= Barton Aqueduct =

The Barton Aqueduct , opened on 17 July 1761 , carried the Bridgewater Canal over the River Irwell at Barton @-@ upon @-@ Irwell in Greater Manchester , England . Designed largely by James Brindley under the direction of John Gilbert , it was the first navigable aqueduct to be built in England , " one of the seven wonders of the canal age " according to industrial archaeologist Mike Nevell .

Construction proceeded quickly , but disaster almost struck when the aqueduct was first filled with water and one of its three arches began to buckle under the weight . Remedial work took several months , but the aqueduct was still opened to traffic only 15 months after the enabling Act of Parliament had been passed , on 17 July 1761 . It remained in use for more than 100 years , until the construction of the Manchester Ship Canal necessitated its demolition in 1893 , replaced by the Barton Swing Aqueduct .

= = Background = =

The original intention was for the Bridgewater Canal to reach Salford from the Duke of Bridgewater 's coal mines in Worsley , by remaining on the north bank of the Irwell . Work began in 1759 , but it was quickly decided to alter the route by building a masonry aqueduct to carry the waterway over the Irwell at Barton , and terminate instead in Manchester , to the south of the river . A Bill to authorise the new route was presented to parliament on 13 November 1759 , and in January the following year Brindley travelled to London to give evidence before a parliamentary committee in support of the proposal .

Although a gifted engineer Brindley had no formal education and rarely , if ever , committed his designs to paper . When questioned by the parliamentary committee about the composition of the puddle he frequently referred to in his evidence , he had a mass of clay brought into the committee room . He then formed the clay into a trough and showed how it would only form a watertight seal if it had been worked with water to form puddle . " Thus it is " said Brindley " that I form a watertight @-@ trunk to carry water over rivers and valleys wherever they cross the path of the canal . " Later , when asked to produce a drawing of the bridge or aqueduct he proposed to build , he replied that he had no representation of it on paper but would demonstrate his intention by use of a model . He then went out and bought a large round of Cheshire cheese , which he divided into two equal halves saying " Here is my model " . Then , to the amusement of the committee , he used the two halves of cheese to represent the semicircular arches and laid a long , rectangular object over the top to demonstrate the position of the river flowing under the aqueduct and the canal flowing over it .

Although the duke had seen navigable aqueducts in use on canals when travelling abroad on his Grand Tour , the idea of an such a structure carrying a canal over a river was new to England and was ridiculed by contemporary engineers . One brought in to review the plans , at Brindley 's request , commented in a report to the Duke of Bridgewater that " I have often heard of castles in the air , but never before saw where one was to be erected . " The necessary Act of Parliament was passed in March 1760 , and was quite specific about the form the aqueduct had to take , to protect the viability of the Mersey & Irwell Navigation below . There was already a three @-@ arch road bridge , Barton Bridge , passing over the Irwell , and the aqueduct was required not to restrict traffic on the river any more than the road bridge already did . It had to have the same number of arches , the foundations for which had to be fixed in the river bed , and the arches had to be at least as wide and high as those of the road bridge .

= = Construction = =

At about 200 yards (180 m) long , 12 yards (11 m) wide and 39 feet (12 m) above the river at its highest point , the aqueduct was , for its time , an enormous construction . Early illustrations show the aqueduct 's piers to have been flat @-@ faced , but an engraving of 1864 shows them to have pointed cutwaters extending beyond the spring of the arch ; it is likely that the piers were refaced in

the early 1820s . The arches were composed of several rings of brickwork , with masonry used for decorative keystones . All the masonry used in the structure was coursed ashlar .

On the day it was first tested the water was allowed to flow in , but one of the arches began to buckle under the weight . Brindley , overcome with anxiety , retired to his bed at the Bishop Blaize tavern in nearby Stretford . Gilbert , realising that Brindley had placed too much weight on the sides of the arch , removed the clay and laid layers of straw and freshly puddled clay ; when the water was allowed to flow in again the masonry held firm . According to a statement by Francis Egerton , 8th Earl of Bridgewater printed in 1820 , his uncle , the duke , had told him that there was a distortion of one of the arches , and that Gilbert had addressed the problem by placing more weight on the crown of the arch and less on the haunches . The arch was then covered with straw and allowed to stand until the following spring , when the mortar was set and the arch had become stable , but its curve remained irregular .

= = Operation and legacy = =

The aqueduct was opened to traffic on 17 July 1761 , only 15 months after the enabling Act had been passed , and it was soon being used by the duke 's barges to carry coal to Manchester from his mines at Worsley . The construction of the aqueduct excited great admiration , and writers of the day often remarked on the strange and novel sight afforded by the canal where it crossed the Irwell . The structure became one of the wonders of the age and crowds came from all over the country to view it , along with the drilling of the sough for the duke 's Worsley navigable levels . Those who saw it were often struck by the advantages of still @-@ water navigation when they saw ten or twelve men slowly hauling a single barge against the flow of the Irwell , while 40 feet (12 m) above a horse , mule , or perhaps two men , could be seen hauling several linked barges across the still waters of the aqueduct .

Although the aqueduct was 12 yards (11 m) wide overall , the waterway it carried was only half that width . The Bridgewater Canal had been built to accommodate the Mersey flat boats then in common use , which had a beam of about 14 feet (4 @.@ 3 m) , making two @-@ way traffic impossible . A signalling system was therefore installed to control access to the aqueduct . A pole 15 feet (4 @.@ 6 m) high in the centre of the arch at the Stretford bank supported a semaphore system with two arms on each side , operated by levers at ground level .

Although Gilbert later had to resurface the aqueduct , the structure remained in use for more than 100 years . In the first volume of his Lives of the Engineers (1862) Scottish author Samuel Smiles said of the construction that " Humble though it now appears , it was parent of the magnificent aqueducts of Rennie and Telford , and the viaducts of Stephenson and Brunel " .

= = Replacement = =

Barton Aqueduct 's fate was sealed with the passage of the Manchester Ship Canal Act 1885 , which allowed for the construction of a navigable waterway large enough to accommodate ocean @-@ going vessels from the estuary of the River Mersey the 36 miles (58 km) into Manchester , partly along the Irwell . As the arches of the aqueduct were too small to allow large ships to pass through it was demolished in 1893 , and replaced by the Barton Swing Aqueduct still in use today . So solidly built was the old aqueduct that dynamite had to be used to expedite its demolition .

Some of the stonework of Brindley 's aqueduct has been preserved in the nearby Barton Memorial Arch , a monument to his " castle in the air " .