Ironbridge Archaeology

The Archaeology Unit of the Ironbridge Gorge Museum Trust

Ironbridge
BIRTHPLACE OF INDUSTRY

Ironbridge Archaeological Series No. 342

Archaeological Watching Brief during Investigative Works at the Iron Bridge

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Prepared for:

Ramboll on behalf of English Heritage

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ARCHIVE AND REPORT STORAGE

This project was managed for the Ironbridge Gorge Museum Trust by Shane Kelleher BA MA MIfA who also carried out the fieldwork and produced this report.

A hard copy of this report, together with the site archive (including all field drawings, notebooks and photographs) is archived at the Ironbridge Gorge Museum Trust's Archaeology Archive in the Long Warehouse, Coalbrookdale.

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SUMMARY

In February and March 2016 Ironbridge Archaeology undertook an archaeological watching brief during investigation works at the Iron Bridge, Shropshire. The investigation works included the excavation of seven trial holes in the deck, including trial removal of caulking, measurements, inspection, levels and reinstatement.

Nothing particularly unexpected was uncovered during the archaeological watching brief. Nevertheless, the current programme of works has provided an excellent insight into the form and location of services located on the Iron Bridge, and has served to identify instances of historic repair. It has also been particularly useful in investigating the nature and extent of caulking and sealants utilised during waterproofing works to the gaps between the deck plates on the main arch and the deck plate upstands on the side arches in the 1970s.

The entire process of removing the deck surface material, identifying, sampling and removing the caulking material was recorded in detail.

1 INTRODUCTION

This report describes the results of an archaeological watching brief during investigative works at the Iron Bridge, Ironbridge, Shropshire, NGR SJ 673 034, in February and March 2016.

Plate 1: The Iron Bridge from the southeast (courtesy English Heritage)

1.1 PROJECT BACKGROUND

English Heritage intends to undertake conservation works to the Iron Bridge in 2017. To inform the preparation of tender and construction drawings/specifications for these repairs, which are recommended in the Conservation Management Plan for the Iron Bridge (Ironbridge Gorge Museum Trust 2011) and subsequent studies, three investigations were required:

- *INVESTIGATION A- CAT Scan and utilities search*
- *INVESTIGATION B- Access inspection of the edges of the deck plates for three spans including visual inspection (from within touching distance and ultrasonic scanning)*
- *INVESTIGATION C- Trial holes in the deck, including trial removal of caulking, measurements, inspection, levels and reinstatement.*

(Ramboll 2015)[1]

[1] Ramboll's Scope of Works document outlines in detail the data and information that they required the on-site contractor, Vertical Technology, to report upon, see Section 1.2 below.

The archaeological watching brief was particularly relevant for the trial holes (*i.e.* INVESTIGATION C), which was the only intrusive component of the proposed works. The Scope for Site Investigations (Ramboll 2015) outlined that up to 10 trial holes (approximately 600mm wide across the width of the footway and 600mm x 1000mm adjacent to the footway) were to be excavated down to the upper face of the cast iron plates (previous interventions suggest a depth between 300mm and 600mm). It was noted that the exact nature of the fill material was not known, however, previous excavations have found sand, clinker, furnace slag and brick in the footway and concrete in the roadway.

In addition to monitoring and recording the trial holes, Ironbridge Archaeology was available during INVESTIGATIONS A and B if archaeological input was required. In addition to this, a photographic record of these investigations was made for purposes of this report and the site archive.

The requirement for an archaeological watching brief during the current works was requested by Bill Klemperer, Historic England's Principal Inspector of Ancient Monuments, as a condition of Scheduled Monument Consent (Case No: S00126896).

Condition (b) of the Scheduled Monument Consent states:

No works shall take place until the applicant has confirmed in writing the commissioning of a programme of archaeological work before and/or during the development in accordance with a written scheme of investigation which has been submitted to and approved by the Secretary of State and advised by Historic England.

It was understood, given the nature of the proposed works, that archaeological watching brief would be the most appropriate methodology to be employed. A written scheme of investigation (Ironbridge Archaeology 2016), based on a brief produced by Ramboll, *i.e*. the 'Scope for Site Investigations' (Ramboll 2015) was produced and approved by Historic England for, and on behalf, of the Secretary of State in advance of the works commencing. This written scheme of investigation set out the scope and extent of the archaeological watching brief and is included as Appendix 1 of this report.

The entire process of removing the deck surface material, caulking and sealing material, and replacing the deck surface material was recorded in detail.

Fieldwork took place in February and March 2016.

1.2 REASONS FOR AND SCOPE OF WORKS

Investigation A: CAT Scan and Utilities Search

The main aim of *Investigation A* was to identify buried statutory services passing along the bridge and locate an access cover at the north end of the bridge.[2]

Investigation B: Touching Distance Visual Inspection and Ultrasonic Testing of Deck Edges

The principal aim of *Investigation B* was to undertake an inspection of the deck plates, beyond the railings for the main span (span 1) and the two southern spans (spans 2 and 3) of the bridge. This was to comprise a detailed visual and photographic record, within touching distance of the elements being inspected, and also gentle tapping of plates to identify any hidden cracks.[3]

Plate 2: Contractors from Vertical Technology Ltd. undertaking a visual inspection of the Iron Bridge

The visual inspection of the deck plates was required, as in a number of locations the ends of the cast iron deck plates, which span across the width of the bridge and their support brackets, have failed and fallen off. More specific aims of the visual inspection were to:

- Carry out detailed inspection of the east and west deck edges
- Inspect for the presence and condition of packers below the deck plates and above deck bearers on the edge frames (A and E)

[2] Information adapted from Ramboll's Scope for Site Investigations. This investigative work was undertaken by Vertical Technology who have produced a separate report outlining the results of this investigation.

[3] Information adapted from Ramboll's Scope for Site Investigations. This inspection was undertaken by Vertical Technology who have produced a separate report outlining the results of this investigation.

- Identify defects, such as cracks and flaws in the cast iron plates and brackets
- Provide information to inform repair method statements and risk assessments
- Provide information to help with programming of repairs
- Confirm typical dimensions

In addition, the following were to be inspected and recorded:

- All the ends of the deck plates, beyond the edge beams/deck bearers on three arch spans on both bridge elevations
- The lower brackets supporting the deck plates
- The down stand lobes
- The presence and absence of packers above deck bearers A (upstream) and E (downstream).

The gentle tapping was required in order to determine, as far as possible, the presence of any cracking of the end of the deck plates so that they can be identified for repair before they are lost.

The specific bridge components that were subject to tapping were:

- All the ends of the deck plates, beyond the edge beams/deck bearers on three arch spans on both bridge elevations
- The lower brackets supporting the deck plates
- The down stand lobes

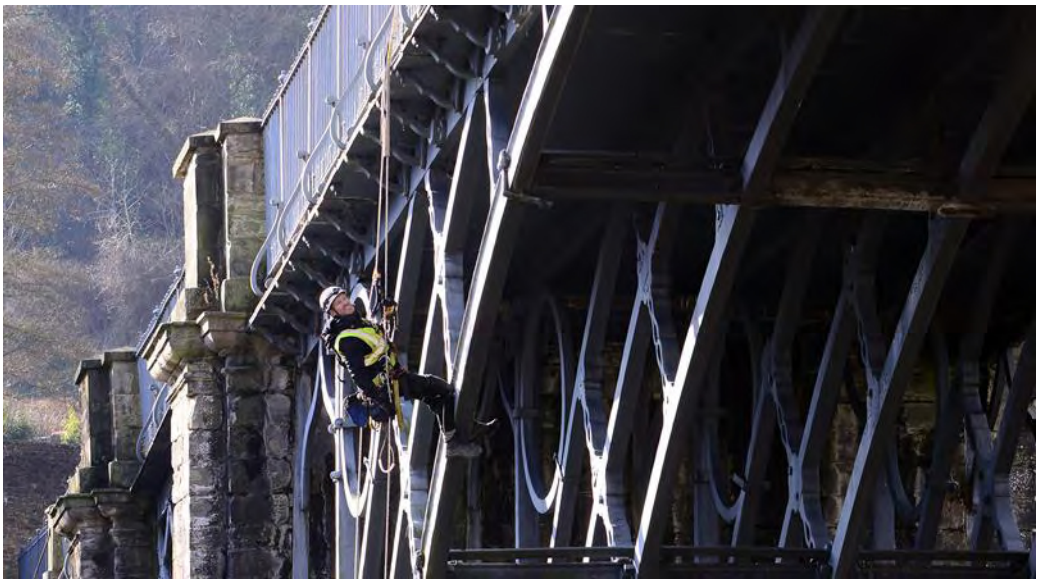

Plate 3: Close up of contractors from Vertical Technology Ltd. undertaking a visual inspection of the Iron Bridge (Courtesy English Heritage)

Investigation C: Trial Holes, Inspections and Making Good

The purpose of the trial holes was to provide a better understanding of the deck plates and the statutory services buried in the footpath.[4] Written descriptions of the excavated material and observations within each excavation were recorded. More specifically the following information was to be recorded:

- In the two holes to the south end of the south span: measurement of the dimensions/levels of the deck plate up stands, edging, water mains and other buried service and exact fill depth to be recorded. This will inform the feasibility of removal of kerbs and the raised pavements because this location appears to be a pinch point for levels

Plate 4: Contractors from Vertical Technology Ltd. begin excavation of a trial hole on the east side of the Iron Bridge

- In up to three further trial holes over the southern spans: Inspection of the condition of the deck plate upstands, check for corrosion and measurement of the up stands. This is to determine whether any cleaning and painting would be required on these areas which are potentially at higher risk of accumulation of water
- Up to five trial holes over the main span. In these holes, as well as those over the southern spans, an assessment of the condition and likely material of waterproofing on the upper surface of the deck plates. In addition, the contractors were required to carry out trials of removal of the flashing and caulking between

[4] Information adapted from Ramboll's Scope for Site Investigations. Excavation and recording of the specific elements of the trial holes was undertaken by Vertical Technology. These works were subject to an archaeological watching brief which was carried out by Ironbridge Archaeology. A separate report produced by Vertical Technology is required to include all of the information requested in Ramboll's Scope for Site Investigations.

the deck plates. This was in order to test the feasibility of the removal of the caulking and flashing to prevent the build-up of water in the deck

1.3 LOCATION, DESIGNATIONS, OWNERSHIP AND GUARDIANSHIP

The Iron Bridge is located at NGR SJ 673 034 and is situated within the Ironbridge Gorge World Heritage Site, which was inscribed by UNESCO in 1986. The designation noted that the Iron Bridge was a "masterpiece of man's creative genius… [which] … exerted great influence on developments in the fields of technology and architecture.".

The Iron Bridge was designated a Scheduled Ancient Monument (SAM 27558) in 1934, and is also a Grade I listed building.

The bridge is owned by Telford and Wrekin Council, who acquired ownership from the former Shropshire County Council (formerly Salop County Council) on 1st March 1997. The bridge was taken into Guardianship from Salop County Council by the then Secretary of State for the Environment on the 29th October 1975; Guardianship now rests with the Department for Culture Media and Sport, whose duties in this respect are delegated to English Heritage.

The Guardianship area includes parts of the abutments and associated features. The Toll House and shed opposite are owned by, and in the control of, the Ironbridge Gorge Museum Trust and do not form part of the Guardianship area.

2 HISTORICAL BACKGROUND

The Iron Bridge was built in 1779 and was the first single span bridge to be formed wholly from cast iron. It was possibly cast at one of the Coalbrookdale Furnaces, under the ownership of the Coalbrookdale Company. The company had been founded earlier in the eighteenth century in an area rich in mineral resources. Coal, ironstone and clay were all extracted locally and used in iron, ceramic and other industries, some established in the early seventeenth century. [5]

The latter half of the eighteenth century saw a large-scale development of the Shropshire and Welsh iron industry. The considerable expansion of the Dale Company continued in the 1750s, which was overseen by Abraham Darby II. The Dale Company erected new blast furnaces at Horsehay in 1755 and 1757 and at Ketley in 1757.

Iron has been used in structures since prehistory. However, to construct a single structure of cast iron which was almost self-supporting, an Iron Bridge, turned into the vision of

[5] The Conservation Plan for the Iron Bridge (Ironbridge Gorge Museum Trust, 2011) outlines in great detail the historical development and construction sequence of the Iron Bridge. Historical events, maintenance and conservation works relevant to the current project are outlined in Section 4 below.

Abraham Darby III. This would raise awareness of the work of the Coalbrookdale Co. and thus enhance the company's competitiveness.

By 1773, the idea of building a bridge across the Severn had already been under active consideration. The first proposal being in a letter from the Shrewsbury Architect, Thomas Farnolls Pritchard to John Wilkinson, an ironmaster of the New Willey Company, located on the Benthall side of the River Severn (Trinder, 1981, 106).

In the March of 1776 An Act of Parliament gave royal assent for a toll bridge,

"an act for building a Bridge across the River Severn from Benthall, in the County of Salop, to the opposite Shore in Madeley Wood, in the said County; and for the making of proper Avenues or roads to and from the same".

The preamble also names those areas which will benefit from the use of the bridge;

"*Whereas a very considerable Traffick is carried on at Coalbrook Dale, Madeley Wood, Benthall, and Broseley….and the persons carrying on the same are put to great Inconveniences, Delays and Obstructions, by reason of the Insufficiency of the present ferry over the River Severn from Benthall to Madeley Wood, commonly called Benthall Ferry."*

The personal account books of Abraham Darby III note expenditure on the Bridge project from 1776 to 1781. Archive evidence suggests the erection of the bridge began in the July of 1779, when the river water was at its lowest. The bridge was opened to traffic in 1781. Even before the bridge was constructed it was celebrated as a radical new application of technology. In the eighteenth and nineteenth centuries it attracted curious visitors from all over the world. Following the construction of the bridge the settlement of Ironbridge developed on the northern bank of the River Severn, initially strung along the River wharfage and then spreading toward the north.

Of particular relevance to the current investigation works are the extensive historical alterations undertaken to the south abutment. Cracks were observed on the original stone south abutment as early as 1784. These continued to worsen necessitating the installation of tie bars to help remedy the problem. Further repairs were exacted between 1792 and 1799. However, the problems continued and a decision was made in 1800 to demolish the abutment and replace it temporarily with two timber arches. In 1821 these wooden land arches were replaced with cast iron arches.

In 1934 the Iron Bridge was deemed to represent a significant point in design and technology. It had retained its original integrity to such an extent that it was recognized as nationally important and thus warranted statutory protection, the Iron Bridge was scheduled on 18th January 1934. The sheer expanse of iron, the craftsmanship, the locality and the design, all add to the rarity of this class of monument and form the reasons for the bridge being considered of such national importance.

Forty years later further protection was warranted and the bridge was placed under the guardianship of the Secretary of State for National Heritage on the 29th October 1975; subsequently English Heritage.

The bridge lies at the centre of an historic landscape of mining and related industries. The north bank comprises many furnace sites and engine houses, mills, maltings, houses, transport systems, warehouses and so on, whilst the south bank comprises large expanses of clay and coal mining, ceramic industries and transport systems, from early inclines and rails to the Severn Valley Railway. However, today the bridge is used for foot traffic only. Vehicular access was disallowed in 1934, tolls were abolished in 1950 and the bridge is now viewed as a prominent historic landmark, visited and photographed by approximately 270,000 people a year.

In 1986 the Ironbridge Gorge achieved designation as a World Heritage Site. The Ironbridge lies at the centre of the World Heritage Site and as such forms a major part of the World Heritage Site Management plan and requires regular management by the statutory body.

3 RELEVANT RECENT ARCHAEOLOGICAL AND INVESTIGATIVE WORK

In 1999/2000 the Ironbridge Gorge Museum Trust Archaeology Unit undertook an extensive programme of survey, recording and analysis of the Iron Bridge (IGMTAU 2002). This ran concurrently with the repainting programme at the time. This project, which substantially added to the understanding of the structure, was required to meet a number of aims, which included:

- Formulating a construction sequence of the iron work to the Iron Bridge with direct relationship to the form and function of the component parts by a detailed record and analysis the structure of the bridge with specific regard to previously inaccessible areas, the joints and new features or materials

- Formulating a chronological sequence of additions to the ironwork on all of the arches

- Formulating a chronological sequence of the south abutment, inner and landward piers and the north abutment

- Ascertaining the differing casting techniques used upon the structure by manual survey techniques and recognition of tell-tale features and to located and describe those components

- Forming a nomenclature, featuring each component part of the structure, describing location, form, function, possible date, photographic reference, material make-up and condition

- Formulating a photographic survey of the structure, featuring photographs of each component part where possible. To be used in the future as an aid to a management plan

- Forming a masonry typology from visual analysis of the outer and inner landward piers, the north and south abutments, to be an interpretation aid for the sequence of builds and insertions

- Forming a radial typology from visual analysis and on site hand measurement to act as an interpretation aid in relation to the construction sequence, casting technology and other associated research

- Producing a record of repairs and site investigations to the monument during that campaign of work

- Develop recommendations for future work

A programme of archaeological monitoring was also carried out during the excavation of trial holes through the upper surface of the deck of the Iron Bridge (Ironbridge Archaeology 2007). This work was commissioned in order to ascertain the nature of sub-surface fixings to the upright railing posts and to establish the extent of water ingress through the road deck level and its effect on the condition of the cast iron deck plates. No artefacts were uncovered within the stratified layers to aid in the dating of sub-surface remains and fittings; however, the excavations did prove that some secondary arches are of a different cast from those on the main and original arch of the bridge. They also revealed that water, which had ingressed through the road deck level, was found to have collected above the flanged deck plates of the secondary arches, whilst those that had ingressed above the main arch had seeped away. It was also found that a number of post fittings on the main arch had been subject to failure. A number of instances of repair on the deck plates, normally covered by a strip of flash-band tape, were believed to be related to a previous campaign of works in the 1970s. The upper surface of the bridge deck was found to be of asphalt covered with a gravel ‘crust’.

In June 2009 a roped access inspection of the deck plate wedges was carried out by Vertical Technology Ltd. Using roped access techniques, the underside of each deck plate was inspected and the condition of each of the wedges was assessed. Each wedge was recorded as being either: Effective *i.e.* if 10mm or more of the wedge projects below

the top of the rib; Ineffective i.e. if the wedge exists but its condition will not give horizontal restraint to the rib; or Missing i.e. if there is no significant vestige of the wedge visible.

A Deck Wedge Replacement Trial was carried out by English Heritage in January 2010 (*Pers Comm* Arthur McCallum, English Heritage). The principal aims of this project were to expose the decking plates over the joints between plates 2 and 3 and 20 and 21 on the eastern (upstream side of the bridge), to record the pavement construction and positions of live and disconnected services within the trial pits, to remove the remains of the existing defective wedges, clean back the holes and replace with new cast iron wedges, and to test the effectiveness of different surface treatments/coatings. During the trial excavation the outer section of the plate end broke away and landed on the river bank below. The parts were recovered and are stored at the Ironbridge Gorge Museum Trust. It was found that the exposed sections of plates were covered in bitumen which could not be removed without recourse to heavy duty tools and was therefore left in place. Three defective wedges were removed from deck plates 2 and 3 and replacement cast iron replacement wedges were inserted. On attempting to remove the sole exposed wedge at deck plates 20 and 21 it was noted that the arch had at some point been displaced westward and was thus partially overlapping the wedge socket. With this in mind it was decided to replace this wedge with a special mild steel wedge that would fit over and behind the arch.

An archaeological watching brief (Ironbridge Archaeology 2011) was undertaken during wedge replacement works at deck level of the bridge. This involved removing the upper surface material of the western (upstream) side of the bridge's deck to expose the original cast iron plates. Once this upper surface material was removed a number of the cast iron wedges, which were observed to be defective and/or ineffective during a previous engineer's survey of the underside of the bridge, were removed. Once the wedges had been removed the exposed wedge slots were cleaned out by hand, painted with Micaceous Iron Oxide and filled with bespoke "pure iron" replacement wedges rather than the mild steel wedges as originally specified. The reasoning behind this alteration of material used is included in the report (Ironbridge Archaeology 2011).

4 RELEVANT HISTORICAL MAINTENANCE AND CONSERVATION WORKS

The Conservation Plan for the Iron Bridge (Ironbridge Gorge Museum Trust 2011) provides an excellent insight into historical events, maintenance, conservation and other works undertaken at the Iron Bridge. Of these, a number have particular relevance to the objectives of the current project. These include:

- The timber land arches were replaced with cast iron arches 'work began in the summer of 1821, and was completed when the new iron arches were painted in 1823' (IGMT 2011, 22).

- ‘In 1902 a large rectangular water main was installed running across the bridge on the downstream footpath. Soon after, on Sunday 24th August, about 30ft of palisading on the downstream side of the north quadrant fell into the river, taking many of the deck plate ends with it, probably caused by vibrations during the laying of the water main. An earthquake in 1896 may also have been a contributing factor” (IGMT, 25).

Figure 1: The riveted main on the downstream footpath seen here in 1962, which wasn’t removed until 1972 (from IGMT 2011)

‘The damaged deck plates were repaired with new ends that could be bolted on. Several other ends were repaired at the same time, all identifiable by three bolts underneath each repaired deck plate just inside frames E and A’ (IGMT, 25).

- ‘Raised kerbs were installed for the first time in 1923. This followed an engineering survey in March that year by Basil Mott, which advised that *there was some risk in using the bridge for vehicular traffic.* As a result, the roadway was reduced to 14ft by the insertion of two 5ft-wide footpaths on either side. Later

photographs confirm that the footpath on the downstream side was laid around the existing water main, thus partly burying it. The report (*i.e.* by Basil Mott) says there was a gas main within the road deck alongside the water main. This must have been a second gas main, as the gas lamp on the upstream balustrade had a supply which was installed soon after December 1839' (IGMT 2011, 26).

- 'Though the road deck had been narrowed by the insertion of footpaths, the increased weight of motor traffic on the bridge required the fractured deck beams to be reinforced with bolted cast iron saddles in 1927' (IGMT 2011, 27).

- 'In April 1972 Shropshire Council began Stage 1 of the repairs, burying water, gas, electricity and telephone services within the footpaths' (IGMT 2011, 30).

  As part of this work 'a 6" water main within each footpath, plus an old 3" gas main in the downstream footpath were cut off and later restored. An 11kV electricity cable ran down past the wing wall in a metal duct- which was moved into the new service duct on the downstream footpath, coming out low down in the wing wall and so doing away with the metal duct' (IGMT 2011, 174). This involved 'gaining access under the many services which make use of the bridge as well as providing new kerbing and surfacing.

- 'In September 1975 Shropshire County Council's staff removed the asphalt and waterproofed the gaps between the deck plates. The waterproofing was done with a *mixture of two parts pitch extended polyurethane or polysulphide applied by gun, Nitroseal PX220 polyurethane or Evode Polysulphide*' (IGMT 2011, 32).

Figure 2: The road fill being removed on the west side of the bridge in 1975 (Courtesy IGMT 2011)

Figure 3: The east side of the bridge with the road surface removed in 1975 (Courtesy IGMT 2011)

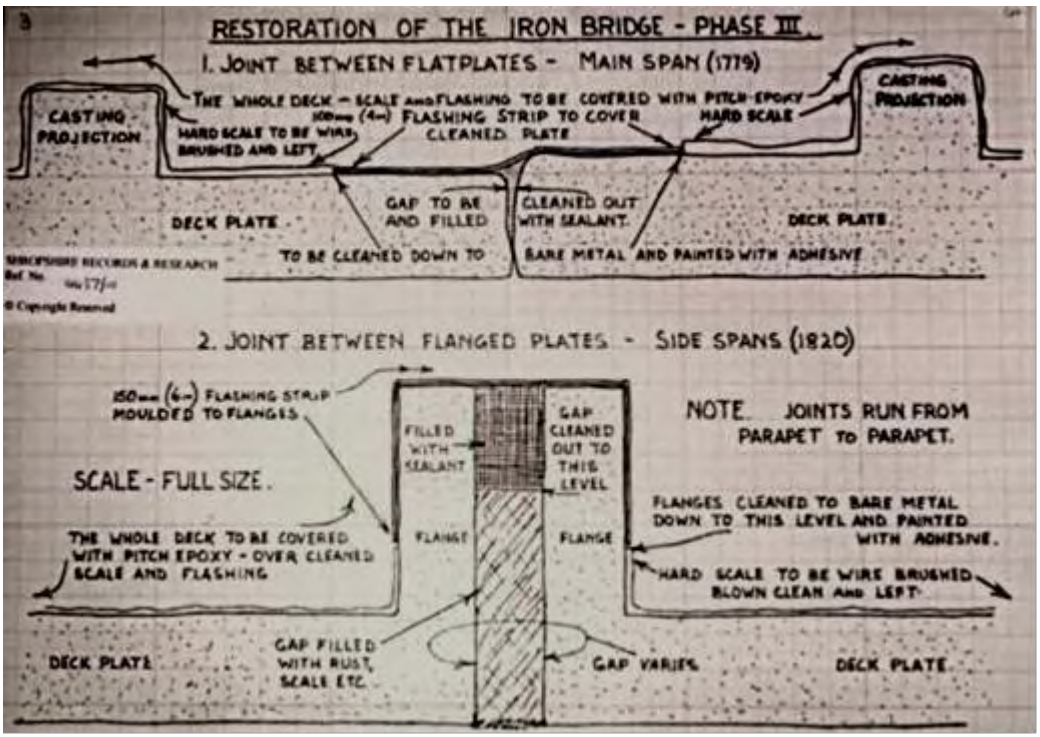

Figure 4: Undated sketch (presumed 1970s) by Sam Blackwell showing the proposed specifications for caulking and sealing the gaps between the deck plates and between the upstands (Courtesy IGMT 2011)

- 'In October 1975 the pavements were edged in cast iron using a pattern from IGMT's collection and cast at Glynwed Foundries in Coalbrookdale' (IGMT 2011, 33).

- 'In 1975 the 'bridge road deck material was renewed' (IGMT 2011, 30)'.

- 'The peanut brittle top dressing currently on the bridge was first laid in 1979, resin-bonded to the asphalt layer over the light weight aggregate beneath which had been laid in 1975' (IGMT 2011, 55).

- 'On 15th January 2000 new nylon packing (Polyethelene PE300) was inserted between the deck bearers and deck plates, wherever thought necessary' (IGMT 2011, 34).

5 AIMS AND OBJECTIVES

The principal aims of the archaeological watching brief were to observe the removal of the upper surface material of the bridge's deck; to recover any find/objects that are of significance or interest; and to produce an illustrated report to the accepted standard for an archaeological watching brief as outlined by the Chartered Institute for Archaeologists (CIfA 2014).

Less specific objectives were to record any archaeological features, structures, deposits or horizons exposed during intrusive groundworks.

6 METHODOLOGY

6.1 ARCHAEOLOGICAL WATCHING BRIEF

- An appropriately skilled and qualified archaeologist was on site to observe the excavation of the trial holes.
- Any exposed archaeological features were recorded by a combination of written, drawn and photographic record (as deemed appropriate).
- All stratigraphic sequences were recorded, including modern constructions.
- Archaeological features were drawn at either 1:20 of 1:50 depending on the complexity of features uncovered, whilst sections were drawn of all cut features and significant vertical stratigraphy at a minimum scale of 1:10.
- A comprehensive written record was maintained using a continuous numbered context system on *pro forma* cards where any archaeological features were found to be present.
- Written records and scale plans were supplemented by photographs using digital photography.
- Any structural details that became visible during the trial trenching, for example deck plates and wedges, were recorded by means of a combination of written record, measured drawing, and photographic record commensurate with the level of detail outlined above.
- Finds (if any) were retrieved as they were revealed during groundworks for cleaning. Recovered finds were cleaned, marked and remedial conservation work was undertaken where necessary. Treatment for all finds conformed to guidance contained within First Aid for Finds (Watkinson and Neal 1998).

No archaeological excavation was undertaken other than cleaning exposed deposits for better definition. Adequate time was allowed by the on-site contractors for observation and recording to take place.

Any exposed historical/archaeological features were recorded using digital photography. On exposure, each of the removed cast iron wedges was photographically recorded, using a 10.0 Megapixel digital camera. Each photograph was recorded on a *pro forma* Photographic Record Sheet. Where deemed and appropriate these photographs included a 50cm scale (red and white) with 25cm gradations or a 40cm scale (black and white) with 10cm gradations for specific details.

All photographs taken during the course of this project were compiled on a CD ROM, copies of which will be deposited with English Heritage, the National Monuments Record (NMR), the Shropshire Historic Environment Record (HER) and the Ironbridge Gorge Museum Trust's Library and Archives as an accompaniment this report.

6.2 DECK-LEVEL SURFACE REMOVAL

The removal of the deck-level surface material was carried out using hand tools only.[6] A circular saw was used to cut through the 'peanut brittle' surface crust layer and to mark out where the trenches were to be excavated. This 'peanut brittle' surface crust layer was then broken up using a lightweight kango-hammer and deposited into heavy duty bags for removal from site. The asphalt layer, *i.e*. beneath the 'peanut brittle' surface and above the deck plates, was broken up using a lightweight kango-hammer and was carefully removed by hand or by shovel.[7] This was retained and stored in heavy duty bags on site for reuse during backfilling.

[6] Deck level surface removal works were undertaken by Vertical Technology under archaeological supervision.

[7] Initial attempts to break up the asphalt layers using manual hand tools proved almost impossible, and the force required to break up this material was causing concern with regard to the impact on the deck plates below.

Plate 5: Contractors from Vertical Technology Ltd. undertaking trial holes on the west side of the Iron Bridge

6.3 RETRIEVAL OF CAULKING SAMPLES

Samples of the caulking encountered between the deck plates and the deck plate upstands were retrieved by Vertical Technology. These samples were removed by cutting through the coated flash band tape using a Stanley knife and then drilling into the caulking material using a combination of a chisel and a hand drill. The samples were then bagged, labelled and taken for further analysis (if required) by Vertical Technology.

Plate 6: Removing the flashband tape using a Stanley knife

Plate 7: Removing the caulking using a hammer and chisel

Plate 8: Removing the caulking using a hand drill

6.4 BACKFILLING

The backfilling of the trenches was carried out by hand.[8] The retained fill material was shovelled back into each trench and hand-tamped down. A new layer of the 'peanut brittle' surface layer was then laid down over the tarmac.

7 THE TRIAL HOLES

7.1 INTRODUCTION

An archaeological watching brief was undertaken during the excavation of seven trial holes at the Iron Bridge for the purposes outlined in Section 1.2 above (see Table 1 and Figure 1 below for approximate locations). [9] Measured sketches of each of the trial holes, which were

[8] Backfilling was undertaken by Vertical Technology under archaeological supervision.

[9] Following consultation on site with Jackie Heath (Conservation Accredited Engineer, Ramboll) it was decided that trial holes TH03, TH07 and TH10 were not required to be excavated at this point in time.

produced by Vertical Technology Ltd. under archaeological supervision and checked on site can be found in Appendix 3.

TH REF	Location
TH01	Span 3, south end, west side, footpath
TH02	Span 3, south end east side, footpath
TH04	Span 2, south end, east side, road
TH05	Span 2, north end, east side, footpath
TH06	Span 1, south end, west side, road
TH08	Span 1, midspan, east side, footway
TH09	Span 1, north end, east side, road

Table 1: Trial holes excavated under archaeological supervision

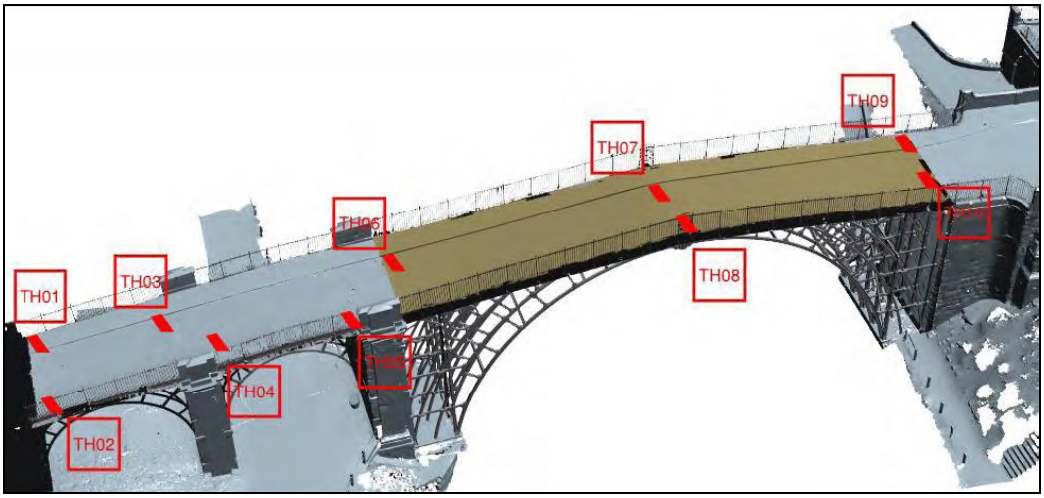

Figure 5: Location of trial holes (NB TH03, TH07 and TH10 were not excavated. Courtesy Ramboll)

7.2 Stratigraphic Sequence

Each of the trenches displayed a relatively generic stratigraphic sequence (also noted in previous trial holes on the bridge (Ironbridge Archaeology 2007, 2011).[10] Located at the base of each trench were the cast iron deck plates, which had upstands when located over the later side arches and were punctuated by wedges over the main arch.

[10] Any divergences from the usual will be outlined below.

Plate 9: A 'typical' trial hole over the main arch of the Iron Bridge

Plate 10: A 'typical' trial hole over the side arches of the Iron Bridge

The junction between the deck plates/upstands was filled with a sealant, covered with flashband tape, which in turn was coated with a sealant.[11] The deck plates were overlain by a layer/s of late 20th century light asphalt or Lytag type material of varying depths, on

[11] More detail regarding the caulking and sealant can be found below.

top of which was the current deck surface material *c.*40/50mm thick, which consists of a gravel 'nut brittle' bonded resin crust. [12]

In each trial hole a concrete 'bench' was encountered as a support for the cast iron kerbing along the footpath.

No stratified artefacts were uncovered within these layers to aid in the dating of the subsurface remains and fittings. It is unlikely that any of the excavated material represents the original bridge surface material especially considering that the surface of the bridge was excavated in the 1970s.

7.3 TRIAL HOLE 02 (TH02)

(NB. The trial holes are described in order of excavation)

A 600mm x 1440mm trench was excavated at this location. This was excavated to deck plate level, which was located at a depth of 470mm below surface level.

Plate 11: Using a circular saw to cut through the 'peanut brittle' surface of TH02

The trench revealed two metal service pipes (understood to be gas and water mains), the easternmost of which was spigoted at the joints. The highest point of the spigot on easternmost pipe (water) was uncovered 78mm below surface level, with the pipe, measuring 172mm in diameter, being located 110mm from surface level and 145mm from

[12] It is possible that this light asphalt type material is processed fly ash from the Ironbridge Power Station.

deck plate level. The other pipe (gas), which was located 240mm to the west, was 102mm in diameter and located 155mm below surface level.

Plate 12: TH02 from the north

The deck plate upstands, which ran east-west through the midpoint of the trench, were 70mm high and 25mm wide. The gap between the deck plate upstands was found to be approximately 20mm wide and filled with caulking. Interestingly, during the excavation of this trial hole, water was found to be pooling on the western side of the trench on the north side of the upstands (see Plate 13).

Plate 13: Water pooling in TH02

Invasive exploratory works were undertaken by the contractors with a view to better understanding the nature and extent of the caulking (see Section 6.3 above for details of the methodology employed). It was found that the 'gap' between the deck plate upstands was filled with a material that resembled 'iron cement'. This was overlain by a plug of a bitumen-type material, which was approximately 3-4mm thick. This was sealed with flashband tape, which covered the horizontal and vertical sections of the caulked upstands and the adjacent deck plates for approx. 55mm. The flashband tape and the deck plates were coated with a brittle sealant layer (see Plate 14). [13]

[13] 'Iron cement' is a paste of iron filings and scale which is often utilised for sealing joints.

Plate 14: Part way through attempts at removing the sealing and caulking material from the upstands in TH02. Note flashband tape and sealant to the left of the photo

When the caulking material had been cleaned out a square notch was observed on the corresponding internal faces of the upstands. It is possible that these had been used to help lift the deck plates into place (see Plate 15).

Plate 15: The gap between the deck plate upstands in TH02. Note the notch on the inner face.

The upstands were found to be bolted together approximately 740mm from the easternmost edge of the trench.

7.4 TRIAL HOLE 01 (TH01)

A 600mm x 1540mm trench was excavated at this location. This was excavated to deck plate level, which was located at a depth of approximately 465mm below surface level. The trench revealed two metal service pipes (gas and water) and a ceramic electric cable conduit. The westernmost pipe (water) pipe, which was 170mm in diameter and flanged at the joints, was located approximately 110mm below surface level, approximately 80mm above deck plate level, and *c*.220mm from the western edge of the trial hole. Located 110mm to the east of this was the gas pipe, which was 130mm in diameter, and 185mm from surface level and 60mm from deck plate level. The ceramic electric cable conduit was uncovered almost immediately adjacent to this (*c*.35mm) to the east. This was approximately 165 mm below surface level and 265mm wide at its widest point. This conduit was surrounded by sand and was stamped with the words 'DANGER ELECTRICITY'.

Plate 16: TH01 from the east

The deck plate upstands, which ran east-west through the midpoint of the trench, were 70mm high and 22mm wide. The gap between the deck plate upstands was found to be approximately 18mm wide and filled with caulking. Similar to TH02, the excavation revealed some pooling of water on the north side of the upstands on the western side of the trench. The caulking between the upstands and the sealant material, were similar in nature to that outlined in TH02 above.

Plate 17: TH01 from the north.

The upstands were found to be bolted together approximately 45mm to the east of the western edge of the trial hole, *i.e*. the bridge edge plate, which had a sizeable crack, and was found to be coated with what appears to be red lead (see Plate 18). Further bolt holes through the upstands approximately 20/30mm in diameter, 2.05m to the east of the bridge end plate do not quite line up and may never have been used for that purpose.

Plate 18: Crack in the bridge edge plate in TH01 from the east

Interestingly, there was a clear distinction in the type of asphalt/aggregate utilised at the lower part of the trench to that of the upper section suggesting two different phases of fill. Here the top *c.*280mm of fill (and only above the services) was much lighter in colour, apart from immediately adjacent to the railings (west).

7.5 TRIAL HOLE 08 (TH08)

A 600mm x 1500mm trench was excavated at this location. This was excavated to deck plate level, which was located at a depth of approximately 350mm below surface level. The trench revealed two metal service pipes (gas and water), the most easterly of which (water) had a flange (280mm in diameter) which was located approximately 45mm below the present footpath surface. This pipe (180mm in diameter) was located approximately 230mm to the west of the bridge edge plate, *i.e*. the easternmost edge of the trial hole, and 280mm to the east of the gas main which was located 165mm below surface level and was 100mm in diameter. A pair of wedges (approximately 10mm (east)/50mm (west) high and 70mm wide) were uncovered in the eastern side of the trench, approximately 390mm from the bridge edge plate and under the water main.

Plate 19: TH08 from west

As this trial hole was located on the main arch of the bridge no deck plate upstands were found to be present. The gap between the deck plates was filled with a hard bituminous-type material similar to that recorded in TH02 and TH01 above, and covered over with flashband tape (110mm wide). Samples of this were removed by the contractors who noted that it was only possible to expose *c.*15mm of the material as the join between deck plates grew tighter at depth. This was possibly due to the fact it was observed that the north plate was 6 to 8mm higher than the south plate at the join.

Plate 20: TH08 from the south

The deck plates and the wedges were coated with a thin and brittle sealant layer. The joint between the deck plates and the bridge edge plates was also sealed with flashband tape (see Plate 21).

Plate 21: Sealing at the joint between the deck plates and the bridge edge plates in TH08 from the west

Similar to TH01 above, there were two distinct layers of aggregate fill.

7.6 TRIAL HOLE 09 (TH09)

A 600mm x 1500mm trench was excavated at this location. This was excavated to deck plate level, which was located at a depth of approximately 440mm below surface level. The trench revealed two metal service pipes (gas and water) and a ceramic electric cable conduit. The westernmost pipe (water) had a diameter of 225mm and was found to be located 85mm below the surface level and 115mm to the east of the bridge edge plate. The gas main, 460mm to the east of the water main was 128mm in diameter and was located 200mm below the surface level. 60mm to the east of this was the electricity conduit, which was 195mm below the surface level, 255mm wide, and 195mm high.

Plate 22: TH09 from the east

Two MIO coated pure iron wedges, which were installed in 2011 (see Ironbridge Archaeology 2011), were uncovered towards the western side of the trench. These were located approximately 440mm to the east of the bridge edge plate. Some corrosion was observed on the deck plates in the around the wedges, presumably where waterproofing had been removed.

Plate 23: Pure iron wedges in TH09

Immediately to the west of these wedges was a repair plate which was secured to the deck plates with square headed bolts. This was located approximately 70mm from the bridge edge plate and was 370mm wide (east to west) and *c.*500mm long (north to south). The plate was found to be 38mm thick (see Plates 22, 23 and 24).

Plate 24: TH09 from east. Note repair plate on west side of trench

The caulking between the deck plates and the sealant coating was found to be similar to that described in TH08 above.

Two distinct layers of 'peanut brittle' in places relate to the fact that a section of this trial hole had previously been opened up during the wedge replacement works in 2011.

7.7 TRIAL HOLE 06 (TH06)

A 600mm x 1000mm trench was excavated at this location. This was excavated to deck plate level, which was located at a depth of approximately 450mm below surface level. No services were encountered in this trial hole.

Plate 25: TH06 from the west (NB black and white scale is 40cm long, red and white scale is 50cm long)

This excavation revealed two wedges on the western side of the trench. These were located 285mm from the kerbing and were *c.* 85mm long and 45mm wide.

The western part of the trench had clearly been disturbed previously as the flashband tape over the gap between the deck plates had been displaced and the brittle sealant on the deck plates had been removed (see Plate 26). It was also possible to see through the gap (6 to 11mm in places) between the deck plates at this point suggesting that the

caulking material, which was consistent with that described above had been deliberately removed. The aggregate over this area was less compacted than that on the eastern side of the trench, again suggesting some form of disturbance (possibly as part of the works carried out to assess the condition of the wedges in 2007). Where present, flashband tape 110mm wide covered over the gap between the deck plates. Caulking material was found to be similar to those that above.

Plate 26: TH06 from above showing partially removed sealant and caulking as uncovered by the excavations

7.8 TRIAL HOLE 05 (TH05)

A 600mm x 1420mm trench was excavated at this location. This was excavated to deck plate level, which was located at a depth approximately 380mm below surface level. The trench revealed two metal service pipes (gas and water). The most easterly of which (water) was found to be located 150mm below surface level and had a diameter of 170mm. This was located 300mm from the bridge edge plate. The gas main, which was located 255mm to the west of this, was found to be 210mm below surface level and had a diameter of 100mm.

Plate 27: TH05 from the west

As this trial hole was located on a side arch deck plate upstands were found to be present. These were *c.*70mm high and were found to be bolted together approximately 470mm to the west of the bridge edge plate.

Plate 28: TH05 from the north

The caulking and sealant layer were similar in detail to those recorded in other trial holes where upstands were located.

An L-shaped brace and repair plate were found at the deck-edge plate, both of which were coated with red lead (see Plates 28 and 29). This corresponds with an area of darker paint on the river-side section of the bridge at this point (see Plate 30). It is unclear what these relate to at this stage. They may be historic repair or have some link to the raising of the bridge deck surface level to accommodate the services at this point. David de Haan (pers comm) notes that in 1999, from a scaffold, he observed a fracture at this point on the outside of the bridge. He believes that this repair was exacted in 1975 when the road material was last lifted.

Plate 29: L-shaped brace in TH05 from west

Water pooling was observed in the western side of the trial hole to the north of the upstands. No water pooling was observed on the eastern side, presumably as water has found means of egress through gaps around the upstands at the bridge edge plate.

Plate 30: Dark area of paint corresponding with the L-shaped brace and plate (where the contractors are working)

7.9 TRIAL HOLE 04 (TH04)

A 600mm x 1000mm trench was excavated at this location. This was excavated to deck plate level, which was located approximately 390mm below surface level.

Plate 31:TF04 from the east

The trench revealed the deck plate upstands which were found to be *c.*70mm high and 22mm wide with a 20mm gap in between, which had been filled with a caulking as detailed above. The upstands were bolted together (approx. 500m from both ends of the trial hole) and sealed with flashband tape with a thin brittle coating as in the other trial holes described above.

Plate 32: TF04 from the south

Two distinct layers of aggregate constituted the fill material. The uppermost layer was 200mm thick and much lighter in colour and less compact than the darker layer below which was 120mm thick.

8 DISCUSSION

Nothing particularly unexpected was uncovered during the archaeological watching brief. Nevertheless, the current programme of works has provided an excellent insight into the form and location of services located on the Iron Bridge. It has also been particularly useful in investigating the nature and extent of caulking and sealants utilised during waterproofing works to the gaps between the deck plates on the main arch and the deck plate upstands on the side arches in the 1970s.

The investigative works have gone a long way to show that the specifications for waterproofing the joints between the deck plates and upstands produced in the 1970s (IGMT 2011, 180, Figure 4 this report) were carried out. These show that on the side arches, the upstands were to be cleaned back to bare metal, with the lower section of the gap to be filled with rust and scale, and the upper section of the gap to be filled with sealant. The upstands were then to be painted with adhesive, and covered with 150mm wide flashing strip. The whole deck plate, including the flashing and upstands was to be covered with pitch epoxy. On the main arch the deck plates were to be cleaned down to bare metal and the gap between the deck plates was to be cleaned out and filled with sealant. The joint was then to be covered with 100mm wide flashing strip and then the whole deck plate, including the flashing was to be covered with pitch epoxy. This also

tallies with the fact that in September 1975 Shropshire County Council's staff removed the asphalt and waterproofed the gaps between the deck plates. The waterproofing was done with a mixture of two parts pitch extended polyurethane or polysulphide applied by gun, Nitroseal PX220 polyurethane or Evode Polysulphide' (IGMT 2011, 32).

The only other features of particular note were the repair plate found in TH09 (Plates 22, 23, and 24) and the repair plate found in TH05 (Plates 28 and 29). David de Haan, the author of the Iron Bridge Conservation Plan, has highlighted a photograph of the underside of TH09 which shows a crack across the corner of the deck plate. This is what he believes the repair plate was aimed at reinforcing. He also noted that the bolt on the plate is directly over the deck bearer and therefore will not be visible from below. He suggests that it is a coach bolt screwed into a tapped hole, and it could have been installed in 1902-3 or 1926. With regards to the repair plate encountered in TH05, he believes that the repairs were undertaken when the road material was last removed in 1975.

Previous reports (such as IGMTAU 2002, Ironbridge Archaeology 2007, Ironbridge Archaeology 2011, IGMT 2011) describe the fill material as asphalt or light asphalt. Discussions on site with engineers working on the bridge (past and present) have raised the possibility that this material is not asphalt and could be a material such as Lytag, a lightweight aggregate which is up to 50% lighter than regular aggregate, which potentially could have been produced using fly ash from the Iron Bridge Power Station. Further research and analysis is required in relation to this.

9 ACKNOWLEDGEMENTS

This project was commissioned by Ramboll on behalf of English Heritage. Thanks are extended to Jackie Heath (Conservation Accredited Engineer/Project Associate, Ramboll) and Ann Towers (National Project Manager, English Heritage) and their colleagues for their help and assistance throughout the project.

Thanks also go to Jon Willis (Vertical Technology Ltd.) and his team for their valued input and enthusiasm throughout.

Gratitude also goes to David de Haan for his input regarding the history and development of the bridge and to Bill Klemperer (Principal Inspector of Ancient Monuments) who monitored the project for Historic England.

Shane Kelleher carried out the archaeological watching brief, compiled and illustrated this report and managed the project for Ironbridge Archaeology on behalf of the Ironbridge Gorge Museum Trust.

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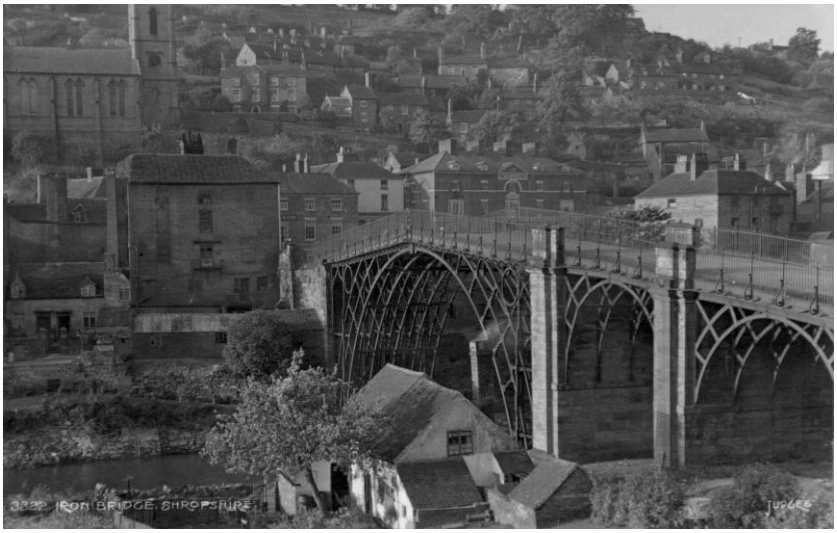
APPENDIX 1: WRITTEN SCHEME OF INVESTIGATION

Ironbridge Archaeology

The Archaeology Unit of the Ironbridge Gorge Museum Trust

Ironbridge
BIRTHPLACE OF INDUSTRY



WSI for an Archaeological Watching Brief during Investigation Works at the Iron Bridge, Ironbridge, Shropshire.

February 2016

Prepared by:
Shane Kelleher MA MCIfA

Prepared for:
Jackie Heath,
Conservation Accredited Engineer,
Project Associate,
Ramboll

WSI FOR UNDERTAKING AN ARCHAEOLOGICAL WATCHING BRIEF DURING PROPOSED INVESTIGATION WORKS TO THE IRON BRIDGE, IRONBRIDGE, SHROPSHIRE

Contents

1 Introduction

This document describes the programme of work required to undertake an archaeological watching brief during proposed investigation works to the Iron Bridge, Ironbridge, Shropshire. This Written Scheme of Invesitgation (WSI) was requested by Historic England with a view to specifying a programme of archaeological fieldwork and recording in order to satisfy one of the conditions of Scheduled Monument Consent for the proposed works (Case No. S00126896).

Condition of the Scheduled Monument Consent (b) states:

'No works shall take place until the applicant has confirmed in writing the commissioning of a programme of archaeological work before and/or during the development in accordance with a written scheme of investigation which has been submitted to and approved by the Secretary of State advised by Historic England'.

It is understood, given the nature of the proposed works, that an archaeological watching brief is the most appropriate methodology to be employed. This WSI, which allows for the identification and recording of any archaeological features exposed by the proposed works, outlines how the archaeological watching brief will be conducted.

This WSI is based on information known to be correct on the 27th of January 2016. Any variation in the scope of work will be agreed with Bill Klemperer, Principal Inspector of Ancient Monuments, Historic England, before implementation.

Project background

English Heritage intends to undertake major repairs to the Iron Bridge in the summer of 2017. To inform the preparation of tender and construction drawings/specifications for these repairs which are recommended in the Conservation Management Plan for the Ironbridge (Ironbridge Gorge Museum Trust 2011) and subsequent studies, three investigations are required:

- INVESTIGATION A- CAT Scan and utilities search
- INVESTIGATION B- Access inspection of the edges of the deck plates for three spans including visual inspection (from within touching distance and ultrasonic scanning)
- INVESTIGATION C- Trial holes in the deck, including trial removal of caulking, measurements, inspection, levels and reinstatement.

(Ramboll 2015)

The archaeological watching brief is particularly relevant for the trial holes (i.e. INVESTIGATION C), which is the only intrusive component of the proposed works. It is understood that up to 10 trial holes (approximately 600mm wide across the width of the footway and 600mm x 1000mm adjacent to the footway- location specified by the client) will be excavated down to the upper face of the cast iron plates (previous interventions suggest a depth between 300mm and 600mm). The exact nature of the fill material is not known, however, previous excavations have found sand, clinker, furnace slag and brick in the footway and concrete in the roadway.

In addition to monitoring and recording the trial holes Ironbridge Archaeology will be available on an as and when required basis during INVESTIGATIONS A and B should

archaeological input be required. In addition to this, a photographic record of these investigations will be made for purposes of the report and archive.

Site location and status

The Iron Bridge is located at NGR SJ 673 034 and is situated within the Ironbridge Gorge World Heritage Site, which was inscribed by UNESCO in 1986. The designation noted that the Iron Bridge was "a masterpiece of man's creative genius... [which] ...exerted great influence on developments in the fields of technology and architecture."

The Iron Bridge was designated a Scheduled Ancient Monument (SAM 27558) in 1934, and is also a Grade I listed building.

The bridge is owned by Telford and Wrekin Council, who acquired ownership from the former Shropshire County Council (formerly Salop County Council) on 1st March 1997. The bridge was taken into Guardianship from Salop County Council by the then Secretary of State for the Environment on 29th October 1975; Guardianship now rests with the Department for Culture Media and Sport, whose duties in this respect are delegated to English Heritage.

The Guardianship area includes parts of the abutments and associated features. The Toll House and shed opposite are owned by, and in the control of, the Ironbridge Gorge Museum Trust and do not form part of the Guardianship area.

Historical Background

The Iron Bridge was built in 1779 and was the first single span bridge to be formed wholly from cast iron. It was possibly cast at one of the Coalbrookdale Furnaces, under the ownership of the Coalbrookdale Company. The company had been founded earlier in the eighteenth century in an area rich in mineral resources. Coal, ironstone and clay were all extracted locally and used in iron, ceramic and other industries, some established in the early seventeenth century.

The latter half of the eighteenth century saw a large scale development of the Shropshire and Welsh iron industry. The considerable expansion of the Dale Company continued in the 1750s, which was overseen by Abraham Darby II. The Dale Company erected new blast furnaces at Horsehay in 1755 and 1757 and at Ketley in 1757.

Iron has been used in structures since prehistory. However, to construct a single structure of cast iron which was almost self-supporting, an Iron Bridge, turned into the vision of Abraham Darby III. This would raise awareness of the work of the Coalbrookdale Co. and thus enhance the company's competitiveness.

By 1773, the idea of building a bridge across the Severn had already been under active consideration. The first proposal being in a letter from the Shrewsbury Architect, Thomas Farnolls Pritchard to John Wilkinson, an ironmaster of the New Willey Company, located on the Benthall side of the River Severn (Trinder, 1981, 106).

In March of 1776 An Act of Parliament gave royal assent for a toll bridge,

"an act for building a Bridge across the River Severn from Benthall, in the County of Salop, to the opposite Shore in Madeley Wood, in the said County; and for the making of proper Avenues or roads to and from the same".

The preamble also names those areas which will benefit from the use of the bridge;

"Whereas a very considerable Traffick is carried on at Coalbrook Dale, Madeley Wood, Benthall, and Broseley….and the persons carrying on the same are put to great

Inconveniences, Delays and Obstructions, by reason of the Insufficiency of the present ferry over the River Severn from Benthall to Madeley Wood, commonly called Benthall Ferry."

The personal account books of Abraham Darby III note expenditure on the Bridge project from 1776 to 1781. Archive evidence suggests the erection of the bridge began in the July of 1779, when the river water was at its lowest. The bridge was opened to traffic in 1781. Even before the bridge was constructed it was celebrated as a radical new application of technology. In the eighteenth and nineteenth centuries it attracted curious visitors from all over the world. Following the construction of the bridge the settlement of Ironbridge developed on the northern bank of the River Severn, initially strung along the River wharfage and then spreading toward the north.

In 1934 the Iron Bridge was deemed to represent a significant point in design and technology. It had retained its original integrity to such an extent that it was recognized as nationally important and thus warranted statutory protection, the Iron Bridge was scheduled on 18th January 1934. The sheer expanse of iron, the craftsmanship, the locality and the design, all add to the rarity of this class of monument and form the reasons for the bridge being considered of such national importance.

Forty years later further protection was warranted and the bridge was placed under the guardianship of the Secretary of State for National Heritage on the 29th October 1975; subsequently English Heritage.

The bridge lies at the centre of an historic landscape of mining and related industries. The north bank comprises many furnace sites and engine houses, mills, maltings, houses, transport systems, warehouses and so on, whilst the south bank comprises large expanses of clay and coal mining, ceramic industries and transport systems, from early inclines and rails to the Severn Valley Railway. However, today the bridge is used for foot traffic only. Vehicular access was disallowed in 1934, tolls were abolished in 1950 and the bridge is now viewed as a prominent historic landmark, visited and photographed by approximately 270,000 people a year.

In 1986 the Ironbridge Gorge achieved designation as a World Heritage Site. The Ironbridge lies at the centre of the World Heritage Site and as such forms a major part of the World Heritage Site Management plan and requires regular management by the statutory body.

Relevant recent archaeological work

An archaeological watching brief (Ironbridge Archaeology 2011) was undertaken during wedge replacement works at deck level of the bridge. This involved removing the upper surface material of the western (upstream) side of the bridge's deck to expose the original cast iron plates. Once this upper surface material was removed a number of the cast iron wedges, which were observed to be defective and/or ineffective during a previous engineer's survey of the underside of the bridge, were removed. Once the wedges had been removed, the exposed wedge slots were cleaned out by hand, painted with Micaceous Iron Oxide and filled with bespoke 'pure iron' replacement wedges.

In addition, archaeological monitoring (Ironbridge Archaeology 2007) has been previously carried out during the excavation of trial holes through the upper surface of the deck of the Iron Bridge. This work was commissioned in order to ascertain the nature of sub-surface fixings to the upright railing posts and to establish the extent of water ingress through the road deck level and its effect on the condition of the cast iron deck plates. No artefacts were uncovered within the stratified layers to aid in the dating of sub-

surface remains and fittings; however the excavations did prove that some secondary arches are of a different cast from those on the main and original arch of the bridge. They also revealed that water, which had ingressed through the road deck level, was found to have collected above the flanged deck plates of the secondary arches, whilst that which had penetrated above the main arch had seeped away. It was also found that a number of post fittings on the main arch had been subject to failure. A number of instances of repair on the deck plates, normally covered by a strip of flash-band tape, were believed to be related to a previous campaign of works in the 1970s. The upper surface of the bridge deck was found to be of asphalt covered with a gravel 'crust'.

In addition to these recent interventions, a Conservation Management Plan (Ironbridge Gorge Museum Trust 2011) has been produced in order to inform the future conservation of the bridge and to provide guidance on the risks, opportunities and issues surrounding it.

2 AIMS AND OBJECTIVES

The principal aims of the archaeological watching brief will be to observe the removal of the upper surface material of the bridge's deck; to recover any finds/objects that are of significance or interest; and to produce an illustrated report to the accepted standard for an archaeological watching brief as outlined by the Chartered Institute for Archaeologists (CIfA 2014).

Less specific objectives will be to record any archaeological features, structures, deposits, or horizons exposed during intrusive groundworks.

3 METHODOLOGY

Archaeological Watching Brief

- An appropriately skilled and qualified archaeologist will be on site to observe the excavation of the trial holes- Adequate time should be allowable by the on-site contractors for observation and recording to take place.
- No archaeological excavation will be undertaken other than cleaning exposed deposits for better definition.
- Any exposed archaeological features will be recorded by a combination of written, drawn and photographic record (as deemed appropriate).
- All stratigraphic sequences will be recorded, including modern constructions.
- Archaeological features will be drawn at either 1:20 or 1:50 depending on the complexity of features uncovered, whilst sections will be drawn of all cut features and significant vertical stratigraphy at a minimum scale of 1:10.
- A comprehensive written record will be maintained using a continuous numbered context system on pro-forma on *pro-forma* cards should any archaeological features be found to be present.
- Written records and scale plans will be supplemented by photographs using digital photography.
- Any structural details that become visible during the trial trenching, for example deck plates and wedges, will be recorded by means of a combination of written record, measured drawing, and photographic record commensurate with the scale and level of detail outlined above.

- Finds will be retrieved as they are revealed during groundworks for cleaning. Recovered finds will be cleaned, marked and remedial conservation work will be undertaken as necessary. Treatment for all finds will conform to guidance contained within First Aid for Finds (Watkinson and Neal 1998).

Should anything of archaeological interest or potential significance arise during the archaeological watching brief intrusive works in that area should halt to allow time for Historic England to be advised and recommend any additional mitigation as appropriate.

4 STAFFING AND MONITORING

The project will be managed for the Ironbridge Gorge Museums Trust by Shane Kelleher MA MCIfA who will also undertake the fieldwork.

Specialist assistance will be sought where appropriate.

All work will be monitored through liaison with Bill Klemperer, Historic England's Principal Inspector of Ancient Monuments.

5 REPORTING

The results of the archaeological watching brief will be presented as a written report, containing appropriate illustrations. We would hope to disseminate the report within six weeks of the end of the fieldwork- any extension of this time scale would be discussed with Historic England and English Heritage. A draft copy of the report will be provided to Bill Klemperer (Historic England's Principal Inspector of Ancient Monuments) for comment by the end of March 2016. A copy of the final report will be lodged at the National Monuments Record and Shropshire Historic Environment Record.

This report will be in the format required by the Management of Archaeological Projects 2 (English Heritage 1991) and Management of Research Projects in the Historic Environment (Historic England 2015) guidelines as appropriate, and will include:

1. Summary
2. Description of the archaeological background
3. Method
4. A narrative description of the results and discussion of evidence, set in their local, regional and national research context, supported by any relevant plans (the results of the watching brief will be annotated on pre-existing architects drawings when deemed necessary and appropriate), sections and photographs
5. Summary of the finds

6 ARCHIVING

The full site archive will include all artefactual remains recovered from the site. Finds and the paper archive will be deposited at the Ironbridge Gorge Museums, the archaeological depository for the Ironbridge Gorge. All retained artefacts will be cleaned, conserved and packaged in accordance with the requirements of the Ironbridge Gorge Museum Trust

and will be deposited, along with the paper archive, in accordance with the storage requirements of the museum.[1]

Preparation and deposition of the site archive will be undertaken with reference to *Guidelines for the Preparation of Excavation Archives for Long Term Storage* (Walker 1990) and *Archaeological Archives: a guide to best practice in creation, compilation, transfer and curation* (Brown 2007).

The archive will include:

- All field notes, logbooks and other documentation generated by the fieldwork stage.
- Research notes, tracings and other documentation generated by research work.
- All field drawings and sketches, including working drawings, annotated plans, sections and details, together with all final inked up drawings. All will be fully indexed and cross-referenced.
- All photographic images on CD with digital images, fully indexed and cross-referenced.
- A hard copy of the site report.

Access to the archive will be available to English Heritage, Historic England, and agreed third parties, at any reasonable time, subject to normal access arrangements in place at the Ironbridge Gorge Museum Trust.

An OASIS form will be filled in for the project.

7 PROFESSIONAL STANDARDS

Shane Kelleher is a Member of the Chartered Institute for Archaeologists (MCIfA).

Shane Kelleher will follow the code of conduct of the CIfA at all times.

The watching brief will be undertaken in accordance with the standards laid down in the 'Standard and Guidance for Archaeological Watching Briefs' (CIfA 2014).

8 HEALTH AND SAFETY

All current Health and Safety legislation, regulations and guidance will be complied with. The watching brief will conform to the *Workplace (Health, Safety and Welfare) Regulations 1992*, *Management of Health and Safety at Work Regulations 1999*, and *Construction (Design and Management) Regulations 2007* and any other health and safety legislation where appropriate. Work will be carried out in accordance with the guidelines laid out in *Health and Safety in Field Archaeology Manual* (SCAUM 2007).

A risk assessment will be undertaken by Ironbridge Archaeology in the set-up stage of the project, and appropriate actions will be taken.

Ironbridge Archaeology is fully covered under the insurance policies of the Ironbridge Gorge Museum Trust for the following:

- Employers Liability (up to £10,000,000)

[1] This is on the proviso that the museum maintains it according to best practice and does not dispose of any part unless offered to the NMR in entirety first.

- Public and Products Liability (up to £10,000,000 any one occurrence, products in the aggregate)

9 REFERENCES

Brown, D. 2007. *Archaeological Archives. A guide to best practice in creation, compilation, transfer and curation*. Archaeological Archives Forum and Institute of Field Archaeologists.

Chartered Institute for Archaeologists 2014 *Standard and guidance for an archaeological watching brief*

English Heritage 1991 *The Management of Archaeological Projects*. English Heritage: London.

Historic England 2015 *Management of Research Projects in the Historic Environment: The MoRPHE project managers' guidelines.* Historic England: London

Ironbridge Archaeology 2007 *Archaeological Monitoring of Trial Holes Excavation at the Iron Bridge, Ironbridge, Shropshire*. Ironbridge Archaeological Series No. 197.

Ironbridge Archaeology 2011 *Archaeological Watching Brief during wedge replacement works at the Iron Bridge, Ironbridge, Shropshire*. Ironbridge Archaeological Series No. 313).

Ramboll 2015 *The Iron Bridge: Scope and Brief for Site Investigations.*

Standing Conference of Archaeological Unit Managers (SCAUM), 2007 *Health & Safety in Field Archaeology Manual.*

Walker, K. 1990 *Guidelines for the preparation of excavation archives for long-term storage*, Archaeology Section of the United Kingdom Institute for Conservation.

Watkinson, D. and Neal, V. 1998 *First Aid for Finds* (3rd edition), RESCUE and the Archaeology Section of the United Kingdom Institute for Conservation.

10 COPYRIGHT AND CONFIDENTIALITY

Copyright

Confidentiality

The Ironbridge Gorge Museum Trust undertakes to respect all requirements for confidentiality about any of English Heritage's activities in relation to the Iron Bridge which may become known during the course of this work. It is expected that such conditions shall not unreasonably impede the satisfactory delivery of the services

required. Ironbridge Gorge Museum Trust further undertake to keep confidential any conclusions about the likely implications of such proposals for the historic environment, until such time as the information is in the public domain. It is expected that English Heritage respects Ironbridge Gorge Museum Trust's general ethical obligations not to suppress significant archaeological data for an unreasonable period.

APPENDIX 2: RAMBOLL'S SCOPE FOR SITE INVESTIGATIONS

Intended for
English Heritage and Contractors

Project no.
33288

Date
26 November 2015

THE IRON BRIDGE

SCOPE AND BRIEF FOR SITE INVESTIGATIONS

Revision History

Revision	Date	Purpose / Status	Document Ref.	Comments
	26.11.2015	Draft for EH comment	33288-S-R06	
Rev A	04.12.2015	For pricing	33288-S-R06 Rev A	

Prepared By	Reviewed By	Approved By
Jackie Heath	**J .D Miller& Rod Pirie**	**J .D Miller**
Project Associate	Technical Director	Technical Director

1. Introduction

English Heritage intends to undertake repairs to The Iron Bridge, Shropshire in the summer of 2016. To inform the preparation of tender and construction drawings/specification for these repairs, which are recommended in The Conservation Management Plan and subsequent studies, three investigations are required:

- **INVESTIGATION A: -** **CAT Scan and utilities search**
- **INVESTIGATION B: -** **Access** Inspection of the edges of the deck plates for three spans including **visual inspection (from within touching distance and ultrasonic scanning**)
- **INVESTIGATION C: -** **Trial holes** in the deck, including trial removal of caulking, measurements, inspection, levels and reinstatement.

We are seeking quotes from contractors to carry out all three of these investigations together.

Detailed scopes for each investigation are included at the end of this document.

The works will be subject to an archaeological watching brief and the archaeologist will be appointed separately by English Heritage.

2. Location, Site Information, Designation and Ownership

The Iron Bridge is located between the villages of Ironbridge and Broseley, spanning the River Severn in the Ironbridge Gorge, Shropshire. Refer to the attached location plan.

National Grid Reference: SJ 67241 03398

The bridge is closed to traffic. Access for a contractor's vehicle is strictly controlled and only possible from the south (Broseley) side, via a locked gate. Refer to Ramboll/ English Heritage Loading Guide for full details.

The bridge is situated within the UNESCO Ironbridge Gorge World Heritage Site.

The bridge is Scheduled under the Ancient Monuments and Archaeological Areas Act 1979. National Monument UID 27558. Work is subject to Scheduled Monument Consent. The Contractor must have experience with working on listed or Scheduled structures.

It is also listed Grade I under the Planning (Listed Buildings and Conservation Areas) Act 1990.

The Iron Bridge is owned by Telford and Wrekin Council but is under the Guardianship of English Heritage.

3. Background

The background to these investigations, together with the description of the bridge and deck plates is described in Ramboll Report *The Iron Bridge: Deck Repairs: Options and Recommendations* 33288-S-R01 March 2014. The contractor is recommended to refer to this report.

4. Health and Safety

The Contractor is responsible for compliance with all current Health and Safety legislation and HSE guidance, including but not limited to Health and Safety at Work Act 1974 and The Work at Height Regulations 2005.

The Construction (Design and Management) Regulations 2015 will apply to Investigation C and therefore the contractor will be required to take on the role of Principal Contractor.

The Contractor shall provide risk assessments and method statements for all activities for review and approval prior to commencement.

All testing, investigations and excavations are to be compliant with current British Standards and best practice.

The Contractor shall provide the necessary welfare facilities for their own staff and for the archaeologists.

5. Target Programme

Subject to receipt of Scheduled Monument Consent:

Task	Date	notes
Issue Brief to contractors	Friday 4 December 2015	
Contractor Return Quotes	**By Thursday 17 December 9am**	2 weeks
Assessment of quotes and appointment by EH	w/c 4 January 2016	1 week
Contractor Mobilisation	w/c 11 January	2 weeks
Site Period	25 January to 19 February	3-4 weeks
Investigation Report Issue	w/c 14 March 2016	3 weeks

6. Stakeholders Contacts

Client: Ann Towers, English Heritage, 29 Queen Square, Bristol, BS1 4ND, Tel 0117 9750 660 Ann.Towers@english-heritage.org.uk

Owner: The Iron Bridge is owned by Telford and Wrekin District Council but it is under the Guardianship of the Secretary of State, effectively English Heritage. Colin Pitcher, Neal Rushton

English Heritage Estates Surveyor Tim.Slator@english-heritage.org.uk

English Heritage: Heather Sebire@english-heritage.org.uk

Historic England Chief Engineer: Stuart.Ellis@HistoricEngland.org.uk

Historic England Engineer: Toby.Murphy@historicEngland.org.uk

Engineer: Ramboll, Jackie.heath@ramboll.co.uk

Principal Designer (CDM): Ramboll, Jackie.heath@ramboll.co.uk

Historic England Inspector: Bill Klemperer

Ironbridge Gorge World Heritage Site Steering Group

Environment Agency John Shaughnessy

7. Archaeological Watching Brief

English Heritage will appoint an archaeologist separately to undertake a watching brief for the investigation, so the costs of the watching brief should not to be included in the Contractor's price. However, the Contractor will be expected to manage the site and programme, receive the

archaeologist's method statement, brief the archaeologist regarding Health and Safety and liaise with the archaeologist regarding progress of the works. The Contractor shall permit and assist the archaeologist with access to carry out the watching brief.

8. Appointment and contract

Appointment will be to English Heritage, as the Client, under English Heritage Terms and Conditions.

9. Necessary Consents

The Client is responsible for obtaining the necessary consents. The Contractor is responsible for checking that all necessary consents are in place prior to commencement for works.

10. Information

1. Location plan
2. Ramboll Report *The Iron Bridge: Deck Repairs: Options and Recommendations* 33288-S-R01 March 2014 (referred to as Report R01)
3. Ramboll/ English Heritage Loading Guide
4. English Heritage Terms and Conditions

11. Quotes

Please confirm that you will be providing a quote for the three investigations as soon as possible. If you do not wish to provide a quote for these works or have any queries, please contact Jackie Heath as soon as possible.

Please return your quotation (electronically or by post) to Jackie Heath, Ramboll, 240 Blackfriars, London, SE1 8NW, Jackie.heath@ramboll.co.uk by **Thursday 17 December 9am.**

We are obtaining quotes from a small number of companies.

Your quote should clearly describe the scope of services you are offering noting any exclusions and assumptions. It is acceptable to sub-contract some of the services . Please break down your quote to provide prices for each investigation. For Investigation C include a cost for adding or omitting trial holes, in case the number of holes changes.

Please include evidence of Public Liability Insurance, certification/ CVs of individuals and evidence of experience of similar projects and work.

INVESTIGATION A: CAT Scan Scope

Brief

The contractor should allow for providing method statement and risk assessment.

a. Review existing plans of services prior to scan (in Report R01).

b. Carry out Utilities Mapping Search and provide up to date plans of utilities to Client.

c. Provide equipment and trained personnel and carry out a CAT scan of the entire length of the bridge deck from the fixed bollards at the north end to the gate at the south end across the full width of the bridge.

d. The contractor is to check that the CAT scanner and all equipment used are working properly (e.g. batteries working) and that operatives are trained adequately.

e. Identify buried statutory services passing along the bridge and locate an access cover at the north end of the bridge.

f. The access cover is understood to be the entrance to a concrete chamber in the north abutment of the bridge.

g. Once located accurately, record on a plan the locations of the services and the access hatch.

h. Once permission has been agreed, mark the access hatch temporarily on the road surfacing. Do not mark the buried services location on the road servicing with a permanent marking. Use temporary marking and take photographs and measurements.

i. This is non-invasive and should ideally be carried out immediately prior to the trial hole excavation. Provide information as to how long it will take and the date when the CAT scan will be undertaken

j. The CAT Scan should be carried out in accordance with current best practice, health and safety legislation

Deliverables

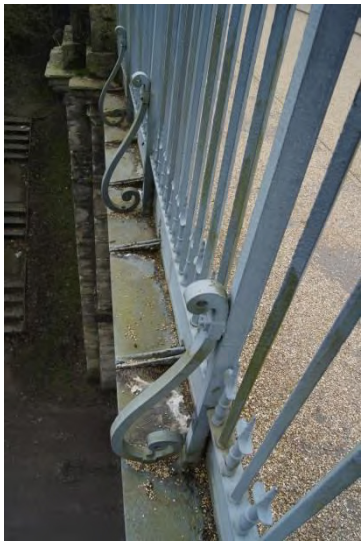
- A plan in CAD, to scale, and in pdf format showing the location and identity of the services and the access chamber with dimensions.
- A brief commentary report explaining method, findings, limitations and other notes from site.
- Utilities records

INVESTIGATION B: Touching Distance Visual Inspection and Ultrasonic Testing of Deck Edges

Brief:

Undertake inspection of the ends of the deck plates, beyond the railings, for the main (span 1) and two southern spans (spans 2 and 3). This will comprise a detailed visual and photographic record, within touching distance of the elements being inspected, and also ultrasonic scanning.

It is assumed that this will be undertaken from Mobile Elevated Work Platforms or roped access but, if the contractor considers that an alternative method of access is preferable this may be possible provided it complies with the loading limits of the bridge, provides good access and causes no damage.



Edge of Deck Plates to be inspected at height, over water

Access requirements:

The contractor shall provide safe access for inspection for the ends of the deck plates. The contractor shall not use railings or radials as anchor points to suspend inspection personnel (abseilers) or any form of suspended platform. No load shall be imposed on the deck plates (e.g. from ropes or any equipment). No damage shall be caused to the Scheduled Monument due to any inspection activity.

The Work at Height Regulation 2005 governs the use of suitable systems for any work activity carried out at height. The Regulation proposes a hierarchy of systems which is the main driver in selecting work equipment and working practices when at height. The preferred solution is to remove the risk; if this cannot be achieved, the risk should be minimised. Furthermore, CDM 2015 requires that designers and clients should allow for safe access and in so doing shall give “Collective” measures priority over “Individual” measures.

Subject to ground conditions on the land on either side of the river, the contractor will explore and investigate appropriate type of Mobile Elevated Work Platforms (MEWP) which will be independent of bridge structure. It may also be possible to use a MEWP situated on the bridge deck provided that

it complies with the loading restrictions, such as a WEMO-tech MBI 45-1/5, and at least temporary packers are inserted between the four cast iron beam and deck under span 2.

In the event that the MEWP(s) are not viable due to several interdependent factors, the contractor will investigate use of portable counterweighted davits suitable for rope access purposes. The abseiling strategy shall comply with BS7985:2009 (Code Of Practice for The Use of Rope Access Methods for Industrial Purposes).

Contractors shall follow IRATA International Code of Practice for Industrial Rope Access. An abseiling team shall consist of at least two certified operatives. One of team member shall be minimum Level 3 IRATA certified. The principle of working in pairs enables mutual surveillance and provides back up in the case of an emergency.

As precautionary measure to mitigate further risk, additional Level 3 personnel must be made available at bridge level to rescue 'Level 3 in work position' during unexpected circumstances. IRATA member companies and individuals are audited and assessed against strict operating protocols to assure the safest techniques are used.

At all times, the proposed rigging equipment shall accommodative a load of 15kN per operative.

The contractor shall submit detailed Risk Assessment and Method Statement for the works clearly outlining rescue plan. Consideration shall be given as to whether a rescue boat is necessary.

The method of access must not endanger the site personnel or members of the public on the bridge, on the footpath or on the river.

The contractor shall have adequate and appropriate Public Liability Insurance.

Visual Inspection

The cast iron deck plates span across the width of the bridge and, in a number of locations, the ends of the plates and supporting brackets have failed and fallen off. The aims of the inspection and scan are to:

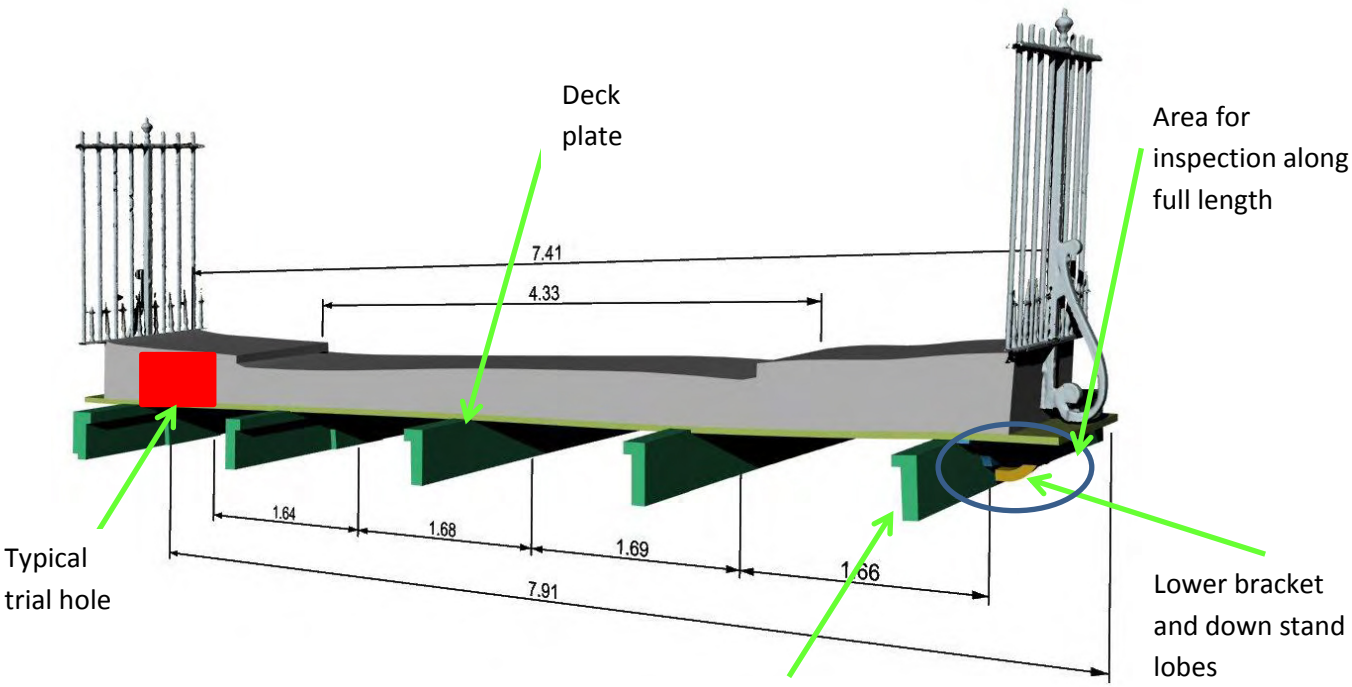
- carry out detailed inspection of east and west deck edges
- inspect for the presence and condition of packers below the deck plates and above the deck bearers on the edge frames (A and E)
- identify defects, such as cracks and flaws in the cast iron plates and brackets
- provide information to inform repair method statements and risk assessments
- provide information to help with programming of repairs
- confirm typical dimensions.

The contractor shall inspect and record:

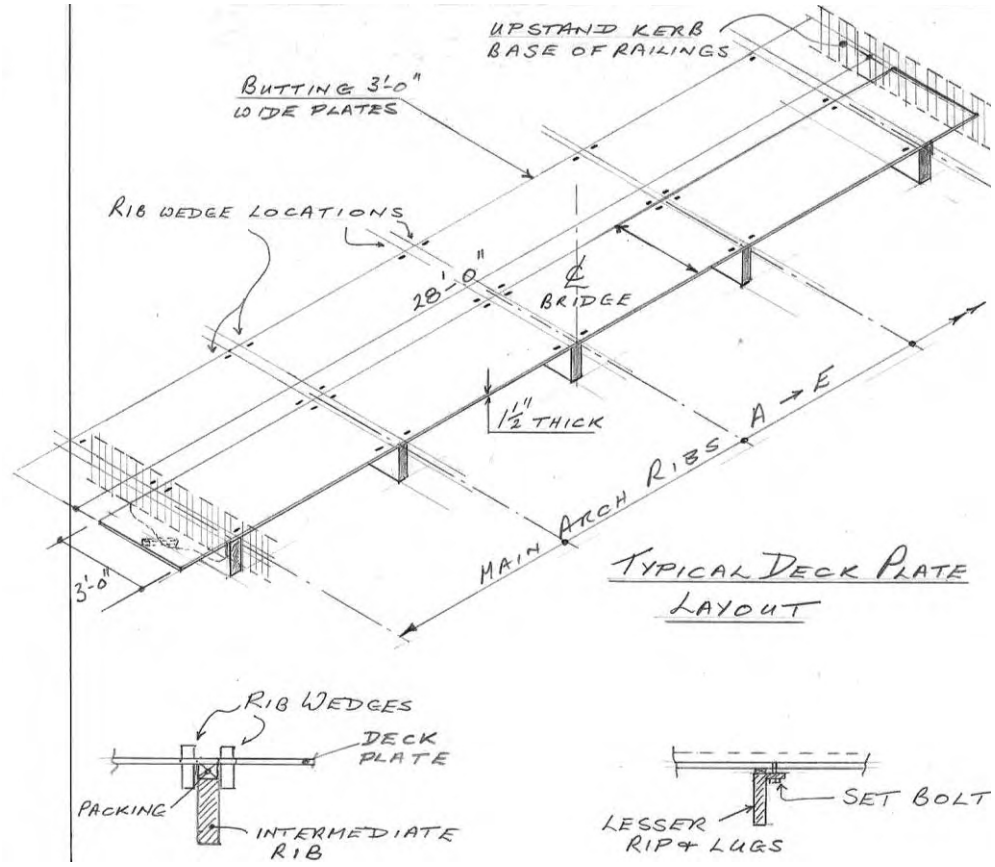
- all the ends of the deck plates, beyond the edge beams (beams are also called deck bearers) on three arch spans on both bridge elevations
- the lower brackets supporting the deck plates,
- the down stand lobes

- the presence and absence of packers above deck bearers A and E

Deck Bearer 'A' is on the upstream side and Deck bearer 'E' is on the downstream side.



Deck construction



Sketch of a Deck Plate

Care must be taken not to dislodge or drop any plate ends into the river during the inspections and investigations. A back-up method statement for temporary restraint of any plates that show signs of movement must be developed.

Ultrasonic Testing

It is known that the ends of the deck plates are vulnerable to cracking and a number have fallen off in the past (Refer to Report R01). The purpose of the ultrasonic testing is to determine, as far as possible, the presence of any cracking of the end of the deck plates so that they can be identified for repair before they are lost.

It is recognised that challenging access and the form of the deck plates mean that the exact method of ultrasonic investigation (or other suitable non-destructive testing method) may need to be developed with the contractor to obtain the most informative results to supplement the visual inspection.

The extent of the Ultrasonic Testing is:

- all the ends of the deck plates, beyond the edge beams (beams are also called deck bearers) on three arch spans on both bridge elevations
- the lower brackets supporting the deck plates,
- the down stand lobes

Allowance should also be made for recording the results of simple hammer test whereby the plate is tapped with a small hammer and the ring is assessed, to inform whether the plates are cracked.

The contractor shall demonstrate experience of Ultrasonic Testing and the Technician should have Ultrasonic Testing Certification.

Deliverables

- Report including method of working and labelled photographs
- Tabulated report of condition of each inspected element and results of Ultrasonic Testing
- Use an agreed reference system, preferably that used on the existing drawings
- Marked up drawings: digital version of the drawings in Appendix A of R01 will be provided for use by the contractor for annotation of defects and Ultrasonic Testing Result

INVESTIGATION C: Trial holes, inspections and making good

Background

We have used the information from two trial holes undertaken in 2010 to inform our understanding of the deck plates and statutory services buried in the footpath and this is described in Ramboll Report *The Iron Bridge Deck Repairs: Options and Recommendations 33288-S-R01 March 2014*.

All works to trial holes shall be in accordance with any Scheduled Monuments Consent. The contractor shall have appropriate Public Liability Insurance.

The works is subject to an archaeological watching brief (the archaeologist will be appointed directly to English Heritage).

Brief

Neat trial holes will be excavated in the deck surfacing down to the upper face of the cast iron plates. Allow for up to ten trial holes approximately 600mm wide across the width of the footway and 600x1000 adjacent to the footway and include a price per hole and indication of time and programme for the works.

The actual number of excavations will depend on the costs, time for excavation and findings in the excavations. The order and priority of excavations will be agreed prior to works commencing.

Excavation

The trial holes will be excavated in accordance with a method statement (to be prepared by the contractor) and heavy breakers will not be permitted on site. The rating or model of all hand-held power equipment will be defined in method statements.

The excavations are expected to be between 300-600mm deep down to the deck plates. The exact nature of the fill material is not known, however, previous excavations have found sand, clinker, furnace slag and brick in the footway and concrete in the roadway.

It is noted that there are water, gas, HV electric and telephone buried services crossing the bridge. The contractor shall be responsible for ensuring that these are not damaged during the excavations. Hand digging and great care will be required around the services. Plans are included in report R01, but the accuracy of these is not known. For the avoidance of doubt Investigation A, the CAT scan, should be undertaken before the excavation of trial holes and information used for Investigation C.

Backfilling

Method statements will be required for infilling the excavations, including replacement and re-compaction of existing fill where appropriate and the use of new clean fill and the reinstatement of surfacing to match existing. The Contractor shall provide the specification and samples of the surface finishes and fill material for approval to ensure a good colour and material match with the existing.

Full reinstatement is required and all debris, rubbish and spoil arising from the works should be removed from site and the site should be swept and left clean, tidy and safe. The contractor is responsible for all making good.

Inspection and Recording

The trial holes shall be made available for inspection by the Engineer and English Heritage prior to back filling.

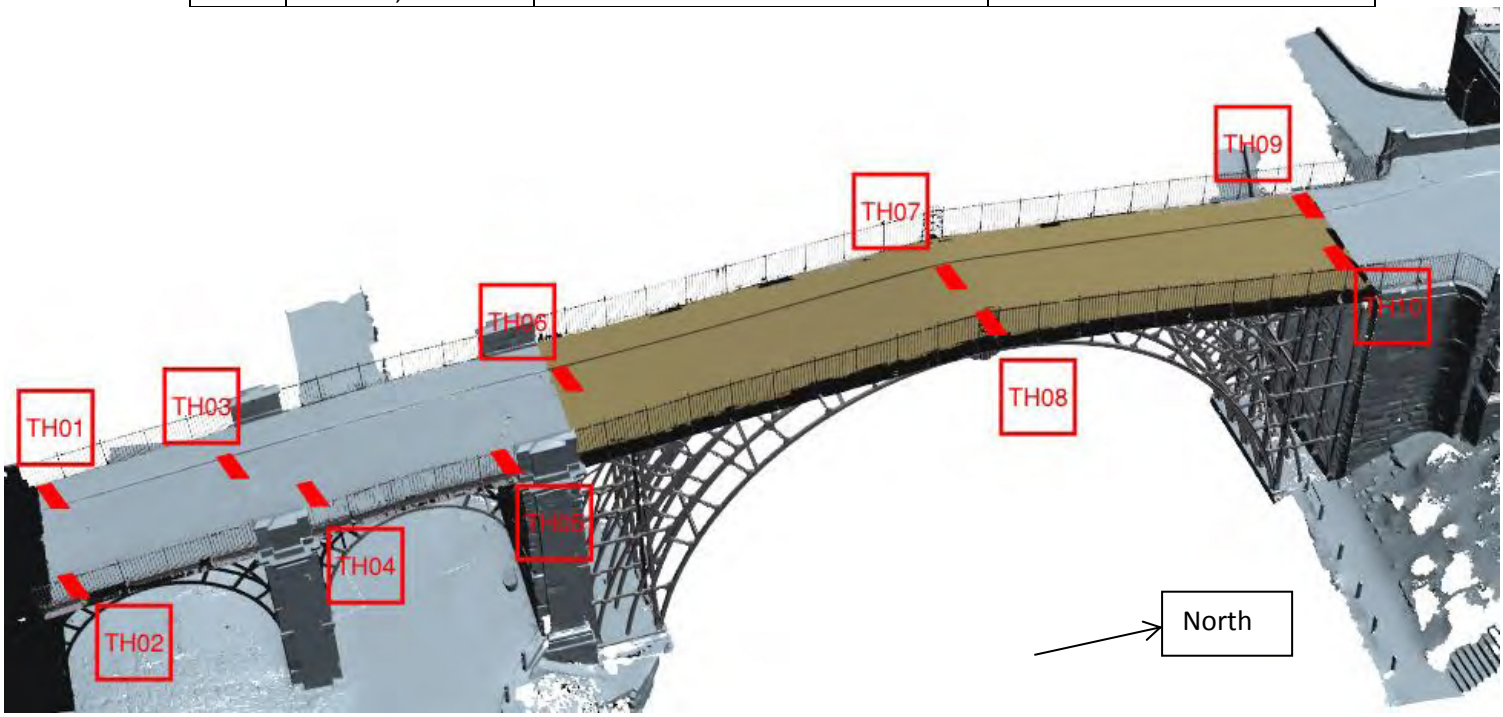
The contractor shall record the excavations; each shall be photographed, drawn and levels of surfacing, deck plates and top of buried services will be taken using a dumpy level or similar and related back to agreed datum. Written descriptions of the excavated material and observations within each excavation shall be recorded.

In addition the following shall be recorded by the contractor:

- In the two holes at the south end of the south span: measurement of the dimensions/levels of the deck plate up stands, edging, water mains and other buried service and the exact fill depth to be recorded. This will inform the feasibility of removal of kerbs and the raised pavements because this location appears to be a pinch point for levels.
- In up to three further trial holes over the southern spans: Inspection of the condition of the deck plate up stands, check for corrosion and measurement of the up stands. This is to determine whether any cleaning and painting (not part of this contract) would be required on these areas, which are potentially at higher risk of accumulation of water.
- Up to five trial holes over the main span are proposed. In these holes, as well as those over the southern spans, the following will be undertaken:
    - Condition and likely material of waterproofing on the upper surface of the deck plates
    - Carry out trials of removal of the flashing and caulking between the deck plates, (note that the deck plates over the main span are flat whereas those over the south spans have an up stand and therefore the caulking and flashing details are expected to be different). This is to test the feasibility of the removal of the caulking and flashing to prevent the build of water in the deck. The contractor shall prepare a method statement for the removal of flashing and caulking and minimise the loss of material into the river.

This is summarised below:

REF	Location	Inspection, condition and levels	Waterproofing and caulking
TH01	Span 3, south end, west side, footpath	measurement of the dimensions/levels of the deck plate up stands, edging, water mains and other buried service and the exact fill depth to be recorded, take levels	Condition and likely material of waterproofing on the upper surface of the deck plates. Carry out trials of removal of the flashing and caulking between the deck plates
TH02	Span 3, south end, east side footpath	As TH01	As TH01
TH03	Span 3, north end, west side, road	Inspect condition of the deck plate up stands, check for corrosion and measure the up stands.	As TH01
TH04	Span 2, south end, east side, road	As TH03	As TH01
TH05	Span 2, north end, east side footway	As TH03	As TH01
TH06	Span 1, south end, west side, road		As TH01
TH07	Span 1, midspan, west side, road		As TH01
TH08	Span 1, midspan, east side, footway	measurement of the dimensions/levels of water mains and other buried service and the exact fill depth to be recorded, take levels	As TH01
TH09	Span 1, north end, west, footway	As TH08	As TH01
TH10	Span 1, north end, east side, road		As TH01



Deliverables

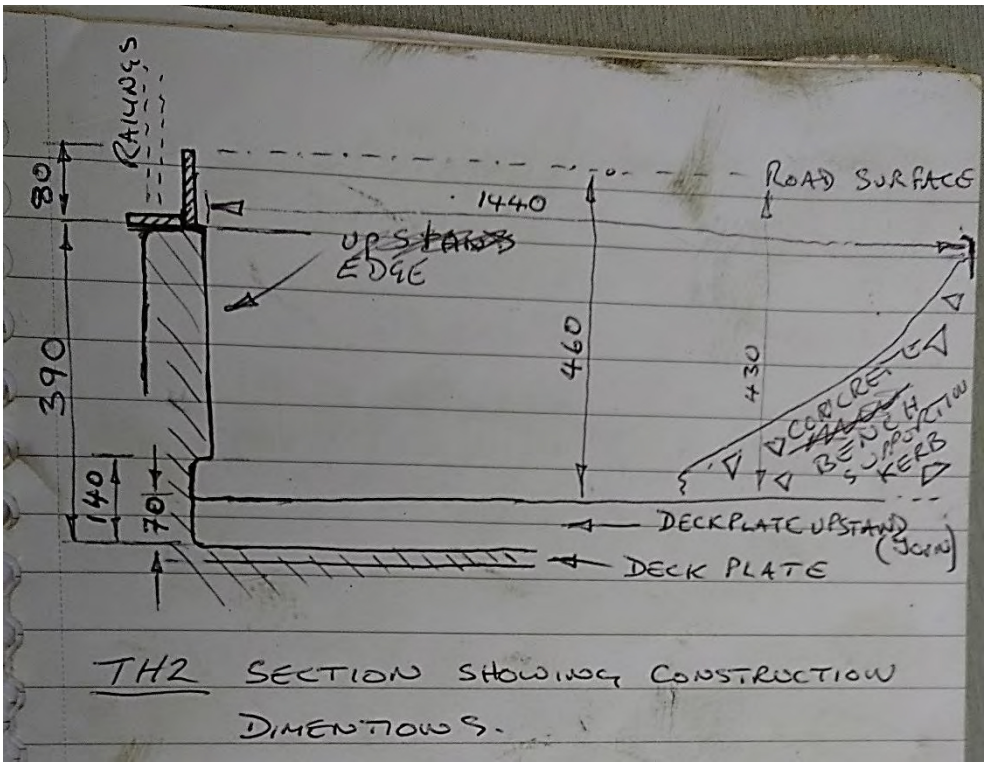
- Report including method of working, location plan, photographs and plan and section sketched of each trial hole labelled including dimensions and levels
- Written description of materials and other findings
- Description of methods trial for removal of caulking and waterproofing, together with assessment of efficacy or otherwise.

END.

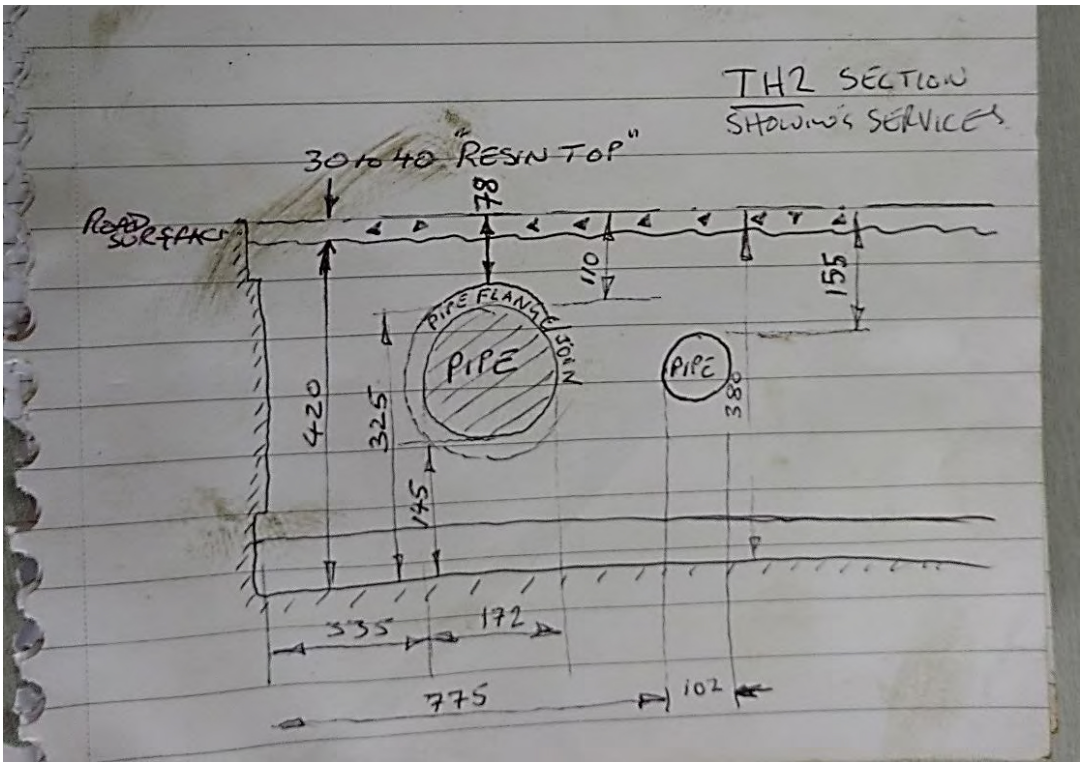
APPENDIX 3: MEASURED SITE SKETCHES PRODUCED BY VERTICAL TECHNOLOGY LTD.

Nb. Sketches produced under archaeological supervision. Dimensions and detail checked on site.

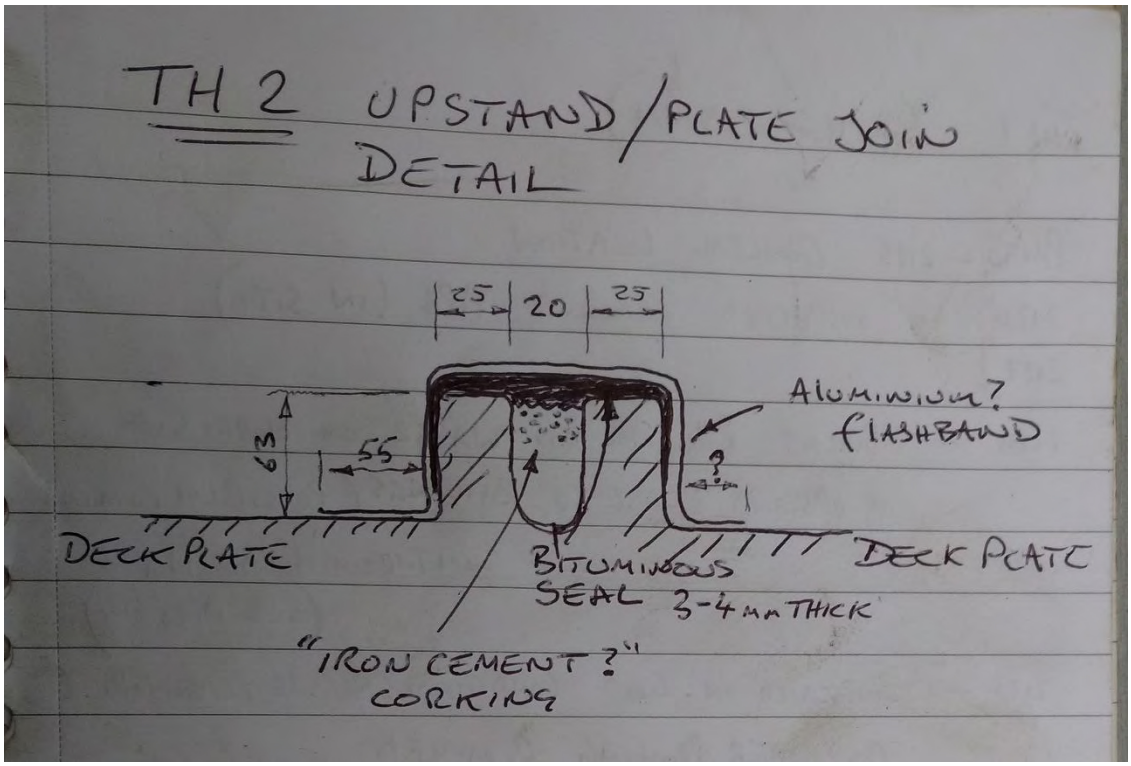
1. **Trial Hole 02 Section Showing Construction Dimensions**



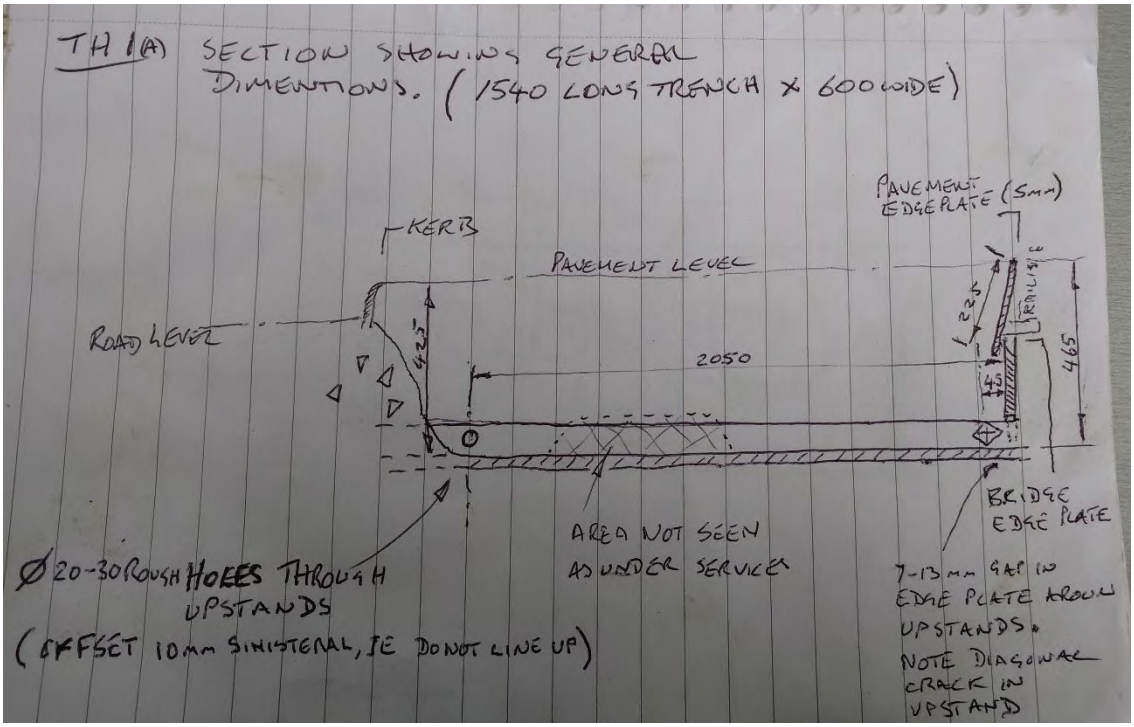
2. **Trial Hole 02 Section Showing Services**



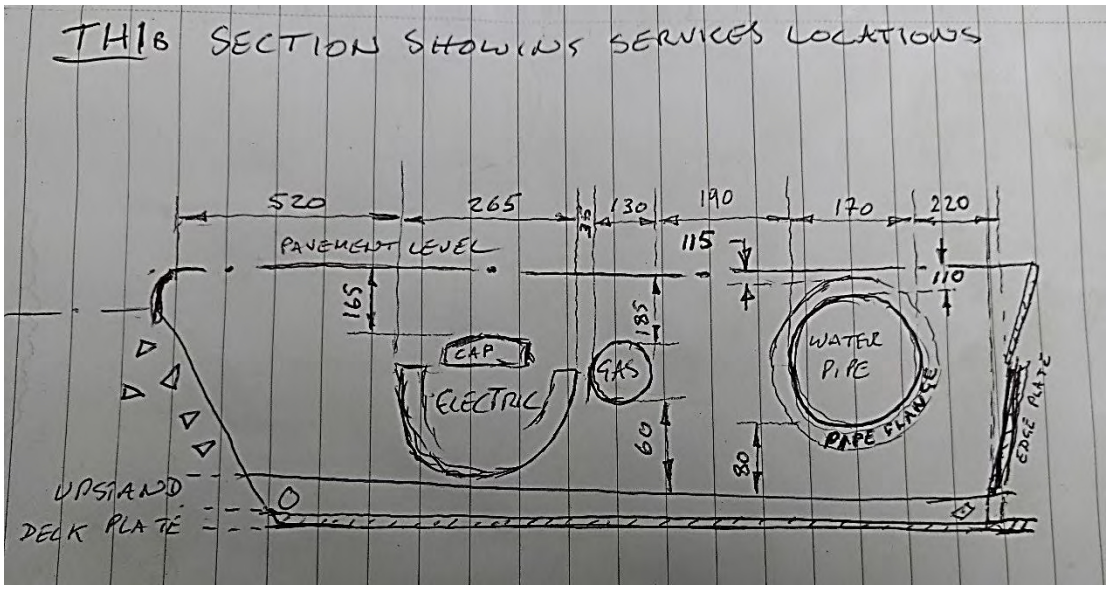
3. Trial Hole 02 Upstand Detail



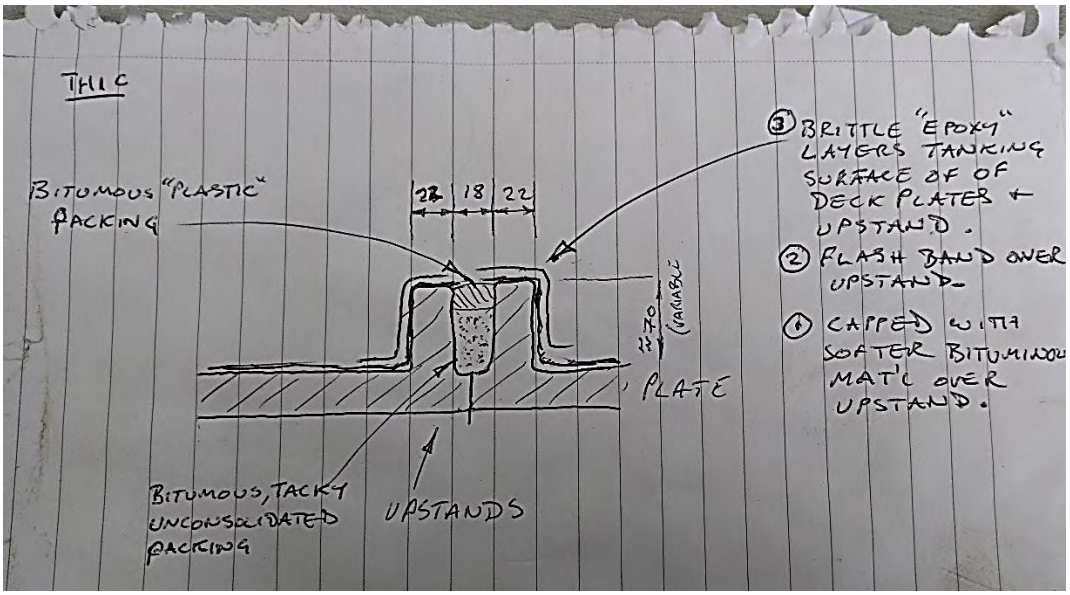
4. Trial Hole 01 Section Showing General Dimensions



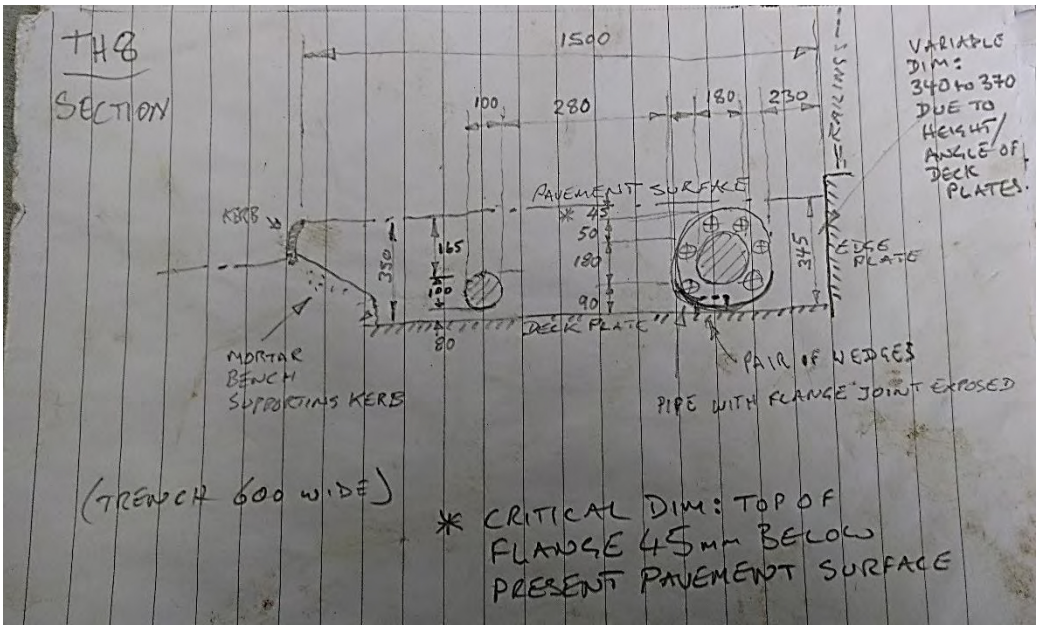
5. Trial Hole 01 Section Showing Services Location



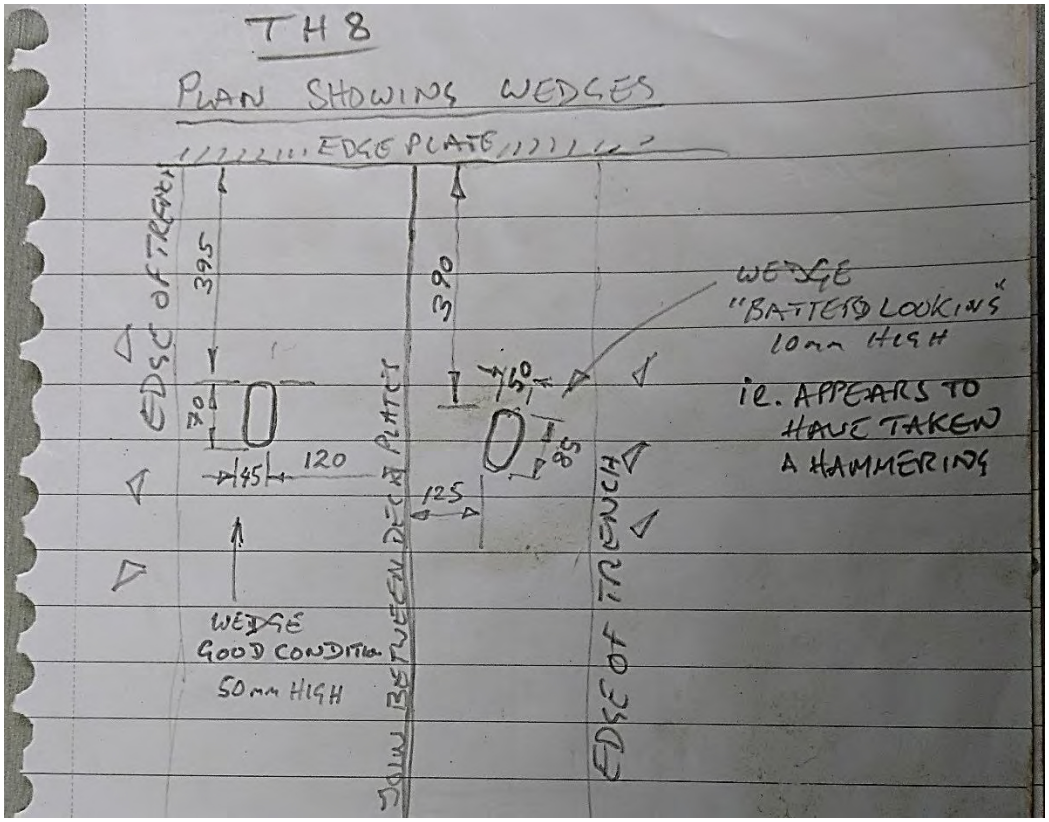
6. Trial Hole 01 Upstand Detail



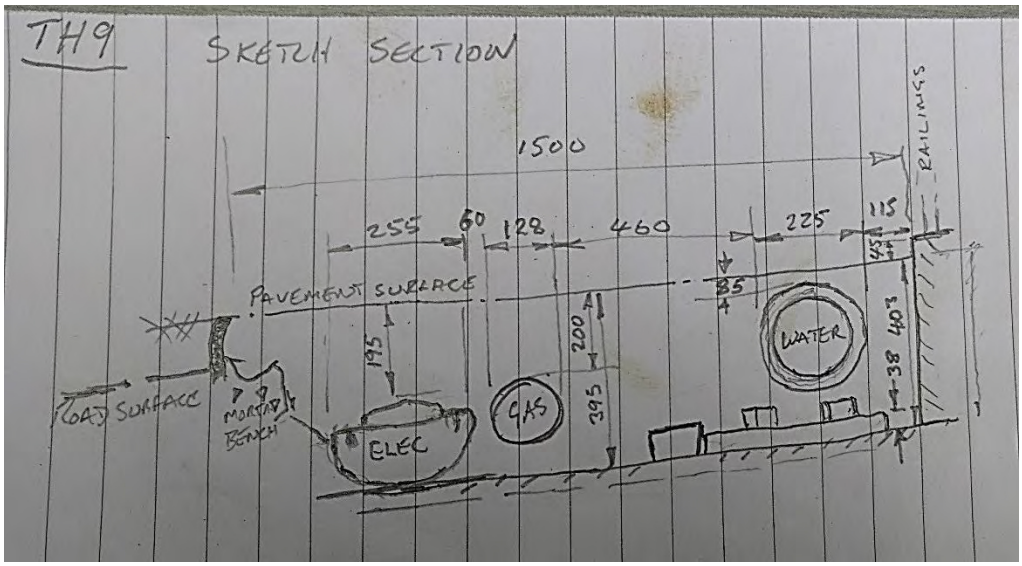
7. Trial Hole 08 Section



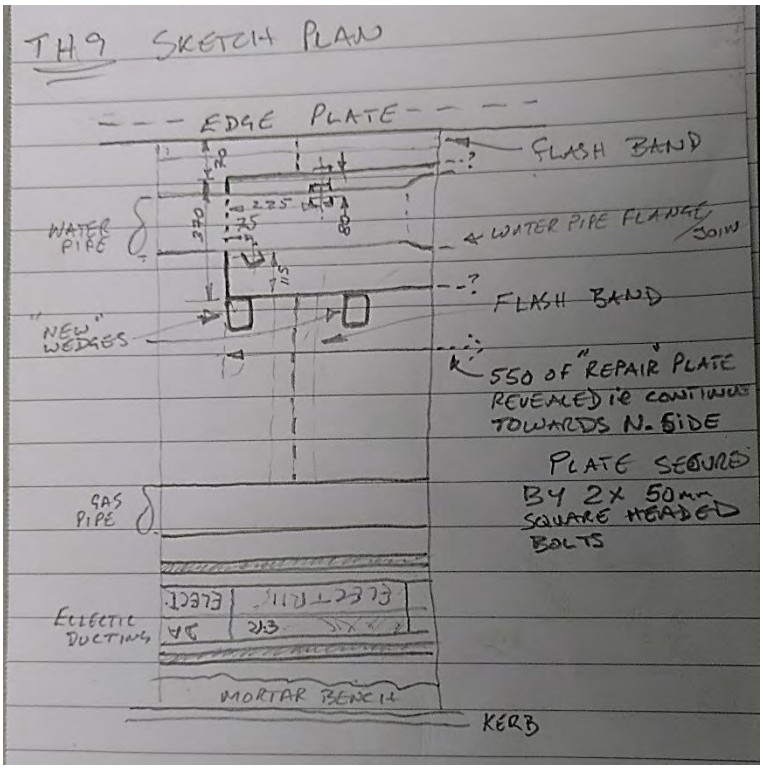
8. Trial Hole 08 Location of Wedges



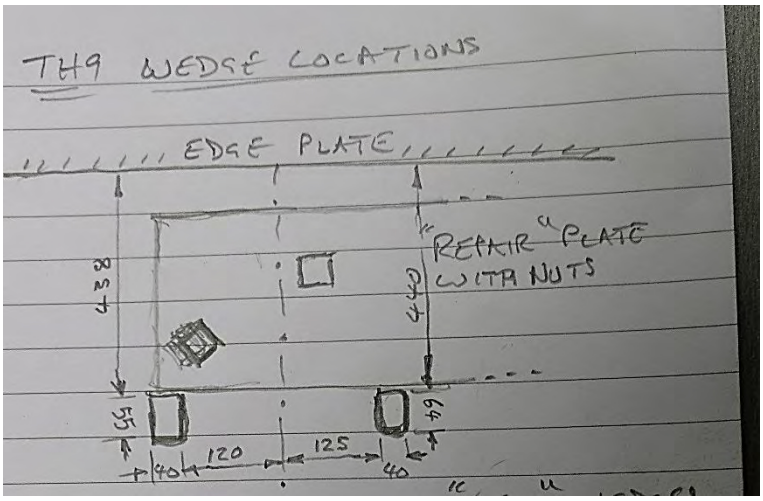
9. Trial Hole 09 Sketch Section



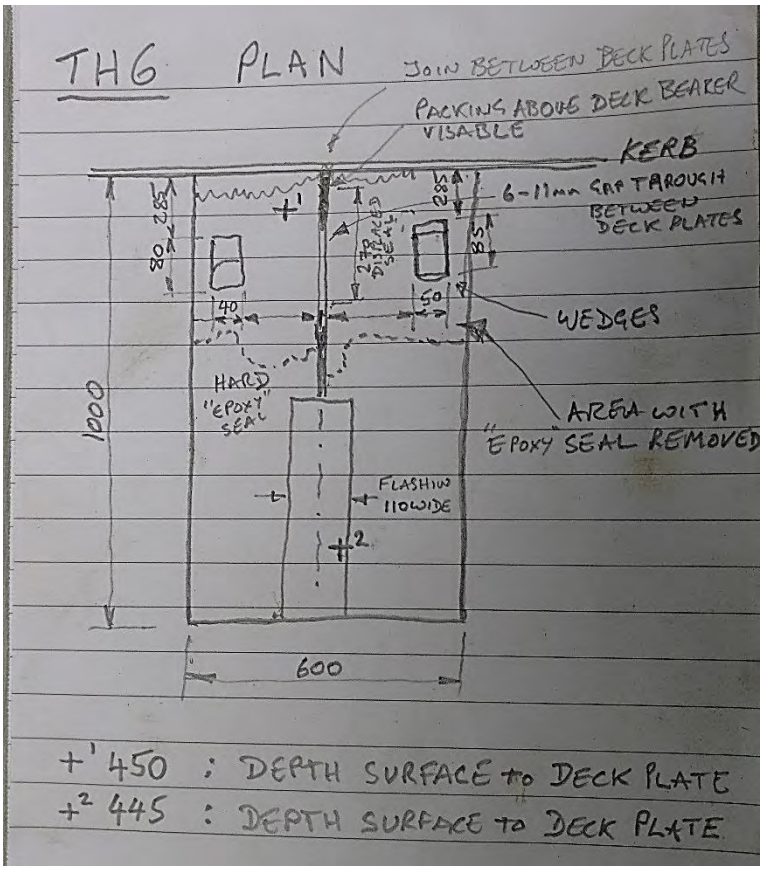
10. Trial Hole 09 Sketch Plan



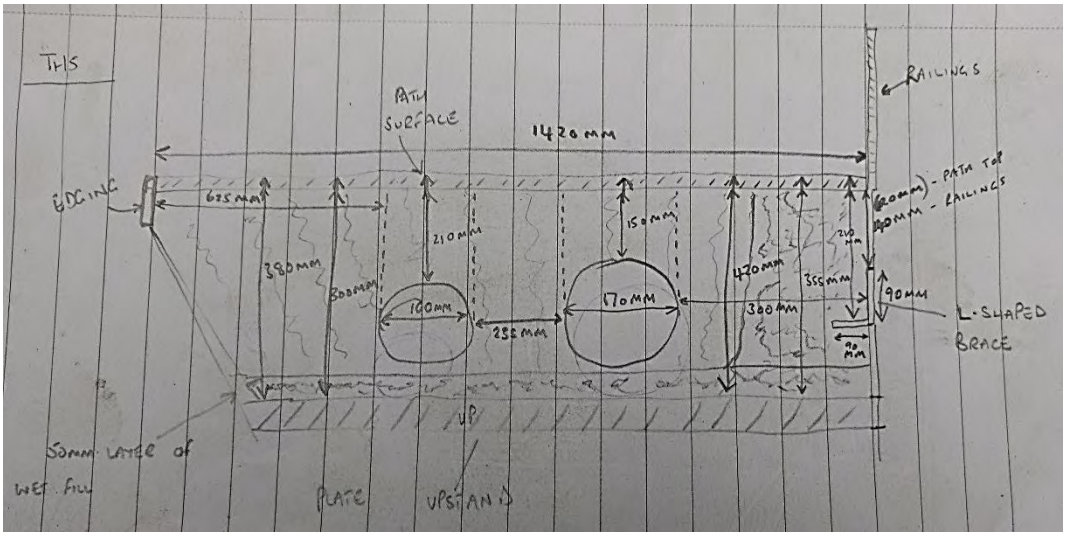
11. Trial Hole 09 Wedge Location Plan



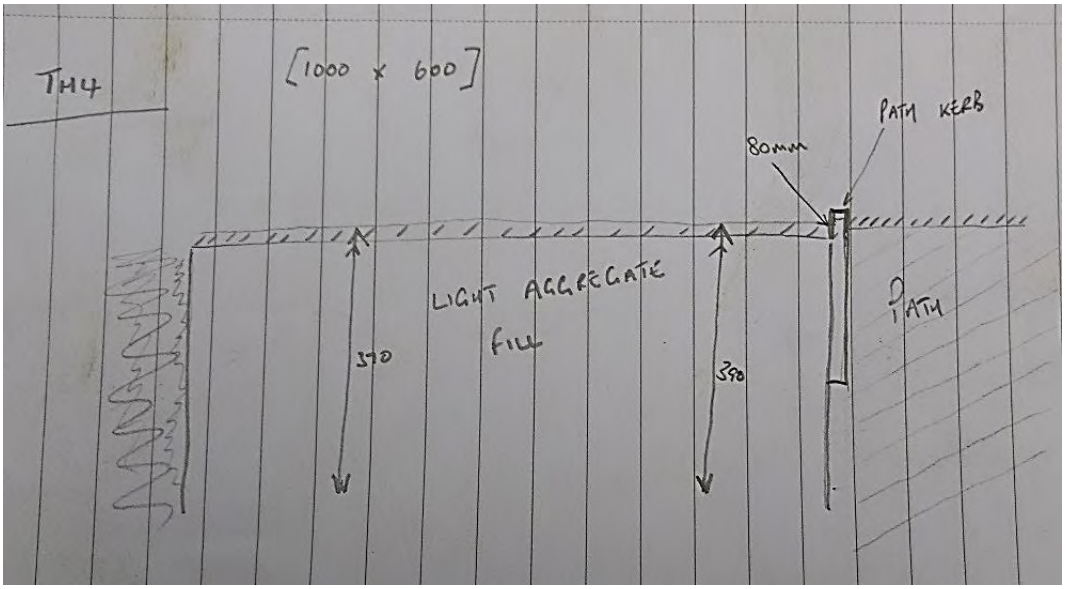
12. Trial Hole 06 Plan



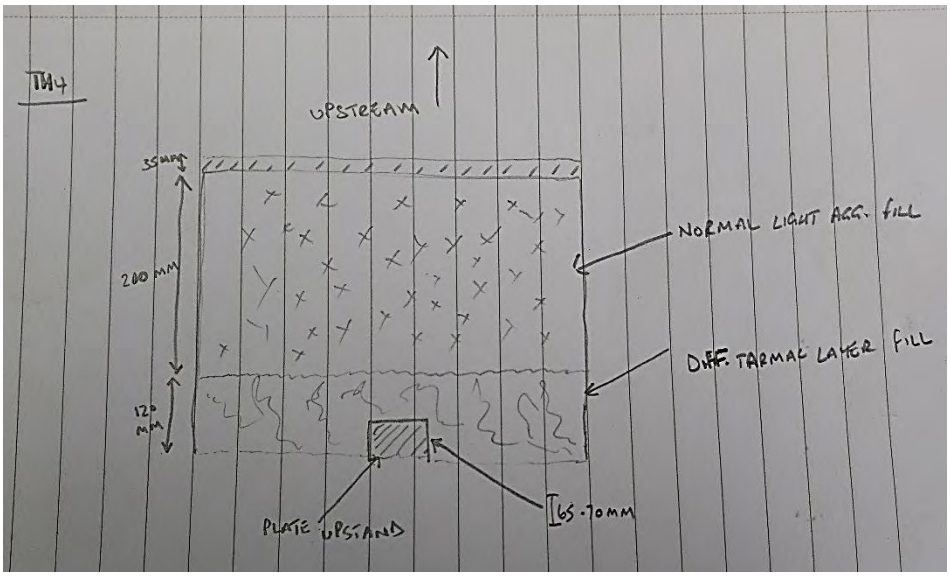
13. Trial Hole 05 Section



14. Trial Hole 04 Plan



15. Trial Hole 04 Section



APPENDIX 4: OASIS FORM

OASIS DATA COLLECTION FORM: England

Printable version

OASIS ID: ironbrid2-258397

Project details

Project name	Archaeological Watching Brief during Investigations at the Iron Bridge, Ironbridge, Shropshire
Short description of the project	In February and March 2016 Ironbridge Archaeology undertook an archaeological watching brief during investigation works at the Iron Bridge, Shropshire. The investigation works included the excavation of seven trial holes in the deck, including trial removal of caulking, measurements, inspection, levels and reinstatement. Nothing particularly unexpected was uncovered during the archaeological watching brief. Nevertheless, the current programme of works has provided an excellent insight into the form and location of services located on the Iron Bridge, and has served to identify instances of historic repair. It has also been particularly useful in investigating the nature and extent of caulking and sealants utilised during waterproofing works to the gaps between the deck plates on the main arch and the deck plate upstands on the side arches in the 1970s. The entire process of removing the deck surface material, identifying, sampling and removing the caulking material was recorded in detail.
Project dates	Start: 23-02-2016 End: 22-07-2016
Previous/future work	Yes / Yes
Any associated project reference codes	27558 - SM No.
Any associated project reference codes	362203 - LBS No.
Type of project	Recording project
Site status	Scheduled Monument (SM)
Site status	Listed Building
Current Land use	Other 11 - Thoroughfare
Monument type	BRIDGE Post Medieval
Significant Finds	N/A Post Medieval
Investigation type	"Watching Brief"
Prompt	Scheduled Monument Consent

Project location

Country	England
Site location	SHROPSHIRE TELFORD AND WREKIN THE GORGE The Iron Bridge
Postcode	TF8 7PW

Study area	0 Square metres
Site coordinates	SJ 367238 303405 52.866495537596 -2.940072798325 52 51 59 N 002 56 24 W Point

Project creators

Name of Organisation	Ironbridge Archaeology
Project brief originator	English Heritage/Department of Environment
Project design originator	Shane Kelleher
Project director/manager	Shane Kelleher
Project supervisor	Shane Kelleher
Type of sponsor/funding body	English Heritage

Project archives

Physical Archive Exists?	No
Digital Archive recipient	Ironbridge Gorge Museum Trust
Digital Archive ID	IAS No. 342
Digital Contents	"Industrial"
Digital Media available	"Images raster / digital photography","Text"
Paper Archive recipient	Ironbridge Gorge Museum Trust
Paper Contents	"Industrial"
Paper Media available	"Correspondence","Miscellaneous Material","Report","Unspecified Archive"

Project bibliography 1

Publication type	Grey literature (unpublished document/manuscript)
Title	Archaeological Watching Brief during Investigation Works at the Iron Bridge
Author(s)/Editor(s)	Kelleher, S
Other bibliographic details	IAS Report No. 342
Date	2016
Issuer or publisher	Ironbridge Archaeology
Place of issue or publication	Ironbridge
Description	Bounded, full colour grey literature report

Entered by	Shane Kelleher (ironbridge.archaeology@gmail.com)
Entered on	22 July 2016

OASIS:

Please e-mail Historic England for OASIS help and advice

Cite only: http://www.oasis.ac.uk/form/print.cfm for this page