ROCHESTER BRIDGE.

THE ROMAN BRIDGE IN MASONRY.

By John J. Robson, M.I.C.E., Bridge Engineer.

The historical inscription on the tablet of the new bridge commences with the following sentence :—

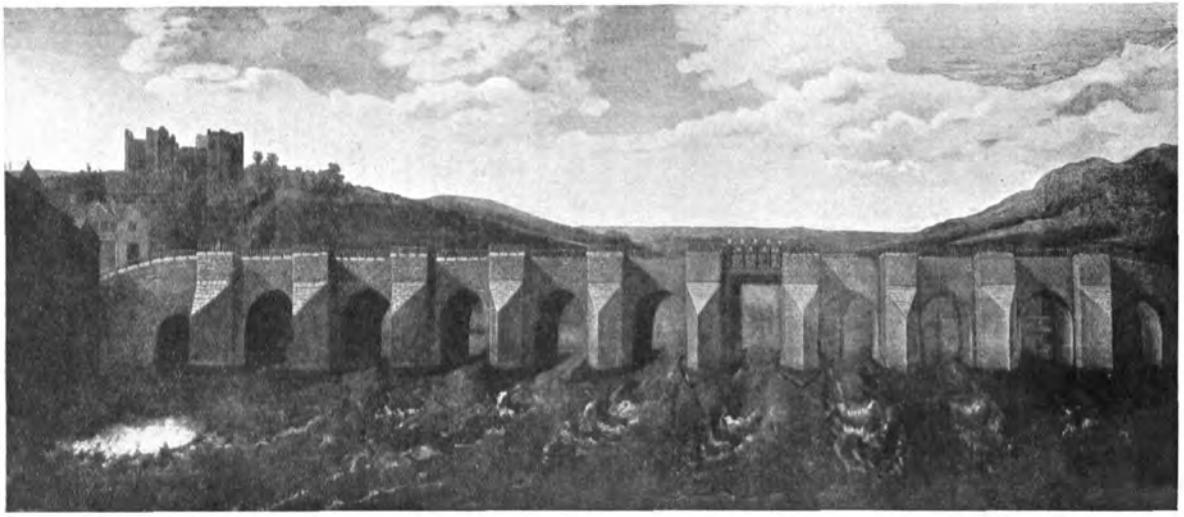
> "The Romans built a bridge of masonry on this site, during their occupation of Britain."

As hitherto the prevailing opinion among archæologists has been that the Roman bridge was constructed of timber, it seems incumbent on me (as responsible, in my capacity of Bridge Engineer, for the said inscription) to set forth my reasons for this categoric statement.

When preparing the plans for the new bridge, I searched diligently among the records of the Institution of Civil Engineers for information respecting the foundations and superstructure of the bridge of 1856, which it was proposed to rebuild, and I was fortunate enough to discover certain engineering reports by the late Mr. John Hughes, M.I.C.E., who superintended the foundation work under the consulting engineer, the late Sir Wm. Cubitt.

This information was invaluable for my purpose as an engineering record, but it also possessed an archæological bearing which had escaped Mr. Hughes, but which at once appealed to me as engineer of the bridge and student of its history. It is in this light that I regard Mr. Hughes' records, and that I appraise their immense importance in relation to the archæological features of the Roman bridge.

Having had many interesting discussions with the late Mr. George Payne, who devoted many years to the elucidation of Roman Rochester, I cannot but express surprise that



ROCHESTER BRIDGE

from an Old Painting in the possession of the Bridge Warden .

there should be any persons who doubt the existence of Rochester as a Roman fortification, with a masonry bridge.

It is, I submit, so superfluous to prove the fact that there was a Roman bridge over the Medway as well as a Roman fortification that, postulating these, I confine myself to shewing that the said bridge was of masonry construction.

At the outset it should be remembered that there is no proof whatever that the Roman bridge was only of wood: an erroneous idea which has arisen through the misinterpretation of records really referring to the provision of timber and labour for the maintenance of the bridge from Saxon times previously to the construction of the stone bridge in 1388. The cost of the aforesaid works was levied on the various contributory parishes and manors, the accounts recording the various timber bridges which were built and rebuilt on the site centuries after the end of Roman civilisation in Britain.

In order fully to appreciate the matter, various points should be borne in mind, viz.:—

The Roman occupation of Britain extended over about 458 years prior to 406 A.D.

The south-eastern portion of the country had attained to a high state of Roman civilisation.

The earliest documentary reference to the bridge is of the date 960 A.D., when it is recorded that the ancient bridge, having become unsafe, was pulled down and rebuilt.

Assuming the Roman bridge to have been erected during the early period of the Roman occupation, it would have been in existence for about a thousand years prior to the above-named demolition.

Now the Romans were eminent bridge-builders in masonry, many of their great works far surpassing our own. In fact, to them a bridge at Rochester would be a comparatively small undertaking. The Romans, moreover, being a great military nation, would discern the tactical importance of the passage of the Medway at Rochester to ensure their access to the capital, and their retreat to the coast in case of disaster.

The road traffic over such a bridge would be greatly in excess of the capabilities of timber bridges, which in subsequent centuries were a constant source of expense to the Wardens, and were never otherwise than inadequate for their purpose. We may, therefore, safely assume that a timber bridge would have been quite insufficient for Roman civilisation during its five centuries of continuance.

The discovery of an ancient pier of masonry directly under the Strood pier of the present bridge is of the utmost importance from the historical standpoint, and it is to be regretted that more careful and accurate details of its construction were not noted at the time.

But what we can do is to examine critically the particulars communicated in 1857 by Mr. Hughes to the Institute of Civil Engineers, and the discussion which followed the reading of his paper. It should, however, be remarked that, according to documents of 1115 A.D., the ancient bridge had nine stone piers, as well as the two abutments, and two openings for the passage of high-masted vessels, whereas, as yet, only one pier has been discovered, so that the remaining ten foundations may still be in the bed of the river; for, considering the great depth to which they were sunk, it is extremely improbable that the Bridge Wardens would dig them out. Let us consider the various points of information given in this paper by Mr. Hughes:—

> The dry-rubble masonry extended down to from 13 feet to 25 feet below the present bed of the river.
>
> It contained enormous quantities of timber built in the masonry; some laid horizontal, and others vertically, being used as piles, and shod with iron which (the timber being of oak, elm, and beech) penetrated into the gravel from one to two feet.
>
> There existed a timber framework at the bottom of the existing foundations, through which the piles were driven into the ballast.
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> During the construction of the bridge (1856) large quantities of timber, some charred, were removed from the bed of the river, which was without doubt the

result of the burning of the bridge by the Earl of Leicester in 1264.

During the discussion on Mr. Hughes' paper this was openly referred to by Capt. Moorsom as "the old Roman foundation," and received as such by those present without challenge.

From the above information it may safely be inferred that the open excavation was heavily timbered and then filled up solid with dry-rubble masonry of Kentish rag stone, the timber being built in.

In applying this information to bridge-building in the light of practical experience, one is compelled to arrive at the following conclusions :—

The fact of the pier foundations being carried down from 13 feet to 25 feet below the bed of the river indicates that it was an important bridge built of masonry. On the contrary, a timber bridge would need only piled foundations. Bridges with masonry piers and a timber roadway are usually applicable to mountain streams, dry at certain times of the year and having rocky bottoms, into which piles cannot be driven.

The timbers found, being of considerable dimensions, were doubtless piles driven down below the proposed foundation to hold up the sides of the excavation, and would either be set close together, or, if at short intervals, would be sheathed with stout planks, enabling the timberwork to be extended upwards so as to form a coffer dam. The cross timbers found built in the masonry would doubtless be the struts to hold the piles in position. The heavy timber platform laid over the bottom of the foundation would probably be to ensure, in a material little known to the builders, uniformity of settlement, and also to keep down the water.

That the Romans, possessed as they were of vast experience in the construction of masonry bridges, must have had some means of keeping their trenches and coffer-dams clear of water, is obvious to all practical men. It will be noted that no such deep foundations in the bed of the rivers were attempted in this country subsequently to the Roman

occupation, but that heavy timber platforms on piles were adopted, as in the case of London Bridge in 1176, and of the stone bridge at Rochester, 1388.

It should be borne in mind that, in those early days, the bed of the river at Rochester would be several feet higher than in 1851—probably, say, at least 5 feet higher (the scour under the bridge between 1856 and 1906 was about 18 inches), so that the depths of the Roman foundations would vary from not less than 20 to 30 feet, a factor which would present certain difficulties in dealing with the water in the foundations. I would suggest that in those early days there might have been two or three channels at Rochester (as at Chatham prior to 1872), and that this particular channel might have been wholly or partially dammed during the construction, as in the case of the Assouan Dam on the Nile. Nevertheless, no matter what alternatives one can suggest, the work was done, and so successfully that it lasted until 1281 A.D., when the old piers were swept away by heavy floods.

It is extremely probable that in 960 A.D. it was found that the arches and superstructure of the ancient bridge were much decayed, but that the piers and foundations were sound, so that it was only necessary to remove the arches and construct a timber roadway upon the already existing piers and abutments.

This timber roadway required frequent repairs and renewals until the piers shewed signs of serious decay and instability (say after the burning of the bridge in 1264), when the old piers would be surrounded by timber piling to strengthen them to carry the road until they finally gave way to serious floods in 1281. It is obvious that the old masonry piers would only be washed away above the level of the bed of the river, and that the foundations would remain as discovered and described by Mr. Hughes. After this disaster the bridge was built entirely of timber, until the stone bridge was erected in 1388. During this period a serious attempt at reconstruction in timber was made in 1344-5 with a drawbridge, and a barbican, at the Strood end

for the defence of the bridge; but in less than three years the volume of traffic threatened the safety of the structure, and a large and more permanent bridge of masonry was found necessary (1388).

It should, therefore, be remarked that the timber bridge referred to by Lambarde in his *History of Kent*, the bridge of which an illustration is in existence, is identical with the timber bridge of 1344-5 which had a barbican at the Strood end, and must not be confused with the more ancient bridges, the Roman bridge of masonry and the succeeding timber structures, which had existed during the long centuries from the advent of Roman civilisation in Britain.

In conclusion, it may be accepted that since the departure of the Romans the art of sinking bridge foundations in river beds was unknown, until the introduction of temporary pumping engines and other mechanical methods which followed the invention of the steam engine and the introduction of railways, which occasioned a peculiar impetus to bridge construction. The discovery, therefore, of pier foundations extending from 20 to 30 feet below the bed of the river at Rochester can be attributed only to the Romans.

February 8th, 1921.