= William Henry Barlow =

William Henry Barlow FRS FRSE FICE MIMechE (10 May 1812 ? 12 November 1902) was an English civil engineer of the 19th century , particularly associated with railway engineering projects . Barlow was involved in many engineering enterprises . He was engineer for the Midland Railway on its London extension and designed the company 's London terminus at St Pancras .

With John Hawkshaw , he completed Isambard Kingdom Brunel 's Clifton Suspension Bridge . Following the Tay Bridge disaster he sat on the commission which investigated the causes and designed the replacement Tay Bridge . Barlow was also an inventor and experimenter , patenting a design for a rail and carrying out investigations on the use and design of steel structures .

= = Early life and education = =

Barlow was born on 10 May 1812 in Woolwich , Kent (now in south @-@ east London) , the son of mathematician and physicist Professor Peter Barlow , who taught at the Royal Military Academy in Woolwich . William Barlow was the younger brother of Peter William Barlow . After a private education , Barlow began to study civil engineering with his father at the age of sixteen . After a year he , went on to a pupillage at the machinery department of the Royal Navy 's Woolwich Dockyard close to his family home . He then worked at the London Docks for Henry Robinson Palmer .

Barlow married Selina Crawford Caffin (date unknown) . The couple had four sons and two daughters . Their son Crawford Barlow became a civil engineer and was in practice with his father .

= = Career = =

From 1832 , he spent six years working as an engineer in Constantinople , Turkey , helping build an ordnance factory on behalf of machine tool manufacturers Maudslay , Sons & Field . He also produced a report for the Turkish government on lighthouses in the Bosphorus , which led to his first two scientific papers . For his services to the Turkish government he was awarded the Order of Nishan Iftikhar (Order of Glory) .

Barlow returned to Britain in 1838 to take up a post as assistant engineer on the Manchester and Birmingham Railway working for George W. Buck . In 1842 , he joined the Midland Counties Railway as resident engineer for the section between Rugby and Derby . When the Midland Counties Railway became part of the Midland Railway in 1844 , he retained the position , later becoming chief engineer of the larger railway . On 1 April 1845 , Barlow was elected a member of the Institution of Civil Engineers and on 6 June 1850 he was elected a Fellow of the Royal Society .

Whilst working on the Midland Railway 's main line , Barlow established that the replacement of sleepers was a larger part of the cost of track maintenance than the replacement of rails because the sleepers decayed more quickly than the rails wore @-@ out and needed renewal more often . To remove the cost of providing and replacing sleepers , he developed and patented his own rail design in 1849 . It had a wide flanged profile which could be laid directly on to track ballast without the need for sleepers , with just periodic tie @-@ bars to maintain the correct gauge . Known as the Barlow rail , it was widely used , especially by the Great Western Railway .

Joseph Paxton , designer of the cast iron and glass Crystal Palace for The Great Exhibition of 1851 , was a director of the Midland Railway and he asked Barlow for his help in the preparation of the structural calculations for the frame of the building .

In 1857 , Barlow left the Midland Railway to form his own consultant engineering practice in London , with the Midland Railway as a significant client . Following the death of Isambard Kingdom Brunel in 1859 , Barlow was commissioned with John Hawkshaw to complete the Clifton Suspension Bridge , Bristol , construction of which had been stalled since 1843 due to insufficient funds to finish it . Reusing the chains from Brunel 's earlier Hungerford Suspension Bridge in London , demolished in 1860 , Barlow and Hawkshaw completed the bridge in 1864 with a more robust deck than Brunel had planned and other variations caused by the reuse of the existing chains . Its 702 @-@ foot (214 m) span was the longest in Britain at the time .

Between 1862 and 1869 , Barlow was consultant engineer for the Midland Railway 's southern extension from Bedford to London , including the layout of the London terminus station at St Pancras on Euston Road . To deal with the sloping site and the need to cross the Regent 's Canal a short distance to the north , the platforms were constructed on a raised structure supported on cast iron columns and girders . Under this storage was laid out for beer from the breweries at Burton upon Trent . With assistance from Rowland Mason Ordish , Barlow also designed the arched , cast iron station canopy which spans 240 feet (73 m) across the platforms without intermediate support ? then the widest of its kind in the world . It was designed as a cost effective and efficient means of avoiding the need for additional solid structure in the lower level . George Gilbert Scott designed the hotel in front of the train shed .

On 28 December 1879 , the central section of the North British Railway 's bridge across the River Tay near Dundee collapsed in the Tay Bridge disaster as an express train crossed it in a heavy storm . All 75 passengers and crew on the train were killed . As the newly elected President of the Institution of Civil Engineers , Barlow was appointed as a member of the Board of Trade 's Court of Inquiry into the disaster . He sat with Henry Cadogan Rothery and William Yolland , co @-@ authoring one of the final reports with Yolland recommending a commission be established to examine wind loads on bridges . In its report dated 30 June 1880 , the Court of Inquiry concluded that the bridge , designed by Sir Thomas Bouch and opened only the year before its collapse , had been " badly designed , badly built and badly maintained " . The entire central box truss section of the bridge known as the " High Girders " collapsed along with the thirteen trestles supporting it , leaving a gap of nearly half @-@ a @-@ mile in the 2 @-@ mile (3 @.@ 2 km) long bridge .

His reputation destroyed , Bouch died in October 1880 . Work on the suspension bridge he had designed to cross the Firth of Forth was stopped after the Tay Bridge collapse and Barlow , Sir John Fowler and Thomas Elliot Harrison , consultant engineers for the three railway companies involved in the construction , were asked to choose a replacement design . The solution was the cantilevered Forth Bridge by Fowler and Sir Benjamin Baker .

In 1881 Barlow sat as member of the Wind Pressure (Railway Structures) Commission established at the recommendation of the Tay Bridge report . He led the design of the replacement Tay Bridge (1882 ? 87) with his son Crawford Barlow as engineer . The new design used large monocoque piers to support a double railway track . The old brick and masonry piers from the first bridge were retained as breakwaters for the new piers upstream . They can still be seen today as a forlorn reminder of the tragedy of 1879 .

Barlow was an early experimenter with civil engineering uses for steel , carrying out research at Woolwich Arsenal in the 1850s and being a member of the Institution of Civil Engineers ' committee on the subject . From 1873 he was a member of a Board of Trade committee which produced the first recommendations on safe working loads for steel in railway structures in 1877 .

Barlow also experimented with sound recording . In February 1874 he presented the Royal Society with a talk On the Pneumatic Action which accompanies the Articulation of Sounds by the Human Voice , as exhibited by a Recording Instrument . He called his ' recording instrument ' a Logograph .

Barlow was a Fellow of the Royal Society of Edinburgh , a member of the Institution of Mechanical Engineers and the Society of Arts . He served as Vice President of the Royal Society in 1881 and was an honorary member of the Société des Ingénieurs Civil de France . He was also a Lieutenant @-@ Colonel in the Railway Volunteer Staff Corps .

With his health failing , he retired from practice in 1896 , along with his son . He died on 12 November 1902 from exhaustion after breaking his leg , and was buried in Charlton Cemetery in a plot adjacent to that of his father 's grave . His home " High Combe " , Charlton Road , Greenwich , is marked with a blue plaque .