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ISSN 0263 5151

THE BUILDING OF THE BALCOMBE TUNNEL 1838-1841

Pat. Millward

PLANNING A RAILWAY BETWEEN LONDON AND BRIGHTON

The first investigation appears to have been made by William James who in 1823 published a plan to build a line from Waterloo Bridge to Portsmouth with branches to Chatham and Brighton.[1] There had been earlier proposals to link the capital and coast by canal to reduce the dangers to shipping in the Channel from enemy action in time of war, and James had been interested in canal building, but he recognised the great potential of railways. It was for this reason that his daughter considered him to be the true 'Father of Railways' and not George Stephenson[2], despite his failure to have his schemes implemented. His line would have run to Croydon and through the Merstham Gap to Newchapel, then curved to the south-west to Crawley Down and Holmbush, where the Brighton branch left to use the Adur Valley to Bramber and Shoreham.

In 1825 John Rennie, son of a Scottish engineer who had worked on a projected canal from Croydon to Portsmouth, was employed by the Surrey, Sussex, Hants, Wilts and Somerset Railway company to search for a line between London and Brighton as the first section of a circuitous way to Portsmouth, Salisbury and the Bristol coalfields. He was to describe the development of his ideas before the House of Commons enquiry on 14 April 1836, saying that having examined a large area he had selected two possible routes. The first, surveyed for him by Charles Vignoles, was to traverse the North Downs by the Dorking Valley, go south by Horsham, use the Adur Valley to Shoreham and then run along the coast to Brighton. For the second he and Thomas Jago investigated lines south from London which, instead of avoiding the rugged land of the High Weald, would cross it to provide a shorter route but one with massive earthworks. From surveys over a wide area he proposed his Direct Line which, with amendments would eventually be built, but the then Sir John Rennie was to be sidelined in favour of John Urpeth Rastrick. Called Chief Engineers, it was Rastrick who was to build the line while Rennie acted only as consultant.[3]

The route was to pass through Balcombe Parish, but the difficulty of crossing the area, the consequent high cost of engineering and the attitude towards the necessary tunnel led to frequent changes in the projections. In 1829 Rennie returned to the scheme and employed Hamilton Fulton, Thomas Jago and others to amend his line using the Newtimber Gap in the south. A plan was deposited on 30 November 1830 showing a route which ran through the high land at Brantridge then south to Slough Green to the west of Cuckfield.[4] The tunnel was not defined, but in a more detailed one of 29 November 1832 signed by brother George Rennie the high barrier to be negotiated would appear to have been about 2,310 yards long.[5] An accompanying longitudinal section which suggests an even greater length shows a gradient of 1 in 264 at the Brantridge summit, 1 in 290 to the north and 1 in 160 to the south.

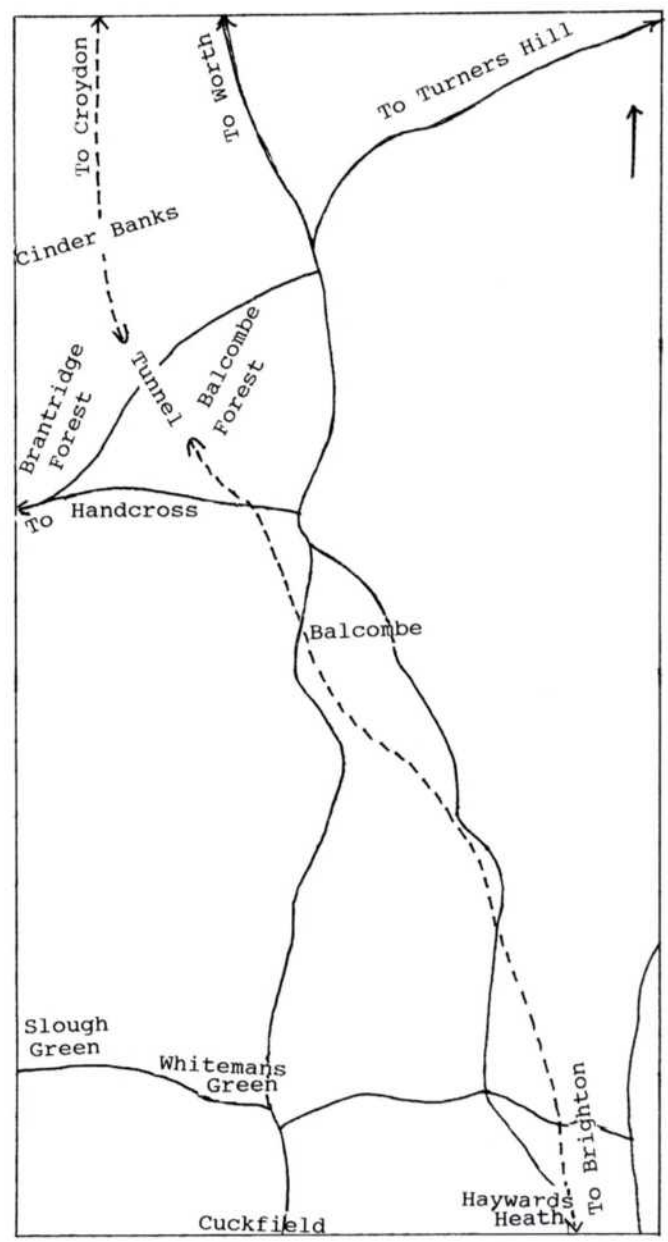


Fig. 1 The Balcombe Tunnel on the route through the High Weald. Scale 1:50,000.
----- Railway ——— Major Roads

In 1833 the Rennie brothers asked Francis Giles to investigate the two routes again and re-survey their preferred Direct Line. The plan and sections, signed by George Rennie, were deposited on 30 November and show the line moved east from the Brantridge to the

Balcombe Forest and a tunnel of about 1100 yards followed by a southward curve leading to another tunnel just to the east of Cuckfield church.[6] That project was abandoned due to lack of investment.

Rennie revised his plan in 1834, and on returning from overseas found that the question of a line linking London and Brighton was to be presented to Parliament. A Railway Committee had been set up and invited Robert Stephenson to adjudicate between Rennie's plan dated 29 November 1834 supplied by brother George[7], and that of Nicholas Cundy who had chosen the western route via the Dorking gap and Adur valley. Rennie's Balcombe Tunnel had been shortened to about 495 yards but that necessitated steeper gradients of up to 1 in 180 which Stephenson was to attack. Solicitor Arthur Rennie Briggs who supported Rennie in Parliament deposited a revised plan dated 30 November 1835 which showed the tunnel lengthened to 800 yards and the more moderate gradients of 1 in 264 restored.[8]

THE PARLIAMENTARY ENQUIRY OF 1836

The proceedings were published from the manuscript records, many of which are held at the House of Lords Record Office.

The enquiry to select the route from the plans of six engineers commenced in the Commons under the chairmanship of Lord John Lennox on 16 March. An article in John Herepath's *Railway Magazine* summed up in rather fanciful phrases the competition to design a railway between London and Brighton:

'Probably no subject has so much occupied the attention of the rail-road public of late as the rival lines to Brighton. Not less than six were some time since in the field at once – one by Sir John Rennie, a second by Mr. Vignoles, a third by Mr. Cundy, a fourth by Mr. Gibbs, a fifth by Mr. Stephenson, and a sixth by Mr. Palmer; to which might be added the wild whims of some others that hardly arrived to a name before they died. At length the first two ceased to exist; Mr. Cundy's, through sheer mismanagement, got hid under a cloud, and there only remained before the public the three last. Among these the fight was expected to be, when all at once Mr. Palmer turned off from going to Brighton to Dover, and left Messrs. Stephenson and Gibbs to contend for the victory. Scarcely was this known to the public, before Mr. Gibbs, owing to some irregularity or neglect, it is said, on the part of his subalterns, found himself so involved in dilemmas from non-compliance with the standing orders of Parliament, that his committee thought it needful to withdraw their intentions of going for a Bill the present session, and Sir John Rennie sprang up again to contest the point with Mr. Stephenson.'[9]

In 1835 engineer Joseph Gibbs had described the competing routes which originated from various parts of London.[10] The projections of Charles Vignoles, Nicholas Cundy, Robert Stephenson and Gibbs himself all turned west at different points to use the Adur Valley to the coast at Shoreham and then east to Brighton. He analysed Rennie's old Direct Line which ran to the west of Cuckfield, not having seen the amended version until his report was going to press. Henry Palmer's line went from Croydon to Oxted and then south across the High Weald to Wakehurst Place, passed Lindfield and Keymer, then on to Pyecombe and Brighton. In places this was close to Rennie's plan, but Palmer's interest changed to searching for a more direct route to Dover.

The involvement of Robert Stephenson, and in the presence of his father George, was to add irascibility to the proceedings. Both Rennie and Nicholas Cundy complained that the plans seen by Stephenson were incomplete. Stephenson dismissed Rennie's route but it was being supported at meetings of Brighton people which kept it in contention. Cundy threatened Stephenson with the courts for having amended his plan and presented it as his own.

Stephenson was the first man to appear before the Parliamentary Committee. Large parts of the sessions were taken up with engineering details such as routes, distances, curves, gradients, inclined planes, rocks, tunnels and earthworks. The demands of railway engineering were far in advance of anything seen in the country before, and at this early period when engines were light and traction between wheels and rails poor, calculations were minute.

The question of tunnels was discussed from the first day. The public were said to be nervous of them and Stephenson claimed that this was a disadvantage on Rennie's Direct Line as tunnels over half a mile were objectionable unless absolutely necessary – as some had been on his own London and Birmingham Railway. Rennie's line required four tunnels, two through the chalk of the North and South Downs, and the two through the High Weald at Balcombe and Cuckfield.

On 24 March the features of Rennie's line were examined in detail. Stephenson had had borings taken at the ends of the Wealden tunnels and denigrated the immense earthworks and time needed to build the proposed railway through the area. The next day he produced geological tables for Rennie's Balcombe Tunnel of 40 chains and Cuckfield Tunnel of 66 chains and stated that it would be necessary to use under drains and side drains to take the water off the clay, for when sand and clay are mixed in the strata water under the clay would make the clay slip. This foresaw difficulties that were met when the line was built. Stephenson dismissed Rennie's line because of the magnitude of engineering, unfavourable gradients,

length of tunnelling, expense and time taken to complete.

On 14 April Sir John Rennie appeared for the first time and the transcripts throughout show that he was often a very poor witness before Stephenson's bullish supporters. He was clearly ill-prepared, often without the necessary data, confused, sometimes hostile and stubborn, at times refusing to answer questions put to him. In his autobiography he wrote 'When cross-examined before parliamentary committees, which examinations I was obliged to undergo at this time, after two or three hours my head got so confused that I could see nothing distinctly – everything appeared either double or upside down.'[11] In his diary entry of 18 April Charles Vignoles, who had surveyed for Rennie in 1825 but was now supporting Stephenson, was to describe Rennie before the Committee as 'a very ridiculous figure – shewing the grossest ignorance of the first principles of Railways', a statement he underlined in red.[12]

On the opening day of his evidence Rennie detailed the development of his latest ideas for the Direct Line, and how the plan that Stephenson had seen with short tunnels and steep gradients had been superseded. On 15 April he put forward a line of 39 miles 25 chains between Brighton and Croydon where it would join the London to Croydon Railway. He described his route in great detail which showed how it would run between the two great Brighton roads to Cinder Banks followed by a short tunnel under the Balcombe Summit of 64 chains or 800 yards and on to the Cuckfield Tunnel. The weak nature of the rocks was to be referred to many times during proceedings. Rennie described the north side of the Balcombe hills as having about 18 ft. of mixed sand and clay over green sand and iron stone intermixed with argillaceous beds of shale with veins and fissures of clay and said 'when you bore through a variety of strata of different degrees of hardness, particularly during the wet weather, it is difficult to pronounce distinctly upon every class of strata, because the boring tool, by being hammered to get through the hard strata, grinds and pounds it as if it were together, and then the clay and other materials mixing with it, give a worse indication than it is really, but when you have the surrounding strata, which you can examine at every height, where you may see stone at the bottom of the streams, stone on the tops of the hills, and stone in the adjoining quarries, there can be no doubt as to the nature of which that strata is composed'. Yet he foresaw no difficulties with the rock. The Balcombe Tunnel he proposed would need no shafts and be arched and completed in a year. The streams to the north were mere rills easily controlled by diversions and culverts. To the south he would cross the Ouse with two embankments and a viaduct.

Resuming on 18 April Rennie had to accept that many of his presented figures had been incorrect including the length of the Balcombe Tunnel which should have been given as 36 chains, and this led to enquiries as to faults in other of his engineering projects. He claimed that he had been confused by the questions. On the following day he returned to the problems associated with the complex geology saying 'when you come to stone you have to hammer the borer, and the borer may very probably split the stone: and the stone being of different density, you may pass through extremely easy after a certain time, and then the clay and water will follow the boring tool, and you may imagine you are boring clay when you are actually in stone'.

Rennie's difficulties before the Committee continued on 21 April when he admitted that he had only constructed temporary horse-drawn railways, but he still objected to questions set to test his engineering skill. On the 22nd. he admitted that with additional money improvements could be made which would result in shorter tunnels and better levels.

Joseph Locke first appeared before the Committee in support of Rennie's Direct Line on 25 April. He had received the results of borings for the Balcombe Tunnel and acknowledged the complex geology; he priced tunnelling overall at £25 a yard. On the following day pollution in tunnels was discussed and he claimed that using coke in the engines would be no more unpleasant than riding through London in a coach on a foggy night with the windows up; the train would move under the steam and the air be diluted but the time taken to regain the air's purity would depend on the size of a tunnel and shafts. Possibly a furnace over a shaft might cause a draft, or even the passage of a train assist with ventilation.

Hearings commenced in the Lords on 6 July with the Duke of Richmond in the chair. Engineer John Parker Bidder had checked the data for Stephenson and also stressed the difficulties of Rennie's line. Bidder considered the country between Balcombe summit and Cuckfield to be the roughest that anyone had ever proposed to put a railway through, a country unfitted for a railroad. The next day he denied that a deviation would improve the line.

On 8 July Stephenson said that the embankments at Balcombe were the worst for time taken to complete, the tunnels worst for expense, and that it would need over three and a half years to build. Father George Stephenson spoke to say that he had examined Rennie's line with Mr. Bidder both from the top of a coach carrying map and sections, and in a chaise with frequent stops. He declared himself astonished that a railway was projected by Balcombe and Cuckfield and that he had difficulty in finding the line as the land was so rugged.

After the engineers came other witnesses. On 16 July Arthur Rennie Briggs as member of the London & Brighton Committee in Brighton, and Lewis Slight, Clerk to the Commissioners of Brighton described meetings and petitioning among the people and how the majority now favoured Rennie's quicker route.

On 18 July Rennie listed the advantages of his Direct Line which included the fact that it was the quickest route to Brighton; was good for branches including that to Newhaven which was a better harbour than Shoreham and so a better route to France; there were no private residences of any consequence so land would be cheap to acquire; the area needed improvement and chalk could be brought in from the Downs for manure at a price farmers could afford; soil was favourable and stone available locally. He returned to the Balcombe and Cuckfield area saying that the long Cuckfield Tunnel might be reduced or eliminated, and that a Balcombe Tunnel of 800 yards might be built without shafts, 25 ft. high and 24 ft. wide. Joseph Locke approved Rennie's estimated average cost of £25 a yard for tunnelling. He reported that he had viewed the route with John Rastrick and on examining the Balcombe Cuckfield area from a chaise and on foot they considered that by deviating to the east from the south of the Balcombe Tunnel the great earthworks could be reduced and Cuckfield Tunnel eliminated. Rastrick had a revised section made for Rennie. Locke commented that he could not understand that Rennie, with his experience, would have made faults that could be so quickly altered on a plan. On the following day Rennie referred to changes suggested by Rastrlck but claimed that most improvements were his.

On 20 July Rastrick appeared before the Committee, an engineer who had been involved in some capacity with many railways under construction and also with the development of steam engines, so his confidence in Rennie's Direct Line must have been important in its final selection. While he considered it a practical proposition with a prevailing gradient of 1 in 264, he believed that it would be considerably improved by alterations which could be made within 100 yards of the line in the deposited plan, so making a return to Parliament unnecessary. He claimed that if he had been working on the line from 1825 he would have made the deviation away from Cuckfield to give a better entrance to Brighton and eliminate the Cuckfield Tunnel. He also costed tunnelling at £25 a yard.

Other engineers spoke in support of Rennie, the last being the scientific writer Dionysius Lardner who returned to the topic of air in tunnels stating that if the Balcombe Tunnel were constructed it would have 19 parts in 10,000 of carbonic acid gas, and that the public objection to tunnels was in being confined and passing from light to darkness. There would be some sulphur which would be pungent and irritating as even open gas pipes in the street are inconvenient with far less a proportion of gas to air.

As the days passed the engineers were followed by a diverse procession of men including coachmen, tradesmen, builders, bricklayers, millers, farmers, merchants, men from the Fullers Earth deposits near Reigate, men supplying timber and bark and spokesmen for Newhaven harbour, all with an interest in the building of a railway and the route that it would take. Faulkner Best of Cuckfield, coachmaster, farmer and innkeeper, with land in Cuckfield, Balcombe and Worth parishes, said that all Cuckfield people wanted the railway.

On 27 July Sir Anthony Carlisle, Vice-President of the College of Surgeons, Dr. James Johnson, Royal Physician and other medical men spoke vehemently against tunnels, in particular for the difference in temperature suffered by their patients travelling through them to reach Brighton, the health-giving town for their convalescents. Sir Anthony claimed to have made a study of the effects of tunnels and spoke at some length on the dangers to people with weak lungs, inflammatory diseases, erysipelas, rheumatism or lumbago in the gaseous damp environment, to be added to with each train. Dr. Johnson also feared loud noises in tunnels for the effect on heart and head; he would not send delicate or pregnant ladies through a tunnel.

The summing up for the competing railway lines commenced on 1 August but on the 8th the Committee decided that it could not proceed with the Bill and the matter was adjourned until 1837.

THE PARLIAMENTARY ENQUIRY OF 1837

On 30 November 1836 Arthur Rennie Briggs had deposited revised plans for Rennie's line[13], and a presentation set was produced when the enquiry resumed in the Commons on 1 March 1837.[14] On 3 March the classification of land to be bought for the railway was discussed for its value would depend on this, for instance did a 'gentlemans pleasure ground' include the paddock outside of the sunken fence? One of the claims Rennie used to promote his Direct Line was the lack of major land owners so that land would be cheap, but in fact many landlords would seek adjudication including Sir Timothy Shelley who held the land where the Balcombe Tunnel was to be built.

On 13 March Rastrick, as Joint Engineer for Rennie's Direct Line, attended the Committee for several days of detailed questioning. He referred to his re-examination of the line with Locke during the previous year and the amendments they had developed with Rennie including the re-routing of the line eastward away from Cuckfield town to cross Haywards Heath. The new plans showed that the Balcombe Tunnel was to be shortened to 470 yards and

slightly curved, 24 ft. wide by 30 ft. high and with deep cuttings at each end. No shafts would be needed for such a short tunnel as it would ventilate itself. A boring made at Balcombe had revealed 2 ft. of loam and sand, over 16 ft. of strong indurate clay, this over green sand and island stone mixed with some pieces of blue clay.

He had not examined wells in the area but did not expect water to be an insurmountable problem and it would be easily drained as the line was driven through. He defended the slight curve in the tunnel and its approaches, believing it not objectionable in such a short and level structure. On costing he was now quoting nearly £38 a yard to include £800 for facings at each end. The cost of excavating would vary with the distance that the spoil would have to be carried, the price for the shortest distance being 9d. a (cubic) yard. Rastrick admitted that while he had had some reservations about tunnels in 1836 he had now changed his mind and believed the public were no longer as prejudiced.

On 22 March Lardner stated that he also had no objection to tunnels or curves within them, saying that they could be lit, although this was impracticable unless near a town gas supply; alternatively lights could be put on the carriages. He denied that the carbonic acid produced from the combustion of coke was offensive, it being the small amount of sulphur which was disagreeable. Warm gases rose and were deflected down from the roof of the tunnel on to the train. Passing trains could not ventilate a tunnel but shafts were not necessary in a short one.

On 7 April engineer Edward Grantham who had worked for Rennie and levelled the line himself said that it had also been checked by William Fairburn and Hamilton Fulton, and recalled how difficult it had been to take levels in the area of Balcombe being full of fern and 'rough stuff' with steep ravines and thick vegetation.

Captain Robert Alderson RE was brought in to examine the competing plans and on the 27th he reported that while he favoured Stephenson's line for engineering, Rennie's shorter route would best serve customers between London and Brighton. As the prejudice against tunnels was being allayed he suggested that the 470 yard tunnel at Balcombe be lengthened to 800 yards to reduce the length of difficult deep cutting.[15]

The Enquiry moved to the Lords on 10 July when Rastrick recommended that the Balcombe Tunnel be built 880 yards long, 30 ft. high, 25 ft. wide and without ventilation. The Act was passed on 15 July and the competitors agreed to unite as The London and Brighton Railway Company to build the Direct Line to Brighton with branches to Shoreham, Newhaven and Lewes.

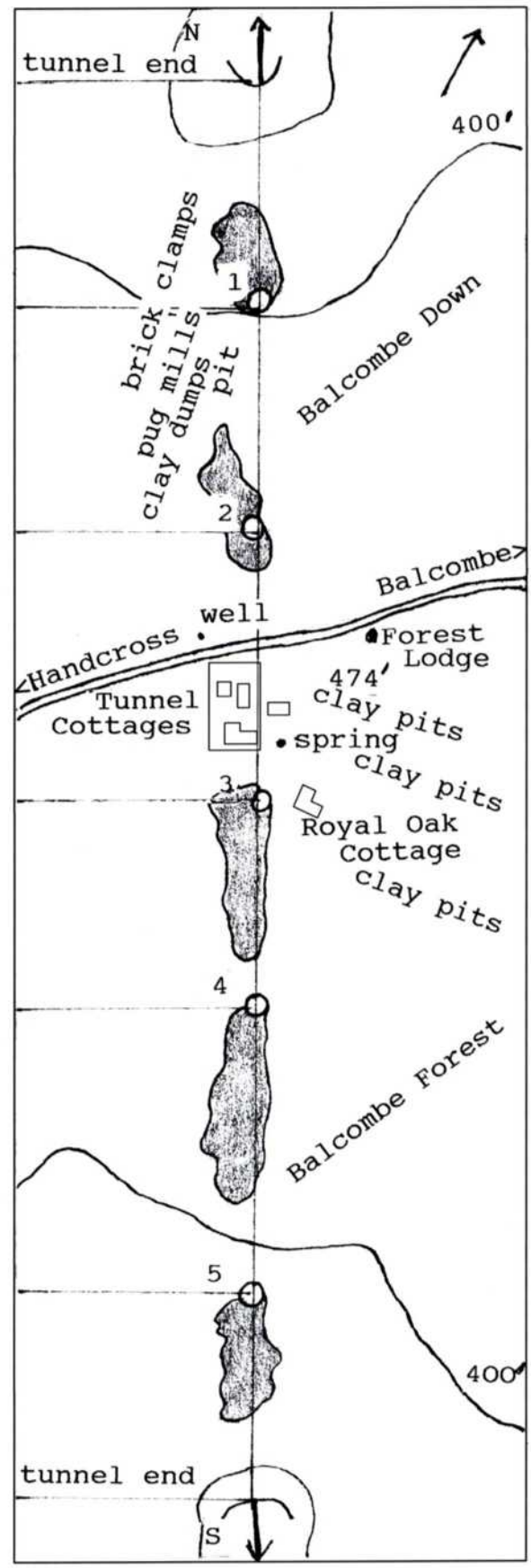


Fig. 2 Diagram of the land over the tunnel based on the Tithe Map of 1842 with additions from OS maps, directories and the report by Southern Archaeology.

Shafts ○ Spoil heaps Contours

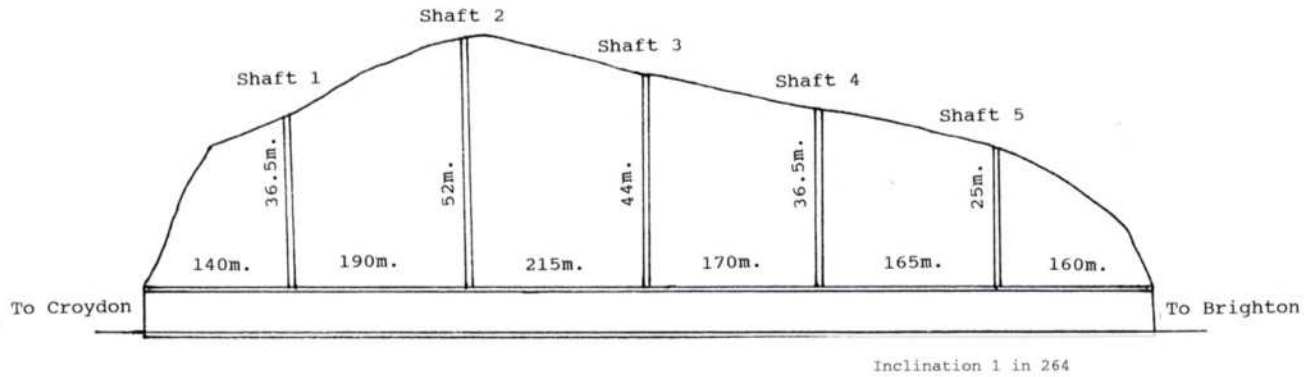


Fig. 3 Longitudinal section of the Balcombe Tunnel.
Data from Railtrack and Vertical Technology of Havant

On 30 September a presentation pack of plans for the Direct Line was produced by Arthur Rennie Briggs using an elaborate printed title page for the year 1836.[16] The old curved tunnel still appeared, but the section was amended by hand in red ink giving the length as 880 yards with a height of 30 ft. and gradients of 1 in 264. A hand-written statement by Rennie and Rastrick said that the 26 sheets, each signed by both men, were exact copies of the plans and sections produced before the Committee and signed by Lord John Lennox.

THE LANDSCAPE AT BALCOMBE

This is an area of high ridges and steep-sided ghylls, part of the High Weald which runs east-west across Mid-Sussex. George Parker Bidder, surveying for railway engineer Robert Stephenson, referred to it as the Great Clay Ridge[17], but the British Geological survey shows that it belongs to the complex Cretaceous Hastings Beds of weak sandstones and clays, faulted and eroded, which was often described before Parliament, and was to prove difficult to engineer.

The tunnel was built to the north-west of Balcombe village and just to the south of the summit of the Balcombe Range which forms a watershead between the head waters of the Mole flowing in the rough area of the Cinder Banks to the north and the Ouse running through steep valleys to the south. The boundaries of Balcombe parish have been altered since the railway was built, but at that time its 4538 acres were classified as containing 1233 of forest and 1055 of woodland.[18] In 1852, botanists walking through the Cinder Banks in Worth Parish and up to Balcombe village recorded spruce and larch fir over birch and heather, with boggy areas supporting a forest of ferns.[19] This landscape of poor sticky soils, woods and warrens, was sparsely settled and an area of extreme poverty in Sussex.

BUILDING A RAILWAY TUNNEL

Excavating a tunnel was not a new procedure, having already been done for mining and canal-building, but the demands of railway contractors were far more complex. The first edition of Frederick Simms' *Practical Tunnelling* was published in 1844 using the construction of his Bletchingley and Saltwood Tunnels on the South Eastern Railway as models. They were built at about the same time as the Balcombe Tunnel and had some of the same problems, for at Bletchingley the clay swelled when wet, and at Saltwood there was a great problem with water. This section presents a very brief outline of Simms' procedures.

Before excavation could start a tall observatory (Fig. 4) was built over the centre of the proposed tunnel housing a transit instrument which Simms described as the sort commonly employed in astronomy with a 30 in. focal length and 2¾ in. aperture. Using this the engineer could align points along the line of the work and select the position of the permanent shafts after temporary ones had been made to test the ground. Simms made his temporary shafts 6ft. in diameter and the main ones 9 ft. to be reduced by the insertion of bricking 9 in. thick (Fig. 5). Guided by a rope down each side of the shaft in the line of the tunnel, and with ends attached to plumb-bobs in buckets of water for stability, the men worked downwards. At first earth and water were brought out in buckets on ropes, but at Saltwood water flooded the working which necessitated the early introduction of horse gins which could raise large barrels to take it out more quickly. The work progressed, lined with planks, to a specified depth, when a flat timber curb resting on a rim of earth would be fitted as a base for bricking the circular section above. Any space left behind the bricks was packed with soil to minimise movement, then raking props on the curb would be added to support the completed piece of work (Fig. 6). Further sections were made in this way until the shaft was within a few feet of the line of the roof of the projected tunnel where bricking ended and the structure was continued down as a square timber column to support the great weight of the bricks above until they could be keyed in to the tunnel permanently. This pillar, made of a series of sills and boards and propped, was continued to below the level of the future floor where a sump was formed to hold water away from the works.

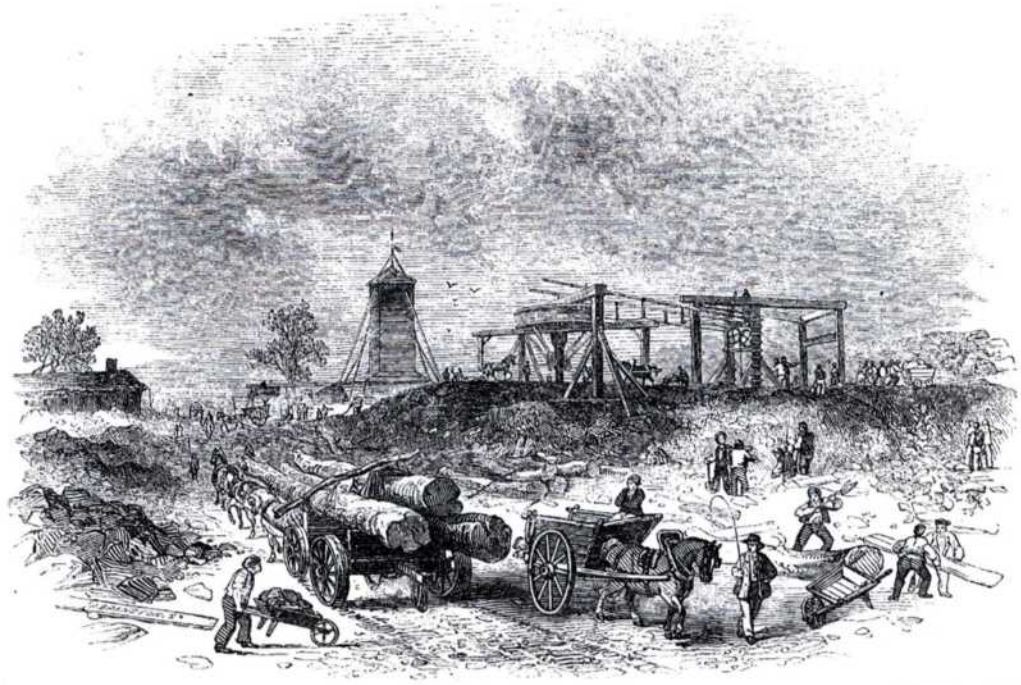


Fig. 3 The works at Bletchingley Tunnel
The observatory, horse gin, spoil heaps, supply of timber and boards.
F.W. Simms, *Practical Tunnelling*.

With plumb-lines suspended at full length to show the direction of the tunnel, and marked with the level of roof and floor, the miners could start on the heading, a small tunnel to link the shafts and the external ends. The first one could be made either at the level of the top or the floor of the tunnel, the latter being favoured when the ground was wet so that it would help drain the water away; Simms started with bottom headings 4 ft. 8 in. high, 3 ft. at the base and 2 ft. 7 in. at the top. By removing some boards near the base of the column the excavators next used timbers and boards to form a small protective horizontal excavation in which a light narrow temporary iron rail would be used to bear small skips carrying earth, manhandled between work face and shaft, and then taken out using horse gins. Once the heading was complete ventilation was improved and connected sumps took off the water. Additional vertical ropes could be hung from the roof to be lined up with those at the shafts to show the exact route.

Using one or two miners and a labourer Simms then put in a top heading 3 ft. wide and high enough for a man to stand in, starting above the roof of the projected tunnel to allow for timbering and bricking (Fig. 7). His diagrams show the profiles of Bletchingley and Saltwood with a central vertical line from which ran measured horizontals representing one foot intervals from top to bottom; the lengths included the depth of bricking (Fig. 8). This would be replicated by ropes as the tunnel progressed with plumb lines knotted at every foot, from which knots a series of tapes defined the width of the excavation; all plumb lines including those at the shafts were linked to a rope along the length of the excavation. A gang of three or four miners and three labourers could then start to 'get in the top' in 12 ft. lengths. First a long crown bar was inserted longitudinally along the line of the top of the future arch, resting on the square timbers beneath the shaft at one end and on a ledge of earth at the working face at the other. The excavation was widened and taken down as shelves to support further timbers, held apart with wooden blocks. Once supported, the earth shelf could be removed and a wall of overlapping poling boards inserted behind to hold back the soil and shape the tunnel. This was guided at the top by a 'centre' (Fig. 9), a semicircular form supported on a timber across the tunnel which also held props. When the level of the bottom of the heading was reached strong wooden sills were put in to take the weight of the timbers and props and relieve the square timbers below the shafts. The work proceeded downwards in the same manner to shape the sides of the tunnel, with a second set of sills installed with vertical timbers immediately under those above to take the weight. At the Saltwood Tunnel Simms used a further excavation and third set of sills. With the walls propped, the base of the tunnel was excavated and the inverted arch built.

The bricklayers followed close behind the excavators who would attempt to extract some timbering and boarding as bricks took over the weight. Several layers of bricks were laid into cement starting with the inverted arch using a ground mould for shaping, moving upwards with side moulds and the work supported by timbers until they reached the crown where the rings of bricks were bonded in and wedged

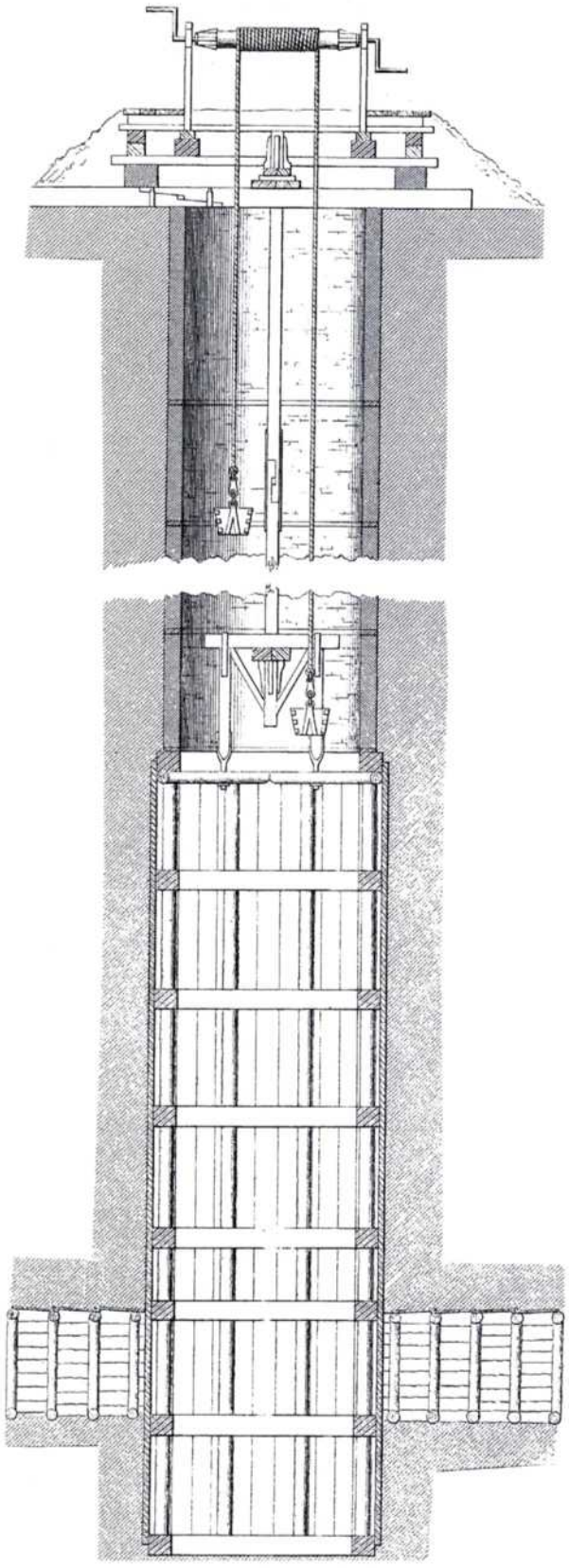


Fig. 5 Longitudinal section of a working shaft of the Saltwood Tunnel showing the bricked structure down to the level of the top of the projected tunnel over the timbering with sills and posts to the base of the future inverted arch. The heading is being excavated from the base. Buckets are raised manually before the major excavation commences when horse gins are used.

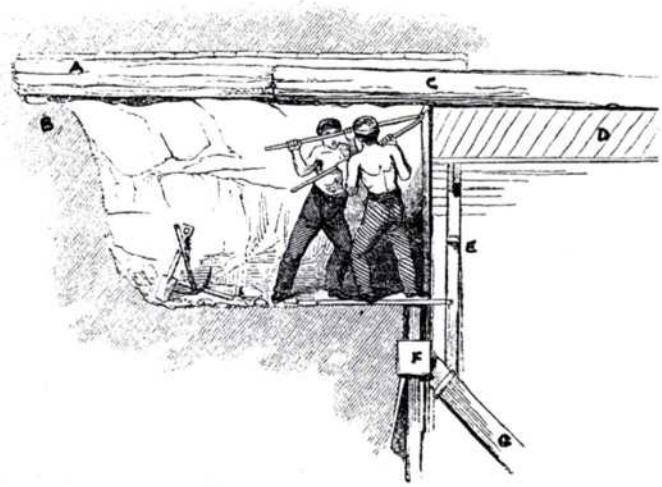


Fig.6 Drawing bars.
A. Bar to be propped.
B. The earth shelf.
C. Bar being driven from over the brickwork.
D. The last length bricked.
E. Leading centre.
F. End of top sill.
G. Upper end of raking prop.
F.W. Simms, *Practical Tunnelling*.

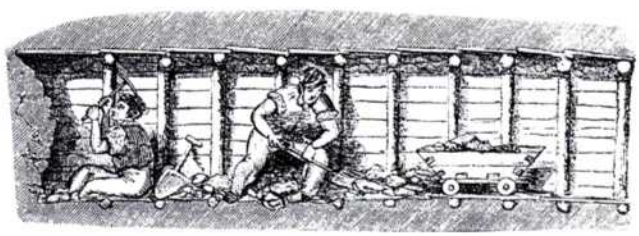


Fig. 7 Driving the headings.
F.W. Simms, *Practical Tunnelling*.

together (Fig.10). The bricks of the shafts were then connected with the tunnel walls and a brick or cast-iron curb built in to take the weight of the shaft. With the timber supporting column of the shafts removed, a temporary floor was installed to take a double set of rails to carry skips to receive soil thrown down from above as the excavation progressed away from the shafts.

Thus the work was advanced as a series of small tunnels to be connected into one when a permanent culvert would be built into the base and a bed made on which the track was laid. Simms' ballast included broken bricks. At each end of the tunnel a massive retaining wall was constructed to withstand the pressure of the soil, and channels made to divert the water away from the structure.

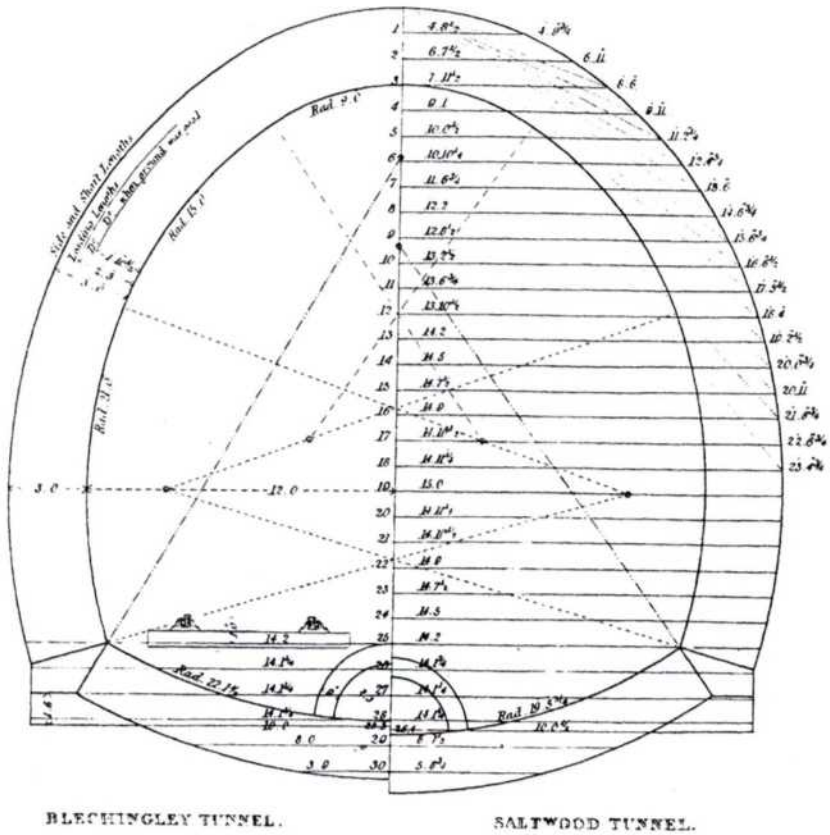


Fig. 8 Transverse sections of the Bletchingley and Saltwood Tunnels.
F.W. Simms, *Practical Tunnelling*.

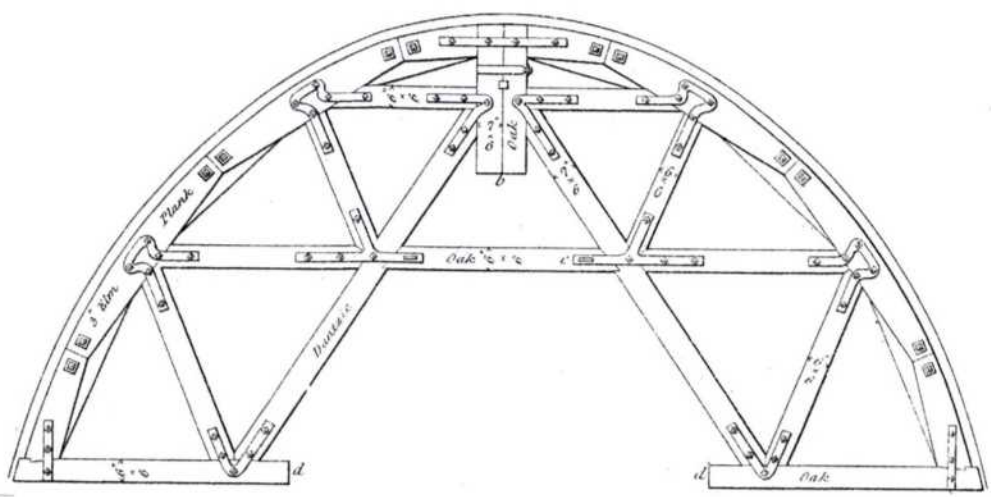


Fig. 9 Centre used for the Balcombe Tunnel
F.W. Simms, *Practical Tunnelling*.

BUILDING THE BALCOMBE TUNNEL: PERSONNEL

The directors of the London and Brighton Railway company met under the chairmanship of John Harman and appointed Sir John Rennie and John Urpeth Rastrick as Chief Engineers under a contract dated 23 January 1838.[20]

ENGINEERS

The terms of engagement for Rennie and Rastrick had been proposed at a meeting of directors on 26 September 1837 when they were described as Joint Engineers at a salary of £2000 p.a. for three years for all work except surveying and valuing land. In London Rastrick lived at Eton Square but as his home was in Birmingham he received a living allowance of

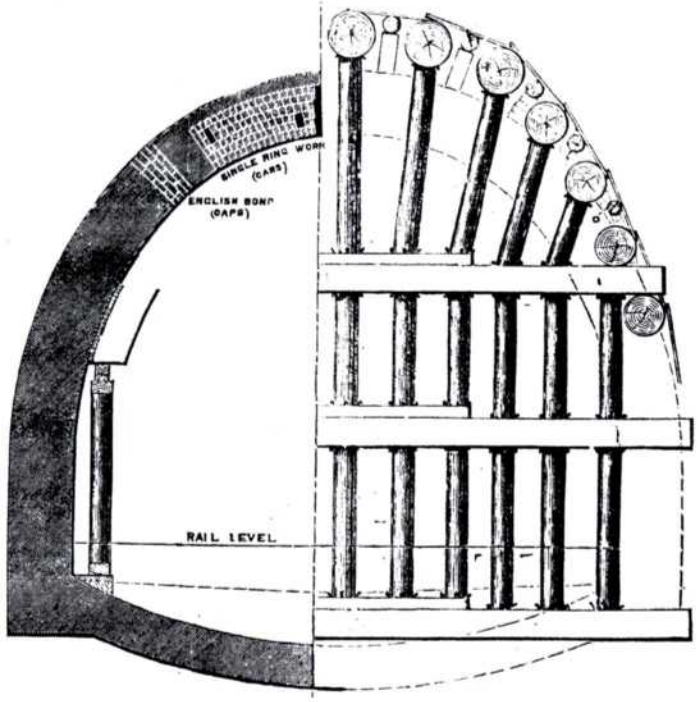


Fig. 10 Section of a tunnel under construction.
Drawn to accompany an article by C.F. Gripper.
The Engineer 18 October 1878, p.275

£5. 5s. 0d (£5.25) for every day he was engaged on work for the London and Brighton Railway Company[21] and his diaries of 1840 and 1842, which have survived, show that the amount was claimed for most days. He maintained a London office at 454 Charing Cross East and often drove out in his own carriage to oversee the work, sometimes leaving it to proceed on horseback or foot.[22]

Edward Maude of Leeds answered directly to Rastrlck for the central part of the line with Matthew Hall as Sub-Engineer.[23] Maude must have been held in regard for he keyed in the last stone of the great Ouse Viaduct, but in 1842 he was found to have misappropriated £600 of money sent to pay for men and materials.[24] Building the line was put to tender in short lengths, but when Rastrick considered the quotes for the Balcombe Tunnel to be too high he decided to oversee the work himself, contracting the construction of the shafts to Thomas Hoof and the tunnelling to James Potter, both of whom subcontracted it, and with Daniel Britton as superintendent.

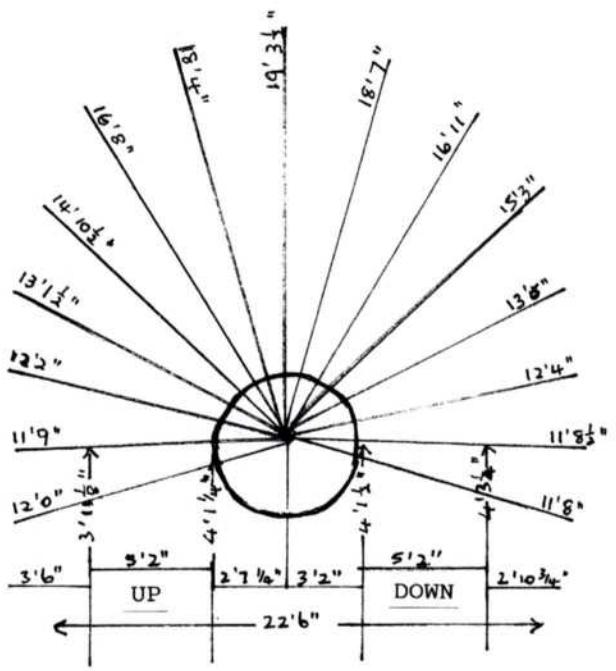


Fig. 11 Section of the north end of the Balcombe Tunnel
London Brighton and South Coast Railway, 1904.
Based on a diagram marked 'Not to scale'.

LABOURERS

The workforce was very complex with the terms 'engineer' and 'contractor' widely used at different levels, with gangers controlling groups and labourers contracting to other labourers. The hardest physical work of building the line was done by 'navvies' using picks, shovels, barrows, explosives and horses to excavate the tunnels and undertake the most difficult earthworks. Tunnelling was particularly arduous being worked round the clock by candlelight and in damp airless conditions. Other required skills for railway building were masonry, carpentry, brickmaking and bricklaying.

Contemporary writers viewed navvies with a mixture of respect for their hard work and disgust for their

violent behaviour. The men liked to keep dogs – bull breeds for fighting and greyhounds for hunting to help supply meat. The Cuckfield magistrates asked the Company to get rid of these animals as they were used for poaching and disturbed the game.[25] There were cases in court as when William Rapley, warrener to farmer Charles Tester, who was tenant to Sir Timothy Shelley at Balcombe, gave evidence against labourers for stealing rabbits.[26] Heavy drinking supported many temporary beerhouses such as the Royal Oak Inn in the Royal Oak cottage over the tunnel[27], and drunkenness was obviously the cause of some crimes.

Agricultural labourers worked on the railways but their most useful skills were in handling horses and digging on the surface. Boys were used to load barrows and on 31 January 1840 the Board of Guardians at Cuckfield agreed to send eight workhouse lads between 14 and 18 to Matthew Hall at Balcombe for one years work. Hall would maintain and clothe them, sick or well, and give them one pair of shoes and one change of linen.[28]

The Tithe Map and 1841 Census show a small settlement on the tunnel (Fig. 2) and an insurance document lists dwelling houses which provided lodgings for single men and families of men working on the project, also outhouses, store rooms, carpenters shops, smiths shops and forges, a tool house, stable and office, open yards for stores and accommodation for Ramsey and Company, contractors who ran a general shop, possibly a tommy-shop.[29] A police house was also provided.[30] The dwelling houses were built of brick and timber but depositions from the Quarter Sessions show them to have been temporary constructions, for in one case a watch was stolen by a labourer putting his hand over the low brick division between rooms[31]. The theft of watches appears in several court records, being valuable for men working on shifts, and tools also featured among cases of stolen goods. Men also lodged in the village, on farms and in barns, often sharing beds of straw and sacking[32]. In 1844 the Company cottages were improved for the use of railway staff[33] but were later pulled down.

THE ARCHITECT

David Mocatta was architect to the London and Brighton Railway Company and designed many of the stations. He was trained by Sir John Soane who encouraged him to continue studying in Italy where he developed a taste for classicism which is particularly seen in his work for Brighton Station and the stonework of the Ouse Viaduct. An unsigned architectural drawing for the gas works for the tunnels would also appear to be his work (Fig. 13).[34]

SERVICES

The Church Pastoral Aid Society appointed chaplains to the line, receiving £100 a year from the Company[35] and also money from magistrate Robert Trotter.[36] Reverend J.H. Broome reported on his work[37] and Reverend George Fraser's name can be seen on church records during his visits. The CPAS and local clergy were active in obtaining compensation for widows with £3. 3s. 0d (£3.15) to Elizabeth Bristow whose husband was killed at the tunnel[38], help for disabling accidents by supplying a wooden leg for a victim[39], and apprenticeships for injured boys.[40] The Society appears to have had influence among the men for quite a large number of baptisms and marriages are registered at Balcombe parish church. Burial records show entries for many children.

The work of navvies was dangerous and they usually put money aside from their pay towards medical expenses. Apart from accidents at work the physical conditions for tunnellers could lead to phthisis (consumption).[41] Cuckfield surgeon Lovel Byass attended the sick in the area and stretchers were provided by the Resident Engineer.[42] On 15 February 1839 The Board of Guardians of Cuckfield considered whether they should admit injured railway men to the workhouse for surgical or other relief[43] which they clearly agreed to do, for entries in their minutes of 8 April and 25 June 1841 record men there that had been hurt on the line.[44] Many seriously injured men were taken to the Sussex County Hospital at Brighton[45], for which the Company made donations.[46]

Initially the Company set up a railway police force but a report of April 1839 records how their solicitor Mr. Faithfull met the Cuckfield magistrates who wished to control the police themselves.[47] Recruits were to be sent to Mr. Trotter at Borde Hill for instruction.[48] Court depositions record fierce opposition to the police by navvies.

THE BALCOMBE TUNNEL : CONSTRUCTION

The London and Brighton Railway Company records at the Public Record Office are incomplete, in particular they lack letter books, reports of the contractors who controlled the workforce, maps and diagrams. The National Railway Museum at York has a small collection of documents including one of Rastrick's own volumes which bears the manuscript amendments to land ownership for the part of the line that was diverted to Haywards Heath[49], and the University of London holds his diaries for 1840 and 1842 and a collection of letters, most of which only exist as covers. Because Rastrick did not contract out the work, but subcontracted it under his management, the Company accounts are more detailed than for other sections of the line. It is unfortunate that two key

pieces are in very poor condition, often illegible and could only be viewed in part.[50] They have now been withdrawn from public use as 'Unfit for production'. Nevertheless the records that have survived give some idea of how the tunnel was built and the difficulties of construction through such a rough landscape. Unless otherwise stated this section is based on PRO Rail 386/ 1, 5 and 25, the Minutes of the meetings of Proprietors, Directors and the Wednesday Works Committee which covered the area from Horley to St. John's Common.

1837

The set of plans presented to the Parliamentary Committee on 30 September 1837 were changed yet again when Rastrick and Locke spent almost two months re-examining the whole line and taking account of suggested improvements. Finally the Balcombe Tunnel was to be lengthened and straight.[51] It would be about 1140 yards long, 23 ft. by 23 ft. 6 in., with five shafts and 60 ft. below ground. Rennie approved the amendments.[52] Modern Railtrack records describe it as 1133 yds/1037 m falling 1 in 264 towards Brighton, from 32 miles 49 yds to 32 miles 1182 yds distance from London, map ref. TQ 291326 to TQ 296317, elliptical, with 5 rings of brick = 22.5" thick except for about 18" thick for the invert, shafts 5 - 13 ft. internal diameter.

1838

lt was important to start major engineering works as soon as possible to allow for settlement, so early possession of the land was needed and the staking out of the line with a post at every chain to inform landowners. Unfortunately as the plans of the tunnel were altered, the works needed recosting. Different pieces of land had to be purchased from Sir Timothy Shelley, and his slowness to agree a price and his demands for arbitration delayed the start. The land of that area was deemed so rough and poor that the Company expected to acquire it cheaply and set a price of not more than £2000 in May, but in June he was voted £3100 with £700 to Charles Tester his tenant, and £l50 for a barn to be replaced. In November the Company leased more of his land for dumping spoil and were also to pay him a royalty on the bricks they made on it.

The weather was extremely wet and water was to be far more of a problem than anticipated. In fact it was a problem that has never been completely solved. Water in the tunnel during building was to be the cause of great over spending, so the contractors' estimates which Rennie rejected as being far too high were possibly realistic.

On 17 July Matthew Hall wrote to Edward Maude at the London office in a letter that has survived intact.[53] He reported that the land was about to be cleared and a start had already been made on the observatory and also trial shafts which were filling with water. Bricks had been obtained from a Mr. Mitchell, possibly Mr. Michell of Three Bridges who had bought a public house standing on land which he also used for brickmaking. His venture was not very successful, at least until the end of the construction of the railway when a large number of bricks were urgently needed for completion. Wet weather carried away brickearth awaiting firing and put out the fires in his clamps,[54] In the meantime Edward Maude was seeking a valuation of the timber on the route between Horley and St. John's Common from Mr. Turner of Holly Bush Farm near East Grinstead.[55]

In August Rastrick ordered a hut to be put up on the summit as a temporary office, an enclosure for supplies and stabling for two or three horses. James Potter was to be provided with a bed in a small room within the hut for when he needed to sleep there, and he was allowed £60 for a horse. Rastrick took him to Kilsby Tunnel to investigate used equipment but found that all had been sent to Clay Cross except for pieces not worth the cost of transporting. So he ordered his five gins from the Birmingham Railway Company for £258. 8s. 2d.[56]

The five shafts and two tunnel entrances would provide 12 working surfaces. By August trial shafts had been driven to eight yards of their extreme depth at each end of the tunnel, but water in the south one, issuing from above the intended tunnel, was so serious that work had to be stopped until a bore was made to 7 ft. below the railway level to drain into the brook course via a 280 yard cylindrical brick culvert, and a garland curb and hand pump were installed. By September the observatory was completed, the main shafts were being set out and the drainage seemed to be effective. Tunnellers were issued with flannel shirts and trousers which were dried in a small room there.[57] At the wet Saltwood Tunnel in Kent men became wet through in minutes and so worked three or four shifts in 24 hours[58] but it is not clear if that was the practice at Balcombe. About 120 men were employed at the end of 1838.

While work progressed Rastrick took members of the Committee to iron works and manufactories in Birmingham, Stafford, Wolverhampton, Manchester, Bolton and Liverpool to examine products and experience travelling on different railways. They favoured rails of 75 lb. per yard supported on stone blocks 4 or 5 ft. apart as used on the Liverpool and Birmingham Railway. In September rails were being ordered, and in November tenders sought for stone blocks 2 ft. square and 1 ft. thick, sleepers and timber.

Rastrick's report of 17 November shows that shaft one had reached 7 yards of the top of the tunnel, two and three to within 30 yards, four to within 16 yards and

five to within 5 yards. One hundred and forty one yards of heading had been completed, 120 men were employed with 37 on brickmaking, but no horses, suggesting that all spoil was being taken out by hand. Rails were on order from the Dowlais Iron Works, to be shipped to Shoreham. Timber on the site was to be cut for use if suitable, and if it contained too much sap was to be kyanized[59], (preserved using a solution of bicarbonate of mercury).

1839

Rastrick had ordered the land beside the entire line to be examined for brick earth and brickfields to be opened wherever necessary. An archaeological survey has found evidence of a pugmill near the tunnel[60], and in June it was noted that huge numbers of bricks were being made along the line. Company accounts show supplies reaching the works including coal, faggots and slates for the brickyards[61], yet in August Rastrick was authorized to buy in additional bricks for the tunnels.

ln January there were five working shafts plus two trial and two air shafts. Men were being employed night and day but were stopped at times because of unexpected water at the level of the bottom of the tunnel, however the driftway (heading) was almost complete from the south end to the first working shaft and the line was becoming drier there. The driftway was also advancing at the northern end and overall 280 yards of it had been completed. On 8 March *The Times* ran an article extracted from the *Brighton Guardian* reporting 50-60 ft. of water in the shafts at Balcombe, and questioned whether the line should not be diverted to avoid these 'dropsical hills', a doubt denied the next day, claiming that the story was put out by people who wanted only to cry down Brighton and its prosperity. ln fact the situation improved during the month, when 239 men and 22 horses were working.

lt had been felt that the tunnel would not be dry until all the shafts had been completed and the driftway forced through, and this was done by July when an adit had been driven up from the brook course. With the problem of water-filled shafts relieved, the Company appears to have contemplated putting the rest of the work to tender, but Rastrick assumed it again as a piece. The contractor who had worked on the shafts for Thomas Hoof was employed on driving and bricking the tunnel for James Potter with a force of 204 men and 20 horses. They expected to have two or three lengths ready for bricking early in August.

A report of Rastrick in August showed that the Company was having financial difficulties and so placing constraints on contractors which damaged their businesses and the railway building at a favourable and profitable time before winter set in. However work on the Balcombe Tunnel had to go on as it was the most difficult part of the whole line, and the Company had already paid for the materials leaving contractors responsible for cash payments for labour and horse work. Another problem was that tunnelling used enormous quantities of bricks and if they had to be manufactured in the winter the Company would have to put up sheds and flues[62]; Rastrick received permission to both make and import bricks for a continuous supply.

1840

The weather had been extremely wet but in the tunnel the water was draining off by the drift way and the work appeared to be going well with an increased workforce of 638 men and 54 horses; in January 160 yards of tunnelling had been completed. The heavy rains had made bringing in supplies along the rough wet roads a great problem, and Rastrick ordered them to be repaired when he experienced difficulty in getting his carriage through.[63] As the Company was finding it hard to raise money to complete the line the directors considered trying to bring in revenue by opening sections linked by coaches. In January they hoped that in the autumn they might open from Earls Wood to Kemps Farm south of Balcombe village where the line ran close to the turnpike, but this was delayed through water in Merstham and Balcombe Tunnels. In July they considered opening to the northern entrance of the Balcombe Tunnel but found that it would cost £1000 to put a suitable road for coaches through the forest to the line.[64] Within the tunnel the ground was said to be very heavy with swells and efflorescences as soon as it met the air necessitating careful work which slowed progress. The accounts show cement, timber, poling boards and hardware coming in, beside fuel for the brickyards but not bricks.[65] In October Rastrick's proposal to light the tunnels by gas from a gas house was accepted. In December £348. 8s. 3d (£348.41) was paid to Sir Timothy Shelley as a royalty for bricks made on his land.

1841

Work had progressed so well that in January almost the whole tunnel was completed except for eight yards at the northern entrance, the central culvert was being made and rails would soon be laid. It was hoped to have it finished by the start of February, but it was not completed until March. As the line south of the tunnel was well advanced the plan was to open to Haywards Heath instead of Kemps Farm, first in May but eventually on 12 July with coach connections to Brighton.

Before passenger traffic could commence Lieutenant-Colonel Sir Fredric Smith, Railway Inspector-General reported to the Board of Trade on the line from Croydon to Haywards Heath.[66] He gave the length of

Fig. 12 The southern entrance to the Balcombe Tunnel today.

the tunnel as 1122 yards and stated that there were places where water was flowing through the arch, but they had been lined with lead and vertical pipes installed to carry it down to the culvert and so away from the trains.

Details of the track: the gauge was 4 ft. 8½ in., rails were 75 lb. a yard and laid on stone blocks, bearings (sleepers) were 4 ft. in the middle and 3 ft. 6 in. at the ends with five in each 15 ft., joint chairs weighed 26 lb. and intermediate chairs 22½ lb. A payment of £580. 3s. 6d had been made to A. Clark & Son for supplying the 'lead shields'.[67] After the opening the north entrance of the tunnel was tidied up and shafts fenced; gas lighting equipment was supplied by Stevens and Son, gas engineers of Southwark, the supply coming from the gas works by the up line about a quarter of a mile to the south (Fig. 13); two men were posted at the tunnel for security. Ventilation was said to be perfect, but on 24 May 1842 Gideon Mantell wrote in his journal that the tunnels on the line were dark, wet and murky.[68]

THE TUNNEL IN THE LAST YEARS OF THE LONDON AND BRIGHTON RAILWAY COMPANY

Despite celebrations and congratulations on the opening of the line the story was not finished, for building it had cost far more than the original estimates. A committee was set up to investigate the accounts and on 17 March 1842 reported that vouchers could not be squared with the books and errors included a £71,000 bank loan which had been entered twice.[69] On 31 July 1842 Rastrick wrote in his diary that he had found 'a great mistake' (unspecified) for tunnelling. He had been praised during the building of the line but now became a scapegoat with even the directors saying they were wrong to have put their trust in him and Locke. The Company Secretary had absconded, Maude had misappropriated money and the Company Accountant was seen as being too inexperienced for the post. It was generally believed that there was no major fraud, but small dishonesties. Shareholders, being asked for more money when they hoped to be getting some return, wrote angry letters to the papers and journals. There were a few sober voices, such as correspondents to the *Railway Magazine* who pointed out that all railways built had had similar problems, and that a passenger line between London and Brighton must eventually prove a good investment.

Rastrick inspected the work and found that the section through the High Weald accounted for much over spending because of the great earthworks needed to traverse the hilly country, and the complex rock that made engineering difficult. The Company eventually listed eighteen causes of over spending for the whole line which included extra bricking to support weak soils and water in the tunnels that needed extra drainage. Tunnelling had cost three times the original estimate.[70] This debacle, much blamed on unforeseen circumstances, contrasts dramatically with the enormous confidence and authority with which the engineers had addressed Parliament in 1836 and 1837, and the generally glowing reports to the public during construction.

An early economy was made by ceasing to light the tunnel. Towards the end of 1841 the Coal, Coke and Wharf Committee were seeking a cheaper source for the four tons of coal needed each week[71], and in 1842 a comparison of costs was ordered for the expense of

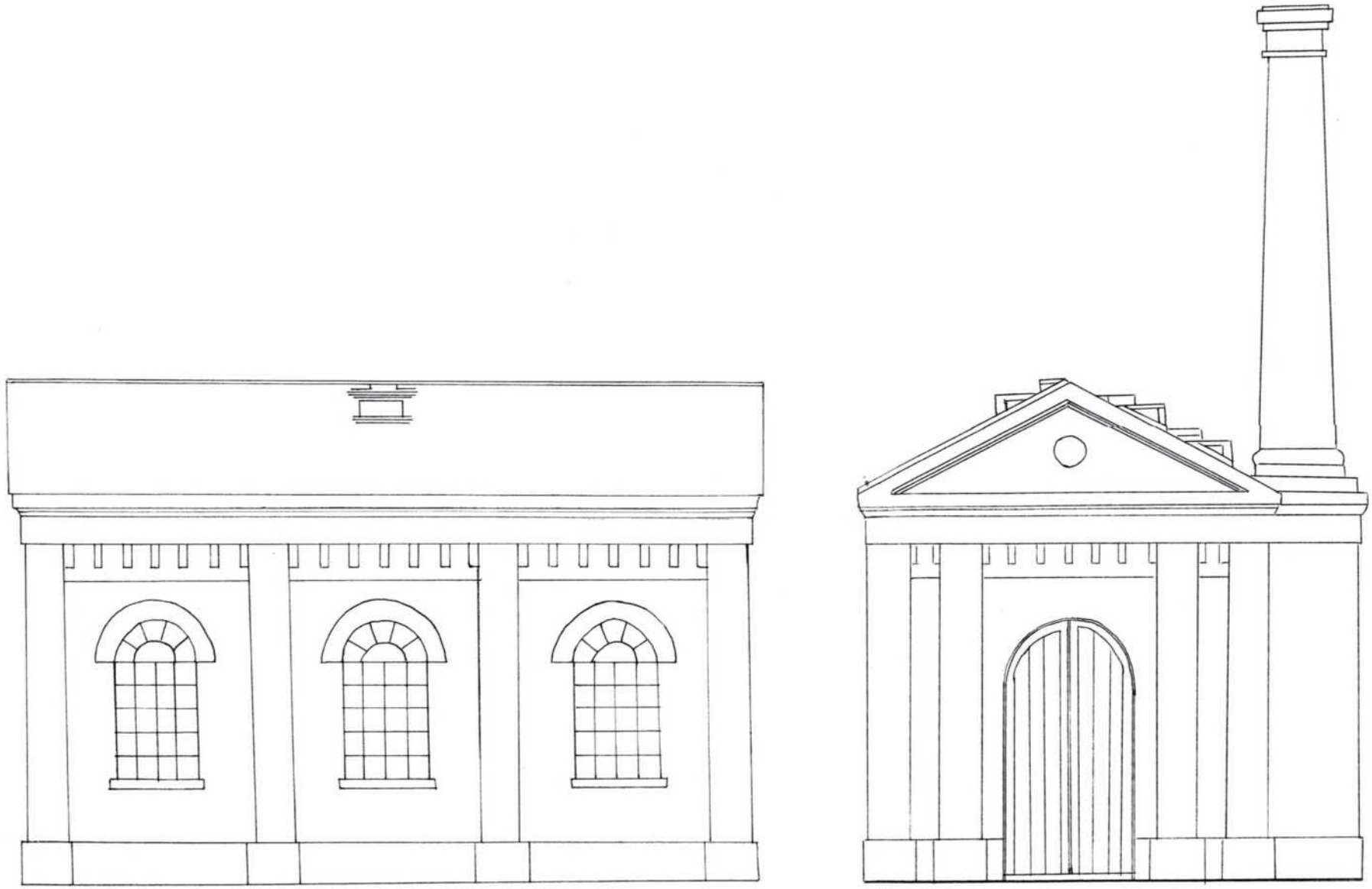


Fig. 13 Plan for proposed gas works for the tunnels on the London and Brighton Railway.
Based on architectural drawings at PRO Rail 386/91(39), March 1841
Approximate size of ground plan is 17 ft. x 17 ft. Height of chimney 20 ft.

lighting the tunnel against putting lamps in the carriages.[72] The Stores Committee had already decided to return the unused lamp glasses to Stevens and Son for 9s. (45p) a dozen or cost price[73], and in the next year some of the 2 in. gas piping was sent to Croydon station to carry water and a report was sought to find the value of the rest.[74] In 1844 the Traffic Committee was planning to dispose of 2½ in. gas piping for £5 a ton to the Hove Gas Company and was having a gasometer (un-named) valued.[75] In June Mr. Stevens was taking pipes at £5 a ton.

The Balcombe Tunnel was to be a continued expense for the Company. In 1842 Major-General Sir Charles Pasley, who had succeeded Sir Frederic Smith as Inspector-General of Railways at the Board of Trade, reported that water and excessive pressure by the soil on timbers during construction had necessitated bricking from 18 in. to 5 ft. thick.[76] Before the end of 1843 the Traffic Committee was seeking a report on the state of the structure generally and the great amount of water there in particular[77], but it was said to be as good as when it was built.[78] Clearly the difficulty continued for in 1845 the Committee was voting £998 to have it drained, the sum to be partly offset by £525 from the sale of lead shielding at £15 a ton.[79] The problem remained for in 1846 the Directors asked the Locomotive Committee for a report[80], and in September the Coaching Committee accepted a recommendation that drains should be built in the wettest shafts leading down to the centre drain in the base of the tunnel, doors inserted in some shafts and covers to protect bricks in cold weather. The cost would be £130 per shaft and roofing £25. Bricks that had already been damaged by frost should be replaced with ones of better quality, the procedure to be repeated each summer as necessary. It was suggested that when damaged bricks had been replaced within the tunnel overlapping strips of corrugated galvanized iron should be placed in the roof and down the sides to keep water from the trains.[81] By then the London and Brighton Railway and the London and Croydon Railway had been amalgamated to form the London, Brighton and South Coast Railway.

One major weakness was due to wooden bars which had been left in during construction and then decayed, so destabilizing the soil and putting excessive pressure on the bricks.[82] In 1906 the tunnel was relined with strong blue bricks but water has remained a problem, leaking randomly as it flows behind them. The shafts are still lined with red bricks, possibly partly original, but an examination by Vertical Technology of Havant who repaired them in the winter of 1995-96 found much evidence of past remedial work. Gutters and down pipes had been installed, holes cut into the walls, some filled roughly by bricks without mortar, some by weep holes. In Shaft 2 (Fig. 3) there were places where the wall was bulging and slumping and at one point water was streaming out under pressure clearing the wall by over 300 mm. Much repointing was needed to stop the clay from oozing through the joints and running downwards. In shaft four there were two bricked-up culverts. It is common for water to shower down the shafts and into the tunnel, now the responsibility of Railtrack.

The history of the tunnel may continue to be one of running repairs, or it is possible that modern technology will provide a more permanent answer. As it is, the problems reflect back to the story of its construction in the first half of the nineteenth century, and even earlier to the discussions during the Parliamentary enquiries when the question of the composition of the rock strata was returned to again and again. Undoubtedly most passengers using this very busy line are completely unaware of the controversy and difficulties of building the tunnel at Balcombe, and of the water round them as they travel through it.

APPENDIX

The accounts for the Balcombe Tunnel in piece PRO Rail 386/103 are no longer available to the public. The volume is in very poor condition and many entries are illegible. The following was extracted showing some suppliers.

Cement	Francis, Charles & Sons.
	White, J. Bazley & Co.
	Turner & Montague.
	Ashby, Wm. & Son.
Coals	Goolee, Burwood.
	Cheeseman, G. & C.
	Dowson & Co.
	Trask, John.
	Collins, Jas.
	Mitchell, Hy.
	Best, F.
Gas pipes	Horsley Iron Co.
Hardware	Packham & Co.
	William & Yearsley.
	Richards & Sons.
Iron bolts ...	Thompson & Forman.
Leasen shields	Clark, Andrew & Son.
Poles Faggots ...	Chatfield, E.
	Ireland, John.
Poling boards	Leigh, Hy.
Slates	Blaker, William
Stone Blocks	Freeman, W. & J.
Timber	Gabriel, Thomas & Sons.
	Webber, John
	Dowson, Joseph & Co.
	Stenning, J. & Son
	Leigh, Hy.
	Alexander, T.

This study has been greatly assisted by the help and courtesy that I have received from the staff of libraries and record offices, and the editing by Dr. Brian Austen.

Quotations from the Parliamentary enquiries have been approved by the Clerk of the Records of the House of Lords.

Quotations from the autobiography of Sir John Rennie and the diary of Charles Vignoles, and reproduction of illustrations from F.W. Simms' *Practical Tunnelling* 1844 have been made with the permission of the British Library. The Copyright Officer of the Public Record Office has allowed me to use architectural drawings from their series Rail 386, and Centaur Communications an illustration from an article in *The Engineer*. I am very grateful for material and advice supplied by Mark Huband of Railtrack plc and Anthony Hallam of Vertical Technology of Havant. Southern Water permitted me to use the report made for them by Southern Archaeology, which was supplied by John Mills of the West Sussex County Council.

BIBLIOGRAPHY

British Geological Survey. Sheet 302 Horsham. 1" series.
E.M.S.P. (Paine, E.M.S.) *The Two James's and the two Stephensons; or, the earliest history of passenger transit on railways.* (1861).
Fairweather, Leslie. *Balcombe: the story of a Sussex village.* (Balcombe, 1981).
Gibbs, Joseph. *Report of Mr. Gibbs, civil engineer, upon the several proposed lines for a Brighton railway.* (1835).
House of Commons. *Minutes of evidence taken before the Committee of the London and Brighton Railway Bills. Engineering evidence ... copy from Mr. Gurney's shorthand notes.* (1836).
House of Lords. *Minutes of evidence taken before the Lords' Committee to whom the bill intituled 'An Act for making a railway to ... form a communication between London and Brighton by way of Shoreham' was committed.* Ordered to be printed 7th July 1836. 2 vols.
House of Lords Record Office. Evidence, H.C. 1837, vols. 17-I8, London and Brighton Railway. Manuscript.
House of Lords Record Office. Evidence, H.L. 1836, vol. 34, London and Brighton Railway. Manuscript.
House of Lords Record Office. Evidence, H.L. 1837, vol. 7, London and Brighton Railway. Manuscript.
Institution of Civil Engineers. *Engineering Conference, 1921, Section 1: Railways, roads, bridges and tunnels.* (1921).
James, William. *Report, or essay, to illustrate the advantages of direct inland communication through Kent, Surrey, Sussex, and Hants, to connect the metropolis with the ports of Shoreham, (Brighton) Rochester (Chatham) and Portsmouth by a line of engine rail-road ...* (1823).
Lloyd, John and McEnnes, K. "Three days in Tilgate Forest: a botanical ramble." *Phytologist.* Vol. IV, 1952.
Mantell, Gideon. *The Journal of Gideon Mantell ... 1818-1852.* (Oxford, 1940).
Michell, Henry. The Diary of Henry Michell, 1809-1874; ed. and with an intro. by Kenneth Neal. (*Victorian Horsham*). (Chichester, 1975).
Railway Magazine and Annals of Science. Also known as *Herepath's Railway Magazine.*
Rennie, Sir John. *Autobiography ...* (1875).
Simms, Frederick W. *Practical Tunnelling.* (1844).
Southern Archaeology. *Report for Southern Water. Turners Hill to Buchan Hill trunk main watching brief.* P46.047. June 1997

ABBREVIATIONS

BL	British Library.
CPAS	Church Pastoral Aid Society.
ESRO	East Sussex Record Office.
HLRO	House of Lords Record Office.
ICE	Institution of Civil Engineers
NRM	National Railway Museum
PRO	Public Record Office
UL	University of London
WSRO	West Sussex Record Office

REFERENCES

1. James, Williams. Report. 1823
2. E.M.S.P. (Paine, E.M.S.) *The Two James's and the two Stephensons.* (1861)
3. PRO Rail 386/66.
4. ESRO QDP/114/1.
5. ESRO QDP/114/4.
6 ESRO QDP/129.
7. ESRO QDP/138.
8. ESRO QDP/145.
9. *Herepath's Railway Magazine.* New series. No. II April 1836.
10. Joseph Gibbs, *Report.* (1835).
11. Sir John Rennie, *Autobiography.* (1875).
12. BL. Add.ms. 34528.
13. ESRO QDP/156.
14. ESRO QDP/162.
15. *Herepath's Railway Magazine.* New series. Vol. III, No. XVIII August 1837.
16. ESRO QDP/164.
17. HLRO, Evidence, H.L., 1836, Vol. 34, London & Brighton Railway. 6 July 1836.
18. WSRO Balcombe Tithe apportionment, 1839.
19. Lloyd, John and McEnnes, K. 'Three days in Tilgate Forest'. 1952.
20. PRO Rail 386/66.
21. PRO Rail 386/5 26 Sept. 1837.
22. UL. Goldsmiths Library. Rastrick papers mss. 242/III(2); 243/III(1).
23. PRO Rail 386/5 23 Jan. 1838.
24. UL. Goldsmiths Library. Rastrick papers mss. 242/III(2); 10 March 1842.
25. PRO Rail 386/25 3 Sept. 1838.
26. ESRO QRE/859 (30).
27. Leslie Fairweather, *Balcombe.* (Balcombe, 1981).
28. WSRO G3/1a/2.

29. PRO Rail 386/90(131).
30. PRO Rail 386/5 27 Sept. 1838
31. ESRO QRE/873(13).
32. ESRO QRE/866(10).
33. PRO Rail 386/8 29 Aug. 1844.
34. PRO Rail 386/91 pt.2 (39).
35. PRO Rail 386/1 18 July 1839.
36. PRO Rail 386/5 4 July 1839.
37. *CPAS Occasional Paper* no. VII. Dec. 1839.
38. PRO Rail 386/5 4 July 1839.
39. PRO Rail 386/5 28 March 1839.
40. PRO Rail 386/5 7 May 1840.
41. ESRO HB 62/1 pp.23-4.
42. PRO Rail 386/5 10 Jan. 1839.
43. WSRO G3/1a/2.
44. WSRO G3/1a/3.
45. PRO Rail 386/94.
46. PRO Rail 386/5 6 Dec. 1838 et al.
47. PRO Rail 386/27 15 April 1839.
48. PRO Rail 386/5 8 Aug. 1838.
49. NRM Library K7B/84R.
50. PRO Rail 386/103,104.
51. *Herepath's Railway Magazine*. New series. Vol. IV No. XX111 Jan. 1838.
52. PRO Rail 386/43.
53. UL. Goldsmith's Library. Rastrick papers ms. 325/82.
54. Henry Michell, *Diary*, (1975).
55. WSRO Add.ms. 48854.
56. PRO Rail 386/102.
57. ESRO QRE/866(10) 30 Dec. 1839.
58. Frederick W. Simms, *Practical Tunnelling* (1844).
59. PRO Rail 386/48.
60. Southern Archaeology. *Report*. June 1997.
61. PRO Rail 386/102, 103.
62. PRO Rail 386/51.
63. UL Goldsmith's Library. Rastrick papers ms. 242/III(2) 9 Jan. 1840.
64. PRO Rail 386/23.
65. PRO Rail 386/103.
66. PRO Rail 1053/2.
67. PRO Rail 386/14, 26 Aug. 1841.
68. Mantell, Gideon. *Journal* 1940.
69. PRO Rail 386/57.
70. PRO Rail 386/1 17 March 1842.
71. PRO Rail 386/12 19 Nov. 1841.
72. PRO Rail 386/12 27 Aug. 1842
73. PRO Rail 386/19 23 June 1842.
74. PRO Rail 386/19 7 & 28 April 1843.
75. PRO Rail 386/21 18 March 1844.
76. PRO Rail 1053/1.
77. PRO Rail 386/21 30 Oct. 1843.
78. PRO Rail 386/7 2 Nov. 1843.
79. PRO Rail 386/21 8 May 1845.
80. PRO Rail 386/9 15 July 1846.
81. PRO Rail 386/22 4 Sept. 1846.
82. ICE Engineering Conference, (1921).

ERIC GILL AND THE DITCHLING COMMON WORKSHOPS

Peter Longstaff-Tyrrell

Fig. 1 Eric Gill, 1927.
Self portrait from the collection of files presented to the Victoria and Albert Museum by his widow Mary in 1952. The monastic type headwear is a simple paper hat made to keep stone chippings out of his hair whilst engaged on his sculptures. The type of disposable hat has been adapted by various trades over the years. Reproduced courtesy of the Victoria and Albert Museum from their 1963 publication *The Engraved Work of Eric Gill* by John Physick.

Of all the illustrious sons of Sussex this century few could have made a more lasting daily visual impact, worldwide, than Eric Gill. It was in Sussex that Gill embarked on his international career – yet few people outside the world of the arts and publishing may have heard of his full name and controversial lifestyle. This article concentrates on Eric Gill's work on the former workshop premises on Ditchling Common and provides an illustrated record of this site.

This writer first came across the name Gill upon commencing employment as an apprentice compositor (hand-setting metal type, or hot metal as it became known) at Burgess Hill, in the late 1950s, at the former Osborne Printing Works/Charles Brett Ltd. premises in Station Road, opposite the town Junior School. Osborne's main factory building was an old aircraft hangar on to which had been built a warehouse at the rear with a later modern office block frontage, where farm sheds and pottery buildings once bordered Station Road.

From 1959 I attended Art School in Brighton, at the old Workhouse building in Circus Street next to the Fruit and Vegetable Market off Grand Parade and with fellow apprentices we were soon engrossed in the history of print and type-founders. Yet amongst all those exotic, ancient and overseas, type-designers was one born in Brighton and active this century and who worked in Chichester and the artistic Ditchling environs. Back at work as lads we were fed with tales of the monk-like commune at the end of Folders Lane, Burgess Hill, where Eric Gill and his contemporaries had worked. Gradually I was to learn more of the group and visited their old site near the railway bridge.

Eric Arthur Rowton Gill was born at 32 Hamilton Road, Brighton, in February 1882. His father was Assistant Minister at the distinctive Countess of Huntingdon Connection chapel in North Street situated between Hanningtons and Vokins stores, built in 1871 and demolished in 1972 because of its unsafe condition. Locally this almost extinct denomination survives with a chapel to the north end of Ditchling Common. There is much evidence of the presence of Gill and his contemporaries in and around the picturesque village of Ditchling.

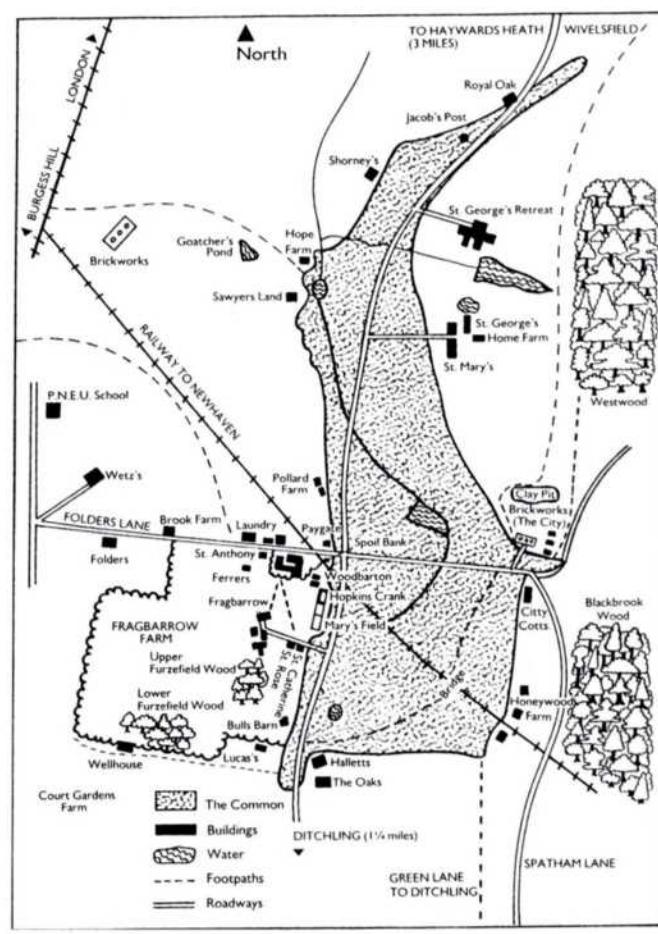


Fig. 2 Map of Ditchling Common

One of a family of 11, he was brought up with the ideal that work, not wealth, mattered in life. He was to visit Chichester often, aged 15, when his father took up a fresh post after attending Theological College in the cathedral city. Eric's early ideas were influenced by the railway track and yards near his childhood Brighton

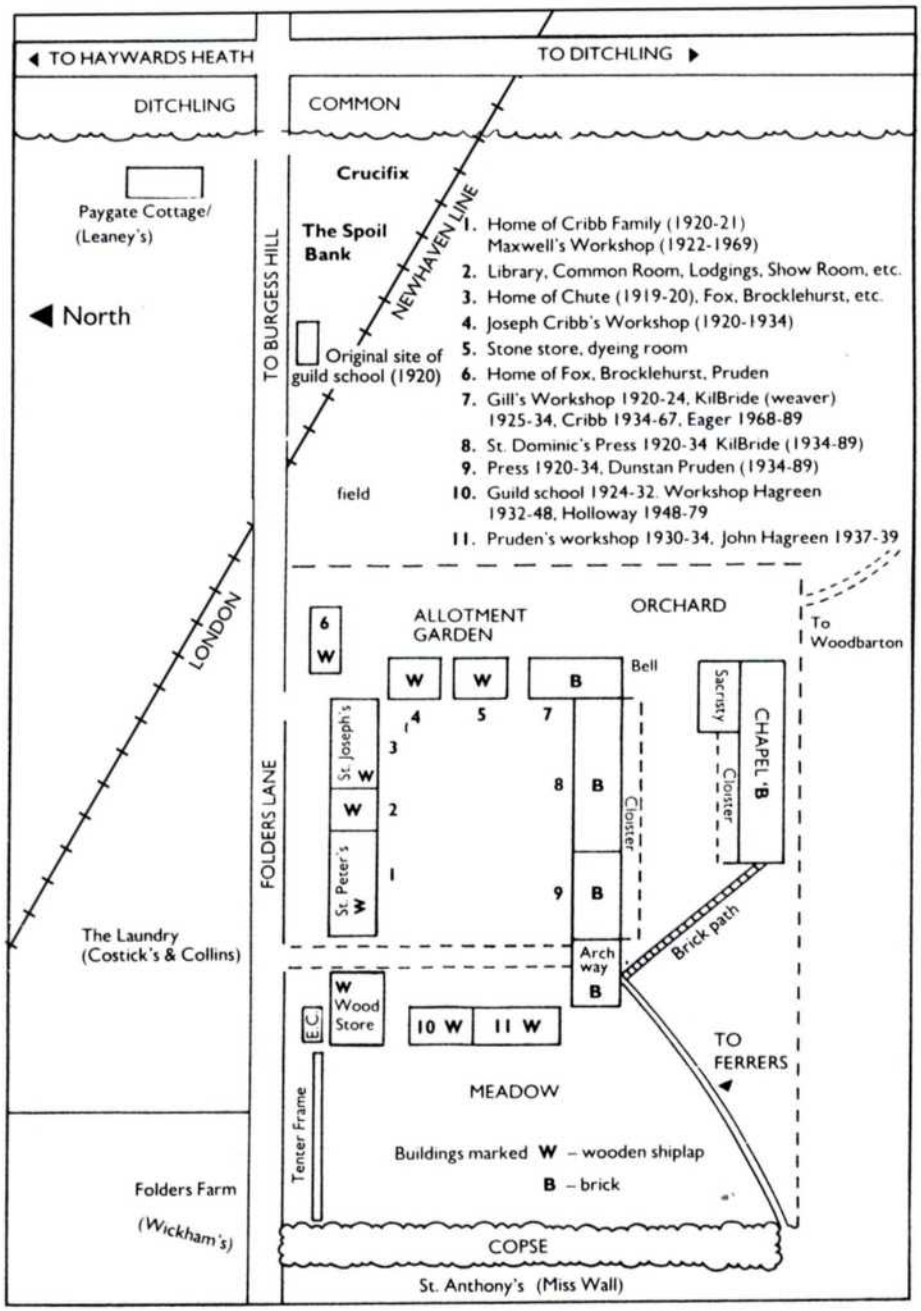


Fig. 3 Plan of the former Ditchling Common Workshop site

home. Later he would cycle over to Chichester to see his father. Sometimes Eric would travel by train as he appreciated aspects of the countryside, its neat villages and the unique orderly manner of the Roman city, as he grew to despise his home town as being a series of slums with a Regency facade.

Gill became a student at Chichester Art School, as an introduction to the world of engraving and letter-cutting. Between 1900 and 1903 Eric Gill was articled to W.D. Caroe, architect to the Ecclesiastical Commissioners in Westminster and it was during this period that his interest in lettering developed. Gill studied at the Central School of Arts and Crafts under Eric Johnston and was later to share rooms with his mentor in Lincoln's Inn. (Gill was later to acknowledge that it was the pioneering Johnston Sans Serif type-face for the London Underground that influenced his Gill Sans series, although Gill's role in the innovative legibility exercise was sufficient for him to be given 10% of Johnston's fee).

In 1903 he took up employment as a letter-cutter and the following year married Mary Ethel Moore setting up home in Battersea, and later Hammersmith, before moving to Ditchling four years later. Mary, or Ettie as she was called by Eric, was to become a commendable mainstay throughout Eric's non-conformist career and domestic life. Edward Johnston and Hilary Pepler were to join the Gills at Ditchling, that was becoming renowned as an artists' retreat, in 1907.

It was the private press movement with its non-commercial ideals led by C.H. St. John Hornby, from his Ashdene Press (1894-1935), that attracted Gill to his peers. St. John Hornby, a partner in the firm W.H. Smith and Co, gave Gill his very first commission for letter-cutting. The vast outlets in publishing, news stalls and book print of St. John Hornby provided enormous opportunities for Gill's influence on type-face trends. His devotion to religious matters led him to convert to Roman Catholicism in 1913. In 1914 he was commissioned to carve the 'Stations of the Cross' in Westminster Cathedral, which he completed over a four year period between taking on other notable commissions and much travelling around the nation.

'Sopers' the Gill family home in Ditchling High Street was given up by the family in 1913 when Eric sought newer premises with more scope for his life-style. He found a home some two miles north on Ditchling Common alongside the B2112 called 'Hopkins Crank', close to the main road railway bridge and bordering Burgess Hill geographically. Hilary Pepler moved into 'Sopers' for a time and set up his press in a wooden shed nearby. By 1916 Pepler formed his St. Dominics Press and was to employ Gill over a period of nine years during which he produced over 200 line engravings – many of which Pepler was to use more than once in his own publications, titles that Gill also contributed to as a writer .

Pepler has been described a 'happy amateur' and had tried various walks of life before joining the ethnic

Fig. 4 Eric Gill's studio viewed from the Orchard and allotment garden in April 1990, just prior to demolition. The tall easterly facing windows allowed ample daylight penetration. (No.7 on plan)

Ditchling community. His father was a partner in an Eastbourne brewery concern and thus Pepler had access to funds that Gill found useful, although they were to fall out eventually over finance and policy straits.

Despite the outbreak of the Great War on 4 August 1914 Eric gave little attention to worldly events. He was then aged 32 and many of his family were on active service. Gill himself was called up in July 1915 and he found himself on downland manoeuvres being encamped on Lewes racecourse. He contested his need to serve in the army and eventually enlisted in the Home Defence Brigade at Burgess Hill. In September 1918 Gill was called-up again and despatched to the RAF Mechanical Transport camp at Blandford Forum, as a driver, which he understandably disliked intently as 'an utterly unfriendly and unchristian place'.

To many people the name of Eric Gill and Ditchling means an association with the Folders Lane commune of seven families who aimed to be self-sufficient. Interest enough was aroused to provide a regular stream of visitors and sightseers. In 1921 the group was organised legally with seven partners on a more formal basis. Firstly the Tertiaries were formed as the Guild of St. Joseph and St. Dominic, described by Gill as 'being a craft Guild, but not primarily a craft Guild'. The community had its own chapel and even a distillery amongst its priorities and still survived on a reduced basis as The Guild Workshops when this contributor was apprenticed as a compositor close-by some 40 years later.

The Guild Workshop buildings in Folders Lane remained generally intact into the mid 1990s, although weak foundations eventually led to their demolition and a luxury housing development 'Summer Lodge' took over the site that could have become an ideal industrial museum, although there would have been access and parking problems. The Guild, with six remaining members, disbanded finally in 1989. Curiously the latest Ordnance Survey Explorer maps still mark the site (TQ331180) as a place of worship which it was in the 1920s when the private chapel was extant. Eric Gill had become disenchanted with Sussex life and moved to remote Capel-y-ffin (1924-28) in the Black Mountains of Wales and finally Speen, near High Wycombe, to continue his commissions until he died in 1940.

Fig. 5a and b Exterior and interior views of the redundant chapel.

Fig. 6 Buildings 7, 8 and 9 on the plan, viewed from the chapel.

At Speen, he engraved for 'The Canterbury Tales' and went on to noted international works and attracted publicity for his carte blanche erotic acceptances. Throughout this time though he continued to undertake type-face designs, notably for the institutional Monotype Corporation at Salfords, Redhill. Much of the mechanical interpretation of Gill's typographic designs must be credited to the skills of the staff at Monotype's Drawing Office and the co-operation of influential employees like Stanley Morison, their Chief Typographic Designer, Beatrice Warde as Head of Publicity and F.H. Pierpoint their Head of Works. Gill's serifed Perpetua series was launched commercially in 1929 and Morison brought out another type-face designed by Gill for their Monotype programme. The hugely successful Gill Sans design was precipitated by the corporation's decision to launch its new Supercaster model in 1928. This elaborate machine enabled printers to cast in-house their own display type in sizes from 18 point to 72 point, as well as rules, ornaments and spacing material. Development of the Gill Sans series continued at Monotype into the 1990s.

Although the legacy of Eric Gill may remain unacknowledged by the public in general, they might just observe how often his innovative Gill Sans type-face comes back into vogue decorating publications and facias. A prime example of this mode is the current type-face used for the BBC television screen titles and media.

Eric Gill died in November 1940 aged 58 at Harefield in Middlesex following an operation for lung cancer and is buried in the churchyard at Speen. There are numerous books on Eric Gill and his contemporaries; perhaps the most comprehensive is *Eric Gill, A Lover's Quest for Art and God* by Fiona MacCarthy, first published in 1989.

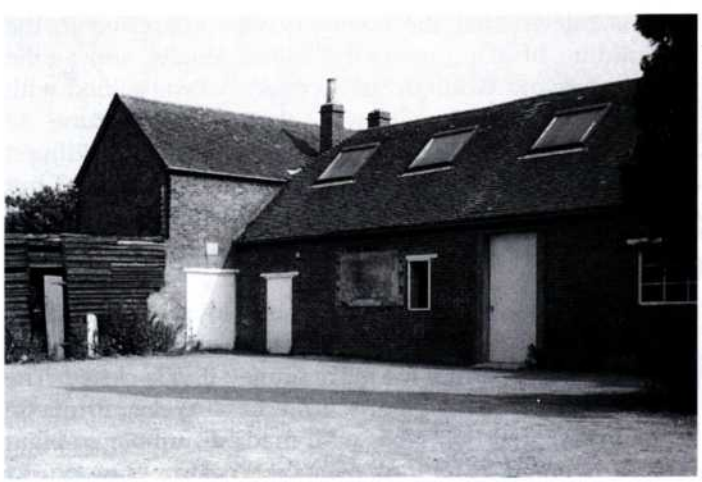


Fig. 7a and b Workshop buildings and sheds seen from the courtyard. The modern roof window panels in building are of course a much later addition to the St. Dominic's Press unit of 1920-1934. (Nos. 4 - 10 on plan)

REFERENCES

1. Fiona MacCarthy, *Eric Gill, A Lover's Quest for Art and God.* (1989).
2. *The Monotype Recorder*. Autumn 1990.
3. *Eric Gill and the Guild of St Joseph and St Dominic*. Hove Museum and Art Gallery publication and exhibition 1991.
4. *The Engraved Work of Eric Gill*. Victoria and Albert Museum. HMSO 1963 & 1969.
5. *The David Hill Company*. Haywards Heath. 1990 correspondence.
6. Personal photographs of former Folders Lane site.

Note: Figs. 1 & 2 Hove Museum & Art Gallery, Royal Pavilion, Libraries and Museums.

MIDHURST WHITES BRICKWORKS: GEORGE CLOKE'S ACCOUNT

INTRODUCTION

Only a store shed and some points from a light railway now survive from the Midhurst Whites Brickworks which were sited close to the former London & South Western Railway station at Midhurst (SU 877213). The Works were established in 1913 by S. Pearson & Son, Civil Engineers, a firm controlled by the Cowdray family. The Works at Midhurst Common were built on land owned by Lord Cowdray. Sand for brick production was extracted from a site close to the Works. After World War I the business was sold and the new owner also operated a lime works at Cocking, three miles south of Midhurst. In 1926 Benjamin Cloke became the owner and by 1930 was trading as the Midhurst Brick & Lime Co. Ltd. He used the railway to despatch bricks to London. In common with other brickworks, the business suffered from the depression of the early 1930s and unsold stocks of bricks mounted.

From this postwar period production concentrated on sand-lime bricks. Damp sand was mixed with slaked lime (6% of the content). Bricks were produced in moulds and heated under pressure in a steam chamber or autoclave. These were about 8 ft. in diameter and 40 ft. long with railway track built in.[1] The finely ground lime came from Cocking. In 1935 the Midhurst White facing brick was introduced and this coupled with a general revival of the brick trade brought a more prosperous future. Success with this new product encouraged the renaming of the Company which from 1938 became Midhurst Whites Ltd. Economies in production enabled their bricks to sell at prices which took trade from other local brickworks and many Midhurst Whites were sold in the Bognor Regis area where they undercut local producers by as much as 50%. Particularly on the coast however Midhurst Whites suffered from excessive weathering and houses built from them had to be rendered to correct this. Despite this fault Midhurst Whites had a much greater compressive strength than ordinary 'red' bricks and could bear the load of a steel joist without fracture. Production continued through World War II when many brickworks were closed down. Road transport was increasingly used after the war and the lorries carrying the name of the firm were based at Liphook, suggesting the use of a contractor. One was a ponderous diesel engined Foden, with two axles at the front and one at the rear.[2] The Works finally closed in 1985.[3]

On 21 May 1988 the Sussex Industrial Archaeology Society met at Midhurst to tour local industrial sites which included the Midhurst Whites works, then derelict.[4] The photographs that illustrate this article were taken by members on this visit. More recently Ron Martin, Secretary of SIAS was contacted by Mr. L.W.H. Knight and shown by him an account of the history of the Works prepared by George Cloke, a nephew of Benjamin Cloke, involved in the management of the Works from 1927 and later Managing Director. This does not appear to have been previously published and is reproduced below.

Brian Austen

NOTES

1. Information supplied by Vic Mitchell who toured the works in the company of George Cloke in 1969.
2. Ibid.
3. Much of this information is based on Molly Beswick, *Brickmaking in Sussex* (1993) pp.96, 98, 210.
4. Sussex Industrial Archaeology Society *Newsletter* No. 59 July 1988 p.3. The visit was organised by Vic Mitchell.

HISTORICAL

The Works at Midhurst was originally constructed and owned by Weetman Pearson, the 1st Lord Cowdray, who gained considerable reputation as the head of S. Pearson & Son, who as public works engineers were responsible for such works as the Blackwall Tunnel, the East River Tunnel in New York, Dover Docks and Vera Cruz Docks, and many other well known schemes abroad.

It is related that the company was interested in the building of a tunnel to the Isle of Wight, and as the Simplon and Gotthard in Switzerland were lined with sand lime bricks it was thought opportune to manufacture some on the Cowdray Estate at Midhurst for that purpose. The works commenced in 1913 but due to the First World War the tunnel project was abandoned.

After the War considerable unemployment existed in Midhurst so the brickworks was re-started but as the men went on strike for more money it was closed. The Works was subsequently sold to a Welsh briquette maker named Dunning, who made a number of plant improvements and took over the Cocking Lime Works for the production of lime for Midhurst. Considerable plant alterations were effected. Extraction of chalk was moved into the South Downs some 500 yards east of the Works and aggregate was conveyed to the same by aerial ropeway. The advantage of this operation was to obtain chalk with a higher carbonate content than could be procured lower down. A Krupps ball mill was installed to procure a fine ground lime which was supplied in sacks to Midhurst.

The two Works were purchased by Benjamin Cloke in 1926 for £6,000. It was always his intention to supply

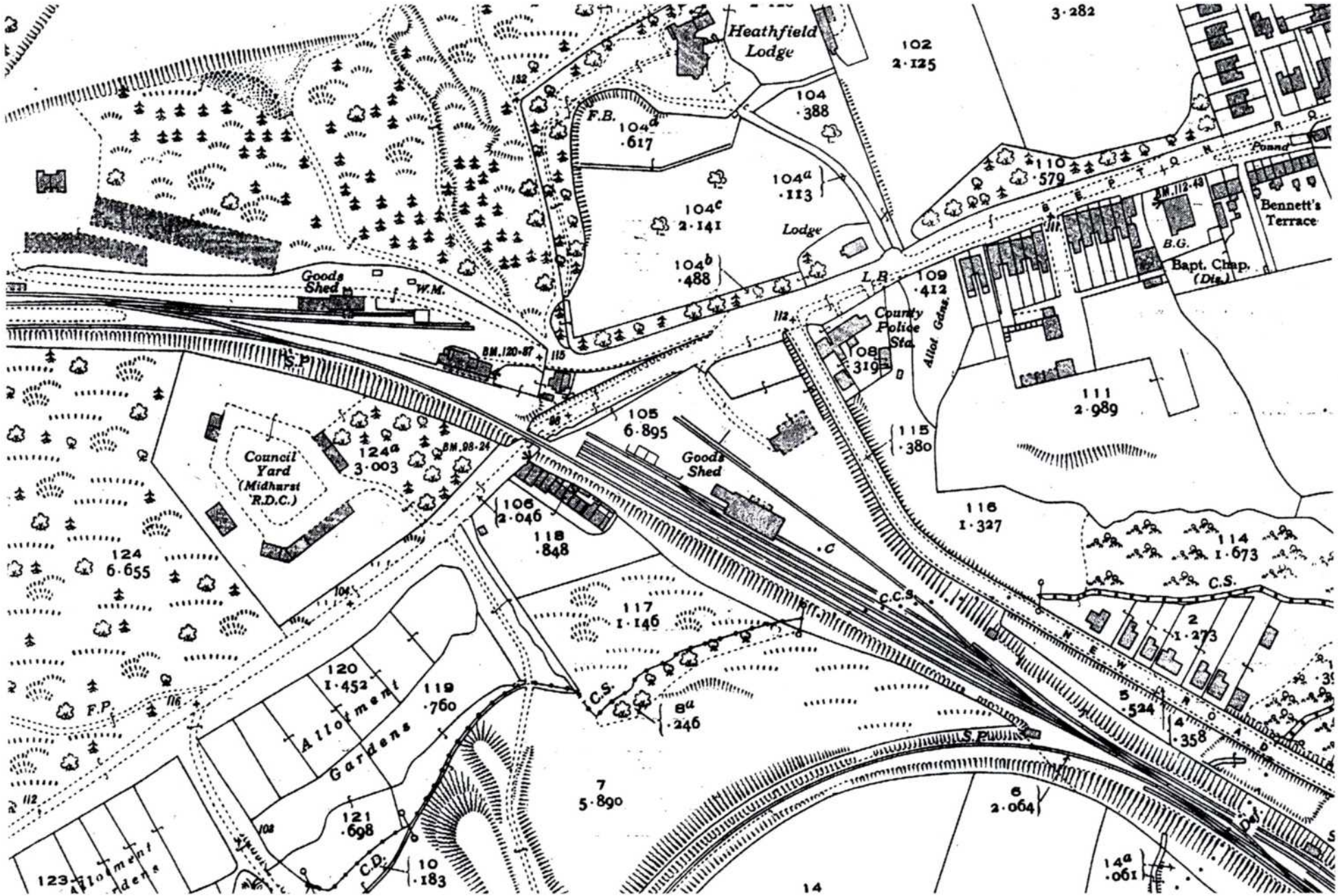


Fig. 1 Location of the Works in relation to Midhurst town. The brick drying sheds are shown to the north of the railway line to Petersfield opposite the Council Yard; other buildings are shown on the adjoining sheet. 25 inch OS map (revisions to 1938)

Fig. 2 General view of the Works showing the 85 ft. chimney stack erected c.1926. Photo: Chris Bryan

bricks to the London County Council for their extensive developments in London and as result he spent some £30,000 on new plant. This included an excavator and locomotive, two Sutcliffe Duplex brick presses, two new 160 psi autoclaves, a No. 8 Lancashire boiler and a home-made locomotive for moving bogies and also a quantity of bogies. The 85 ft. brick chimney was constructed. Six new draw lime kilns were built at Cocking which facilitated a continuous production of lime compared with the three earlier flare kilns. The product from the draw kilns did not prove as reliable in quality as that of the old flare kilns which were more labour intensive and used more fuel. They were later converted to the flare kiln principle. A Morris electric telpher crane was installed to facilitate filling the kilns from the ropeway. Unfortunately the LCC contracts did not mature and Benjamin Cloke was considerably discouraged and contemplated selling out.

He had the idea of selling sand lime bricks as a cheap substitute for glazed brick "for well and areas" (spaces in the centre of large buildings into which only windows open), which was acceptable to London architects. In view of his heavy capital expenditure he decided to invest £3000 on an extensive advertising campaign to offer sand lime bricks at £5 per thousand against £30 for glazed bricks delivered to London sites. The product was named Midhurst Whites as the best engineering bricks were called Stafford Blues.

Within one year the company's fortunes were reversed and Midhurst Whites were being delivered all over the country and a profit of over £1,000 per week was being made. The accumulated stock of four million bricks which had accrued for LCC contracts was disposed of to a local builder for £1 per 1000 and used in the construction of Park Crescent in Midhurst and storage sheds of Dutch barn design were erected on the land now available. The Southern Railway provided some 150 special truck containers to transport bricks without additional handling at the station to give a works-to-site delivery service. Many well-known buildings used Midhurst Whites, including the ARIBA headquarters, the BBC, the Masonic Chapel and it can be said Midhurst put the sand lime industry on the map.

My own entrance to the brick industry was rather providential as I had been sent to Garratt & Sons of Leiston in Suffolk to learn all about steam engines, particularly for wagons and rollers for road making, as it was intended that I should enter my Uncle George Cloke's business and start a public works division. Whilst I was being so initiated my Uncle developed a heart condition and sold his business to Hudson's of Brighton. At the same time another Uncle, Ben, purchased the brickworks at Midhurst and became disenchanted with his works manager. It was with some surprise that I received a telegram summoning me to visit my Uncle Ben at Bromley. He proposed to me that I should take up a position as Assistant Works Manager at Midhurst. As I had not completed my full stint at Leiston it was decided that I should consult my Managing Director who offered the advice that although I was now becoming an asset to Garratts he considered my Uncle's offer was a good opportunity for a young man and his company would regard me as an ambassador for Garratt. It was therefore with considerable trepidation that I travelled to Midhurst on my Triumph SD chain-cum-belt motor cycle on lst November 1927 just two days after my 2lst birthday. My Uncle Ben had had previous experience of Midhurst as a youth when he was sent as a butcher's boy age 16 years to Blackistons in West Street. The Blackistons kindly assisted me to obtain lodgings with Miss Guy in Bepton Road but I stayed the first few nights at the Spread Eagle Hotel which was then lit only by oil lamps and candles. When I had remonstrated with my Uncle that I knew nothing about sand lime brick making his reply was that there was "nothing to it and you only take sand and lime and mix them together", words which I came to remember many years after.

The plant at the brickworks consisted of a No. 6 Ruston steam navvy and a Montani German single cylinder petrol locomotive to extract sand from Midhurst Common which was transported to three

Fig. 3 Shed interior showing brick presses at the far end.
Photo: Don Cox

jogging screens. The resultant aggregate was then conveyed to two Polysius (German) mixing drums after the addition of ground quick lime obtained from the company's Cocking lime works some three miles distant. The lime was supplied in 1 cwt hessian sacks to facilitate gauging quantity to each drum.

After half an hour rotating in the slaking drums the mixture was discharged into a hopper from whence same was passed through an edge runner mill to the two Sutcliffe Duplex and one Bernhardi (German) presses. The former were double mould machines which exerted 100 ton pressure on each pair of moulds producing 2800 bricks per hour, the Bernhardi was of eight single moulds and produced 1200 bricks per hour. Bricks were stacked by four operatives on flat bogies which carried 868 each while the German press required the services of two operatives usually one man and a boy. Bogies were pushed by hand to one of the six autoclaves and when thirteen were inserted the door was closed and secured by eye bolts. Steam was then applied from the No. 8 Lancashire boiler which was stoked by hand and provided saturated steam up to 160 lbs. per sq. inch. After 8 to 12 hours at high pressure, the steam was exhausted and doors opened to permit the bogies to be withdrawn by a capstan and passed by the 2 ft. 6 in. gauge light railway system to a loading point for lorries or railway wagons. The locomotive used for such work was an education in improvisation as it consisted of a car chassis and engine provided by the company's consulting engineer, Jimmie Whatnall, mounted on rail wheels and surmounted by a canopy resembling those used by Mexican launches. The motive power for line shafting to machinery was by a Robey compound condensing steam engine with rope drive of impressive proportions. A spare No. 6 Lancashire boiler was also available. The 85 ft. chimney shaft built of the company's bricks completed the plant.

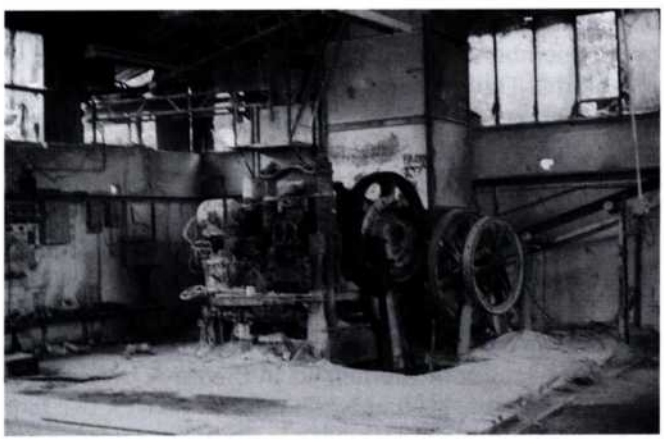


Fig. 4 Sutcliffe Duplex brick press introduced c.1926 (or Bernhardi press of German manufacture).
Photo: Don Cox

Fig. 5 Bogies used for brick transportation on 2 ft. 6 in. gauge Works railway.
Photo: Brian Austen

The workforce consisted of one topper (heather remover), excavator driver, locomotive driver, screen attendant, lime man, mixing drum operator, edge mill attendant, ten press hands, two bogie removers, three oven men, four loaders, two boiler men and mates, a blacksmith, a carpenter, a bricklayer, two maintenance fitters and a greaser. The foreman, Bill Knight, was a man of considerable resource and greatly respected by all for his ability to deal with most problems. A Cockney by birth with a strong Salvation Army back-

ground inherited from his father, he and his family lived on the job in a building used originally as the *Daily Telegraph* stand at the Wembley Exhibition.

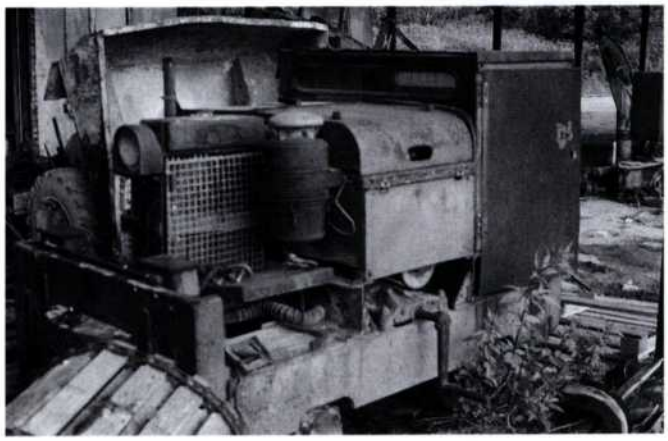


Fig. 6 Petrol locomotive used on 2 ft. 6 in. gauge works railway. Photo: Brian Austen

THE THIRTIES

The period from 1930 was of mixed fortunes for Midhurst with considerable depression at the early stage with general trade recession and the non procurement of LCC contracts resulting in the Works being closed twice due to overstocking.

With the introduction of Midhurst White facing bricks and their subsequent success the company fortunes were enhanced and a busy period resulted about 1935. Because of the company's success other firms entered the facing brick market and price cutting resulted. Whilst the company was prosperous Benjamin Cloke decided or was persuaded to go public and a flotation was made in 1938 which proved not to be successful and Benjamin Cloke decided to retain a considerable block of shares to prevent the flotation being a failure. Unfortunately he contracted a thrombosis about this time and died as a result. The new Board of Directors was not strong financially but Benjamin Cloke had asked me to remain with the company for a period to help them in their early years.

With the advent of the Second World War the company's fortunes were again in jeopardy but as we had been working on several War Office contracts, such as Thorney Island RAF Station, and had developed CALCO at Cocking, which was a mixture of lime and chalk, which I had taken out a patent for, as an agricultural fertiliser and approved under the Ministry of Agriculture scheme. This product was offered as a package, i.e. testing land for acidity, recommended application and complete delivery and spreading service leaving the farmer to pay the net account, less the government subsidy, which varied from 50-70% of the gross cost.

The success of this product necessitated the installation of additional plant to meet demand in the form of a Ruston Bucyrus forward shovel for chalk extraction. The use of conveyers and mechanical traction of ropeway buckets proved insufficient and so a road was constructed to enable lorries to be loaded direct by the excavator and conveyed direct to grinding plant at the Cocking Works. The rope way was consequently made redundant.

THE WAR

The commencement of hostilities resulted in a number of our staff being called up as reservists and others later conscripted. The result was that our staff consisted of a few men over military age, about eight women and a skeleton of skilled men who were granted exemption. When we could not meet such demands made on us for military camps or air-raid shelters, German POWs could be procured from the adjacent POW Camp in Bepton Road. They were quite hard working and were from the Africa Corps. One of their number was obviously an aristocrat with von before his name; their leader was an SS man and greatly feared by them. Our own foreman, an ex Army type, was a match for this man and when threatened with being sent back to camp he would soon subside. We were sorry for these men and helped them with food to augment their meagre allowance of potatoes and soup. It surprised us that when the war ended and they were to be repatriated, of 30 prisoners 15 asked to remain with us as they were entitled to, due to our shortage of labour. In fact some of those who returned to Germany wrote and asked to return as Germany was so devastated.

Despite the Battle of Britain raging overhead and cartridge cases raining down, we did not stop once for enemy action. One doodle bug dropped about a mile from us without damage to the Works. We had our own platoon of Home Guard and used to come to work in the early 40s with our arms and equipment for immediate action. Considerable disgust was registered by the members when after much training and promise of action D-Day came and we were not called upon to do anything of consequence. To enable those works which had been closed for the period of the War to be kept in a workable condition, 3s 6d was paid in levy to the Ministry for each thousand bricks and those working were encouraged to stock for the resumption of building at the cessation of hostilities, in fact our stock was some 8 million when the war ended. The fact that we were very busy supplying lime from Cocking for agriculture helped in the brick production as both tended to go hand-in-hand.

THE KEYMER TILE WORKS

(formerly Keymer Brick and Tile Works)
Burgess Hill, West Sussex. TQ 323193

Frederic M. Avery

Big hole, Big Bertha, green clay, blue lake, primrose heat, beehives, frogs and dinosaurs are all terms that may have been heard by visitors to the Keymer Works. What do these terms mean you may ask? All will be revealed in an attempt to condense the history of the Works, covering more than two and a half centuries.

From its early beginnings on Ditchling Common, to its establishment on the eastern side of Burgess Hill in the Parish of Keymer, (from whence the Works takes its name), various descriptions of the Works have appeared in newspapers and books over the years. As we enter the new millennium, plans for the Works have taken a new direction and the opportunity to present another updated account of the Works seems apt, since it becomes more urgent as time goes on, to record all that has recently happened.

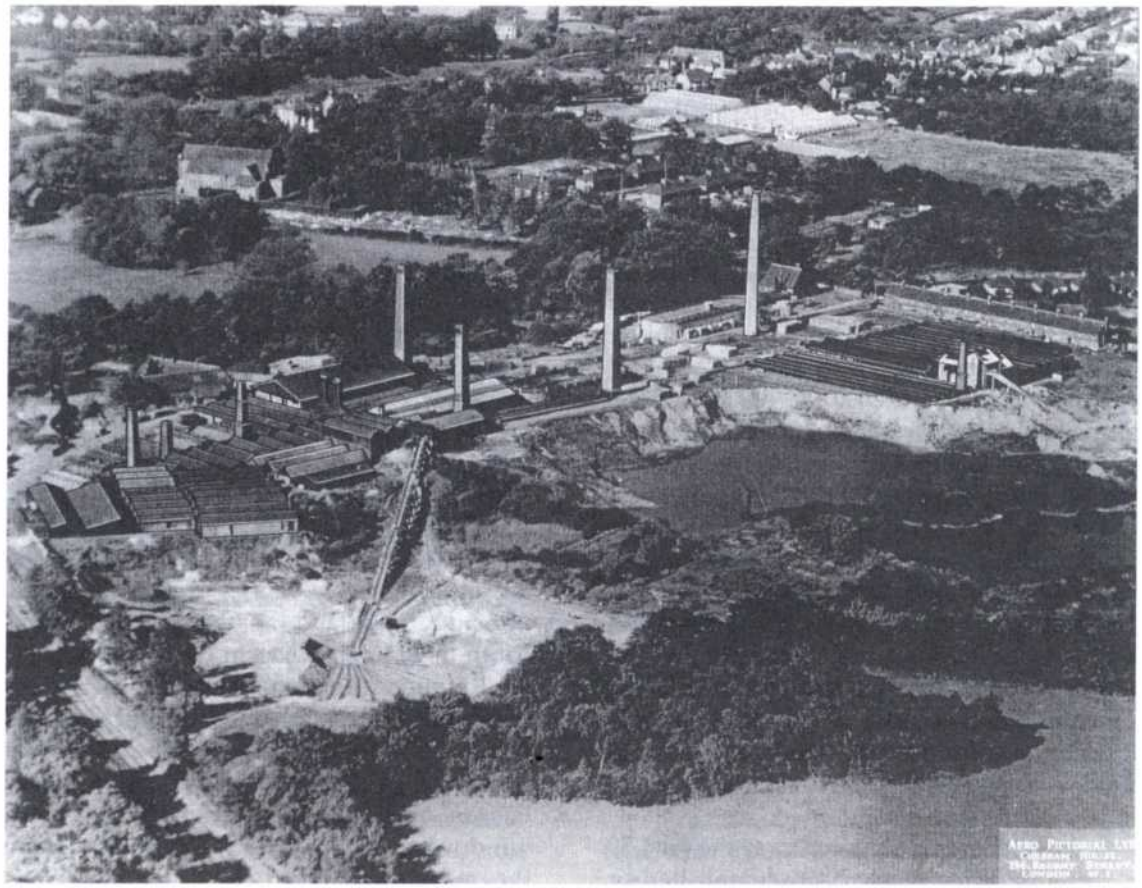
Keymer Works have changed so much over the past 50 years, and several buildings have been demolished or altered. All four circular downdraught beehive kilns were demolished in the last few years and none of the three "Hoffmann" kilns remain intact. One was demolished several years ago when it became structurally unsound, and the other two have been radically altered into workshops for tilemaking and to house the modern tile ovens. The earliest of the main works (No. 1) has been derelict for forty years and a survey is published in this issue of *Sussex Industrial History*. The works ceased operating in the early 1960s, when the shale content of the clay increased to such a high level that it caused the bricks to "blow" during firing. Change is necessary if the works are to survive in a competitive world. To put this change into perspective, it is necessary to precis the history of the Works, beginning 260 years ago.

In 1740, the Manor Court Book records that a John Billinghurst acquired a piece of land and a cottage (about 2 miles north of Ditchling village), from Thomas Newnham. The clay was said to have been of fine quality and would burn to a very bright red. In 1802 the site passed to Francis Foster and John Caffin and in 1820 to William Gravett who was the first owner to be described as a potter rather than a brickmaker. He was also Pastor of Ote Hall Chapel, Wivelsfield from 1817 until his death in 1872. He married a Mary Avery, and one of his sons John, took over another pottery works at Burgess Hill in 1853. When William retired, George Chin(n)ery took over the works about 1857 and was soon employing 19 people. By 1871, the number of people employed dropped to 10, but in 1873 fortunes changed, and a wealthy merchant banker, Sampson Copestake (senior partner of the firm Copestake, Hughes, Crampton & Co, in Cheapside, London) bought the Works. He leased the works to Henry Johnson, already manager after George Chin(n)ery retired in 1871, and was ready to expand the Works at Ditchling.

He was also looking elsewhere to expand his land holdings for the purpose of brickmaking and in 1873, Cants and Inholmes Farms came on the market and were purchased by Copestake. Henry Johnson leased the land and also became manager of "Keymer Junction Works" covering about 5 acres at Burgess Hill, as well as being manager of "Ditchling Terra Cotta Works" covering 25 acres. By 1875, the Keymer Works were well established on the northern part of the site and access was by way of Cants Lane, then an unmade road, and as the works expanded further south, Nye Road adjacent to the railway level crossing at Keymer Junction, became the main entrance. Sampson Copestake lived in Burgess Hill and built himself a superb mansion of red terracotta blocks produced at Ditchling, with magnificent decorative lizards and entwined grape vines on lintels over window and door heads. Eventually he moved from the mansion at the top of the hill (later known as "Wynnstay") and built himself another large property known as "Inholmes Mansion". He built a new access road (now Inholmes Park Road) leading directly to the mansion from Junction Road (which was also formerly known as Cants Lane). Inholmes Park Road crossed over the railway by means of a bridge, presumably financed by Copestake and led through cultivated gardens to the mansion.

By now, the Works had expanded, employing some 300 people and both brick and terracotta products were in great demand, so much so that a railway siding was constructed from the main London to Eastbourne line into the Works (some rails still remain despite the closure of the siding in the late 1950s). This enabled coal to be delivered into the Works for firing the kilns, and finished products taken away to their destinations. Copestake was also a pious man who financed the building of a Church School in Cants Lane about 1881 (now demolished) and later provided more funds for a large "tin chapel" to be built adjacent to the Junction Road frontage in 1899 (which burnt down in 1959), and in 1908 a brick-built church which was dedicated to St. Andrew, forming a separate parish on the eastern side of Burgess Hill.

Henry Johnson, previously living at Ditchling, also moved to Burgess Hill into a large house in Keymer Road (which in 1906 became the P.N.E.U. school and latterly the Burgess Hill School). This contained several bedrooms, billiards room, library and coach house with large gardens and lawns.



Aerial view of Keymer Brick & Tile Works in the 1940s or early 1950s.
(The original photograph is endorsed 1939 on the reverse but appears to include later buildings.)

In April 1883, however, because of a landlord and tenant dispute over rent and royalties, the entire Works were sold by auction, to be followed by the sale of the Ditchling Works. Whilst the Works at Burgess Hill were unoccupied soon after the auction, in May 1884 a disastrous fire engulfed the works, said to have been caused by three boys who set alight some oil in one of the sheds. But, like the "Phoenix", new works arose from the ashes and architects sketches of the works both at Ditchling and Keymer, survive. The Keymer Works then comprised 13 large kilns each with separate chimney shafts including 3 double domed kilns capable of holding 200,000 bricks each, one gigantic "Hoffmann" kiln with 23 chambers ranged in a row to contain 450,000 bricks, pug mills, several drying sheds some 30 yards wide by 100 yards long, and a two storey moulding shed for bricks and terracotta some 30 yards wide by 80 yards long also housing machinery. The works then occupied about five acres.

Following the major reconstruction of the works, a row of terraced properties on the north side of the site (later known as the "Bird cages") provided brick and terracotta moulding rooms with basic living accommodation for the workers over. Also a "triangular-on-plan" housing accommodation for workers and their families was built near the entrance from Nye Road, which still survive, although in need of further restoration. These have several decorative terracotta string courses, ridge crestings, and chimney pots, also three magnificent eagles (grotesques) surmounting the tiled roof. It is expected that these buildings known as "Triangle Cottages" will be "listed" in the near future in order that they will be preserved for posterity.

Other surviving relics include a catalogue of products printed about 1906, some old photographs and an auction catalogue c.1917 containing photographs and details of 274 acres of land in 16 lots. This sale occurred after Sampson Copestake's death in 1917. The catalogue c.1906 of "The Keymer Brick and Tile Work Co. Ltd." (formerly Johnson and Co.) contains several detailed illustrations with a comprehensive price list of ornamental moulded bricks, tiles, ridge crestings, finials, chimney pots and an extensive range of moulded terracotta vases, string course blocks, pier cappings, wall copings, decorative window and door surrounds, arches, keystones and many more products too numerous to mention. Such a comprehensive range of products were made at Ditchling and Burgess Hill works, and were of such good quality that in 1876 the company received a prize medal at the Philadelphia Exhibition for architectural terracotta and good design. Much of the decorative terracotta was made from sectional plaster of paris moulds, but the basic manufacturing process from pit to product has remained much the same over the years although the

materials for firing have ranged from wood, coal, butane gas and latterly town gas.

When the clay is dug, it ranges in colour from yellow, brown, red and blue and at Keymer Works the blue clay area left a "blue lake" when rainwater accumulated. The first pit to be dug at the Keymer Works is now disused and filled with water. It was known as the "Big Hole" and became Burgess Hill's first swimming pool but it is now used by a local angling society. The different coloured clays can be mixed if required and left to weather in layered heaps called "curfs", for about a year prior to use. The weathered clay is then taken from the pit, loaded on to conveyor belts or before 1980 by trucks or skips which were winched up an inclined track to the mill house at first floor level.

The "No. 1 works" at Keymer housed a large diesel engine nicknamed "Big Bertha" which drove all the machinery in the millhouse and provided steam for the drying tunnels at ground level.The processed clay was moulded into bricks by hand, or extruded from a machine to make wire-cuts with no "frog" (the indentation at the top of a brick on handmade or pressed bricks only).

The "green" clay bricks were then stacked on to trolleys which ran through the drying tunnels on slightly inclined rails, progressing very slowly so that the moisture content was greatly reduced to prevent cracking during the firing process. The types of kiln ranged from "beehive circular downdraught" to "intermittent", also "Hoffmann" continuous type kilns, and recently the latest type of gas fired "ovens". Fifty years ago there were at least 12 chimney shafts at Keymer Works, but most have now been demolished using explosive charges set into the base.

After the drying process had been completed, the bricks were stacked into the kilns to be fired, where temperatures usually exceeded 1000°C. In the old "beehive" kilns the highest required temperature reached was termed "primrose heat", but modern technology now tests and maintains the temperature more accurately and it is constantly monitored for quality control. The colour of the finished bricks depended on the colour of the clay, the oxygen content in the kiln and temperature reached during the firing process. Some bricks were made in moulds where the dry sand added to the faces of the brick contained coloured dye, which in turn gave the face of the brick a different colour to the main body. Terracotta was mainly a "warm" colour ranging from deep red to orange and even light brown or buff.

In July 1978, the Keymer Works stopped making bricks in favour of "hand made" clay tiles, and the process of manufacture although similar to that of bricks, goes through one more process, that of "cambering" by using a slightly curved checker board to give the tile a slight curve in length and width. The clay is extruded in the form of "bats" or tile sized portions, and each one is placed by hand into a metal sanded mould which adds nibs, by means of a hinged frame, to the top edge and two perforations for nailing. The moulded tile is then lifted by the palm of the hand from the mould leaving a complete hand print visible on the reverse of every tile after firing. Several specially shaped tiles are made in separate workshop areas, and the manufacture of ridge crestings and finials of varying design have recently been revived. The modern gas fired ovens hold up to 35,000 tiles and at present there are six ovens in use. Sixty people are employed in the manufacturing process and 12 in administration, sales and the provision of catering facilities.

There is plenty of clay left in the pits and the Works can keep producing tiles for up to 30 years, after which the whole of the workings must be vacated and all associated buildings demolished. It is with this in mind that the present owners (a trust set up by former owner, the late Neil Wates) are negotiating with the Mid-Sussex District Council about the future use of the 50 acre site, 30 acres of which is the pit area up to 100 ft. deep. The area to the north of the site fronting Cants Lane has been disused for about 40 years and during that time it has been allowed to develop into a wildlife habitat. Also, some remarkable discoveries of "dinosaurs" and other life forms over 65 million years old are being studied by a group of scientific experts who regularly meet on site.

In December 1999, the Mid-Sussex D.C. considered proposals for housing development on part of the site and have liaised with Keymer Tile Works management regarding the future of the site and its value as a "wildlife park" and "working museum". Until consideration is given to the possibility of filling in some of the pits it will be difficult to formulate an overall design layout.

If the northern part of the site becomes suitable for housing, then the old "No. 1 works" may have to be demolished and for this reason a comprehensive survey has recently been undertaken. As future areas of the works are considered for re-development, surveying will become an on-going but essential and worthwhile task.

BIBLIOGRAPHY

F.M. Avery, "The Development of Burgess Hill and its Potteries 1828-1978". Unpublished manuscript (1979).
J.M. Baines, *Sussex Pottery*. Edited by Judith Fisher (1980).
M. Beswick, *Brickmaking in Sussex* (1993).

Note: A comprehensive history of all brick, tile and pottery works in Burgess Hill by Heather Warne will soon be available as a separate publication .

KEYMER NO.1 BRICKWORKS, BURGESS HILL

Ron Martin

This site was surveyed by the writer with the assistance of Peter Holtham in January and February, 2000 prior to its imminent demolition before development for housing.

DESCRIPTION

The brickworks comprises three groups of buildings and two isolated chimney stacks. The first group of buildings are the contiguous Power House and Mill House at right angles to each other. The Power House is a single storey structure with a high gabled roof. The walls are one brick thick (225 mm - 9" thick) in Flemish garden wall bond. The roof is covered with corrugated asbestos-cement sheeting on timber purlins supported by steel trusses. It has been extended at one end with walls one brick thick in English bond with external attached piers and the roof has steel purlins with a raised ventilating lantern. There are timber casements in the extension.

The Mill House is partially two stories high but most of the first floor structure had been demolished. The construction is similar to the original part of the Power House. At one side is a high level gantry raised on brick piers. A rectangular chimney stack with plinth and battered shaft is located to the south of the Power House.

The main building on the site is the brick drying tunnels. This building is 45.7 m long and 12 m wide on two stories. The ground floor consists of ten tunnels with a slight fall to assist in the movement of the trolleys. Above the tunnels there is a sand drying floor which formerly had steel framed walls, subsequently infilled with brickwork with steel casement windows. The gabled roof is covered with corrugated asbestos-cement sheeting on steel purlins with steel trusses supported by brick piers. To one side there is a recent annexe with steel portal frames and an extension at one end. The second chimney stack is located behind the Drying Tunnels as a outlet from the heater.

Behind the Mill House and at the end of the Drying Tunnels there is a range of buildings which were used for hand-moulding bricks and as a trolley marshalling area.

OPERATION OF THE SITE PRIOR TO CLOSURE[1]

The raw material was dug in the clay pits and transported to the works by the tramway to the overhead gantry. This operated with a single truck which tipped the clay at the top of its travel into the pug mill at the mezzanine floor level. It was then extruded in a machine at ground floor level. Hand moulded bricks were made in the area to the north-east and the bricks were then loaded on to trolleys and passed into the trolley marshalling area using the transfer tracks. They then entered the Drying Tunnels where they slowly passed through being gently heated using a plant adjacent the south of the tunnels. The outlet chimney is located at the north east side of the tunnels. On emerging from the tunnels, the green bricks were then loaded on to barrows for loading into the kilns. The trolleys were then returned along the track running along the south side of the tunnels. The heater also supplied hot air by way of ducts under the floor to the tunnels and above the tunnels to the sand drying floor.

INTERPRETATION

Historical interpretation of the site has been difficult as the documentary evidence does not relate to the extant remains but the recollections of three employees, Mr. George Freeman, Mr. Alf Munday and Mr. Chris Heasman who all had previously worked on the site have been valuable.

The site, owned by Sampson Copestake, was leased to Henry Johnson in 1873. By 1875 the brickworks was established and managed by Henry Johnson. The works closed in 1883 due to a legal wrangle and they were accidentally burnt down in 1884[2] and subsequently rebuilt but the appearance of the chimney shaft suggests that this was part of the original 1875 works. Confusingly there is nothing shown of this on the OS maps of 1899[3], 1910[4] or 1938[5]. There is also no indication of a boiler house either on the site or on the maps, although these all show the three kilns on the west side of the large area of covered hacks for air drying the bricks. Along the north boundary was erected a terrace of two storied houses, known as "The Birdcage", the ground floor being for hand moulding of bricks with living accommodation over, which are also shown on all three maps.

The Power House and Mill House were probably built at the same date and hearsay evidence[6] suggests that the former housed a diesel powered plant. The construction of this with timber lintels and timber purlins suggests that its date was probably between 1890 and 1914. If this was diesel powered it would not have required the use of the chimney so it is difficult to understand why this was not demolished at the same time as the rest of the fire damaged works unless the works, as rebuilt in the 1890s, was steam powered and the chimney stack was retained for this use. Where the boiler house was sited remains a mystery. The west extension to the Power House was probably added to house "Big Bertha" an ex-submarine diesel engine of WWI vintage[7]. This would have needed more ventilation hence the louvres in the roof.

The gantry at the east side of the Mill House is of a later date than the Mill House itself. The 1899 25" OS map[8] shows a 3 ft. gauge tramway running from the south of the site, but by 1910[9] this has been realigned and there is an additional tramway from No. 1 clay pit to the east. The tramway with the overhead bridge to the gantry was probably not installed until World War II and it was not shown on the 1938 6" OS map.[10]

The standard gauge railway line, as a siding from the main line, also ran along the west of the site from at least 1899.

Up to 1953 some of the bricks from the works were still dried under hacks and these are shown on the OS maps of 1899, 1910 and 1938. The two former ones are to a scale of 25" to the mile and are shown with the edges of all the structures with broken lines, which is the convention for buildings without walls. This does suggest that there were no substantial buildings within the area shown.

The brick drying tunnels were built c.1947 with a duct from the heater over the top of the tunnels[11] letting heat through to the sand drying area over. The external walls of the first storey were probably originally covered with corrugated iron and the brick infilling was of a later date. At the same time the east end truss was removed and a brick wall, partly one-brick and partly half-brick thick was built. The sand was brought in by a barrow hoist at the north side being delivered to the standard gauge railway siding.

As originally erected there was an annexe along the south side of the drying tunnels, supported on iron columns[12]. This is no longer extant although the bases of the columns are still visible.

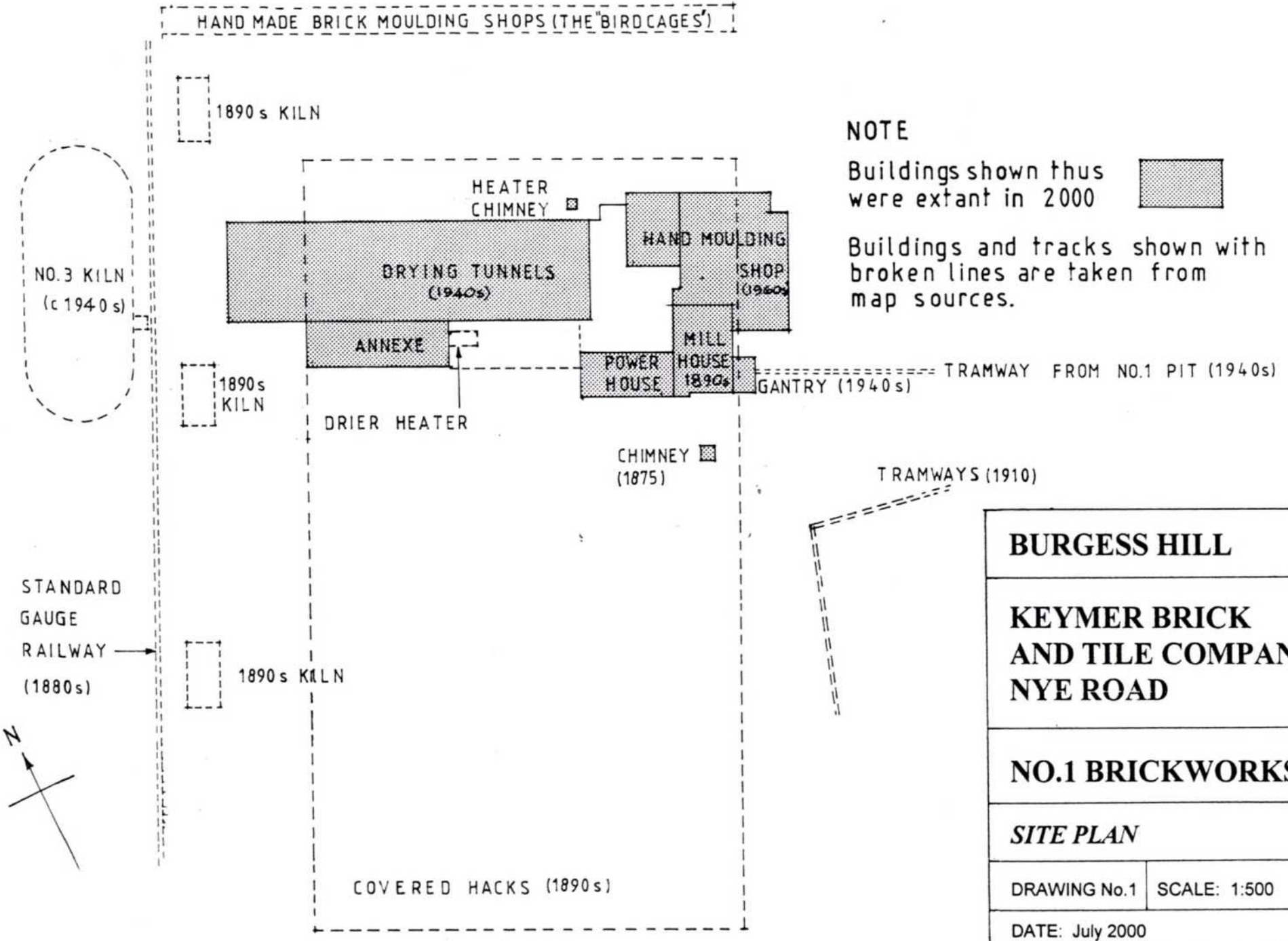
Also shown on the 1947 works map[13] is the large No.3 kiln located on the west boundary of the site. This had a chimney stack which is shown on the c.1955 25" OS map. Both this kiln and the chimney have now been demolished.

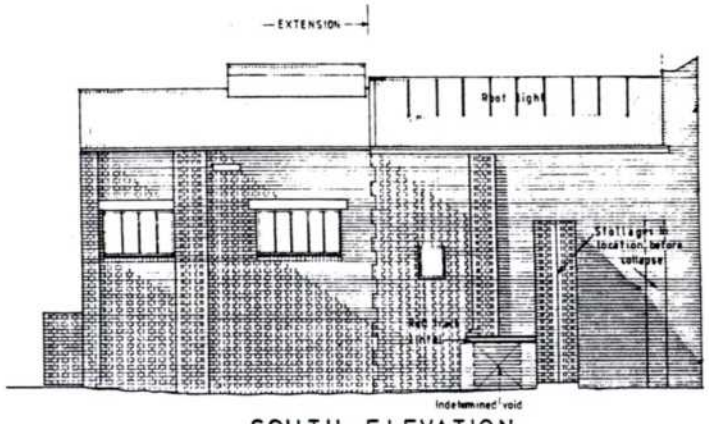
The hand moulding shops were probably erected about the 1960s, the smaller one being first and the larger one later.[14]

REFERENCES

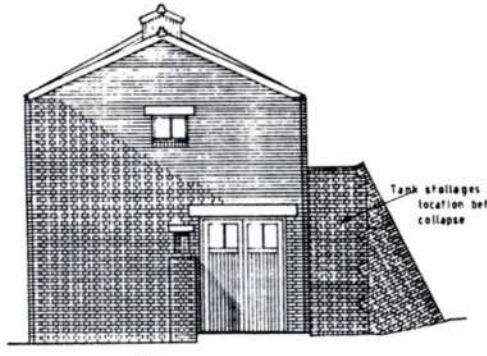
1. Personal comments from George Freeman, Alf. Munday and Chris. Heasman.
2. F.M. Avery, "The Keymer Tile Works", *Sussex Industrial History* 30 (2000) p.30
3. 25" OS Map XXXIX/6, 2nd edn 1899
4. 25" OS Map XXXIX/6, 3rd edn 1910
5. 6" OS Map XXXIX/NW, Provisional edn 1901 with additions 1938
6. Personal comments from George Freeman, Alf. Munday and Chris. Heasman.
7. *Ibid.*
8. 25" OS Map XXXIX/6, 2nd edn 1899
9. 25" OS Map XXXIX/6, 3rd edn 1910
10. 6" OS Map XXXIX/NW, Provisional edn 1901 with additions 1938
11. Personal comments from George Freeman, Alf. Munday and Chris. Heasman.
12. Keymer Brick & Tile Co., plan of works 1947
13. *Ibid.*
14. Personal comments from George Freeman, Alf. Munday and Chris. Heasman.

The author would like to acknowledge the help provided by Neil Tobin, Managing Director of Keymer Tiles and the staff mentioned above.

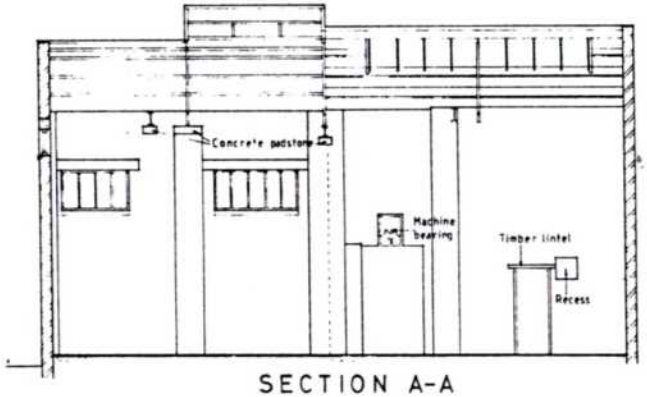

HAND MADE BRICK MOULDING SHOPS (THE "BIRDCAGES")
1890s KILN
NO.3 KILN
(c 1940s)
HEATER
CHIMNEY
DRYING TUNNELS
(1940s)
HAND MOULDING
SHOP
(1960s)
ANNEXE
MILL
HOUSE
1890s
POWER
HOUSE
TRAMWAY FROM NO.1 PIT (1940s)
GANTRY (1940s)
1890s
KILN
DRIER HEATER
CHIMNEY
(1875)
TRAMWAYS (1910)
STANDARD
GAUGE
RAILWAY
(1880s)
1890s KILN
N
COVERED HACKS (1890s)
NOTE
Buildings shown thus
were extant in 2000
Buildings and tracks shown with
broken lines are taken from
map sources.
BURGESS HILL
KEYMER BRICK
AND TILE COMPANY
NYE ROAD
NO.1 BRICKWORKS
SITE PLAN
DRAWING No.1
SCALE: 1:500
DATE: July 2000
Drawn by and © R.G.MARTIN



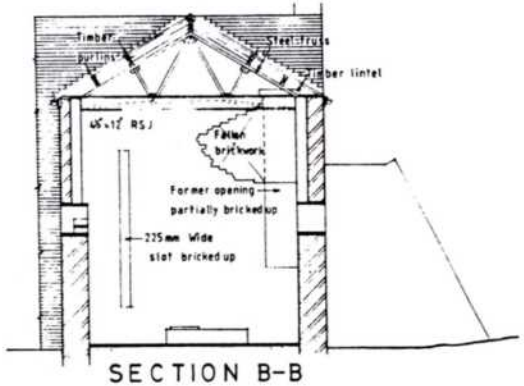
SOUTH ELEVATION



WEST ELEVATION



SECTION A-A



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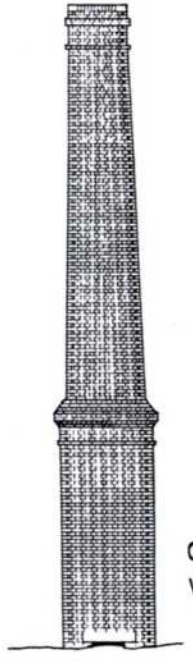
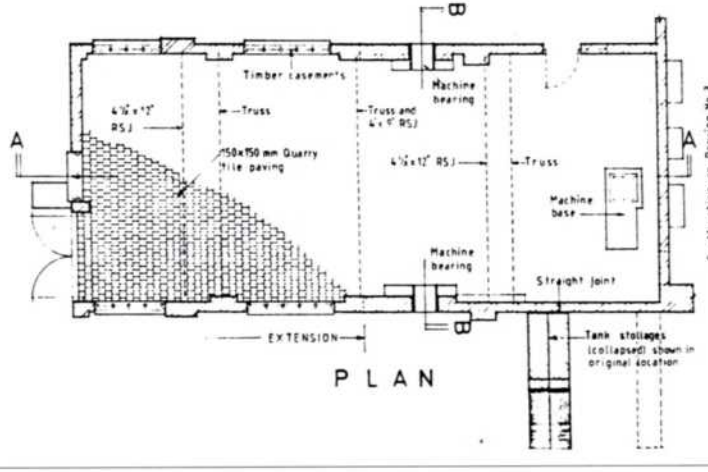


CHIMNEY SHAFT
WEST ELEVATION

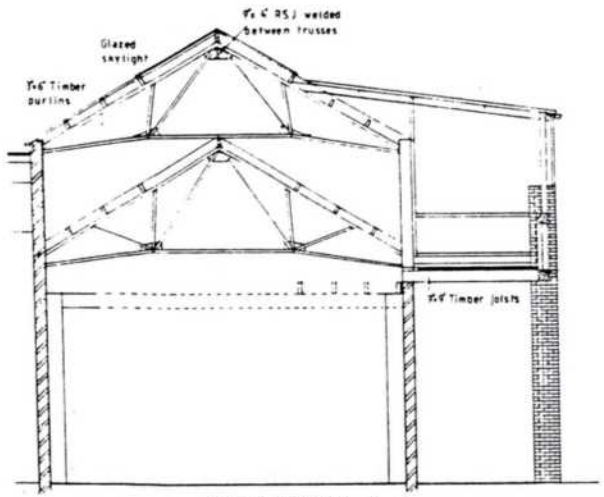


PLAN

PLAN

SCALE
0 1 2 3 4 5 6 Metres
0 1 2 3 4 5 10 15 20 Feet

BURGESS HILL
KEYMER BRICK AND TILE COMPANY NYE ROAD
NO.1 BRICKWORKS
POWER HOUSE & CHIMNEY SHAFT
DRAWING No.2
DATE February 2000
Drawn by and © R.G.MARTIN



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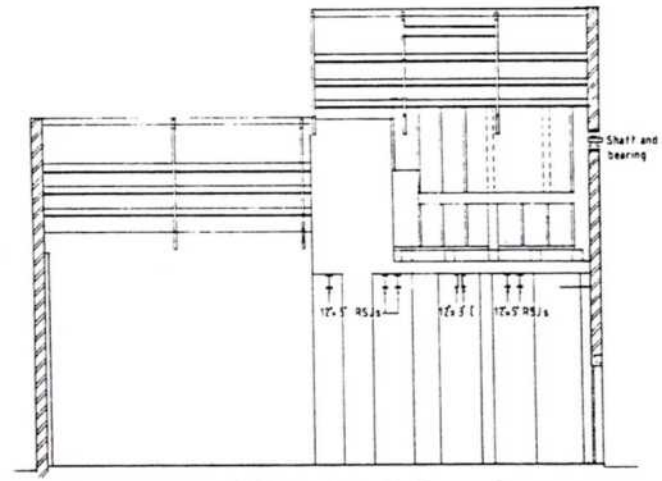

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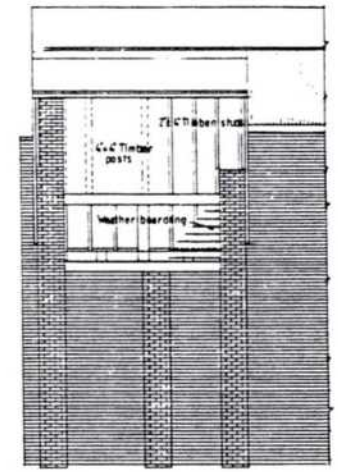
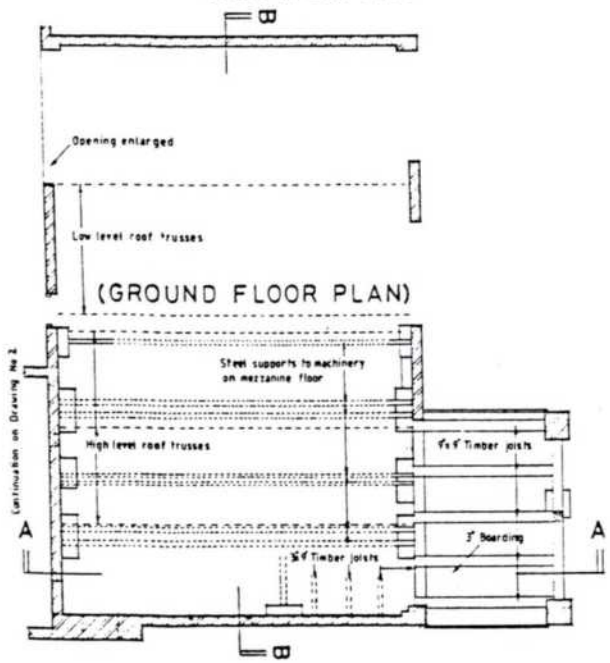
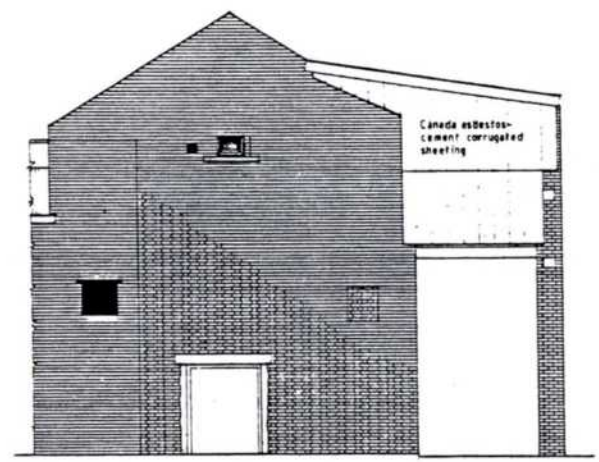


EAST ELEVATION



MEZZANINE FLOOR PLAN



SOUTH ELEVATION

SCALE

0 1 2 3 4 5 6 7 8 Metres

0 1 2 3 4 5 10 15 20 25 Feet

NOTES

Drawing is shown as extant.
Demolished parts are shown in their original locations.
Members shown with broken lines are missing but assumed.

BURGESS HILL

KEYMER BRICK AND TILE COMPANY NYE ROAD

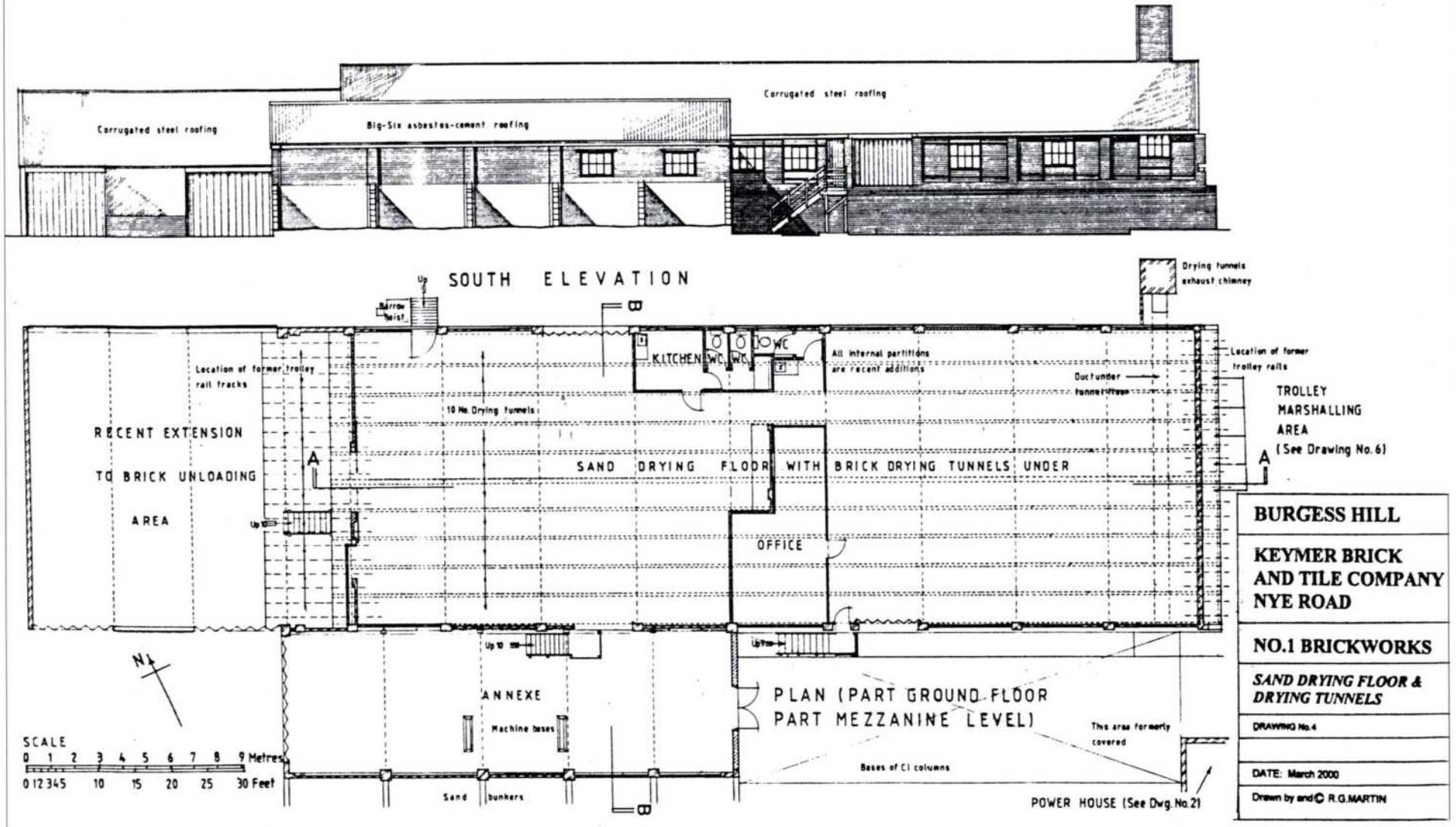
NO.1 BRICKWORKS

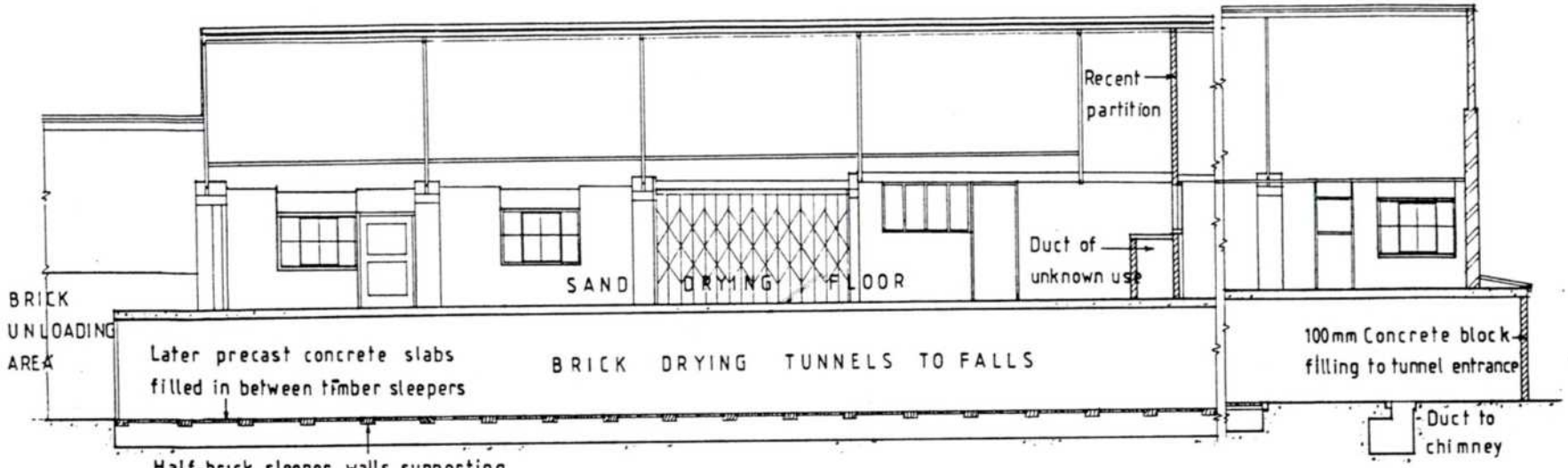
MILL HOUSE

DRAWING No.3

DATE: February 2000

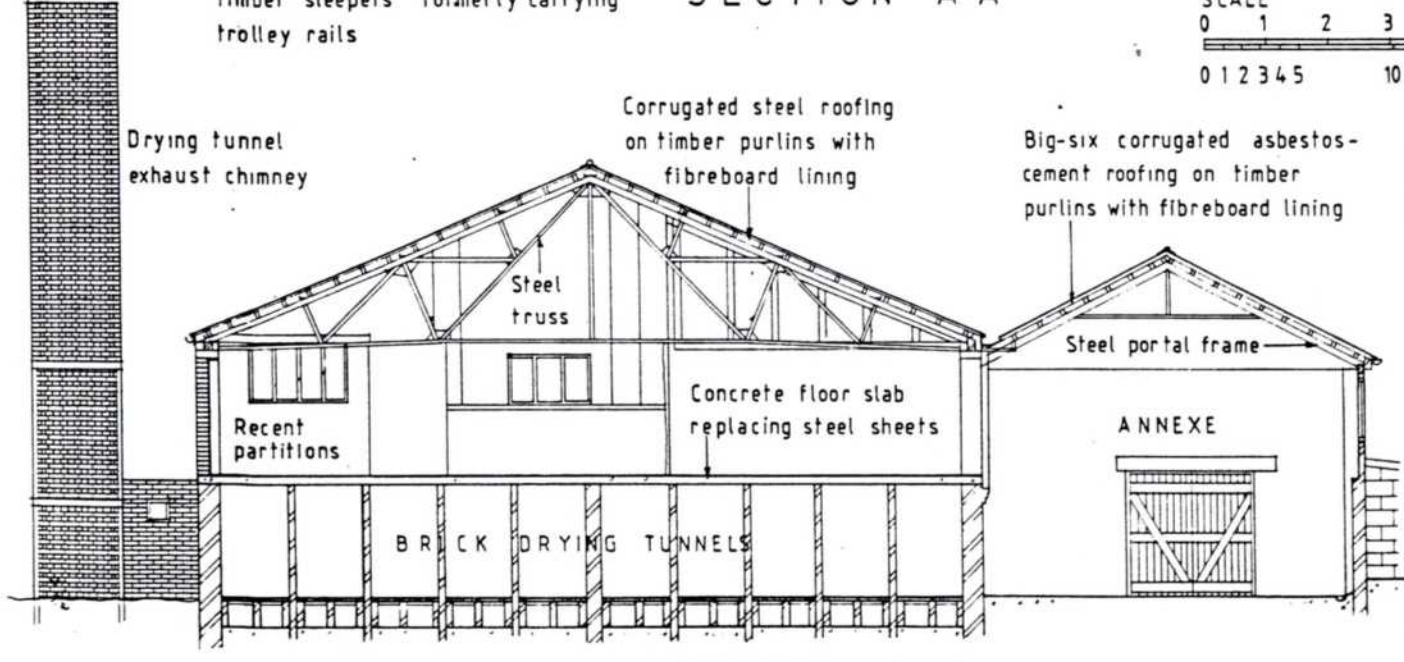
Drawn by and C R.G.MARTIN


Corrugated steel roofing
Big-Six asbestos-cement roofing
Corrugated steel roofing
SOUTH ELEVATION
Drying tunnels exhaust chimney
Barrow hoist
KITCHEN
WC
WC
WC
All internal partitions are recent additions
Location of former trolley rails
Duct under tunnel floor
Location of former trolley rail tracks
10 No. Drying tunnels
TROLLEY MARSHALLING AREA (See Drawing No. 6)
RECENT EXTENSION TO BRICK UNLOADING AREA
SAND DRYING FLOOR WITH BRICK DRYING TUNNELS UNDER
OFFICE
ANNEXE
Machine bases
Sand bunkers
Bases of CI columns
This area formerly covered
PLAN (PART GROUND FLOOR PART MEZZANINE LEVEL)
POWER HOUSE (See Dwg. No. 2)
SCALE
0 1 2 3 4 5 6 7 8 9 Metres
0 12 3 4 5 10 15 20 25 30 Feet
BURGESS HILL
KEYMER BRICK AND TILE COMPANY NYE ROAD
NO.1 BRICKWORKS
SAND DRYING FLOOR & DRYING TUNNELS
DRAWING No. 4
DATE: March 2000
Drawn by and© R.G.MARTIN



SECTION A-A

SCALE
0 1 2 3 4 5 6 7 8 Metres
0 1 2 3 4 5 10 15 20 25 Feet



SECTION B-B

BURGESS HILL

KEYMER BRICK AND TILE COMPANY NYE ROAD

NO.1 BRICKWORKS

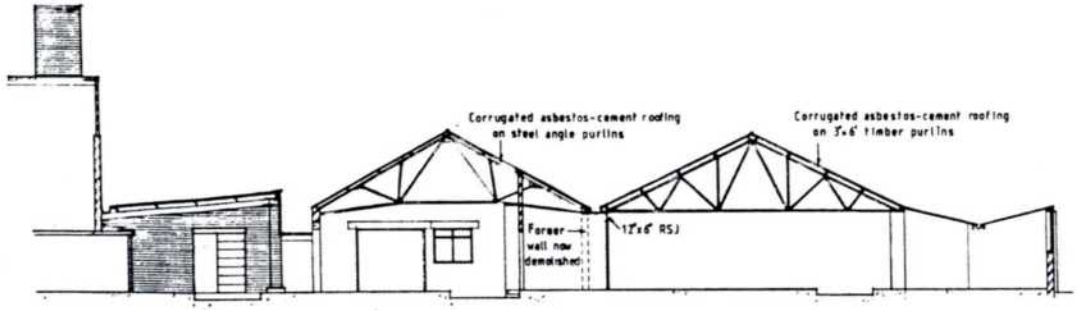
SAND DRYING FLOOR & DRYING TUNNELS

SECTIONS

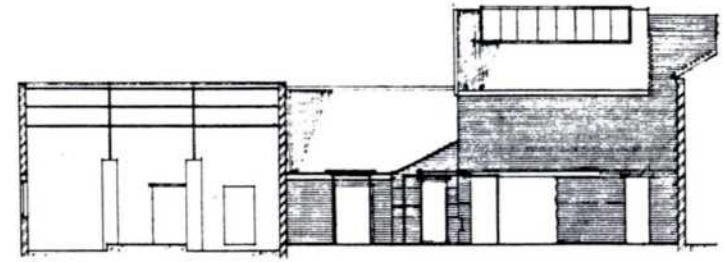
DRAWING No.5

DATE: March 2000

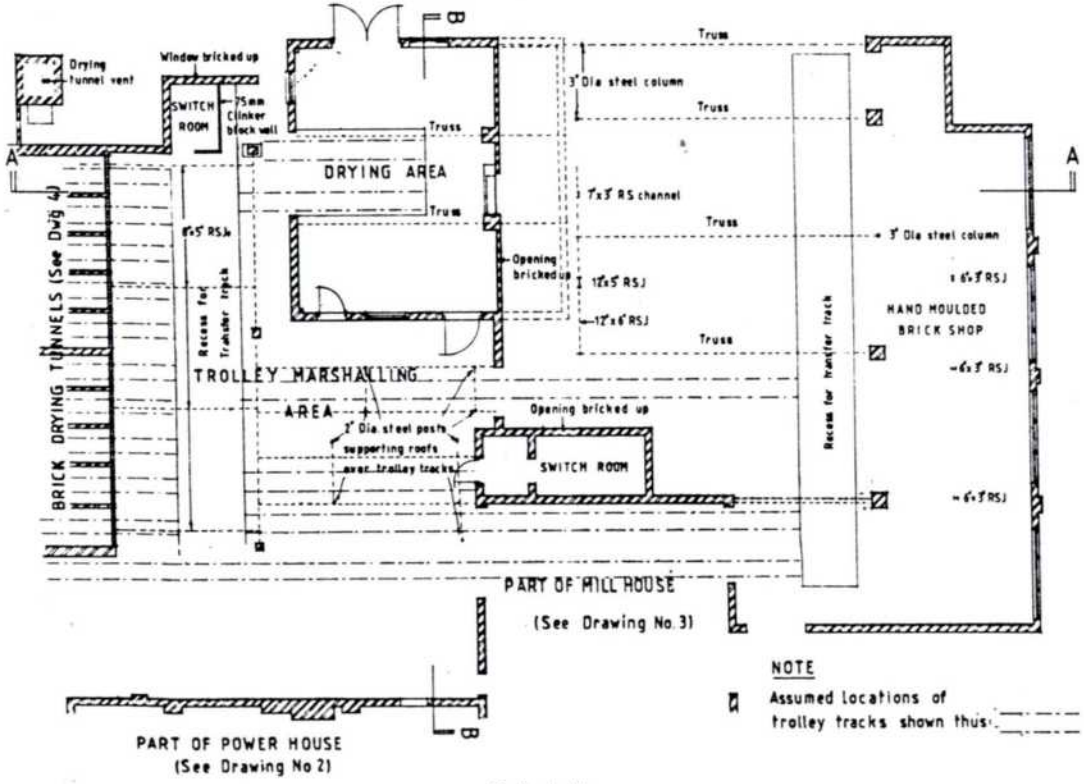
Drawn by and © R.G.MARTIN



SECTION A-A



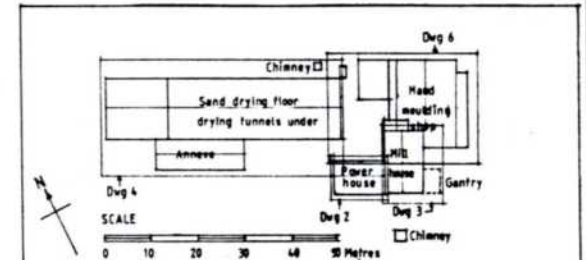
SECTION B-B



PLAN

NOTE

Assumed locations of trolley tracks shown thus:



BLOCK PLAN Scale:1-500 on A1

SCALE

0 1 2 3 4 5 6 7 8 9 Metres

0 1 2 3 4 5 10 15 20 25 30 Feet

BURGESS HILL

KEYMER BRICK AND TILE COMPANY NYE ROAD

NO.1 BRICKWORKS

HAND MOULDED BRICK SHOP AND TROLLEY MARSHALLING AREA

DRAWING No.6

DATE: March 2000

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