

	Job First Street (Plot 9a), Manchester	Project No		1515	
		Rev.		0	
		Date		22/08/2022	
	Subject DESIGN RISK ASSESSMENT	Prepared By		RS	
		Date		22/08/2022	
		Checked By		SO	
Part 1: DESIGN RISK ASSESSMENT					
Scope of Works:					
<u>This design risk assessment covers the risks associated with the CFA Bored Pile Retaining Wall and Bearing Piles.</u>					
The Design Risk Assessment is based on the documentation provided with the enquiry as listed in the design calculations. It relates specifically to the elements designed by BAUER Technologies which are to be incorporated in a structure designed by others, “the scheme designers”. In this case the scheme designer is Ramboll.					
The Client for the project is subject to duties by virtue of the Construction Design & Management (CDM) Regulations (2015) which relate to all construction work and which apply equally to the elements designed by BAUER Technologies. The client will normally have been advised of these duties at concept and feasibility stage. Unless otherwise agreed the scheme designer will take reasonable steps to ensure that the client for the project is aware of these duties prior to the issue of the pre-tender stage health and safety plan and no separate approach in respect of the elements designed by BAUER Technologies is required.					
Design risks / safety considerations are detailed in part 2 of this design risk assessment, which includes residual risks and methods of designing out risks. It should be noted that this design risk assessment is based on limited information and is intended to identify unusual elements of BAUER’s design or proposed construction sequencing that may not be obvious to those involved in the construction, maintenance or demolition phases of this project. It does not constitute or remove the need for task related risk assessments for the activities carried out in the implementation of the design. Task risk assessments are only carried out by BAUER for the works under its control, in accordance with BAUER’s risk management procedure. The Project Specific Risk Assessment(s) form a key part of BAUER’s Project Management arrangements for this contract. The assessment(s) specifically address the construction works to be undertaken by BAUER Technologies.					
Health and Safety issues which arise from the overall scheme requirements are also identified and should be resolved in co-operation with the co-ordinator and the other designers involved with this project.					
Item No.	Hazard	Potential effects	Risk management or mitigation	Action Taken by Designer	Residual Risk
1	Inadequate or non- existent ground investigation report. Change in ground Conditions.	Inaccurate assumptions about soil parameters & profile leading to inadequate pile performance.	Discussions carried out with the Client regarding the value of a good GI and the scope of intrusive investigation works that is appropriate to the nature of the project and the anticipated ground conditions, starting with a good desk study. Client has provided full SI relevant to site with deep boreholes. Perform trial bores when on site.	Full review of SI carried out and appropriate allowance made to select founding strata level and strength parameters	Acceptable
2	Inadequately designed, constructed, maintained working platforms	Rig overturning, unsafe working conditions for operatives.	Ensure working platform is designed, constructed and maintained in accordance with published guidance or other appropriate best practice. Specify site investigation works to take account of the need for measuring near surface soil properties required for design. Construct platform according to specification, inspect regularly and maintain to original specification.	BAUER to provide rig loadings and required platform working area to BAM temporary works. Platform to be designed by BAM temporary works. Platform to be constructed and maintained by BAM	Acceptable
3	Design Loading	Unexpected forces in piles	State clearly the source of pile loading and whether any group effects are applicable.	Detailed discussions held between Ramboll/BAM/BAUER to confirm design loading	Acceptable
4	Concrete durability	Pile disintegration due to chemical attack.	Ensure that ground and groundwater samples are collected and tested to establish the chemical properties required to apply BRE SD1 protocol for classification.	Concrete to be selected in accordance with Ramboll reports and design requirements	Acceptable
5	Reinforcement detailing	Install reinforcement cage with different outside diameter (OD) than used in the design. Install helical rather than circular links	Ensure that design states clearly what is the outside diameter of the cage used in the design and also state clearly whether helical or circular links are required.	Reinforcement details to be provided in site schedule. Fabrication drawings reviewed by pile designer. BAUER representative to check cages conform to fabrication drawings when arrive on site.	Acceptable
6	Obstructions	Damage to piling equipment, delay to project.	If obstruction is encountered within the top 4m of ground penetrated, BAM will remove using suitable equipment and tooling. Obstructions at a greater depth that are unable to be removed by CFA techniques will require rotary equipment being mobilised to site and the obstruction bored out.	Should CFA pile meet obstruction design review to be carried out by BAUER/Ramboll. CFA piling should not attempt to overcome obstruction above refusal criteria. Refusal criteria to prevent "flighting" provided in design.	Acceptable
7	Pile Testing	Structural pile failure due to low concrete strength on test day. Failure to meeting performance criteria.	Ensure maximum test load and rig capacity stated. Check cube strength on test day is sufficient to take maximum test load together with some eccentricity moments. Carry out calculations to ensure that pile test can meet performance criteria.	Partial Factors selected in accordance with static load tests being carried out on bearing piles. Retaining wall piles are not to be load tested. Design Schedule will detail predicted settlement.	Acceptable

Item No.	Hazard	Potential effects	Risk management or mitigation	Action Taken by Designer	Residual Risk
8	Over reliance on pile end bearing in variable/layered rocks	Excessive pile settlement possible pile failure.	Consideration of partial factor of safety greater than unity on shaft resistance only or reduced end bearing component.	Designer has chosen strata levels and parameters to reflect quality of SI provided. Factor of safety on shaft alone will be maintained to meet SLS design criteria	Acceptable
9	Incorrect retaining wall excavation sequence	Excavation below design depth leading to potential wall failure.	Ensure excavation sequence (including excavation and prop levels) is communicated to all parties involved.	Discussed with BAM/Ramboll project team	Acceptable
10	Overall stability of embedded retaining wall	Failure passing beneath toe of retaining wall.	Ensure responsibility for considering this failure mode has been assigned and communicated to project team.	Overdig allowance has been made where appropriate and will be detailed in design document.	Acceptable
11	Excess surcharge placed behind retaining wall	Collapse or distress of retaining wall.	Ensure surcharge loads/limits are clearly specified and accounted for in the design. Ensure any limitations on surcharges are communicated to project team.	Discussions with Ramboll/BAM carried out to confirm design surcharge. To be detailed in design.	Acceptable
12	Ground movements behind retaining walls	Damage/instability of adjacent structures.	Consider the effect of ground movements arising out of pile installation and wall excavation on adjacent structures. Consider if any monitoring is required. Communicate any construction controls (including responsibilities) to project team.	BAUER to provide predicted wall deflection. BAM to monitor wall deflection during excavation.	Acceptable
13	Wall exposed early	Excessive wall movement and potential retaining wall collapse.	Ensure that 28 day strength achieved prior to wall excavation. State clearly in design document what is the required concrete strength required prior to excavation.	Design carried out based on 35N/mm ² . Pile designer to confirm excavation sequence with BAM prior to detailed retaining wall design completion.	Acceptable
14	Buried River Channel	Reduction in pile capacity and wall resistance if bedrock has been scoured away.	Ensure site crew is aware of feature at prestart briefing. Geotechnical designer to visit site and monitor auger arisings during initial pile bores and in area identified at risk of being above channel.	Allowance made for deeper fill in design calculations.	Continual review to be carried out as works commence/proceed.
15	Creation of preferential Contamination Pathways	Contamination migrating down pile shaft	CFA piling method selected. Wet piling technique means concrete is cast immediately after boring.	Piles designed based on CFA pile diameters	Acceptable
16	Creation of preferential pathways, through a low permeability layer (an aquitard)	Potential contamination of an aquifer.	The site investigation did not identify a continuous aquitard layer between the made ground and the sandstone bedrock therefore the risk of creating preferential pathways is low. In addition CFA piling (non- displacement piling methods) is considered to be a suitable method with negligible risk of creating preferential pathways subject to good workmanship and support of the bore throughout pile construction. (Reference: Environment Agency (2001) Piling and Penetrative Ground Improvement Methods on Land Affected by Contamination: Guidance on Pollution Prevention. NC/99/73).	Piles designed based on CFA pile diameters. Rotary piling may be used should bedrock strength be in excess of that highlighted by SI.	Acceptable
17	Creation of preferential pathways, through a low permeability layer (an aquitard), to allow potential contamination of an aquifer due to unsupported bore	Potential contamination of an aquifer.	It is vital that the bore is supported at all times throughout the construction of the pile to avoid disturbance of the surrounding soils which may cause collapse of the bore or formation of voids which may create a preferential flow pathway or collapse. CFA piling relies on the retention of soil on the auger to provide support to the surrounding soil until the auger is withdrawn and concrete intruded. It is vital that the intruded concrete is placed under pressure at a rate consistent with that of the withdrawal of the auger to ensure the bore is supported. A high level of workmanship is required in the construction process to	Piles designed based on CFA pile diameters. Trained, qualified and competent CFA operators will be used. Rigs are fitted with sophisticated monitoring systems to monitor concrete pressure, flow rate and auger lift speed amongst other drilling and concreting parameters.	Acceptable
			Rotary bored piling uses a temporary casing to support the bore. Care should be taken to ensure under reaming of the casing does not occur during boring which can cause bore collapse.	Rotary bored piles will only be used if rock strengths on site mean tension piles or wall piles can not be constructed to the required toe level. Trained, competent rotary rig operators will be used.	

Item No.	Hazard	Potential effects	Risk management or mitigation	Action Taken by Designer	Residual Risk
18	Creation of preferential pathways, through a low permeability layer (an aquitard), due to poor workmanship	Potential contamination of an aquifer.	Appropriate QA measures should be incorporated into the construction works to enable workmanship to be monitored. In CFA piling the onboard instrumentation is used as a quality control measure. To ensure the bore remains supported at all times, the operator can ensure that positive concrete pressure is maintained as the auger is being withdrawn by monitoring the onboard instrumentation. In rotary bored piling, depth of casing installed versus depth of bore should be carefully monitored and recorded. It is important that QA instrumentation in piling rigs is calibrated and operating correctly.	Piles designed based on CFA pile diameters. Other rotary bored techniques including temporary casings may be used if rock strengths onsite are higher than recorded by the site investigation causing premature refusal of tension/wall piles. Concrete pump and flow meters will be calibrated at mobilisation and then as per the inspection and test plan thereafter. Rigs fitted with sophisticated rig instrumentation to monitor concrete pressures, flow and auger lift speed in addition to other drilling and concreting parameters. All rig operators are BAUER trained and competent operatives.	Acceptable
19	Creation of preferential pathways, through a low permeability surface layer	Upward migration of landfill gas, soil gas or contaminant vapours to the surface	The risk of upward migration of landfill gas, soil gas or contaminant vapours has not been assessed by ourselves. We have assumed that the Client's Engineers have made this assessment. However, if such contaminants are present, the likelihood of piling works creating preferential pathways is low as per items 16, 17 and 18.	Piles designed based on CFA pile diameters to minimise risk of flow path creation.	Acceptable
20	Direct contact with contaminated soil arisings that have been brought to the surface	Negative impact on health & safety of operatives or other site personnel	Any contaminated arisings generated from the piling works are required to be disposed of offsite in an appropriately licensed waste management facility. Made ground is present in every borehole extending to the rockhead in most boreholes therefore there is high potential for contamination in ground. The Main Contractor should highlight any abnormal risk to the Piling Sub Contractor.	BAM to highlight any abnormal risk to the piling subcontractor and constantly review.	Acceptable
21	Direct contact with contaminated soil arisings that have been brought to the surface	Negative impact on health & safety of operatives or other site personnel	Both CFA and rotary bored piling necessitate bringing to the surface a volume of soil from within the bore in order to construct the pile. Handling, transport and disposal of this material needs to be addressed appropriately by the MC.	BAM to handle, transport and dispose of material in appropriate manner. BAM to highlight any additional measures required by BAUER operatives.	Acceptable
22	Direct contact of the piles or engineered structures with	Degradation of pile materials	The exposure classes for concrete within piles is defined by the Client's Engineer. The concrete should conform to the specified	Concrete mix design to conform to specified Class	Acceptable
23	Vibration from piling	Damage to structures/assets	CFA piling method selected, low vibration piling technique. Vibration monitoring to be carried out in sensitive areas.	Piles designed based on CFA pile diameters	Acceptable