Historic England

Gasworks and Redundant Gasholders

Guidelines for their Evaluation and Recording

Summary

These guidelines for evaluating and recording England's former gasworks and redundant gasholders are designed to inform an understanding of their significance, whilst ensuring adequate records (both above and below-ground) are made where evidence is likely to be damaged or destroyed. Such information, gathered in a proportionate manner determined by the significance and characteristics of each site, may in some circumstances guide decisions regarding the possible retention or inclusion of historic fabric and site layout within a future redevelopment. Such an approach is also of relevance for buildings and structures, including gasholders that are to be conserved, including those where dismantling for repair may be necessary. The guidelines also take into account the important role of community engagement and oral history projects in capturing the memories and experiences of those who worked in and lived adjacent to gasworks.

This document has been prepared by Matthew Bristow of Historic England. It is one is of a series of seven documents on the manufactured gas industry. This edition published by Historic England December 2019.

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Front cover: The relocated and restored gasholder guide frames from the Imperial Gas Light and Coke Company's St Pancras works. The linked gasholders numbers 10, 11 and 12, known as the 'Siamese Triplets', were constructed in 1880. Along with the frame from gasholder number 8 (foreground) they form Wilkinson Eyre's Gasholder Park, on the bank of the Regent's Canal north of Kings Cross. [DP220107]

Contents

1 Introduction

Historic England recognises the important role town gasworks and sites of small-scale gas manufacturing played in meeting the nation's energy needs during the 19th and 20th centuries, their high technological interest and wider landscape impact. Following the final and complete redundancy of low pressure gasholders, many sites of former gas manufacture are now in the process of being remediated and released for redevelopment. This last act in the story of manufactured gas provides a final opportunity to consider which sites and their associated fabric merit retention, and to record key evidence, both material and intangible, of the remaining vestiges of England's manufactured gas and low pressure gas storage industries, and to convey the historical, technological, social, and architectural significance.

This guidance document outlines a framework for evaluating and recording former gasworks sites and gas industry heritage, both above and below ground, and the investigation process may comprise a number but not necessarily all of the interrelated activities detailed below. The document details a variety of approaches and best practices which may be adopted and which are designed to collectively evaluate the significance of former sites of gas manufacture and storage, and to produce a lasting record. Though the majority of future recording is likely to take place outside of the planning process, this process of rapid evaluation and selective recording will also be applicable as part of the pre-application and post-determination planning stages. Similarly, evaluation and recording should be applied in the context of proposed alterations to listed structures. Assessment and recording will also play an integral part in any future conservation strategy for retained buildings and structures, including gasholders.

These guidelines are aimed at a wide audience comprising but not confined to:

- The national gas networks whose portfolios of former gasworks are now being released for redevelopment
- Owners of former gasworks sites and buildings
- Developers seeking to understand the significance of historic gas industry fabric or building elements

- Remediation consultants charged with decontaminating and clearing gasworks sites
- Heritage consultants
- Archaeological and historic building contractors
- Local authority planning teams (including local authority archaeological and historic building conservation officers)
- Historic Environment Records (HER)
- Independent academics and researchers

As the Government's statutory adviser on all aspects of the historic environment, Historic England provides advice on whether a site merits statutory protection. A number of those associated with the gas manufacturing and storage industries are already protected and the *Infrastructure: Utilities and Communication Listing Selection Guide* (Historic England, 2017) contains information on what might be eligible for listing. Others will be locally designated by lying within conservation areas or locally listed, and Historic England's *Local Heritage Listing* gives advice on local listing (2016).

The principles set out in the Government's National Planning Policy Framework (MHCLG 2019) describe how the historic environment should be dealt with through the planning process in terms of assessing the significance of heritage assets, considering potential impacts on that significance and ensuring records are made where heritage assets are to be lost (wholly or in part). When the future of sites is being considered outside the planning framework, including site remediation, these principles may still usefully be followed. The accompanying Planning Practice Guidance (MHCLG, 2019) and Historic England's *Historic Environment Good Practice Advice in Planning 2 – Managing Significance in Decision Taking in the Historic Environment* (2015) also contain helpful advice. It is always advisable to discuss and agree the general approach, techniques and methods to be employed with the relevant local authority specialist historic environment advisor prior to their implementation.

Since the late 1990s, a number of early gasworks sites have been subjected to archaeological evaluation, assessment and detailed recording (see Linnane, 1998; Evans, 2003; Rayner, 2008), and a limited number of detailed monographs on individual gas undertakings have also been published (Francis, 2010).

Historic England has commissioned a summary overview on the history of the manufactured gas industry and will produce an Introduction to Heritage Assets for the manufactured gas industry. Both of these products will be published to supplement these recording guidelines.

2 Manufactured Gas

2.1 Remediation of redundant sites

The investigation of a former gas manufacturing site is a key part of the process of site remediation. Assessments which draw on previous land investigation and the documentary, photographic and cartographic record to produce a chronological overview of the development of a site can pinpoint the location of the various gas manufacturing processes and advise geotechnical desk-studies which identify the likely sources of contamination. This in turn can advise the location of boreholes and test pits to confirm the presence of sources of contamination. The process of site remediation; the identification of and removal of sources or pathways of contamination, and the preparation of a site for redevelopment may result in the identification of former (and often unknown) elements of the gasworks and its buildings (Figure 1). As such the remediation of large gasworks and the evaluation/ recording process described in this document should be fully integrated from the outset, though assessment of each gasworks site during remediation should be proportionate to the scale of the remediation relative to the site as a whole. Further guidance on archaeological recording within the context of contaminated land can be found in *Land Contamination and Archaeology: Good Practice Guidance* (Historic England, 2017). Archaeological requirements, including the possible presence of non-gas related archaeological remains, should be discussed in advance with the local authority archaeological adviser (see Below Ground Archaeological Investigation below).

2.2 Overall Priorities

Prior to site redevelopment/clearance and as part of site preparation/ remediation, a prior notice of proposed demolition, or the pre-application stage of the planning process, a basic Level 1 'walkover' record should be made of all extant components of a former gasworks, inclusive of both standing buildings and the potential for below ground archaeology (described further in section 3 below). This initial assessment will seek to provide a preliminary understanding of the significance of the site and its associated fabric identifying the need for any further follow-on work, where necessary (including below ground investigation). Additional detailed investigation may not be required and the following priorities outlined below should be considered to ensure that the significance of a site is fully understood, whilst further detailed recording seeks to enhance

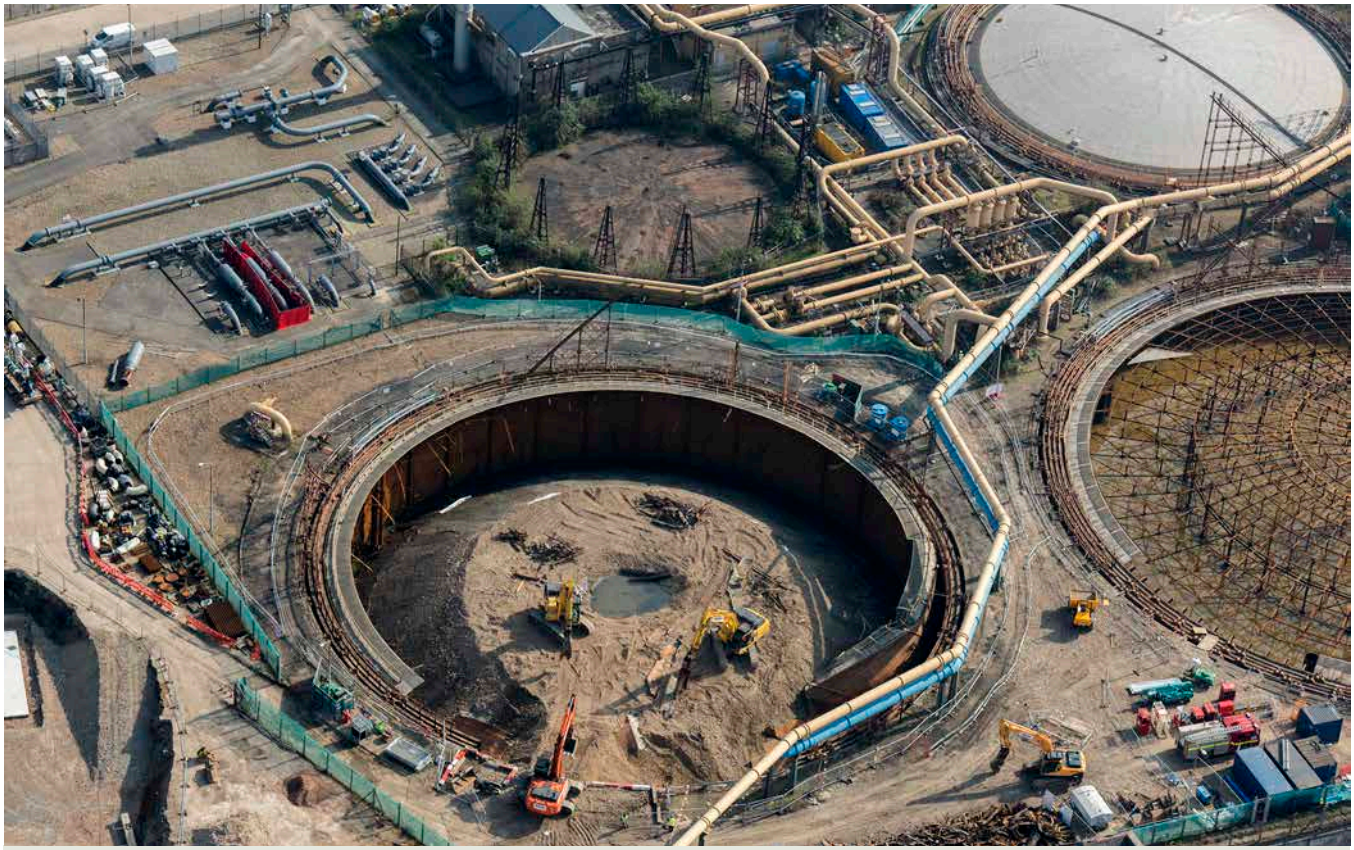


Figure 1: The former Imperial Gas Light and Coke Company gasworks, Sands End, Fulham, during the demolition and remediation of the gasholder station in 2017. The gas holder to the right has had its crown removed, revealing the radial trusses which supported the crown when the holder was in an unpressurised state. The gas holder in the centre of the view has had its trusses removed, exposing the 'dumpling' (the cone of earth in the centre of an in-ground gasholder tank) which is in the process of being excavated to remove the source of contamination. The small gasholder at the top of the image was constructed in 1829-30 and is Grade II* listed. [33093_012]

our understanding of the industry. All work will need to be appropriate and proportionate to the asset's importance. Further information on the recording levels described below can be found in *Understanding Historic Buildings: A Guide to Good Recording Practice* (Historic England, 2016).

Date

The highest priority should be afforded to sites, structures and archaeological deposits relating to the earliest phase of the manufactured gas industry in England between the construction of the Gas Light & Coke Company's first gasworks in Westminster in 1812 and the passing of the Metropolitan Gas Act of 1860. Any physical remains from the early 19th century are of the highest significance, especially as the earliest sites are likely to be less well documented and predate large scale Ordnance Survey mapping. Given the rapid pace of development during the 19th century, it is most likely that remnants of the earliest phase of the manufactured gas industry will survive as below-ground archaeology or as fragments of later buildings.

Figure 2: No. 1 retort house at Basford gasworks in 1950. Built between 1854 and 1857 by the Nottingham Gas Light and Coke Co., the works were extended after they were acquired by the municipality in 1874. In 1883, a large horizontal retort house was constructed on the work's southern extension which was later reconfigured to accommodate Woodhall-Duckham vertical retort ovens. The photograph shows the vertical retort house (right) and the earlier horizontal retort house (left, background). The conveyor provided the retorts with a continuous feed of fossil fuel. No vertical retort houses are believed to be extant in England.

Plant and Machinery

Priority should also be given to any *in situ* plant and machinery, or any structural elements of buildings which relate directly to the processes involved in gas manufacture. The survival of machinery *in situ* is likely to be exceptionally rare, but where ovens, retort benches, purifiers and exhausters are found, detailed recording will contribute greatly to the understanding of the industry.

Standing Structures

The investigation of standing structures should also be prioritised according to their significance within the gas making process in addition to their rarity, architectural quality and contribution to wider understanding.

- **Retort Houses** lay at the heart of the works and horizontal retort houses, with their suitability for reuse as stores and workshops, survive on a number of former sites. None of the later inclined or vertical retort houses are believed to survive in England (Figure 2).

- **Purifier Houses** of which fewer survive than horizontal retort houses should also be prioritised for both their architectural quality and to enhance understanding of that part of the process.

Figure 3: Gasholder number 2 at the Imperial Gas Light and Coke Company gasworks, Sands End, Fulham. Constructed in 1829-30, it was, at that time the largest gasholder in the world. A Type 20 holder according to Malcolm Tucker's typology, it is now the only known example of that type in the world. [DP262679]

- **Gasholders** survive in far greater number than any other structure related to historic gas production and their recording should be prioritised by significance (Figure 3). *The Development of the Gasholder in London in the Later Nineteenth Century* (Tucker, 2000) provides a robust typology (reproduced in summary form as an appendix to this document) and useful reference to assess significance in both London and other parts of the country. Where extant, a record should always be made of the columns or guide-frame, standard crowns, finials, decorative motifs, the roller carriages, crown and any associated signage in accordance with the following priorities:

    - Prototypes or the earliest known example of a particular family of gasholder type should be considered as being of the highest significance and subjected to Level 4 recording.

    - All column and frame guided gasholders should be subjected to Level 2 (Enhanced) recording, while very early or very late examples of a type which demonstrate technological change should be subjected to Level 3 recording, as should examples of a type of which few holders survive.

- Spiral guided gasholders will generally require only a Level 2 (Basic) record with the exception of those early examples dating to the 1890s or those which retain non-standard tanks, roller carriages or decorative plaques which should be recorded at Level 3.

- **Meter Houses, Stores, Jetties, Piers** and **Tanks** survive in limited numbers and generally require limited investigation, however they have potential for significance and should not be discounted.

- **Carburetted Water Gas, Producer** and **Natural Gas Installations** rarely survive but are significant in understanding the development of gas provision beyond the production of gas by Carbonisation. Where identified they should also form part of the recording exercise.

- **Company Offices, Research Laboratories** and **Showrooms** often have some architectural pretension and survive in greater numbers with greater potential for reuse. Like offices, housing constructed by the gas companies for their workforces often survive where the gasworks do not.

- **War Memorials** and **Statues of Company Officials** often survive, though rarely require more than a photographic record.

2.2.1 Small Gasworks

Unlike the large, urban gasworks, less research has been conducted into smaller gasworks, such as those found associated with country houses, on private estates, within large factories or in village and small town contexts. Again, the focus should be on those that have the potential to inform our understanding of the development of the gas industry in line with the priorities outlined above.

The table highlights the key components of a gasworks together with the recommended level of recording as described in *Understanding Historic Buildings: A Guide to Good Recording Practice* (Historic England, 2016)

	Level 2 (Basic)	Level 2 (Enhanced)	Level 3	Level 4
Vertical or Inclined Retort House				X
In Situ Plant or Machinery				X
Prototype Gasholder				X
Structure pre-dating 1840				X
Horizontal Retort House			X	
Purifier House			X	
Early or rare example of a Gasholder family 'type'			X	
A Complete Small Town, Village or Estate works			X	
Column Guided Gasholder			X	
Frame Guided Gasholder		X		
Meter House or Station Governor		X		
Company Office or Showroom pre-dating 1900		X		
Company Office or Showroom post-dating 1900	X			
Ubiquitous Spiral Gasholder	X			
Jetties, Piers and Tanks	X			
Carburetted Water Gas House	X			
Natural Gas Installation	X			
Associated Workers' Housing	X			
Coal or Coke Store	X			
Boundary Walls and Gate Piers	X			

3 Landscape settings

3.1 Evaluation

When dealing with any site related to the manufacture and storage of gas from fossil fuels the initial objective is to gain a high-level overview of the site and its significance. Such an approach will enable the identification of the areas of the site associated with the various stages in the process of manufacturing gas and to illustrate the relationships and linkages between these areas, many of which may have altered through time as technological advances led to changes in these processes. From this preliminary analysis it may be possible to identify groups of buildings, individual structures or structural elements, plant and machinery, archaeological deposits and landscape features that may be worthy of more detailed investigation. The extent to which the above are applicable will be determined by the nature of each individual site and the scope of the project, while preliminary analysis and high-level documentary research may eliminate the need for further recording. An analytical understanding of the layout of the buildings and the functional relationship between them and the landscape they both inhabit and created, is a fundamental objective of the evaluation phase of assessing a gasworks site. This information will probably be most intelligibly gathered and collated by annotating historic large-scale plans, maps and diagrams of the site. These records can be subsequently re-presented to depict, in intelligible form, the phased development of the site and the functional areas within it. Analysis of cartographic and drawn depictions of the site will likely be supplemented by documentary research and investigation of contemporary material such as gas company records, industry journals and historic newspapers.

3.2 Desk Based Assessment

The most commonly produced product of the evaluation phase of the recording exercise will be the Desk-Based Assessment (DBA) report, the components of which are detailed in The Chartered Institute for Archaeologists', *Standard and guidance for historic desk-based assessment* (2017). A DBA will not always be required and in some cases the DBA itself will fulfil the evaluation and recording requirements, while in others it will highlight the significant structures and buried remains that merit further detailed investigation – see 1.2 above. The identification of heritage assets, their significance and the significance of the site as a whole within the

national context of the development of the manufactured gas industry will inform the level and nature of recording to be undertaken and whether any further recording is needed.

Documentary Research

The manufactured gas industry produced an extensive documentary record, rich in detail and material, the consultation of which should be integral to the compilation of a DBA report. The main repository for this material is the National Gas Archive (NGA) at Warrington which holds both the legacy archives of the local gas undertakings created before nationalisation in 1949 and the subsequent records generated by the successor bodies the Gas Council, Regional Gas Boards, British Gas Corporation and British Gas plc and latterly by National Grid (Figure 4). The NGA also holds a substantial photographic archive covering the periods prior to and post nationalisation.

The National Archives at Kew hold a large number of plans and maps specifically detailing the construction of and alteration to municipal gas works within the series HLG/6 and railway company records which detail their own gas manufacturing, while the Simmons Simmons Aerofilms collection, contains more than 1000 aerial views of gas works taken

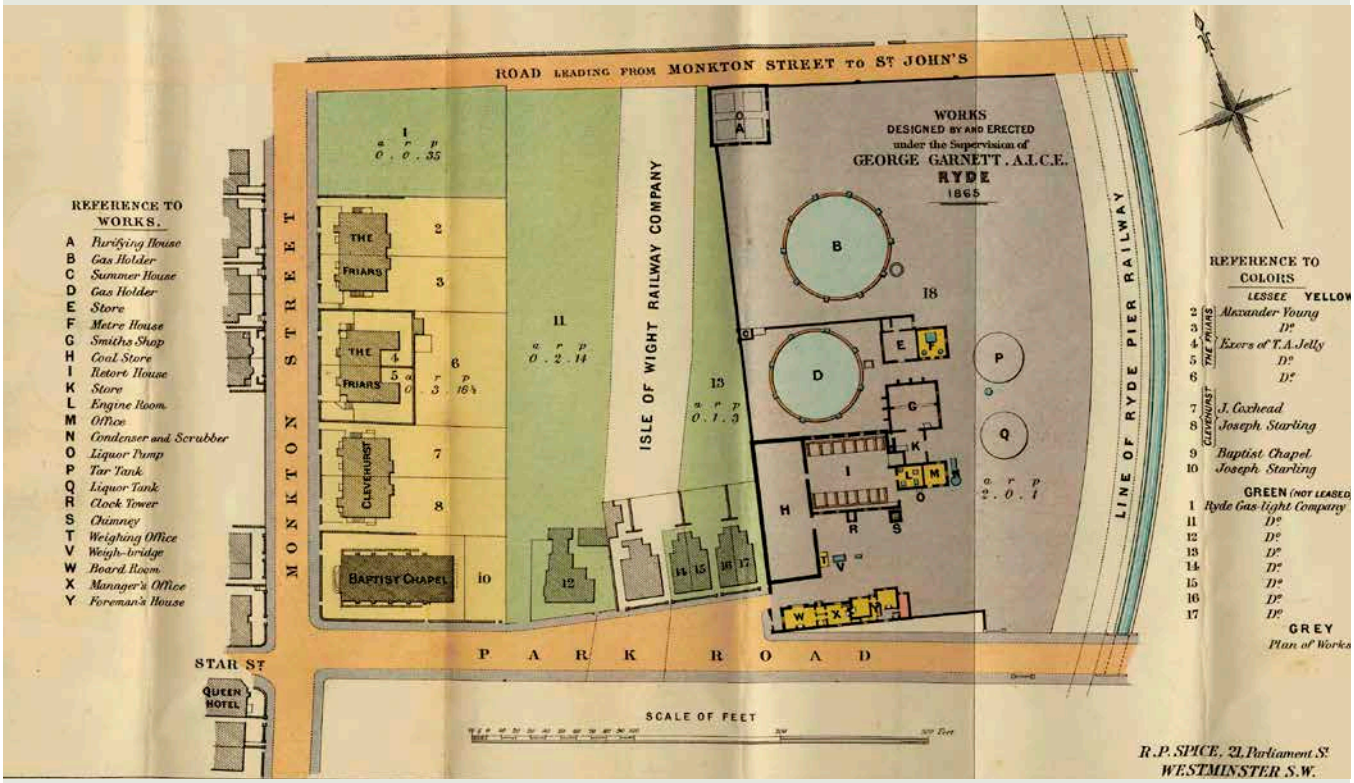


Figure 4: A plan of the Ryde Gas Light Company works, Isle of Wight as built in 1865. Detailed plans such as these can be invaluable as part of a Desk Based Assessment. © National Gas Archive, National Grid.

between 1919 and 1953 (Figure 5). The British Library holds complete runs of industry journals published during the life of the manufactured gas industry, among them; *Gas Journal*, *Gas World*, *Journal of Gas Lighting* and the *Transactions of the Institute of Gas Engineers* and a complete set of large-scale historic Ordnance Survey maps. The examination of the written and photographic record may also include consultation with the National Gas Museum at Leicester and the Institute of Gas Engineers and Mechanics' (IGEM) Panel for the History of the Gas Industry. Existing archaeological surveys of former gas works' sites can be found in the local Historic Environment Records (HERs), or archived with the Archaeological Data Service (ADS), while Local Studies libraries may retain archive photographs and other relevant material.

Figure 5: The Stafford Corporation gas works photographed from the air in 1929. This image, which forms part of the Britain from Above collection, clearly shows the phases of development as the town's works expanded and new processes were adopted. Aerofilms Collection [EPW017027] © Historic England Archive.

Country House, private and small village gasworks are less well represented in the documentary record, though the private family archives of major estates are likely to include information related to the provision of power and may detail the construction of gasworks. These archives will either have been accessioned by the county record office, be held by the local studies library, or remain in private hands.

The DBA report should endeavour to convey either textually or graphically the chronological progression of the site through its various phases of development, locating and identifying the various processes involved in the production of gas and the buildings and plant, both extant and removed associated with each process. Diagrams interpreting the movement of materials and production of energy (process flow) might be warranted, so long as these are not unduly technical in nature, and the evidence supporting the interpretations is provided. Completed DBA reports must, in addition to being supplied to the client, local planning authority or land owner who initiated them, be disseminated and archived in accordance with CIfA and Historic England guidance (see section 5 below).

3.3 Geophysical Survey

In cases where a gasworks was sufficiently early or short lived as to not appear within the sequence of published Ordnance Survey maps, is poorly documented or was previously cleared and only partially remediated, geophysical survey may form part of the evaluation phase in order to accurately locate the gasworks site and to ascertain the likelihood of associated archaeological deposits and their significance. As determined by the nature of the site and scope of the recording exercise, this could comprise but not be restricted to, a ground penetrating radar (GPR) survey which unlike conventional geophysical techniques can be applied on sites covered by a hard surface or where there is a prevalence of above ground ferrous disturbance (Figure 6). The guidance document, *EAC Guidelines for the Use of Geophysics in Archaeology, Europae Archaeologiae Consilium* by Schmitt, A, *et al* (2016) should be referred to for guidance regarding the conditions in which GPR surveys will most likely yield results, survey methodology and best practice, and survey reports and report dissemination and archiving.

3.4 Recording

Where a DBA has identified historic structures associated with gas manufactring, a Level 2 record should be the minimum requirement (see section 2.2). The technical nature of the surviving elements of former gasworks and the likelihood that the recording exercise will form a final record at the point of demolition, renders Level 1 records of standing structures inappropriate as part of this recording exercise. All records should be accompanied by a photographic survey (see Photographic recording below) but not all will require a full drawn record. In order to ensure a full

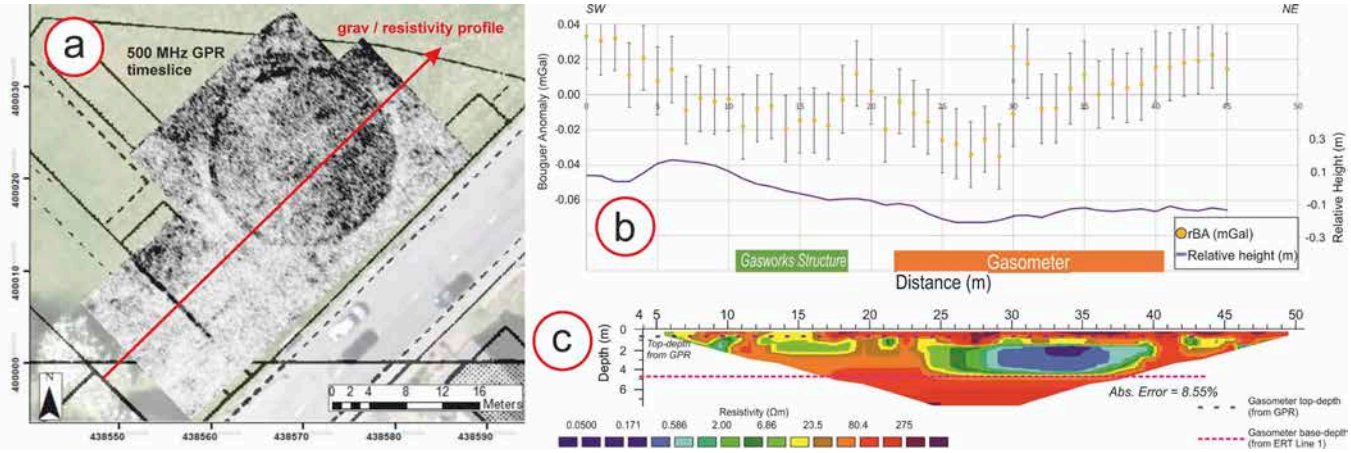


Figure 6: Resistivity and Ground Penetrating Radar plots of the site of the former gasholder at Elsecar gasworks. © University of Leeds.

and proportionate permanent record, it is proposed that a Level 2 record is produced for all historic structures, but for those of greater significance or rarity an enhanced Level 2 record is produced. The extent of the enhancement can be summarised as:

Level 2 (Basic): A descriptive record drawn from a visual inspection of the interior and exterior of a structure, advised by historical research and accompanied by a photographic survey.

Level 2 (Enhanced): A descriptive record drawn from a visual inspection of the interior and exterior of a structure, advised by historical research, accompanied by a photographic survey and supplemented by sketches of key structural elements and 3D survey – the latter dictated by significance and prevailing site conditions.

Structures identified during the evaluation phase or in DBA reports as being of potential national significance or high heritage value should then be recorded at Level 3 or 4. Care should be taken to ensure that *ex situ* fabric from earlier phases of the gasworks, reused in later structures is identified and forms part of the recording exercise (Figure 7). Again it is always advisable to discuss and agree the approach with the relevant local authority historic environment adviser.

Gasholders in particular are complex structures – part building, part machine – the interiors of which are generally inaccessible prior to demolition due to risks posed by contamination and confined-space working. Accordingly, a staged recording process whereby historical research and exterior recording is completed in advance of demolition and photographic recording of the interior is completed during demolition, is likely to be the most successful approach The Historic England recording guidance document; *Understanding Historic Buildings: A Guide to Good Recording Practice* (2016) should be used to advise the methodology and coverage of the above ground recording exercise.

Figure 7: *Ex Situ* remnants of an early retort house reused in a boundary wall at the Imperial Gas Light and Coke Company works, Fulham. © Matthew Bristow.

Historic Building Recording Levels

- Level 1: a basic **visual** record, supplemented by the minimum of information needed to identify location, age and type.
- Level 2: a **descriptive** record made when more information is needed.
- Level 3: an **analytical** record comprising a systematic account of the building's origins, development and use.
- Level 4: a **comprehensive** analytical record reserved for buildings and structures of special importance

In a rural or country house context, the former sites of small gasworks may only be represented by earthworks. In these cases landscape recording techniques could be considered. Larger sites which have previously been cleared may also retain no above ground structures, yet still warrant a descriptive record. The Historic England guidance document *Understanding the archaeology of Landscapes: A Guide to Good Recording Practice* (2017) should be used to advise the recording methodology with one of three recording levels selected to record the site.

Landscape Recording Levels

- Level 1: a mainly **visual** record with the minimum level of information needed to identify the site's location, date and type.
- Level 2: a **descriptive** record that provides qualitative information and a basic interpretative record of the monument or landscape.
- Level 3: an **enhanced and integrated**, multi-disciplinary record resulting from field investigation.

In the majority of landscape cases, a Level 2 record will be appropriate for gasworks sites and landscapes. However, where a gasworks is not depicted at 1:2,500 or larger in the Ordnance Survey or documentary record, where there are complex surviving earthworks or where a site has been identified to date from the earliest phase of the manufactured gas industry, then a Level 3 record should be produced.

Measured survey and the drawn record

Producing drawings can have resource implications and care is therefore needed in determining whether drawings are required when recording a site. A detailed drawn record should be considered when gas manufacturing plant remains *in situ*, when investigating a site dating from before 1860 and without a cartographic record, in the case of prototype gasholders and structures demonstrative of technological innovation, and where a detailed drawn record can explain the function of a heavily altered structure. The drawn record may also be helpful as part of the conservation strategy for gasholders, especially where they have to be dismantled for repair (Figure 8).

Measured drawings deriving from site survey are only likely to form a part of some Level 2 (Enhanced) and all Level 3 and 4 building records in line with the priorities outlined above. Though photography is the most practical and efficient way to record a gasworks site, the drawn record may include one or more of the following:

- Measured plans of buildings as existing at the time of the survey.
- Measured drawings recording the form and location of significant structural detail, such as flanges, joints and company motifs on gasholders.
- Measured cross-sections or long-sections to illustrate the vertical relationships within a building.
- Measured elevations of buildings or structures.

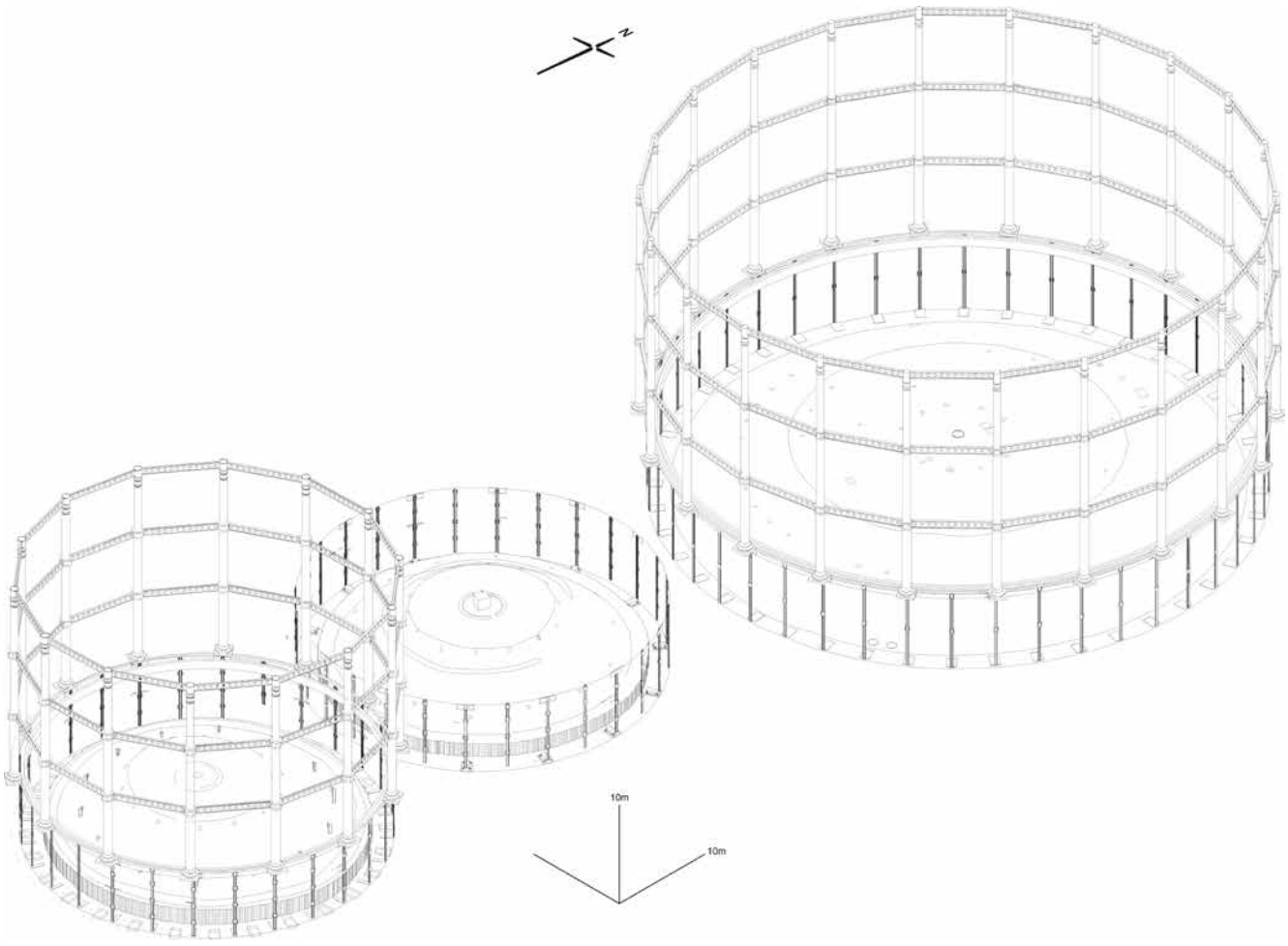


Figure 8: Isometric view of gasholder numbers 1, 2 and 3 at the Commercial Gas Light and Coke Company's works, Harford Street, Stepney. Drawn at a scale of 1:450, they form part of a Level 4 record. © Museum of London Archaeology.

- A site plan relating the building to other structures or related landscape features.
- Three dimensional projections or isometric views to accompany plans, sections and elevations.
- Process flow diagrams interpreting the movement of materials in cases of a highly significant or technologically innovative site.

All measured drawings produced during the recording of a site of former gas manufacture should adopt the graphic conventions set out above in *Understanding Historic Buildings: A Guide to Good Recording Practice* (2016) and *Understanding the Archaeology of Landscapes: A Guide to Good Recording Practice* (2017).

Figure 9: Attention should also be paid to recording the setting and context of the gas works and in particular the gasholders and their dominant position within the skyline and townscape. This view, looking north along Norway Street in Manchester past rows of terraced houses, records the Thomas Street gasholder's place within its wider landscape context. [DP186271]

Figure 10: Photography should also be used to capture architectural and structural details, such as this phoenix emblem on number 2 gasholder at the Phoenix Gas Light and Coke Company's Kennington Lane works. [DP182538]

Photographic recording

Like measured drawings, photographs amplify and illuminate the record of a site and in many cases are a quicker way of capturing data than the drawn or written record. The size and complexity of gasworks sites, in particularly the large gasholders, favours photography as a way of capturing data.

Photography will form part of a Level 2, 3, or 4 record, will be used extensively to illustrate the report and will form a major part of the project archive. A photographic survey, accompanied by a brief written narrative, will be appropriate in cases of complex and decorative structural detail but for which there is no need for detailed analysis or for buildings/structures of a well-known type but where existing documentation is in other respects adequate.

For efficiency and coverage, oblique three-quarter views of individual buildings/structures rather than systematic recording of external elevations are to be preferred (Figure 9). However, discretion is required: where, for instance, an individual elevation embodies an unusual degree of engineering or architectural input, views at right angles to the plane of the elevation may also be appropriate. The oblique three-quarter view preference is also applicable – with similar caveat – to the interiors of the (accessible) buildings, and structures. Where a high vantage point is available, this should be utilised to permit longer, more revealing views of the site. Any external or internal detail, structural or decorative, which is relevant to the building/structure's design, development or use and which does not show adequately on general views, should merit additional coverage (Figure 10). General, and selective details of any extant historic machinery and plant is essential. The size of gasworks sites and their direct relationship with infrastructure favours oblique aerial photography as a means of recording. Oblique aerial photographs, captured from either a light aircraft or by remotely operated drone, can add greatly to the understanding of a gasworks in both urban and rural contexts, and record their place in the wider landscape, though they are not a prescribed part of a Level 1, 2, 3 or 4 record (Figure 11).

Digital capture of images is preferable to film capture provided that a high-resolution camera is used – that is, one with sensors exceeding 20 mega pixels (the equivalent of 35mm film). Care should be taken to ensure that any images taken to form the permanent record are shot at the highest resolution available on the camera. Most archives prefer uncompressed files and digital images to be submitted for archiving should be saved as unsharpened Adobe RGB 1998 tiffs.

Laser Scanning and 3D Photogrammetry

Like measured drawings and photography, laser scanning, or the collection of 3D (XYZ) co-ordinates to generate a point cloud from which 3D models and line drawings can be produced, can be used to amplify the record of a building, structure or artefact. 3D data capture can be combined with photography to produce photo-realistic 3D models of buildings and structures. Multi-image photogrammetry, commonly referred to as Structure-from-Motion (SfM) can generate comparable resolutions to

Figure 11: This aerial view, captured in 2017, shows the seven Grade II listed gasholders at Bromley-By-Bow, London. The road bridge in the bottom-right of the image was built by the Imperial Gaslight and Coke Co. in 1872 and is also Grade II listed. [29228_025]

laser scanning and have been used to produce 3D models of structural elements of redundant gasholders (Figure 12). This method of recording is particularly applicable where complex structural details survive as part of a gasholder frame and is most successfully applied to rounded objects such as columns. Although the collection and processing of the data is very efficient with regards to time on site, this technique is limited by the challenge of recording a complex three-dimensional object and the difficulties associated with successfully illuminating the gasholder for image based recording. Further guidance on the use of laser scanners and 3D data capture can be found in the Historic England guidance document; *3D Laser Scanning for Heritage* (2018),

Below Ground Archaeological Investigation

The process whereby a former gasworks is remediated and prepared for redevelopment through the elimination of sources of contamination is also likely to reveal buried archaeological remains (see 2.1 above). Test pitting in areas formerly occupied by gasworks buildings identified through analysis of historic maps and plans may expose foundations and low-level walling

Figure 12: Structure-from-Motion photogrammetry has proved to be a highly effective way of recording in detail structural elements of redundant gasholders. This wrought iron standard base was recorded at the Washwood Heath works, Birmingham. © Museum of London Archaeology.

of demolished structures and pipework and tanks associated with gas production. Similarly, following the completion of a DBA, an archaeological watching brief or excavation may occasionally be warranted.

In all cases the need for such work should be governed by the priorities set out in Section 2.2 and considered where there is the likelihood of uncovering early 19th-century remains from the earliest phase of the industry which are of the greatest significance and which are not detailed on later large-scale mapping. Priority should also be given to structures demonstrative of technological change and innovation, namely retort houses, purifier buildings and gasholder bases, and to buried remains only where they are likely to enhance our understanding of the industry. The evidence can also be used/incorporated in future design proposals to reflect a sites former use as an historic gasworks.

Where structures associated with the gasworks are identified, they should be surveyed *in situ* in accordance with CIfA guidance and recorded at a scale of at least 1:50 and plotted on a site plan of at least 1:1,250. The location of buried features that are to be preserved *in situ* should be similarly recorded. These drawings form part of the archaeological record and should be archived, along with any relevant GIS shape files, and an OASIS form as required by the appropriate Historic Environment Record (see section 5).

Where archaeological investigation is appropriate it should seek to adhere to The Standard as defined by the CIfA in the 2014 guidance documents; *Standard and Guidance for archaeological excavation* and *Standard and Guidance for an Archaeological Watching Brief*. All data generated should be included in the project archive and linked directly to the report.

Advice on the need and requirements of below ground archaeological investigation should be discussed in advance with the local authority archaeological advisor, together with the possible presence of non-gas related archaeological remains and the Historic England guidance document; *Science for Historic Industries: Guidelines for the Investigation of 17th–19th century industries* (2018), should also be consulted.

3.5 Reporting

The written account of a gasworks or gasholder site, either the result of a DBA or of further detailed recording, underpins the entire process by providing locational information, together with context, description, analysis and interpretation. Insights and understanding derived from site evaluation, investigation, survey, photography and documentary research should be presented in an analytical report that is concise yet well-illustrated. Photographs on their own present evidence but seldom convey understanding, so this written account is extremely important as an overall synthesis of the historical, architectural and archaeological enquiry. The emphasis within the report will be on analysis and interpretation as well as description, and should consider the significance of the site (in whole and in part) within the wider local and national context.

As well as being illustrated by new and (if locally available) historic photographs, it may (where appropriate) incorporate plans and diagrams showing the phased development of the site, the functional areas within it, the movement of materials and the flow of processes. A descriptive list of photographs, including orientation of views (and GPS coordinates, if images are 'Geotagged') and the date taken, and cross-referenced to its digital file, should be appended to the report. A descriptive list of documents and artefacts consulted, encountered, and deposited (together with the name(s) of the receiving archive) in the course of the project should also be appended. A guide to the sections which should be included in the synthetic account as dictated by the recording levels can be found on pages 22-23 of *Understanding Historic Buildings: A Guide to Good Recording Practice* (2016).

It is recommended that draft copies of all reports arising from the process are provided to the local authorities' specialist historic environment advisors for comment prior to final issue.

4 Oral History and Community Engagement

Gasworks were major employers and dominated their surroundings. In some instances, particularly where communities around redundant gasworks retain strong links to these former industrial sites, there may be opportunities – possibly identified during the compilation of the DBA – for oral history, community history and outreach projects (Figure 13).

The recording of a former gasworks or site of gas manufacture therefore, might not be restricted to traditional archaeological techniques for capturing historic standing buildings, relict plant and archaeological remains prior to

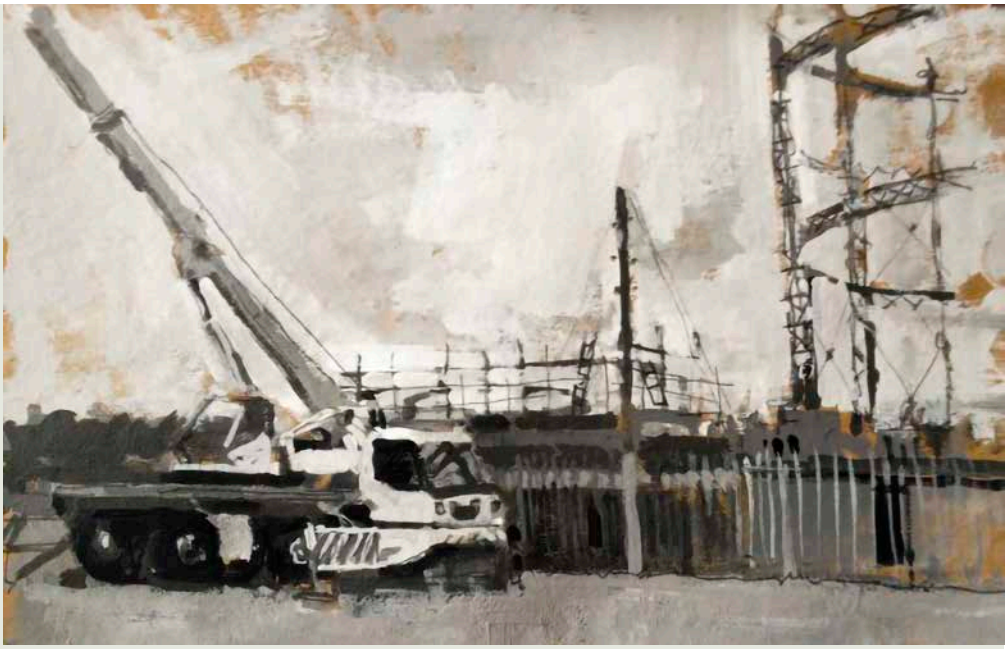


Figure 13: "Day of tearing down, day of recycling, wait a while! Let the wind whistle through those defenceless arms and the moon bend a modicum of its glamorous light upon you, my familiar, my stranded hulk – a while!" Edwin Morgan's 2002 poem *Gasometer* conveys something of the affection with which gasholders are viewed by the communities whom they have stood sentinel over for generations. Northern Gas Network attempted to capture this connection between community and gasholder through their 'Artist in Residence' programme which featured the work of Mick Hand. © Mick Hand.

redevelopment. As a means of creating a permanent record that contributes to an understanding of the social history of the gas industry, the oral testimony of personnel who served in these installations is invaluable. Whilst most of those personnel who worked in the gas industry prior to nationalisation are deceased, some who worked in the industry before the start of the move to natural gas in 1967, occupying key roles and whose recollections are important to understanding the operation of the works may still be traceable. These people will not only be able to recount for posterity much of their own knowledge and experiences, but provide a perspective on what it was like to work in an industry which has since ceased to exist in this country and detail industrial processes which are no longer performed. Their testimony is particularly important. Likewise is the testimony of their families and those who lived in close proximity to gasworks. The collection of oral testimonies is generally undertaken by specialist interviewers and should be viewed as an addition to rather than an integral part of the recording exercise. Further guidance on the collection of oral testimony is provided in; *Principles for Oral History and Best Practice for Oral History* (2000) produced by the Oral History Society and any oral record produced, should be reflected in the final report and submitted to an appropriate local archive, in addition to the British Library's oral history collection.

5 Dissemination and Archiving

The dissemination and archiving of the results of the recording exercise in a clear and accessible form is an essential part of the process and where the work is undertaken as part of the planning process, this may form part of any conditions. Public access to published reports, desk-based assessments and photographic surveys is also crucial. It is important to ensure, as a minimum, that reports are sent to the local Historic Environment Record (HER) and to the appropriate Local Studies Library.

All reports and data generated should also be documented on an OASIS form. This is to ensure that data from archaeological investigations, published reports and project archives reaches local Historic Environment Records (HERs) and respective National Heritage Bodies. The resulting information (including shape files as part of the archive) will be validated by the relevant National Record for inclusion on Historic England's Excavation Index and passed onto the Archaeological Data Service for inclusion in its on-line catalogue. Completion of an OASIS form is the minimum requirement as outlined in CIfA guidance on dissemination and archiving.

6 Bibliography

Select Source List

Brown, D H 2007 *Archaeological Archives: A guide to best practice in creation, compilation, transfer and curation*. Institute of Field Archaeologists on behalf of the Archaeological Archives Forum. http://www.archaeologyuk.org/archives/Archives_Best_Practice.pdf

Chartered Institute for Archaeologists 2014 *Standard and guidance for historic environment desk-based assessment*. CIfA: Reading. https://www.archaeologists.net/sites/default/files/CIfAS&GDBA_2.pdf

Chartered Institute for Archaeologists 2014 *Standard and guidance for the creation, compilation, transfer and deposition of archaeological archives*. CIfA: Reading. https://www.archaeologists.net/sites/default/files/CIFAS&GArchives_2.pdf

Chartered Institute for Archaeologists 2014 *Standard and guidance for archaeological excavation*. CIfA: Reading. https://www.archaeologists.net/sites/default/files/CIfAS&GExcavation_1.pdf

Chartered Institute for Archaeologists 2014 *Standard and guidance for an archaeological watching brief*. CIfA: Reading. https://www.archaeologists.net/sites/default/files/CIfAS&GWatchingbrief_2.pdf

MHCLG (Ministry of Housing Communities and Local Government) 2019 National Planning Policy Framework. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/740441/National_Planning_Policy_Framework_web_accessible_version.pdf

English Heritage 2010 *Measured and Drawn: Techniques and practice for the metric survey of historic buildings*. English Heritage: Swindon. https://historicengland.org.uk/images-books/publications/measured-and-drawn/

Evans, P. 2003 *Archaeological Evaluation, Ansell Road Gasworks, Warwick*. Cambrian Archaeological Projects Report No. 267: Llanidloes

Francis, A 2010 *Stepney Gasworks: The archaeology and history of the Commercial Gas Light and Coke Company's works at Harford Street, London E1, 1837-1946*. MOLA Archaeological Studies Series 22: London

Historic England 2017 *Land Contamination and Archaeology: Guidelines for Best Practice*. Historic England: Swindon. https://content.historicengland.org.uk/images-books/publications/land-contamination-and-archaeology/heag096-land-contamination-and-archaeology.pdf/

Historic England 2016 *Understanding historic buildings a guide to good recording practice*. Historic England: Swindon. https://content.historicengland.org.uk/images-books/publications/understanding-historic-buildings/heag099-understanding-historic-buildings.pdf/

Historic England 2016 *Local Heritage Listing: Historic England Advice Note 7*. Historic England: Swindon. https://historicengland.org.uk/images-books/publications/local-heritage-listing-advice-note-7/

Historic England 2017 *Understanding the archaeology of landscapes: a guide to good recording practice*. Historic England: Swindon. https://content.historicengland.org.uk/images-books/publications/understanding-archaeology-of-landscapes/heag142-understanding-archaeology-of-landscapes.pdf/

Historic England 2017 *Designation Listing Selection Guide: Utilities and Communications Structures: a guide to outline the selection criteria used when designating utilities and communication structures*. Historic England: Swindon. https://content.historicengland.org.uk/images-books/publications/dlsg-utilities-communication-structures/heag117-infrastructure-utilities-and-communication-lsg.pdf/

Historic England 2018 *3D Laser Scanning for Heritage* (3rd edn). Historic England: Swindon. https://content.historicengland.org.uk/images-books/publications/3d-laser-scanning-heritage/heag155-3d-laser-scanning.pdf/

Historic England 2018 *Science for Historic Industries: Guidelines for the Investigation of 17th – 19th century industries*. Historic England: Swindon. https://historicengland.org.uk/images-books/publications/science-for-historic-industries/heag258-science-for-historic-industries/

Historic England 2019 (Forthcoming) *Introduction to Heritage Assets: The Manufactured Gas Industry*. Historic England, Swindon.

Historic England 2015 *Managing Significance in Decision-Taking in the Historic Environment*. Historic England, Swindon. https://historicengland.org.uk/images-books/publications/gpa2-managing-significance-in-decision-taking/gpa2/

Lancaster University Archaeological Unit 1997 *Monuments Protection Programme, The Gas Industry: Step 1 Report*. LUAU: Lancaster.

Lancaster University Archaeological Unit 2001 *Monuments Protection Programme, The Gas Industry: Step 3 Report*. LUAU: Lancaster.

Linnane, S J 1998 *Early Gasworks, Gas Street, Birmingham*. Architectural Recording and Analysis BUFAU Project no 550: Birmingham

Rayner, T 2008 *Archaeological Watching Brief at Former Gasworks, Old Mill Lane, Barnsley, South Yorkshire*. ARCUS Project Report 1075b.2 (1): Sheffield

Schmitt, A *et al* 2016 *EAC Guidelines for the Use of Geophysics in Archaeology*. Europae Archaeologiae Consilium.

Thomas, R 2019 (Forthcoming) *The Manufactured Gas Industry*. Research Report Series. Historic England: Swindon

Tucker, M 2000 *The Development of the Gasholder in London and in the Later Nineteenth Century*. English Heritage.

7 Appendix: Guide Frame Typology

Code	Frame Type	Bracing	Typical Girder Types		Approx Period	Original Numbers	Survival (GB)
			Top	Lower			
0: Early types							
1	Enclosing House	0	B	-	1800s–1830s	? Many	Saltisford
2	Enclosing Walls	0		-	1820s–1830s	Several	None
3	Wooden Frame	?	A	-	Early C19	?	None
4	Freestanding Columns	0	-	-	1810s–midC19	? Many	None
5	Diametrical Beams	0	A, E	-	c1815–?	? Many	None
6	Transverse Trusses	0	B	-	1820s–1830s	? Many	None
7	Central Guide Pole	0	-, A, E	-	c1817–1830s	Several	None
1: With hollow cast-iron columns							
10	Small single order	0	**E**, F, **G**	-	1820s–1890s	Many	Lavenham
11	Giant single order, single tier of girders	0	**E**, F, **G**, **H**	-, C	1847–1870s	Many	Fakenham
12	Giant single order, double tier of girders	0	G, (G2)	G, (G2)	c1870	Several	Battersea
13	Paired columns in multiple order	0	**E**	-	c1835–c1855	Many	None ?
14	Double order, double tier	+	**F**, **G**, H	**F**, **G**, H	1858–1880s	Many	None
15	Triple order, triple tier	+	**G**, H	**G**, H	1861–1890s	Many	Many
16	Giant single order cols with external joints, lower girders abutted	X	**G**	**G**	1870s–1890s	Many	Several
17	Giant single order cols with external joints and joint boxes	X	**G**, (L)	**G**, (L)	1880s	Several	Some
18	Giant single order, subsequently enlarged	X	G, H, R, T	G, H, R, T	Late C19–C20	Several	Some

Code	Frame Type	Bracing	Typical Girder Types		Approx Period	Original Numbers	Survival (GB)
			Top	Lower			
2: With cast-iron standards							
20	Tripods, free standing	0	-	-	c1829–1850	Several	Fulham
21	Tripods with ties	0	D	-	c1850	Few	None
22	I-section CI stds, with girders	0	F, G	F, G	c1860–1875	Few	None
23	I-section CI stds, ties	0	D	D	1850	Few	None
24	I-section CI stds, with girders	+	**G**	**G**	c1865–1879	Several	None
3: With rivetted lattice standards							
30	T-section lattice standards	X	G, (GV) (G2)	G, (GV) (G2)	1876–c1890	Several	Few
32	Equal-I-section lattice standards	X	**G**, L, **M**, O, P	**G**, L, **M**, **N**, O, P	c1880–c1930	Many	Several
34	Box-section standards with vertical-web girders	+	**G**	**G**	1882–1890s	Several	Some
35	Box-section standards with horizontal-web girders	+	**L**, M, N	**N**, O	1886–c1930	Many	Several
36	Narrow-box standards, considerably tapered	X	GV, G	(LV), G	1882–c1890	? Few	? None
37	Narrow-box standards, lightly tapered	X	G, **L**, P	M, **N**, O, P	c1890–1930	Many	Many
38	Dumbell-section standards	XX	K	(NV)	1886	1 pair	Windsor St
39	Cutler's Patent (shallow I-section lattice standards and helical girders)	★	**L**, G	**NZ**	1889–c1935	Many	Several

Code	Frame Type	Bracing	Typical Girder Types		Approx Period	Original Numbers	Survival (GB)
			Top	Lower			
4: With solid-webbed I-section standards (usually with little or no taper, on Livesey shell principle)							
41	Plate standards, double- or multi-braced panels	XX	J, K, S	S	1881–1888	Few	OKR No 13 E Gr No 1
42	Plate standards braced by struts without girders	XXX	J	-	1892–1921	Few	Example: Croydon
43	Plate standards, single braced panels	X	G, J, S, T, T1	R, S, T	1884–1920s	Several	Some
44	Plate standards, strnt braced panels	X	(G), J	R	Early C20	Few	Example: Bath
45	Rolled standards, single braced panels	X	**R**, J	**R**	1890s–1950s	Many	Many
47	Plate standards, horizontally-stiff girders	X	O	O	C20	Some	Some
5: With tubular standards of wrought iron or steel (Rare)							
50	Riveted tubular standards	0	C	C	1854	One	None
51	Welded tubular standards	x	L	G	mid C20	Few	2 in Birmingham

Table A1: Typology of guide frames. Source: Tucker (2000), pages 10-11. All cited examples were extant at the time of publication.

Notes for Table A1

Diagonal bracing

0	Never
X	Always, except in smallest holders
+	Sometimes
XX	Two braces per panel (sloped at 1 in 2)
*	Triangular panels
XXX	Two systems overlaid

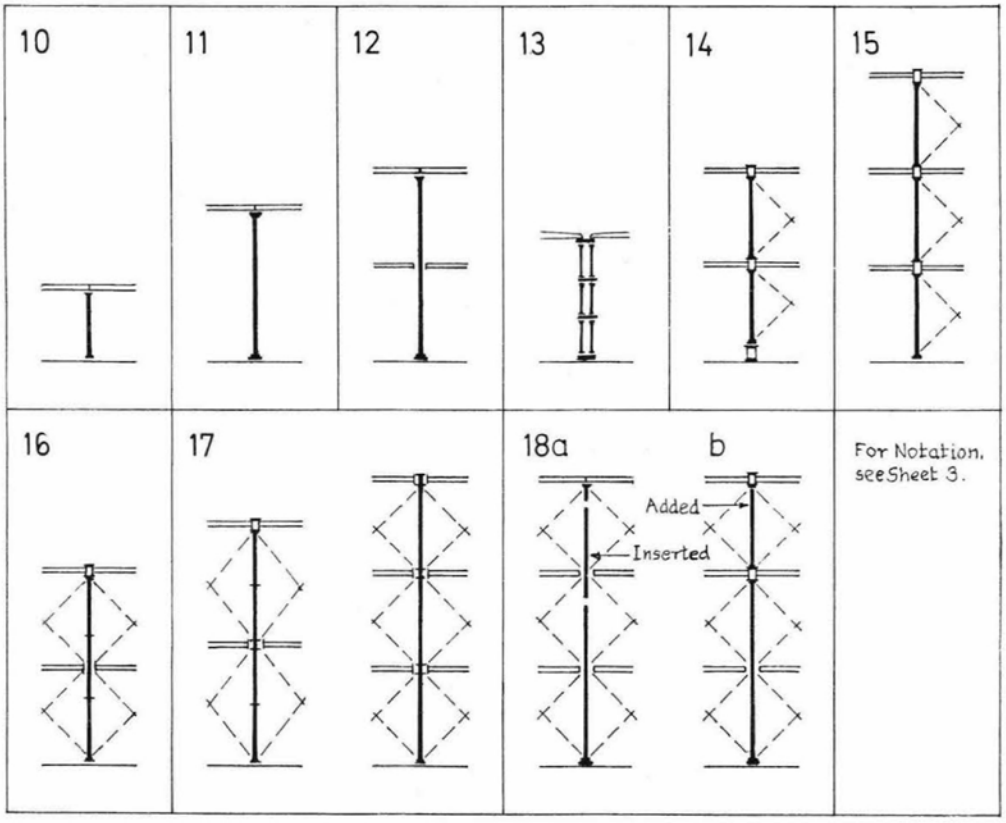
Girder type		Approx Period
-	None	Early C19
A	Timber Beams	Early C19
B	Timber Trusses	Early C19
C	Tie bars	c1850–1875
D	Light struts (such as rolled tees)	c1850–1875
E	Cast-iron (I- or inverted-T-section)	c1815–1865
F	Composite iron I-section (w.i.flanges, c.i. web)	c1855–1875
G	I-section lattice (St Andrew's Cross, repeated cross and Warren configs)	c1860–1930s
G2	I-section with shallow-x-braced web (as at Kennington)	c1865–1890
H	I-section fabricated plate	c1860–1890
J	Unequal-I- or T-section fabricated plate	c1886–1920s
K	Double-webbed fabricated plate	c1886–1942
L	Box-section lattice	c1877–1930
M	Double-webbed lattice(= narrow box section)	c1890–1930s
N	Horizontal I-section lattice	1886–1930
O	Horizontal double-webbed lattice(= narrow box section)	c1892–1930
P	Triangular-section lattice	c1895–1930
R	Rolled I- or channel-section	c1895–1960
S	Cruciform-section or shallow-T-section fabricated plate	c1881–1930
T	Cruciform fabricated with tubular core (such as Birmingham Nechells)	c1900
T1	As type T with horizontal plate extension	c1900
U	Castellated (used in reconstructions)	c1945–1960
Y	Welded-tube triangular box lattice	c1960+

Table A2: Girder types. In Table A1, common types are shown in **bold**, rare types in brackets. See Figure A2. Source: Tucker (2000), page 12.

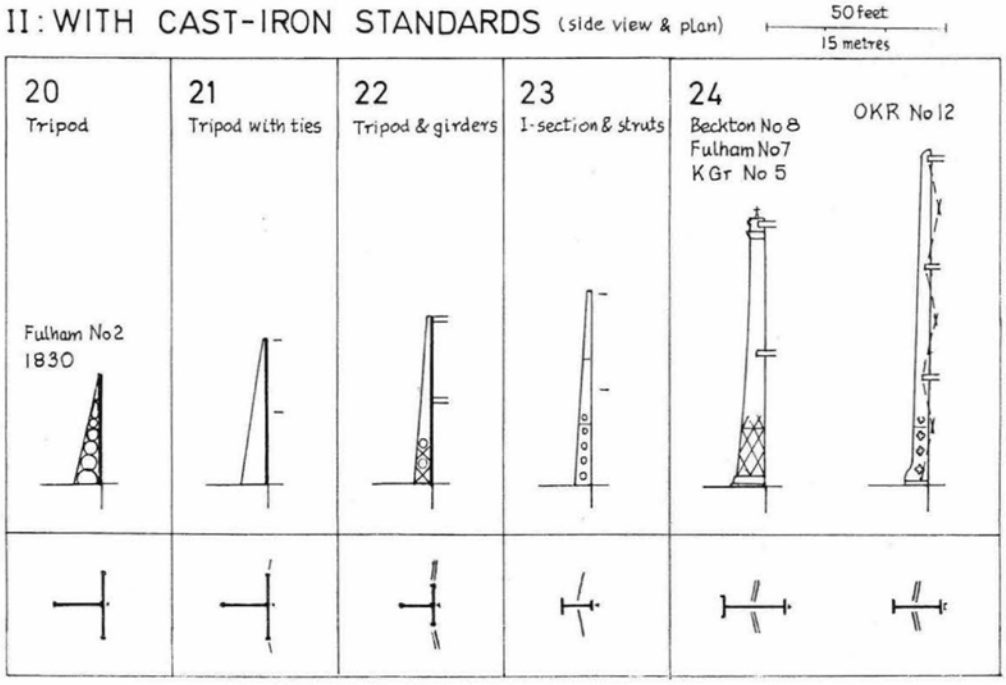
Suffix V: Tapered towards middle
Suffix Z: Placed helically

Note: Paddon's Wind Ties were often installed to stiffen the top girders (except those of box section), from 1870s to 1930s.

I : WITH HOLLOW CAST-IRON COLUMNS (frontal elevations)

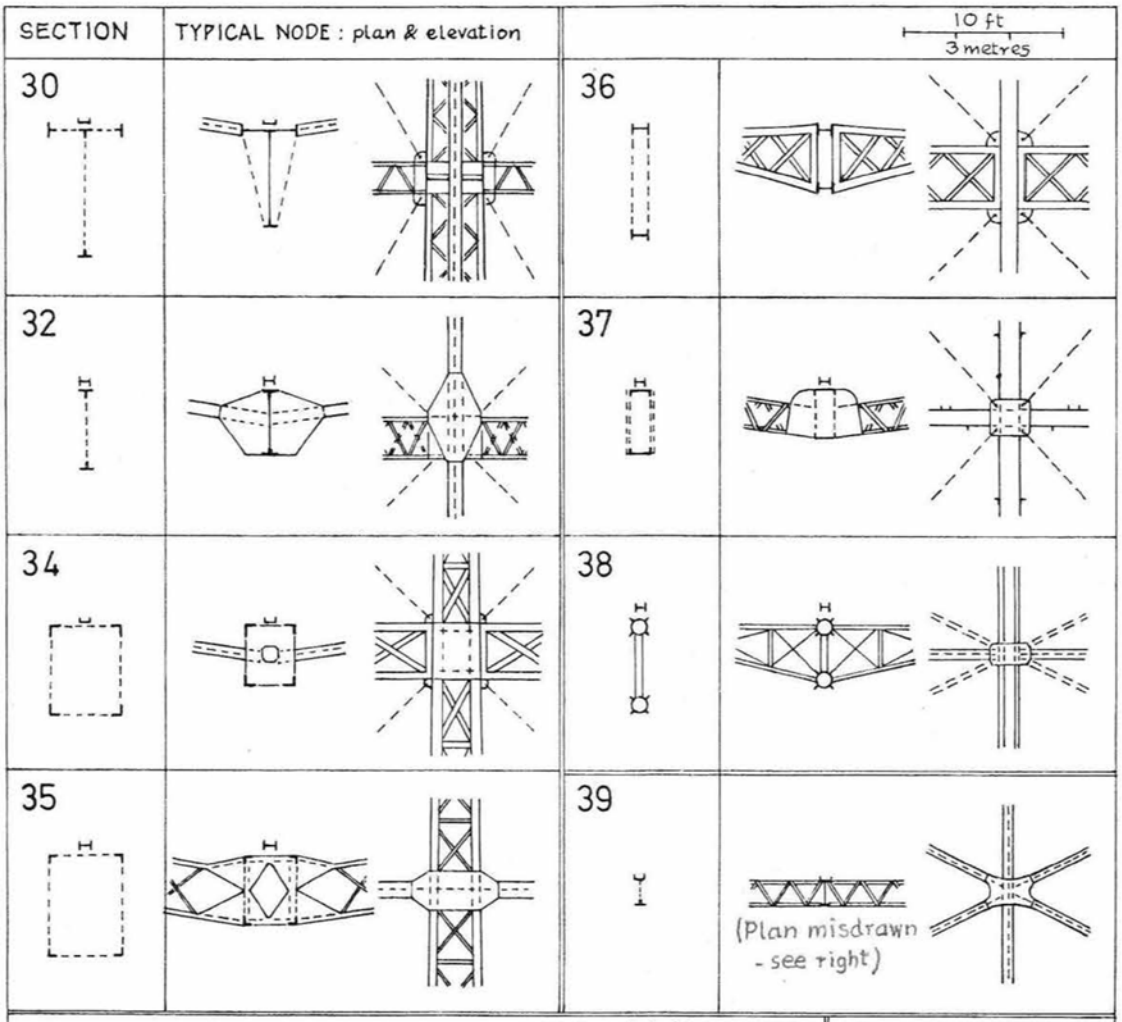


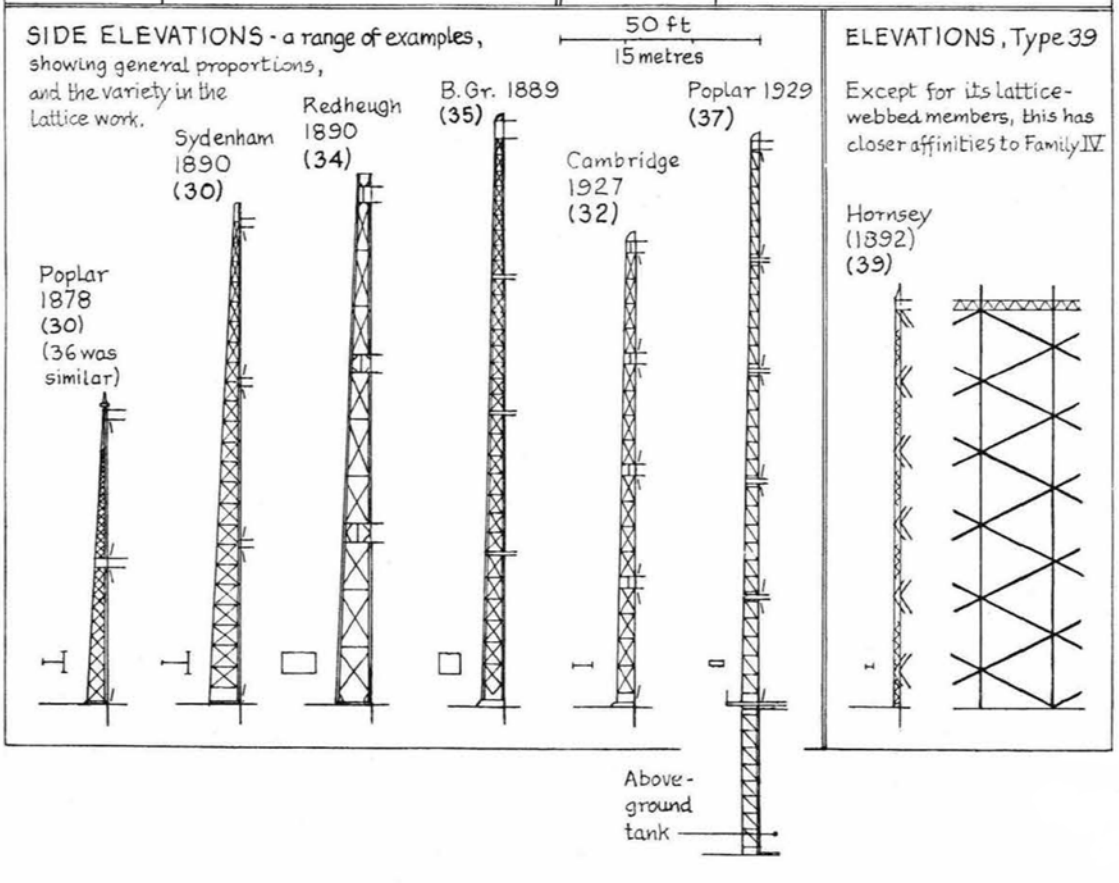
II : WITH CAST-IRON STANDARDS (side view & plan)



III : WITH RIVETED LATTICE STANDARDS

Types differentiated primarily by sectional form of the standards.





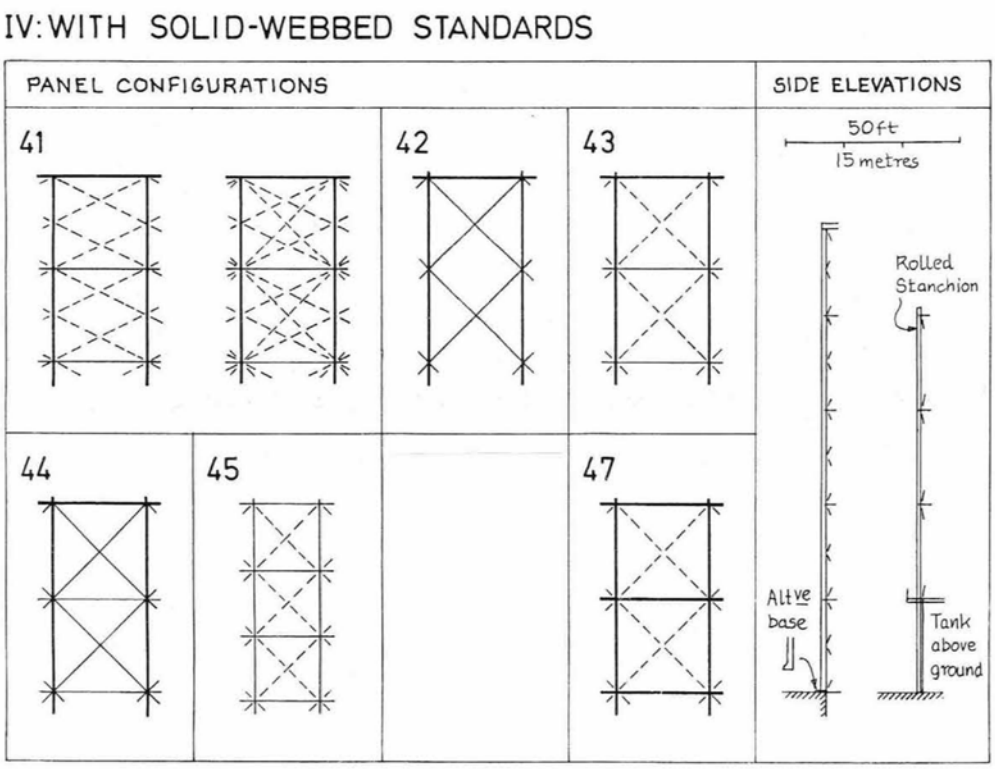


Figure A1, parts I to IV: Typology of guide frames. Source: Tucker (2000), pages 13-15.

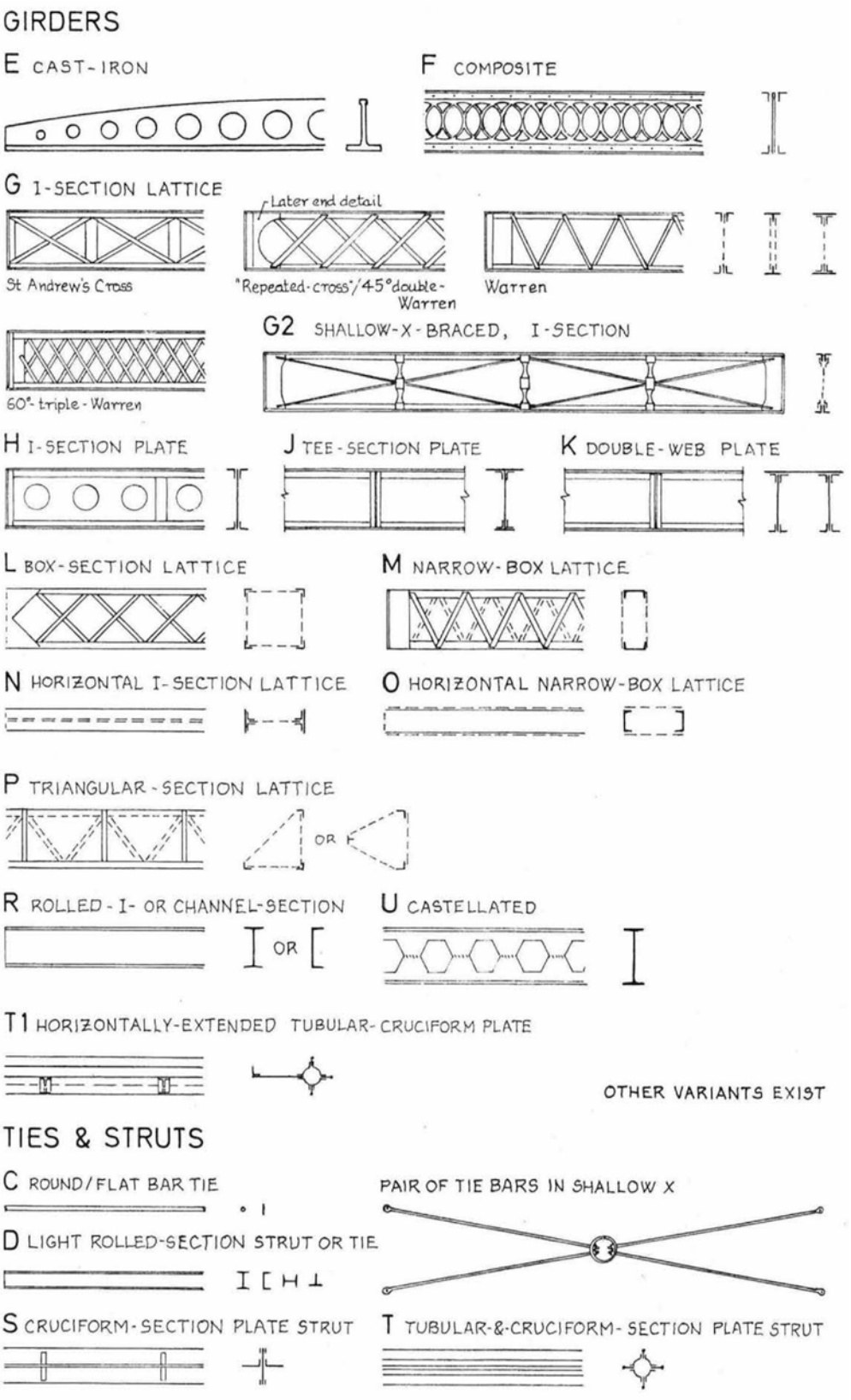


Figure A2: Types of girder used in guide frames. Source: Tucker (2000), page 16.

8 Where to get Advice

The Historic England Archive (archive@HistoricEngland.org.uk) will provide advice on repositories for the project report and archive, which are likely to include the Historic Environment Record, the local authority record office, the Historic England Archive and, likely the National Gas Archive.

Matthew Bristow will provide advice on recording methodologies.
matthew.bristow@HistoricEngland.org.uk

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