

THE BUTTERLEY GANGROAD

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INTRODUCTION

Canals became the favoured mode for moving heavy goods during the eighteenth century and railways captured most of this traffic during the nineteenth century. There was a transition period during which primitive railways were built as feeders to canals and sometimes as a means of linking them together. This combined transport system greatly extended the catchment area of inland waterways and also provided a “test bed” for the development of railway technology.

This transition was very important in Derbyshire. In 1839 the first public steam railway to serve the county was opened between Derby and Nottingham, but before then the Cromford and High Peak Railway provided a north/south transport route right across Derbyshire by linking canals. The Cromford Canal was already linked to Mansfield in Nottinghamshire by means of the Mansfield and Pinxton Railway and it also had around 30 railway branches linking it to coal mines, quarries, ironworks, etc. (Fig.1). Traction on all of these early railways was provided by horses, gravity or by means of stationary steam engines via ropes or cables.

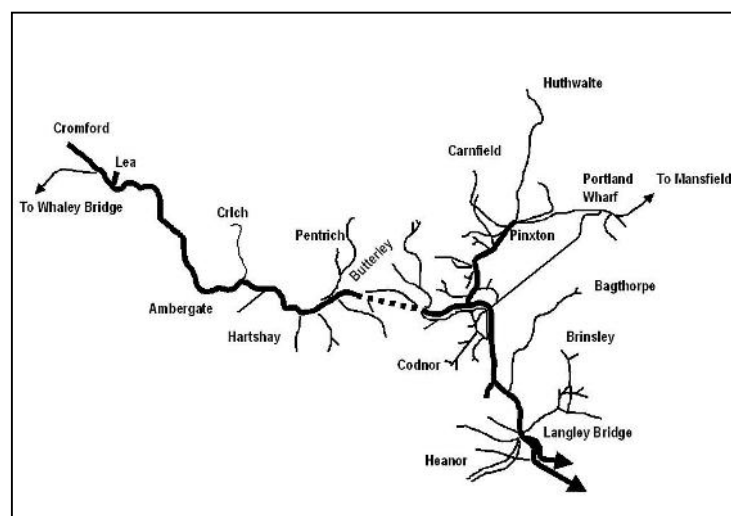


Fig.1. Map of branch railways serving the Cromford Canal pre-1839, based on Sanderson's Map of 25 Miles around Mansfield, the first edition Ordnance Survey 1 inch to 1 mile Map and other sources.

Benjamin Outram played an important part in the development of early railways in this area and throughout the country. He was a co-founder of a company that originally bore his name but which after his death became the Butterley Company based at Ripley. He was one of the first people to realise the potential of railways to create a nation-wide transport system and to advocate common standards to facilitate interoperability¹. Riden has shown how his company became a significant “exporter” of both railway components and of technical consultancy².

The creation of the Cromford Canal in the 1790s can be seen as the catalyst for the development of the Butterley Company and the type of products it sold. It ran through the area where the company eventually developed its own manufacturing and mining activities and Outram recognised this potential early on. He used railways to link the sites used by his company to the canal so that it could be used as a means of transport. One of the earliest was a relatively short line of just over 1 mile (1.6km) built to link a limestone mine at Crich to the canal at Bull Bridge near Ambergate. Limestone was needed as part of the ironmaking process at Butterley works. This short railway was referred to as the “Crich Gang Road”; it was also referred to as the “Crich Railway” and later as the “Butterley Gangroad”³.

The railway was important for two main reasons. It may have been the first substantial one with which Benjamin Outram was personally involved and where he developed his ideas that were subsequently adopted throughout Britain. It was also one of the first railways in the world and certainly in the East Midlands where a “steam locomotive” operated successfully.

This importance was recognised early on by John Farey who devoted nearly two pages of his great survey of Derbyshire to the Crich Railway, whereas other railways connecting to the Cromford Canal got only a brief mention⁴.

The Crich Gang Road was a plateway using “L” shaped cast iron rails, each one 1 yard (0.91m) long. The ends rested on stone blocks, although originally timber sleepers may have been used (Fig.2). The trains, or “gangs”, ran down to the canal by gravity and were hauled back empty by teams of horses. The line was subsequently “modernised” by being rebuilt as a narrow gauge steam mineral railway with conventional track and remained in operation until 1933.



Fig.2. Plate rail from another early Outram line at Codnor Park, kindly donated to the Butterley Gangroad Project by the Portland Path Project. The rail weighs 38lb (17.2kg).

Over the years the line has been mentioned in various publications, often in conjunction with the other Crich mineral railway (1841-1957) that was owned by the Clay Cross Company. In 1959 Rawson Cowlshaw prepared a paper on the subject of the two railways⁵. Mr.Cowlshaw had lived in the area and could remember the railway back to before the turn of the century but, by his own admission, he made

many errors in the first edition of his paper. In 1971 A.R.Cowlshaw was one of the co-authors of a Tramway Museum Society publication that described the two Crich mineral railways⁶. The three authors used the pseudonym “Dowie”. Unfortunately Cowlshaw and Price have since died and Dr.Tebb was not involved with the Gangroad history section and has no notes either.

Although the railway closed over 80 years ago most of the infrastructure survives. At Fritchley there is short tunnel under a road junction, which has been blocked at both ends since the 1960s. Farey and other authors had described it as a “bridge”. It is of interest however since the Guinness World Book of Records has recently accepted it as being the oldest railway tunnel in the world⁷.

A few years ago David Smith, a railway historian living in Crich, showed that the route of the Butterley Gangroad had been altered considerably over the years. It had originally followed a curving contour hugging alignment and was later straightened over most of its length. Therefore the cuttings, embankments and bridges that remain in the valley today are not exceptional marvels of eighteenth century railway engineering but date from the mid- to late nineteenth century. The remains of the original route are much less easy to see, which is what one usually finds when searching for the routes of early railways (Fig.3).



Fig.3. Comparative views of the old and new alignments looking north from just south of Fritchley village (OS Grid Ref. SK358529). The image on the left⁸ was taken in 1946 and shows an occupation bridge and the tunnel in the distance on the new alignment. The right image was taken in 2014 from about 50m to the east and shows the formation of the earlier alignment.

In 2011 Trevor Griffin was preparing a guided walk to follow the route of the Gangroad for Derwent Valley Mills World Heritage Site Discovery Days. He contacted landowners to gain access. One of these, the owner of the land to the north of Fritchley Tunnel, suggested that it might be worthwhile to try to open up the tunnel to discover if it was still accessible. The Butterley Gangroad Project of the Derbyshire Archaeological Society developed from this idea. The project received Heritage Lottery funding of £17,900, started in January 2013 and was due to end in September 2014.

One of the project objectives was to excavate and investigate the tunnel to learn more of its history. Was it a tunnel or a bridge? Was the infrastructure as old as the railway?

The project also had much wider objectives to study, interpret and disseminate information about the railway, the associated quarries and limeworks. It achieved this through a mix of professional archaeology, fieldwork by trained amateurs, recording memories, collecting information, photographs, and maps and through research.

The early archives of the Butterley Company were deposited at the Derbyshire Record Office before Riden published his major study of the history of the Butterley Company in 1973, which forms an invaluable overview and background⁹. Hanson Brick deposited further archives there in 2003. These include the original letterbook¹⁰, previously missing financial records¹¹, which include an early ledger covering the period 1793-1800¹². These have thrown new light on the early history of the Gangroad.

As a result of the project this paper is able to provide a much fuller and more accurate history than those previously available. It draws on information from the archaeological report prepared for the project by Wessex Archaeology¹³ and also a study undertaken on behalf of the Panel for Historic Engineering Works of the Institution of Civil Engineers¹⁴ where these provide evidence¹⁵. The paper also uses information from as yet unpublished reports prepared for the project covering the people who worked at the limeworks and quarries, land ownership along the route and the output and profitability of the business.

THE EARLY GANG ROAD (1790-1840)

In 1790 Benjamin Outram, superintendent of the making of the Cromford Canal and his wealthy patron Francis Beresford jointly purchased the Butterley Hall estate and began to exploit it under the name of Benjamin Outram and Company. John Wright and William Jessop joined the company soon after¹⁶. The first furnace was established at Butterley in 1791¹⁷. Soon after they were paying miners to sink pits to obtain coal and ironstone on the estate¹⁸ but limestone was also required to produce iron. A suitable source was known to exist at Crich. William Jessop is known to have used Crich lime for Wigwell aqueduct on the Cromford Canal; he blamed it for the collapse of the structure¹⁹.

Beresford purchased land for limestone extraction at Crich in 1791 and also leased a quarry under the Leys Close from Hon.Nathaniel Curzon for 21 years²⁰ (Fig.4).

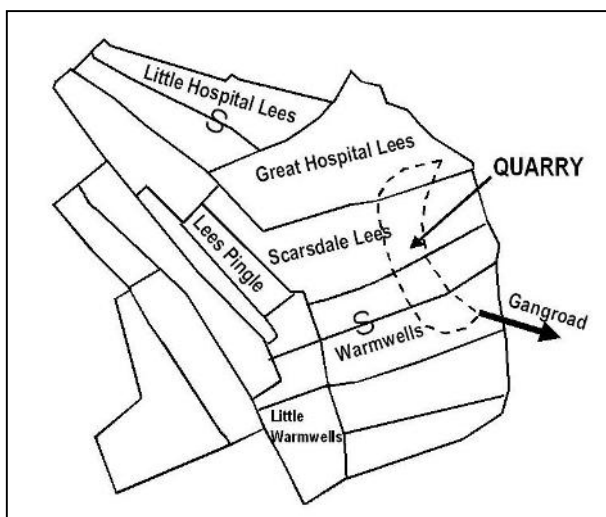


Fig.4. Map of the lands where limestone extraction took place c.1800, based on a contemporary plan by John Nuttall.

About this time Beresford also purchased land beside the Cromford Canal at Bull Bridge for use as a wharf²¹. Limestone kilns were built there and were in operation by April 1793²²; the canal was opened throughout in October of the same year²³.

The “Gang Road” was built to link the initial limestone mine at Crich to the kilns and Amber Wharf at Bull Bridge (Fig.5) whence the limestone could be taken by canal to Butterley works.

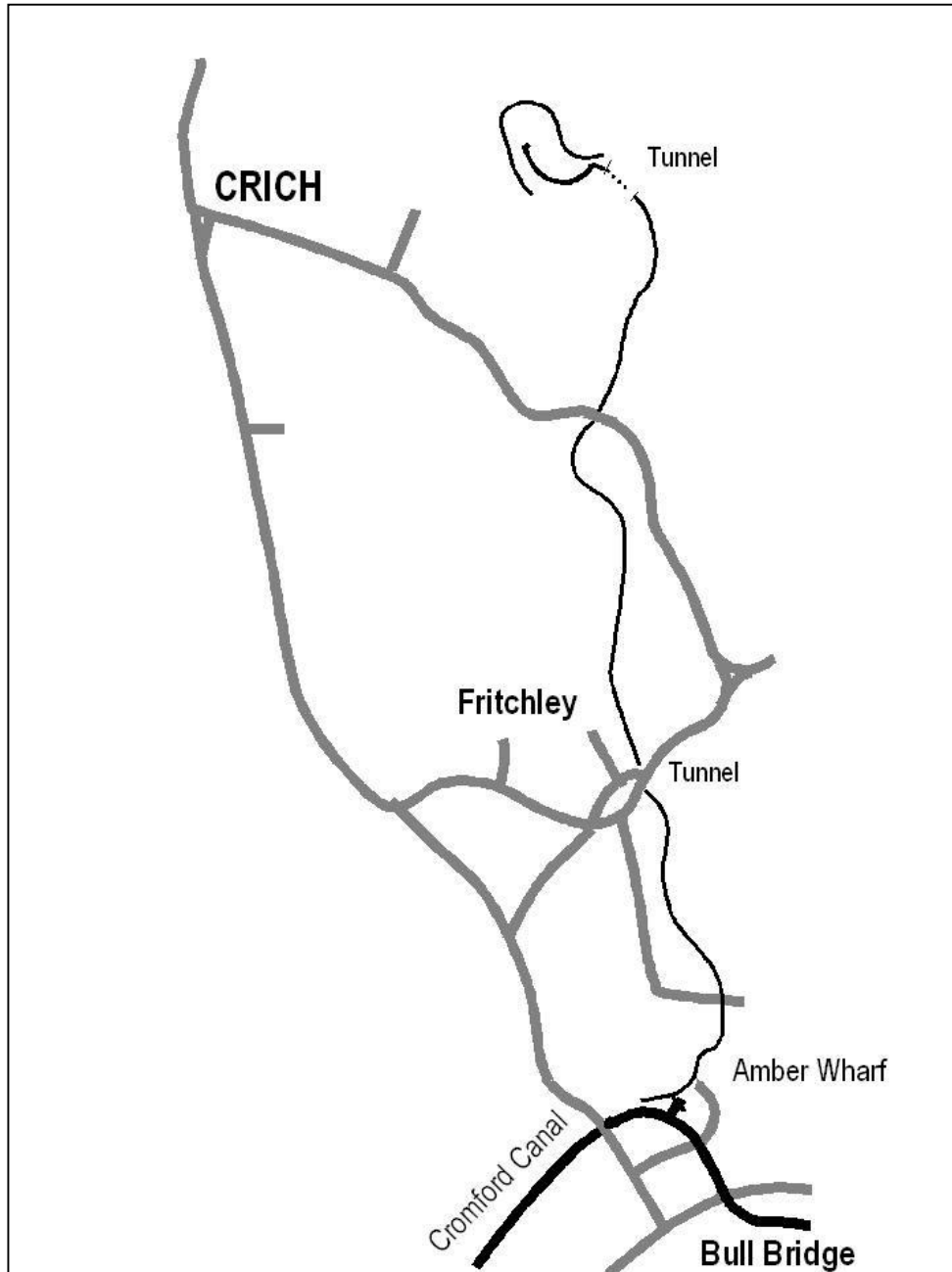


Fig.5. Map of the Crich Gang Road as built.

Farey stated that the railway was in use from 1793²⁴, and this has generally been accepted. Accounts show lime being purchased from George Young of Crich from October 1793²⁵, which corresponds to the opening of the canal.

As built the line ran downhill from the mine on a sharply curving but relatively evenly graded route. It followed a stream, crossed Dimple Lane, possibly by means of an underbridge²⁶, and then ran down the west side of the valley towards Fritchley

village. Here it passed under a road junction by means of a short tunnel about 90 feet (28m) long, 8ft 6in (2.5m) wide and 10ft (3m) high²⁷. The tunnel was constructed by the “cut and cover” method. A deep trench was dug, walls were constructed directly on the earth on either side, a former was put in place and an arch created over it. The ground was then restored above the arch²⁸. From Fritchley the line continued down the valley to Amber Wharf entering the site over a bridge that crossed an old pack horse route. A bridge survives at this location but it is probably of later date.

The line was probably built using the powers created by the Cromford Canal Act of 1789 that allowed industrialists to build feeder railways to the canal provided that they compensated landowners²⁹.

Apart from the land purchased at the mine and the wharf the rest of the route was apparently built across private land by leases and possibly wayleaves³⁰.

The tunnel and the bridges, together with their approach cuttings and embankments, were the only significant earthworks on the early railway apart from between Dimple Lane and the mine where the line was built along a terrace. Cuttings and banks were lined in stone and stone boundary walls were provided. These are more substantial than those found on some other early lines where wooden fences or quickset hedges were typically used. There were pre-existing stone quarries at Bull Bridge, just north of the wharf. These produce “Rough Rock”, a form of Millstone Grit. The beds extend north as far as Fritchley. This stone has been used for walling and stone sleeper blocks. The Rough Rock in contrast to the Ashover Grit, which lies to the north, is generally thinly bedded - almost a flagstone in part - which lends itself to good walling stone. Generally it is finer grained than the Ashover Grit, easier to split but not as massive. The tunnel at Fritchley was also originally lined, it would seem, in Rough Rock as to be expected as it cuts through it. The section to the north of Fritchley where it passes into the next cutting is going further down the sequence out of the Coal Measures into the Millstone Grit Series (Namurian), in particular Chatsworth Grit. It seems most likely that this too was used especially for walling in this vicinity and possibly some sleeper blocks too. It if anything is slightly more reddish coloured than the Rough Rock and can be thicker bedded too, but it is quite variable. In the vicinity of the Hat Factory the line passed through the lowest gritstone, the Ashover Grit. This may have been used in this vicinity although no evidence of this has been noted. The fact that the walling and other stonework of the original line is very consistent in appearance, and distinct from the later construction, suggests that it may all have been built within the same period, although this may not have been when the line first opened.

The next major railway that Outram was associated with, i.e. the Derby Canal Railway (Little Eaton Gangway), originally had rails supplied by Joseph Butler of Wingerworth that may have been laid on timber cross sleepers³¹. The early plateways of Butler and Curr had all used wooden sleepers. It therefore seems unlikely that the Crich Gang Road, which was built earlier, would have been any different. The earliest record of “Gang Rails” being supplied to Crich by Benjamin Outram and Co. show them mostly being delivered between April 1796 and January 1797. This information appears in a ledger that dated from 1793 so it would not have included rails supplied prior to that date. The rails would have been sufficient to lay 1852 yards (1694m) of track, which was less than the length of the line without any sidings and may therefore have been part of a wholesale replacement exercise³². In addition there is a payment of £20 in 1797 to John Crofts, a timber supplier, for “Wood Sleepers for Crich Gang Road”³³. Its possible that the original line was built relatively quickly using Butler “technology” and may have even had a narrower gauge as was the case with earlier

Butler railways, since it started out of a mine. There is a record of the supply of sleepers to the Gang Road by Benjamin Outram and Co. in 1796³⁴. Was this an experiment in using cast sleepers? It seems that Benjamin Outram introduced stone sleeper blocks but in view of these facts it is by no means certain that the Gang Road was the first of “his” lines to make use of them.

The plateway was eventually built to a gauge of 3ft 6in (1067mm) between the backs of the upright rail flanges, this was narrower than the 4ft 2in (1270mm) equivalent dimension adopted by Outram for his later lines³⁵. Each rail was 3ft (914mm) long and fastened down to each stone block by means of an iron spike set into an oak plug in a hole drilled into it. The rails had circular cut outs at each end so one spike held down the ends of two rails. This arrangement was prone to failure and on later plateways holes were made in each rail and each block had two holes to take them. Cast iron chairs were used later still. However the Butterley Gangroad was still using the earliest fixing method on its “main line” until it ceased to be a plateway³⁶.

The original plateway did not use ballast. The stone sleeper blocks were laid directly onto the stony natural surface³⁷. This is of interest because Outram later recommended the use of gravel ballast for railways³⁸. On another local line Outram regretted that, “time would not allow of a Bed of Broken Stones under the Sleepers.”³⁹ This is further evidence to suggest that the original line was built in a hurry.

The average gradient between Amber Wharf and the entrance to the mine was 1 in 30 (3%)⁴⁰. The line was worked by a combination of gravity and horses, which were mainly used to draw empty wagons uphill. The Peak Forest Railway continued to use horse operation into the 1920s and the detailed descriptions of the techniques used to control their trains probably applied at Crich as well⁴¹. Another useful reference suggests how the horses would have been harnessed to pull the trains⁴².

Operation of the railway seems to have been subcontracted out from the beginning and in 1796 Samuel Rowe took over this job of “limestone leader” from George Young⁴³.

Also in 1796 we find Benjamin Outram’s first mention of the railway when he stated that men were laying rails for him at Crich⁴⁴. The gang rails and other parts being supplied at that time seem to be associated with the construction of at least one more kiln and sidings at Amber Wharf and a general improvement to the railway⁴⁵.

An agreement had also been put in place in April 1796 by Benjamin Outram with John Chilton for getting the limestone at Crich. In a letter to Chilton dated 22 April 1797 Outram was clearly dissatisfied with the management of the works and required Chilton to immediately enter into strict articles for the full performance of the agreement or terminate the agreement⁴⁶.

A house was built at Amber Wharf for the use of the manager in 1796-7. John Crofts undertook the joinery⁴⁷ and Benjamin Outram & Co. supplied seven cast iron window frames⁴⁸.

By 1801 the railway, mine and limeworks were being operated by Robert Tipping of Crich. In that year he was purchasing wheels, rails and axles from Benjamin Outram and Co. and also significantly, in 1803, rails for a “stage” and “long rails for wood bridge”⁴⁹. In 1802 he added six new iron and four new wood wagons. Also in the period 1802/3 he was paid for work he had carried out for, “new railway and tunnel, bottoming, opening and levelling the quarry and making drains.”⁵⁰ This is a reference to the opening out of the mine into a quarry beyond, so that the mine became a tunnel about 100 yards (91m) long.⁵¹ Drainage would have been an issue that needed attention if the only low-level way into the quarry was via this tunnel⁵². He also built an extra kiln and a kiln road at Amber Wharf at this time⁵³.

The Butterley Company issued specific rules for working at the Bullbridge lime works in 1803. The rules emphasised the company's desire to have good business relations with customers, for each customer to be served in turn and to be sold the exact measure without partiality and engagements with customer to be punctually met. In addition the daily duties of the lime burners included the cleaning of the holes and the yard and ensuring the kilns were well filled, regularly drawn and kept in the best possible order⁵⁴.

In 1805 Edward Banks and Co leased the quarry, kilns and railway for 14 years. The lease and its plans, which show Amber Wharf and the Quarry, provide the first description of the railway. The lease also included another limeworks at Codnor Park and it's associated plateway⁵⁵.

Edward Banks was born near Richmond in Yorkshire in 1770. His career started as a labourer working on canal projects. It progressed rapidly in connection with working for Benjamin Outram and Co. as a sub-contractor building the Derby-Alfreton turnpike from 1802 and on the Croydon, Merstham and Godstone Railway until 1805.

Banks now resided at Butterley Park; his partners in his company were George Harrison Eades and Henry Wright. They took over the limeworks operation from Robert Tipping.

The railway now had forty iron and four wooden wagons in use. The lease and plans of the land being leased show that there were now three kilns at Amber Wharf situated on a curved bank to the east of the canal (Fig.6). The top of this bank was level with the canal which would have facilitated loading the kilns with coal⁵⁶. This curved bank can still be seen. The wharf was served by a narrow cut from the canal. Above this cut the plan shows four semi-circular shapes that may have been the tops of the chutes down which limestone was tipped into boats⁵⁷. One of the buildings is clearly the house built in 1796/7 that survives today as "Lime Grange"; the lease refers to a "dwelling house". A small square linked to this house may be a representation of a weighbridge⁵⁸.

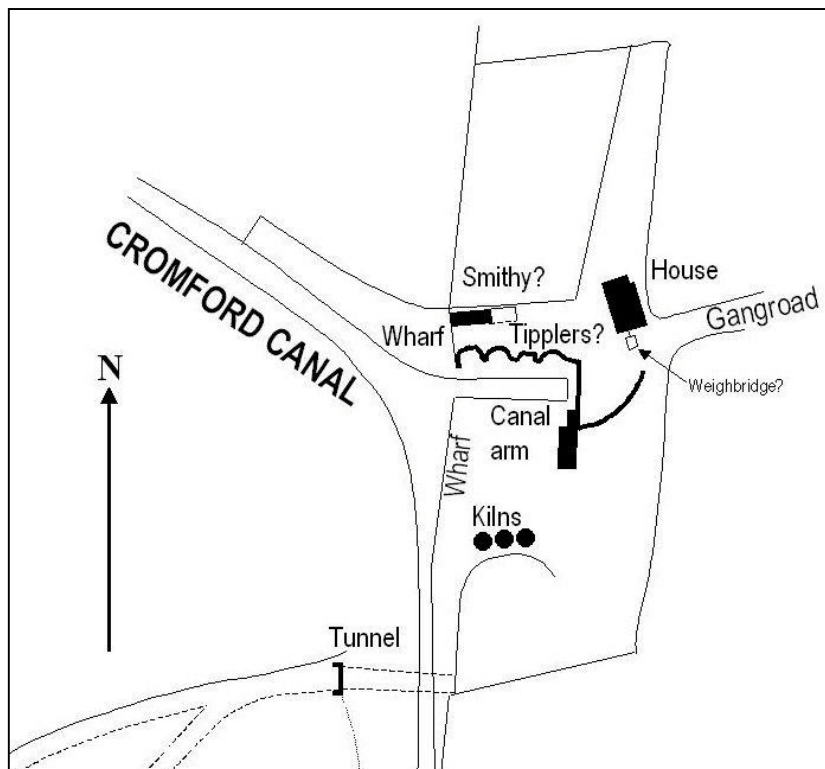


Fig.6. Plan of Amber Wharf 1805 based on the plan attached to the lease of Edward Banks and Co. and other known information.

Edward Banks went on to greater things. He got to know William Joliffe, Lord of the Manor of Merstham and quarry owner through his railway contract and formed a partnership with Joliffe's son Hylton. The company Joliffe and Banks became a great contracting firm. Among their projects were the Limehouse entrance to the West India Docks, Waterloo Bridge, Southwark Bridge, Goole Docks, Heligoland lighthouse, and Sheerness Dockyard. Banks was knighted in 1822. Two years later Sir Edward Banks and William John Joliffe (Hylton's younger brother) formed the General Steam Navigation Company that expanded world-wide and bought ship engines and spares from the Butterley Company.

The lease was completed in June 1805 but sadly Benjamin Outram had died suddenly in May, probably as the result of a stroke, so his widow Margaret signed it. Two years later the company changed its name to the Butterley Company⁵⁹.

Close by where the railway crossed Dimple Lane a hat factory had been established around 1800. This business appears to have failed early on because the two large buildings were purchased by the Butterley Company in 1810 and converted into dwellings for its workers. This was a convenient point for people to live who worked at the quarry or on the railway. It was one of the first of many houses that the company eventually built for its work force at its various sites⁶⁰.

Old wagons could be "traded in", in 1812 eight "wrought iron gang wagons" were credited in the accounts⁶¹, and another ten the following year⁶².

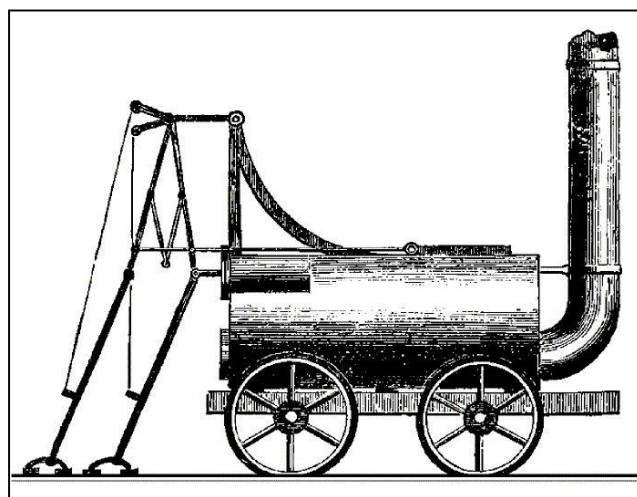


Fig.7. Brunton's Horse.

1813 was a very significant year in the history of the railway. William Brunton, a Scottish Engineer employed at the works by the Butterley Company applied to them to use their facilities to construct one of the world's first steam locomotives, although he saw it as a "mechanical horse" or a "traveller" (Fig 7). It is quaintly referred to in the accounts as a "Horse made for Crich Railway"⁶³. It ran on four wheels and propelled itself by means of a complicated mechanism resembling ski sticks that pushed against the trackbed. This seemingly bizarre contraption was actually a working solution to a problem that arose in applying steam traction to these early cast iron railways. Richard Trevithick's first experiments on the Penydarren Tramroad in South Wales, another Outram plateway, resulted in the cast iron plates breaking up. They could not withstand the hammering created by the dynamic loading of the passing steam engine. Blenkinsop's successful steam locomotives used on the Middleton Railway near Leeds from 1812 used a rack and pinion arrangement so as to

provide traction without loading the rails. Brunton was trying another solution that did not require the track to be rebuilt.

The remarkable thing is that his machine weighed a mere 2.5 tons (2.54 tonne) and yet hauled trains of empty wagons successfully on the Butterley Gangroad up the 1 in 30 (3.3%) gradient for several months. It was many years before conventional steam locomotives that relied on adhesion for traction could manage such gradients.

Inspired by this success he went on to build a second similar locomotive on a larger scale for use at a colliery in the north-east. Unfortunately the boiler exploded due to a combination of factors not due to Brunton himself and that was the dramatic end of his locomotive experiments.

The full story of this remarkable locomotive has been studied in detail and is expected to be published soon⁶⁴. The significance of what Brunton achieved at Crich has never been fully appreciated in Britain.

In the same year that Brunton was carrying out this experiment Farey was collecting information for volume 2 of his survey⁶⁵. He describes the railway at Crich as being 1¼ miles (2km) long serving the “Crich SE (south-east) or great Limestone Quarries”. In view of the error of the date that he gives for opening out of the tunnel his description may need to be treated with care. He describes the tunnel at Fritchley as a “Stone Bridge” and says that a quarter of a mile (400m) north of this the line passed over a private road on a “Wooden Bridge”. Exactly where and what this was remains a mystery but it may have been associated with the purchase of long rails for a wood bridge by Robert Tipping in 1803.

Farey describes the tunnel at the quarry as being 100 yards (91m) long. He also says that there were six tippers or machines at Bull Bridge, “on a high bank, for overturning and shooting the contents of the trams.” He says that four tipped stone onto the wharf, which corresponds to the number of semi-circular shapes shown on the 1805 plan mentioned above. The other two “tipped” the stone directly into boats. He says that the boats were built of wrought iron with deal planks “laid along the bottoms” for taking the loading shock.

He describes the “trams” as having “plate-iron bottoms and sides” to hold about 34 to 35cwt (1780kg) in blocks of 0.5 to 3 or 4 cwt each (30 to 180 or 240kg each). He said that the wheels were cast with holes in them instead of spokes to facilitate braking using “short truncheons of wood” and to lever them from rest. One horse drew five trams.

He went on to describe the trial of “one of Mr. Brunton’s patent propellers, worked by a steam engine” in November 1813.

Following the expiry of Edward Banks’s lease we find Joseph Mather acting as agent for the Butterley Company and living in the manager’s house (now Lime Grange). In 1827 he obtained a licence for a gunpowder store at Amber Wharf⁶⁶. The census return for 1841 shows Joseph Mather living with his wife, Martha, and their seven children and one servant at Bullbridge. The entry for Crich in Bagshaw’s directory of 1846 identifies Mr Joseph Mather as bar master. There are no further references to either Joseph Mather or any of his family in the later census returns. However there was a death notice in the Sheffield & Rotherham Independent newspaper on 3 November 1849 as follows, “In America on 4 October, Joseph Mather aged 47 years, late of Bullbridge Derbyshire.” Therefore Joseph Mather and his family probably emigrated to America in the late 1840’s.

The Butterley Company made a valuation of its property in 1834. This showed that the only land owned along the line of the railway remained as it had been in 1805, just the quarry and the wharf⁶⁷. Five years later the Crich Poor Rate Assessment was

prepared. This includes a detailed map of the parish, drawn by John Bromley of Derby and a schedule that includes the ownership and occupiers of land. This is the first large-scale plan that we have discovered that shows the original railway route. It includes an inset enlargement of Fritchley village, which, very usefully, shows the tunnel in its original condition (Fig.8)⁶⁸.

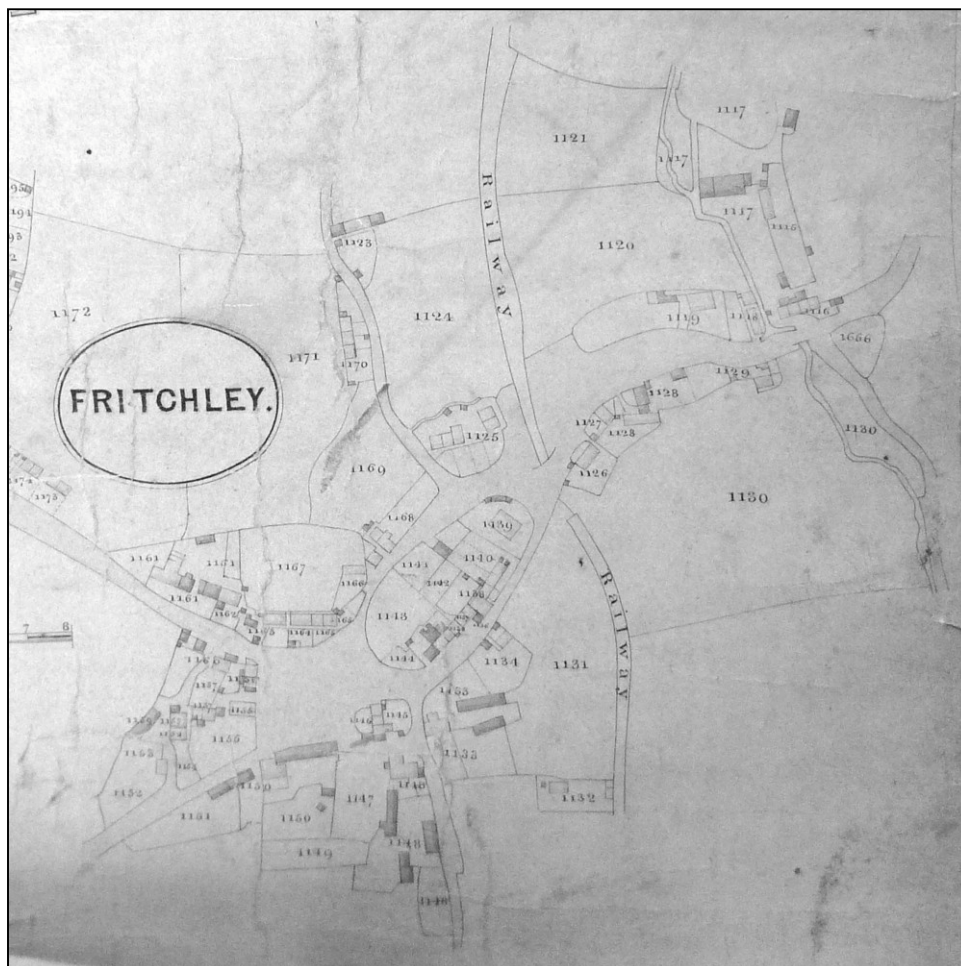


Fig 8. Map of Fritchley showing the tunnel 1839. A detail from the larger plan of Crich parish prepared by John Bromley of Derby for the Crich Poor Rate Assessment. Reproduced with permission of the Derbyshire Record Office and the Rev.P.Brooks, Vicar of Crich.

INTO THE RAILWAY AGE (1840-1893)

The North Midland Railway opened from Derby to Normanton near Leeds in 1840. It passed very close to Amber Wharf at Bullbridge.

The new railway companies saw serving industry as a main source of profit. The older Cromford and High Peak Railway had aspirations to tap new markets as well, perhaps to improve its failing health⁶⁹. In 1842 the company proposed an extension from its then terminus at Cromford to the North Midland Railway at Ambergate. The route would have continued along the west bank of the Derwent, the path taken in part by its High Peak Junction extension of 1853. It would have continued along this side of the river until crossing it by means of a bridge just north of Whatstandwell Bridge.

From there to Ambergate the route would have been much the same as the 1849 Manchester, Buxton, Matlock and Midlands Junction Railway, the present "Matlock Line". From Ambergate the scheme had two extensions, one via Heage to the Morley Park ironworks (with two alternative options) and the other to a terminus just west of the canal at Amber Wharf to serve the Butterley limeworks⁷⁰.

In 1844 the Butterley Company bought land for a "Tramway to the North Midland Railway"⁷¹. The sidings connected with the main line by a junction facing east and were constructed on a substantial stone-faced embankment, which still exists. The sidings served the base of the kilns allowing burnt lime to be sold further afield. Raw limestone continued to be taken away by canal as at this time Butterley Works had no rail connection to the west.

The quarry at Crich was proving more difficult to work, presumably because of the depth and quality of the limestone seam. A more promising area existed to the west closer to Crich village and land was purchased in order to open up a second quarry that became known as "Hilt's"⁷². The original quarry became known as the Warner or Old Quarry.

A new branch line, about 700 yards (630m) long was constructed from the Hat Factory to serve Hilt's Quarry. This included a 550 yard (503m) double track rope worked self-acting incline with a gradient of 1 in 15 (7%). Extensive changes were made at the Hat Factory to accommodate the new branch line that involved changing levels and altering the course of Dimple Lane (Fig.9). The new line was laid on stone blocks⁷³. From 1841 there are references to "pedestals" and parts for the incline being acquired. Pedestals were probably track chairs indicating a different form of track construction. A crane was also purchased for Amber Wharf in that year⁷⁴. "Trough rails" were supplied in 1843: these could have been for the altered arrangement by which the older route now crossed Dimple Lane by means of a level crossing. The following year castings were supplied for a bridge, these are believed to be for the new bridge by which the new branch line passed under Dimple Lane. In the same year a lead ore crusher was supplied. This is interesting because a lead mine was cut into at the entrance to Hilt's Quarry (it can still be seen). Possibly the Butterley Company, or the Limeworks management, decided to exploit it at this time⁷⁵.

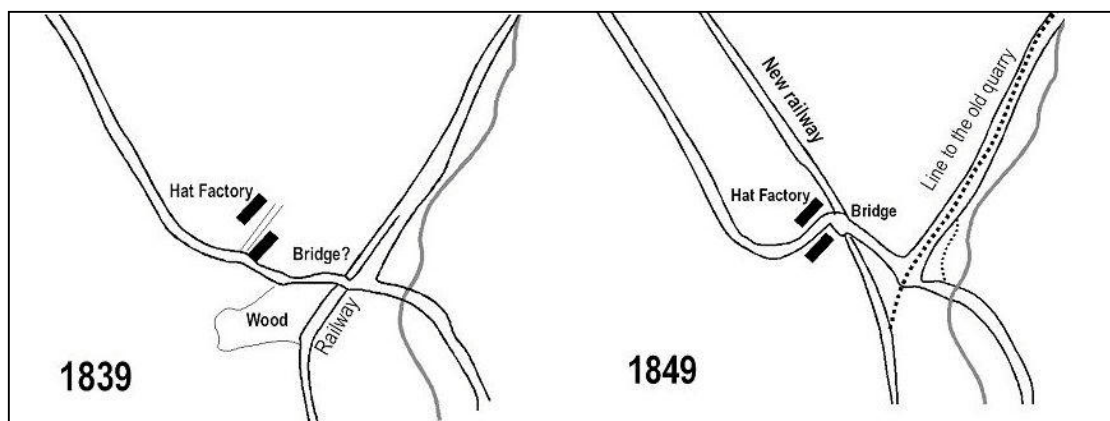


Fig.9. Plans of the Hat Factory area 1839 and 1849 based on Bromley's map (see Fig.8) and the Crich Tithe map.

Also in 1844 the Midland Railway had been formed by the amalgamation of the North Midland Railway and the two other railway companies serving Derby. Under the forceful chairmanship of George Hudson it was now the largest railway in the

country⁷⁶. Clearly it needed to make the most of its investment by serving lineside industry and protecting itself from competition. A private company placed a bill before parliament in 1844 for an Erewash Valley Railway but it was objected to by local land and colliery owners because of the high cost and difficulty of having to build connecting standard gauge branches in order to replace the existing tramroads that connected their industries to the canals⁷⁷. On the 9th April 1845 the Speaker of the House of Commons drew the members attention to a clause in a private bill of the Midland Railway, then before parliament. It would have allowed the "proprietors of any manor or estate containing any mines of coal, ironstone, limestone, or other minerals, lying within a distance of five miles from the main line" to make branch railways provided they paid compensation to land owners. The speaker pointed out that it would have given compulsory powers to take lands without serving notice, making plans, sections and estimates as required by Standing Orders. One of the members present referred to this as a "great violation of the standing orders". The matter had been referred to the Speaker by Edward Strutt, the then MP for Derby, " a landowner affected by the bill". Lord Somerset said that the clause had been "surreptitiously introduced". The bill was rejected⁷⁸.

The Midland had been trying to do what had been acceptable for the earlier canal companies, but times had moved on and the new railways were more substantial. From now on they had to anticipate what branches would be required and include these in bills. By now they had taken over the Erewash Valley Railway scheme and re-submitted plans that this time included branch lines to serve the various lineside collieries etc.⁷⁹

The first "Railway Mania" was now at its height, people were eager to buy shares in railways to earn big profits and many companies were set up that had ill thought out plans. New schemes often attacked the markets already served by the successful older companies, so the Midland Railway was especially vulnerable⁸⁰. At the meeting of Midland Railway shareholders held in Derby on 2nd May 1846, George Hudson persuaded them to approve an unparalleled application of 26 parliamentary bills in line with an aggressive expansionist and defensive strategy. One of the bills was for the "Erewash Valley Extension" from Pye Bridge to Clay Cross, which it was said "provided better means for dealing with the mineral traffic in the district"⁸¹. Another bill submitted to parliament during the "Railway Mania" was for a line from Crewe to Mansfield via Fritchley and Crich⁸², so it was against such a background that the Midland had to protect its interests and be specific in making plans. The plans for the Erewash Valley Extension, prepared in 1845, included two branch lines to replace existing tramroads in the Amber Valley alongside the earlier North Midland line. One was for a branch from Butterley Park to Greenhill Lane at Alfreton to replace Mrs. Morewood's plateway of 1797 and the other was a branch to Crich⁸³.

The Crich Branch would have left the main line from a west facing junction at Ambergate and rising at 1 in 38 (2.6%) cut through Amber Wharf and curved north towards Fritchley. The original route of the Butterley Gangroad is clearly shown on the deposited plans. At Fritchley it would have passed under the road where the old tunnel was situated. The difference in height between the level of the road and the level of the rails of the new line are given on the plans as 13 feet (4m), so the level of the tunnel floor would have remained as it is now and the clearance would have been very limited. From here the line would have continued in a straight line at a gradient of 1 in 36 (2.8%) to a terminus at the Hat Factory, by means of an embankment 12ft (3.7m) high, a cutting 12 ft (3.7m) deep and another embankment 15ft (4.6m) high.

The overall length of line would have been 1 mile 2 furlongs (2km) and the increase in height 157 feet (48m).

The Bill received Royal Assent in July 1846; in its final form it excluded the Greenhill Lane branch but retained the one to Crich⁸⁴. Three years were allowed to buy land and five to complete construction, but no construction took place. Very soon railway capital would be in short supply again and the major threats had passed as the "Railway Mania" bubble burst. The Erewash Valley extension eventually opened in 1862, but new powers had to be obtained for this.

The earlier Erewash Valley branches act⁸⁵ included a clause that gave powers to the owners of the collieries etc. served by the new branches to adapt their older tramroads to reconnect to the canals but the Crich branch powers gave no such provision. It seems that the Midland Railway's Crich branch proposal was for a purely mineral line to replace the gangroad. With its fierce gradients and tight clearances it would have been a challenge to operate and its possible that the intention was to continue to use gravity and horse traction.

Despite this, by some process, the Butterley Company "modernised" the gangroad by re-routing it most of the way using the alignment and works proposed by the Midland Railway. Eliminating the curves of the old route would have been a significant advantage, reducing wheel wear and derailment risks. It does not seem that it was the intention to convert to standard gauge because the new alignment was built at the same width as the old one at about 13ft (4m), whereas a standard gauge line would have been built at least 15ft 6in (4.7m) wide. Land was purchased for the "new railway" from 1845 onwards⁸⁶.

In 1848 a new agent was appointed to manage the Limeworks, this was Peter William Bowne who was born at Codnor Park in 1821. The 1851 census return shows him living at Bullbridge with his wife, Mary, and one son and one house servant. His occupation is specified as employing 27 men as manager of the limestone quarry and lime works and as an agent for customs due to having a gunpowder magazine.

The 1849 Tithe Map of Crich shows that by then the new alignment was in use from the Hat Factory down to Fairfield Farm but the old alignment remained in use south of there through Fritchley tunnel⁸⁷. The re-alignment continued into the 1850s by means of the lengthy embankment north of Fritchley, alterations within the tunnel and a cutting and embankment down towards Bowmer Lane. Just north of the crossing the old route continued in use but land was purchased alongside on the planned Midland Railway alignment⁸⁸. At the point where the new route met the old route the latter was cut into because of the change in level and there was a very sharp curve: perhaps it had been intended to continue the re-alignment. Another straightening also occurred on the approach to the bridge into Amber Wharf, where the old alignment has been partly quarried away but the "kink" in the boundary wall shows where the deviation occurred. This was not part of the Midland Railway proposal but was on land already owned by the Butterley Company.

The "new railway" was substantially built. Cuttings and embankments were stone lined throughout. Dry-stone walls were provided on either side, including on the embankments, indicating that the railway was intended for horse traction. The change of route in the tunnel meant that the southern half was rebuilt using larger stones and a wider cross section. The joint between the two areas of stonework was roughly made and had to be strengthened later by means of a blue brick buttress, partly due perhaps due to the weight of a building above. A substantial wide stone portal was built at the southern end. An overbridge of similar cross section to the new tunnel section was provided where the footpath crossed the line north of Fairfield Farm. All of these

features are typical of narrow gauge railway construction in the period. Where the new alignment met the old alignment the old alignment was walled off (Fig.10). The newer stone walls still used the local millstone grits but make use of larger blocks including slabs of “lintel” size.

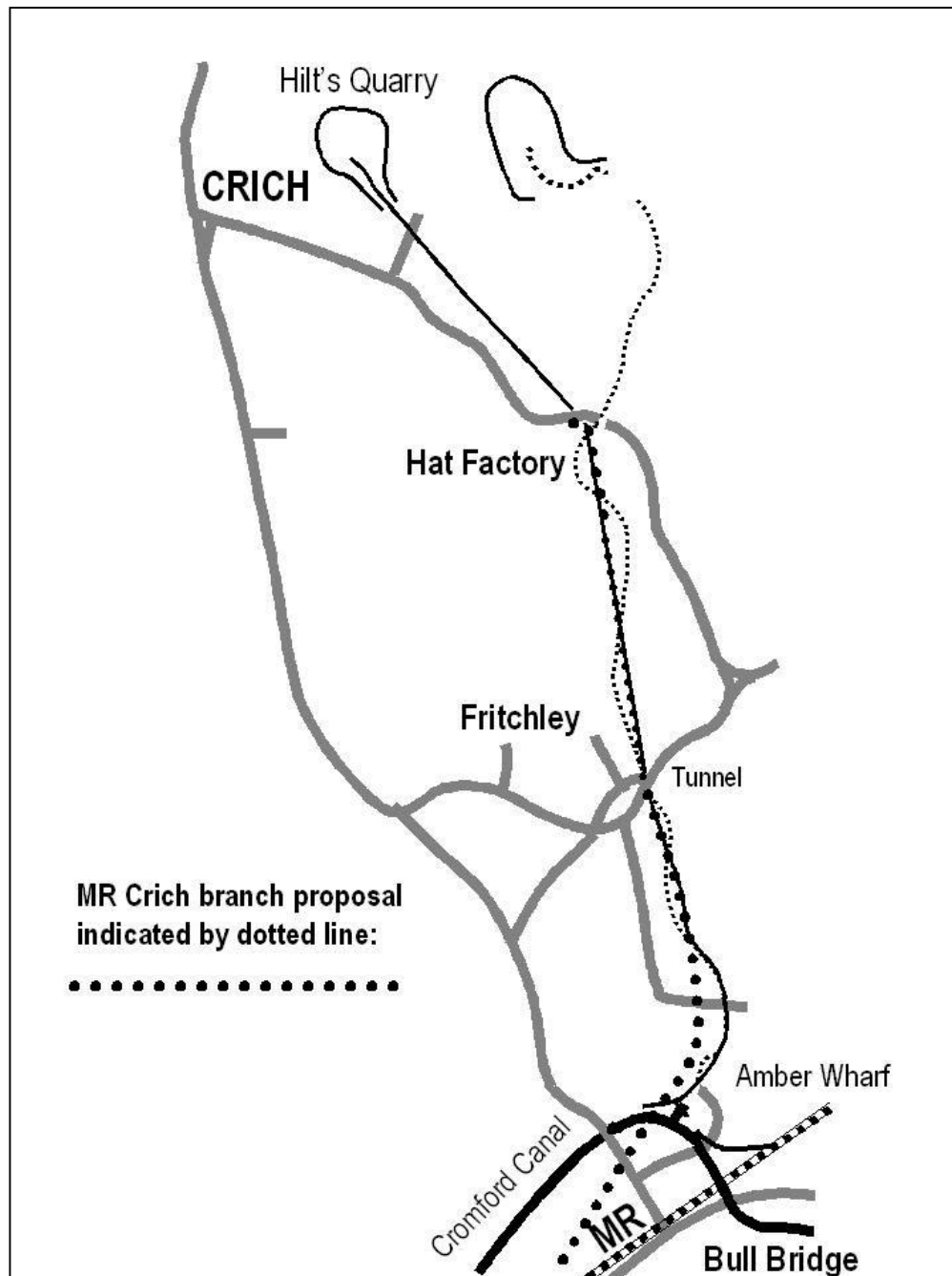


Fig.10. Map of the Butterley Gangroad c.1860 showing the old and new alignments and the route of the Midland Railway Crich branch proposal of 1846.

Land was purchased from the Bowmer family for the new line north of Bowmer Lane in 1850 and in 1856 a retrospective exchange of land was made with Lord Scarsdale relating to the incline⁸⁹.

About this time the gangroad was converted from a plateway to an ordinary narrow gauge railway; this involved a “transition” stage. The new gauge was about 3ft 10in

(1168mm) measured in the normal way, i.e. between the rails. This allowed wagons with flanged wheels to run both on this new track and on the old plateway, in the latter case by running on the tips of their flanges (Fig.11). It is not known over how long a period this transition arrangement existed. The first mention of rails and chairs being supplied, as distinct from gangway rails and pedestals, occurs in 1850⁹⁰. A section of “T” section wrought iron rail, 4ft (1219mm) long, typical of the mid-nineteenth century was found in Hilt’s Quarry by the project team in 2013. Other rail sections that survive are light rails 3in (75mm) high of the “Bull Head” type.

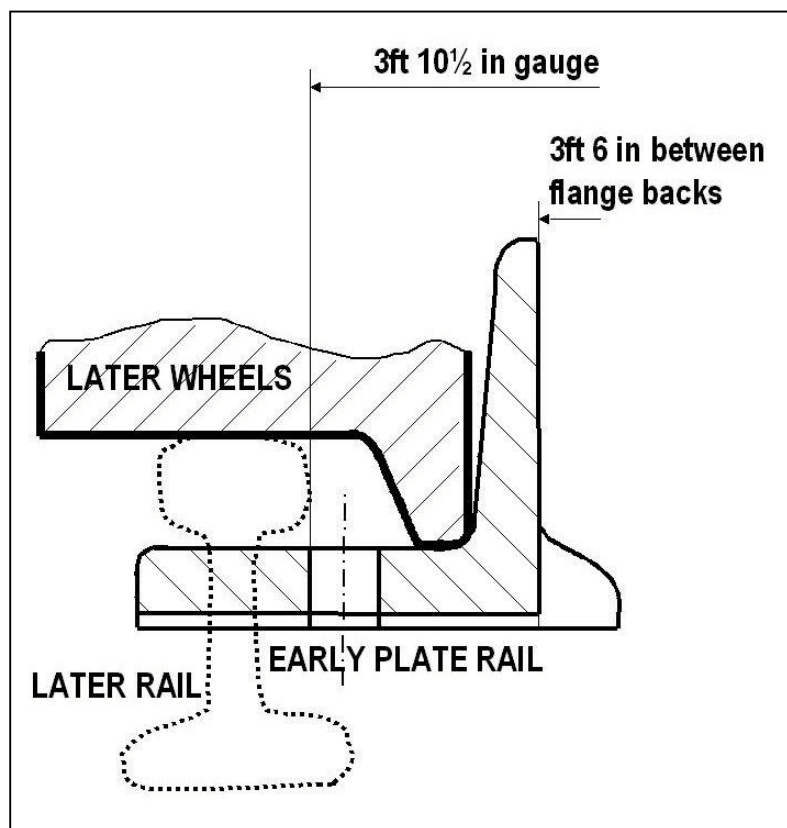


Fig.11. Diagram showing the possible transition arrangement between the plateway and the later railway track.

In 1852 the Midland Railway added further sidings between the main line and the branch line to the Bullbridge kilns. The Butterley Company met these costs⁹¹.

The entry for Crich in White’s directory for 1857 included the following notes; “The Butterley Iron Company has also extensive lime works at Bull Bridge, where about 8000 tons of lime and 30,000 tons of stone are sold yearly. About 50 men are employed at these works; Mr. Peter Wm. Bowne is the resident manager. Messrs. Curtis and Harvey’s gunpowder magazine is also situated at Bull Bridge.”

Hilt’s quarry was to become the main quarry and sometime around 1860 the old quarry was abandoned and the track between it and the Hat Factory taken up.

It has been claimed that a steam locomotive was introduced to the railway around 1860 but other researchers and ourselves have found no evidence for this⁹².

In 1865 Peter Bowne left Bullbridge and his employment with the Butterley Company and moved to Coney Grey House in Pentrich. In the 1881 census his occupation was stated to be the owner of stone quarries. He was the co-owner of the Bowne & Shaw quarry in Wirksworth. He died in 1885 aged 64. The new agent was George Grey Bates who originated from Gateshead, County Durham. During his term as manager his name appears in newspaper reports in two court cases relating to

charges of embezzlement at the Butterley works. In both cases he was not the person being charged or linked with the alleged embezzlement.

In 1869 Chaplins of Glasgow supplied a 4 wheeled vertical boiler chain driven locomotive of 6hp (4.4kW) to the Butterley Company. This was their works number 1109. Chaplins were established in 1849 and held a patent for vertical boiler locomotives from 1857. No.1109 was of the smallest size produced and they were built for narrow as well as standard gauges⁹³. It seems likely, based on other information about Chaplin locomotives and other standard gauge vertical boiler locomotives used by Butterley, which are recorded as being more powerful, that this was the locomotive that is recorded later as being used on the Butterley Gangroad⁹⁴. The axles were driven by means of toothed wheels, geared in the ratio 3:1. The cylinders were stated to be of 4 inches (100mm) diameter. There is an account of this locomotive operating that states that the chimney had to be lowered to allow it to pass under the bridges and through the tunnel⁹⁵. It is likely that the building at the Hat Factory, which served as a locomotive shed, was built to house this locomotive.

The first large scale Ordnance Survey map of the area was published in 1880 and provides a very good picture of what the line looked like at that time. Hilt's quarry is shown with a complex of sidings and the double track incline can be seen leading up to it. The old quarry is shown as disused and covered in trees with the "old tunnel" at the entrance. The area at the Hat Factory shows the engine shed and a siding leading into an area that later became a large spoil heap (Fig.12). The old alignment was still bounded in part by walls in the Fritchley area. Five kilns, the canal arm, the original Midland Railway Sidings and a gunpowder store are among the features shown at Amber Wharf (Fig.13).

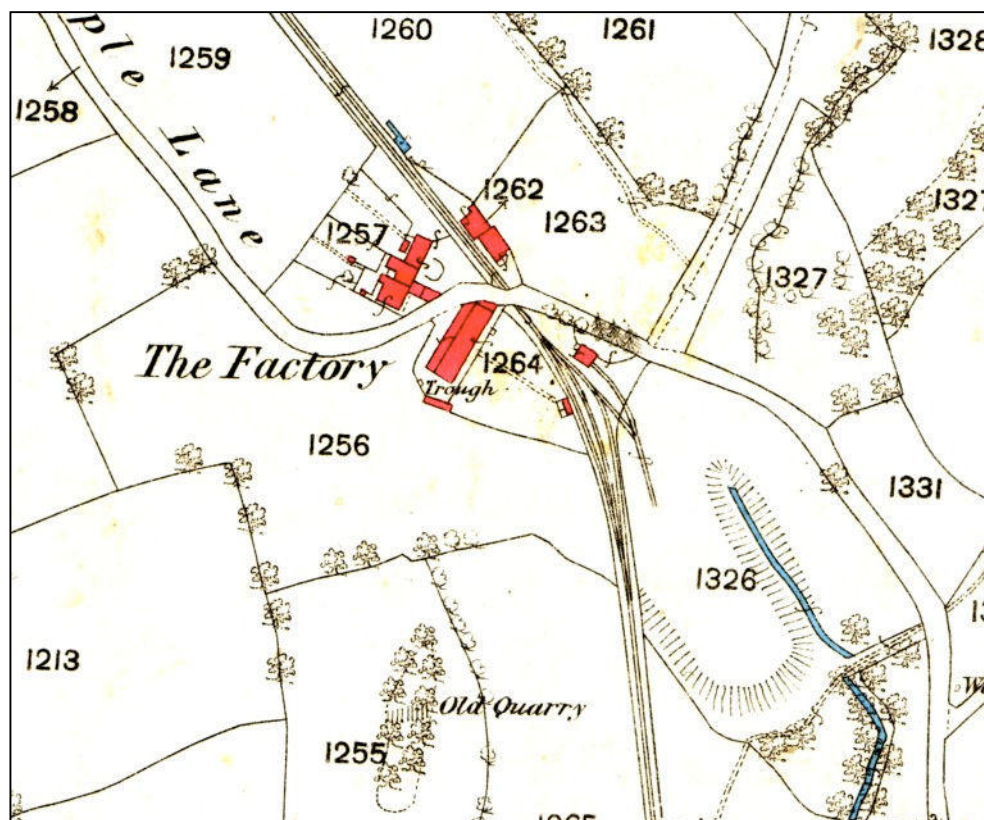


Fig.12. The Hat Factory area as shown on the 1880 Ordnance Survey 25inches to one mile map.

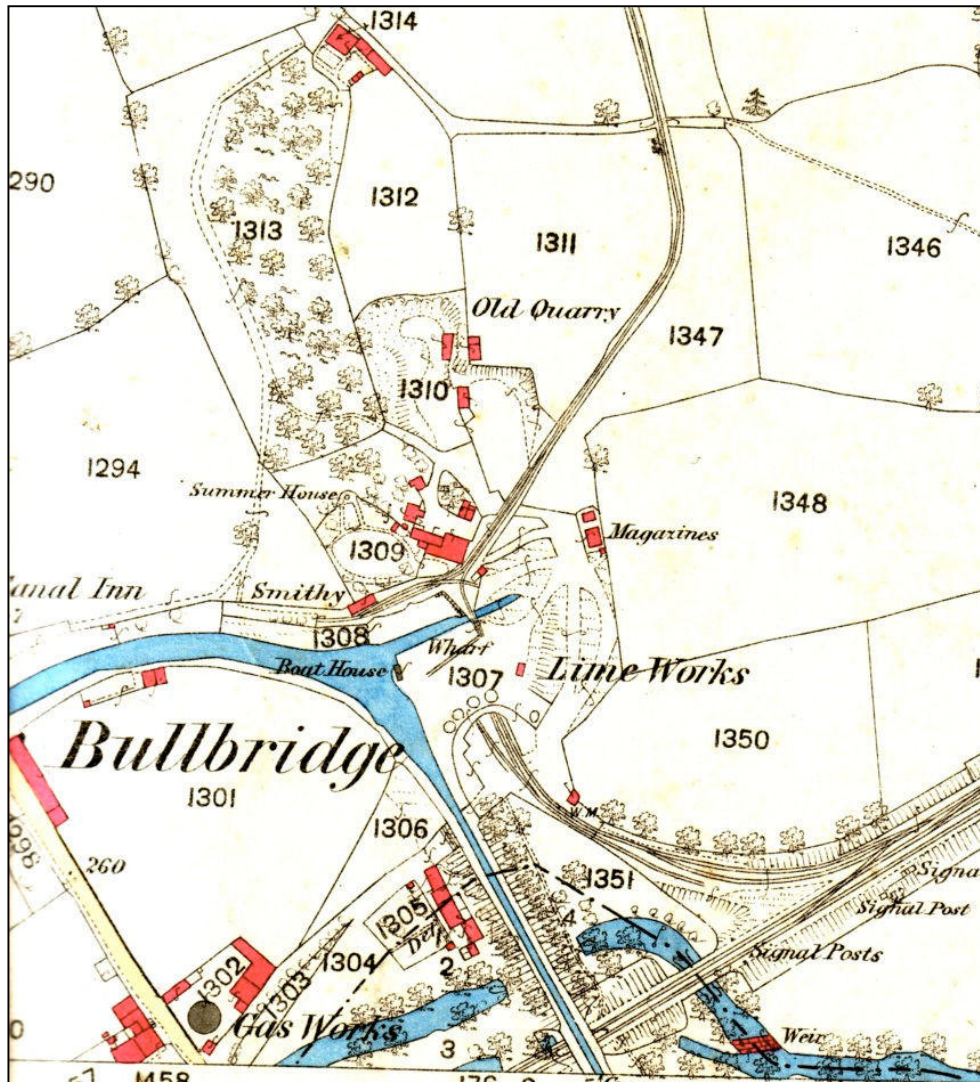


Fig.13. The Amber Wharf area as shown on the 1880 Ordnance Survey 25 inches to one mile map.

Bates died in 1881; the new manager was John Henry Day who was born in Ripley in 1854. His father, George Day, started with the Butterley Company as a clerk to the bookkeeper, Mr George Staley. George Day then became an accountant and in the 1871 census was recorded as an agent to the Butterley Company (but not at the Limeworks). John Henry Day's mother, Isabella, was born in Newcastle-upon-Tyne and was a Professor of Music. Before she married George Day she was Isabella Bates and was the sister of the previous manager, George Grey Bates. In the 1871 census John Henry Day was living with his family at Outram Street, Ripley and he was recorded as a clerk.

These details are neatly augmented by a description of the railway published a few years later in 1886⁹⁶. The article states that the quarry then had a working face 100 yards (91m) wide and 114 feet (35m) deep and was producing about 150 tons (152 tonne) of limestone per day. The railway was said to be of 3ft 10½in (1181mm) gauge with a gradient of about 1 in 40 (2.5%). It said that most of the limestone was burnt into lime in the five kilns.

The locomotive had become known locally as the “coffeepot” and was used to return the empty wagons. This implies that gravity was still being used downhill and the locomotive, like Brunton’s earlier machine, was simply doing the work of horses in returning empties.

The canal was still the method by which limestone was transported to Butterley and Codnor Park, despite the opening of the direct Midland Railway line from Ambergate in 1875. Lime was being used for purification at gas works and in chemical industries as well as for agriculture and building.

The article also referred to machinery used at Bull Bridge to break up the harder rock, known as chert, for road making. It also mentioned the fact that lead ore was found in workings and that there were seventeen distinct levels of limestone in the quarry of various qualities.

The limeworks were now employing nearly one hundred men and were said to be under, “the skilful management of Mr.J.H.Day.”

The quarry needed to expand to maintain output and in 1889 further land was leased at Crich from G.A.Smith with an associated access right of way. 9½ acres (3.8 ha) were also purchased at Crich and Ambergate⁹⁷.

Between 1852 when the Furnace Ledgers end and 1878, when the board of the Butterley Company finally decided to keep minute books⁹⁸ there is a paucity of records. This “laissez-faire” attitude seems to have backfired however because in 1893 the minutes report that the directors had investigated and found “gross irregularities and falsification of the Bull Bridge accounts by Mr.J.H.Day the Manager”. He was given three months notice and a new manager was appointed⁹⁹. Two years later the money still owed by Day was written off. It was £1064 2s 3d, equivalent to over £1 million in 2014¹⁰⁰. The matter was considered closed¹⁰¹. A new era had begun and fortunately for historians much more detailed records were now kept.

EXPANSION AND MODERNISATION (1893-1914)

John Pakenham Hamilton was appointed as the new manager in 1893¹⁰². He was born in Donegal and spent his early life in Fife, Scotland. One of the first things to change under his management was that the men were now employed directly by the Butterley Company rather than as individual contractors¹⁰³. This may be a clue to how the fraud had been perpetuated. Contracting had probably taken place since the limeworks began because there was a reference to “bargainmen” as early as 1797¹⁰⁴.

Hamilton also began to introduce significant improvements to equipment and operating methods. He obtained authorisation for a new kiln and a new locomotive¹⁰⁵. The four coupled wing tank (0-4-0T) locomotive arrived in May 1894 from Bagnalls of Stafford, their works number being 1435. It was named “Fitz” after the then managing director Fitzherbert Wright. It was said to be a 3ft 9in (1143mm) gauge locomotive¹⁰⁶. The disparity in gauge may exist for various reasons but a locomotive built for this gauge and having wide wheel treads would have worked on a slightly broader gauge line. The use of this locomotive in place of the relatively weak “Coffeepot” meant that it could take wagons up the slope into Hilt’s Quarry. The incline was singled and larch sleepers were laid to replace the original stone blocks. The incline and a further 400 yards (366m) of siding were re-laid using heavier rail. This was probably the 4in (100mm) high rail, examples of which survive today beside

the route. Five new wagons were provided each of which could carry 3 tons (3.05 tonne). This all happened in 1894¹⁰⁷. It was probably at this time that the engine shed was extended to accommodate the new locomotive, the vertical boiler locomotive possibly remaining in use as a spare. A local author remembered “Fitz” working trains of sixteen wagons, three or four times a day in 1896¹⁰⁸.

Twelve acres (4.86 ha) of land were purchased in 1895 at Bullbridge from the trustees of the Bowmer Estate¹⁰⁹.

The following year Hamilton wrote to the company asking for permission to reopen the old quarry because Hilt’s Quarry was at risk of being worked out if extraction continued at the current rate¹¹⁰. The standard gauge sidings were still horse worked and consideration was given to buying a locomotive. Additional standard gauge sidings were to be constructed on the east side of the limekilns. These would allow limestone to be taken out directly by rail. Iron girders, a stone pillar, plates for a stage and a new stone breaker screen were acquired along with the rails for the sidings as part of this development¹¹¹. A second gunpowder store was also to be built at Bull Bridge¹¹².

A year later the Directors were trying to acquire more land to extend Hilt’s Quarry. It was decided to spend capital on barring 600 square yards (500 m²) at this quarry and to build a temporary tramway to take the material for dumping in the old quarry. Negotiations continued with the Midland Railway in order to build the new sidings, the Butterley Company agreeing to provide the land and a third of the cost. A boiler and engine for the crushing machine was also purchased¹¹³.

Capital work continued through 1898. The agreement for the sidings was sealed. Arrangements were made to extend Hilt’s Quarry and Hamilton’s plan to reopen the old quarry was approved¹¹⁴.

The 6-inch to 1-mile Ordnance Survey map of 1899 shows the temporary tramway between the quarries. It had loops at each end and did not connect to the existing railway so it may have been built to a different gauge. At this time temporary construction tramways were often light 2ft (600mm) gauge lines that used portable track and “Jubilee” side tipping wagons.

Hamilton now proposed raising the height of the kilns at Amber Wharf by 25ft (7.6m) in conjunction with building a new kiln with engine, crusher, screens, hoppers and elevators. The directors agreed to a simpler version of the scheme in which the kilns would be raised by just 15ft (4.6m) and the railways below the crusher were to be lowered by 11ft (3.6m) to allow larger hoppers¹¹⁵. This work was carried out. As part of this the railway approach over what is now Drover’s Way was raised. The embankment was raised reducing its gradient to about 1 in 40 (2.5%) and the iron bridge raised up as well. On the far side it seems that the yard by the manager’s house was increased in height. Adding a flight of steps at the top raised the old approach path into the yard from the south side of the bridge. These steps still exist: they consist of 62 stone sleeper blocks, each of which have two holes arranged diagonally. Only two of these have light marks caused by chairs. The edges of the blocks have been dressed suggesting that they were recycled from a previous use in a building or wall after their railway use. The new higher kiln was built and the area raised as can be seen in later photographs¹¹⁶.

Unfortunately the extension of Hilt’s Quarry was proving difficult due to the quality of the strata¹¹⁷. A contract was made with Messrs. Bott and Lewis Jones for barring limestone at the old quarry¹¹⁸. The contract was for removing 100,000 cubic yards (76,455m³) from areas north of Hilt’s quarry and in the old quarry. The material to be removed would be soil and stone boulders so as to bare the top of the limestone

Working on the kiln tops was both a labour intensive and hazardous occupation. In 1902 the company decided to address these issues by installing a conveyor system although there were concerns that kiln fumes might affect the India rubber belts. Frasers and Chalmers prepared a scheme¹²⁸. Mr Ellson, a company draughtsman, prepared a set of drawings to show how these were to be arranged. The conveyors were supported by trestles and were designated “A, B, C and D”¹²⁹. From photographs, maps and similar installations elsewhere it seems that the arrangement consisted of:

- A central tower that contained the crushing machinery.
- A horizontal conveyor to take limestone from the tipping siding to the tower.
- A sloping conveyor to bring coal up from the canal wharf to the tower.
- A horizontal conveyor from the central tower to the tops of the newer elliptical kilns to load coal and crushed stone.
- A conveyor that fed crushed stone from the tower into railway wagons on the eastern sidings. There was probably also a tipping arrangement by which stone could be transferred directly from the gangroad wagons to railway wagons on these sidings.

Perils other than kiln fumes existed. In 1902 John Johnson, a labourer employed by the Midland Railway Company on the Cromford Canal, who lodged at the Hat Factory, was walking up the railway from Fritchley one dark night when he fell 14 feet over the low wall into the field below and was found dead by his colleagues¹³⁰. This was probably the embankment immediately north of the tunnel.

Hadfields provided the stone breaker and the conveyors were erected in 1903¹³¹, the limestone accumulated under the conveyors filling in the site of the old canal arm. In the same year the heavier rail replaced the remaining light track on the railway¹³².

Baring had taken two years to complete and the capital works were not completed until 1904¹³³. A number of new wagons were purchased, some of which had steel bodies. A list of wagons showed 43 iron “gang wagons” in 1904. There were also an assortment of wooden, iron and steel side and end tipping wagons totalling 26. It is not certain if all of these were in use on the gangroad: some may have been in use at the Wirksworth quarry. 16 limestone wagons also listed may have been in use there as well or could have been standard gauge private owner wagons¹³⁴.

Disposing of the waste at the two quarries created massive tips alongside the railway over the years. There was a large tip beside the old incline up to Hilt’s Quarry parallel to Dimple Lane. This was fed by a siding along the top of the tip from the footpath crossing at the quarry entrance. There were smaller tips to the east of the old quarry and a large rail-connected one just south of the Hat Factory that covered the stream and the site of old buildings. A very large tip was also situated to the north of the new branch to Warner Quarry. This was fed by a steep track up a terrace that survives today. There was a short shunting neck at the south end from where trains reversed onto the top of the tip. There was also a chord, said to have been used to turn locomotives around (Fig.15). A photograph exists that shows either “Fitz” or “Salisbury” climbing the steep incline with a train of five side tipping wagons.

The railway, quarries and limeworks settled down to make the most of the turn of the century investments. In 1908 wages had to be increased because men were leaving to work for the Derwent Valley Water Board¹³⁵. This was a massive project that involved constructing a buried “aqueduct” from the Derwent Valley dams to East Midlands cities. Temporary steam worked narrow gauge railways were built all along the route by the contractors to move construction materials. The aqueduct passed

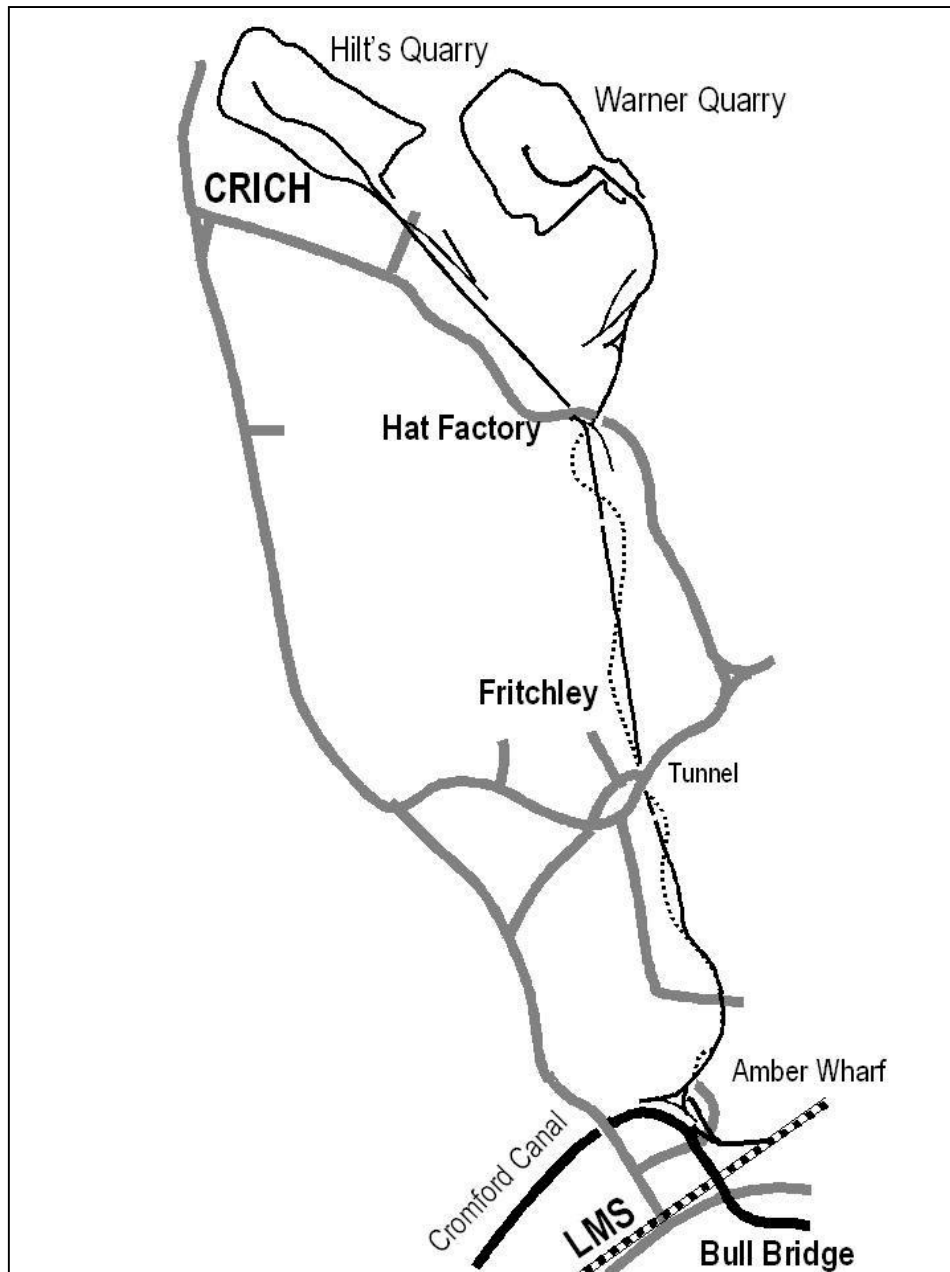


Fig.15. Map of the railway at its fullest extent showing the sidings to tips. Based on the 1916 Ordnance Survey Map.

under the gangroad just north of Bowmer Lane on the short section of original alignment that remained in use. One can still see where a length of the early walling was taken down and carefully restored using the original materials; it remains in very good condition. More wagons were also purchased in 1904¹³⁶. The 1912 accounts show a total of 52 wagons allocated to the limeworks business¹³⁷.

The turn of the century improvements had increased the output of the quarries but it peaked in 1906 and then began to decline again (Fig.16). The maximum output achieved averaged about 200 tons (2.03 tonne) per day.

Further improvements were made to the machinery at Amber Wharf in 1913 and 1914¹³⁸. With the outbreak of war and conscription of men working at the limeworks a new labour force had to be found and this proved to be German and Italian prisoners of war. In 1914, 13 workers employed at the lime works (excluding those men

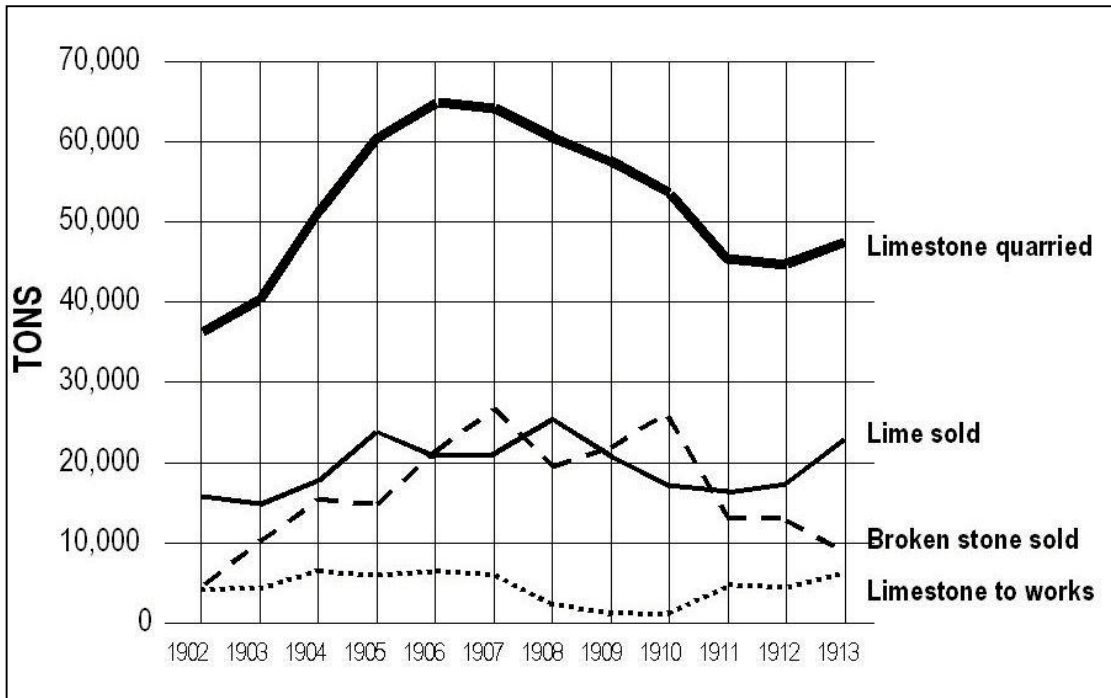


Fig.16. Output from the Crich Limestone Works 1902-1913.

working at Dale Quarry, Wirksworth) joined the army and went to war. The Butterley Co. record indicates three were killed in action – Thomas Coleman, John William Curzon, and George Perry¹³⁹. The German prisoners of war originally worked in the Warner Quarry, where they were camped during the summer, and later were employed at Hilt's. One had previously managed a hotel in Berlin and died before being repatriated: he was buried in Crich but re-interred later¹⁴⁰.

DECLINE, CLOSURE AND NEW USES (1914-1990)

The old vertical boilered locomotive was disposed of during the war. It is reported to have been sitting out of use beside the old Smithy¹⁴¹. It was sold to a dealer, Newton of Flint in 1915¹⁴². The “sale of old engine” was recorded in 1918¹⁴³.

The production of limestone over the years proved to be fairly erratic (Fig.17). Warner Quarry did not live up to expectations, Hilt's continued to be difficult to work and demand was variable. The kilns were closed for a year due to slackness of trade in 1922 and the use of Dale Quarry also terminated.

A contemporary photograph shows horses still shunting standard gauge wagons at Amber Wharf alongside the new machinery tower. A standard gauge locomotive had been acquired for use at Dale Quarry. This was a Peckett four coupled saddletank (0-4-0ST), works number 822 of 1900¹⁴⁴. This was transferred to Bullbridge in 1924 to replace the horses on the standard gauge sidings¹⁴⁵. A locomotive shed was built in order to house it in 1923¹⁴⁶; this was located on the sidings beside the main line. It was brick built with a slate roof an inspection pit and a water tank nearby¹⁴⁷.

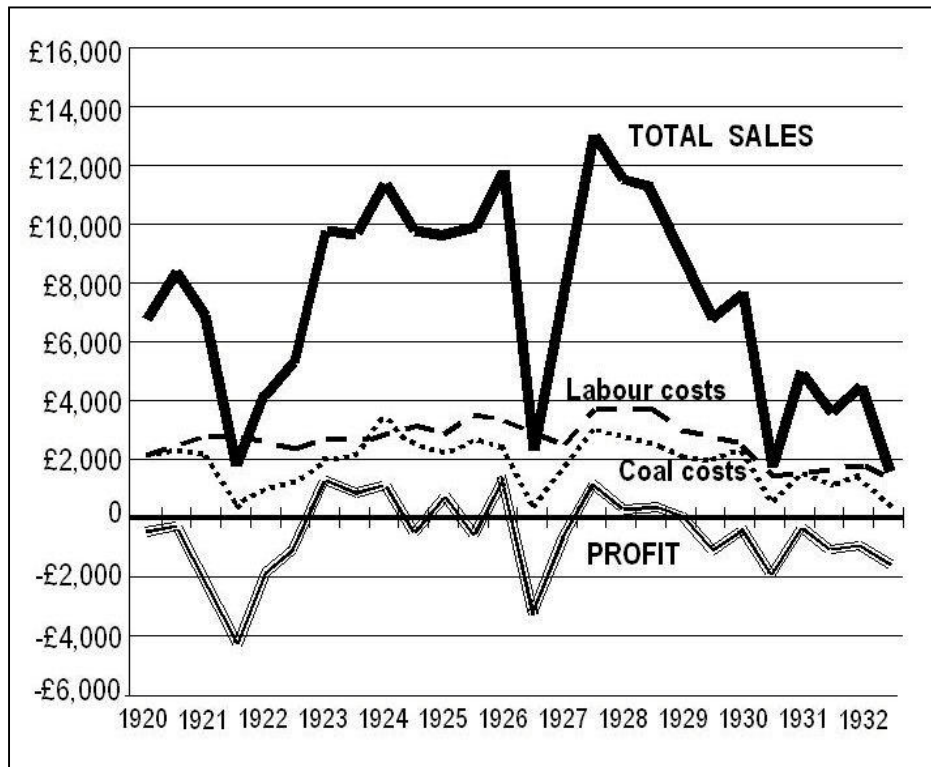


Fig.17. Sales, costs (labour and coal) and profit 1920-1932.

The weighbridge was replaced in 1926¹⁴⁸. A new boiler was purchased for “Salisbury” in 1927 and it was reported that this locomotive now worked most trains¹⁴⁹.

Stan Byard, who was born in 1916, gave the project an account of how the railway operated in its final days. He remembers Hamilton, who was known as “Snush” by the employees but who appear to have respected him. The train from the quarries would terminate at the weighbridge, the full wagons would be left on one siding and the empties picked up from the other. The wagons would then be pushed by hand into the works as required. He identified the horizontal metal tube shown in a photograph as being the riddler, which was steam driven and graded the stone into different sizes. The “Lime drawers” shovelled the burnt lime into wheelbarrows at the base of the kilns. These were then tipped direct into open railway wagons from raised stone platforms beside the standard gauge tracks at the base of the kilns. The wagons had to be quickly sheeted over to protect the contents from rain. Some lime was made use of by local people for whitewashing houses, cleaning toilets etc. Shunting movements took place at night to avoid accidents.

He also remembered a number of buildings at Amber Wharf that have since disappeared. The smithy was a ramshackle building made of “zinc”. There was a brick built office in the standard gauge railway sidings where Sammy Alsop, the clerk managed the daily operations. A wooden footbridge across the east side sidings was used by the workmen to access the site. He remembered horses still in use in the sidings and the arrival of the steam locomotive in 1924. The stables were in the field by the two stone built, tiled roof gunpowder magazines. The old circular stone built summerhouse in the manager’s garden, which some historians have believed was a powder magazine, was actually used during Stan’s time as a toilet by the workmen!¹⁵⁰

The standard gauge locomotive was replaced in 1930 by a similar Peckett 0-4-0ST works number 1669 of 1924 purchased second hand from J. & J.Colman Ltd. of Norwich¹⁵¹.



Fig.18. Postcard c.1930 showing the “Tramway” at Fritchley.

Fig.18 is a postcard published in the early 1930s showing three young children at the Fritchley embankment waiting to wave to the train driver of the descending train from the quarry to the lime works. The memories activity of the Butterley Gangroad Project has identified one of the children as Jane Minard (nee Byard) who still resides in Crich today, the other was her cousin May Swindel. Her father, Jarvis Byard (born 1899) worked as an engine driver in the last 10 years that the works were operational¹⁵². The reopening of Warner Quarry proved unsuccessful and Hilt’s Quarry was worked up to the backs of gardens in the village. In 1933 it was decided to close the limeworks business down. 1000 tons (1016 tonne) of stone that remained at Amber Wharf was subsequently sold. The narrow gauge track was sold for scrap to W.Bush of Alfreton in 1936. The wagons were cut up at the Hat Factory. Ironically photographs taken at the time are the only ones that show details of the wagons used on the line. The standard gauge locomotive was sold in 1937 to the Derbyshire Stone Company and survived at Ashwood Dale until 1957. The two narrow gauge locomotives did not find a buyer and were cut up the following year¹⁵³.

It seems that the track remained in situ until the scrap drive of the Second World War¹⁵⁴. The infrastructure remained and during this period the tunnel at Fritchley was used as an air raid shelter.

Bertram Baxter, an expert on early railways, took photographs of the disused railway in the Fritchley area during 1946. They show the infrastructure still in good condition with no vegetation growth and the sleeper marks still clearly visible¹⁵⁵.

The derelict site at Amber Wharf became an adventure playground for local children.¹⁵⁶

From 1950 Hilt's Quarry began to be used as a municipal rubbish tip. As late as 1960 the Butterley Company was thinking about re-using the railway. Their idea was to dispose of power station fly ash in the two quarries, bringing it by train to re-laid sidings at Bullbridge. The means of transport between the wharf and the quarries was now to be by pipeline but presumably using the railway right-of-way¹⁵⁷.

In 1961 the company sold the quarries, wharf and the whole railway route to New Birchwood Properties for £7000¹⁵⁸. The Amber Wharf area was developed by Gerald Crane from 1965¹⁵⁹. However most of the old buildings and industrial archaeology, such as the ruined kilns, survived among the new houses. Derbyshire County Council obtained the Warner Quarry and the old route from Dimple Lane for use as a landfill site in 1983.

Alfred Tomes purchased 700 yards (640m) north of the tunnel as a means of extending his garden over the approach cutting. This purchase included the embankment at Fritchley, which by 1976 was in poor condition. Local people paid him a small amount each year in order to use the railway as a private footpath. The Arkwright Society considered a restoration project and carried out some practical work but Mr. Tomes himself went on to restore the embankment to its present excellent condition.

Fritchley tunnel has been filled in at both ends and the bridge under Dimple Lane has been removed (although the ironwork has been rescued). Apart from this most of the rest of the railway has survived remarkably well, including some remains of the original 1793 alignment.

ACKNOWLEDGEMENTS

The authors wish to thank the officers of the Derbyshire Archaeological Society for their interest and assistance with the project and also Dudley Fowkes and Ian Mitchell for their direct involvement. This paper also draws on information supplied by Graeme Bickerdike, Jenny Bunting, John Gabb, Philip Gilks, Eric and Denise Grace, Peter Harris, Dieter Hopkin, Robin Jeffcoat, Mary John, Horace Key, Robert Larimore, Martin Long, Philip Riden, Stuart Saint, Eric Singleton, David Smith, Peter Smith, Martyn Taylor-Cockayne and Ian Thomas among others. It has also made use of the hard work undertaken by Freda Raphael collecting and transcribing memories.

We also wish to thank the landowners who kindly allowed access to their land in order to make investigations as well as the Friends of Cromford Canal, Wessex Archaeology, the Bullbridge and Sawmills Association, Crich Parish Council, Crich Heritage Partnership, the Derwent Valley Mills World Heritage Site, the Glebe Field Centre and finally the Heritage Lottery Fund without which this research would never have taken place.

ILLUSTRATIONS

Fig.1. Map of branch railways serving the Cromford Canal pre-1839, based on Sanderson's Map of 25 Miles around Mansfield, the first edition Ordnance Survey 1 inch to 1 mile Map and other sources.

Fig.2. Plate rail from another early Outram line at Codnor Park, kindly donated to the Butterley Gangroad Project by the Portland Path Project. The rail weighs 38lb (17.2kg).

Fig.3. Comparative views of the old and new alignments looking north from just south of Fritchley village (OS Grid Ref. SK358529). The image on the left¹⁶⁰ was taken in 1946 and shows an occupation bridge and the tunnel in the distance on the new alignment. The right image was taken in 2014 from about 50m to the east and shows the formation of the earlier alignment.

Fig.4. Map of the lands where limestone extraction took place c.1800, based on a contemporary plan by John Nuttall.

Fig.5. Map of the Crich Gang Road as built.

Fig.6. Plan of Amber Wharf 1805 based on the plan attached to the lease of Edward Banks and Co. and other known information.

Fig.7. Brunton's Horse.

Fig.8. Map of Fritchley showing the tunnel 1839. A detail from the larger plan of Crich parish prepared by John Bromley of Derby for the Crich Poor Rate Assessment. Reproduced with permission of the Derbyshire Record Office and the Rev.P.Brooks, Vicar of Crich.

Fig.9. Plans of the Hat Factory area 1839 and 1849 based on Bromley's map (see Fig.8) and the Crich Tithe map.

Fig.10. Map of the Butterley Gangroad c.1860 showing the old and new alignments and the route of the Midland Railway Crich branch proposal of 1846.

Fig.11. Diagram showing the possible transition arrangement between the plateway and the later railway track.

Fig.12. The Hat Factory area as shown on the 1880 Ordnance Survey 25inches to one mile map.

Fig.13. The Amber Wharf area as shown on the 1880 Ordnance Survey 25inches to one mile map.

Fig.14. The Amber Wharf area as shown on the 1900 Ordnance Survey 25inches to one mile map.

Fig.15. Map of the railway at its fullest extent showing the sidings to tips. Based on the 1916 Ordnance Survey Map.

Fig.16. Output from the Crich Limestone Works 1902-1913.

Fig.17. Sales, costs (labour and coal) and profit 1920-1932.

Fig.18. Postcard c.1930 showing the "Tramway" at Fritchley.

NOTES AND REFERENCES

- ¹ National Archives, Public Record Office, RAIL 803, Letter from Benjamin Outram to the Ashby Canal Company, 3/12/1799.
- ² Riden, P.J. "The Butterley Company and Railway Construction, 1790-1830", Transport History vol.6 No.1 (March 1973), pp.30-52 (David and Charles, Newton Abbot).
- ³ The term "Crich Gang Road" is found from 1796 in an early ledger of Benjamin Outram and Company, Derbyshire Record Office D5974-5-1. Outram, Farey and others referred to it as a railway. The first use of the name "Butterley Gangroad" that we have found is in the "Dowie" book, see note 6. The word "gang" was used by Outram and others to mean a train on these early railways.
- ⁴ Farey, J. "A General View of the Agriculture and Minerals of Derbyshire" Vol.2, 1813. pp 338-340.
- ⁵ Cowlshaw, R. "The Crich Mineral Railways", 20/3/1959 with addendum. Presentation notes.
- ⁶ Cowlshaw, A.R, Price, J.H., Tebb, R.G.P., "The Crich Mineral Railways", (Tramway Publications, Crich, 1st Edition 1971).
- ⁷ Baxter.B, "Stone Blocks and Iron Rails" (David and Charles, Newton Abbot 1966) p 67, this shows a list of "railway tunnels built up to about 1828". The Stodhart tunnel at Chapel Milton on the Peak Forest Tramway is first on the list and Baxter dated it as 1796 although construction began on the tramway in 1795 and it was not opened for traffic until 1799. The list also shows a number of tunnels on other non-public railways like the Crich Gang Road so clearly Baxter had seen the Fritchley tunnel as being a bridge. He photographed it in 1946, see note 159. The next three tunnels on Baxter's list were on the Ashby Canal Railway at Ticknall in South Derbyshire and were dated 1803. Perhaps significantly all these early tunnels were engineered by Outram.
- ⁸ RCHS Photographic Archive, op.cit. Baxter collection image 20413
- ⁹ Riden.P.J. "The Butterley Company 1790-1830", (Published by the Author 1973). 2nd edition 1990 (Derbyshire Record Society, Chesterfield).
- ¹⁰ Derbyshire Record Office D5974/3/1.
- ¹¹ DRO D5974/4/1, D5974/5/1, D5974/6/1, D5974/7/1, D5974/8/1.
- ¹² DRO D5974/5/1
- ¹³ "Fritchley Railway Tunnel, Fritchley, Derbyshire, Archaeological Evaluation and Buildings Survey", (Wessex Archaeology, Sheffield April 2013) Ref. 89010.01 External draft version.
- ¹⁴ Harris,P and Bickerdike,G, "Fritchley Tunnel", Report for the Panel for Historical Engineering Works, 2013.
- ¹⁵ Benjamin Outram refers to his plateways as "railways" in his letters. Contemporary descriptions use the word "tramroad" referring to the simple wagons then called "trams". By the 1820s the word "railway" was being used to distinguish lines that used edge rails from "tramroads" which used plateway technology. From the 1830s the new generation of steam worked public railways were known as railways and the term "tramway" began to be used to describe any industrial railways of lighter construction. Some historians have continued to use "tramroads" to distinguish plateways from other industrial tramways. The terms "Gangroad" and "Gangway" are peculiar to the Derbyshire area.
- ¹⁶ Riden.P.J. op.cit. pp12-15.
- ¹⁷ From a datestone "B.O. 1791 reset on a later blast furnace, the transfer from the original blast furnace is noted in reference 93.
- ¹⁸ Lindsay.J. "The Butterley coal and ironworks, 1792-1816", Derbyshire Archaeological Journal, 85 (1965) p 27.
- ¹⁹ Cooper.B, "Transformation of a valley – the Derbyshire Derwent", Heinemann 1983, p 192.
- ²⁰ DRO D503-64-1, summary of mineral leases, leases 1 and 1A.
- ²¹ Riden.P.J. p 12. He refers to "The Estates of the Butterley Company Limited, Abstract of Conveyances with references to Estate Plans" (2 MS vols), which is no longer available.
- ²² Derby Mercury 25/4/1793. "Crich Lime Kilns :This is to give notice, that lime at Crich kilns will be sold, this present year, at the following rate of one shilling and seven pence per quarter ready money; until Christmas then to be at the rate of one shilling and eight pence per quarter; and after that time, at the rate of one shilling and ten pence per quarter. WM Rowe, Geo. Young, C. Silvester, Daniel Heapy, John Gibbins, Tho. Beardsley, April 20, 1793.
- ²³ Derby Mercury 24/10/1793
- ²⁴ Farey, J. op.cit. Vol.2, 1813. pp 338-40.
- ²⁵ DRO D5974/5/1. Ledger 1793-1800. p 4.
- ²⁶ See Fig.9.

- ²⁷ Cross section dimensions from Wessex Archaeology laser survey 2013, length estimated from map data.
- ²⁸ Harris,P and Bickerdike,G, op.cit.
- ²⁹ 29 Geo.III,c.74, 1789.
- ³⁰ Payments for rents associated with leases are given in DRO D5974/5/1 pp 40,65, from 1796. Part of the old alignment, just north of Bowmer Lane, remained leased until after the eventual closure of the railway, see ref. 87.
- ³¹ The supply of rails to the Little Eaton line is recorded in the minute book of the Derby Canal Company for December 1793, which is held by Elliot Mather, Solicitors, Friargate Derby. An advertisement for oak sleepers for this line: Lincoln and Stamford Mercury 16/8/1793. See also Boyes.G and Lamb. B, “The Peak Forest Canal and Railway” Railway and Canal Historical Society, 2012, p 94.
- ³² DRO D5974/5/1, folios 111 and 129.
- ³³ Ibid, folio 105.
- ³⁴ Ibid, folio 75.
- ³⁵ National Archives , Public Record Office, RAIL 803, Letter from Benjamin Outram to the Ashby Canal Company, 3/12/1799.
- ³⁶ “Fritchley Railway Tunnel, Fritchley, Derbyshire, Archaeological Evaluation and Buildings Survey.”op.cit.
- ³⁷ Ibid
- ³⁸ Outram.B., “Minutes to be Observed in the Construction of Rail-ways”, Recreations in Agriculture, iv (1801).
- ³⁹ DRO D5974/3/1, Butterley Co. Letterbook, 9/5/1797.
- ⁴⁰ Based on estimated height difference of 60m (using original ground level at wharf) and an estimated length of 1760m using “Google Earth”.
- ⁴¹ Ripley.D. “The Peak Forest Tramway”, Oakwood Press, 1972 p 11.
- ⁴² Ripley.D. “The Little Eaton Gangway and Derby Canal”, Oakwood Press, 2nd ed. 1993, pp25-6.
- ⁴³ DRO D5974/3/1, Butterley Co. Letterbook
- ⁴⁴ Ibid
- ⁴⁵ DRO 5974/5/1, folio 150.
- ⁴⁶ DRO D5974/3/1.
- ⁴⁷ DRO D5974/5/1, folio 105
- ⁴⁸ DRO D5974/5/1, folio 73
- ⁴⁹ DRO D503/41/1, furnace ledger B, folios 61 and 108
- ⁵⁰ DRO D503/35/5, Account book (1802/3). Final page is a summary that includes “To what paid Tipping for new Railway Tunnel and opening Crich Limestone Quarry”.
- ⁵¹ Scaled from the 1880 25 inch to 1 mile OS map.
- ⁵² Farey (see note 4) referred to this work but said that it occurred in 1808, clearly an error because apart from the ledger references it is shown as opened out in the 1805 plan (ref. 54)
- ⁵³ DRO D503/35/5
- ⁵⁴ Lindsay.J, op.cit., referring to a now lost document.
- ⁵⁵ DRO D503/1/17
- ⁵⁶ The lease mentions these three limekilns, a kiln yard, stages and three iron wagons associated with them. These may have been wagons that ran into each kiln at the base when the burnt lime was withdrawn.
- ⁵⁷ The lease also mentions basins, stages, pens and “machines” associated with the wharf and later on describes these machines as “tipping frames”. The “rails for a stage” that Robert Tipping had purchased in 1803 may have been for one of these.
- ⁵⁸ This was probably the point at which the railway from the quarry divided to serve both the tipping area and the kilns and so would have been a suitable location for a weighbridge. Compare the similar arrangement that existed by the toll collector’s house on the Ticknall Tramway until 1913.
- ⁵⁹ Riden.P.J. op.cit. p 34
- ⁶⁰ Ibid, p.92.
- ⁶¹ DRO D503/42/1, Furnace ledger, folio 584
- ⁶² DRO D503/42/2, Furnace ledger, folio 11
- ⁶³ Ibid, folio 62
- ⁶⁴ Hopkin.D, “William Brunton’s walking engines and the Crich rail-road”, in the papers from the 5th. International Early Railways Conference, Caernarvon,2012, publication pending.
- ⁶⁵ Farey, J. op.cit. pp 422-3

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- ⁶⁶ DRO Q/AM/41
- ⁶⁷ DRO D503/67/1, schedule and valuation of Butterley Company property.
- ⁶⁸ DRO D1281/2/P1-2, Map and schedule.
- ⁶⁹ Marshall, J, "The Cromford and High Peak Railway", David and Charles 1982, p 11.
- ⁷⁰ DRO Q/RP2/7
- ⁷¹ NA RAIL 530/39 North Midland Railway Land plans
- ⁷² The Crich Tithe Map and Schedule of 1849 (ref.86) shows that the Butterley Company had acquired land owned by Samuel Travis on the 1839 map (ref.67).
- ⁷³ DRO D503/14/1, Management report of September 1894 refers to this.
- ⁷⁴ DRO D503/42/4, folio 421
- ⁷⁵ Ibid
- ⁷⁶ Stretton, "The History of the Midland Railway", (1901), Chapter 7
- ⁷⁷ Taylor-Cockayne M., Saint S., Hill. D, op.cit.
- ⁷⁸ Hansard vol.79 cc 375
- ⁷⁹ Taylor-Cockayne M., Saint S., Hill. D, "The Portland Path", Portland Path Project (2012)
- ⁸⁰ Stretton, op.cit. Chapter 8.
- ⁸¹ Stretton, op.cit. Chapter 10
- ⁸² London Gazette, Issue 20540, pp5761-3 (22/11/1845)
- ⁸³ DRO Q/RP2/34
- ⁸⁴ House of Lords Archives HL/PO/PB/1/1846/9&10V1n133: (chapter 102): An Act to empower the Midland Railway Company to make a Railway from Pye Bridge to the Clay Cross Station of the Midland Railway and a Branch in the Parish of Crich
- ⁸⁵ HL/PO/PB/1/1846/9&10V1n195: (chapter 56): An Act to empower the Midland Railway Company to make several Branches from the Erewash Valley Railway
- ⁸⁶ DRO D503/42/4, folio 640 shows payments to William Haynes (1844), William Lynam (1845) and Joseph Leam (1849) for land on the new alignment.
- ⁸⁷ NA IR 30/8/65
- ⁸⁸ From a plan attached to "Abstract of the Title of New Birchwood Properties Limited 1965 to land at Crich in the County of Derby" (copy obtained by the Butterley Gangroad Project team)
- ⁸⁹ DRO D503/74/2
- ⁹⁰ DRO D503/42/4, folio 940
- ⁹¹ NA RAIL 491/91. Midland Railway Way and Works Committee No.2.
- ⁹² Jones.F, Lodge.T. "Butterley Locomotives", Industrial Railway Record 138, (Industrial Railway Society September 1994)
- ⁹³ Abbott, R.A.S. "Vertical boiler locomotives and rail motors built in Great Britain", Oakwood Press, Oxford (1989) pp34-42.
- ⁹⁴ "A Visit to the Works of the Butterley Company", Machinery Market, 1st March 1886, p 22
- ⁹⁵ In a family letter recalling life in Fritchley before 1913 that is in the possession of Ian and Jean Tomes.
- ⁹⁶ "A Visit to the Works of the Butterley Company", op.cit.
- ⁹⁷ DRO D503/8/11 Item 2, Butterley Company Minute Books 1888-1905, 12/11/1889.
- ⁹⁸ DRO D503/8/11 Item 1, Butterley Company Minute Books 1878-1888, 17/12/1878.
- ⁹⁹ DRO D503/8/11 Item 2, Butterley Company Minute Books 1888-1905, 5/9/1893.
- ¹⁰⁰ In income or wealth terms..
- ¹⁰¹ DRO D503/8/11 Item 2, Butterley Company Minute Books 1888-1905, 9/6/1896. In the 1901 census John Henry Day is recorded living with his wife and four children in Albert Street, Belper and working as a clerk and by 1911 he had moved with his wife to Liverpool and was living with his sister-in-law and working as an accountant.
- ¹⁰² DRO D503/8/11 Item 2, Butterley Company Minute Books 1888-1905, 14/11/1893
- ¹⁰³ DRO D503/14/1
- ¹⁰⁴ DRO D5974/3/1, Letter Benjamin Outram to John Chilton, 22/4/1797.
- ¹⁰⁵ DRO D503/8/11 Item 2, Butterley Company Minute Books 1888-1905, 13/2/1894.
- ¹⁰⁶ Cowlshaw, A.R, Price, J.H., Tebb, R.G.P. "The Crich Mineral Railways", (Tramway Publications, Crich, 1976 Edition). p10.
- ¹⁰⁷ DRO D503/14/1
- ¹⁰⁸ Watkins.A, "The Manor of Crich", (1952).Ms.p33
- ¹⁰⁹ DRO D503/8/11 Item 2, Butterley Company Minute Books 1888-1905, 12/11/1895 and D503/37/1.
- ¹¹⁰ DRO D503/8/11 Item 2, Butterley Company Minute Books 1888-1905, 8/9/1896.
- ¹¹¹ DRO D503/8/11 Item 2, Butterley Company Minute Books 1888-1905, 18/11/1896 and D503/37/1.

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- ¹¹² DRO D503/37/1, folio 320
- ¹¹³ DRO, D503/8/11 Item 2, Butterley Company Minute Books 1888-1905, 12/1/1897, 9/3/1897, 13/4/1897, 7/9/1897, 5/10/1897.
- ¹¹⁴ DRO D503/8/11 Item 2, Butterley Company Minute Books 1888-1905, 8/3/1898, 12/4/1898, 14/6/1898.
- ¹¹⁵ DRO D503/8/11 Item 2, Butterley Company Minute Books 1888-1905, 14/3/1899.
- ¹¹⁶ Photographs show a distinct change in the stonework at a level above the older kilns, e.g. "Picture the Past" image DMAG 100177.
- ¹¹⁷ DRO D503/8/11 Item 2, Butterley Company Minute Books 1888-1905, 13/6/1899.
- ¹¹⁸ DRO D503/8/11 Item 2, Butterley Company Minute Books 1888-1905, 14/11/1899.
- ¹¹⁹ DRO D505/72/2, contract between the Butterley Company and Bott and Lewis 30/10/1899.
- ¹²⁰ DRO D503/8/11 Item 2, Butterley Company Minute Books 1888-1905, 12/6/1900..
- ¹²¹ DRO D503/37/1
- ¹²² A Midland Railway wagon label has been found in the ruin of this building suggesting that this may have been where traffic was sorted and consigned.
- ¹²³ DRO D503/14/1
- ¹²⁴ Cowlshaw, A.R, Price, J.H., Tebb, R.G.P. "The Crich Mineral Railways", (Tramway Publications, Crich, 1976 Edition). pp 11-12.
- ¹²⁵ DRO D503/14/1
- ¹²⁶ DRO D503/8/11 Item 2, Butterley Company Minute Books 1888-1905, 11/6/1901.
- ¹²⁷ DRO D503/14/1
- ¹²⁸ DRO D503/8/11 Item 2, Butterley Company Minute Books 1888-1905, 13/5/1902.
- ¹²⁹ DRO D503/38/6 p59. List of drawings relative to the Bull Bridge Lime Works 1894-1921. The actual drawings have not been found.
- ¹³⁰ Derbyshire Times and Chesterfield Herald 16 August 1902
- ¹³¹ DRO D503/8/11 Item 2, Butterley Company Minute Books 1888-1905, 7/8/1903.
- ¹³² DRO D503/14/1
- ¹³³ DRO D503/8/11 Item 2, Butterley Company Minute Books 1888-1905, 14/6/1904.
- ¹³⁴ DRO D503/37/1, p 461.
- ¹³⁵ DRO D503/14/1
- ¹³⁶ *ibid*
- ¹³⁷ DRO D503/37/1 p225
- ¹³⁸ DRO D503/37/1
- ¹³⁹ DRO D503/82/25
- ¹⁴⁰ Handed down memories of Patrick Cooke (born 1944), recorded and transcribed by Freda Raphael.
- ¹⁴¹ Cowlshaw, A.R, Price, J.H., Tebb, R.G.P.op.cit. p 12.
- ¹⁴² Pocket Book No.2, "Industrial Locomotives of the East Midlands", Birmingham Locomotive Club 1947.
- ¹⁴³ DRO D503/37/1
- ¹⁴⁴ Pocket Book No.2, op.cit.
- ¹⁴⁵ Cowlshaw, A.R, Price, J.H., Tebb, R.G.P.op.cit. p 37.
- ¹⁴⁶ DRO D503/37/1
- ¹⁴⁷ This building survived until the 1960s and this description is compiled from memories of local residents recorded and transcribed for this project by Freda Raphael.
- ¹⁴⁸ DRO D503/37/1
- ¹⁴⁹ Cowlshaw, A.R, Price, J.H., Tebb, R.G.P.op.cit. p 12.
- ¹⁵⁰ Memories of Stan Byard, born 1916, recorded and transcribed for the project by Freda Raphael.
- ¹⁵¹ Pocket Book No.2, op.cit., Cowlshaw, A.R, Price, J.H., Tebb, R.G.P. op.cit. p 37.
- ¹⁵² Memories of Jane Minard, born 1925, recorded and transcribed for the project by Freda Raphael.
- ¹⁵³ Pocket Book No.2, op.cit., Cowlshaw, A.R, Price, J.H., Tebb, R.G.P. op.cit. pp12,13,37.
- ¹⁵⁴ Mary Stevenson remembers that the track was still in situ into the 1940s. Memories recorded and transcribed for the project by Freda Raphael.
- ¹⁵⁵ RCHS Photographic Archive, Baxter collection images 20412-7, accessible online via www.rchs.org.uk (accessed June 2014).
- ¹⁵⁶ Memories of Tony Elliot, born 1941, recorded and transcribed by Freda Raphael.
- ¹⁵⁷ Various newspaper articles 1960/1, collected by B.Key, sources not recorded.
- ¹⁵⁸ See note 87, same source.
- ¹⁵⁹ Newspaper article, collected by B.Key, source not recorded.
- ¹⁶⁰ RCHS Photographic Archive, op.cit. Baxter collection image 20413