


Project ref: BAP1130GH8	BAP 1130				
Project Name:	King's Cross Central				
Client:	Argent				
Method statement ref:	BAP1130/GH8/AP001	Revision	00		
Method statement title:	Gasholder No.8 Guide Frame Re-erection				
<b>Scope:</b>  The refurbished Gas Holder no.8 Guide Frame is to be re-erected at a new location north east of the Regents Canal adjacent to Buildings T1 and P1. This Method Statement provides details of how the erection should be carried out maintaining structural integrity throughout the works.  The cast and wrought iron components will be delivered to site utilising the purpose built transport frames used to deliver the dismantled components to Shepley Engineers for refurbishment. The dismantling frames will also be strengthened and re-used for the re-erection works. Bam Nuttall will be able to call on the experience of a number of staff directly involved in the dismantling and storage of this gas holder guide frame under the SEFI Section 2 contract to manage the day to day operations on site.					
Reference documents: <ul style="list-style-type: none"><li>• Risk Assessment BAP1130/GH8/RA/001</li><li>• Lift Plan</li><li>• 3D Lazer Scan</li></ul>					
<b>People consulted during preparation of this method statement:</b> Trevor Timmins (Craddy Pitchers Davidson) Paul Fewtrell (Bam Nuttall)					
<b>Authorisation:</b>					
<b>Prepared for Bam Nuttall by:</b> <b>Name:</b> Stuart Woolsey <b>Position:</b> Sub Agent <b>Signature</b> <b>Date:</b> 13-09-2012			<b>Approved for Bam Nuttall by:</b> <b>Name:</b> Paul Fewtrell <b>Position:</b> Construction Manager <b>Signature:</b> <b>Date:</b>		
<b>Approved for third party by:</b> <b>Name:</b> <b>Position:</b> <b>Signature:</b> <b>Date:</b>			<b>Approved for client/engineer by:</b> <b>Name:</b> <b>Position:</b> <b>Signature:</b> <b>Date:</b>		

<b>Reviewed for Bam Nuttall by:</b>		<b>Reviewed for Bam Nuttall by:</b>	
<b>Name:</b>		<b>Name:</b>	
<b>Position:</b>		<b>Position:</b>	
<b>Signature:</b>		<b>Signature:</b>	
<b>Date:</b>		<b>Date:</b>	
<b>Distribution:</b> File copy (Bam Nuttall) Argent London borough of Camden David Divers (Museum Of London Archaeology) English Heritage			
<b>Method statement briefing [recorded on SF201]</b>			
Contents of briefing – sections 2, 3, 4 and 5			
The following critical items must be emphasised:			
<ul style="list-style-type: none"><li>• <b>The components of the Gasholder Guide Frame that are to be re-erected are listed. Extreme caution needs to be taken when working with and around these items.</b></li><li>• Risk Assessment shall be discussed prior to commencement of work.</li><li>• All lifting activities need to be covered by an approved lift plan</li><li>• All working from height needs to be approved and covered by a method statement</li><li>• Risk assessment for working on MEWP (Mobile Elevating Work Platform)</li><li>• Men in MEWP must wear and be secure by harness</li><li>• Banks Man on site when plant is operating.</li><li>• Slinger/signaller required for all lifting operations</li><li>• Operatives competency must tested (ie appropriate CSCS cards for operations)</li><li>• All supports must be in place during the various stages of transport. – slings/frames/packing</li></ul>			

1. Responsibilities

NAME	POSITION	DUTIES
P. Fewtrell	Construction Manager	Liaise with sub contractors / clients. Co ordinate staff to ensure safe methods of work.
G. Wynne	Section Eng	Liaise with works manager and client, Production of method statements and risk assessments, supervision of setting out engineers and subcontractors, ensure safe systems of work.
C. James	General Foreman	Organise plant and labour in order to ensure competent persons carry out the tasks appointed to them, ensure safe systems of work. Supervision of site personnel and subcontractors.
A. Reddy	Engineer	Set out works area, ensure safe systems of work. CAT scan and mark services. Site control of subcontractors.

2. Resources

<b>Materials:</b>	
16 no Sub Frames 6 no bottom column Support Frames 4 no top column Support Frames	
<b>Plant &amp; equipment:</b>	
12m Lifting Beams Various lifting strops Various shackles 120T Crawler Cranes Steel racking/storage frame Scaffolding/work platform	Heras Fence panels Cherry picker boom lift Lorries Hand held tools
<b>Personnel</b>	
Foreman Operatives Site engineer Crane operator	Security Personnel Plant Operator Drivers Banksman

3. Method

**The following is the methodology for the Re-erection of the Gas Holder No.8 guide frame.**

**Activities prior to re-erection works.**

As part of the ground works purposely designed steel sub frames will be installed around the 16no. concrete plinths to act as a base and support for the above ground support frames.

The intended works and laydown area will have a designed crane mat compacted and rolled to enable safe and unobstructed movement of crane and delivery lorries. This will also form a clean and level surface for the storage and erection frames to sit.

Cranes, lifting beams, erection frames and lifting tackle certification to be checked and relevant Lift Plans signed.

An initial condition survey of all components at Shepley will be carried out before transportation to King's Cross to identify any defects that could impact on the operations.

Before dispatch the tagging labels will be checked to ensure no untagged items are delivered to site. On arrival at King's Cross and before unloading a check will be made to ensure the tagging labels have not been lost in transit and any lost tags are to be replaced before unloading.

A transportation schedule will be prepared giving details of the intended order of loading and what items will be included in each load to enable efficient erection with minimal on-site storage.

### **Transportation, Handling and Storage of Components**

A minimum of two number bespoke storage frames as previously used will be transported and fabricated on site and placed in the western corner of the N1 plot which will be the designated storage area for all deliveries.

The works area and plot N1 will allow adequate space for lorry movements and storage up until the point where approx 75% of the Guide frame has been erected at which time a smaller amount of storage space is required and deliveries can be called off from Shepley as and when the components are required.

The cast iron columns will be transported on specially designed transport frames as previously used for the relocation of the Triplet and GH8 Guide Frame components from King's Cross to Shepley. Each frame is fitted out with timbers and wedges and the placed columns stabilized using ratchet straps. Lattice girders also have a specially designed transport frame to take 6no frames per lorry load and secured in a similar manner.

Smaller items and decorative features will be secured to the lorry trailer by strops and chains on timber supports. Suitable protective material will be used between the strops and chains and the surface of the components to ensure that the restraints do not cause concentrated stresses to the components.

It is envisaged that initially there will be 2no truck movements per day each carrying 1 no column and an assortment of decorative features and guide rails in accordance with the lorry weight limitations.

On arrival the columns will be lifted from the transport frames using a specially designed 12m lifting beam. The beam has been fitted with lifting points at 1m centres to ensure that the best lifting pattern for each column can be achieved. This will allow for adjustment in the lifting slings along the column length.

All other items will be slung with an appropriate means according to their shape and size. Items such as bolts will be palletized whereas lattice girders will be be lifted with 2no 11.5 tonne chains wrapped and choked at both ends and placed on level timber chocs. All lifting operations will be supervised by the lifting coordinator.

The onsite handling of components will follow the same method as described above for moving firstly columns from support frames to the erection frames and subsequently remaining components to be lifted in place prior to permanent fixing.

### **Base Column Installation**

Lay down base support frame in a suitable position. Undo bolts and clamps so one side is open on top to take the column.

Levels to be taken of the concrete plinth height and sub frame to calculate where exactly in the support frame the column should be positioned. Attach strops in correct positions, using purpose made lifting beam and tensioned strop arrangement and lift the base column into the support frame. Inch up and down with crane to achieve accurate position.

Re-attach loose members of the support frame and clamps. Specified pads should be placed between the clamps and the column to protect paint finish. Frame members will be bolted and clamp bolts tightened to the required torque.

Check the torque in all clasp bolts along the frame.

Temporary Works Co-ordinator to check all bolts are securely fastened. Signed Check Sheet required.

Attach 4 chains from head crane to top of frame and two chains of tail crane on the bottom. Using two cranes turn the frame to vertical with a tandem lift to avoid drag on the frame feet.

With the base bolts in position (taken from Craddy Pitchers Davidson set out) place the support frame on the below ground steel subframe and secure all four corners when column bolt holes line up.

With the column and support frame secured, undo the top four chains.

Repeat this column lift procedure for the second column.

### **Lattice Girder Installation**

Scaffold and board out wider working platform at top of each support frame for safe working area to install lattice girders.

Banksman/ Slinger to place strops around each end of the required lattice girder and lift directly from storage on ground to top of columns. Make primary "V" connection first and install pvc wedges to suit. Install secondary bolts to column holes and leave slack for any movement which might be required later. Connections on both ends of lattice girder to be carried out simultaneously.

Repeat base column and lattice girder installation continually until 6 no bottom columns are in place.

Check all six columns are in correct position comparing data from 3D laser scan.

Grout up 6no bottom column bases.

### **Top Column Installation**

Lay down top support frame in a suitable position. Undo bolts and clamps so one side is open on top to take the first top column.

Measurements to be taken on the top of base column and top of base support frame to calculate where exactly in the top support frame the top column should be positioned. Attach strops in correct positions, using purpose made lifting beam and tensioned strop arrangement and lift the base column into the support frame. Inch up and down with crane to achieve accurate position.

Re-attach loose members of the support frame and clamps. Specified pads should be placed between the clamps and the column to protect paint finish. Frame members will be bolted and clamp bolts tightened to the required torque.

Check the torque in all clasp bolts along the frame.

Place top column base bolts loosely with nuts attached ready to be placed on base column.

Temporary Works Co-ordinator to check all frame bolts are securely fastened. Signed Check Sheet required.

Attach 4 chains from head crane to top of frame and two chains of tail crane on the bottom. Using two cranes turn the frame to vertical with a tandem lift to avoid drag on the frame feet. When support frame is in vertical position undo the two bottom chains from to tail crane. Continue the lift to place top column on top of base column.

At least 2no operatives to be on the modified working platform on top of the base frame to receive tag lines and lower the column down to correct position.

Undo the nuts of the loose bolts on the base of the top column and use frame adjustment to lower to meet top of base column fix down column bolts and support frame connections while still taking the weight with the head crane

Scaffold and board out wider working platform at top of each support frame for safe working area to install lattice girders, splice plates and top capital casting.

<p>Repeat method for 4no top columns and repeat the installation of top lattice girders</p> <p>Banksman/ Slinger to place strops around each end of the required lattice girder and lift directly from storage on ground to top of columns. Make through bolt connection first and install pvc wedges to suit. Install secondary bolts to column holes and leave slack for any movement which might be required later. Connections on both ends of lattice girder to be carried out simultaneously.</p> <p>When two lattice girders are permanently in place bolt down the splice plates across the shared column.</p> <p>On the ground place bolts loosely in top capital ready for fixing at high level. Banksman/Slinger to place strops around top capital and lift to high level. Two operatives on the modified platform on the second tier will receive the top capital with tag lines, carefully place in correct position and fasten bolts.</p> <p>Place top cover plate and install bird protection inside the top capital.</p> <p>When top capital and lattice girder are securely fixed undo support frame clasps and bracing on the outside face. Banksman/Slinger to attach four leg chains on the top of the support frame. Undo the fixings between top and bottom support frame at first tier level. With the crane lifting the top support frame carefully slide frame towards the inside of the gasholder away from column to remove completely and lay down at ground level ready to receive another top column.</p> <p>At this stage top and bottom column are fixed and bottom support frame is still in place. Banksman/Slinger to place strops around 3 sided casting at ground level. Crane to lift to 1st tier level where two operatives can receive on the modified platform of the base support frame. Carefully slide the 3 sided casting from the outside to cover the connection joint between the columns.</p> <p>Continue installations until 14 no complete columns are in place. Both cranes can be tracked outside the Gas Holder for the completion of the final two columns using the same methods as previous installations.</p>
--

#### 4.1 Health, safety & welfare precautions

The following <b>additional</b> PPE is required as identified in the risk assessment attached	
High visibility Vest, High visibility Jacket	Safety Glasses
Ear Protection	Gloves
Hard Hat	Steel toe Boots Footwear
Safety Harness	Welding Gauntlets and Mask
Personnel involved in this operation shall have received the following tool box talks:	
<ul style="list-style-type: none"> <li>Manual Handling</li> <li>Working at height</li> </ul>	

#### 4.2 Welfare & First Aid Provisions

The following additional welfare is needed
<p>First aid – A first aid kit shall be kept in the foreman's site office</p> <p>Welfare area and site toilets/wash-up area are located on site</p>

#### 5. Environment

<b>Adverse effects of activity on environment</b>
<p>Re fuelling of plant must be over a drip tray.</p> <p>Spill kits to be readily available</p> <p>All works will be carried out in close proximity to the Regent's Canal. Care should be taken to ensure this is not impacted in any way.</p>
<b>Adverse effects of environment on activity</b>
<p>Wind while working at height</p> <p>Adverse weather – High Winds / Excess Rain</p>

#### 6. Inspection & test records

The following inspection & test checklists, when completed for each section of this activity, demonstrate that this work meets specified requirements	
<p>Time sheets to be completed</p> <p>Photographs shall be taken</p> <p>Check sheets for bolt tightening</p>	<p>Completed condition survey</p> <p>Paint finish inspection records</p> <p>As built survey of Gasholder No.8</p>

GAS HOLDER #8



Kings Cross, London

Re-erection Sequence – Method Statement

CLIENT  
BAM Nuttall Ltd

Kings Cross Central  
Regeneration House  
Kings Cross Freight Depot  
Wharf Road (off York Way)  
London  
N1 0UZ

AUTHOR  
CRADDY PITCHERS DAVIDSON

EDEN LODGE STUDIOS  
EDEN OFFICE PARK  
CHAPEL PILL LANE, HAM GREEN  
BRISTOL  
BS20 0BX

PHONE: 01275 371333  
E-MAIL: TrevorTimmins@CraddyPitchers.co.uk

DATE: 19 October 2012  
CRADDY PITCHERS DAVIDSON'S DOCUMENT REFERENCE: 9065w0007F



CONTENTS

1.	INTRODUCTION	2
2.	SETTING OUT	3
3.	RE-ERECTION SEQUENCE	3
Appendix A	- Key to Gas Holder 8 Guideframe Elements	
Appendix B	- Sequence of Erection	
Appendix C	- Summary of Foundation Loading	
Appendix D	- Schedule of Site Fixings	

Revision	Date	Notes	Author	Checked	Approved
-	13.04.12	Preliminary Issue for Comment	TAT	CSD	CSD
A	09.05.12	Revised following meeting with Client and Contractor	CSD	CSD	CSD
B	05.07.12	Minor amendments/clarifications added. Schedule of site fixings added to Appendix D. Final Issue at completion of repair/refurbishment works.	TAT	CSD	CSD
D	12.09.12	Revised throughout to suit CPD appointment by BAM and confirmed method of works. Stage D Submission.	TAT	CSD	CSD
E	16.10.12	Planning submission amendments incorporated as requested by Argent	TAT	CSD	CSD
F	19.10.12	Further planning submission amendments incorporated as requested by Argent	TAT	CSD	CSD

1. INTRODUCTION

1.1. **Introduction:** The Gas Holder #8 guideframe structure has been dismantled and transported to Shepley Engineers Limited's (SEL) yard in Shafton for storage and refurbishment by SEL. Craddy Pitchers Davidson (CPD) were appointed by SEL as the structural engineers responsible for the refurbishment works.

Craddy Pitchers Davidson have now been appointed by BAM (Principal Contractor) as the structural engineers responsible for the G8 guideframe re-erection works including the provision of new foundations.

This report is a development of previous reports issued by CPD under their appointment with SEL and follows principles, guidance issued therein.

1.2. **Objective Of This Report:** The gasholder guideframe structure is to be re-erected at a new location within the Kings Cross redevelopment site. This report provides a method statement for how this re-erection will be carried out in order to maintain the structural integrity of the gas holder components throughout the re-erection works and beyond.

The gas holder guideframe structure will be supported by new purpose built foundations, designed by CPD. The load carrying requirements of these foundations, based on the structural assessment carried out previously by CPD under their appointment to SEL are summarised in this report at Appendix C.

1.3. **Re-erection Sequence Method Statement:** This report provides a method statement for the re-erection works, principally detailing the sequence of operations.

1.4. **Notation.** The gas holder 8 guideframe structure is constructed from a number of discrete elements which are connected together to form the structure. The individual elements are identified in Appendix A and the notation set will be used throughout this document.

1.5. **Considerations:**

- (a) BAM have proposed to undertake a particular erection sequence ('erect double height columns') in order to accelerate the re-erection programme.
- (b) The site is constrained on three sides by the Regents Canal and new developments known as PI and TI. Consequential to this, re-erection operations will need to be undertaken from the 'inside' of the structure, contrary to the dismantling works.
- (c) Under the proposed re-erection sequence, two number additional lower erection frames are required.
- (d) The original four number erection frames (four upper and four lower) are to be re-used. Frames require minor strengthening modifications. The original six number base frames to the erection towers as utilised in the dismantling works are not utilised in the re-erection works.
- (e) Erection Frame Works Generally. Under the dismantling works, the dismantling frames relied upon the gasholder guideframe structure for stability. Under the re-erection works the frames need to be designed to resist wind acting both on themselves and the gasholder guideframe structure until such time as the re-erection works reach their 'final fix' state enabling the removal of the erection frames. A detailed structural assessment to verify the structural adequacy of the original dismantling frames for the re-erection works has been undertaken based upon the 'construction drawings' provided by BAM for the original frame assemblies. Minor strengthening works have been identified.
- (f) The erection frames are to be supported via a steel transfer frame fixed to the rc annular ring beam and rc piers at each column location. The steel transfer frames will be installed prior to backfilling subsequent to completion of substructure works. The steel transfer frames will be abandoned in situ albeit cut down to a suitable level depending upon the clients finalised requirements for site levels at completion of the works.
- (g) Original lifting beams will be reused, additional lifting frames will be provided to enable adjustment

- of columns within the erection frames as detailed in the Erection Method Statement.
- (h) The start point for the erection works is to be finalised with BAM.
- 2. SETTING OUT**
- 2.1. **Setting Out Principles:** The principle being adopted is that the structure is re-erected as it was immediately prior to dismantling i.e. columns will be set out in 3 dimensions to match the original structure – if columns were not plumb in the original structure then they will not be subsequent to the re-erection works.
- 2.2. **HD Bolt Setting Out:** The following sources of information will be used to establish the holding down bolt positions.
- (a) Plowman Craven scatter survey
- (b) BAM HD bolt survey
- (c) SEL base plate survey
- (d) CPD base plate survey
- HD bolt positions will be jointly established by BAM &CPD utilising best fit envelopes. CPD will ensure lateral tolerance within the HD bolt assemblies cater for projected variation in bolt setting out.
- Bolt setting out as determined by BAM/CPD will be issued to Bell Philips Architects whom will position the Gasholder 8 structure to coordinate with the requirements of Townshend Landscape Architects 'site setting out'.
- 2.3. **3D Dimensional Setting Out:** The 3D setting out for columns will be established via the Plowman Craven scatter survey relating to the original structure. Setting out co-ordinates will be converted to site co-ordinates.
- 2.4. **Finalising Setting Out On Site:** The techniques to be adopted for fitting the columns over the HD bolts and adjusting the columns within the erection frames to achieve the required 3D positioning in accordance with the Plowman Craven scatter survey are detailed within the Erection Method Statement a draft of which is included at Appendix E of the Stage D submission.
- 2.5. **Monitoring the Erected Structure:** The erection sequence proposed, grouts up column base plates and denies full access to the lattice beam/CI column connections as the works progress both of which equate to avoiding the necessity to come back to 'finished' columns to make positional adjustments.
- In order to mitigate this eventuality the structure will need strict monitoring against the 3D setting out for the structure still to be erected to ensure erection tolerances do not creep such as to compromise the fit of the structure still to be erected.
- 3. RE-ERECTION SEQUENCE**
- 3.1. **Sequence of Works:** A sequence of works is included in Appendix B. The sketches show how Craddy Pitchers Davidson/BAM proposes the gas holder guideframe structure being re-erected whilst maintaining structural stability. The sequence generally consists of the installation of the lower columns supported in the erection frames, followed by the installation of the lower lattice beams between columns. The lower level columns and associated lattice beams are final fixed prior to the upper half of the column being installed. This allows the 'V' brackets and bolts for the lower lattice beams to be accessed from above. As a result, the lower ring of columns and beams will progress slightly in advance of the upper ring, as detailed on the sketches.
- The temporary structure is considered to remain stable at all stages of the re-erection.

- Stability to columns within erection frames is provided by the erection frames and their transfer frames back to the permanent works foundations.
- Stability to columns where erection frames have been removed is provided by:
- a minimum of 1 ½ erection frames at each end of the run of erected columns
  - columns are fully grouted and fully fixed to their final permanent works state prior to removal of erection frames.
  - as the works progress, the stability of the erected part of the structure increases.
- 3.2. **Lattice Beam Connection:** Connection fixings between the lattice beams and the column are referred to in the re-erection sequence as either 'Preliminary fix' or 'Final fix'. These are defined as follows:
- (a) Preliminary fix: This is an initial fix for the lattice beams to the column. The connection is made using only the bolts between the lattice beam end plate and the column. Items such as 'V' brackets, tie bars and knee plates cannot be fully installed. Packing between the lattice beam and the column should be installed to allow the column to be lined and levelled, and bolts should be tightened to provide temporary restraint to the head of the column.
- (b) Final fix: Final fix can only be carried out when the lattice beam both sides of the column is installed. All elements and components at the joint are installed, including 'V' Brackets, 50mm diameter tie bars and Knee plates. Packers are installed to allow correct line and level to be achieved. All connections tightened to final state. Stability of structure in the temporary condition requires these connections to be made prior to removal of erection frames/temporary support as indicated in the sketches in Appendix B.
- 3.3. **Individual Steps during Erection:** The following steps relate to the re-erection principles of a single column including all associated elements, whilst not stated within the individual steps, this sequence relies upon the erection of adjacent elements. See Appendix B for schematic re-erection sequence for the structure as a whole.
- (a) Gasholder guideframe structure permanent foundations to be constructed including the provision of holding down bolts.
- (b) Erection frame transfer frame installed to line and level on permanent foundations.
- (c) Lower column to be placed into U shaped erection frame via approved lifting beam. Guide rail to be fixed to column. Projection of column below erection frame to coordinate with levels of column and erection frame transfer frame. 4<sup>th</sup> side of erection frame to be fitted together with all clasps and internal access platforms. Consideration to be given for securing access ladders at this stage. Adopt 'Permit To Lift' procedure incorporating a full check on the security of the column within the frame.
- (d) Lower column to be lifted into vertical position and installed over holding down bolts. Provide shims to suit design level. Minimum 3No sets of shims to be provided adjacent each holding down bolt location and 1No set at the midpoint of each side of the baseplate (16 sets per column base). Shims to be positioned at internal stiffener locations.
- (e) Fit lifting frame to column and support column via crane. Release clamps full height.
- (f) Column verticality and orientation to be checked against target line and level as established from the 3D survey and the position adjusted to suit. Nuts, washers and bearing plates to be fitted to the holding down bolts and tightened to provide a rigid connection between the base of the column and the foundation. Columns secured by top clasp. The crane can now release the column.
- (g) Remove bracing, clasps etc from the erection frame as required to suit installation of lattice beams.
- (h) Lower lattice beams to be lifted in accordance with previously approved methods. Beams to be seated on column castings whilst crane support maintained. Position lattice beam