# Movement & Tolerances Specification

Bedford Passage Development

Middlesex Annex LLP
RIBA Stage 4

Project reference: 60516144

MHA-ACM-XX-SP-SE-0007

23 October 2020

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## Quality information

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## Revision History

| Revision | Revision date | Details | Authorized | Name | Position |
|---|---|---|---|---|---|
| T1 | 20.07.18 | First Issue | DW | Daniel Wallington | Project Manager |
| T2 | 26.10.18 | Second Issue | DW | Daniel Wallington | Project Manager |
| C1 | 16.04.20 | Construction Issue<br>Revisions are in italic and are underlined | DW | Daniel Wallington | Project Manager |
| C2 | 17.6.20 | Construction Issue during EW contract (secant piling only) | DW | Daniel Wallington | Project Manager |
| T3 | 23.10.2020 | RIBA Stage 4 | DW | Daniel Wallington | Project Manager |

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# Table of Contents

# 1. Introductory Notes

## 1.1 Essential Requirements

The contractor MUST adhere to the following, and is considered to do so in using this document:-

- This document should be read in conjunction with all the Contract documentation prepared in relation to the Trade Contract.
- It is the Main Contractors responsibility to ensure that the above documentation is circulated and made available to his Trade or Sub Contractors, Specialist Contractors, or any Novated Contractors employed in the works prior to the formal appointment of the Main Contractor. The Main Contractor must act to ensure that the Sub Contractors, Specialist Contractors, and Novated Contractors are aware of the documentation referred to above. ALL contractors must proactively seek out this information at every opportunity.
- The responsibility for circulation of information lies with the Main Contractor and it is their responsibility to ensure that they obtain all advance information relating to the following main contract work in sufficient time. If this is not forthcoming at timings required to undertake their contracted work, this must be clearly flagged to the CA.
- The Specification relates to, and should be read in conjunction with the drawings prepared by AECOM. This specifically means General Arrangement drawings, Section and Detail drawings, Schedule drawings and General Notes drawings. It also specifically means any drawing details or sketches released by AECOM to cater for any Changes on Site – whatever the reason for, or timing of, their production.
- Reference should always be made prior to commencing the works and periodically throughout the course of the works, to all other drawings produced by other disciplines (i.e. Architectural, M&E, Specialist Subcontractor's, etc.). It is the Contractors responsibility to coordinate their package specific work requirements with all the Design Team disciplines – and not rely upon one principle discipline providing all the information to which their contracted works covers.
- The Main Contractor and their contractors are to ensure they have complete sets of the latest information at each stage of the work, and take all proactive steps to ensure they seek out this information.
- The Trade Contractor should review all information thoroughly, in advance of starting the works. Should any discrepancies exist within the information which create contradiction, or differ from the industry standards – this should be highlighted to the Main Contractor and Structural Engineer (SE) well in advance of starting on site. Late notification of such instances is not acceptable as the Contractor is understood to have made themselves fully aware of the contract at the time of tender submission.
- The Contractor is responsible for visiting site and undertaking a thorough visual site survey, in the attendance of the CA. A Full report of observations and discussions at this walk round visual survey is to be prepared and submitted by the Contractor. The contractor, as part of this report, is to provide within, agreement that all elements and features of the site are in agreement with the contract documents (as can be visually verified), or flag any discrepancies to the contrary. This report is an important requirement of the pre-commencement work.
- Monitoring of the surrounding structures and retained structures present on or around the site is critical throughout the course of the contract. At the outset of the Contract, a full record survey is required. This must be followed by continual monitoring of surrounding buildings and structures as the works progress to a conclusion. Refer to AECOM Movement & Tolerances Specification for further details.
- The Demolition Contractor is to provide Monitoring of all these structures through until the completion of their contract – beyond this it is the responsibility of the Main Contractor. Monitoring works should include, but not be limited to, the following items:

1. Retaining structures to the Perimeter of the site.
2. Retained Roadways and Pavements.
3. Directly adjacent building elevations (and their foundations should they be exposed and/or underpinned throughout the course of the works).
4. All installed temporary works (for the life of the temporary works installation).
5. All items supported or shored by the temporary works (in item 4 above).

# 2. Scheme Description

AECOM have been appointed by *Middlesex Annexe LLP* as Civil and Structural Engineering consultants and instructed to prepare RIBA Stage 4 technical design information for the proposed redevelopment of the Middlesex Hospital Annex site.

The Middlesex Annex site is located in the Bloomsbury Area of the London Borough of Camden. Situated at 44 Cleveland Street, it lies south of Howland Street, north of Tottenham Street/Mews and west of Charlotte Street. The site is located close to the Camden-Westminster local authority boundary and is situated within the Charlotte Street Conservation Area (CSCA).

The site's northern boundary borders the Sainsbury's Wellcome Centre Building (completed 2015). The 8 storey Astor College and 5 storey Middlesex House form the site's eastern and southern boundaries respectively. The block to the south of Foley Street, opposite the former Workhouse is fronted to the west by the six-storey 1930s red brick Courtauld Institute building.

The site comprises the U-shaped, 18th Century former Strand Union Workhouse which is Grade II listed and on the Historic England Buildings at Risk Register. The Workhouse is comprised of a basement, ground, first, second and third floor plus roof space housing plant. The building fronts onto Cleveland Street, set behind a tall boundary wall. Behind the Workhouse two wings of a similar height extend eastwards forming a courtyard were added in the 19th Century. Two four-storey19th C buildings (including basements), namely the North and South buildings sit on the site boundaries of the site.

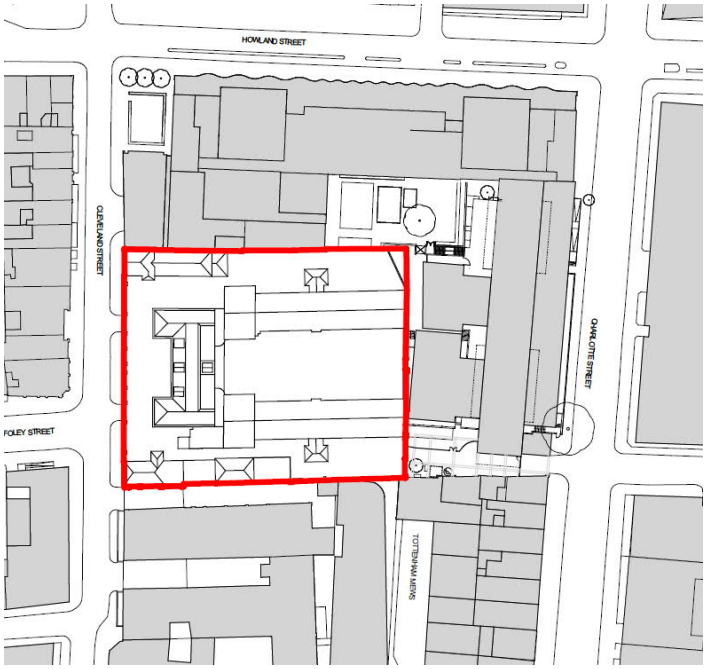



**Figure 1 – Site Plan**

The proposed development comprises three main elements. Firstly the east-west wings of the hospital annex (the rear of the site) will be demolished with the listed Workhouse building retained and refurbished for market housing units. The existing North and South Houses of the main hospital annex building, also fronting onto Cleveland Street, will be largely retained and refurbished (the eastern section of the South House will be demolished). To the rear of the retained Workhouse and North and South Houses a new 8 storey building is proposed with two basement levels.

## 2.1 Design Team

| | |
|---|---|
| Middlesex Annexe LLP | Client |
| Llewelyn Davies Architects | Architect / Lead Designer / Contractor Administrator |
| Equals | Cost Consultant |
| AECOM | Structural, Underground Drainage, Geotechnical & Geo-environmental Engineer |
| Arup | Building Services Engineer / BREEAM Lead Consultant / Vertical Transportation |
| Delva Patman Redler | Party Wall Surveyors |

## 2.2 Outstanding Design Risks

### 2.2.1 Party Walls

Research of the Land Registry shows that there are multiple neighbouring properties that fall within the confinements of the Party Wall Act 1996, and a Party Wall Surveyor has been engaged following planning permission for the redevelopment of the building, to mediate with adjoining owners and negotiate access rights and submit proposed Engineering works for agreement.

It will be important to ensure that the technical Engineering solutions for the demolition and re-development of the site are sufficiently robust to ensure the protection of all neighbouring buildings. This applies in particular to the retained buildings, notably the Grade II listed Strand Union Workhouse.

The proposed rear extension to the Astor College site to the east of the Bedford Passage Development site was completed in 2019. The works to the Astor College building comprised of a new basement and significant alterations to the existing structure. AECOM have obtained various drawings for the development which will be useful as a reference to the project at the Bedford Passage Development site to determine viable structural options for the basement and boundary conditions.

AECOM recommends a strategy for the frequent monitoring of adjoining buildings during any demolition and construction phases to safeguard each of these existing buildings against vibration, ground movement, settlement and damage.

### 2.2.2 Archaeology

There is provision for a Written Scheme of Investigation (WSI) for the archaeological excavation and watching brief at the Bedford Passage Development site. It is pursuant to Condition 6 of Planning Application Number 2018/1584/P which requires archaeological mitigation of the site in advance of the development. The WSI (by Iceni) details the proposed methodology (by LP Archaeology) covering the enabling works and main site bulk excavation.
The archaeological potential of the site includes:

- **Late 18th century building remains / foundations** associated with the construction and occupation of Covent Garden Workhouse (later the Strand Union Workhouse)
- **18th / 19th century burials** relating to the Workhouse and St Pauls Covent Garden Parish

### 2.2.3 UXO Risk

According to regional unexploded bomb (UXB) mapping published by Zetica, the site lies within a zone that experiences a high risk of UXB. Furthermore, the LCC Bomb Damage Map 61 in publication no.164 by the London Topographical Society shows that during WW2 the Listed Building and its south wing suffered “general blast damage-not structural”, the north wing and north building were “seriously damaged doubtful if repairable”.

It is recommended that the Client commissions a specialist UXO report in advance of any future intrusive site works or development. The report should be prepared with cognisance of CIRIA publication C681 (Stone and others, 2009).

*Post Note: April 2020 – Refer to UXO Desk Study & Risk Assessment by Zetica UXO dated 19th June 2019 Document Ref. P8690-19-R1*

*Refer to Project Team Risk Register for Design Risk Items.*

# 3. Purpose of the Document

This document defines the anticipated movements and required tolerances associated with the primary structure. This specification should be included in the subcontract documentation for all trades where there is a direct interface with the structure, which may be affected by the constructional tolerances of the main frame or its subsequent movement under load.

The Specifications are in accordance with the criteria laid down by the National Structural Steelwork Specification for Building Construction, the National Structural Concrete Specification for Building Construction and for other materials the tolerances as stated and appropriate in BS 5606 – Guide to Accuracy in Building.

The standards provide for a level of accuracy that can be obtained by normal construction methods.

These standards should be referred to in the General Preamble to the contract.

This document defines the pertinent requirements for tolerance and movement of the erected steelwork and concrete structural elements as specified in the executive team specifications. **Particular reference is to be made to the individual AECOM Structural Specifications.**

The contractor is responsible for verifying all site and setting out dimensions before commencing the works.

The contractor shall be responsible for checking dimensions of all elements on arrival at site and notify the Contract Administrator if the dimensions have exceeded the permissible deviations and tolerances.

All stated tolerances are not cumulative and shall be related to the design gridline positions and floor levels.

The contractor shall carry out positional adjustments on site within allowable tolerances to permit the correct installation of components. This way any adverse results caused by an accumulation of individual permissible deviations and tolerances can be avoided. If it is apparent that the foregoing adjustment will not achieve the required results the contractor shall inform the Contract Administrator immediately.

During execution of works, at regular intervals the contractor shall satisfy the contract administrator that the tolerances given in this document have not been exceeded. It is anticipated that such checks shall be made at completion of piling or other foundation constructions, construction of columns and walls at successive floor levels or critical headrooms and staircases etc.

Should the Trade Contractor feel the tolerances within this document are not being met, or the Main Contractor has reason to believe they are not being met; then the Trade Contractor should undertake a line and level survey of the as built structure. This survey should relate to, and hence make comparison to, the lines and levels indicated on the drawings. A drawing shall be issued showing this information to the Main Contractor, Structural Engineer, Architect and Quantity Surveyor.

The survey shall be carried out in a manner that provides sufficient information about the new build structure in order that any necessary remedial work can be carried out prior to proceeding with the subsequent elements of the structure.

All costs and consequences of the survey, delay to follow on works, or any necessary remedial works, will be the contractor’s sole responsibility.

# 4. Tolerances

## 4.1 Steelwork

The specified construction tolerances are in accordance with the National Structural Steelwork Specification for Building Construction, Seventh Edition 2020, Section 9: Workmanship – Accuracy of Erected Steelwork, and summarized below:

### 4.1.1 Permitted Deviations for Foundations, Walls and Foundation Bolts:

- Foundation Level: deviation from exact level ± 20mm
- Vertical Wall: deviation from exact position at steelwork support point. ± 15mm
- Pre-set Foundation Bolt or Bolt Groups when Prepared for Adjustment: deviation from specified position:
  - from specified position at top of concrete ± 10mm
  - bolt level +25 / -5mm
  - clearance at top of concrete 25mm (min)
- Pre-set Foundation Bolt or Bolt Groups when Not Prepared for Adjustment: deviation from specified position:
  - from specified position at top of concrete ± 3mm
  - bolt level + 45mm<br>- 5mm

### 4.1.2 Permitted Deviations for Erected Components:

- Positions of Columns at Base Plates: deviation of section centreline from the specified position ± 10mm
- Single Storey Columns Plumb: deviation of top relative to base, excluding portal frames, on main axis. ± H/600 or 5mm whichever is greater.
- Multi-storey Columns Plumb:
  - Deviation in each storey ± H/600 or 5mm whichever is greater.
  - Maximum deviation relative to base. ± H/1000 or 25mm whichever is greater.
- Alignment of Adjacent Perimeter Columns: deviation relative to next column on a line parallel to the grid line when measured at base or splice level (critical face). ± 10mm
- Beam Level: deviation from specified level at supporting column ± 10mm
- Level at Each End of Same Beam: relative deviation in level at ends. ± 5mm
- Level of Adjacent Beams within a Distance of 5m: deviation from relative horizontal levels (measured on centreline of top flange). ± 5mm
- Beam Alignment: horizontal deviation relative to an adjacent beam above or below, for storey height h: h <3m = 5mm<br>h >3m = h/600
- Permitted deviation to specified pre-camber: ± L/1000 or 6mm whichever is greater.

The permitted deviation in the axis of a compression member at a splice is 5mm about either axis.

Members other than columns shall not deviate from their specified position relative to the adjacent columns by more than 5mm.

Where it is necessary to combine permitted deviations to establish the acceptability of the position of the steelwork the deviation shall be combined using the root sum square method and where consideration is taken of more than one element with the same permitted deviation, then a normal distribution shall be used in this calculation

## 4.2 Concrete

The specified construction tolerances are in accordance with the National Structural Concrete Specification for Building Construction, Fourth Edition 2010, Section 7: Construction Accuracy and summarised below:

### 4.2.1 Size of Elements

- Slab thickness: permitted deviation on slab thickness shall be as follows:
  - up to and including 150mm ± 8mm
  - over 150mm up to and including 600mm ± 10mm
  - over 600mm up to and including 1m ± 15mm
  - over 1m ± 20mm

- Formed Elements: the linear dimension of formed elements shall be accurate to within the following distances:
  - up to and including 600mm ± 6mm
  - over 600mm up to and including 1.5m ± 10mm
  - over 1.5m up to and including 8m ± 15mm
  - over 8m up to and including 15m ± 20mm
  - over 15m up to and including 30m ± 30mm
  - over 30m ± 30mm ± 1mm per meter or part of 30m

### 4.2.2 Twist of Elements

- The distance from any one corner to the plane containing the other three corners shall be accurate to within the following:
  Diagonal of element:
  - up to and including 600mm ± 6mm
  - over 600mm up to and including 3m ± 10mm
  - over 3m up to and including 8m ± 15mm
  - over 8m ± 15mm + 2mm per metre or part over 8m

### 4.2.3 Squareness of Elements

- Permitted deviation on squareness shall be as follows:
  Length:
  - up to and including 600mm ± 6mm
  - over 600mm up to and including 2m ± 10mm
  - over 2m up to and including 4m ± 15mm
  - over 4m ± 15mm + 1mm per metre or part over 4m

### 4.2.4 Position on Plan

- The position on plan of any element of the foundation relative to the intended position shall be accurate to within: ± 30mm
- The position on plan of any element above the foundation relative to the intended position shall be accurate to within (measured at floor level): ± 10mm
- The position on plan of slab edges relative to the intended position shall be accurate to within (measured at floor level): ± 10mm
- The position on plan of slab edges (to receive s/s angles) relative to the intended position shall be accurate to within (measured at floor level): ± 10mm

### 4.2.5 Level of Elements

The first paragraph of Section 7.6 of Part 1:Standard Specification is to be replaced with the following:

"The following tolerances are for surfaces that may or may not receive further levelling finishes and are 'pre-strike'":

- Permissible deviation from intended level shall be within: ± 10mm
- The top surface of any foundation shall be within ± 15mm of the intended level
- Intersecting beams intended to be at the same level be accurate to within: ± 10mm
- Deviation in level between two points 6m apart shall be: <15mm
- Deviation at any point under a 3m straight edge placed at any position on self finished floor shall be: < 10mm
- Deviation at any point under a 1m straight edge placed at any position on self finished floor shall be: < 2mm
- Deviation at any point under a 1m straight edge placed at any position on floor to receive screed or mastic asphalt shall be: < 10mm

### 4.2.6 Abrupt Changes of Continuous Surfaces Where Finish is Not Specified

- Normal permitted deviation as measured from the nominal surface of the finish face. < 3mm
- Permitted deviation at construction or movement joints as measured from the nominal surface of the finish face. < 5mm

### 4.2.7 Cast in Fixings

- Excluding bolts, no fixing shall be more than 10mm from the intended position.
- Embedded steel plates in concrete cores to be installed within ± 10mm from intended position and face plate to be within +0mm and -20mm of intended position.

### 4.2.8 Verticality of Elements

- Plumb over a height including beams or edges above each other shall be accurate to within the following: height:
  - up to and including 1.5m 5mm
  - over 1.5m up to and including 2.5m 10mm
  - over 2.5m up to and including 4m 10mm ***
  - over 4m up to and including 8m 20mm
- Plumb of Walls over Floor height ± 10mm ***

***Stricter tolerance than NSCS

### 4.2.9 Bow of Elements

- Unspecified bow measured between extremities shall not exceed the following:
  - Extremities up to and including 1.5m apart ± 5mm
  - over 1.5m up to and including 3m apart ± 8mm
  - over 3m up to and including 5m apart ± 10mm
  - over 5m up to and including 8m apart ± 15mm
  - over 8m ± 15mm

- Permitted deviation to specified pre-camber:
  - Up to and including 20mm ± 5mm
  - over 20mm and up to and including 40mm ± 10mm
  - over 40mm ± 15mm

### 4.2.10 Cast in Bolts

- As for steelwork. Refer to Section 4.1.1 above.

### 4.2.11 Gradual Irregularities

- Gradual irregularities as expressed as maximum permissible deviation from a 1m straight edge to be not greater than 3mm.

## 4.3 Demolition

- Slab edges with projecting reinforcement to tie into new slabs: + 10/-25mm
- Saw cut edges to receive architectural finish to be + 5/-10mm
- New steelwork connections: ± 10mm

## 4.4 Movements

### 4.4.1 Deflection (Generally U.N.O. Elsewhere in this Document)

Deflection generally comprises of three components:

- Instantaneous deflection that occurs during the construction of the building.
- Variable load due to occupancy.
- Long term deflection due to creep and shrinkage effects. This will occur over a number of years in concrete floor construction.

When assessing deflections and vibrations, and how to control them, each span/loading condition needs to be considered on its own merits. In general however, the following criteria will be adopted in the design:

### 4.4.2 Concrete

The beam and slab elements are designed to limit the total deflection (due to dead load, superimposed dead load and variable load including effects of creep and shrinkage) to span/250 and this should normally ensure that the part of the deflection occurring after the construction of the finishes and partitions will be limited to span/500 or 20mm, whichever is the lesser, for spans up to 10m.

**NOTE: The current structural design assumes a "traditional" brick cladding, comprising half brick outer leaf and cold-rolled steel infill inner leaf, supported at storeys to suit the cavity width, as identified on the Structural Drawings. Should the proposed cladding system be changed to an alternative, such as pre-cast concrete with cast-in brick slips, the deflection criteria is to be revised to suit the requirements of the system supplier.**

### 4.4.3 Steel Beams (Including Cantilevers) and Metal Decking

These are the general limits for the steel beams.

- Vertical deflection of beams (variable load): Span/360 <20mm
- Vertical deflection of cantilever beams (variable load): Span/180 <20mm
- Vertical deflection of edge beams supporting cladding (variable load): Span/500 <10mm
- Vertical Deflection of edges of sensitive areas (Lift shaft thresholds): Span/500 <10mm
- Compound deflections for positions remote from columns: <25mm from position of support at Column.

- Vertical Deflection of Metal Decking at Centres of Spans between Supports (variable load): Span/360 <10mm
- Vertical Deflections of Metal Decking at Cantilever Edges: Span/180 <3mm

### 4.4.4 Horizontal Sway Deflection

- Horizontal frame deflections due to 50 year return wind loading to EN1991-1-4:2005 shall be limited to H/2500 (However please refer to the notes contained within item 2.8 of this Specification).

### 4.4.5 Vertical Column Shortening

- Maximum elastic column shortening per storey: 4mm

### 4.4.6 Foundations

The specified/expected tolerances and settlement for foundations are to be in accordance with the Institution of Civil Engineers Specification for Piling *and Embedded Retaining Walls Third Edition dated 2017* unless noted otherwise and quantified by the Contractor.

- Settlement of any part of the structure at working load is not to exceed *20mm*.
- Settlement of any individual pile at *working load is not to exceed 4.5mm and 6.0mm for 450mm and 600mm diameter piles, respectively. The pile settlement behaviour is to remain elastic at 1.5 x working load during any maintained load testing. Practically elastic rebound is required after the removal of test loading after the first load cycle – i.e.100% of design verification load (DVL).*
- *Pile group* settlement must not exceed *20mm*.
- Differential settlement between adjacent columns at working load is not to exceed *1/500.*

### 4.4.7 Adjacent Structures

Independent monitoring is to be undertaken to the Workhouse, North House, South House and neighbouring buildings. Monitoring will be carried out by placing movement targets on the existing walls in locations as shown on AECOM drawings **MHA-ACM-MON-00-DR-S-00001 & 00002** both included within *Appendix A* of this document.

The existing structures being retained must be maintained in position adhering to the following control conditions:

- Settlement of any part of the structure at working load is not to exceed 6mm or that which would cause any damage to the existing fabric.
- Overall Lateral Movement to not exceed h/1500 (Please trigger levels see below).
- Any cracking that manifests as a result of the retention must not exceed 1.0mm in width and should be limited as much as possible in stone facades to avoid extensive repairs

### 4.4.8 Monitoring of Secant Piling

During the monitoring periods, a traffic light warning system should be adopted with the trigger values being:

~~**For Demolition of the superstructure to ground floor level**~~

~~Green – No action is necessary – 0-11mm~~
~~Amber – Continue works but inform the CA and Structural Engineer Immediately – 11-15mm~~
~~Red - Cease all work in the vicinity and inform the engineer immediately – Greater than 15mm~~

**For Sub-structure Demolition (*bulk excavation and demolition of subterranean structures*)**

Green – No action is necessary – *Lateral deformation ($\delta$) less than 10mm and vertical deformations not exceed half of the values set out in Section 4.4.7 for adjacent structures.*
Amber – Continue works but inform the CA and Structural Engineer Immediately – *Lateral deformation ($\delta$) between 10 and 15mm. Vertical deformations not to exceed values set out in Section 4.4.7 for adjacent structures.*
Red - Cease all work in the vicinity and inform the engineer immediately – *Lateral deformation ($\delta$) greater than 15mm. Vertical deformations greater than the criteria set out in Section 4.4.7 for adjacent structures.*

The Contractor is to propose survey points for review and approval by AECOM SE prior to “Stage 1” as referred in the table below;

- Position survey points to ensure, as much as possible, that they will be accessible throughout the demolition and main contract works.
- Record results (monitor) at regular intervals – as per table below.

- The Contractor is to draw each elevation where monitoring locations are installed to ensure stop locations are accurately recorded on site.
- Readings are to be submitted weekly within 24 hours of monitoring work – readings to be submitted in tabulated and graphical formats.
- The Contractor is to provide samples of format to be used for approval.

### Monitoring Frequency

| STAGE | ACTIVITY | FREQUENCY OF READINGS | | |
|---|---|---|---|---|
| | | PRECISE LEVELLING | TOTAL STATION | INCLINOMETERS |
| 1 | Installation of total station targets – monitoring through demo and underpinning, prior to piling and deep excavation | None | Fortnightly | None |
| 2 | From start of piling works up to commencement of main excavation works | Weekly | Weekly | None (2nd base readings weekly prior to dig) |
| 3 | Main excavation works to completion of insitu RC works | Twice Weekly | Weekly | Weekly |
| 4 | Practical Completion | Fortnightly | Fortnightly | None |
| 5 | Defects liability period | None | None | None |

# Appendix A – Building Monitoring Requirement Drawings

| Document Reference | Document Title | Date | Revision |
|---|---|---|---|
| MHA-ACM-MON-00-DR-S-00001 | Building Monitoring Requirements – Sheet 1 | 20.07.18 | T1 |
| MHA-ACM-MON-00-DR-S-00002 | Building Monitoring Requirements – Sheet 2 | 20.07.18 | T1 |


GROUND FLOOR PLAN [LEVEL 00]

SPECIFICATION NOTE FOR MONITORING WORKS

- Structure to be kept in place: Locate and record initial positions.
- Positions as noted on this plan are indicative - exact locations to confirmed on site. Exact positions to be recorded and monitored by Main Contractor.
- Install monitoring locations on existing surfaces to be retained as demolition works proceed. - Position survey points to ensure, as much as possible, that they will be accessible throughout the demolition and main contract works.
- (In previous experience, this is likely to be approximately 1.0 m above corbel level to avoid damage)
- Record results (monitor) at regular intervals - as per table.
- Note: Record ◢+◣ targets local to the underpinning works, throughout the underpinning contract - or completion of underpinning works - 'Re-establish zero BM' for for main basement works'
- The contractor is to draw each elevation where monitoring locations are installed to ensure stop locations are accurately recorded on site.
- Readings are to be submitted weekly within 24 hours of monitoring work - readings to be submitted in tabulated and graphical formats.
- The contractor is to provide samples of format to be used for approval

DIFFERENT MONITORING INSTALLATIONS (REFER TO PLAN FOR LOCATIONS)

TARGET TO BE PLACED ON EXISTING WALLS TO ALLOW 'PRECISE - LEVELLING' TO BE UNDERTAKEN. NOTE: LOCATE THE POSITIONS AS CLOSE TO FOUNDATION LEVEL AS POSSIBLE.

HIGH LEVEL = H
MID LEVEL = M
LOW LEVEL = L

TOTAL STATION TARGETS TO BE LOCATED AT HIGH AND LOW - LEVEL ON EXISTING WALLS WHEN THEY ARE EXPOSED AND AFTER DEMOLITION.

MONITORING TARGETS TO BE AMENDED LOCALLY TO SUIT CONTRACTORS TEMPORARY WORKS SCAFFOLDING ETC.

SUMMARY OF PROPOSED TRIGGER LEVELS FOR INSTRUMENTATION.

| TRIGGER VALUES | GREEN ZONE. | AMBER ZONE. | RED ZONE. |
|---|---|---|---|
| Maximum Deflection Criteria. | Less than 75% of Predicted wall deflection values. | 75% of Predicted wall deflection values. | Predicted wall deflection values. |
| Equivalent Deflection Criteria. | <11mm | 11mm | 15mm |

(Refer to Structural Tolerance and Movement Report)

| STAGE | ACTIVITY | FREQUENCY OF READINGS | | |
|---|---|---|---|---|
| | | PRECISE LEVELLING | TOTAL STATION | INCLINOMETERS |
| 1 | Installation of total station targets – monitoring through demo and underpinning, prior to piling and deep excavation | None | Fortnightly | None |
| 2 | From start of piling works up to commencement of main excavation works | Weekly | Weekly | None (2nd base readings weekly prior to dig) |
| 3 | Main excavation works to completion of insitu RC works | Twice Weekly | Weekly | Weekly |
| 4 | Practical Completion | Fortnightly | Fortnightly | None |
| 5 | Defects liability period | None | None | None |

AECOM

**PROJECT**

# MIDDLESEX HOSPITAL ANNEXE

**CLIENT**

UCLHC

**CONSULTANT**

AECOM
Aldgate Tower
2 Leman Street
London, E1 8FA
www.aecom.com

**GENERAL NOTES**

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT DOCUMENTATION.
2. DO NOT SCALE FROM THIS DRAWING, USE ONLY PRINTED DIMENSIONS.
3. ALL DIMENSIONS IN MILLIMETRES, ALL CHAINAGES, LEVELS AND CO-ORDINATES ARE IN METRES UNLESS DEFINED OTHERWISE.
4. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH THE PROJECT HEALTH AND SAFETY FILE FOR ANY IDENTIFIED POTENTIAL RISKS.
5. FOR EXISTING LEVELS AND BUILDING FEATURES REFER TO THE LATEST REVISION OF THE MEASURED SURVEY DRAWINGS BY GREENMATCH SURVEYS. Ref: 13514 DATED JULY/AUG 2018 & UPDATED WORKHOUSE SURVEY SEPTEMBER 2018.
6. FOR GENERAL NOTES REFER TO DRAWING: MHA-ACM-XX-XX-GN-S-00001
7. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH THE AECOM DEMOLITION SPECIFICATION.
8. THE CONTRACTOR IS RESPONSIBLE FOR VERIFYING ALL SITE AND SETTING OUT DIMENSIONS BEFORE COMMENCING ANY WORK.
9. ALL TEMPORARY WORKS DESIGNS AND METHOD STATEMENTS TO BE SUBMITTED BY THE DEMOLITION CONTRACTOR TO THE CA PRIOR TO COMMENCEMENT OF THE WORKS.
10. ANY DISCREPANCIES MUST BE REPORTED TO THE CA BEFORE THE COMMENCEMENT OF ANY WORKS.

**ISSUE/REVISION**

| I/R | DATE | DESCRIPTION |
|---|---|---|
| T1 | 20.07.18 | TENDER ISSUE |

**KEY PLAN**

**PROJECT NUMBER**

60516144

**SHEET TITLE**

BUILDING MONITORING REQUIREMENTS - SHEET 1

**SHEET NUMBER**

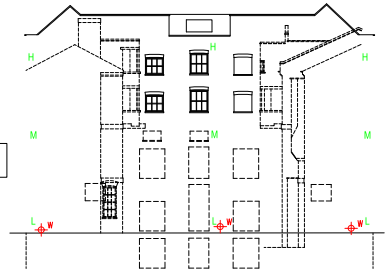
MHA-ACM-MON-00-DR-S-00001


VIEW A


VIEW B


VIEW C

TARGETS TO BE INSTALLED AFTER DEMOLITION




TARGETS TO BE INSTALLED AFTER DEMOLITION

VIEW D

SPECIFICATION NOTE FOR MONITORING WORKS

- Structure to be kept in place. Locate and record initial positions.
- Positions as noted on this plan are indicative - exact locations to confirmed on site. Exact positions to be recorded and monitored by Main Contractor.
- Install monitoring locations on existing surfaces to be retained as demolition works proceed. - Position survey points to ensure, as much as possible, that they will be accessible throughout the demolition and main contract works.
- (In previous experience, this is likely to be approximately 1.0 m above corbel level to avoid damage)
- Record results (monitor) at regular intervals - as per table.
- Note: Record ⊕ target's local to the underpinning works, throughout the underpinning contract - or completion of underpinning works - 'Re-establish zero BM for for main basement works'
- The contractor is to draw each elevation where monitoring locations are installed to ensure stop locations are accurately recorded on site.
- Readings are to be submitted weekly within 24 hours of monitoring work - readings to be submitted in tabulated and graphical formats.
- The contractor is to provide samples of format to be used for approval

DIFFERENT MONITORING INSTALLATIONS (REFER TO PLAN FOR LOCATIONS)

W TARGET TO BE PLACED ON EXISTING WALLS TO ALLOW 'PRECISE - LEVELLING' TO BE UNDERTAKEN. NOTE: LOCATE THE POSITIONS AS CLOSE TO FOUNDATION LEVEL AS POSSIBLE.

HIGH LEVEL = H
MID LEVEL = M
LOW LEVEL = L

TOTAL STATION TARGETS TO BE LOCATED AT HIGH AND LOW - LEVEL ON EXISTING WALLS WHEN THEY ARE EXPOSED AND AFTER DEMOLITION.

MONITORING TARGETS TO BE AMENDED LOCALLY TO SUIT CONTRACTORS TEMPORARY WORKS SCAFFOLDING ETC.

SUMMARY OF PROPOSED TRIGGER LEVELS FOR INSTRUMENTATION.

| TRIGGER VALUES | GREEN ZONE. | AMBER ZONE. | RED ZONE. |
|---|---|---|---|
| Maximum Deflection Criteria. | Less than 75% of Predicted wall deflection values. | 75% of Predicted wall deflection values. | Predicted wall deflection values. |
| Equivalent Deflection Criteria. | <11mm | 11mm | 15mm |

(Refer to Structural Tolerance and Movement Report)

| STAGE | ACTIVITY | FREQUENCY OF READINGS | | |
|---|---|---|---|---|
| | | PRECISE LEVELLING | TOTAL STATION | INCLINOMETERS |
| 1 | Installation of total station targets – monitoring through demo and underpinning, prior to piling and deep excavation | None | Fortnightly | None |
| 2 | From start of piling works up to commencement of main excavation works | Weekly | Weekly | None (2nd base readings weekly prior to dig) |
| 3 | Main excavation works to completion of insitu RC works | Twice Weekly | Weekly | Weekly |
| 4 | Practical Completion | Fortnightly | Fortnightly | None |
| 5 | Defects liability period | None | None | None |

AECOM

**PROJECT**

MIDDLESEX HOSPITAL ANNEXE

**CLIENT**

UCLHC

**CONSULTANT**

AECOM
Aldgate Tower
2 Leman Street
London, E1 8FA
www.aecom.com

**GENERAL NOTES**

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT DOCUMENTATION.
2. DO NOT SCALE FROM THIS DRAWING. USE ONLY PRINTED DIMENSIONS.
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**KEY PLAN**

**PROJECT NUMBER**

60516144

**SHEET TITLE**

BUILDING MONITORING REQUIREMENTS - SHEET 2

**SHEET NUMBER**

MHA-ACM-MON-00-DR-S-00002