

26-135-RR01-Rev 0 Designer's Risk Assessment for Soil Nail Reinforced Slope at Faussagh Avenue, Cabra

DESIGNERS RISK ASSESSMENT – FOR SOIL NAIL REINFORCED SLOPE AT RAILWAY							
	Hazard	Cause	Potential Impact	Initial Risk	Mitigation steps taken in design	Construction Control	Residual Risk
1	Strike of permanent CFA bearing pile by soil nail causing damage to building	1. Incorrect set out. 2. Excessive deviation of soil nail during installation 3. CFA piles not correctly located	1. Damage to building 2. Cessation of works.	High	1. A sacrificial “dummy” piles is to be installed on the railway side of each bearing pile that is within the plan extent of the soil nailing. This ensures that the piles supporting the building can't be damaged by the soil nailing works. 2. The as-built location of the CFA piles is to be recorded and clearly marked on the slope face. 3. The soil nails are to be set out to allow for minimum 0.5m offset from the CFA piles.	1.The mitigation measures as given in the AGL GDR 26-135-R01 are to be implemented	Low
2	Collapse of existing retaining wall at crest of slope on to the railway	1.Soil nailing works destabilises retaining wall 2.Wall in poor condition 3.Stockpiling of material behind wall 4.Excessive plant loading on wall	1. Death or injury to site personnel working at the base of the slope. 2. Loss and cessation of works.	Medium	1.The existing retaining wall is to be stabilised by a row of soil nails to ensure that a future collapse on to the railway cannot occur. 2.The shotcrete facing may also extend over the wall depending on its structural condition.	1.The Contractor shall follow the Construction Sequence set out in the GDR, in particular the limits on excavation of unsupported slope faces below the soil nails. 2.A temporary works design is required for construction of access track and working platform on the slope and for the excavation of slip material. 3.No materials or plant are to be stored at the top of the slope during construction. 4.Daily visual inspections of the slope and ground surface	Low

DESIGNERS RISK ASSESSMENT – FOR SOIL NAIL REINFORCED SLOPE AT RAILWAY							
	Hazard	Cause	Potential Impact	Initial Risk	Mitigation steps taken in design	Construction Control	Residual Risk
						shall be carried out (i.e., observe of evidence of tension cracks or other signs of slope movement), especially following periods of heavy rainfall. 5.The slope should be observed during drilling for any signs of instability due to drilling the soil nails. 6.Construction works carried out during or after periods of prolonged heavy rainfall should be minimised. 7.Cut slope angles are not to exceed that given in the drawings.	
3	Collapse of the slopes during construction	1. Destabilising of slopes due to excavation, plant loading or stockpiling of materials or spoil	1. Death or injury to site personnel working at the base of the slope. 2. Loss and cessation of works. 3. Disruption of railway	High	1.A staged construction sequence has been provided to ensure temporary stability of slopes	1.The soil nails and facing are to be constructed as given in the GDR and as shown on the construction drawings. 2.If ground conditions encountered during drilling the soil nails differs to that assumed in the design then AGL is to be informed immediately.	Low
4	Collapse of slope following completion of the works	1. Ground conditions differ from those indicated by the ground investigation. 2. Ground levels are higher than those used in the design.	1.Death or injury to persons. 2.Loss and cessation of works. 3.Disruption of railway	Medium	1. The Soil Nail slope is designed in accordance with IS EN 1997-1:2005 and BS 8006-2:2011 and for a Category 2 structure 2. The ground model for the design is based on ground investigation information.	1. The soil nails and facing are to be constructed as given in the GDR and as shown on the construction drawings. 2.If ground conditions encountered during drilling the soil nails differs to that assumed in the design then	Low

DESIGNERS RISK ASSESSMENT – FOR SOIL NAIL REINFORCED SLOPE AT RAILWAY							
	Hazard	Cause	Potential Impact	Initial Risk	Mitigation steps taken in design	Construction Control	Residual Risk
		3. Surcharge loads applied exceed those assumed in the design.			3. Moderately conservative soil parameters have been used in the design for its drained and undrained shear strength. 4. Ground levels used for the design have been obtained from the topographical survey provided to AGL to develop the ground profiles. 5. Sacrificial soil nail tests and production soil nail tests are to be carried out to verify the design 6. A minimum general surcharge load of 10kPa at the slope crest has been assumed in the design. 7. AGL shall be informed if excessive overbreak of the slope face occurs.	AGL is to be informed immediately. 3. Soil nail testing is to be carried out as set out in the GDR.	
5	Fall from height	1. Working from the top of the slope without fall protection. 2. Access by site personnel/public to the top of the slope.	1. Death or injury to site personnel. 2. Loss and cessation of works.	High	1. Access to the top of the slope shall be restricted to the general public throughout the construction works. 2. The soil nail slope shall be constructed in stages from the top to the base in accordance with the Construction Sequence set out in the GDR and on the construction drawings.	1. Access to the top of the slope shall be restricted to the general public throughout the construction works. 2. Appropriate fall protection measures are to be implemented to allow work to be carried out safely from height on the slope, if necessary (e.g., scaffolding, personal restraints). 3. Contractor shall submit a method statement detailing the construction methods proposed for the works which shall be	Low

DESIGNERS RISK ASSESSMENT – FOR SOIL NAIL REINFORCED SLOPE AT RAILWAY							
	Hazard	Cause	Potential Impact	Initial Risk	Mitigation steps taken in design	Construction Control	Residual Risk
						approved by AGL prior to commencing the works. 4. Contractor shall carry out the works in accordance with the Method Statement and any deviations shall be approved in writing by AGL.	
6	Underground/Overground services	1. Striking overground services with plant 2. Striking underground services during soil nail installation.	1. Death or injury to site personnel 2. Loss and cessation of works.	High	1. Risk identified	1. The Contractor shall clearly identify the location of the services prior to commencing the construction works. 2. Checks for any other unidentified services shall be carried out prior to commencing construction. 3. The Contractor shall ensure that the location of the services and the requirements for the safe construction of the soil nail slope to avoid these services are communicated to all site personnel. 4. If services are identified at the location of the proposed soil nails then AGL shall be informed to relocate the soil nails.	Medium
7	Collapse of soil nail hole before grouting	1. Presence loose sand or gravel	1. Void in the ground leading to ground settlement. 2. Non-continuous grout in the soil nail	Medium	1. Self-drill hollow bars are specified, which are suitable for loose granular soils	1. Following completion of drilling to the full length of the soil nail the final length shall be recorded.	Low

DESIGNERS RISK ASSESSMENT – FOR SOIL NAIL REINFORCED SLOPE AT RAILWAY							
	Hazard	Cause	Potential Impact	Initial Risk	Mitigation steps taken in design	Construction Control	Residual Risk
			giving low soil nail pull-out capacity and leading to long term slope instability.			2. Driller shall observe flush returns from drilling fluid for indications of excessive soil extraction during drilling the soil nails. 3. Collapsed bores are to be re-drilled and all voids filled with grout.	
8	Soil Nail Hole not fully filled with grout.	Not enough grout pumped into soil.	1. Void in the ground leading to ground settlement. 2. Non-continuous grout in the soil nail giving low soil nail pull-out capacity and leading to long term slope instability.	Medium	1. The filling of any voids below the nail bearing plate is identified in the construction sequence	1. Contractor shall ensure that the hole is fully filled with grout by allowing the grout to overflow onto the slope face. 2. Any voids below the bearing plate shall be filled with thick grout or a sand & grout mortar prior to installation of the bearing plates.	Low
9	Soil nails do not achieve the required pull-out resistance required by the design.	1. Ground conditions differ from those indicated by the ground investigation.	1. Low soil nail pull capacity and leading to long term slope instability.	Medium	1. Conservative soil parameters have been used in the design. 2. Sacrificial tests (2 No.) have been specified to be carried out in the made in advance of construction of the working nails. 3. Production tests (2%) have been specified to be carried out on working nails to verify that the required structural resistance has been achieved on the working soil nails.	1. Soil nail testing is to be carried out as specified. The results shall be provided to AGL as soon as possible to verify the design. 2. Additional soil nails may be required where the design soil nail pull-out resistance has not been achieved.	Low
10	Shallow slope failures between soil nails.	1. Insufficient support of the soil between nails.	1. Degradation of slope	Medium	1. A flexible facing comprising a shotcrete facing. 2. Where required temporary shotcrete and steel mesh is to be placed on the slope face to	1. The facing shall be installed as set out in the construction drawings. 2. Existing obstacles and vegetation are to be removed to	Low

DESIGNERS RISK ASSESSMENT – FOR SOIL NAIL REINFORCED SLOPE AT RAILWAY							
	Hazard	Cause	Potential Impact	Initial Risk	Mitigation steps taken in design	Construction Control	Residual Risk
					stabilise the face and allow safe excavation.	ensure a regulated and even slope face prior to installing the wire mesh facing.	
11	Obstructions to drilling	1. Tree roots encountered during drilling. 2. Cobbles and boulders in glacial till	1. Shorter soil nail length resulting in insufficient bond length in soil nail leading to long term slope instability. 2. Prevention of nail installation due to surface obstruction	Medium	1. Risk identified	1. 3. Advise AGL of obstruction to soil nails that cannot be removed or encountered during nail installation. Additional soil nail/nails to be offset from construction as agreed with AGL	Low
12	Obstructions causing deflection of soil nail.	1. Soil nail deflecting due to boulder partially covering soil nail hole.	1. The design inclination of the soil nail is not achieved resulting in insufficient reinforcement of slope.	Medium	n/a	1. Contractor shall have equipment available to bore through boulder obstructions, if encountered. 2. The driller shall be aware of any deflections in the soil nail inclination during drilling.	Low
13	Excessive Overbreak on Slope Face.	1. Loose/soft ground. 2. Water seepage from slope face.	1. Excessive Overbreak would leave a gap between the slope face and the steel mesh when placed on the slope, thus, this section of the slope face would be unsupported.	Low	1. AGL have specified maximum cut slope angles for each zone of the soil nailed slope.	1. AGL shall be informed if excessive overbreak occurs on the slope face. 2. Slope cut angles shall not exceed that specified. 3. Temporary shotcrete facing to be used to stabilise the slope face where required and agreed with AGL	Low
14	Surface runoff causing erosion or collapse of the slope face	1. Surface water from surrounding area	1. Erosion of the slope face or local collapse	Medium	1. Risk identified	1. AGL to be advised of any surface water issues. Surface drains or temporary bunds may be required to divert or intercept surface water.	Low