IX.—*Wooden Bridge over the River Calder, at Mirfield, Yorkshire, designed and erected by WILLIAM BULL, A.Inst.C.E.*

THIS bridge was erected for the use of the hauling horses on the Calder and Hebble Navigation, in the summer of 1835.

The chord of the arc is 147 feet 6 inches, the versed sine 11 feet. The width of the roadway is 8 feet at the abutments and 5 feet at the crown.

The arch is composed of two ribs of fir timber, with cross stays and diagonal braces. The timbers are wrought to the curve of the arch on the under and upper sides and straight in the intermediate joints. The ends abut on each other in the line of the radii, and are secured in their places by two wrought iron bolts passing through them in a vertical direction at each joint; which bolts are connected at each end by iron straps let into the wood. The ribs are also secured to each other by wrought iron bolts (having a strong cast iron washer at each end) passing through them and the cross braces in an horizontal direction. The roadway is composed of three inch deal plank, on which a coat of pitch and tar mixed with small gravel, about an inch thick, is laid, to protect the planks from the weather and horses' feet. The ribs are let into the springing stones about six inches at each end, and are wedged in with oak and the chases filled with lead.

The abutments are formed of Ashler stone unhewn, except on the beds and joints, backed with rubble laid in mortar and grouted; the wing walls which form the approaches are of rubble stone laid dry, as are also the walls of the hauling paths under the bridge.

The foundations are sunk in the silt or debris of the valley to about six feet below the ordinary surface of the water in the river, in the front of the abutments, and rise towards the back, as shewn in the drawing. (See Plate VIII.)

The footings consist of two courses of flat stone, from 8 to 12 inches thick, and from 3 feet to 5 feet each way, laid rough as taken from the quarry; no piling is used in any part.

The arch was formed and perfectly fitted in all its parts at the carpenter's yard belonging to the Navigation Company, and taken to the spot in separate pieces.

The manner of erecting the arch was very simple, and attended with trifling expense; it was as follows. Three barges were moored in the river at equal distances between the abutments, with their heads to the stream, and a temporary scaffolding of planks erected on them, on which the ribs and braces were put together a little above the chases in the springing stones, and as soon as they were firmly screwed up were lowered into their places by striking the packings from under them. The time occupied in erecting the arch was only about three days, and the planking was completed so that horses passed over in about a week.

Considering the slightness of the ribs and the length of the span, but little vibration takes place when the horses pass over it.

The arch form given to the ribs in the plan was with a view to resist the action of the wind, which frequently rushes with great force through the valley, and which it was apprehended might have the effect of upsetting so slight a structure, if erected of an uniform width of 5 or 6 feet, (which is all that is necessary for the purposes for which this bridge is erected,) and it is found to answer the intention perfectly well. The author has been several times on the bridge when severe gales of wind were acting directly on it, without observing any sensible effect.

One great recommendation to the construction of bridges of this description for similar purposes is their cheapness; the cost of this was as follows:—

	£	s.	d.
Masonry of the abutments and wing walls, including about 40 yards of towing-path wall on each side	253	15	0
The arch, including wood and iron work, and the labour of erecting, painting, &c.	418	17	5
Earth work in sinking foundations and forming approaches . .	70	16	0
	<hr/>		
	£ 743	8	5
	<hr/>		

WOODEN BRIDGE OVER THE RIVER CALDER AT MIRFIELD, YORKSHIRE,

Plate VIII.

BY WILLIAM BULL, CIVIL ENGINEER.

John Weale, Architectural Library, 59, High Holborn.

J.W. Lowry, sc.