

MCFC North Stand Extension

Project Specification for Piling

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28 July 2023

Revision P03

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author

Alice K Shrubshall

date

28th July 2023

approved

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28th July 2023

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1 Introduction

1.1 Specification

The Specification for the works shall be the **Institution of Civil Engineers' Specification for Piling and Embedded Retaining Walls (SPERW)**, Thomas Telford, 2017, with amendments and Project Specifications, as noted in the Sections below.

Throughout this Specification the term Contractor shall apply to the party with agreed responsibility as determined by the subcontract Agreement between the Main Contractor and Piling subcontractor.

2 Project Specifications and Amendments to the ICE SPERW

The Section numbers and letter references given in the Project Specification relate to those given in the SPERW.

Amendments

None.

Project Specification (SPERW Clause 1.2)

(a) Role of the contract administrator

The role of contract administrator shall be undertaken by TBC.

(b) Location and description of the site

The Site covers some 3.3 ha, north of Manchester City Football Club Stadium located off Joe Mercer Way. It is centred on National Grid Reference SJ 86777 98676 within the remit of Manchester City Council. The Stadium, City Shop and surrounding infrastructure currently occupy the Site. To the north are Ashton Canal, Joe Mercer Way with the new Co-Op Live arena to the north east, Alan Turing Way to the east and the Manchester Tennis and Football Centre to the east. Beyond these is Sportcity Way. To the south is the Manchester City Football Club Stadium.

The extent of the Site is shown below in **Figure 2-1**.

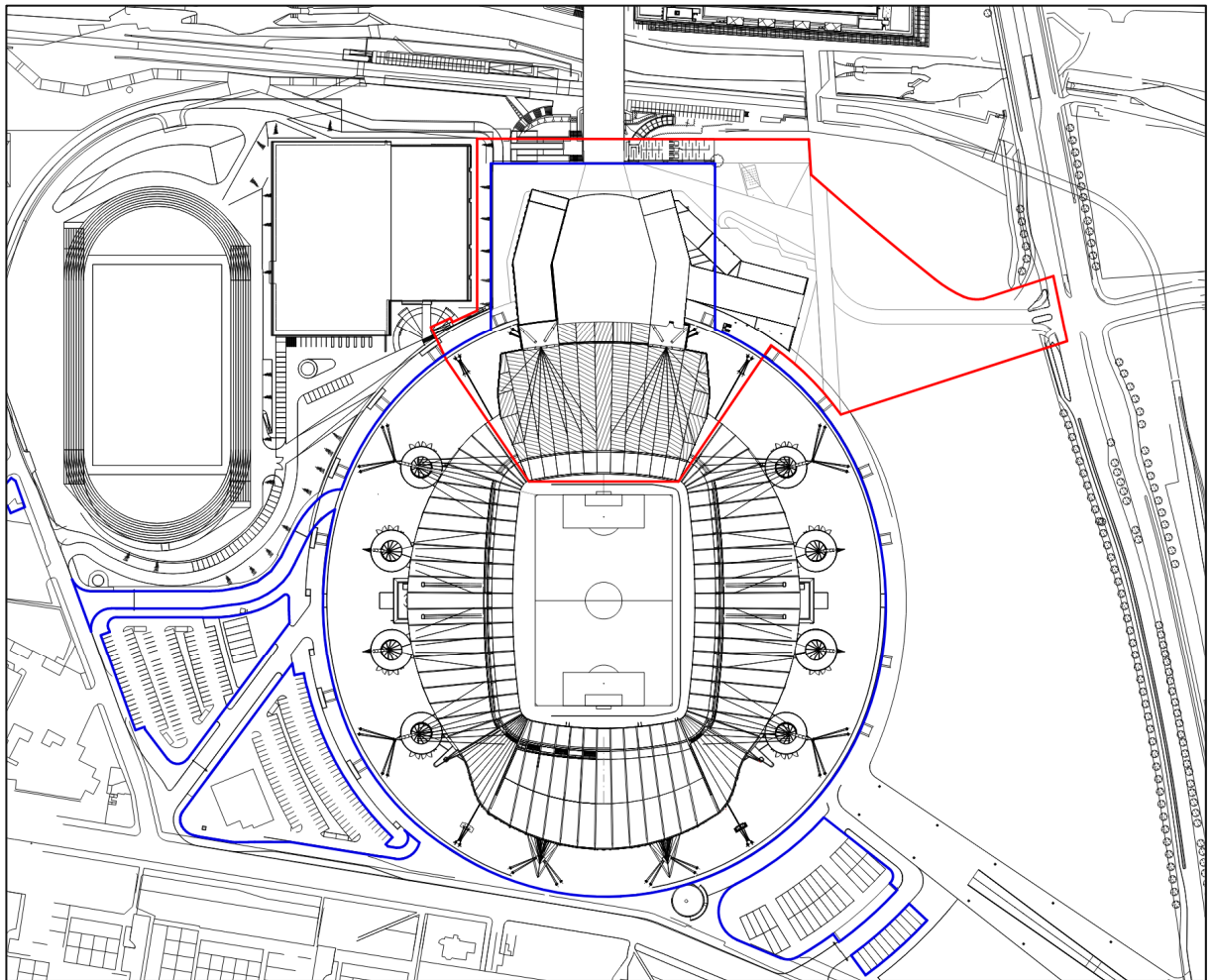


Figure 2-1 Extent of site (red line)

(c) Nature of the works

The works shall comprise the design and construction of foundation piles.

This shall include, but is not necessarily limited to:

- Final design and construction of the piling works including, but not limited to, method statements, design statements, reporting, risk assessments, submissions for approvals and record drawings.
- Liaison with the Main Contractor with regards to adequacy of probing, preparatory and enabling works to enable foundation pile construction.
- The design and undertaking of works required to the site preparation in advance to the installation of piles, such as providing a construction platform and grouting.
- Agree with the Main Contractor working platform requirements and responsibilities.

- Installation of compression working piles and tension working piles (as detailed in the piling schedule, subject to Contractor proposals). All piles to be given a unique identifying reference, either by number of letter/number. Piles are rotary bored cast in situ and/or Continuous Flight Auger (CFA).
- Removal of obstructions and/or existing foundations if required.
- Construction of 2No. test bores to be left overnight (minimum 24 hours) and inspected for collapse using CCTV.
- Installation and testing of preliminary test piles/bores (trial piles) in advance of the main works, subject to Contractor proposals. The location and load testing requirements for the preliminary test piles are to be agreed in advance with the Contract Administrator and Engineer. Minimum 1No. test each in tension and compression.
- Liaise with the Main Contractor with regards to removal of all pile spoil arising from the site to an appropriately licensed waste management facility.
- Working tests of 1.5% of each type of working compression piles, including both CFA and rotary bored piles, and associated reporting (percentage of testing assumed subject to agreement with the Engineer and relevant authorities).
- All pile test locations are to be agreed with Building Control.
- Integrity testing of all piles as per Section 2.4 (and associated reporting).
- Pile cut-off and head preparation in accordance with appropriate means and methods as set-out in the specification.
- Data processing and reporting of all preliminary and contract working pile test results, including concrete tests and integrity tests.
- Preparation of relevant risk register, assessment and submissions in accordance with current Health, Safety and Environmental Legislation (e.g. CDM 2015, LOLER 1998, PUWER 1998, EA guidance etc.) including engineering/technical risks (e.g. from artesian groundwater, pile bore stability, contamination, ground gas, combustion of coal seams etc.), prior to commencement on site. The Contractor is responsible for compliance with appropriate health and safety legislation and in addition the requirements in this regard of stakeholders including but not limited to the Coal Authority and Building Control.
- Reporting and production of as-built survey records of all piles as per specification requirements.

All details and programming are to be confirmed by the Main Contractor and Contract Administrator.

This performance specification is in respect of the Permanent Works only, any Temporary Works requirements are the sole responsibility of the Contractor.

(d) Working area

The working area shall be determined by the Contractor in consultation with the Main Contractor (as per site boundaries identified in the Main Contract Documents).

The Contractor shall liaise with the Main Contractor and Contract Administrator with regards to any other activity on site throughout the duration of the piling and associated works contract, including material set-down/storage, accommodation and welfare areas.

Unless otherwise agreed, the Main Contractor shall also provide all the appropriate working requirements as given in the following Federation of Piling Specialists documents:

- Piling: Pre-commencement Requirements;
- Schedule of Attendances and Facilities to be provided by the Client to the Contractor.

Existing buried services and foundation obstructions information is shown on the relevant Contract Documents. Numerous existing buried services are known to exist on site and a series of surveys and records are available – The contractor should familiarise themselves with all the relevant service information/drawings/diversions information available. No damage/adverse effects to existing services is allowed. Concrete obstructions were also encountered during the ground investigation, refer to the Factual Report for details. Their locations are indicative only and no assurance is given to its accuracy.

The Contractor shall refer to the Contract Administrator for any records or risk assessments in relation to potential specialist underground features, such as Unexploded Ordnance (UXO) and archaeology.

The Contractor shall obtain all required permitting/licenses or similar authority approvals in relation to his proposed works and all aspects of this specification. The Contractor shall present his strategy in this regard with his Tender. A Coal Authority permit will be required for this site.

(e) Sequence of the works and other works proceeding at the same time

The sequence of works will be provided by the Contractor prior to commencement of the works and agreed with the Contract Administrator and Engineer.

Where preliminary pile testing is carried out (subject to Contractor proposals), it shall be completed prior to installation of the contract working piles. However, if the Contractor chooses to carry out these works concurrently, installation of working piles will be undertaken at the Contractor's risk.

(f) Contract drawings

Refer to the Main Contract documentation for details, including piling schedule and substructure drawings. The Contractor shall ensure that the latest revision of all documentation is obtained from the Contract Administrator.

(g) Construction tolerances

As per SPERW Table B1.4. Departures from this are as noted on the contract drawings. Where piling is to be undertaken from a higher level, the Contractor is to ensure that the tolerances are met and the Contractor is to allow for additional eccentricity at pile head cut off level.

(h) Submission of information

The information which shall be submitted at the stated stages of the Works Contract is listed in Table B1.1 of the Piling Specification.

In addition, following subcontract award but prior to commencement of construction, the Contractor shall submit the following details:

- Type of piles offered and installation method, including details of the rig and other plant/machinery required. The Contractor shall also include full details of any additional probing proposed.
- A priced and programmed scope of any investigation works to supply the information the Contractor considers necessary to complete a safe, economical design meeting the requirements of this Specification.
- Intended standards of control in terms of performance of the design and including setting out.
- Details of how the calculation and checking of the load carrying capacity (axial & lateral, in compression & tension), settlement and reinforcement requirement of the piles will be carried out
- Details of proposed testing or proof loading to verify performance requirements.
- Assessment of the noise and vibration characteristic of the proposed foundation piling operations and their attenuation with distance will be dealt with.
- Details of the methods proposed for drilling (including an assessment of the likely effects of “flighting” if CFA techniques are adopted), together with the methods of transporting and placing concrete in the pile bores.
- Details of the proposed corrective actions if the following situations occur:
 - breakdown of the rig during pile installation.
 - obstructions encountered at depth.
 - water ingress into the pile bore.
 - concrete supply is not available after completions of the pile bore or if its supply is interrupted during the concrete pour.

Prior to the acceptance of the design, where Contractor designed or an alternative design has been proposed, the Contract Administrator and the Engineer will require submission of detailed design calculations with the design submission. The calculations shall clearly state the parameters and assumptions used, with justification for them, and the analytical formulae used, and present the results, including (as a minimum) submission of pile load capacity, pile settlement calculations. The Contractor retains responsibility for the adoption of any proposals and their compliance with this specification.

The Contractor’s attention is drawn to horizontal forces, moments and negative skin friction, loads that must be considered in addition to compressive forces when designing the proposed piles. The Contractor is to determine any loads from temporary works. Consideration shall be given to the possibility of additional loads on the piles if they are to be installed prior to excavation.

Information may be submitted electronically or in hard copy as agreed with the Contract Administrator. All records shall be signed.

Where Table B1.1 and the associated Specification clause require records to be provided ‘within 24 hours’, they shall be provided by not later than noon of the next working day.

Records shall be kept for the installation of each pile element as indicated by an asterisk in the SPERW documentation and two signed copies of these records shall be submitted to the Engineer not later than noon of the next working day after the pile element was installed. The signed records will form a record of the work. Any unexpected driving or boring conditions shall be noted in the records.

Within 1 week of completion of pile installation, the Contractor shall produce as-built drawings showing the exact surveyed plan positions related to the site grid, the cut-off elevations of the piles, and their installed lengths/diameters/section properties and toe elevations. The pile numbering, layout, scale and format of the drawings shall be agreed with the Main Contractor and Engineer during the initial stages of the Contract.

Within 2 weeks of installation of the final pile, the Contractor shall produce a completion report, as defined in Clause B1.12.2, which shall also contain the as-built survey records of all piles including all construction record, contract correspondence on variations to the piling construction works and pile locations plans. The report shall be submitted within two weeks of practical completion of the works.

(i) Responsibility for design, including any division of this responsibility

Option 2 (contractor provides design of piles and/or embedded retaining walls) is specified, with the division of design responsibility being presented as follows:

Design Responsibility	Employer	Contractor
Design of foundation scheme (including F_{rep} and location of load support)	X	
Choice of piling and method		X
Design of piles to carry specified loadings		X

The Engineer's foundation scheme developed for costing purposes is shown on drawings listed under section 2.1(f). No responsibility is accepted for incorporation of the scheme as part of the detailed design. The foundation pile details including specified loadings are tabulated in the schedule (refer to section 2.1(f)). The Contractor may, subject to the approval of the Engineer, undertake his own design of the layout of piles but shall have due regard to potential effects on ground movements and structural performance including settlements, taking due account of potential group effects where applicable.

The Contractor is responsible for applying the appropriate ULS load combinations in accordance with BSEN1990, BSEN1991 and BSEN1997.

Where the Contractor's design differs from the Engineer's foundation scheme, account should be taken of any knock-on effects on the design of other associated substructure elements including but not limited to columns, pile caps, ground beams, utility arrangements, etc. Where these or other structural elements (see Contract Drawings) are required to change due to the Contractor proposed pile design, the Contractor shall carry out the design of these elements and provide revised general arrangement and detail drawings as necessary for review by the Engineer.

(j) Design standards and criteria for the piles or walls including design life

All pile elements shall be designed in accordance with 'Eurocodes', together with the relevant UK National Annexes and execution standards. This shall include, but is not necessarily limited to: (a) BS EN 1990; (b) BS EN 1992-1; (c) BS EN 1993-5; and (d) BS EN 1997-1.

All piles shall be designed for a service life of 50 years.

Maximum crack width to be 0.3mm for direct tension and flexure in accordance with BS EN 1992_1_1: clause 7.3. Tensile stress in reinforcement to be reduced accordingly, depending on crack width and bar spacing.

For all piles reinforcement is to be provided through the Made Ground and into natural material as a minimum. Tension piles are to be reinforced full length, or to a level anchored beyond the point at which the pile designer can demonstrate that sufficient geotechnical capacity is achieved.

Durability (concrete in aggressive ground) criteria shall be in accordance with BRE Special Digest 1 (2005).

The Contractor shall produce calculations and any required design related documentation in order to satisfy all relevant stakeholders and authorities (including but not limited to Building Control, Manchester City Council, Coal Authority, Environment Agency, Canal and River Trust,). The Contractor shall coordinate all such requirements with the Main Contractor, Contract Administrator and Engineer.

(k) Constraints on design, including the need to verify design assumptions

The contractor shall provide details of his proposed design basis for Buro Happold's review at tender stage. This information shall include but is not necessarily limited to:

- Soil stratigraphy – including coal seam depths (see below);
- Groundwater levels;
- Characteristic geotechnical parameters;
- Partial factors;
- Example calculations demonstrating the means by which characteristic shaft and base resistance values have been obtained;
- Negative skin friction calculations (in areas where appropriate); and
- Any assumptions and/or limitations which are inherent to the design.

The Contractor's attention is drawn to the presence of a number of coal seams present beneath the site and associated structures (shafts) in close proximity to the site. The Contractor must produce a detailed ground model for the site showing these constraints and appropriate analysis of their impact on the pile design. In addition the Contractor shall include within their design philosophy and construction control measures details of how the risk of potential mine workings (including unrecorded shafts) and presence of coal seams that may impact on the theoretical pile load capacity is to be managed and mitigated.

If installation records indicate that the pile is founded on or encounters unexpected weak ground not as anticipated, the Contractor shall review the design and propose design modifications as appropriate. The Contractor is responsible for ensuring that the Coal Authority are satisfied that the piling methodology sufficiently mitigates the risks associated with the coal seams and historic shafts.

The Contractor is to ensure that their chosen piling methodology is adequate to deal with any possible obstructions or that they have been removed ahead of piling operations. Consideration should be given to probing ahead of piling in areas of obstructions.

A detailed UXO risk assessment has been undertaken and is provided within the following report:

- 6Alpha Associates (October 2022). "Detailed Unexploded Ordnance (UXO) Threat and Risk Assessment, MCFC North Stand." Project Number 10147

Chemical Concentrations within the Made Ground are presented in the Factual Report and the Contractor is to review the available data and adapt their construction methodology, accordingly, taking into account the more onerous material disposal requirements.

The Contractor is responsible for preparing documentation for all relevant submittals required for obtaining approvals/consents required for the proposed works.

Prior to commencing on site, the contractor shall be responsible for undertaking consultations with the Local Authority's Environmental Health Officer (EHO) and the Environment Agency (EA), and preparing a submission (including method statements and foundation works risk assessment) to demonstrate that the piling operations will not adversely affect the quality of the land or controlled water beneath the site and its surrounding areas. The pile type and installation method shall meet all the statutory requirements with respect to pollution prevention on land affected by any contamination, including not transporting any contaminated materials down water during pile installation and construction.

Work is required in close proximity to the existing backstay foundations. The Contractor is to ensure that their methodology does not cause distress or permanent movement to the roof.

Any Temporary works requirements are the responsibility of the Contractor.

(l) Working platform and commencing surface level

As per contract documents. Requirements to be agreed with the Main Contractor.

(m) A schedule of specified actions (or specified working loads)

As per contract drawings.

(n) Pile or wall element dimensions

As per contract drawings.

(o) Preliminary piles and trial bores/drives/panels

The Contractor shall confirm any preliminary pile testing intent within his Tender which shall include a minimum of 1No. each preliminary pile tests in compression and tension, and 3No. further trial bores where CFA piles are proposed. The purpose of these trials is to ensure that CFA piling is an appropriate methodology given the geological risks on the site.

Further to the above an assessment into the impact of construction delays on pile bores shall be undertaken. 2No. bores shall be left open for 24 hours, then inspected (CCTV and depth measurement) for collapse. The CFA trial bores can be utilised for this purpose, however, where both CFA and rotary piles are proposed, a minimum of 1No. test bore shall be constructed using rotary techniques.

Any preliminary testing proposals shall substantiate number of piles to be tested, type of test, loading details and design intent optimisation and submitted to the Contract Administrator and Engineer for review.

(p) Performance criteria for the structure to be supported on the piles or by the wall

For information, the settlement of the structure is limited to 15mm at SLS, with differential settlement between adjacent load supports being limited to 10mm. Lateral movements are to be limited to 5mm.

(q) Performance criteria for piles under test or wall elements during service (see Tables B1.2, B1.3)

Tables B1.2 below states the performance criteria expected of the piles.

When a Preliminary Pile test is carried out, the Failure Load is defined as the constant load at which the test pile continues to settle at a steady rate or the load at which the maximum settlement of the pile top during one continuous loading cycle is one tenth of the pile base diameter, whichever is the lesser.

When no preliminary pile test is carried out the Failure Load is defined as the calculated ultimate load.

When the Failure Load is measured, the DVL is the Failure Load divided by the Load Factor.

When the Failure Load is not measured, the DVL is the calculated ultimate load for the pile divided by the specified Load Factor.

Refer to section 2.1(o) for further details regarding potential preliminary pile testing.

Table B1.2a Performance Specification Criteria for Piles		
Pile ref.		To be confirmed by the Contractor
Permitted type(s) — Performance Specification Section No.		Bored, CFA
Specified working load – SWL (kN)		As per piling schedule (refer to Contract Administrator or Engineer for latest revision)
Pile designation		Compression
Pile testing	Working Piles	1.5% of each type of working pile including both CFA and rotary bored. Contractor is to ensure that Building Control are satisfied with the testing proposals.
	Preliminary Pile(s)	Refer to section 2.1(o). The Contractor shall review and propose any potential preliminary testing as part of his Tender

Table B1.2a Performance Specification Criteria for Piles	
Design verification load – DVL (kN)	The Contractor shall confirm the DVL based on his intended testing regime. The Contractor's evaluation of the DVL shall account for all design and installation conditions relevant at the time of the proposed testing. The Contractor shall evaluate the DVL by means of calculation and shall submit to the Engineer for review
Permitted settlement at DVL (mm)	6mm for a 450mm diameter pile 6mm for a 600mm diameter pile 8mm for a 750mm diameter pile Where an alternative pile size is proposed by the Contractor, permitted settlements are to be agreed.
Permitted settlement at DVL + 1/2 SWL (mm)	8mm for a 450mm diameter pile 10mm for a 600mm diameter pile 12mm for a 750mm diameter pile Where an alternative pile size is proposed by the Contractor, permitted settlements are to be agreed. (any deviation from permitted settlement at DVL + 1/2 SWL is subject to agreement with the Engineer)
Permitted lateral movement at SLS	5mm
Piling Platform Level(s)	Contractor's design
Cut Off Level(s)	As per piling schedule (refer to Contract Administrator or Engineer for latest revision)
Minimum pile length from cut-off-level to toe (m)	To be determined by the Contractor
Minimum or maximum pile diameter or dimensions of cross section (mm)	Refer to piling schedule (see section 2.1(f))

Where preliminary pile testing is undertaken the criteria in table B1.2a shall be reviewed and revised criteria agreed if required. If preliminary pile performance is within the criteria specified, the criteria stated in the table shall be adopted.

(r) Sampling and testing of materials (other than concrete)

Not specified.

(s) Permissible damage criteria for existing critical structures or services

No damage to neighbouring structures or services is permitted as a result of piling installation operations. The contractor shall be responsible for repair of any damage arising from the pile installation works.

If the Contractor considers that by any means arising from his proposed works, the neighbouring structures or infrastructure may be significantly damaged, this should be stated in the Tender alongside any necessary protective/mitigation measures.

(t) Additional temporary works plant and duration of loading for which the working platform should be designed

To be coordinated with the Main Contractor

(u) Site datum and site grid

As per contract drawings.

The Contractor shall be responsible for setting out all pile locations to the agreed site datum and grid prior to the commencement of works.

(v) Restrictions on permissible working hours

As per contract documents.

(w) Restrictions on noise and vibration levels

The Contractor is to provide adequate noise and vibration information to satisfy stakeholders (including but not limited to service providers, local residents) that their working methodology will not cause disruption or damage to adjacent assets.

The assumed limits from Cadent are as below:

"Any piling or boring work within 15m of any of the buried gas plant should not be allowed without an assessment of the vibration levels at the location of the gas plant, for steel and PE the peak particle velocity at the asset should be limited to 75mm/sec. Where the PPV is predicted to exceed 50mm/sec, an assessment of the asset stress state, which includes the incremental load due to vibration, is required. For cast iron or ductile iron asset the PPV should not exceed 25mm/sec."

The Contractor should note that other stakeholders may have more onerous requirements and are responsible for obtaining these requirements and complying with them.

(x) Site Investigation including geotechnical and geo-environmental information, and the need for further ground investigation

A number of relevant historic reports are contained within the contract documents and summarised in Table 2-1 below.

Table 2-1 Summary of historic ground investigation / remediation reports available

Date	Author	Title	Location
1991	Northern Foundations Ltd	Various documents (S.I. 5400): Appendix A and Appendix B, borehole logs, drawings, groundwater and ground gas data	Eastlands (Etihad Campus area) excludes gas works site.
1995	Northern Foundations Ltd	Reports on Phase 2 site Investigations at Eastlands, Manchester Plot 16-19 and Plot 23	Across the Stadium area
1998	Norwest Holst	Report on Ground Investigation at Manchester Stadium Area S. Volume 1 to 4.	Across the Stadium area
2000	Alfred McAlpine Civil Engineering Ltd	Site Remediation Completion Report	Across the Stadium area
2010	May Gurney	Site Investigation Report No SI565 Final	Across the Etihad Campus area, information relevant to the site includes Area A Central
2011	Buckingham Group Contracting Ltd	Remediation Validation Report, Area A Central	Across the Etihad Campus area, information relevant to the site includes Area A Central (covers eastern part of the Site only)
2014	ESG	Report No A3174-13 Factual and Ground Conditions Report - Expansion of North and South Stands	Across the northern and southern Stadium expansion areas

The output reports for the investigations undertaken are provided to the Contractor by the Employer for information. Neither the Employer nor the Engineer offer any warranty, guarantee or undertaking of any kind as to the accuracy of these investigations and none should be inferred.

Ground investigation works were also undertaken by Geotechnical Engineering Limited (GEL) specifically for this development in December 2022. The scope of the works was as follows:

- 8 No. boreholes to depths between 45m and 65m bgl. Boreholes to be cable percussion with rotary follow on;
- 3 No. windowless sample holes through the Made Ground (initially trial pits but owing to site constraints altered to windowless sample holes);
- 4 No. machine excavated trial pits to depths between 3m and 4m bgl, through the Made Ground;
- 5 No. vacuum excavated observation trenches to depths between 2m and 3m bgl, to identify services;
- 8 No. static Cone Penetration Testing (CPT)
- 2 No. In situ California Bearing Ratio (CBR) tests;
- Standard Penetration Testing (SPTs);
- Downhole geophysics in selected locations;
- Standpipe installations within all borehole and window sample locations;
- Geotechnical and geoenvironmental laboratory testing; and
- Groundwater and ground gas monitoring (including a six-round post fieldwork monitoring programme).

The ground conditions encountered on the Site are summarised below in Table 2-2.

Table 2-2 Encountered geological conditions

Strata	Description	Top of Strata		Thickness (average) m
		m BGL	m OD	
Made Ground	Tarmac across the majority of the Site (with the exception of those locations in the east).	0.0		0.1
	Light grey concrete and limestone GRAVEL (Type 1 material). Occasionally a geotextile identified separating this material from the underlying Made Ground (generally recorded between 0.3 – 0.5m bgl).	0.1		0.15 – 0.4 (0.2)
	Brown to dark grey silty sandy GRAVEL or sandy gravelly CLAY. Gravel is fine to coarse, subangular to subrounded, brick, concrete, sandstone, limestone, quartzite, clinker, rare glass and metal. Occasional concrete and brick obstructions. Occasional hydrocarbon odours.	0.3-0.5		3.0 – 8.0 (4.8)
Glacial Till	Soft to firm light grey mottled light brown slightly sandy silty CLAY. Stiff becoming very stiff brown to grey slightly sandy slightly gravelly CLAY.	3.0 – 8.0		9.7 – 12.6 (11.4)
Coal Measures	Extremely weak to weak light grey to dark grey MUDSTONE. Bedding fractures are sub-horizontal to 20° and sub-vertical to 80°. Mudstone becomes carbonaceous and occasionally tends to black pyritic COAL. Moderately weak grey SILTSTONE, locally with thin interlaminated mudstone. Moderately weak light grey fine to medium SANDSTONE with extremely closely to closely spaced thinly and thickly interlaminated mudstone and siltstone.	15.0 – 17.7		Not proven

The full findings of this investigation are contained in Geotechnical Engineering Limited (2023), "Etihad Ground Investigation", report ref 37349 version C (Final).

The Contractor should satisfy himself that sufficient investigation and testing has been undertaken and if he considers it necessary, he should supplement it with further testing. Any such proposals shall be submitted to the Contract Administrator for approval.

(y) Disposal of excavated material and trimmed excess pile and wall material

The Contractor is responsible for the assessment, removal and disposal of spoil, pile arisings and excess concrete from the site produced by piling and associated works.

Spoil and arising generated as a result of the works will require disposal in accordance with the Environmental Protection Act 1990, The Landfill (England and Wales) regulations 2002, Environmental Permitting (England and Wales) Regulations 2007/3538 and any other relevant statutory instruction and guidance.

The Contractor shall inform the Contract Administrator and Engineer immediately if suspected contaminated materials are encountered.

(z) Other particular technical requirements

- The Contractor is required to work to a Quality Management system established in accordance with BS EN ISO 9001:2015. Details shall be provided prior to commencement on site.
- Where it is intended to penetrate the ground for the purpose of rig calibration, construction of auger flights, trial piling, proof drilling, or any other purpose except for construction of the permanent works, the Contractor must obtain prior permission from the Contract Administrator. Where this does or is likely to require an increase to the plan area of the working platform beyond that necessary for the permanent works, then the Contractor shall obtain permission prior to the commencement of the works.
- Probing may be carried out at the Contractor's discretion. Where probing is carried out prior to piling the depth and details of probing will be as detailed by the Contractor. Probing should be carried out using appropriate approved equipment of lesser diameter than the pile, using the same setting out criteria as for the piles themselves.
- Probing must be programmed to suit the overall piling programme and must be incorporated in the programme submitted by the Contractor. Due allowance must be made for possible redesign/rearrangement of piles and for any re-probing required to suit revised details.
- The upper portion of concrete piles above cut-off level shall be removed by mechanical means (mechanical pile breaker (cracker)) by the Contractor. The reinforcement shall be de-bonded between the commencing surface and cut-off level to allow the clean removal of the upper portion of the pile. The use of hand-held pneumatic tools shall be avoided as far as practicable. Where such use cannot be eliminated, it shall be undertaken with due regard for the Health and Safety of the operators, particularly in respect of 'vibration white finger' and similar adverse effects, and shall comply with the Control of Vibration at Work Regulations 2005.
- The specialist Piling Contractor shall provide full time site supervision and attendance by personnel experienced in piling works of the nature of this contract. The supervisory staff will be responsible for ensuring that all aspects of the Specification are satisfied during the construction of the piles throughout the piling works. The specialist Piling Contractor shall not remove engineers from site without obtaining written permission from the Contract Administrator.
- The Contractor shall liaise with the Main Contractor and Contract Administrator with regards to other on-going works and investigation. The Contractor shall make appropriate allowance for coordinating his works with other specialist/trade contractors appointed for other supporting elements of work. The Contractor shall liaise with the Contract Administrator on a weekly basis (as a minimum) with regards to the items and facets outlined under this point.
- If/where unrecorded features are encountered; the Contractor shall inform the Contract Administrator and Engineer immediately. The Contractor shall survey and document any unrecorded features prior to agreeing clearance action with the Contract Administrator and Engineer.
- The Contractor's design shall be closely coordinated with the Main Contractor's requirements and supply chain.
- The Contractor shall consider the environmental impact (and embodied carbon) and supply chain environmental credentials when evaluating its procurement strategy. This shall be described in his Tender.

(aa) Special requirements for retaining walls

- n/a
- (bb) Loads on walls and excavation depths**
- n/a
- (cc) Details of surrounding structures, their foundations, and associated loadings**
- As per contract documents.
- (dd) Water retention function and degree of retention for retaining wall in both temporary and permanent conditions**
- n/a
- (ee) Design external groundwater level for water retention system water-tightness**
- n/a
- (ff) Design water retention grade for permanent overall system and the role of the retaining wall as a system component**
- n/a
- (gg) Programme for water-tightness inspections**
- n/a
- (hh) Permissible limits on ground movement during wall installation**
- n/a
- (ii) Details of surrounding services including distance, depth, and permissible movement**
- As per contract drawings.
- Unless noted otherwise in the contract documents, all services shall remain in an operative condition throughout the works.

2.1 Bored Cast-In-Place (SPERW Clause B3)

Amendments

None.

Project Specification (SPERW Clause B3.2)

(a) Support fluid

Contractor to propose at tender stage.

(b) Base or shaft grouting

Not required.

(c) Pile shaft and base inspection by CCTV and or sampling/probing (see SPERW Clause B3.5.8)

Where the Contractor's pile design is dependent on end bearing from strata other than coal seams, the Contractor is to detail the proposed methodology in the design and for construction verification (e.g. inspection of the base of the pile) to prove that it has not terminated within or in close proximity to a coal seam or associated weak strata. A plan or series of sections shall be produced upon which the as encountered coal can be plotted and compared to the anticipated pile toe location.

(d) Details of permanent casings

Not required.

(e) Inspection of underreams

Not required.

(f) Ribbed piles

Not required.

(g) Details of plunge columns

Not required.

(h) Other particular technical requirements

- i) The Contractor shall allow for any appropriate obstruction mitigation measures. Probing ahead of piling shall be considered in areas of known obstructions.
- ii) Integrity testing as per Section 2.4.

2.2 Piles Constructed Using Continuous Flight Augers or Displacement Augers (SPERW Clause B4)

Amendments

Item B4.4.10.3 shall be amended as follows:

Delete; 'Prior to the commencement of piling, the contractor shall inform the contract administrator of values of the following parameters:'

Replace with; 'The contractor shall submit values for the following parameters for the contract administrator's review. These values are to be agreed with the contract administrator prior to the commencement of piling'.

Item B4.2(c) shall be amended as follows to correct a printing error in the SPERW third edition:

Delete: "... (see clause B4.4.5.3) "

Replace with: "... (see clause B4.4.6.3) "

Project Specification (SPERW Clause 4.2)

(a) Permitted pile types

CFA piles only.

(b) Whether splitting of augers shall be permitted

Not permitted.

(c) Whether concrete supply is to be controlled by pressure or volume (see SPERW Clause B4.4.5.3)

Contractor to propose at tender stage. The Contractor shall provide full details of the method of controlling concrete delivery and placement, indicating the nature of the monitoring equipment and where each sensor is placed on the piling equipment.

(d) Detailed requirements for monitoring records

Automated monitoring system data shall be provided to the contractor administrator by noon of the day after construction of each pile. All data shall be provided in an interpreted format and in accordance with Clause B.4.4.10.1.

(e) Whether compressed air shall not be permitted to assist with boring

Not permitted.

(f) Other particular technical requirements

- i) Further to Item B4.4.10.3 of the SPERW; if the value of auger revolution per metre is less than the target minimum value or greater than the target maximum value, then the workmanship of the pile shall be considered a non-conformance and shall be subject to Item B1.16 of the SPERW and may be subject to additional proof load testing.
- ii) Further to Item B4.4.10.3 (ii) of the SPERW; if the percentage concrete over-supply is less than the target minimum value or greater than the target maximum value, then the workmanship of the pile shall be considered a non-conformance and shall be subject to Item B1.16 of the SPERW.

- iii) Integrity testing as per Section 2.3. All piles up to and including 600mm diameter constructed using continuous flight auger (CFA) equipment shall be integrity tested. Larger diameter piles constructed using CFA equipment shall be selectively tested. Integrity testing shall be carried out in accordance with Clause 2.8 of this Particular Specification
- i) All instances of excessive concrete take or large over breaks are to be raised with the Engineer immediately.
- ii) The Contractor shall ensure that the proposed rig(s) can achieve the proposed pile toe levels. If additional or alternative piling equipment and/or associated plant proves to be necessary this must be provided.
- iii) The use of rigs without an automated system of monitoring for pile construction is not permitted.
- iv) If tension piles are constructed by means of CFA method, the Contractor shall ensure that the installation of reinforcement is achievable over the design pile length, in order to mobilise the entire shaft friction and prevent potential cracking to occur at unreinforced pile sections.
- v) The Contractor shall allow for any appropriate obstruction mitigation measures.
- vi) The Contractor is provide at tender details of how they will satisfy themselves, the Engineer and the Coal Authority that CFA piles aren't terminating in a coal seam or in close proximity to an abandoned mine access shaft.

2.3 Integrity Testing (SPERW Clause B15)

Amendments

None.

Project Specification (SPERW Clause B15.2)

(a) The method of testing to be carried out

Method (b), as per SPERW Clause 15.2.

(b) The number, type and location of elements to be tested

All foundation piles up to and including 600mm diameter shall be integrity tested using a low-strain method. This shall be analysed using Transient Dynamic Response (TDR) approach.

Foundation piles with a diameter of 750mm or larger shall be selectively tested (anticipated 20%) using Thermal Integrity Profile (TIP) testing.

Where TIP testing is undertaken this shall be over the full length of the pile.

(c) The stages in the programme of works when a phase of integrity testing is to be carried out

Unless otherwise agreed, the first when no more than 10% of the piles have been installed; the last once all the piles have been installed (prior to demobilising plant and piling equipment).

(d) Where cross-hole sonic logging is used, the following shall be specified: the number and location of elements to be tested, the number and location and length of ducts to be placed, the depth over which the testing is required, and the depth interval

Not required.

(e) Where distributed fibre optic sensing is used, the number and location of fibre optic cables to be installed in each element, the depth of which testing is required, and the depth interval

Not required.

(f) Where thermistor based testing (TIP) is used; the number, location, and length of embedded thermal sensor cabling to be placed.

Contractor to propose.

(g) The time after testing at which the test results and findings shall be available to the contract administrator (if different from the requirements of SPERW Clause B15.8)

As SPERW Clause B15.8.

(h) Where acoustic methods are used, the number of days to elapse between casting and integrity testing

Tests shall not be carried out until 7 days or more have elapsed since pile casting.

- (i) **Where thermal methods are used, the maximum time from concrete casting to the start of monitoring, the interval between consecutive measurements (that shall not be greater than 30 minutes), and minimum duration of monitoring from concrete casting**

Real time data collection using a data logger shall be implemented.

- (j) **Other particular technical requirements**

The Contractor shall provide the testing contractor with a site plan showing the pile layout and list of the piles to be tested, with the records as per SPERW Clause B1.12 for each pile. Before testing, the heads of the piles shall be inspected by the testing contractor for regularity and soundness, and any unsatisfactory pile heads reported to the Contractor and Engineer. Defective heads shall be made good as instructed by the Contractor (and reviewed by the Engineer).

2.4 Static Load Testing on Piles (SPERW Clause B17)

Amendments

None.

Project Specification (SPERW Clause B17.2)

(a) Type of pile

Contractor to propose at tender stage.

Piles to be tested will be nominated by the Contract Administrator or Engineer based on examination of the piling records. In order to limit any disruption to the piling works the contractor may identify preferred pile test locations in advance, for agreement with the Contract Administrator or Engineer. These will be the designated test piles unless there are clear anomalies in the records for which the contractor cannot provide an acceptable explanation, in which case alternative and/or additional testing locations may be nominated.

(b) Type of test

Maintained load compression/tension test, as per SPERW Clause B17.13.

(c) Loads to be applied and procedure to be adopted in testing preliminary piles, including maximum reaction capacity

Preliminary test piles shall be loaded to geotechnical failure. The Contractor shall demonstrate that the pile has yielded under the applied load. This is in exceedance of BS EN 1997-1, which requires that preliminary test piles only be loaded to the calculated characteristic resistance value.

The contractor shall confirm his maximum reaction capacity at tender stage. The reaction system shall be appropriate for the anticipated geotechnical failure load.

(d) Loads to be applied and procedure to be adopted in proof-testing of working piles, including maximum reaction capacity

All working pile tests shall be taken to $DVL + 50\%$ of F_{rep} .

Values of DVL and F_{rep} shall be agreed with the contract administrator prior to the carrying out of any proof load testing.

The contractor shall confirm his intended maximum reaction capacity at tender stage.

(e) Whether test is to be compression or tension and number of loading cycles

1No. preliminary test each in tension and compression.

Compression pile tests shall include two load cycles, as per SPERW Table B17.1.

(f) Special materials to be used in construction of preliminary test piles where appropriate

Contractor to propose at tender stage.

(g) Special Construction detail requirements for test piles, including requirements for additional reinforcement, increased concrete strength, sampling or in-situ testing

- Contractor to propose at tender stage.
- (h) Special requirements for pile testing equipment and arrangement, including requirements for any pile instrumentation**
- Contractor to propose at tender stage.
- (i) Pile instrumentation criteria**
- Contractor to propose at tender stage.
- (j) Time interval between pile installation and testing**
- Contractor to propose at tender stage.
- No pile shall be tested before data has been provided which demonstrates that the concrete has achieved an adequate strength.
- (k) Whether interpretation is required and extent of interpretation**
- The contractor shall be responsible for interpretation of all static load testing and shall undertake his interpretation in accordance with SPERW B17.15.2 and B17.15.3, as appropriate.
- (l) Additional records or information required from the load test**
- None.
- (m) Displacement transducer stem travel**
- As per SPERW.
- (n) Cut-off level for test**
- Contractor to propose at tender stage (subject to relevant calculations and appropriate assessment of DVL as per specification requirements).
- (o) Details of work to be carried out to the test pile cap or head at the completion of a test**
- To be confirmed by the Contractor and agreed with the Engineer and Main Contractor.
- (p) Special requirements for the application of a lateral load to a pile detailed in accordance with the expected conditions of loading**
- Not required.
- (q) Other particular technical requirements**
- (i) All working pile tests are to be completed before the piling rig and associated plant leaves site including all relevant interpretation and approvals requirements).
 - (ii) In all tests, on return to zero load the monitoring of the pile head movement shall continue until the rate of rebound does not exceed 0.05mm in half an hour. The rate of rebound shall be calculated from two readings separated by a period of 30minutes.

- (iii) Where piles are tested from a different cut-off level from the final cut-off level (further to SPERW Clause B15.6) the proposed test load for such piles shall be submitted to the Engineer for approval prior to commencement of testing (including appropriate calculations substantiating the adopted approach).
- (iv) In addition to the requirements of SPERW Clause B17.11.1 and B17.11.2, all pile tests shall comply with the guidance given in section 4 of CIRIA Report PG7 *Pile Load Testing Procedures*, 1980 and the following items:
 - a. *Reference beams for the test pile set up shall comprise of heavy channel or box section or other fabricated truss section;*
 - b. In addition to the monitoring of reference beams and the pile head, the Contractor shall also monitor either anchor piles or kentledge for vertical movement;
 - c. The Contractor shall comply with Figure 9 and 10 of CIRIA Report PG7, and the minimum dimensions prescribed by SPERW Clause B15.9.5, and adopt the least onerous option if there are differences;
 - d. Item 4.2.1 (paragraph 3) of CIRIA Report PG7; delete from '*Gauges with coarser gradations...*' to '*...must be maintained*';
- (v) Where dial gauges are adopted, the contact point of the dial gauges shall be recorded with an indelible mark on the glass slide or machined plate at the start of the test. Alternatively displacements shall be recorded using linear transducers in place of dial gauges.
- (vi) All instruments and equipment used shall be calibrated. Copies of calibration certificates shall be maintained on site for inspection by the Contract Administrator.

2.5 Support Fluid (SPERW Clause B20)

Amendments

None.

Project Specification (SPERW Clause B20.2)

(a) Minimum material testing requirements and schedule of testing

As per SPERW Tables B20.1, C20.1, and C20.2.

(b) Environmental restrictions and use

Contractor to advise at tender stage.

(c) Testing of support fluid mix water and schedule of testing

As per SPERW Tables B20.1, C20.1, and C20.2.

(d) Submission of testing records to the contract administrator

Test records shall be provided to the contract administrator on a weekly basis, with the contract administrator being notified immediately of any test failure.

(e) Other particular testing requirements

None.

2.6 General Requirements for Concrete and Steel Reinforcement (SPERW Clause B21)

Amendments

Replace SPERW Table B21.3 as follows:

Test	EFFC/DFI Terminology	Standard	Acceptance criteria and/or limits
Strength class		BSEN 206 :2006 (BSI, 2006f)	C30/37 minimum to Contractor design
DC-class		BRE Special Digest 1 BS 8500:2006	DC-2
Sampling for compressive strength testing		BS EN 12390: 2012 (BSI, 2012d)	A minimum of four cubes shall be made from each pile and tested as per ICE SPERW 2017
Nominal maximum size of aggregate (mm)			20mm
Maximum chloride content by mass of cement		BS8500-2:2006	0.40%
Recycled aggregate (CCA) permitted?			Recycled Aggregate conforming to BS 8500-2:2006 CL 4.3 is permitted to max. 20% mass fraction
Flow Table	Consistence	S EN 12350-5:2009 (BSI, 2009c)	Open bore target = 500mm CFA target = 560mm +/- 50mm (initial discharge) +/- 40mm (composite sample)
Visual stability index (VSI)	Segregation resistance/ water retention	BS EN 12350:2009 Parts 5, 8 (BSI, 2009c)	No signs of segregation or bleeding
Bleeding and bleeding rate	Water retention	Modified ASTM C232 (ASTM, 1999) (to include determination of bleeding rate – see clause C21.5.4)	Bleeding rate to be less than 0.1ml/min after approx. 2 hours.

Project Specification

Not applicable.

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