



C129/JULY/2017

STRUCTURAL INSPECTION

**AT
JANE PIT, MOSSBAY ROAD, WORKINGTON**



**FOR
WORKINGTON TOWN COUNCIL**

OFFICES AT SHREWSBURY, CHORLEY, LANCASTER & WORKINGTON





REPORT VERIFICATION

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1 INTRODUCTION

Thomas Consulting have been instructed by Workington Town Council to carry out a structural inspection to establish the general condition of the structural fabric of the ruined property know as Jane Pit, Mossbay Rd, Workington.

We have confined this inspection to those structural elements of the property which are typically associated with the structural fabric e.g. walls, floors and where exposed footings.

The inspection is confined to a visual inspection of the property and we have not investigated woodwork or other parts of the structure which are covered, unexposed or inaccessible. We are therefore unable to report that any such part is free from defect.

The object of the report is to assess the effect of the reported defect on the structural integrity of the property. No assurances can be implied as to the effect that the reported defect may have on the saleability of the property.

Defects identified in the report may not be sufficient to cause significant structural weakness of such an extent to prevent normal use of the property but could be unacceptable on aesthetic grounds. The client should therefore consider whether or not the defect is acceptable or desirable on these grounds and seek qualified advice as to the effect on the market value of the property.

There may be observations recorded under section 4.0 of the report which are highlighted by italics. These relate to defects which fall outside of our brief but have nonetheless been included as part of the inspection. No further advice may be given in respect of these items but the Client should be aware that they may require further investigation or remedial action.

Please note the appended Conditions of Inspection.



2 GENERAL

The property is sited on a reasonably level site in Workington.

The property is a former Pit Head steam engine house and associated flue stacks which is understood to have formerly accommodated a steam-powered beam winding engine. The property was constructed in 1843-1844. The property is constructed in dressed and rubble sandstone masonry with brickwork lining to the flues. There is no roof, nor any floors. The property stands as a ruin.

The Geological Survey for England and Wales sheet (Solid and Drift) indicates that the property is situated upon Glaciofluvial Deposits, Devensian - Sand And Gravel. Superficial Deposits formed up to 2 million years ago in the Quaternary Period. Local environment previously dominated by ice age conditions. Clearly, the site is underlain by Coal Measures and has been mined in the past. A Coal Authority report would be needed to provide further information but in view of the history of the site, there seems little point in obtaining a coal report.

The inspection took place on Tuesday 18th July 2017, the weather at the time of the inspection was dry.

3 SYNOPSIS

The report identifies damage to the property which has been noted in Paragraph 4 below. The damage includes deterioration to masonry due to weathering and localised collapse internally due to infestation of timber lintels over openings on the face of the inner leaf of masonry in external walls. There is some nominal leaning of the former roof parapet walls. The significance of damage is discussed later in the report and recommendations given for remedial action in general terms.

There may be observations recorded under section 4.0 of the report which are highlighted by italics. These relate to defects which fall outside of our brief but have nonetheless been included as part of the inspection. No further advice may be given in respect of these items but the Client should be aware that they may require further investigation or remedial action.



4 OBSERVATIONS

Notation: - The elevations are referenced relative to the North Point with Mossbay Road lying to the East.

The terms left and right when used in respect of other individual elements are made with respect to the observer's relative position when making the observation.

4.1 External

As stated in the conditions of inspection, the following observations have been made from ground level only/ with the benefit of a 4m surveyor's ladder.



4.2 East elevation presenting to Mossbay Road





Coursed, squared, faced sandstone masonry and rubble sandstone masonry in lime mortar beds.

The curved ended main structure is supported by a rectangular plinth type arrangement of approximately 2m height. There are quoined corners to the rectangular plinth arrangement at the base.

Dressed stone lintels, cills, jamb stones and quoin stones to the various window openings as shown on the enclosed photographs.

At high level the castellated parapet type arrangement is supported by a corbel structure which corbels out from the elevation an estimated 200mm to 225mm. This runs around the entire perimeter of the main structure.

The elevation is reasonably plumb throughout.

The central castellation upstand in the parapet arrangement leans out slightly.

At each end of the main curved structure above plinth level, the masonry and pointing is generally in good order. Throughout the centre of the elevation, for the majority of its height, there is extensive spalling of the masonry units which appears to be associated with the inappropriate pointing of the masonry in an Ordinary Portland Cement (OPC) based mortar.

There is severe weathering of the lintel member of the small high level central window opening.

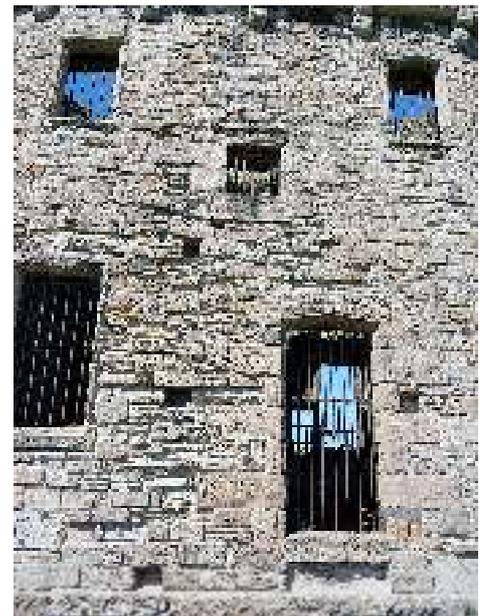
There is spalling of the jamb stones forming the lower left hand window opening at the right.

All the window openings are protected by steel railings to prevent access.

There are a number of missing masonry units (6No significant units) – see photograph right.

Below the cill of the large lower window opening to the right of centre there is spalling of the facing masonry to reveal rubble masonry inner stonework.

The quoined corners of the lower rectangular plinth arrangement are generally in good order with only localised spalling of masonry. Down the centre of the elevation within the lower plinth there is spalling of the masonry facing. There is evidence of re-pointing with ordinary Portland cement mortar and the spalling may be associated with this poor practice.



There is a small window opening at ground level where the thickness of the base plinth structure wall can be confirmed to be approximately 675mm. The main curved structure above plinth level is set back by approximately 100mm and this equates to a wall thickness within the main curved structure of approximately 575mm.

Just above the base plinth level and below and left of the lower left hand window opening, there is an in-filled window opening with a dressed stone lintel over and quoined corner which has been in-filled with rubble masonry in OPC mortar beds to a poor standard and two mild steel straps are anchored over the face of this infill.



4.3 North elevation



The North elevation comprises of the rectangular plinth structure at the base and the semi-circular end to the main curved structure above.



STRUCTURAL INSPECTION

There are 2 No window openings with steel railing protection with dressed sandstone cills, lintels and jamb stones.

Generally the elevations of the plinth structure at the base and the curved structure above are reasonably plumb.

There is an in-filled window opening at the base of the plinth structure at the base of the elevation with a dressed lintel over, in-filled to a poor quality with rubble masonry in OPC mortar beds.

There is a rope tied around the castellation upstand to the left of centre.

The masonry in the curved main structure is generally in good order towards the centre and left but at the right running into the West elevation there is extensive spalling of the facing of the dressed stone masonry which appears to be associated with the poor practice of re-pointing in OPC mortar. The spalling includes almost complete loss of the thickness of some of the masonry facing units, particularly at low level resulting in holing of the elevation as shown in the photograph - right.

There is a missing masonry unit just above the base plinth level at the approximate right hand quarter point of the curved elevation.





4.4 West elevation presenting towards the Irish Sea and including a tall central circular/semi-circular tower stack at the centre



The tower stack bears onto a rectangular plinth type arrangement similar to the main structure. Just above plinth level is a cast iron string band of unknown purpose running around from the main structure.



STRUCTURAL INSPECTION

There are window openings either side of the tower stack structure typically formed in dressed sandstone with lintels, cills and jamb stones and protected by steel railings.

The elevation is generally reasonably plumb including the tower stack structure although this tapers in diameter with height.

To the left of the central tower stack structure the elevation of the main structure is severely weathered with spalling masonry and to the right of the large lower window opening there is complete loss of masonry with the lower right hand jamb stone standing as an independent column supporting the central quoin stone and masonry above. The defect is a continuation of that noted to the right of the North elevation. The holing of the masonry to the right of the lower ground floor window is being guarded with mild steel strapping. There is cracking and dislodgement of masonry above and right of the lower large ground floor window probably associated with loss of masonry below. Below the area of missing masonry, below and right of the lower window opening there is a missing masonry unit.

A fire has been lit in the corner between the elevation and the central tower stack at the left which has charred and blackened the stonework. In addition there is Graffiti on the elevation.

There are openings at the base of the wall within the plinth arrangement either side of the tower stack which are protected by steel railings and reveal a clay brickwork lining to the stack.

There are 4No missing masonry units towards the right of the tower stack and in the main structure at the right – see photograph right.

In the plinth structure to the main building to the right of the tower stack there is holing in the wall due to missing masonry and this has been covered by steel railings as per the photograph below. There is further missing masonry to the left of this in the base of the tower stack.



There is a crack estimated less than 5mm wide through the lintel of the right hand upper window opening. Above this, a steel rod projects from the elevation and the crack damage may be associated with expansive corrosion of this. There is cracking above the window running up into the parapet corbel arrangement.

At the head of the tower stack the masonry corbels out by an estimated 200mm to 250mm with a castellated arrangement similar to that of the main structure. There is a tree growing at the East of the parapet arrangement to the tower stack.



4.5 South elevation



The main curved structure is presented above the rectangular plinth arrangement as a semi-circular end to the South.



STRUCTURAL INSPECTION

There are two openings within the curved structure with dressed sandstone cills, lintels and jamb stones forming the openings.

There is a central opening within the rectangular base plinth structure at ground level with a dressed stone lintel over and quoined jambs and above this is a date stone 1844.

The elevation is generally reasonably plumb.

There is a missing masonry unit at the right quarter point just above the lower window cill level.

4.6 Tower stack structure to North West of main structure

Circular, dressed, coursed stone stack structure above dressed stone plinth arrangement which is square on plan. The plinth structure is approximately 2.75m high.

The plinth structure quoined corners and main tower stack are all reasonably plumb albeit the circular stack tapers in diameter with height.

There is a date stone 1844 with the initials ESC_{ESQ} above this.

There is an opening with steel rail protection in the East elevation formed by a clay brickwork arch. The arch masonry has spalled towards the right and there is total loss towards the left as per the photograph right. There is no access internally however, the stack can be seen to be lined in clay brickwork masonry.



There is a further opening in the North elevation with steel railing protection. There is spalling and loss of masonry at the head of the sandstone masonry arch and crack damage to the lintel member over apparently on a cleave line.

There are no significant structural defects in the West elevation other than localised weathering of the masonry units.

At the base of the circular stack, approximately 0.5m above plinth level is a circular string course feature and there is extensive spalling and shaling of the sandstone in this string course including complete loss of stonework to the South.

There are no significant structural defects in the circular stack masonry fabric other than localised weathering and spalling of masonry units.

4.7 Internal

There is no access to the structure internally however, limited observations can be made with the benefit of a surveyor's ladder through window openings.

Internally the main circular structure is finished in a partly dressed stone and partly rubble masonry.

Generally there are timber lintels over the window openings including curved lintels.

STRUCTURAL INSPECTION



In the North elevation infestation in the North window opening to the East elevation and loss of the lintel over the lower window to the North elevation has resulted in localised collapse of the inner leaf of masonry covering an area estimated to be approximately 4m²- see Photograph below.





There are localised areas of missing masonry in the East and South elevation on the line of the inner leaf each being less than 1m^2 as per the following photographs.



The castellated parapet arrangement at the head of the wall is substantially thinner than the main wall itself resulting in a significant ledge at the base of the parapet and there is extensive vegetation growth including small saplings as shown by the photograph right.

There is vegetation including sapling growth and litter in the base of the main structure which hampered the limited inspection available at low level. Notwithstanding, in the South East corner there is an area of poor quality rubble masonry extending over an area estimated to be approximately 4m^2 including corbelling out of the dressed stone masonry to the left as per the following photograph.



There are a number of pockets, missing masonry units and areas of missing masonry which may have been associated with bearers for former suspended timber floor structures. Damage may have occurred when these structures which probably suffered from infestation, collapsed and articulated.



At the internal face of the lower substantial window opening in the West wall, there is significant loss of masonry covering an area estimated to be 2.5m wide by 3m high maximum. This includes the significant loss of masonry noted from the West elevation where the window jamb stone is acting as an independent column. The original timber lintel over this window has been lost resulting in the masonry collapsing and arching above. To the left of the window when viewed internally is an original fire with the flue leading to the main stack. The destabilisation of masonry between the fire and the adjacent window forms part of the masonry loss – see photograph below.



In the West elevation at high level there is what appears to be a cast iron or steel lintel above an infested timber lintel above the opening to the South.

In the West elevation adjacent to the main tower stack at high level, there is a substantial opening in the wall with a partially un-supported lintel arrangement possibly forming a fireplace of some kind. This is forming a void estimated to be approximately 1m². Depending on the historical importance of this opening, it either needs infilling or restoring to the original arrangement to ensure stability of the masonry. The opening is shown on the photograph right.





4.8 Vegetation

In addition to the vegetation specifically commented upon in this section of the report, there are a number of areas where vegetation is growing from the fabric and requires removal and eradication.



5 DISCUSSION, CONCLUSION AND RECOMMENDATIONS

The property has suffered from damage as a result of structural movement and weathering. The damage includes spalling or loss of masonry and localized collapse of masonry typically associated with loss of infested timber lintels over openings.

The damage can be classified in accordance with The Building Research Establishment Digest No. 251 "The Assessment of Damage in Low Rise Buildings" into category of damage 5 in a range of categories from 0 (negligible) to 5 (very severe). This category only applies due to the localized collapse of masonry walling. Generally the structure is plumb and true to line. In view of the age of the property, the fact that it is open to the elements and in a state of ruin, the structure is generally in good condition. Notwithstanding, a number of repairs are needed and these will be discussed separately. The repairs are recommended on the basis that the structure is to be retained as a ruin. All necessary Listed Building Consents and other approvals must be obtained prior to undertaking any repairs.

Internal collapse and masonry loss

Due to exposure to the elements, the originally internal timber lintels have been exposed to (often inclement) West Cumbrian weather. The lintels are probably Oak, but none the less several are suffering from infestation and a few have been totally lost resulting in masonry collapse. We would recommend that the areas of localized collapse be reinstated to ensure the long term stability of the fabric of the structure. This should include:-

- a) Temporary propping and safe access provision as necessary
- b) Removal of loose masonry to form solid bases
- c) Building in dressed or rubble sandstone masonry in lime mortar beds to infill areas of lost masonry – width and style to match the existing. The reconstruction process should include for stainless steel fixed, stainless steel remedial wall ties all in compliance with BS EN 1996-2:2006.
- d) Replacement of all lost or infested timber lintels with new treated Oak members to match the original elements.
- e) Final pinning of unsupported masonry onto the new fabric should be a pressure pointing with lime putty.

Masonry shaling and masonry unit loss in the external elevations

There is extensive (more than 20% of the total area) shaling and spalling of masonry. The worst areas include the center of the East Elevation and in the North West corner. Much of this appears to be the very poor practice of pointing the historic lime mortar bedded masonry with brittle OPC Mortar. Much of the masonry facing loss will not be compromising the integrity of the elevations as a whole but where loss exceeds 50mm depth this is clearly undesirable. From an aesthetic view point, replacing areas where the depth of spalling exceed 50mm and leaving others would be undesirable. Consequently, our advice would be to treat all areas where spalling exceeds 50mm depth locally. Where local areas of spalled masonry (less than 0.25m²) exist, these can remain without remediation unless Client budget permit the replacement of all spalled masonry. All remediated areas should include the removal of any OPC Mortar pointing, cutting out shaled or spalled masonry, replacing missing masonry units and making good with new masonry in lime mortar beds to match the surrounding elevation.

The recommendation to replace missing masonry applies to all missing masonry including that in brickwork and stonework arches, string courses, and other masonry as identified in Section 4.0 of the report.



Stability of Parapet

The parapets to the tower stacks and main structure are of a similar design. The stacks benefit from circular continuity of the masonry however the main structure does not, particularly along the East elevation where some leaning of a castellation was noted. The arrangement has, by and large survived the test of time but the arrangement is structurally unsatisfactory with the centre of gravity of the parapet walls being close to the outer face of the supporting wall below. We would recommend the installation of a suitable ring beam structure behind the parapet walls, just below the base of the castellation upstands (so this cannot be seen externally from ground level). The ring beam could take the form of a galvanized hot rolled (PFC) channel section (suitably curved), resin anchored into the wall and ties across from West to East.

Cracking

There is a crack through the lintel over the West elevation, upper right hand window. There is a steel rod above this which must be removed. The lintel should be repaired in accordance with the attached specification including bonding the crack and introducing an epoxy resin bonded stitch bar installed into a discreet chase cut under the soffit of the lintel (see image below). The crack above should be repaired also in accordance with the Specification incorporating stitching.



Vegetation

All vegetation must be removed and eradicated throughout the property.

The Client's attention is drawn to any observations recorded under section 4.0 and highlighted by italics. These fall outside the extent of our brief but may require further investigation or remedial action.



APPENDIX A
CONDITIONS OF INSPECTION



STRUCTURAL INSPECTION

CONDITIONS OF INSPECTION

Instructions are in all cases (unless any variation is agreed in writing by the Company) accepted on the basis of the following conditions which shall govern the inspection and report, and any related matters.

The object of this Report is to assess the effect of the reported defect on the structural integrity of the property. No assurances can be given or can be implied as to the effect that the reported defect may have on the market value or saleability of the property.

- i) The Report is confined to an inspection of the clients specified structural elements of the property alone, i.e. foundations (if exposed), walls, floors, roof members (if accessible), and other such members providing structural support to the property, that may be deemed necessary for inspection by the Company.

The report will not cover such items as damp proofing, heating and ventilation, plumbing and electrical circuits, doors, window frames, plasterwork, fitted furniture, decoration or items of general serviceability, unless expressly agreed with the Company before the inspection is undertaken.

- ii) We shall not investigate woodwork, or other parts of the structure, which are covered, unexposed or inaccessible. We are therefore unable to report that any such part is free from defects.
- iii) It must be clearly understood by the client that the degree of inspection referred to in (i) above will not reveal all defects. Defects in concealed parts such as foundations, under floor areas, and areas covered by wall coverings, plaster or render, will not be revealed. It is, of course, possible to make more detailed investigations and where there is evidence to warrant this, recommendations for further investigations will of course incur further costs and may require the lifting of floor boards, breaking out brick work or digging trial holes. When such detailed investigations is required, it is the responsibility of the client to:
 - a) give specific written instruction to this effect to the Company and
 - b) obtain the necessary permission of the owner and to indemnify the Company against liability for damage caused or rectification costs.
- iv) Externally the building will be inspected from ground level only, ladders will not be used to inspect roofs.
- v) Internally, where appropriate, exposed surfaces of rooms will be inspected as far as reasonably possible. The engineer will not move or disturb furnishings, fittings, fitted carpets or furniture, and no responsibility will be accepted for defects which are concealed.



- vi) If requested by the client or judged necessary by the Company and a trap door access exists, the roof spaces will be inspected so long as it is considered safe to do so and crawler boards, ladders etc, are available. Note that high or low confined parts of the roof space will not be inspected.
- vii) Readily visible parts of the drainage installations will be inspected, if requested by the client or judged necessary by the Company.
- viii) No inspection will be made of services such as gas, electricity and central heating. The client is advised to engage the services of a competent electrician and/or plumber if inspection is required.
- ix) Outbuildings, including detached garages, sheds, greenhouses and similar structures will not be inspected, unless expressly requested prior to the inspection.
- x) Easements, planning and other proposals by statutory authorities are outside the scope of this structural survey.
- xi) Should the client require advice upon any matter other than the structural survey, e.g. proposed additions and alterations, this must be subject of a further separate instruction.
- xii) The report is provided for the sole use of the named client and is confidential to the client and professional advisors. The Company accepts responsibility to the client alone and accepts no responsibility whatsoever to any person other than the client himself.

Thomas Consulting will consider re-issuing the report in its original format to a named third party within 3 months of the original report date provided:

- a) We have the written permission of our original client to do so and
- b) Upon payment of an administrative fee, currently set at 50% of the cost of the original report fee.

In any event the condition of the property is to be taken as that at the time of the inspection.



APPENDIX B
CRACK REPAIR SPECIFICATION



THOMAS CONSULTING

SPECIFICATION FOR CRACK REPAIRS

1.0 GENERAL

Cracks to be repaired by the Contractor to include all visible cracking and cracking within the structural fabric uncovered following removal of render/plaster finishes.

The extent of cracking is identified in the contract including schedules, drawings and sketches.

2.0 PREPARATION

Remove any crack monitor gauge screws, tell-tales or Demec gauge discs fixed across the cracks.

Along the line of all cracking to be repaired cut back and clean off all finishes in a band nominally minimum 300mm wide central to the crack. All loose bed-joint and masonry material to be cut out and made good as necessary. Clean out crack with compressed air. Investigate along the length of the crack with a metal detector and report the results to Thomas Consulting.

3.0 CRACK REPAIRS

Dependant on crack widths the following repairs are to be undertaken :-

3.1 Cracks in excess of 10mm wide.

On the line of the crack cut out masonry along the line of the crack and rebuild bonding into the masonry on either side to reinstate continuity. A suitable non-shrink additive should be adopted in the mortar mix to Thomas Consulting approval.

3.2 Cracks between 0.1mm and 10mm wide.

Inject cracking with epoxy resin, Sika 'Sikadur 33' or similar approved, carried out strictly in accordance with the manufacturer's instructions. In exposed masonry only, following completion of the injection, cut back resin grout to a depth of 15mm and repoint in OPC / lime mortar. In faced masonry, any broken masonry units should be cut out and replaced with new/ reclaimed undamaged units suitably chosen to match the type, texture and colour of the unit being replaced.



STRUCTURAL INSPECTION

3.3 Cracks less than 0.1mm wide.

No repair unless specifically identified by Thomas Consulting, other than in external facing masonry where the following should be employed:-

- a) In bedjoints - rake out cracked mortar (disc cut if necessary) and repoint using 1: 1: 6, cement:lime:sand mortar mix.
- b) Through masonry units - cut out and replace unit.

4.0 STRAPPING/STITCHING (Vertical and Stepped Diagonal Cracks Only)

Where required in the Contract Documentation the following should be undertaken:

4.1 Strapping (plastered/rendered walls)

- 4.1.1 Cut back render finishes to facilitate works.
- 4.1.2 Supply and fix bat M305 straps 900mm long central to the crack at 450mm vertical centres.
- 4.1.3 Straps should be hot dipped galvanised to internal walls and stainless steel to all external walls.
- 4.1.4 Fixings should be by No. 12 wood screws, 6 No. per strap x 65mm long in Rawl brown plugs. Stainless steel screws should be used in external applications.
- 4.1.5 The straps should be covered by expanded metal lathing as specified above prior to finishings.

4.2 Stitching (faced masonry)

- 4.2.1 At 450mm vertical centres along the crack, locally cut out the bed joints to a depth of one half of the masonry leaf + 10mm for a length of 900mm central to the crack. Depending upon the size of masonry panel being repaired consideration must be given to short term stability of the masonry.
- 4.2.2 Insert 10mm nominal diameter stainless steel Spirobar or similar approved product into the bed joints.
- 4.2.3 Fill chase with Sika 'Sikadur 33' 2 part structural epoxy adhesive.
- 4.2.4 Finish the affected bed joints in accordance with the specification.

5.0 MAKING GOOD

Prior to patching render/plaster finishes, fix strip of "Expamet" expanded metal meshing (nominally 300mm wide) over the crack, fixed in accordance with manufacturer's recommendation. Stainless steel "Expamet" should be used externally, galvanised mild steel internally. Make good to finishes and decoration as necessary.

6.0 MATCHING

In repointing masonry, replacing broken masonry and patching render coatings, the contractor should ensure as far as possible that accurate colour and texture matching is achieved.

7.0 OTHER GUIDANCE

This specification should be read in conjunction with the Building Research Establishment Digest No. 200 - "Repairing Brickwork" and BS8000 - "Workmanship".