However, at Twyford we remember Baldwin Latham.

He left his mark in many places but most of his work lies underground. As Engineer and Surveyor of Croydon he was responsible for the enlargement of the water works, including the design of the water tower which adjoins the last house in which he lived. Of comparable importance was the main drainage system including the sewage farm. He became an authority on underground water, including the intermittent Croydon Bourne, on which he wrote papers.

In 1871, at the age of 34, he decided to go into private practice as a consultant and a designer. His fields of interest are reflected in the organisations to which he was attached. First he joined the Society of Engineers in 1861 and in 1868 was elected to membership of the Institution of Civil Engineers. In 1870 he presented papers at the Annual Meeting of the British Association for the Advancement of Science. This was followed by the Royal Meteorological Society, the Geological Society and the Royal Sanitary Institute, all of which he joined in 1876. At a time when London was more dominant than now, he was able to attend London meetings from Croydon, and serve various sections in senior positions. For instance, he became President of the Society of Engineers in 1868, President of the Royal Meteorological Society from 1890 to 1892 and Vice President of the Royal Sanitary Institute from 1914 until his death. Perhaps of more significance, he used the Institutions to make contacts which secured work for him. He also found time to write books, perhaps the best known being *Sanitary Engineering; a Guide to the Construction of Works of Sewage and House Drainage*, first published in 1873.

From 1863 until his death he lived and worked in Croydon. He was present at the inaugural meeting in 1870 of the Croydon Microscopical Society (later to become the Croydon Natural History and Scientific Society) and became its President in 1907. His work on the Croydon Bourne has already been mentioned; he presented his first paper on this subject to the Society in 1881. He was responsible for water supply and drainage schemes in many places in Britain and overseas, beginning with a report for Bideford in Devon in 1865 when he was still employed by Croydon.



Figure 32: A newspaper photograph of Baldwin Latham

The South Hants Water Company, for which he was Consulting Engineer, was authorised in 1876 to serve the areas surrounding Southampton. There were great increases in the demand for water, not only for drinking but also for washing, bathing and flushing water closets. At the same time the demand by industry was growing. In 1894 the company was authorised to extend its territory to the south and east of Southampton. It was decided to erect a new pumping station to supplement its existing works at Timsbury, north of Romsey, at a site to be selected in the eastern part of their area. In 1896 Baldwin Latham was appointed with the task of locating and designing the new works as a priority. His studies of the extraction of water from the chalk in Croydon and elsewhere made him an ideal choice. He found that the chalk aquifer under Twyford provided an enormous

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reservoir which was so extensive that variations in rainfall were hardly significant. He selected a number of sites for exploratory boreholes in and around Twyford. Being also a sanitary engineer, he was aware not only of the importance of the availability, but also of the purity of a water supply. Because of the proximity of cesspits, he rejected a site near the village in favour of one in open country about half a mile to the east. Another factor was that the new wells had to be at least two miles from the Southampton Corporation pumping station at Otterbourne.

The sinking of the first well was finished in 1898 and, by 1899, the second well and the construction of the service reservoir on the hill above the works was proceeding. The engine and boiler houses had been completed. By 1900 the works was fully operational with a supply of water far beyond expectations. The original engines and pumps were supplied by the ship builders, Day, Summers and Co. of Southampton, perhaps because they were known to the Directors rather than to the Consulting Engineer. However, they proved less than ideal and Baldwin Latham proposed the substitution of a triple expansion engine for the original compound. He claimed that it would pump a given quantity of water for only 75% of the coal fuel. Although the contract was let in 1905 to Richardson Westgarth of Hartlepool, it was the July of 1907 before the new engine was finally accepted.

The Consulting Engineer was not only responsible for design but also for the operation of the Company's pumping stations. For instance, in 1902 he reported on his meeting with Mr Armstrong of Day, Summers regarding an engine vibrating. (This was traced to the delivery valves on the pumps and after modification the 'knocking' almost entirely ceased). Baldwin Latham made regular journeys to South Hampshire in the days of horses and steam railways. He attended the Board Meetings in Southampton to give his monthly reports and also visited the works at Twyford and Timsbury at least once a month. Presumably, he used his own carriage to get from his home in Croydon to Wimbledon Station and then travelled by train to Shawford Station for Twyford, or Romsey Station for Timsbury. From there he would hire one of the horse drawn cabs which spent their days waiting for custom outside the stations. If, for any reason, he was unable to make a visit, he sent his son. In October 1907 his monthly report included the information that, for the first time, he had been driven for his monthly inspection in a motor car. For the day to day operation of the system, great reliance was placed on the Works Engineer. In the case of Twyford, this was Mr Stone. Mention in the monthly reports indicates that he was highly regarded by the Consulting Engineer.

A set of five photographs taken about 1909 provide a record of the buildings for which Baldwin Latham was responsible. The original building of 1900 appears with its 1905 addition. The water softening plant including the lime mixing building and the filter house, all completed in 1903, are visible. Details include the weighbridge and the impressive chimney. The two foot gauge railway, with its rope worked incline, must have been designed or at least approved by the Consulting Engineer.

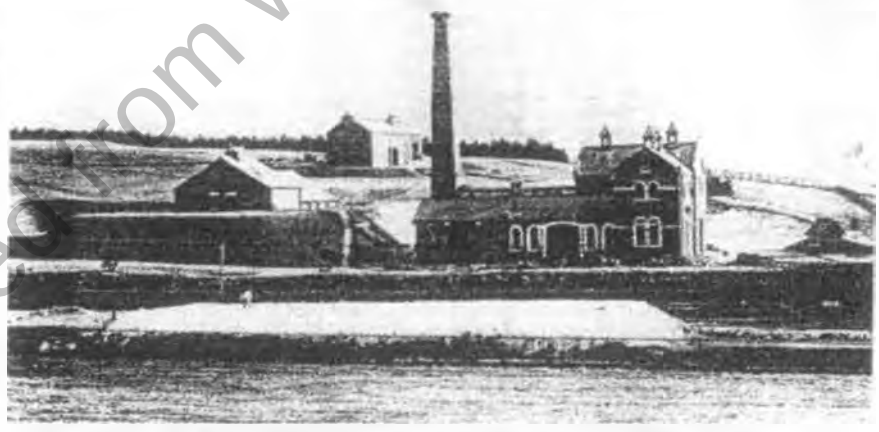


Figure 33: Twyford Waterworks from the north, about 1909. From l to r, filter house and softening tank, lime-making building, original 1900 building with 1905 addition and weighbridge house

This was the stage reached when Baldwin Latham received a letter from the Board stating that the Directors had decided to dispense with his services from the end of 1908. In fact he showed little resistance to what amounted to effective dismissal. South Hampshire was not as remote as the location of some of his responsibilities, Aberdeen or Bombay for example.

Although, at the time, retirement depended on health rather than age, he was 72 and not having to make regular journeys to South Hampshire may have come as a relief. It gave him more time for other activities. The official reason for his enforced retirement was given as lack of knowledge of the district, which was palpably false. Perhaps, by coincidence, he was replaced by William Matthews who happened to be retiring as Engineer for the Southampton Corporation Waterworks Department.

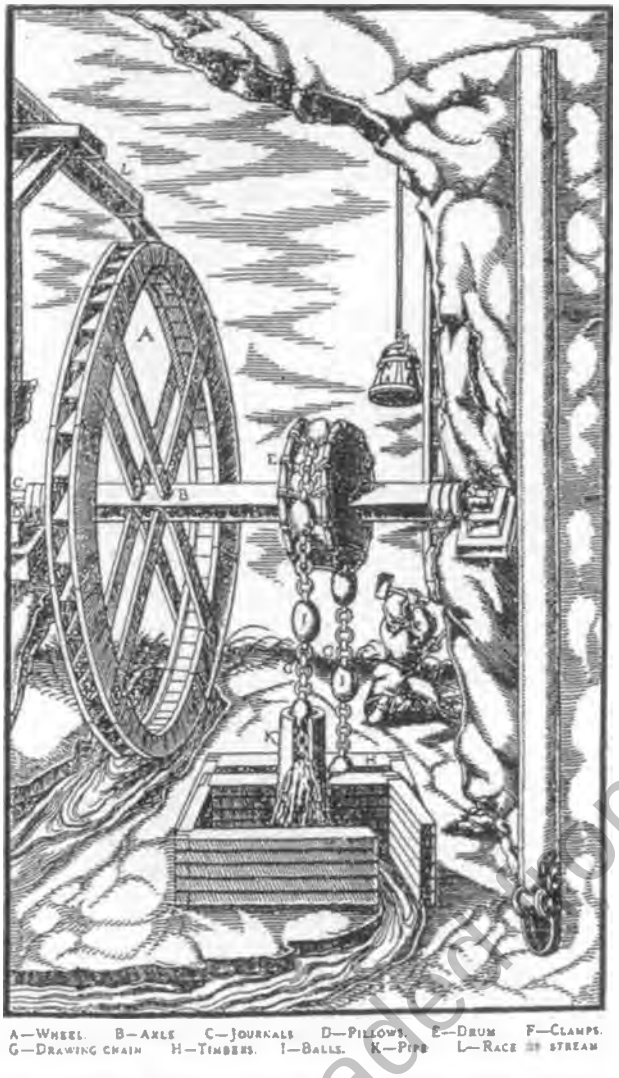
Baldwin Latham left his mark in the water supply and drainage arrangements in many places in Britain and beyond. Despite the manner of his departure from Twyford, members of the Twyford Waterworks Trust appreciate and respect the work he did there.

Dr Edwin Course

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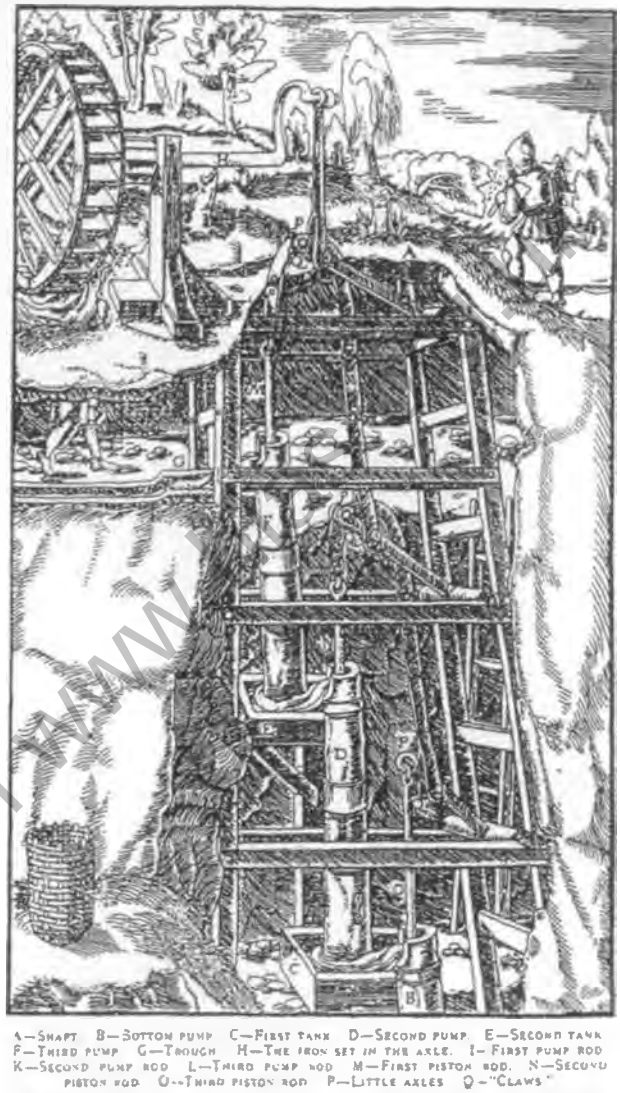
Pumps for water supplies

Devices to pump water have been of major technological interest for centuries. Water pumps were, and are, required to supply water for drinking and other household purposes, to remove sewage and storm water, to irrigate land, and to drain low lying land and mines. Agricola's great treatise on mines and mining technology, De Re Metallica, published in 1556 has tens of illustrations showing methods of raising water from mines with chains of buckets, ball and chain pumps and reciprocating pumps (Figures 34 and 35).



A—Wheel. B—Axle. C—Journals. D—Pillows. E—Drum. F—Clamps. G—Drawing chain. H—Timbers. I—Balls. K—Pipe. L—Race of stream.

Figure 34: Ball and chain pump (Agricola 1556)



A—Shaft. B—Bottom pump. C—First tank. D—Second pump. E—Second tank. F—Third pump. G—Trough. H—The iron set in the axle. I—First pump rod. K—Second pump rod. L—Third pump rod. M—First piston rod. N—Second piston rod. O—Third piston rod. P—Little axles. Q—"Claws."

Figure 35: Reciprocating pump (Agricola 1556)

The simplest form of reciprocating pump is the lift pump familiar as the village pump for shallow wells (Figure 36). When the piston is raised the atmosphere, acting on the water in the well, pushes water through the foot valve to fill the cylinder. On the down stroke of the piston, the foot valve is closed and the water is forced through the valve in the piston to rest above the piston. On the next up stroke of the piston, the water above the piston is displaced out of the delivery nozzle and the atmosphere pushes more water into the cylinder through the foot valve. The pump operates delivering water on the up stroke of the piston. Because atmospheric pressure is limited the pump can only raise water from about eight metres below the pump, less if the valves leak!

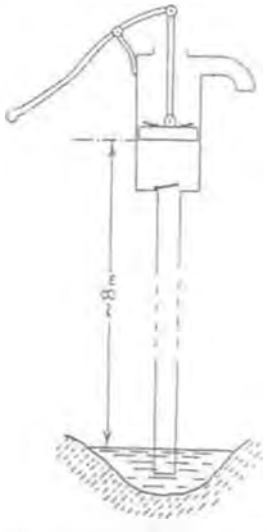


Figure 36: Diagram of lift pump

Power to drive the pumps came initially from men and animals. Man and animal power even survived in England into modern times. A man engine for raising water from a well still exists at Beech in Hampshire (Figure 37) and has been the subject of restoration work by the HIAS 'heavy gang'. The well is over 200 ft (60m) deep and the man engine raises water one bucket at a time.

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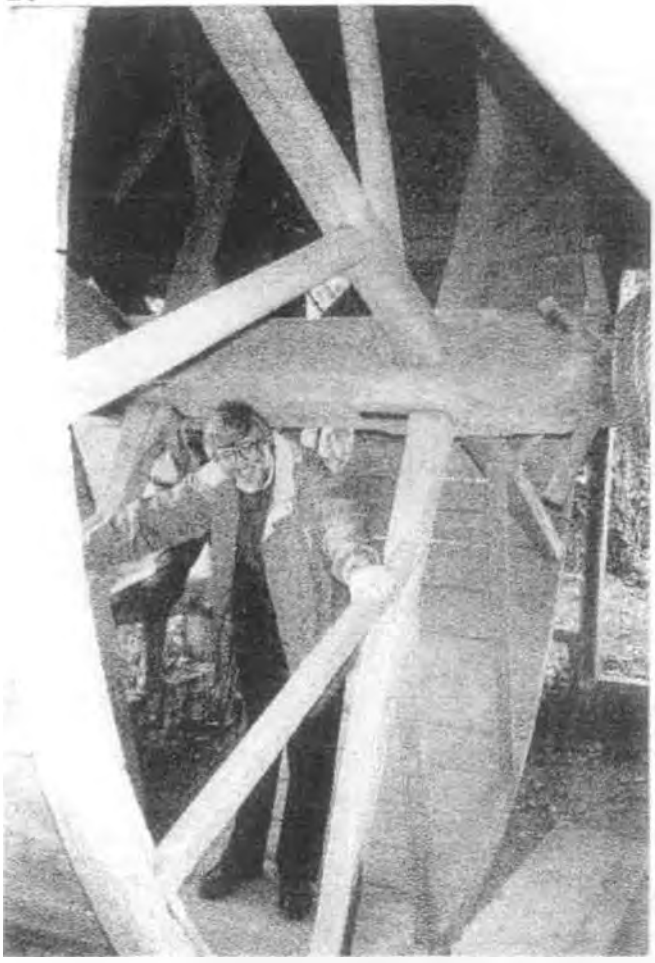


Figure 37: Man powered engine at Beech

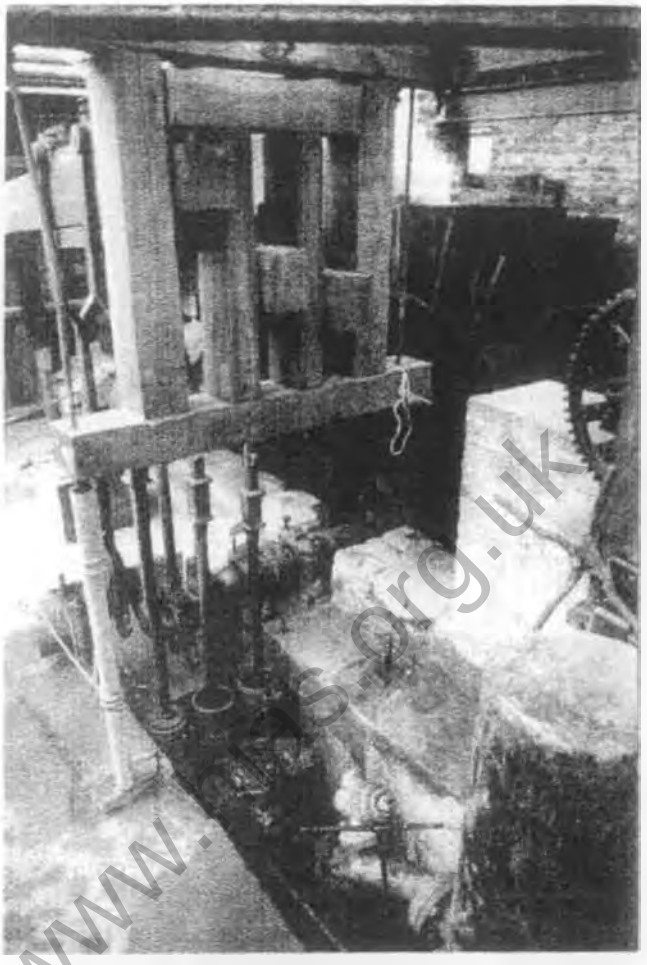


Figure 38: Water wheel powered pump at Coultershaw



Figure 39 (left): Wind powered pump at Crux Easton

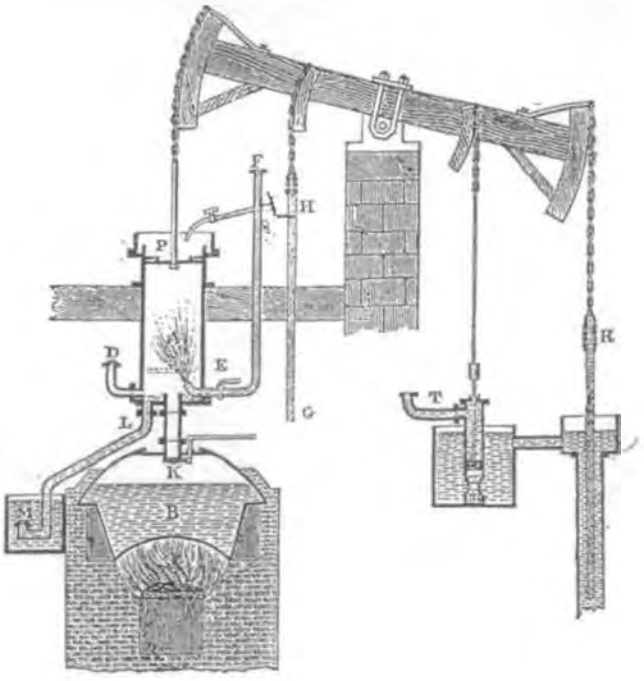


Figure 40 (above): Newcomen pumping engine

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Later, water wheels and wind engines enabled larger quantities of water to be pumped through greater heights. A preserved set of pumps driven by a water wheel can be seen at Coultershaw, raising water from the River Rother to supply Petworth house (Figure 38). In the late nineteenth century many simple wind engines were installed on farms to provide water for drinking troughs around the farm. One such at Crux Easton in Hampshire is the last surviving 'Simplex' type built by John Wallace Titt of Warminster (Figure 39 shows it before restoration). This wind engine originally had 48 radial sails with a diameter of 20 ft (6.1 m). The tower is 32 ft (9.8 m) high. Restoration was commenced by the HIAS 'heavy gang' and is to be completed with the help of a Lottery grant. On test in 1903, a 16ft (4.9 m) diameter wind engine by J W Titt pumped 47 000 gallons in 150 hours giving a mean power output over that time of 240 W.

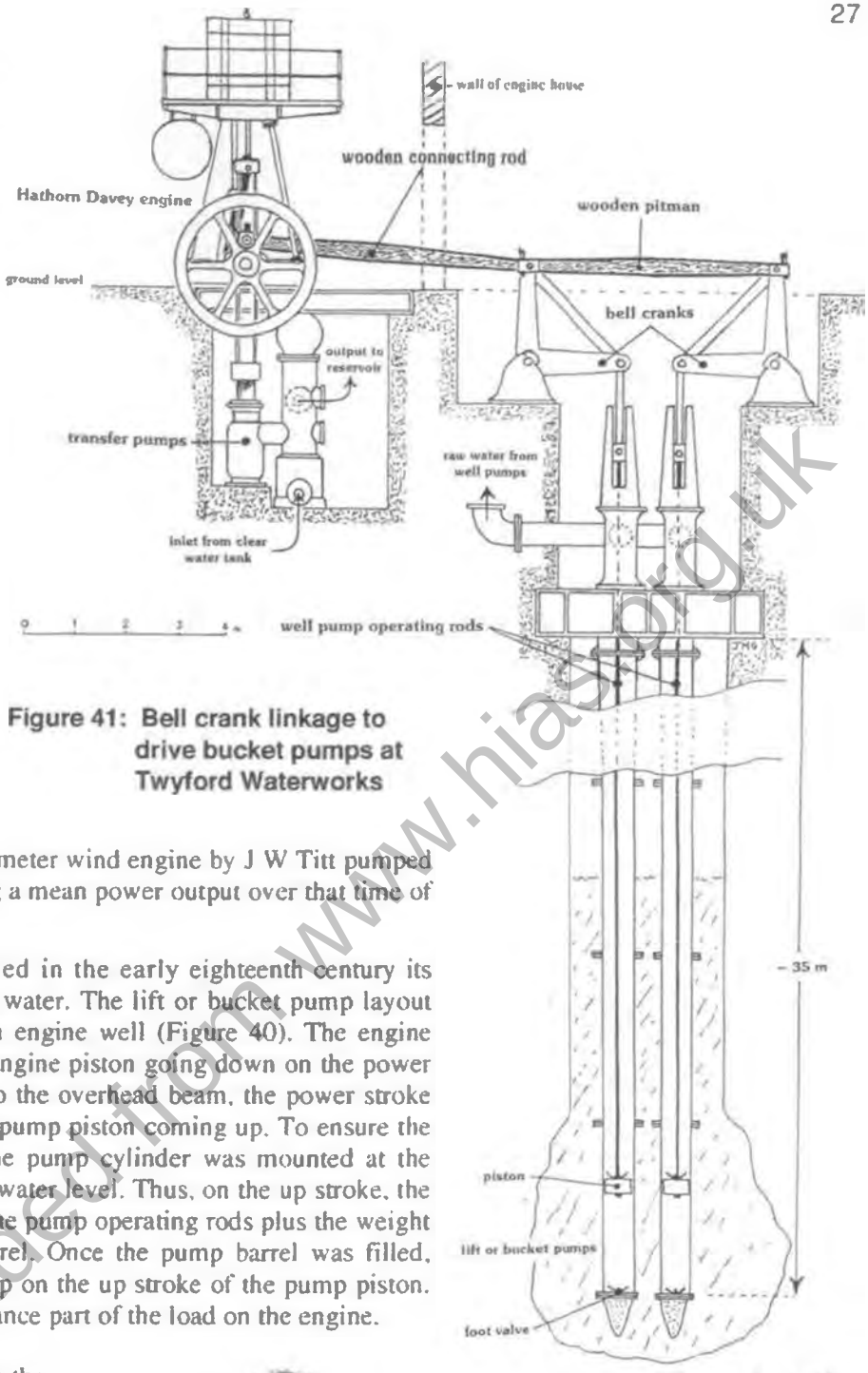


Figure 41: Bell crank linkage to drive bucket pumps at Twyford Waterworks

When the steam engine arrived in the early eighteenth century its first application was for pumping water. The lift or bucket pump layout suited the early Newcomen steam engine well (Figure 40). The engine was single acting with the steam engine piston going down on the power stroke. Through the connections to the overhead beam, the power stroke of the engine corresponded to the pump piston coming up. To ensure the pump did not try to pump air, the pump cylinder was mounted at the bottom of the well or mine below water level. Thus, on the up stroke, the engine had to raise the weight of the pump operating rods plus the weight of the water filling the pump barrel. Once the pump barrel was filled, water was delivered from the pump on the up stroke of the pump piston. Counterweights were added to balance part of the load on the engine.

A history of water pumps over the last hundred years can be seen at Twyford Waterworks in the plant installed there. The original well pumps at Twyford were lift or bucket pumps placed approximately 120 ft (40 m) down the wells. Each well contained two pumps, each of 17.25 inch (438 mm) diameter and with a stroke of 3 ft (0.915 m). The linkage to drive them (Figure 41) ensured that the two pumps were in antiphase so

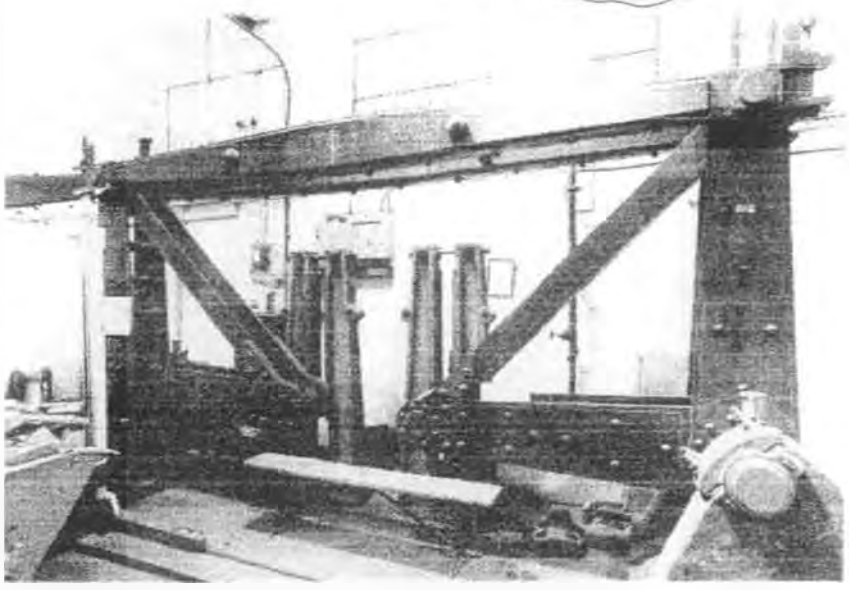


Figure 42: Wooden connecting rods at Twyford Waterworks

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that the supply of water was continuous and the load balanced. Water is almost incompressible so that if a pipe were to get blocked or a valve stick, the pump would seize and could wreck the engine. For this reason the connecting rods between the engine and the pumps (figure 42) were made of wood which would absorb the energy and shatter rather than damaging the engine.

Whilst the lift pump is used to raise water a different arrangement of pump parts is used to make a force or plunger pump to supply water at high pressure. Figure 43 compares the two. In the force pump, water is drawn in through the foot valve *A* on the up stroke of the piston or plunger, and forced out through valve *B* on the down stroke of the piston. At Twyford, the plunger pumps (Figure 44) are mounted under the steam engine. There are three force pumps 13.75 inch (350 mm) in diameter with a stroke of 3 ft (0.915 m) to deliver the water to the reservoir on the top of a nearby hill 180 ft (55 m) above the engine. The valves on these pumps are simple discs of rubber. Water forced up from below through the holes in the valve plate lifts the rubber disc and enters the pump cylinder. When the flow of water is reversed the water pressure seals the rubber disc against the valve plate and shuts the valve (Figure 45). Although seemingly crude, such valves work reliably and last for many years.

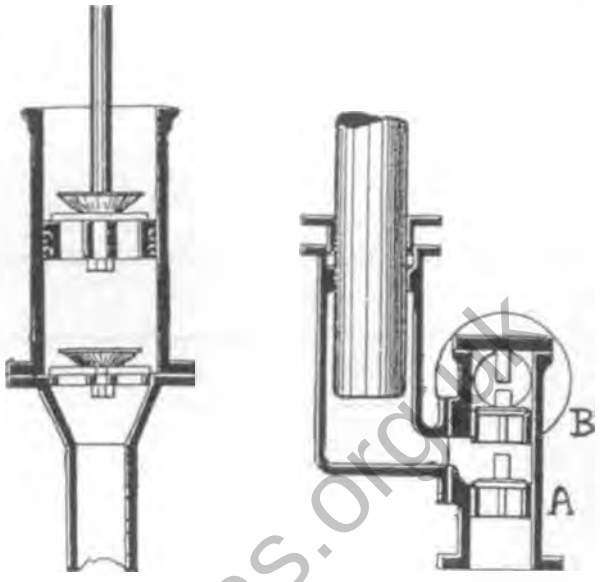


Figure 43: Comparison of lift and force or plunger pumps

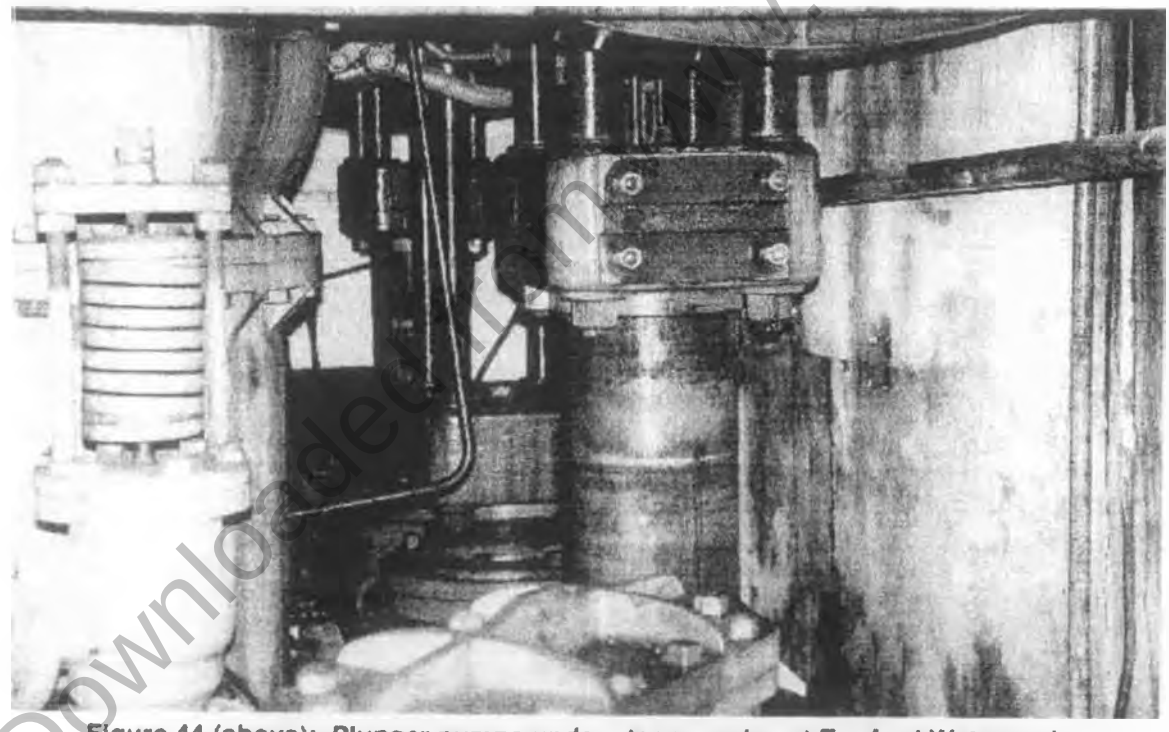
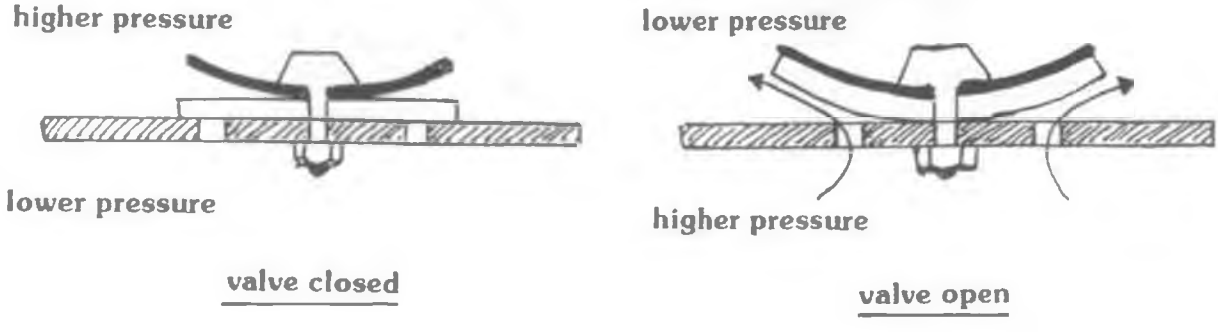


Figure 44 (above): Plunger pumps under steam engine at Twyford Waterworks

Figure 45 (below): Diagram of disc valve for water pump



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As water is incompressible and the water flow has to be stopped and reversed every time the piston of the force pump changes direction, reciprocating water pumps can only be operated slowly (up to around 30 strokes per minute). This is ideal for pumps driven by a water wheel or a slow-speed steam engine like that at Twyford but does not match the characteristics of electric motors or diesel engines. To couple these to a plunger pump a step-down gearbox is required. One such installation used to exist in the sewage pumping plant at Garnier Road, Winchester (Fig. 46). Here, three sets of plunger pumps were driven by two diesel engines and an electric motor.

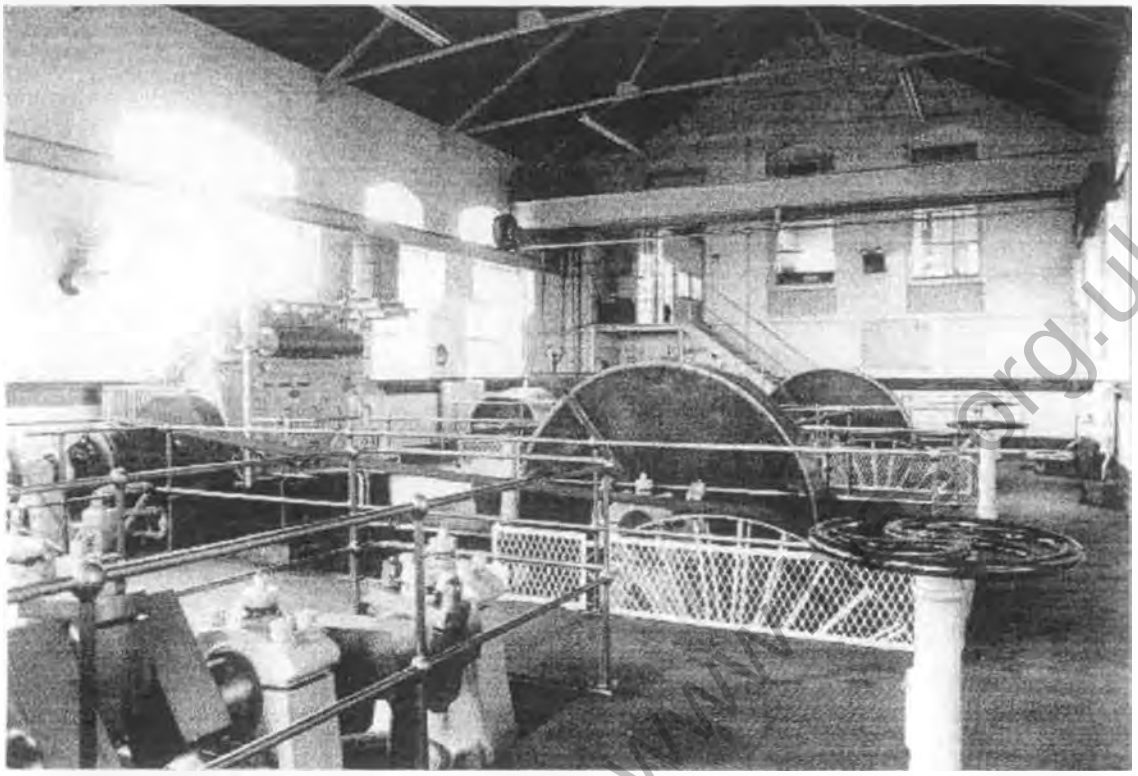


Figure 46: Bucket pumps at Garnier Road, Winchester

Another family of water pumps which has now become the most popular type of pump, is that of the centrifugal pump. This is the type of pump used in washing machines, central heating pumps and garden water features, etc. It consists of an impeller rotating in a 'snail' shaped casing (Figure 47). Water enters at the centre of the impeller and is accelerated radially outwards. As it leaves the impeller it is moving much faster and is collected by the casing and delivered to the outlet pipe. The pump has no valves so that when the impeller is stationary water will drain back through the pump unless isolating valves are fitted. Centrifugal pumps will not start unless flooded with water and so must be mounted below the level of the intake from the supply. They work well when delivering large volumes of water through moderate heights. When high pressures are required two or more pumps may be cascaded in series.

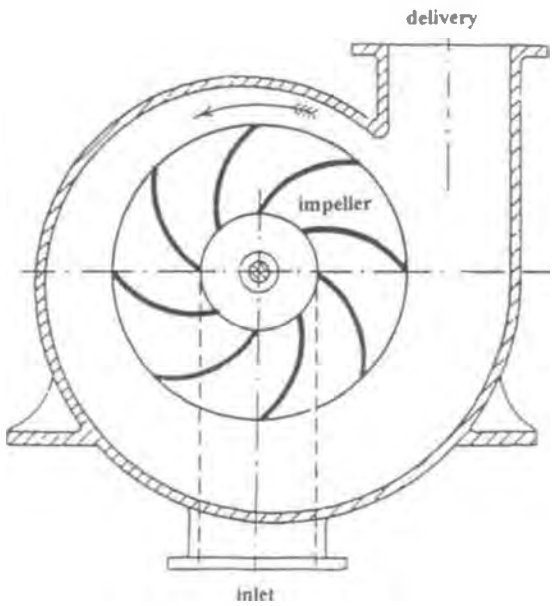


Figure 47: Diagram of simple centrifugal pump

When Twyford Waterworks was extended in the 1930s diesel pumps driving centrifugal pumps (Figure 48) were selected to complement the steam engines and reciprocating pumps. There were three sets of pumps; one to raise water from a new well under the diesel engine house, and two to deliver water to the supply. To pump against a given pressure difference a smaller centrifugal pump requires a higher rotational speed. Thus the Twyford diesel engines drove their pumps through step-up gearboxes. One of the two stage pumps (Figure 49) has had half of its casing lifted so that the impeller can be seen. This pump delivered three million gallons per day (0.15 m3 per s) to a height of 180 ft (55 m) above the pump. The impeller rotated at 1357 r.p.m.

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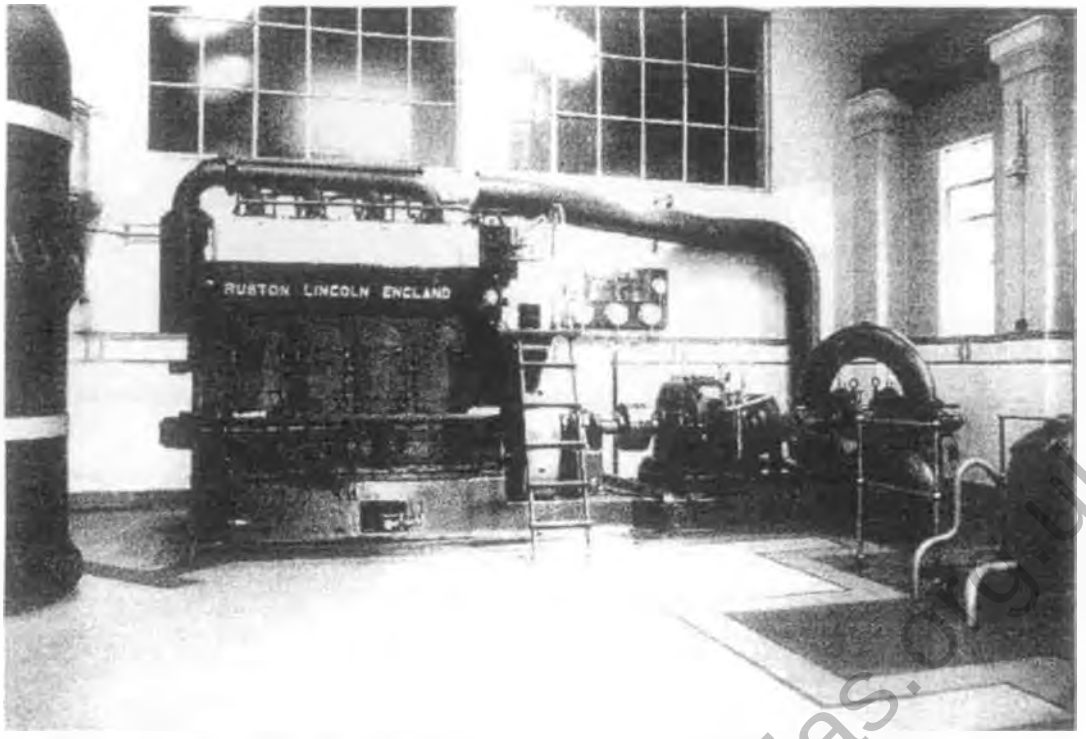


Figure 48: Diesel engines driving centrifugal pumps at Twyford Waterworks

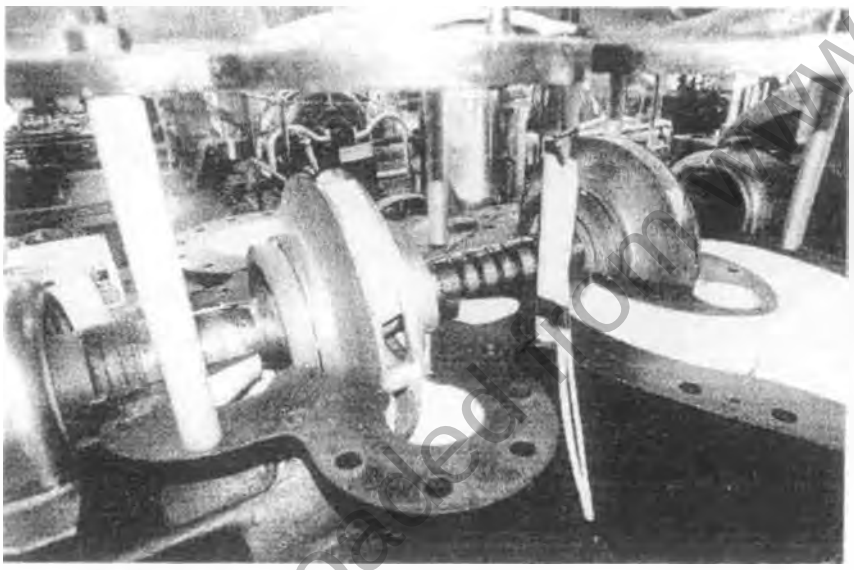


Figure 49 (above): Two stage centrifugal pump at Twyford Waterworks

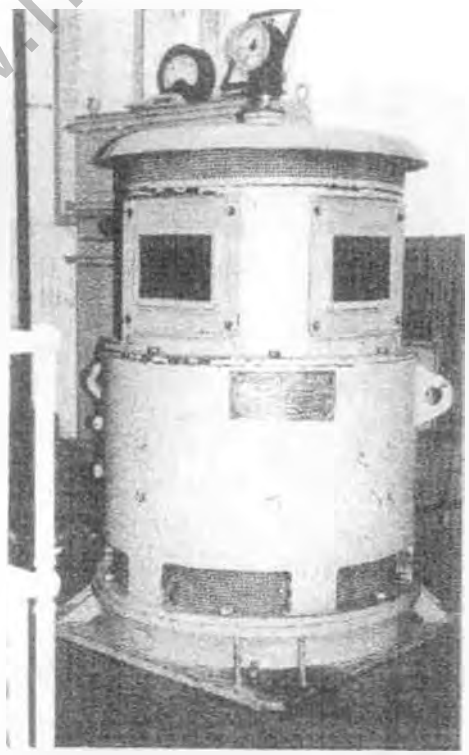


Figure 50 (right): Electric motor to drive centrifugal pump

A mains electricity supply came to Twyford Waterworks in 1950 and with it came electric pumps. The first generation used two stage centrifugal pumps capable of delivering 5 million gallons per day (0.25 m3 per s). The well pump was mounted at the bottom of the well and driven by a d.c. motor at ground level (Figure 50). The delivery pump was mounted directly under its motor in the basement of the engine house. These pumps have now been replaced by submersible electric pumps driven by a.c. electric motors. The motor itself is at the bottom of the well and is directly attached to sufficient pump stages to raise the water directly from well to supply.

Martin Gregory

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Hampshire Industrial Archaeology Society was founded as the Southampton University Industrial Archaeology Group in the 1960s from members of University Extra-Mural classes who wished to continue and develop the practice of industrial archaeology. Recording has included surveys of mills, breweries, brickworks and farm buildings. Restoration work is undertaken directly or by associated groups, such as Tram 57 Project, the Hampshire Mills Group or the Twyford Waterworks Trust. In addition to the Journal, the Society publishes a newsletter and has also published several monographs. Lecture meetings are held every month. Current membership fees are £11.00 (single member); £16.50 (joint membership); £18.00 (Corporate); £8.50 (out of county).

To join, contact the Membership Secretary:
Keith Andrews, 13 Ashley Close, Harestock, Winchester, Hampshire, SO22 6LR

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