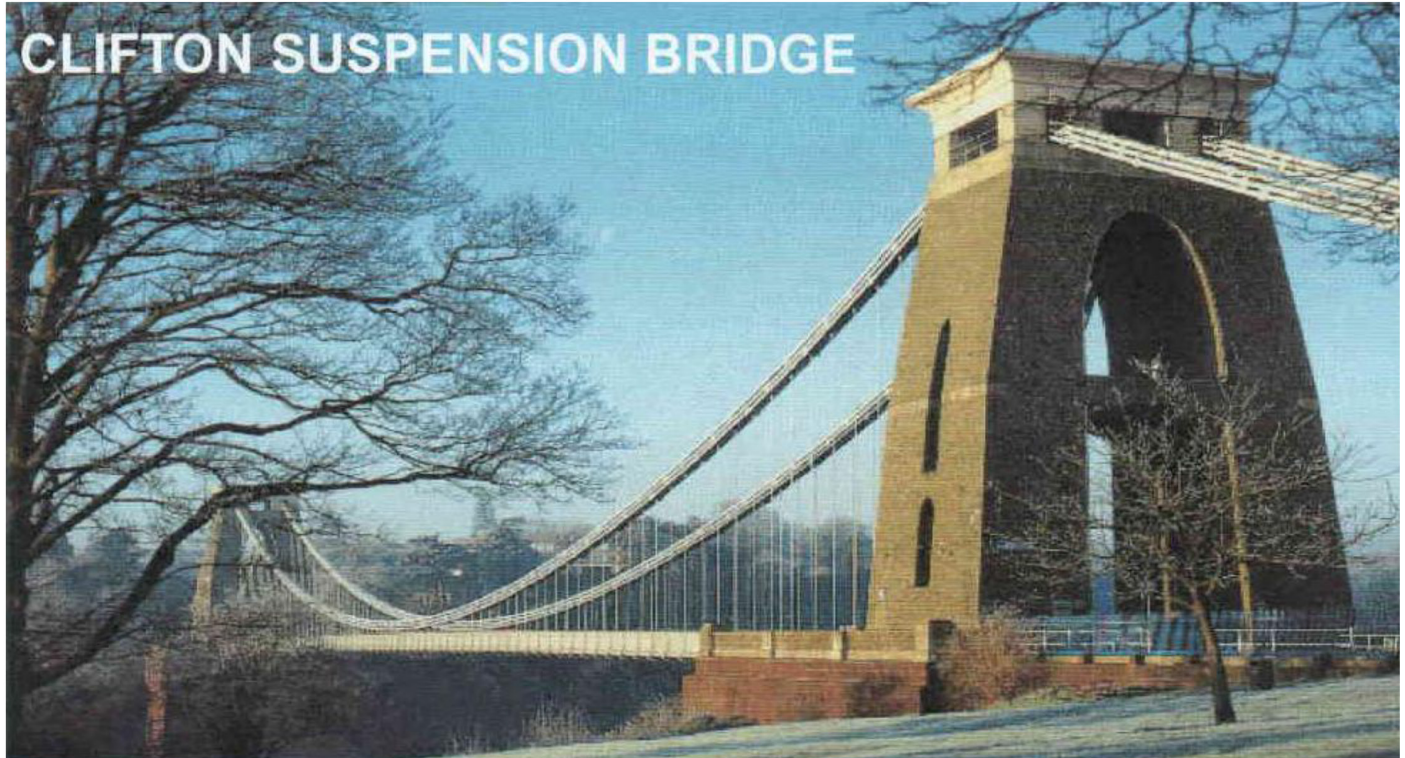


Clifton Suspension Bridge



The Clifton Bridge is a grade 1 listed structure. It was designed by Isambard Kingdom Brunel and spans 214m (234 yards) from tower to tower across the Avon Gorge. Opened in 1864 it remains a testament to 19th Century engineering. Previously thought to be solid, in 2002, an electronic survey of the sandstone abutment supporting the 26m (28.5 yards) high tower provided evidence of 12 vaulted chambers. Arranged in two tiers - they are interlinked by narrow tunnels and shafts just 0.6m in diameter. The purpose of the chambers is unclear. However, with each chamber measuring on average 11m (12 yards) high by 15m (16.4 yards) long - they would have offered a considerable saving in material. In order to gain a discreet access to these chambers and after engineering surveys confirmed that the abutment was structurally safe, work began on forming a permanent door for maintenance access.

An exploratory core found the walls to be solid with an overall thickness of 1,800mm (70"). It comprises two sandstone skins with lime mortar in between.

In spring 2003, work commenced to form a doorway 12m (13 yards) below the level of the footway, approximately halfway down the abutment where the wall returns to tie into the side of the gorge. The work began with the stitch drilling of 70 holes to a length of 1,800 mm(70") each with a diameter of 102mm (4") in order to create an opening approximately 2,000mm (79") high by 830mm (33") wide.

Following this, 20 CINTEC stainless steel rebar anchors were used to pin together the external and internal sandstone blocks cut through by the opening. These 16mm (5/8") diameter solid circular section anchors, measuring 1,500mm (59") long, were installed at an angle and at 300mm centers around the doorway. The anchors were inserted in 40mm (1 1/2") diameter predrilled holes, oversized to accommodate expansion of the anchor sleeve with grout. In order to maintain the aesthetics of the bridge the anchors were in set by 200mm (8") to ensure they would not be visible on the external sandstone face, achieving a sympathetic invisible bond around the new opening in the listed structure. Falcon Structural Repairs of Portishead - UK, undertook the stitch drilling and anchoring to create the new doorway, it required eight days to cut the opening and just two days to install the CINTEC anchors. The work was approved by English Heritage as well as the local planning authorities.

