= Everard Calthrop =

Everard Richard Calthrop (3 March 1857 ? 30 March 1927) was a British railway engineer and inventor . Calthrop was a notable promoter and builder of narrow gauge railways , especially of 2 ft 6 in (762 mm) narrow gauge , and was especially prominent in India . His most notable achievement was the Barsi Light Railway ; however he is best known in his home country for the Leek and Manifold Valley Light Railway . Calthrop has been described as a " railway genius " . Later in life he took an interest in aviation , patenting some early designs for parachutes .

= = Early life and career = =

Calthrop was born on 3 March 1857 , the eldest son of farmer Everard Calthrop . He had six brothers , one of whom was Sir Guy Calthrop , general manager of the London & North Western Railway . The family lived at Deeping Fen , Lincolnshire , where Calthrop was born , and later at Sutton in the Isle of Ely . Calthrop was educated at Uppingham School .

Calthrop started work with Robert Stephenson & Co and then was apprenticed to the London & North Western Railway at Crewe in 1874 . In 1879 he joined the Great Western Railway , where he rose to assistant manager of the Carriage and Wagon Works . In 1882 he went to India to join the Great Indian Peninsula Railway as a locomotive inspector .

Once in India , Calthrop came to see narrow gauge railways as a way to help develop the country . This led him to chairing a Government committee to investigate light railways throughout India . He then published a pamphlet entitled A System of Standard Details as applied to the Construction of Rolling Stock in India . As a result of this pamphlet , the Indian Government adopted systems of uniformity of gauge and equipment throughout the country , and eventually adopted 2 ft 6 in (762 mm) gauge as the standard narrow gauge throughout the country .

Calthrop requested leave in 1886 to investigate proposals for independent branchlines . He identified two schemes of particular interest , a 5 @-@ mile (8 km) tramway connecting the Hindu religious centre of Nasik with the railway , and a 21 @-@ mile (34 km) branchline to the town of Barsi . The Great Indian Peninsula Railway approved both schemes , and Calthrop undertook a survey of both lines . In 1887 he registered the Indian Railways Feeder Lines Company in London to promote the construction of feeders to the railway . The Great Indian Peninsula Railway suggested that he either return to his duties as a locomotive inspector , or , with their support , resign to further promote branch lines . His health was failing , and so in 1889 Calthrop resigned from the Great Indian Peninsula Railway . Working as a consultant he then supervised the construction of the 2 ft 6 in (762 mm) gauge horse @-@ powered Nasik Tramway , using his previous survey .

= = Move to Liverpool = =

Returning to the United Kingdom in 1892 Calthrop established a railway engineering consulting practice in Liverpool , where three of his brothers had started a stockfeed company . Soon Calthrop had entered into a partnership with them and spent much of the next two years designing equipment for feed production . He took out a number of patents relating to the equipment and to refrigerated transport .

While Calthrop was resident in Liverpool the Chamber of Commerce was concerned future expansion was being limited by the railway companies that linked that city with Manchester , and invited proposals for alternative methods for moving goods . Calthrop proposed a system of narrow gauge railways linking the two cities , running along streets directly serving factories . His proposal was highly commended , but the proposed street running precluded its adoption .

Calthrop was also interested in road transport . He was a member of the Self @-@ Propelled Traffic Association and in May 1898 was a judge at their trials for " motor vehicles for heavy traffic " , held in Liverpool . The winner was a Thornycroft 4 @-@ ton steam wagon . Later he was a foundation member of the Royal Automobile Club .

= = Development of narrow gauge concepts and the Barsi Light Railway = =

During his time in India Calthrop developed his ideas on the construction of narrow gauge railways . He surmised that the axle load on the axles of all rolling stock , including locomotives , could be equal , allowing a maximum loading of goods wagons . He settled on a loading of 5 long tons (5 @.@ 1 t ; 5 @.@ 6 short tons) per axle , which was light enough to allow railway lines to be built with 30 pounds per yard (14 @.@ 9 kilograms per metre) rail . It also allowed the loading of one 20 long tons (20 @.@ 3 t ; 22 @.@ 4 short tons) capacity 4 @-@ wheel standard gauge wagon to be carried on a single bogie narrow gauge wagon . Further , he argued that using a track gauge of 2 ft 6 in (762 mm) gave the greatest capacity as a percentage of capital cost . He estimated a 2 ft 6 in (762 mm) gauge railway could be built to four times the length of a standard gauge railway for the same capital cost .

Calthrop had been engaged in negotiations with the Indian government for concessions to build a railway from Barsi Road to Barsi since 1887 . In 1895 negotiations reached a satisfactory conclusion , and Calthrop formed a new company to build the Barsi Light Railway , and employed himself as consulting engineer . The railway became a showcase for his ideas . Five 0 @-@ 8 @-@ 4T locomotives , with even distribution of axle load , were constructed to Calthrop 's specification by Kitson & Co . The goods rolling stock was constructed on common 25 by 7 feet (7 @.@ 6 m × 2 @.@ 1 m) pressed steel underframes , reducing tare weight and maximising potential wagon loads . Calthrop recognised the importance of railways in warfare , and designed the rolling stock to facilitate the movement of troops and equipment . Rolling stock rode on pressed @-@ steel Fox bogies , using the Timmis system of double coiled springs . The line was constructed with rail inclination , then a new idea , which involves tilting the rail a few degrees to make its surface more nearly parallel with that of the tyre . Inclination is now applied universally to railways . The rolling stock could accept 100 @-@ foot (30 @.@ 48 m) radius curves .

Prior to shipment of the rolling stock to India , Calthrop and the Leeds Forge Company , manufacturer of the rolling stock , conducted tests on a specially built test track located at Newlay , near Leeds . The line was opened for inspection by railway officials and journalists , and a number of reports were published in the technical railway press .

The Barsi Light Railway opened in 1897 , and was extended on a number of occasions until it reached a total length of 202 miles (325 km) in 1927 . The example of the Barsi Light Railway is regarded as having revolutionised the narrow gauge railway system of Indian subcontinent , and the railway was immensely successful , establishing Calthrop as one of the leading figures in the field . Calthrop remained Consulting Engineer until he retired due to ill health two years prior to his death . The Barsi Light Railway continued to be operated as a privately owned railway until 1954 when it was purchased by the Indian government , and continued to operate as a narrow gauge railway until conversion to broad gauge began in the late 1990s as part of Indian Railways conversion program for all metre and narrow gauge lines .

= = Involvement in other railways = =

With the success of the Barsi Light Railway , Calthrop was in demand as a consultant for other narrow gauge railway projects .

= = = Barbados Railway = = =

The Barbados Railway opened in 1883 as a 3 ft 6 in (1 @,@ 067 mm) gauge railway from Bridgetown to St Andrew , Barbados . By 1897 the railway and its rolling stock was in very poor condition . Further much of the railway had been constructed with rail too light for the railway 's locomotives . A new company was established in 1898 to rebuild and operate the railway , and Calthrop was engaged as consulting engineer . Calthrop arranged for the railway to be rebuilt in 2 ft 6 in (762 mm) gauge , and had Baldwin Locomotive Works build four new locomotives , two 2 @-@ 8 @-@ 2T 's , an 2 @-@ 6 @-@ 0T and an 0 @-@ 6 @-@ 0T .

= = = Welshpool and Llanfair Light Railway = = =

Calthrop appeared at the Light Railway Inquiry for the Welshpool and Llanfair Light Railway on 3 ? 4 August 1897 and spoke particularly on the proposed open level crossings and the use of transporter wagons . Calthrop claimed it only took 3 minutes to transfer wagons , based on his experience on the Barsi Light Railway . However the Order was not made until 8 September 1899 and in early 1900 the proprietors reached agreement with the Cambrian Railways to build the line . Their engineer , Alfred J. Collins , took charge of the engineering requirements , with consequent conservative 4 @-@ wheel wagons and other provisions .

= = = Victorian Railways narrow gauge lines = = =

In 1898 Calthrop corresponded with the government of the colony of Victoria , Australia , regarding proposals for the construction of narrow gauge lines in that colony . Subsequently on his advice the gauge of the railways as built was changed from 2 ft (610 mm) to 2 ft 6 in (762 mm) .

= = = Fayoum Light Railway = = =

Calthrop was appointed to advise on engineering matters for this 750 mm (2 ft 5 1 ? 2 in) gauge Egyptian light railway , construction of which began in 1898 . The railway comprised seven , mostly roadside , branch lines with a total length of 97 miles (156 km) . The Fayoum Light Railway served an irrigation district south of Cairo , centred on the provincial capital of Medinet @-@ el @-@ Fayum . Calthrop used pictures of rolling stock from the railway to illustrate a chapter he wrote for the book Pioneer Irrigation and Light Railways .

= = = Serbian Narrow Gauge Railways = = =

Calthrop was one of several foreign concessionaires involved with the initial development of 760 mm (2 ft 5 15 ? 16 in) Bosnian gauge gauge railways in Serbia after 1898 .

= = = Cleobury Mortimer and Ditton Priors Light Railway = = =

The Cleobury Mortimer and Ditton Priors Light Railway was a 12 @.@ 3 @-@ mile (19 @.@ 8 km) long standard gauge branch line linking the Great Western Railway at Cleobury Mortimer in Shropshire with mineral deposits in the Clee Hills . Calthrop was appointed Consulting Engineer in 1900 , responsible for surveying the route and preparing the construction plans .

= = = Leek and Manifold Valley Light Railway = = =

In the United Kingdom Calthrop is most associated with the Leek and Manifold Valley Light Railway . The line had been promoted under the Light Railways Act , and the initial plan was to build a railway of 2 ft 6 in (762 mm) gauge to be powered by electricity . Under the influence of one of the Light Railway Commissioners the company directors commissioned a report on the proposed line from Calthrop in mid @-@ 1900 . In early December the railway 's engineer died , and on 19 December 1900 the Directors sat down to consider both a replacement and Calthrop 's report . Calthrop proposed specifications for the line which would result in substantial savings in construction costs , and so he was offered the position of engineer , which he promptly accepted .

Calthrop constructed the line for £ 35 @,@ 944 , £ 11 @,@ 000 less than the original estimate . He had Kitson & Co construct two 2 @-@ 6 @-@ 4T locomotives , similar in outline but smaller than the Barsi Light Railway locomotives . Goods rolling stock included four coaches , two bogie open wagons and one bogie van , once again similar to Barsi stock . He also introduced four transporter wagons , designed to transport standard gauge wagons . Each station on route had a short section

of standard gauge track where the wagons could be placed . The use of transporter wagons eliminated transshipment , and removed the need for large numbers of goods wagons .

= = = Matheran Light Railway = = =

The Matheran Light Railway is a mountain railway near Mumbai , India , and opened in 1905 . Unusually for a railway for which Caltrhrop was consulting engineer , it was of 2 ft (610 mm) gauge , with tight curves and 1 in 20 (5 %) grades . Calthrop designed a 0 @-@ 6 @-@ 0T with Klein @-@ Linder articulated coupled axles to provide a flexible wheelbase , and four were supplied by Orenstein & Koppel . Calthrop 's firm also supplied the wagon stock and the points and crossings for the railway .

= = = Arakan Light Railway = = =

In 1910 Calthrop was engaged as consulting engineer by the promoters of a new railway between Buthidaung and Maungdaw in Burma , later known as the Arakan Light Railway . Calthrop had the proposed gauge changed from 2 ft (610 mm) narrow gauge to 2 ft 6 in (762 mm) narrow gauge . For this railway Calthrop had built two 0 @-@ 6 @-@ 0 + 0 @-@ 6 @-@ 0 Garratt locomotives , to which he had attached plates reading " E.R.Calthrop 's System of Narrow Gauge Mountain Railways " . Calthrop was an early adopter of the Garratt type , this being the ninth order for Garratts taken by Beyer @-@ Peacock , and the smallest Garratt design ever built by them .

= = Patents for parachutes = =

Calthrop was a close personal friend of Charles Rolls , of Rolls @-@ Royce fame . Rolls was a pioneer aviator , being the first man to fly across the English Channel in both directions . On 12 July 1910 Calthrop accompanied him to the Bournemouth International Aviation Meeting , and was present when Rolls died after he lost control of his biplane and crashed . That and a similar , non @-@ fatal , accident involving his son Tev , led Calthrop to believe that a parachute could be used to save pilots in similar circumstances .

In 1913 he patented his first parachute . As World War I progressed he continued to develop his parachute . In 1915 he offered it to the Royal Flying Corps , and successful tests were completed at the time . An unofficial report offered the opinion that parachutes " might impair the fighting spirit of pilots " and the offer was rejected . Calthrop was encouraged to remain quiet about his invention , but faced with increasing losses of pilots he publicised the parachute in 1917 . Despite a campaign by some pilots , the Royal Flying Corps declined to introduce parachutes during World War One , although air forces of most other nations did so .

Calthrops " Guardian Angel " parachute received much praise and was used during the war to drop agents behind enemy lines . In October 1918 an article on use of parachutes stated that the " Guardian Angel " was one of the best known and that " balloonists can take their perilous leap , when attacked by a Hun scout , with real confidence in a safe landing " . By 1918 it was known that the Germans were fully aware of Calthrop 's work , and supplied their pilots with a similar design . However when the Royal Air Force finally adopted parachutes after the war , they chose an American design .

In 1916 Calthrop also patented an ejector seat for aircraft using compressed air .

= = Private life = =

During his time in India , Calthrop made occasional trips back to Britain . On one such trip he married Isabel Mary Earle , the daughter of the Reverend Walter Earle , a friend of his parents . The wedding took place on 19 November 1890 at the Bilton Parish Church , Rugby . They had four children , Everard Earle (Tev , b . 1892) , Keith de Suffield (b . 1894) , Isabelle Iris (b . 1895) , and Betty Marion (b . 1899) . Tev joined the army and became a Colonel in the Royal Engineers ,

while Keith , after a stint in the Royal Engineers went on to become Assistant General Manager and Mechanical Engineer of the Barsi Light Railway , a post he held until 1932 .

Calthrop had a great interest in breeding Arabian horses . Following the long @-@ term rental of a villa in Goldings Road , Loughton , Essex , he purchased a permanent home , Goldings , at Clays Lane in Loughton , with stables and 40 acres (160 @,@ 000 m2) of grounds . It was here that he bred his horses and developed his theories of horse training . Calthrop rejected the cruel methods of breaking horses common in that era , and practiced gentle methods . Such was his concern for his horses that he had them humanely destroyed rather than have them commandeered by the British army at the start of the First World War . After the war he was able to return to his horses , and wrote an authoritative book , The Horse , as Comrade and Friend , published in 1920 . Calthrop was a prominent member of the Arab Horse Society , and received commendations for his stallion , Fitz , at its first show in 1919 .

Developing and promoting his parachute had left Calthrop drained , both financially and physically . Failing health forced him to resign his position as consulting engineer for the Barsi Railway in 1925 , although he remained a director . Calthrop died at his Paddington , London , home on 30 March 1927 , in the company of his son , Tev . He was seventy years old .

Calthrop is commemorated by a blue plaque on Goldings , unveiled in June 2008 .

= = Other narrow gauge pioneers = =

Paul Decauville
Robert Fairlie
Abraham Fitzgibbon
Thomas Hall
Carl Abraham Pihl