The Timber Viaducts

The route Brunel adopted in 1835 for the railway between Standish and Sapperton Tunnel crossed the River Frome at Stroud. It then continued on the southern side of the valley up to the tunnel. He had to ensure that the route maintained a steady rate of climb all the way up to the summit. Even a very short steep stretch would have caused enormous difficulties to the locomotives of the day. The undulating terrain is shown dramatically in the cross-sections of the route. Major feats of engineering were required to take the line across the main valley at Stroud and the various side valleys.

Brunel built conventional embankments and cuttings where this was possible but he also built nine large viaducts to overcome the biggest of the obstacles. The viaducts were constructed largely of timber rather than masonry and served as prototypes for more than 60 viaducts that he was responsible for in Devon and Cornwall. The locations of the nine viaducts on the Stroud line are shown on the map and the cross-sections.

Why Timber in the Stroud Valleys?

When Brunel was faced with similar problems on the Great Western Railway near London he built bridges and viaducts out of masonry. He could afford to do this near the capital because it was thought that the high return expected from the railway would soon repay the high initial cost of using brick and stone. However, on the Stroud line the revenue was expected to be much smaller and the finances of the Cheltenham & Great Western Company Union Railway Company building the line were already in a poor state. Brunel therefore made the bold decision to build the viaducts mainly out of timber even though they were likely to have a much shorter working life than masonry.

Advantages and Disadvantages of Timber

Timber may have been relatively cheap in the 1840s but when used out of doors it has always been liable to decay. It is a relatively good material for structures when used in compression (that is being squeezed inwards) as in the legs of a table or a chair. However it not such a good material when used in tension as bending a pencil until it snaps will readily demonstrate. A further limitation of timber over the centuries has been that its use is largely governed by the cross-section and the length of pieces that are available from the tree.

Brunel's Approach.

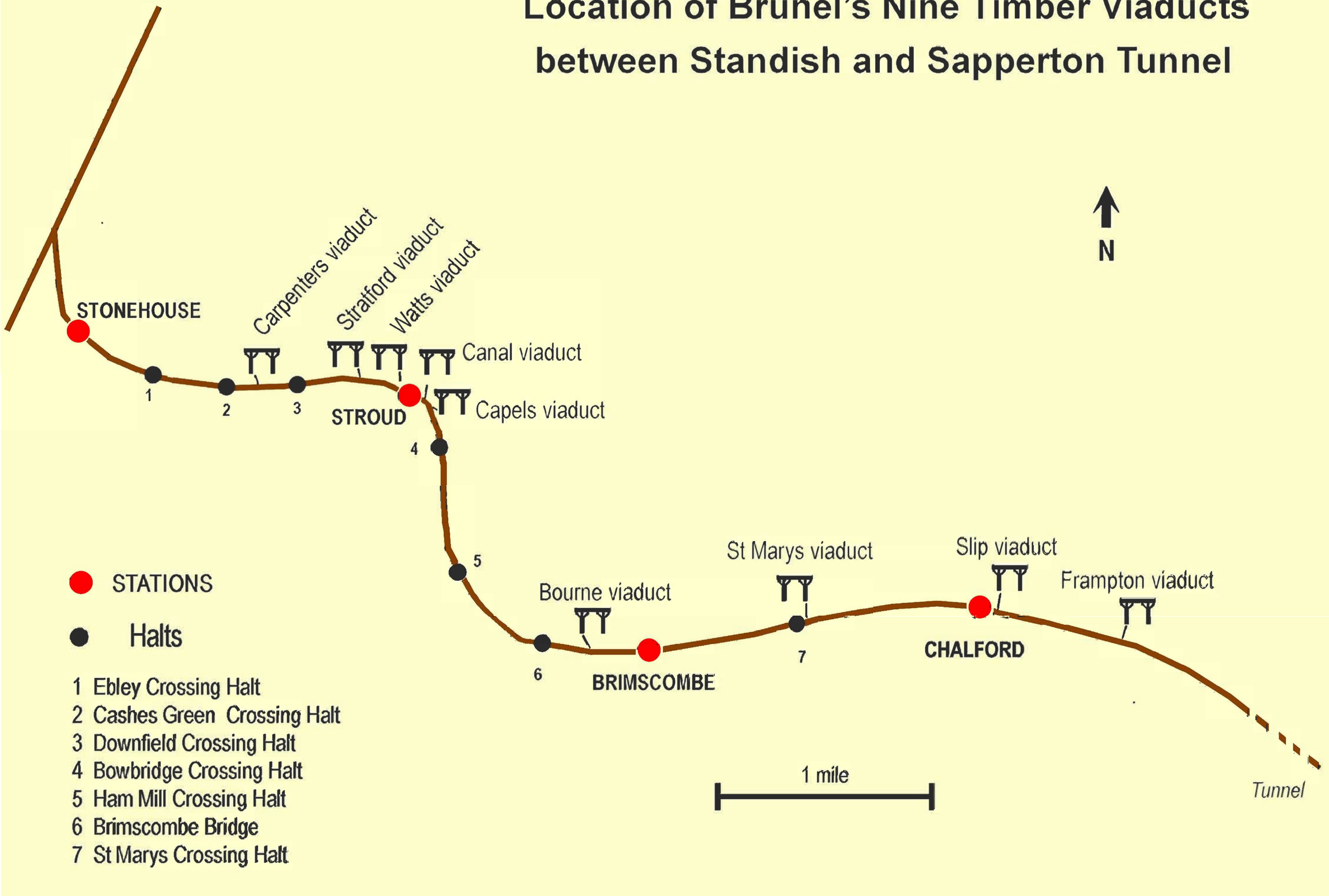
What set Brunel apart from other engineers of the day is that it appears that he carried out detailed tests on all aspects of his designs. The emphasis was on testing for some particular end rather than for the purpose of producing a general theory. He tested several different timber treatments like mercuric chloride (called Kyanising after its inventor), zinc chloride and creosote which he eventually preferred.

He also carried out extensive testing of the strengths of different timbers and ended up specifying imported Baltic Pine until that ceased to be available in 1888. Brunel needed to address the limitations of the size of timbers as cut from the tree. He did this by two methods:-

(1) A framework is formed in which the individual timbers are arranged in a pattern that distributes the loads to the supports

(2) Individual pieces of timber are fastened together so that a longer or thicker piece results

Location of Brunel's Nine Timber Viaducts between Standish and Sapperton Tunnel



Details of the Viaducts

Carpenters	Four 32ft spans
Stratford	One span of 40ft and seven 30ft spans
Watts	Eight 30ft spans and 4 stone arches
Canal	One 51ft span skew bridge and 30ft, 28ft & 32ft spans
Capels	Eighteen 30ft spans
Bourne	One 67ft span skew bridge and sixteen spans of 18ft to 30ft
St Marys	One 75ft span skew bridge
Slip	Twenty two 30ft spans
Frampton	Twelve 30ft spans