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Hampshire Industrial Archaeology Society

Journal



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No. 19

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Front cover picture:
The Saunders Roe SR45 Princess taking off from the Solent (Bob Wealthy)

Back cover pictures:
Top: Southampton Corporation Tramways ticket (Jeff Pain)
Centre: The water tower at the 'Absent Minded Beggar' hospital at Alton (Jane Hurst)
Bottom: Baldwin Latham's engine house at Surrey Street Pumping Station, Croydon (Martin Gregory)

Hampshire Industrial Archaeology Society

(formerly Southampton University Industrial Archaeology Group)

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Editorial

Welcome to Issue **19** of our *Journal*. Once again the *Journal* covers a variety of subject areas in Industrial Archaeology.

We start with an article on the Saunders Roe aircraft company on the Isle of Wight. The Solent area was very much the cradle of early aircraft manufacture in the UK. The ex-Saunders Roe Columbine Hangar still dominates East Cowes and the manufacture of aircraft components continues on the island. Bob Wealthy writes about the SR45 *Princess* flying boat, conceived at the end of the Second World War as a successor to the *Empire* flying boats which had sustained communication around the British Empire in the 1930s. Jane Hurst tells the story of the surviving remains on a site near Alton which served as a hospital and college for over a century under several auspices. Baldwin Latham was a Waterworks Engineer with a world-wide practice in the late nineteenth century. He is remembered locally as the Engineer of Twyford waterworks, near Winchester, and Croydon waterworks. The earliest street tramway systems were powered by horses. Jeff Pain gives us a glimpse of the Southampton Tramway Company's horse trams before the takeover by Southampton Corporation.

Martin Gregory
May 2011

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The Contributors

Bob Wealthy
Bob Wealthy has had a lifelong interest in aviation from the early 1950s when the British Aircraft Industry was a hive of activity. Living on the Isle of Wight meant that the Saunders Roe company and its various activities were a source of great interest. This interest has continued to the present day and after retiring in 2006 from a career in the Defence Electronics and Communications industry, Bob has found time to present the achievements of local companies such as Saunders Roe to a wider audience through the production of books, publications and DVDs, and talks to various organisations and local interest groups.

Jane Hurst
Jane Hurst is Secretary of the Curtis Museum and Allen Gallery in Alton and a member of the Hampshire Field Club. Her works include *Alton's Inns*, *Alton's Pubs* and *Alton and Jane Austen* and she has co-authored *Alton and its Villages*, *Around Alton* and *Alton and its Villages Through Time*.

Martin Gregory
Martin Gregory is a retired schoolmaster. His interest in the history of technology goes back over 45 years. He has researched and built model steam and Stirling engines for many years and also works on the history of the sewing machine. He has been a member of HIAS and its predecessor for over 40 years, has served as Secretary and Chairman and is the present editor of the Journal.

Jeff Pain
Jeff Pain has been a member of the Hampshire IA group since its 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 work. After the reorganisation of shipping, he spent twenty years or so with Pirelli, first at Southampton and, when that closed, at Eastleigh. His main interest has always been in transport covering ships, railways and aircraft, with road interest limited to trams and buses.

Acknowledgements

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Saunders Roe and the Princess Flying Boat

Bob Wealthy

This article describes how a small company on the Isle of Wight designed, built and flew the world's largest turbine-powered commercial flying boat nearly sixty years ago, and all the setbacks that were encountered on the way. Of the three examples of the Princess constructed, only the first, identified by its registration mark G-ALUN, was flown. By the time of the maiden flight on 22nd August 1952 it had become evident that there was no longer a real market for large flying boats. Nevertheless sufficient flight testing was done to show that the Princess was capable of meeting its required specification.

Flying boat travel, even today, inspires the romantic notion of global travel, allowing enjoyment of all the benefits of the speed of an aircraft, but with the comfort of an ocean liner. This notion was perhaps exemplified to the greatest extent in the days of the Imperial Airways Empire flying boat services in the long gone days of the British Empire. Whilst it was to become evident that the world had changed as a result of World War Two, the dream of re-instating flying boat services in the post-war era led to the British Government letting a contract to the Saunders Roe Company in 1946 for the next generation of large flying boats.

The main aim of this venture was to topple the supremacy of the ocean liners and their dominance of the lucrative trans-Atlantic route. This project was the responsibility of the Ministry of Supply (MoS), including the supply of engines for the aircraft on a free issue basis. The Ministry of Civil Aviation (MCA) and the state-owned British Overseas Airways Corporation (BOAC), as the potential operator, were also involved in the project to specify details to cover their respective regulatory and operational requirements.



Figure 1. An artist's impression of the next generation large flying boat

The origins of the SR45 Princess.

Despite the pre-war airline success of the Imperial Airways Short Empire flying boats, and the wartime contribution of the Sunderland derivative, flying boats were excluded from the terms of reference of the wartime Brabazon Committee formed to advise the British Government on post-war civil aviation. Saunders Roe and Short Brothers had co-operated on the development of ideas and concepts for a next generation large flying boat since 1939. In 1943 Saunders Roe discovered the omission of flying boats from the Brabazon Committee's brief and sent a memorandum to the chairman. Saunders Roe had continued their research into the future development of the flying boat whilst concentrating their main efforts on war production. Under the chief designer Henry Knowler, the company had produced a number of flying boat designs. Arthur Gouge, the Chief Designer at Shorts for a number of years, with responsibility for the Empire Class and Sunderland flying boats, joined Saunders Roe in 1943 as Chairman and Chief Executive. Arthur Gouge and Henry Knowler became the driving force behind the large flying boat project. The first design under their leadership was the SRA/1 jet fighter flying boat that was flown in 1947.

In 1944, Saunders Roe put forward detailed proposals for two flying boats of 184 000 lb (83 tonnes) and 187 000 lb gross weight with six Bristol Centaurus piston engines for non-stop London to New York service. Another design was proposed of 250 000 lb (113 t) gross weight with eight Centaurus engines coupled in four pairs, the engine configuration being the same as that for the Bristol Brabazon 1 landplane. A further design was put forward at the request of the Ministry of Aircraft Production, later to become the Ministry of

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Figure 2. The Saunders Roe works at East Cowes where the Princesses were built. The Columbine Hangar on the left was the main assembly area and the Medina hangar in the centre was used to construct major sub-assemblies. The building further to the right was Seaholme House that accommodated the Saunders Roe managers' offices.

Supply, of 260 000 lb gross weight powered by six Rolls-Royce Eagle piston engines, later to be replaced by turbo-propeller engines. These proposals were identified as P.136/1 and 2, and were to become the starting point for the SR45 project that emerged around 1945, and was later to become known as the Princess. Saunders Roe did not suggest the class name until November 1948, some two years after the contract was awarded. At the time the MoS stated that prior approval would be needed if any Christian names followed the generic Princess class title for obvious reasons.

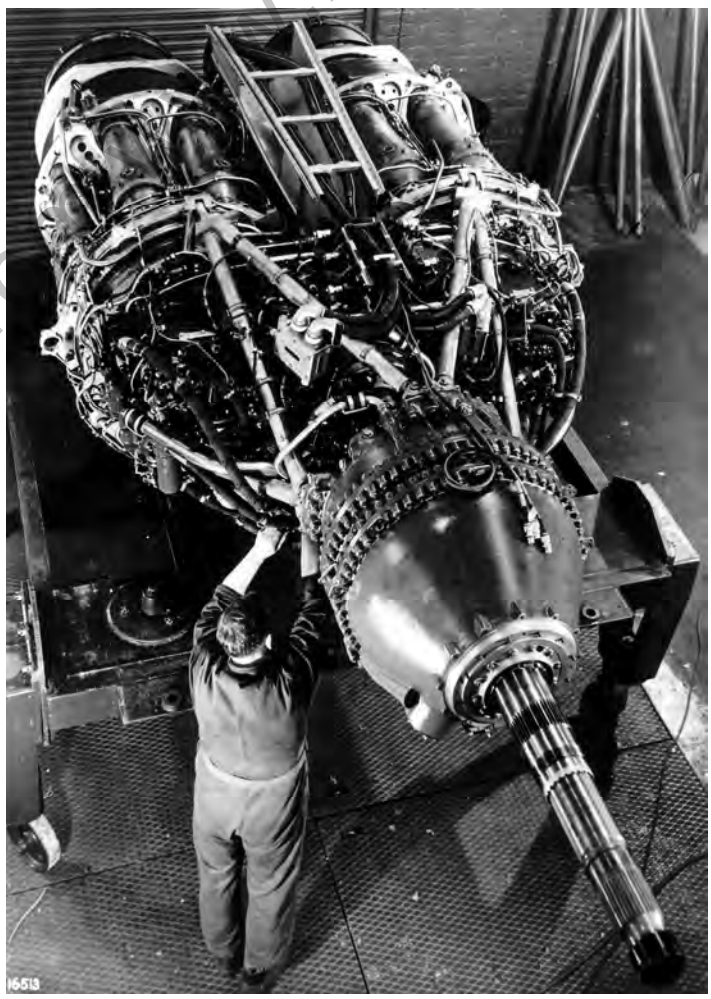


Figure 3. Bristol Twin Proteus engine and gearbox (GKN)

The engine choice presents difficulties.

By February 1945, projected engines were six gas turbines of Rolls-Royce or Bristol origin. In July 1945, Saunders Roe made a request to submit a formal tender for the SR45 project, and this was submitted to the Ministry of Supply in September 1945. The design proposed was of 266 000 lb (117 t) gross weight and powered by six Rolls-Royce Clyde turboprop engines. This proposal was followed up with more detailed proposals for passenger accommodation and application to the Empire air services and main world air routes. Within a month of a meeting in April 1946 involving MoS, MCA, BOAC and Saunders Roe representatives, a draft specification 10/46 was drawn up by the MoS. This specification formed the basis of a contract for the design and construction of three SR45 flying boats by Saunders Roe for intended operational use by BOAC. By the middle of 1946, BOAC had

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decided that it was too early in the project to be precise and wanted the contract to be confined to essential features only. In January 1947, the MoS decided not to complete the specification and passed the responsibility on to Saunders Roe.

Meanwhile, the vital question of the choice of engine remained unresolved. All the turboprop powerplants were in various stages of development and none had reached production. Four engines were considered - the Armstrong Siddeley Python II and Cobra, the Rolls-Royce AP 25 Coupled Tweed, and the Bristol Coupled Proteus. With the Cobras and a gross weight of 300 000 lb (135 t), it was estimated that the Princess could carry 72 passengers and 1500 lb of freight between London and New York. The Rolls-Royce Tweed engine was preferred because of its technical advantages in the Princess, the fact that it was being developed for military use and the quoted delivery dates conveniently suited the Princess programme.

The first setback came when Saunders Roe learned that Rolls-Royce would only supply bare engines, leaving Saunders Roe to obtain ancillary equipment from other companies such as Bristol, and to design and construct other items themselves. Another blow came when the MoS decided to cancel the military aircraft designed for the Tweed engine. A third blow fell when Rolls-Royce declared that the Coupled Tweed engine would not be ready in time for the Princess. Thus, the Tweed was no longer a viable possibility and an alternative engine solution was sought.

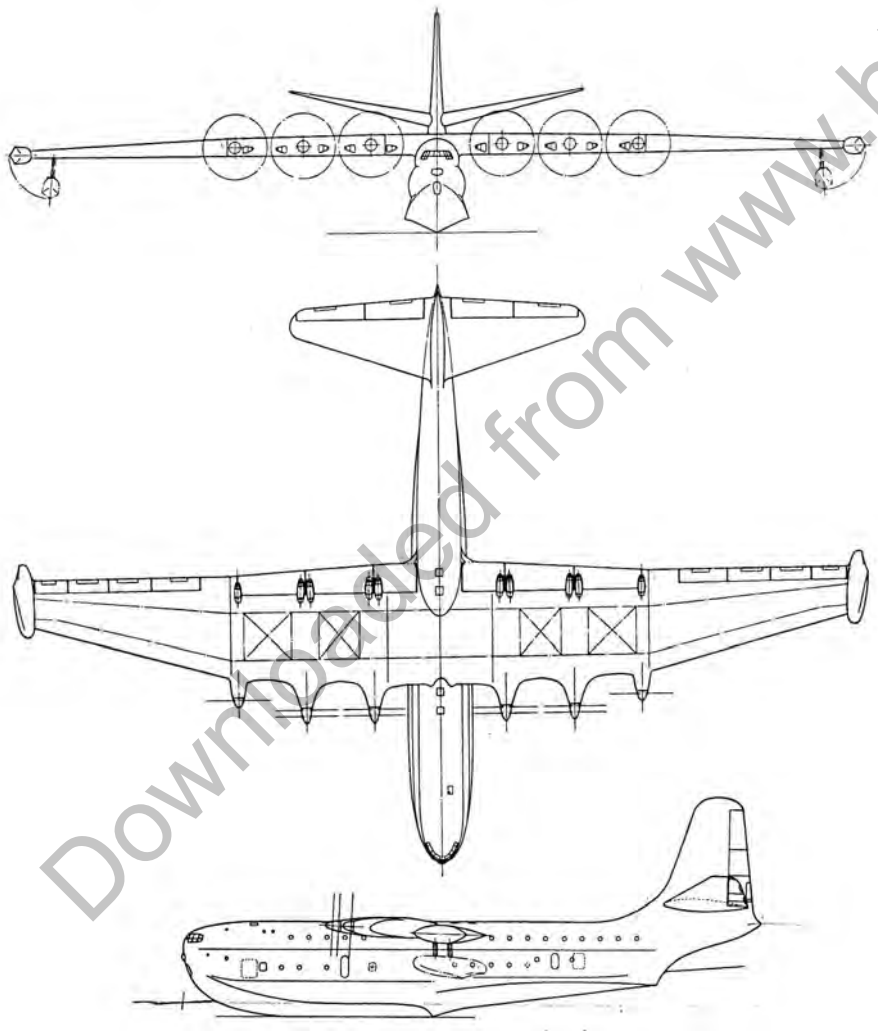


Figure 4. General arrangement drawing of the Princess showing the "double bubble" pressurised hull configuration and the arrangement of the four Coupled Proteus and two single Proteus engines

In the spring of 1947, the MoS, having taken advice from all parties involved in the project, decided that the Bristol Proteus engine should be selected for the Princess. BOAC found this advantageous because the same engine was envisaged for the Brabazon I Mk II. Saunders Roe concurred with this decision and the consequent powerplant configuration for the Princess of ten Proteus engines, eight as coupled pairs and two as single engine installations. Delivery times promised for the Proteus were six months earlier than those offered by Rolls-Royce for the Tweed. Use of the Proteus allowed a revised gross weight, including full BOAC allowances, of 315 000 lb (142 t) for the Princess.

However, for Saunders Roe the change of engine involved re-design of the wing, the scrapping of parts made, and dislocation of the workforce including some temporary unemployment. These disadvantages were offset to some extent by the Bristol Aircraft Company accepting responsibility for powerplant installation work that Rolls-Royce had been unable to provide for the Tweed. Alternative propellers were designed for the Princess to suit the Proteus engines. The large contra-rotating propellers and single reversible-pitch propellers were designed and supplied by de Havilland Propellers. The

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Rolls-Royce Clyde was tentatively suggested as possible insurance against any difficulties with the Proteus, which, when selected, was still under development. Bristol planned a succession of versions as Mks 1, 2 and 3 as development work progressed. The Mk.l was the Proteus prototype, the Mk.2 a development engine of lower power and higher fuel consumption than the planned Mk.3 production version. In the autumn of 1947, Bristol informed Saunders Roe that only the Mk.2 Proteus would be provided for the first Princess. By increasing the fuel weight required and with the reduced power output from the Mk.2 engine, the performance and economics of the Princess were adversely affected. Saunders Roe pressured Bristol to supply the full rated engines, but this was not possible, and the company was forced to make the best of what could be provided to meet the programme agreed with the MoS and BOAC.

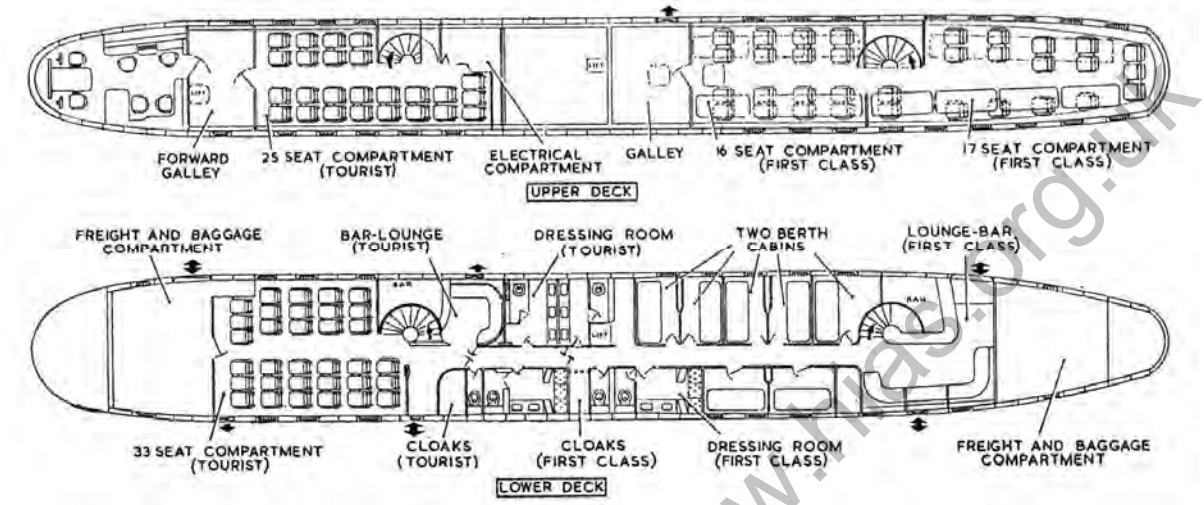


Figure 5. Princess seating plan to accommodate 105 passengers for the trans-Atlantic route as agreed with BOAC

Progress is made but costs increase.

At this time, the Saunders Roe design department employed 218 staff, with 177 working directly on Princess construction and twelve others investigating its handling, beaching and maintenance equipment. The original Tweed-engined Princess had been scheduled for completion and launching by October 1949, with the wing re-design for the Proteus causing a delay of at least two months. Flight trials were estimated to take thirteen months, followed by a period of fitting out for passenger service. From the first delivery date forecast from Bristol for the Proteus engines, it was calculated that the first Princess would be handed over to BOAC in March 1953. Initially it was intended to fit reversible propeller controls on the outermost Coupled Proteus engines, but this was later changed to a simplified arrangement where reversible propellers were only fitted to the outer single Proteus engines.



Figure 6. Part of the huge interior of the Princess, the centre cabin, upper deck, looking forward. The prototype Princess was not fitted out with passenger seating as the aircraft was equipped with test instrumentation and ballast tanks for the flight testing programme. (GKN)

The costs quoted by Saunders Roe for the project included design costs of £321 750 to meet the specification, and £812 750 for each Princess, less engines, propellers and items supplied by MoS. It was estimated that the whole project would cost about £5 million. The MoS would bear costs of £2 million, including £1.3 million for the engines and £700 000 for research and development. Saunders Roe undertook to pay the capital cost of new plant and buildings which, up until April 30th 1953, amounted to £184 504. Costs increased as a result of subsequent MoS requirements including:- manufacture of half-scale wing and

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pressure hull sections; the design and manufacture of mock-ups, models and test specimens; the adoption of the 5-day week in industry; engine changes affecting the wing design; the intention of the Government not to act as its own insurer. Jigs and tooling were designed with the aim of supporting production of up to twelve aircraft each year during the production phase. In view of the magnitude of the project and the technical risks involved, the cost estimates could only be considered as provisional. At a later stage the MoS asked Saunders Roe to give prices for production aircraft. Based on a total run of 23 aircraft, the first three were priced at £850 000, £750 000 and £650 000 respectively.



Figure 7. Work underway on the Princess upper deck looking forward. (GKN)

A major part of the Princess project was the adoption of a large pressurised double deck hull. In addition to supplying the engines for the Princess, Bristol undertook to supply the main part of the cabin air conditioning system, which was similar to the Brabazon. However, Bristol was to abandon manufacture of this equipment, so Saunders Roe had to look elsewhere. Recovery of the time lost was impossible, and further delays ensued. The fundamental difficulty for the project was the slow development of the Bristol Proteus engines. Bristol had indicated that there might be some weight increase, but it was not revealed until January 1950 that this would mean an increase of 1326 lb (600 kg) per aircraft. Four months later this was reduced to 532 lb (240 kg) through deletion of the isolating clutch from the coupled engines. This meant that if one of a pair of coupled engines failed, then both would have to be shut down in flight.

Saunders Roe had expected to receive ten Proteus engines in July 1949, eight coupled and two single units. But in February 1947, this delivery date was postponed to the Spring of 1950, thus deferring the first possible flight date by nine months. Wooden mock-ups of the engines were supplied to allow airframe construction to proceed, with the wooden single engine unit reaching Cowes in mid-November 1949,

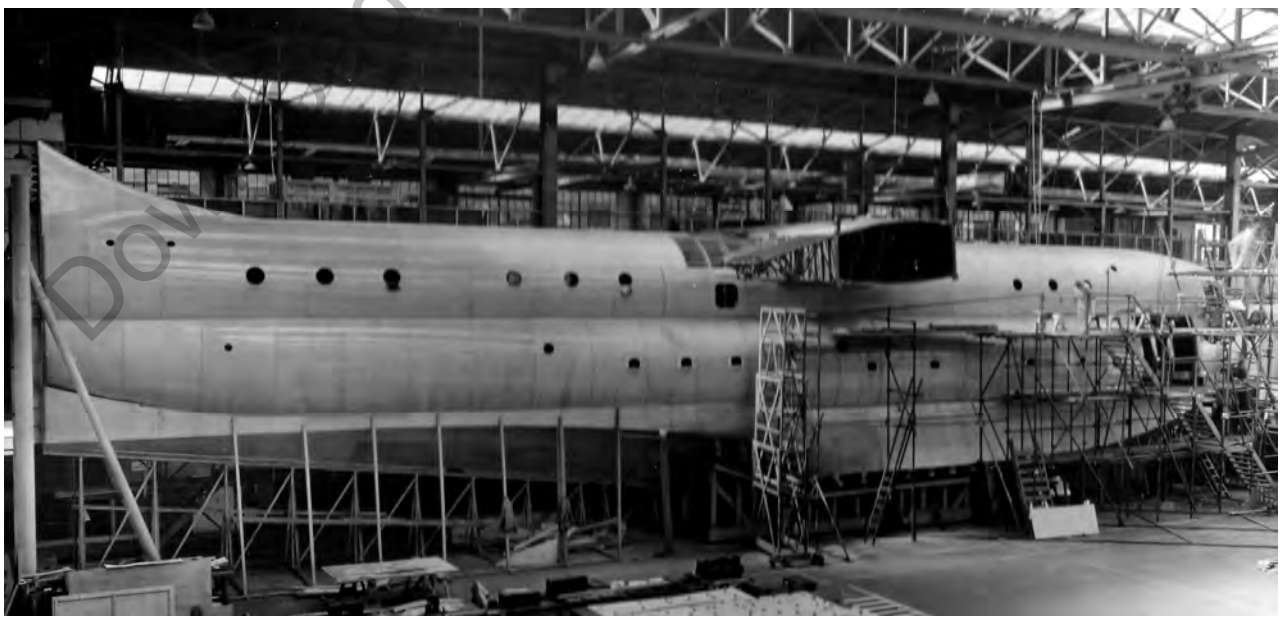


Figure 8. Princess hull under construction in the Columbine Works main assembly bay. (GKN)

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followed by the coupled engine mock-up at the end of December 1950. More accurate metal mock-up engines were promised - the first for a single engine was received in September 1950 and installed in the starboard outer position for work on firewalls and cowlings. The first Coupled Proteus engine unit was delivered to Saunders Roe in January 1951, and this was installed in the port centre position by mid-February. However, this was only a "slave" unit to prove the installation for different engine positions, and it had to be returned to Bristol for modifications.

The final specification for the Princess, dated March 1st 1949, was approved by the MoS, but in the same month, Bristol announced that there might be a 5% increase in fuel consumption. Early in 1951 Bristol confirmed that the Proteus 600 (single unit) and 610 (coupled) would only provide 2500 shp (1.9 MW) per engine as opposed to the expected 3750 shp (2.8 MW). This left the prototype Princess with a serious power deficiency of some 30 per cent. The first usable single Proteus engine unit was received at Cowes on August 31st 1951, and the second on September 20th. The first Coupled Proteus engine unit was delivered on October 26th 1951, but the fourth was not received until August 1st 1952, just three weeks before the first flight of the Princess took place. The first of these deliveries was 26 months behind the originally intended date, and the last was 37 months late. Saunders Roe suffered badly from these delays that were entirely due to the Proteus engine development programme that was beyond the company's control.

Work proceeds towards the maiden flight.

Following laying of the keel section, the main pressure hull was constructed in the Columbine Hangar part of the main works at East Cowes. The wing centre section, tail section and inner and outer wing sections were built in the adjacent Medina Hangar. The wing centre section and hull section assemblies were moved to the centre of the Columbine Hangar to allow the inner wings and tail sections to be attached. At this stage the partially completed airframe was moved outside onto the slipway apron for attachment of the outer wing sections, and for engine installation and final fitting out.



Figure 9. Saunders Roe Chief Executive Sir Arthur Gouge (right) and Chief Designer HenryKnowler (left) await the commencement of the move to get the Princess out of the Columbine Hangar. (GKN)

The final Proteus engine unit was installed by August 7th 1952, and ten days later Princess G-ALUN was weighed on the slipway apron in front of the Columbine Works at East Cowes. This apron had been strengthened specially at a cost of £30 000. Five flight loading schedules were prepared covering all-up weights to 280,000 lb (126 t), later increased to 330 000 lb (149 t). With a wingspan of 219 ft (67 m) and an overall length of 148 ft (45 m), the Princess became the largest all-metal flying boat ever built.



Figure 10. The hull of the prototype Saunders-Roe Princess emerges from the Columbine Hangar for the final assembly stage. (GKN)

The "double bubble" pressurised hull was intended to offer luxurious accommodation for 105 passengers on two decks. She was expected to cross the Atlantic at a cruising speed of 330 knots at altitudes varying between 30 000 ft (9159 m) and 39 000 ft (11 900 m) and,

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Figure 11. Cockpit and instrument panel. (GKN)

dependent on the payload carried, the predicted still-air range was 3640 mile (5860 km) (50 000 lb payload) to 5 190 mile (8360 km) (20 000 lb payload). Flight controls were to be fully powered in view of the control loads for a craft of this size, with mechanical linkages to electrical power control units distributed around the airframe. At the time, the Princess was one of the most challenging designs undertaken by the British aircraft industry. For the Princess project, the wide-ranging capability of the industry in the post-war era meant that virtually the whole project could be considered as "British Made".

The first Princess is launched.

Princess G-ALUN was made ready for launching on August 19th 1952. The launch was delayed due to adverse wind conditions, with the launch proper being accomplished during the night of August 20th/21st. On August 22nd the Princess was made ready for taxi trials and a possible first flight. With Geoffrey Tyson, the Saunders Roe Chief Test Pilot, and his flight test crew on board, the Princess slipped her moorings just before midday and moved out into the Solent. After some thirty minutes of taxiing the Princess in open water, Tyson took the aircraft to the eastern end of the Solent off Stokes Bay at Gosport. With virtually ideal weather conditions and some seventeen miles of clear water ahead in case of emergencies, the Princess was prepared for her first take-off. Once clearance had been given from the safety boats patrolling the take-off area, Tyson opened up the ten Bristol Proteus engines to full power. Spectators assembled along the shoreline witnessed the majestic sight of the Princess emerging from a cloud of spray as the speed increased to a point where the craft was riding on the "step". At this stage all was well, and Geoffrey Tyson took the decision to continue the take-off sequence. The Princess gently rose from the water at 12.28 pm precisely. This first flight lasted about 35 minutes. On his return, Geoffrey Tyson announced that he was very pleased with the way the Princess had handled, both on the water and in the air, and there had been no major snags.



Figure 12. The first attempt at launching the Princess on 19th August 1952 was hampered by adverse weather conditions. The launch was successfully accomplished overnight on 20th/21st August. (GKN)

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Figure 13. Saunders Roe Princess G-ALUN taking off on one of her test flights from the Solent. Geoffrey Tyson first flew this graceful aircraft on August 22nd 1952. During this initial flight the Princess was restricted to an airspeed of 240 knots, and although the flight was declared a success, Tyson brought her back early due to some inaccurate readings on the two airscrew translation bearing gauges. (GKN)

With the Princess scheduled to appear at the SBAC Farnborough Show early in September, further test flights were undertaken in order to amass the required minimum number of flying hours before the show. Despite early difficulties with engine reliability, the Princess gave an impressive display at her Farnborough debut on September 2nd. Unfortunately, plans for the Princess to make a similar appearance at the Farnborough Public Preview day on September 5th had to be abandoned due to the failure of a Proteus engine.

Princess G-ALUN made her last public appearance at the 1953 SBAC Farnborough Show, on this occasion sporting a rather more attractive colour scheme as compared to the original dull aluminium finish. In total, 46 flights were made during the period August 22nd 1952 until the end of May 1954. By this time, the Princess had logged around 97 flying hours and completed a substantial part of the manufacturer's test flying requirements. The Princess had also been subject to a handling assessment trial by Saunders Roe at the direction of the Marine Aircraft Evaluation Establishment (MAEE) at Felixstowe, receiving a favourable report. Flight testing continued following replacement of the faulty powerplant, but suffered interruptions due to persistent engine and gearbox reliability problems. No hydrodynamic problems were encountered. The Princess handled exceptionally well on the water, and exhibited the qualities of a large ship in rough seas.

Water paraffin spray rings were fitted to each engine. By spraying separate quantities of water and paraffin into the engine air intakes, during surface running and at the beginning and end of each flight, the engine compressors were cleaned of any salt deposits. No problems were encountered due to sea water being sucked into the turbines. This had been thought possible, particularly with the Coupled Proteus engines with their 16.5 ft (5 m) diameter contra-rotating propellers. One unexpected phenomenon was the effect of the spray thrown up on to the inboard propellers, causing the tips to be bent forward by about three inches (75 mm). This did not appear to cause any noticeable performance degradation, and this effect was lived with during the test phase. It was believed that this problem would have been cured by using steel propellers on later versions in place of the aluminium propellers fitted to G-ALUN.

The Princess became a familiar sight around the Solent region, and by the end of May 1954 sufficient testing had been accomplished to confirm that, with the fully rated Proteus engines installed, the aircraft would have been capable of achieving the specified performance requirements.

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Figure 14. Princess G-ALUN made her last ever flight on May 27th 1954, and with the completion of the MoS contract, this aircraft was cocooned pending a decision on the way ahead. (GKN)

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As BOAC loses interest other options are investigated.

By 1948, BOAC interest in the Princess was declining, but another state airline, British South American Airways (BSAA), had examined the use of the Princess on its routes to South America. A survey undertaken by BSAA over the period between December 1948 and February 1949 had found no obstacles to flying boat operations between the UK and Buenos Aires-Rosario via Bathurst, Dakar, Brazil and Uruguay. However, the merger of BSAA and BOAC on July 30th 1949 provided a further twist in the saga, and led to the Princess being back on the BOAC agenda. Six weeks after the merger, BOAC stated that they wanted the Princess to provide accommodation for 108 passengers with about 60 per cent tourist seating. Later the Air Registration Board approved the Princess for 120 persons, made up of 105 passengers and a crew of fifteen.

BOAC initially envisaged use of the Princess powered by Mk.2 Proteus engines on the South African routes, while a later version with Proteus Mk.3 engines was considered suitable for the schedules to the West Indies. Use of the Princess for longer routes, particularly the North Atlantic, was also investigated assuming the use of the more powerful Proteus engines and at an all-up weight of 330 000 lb (149 t). However, BOAC was reluctant to give approval for interior furnishings until the route policy had been finalised, and would accept no liability for the cost of interior work done in advance, with the result that work was halted in this area by Saunders Roe.

Performance studies were continued using a number of other powerplants for the Princess. These included the Napier Nomad compound engine, Allison, Wright and Napier turboprops, and Pratt & Whitney and Allison turbojets. Flight refuelling with Proteus 620/630 engines was also considered, and a version powered by ten Rolls-Royce Avon turbojets would have offered a maximum payload of 230 fully equipped troops carried at high speed on stage lengths similar to that from the UK to the Suez Canal Zone.

By the Spring of 1951 the prospect of the Princess entering commercial airline service had all but disappeared. It was then proposed that the three Princesses on order should be completed as long-range troop transports for use by the RAF. Three days after this proposal had been made known the RAF interior design work was halted when the Minister of Supply announced that only the first of the three Princesses on order would be completed for flight trials. Meanwhile in the summer of 1951, Saunders Roe attempted to save the Princess for commercial use by proposing to form, with Airwork, a Princess Air Transport Company to operate the three flying boats on behalf of the Government. Captain H W C Alger, an experienced BOAC flying boat pilot, was seconded to Saunders Roe on August 1st 1951 to assist with this venture. However, this attempt to utilise the Princesses and to gain some benefit from the money spent on the project failed, thus effectively sealing their fate.

Background politics.

Although undoubtedly a magnificent technical achievement, the Princess was essentially a "political" project. The optimism shown in the mid-forties had evaporated within ten years, and the political in-fighting reached a new peak. Duncan Sandys, then Minister of Supply, announced in Parliament on March 17th 1952 that the postponement of work on the second and third Princesses was to await the more powerful Proteus Mk.3 engines, and that there was no intention of abandoning this and the Brabazon projects. One week later, the White Paper of March 25th stated that, a year before, it was thought likely that the Comet was better adapted to the needs of civil aviation than the larger flying boats that would be completed for the RAF.

Questions of cost escalation and mismanagement of public funds now rose to the fore. In May 1946, the MoS had thought that the cost of the Princess project, including engines, would be £2 million. By the end of 1947, when £750 000 had been spent, the estimated cost had risen to £4.8 million, due mainly to changes in engine type and consequential airframe modifications. At that time, the MoS, MCA and BOAC thought that the project should be abandoned. But BSAA believed that the Princess could be successful if it were offered to the airline at the right price, BSAA having made an offer of £800 000 each. In 1949, after the BSAA merger with BOAC, BOAC offered to take the Princesses at £700 000 each, and hire the engines for temporary use. This price was based on a production run of 23 aircraft.

Another White Paper of January 22nd 1953 stated that by 1950 the cost of the three Princesses had risen from £2.8 million in 1946 to £10.8 million in 1950. This increase was mostly attributable to the engines, where the estimated cost had soared from £407 000 to £4.9 million by 1952, plus the resultant airframe modifications caused by the change of engine in 1947. The Permanent Secretary to the MoS told the House of Commons Committee on Public Accounts that it was estimated that completion of the three Princess flying boats would cost £13.2 million. Unless the Ministry was sure that a buyer could be found, it would not go on with the project. Effectively the Princess project had been cancelled.

Attempts to find a buyer continued for several years together with other design proposals made by Saunders Roe for a landplane conversion, AEW variant and work for the US Navy on conversion of the Princess to run on nuclear power. Southampton-based Aquila Airways, as the only remaining British commercial flying boat operator at the time, had mounted an unsuccessful bid for the Princess in the early fifties. Air Vice Marshal Don Bennett, the former Chairman of BSAA, fought a vigorous campaign to purchase the Princesses in the late fifties. His efforts were thwarted mainly by an inability to gain approval for the routes he intended to operate, and without these agreements the MCA would not sanction the sale of the aircraft. BOAC was still involved as concern had been expressed regarding the effect on its business if Don Bennett was allowed to compete on existing routes.

The Princess project comes to a close.

The second and third Princesses built were allocated the registrations G-ALUO and G-ALUP, but work never proceeded beyond the basic airframe stage. As Government property, these two craft were ordered to be put into long term storage. On February 13th 1953, the second Princess was launched, and the next day was towed to Calshot. Two days later it was brought ashore where the final stages of the cocooning process and desiccation were completed. In April 1953 the third Princess was subjected to the same procedure, and both aircraft were destined to remain at Calshot until broken up for scrap there by 1967.

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Figure 15. Unflown Princesses G-ALUO and G-ALUP were cocooned in 1953 and stored at Calshot until scrapped there by 1967. (GKN)



Figure 16. Princess G-ALUN was cocooned and stored by the floating bridge at West Cowes until it was towed away to be scrapped in 1967. (GKN)

The only Princess to fly, G-ALUN, was also cocooned and put into storage at West Cowes soon after completion of the test flight programme in May 1954. She remained there until April 1967 when she was towed to a scrapyard on the River Itchen in Southampton; her subsequent destruction thereby bringing the Princess project to a melancholic end.

Completion of the Princess contract represented the end of large flying boat development in the British Isles. Saunders Roe and Cowes had been synonymous with the design and construction of flying boats for over forty years. In 1912, S E Saunders Ltd. had constructed the hull for one of the first successful flying boats, the Sopwith Bat Boat. In 1929, Sam Saunders and A V Roe formed the Saunders Roe Company. The Princess project, although not commercially successful, demonstrated what could be achieved by a relatively small company with a carefully chosen team of designers and skilled craftsmen.

August 22nd 2002 marked the fiftieth anniversary of the first flight of the Princess, and to celebrate this event a memorial plaque was unveiled on the anniversary day alongside the Saunders Roe works at East Cowes where the Princess was built. This was followed by a reunion of former Saunders Roe employees in the East Cowes Town Hall. It is hoped that a similar commemorative event can be held in August 2012 to mark the 60th anniversary of the flight.

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This article is dedicated to the technical achievements of the Saunders Roe Company, and to all those who contributed their efforts to making the Princess possible and had to suffer the disappointment of seeing the fruits of their labours scrapped only a few years after the Princess had flown.

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The Water Towers on the old Princess Louise Hospital and Lord Mayor Treloar College and Hospital Site

Jane Hurst

To the north of Chawton Park Road in Alton lies a Community Hospital and housing estate. Originally the site was agricultural land belonging to the Knight family of Chawton and lay in that parish until the boundary changes in the 1930s when it became part of Alton.

Within the area are two water towers which are in a very sad state of repair. The one on the perimeter of the site has three hexagonal cast iron tanks on a high brick base and seems to have been built by the Army. Nearby lies one of the WD boundary markers. The second water tower is later and built by the Lord Mayor Treloar Trust lower down the hill. This is smaller and made of brick. There was also a reservoir or storage tank in a field above the buildings.

During the Boer War there was rising concern for the welfare of the soldiers and their families, with Rudyard Kipling taking a leading part in finding ways to collect money. He wrote several verses called 'The Absent Minded Beggar' which became very popular and sold well through the *Daily Mail* with the image of the Beggar being put on pieces of china and other items. The profits became known as 'The Absent Minded Beggar Fund' and it was decided to build a camp to receive the wounded soldiers when they returned to England from South Africa. The site chosen was on land acquired from Montagu Knight of Chawton (a descendent of Jane Austen's brother Edward (Austen) Knight).

The Minutes of the Alton Urban District Council (AUDC) for 18th June 1900 mention the proposed construction of a Soldiers' Hospital Camp adjoining Chawton Park Road in Chawton. It was planned that the buildings would be of timber with wooden tiles and calculated to receive 500 invalid soldiers. The scheme applied for the AUDC's consent for their obtaining a supply of water from the Council's mains for which they would pay by meter 1/6 [7p] per 1000 gallons, and for leave to use the Council's sewers. This was agreed subject to various conditions. Water was first supplied to the building contractors from a stand pipe at The Butts in Alton at 1/6 per gallon. There then followed several discussions over the years about



Figure 17. The army water tower: three hexagonal steel tanks on a three-lobed brick tower.

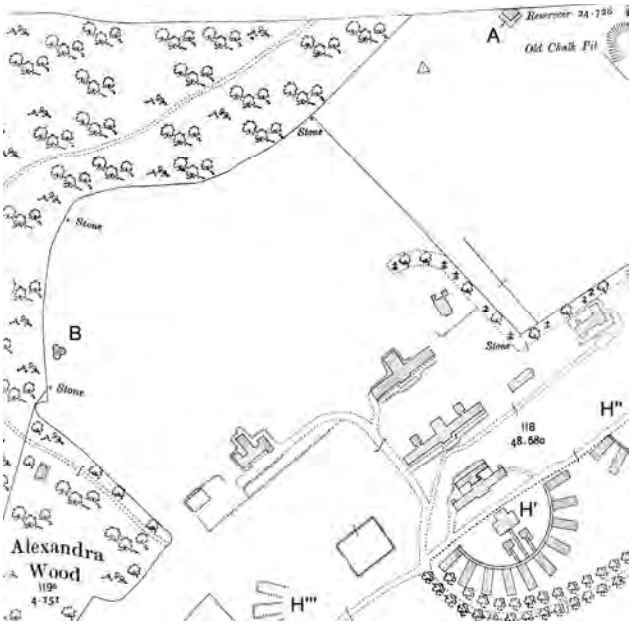


Figure 18. Part of the 1910 OS map of the site. A, the reservoir [1]; B, the brick water tower; H', H", two of the semicircles of huts forming the hospital wards.

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Figure 19. The 'AMB' camp looking west and showing the ranges of wooden huts and the buildings stretching up the hill [(2)].

Inset, an enlargement of the rectangle near the skyline, showing the brick water tower peeping over the hut furthest up the hill.

the Hospital's water meter, which became defective, with 40 000 gallons passing through unregistered at one time. The AUDC decided to put a stop cock, in the parish of Alton, into the main supplying the Hospital! The first water tower was presumably built for the 'Absent Minded Beggar' Hospital. The brick tower would have been a feature of the site [(3)].



Figure 20. W↑D boundary marker: one of several War Department markers on the site.

By March 1903, the hospital was not needed for soldiers convalescing after the South African War any more and the *Alton Gazette* reported that 'In the House of Commons ... Colonel Welby desired to know what was to be done with the 'Absent Minded Beggar' Hospital at Alton. ... At present it seems to be used as a refuge for partridges from neighbouring estates.' Lord Stanley answered that it was planned to use the premises 'as a convalescent hospital for the Army, and will be available for men from Aldershot, and perhaps for men from London.'

Her Royal Highness Princess Louise, Duchess of Argyle, had taken a great interest in the hospital and she came to open it officially in July that year, after which it was known as the 'Princess Louise Hospital'. The local papers published long articles describing the buildings, including mentioning that 'The water is received from Alton water system, and is most excellent water, though somewhat hard for washing purposes, it being about of the same composition as the Kent water. It is received from the Alton mains and pumped to a reservoir on the top of a hill, whence there is a hundred feet fall to the wards of the hospital.' For a 100 ft fall to the buildings, this must refer to the water tower. The site certainly had a pumping station and the local Council Surveyor asked the Hospital to take their supply at night time as far as possible.

Four years later the Hospital was again abandoned and stayed empty until spotted by Mr J Hall Richardson of the *Daily Telegraph*. He inspected the premises and reported back to Sir William Purdie Treloar.

Sir William had for many years been concerned about the plight of the poor and crippled children of London. First he had started 'The Hamper Fund' whereby hampers of food were distributed to disabled youngsters on New Year's Day. When he became Lord Mayor of London in 1905, Sir William decided to raise money to fund an institution with two objects:-
a) the treatment of children up to the age of 12 who were suffering from tuberculous disease of the bones or joints;
b) the training of crippled boys from 14-18 years of age in skilled handicrafts to enable them to earn their own living.
The Treloar Trust was formed and the Hospital premises handed over by the War Department.



Figure 21. The original water tower today, showing two of the three hexagonal tanks.

The Trust minutes show bills for work done converting the hospital. There is mention of water tanks which seem to have been connected with the old and new power houses. The water tanks must have been those of the larger water tower. A bill dated 30th January 1909 from Blackburn, Starling & Co. Ltd. of Nottingham included sums for reinstalling old dynamos in the New Engine House, a new switchboard, 2½ miles of lead covered underground mains, 2 miles of lead covered underground telephone cables, a 15-line telephone exchange, various motors in the laundry, heating and power points, steriliser plugs, electric bells, 894 lights and 21 miles of cable. The buildings listed included the Governor's house, gardener's cottage, convalescent home, nurses' home, chapel, schoolmaster's house, 10 wards in No.1 pavilion, 10 wards in No.2 pavilion, schoolhouse, recreation hall, technical school, etc. There was a bill from L. D. Berry, engineers, to provide and install two Lancashire Boilers, erect a new Power House, new heating apparatus throughout, new hot and cold water systems, new laundry, test the existing water main and check the fire hydrants. E. Wingfield Bowles was the consulting engineer. There was also a contract for water softening. The power house was served by a siding from the Basingstoke and Alton Light Railway which ran alongside the end of the site.

The first eighteen patients were collected from Alton Station by Sir William and his wife on 8 September 1908. From April 1910, there was also a small private platform on the B. & A. L. R. for patients arriving at the hospital.

In May 1915, it was reported that there had been problems with leaks in the 3 inch diameter cold delivery main. 'Much of the water supplying the tower has gone to earth as it was being pumped from the Power House to the water tower.' The pipes ran through chalk which 'readily absorbs all the lost water' and so it was difficult to find the leaks. However, they had found that one large joint had blown out. The meter readings showed that the water loss was considerable and the trouble was located 'as being within the limits of the tennis court under which the pipes run. Unfortunately, they are laid very deep in the ground there - at one point they are nine feet below the surface. ... We have always had trouble with this main as all the joints were laid in the wrong direction when the War Office laid it down and as the pressure is very heavy, they are liable to quickly blow out.' The pipes were re-laid and all joints fixed in the right direction.

By 1922, the old water tower was in need of repair. The minutes note that 'the Water Tower which feeds the hot water supply system has been carried 6 ft higher with a great improvement in the supply to the buildings situated on the high ground of the estate' and that 'necessary work of repainting the bottom of the tanks and girders in the water tower to preserve the iron from rusting has been put in hand and the permanent platforms

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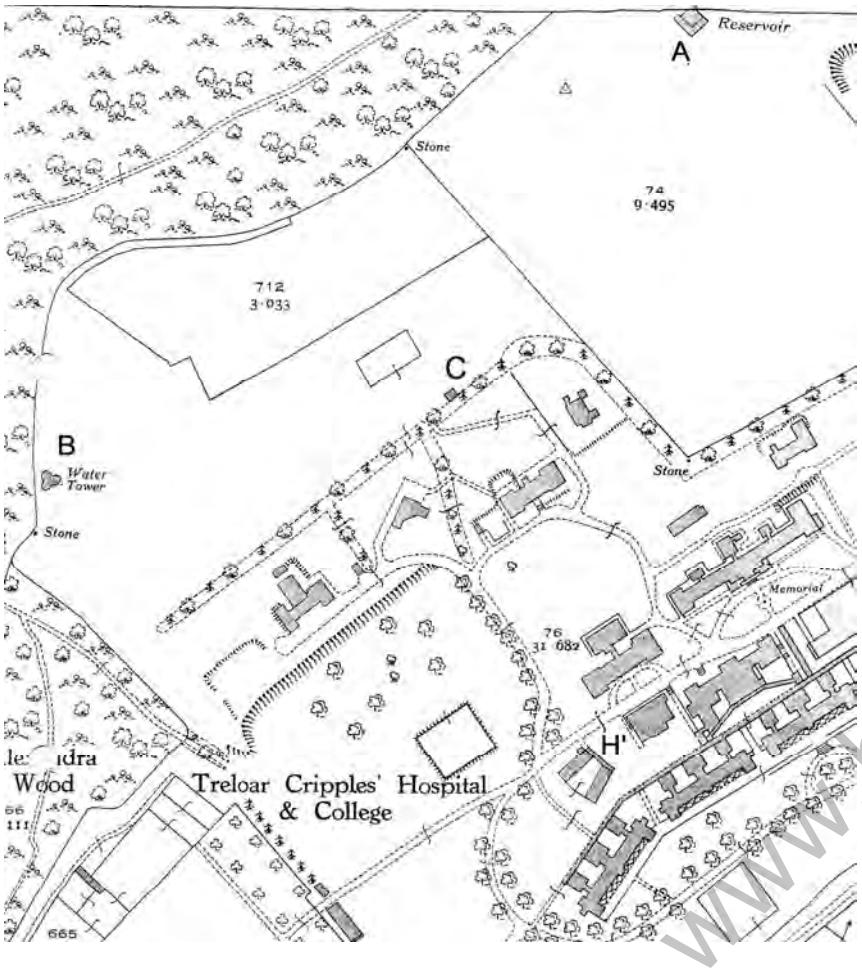


Figure 22. Part of the 1939 OS map of the site.
Nearly all of the wooden army buildings have been replaced by more substantial structures.
A, the reservoir; B, the army water tower; C, the 1930 water tower; H', two remaining wooden huts from the middle semicircle of ward huts.

made safe.' At the same time 'the work of repairing the shed and storage tank in the meadow above the Hospital is now in hand' (this 'tank' would have been the 'reservoir').

Five years later it was said that there had been some difficulty in keeping up the reserve of water in the storage tanks in January, 'due partly to the increase in consumption and the poor supply received from the town. ... a better supply has now been maintained.' Staff were told to avoid waste and extravagance. During December, consumption had been 1 087 000 gallons - an average of 66.6 gallons per head per day - although there had been some leaks because of burst pipes.

As time progressed, more water was needed and so it was decided to build a second tower. Mr Henry C Smart was the architect who submitted a tender from Messrs Mills & Sons for the erection of the water tower at a cost of £398 - which was accepted. Also in 1930, 'the 30 000 gallon storage tanks on the top of the hill [the old tower], which have not been cleaned out for several years, have now a deposit of several inches of lime and mud in the bottom, and should be cleaned out. At the same time, the outside of the tanks should be painted with some anti-rust paint. On the last occasion on which the work was done contractors were employed, as we have not the necessary staging and scaffolding.' A tell-tale cable between the Power House and water towers was also laid.



Figure 23. The 1930 water tower.

With the formation of the National Health Service came the break up of Treloars. The College moved to the village of Froyle and the Hospital became a well-known orthopaedic establishment which was closed a few years ago despite a vigorous campaign to save it. The story of Treloars can be found in *The Lord Mayor Treloar Hospital and College* by G. S. E. Moynihan and *Treloar's, One Hundred Years of Education* by the author.

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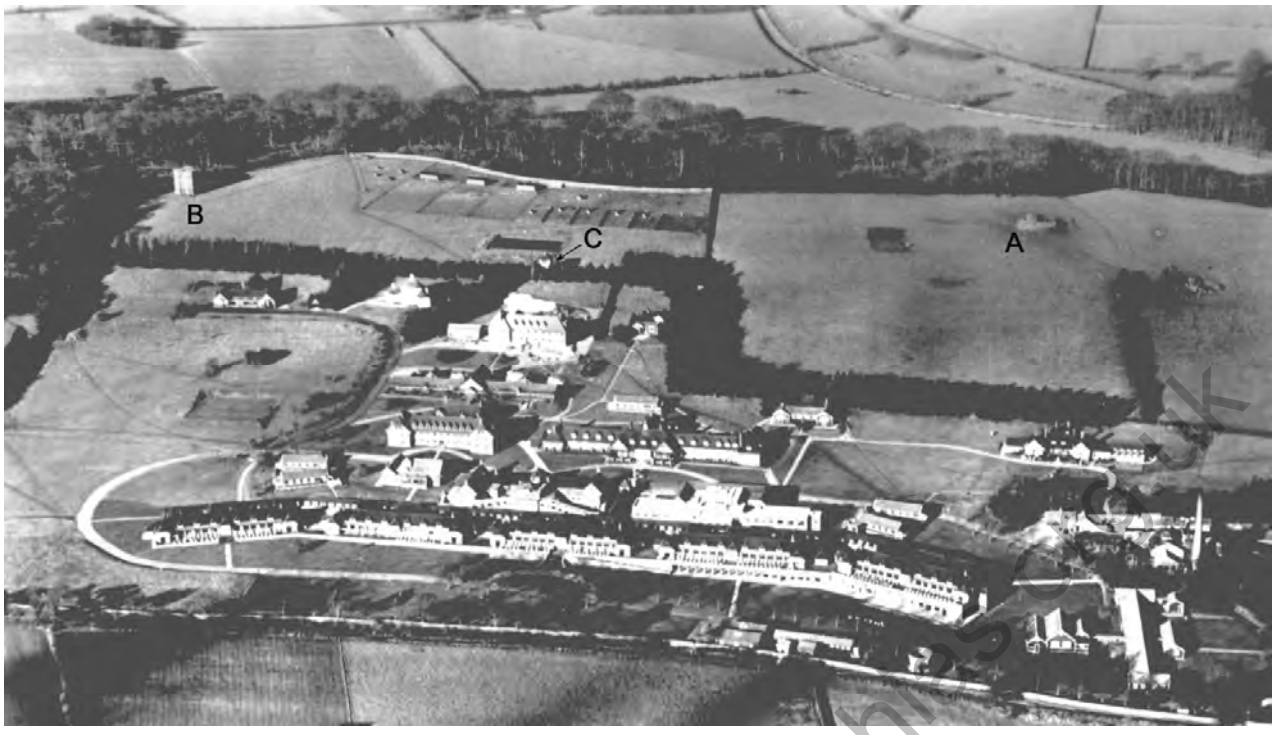


Figure 24. An aerial view of the Lord Mayor Treloar Hospital looking north.
A, the site of the reservoir; B, the larger, army water tower; C, the smaller, 1930 water tower.
The power house is at the extreme right of the picture. A few wooden buildings still remain.

Notes:
1) The 1910 (surveyed 1908-09) OS map shows a covered brick reservoir in the field on a hill to the north-east of the hospital, and the older water tower. This was mentioned in July 1903 and so was probably built for the 'The Absent Minded Beggar' hospital

2) The larger, older water tower can be seen on postcards of the Military Hospital, though it was not described in the detailed report of the re-opening of 1903. This seems to be the only part of the Military Hospital surviving today.

3) Following the establishment of the Army Sanitary Commission in 1862, most army camps incorporated a piped water supply by 1900. By 1914 the 'standard' army water tower was a steel Braithwaite tank on a lattice tower.

References
Hampshire Record Office 12M75, 47M94.

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Baldwin Latham (1836-1917)

Martin Gregory



Figure 25. Baldwin Latham, c1890

Baldwin Latham was born in Nantwich, Cheshire, on the 6th December 1836, the second son of George Latham, an architect and surveyor. After attending Nantwich Grammar School, at the age of fifteen, he began a three year pupillage in his father's office to become a civil engineer. He then worked for the firm of Douglas & Beckett, contractors of Chester, for three years before joining Joseph Glynn C.E., F.R.S. in Ely. Another obituary states that, after school, he was apprenticed to Douglas & Beckett for three years before entering his father's office.

His first appointment on his own account was as Surveyor of the small city of Ely in the Fen country in 1860. There, he married Ann Elizabeth Neal, with whom he had a large family. In 1863 he moved to Croydon as Engineer and Surveyor to the Croydon Local Board until 1870. He remained interested in the water supply and sewerage of Croydon until his death in 1917. He specialised in clear water supply and foul water disposal; a branch of engineering which developed dramatically during his lifetime as improvements in public health enabled him to build up a large practice. As Engineer and Surveyor to the Croydon Board he was responsible for the enlargement of the Surrey Street water works, including the design of the water tower on Park Hill which adjoins the last house in which he lived, and the layout of the sewage farm. He also laid out the Queen's Road cemetery where he is buried.

He joined the Society of Engineers in 1861 and in 1865 was proposed for Associate Membership of the Institution of Civil Engineers by John Rennie. The proposal form gave details of the many local boards and councils for which he had already drafted schemes; they included Croydon, Dorking, Merton, Reigate, Rugby and Warwick. Also in 1865, he was appointed Consulting Engineer to the Bideford Board of Works, with the permission of the Croydon Board. By 1870 Latham had designed sewerage and water works for fifteen English towns and taken out several patents for the treatment of sewage (1865-69). In 1868, when he was President of the Society of Engineers he gave his business addresses as Croydon Town Hall and 6 Westminster Chambers, Victoria Street, Westminster (the office of the Society of Engineers).

In 1871, at the age of 34, he decided to go into private practice as a consultant and a designer. Initially, he had an office in 7 Westminster Chambers, Victoria Street. In 1873, he filed his last patent for "improvements in purifying sewage ……. for the production of manure." Probably he did not make money out of his patents as several were never sealed; acting as a Consultant proved more lucrative.

His professional interests led him to join other societies and institutions. He joined the British Association for the Advancement of Science in 1870. This was followed in 1876 by the Royal Meteorological Society, the Geological Society and the Royal Sanitary Institute. With an excellent train service between Croydon and London, he was a regular attendee of London meetings, and served various societies in senior positions. For instance, he became President of the Society of Engineers in 1868, President of the Royal Meteorological Society, 1890 and 1891 and was Vice President of the Royal Sanitary Institute from 1914 until his death.

In 1883, he presented papers at the Annual Meeting of the British Association for the Advancement of Science at Southport. Of more significance, he used the Institutions to make the contacts which secured work for him. He also found time to write books, the best known being *Papers upon the Supply of Water to Towns*, E. & F. N. Spon (1865) and *Sanitary Engineering; a Guide to the Construction of Works of Sewage and House Drainage,* first published by E. & F. N. Spon 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, an intermittent stream, led to several

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papers on this subject to the Society. He was particularly interested in rainfall and devised the first recording rainfall gauge. He encouraged members of the Croydon N. H. & S. Society to set up rain gauges and send their statistics to the British Rainfall Association. Baldwin Latham was a well known public figure in Croydon. Outside his work, he was a member of the Worshipful Company of Makers of Playing Cards for forty-two years, serving as Master in 1881 and 1906.

For nearly fifty years he was responsible for water supply and drainage schemes in many places in Britain and overseas, both as the designer and as a consultant. He designed an early rotary screen for removing solid matter from the sewage at the Croydon Sewage works. After he left the employment of the Croydon Local Board he remained as a consultant, later designing the Wandle valley scheme (1883). He produced a myriad of schemes or reports for municipal authorities, with over forty papers on water supply, drainage, sewerage and public health matters in journals. I have found references to reports for Maidenhead (1867), Nuneaton (1869), Hornsey (1868-86), Leicester (1870), Finchley and Friern Barnet (1874), Margate (1877-89), Southport (1883), Port of London main drainage over the pollution of the Thames (1882-4), Aberdeen (1886), Thames Ditton (1886), Plymouth (1888), Buckingham (1889), Friern Barnet (1891), Rhyl (1892-1911), Chichester (1894), Newhaven, Sussex (1897-9) Manchester, Davyhulme (1899), Paignton (1899), Burgess Hill (1901), Pontefract (1905), Cwmtillery (Western Valleys project) (1906). Three of his waterworks remain at Croydon, Wombourne and Twyford. He also wrote on the "Drainage of the Fens" (1862) and "On the application of steam to the cultivation of the soil" (1868) for the Society of Engineers, "Climatic conditions for the spread of plague" for the Royal Meteorology Society (1900) and on the advantages of sanitation for *Popular Science Monthly* (April 1906) in which he "estimated a saving to the country over twenty years of £267 141 060 in funerals avoided, sickness prevented and wage earning powers retained" due to improved sanitation!

He was active in producing schemes and reporting on existing schemes as a Consultant overseas. His first great foreign project was the sewerage for Dantzig, now Gdansk, (1870). This was an enormous project for a young engineer just starting out in private practice. A German engineer, Herr Wiebe, had produced a scheme which Latham modified for the contractor, J. & A. Aird, who wanted an English engineer. After an initial visit, Latham reported "in the whole course of my experience I have never before been called upon to visit and inspect a town in which such an utter disregard is paid to sanitary measures as I find in Dantzic (sic); and I am still more surprised that such an unsanitary state of things could be

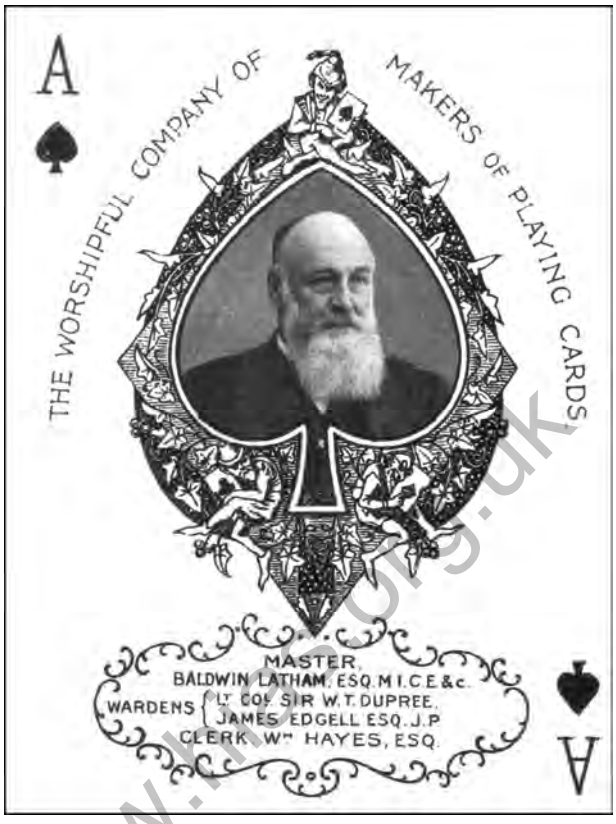


Figure 26. Presentation card for Baldwin Latham as Master of the Worshipful Company of Makers of Playing Cards in 1906

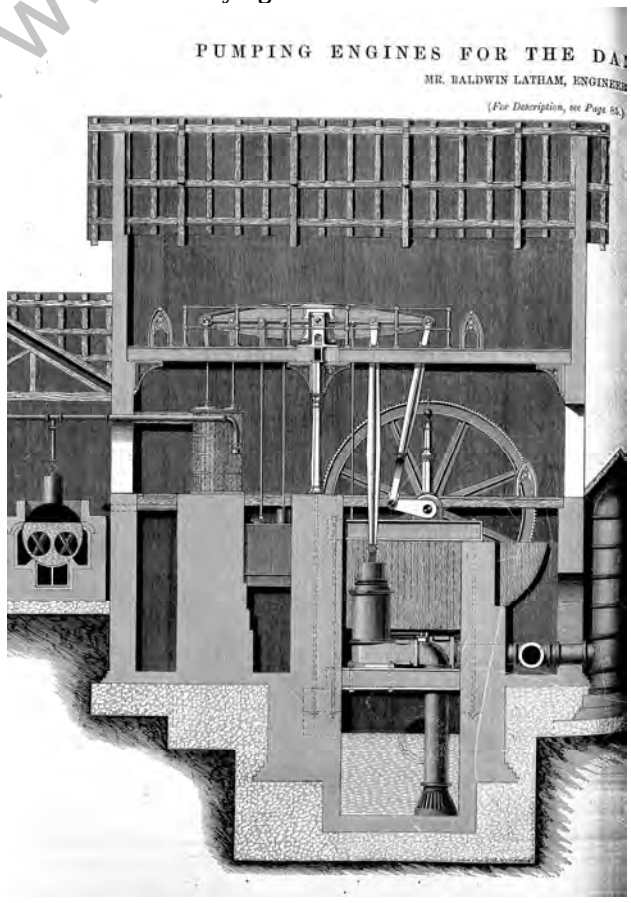


Figure 27. The beam engines for the Dantzic (sic) sewage works, 1870.

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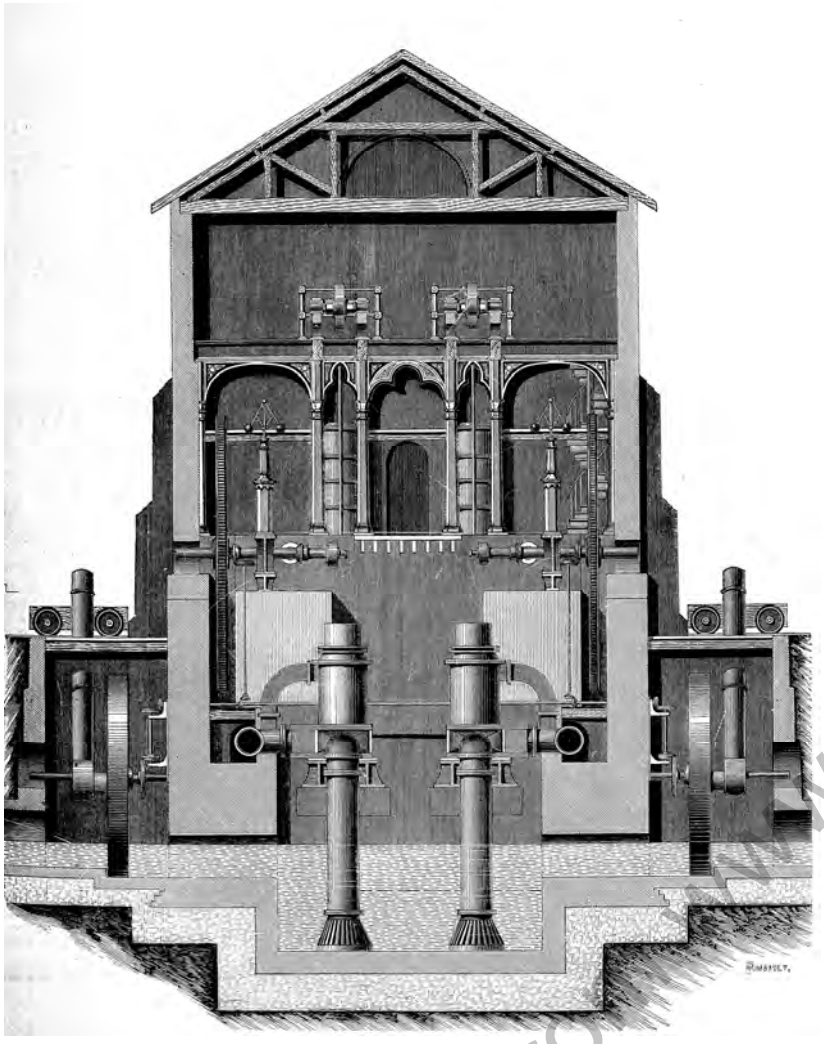


Figure 28. The beam engines for the Dantzic (sic) sewage works, 1870. Latham's patent screens to remove solids can be seen on either side of the engine house

allowed to exist for one moment longer than necessary in any civilised community." He points out that the death rate in 1869 of 37 per thousand is 10 times that in Croydon and that the average life expectancy in Dantzic (sic) is only 23 years. The scheme implemented used several of Latham's patented ideas.

Later he was a consultant and designer for Khadia (Ahmedabad) in India (1890) and reported on Bombay (1890), Benares (1891), Cawnpore (1891) and Calcutta (1901). He first reported on Cairo in 1890 and, as late as 1916, when he was eighty years old, he was consulted again over the drainage of Cairo.

The Croydon Member of Parliament, Ian Malcolm, told Parliament in 1912 that "Mr. Baldwin Latham is recognised as the greatest authority upon the chalk waters in England." In 1912, he was still retained by the East Surrey Water Co. over forty years after leaving the employ of the Croydon Board. On matters of water supply and sewage disposal, his obituary states "no figure indeed became more familiar in Parliamentary Committee-rooms, or in various other places of public enquiries than that of Baldwin Latham; and he was an indefatigable worker, a great amasser of information and recorder of facts: indeed, he spent much money on various continued observations." He remained active up until his death, retaining an office in Parliament Mansions, Westminster. Baldwin Latham died aged eighty-one on March 13th 1917 at his home, Park Hill House in Croydon.

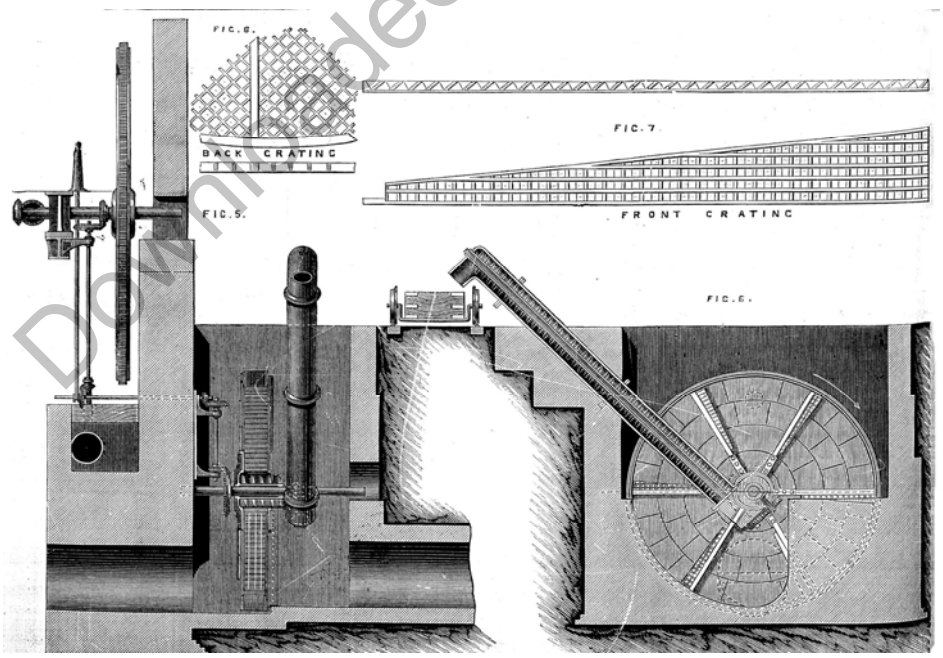


Figure 29. Detail of Latham's patent screens. The design was first used in Croydon sewage works. The engraving shows the arrangement of the scraper wheel and the screw auger to remove the solids into tramway skips at ground level.

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Surviving waterworks by Baldwin Latham

1. Croydon, Surrey Street Pumping Station and Park Hill Water Tower



Figure 30. The Surrey Street pumping station buildings today. In the centre is the 1851 engine house utilising the London & Croydon Railway engines. Behind it is Latham's castellated engine house of 1867. At the right is the boiler house as rebuilt in 1912.

Surrey Street pumping station was opened in December 1851 by the then Archbishop of Canterbury, in Sturt Place, off Surrey Street. To keep the cost down, the Local Board purchased two Cornish beam engines by Vivian, complete with their house, from the defunct 'atmospheric' system of the London to Croydon railway at West Croydon. They were rebuilt on a site in the lowest part of town where the shallow well was soon contaminated by seepage of sewage from adjacent property. The water level in the well was only 2½ ft (0.75 m) below ground level when not pumped! The service reservoir on Park Hill was a buried circular brick reservoir, 75 ft (23 m) diameter and 32 ft (10 m) deep with a domed brick roof.



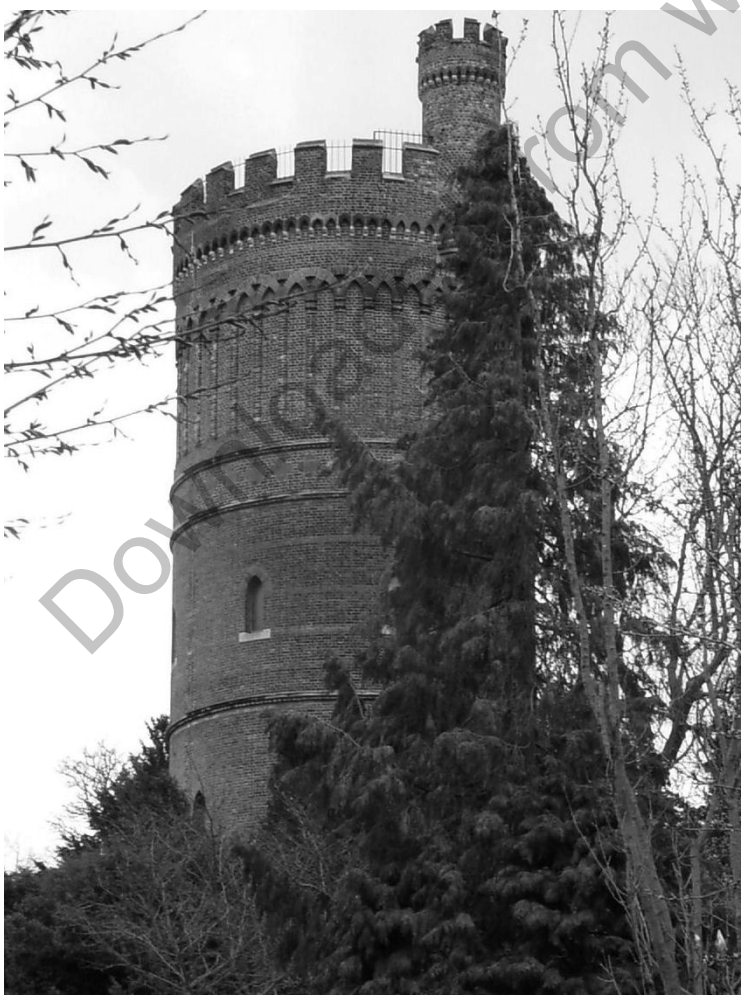
Figure 31. Latham's 1867 engine house for the Cornish beam engine

Baldwin Latham moved to Croydon in 1863 as Engineer and Surveyor to the Croydon Board. He was soon at work. On 1st March 1864 the Local Board resolved to "sink a new well at the works". This new well would go down deep into the chalk and, to reduce contamination, it was to be lined with cast iron segments where it went through gravel near the surface. In September 1866, Latham was able to show the visiting members of the Society of Engineers the new "lofty engine house not more than half finished". The new Cornish beam engine, made by the Kirkstall Forge was at work by October 1867 and from 23rd March 1868, a "constant supply of water" was available from the new well, pumping engine and water

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Figure 32. The Surrey Street pumping station, the 1877 extension to the engine house for a horizontal compound steam pumping engine.



tower. Latham designed the associated water tower on Park Hill alongside the service reservoir. The water tower is 30 ft (9 m) diameter and 125 ft (38 m) high. It held 40 000 gallons (180 kl) but the tank has been removed. Prior to 1914 the public could climb the turret staircase to a rooftop viewing platform for a fee of one penny. There was also a 94 000 gallon (420 kl) tank in the basement of the tower. The engine had cost £6300 and its house £2000 plus a further £2600 for the water tower.

After going into private practice, Latham retained his interest in Croydon's water supply as a consultant, and still lived in Croydon. Despite its unsuitable position, the Surrey Street works was further extended and rebuilt. A new engine house containing a horizontal compound steam engine was added in 1877 and the boiler house was rebuilt with new boilers in 1912. The 1867 beam engine was removed in 1921 and replaced by a horizontal triple expansion non-rotative engine by Worthington-Simpson. After the new Croydon waterworks was opened at Addington and, later, a further works at Waddon, the Surrey Street station saw less use and was closed in the late 1920s. The old service reservoir was disconnected after the 1939-45 war in which it served as an 'emergency water supply' for firefighting.

The pumping station building is listed Grade 2. After many years of deterioration, it is still unoccupied but in reasonable external repair and has been removed, at last, from English Heritage's 'At Risk' register.

Figure 33. Latham's water tower on Park Hill, Croydon, (1867)

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2. Bilston U. D. C., The Bratch Pumping Station, Wombourne

Bilston Urban District Council initially drew its water supply from Wolverhampton but, after a legal dispute in the High Court (1889-90) in which Baldwin Latham provided a deposition for Bilston Council, he was commissioned to provide an independent supply. He selected the site for a station, The Bratch, at Wombourne, some six miles (10 km) away and work started in 1895. The station pumped water from wells in the Bunter sandstone to a high level covered service reservoir 3¼ miles (5 km) away through a total height of 505 ft (154 m). The pumping plant consisted of two triple expansion, inverted vertical, steam engines each rated at one million gallons (4.5 Ml) per day. They are named *Victoria* and *Alexandra*. The engines were ordered from James Watt & Co. who went into liquidation at the bare castings stage. The engines were completed by Thornewill and Warham of Burton-on-Trent and the station was officially opened on 12th August 1897. The engine house is in Ruabon red brick with blue brick and Hollington stone details in a Venetian Gothic style. It is the most ornate of the surviving Latham buildings.



Figure 34. The Bratch engine house

The steam plant was replaced by electric motors in 1960, when the boilers were scrapped and the 90 ft (27 m) high square section chimney felled. One engine, *Victoria*, was restored in the 1990s and is steamed by a modern package boiler. The surviving steam plant is listed Grade 2* and the site is still used operationally by Severn Trent Water.



Figure 35. The Bratch, the entrance to the engine house

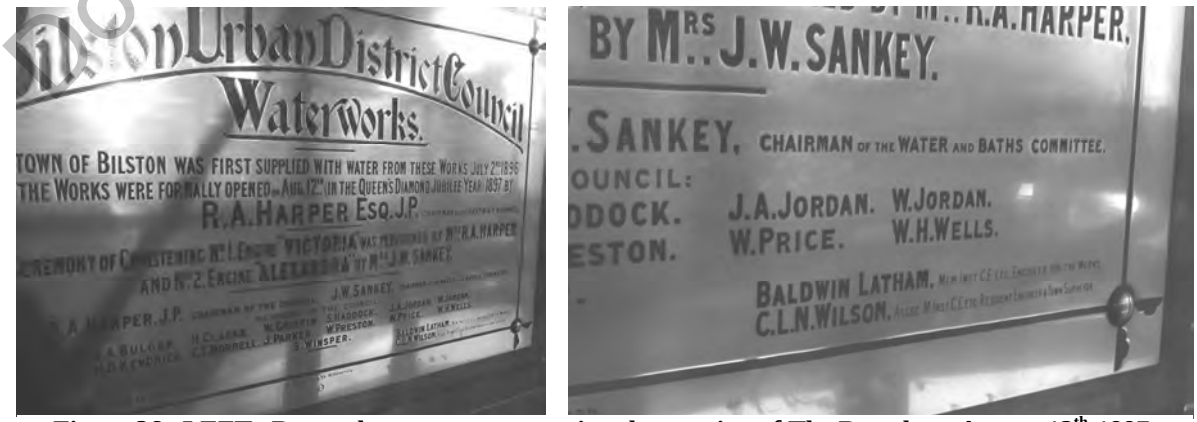


Figure 36. LEFT. Brass plaque commemorating the opening of The Bratch on August 12th 1887. RIGHT. Detail of the bottom right hand corner of plaque showing Baldwin Latham's name.

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3. The South Hants Water Company, Twyford Pumping Station



Figure 37. The main pumping plant at Twyford. The dates form a timeline for the construction of the buildings.

The South Hants Water Company was authorised in 1876 to serve the areas surrounding Southampton. The demand for water increased rapidly, not only for drinking but also for washing, bathing and flushing water closets. In 1894, the South Hants 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 the existing works at Timsbury, north of Romsey, at a site to be selected in the eastern part of their area. Baldwin Latham was appointed in 1896 with the task of locating and designing the new works. 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 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. Another factor was that the new wells had to be at least two miles from the Southampton Corporation pumping station established at Otterbourne in 1884, and which pumped wells in the same body of chalk.

The first well was completed in 1898 and, through 1899, construction proceeded of the second well and the service reservoir on the hill above the works. The engine and boiler houses were completed, so that by 1900 the works was fully operational with a supply of water far beyond expectations. The original engines and pumps were supplied by the shipbuilders, Day, Summers & Co. of Southampton, perhaps because they were known to the Directors rather than to the Consulting Engineer. However, they proved unreliable and Latham proposed the substitution of a triple expansion steam engine for the original pair of compound engines. He claimed that it would pump a given quantity of water with a saving of 25% in the amount of coal burnt. Although the contract was let in 1905 to Richardson Westgarth of Hartlepool for the engine and Easton and Anderson for the pumps, it was July of 1907 before the new engine was finally accepted.

As the Consulting Engineer, Latham was responsible for both the design and the operation of the Company's pumping stations. For instance, in 1902 he reported on his meeting with Mr. Armstrong of Day, Summers & Co. regarding an engine vibrating. (This was traced to the delivery valves on the pumps, and after modification, the 'knocking' almost entirely ceased). Latham made monthly journeys to South Hampshire to attend Board Meetings in Southampton and to give his monthly reports. He regularly visited the works at Twyford and Timsbury. Presumably, he used his own or a hired carriage to get from Croydon to Wimbledon Station and then travelled by train to Shawford Station for Twyford, or Romsey Station for

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Timsbury. From there he would hire a horse-drawn cab. In October 1907 his monthly report commented 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 Latham.

Early in 1908, Baldwin Latham received a letter from the Board stating that the Directors had decided to dispense with his services from the end of 1908. He showed little resistance to what amounted to effective dismissal. 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. However, he continued as a Consultant for many other companies and authorities. The official reason for his enforced retirement was given as 'lack of knowledge of the district', which was demonstrably false. Perhaps by coincidence, he was replaced by William Matthews who happened to be retiring at that time, as Engineer to the Southampton Corporation Waterworks Department.

Water is still extracted from the original wells of 1898 and 1900 by Southern Water. Twyford waterworks is now a Scheduled Ancient Monument with the non-operational parts of the site looked after by the Twyford Waterworks Trust.



Figure 38. Latham replaced the Lancashire boilers with Babcock & Wilcox water tube boilers in 1903-06.
Restoring one to steam is the subject of an HLF bid by the Twyford Waterworks Trust.

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Acknowledgements:

My thanks are due to David Curtis for photographs of The Bratch and Brian Lancaster for information of Baldwin Latham in Croydon.

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The Horse Trams of Southampton

Jeff Pain

The issue of *The Southampton Times* on March 23rd 1872 carried a report of a recent council meeting which discussed an application to lay and operate street tramways in the borough and suburbs. Apparently a Special Works Committee had approved the proposals 5 to 4 with the chairman's casting vote. However, before the full council, there were many objections, in particular regarding the passage of trams along Above Bar and High Street. Some of these concerns are recorded by (Sir) James Lemon in his autobiography; "that they would be dangerous; ruin would befall tradesmen in the High Street and also the proprietors; the only benefit would be for wheelwrights and doctors". Lemon, himself, was generally in favour.

One of these objectors was Mr. Charles Cox, then editor of the *Southampton Times*, who was responsible for the comment in the paper that the High Street would be greatly deteriorated by the introduction of trams, which could also lead to traffic blocks at the Bargate, however skilfully they may be regulated.

James Lemon was confined to his bed at this time but he presented his views by letter stating that trams, in his opinion, caused if anything less obstruction than an omnibus (horse drawn bus) as trams had to follow a track, also their breaks (sic) were more efficient. Notwithstanding these points the full council decided that trams should not be allowed into town, with the junction of the Portswood and Shirley routes at Commercial Road being the limit. This obviously was not practical from a commercial point of view.

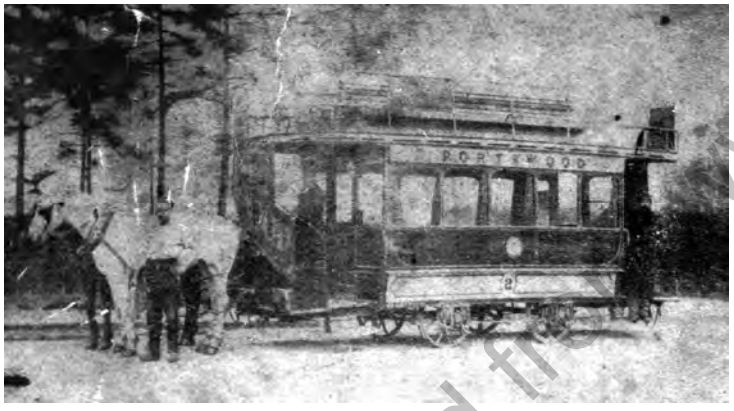


Figure 39. Dated 1880, this is the earliest picture found. Car 2 with Portswood shown as its route. Note how the platforms are sagging which illustrates the construction method of a rigid frame for the wheels and saloon, with the platforms added on.

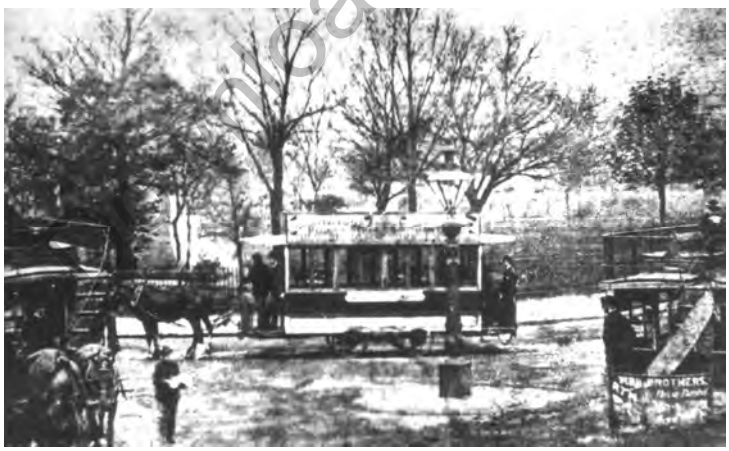


Figure 40. An early view of a single deck car on the West-North link at the town junction.
All horse cars could be accessed from both sides as there were long stretches of single track and no specific stopping places, the practice being that passengers would hail the cars which would stop anywhere on request.

In spite of this the British & Foreign Tramway Co. obtained an Act of Parliament dated 6th August 1872 to authorise the construction of tramways in and near Southampton, though Section 7 required the consent of the council to be obtained at a special meeting, attendance being obligatory. If approval was obtained another meeting must follow not less than one month, and not more than two months, thereafter to be of the same opinion. In the event, no change of heart came about and the powers lapsed after three years.

In the Act, The Southampton Street Tramways Company was authorised to construct three lines of Tramways as follows:-

(1) Commencing in the main upper turnpike road between Southampton and Winchester near Alma Road and proceeding southwards along the Avenue, Bellevue Place, Waterloo Place, East and West Marlands Parks, Anglesea Place, Above Bar Street, High Street, Bridge Street, Bernard Street and Oxford Street, terminating opposite John Street, the line to be single with eight passing loops.

(2) Commencing Portswood Road on the lower turnpike from Southampton to Winchester opposite Highfield Lane near the Belmont turn, proceeding southwestwards along Portswood

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Road, turning into Bevois Road to a junction with line 1 in the Avenue, also single track with two passing loops.

(3) Commencing in Shirley at the junction of Park Street and High Street passing southeastwardly through High Street, Shirley Road, Romsey Lane, Four Posts Hill, Commercial Road and the street in front of Anglesea Place to join line 1, again single track with four passing loops.

It is interesting to note the changes in street names; line 1 is now the Avenue – London Road – Above Bar – High Street – Bernard Street – Oxford Street. In line 2, Bevois Road is now Lodge Road and the reference to the upper (via Chandlers Ford) and lower (via Eastleigh and Twyford) turnpike roads to Winchester.

The total route mileage was 4 miles 4 furlongs 8 chains (7.5 km) and for this length the number of passing loops seems rather sparse, though presumably it was only intended to run cars at between 15 or 20 minute intervals.



Figure 41. Outside the Ordnance Survey Office. A short working round for Stag Gates. A bit of a mystery as it appears they are changing horses at an unlikely spot, perhaps an emergency or a horse gone lame? One place where a trace horse was required being in Commercial Road to surmount the steep rise at Four Posts Hill.

The remaining clauses of the Act were mainly, as to be expected, in line with the general provisions of the Tramway Act 1870, some examples being –

Clause 9. Only carriages with flanged wheels to run in ground rails to be used and only animal power to be used.

Clause 12. The Capital to be £50 000 in five thousand shares at £10 each.

Clause 27. The first three directors to be Lieutenant Colonel Charles Napier Sturt, Herman Gustav Erichsen and William Morris.

Clause 38. Every passenger is entitled to personal luggage not exceeding 28 lb (12.7 kg) in weight without charge.

Clause 39. The Company may carry small parcels not exceeding 112 lb at no more than the following rates: (money in £.s.d.) Not exceeding 7 lb (3.2 kg) – 3d; 14 lb (6.4 kg) – 5d; 28 lb (12.7 kg) – 7d; 56 lb (25.4 kg) – 9d. Over 56 lb (25.4 kg) any sum which the Company shall think fit.



Figure 42. No. 23 in a sylvan setting. Note the driver was not supplied with a uniform in private company days. Conductors had a cap, only Inspectors had a uniform of sorts.

Clause 41. The Company shall run two carriages each way mornings before 7 am and evenings after 6 pm (Saturdays, Christmas Day and Good Friday always excepted) for artisans, mechanics and daily labourers at a fare not exceeding ½d per mile.

Following the failure of these first proposals, the idea of a tramway in Southampton was not allowed to drop. New plans were deposited in 1876 by the Southampton Tramways Company, the proposers being named as William Marshal Cochrane, Woodbine Cloete, George Thomas Harper and Alexander Clunes Sherriff. With more local backing this time the proposals obtained the blessing of the Corporation and the L.S.W.R. for the full system. The Act received the Royal Assent on August 10th 1877 and contained the following clauses which in effect were the reason for the earlier failure.

Tramway no.1 between Commercial Road and the Terminus Station and no.2 between St. Lawrence Road and Floating Bridge Road and the loops or passing places connected with and subsidiary to those tramways, shall be paved with wood between the rails, and so much of the road as extends eighteen inches (460 mm) beyond the rails of and on each side of those tramways shall be paved with granite sets, all to the reasonable

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Figure 43. A scene in Carlisle Road outside Shirley depot with a selection of staff posing for the photographer.

satisfaction of the surveyor of the Borough of Southampton. This overcame the objections relating to the High Street and Above Bar. The wood blocks were to suppress the noise created by the horses' hooves.

Then followed the clauses protecting the London and South Western Railway Company: The crossing on the level shall be at the cost of the S.T.C. and maintained by them at all times to the satisfaction of the L.S.W.R. engineer. The traffic of the L.S.W.R. shall at all times have precedence over the S.T.C. and the cars of the company shall not approach or pass over any of the lines of the L.S.W.R. at a greater rate of speed than four miles per hour, and the cars of the company shall not on any pretence be permitted to stop upon any of the lines of the L.S.W.R.

In working and using the tramway the company shall at all times, before any car approaches or passes over any of such lines, announce and give proper and timely warning of the approach of such cars by means of a bell or horn or other agreed means sounded from such.
However, immediately upon the exhibition of a red flag or red light, or the ringing of a bell by any servant of the L.S.W.R. any such car shall be stopped before it passes over any line of the L.S.W.R.
It goes on to state that the railway can take the company to court to recover any damages caused by the company or its servants, and not more than one car or carriage to be drawn by one team of horses, this last comment puzzled me as I could not recall this situation being used on any contemporary systems, then I remembered that the railway had themselves operated trains of three carriages drawn by horses to the Royal Pier from the Terminus Station before the route was upgraded for steam engines.

Of these clauses, the ringing of a bell by a railway company servant and red flag waving persisted until recent times but nowadays somebody arrives by car to unlock the dock gate and flag the two or so trains a day across Canute Road.



Figure 44. Outside Portswood depot with its wooden facing and clock to the right of the tram with driver, conductor and inspector to the fore. The oil lamp above the driver's head was coloured to indicate the route at night; red for Shirley and green for Portswood.

The other clauses of the Act were as would generally be expected, but I have selected some of the more interesting points as follows:
Clause 6. The Corporation may and shall have power to use the tramways for sanitary purposes at any time between the hours of twelve o'clock at night and five o'clock in the morning, paying such tolls as may be agreed between the corporation and the company.
Clause 7. It shall not be lawful for the proprietors at any time to take up or set down any passenger or parcel, or to allow passengers to enter or leave any of their carriages between a point ten yards northwards of the subsidiary tramway F shown on the deposited plans (this is the passing loop on the south side of the Bargate). For every such offence liable to a penalty not exceeding forty shilling (£2) and any person entering or leaving or attempting to do so having been warned by a servant of the company shall be liable to a like penalty of forty shillings.
Clause 10. All carriages used on the tramway shall be moved by horse power only.
Clause 29. The tramways shall be completed within two years and six months from the passing of this Act.

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Clause 33. Every tramway to be made, formed, or laid down under the powers of this Act shall be constructed with two rails at a gauge of four feet eight and a half inches, to be laid at a distance (between the outer edges of each rail) of five feet three inches from each other.
Clause 38. The company may widen and improve in the manner shown on the deposited plan so much of Shirley Road (otherwise Romsey Lane), Four Posts Hill and Commercial Road and may alter the levels of the said portion of road in the manner shown on the deposited section and may enter upon, take, and use such of the land shown on the deposited plans as may be necessary for the purpose of such widening and improving. Though it still remained steep enough for an additional horse to be stabled nearby to assist Shirley bound trams.
Clause 48 gave the corporation powers of compulsory purchase any time from eleven years after completion of any section of tramway but not later than twenty years from the passing of this Act and conceded to the probable necessity of arbitration.

The Chairman of the company was Mr. G. T. Harper, the Engineer Mr. Wilson and Mr. W. G. Lankester was the General Manager.

Thus Southampton entered the era of transport for the masses, allowing people to live away from their place of employment and travel in comparative comfort. They could even consider family excursions which up to then, for the vast majority, had meant either walking or not going. After inspection by the Major-General Hutchinson of the Board of Trade on Saturday May 3rd 1879, the Portswood section was opened on Monday 5th with receipts of £26 on this day. The Shirley route opened on the 9th June.



Figure 45. No. 22 in Shirley Road outside the Shirley Temperance Hotel and Restaurant. Note the universal destinations now reading Shirley, Portswood and Railway Station (this was the Terminus Station).

So the service commenced, but not without financial and other problems. At a meeting held at the Victoria Rooms on July 29th 1879, the "Anti Sunday Service" lobby canvassed support for their case,. The S.T.C. chairman, G.T. Harper attended and pointed out that cars did not run during the recognised times for church services (this was in line with early railway practice) and in fact trams were used by people to go to church, whilst he respected their feelings it was for the share-holders to make the final choice.



Figure 46. In the High Street outside the Dolphin Hotel. It must be summer time as the driver is wearing a pith helmet.

At the subsequent shareholders meeting held in London on September 1st, the matter was fully discussed and (as might be expected) the practical approach won the day, i.e. providing it made a profit, Sunday services would continue, as usage constituted tacit approval by the local residents. The meeting was also informed that, to date, expenditure amounted to £66 909 and that the average traffic receipts for the previous 12 weeks were £217 per week.

Regarding the finances, the situation was not so good; bad weather, mismanagement and poor materials all having an adverse effect on receipts. Bad weather was specifically mentioned as a major cause of poor results in the Directors' half yearly reports for 1879, '81, '83, '86 and '88, then the weather presumably improved, or at least as the dividends were better, excuses were not required.

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Figure 47. No. 28 having passed through the Bargate. Summer again, note the blind on the saloon window and sun-shades on the upper deck.

At the meeting held in March 1881, the chairman related a very dismal situation and implied that, in part at least, the (ex) manager who had left the company (and indeed the country, being now in America) was to blame. However, the shareholders considered others must take some blame, and a new Board was elected (see **Appendix A**), only the secretary remained and indeed Mr. J. Barber-Glen held this office throughout the existence of the company.

One reason for the troubles were the cars themselves (see **Appendix B**) as the first ten, at least, were not well built, although it appears the specification was for double-deck two horse cars, the Directors' Reports give the following information:-

Date	Information in the Directors' Report
15 Feb 1880	9 double-deck horse cars and 6 single-deck horse cars
30 Sept 1880	9 double-deck horse cars and 6 single-deck horse cars. It was proposed to convert 4 doubles to singles before the commencement of winter traffic.
19 Aug 1881	Are aware some cars badly constructed, many required heavy repairs, top seats removed from 2 cars, 3 others had collapsed, 2 already rebuilt and 1 receiving attention, others waiting for repairs, not enough cars to run services, many breakdowns causing irregularity in schedules added to which loss of carrying capacity by removal of top seats has all affected revenue. 4 new cars now on order to be paid for over 5 years.
20 Feb 1882	Still rebuilding cars, 11 double-deck cars and 9 single-deck cars
21 Aug 1882	A total of 20 cars of which 4 cars have been entirely rebuilt, 4 cars partly rebuilt and 4 cars in process of being rebuilt
31 Aug 1883	The cars are now in good condition except for 2 of the small ones.

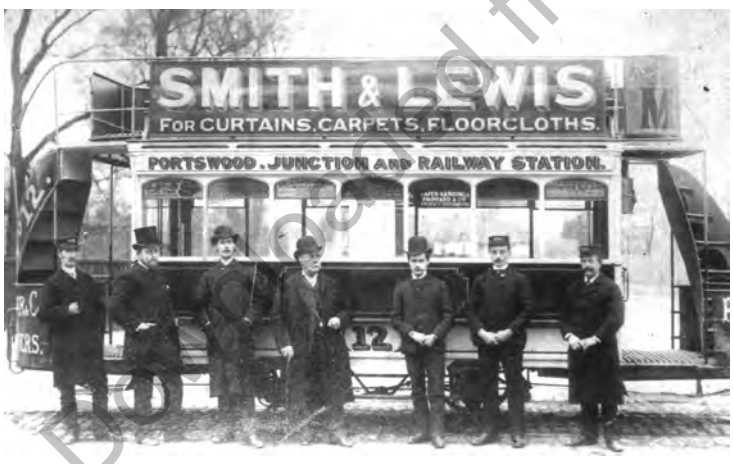


Figure 48. The Management c1889.
(L ➔ R) Inspector Glasby; Veterinary Surgeon G.S.Gould; Manager G.B.Carnon; Cashier J.Nash; unknown; Inspector C.G.Simpson; Inspector Newman.

With all this rebuilding or modification I find it difficult to relate the available photographs to the quoted manufacturing batches in the 1898 valuation. It would require the original workshop records to sort out the apparent anomalies.

After 1884, the system began to pay dividends regularly and it was found necessary to improve the operation, so an Act of Parliament was obtained on the 28th June 1888 which gave the company powers to improve the track by almost doubling the number of passing loops (to increase the capacity), removing the track between Stag Gates and Alma Road along the Avenue which was underused, and constructing a line through Spear Road and Avenue Road, between Lodge Road and Portswood Road to avoid the awkward camber at the junction of these roads. One proposal which was refused covered a line down the bottom of the High Street to the Royal Pier, presumably because of the limited clearances where the street narrowed. The Act granted authorisation to "build, purchase or hire, to use and work horse omnibuses for reward, carrying passengers, articles and goods".

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Omnibus services were started and the main routes were between the Clock Tower (at High Street/New Road junction) to Hampton Park and later Bitterne Park via the St. Mary's and Newtown areas to Portswood, also to the western boundary at Tanners Brook.

Over the remaining years until the town took over, the company paid a regular dividend, though perhaps at the expense of the track and roadway, as they were continually at loggerheads with the council over repairs and maintenance.

The Company was handed over as a going concern, at midnight on June 30th 1898, when a supper was given to half the employees by the Tramway Company, the Chairman, Colonel Bance, presiding with the Mayor and other members of the council attending. In his speech the Chairman stated "the company had 200 horses, the mileage run was 360 000 in the last year, income had increased from £11 000 in 1880 to £20 000, the passengers carried numbered 2.5 million, the half million being in the last two years, the wages sheet represented £150 per week with about £100 for forage. In conclusion he was pleased that the Corporation has agreed to take over the whole of the staff, the only men not staying were the Director and Secretary. After suitable responses from the Mayor, etc….the party continued until midnight when in a short speech the Chairman asked the Mayor to take over the tramways on behalf of the town. The Mayor accepted the responsibility and the company sang "Auld Lang Syne". The following evening the other half of the staff received their supper and speeches, but obviously the occasion had lost some of the drama of the previous evening.

Appendix A

Directors	W. Cloette	1879
	P. B. Turner	1879-1881?
	E. Bance	1881-1892
	A. W. White	1881-1882
	J. B. Concannon	1882-1898
	P. E. Marshall	1892-1898
Chairmen	G. T. Harper	1879-1881
	W. Roebuck	1881-1892
	E. Bance	1893-1898

Appendix B (Details from the Corporation valuation of February 1898)

HORSES.

Stabled at Portswood for cars,- 63
Stabled at Portswood for buses,- 24
Stabled at Highfield for buses,- 24
Stabled at Shirley for cars,- 70
Total 181.



Figure 49. Portswood Depot with farriers and horses. Underneath the bowler is Bill Lock, described as a 'horse trainer'.

CARS (Double-deck, knifeboard seats)			
Car No.	Purchase date	Builder	Estimated value
1	1879	Bristol Wagon	£40
2	"	Co.	£40
3	"		£40
4	"		£40
5	"		£40
6	"		withdrawn
7	"		withdrawn
8	"		£40
9	"		£40
10	"		withdrawn
11	1879	Starbuck Co.	£40
12	"		withdrawn
13	"		£40
14	"		£40
15	"		withdrawn
16	"		withdrawn
17	1881	Starbuck Co	£50
18	"		£50
19	"		£50
20	"		£50

Car No.	Purchase date	Builder	Estimated value
21	1890	North	£105
22	1890	Metropolitan	£105
23	1891	Tram Co.	£110
24	1893		£120
25	"		£120
26	"		£120
27	"		£120
28	1896	Brush	£140
29	"	Electrical	£140
30	"	Engineering	£140
31	"	Co.	£140
OMNIBUSES (Double-deck, garden seats)			
118	1892	G. Roe,	£80
119	"	Hammersmith	£80
130	"		£80
138	"		£80
122	1887	Andrews,	£40 Remains
131	"	Cardiff	£40 of 12
140	"		£40 purchased
141	"		£40 in 1887

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Hampshire Industrial Archaeology Society

Hampshire Industrial Archaeology Society was founded as the Southampton University Industrial Archaeology Group in the 1960s from members of the University Extra-Mural classes who wished to continue their studies in industrial archaeology. Recording has included surveys of mills, breweries, brickworks, roads and farm buildings. Restoration work is undertaken by associated groups such as the Tram 57 Project, the Hampshire Mills Group and the Twyford Waterworks Trust. In addition to the Journal, the Society publishes a newsletter (Focus) twice a year and lecture meetings are held every month throughout the year.

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

Southampton Corporation Tramways horse tram ticket issued just after the takeover in 1898.
Note the differing instructions on the two sides of the ticket: destroy the ticket if not collected, or take the ticket to the advertiser for a refund.





The water tower of the 'Absent Minded Beggar' hospital at Alton.



Baldwin Latham's engine house of 1867 for a Cornish steam pumping engine at Surrey Street Pumping Station, Croydon.

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