HS2

COSTAIN SKANSKA

1EW02 Enabling Works – Area South

Document Title: Heritage Agreement Method Statement for the Installation of Instrumentation and Monitoring at the Royal George Public House

Document number: 1EW02-CSJ-EV-MST-S003-000016

Revision: C03
WP Reference: P007

Revision	Author	Reviewed by	Approved by	Date	Revision Details
C03	L. Gray Graduate Heritage Consultant	J. Critchley Heritage Consultant	J. Timothy Principal Heritage Consultant	22/04/21	Issued for Acceptance
Signature					

STAKEHOLDER REVIEW REQUIRED (SRR)
☐COUNTY/DISTRICT/LONDON BOROUGH COUNCIL
☐LOV
☐LUL
☐NRL
☐TFL
☐UTILTIES COMPANY
☐OTHER
.....

PURPOSE OF SRR
☐ ACCEPTANCE
☐ APPROVAL
☐ NO OBJECTION
☐ CONSENT

Code 1 - Accepted

REVISION CHANGES, AUTHORISATION & ISSUE RECORD

Version	Date	Sections revised	Brief description of the revision	Prepared by	Checked by	Approved by	Reason for Issue	HS2 Acceptance Decal Code
C0.1	23/10/2020	Full document	Original version	L. Gray	J. Critchley	J. Timothy	For Acceptance	
C01	20/11/2020	Full document	Document amended following client comments	L. Gray	J. Critchley	J. Timothy	For Acceptance	
C01	08/12/2020	3.6.6	Text added regarding the building damage category following client comments	L. Gray	J. Critchley	J. Timothy	For Acceptance	
C01	20/01/2021	Full document	Updated following change in monitoring requirements	L. Gray	J. Critchley	J. Timothy	For Acceptance	
C02	19/03/2021	Full document	Updated following HS2 review	L. Gray	J. Critchley	J. Timothy	For Acceptance	
C03	21/04/2021	3.4.5	Updated following HS2 comment	L. Gray	J. Critchley	J. Timothy	For Acceptance	

CSjv Review and Acceptance Decal

Code 1 - Accepted

COSTAIN SKANSKA	CSjv Review and Acceptance Decal This decal is to be used for submitted documents requiring acceptance by CSJV.
☒	Code A. Accepted. Work may proceed.
☐	Code B. Not Accepted. Revise and resubmit. Work may proceed following incorporation of changes indicated.
☐	Code C. Not Accepted. Revise and resubmit. Work may not proceed.
☐	Code D. Received for information only. Receipt is confirmed.

Reviewed/Accepted by:(signature)	Name:	Position:	Date:
	Giles Mann	Senior Engineer	06/05/2021

Acceptance by CSjv does not relieve the designer/supplier from full compliance with their contractual obligations and does not constitute CSJV approval of design, details, calculations, analyses, test methods or materials developed or selected by the designer/supplier.

Code 1 - Accepted

Contents

Code 1 - Accepted

Figures

Code 1 - Accepted

Code 1 - Accepted

1 Introduction

1.1 Project Context – Schedule 18: Listed Buildings

1.1.1 High Speed Two (HS2) is a network of new high speed lines across Britain, being planned and built in two phases: Phase One, which will connect London with Birmingham and the West Midlands; and Phase Two, which will extend the route to Manchester, Leeds and beyond. Powers to construct and operate the railway have been secured through the High Speed Rail (London – West Midlands) Act 2017 (the Act), which received Royal Assent on 23 February 2017.

1.1.2 The Secretary of State has appointed High Speed Two (HS2) Ltd as the nominated undertaker responsible for delivering Phase One of HS2. HS2 Ltd is an executive non-departmental public body, sponsored by the Department for Transport.

1.1.3 Schedule 18 'Listed Buildings' to the Act concerns how legislation in respect of listed buildings under the Planning (Listed Buildings and Conservation Areas) Act 1990 ("the 1990 Act") applies to the Phase One works. "Schedule 18" refers to Schedule 18 of the High Speed Rail (London – West Midlands) Act 2017 (the Act). Paragraph 2 of Schedule 18 disapplies some of this legislation, and in particular the requirement for listed building consent for alteration or extension for heritage or monitoring purposes for buildings identified in Table 2 of Schedule 18

1.1.4 The Royal George is identified in Table 2 of Schedule 18 as a building authorised to be altered or extended for heritage or monitoring purposes – in this case for the installation of monitoring instrumentation. HS2 Ltd entered into a Heritage Agreement (PH1-HS2-EV-AGR-010-000005) with London Borough of Camden and Historic England dated 20th February 2017 that requires HS2 Ltd to submit method statements concerning the alteration of the building to London Borough of Camden for approval.

1.2 Scope of the Method Statement

1.2.1 The following method statement has been prepared to address the method of installation of instrumentation and monitoring at the Royal George Public House, Eversholt Street.

1.2.2 This method statement will include an assessment of the significance of elements of the structure which are to be impacted by the proposed works.

1.2.3 Clause 2.1 of the Heritage Agreement with London Borough of Camden and Historic England, dated 5 May 2017, requires the Nominated Undertaker to carry out decontrolled works as specified in particulars submitted by themselves to the council.

1.2.4 This document addresses heritage constraints and outlines a method statement for the proposed works.

Code 1 - Accepted

1.3 Outstanding Matters for Agreement

1.3.1 There are no outstanding matters for agreement.

1.4 Summary of Proposed Work

1.4.1 The Royal George Public House has been identified as requiring vibration and ground movement monitoring, as it is a built heritage asset adjacent to the construction site. Construction works with the potential to cause ground movement have been identified. They are as follows;

- Stage 1 – Demolition (WP140);
- Stage 2 – LU shaft and tunnel (WP137/138);
- Stage 3 – Fleet Sewer diversion and 36-way telecommunication installation;
- Stage 4 – Cobourg Street Sewer installation;
- Stage 5 – Euston Station Phase A wall installation;
- Stage 6 – Euston Station Phase A excavation and LU tunnels;
- Stage 7 – Euston Station Phase B1 wall installation and excavation ;
- Stage 8 – Euston Portal wall installation and excavation; and
- Stage 9 – Euston Cavern works.

1.4.2 Asset specific monitoring is therefore required to be undertaken before, during, and after these construction works to check that any building movement which does occurs is in line with prediction and limits any permanent damage to the building. The monitoring will use a number of intrusive and non-intrusive methods to monitor movement to the exterior and interior of the building. The monitoring equipment will be installed until the effect of all HS2 works around Euston Station have stabilised.

1.4.3 In summary, the proposed monitoring equipment will include a combination of the following:

- **Levelling points** (eg. British Research Establishment (BRE) sockets) to monitor vertical displacements at the base of the façade;
- **Mini circular prism** to monitor absolute displacement and distortion of facade in the x, y and z planes;
- **Crack mapping and/or crack meters** to monitor existing cracks and any new cracks in the exterior face of façade before and during the works; and

Code 1 - Accepted

- **Strain gauge or automatic crack meter** to monitor the movement of the ends of the ground floor steel transfer beam where it is supported by the north basement wall and the steel column.

1.5 Assumptions and Limitations

1.5.1 This report has been produced using the best available information, as provided by the Costain Skanska Joint Venture (CSJV), at the time of writing.

1.5.2 A site visit was not undertaken by the author of this report due to the restrictions on movement due to COVID-19. Visual assessment of the asset has therefore been undertaken remotely using readily available desk-based sources and records from a building interior walkover which took place in April 2019 by Station Design Services Contract (SDSC) engineers and a SDSC heritage specialist.

1.5.3 No intrusive survey has been carried out. The walkover by SDSC was brief and was not intended to capture all-encompassing details of the structure, components and condition within. It was also not possible to identify all building features, both structural and non-structural, due to lack of access or lack of exposure of the structural elements covered with architectural finishes. For example, the north-east parapet wall and north-eastern elevation were not accessible and therefore not photographed. If any sensitive features are uncovered during future surveys, reassessment of the building is recommended accordingly.

1.5.4 The information gathered during the interior walkover is strictly relevant to the time at which it was conducted. Ongoing or future building alterations have not been considered in the assessments. If major structural or non-structural features are subject to change due to future works reassessment of the building is recommended, as outlined in 1SN01-ARP-ST-REP-SS06_SL09-000037 C01.

2 Heritage asset description and history

2.1 General information

2.1.1 The Royal George is a public house constructed in 1939, located approximately 30m to the east of Euston Station, at 8-14 Eversholt Street, between Lancing Street and Wellesley Place in London, UK.

2.1.2 The asset is located on National Grid Reference TQ2971182697.

2.1.3 The Royal George is designated Grade II listed (National Heritage List for England 1342046) and was first designated 11-Jan-1999. See Appendix 1 for List Description.

2.1.4 The extent of the asset as presently understood is recorded in a Location Plan in Appendix 2.

Code 1 - Accepted

Figure 1. Front (east) elevation of the Royal George. Mott MacDonald (2020).

2.2 Historical Background

2.2.1 The Royal George of Eversholt Street, near Euston Station was built in 1939 to replace a pub of the same name, formerly located nearby at 25 Drummond Street (blue circle on Figure 2). The Royal George name came from the HMS Royal George, a flagship naval vessel from the eighteenth century, once the largest warship in the world. It is possible that the earlier pub was demolished as part of the planned, but not realised, redevelopment of Euston Station in the 1930s. This redevelopment was planned to extend the station towards Euston Road, truncating Drummond Street, Euston Street, Euston Grove and Euston Square, and would have included the former site of the Royal George.

Code 1 - Accepted

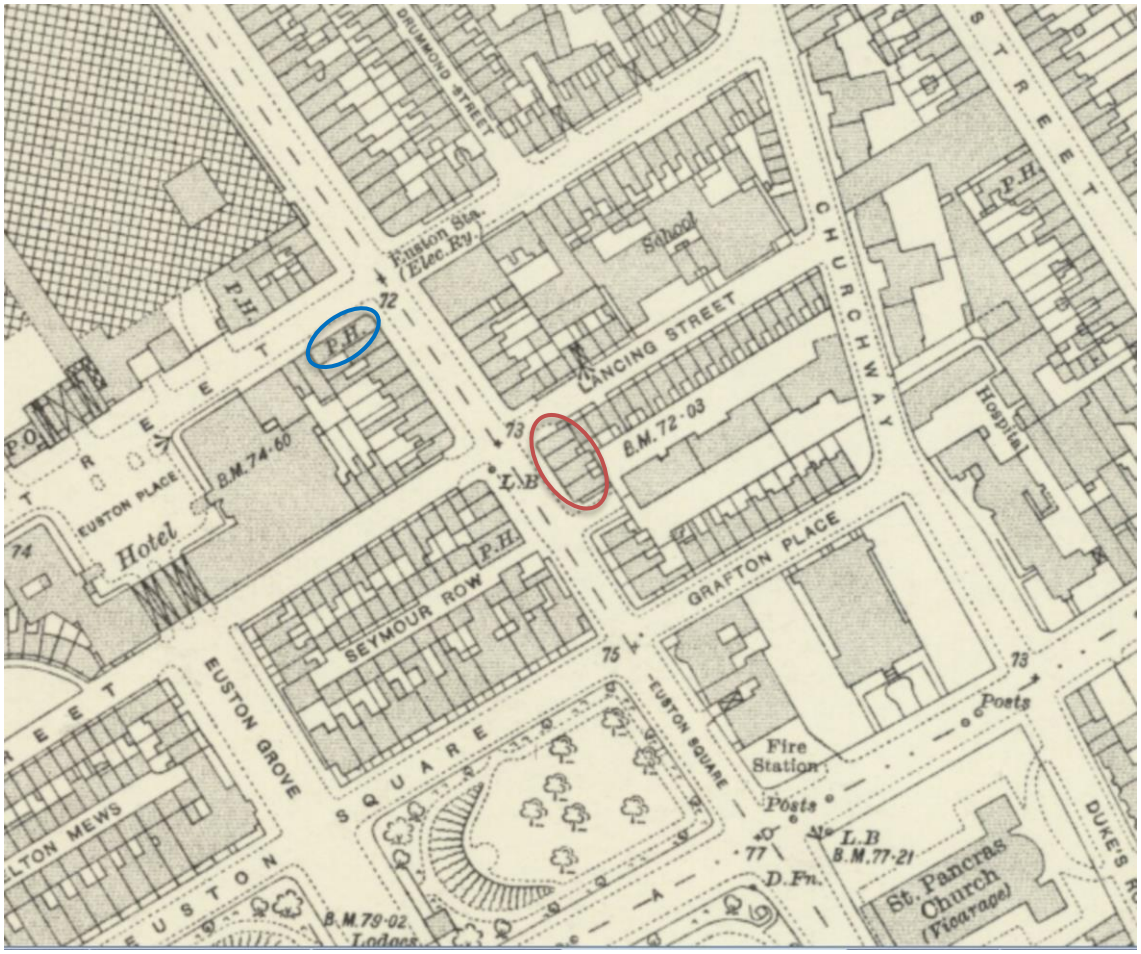


Figure 2. Map illustrating the site of the Royal George prior to its construction (blue) and present location (red). Ordnance Survey, London (1915- Numbered sheets) V.5 (St Marylebone; St Pancras) Revised: 1914; Published: 1916.

Code 1 - Accepted

Figure 3. Map illustrating the site of the Royal George prior to the redevelopment of Euston Station. Ordnance Survey, TQ2982NE - A (includes: Holborn; St Marylebone; St Pancras) Surveyed: 1952; Published: 1953

2.2.2 Truman's Brewery had purchased the previous Royal George pub and commissioned their lead in-house architect, A. E. Sewell, to construct the replacement pub nearby, replacing nineteenth century terraced housing (see Figure 2 and Figure 3). Sewell was responsible for around 50 pubs constructed during the early twentieth century, including the Royal George, which is believed to be his last (Historic England, 2015).

2.2.3 The interwar period witnessed the 'improved pub' movement that promoted the redevelopment of pubs with the aim of making them a more welcoming environment, acceptable to families and women as opposed to their traditionally male clientele. Improved pubs typically included rooms for non-alcoholic entertainment and eating. Truman's Brewery was particularly enthusiastic about 'improving' their pubs and ran redevelopment projects on 151 of their pubs across England. Sewell's design for the Royal George reflects these 'improving' tendencies, particularly with its original layout of separate rooms and modern appearance.

Code 1 - Accepted

2.3 Description

2.3.1 The following description is based upon desk-based sources, including Historic England's listing text and aerial imagery.

2.3.2 The Royal George comprises a ground floor public house and a first and second floor residential accommodation in a neo-Georgian style with art deco influences. The ground and second storeys are of artificial stone (brown on ground floor; grey on second floor), with the larger central section, reminiscent of a Georgian *piano nobile*, in stock brick. At the base of the masonry walls there is a shallow concrete plinth, painted black. The building is rectangular, occupying the full plot between Lancing and Eversholt Streets and Wellesley Place. Its principal elevation is south-west facing with curved corners to Lancing Street and Wellesley Place. At the rear, it is staged between 1 and 3 storeys. Cast iron rainwater downpipes run inside the structure from the first floor downwards, and drain through the basement.

2.3.3 On the ground floor, there are three entrances, one centrally in the south-west elevation and one each at either corner. A row of small windows runs along the south-west elevation either side of the main, central door. Windows of the same scale also occupy the north elevation. A door on the south elevation gives access to the flat above.

2.3.4 At first floor level, the south-western elevation features four tall windows with slim horizontal glazing bars. The corner elevations also feature windows, with characteristic curved glazing to match the curved façade. The north elevation is plain brick, while the south elevation features a tripartite window with broad stone jambs and lintel.

Figure 4. South-eastern elevation. Mott MacDonald (2020).

Code 1 - Accepted

2.3.5 The second storey is shadowed by a heavy eaves overhang. Six windows occupy the south-west elevation, four above the windows below and an additional one to either end. Large relief outlines of eagles span the curved corners. They appear to have been cast. Eagles were a symbol of the Truman's Brewery.

2.3.6 The roof is split across three levels, with a flat roof above the ground and first floors to the north and east, and a truncated hip roof with stone tiling above the second floor and attic space to the south and west. The roof above the ground floor is accessible and is surrounded by masonry parapet walls up to 4m in height and a 9m tall masonry chimney that protrudes up from the north-east corner of the building. A second masonry chimney protrudes from the roof on the southern edge. The chimney locations correspond with internal fireplaces. The typology of the truncated hip roof is unknown but may be of timber construction.

2.3.7 The interior was historically divided into three: a lounge and public bar at either end, with a private bar in the middle. Double doors provided access from the street to each separate space. Today, the rooms have been combined into a large space, though the central bar remains. The interior features typical 1930s veneer panelling to dado level, and around the bar. A row of decorative tiles were used above the panelling in some seating areas. The chimneypieces are distinctive, with marquetry decoration.

Figure 5. Marquetry panels. Available via: https://londonpubsgroup.camra.org.uk/viewnode.php?id=32546

Accessed October 2020.

Figure 6. Marquetry panels. Available via: https://londonpubsgroup.camra.org.uk/viewnode.php?id=32546

Accessed October 2020.

Code 1 - Accepted

2.4 Assessment of Condition

2.4.1 A site walkover was undertaken in April 2019 by SDSC engineers and SDSC heritage specialist.

2.4.2 During the interior walkover, the building was found to be in relatively poor condition. The basement exhibited cracking in loadbearing and partition masonry walls, as well as concrete spalling of the underside of the slab above in the boiler room to the south of the building. Cracking, water damage and a general lack of maintenance were also observed in the walls and ceilings in the first and second floors.

2.4.3 Overall, the external features of heritage significance are generally robust and repairable with standard heritage conservation processes.

2.4.4 Pre-construction baseline condition surveys shall be carried out shortly before construction begins to produce as complete as possible a record of existing detected defects.

2.4.5 The condition survey shall be repeated following completion of the works.

2.5 Assessment of Significance

2.5.1 The significance of this heritage asset will be considered in the context of its archaeological, architectural and artistic, and historic interests, in accordance with Historic England's Advice Note 12: Statements of Heritage Significance: Analysing Significance in Heritage Assets (Historic England, 2019).

2.5.2 The significance of the Royal George is in part due to it having survived largely unaltered since the 1930s, and throughout a period of significant change around Euston Station. The pub was likely built to serve clientele passing through the area to travel via Euston Station. While the pub was built in close proximity to what was then the Victorian Euston Station, the building survived the widespread redevelopment of the area during the 1960s and 1970s which saw the replacement of the Victorian station with modern buildings. The pub continues to operate, adjacent to the eastern entrance of the modern station and serves as a connection between the earlier and the present station buildings. The illustration of the historic character of the area prior to the demolition of the Victorian station is of interest and contributes to the significance of the Royal George.

2.5.3 The pub's significance is principally derived from the building's exterior, which is a good example of a late 1930s public house, designed to attract a broad range of clientele as opposed to being a male-only domain. The domestic scale of the pub, combined with its art deco and, neo-Georgian-influenced design make it particularly distinctive in its modern setting, where it is dominated by larger buildings on all sides. The characteristic relief eagles on the north-west and south-west corners are also a distinctive feature. The survival of these features contributes to the building's high architectural and artistic interest, which relates to the quality of craftsmanship and design that is evident in the building's carefully composed exterior.

Code 1 - Accepted

2.5.4 The interior of the pub also holds significance due to its surviving décor, including two fireplaces and surrounds; a large marquetry panel of the Royal George ship on the south wall, marquetry and coloured stained illustration panels on both sides of the north-east chimney breast, and some wood and ceiling mouldings. The building's list description refers to it as "as a remarkably complete example of a 1930s pub, with excellent marquetry panels depicting features from the style of the period done with charm and panache" (Historic England, 1999). The alterations to the interior, in particular the knocking through of the separate rooms to create a large, open space, reflects changes in the public house industry, in the same way that the historical context of public houses of the 1930s prompted its original design. Although these changes do reduce the significance of the building as a surviving heritage asset, it is illustrative of its lifetime in operation. Furthermore, these surviving interior features bolster the building's architectural and artistic interest: the marquetry panels in particular being an unusual feature of high value.

2.5.5 The association with Truman's lead in-house architect, A. E. Sewell, also contributes to the historical interest of the asset. A particularly prolific architect of public houses during the early twentieth century, Sewell's pubs are distinctive for their neo-Georgian or neo-Tudor style. The Royal George is Sewell's last known work, and therefore arguably a culmination of a career focused on the design of public houses. The ability to appreciate and understand Sewell's original design and identify the original fabric enhances the ability to appreciate the building's historic significance.

2.6 Setting

2.6.1 The setting of the asset is diverse, with residential, commercial, transport and educational buildings all located adjacent to the Royal George.

Code 1 - Accepted

Figure 7. Royal George from Euston Station, illustrating wider context. Mott MacDonald (2020).

2.6.2 Particularly notable is the asset's proximity to the major railway interchange, Euston Station, which is central to understanding the context of the pub's establishment and location: the latter having been relocated when the proposal for Euston's extension to the south was first proposed in the 1930s. The building therefore reflects a key period of development during British Railway History. Furthermore, the presence and expansion of the station has likely contributed to the survival of the pub in its present location, due to the high footfall created. The visible and historic relationship between the station and the Royal George are key to its significance.

2.6.3 The surrounding built environment of Eversholt Street, Euston Road, Churchway and Chalton Street also comprises part of the setting of the asset. The historic character of the area is preserved by the survival of some residential terraces, such as on Eversholt Street. Though many similar terraces have been demolished, the survival of this one, which is of a comparable scale to the Royal George, aids understanding of the historic context of the public house when built.

2.6.4 The range of other architecture in the area, including the mid twentieth century flats on Churchway and Drummond Crescent, and the large office blocks, such as Euston House on Eversholt Street, reflect the changing nature of the area, including increasing land prices and high demand for space adjacent to the station. The range of materials used in the construction of these buildings, specifically the move away from stock brick, reflects the area's increasing grandeur, reinforcing the Royal George as a rare survival of Eversholt Street's former character.

Code 1 - Accepted

3 Specification for installation of instrumentation and monitoring

3.1.1 This section outlines the reasons for monitoring the Royal George, the equipment to be used and how it will be fixed and removed, where the monitoring locations are and the monitoring regime.

3.2 Reasons for Monitoring Royal George Public House

3.2.1 As described in section 1.2, asset specific monitoring of the Royal George is required to ensure any ground movements caused as a result of the HS2 works are within the specified parameters and in order to ensure that the special interest of the building is protected.

3.2.2 Ground movement analysis predicted that nearby demolition and ground excavation for the construction of the new HS2 railway and station at Euston would cause vertical and horizontal movements towards the north side of the building (Figure 8). However, monitoring of the building will cover the whole building in order to accommodate possible future design changes and also allow for an understanding of differential movement across the building.

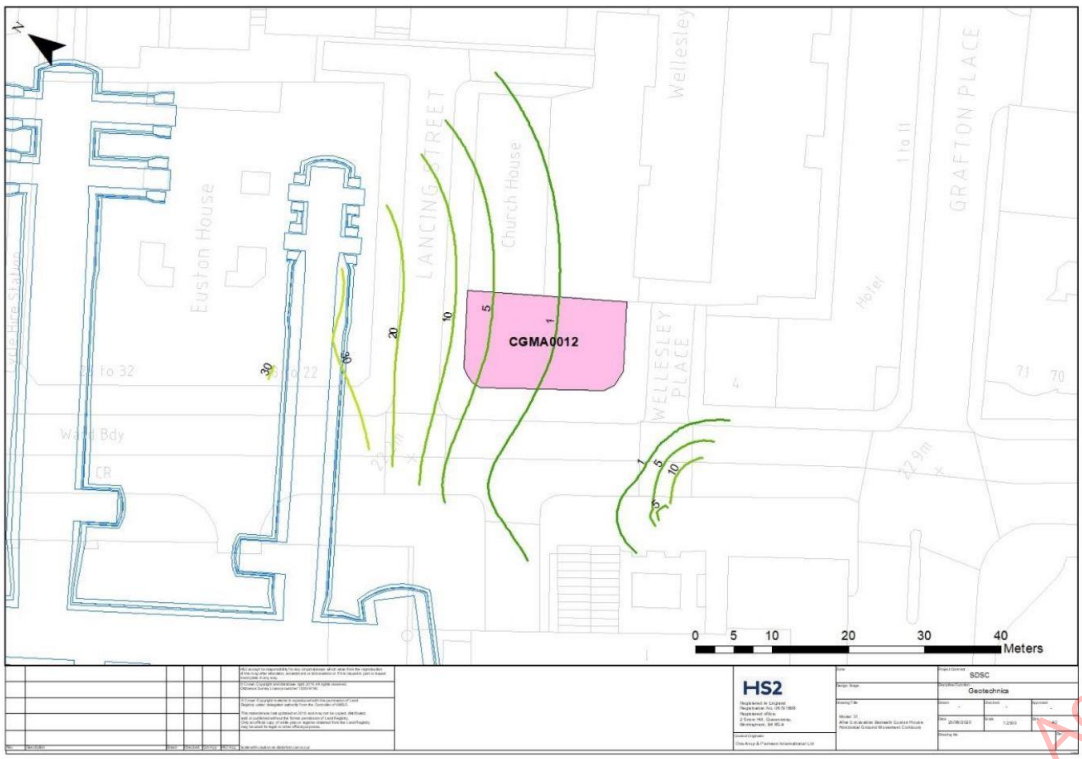


Figure 8: Plan view of Royal George Public House and predicted settlement contours [mm] at reference settlement depth 19.6mOD

Code 1 - Accepted

3.3 Monitoring Equipment

3.3.1 The following Instrumentation and Monitoring (I&M) will be installed on to the external facades of the Royal George to monitor building movement, particularly displacement, distortion and cracking associated with these works and consequential settlement:

- Mini Circular Prisms
- Levelling Points (eg. BRE sockets)
- Crack Meters

3.3.2 Two strain gauges, automatic crackmeters or LVDT (Linear Variable Displacement Transducers) will be installed between the transfer beam and the walls in the interior of the basement, in order to assess the impact of the works to the interior of the building. These will be placed to measure whether there is any movement between the beams and the interior walls.

3.3.3 The survey targets and monitoring points will be located along the facades in vertical lines to allow deflection movements of the facades to be monitored. On the south-west elevation, lines of monitoring points are located to assess changes adjacent to the downpipes and on an existing crack on the north-east elevation (Figure 99). The points will monitor absolute movement and allow differential or relative move between points to be monitored.

Code 1 - Accepted

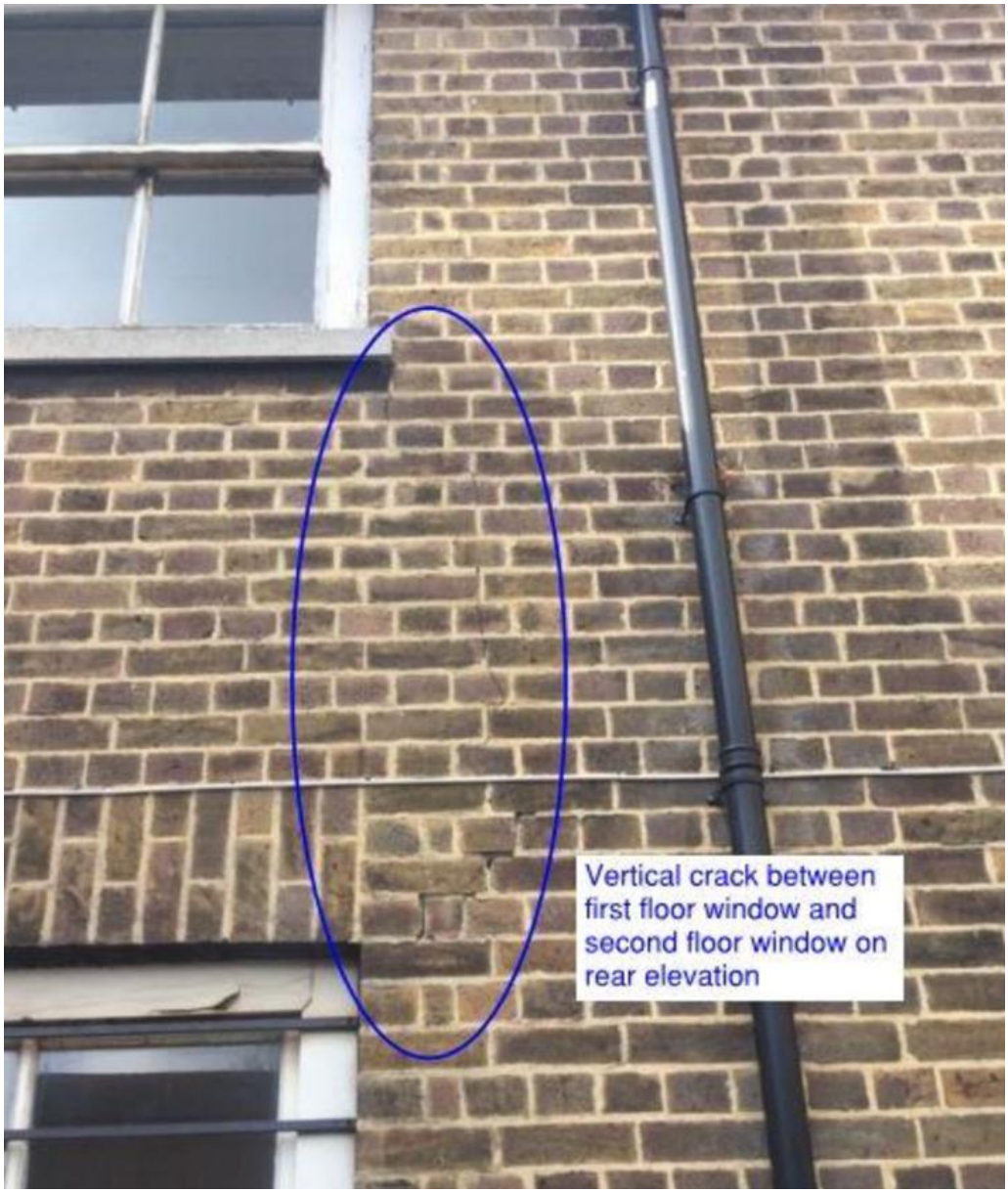


Figure 9. Photo illustrating the vertical crack on the rear (north-east) elevation. See Figure 9, 1SN01-ARP-ST-REP-SS06_SL09-000037

3.3.4 The monitoring points will be located either side of changes in material and structure to assess differential movement, for example the base of the façade panel of the attic storey, and on the parapet wall and chimney on the north elevation.

3.3.5 Important architectural features, such as the decorative eagles on the curved corner elevations, will also be monitored to ensure they are not at risk of being damaged.

3.3.6 Survey coordinates at each survey target fixed to the building facades will be taken using a 'total station' set up at temporary locations on the pedestrian pavements on Eversholt Street, Wellesley Place and Lancing Street. The total stations may be mounted on tripods, or on semi-

Code 1 - Accepted

permanent pillars to measure and record data at each location. These locations will be away from the Royal George and will not affect the property or be attached to other heritage assets in the vicinity. Survey positions often change through the project duration depending on surrounding work and access constraints, but all new positions will be referenced to the survey and control data to ensure accuracy.

3.3.7 **BRE sockets**. BRE Level bolts are to be fixed to the façade at a low level to allow a surveyor and assistant to be able to take a reading on each bolt on a regular basis (Figure 10). They will be installed by drilling a 10mm diameter hole into the masonry substrate so that a brass or stainless steel 'shell anchor' can be installed. A non-percussive drill with a built-in dust extractor will be used. A survey level bolt is then screwed into the anchor and hand tightened, once the survey reading is taken, the level bolt is removed leaving only the 'shell anchor' in place with no visual impact.

Figure 10. Example of the 'shell anchor' (top) and BRE level bolt (bottom).

3.3.8 **Mini Circular Prism.** It is expected that the majority of the targets to be installed onto the Royal George will be mini circular prisms because they are durable and easy to target by the total station.**Error! Reference source not found.** These have been widely used at Paddington Station, Kings Cross Station and St Pancras Station during rail infrastructure works as well as other listed buildings. The target bracket colour will be changed to adapt as best as possible to the building façade material, such as white or cream to blend into the stock brick or stone. The prisms are installed by drilling a 10mm diameter hole into the masonry substrate so that a brass or stainless steel 'shell anchor' can be installed (see section 3.4). A drill with a built-in dust extractor will be used. A stainless-steel survey spigot is then screwed into the anchor and hand tightened (Figure 2). The prism is then pushed into the spigot and rotated and aligned to the total station positions. This is achieved by rotating the 'L-shaped' bracket and prism head. The prism alignment can be subsequently adjusted and realigned to new station positions if the base station positions change, with no need to change the prism position on the building façade, but

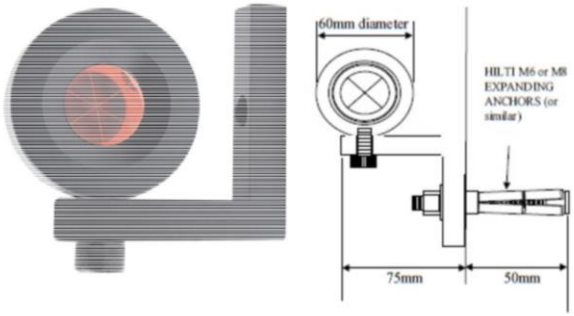


Figure 11. Example of a mini circular prism with L-shaped support bracket

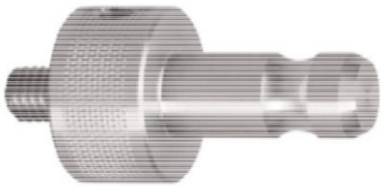


Figure 12. Example of the spigot fixing

Code 1 - Accepted

a limited number of new prism positions may be required during the project duration. This will take place in consultation with HS2 heritage specialists.

3.3.9 **Crack meters.** Crack meters consist of two overlapping acrylic plates, one with a black millimetre grid, and one with red crosshairs centred over the grid. The crosshairs shift horizontally or vertically when movement occurs, demonstrating the extent of the movement. They can be installed using either anchors (bolts/screws) or epoxy adhesive, depending on the type of surface the crack appears on, its location and the risks associated with drilling holes with a non-percussive drill or removing some surface when the epoxy is removed. The number and location of the crack meters will be determined following a full survey of the building, and will be re-evaluated throughout the works, in the event of further cracks appearing.

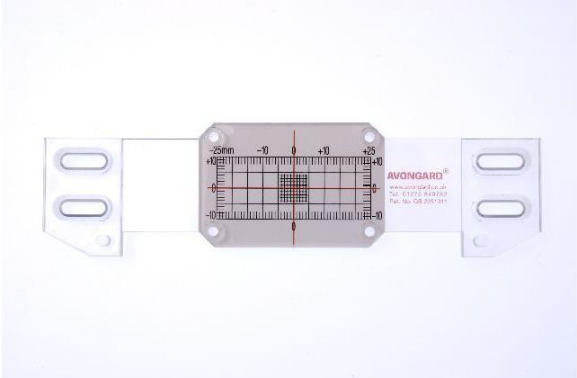


Figure 13. Example of a crack meter with pegs to aid installation.

3.3.10 **Wire lead strain gauges** consist of a very fine metallic or semiconductor material, bonded to the surface of the building, designed for the measurement of strains in and on structural elements. It consists of an electromagnetic coil to provide a pulse and receive a resonant frequency of a wire tensioned between the end mountings of the gauge used for measuring static strains. A common dynamic strain gauge consists of a very fine metallic wire, foil or semiconductor material in a grid bonded to a surface. Variations in electrical resistance of the grid indicate strain. Typically, the location and size of the gauge makes the wire susceptible to damage. However, their location high in the basement of the Royal George should mean they are somewhat shielded from normal wear and tear and makes them an appropriate choice.

Figure 14. Example of a wire lead strain gauge

3.3.11 An **LVDT (Linear Variable Displacement Transducers)** consists of an electromechanical sensor that is used to convert mechanical motion or vibrations into a variable electrical current, voltage or other electric signal. The sensor is located within a hollow metallic cylinder, within which the sensor, known as the pushrod moves freely. One end of the pushrod features a magnetically-conductive

Figure 15. Example of a LVDT sensor

Code 1 - Accepted

core, and is affixed to a reference point, while the other end attached to the moveable point. Any movement between the two points is electrically measured.

3.4 Fitting

3.4.1 This section outlines the means by which the above monitoring equipment will be installed. A relevant heritage specialist should oversee this work.

3.4.2 **Brickwork facades**: Prisms installed on the brick facades will comply with the following principles:

a) Holes will be drilled into the brickwork mortar joints where possible (which are generally more than 10mm thick) and not the bricks using a non-percussive drill. This will allow easier repair to the mortar joint rather than a coloured mortar repair to the brick. Where defects are already present in the brickwork, if these are close enough to the proposed locations to achieve the required data, then to prevent additional damage to the facades these will be used to install the instrumentation.

b) Prism positions will be vertically and horizontally aligned as closely as possible, taking into account avoiding existing fixtures and fittings and using existing defects for installation, to create a survey grid across the façade. This will minimise visual impact.

3.4.3 **Artificial stone facades**: Prisms installed on the artificial stone facades will comply with the following principles:

a) Prisms will be located on plain ashlar masonry and flat masonry surfaces such as band courses, in order to not detract from decorative elements of the building

b) Holes will be drilled into the stone and not the narrow mortar joints, in order to reduce long term visual impact. The mortar joints are very narrow, and may result in a visually disruptive repair that is more challenging to repair.

c) If previous repair holes are present these will be used to drill into to fix the prism, rather than drill a new hole into the stone.

d) Holes will be placed at least 150mm from corners of stone to prevent spalling

e) Prism positions will be vertically and horizontally aligned as closely as possible, wherever possible, to create a survey grid across the façade. This will minimise visual impact.

3.4.4 **Crack meters** will be fixed in place using screws or epoxy resin, as outlined in 3.3.9.

3.4.5 **Wire lead strain gauges** or **automatic crack meters** will be installed in the basement between a wall and a beam and column and beam. They will be fixed in place using screws or epoxy resin.

Code 1 - Accepted

3.5 Removal

3.5.1 On completion of the HS2 works at Euston and completion of all survey and monitoring work, monitoring equipment will be removed from the Royal George. A relevant heritage specialist should oversee this work. Any damage will be made good, using like for like materials and following building conservation best practice. Method of making good will be agreed with the conservation officer prior to undertaking any repairs.

3.5.2 Monitoring equipment is expected to remain in place for approximately 10 to 15 years, but this period may be longer subject to satisfactory completion of settlement and building movement mitigation works.

3.5.3 A specialist masonry subcontractor will be appointed on behalf of HS2 Ltd by the principal contractor to remove all survey targets and carry out minor repairs to the building facades, overseen by the main contractor's heritage specialist. The method of repair will be agreed with the conservation officer prior to undertaking works.

3.5.4 **Brickwork facades:** The prism and 'L-shaped" bracket will be gently pulled away from the stainless-steel spigot and the spigot will be unscrewed from the shell anchor. An old spigot or fixing will then be screwed a couple of turns into the shell anchor leaving a gap between the spigot and stone surface. The spigot will then be lightly tapped on the sides to loosen the shell, whilst pulling on the spigot to pull the anchor from the hole. If slightly greater force is required, a thin piece of timber will be placed onto the masonry to protect the stone whilst using a lever to gently pull the fixing from the stone.

3.5.5 Once the fixing is removed the open hole will be filled with a specialist mortar to match the colour and composition of the existing mortar. The repair will be finished flush with the surrounding mortar joint and textured to match the existing. The mortar specification will be agreed with the conservation officer prior to repair.

3.5.6 **Artificial stone facades**: The prism and 'L-shaped" bracket will be gently pulled away from the stainless-steel spigot and the spigot will be unscrewed from the shell anchor. An old spigot or fixing will then be screwed a couple of turns into the shell anchor leaving a gap between the spigot and stone surface. The spigot will then be lightly tapped on the sides to loosen the shell, whilst pulling on the spigot, to pull the anchor from the hole. If slightly greater force is required, a thin piece of timber will be placed onto the masonry to protect the stone whilst using a lever to gently pull the fixing from the stone.

3.5.7 Once the fixing is removed, the open hole will be filled with a suitable artificial stone repair, finished flush with the surrounding stone, and colour and texture-matched to match the existing surface. The method of repair will be agreed with the conservation officer prior to undertaking the work.

Code 1 - Accepted

3.6 Monitoring Locations

3.6.1 Locations will be chosen on site, taking advantage of existing defects. The final locations are at the discretion of the Construction Partner (CP) but to be agreed with SDSC. Please refer to sections 3.3 - 3.5 and Appendix 3.

3.6.2 It was not possible to get access to the rear of the building to survey, as it backs onto a gated community. A description of the location of monitoring on this elevation is included below.

Building Element/Location	Number on Figures	Type of Monitoring	Number of Monitoring Points	Comments
South-west façade	17, 21, 24	Levelling points (eg. BRE sockets)	3	To monitor vertical displacements at the base of the façade. See Figure 17 for suggested locations.
South-west façade	13, 14, 15, 16, 18, 19, 20, 22, 23	Prism	8	To monitor absolute displacement and distortion of facade in the x, y and z planes. To monitor absolute displacement and distortion of bottom of ornate panel above second floor in the x, y and z planes. See Figure 17 for suggested locations. Note: prisms near the northwest corner are intentionally located near the rainwater downpipe
North-west façade	4, 8, 12	Levelling points (eg. BRE sockets)	3	To monitor vertical displacements at the base of the façade. See Figure 16 for suggested locations.

Code 1 - Accepted

North-west façade	1, 2, 3, 5, 6, 7, 9, 10, 11	Prism	9	To monitor absolute displacement and distortion of façade in the x, y and z planes. To monitor absolute displacement and distortion of top and bottom of north parapet wall and top of north-east chimney in the x, y and z planes. See Figure 16 for suggested locations. Note: prisms at the north-east corner of the building are located near the rainwater downpipe that runs adjacent to the ground floor fireplace.
South-east façade	29, 32, 35	Levelling points (eg BRE sockets)	3	To monitor vertical displacements at the base of the façade. See Figure 19 for suggested locations.
South-east façade	26, 27, 28, 30, 31, 33, 34	Prism	7	To monitor absolute displacement and distortion of façade in the x, y and z planes. To monitor absolute displacement and distortion of top and bottom of north parapet wall and top of north-east chimney in the x, y and z planes. See Figure 18 for suggested locations.
North-east façade	N/A	Prism	5	To monitor absolute displacement and distortion of top and bottom of east parapet wall. See Figure 19 suggested locations.
North-east façade	N/A	Levelling points (eg BRE sockets)	2	To monitor vertical displacements at the base of the façade. See Figure 19 for suggested locations.
Ground floor transfer beam (in basement)	N/A	Strain gauge	2	To monitor the movement of the ends of the ground floor steel transfer beam where it is supported by the north basement wall and the steel column.

Code 1 - Accepted

All elevations	N/A	Crack mapping and/or crack meters	To be confirmed following survey.	To monitor existing cracks and any new cracks in the exterior and interior faces of the building following survey. Including chimneys and parapet walls.

Table 1. Monitoring locations

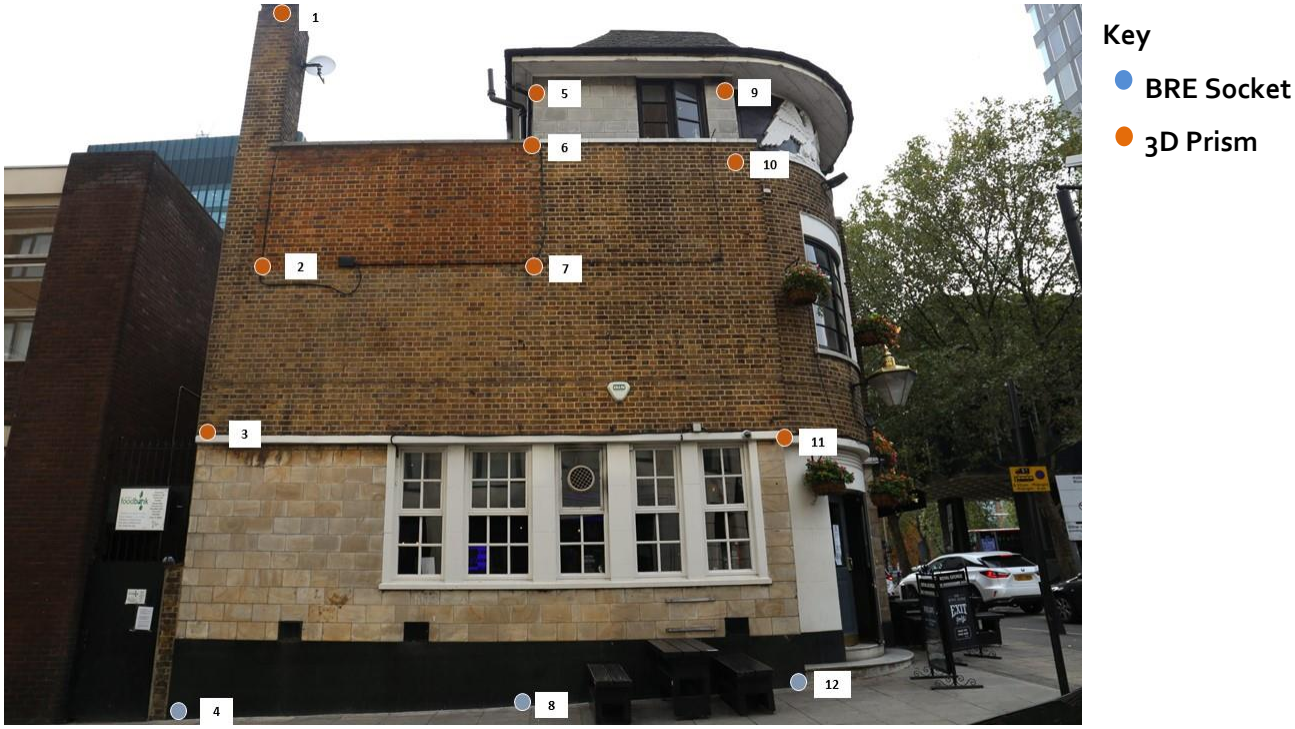


Figure 16. Recommended structural monitoring of north-western façade of Royal George public house.

Code 1 - Accepted

Figure 17. Recommended structural monitoring of south-western façade of Royal George public house.

3.6.3 Monitoring point 15 is located to the north of the green Royal George sign in order to avoid interference with monitoring.

Figure 18. Recommended structural monitoring of south-eastern façade of Royal George public house.

Code 1 - Accepted

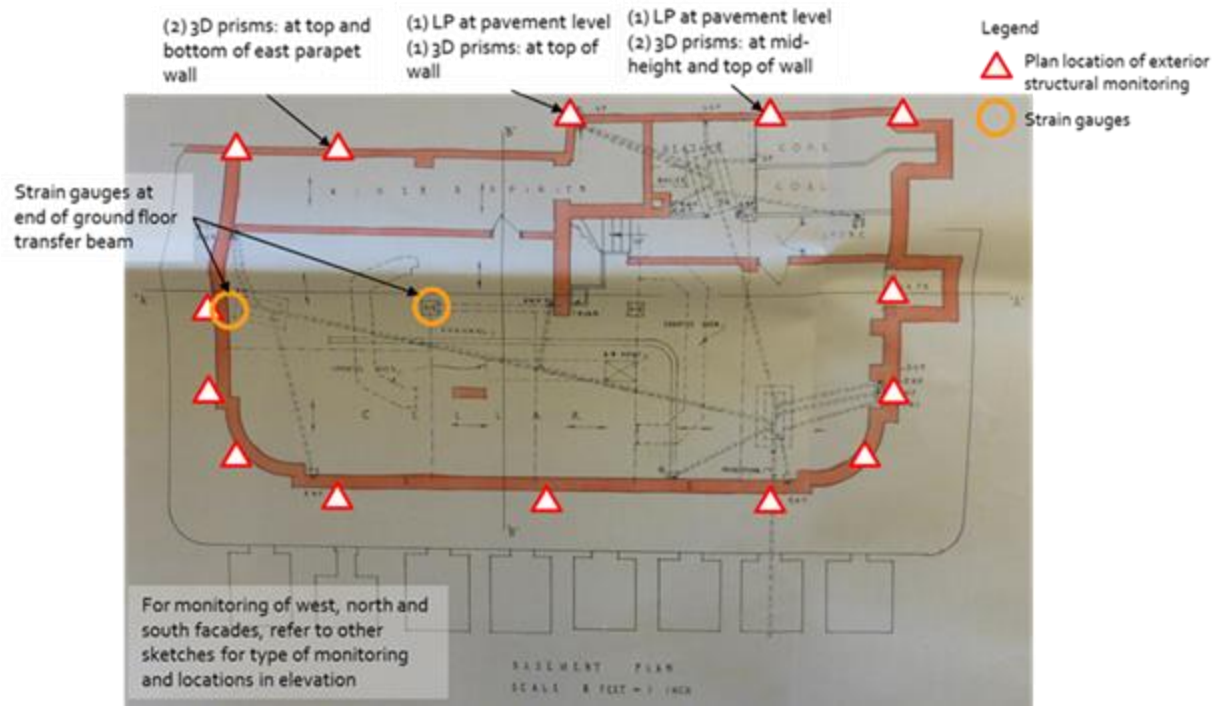


Figure 19. Recommended structural monitoring of the basement of the Royal George public house.

3.6.4 As noted in Figure 19, 3D prisms will be installed at the top and bottom of the east parapet wall on the north-eastern elevation at the northern end, and at mid height and the top of the wall at the southern end. Levelling points will be installed at pavement level on this elevation in two locations, depicted in Figure 19.

3.7 Monitoring Regime

3.7.1 Three-dimensional survey and monitoring will be carried out on a regular basis to confirm the level and position of the building facades in relation to the baseline. The survey frequency will change throughout the project duration depending on the nature of work at the time; survey frequency typically ranges from daily, weekly, monthly to three-monthly.

3.7.2 Three-dimensional coordinates will be collected from all the survey targets for a period of 3 months, before commencement of demolition work to adjacent buildings. This data provides a baseline confirming the level, position and horizontal and vertical alignment of the building facades before commencement of the HS2 works.

3.7.3 Subsequent survey data collected during the project duration will then compared to the baseline to confirm how much building movement and ground movement may have occurred.

3.7.4 This data is used to monitor buildings and ground movements throughout the HS2 works to ensure the buildings are moving as predicted.

Code 1 - Accepted

3.7.5 Buildings naturally move as a result of weather conditions and the use of the building and surrounding environment. Demolition of surrounding buildings and nearby ground excavation and construction work is expected to cause minor levels of additional building and ground movement. Monitoring, and subsequent mitigation work if required, seeks to protect the listed building to ensure compliance with predicted building settlement, and legal obligations contained in High Speed Rail (London – West Midlands) Act 2017 and the Heritage Agreement.

3.7.6 The Ground Movement Assessment and Scheme Mitigation Report – Royal George Public House notes the building has been assigned an overall Building Sensitivity Score of 2, which is the sum of the Structural Sensitivity Score of 1 and the Feature Sensitivity Score of 1. Based on the Building Damage Category of 2 (Slight) and the Building Sensitivity Score, the Listed building Magnitude of Impact is 4 (Moderate).

4 References and Glossary of Terms

4.1 References

Title	Reference
HS2 Technical Standard – Civil Engineering Instrumentation and Monitoring	HS2-HS2-CV-STD-000-000004
Historic England. 2016. *Understanding Historic Buildings: A guide to good recording practice* [Online] Available at: https://historicengland.org.uk/images-books/publications/understanding-historic-buildings/heag099-understanding-historic-buildings/ [Accessed: 12/03/19]	Historic England. 2016.
CIfA. 2014. Standards and guidance for the archaeological investigation and recording of standing buildings or structures [Online] Available at: https: https://www.archaeologists.net/sites/default/files/CIfAS&GBuildings_1.pdf [Accessed: 12/03/19]	CIfA. 2014.
Ground Movement Assessment and Scheme Mitigation Report – Royal George Public House	(1SN01-ARP-ST-REP-SS06_SL09-000037 C01)
Asset Protection –Third Party Owned Buildings: Royal George Public House Survey Scope	(1SN01-ARP-ST-REP-SS06_SL09-000039, C01
Designer's Monitoring Plan SDSC, 2019	1SN01-ARP-GT-REP-SS06_SL09-000016, C05
Table 2 Heritage Agreement	London Borough of Camden, 2017 – Table 2 Heritage Agreement

Code 1 - Accepted

'The Royal George, 8-14, Eversholt Street (1342046)' National Heritage List for England. Available via: https://historicengland.org.uk/listing/the-list/list-entry/1342046 [accessed 9 October 2020].	Historic England, 1999
'The Royal Oak (1426765)'. National Heritage List for England. Available via: https://historicengland.org.uk/listing/the-list/list-entry/1426765 [accessed 9 October 2020].	Historic England, 2015
Advice Note 12: Statements of Heritage Significance: Analysing Significance in Heritage Assets (Historic England, 2019).	Historic England, 2019

4.2 Glossary of Terms

Abbreviation	Definition
I&M	Instrumentation and Monitoring
CP	Construction Partner
CSjv	Costain Skanska Joint Venture
GIS	Geographical Information Systems
HAMS	Heritage Agreed Method Statement
HS2	High Speed 2 Ltd
LVDT	Linear Variable Displacement Transducers
SDSC	Station Design Services Contractor

Appendix 1 Listing Description

The Royal George, 8-14, Eversholt Street
List Entry Number: 1342046

Grade: II

Date first listed: 11-Jan-1999

National Grid Reference: TQ 29703 82699

List description:
Public house with staff flat over. 1939-40. By AE Sewell, LRIBA, architect to Mssrs. Truman, Hanbury and Buxton, brewers to replace a public house of the same name in Drummond Street. Stock brick between bands of artificial stone to ground floor and attic, green slate roof. Rear stacks. EXTERIOR: 3 storeys and cellars on rectangular plot with curved corners. Corner entrances to former public (north) and saloon

Code 1 - Accepted

(south) bars, and central entrance to former private bar; all have double doors. Band of six 2-light sash windows either side of central entrance. First floor has large 2-light casements under stone heads, four in centre and one on each corner; similar casements form a strip in attic, set back under projecting eaves and with set-back corners dominated by relief sculptures of eagles. Access to upper flat in Wellesley Road, where a door in similar style sits under first-floor tripartite window with stone jambs. INTERIOR: the interior originally consisted of lounge and public bar at either end, with private bar in centre and games room at rear now occupied by food counter. These bars now united, but central counter remains. This, the back bar and the walls and supporting columns to frieze height all with veneer panelling typical of the late 1930s, with banded decoration to bar and fitted seats to former lounge area clad in the same timber. The chimney-pieces are most elaborately treated, with marquetry decoration, that to the public bar with small panels contrasting the steam age of the 1830s with the radios and cocktails of the 1930s; a larger marquetry panel in the lounge depicts the sailing ship The Royal George. Banded coving over bar fascia and to cornices; inset roundels in ceiling serve later C20 light fittings. Included as a remarkably complete example of a 1930s pub, with excellent marquetry panels depicting features from the style of the period done with charm and panache.

Appendix 2 Location Figure

Code 1 - Accepted

Euston

EVERSHOLT STREET
DORIC WAY
1 to 9 Ian Hamilton House
1 to 79
21.8m
TCBs
LB
Cycle Hire Station
Euston House
26 to 32
16 to 22
LANCING STREET
Play Area
1 to 31
CHURCHWAY
Seymour House
1 to 30
Victoria (PH)
1 to 20 Avigail House
Shelter
22.2m
Church House
Royal George (PH)
8 to 14
Wellesley House
1 to 80
Grafton Chambers
1 to 6
Christopher Place
1 to 5
CHALTON ST
1 to 6
126
Bank
TCBs
WELLESLEY PLACE
Hotel
1 to 11
GRAFTON PLACE
128 to 144
Air Shaft
22.9m
71
70
Fire Station
172
156 to 160
Underground Railway
EUSTON SQUARE
EUSTON ROAD
22.4m
Statue
Playground

Code 1 - Accepted

HS2 Ltd accept no responsibility for any circumstances, which arise from the reproduction of this map after alteration, amendment or abbreviation or if it issued in part or issued incomplete in any way.

© Crown copyright and database rights 2020 OS 100049190

Derived from (...cite the scale of the BGS data used...) scale BGS Digital Data under licence 2011/111 BP British Geological Survey. © NERC.

Contains Environment Agency information © Environment Agency and database right.

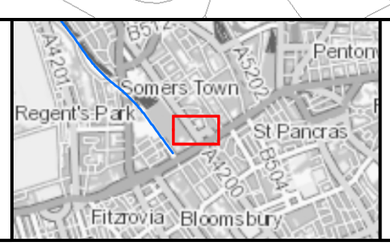
© Crown copyright material is reproduced with the permission of Land Registry under delegated authority from the Controller of HMSO.

This material was last updated on [date] and may not be copied, distributed, sold or published without the formal permission of Land Registry and Ordnance Survey. Only an official copy of a title plan or register obtained from the Land Registry may be used for legal or other official purposes. © Crown Copyright Ordnance Survey.

Legend

Phase One Final Preliminary Design alignment January 2017

- Bored Tunnel
- Cutting
- Embankment
- Green Tunnel
- Retaining Wall
- Station
- Tunnel Portal
- Viaduct



High Speed Two

Location Plan of Royal George

Published

HS2

Registered in England. Registration number 06791686.
Registered office: 2 Snowhill, Queensway, Birmingham B4 6GA.

Scale at A3: 1:800

0 5 10 15 20
Metres

Date: 23/10/20

Appendix 3 List of Targets and Fixing Method

The following tables list the targets to be installed on each façade and the fixing method to be used:

Elevation 1 (N): Lancing Street			
	Target Type	**High/Low level**	**Fixing Method**
Target 1	Prism	High	Drill & Fix
Target 2	Prism	High	Drill & Fix
Target 3	Prism	High	Drill & Fix
Target 4	BRE Socket	Low	Epoxy Resin
Target 5	Prism	High	Drill & Fix
Target 6	Prism	High	Drill & Fix
Target 7	Prism	High	Drill & Fix
Target 8	BRE Socket	Low	Epoxy Resin
Target 9	Prism	High	Drill & Fix
Target 10	Prism	High	Drill & Fix
Target 11	Prism	High	Drill & Fix
Target 12	BRE Socket	Low	Epoxy Resin

Elevation 2 (W): Eversholt Street			
	Target Type	**High/Low level**	**Fixing Method**
Target 13	Prism	High	Drill & Fix
Target 14	Prism	High	Drill & Fix
Target 15	Prism	High	Drill & Fix
Target 16	Prism	High	Drill & Fix
Target 17	BRE Socket	Low	Epoxy Resin
Target 18	Prism	High	Drill & Fix
Target 19	Prism	High	Drill & Fix
Target 20	Prism	High	Drill & Fix
Target 21	BRE Socket	Low	Epoxy Resin
Target 22	Prism	High	Drill & Fix
Target 23	Prism	High	Drill & Fix
Target 24	BRE Socket	Low	Epoxy Resin
Target 25	Prism	High	Drill & Fix

Elevation 3 (S) Wellesey Place			
	Target Type	**High/Low level**	**Fixing Method**
Target 26	Prism	High	Drill & Fix
Target 27	Prism	High	Drill & Fix
Target 28	Prism	High	Drill & Fix
Target 29	BRE Socket	Low	Epoxy Resin

Code 1 - Accepted

Target 30	Prism	High	Drill & Fix
Target 31	Prism	High	Drill & Fix
Target 32	BRE Socket	Low	Epoxy Resin
Target 33	Prism	High	Drill & Fix
Target 34	Prism	High	Drill & Fix
Target 35	BRE Socket	Low	Epoxy Resin

Elevation 4 (E) Eastern Elevation			
	Target Type	**High/Low level**	**Fixing Method**
Target 36	Crack monitor	High	Epoxy Adhesive
Target 37	Crack monitor	High	Epoxy Adhesive
Target 38	Crack monitor	High	Epoxy Adhesive
Target 39	Prism	High	Drill & Fix
Target 40	Prism	High	Drill & Fix
Target 41	BRE Socket	Low	Epoxy Resin
Target 42	Prism	High	Drill & Fix
Target 43	BRE Socket	Low	Epoxy Resin
Target 44	Prism	High	Drill & Fix
Target 45	Prism	High	Drill & Fix

NB: The number of targets to be installed on Elevation 4 will be confirmed following a full survey of the building.

Interior: Basement			
	Target Type	**High/Low level**	**Fixing Method**
Target 39	Strain gauge	High	Adhesive
Target 40	Strain gauge	High	Adhesive

Code 1 - Accepted