Technical note

Project:	Cambridge Science Park Station	**To:**	Victor Franciso-Suarez
Subject:	Trackbed Single Option Design Development	**From:**	Sean Gallacher
Date:	18/09/13	**cc:**	Kenny Paxton

1. Introduction

This Technical Note is to support the single option design development for the proposed station works at Chesterton Interchange by providing an outline design for trackbed formation and highlighting key risks for detailed design.

Atkins has been commissioned by Cambridgeshire County Council to progress design work following on from the initial AIP submission to Network Rail. These proposals include for:

- Provision of a new station building with associated Train Operating Company (TOC) facilities and retail shell;
- Provision of a new station platform with passenger waiting facilities, integral lifts and stairs and provision for future TOC and retail development;
- Covered footbridge served by new lifts and stairs;
- Covered cycle parking in two dedicated zones north and south of the station building for approximately 1000 bicycles;
- Car parking for approximately 450 cars;
- Dedicated taxi and 'kiss and ride' area served from Cowley Road;
- Extension to the busway and associated service path / cycleway;
- New access to busway extension from Milton Road, and;
- Pedestrian and cycle access points.

In addition to the above, much of the existing Network Rail infrastructure affected by the proposed works will require upgrade, including the following:

- Lifting and relaying of existing freightliner siding to the north of the siding away from the new station development;
- Lifting of main track line;
- Relocation of DNO generator building, and;
- Relocation of Signal Supply Point building to a dedicated Network Rail compound south of the site

To support design development a ground investigation was commissioned and supervised, over several phases by Atkins between 17 September 2012 and 30 June 2013. Investigation works were undertaken by URS Infrastructure and Environment UK Limited (URS).

1.1. Site Description

The site is located in Chesterton, in the northwest area of Cambridge off Cowley Road, approximately 1km south of the A14 ring road. The site is located at approximate National Grid Reference 547500, 260900. The proposed station is between the Down Loop and the Kings Lynn Line (BGK) between chainage 57m 54ch (57 miles 1188 yards) and 58m 40ch (58 miles 880 yards).

The existing main line crosses Waybeam Bridge at approximate Design Chainage (DC) 770m – 820m and Fen Road Level Crossing at approx. DC 875m – 885m.

The site is close to the River Cam on relatively flat and low-lying ground (approx levels of between 5.8m to 7.7m AOD). The land generally slopes towards the River Cam (in a southeast to easterly direction) across the site extents.

2. Sources of information

- Atkins GRIP 4 Approval in Principle for Chesterton Interchange, 5110967-RLS-CSP-FORM A-001 (March 2013);
- Draft GI information (logs and lab tests) received from URS;
- Draft desk study (technical note from Karena Tse, 120702am Desk Study – DRAFT);
- Atkins Draft Ground Investigation Report and Land Contamination Assessment (March 2013);
- Permanent Way General Arrangement 5110967-RLS-CSP-CPW-001 and 002 revA01 (dated 11/12/12);
- British Geological Survey (BGS) GeoIndex Onshore;
- British Geological Survey Map, scale 1:50,000, Sheet 188 for Cambridge (Solid and Drift Edition), 1981, and;
- Envirocheck Report.

3. Desk Study

A brief summary of the relevant site conditions, as extracted from Atkins Desk Study and Ground Investigation Report is provided in the following section.

3.1. Site History

In summary, the site has been occupied by a number of railway lines and sidings in the past 120 years since records began. The St Ives railway line is now disused and the number of sidings has been increased and decreased in the past 120 years as shown on the historical maps. Several drains were indicated to be present within the site.

Gravel pits, and some pits with unknown use, were shown within and adjacent to the site. These pits were no longer shown on the historical maps of recent years and may therefore have been filled in. A few industrial units and a farm were shown within the site but are no longer shown on the historical maps of recent years. A few depots with unknown use are also present within the site.

3.2. Geology

Published geological information indicates that the site is underlain by Terrace Deposits overlying Cretaceous strata of Gault and Lower Chalk. Alluvium is shown close to the site to the south and east near the River Cam. The map indicates that the solid geology is at or near the surface in areas to the east of the site with outcrops of Gault. Although not recorded by the published geological information, significant Made Ground associated the site's historical uses is likely to be present.

The Terrace Deposits are described as sand and gravel, locally with lenses of silt, clay or peat while the Alluvium is described as a normally consolidated soft to firm, compressible silty clay, but can contain layers of silt, sand, peat and basal gravel. A stronger desiccated surface zone is noted as potentially being present.

The Gault Clay is described as a pale to dark grey or blue grey clay or mudstone, glauconitic in part, with a sandy base. The Lower Chalk is described a grey marly chalk with marl content decreasing upwards. Solid geology is at or near the surface in areas to the east of the site with outcrops of Gault.

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4. Fieldwork and Ground Conditions

A full summary of the completed ground investigations and associated testing is presented in Atkins GIR. A summary of the investigations applicable to the proposed track design is provided in the following section.

4.1. Fieldworks

Ground Investigations have been carried out by URS. The majority of trial pits and window samples have been carried out on the disused St. Ives line and in the sidings area with some investigation locations in the cess of the existing main lines. GI has been undertaken near the main lines between approx. DC 940m and 1,410m. Investigations within the four-foot of the main line has been undertaken between approx DC 680m and 1,160m

Ground investigation applicable to the proposed mainline comprises WS01, WS02, WS03, TP18, TP22, TP28A, TP29, TP30, TP34 and TP35.

Ground investigation applicable to the sidings comprises BH03, WS07, WS08, TP07, TP08, TP10, TP13, TP17, TP21, TP23 and TP27. However, to provide an improved understanding of the underlying stratigraphy exploratory holes across the site have also been consulted.

Copies of the relevant logs together with an investigation location plan are included in Appendix A.

4.2. Ground Conditions

The GI carried out indicates the site to be underlain by Made Ground to a depth of between 0.3m and 5.0m below ground level, typically around 1.0m thick and hence this is expected to be the most commonly encountered formation material. The Made Ground is highly variable and typically comprises sandy gravel or gravelly sand, although numerous areas of clayey sand are recorded and a few locations record small clay pockets, as high as 0.6m bgl. Ash, clinker and building waste are present within the Made Ground.

Cohesive alluvium underlying the Made Ground was recorded in exploratory holes WS01 (approx Ch. 1,410m) between depths of 4.4m and 5.5m bgl and TP30 (approx Ch. 920m) between 1.1m and 1.2m bgl (note trial pit was terminated in deposit without the base being proven). The deposit is typically described as a soft sandy clay although a band of slightly gravelly sand is also noted.

River Terrace deposits are typically recorded as a loose to medium dense clayey sand or gravel encountered at depths of between 0.5m (WS03) and 5.5m bgl (WS12). It should be noted that the thickness of the River Terrace deposits was not proven by the available investigations.

The underlying Gault Clay is generally encountered as soft or firm clay below the Terrace gravels, becoming firm and stiff with depth. The top of the Gault Clay is encountered between 2.05m (WS09) and 5m bgl (WS02) and as such is unlikely to be of significant influence on trackbed design. The Gault Clay was proven to a depth of 15m bgl in two exploratory holes (BH02 and BH03) with the base of the deposit unproven. Although not proven in the remaining holes it is considered that the Gault Clay will be present across the site.

A generalised geological section along the main line is included for reference within Appendix B

Numerous groundwater strikes have been observed within the Made Ground and Terrace Gravels, possibly due to the varied nature of these deposits and alternating sand/clay layers. Groundwater levels of between 0.16m bgl to 1.20m bgl were observed in trial pits and in some cases, resulted in early termination of the pit. The window samples encountered groundwater between 0.1m and 3.0m bgl. Within the mainline investigations groundwater was encountered at 1.1m bgl in WS03.

Unsoaked CBR tests at natural moisture content have been carried out on recompacted samples from trial pits and the granular material generally achieves a CBR of 40-70%, however, on a few occasions where clayey sand / gravel or clay pockets are encountered the CBR may be as low as between 2% and 5%.

PSD tests on granular material generally indicate low (<15%) fines content in the material reported as largely granular. PSD tests on clayey Made Ground indicate around 10% clay, with the majority of the fines falling within the silt region.

5. Permanent Way Proposals

A new bay platform line feeding the proposed station at Chesterton is proposed, which will run through the location of the existing sidings (these are to be dismantled). A passing loop and four sidings by the station interchange building, generally following the alignment of the existing siding lines (although with some minor alignment changes) are also proposed.

To accommodate the lines and platforms for the new station, adjustments to the horizontal and vertical alignment of the existing main line is required. The permanent way general arrangements indicate all slues are less than 100mm (the maximum slue is ~90mm). Track lowering is required at a number of locations, detailed below:

Down Main Line

- Ch 680m to 760m, up to 120mm
- Ch 810m to 860m, up to 17mm
- Ch 900m to 1,030m, up to 48mm
- Ch 1,580m to 1,600m, up to 2mm
- Ch 1,670 to 1,707.4m, up to 7mm

Up Main Line

- Ch 670m to 770m, up to 105mm
- Ch 840m to 880m, up to 15mm
- Ch 900m to 950m, up to 4mm

Reception Sidings

- Ch 940m to 980m, up to 41mm
- Ch 1030 to 1040m, up to 13mm
- Ch 1290m to 1385m, up to 69mm

Bay Platform

- Ch 900m to 1,030mm, up to 48mm

New S&C locations are required on the main line and new lines where lines converge and diverge.

6. Key Risks for Trackbed Design

Clay or clayey gravel within the Made Ground encountered at formation level

Due to the inherent variable nature of the underlying Made Ground there is a risk that localised clay pockets could be encountered which would adversely affect the stiffness and drainage of the track formation across the whole site. Migration of clay fines into the trackbed is also of concern and a filtration layer is required to prevent this and improve the life of the trackbed.

Perched water tables and poor drainage

Encountering groundwater at numerous locations, plus the low-lying topography of the site, suggests drainage through the site to the River Cam is poor. The proposed new lines and lowering of the existing main line may suffer from poor drainage of the track formation, leading to increased deterioration and design will need to ensure drainage of the formation is sufficient.

Uncertainty in ground conditions and trackbed condition

Limited investigations have been completed to date in the four-foot of the existing lines. Further investigation works to support detailed design, on the existing main line both Up and Down from the site, is required to better understand the risk and quantify treatments proposed in this note.

7. Proposed trackbed treatments

Ground investigations completed within the four-foot would suggest that the depth of granular material is sufficient for the main line to be lowered. Accordingly, re-ballasting to the required depth with the provision of a Geotextile separator (Terratex or equivalent) – Treatment Option 1 is likely to be acceptable.

However, it is noted that limited investigations have been undertaken on mainline and as such, the residual risk of clay / clayey deposits at formation remains. Furthermore, recorded groundwater observations suggest drainage through the site to the River Cam is poor.

Due to the uncertainties in ground conditions, it is recommended that a contingency for blanketing sand / Type 1 fill based on previous experience of similar work to deal with the risk of localised soft spots. Furthermore, to address the risks outlined in Section 6, consideration should be given to the following trackbed formation treatment for lines carrying main line traffic (i.e. the bay platform line, main line and passing loop) (Treatment Option 2).

- 300mm ballast below bottom of sleeper level
- Geotextile separator (Terratex or equivalent)
- 100mm blanketing sand
- If soft cohesive spots are encountered at the base of formation, Treatment 3 (an additional 200mm DOT Type 1 or equivalent fill) is to be used.
- Formation level is to be compacted using the same method as the rest of the trackbed layers.
- The base of ballast and base of blanketing sand to have a cross fall of 1:30 towards the nearest existing drainage run or nearest cess to facilitate trackbed drainage.

For new sidings, due to the lower frequency of use and line speed, a less robust treatment is considered to be acceptable:

- 250mm ballast below bottom of sleeper level
- Geotextile separator (Terratex or equivalent)
- If soft cohesive material is encountered at formation level, a further 100mm is to be excavated and 100mm blanketing sand is to be used (i.e. as per Treatment 3).

Treatment Option 2 includes for the allowance of a blanketing sand to assist with drainage across the site. The requirement for the proposed blanket should be developed in accordance with overall site drainage design strategy (e.g. is trackbed required to act as infiltration drainage, does car park drainage adequately collect / intercept surface and groundwater west of track).

For S&C locations where trackbed treatment is required (i.e. where significant slues or lowers are proposed), geogrid reinforcement is proposed (to be installed above the geotextile separator layer) in addition to the above treatments. Treatments with geogrid reinforcement are given the suffix ‘R’ on the Trackbed Treatment Types drawing. This treatment must extend for 30m beyond the S&C on both lines to avoid the risk of differential stiffness. It is recommended GI is carried out at all S&C locations as these are at greater risk from soft spots.

Drainage for the station passing loop is also recommended due to the potential presence of perched water. This should be provided on the cess of the proposed line to intercept run-off from the current sidings area. A drainage survey of the existing main lines is recommended prior to detailed design.

8. Contamination Assessment

With regards to chemical testing carried out in trial pits TP30, TP34, TP35 and window sample WS03, no human health risks or potentially hazardous waste were identified. The suite of testing that was undertaken is in accordance with that which is included in Network Rail Guidance Document NR/SP/ENV/044 *Company Procedure: Track Maintenance, Renewal or Alteration – Used Ballast Handling* (August 2008) and this document states that the assessment of material for risk to human health and for the identification of hazardous waste is sufficient for assessing ballast material. As no human health risk or potentially hazardous waste was identified at these locations there will be no implications for the handling or storage of the materials tested.

Materials were tested from across the rest of the site, including materials with descriptions fitting that of ballast, and in general these were also found to be free from human health risk, would not be classed as potentially hazardous waste and did not exceed the Checklist C criteria. Isolated human health risks from PAH and asbestos were encountered elsewhere on the site and these occurrences are detailed in the Ground Investigation Report.

It is recommended that appropriate Health and Safety measures such as dust suppression (if necessary) and the use of PPE are implemented during any excavations at the site and site operatives should maintain vigilance for potentially contaminated materials including suspected asbestos containing materials during any works. In the event that potentially contaminated materials are encountered, appropriate measures should be implemented.

A risk to the underlying groundwater and River Cam were identified in materials taken from TP30 and TP34 as well as at various locations across the entire site and recommendations are provided in the Ground Investigation Report.

2	For Review	Sean Gallacher	Kenny Paxton	Gary McCann	Victor Franciso-Suarez	16/08/13	
1	For Approval	Chris K-Shaw	Imad Alobaidi	Kenny Paxton	Imad Alobaidi	21/11/12	
Revision	Purpose Description	Originated	Checked	Reviewed	Authorised	Dated	Client
		Atkins Ground Engineering					

Appendices:

Appendix A – Ground Investigation Information and Investigation Location Plan

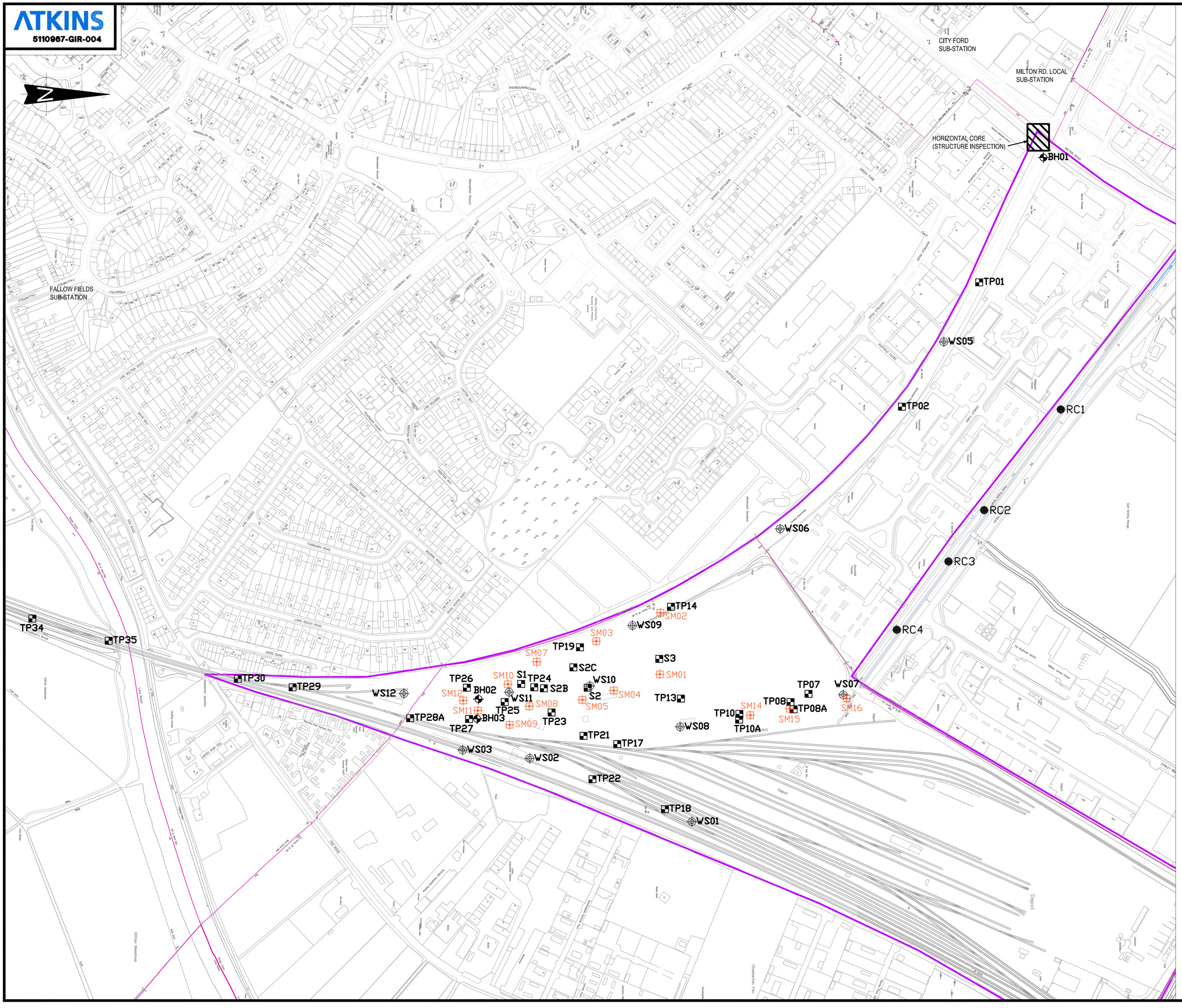
Appendix B – Longitudinal Ground Profiles

Appendix C – Proposed Trackbed Treatments

Technical note

Appendix A. Ground Investigation Information

ATKINS
5110967-GIR-004



NOTES:

1. A SURVEY OF COMPLETED ARCHAEOLOGICAL INVESTIGATION HAS NOT BEEN UNDERTAKEN THEREFORE PRESENTED LOCATIONS ARE INDICATIVE ONLY.
2. A SURVEY OF POSITIONS WS03, TP30, TP34 & TP35 HAS NOT BEEN UNDERTAKEN THEREFORE PRESENTED LOCATIONS ARE INDICATIVE ONLY.
3. DYNAMIC CONE PENETRATION TESTS UNDERTAKEN AS FOLLOWS ON TO COMPLETED TRIAL PITS.

KEY:

BH	BOREHOLE
TP	TRIAL PIT
WS	WINDOW SAMPLE
S1	SOAKAWAY PIT
RC	ROAD CORE
SM	ARCHAEOLOGICAL TRIAL PIT

REVISIONS	Drawn By	Checked By	Date

PURPOSE OF ISSUE	Rev.	Authorised for issue	Date

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CLIENT
CAMBRIDGESHIRE COUNTY COUNCIL

PROJECT
CHESTERTON INTERCHANGE

DRAWING TITLE
AS BUILT EXPLORATORY HOLE LOCATION PLAN

Scales	DRAWN	CHECKED	CO-ORD CHECK
1:2000	SM	KP	AC
	DATE 06/03/2013	DATE 06/03/2013	DATE 06/03/2013
0		SHEET A1	PLOT DATE 28/08/13

DRAWING NO 5110967-GIR-004 REV 4

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Trial Pit No. TP07

Sheet: 1 of 1

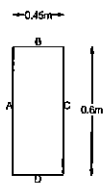
Equipment & Methods: Hand Tools Support Used:None	Project Name: Chesterton Interchange Ground Investigation Project Location: Chesterton, Cambridge Client: Atkins Limited	Job No: 47064416
Co-ordinates: E: 547452.035 N: 260945.301	Ground Level (m): 6.40 AOD	Date Started:17/09/2012 Date Completed:17/09/2012

Samples and In situ Testing				Field Records	DESCRIPTION	Reduced Level (m)	Legend	Depth (Thick) (m)
Depth (m)	No.	Type	Result					
0.10- 0.20		B			MADE GROUND: Grey/pink angular to subangular medium to coarse gravel of igneous rock	6.30		(0.10) 0.10
0.20		E			MADE GROUND: Grey/pink sandy angular to subrounded fine to coarse gravel of igneous rock. Sand is fine to coarse	6.20		(0.10) 0.20
0.20- 0.55		B			MADE GROUND: Grey very sandy angular to subrounded fine to coarse gravel of igneous rock. Sand is fine to coarse			(0.35)
0.40		E			MADE GROUND: Tarmacadam	5.85		0.55 (0.20)
0.55- 0.75		B			MADE GROUND: Black sandy angular to subrounded fine to coarse gravel of brick, slate, igneous rock and quartz with pockets of clay. Sand is fine to coarse	5.65		0.75 (0.45)
0.75- 1.20		B						
1.00		E				5.20		1.20

End of Trial Pit 1.20 m
(Thickness of basal layer not proven)

Groundwater Observations			
Strike Depth	Post Mins	Post Depth	Flow

Plan View



Remarks

1. Trial Pit located on Network Rail land adjacent to ballast stockpile. 2. Topography: Grade. 3. No groundwater encountered. 4. Trial Pit completed at 1.20m bgl. 5. No visual or olfactory evidence of contamination. 6. Trial Pit backfilled with arisings on completion. 7. Dynamic Cone Penetrometer (DCP) test refused at 3.43m bgl - see separate report sheet for results.

Notes: For explanation of symbols and abbreviations, see Key Sheet.

Scale:

Logged By: MB

Checked By: NW

STANDARD TRIAL PIT LOG - NOTTS CHESTERTON ALL V3.1.GPJ AGS3_1.GDT 5/9/13

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Trial Pit No. TP08

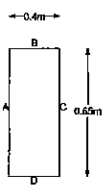
Sheet: 1 of 1

Equipment & Methods: Hand Tools Support Used:None	Project Name: Chesterton Interchange Ground Investigation Project Location: Chesterton, Cambridge Client: Atkins Limited	Job No: 47064416
Co-ordinates: E: 547461.229 N: 260925.139	Ground Level (m): 6.08 AOD	Date Started:18/09/2012 Date Completed:18/09/2012

Samples and In situ Testing				Field Records	DESCRIPTION	Reduced Level (m)	Legend	Depth (Thick) (m)
Depth (m)	No.	Type	Result					
0.10		E			MADE GROUND: Pink/grey sandy angular to subangular medium to coarse gravel of igneous rock. Sand is fine to coarse			(0.50)
0.00-0.50		B						
0.50		E				5.58		0.50
0.50-1.00		B			MADE GROUND: Black sandy angular to subangular fine to coarse gravel of clinker with ash and low cobble content. Cobbles are angular of brick. Sand is fine to coarse			(0.50)
0.76		W						
0.95		D				5.08		1.00
					End of Trial Pit 1.00 m (Thickness of basal layer not proven)			

Groundwater Observations			
Strike Depth	Post Mins	Post Depth	Flow
0.95	20.00	0.76	Rising

Plan View



Remarks

1. Trial Pit located on Network Rail land adjacent to ballast stockpile. 2. Topography: Grade. 3. Groundwater encountered at 0.95m bgl rising to 0.76m bgl after 20 minutes. 4. Trial Pit terminated at 1.0m bgl due to standing water. 5. No visual or olfactory evidence of contamination. 6. Trial Pit backfilled with arisings on completion. 7. Dynamic Cone Penetrometer (DCP) test not undertaken due to standing water preventing inspection pit being excavated to full depth and cleared of buried services.

Notes: For explanation of symbols and abbreviations, see Key Sheet.

Scale:

Logged By: MB

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STANDARD TRIAL PIT LOG - NOTTS CHESTERTON ALL V3.1.GPJ AGS3_1.GDT 5/9/13

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Trial Pit No. TP10

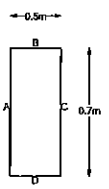
Sheet: 1 of 1

Equipment & Methods: Hand Tools Support Used:None	Project Name: Chesterton Interchange Ground Investigation Project Location: Chesterton, Cambridge Client: Atkins Limited	Job No: 47064416
Co-ordinates: E: 547474.584 N: 260867.894	Ground Level (m): 6.04 AOD	Date Started:18/09/2012 Date Completed:18/09/2012

Samples and In situ Testing				Field Records	DESCRIPTION	Reduced Level (m)	Legend	Depth (Thick) (m)
Depth (m)	No.	Type	Result					
0.20 0.00- 0.50		E B			MADE GROUND: Grey sandy angular to subangular fine to coarse gravel of igneous rock. Sand is fine to coarse			(0.50)
0.50		E			At 0.35m bgl: becomes very sandy.	5.54		0.50
0.50- 0.90 0.70		B W			MADE GROUND: Black sandy angular to subrounded fine to coarse gravel of clinker with some ash. Sand is fine to coarse			(0.40)
0.90		D			MADE GROUND: Grey mottled brown very gravelly clay. Gravel is angular to subrounded fine to coarse of igneous rock and clinker	5.14 5.12		0.90 (0.02) 0.92
					End of Trial Pit 0.92 m (Thickness of basal layer not proven)			

Groundwater Observations			
Strike Depth	Post Mins	Post Depth	Flow
0.87	20.00	0.70	Rising

Plan View



Remarks

1. Trial Pit located on Network Rail land adjacent to ballast stockpile. 2. Topography: Grade. 3. Groundwater encountered at 0.87m bgl rising to 0.70m bgl after 20 minutes. 4. Trial Pit terminated at 0.92m bgl due to standing water. 5. No visual or olfactory evidence of contamination. 6. Trial Pit backfilled with arisings on completion. 7. Dynamic Cone Penetrometer (DCP) test not undertaken due to standing water preventing inspection pit being excavated to full depth and cleared of buried services .

Notes: For explanation of symbols and abbreviations, see Key Sheet.

Scale: | Logged By: MB | Checked By: NW

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Trial Pit No. TP13

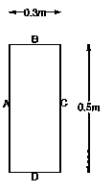
Sheet: 1 of 1

Equipment & Methods: Hand Tools Support Used:None	Project Name: Chesterton Interchange Ground Investigation Project Location: Chesterton, Cambridge Client: Atkins Limited	Job No: 47064416
Co-ordinates: E: 547457.394 N: 260802.345	Ground Level (m): 6.07 AOD	Date Started:19/09/2012 Date Completed:19/09/2012

Samples and In situ Testing				Field Records	DESCRIPTION	Reduced Level (m)	Legend	Depth (Thick) (m)
Depth (m)	No.	Type	Result					
0.20		E			MADE GROUND: Brown/grey very sandy angular to subrounded fine to coarse gravel of igneous rock and limestone with some ash. Sand is fine to coarse			
0.00- 0.50		B						
0.50		E			From 0.50m bgl to 0.90m bgl: with medium cobble content. Cobbles are subangular to subrounded of clinker and refractory material.			(1.20)
0.50- 1.00		B						
0.95		W			From 0.50-1.0m bgl: becomes sandy			
1.00		E						
1.00- 1.20		B						
						4.87		1.20
					End of Trial Pit 1.20 m (Thickness of basal layer not proven)			

Groundwater Observations			
Strike Depth	Post Mins	Post Depth	Flow
1.20	20.00	0.95	Rising

Plan View



Remarks

1. Trial Pit located adjacent to ballast stockpile. 2. Topography: Grade. 3. Groundwater encountered at 1.20m bgl rising to 0.95m bgl after 20 minutes. 4. Trial Pit completed at 1.20m bgl. 5. No visual or olfactory evidence of contamination. 6. Trial Pit backfilled with arisings on completion. 7. Dynamic Cone Penetrometer (DCP) test refused at 3.68m bgl - see separate report sheet for results.

Notes: For explanation of symbols and abbreviations, see Key Sheet. | Scale: | Logged By: MB | Checked By: NW

STANDARD TRIAL PIT LOG - NOTTS CHESTERTON ALL V3.1.GPJ AGS3_1.GDT 5/9/13

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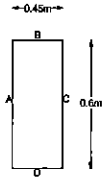
Trial Pit No. TP17

Sheet: 1 of 1

Equipment & Methods: Hand Tools Support Used:None	Project Name: Chesterton Interchange Ground Investigation Project Location: Chesterton, Cambridge Client: Alkins Limited	Job No: 47064416
Co-ordinates: E: 547508.302 N: 260730.989	Ground Level (m): 5.90 AOD	Date Started:18/09/2012 Date Completed:18/09/2012

Samples and In situ Testing				Field Records	DESCRIPTION	Reduced Level (m)	Legend	Depth (Thick) (m)
Depth (m)	No.	Type	Result					
0.20 0.00- 0.50		E B			MADE GROUND: Black/brown sandy angular to subrounded fine to coarse gravel of igneous rock and clinker with some ash. Sand is fine to coarse			(1.00)
0.50		E						
0.50- 1.10		B						
1.00		E				4.90		1.00
1.20		D			MADE GROUND: Beige/black sandy angular to rounded fine to coarse gravel of quartz and clinker. Sand is fine to coarse	4.70		(0.20) 1.20
					End of Trial Pit 1.20 m (Thickness of basal layer not proven)			

Groundwater Observations				Plan View	Remarks
Strike Depth	Post Mins	Post Depth	Flow		1. Trial Pit located on Network Rail land adjacent to ballast stockpile. 2. Topography: Grade. 3. No groundwater encountered. 4. Trial Pit completed at 1.20m bgl. 5. No visual or olfactory evidence of contamination. 6. Trial Pit backfilled with arisings on completion. 7. Dynamic Cone Penetrometer (DCP) test completed at 4.00m bgl - see separate report sheet for results.

Notes: For explanation of symbols and abbreviations, see Key Sheet.

Scale:

Logged By: MB

Checked By: NW

STANDARD TRIAL PIT LOG - NOTTS CHESTERTON ALL V3.1.GPJ AGS3_1.GDT 5/9/13

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Trial Pit No. TP18

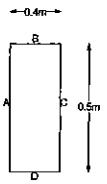
Sheet: 1 of 1

Equipment & Methods: Hand Tools Support Used:None	Project Name: Chesterton Interchange Ground Investigation Project Location: Chesterton, Cambridge Client: Atkins Limited	Job No: 47064416
Co-ordinates: E: 547581.248 N: 260784.464	Ground Level (m): 5.86 AOD	Date Started:20/09/2012 Date Completed:20/09/2012

Samples and In situ Testing				Field Records	DESCRIPTION	Reduced Level (m)	Legend	Depth (Thick) (m)
Depth (m)	No.	Type	Result					
0.20		E			MADE GROUND: Black/brown sandy angular to subrounded fine to coarse gravel of clinker, brick and refractory material. Sand is fine to coarse			
0.00- 0.60		B						
0.50	DUPA4	E						(1.20)
0.60- 1.20		B						
1.00		E						
						4.66		1.20
					End of Trial Pit 1.20 m (Thickness of basal layer not proven)			

Groundwater Observations			
Strike Depth	Post Mins	Post Depth	Flow

Plan View



Remarks

1. Trial Pit located on disused railway sidings 2. Topography: Grade. 3. No groundwater encountered. 4. Trial Pit completed at 1.20m bgl. 5. No visual or olfactory evidence of contamination. 6. Trial Pit backfilled with arisings on completion. 7. Dynamic Cone Penetrometer (DCP) test completed at 3.00m bgl - see separate report sheet for results.

Notes: For explanation of symbols and abbreviations, see Key Sheet.

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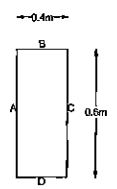
Trial Pit No. TP21

Sheet: 1 of 1

Equipment & Methods: Hand Tools Support Used:None	Project Name: Chesterton Interchange Ground Investigation Project Location: Chesterton, Cambridge Client: Atkins Limited	Job No: 47064416
Co-ordinates: E: 547499.157 N: 260693.118	Ground Level (m): 6.13 AOD	Date Started:19/09/2012 Date Completed:19/09/2012

Samples and In situ Testing				Field Records	DESCRIPTION	Reduced Level (m)	Legend	Depth (Thick) (m)
Depth (m)	No.	Type	Result					
0.20 0.00- 0.50		E B			MADE GROUND: Dark brown/black sandy angular to subrounded fine to coarse gravel of igneous rock, chert, brick and clinker with some ash and occasional rootlets. Sand is fine to coarse			
0.50		E						(1.00)
0.50- 1.00		B						
1.00		E				5.13		1.00
1.00- 1.20		B			MADE GROUND: Black very gravelly fine to coarse sand with some ash. Gravel is angular to subrounded fine to coarse of clinker and igneous rock			(0.20)
						4.93		1.20
					End of Trial Pit 1.20 m (Thickness of basal layer not proven)			

Groundwater Observations				Plan View	Remarks
Strike Depth	Post Mins	Post Depth	Flow		1. Trial Pit located adjacent to ballast stockpile. 2. Topography: Grade. 3. No groundwater encountered. 4. Trial Pit completed at 1.20m bgl. 5. No visual or olfactory evidence of contamination. 6. Trial Pit backfilled with arisings on completion. 7. Dynamic Cone Penetrometer (DCP) test refused at 3.85m bgl - see separate report sheet for results.

Notes: For explanation of symbols and abbreviations, see Key Sheet. | Scale: | Logged By: MB | Checked By: NW

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Trial Pit No. TP22

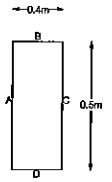
Sheet: 1 of 1

Equipment & Methods: Hand Tools Support Used:None	Project Name: Chesterton Interchange Ground Investigation Project Location: Chesterton, Cambridge Client: Atkins Limited	Job No: 47064416
Co-ordinates: E: 547547.706 N: 260703.208	Ground Level (m): 6.03 AOD	Date Started:20/09/2012 Date Completed:20/09/2012

Samples and In situ Testing				Field Records	DESCRIPTION	Reduced Level (m)	Legend	Depth (Thick) (m)
Depth (m)	No.	Type	Result					
0.00- 0.30 0.20		B E			MADE GROUND: Grey/brown sandy angular to subrounded fine to coarse gravel of clinker, limestone and refractory material with occasional rootlets. Sand is fine to medium			(0.30)
						5.73		0.30
0.30- 0.70 0.50	DUPA3	B E			MADE GROUND: Black/brown clayey silty sandy angular to subrounded fine to coarse gravel of roof slate, brick, chert, limestone and refractory material with some ash. Sand is fine to coarse			(0.90)
0.70- 1.20 1.00		B E						
						4.83		1.20
					End of Trial Pit 1.20 m (Thickness of basal layer not proven)			

Groundwater Observations			
Strike Depth	Post Mins	Post Depth	Flow

Plan View



Remarks

1. Trial Pit located on disused railway sidings. 2. Topography: Grade. 3. No groundwater encountered. 4. Trial Pit completed at 1.20m bgl. 5. No visual or olfactory evidence of contamination. 6. Trial Pit backfilled with arisings on completion. 7. Dynamic Cone Penetrometer (DCP) test completed at 3.00m bgl - see separate report sheet for results.

Notes: For explanation of symbols and abbreviations, see Key Sheet.

Scale: | Logged By: MB | Checked By: NW

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Trial Pit No. TP23

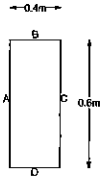
Sheet: 1 of 1

Equipment & Methods: Hand Tools Support Used:None	Project Name: Chesterton Interchange Ground Investigation Project Location: Chesterton, Cambridge Client: Atkins Limited	Job No: 47064416
Co-ordinates: E: 547472.898 N: 260657.375	Ground Level (m): 6.04 AOD	Date Started:19/09/2012 Date Completed:19/09/2012

Samples and In situ Testing				Field Records	DESCRIPTION	Reduced Level (m)	Legend	Depth (Thick) (m)
Depth (m)	No.	Type	Result					
0.20 0.00- 0.45		E B			MADE GROUND: Black very gravelly fine to coarse sand with some ash and low cobble content. Cobbles are subangular of clinker. Gravel is angular to subrounded fine to coarse of clinker and refractory material			(0.45)
0.50		E			MADE GROUND: Grey slightly silty fine sand	5.59		0.45
0.45- 0.80		B						(0.35)
1.00		E			Beige fine to medium SAND with rare angular to subrounded fine to medium gravel of quartz and chert (RIVER TERRACE DEPOSITS)	5.24		0.80
1.20		D			**End of Trial Pit 1.20 m** (Thickness of basal layer not proven)	4.84		(0.40) 1.20

Groundwater Observations			
Strike Depth	Post Mins	Post Depth	Flow

Plan View



Remarks

1. Trial Pit located adjacent to ballast stockpile. 2. Topography: Grade. 3. No groundwater encountered. 4. Trial Pit completed at 1.20m bgl. 5. No visual or olfactory evidence of contamination. 6. Trial Pit backfilled with arisings on completion. 7. Dynamic Cone Penetrometer (DCP) test refused at 3.31m bgl - see separate report sheet for results.

Notes: For explanation of symbols and abbreviations, see Key Sheet.

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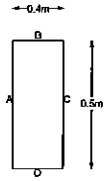
Trial Pit No. TP27

Sheet: 1 of 1

Equipment & Methods: Hand Tools Support Used:None	Project Name: Chesterton Interchange Ground Investigation Project Location: Chesterton, Cambridge Client: Atkins Limited	Job No: 47064416
Co-ordinates: E: 547480.212 N: 260564.929	Ground Level (m): 6.13 AOD	Date Started:21/09/2012 Date Completed:21/09/2012

Samples and In situ Testing				Field Records	DESCRIPTION	Reduced Level (m)	Legend	Depth (Thick) (m)
Depth (m)	No.	Type	Result					
0.00- 0.30 0.20		B E			MADE GROUND: Dark brown/grey sand and gravel with some ash and abundant rootlets (up to 30mm diameter). Gravel is angular to subrounded fine to coarse of igneous rock and clinker. Sand is fine to coarse			
0.50 0.30- 0.90		E B			At 0.40m bgl: with low cobble content. Cobbles are subangular of brick			(0.90)
						5.23		0.90
1.00		D E			MADE GROUND: Dark brown/black very gravelly fine to coarse sand with ash. Gravel is subangular to subrounded fine to coarse of igneous rock and refractory material			(0.30)
						4.93		1.20
					End of Trial Pit 1.20 m (Thickness of basal layer not proven)			

Groundwater Observations				Plan View	Remarks
Strike Depth	Post Mins	Post Depth	Flow		1. Trial Pit located on disused railway sidings. 2. Topography: Grade. 3. No groundwater encountered. 4. Trial Pit completed at 1.20m bgl. 5. No visual or olfactory evidence of contamination. 6. Trial Pit backfilled with arisings on completion. 7. Dynamic Cone Penetrometer (DCP) test completed at 3.00m bgl - see separate report sheet for results.

Notes: For explanation of symbols and abbreviations, see Key Sheet. | Scale: | Logged By: LR | Checked By: NW

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Trial Pit No. TP28A

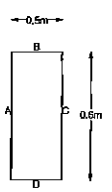
Sheet: 1 of 1

Equipment & Methods: Hand Tools Support Used:None	Project Name: Chesterton Interchange Ground Investigation Project Location: Chesterton, Cambridge Client: Atkins Limited	Job No: 47064416
Co-ordinates: E: 547479.325 N: 260498.791	Ground Level (m): 6.34 AOD	Date Started:07/01/2013 Date Completed:07/01/2013

Samples and In situ Testing				Field Records	DESCRIPTION	Reduced Level (m)	Legend	Depth (Thick) (m)
Depth (m)	No.	Type	Result					
					MADE GROUND: Grey angular to subrounded medium to coarse gravel of igneous rock	6.24		(0.10) 0.10
0.00- 0.50		E			MADE GROUND: Black very sandy angular to subrounded fine to medium gravel of clinker with some ash and low cobble content. Cobbles are subangular of clinker. Sand is fine to coarse			
0.10- 0.60		B						
0.50		E						(1.10)
0.60- 1.20		B						
1.00		E						
						5.14		1.20
					End of Trial Pit 1.20 m (Thickness of basal layer not proven)			

Groundwater Observations			
Strike Depth	Post Mins	Post Depth	Flow
1.15	20.00	1.05	Rising

Plan View



Remarks

1. Trial Pit located in 4ft of disused railway sidings. 2. Topography: Grade. 3. Groundwater encountered at 1.15m bgl rising to 1.05m bgl after 20 minutes. 4. Trial Pit completed at 1.20m bgl. 5. No visual or olfactory evidence of contamination observed. 6. Trial Pit backfilled with arisings on completion. 7. Dynamic Cone Penetrometer (DCP) test completed at 3.00m bgl - see separate report sheet for results.

Notes: For explanation of symbols and abbreviations, see Key Sheet.

Scale:

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STANDARD TRIAL PIT LOG - NOTTS CHESTERTON ALL V3.1.GPJ AGS3_1.GDT 5/9/13

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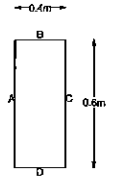
Trial Pit No. TP29

Sheet: 1 of 1

Equipment & Methods: Hand Tools Support Used:None	Project Name: Chesterton Interchange Ground Investigation Project Location: Chesterton, Cambridge Client: Atkins Limited	Job No: 47064416
Co-ordinates: E: 547444.707 N: 260367.108	Ground Level (m): 6.95 AOD	Date Started:21/09/2012 Date Completed:21/09/2012

Samples and In situ Testing				Field Records	DESCRIPTION	Reduced Level (m)	Legend	Depth (Thick) (m)
Depth (m)	No.	Type	Result					
0.00- 0.30		B E			MADE GROUND: Pink/grey slightly sandy angular to subangular medium to coarse gravel of igneous rock. Sand is fine to medium	6.65		(0.30) 0.30
0.30- 0.70 0.50	DUPA7	B E			MADE GROUND: Grey/brown clayey silty sand and gravel. Gravel is angular to subrounded fine to coarse gravel of igneous rock, clinker, quartz and chert with pockets of clay (up to 10mm diameter). Sand is fine to medium	6.25		(0.40) 0.70
0.70- 1.20 1.00		B E			Orange/brown clayey silty SAND and GRAVEL. Gravel is angular to subrounded fine to coarse of quartz and chert. Sand is fine to coarse (RIVER TERRACE DEPOSITS)	5.75		(0.50) 1.20
					End of Trial Pit 1.20 m (Thickness of basal layer not proven)			

Groundwater Observations				Plan View	Remarks
Strike Depth	Post Mins	Post Depth	Flow		1. Trial Pit located on disused railway sidings. 2. Topography: Grade. 3. No groundwater encountered. 4. Trial Pit completed at 1.20m bgl. 5. No visual or olfactory evidence of contamination. 6. Backfilled with arisings on completion. 7. Dynamic Cone Penetrometer (DCP) test completed at 3.00m bgl - see separate report sheet for results.

Notes: For explanation of symbols and abbreviations, see Key Sheet.

Scale:

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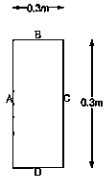
Trial Pit No. TP30

Sheet: 1 of 1

Equipment & Methods: Hand Tools Support Used:None	Project Name: Chesterton Interchange Ground Investigation Project Location: Chesterton, Cambridge Client: Atkins Limited	Job No: 47064416
Co-ordinates: E: 547437.902325 N: 260313.111706	Ground Level (m):	Date Started:30/06/2013 Date Completed:30/06/2013

Samples and In situ Testing				Field Records	DESCRIPTION	Reduced Level (m)	Legend	Depth (Thick) (m)
Depth (m)	No.	Type	Result					
0.00- 0.40		B			MADE GROUND: Grey sandy angular to subangular medium to coarse gravel of igneous rock and limestone. Sand is fine to coarse (SLIGHTLY DIRTY BALLAST)			(0.40)
0.20		E				-0.40		0.40
0.50		E			MADE GROUND: Grey slightly gravelly fine to coarse sand with some ash. Gravel is subangular to subrounded fine to coarse of igneous rock and limestone			(0.30)
0.40- 0.70		B				-0.70		0.70
0.70- 1.10		B			Orange/brown gravelly fine to coarse SAND with low cobble content. Gravel is angular to subrounded fine to coarse of chert. Cobbles are subangular of chert (RIVER TERRACE DEPOSITS)			(0.40)
1.00		E				-1.10		1.10
1.10- 1.20		B			Soft grey slightly gravelly sandy CLAY. Gravel is angular to subangular fine to coarse of chert (RIVER TERRACE DEPOSITS)	-1.20		(0.10) 1.20
					End of Trial Pit 1.20 m (Thickness of basal layer not proven)			

Groundwater Observations				Plan View	Remarks
Strike Depth	Post Mins	Post Depth	Flow		1. Trial Pit located in the 4ft of the Down Main in-line with the specified coordinates. 2. Topography: Grade. 3. No groundwater encountered. 4. Trial Pit completed at 1.20m bgl. 5. No visual or olfactory evidence of contamination. 6. Backfilled with arisings on completion. 7. Dynamic Cone Penetrometer (DCP) test completed at 3.00m bgl - see separate report sheet for results.

Notes: For explanation of symbols and abbreviations, see Key Sheet.

Scale: | Logged By: LR | Checked By: JW

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Trial Pit No. TP34

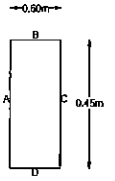
Sheet: 1 of 1

Equipment & Methods: Hand Tools Support Used:None	Project Name: Chesterton Interchange Ground Investigation Project Location: Chesterton, Cambridge Client: Atkins Limited	Job No: 47064416
Co-ordinates: E: 547370.874854 N: 260084.591727	Ground Level (m):	Date Started:31/03/2013 Date Completed:31/03/2013

Samples and In situ Testing				Field Records	DESCRIPTION	Reduced Level (m)	Legend	Depth (Thick) (m)
Depth (m)	No.	Type	Result					
					MADE GROUND: Pink/grey angular to subangular medium to coarse gravel of igneous rock (SLIGHTLY DIRTY BALLAST)	-0.15		(0.15) 0.15
0.00- 0.50		B E			MADE GROUND: Brown sandy angular to subrounded fine to coarse gravel of igneous rock. Sand is fine to medium (DIRTY BALLAST)	-0.50		(0.35) 0.50
0.60		E			MADE GROUND: Black gravelly fine to coarse sand. Gravel is angular to subrounded fine to coarse of quartz, clinker and chert	-0.90		(0.40) 0.90
0.50- 0.90		B						
1.00		E			MADE GROUND: Orange/brown very sandy angular to subrounded fine to coarse gravel of chert. Sand is fine to coarse	-1.20		(0.30) 1.20
0.90- 1.20		B						
					End of Trial Pit 1.20 m (Thickness of basal layer not proven)			

Groundwater Observations			
Strike Depth	Post Mins	Post Depth	Flow

Plan View



Remarks

1. Trial Pit located in 4R of the Up Main, offset 10.5m from toes of 1108A points. 2. Topography: ~3.00m high Embankment. 3. No groundwater encountered. 4. Trial Pit completed at 1.20m bgl. 5. No visual or olfactory evidence of contamination observed. 6. Trial Pit backfilled with arisings on completion. 7. Dynamic Cone Penetrometer (DCP) test completed at 3.29m bgl - see separate report sheet for results.

Notes: For explanation of symbols and abbreviations, see Key Sheet.

Scale:

Logged By: MB

Checked By: JW

STANDARD TRIAL PIT LOG - NOTTS CHESTERTON ALL V3.1.GPJ AGS3_1.GDT 5/8/13

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Trial Pit No. TP35A

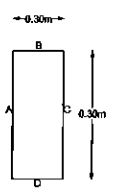
Sheet: 1 of 1

Equipment & Methods: Hand Tools Support Used:None	Project Name: Chesterton Interchange Ground Investigation Project Location: Chesterton, Cambridge Client: Atkins Limited	Job No: 47064416
Co-ordinates: E: 547391.959101 N: 260157.719619	Ground Level (m):	Date Started:31/03/2013 Date Completed:31/03/2013

Samples and In situ Testing				Field Records	DESCRIPTION	Reduced Level (m)	Legend	Depth (Thick) (m)
Depth (m)	No.	Type	Result					
0.00- 0.50 0.30		B E E			MADE GROUND: Light grey very angular coarse gravel of igneous rock (SLIGHTLY DIRTY BALLAST)	-0.20		(0.20)
					MADE GROUND: Brown/ grey sandy very angular to subangular fine to coarse gravel of igneous rock, limestone and clinker. Sand is fine to coarse (DIRTY BALLAST)	-0.50		0.20 (0.30) 0.50
0.80 0.50- 1.20		E B			MADE GROUND: dark brown/ black very sandy angular to subrounded fine to coarse gravel of clinker and limestone. Sand is fine to coarse At 1.10m bgl: with frequent angular to subangular medium to coarse gravel of limestone	-1.20		(0.70) 1.20
					End of Trial Pit 1.20 m (Thickness of basal layer not proven)			

Groundwater Observations			
Strike Depth	Post Mins	Post Depth	Flow

Plan View



Remarks

1. Trial Pit located in 4ft of the Up Main, offset 5.0m from toes of 1106B points. 2. Topography: ~4-5m high Embankment. 3. No groundwater encountered. 4. Trial Pit completed at 1.20m bgl. 5. No visual or olfactory evidence of contamination observed. 6. Trial Pit backfilled with arisings on completion. 7. Dynamic Cone Penetrometer (DCP) test completed at 3.82m bgl - see separate report sheet for results.

Notes: For explanation of symbols and abbreviations, see Key Sheet.

Scale:

Logged By: JW

Checked By: JW

STANDARD TRIAL PIT LOG - NOTTS CHESTERTON ALL V3.1.GPJ AGS3_1.GDT 5/9/13

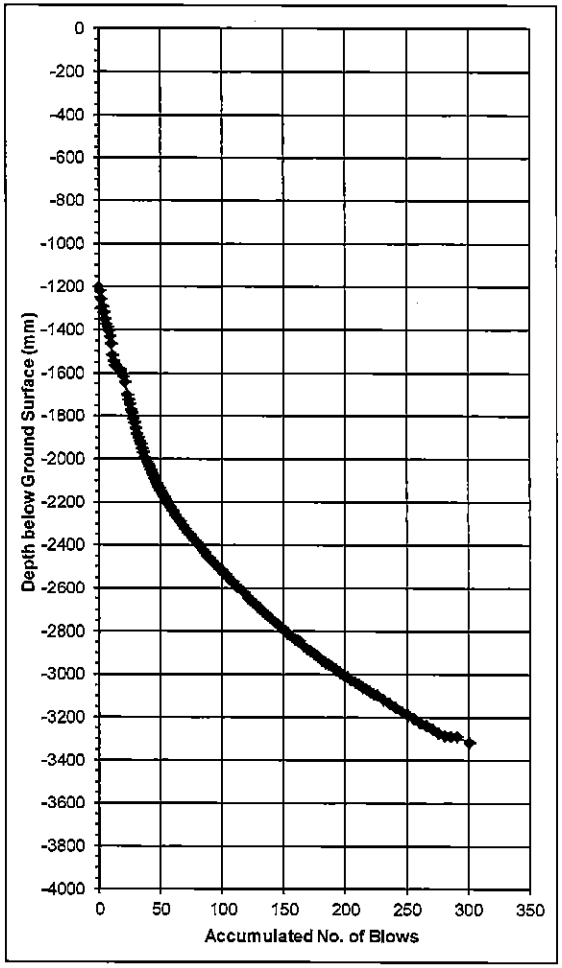
DYNAMIC CONE PENETROMETER RESULTS

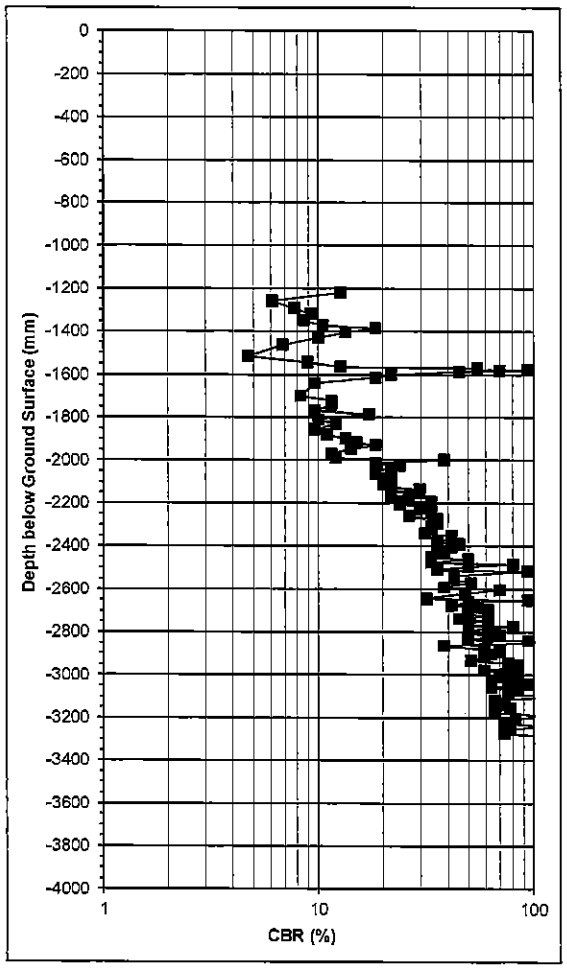
Job Number :	47064416
DCP/Core Number :	TP07
DCP Operator :	SL / BWH
Date Tested :	17/09/12
Plot Prepared By :	RS
Plot Checked By :	MT
Date Prepared :	17/09/12

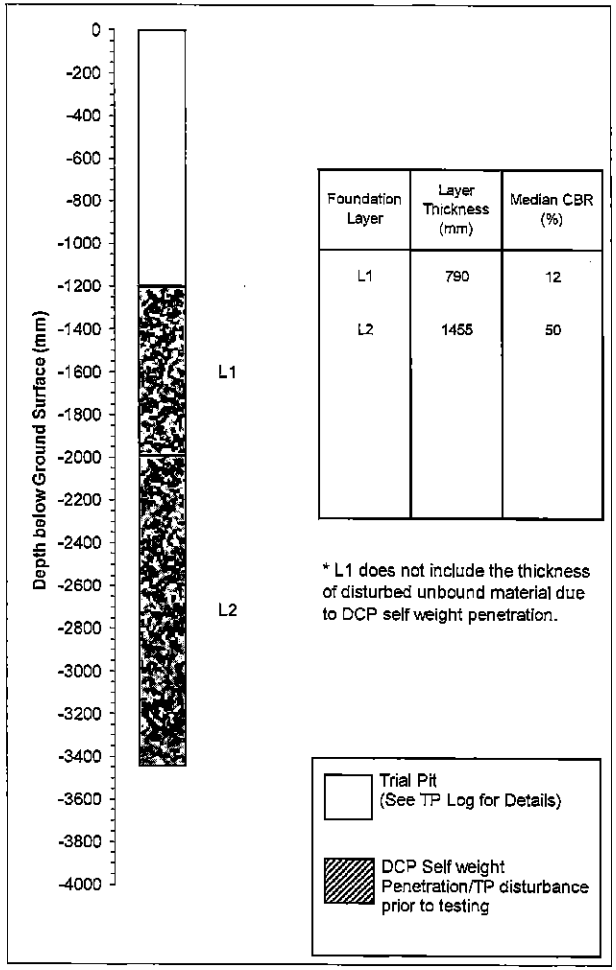
Location : Chesterton Interchange

Notes: DCP advanced through the base of TP07.

URS







Foundation Layer	Layer Thickness (mm)	Median CBR (%)
L1	790	12
L2	1455	50

* L1 does not include the thickness of disturbed unbound material due to DCP self weight penetration.

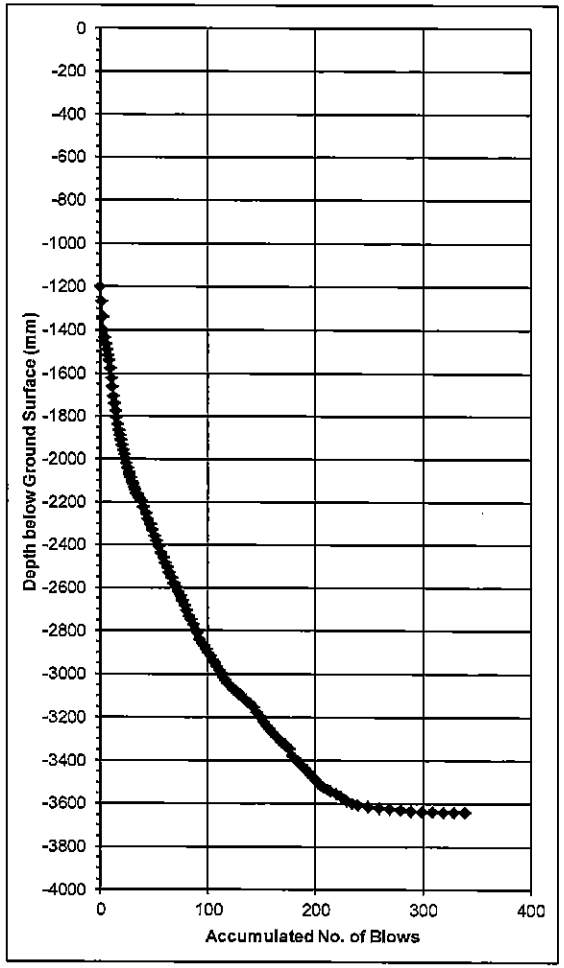
DYNAMIC CONE PENETROMETER RESULTS

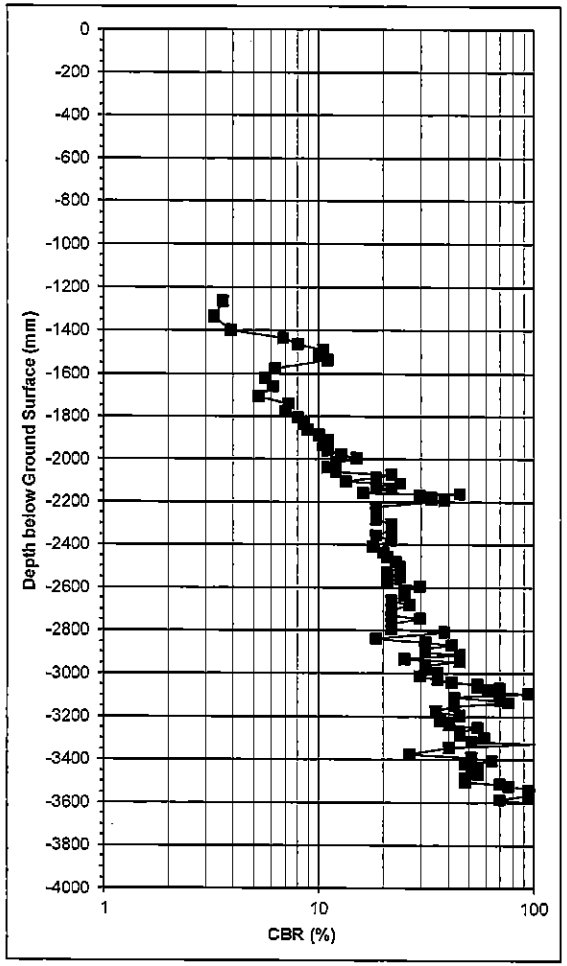
Job Number :	47064416
DCP/Core Number :	TP13
DCP Operator :	SL / BWH
Date Tested :	19/09/12
Plot Prepared By :	RS
Plot Checked By :	MT
Date Prepared :	17/09/12

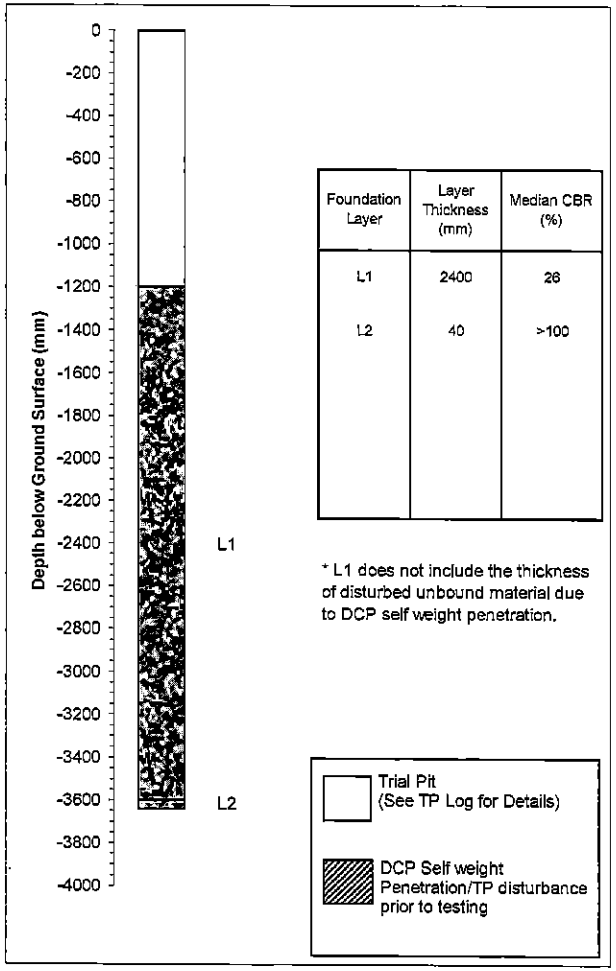
Location : Chesterton Interchange

Notes: DCP advanced through the base of TP13.

URS







Foundation Layer	Layer Thickness (mm)	Median CBR (%)
L1	2400	26
L2	40	>100

* L1 does not include the thickness of disturbed unbound material due to DCP self weight penetration.

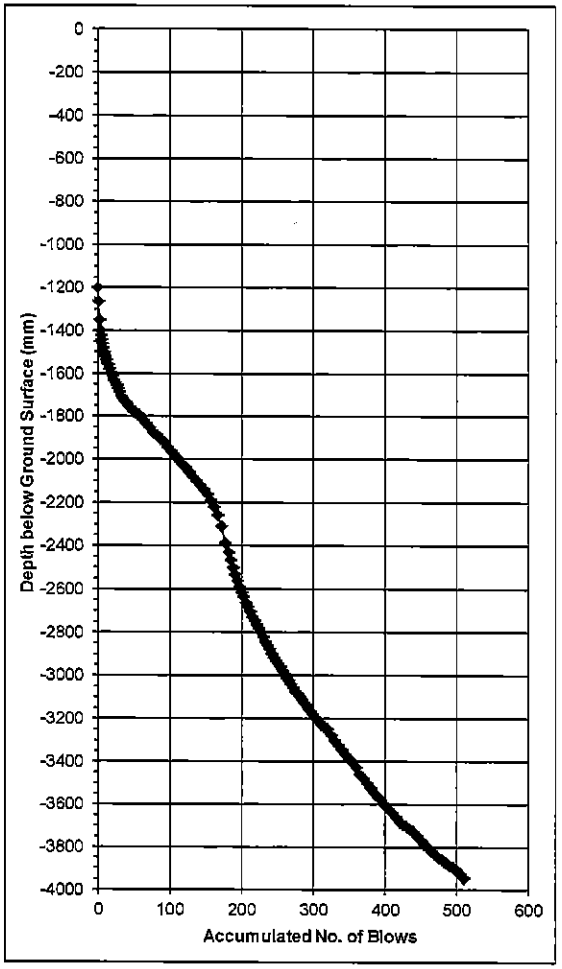
DYNAMIC CONE PENETROMETER RESULTS

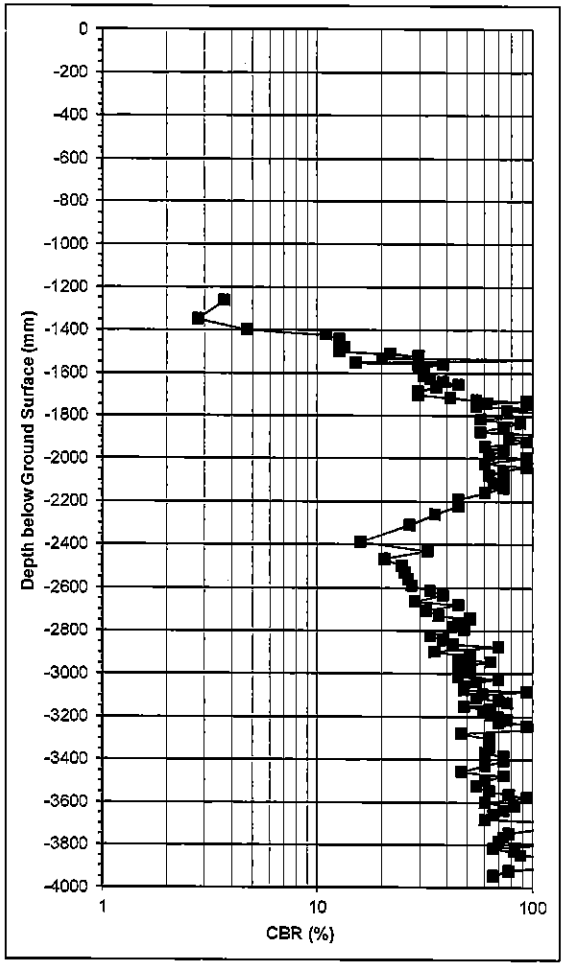
Job Number :	47064416
DCP/Core Number :	TP17
DCP Operator :	SL / BWH
Date Tested :	18/09/12
Plot Prepared By :	RS
Plot Checked By :	MT
Date Prepared :	17/09/12

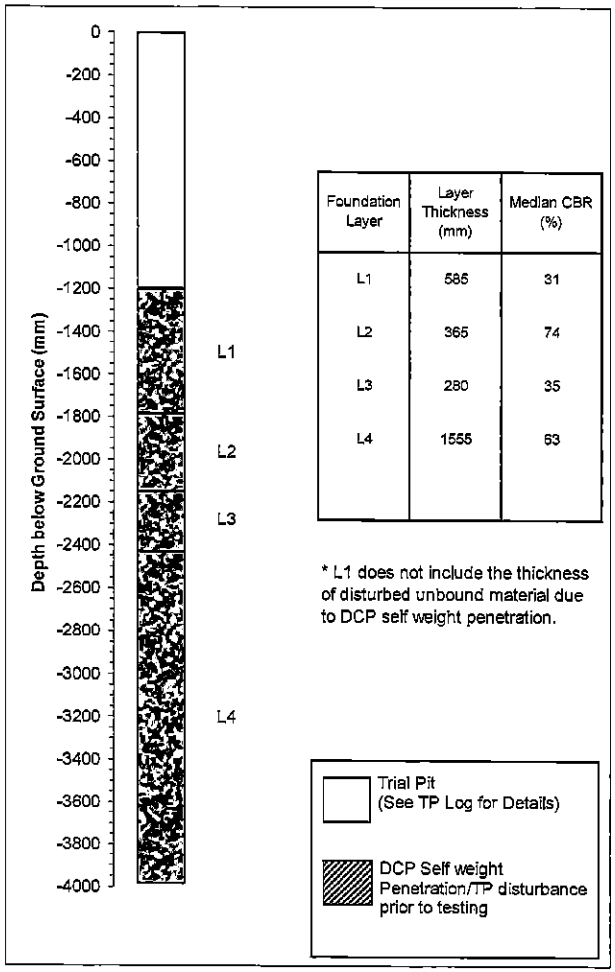
Location : Chesterton Interchange

Notes: DCP advanced through the base of TP017.

URS







Foundation Layer	Layer Thickness (mm)	Median CBR (%)
L1	585	31
L2	365	74
L3	280	35
L4	1555	53

* L1 does not include the thickness of disturbed unbound material due to DCP self weight penetration.

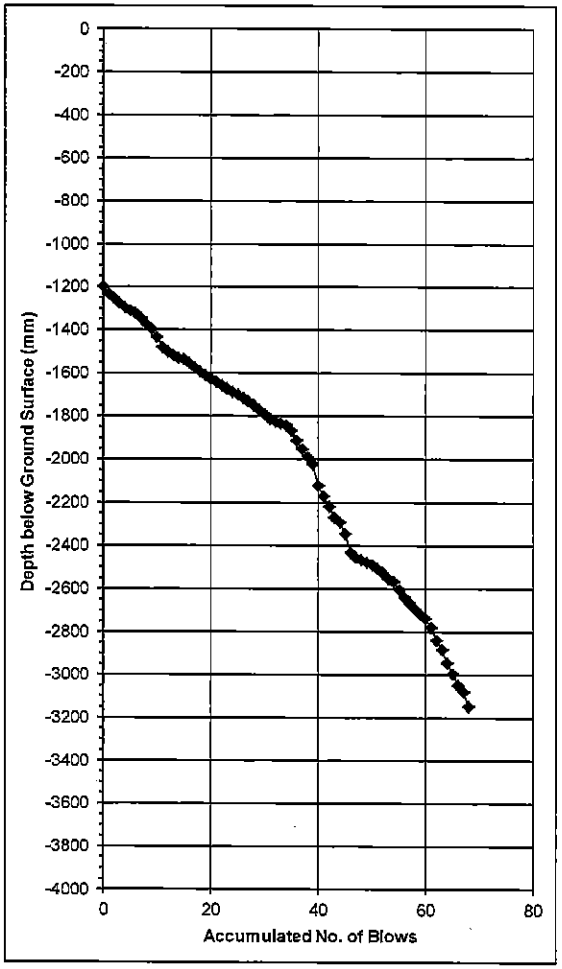
DYNAMIC CONE PENETROMETER RESULTS

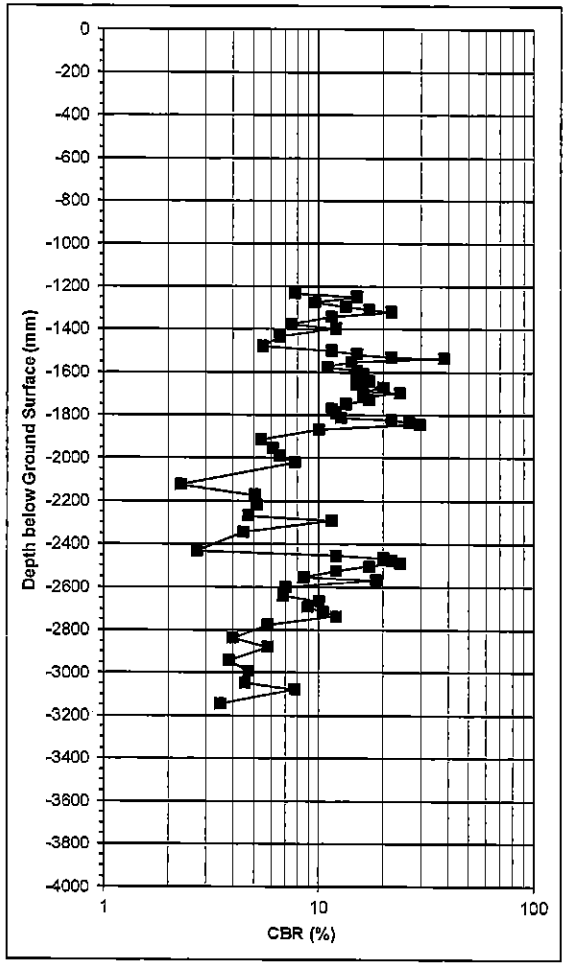
Job Number :	47064416
DCP/Core Number :	TP18
DCP Operator :	SL / BWH
Date Tested :	20/09/12
Plot Prepared By :	RS
Plot Checked By :	MT
Date Prepared :	17/09/12

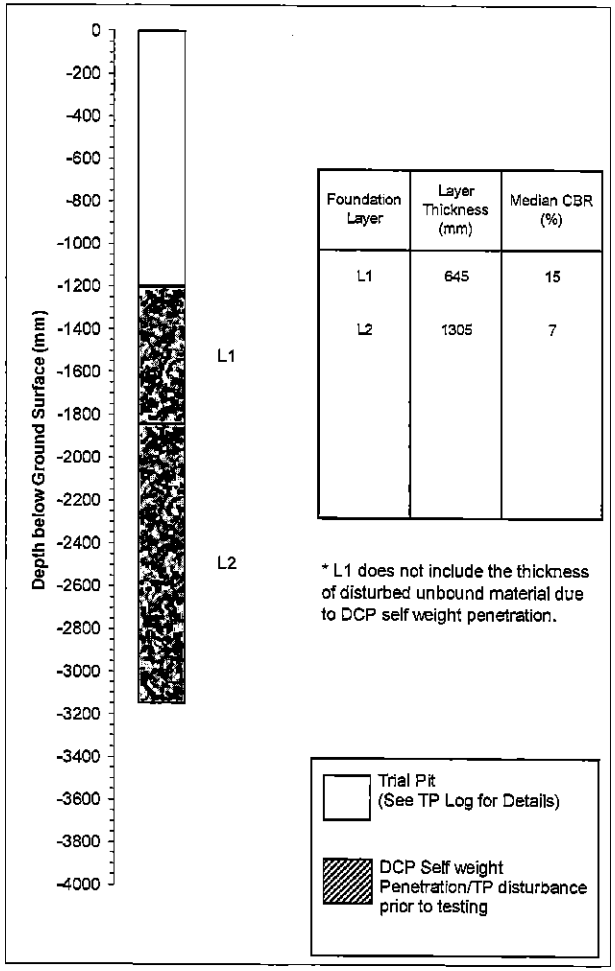
Location : Chesterton Interchange

Notes: DCP advanced through the base of TP18.

URS







Foundation Layer	Layer Thickness (mm)	Median CBR (%)
L1	645	15
L2	1305	7

* L1 does not include the thickness of disturbed unbound material due to DCP self weight penetration.

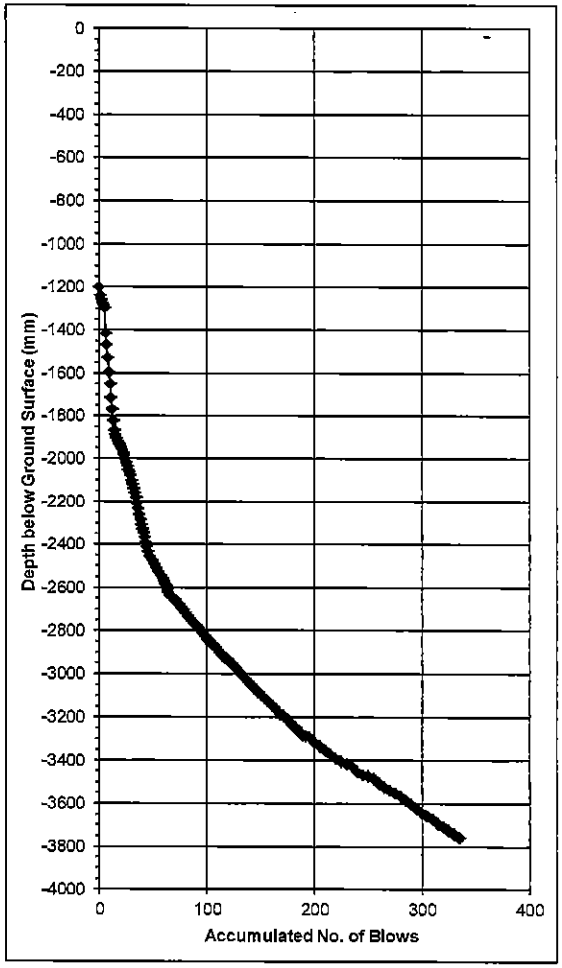
DYNAMIC CONE PENETROMETER RESULTS

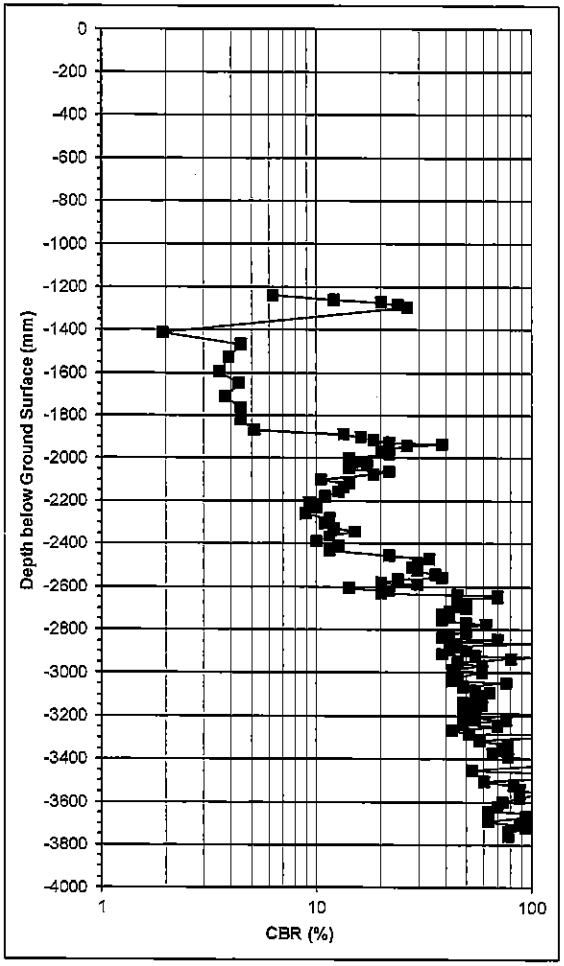
Job Number :	47064416
DCP/Core Number :	TP21
DCP Operator :	SL / BWH
Date Tested :	19/09/12
Plot Prepared By :	RS
Plot Checked By :	MT
Date Prepared :	17/09/12

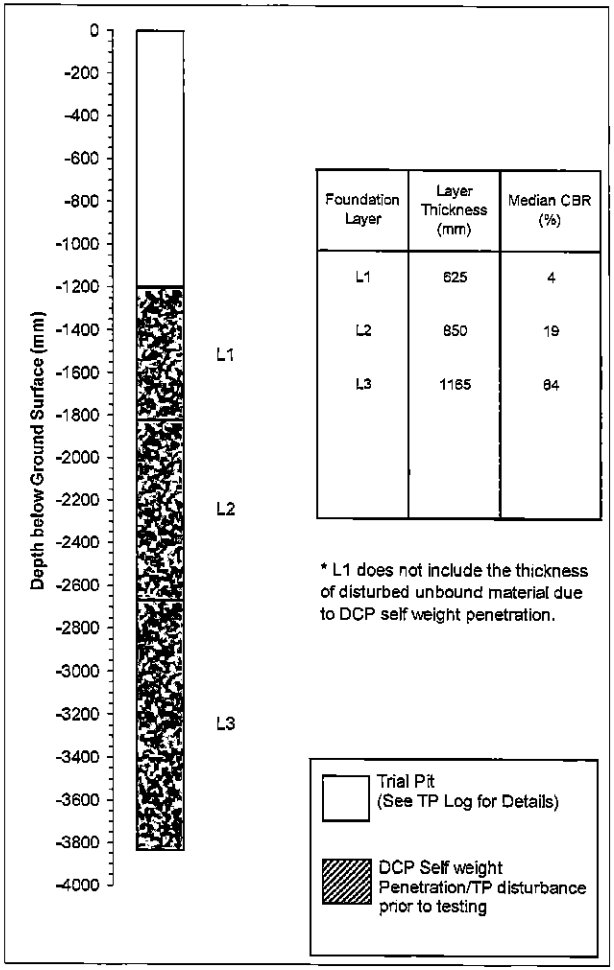
Location : Chesterton Interchange

Notes: DCP advanced through the base of TP021.

URS







Foundation Layer	Layer Thickness (mm)	Median CBR (%)
L1	625	4
L2	850	19
L3	1185	84

* L1 does not include the thickness of disturbed unbound material due to DCP self weight penetration.

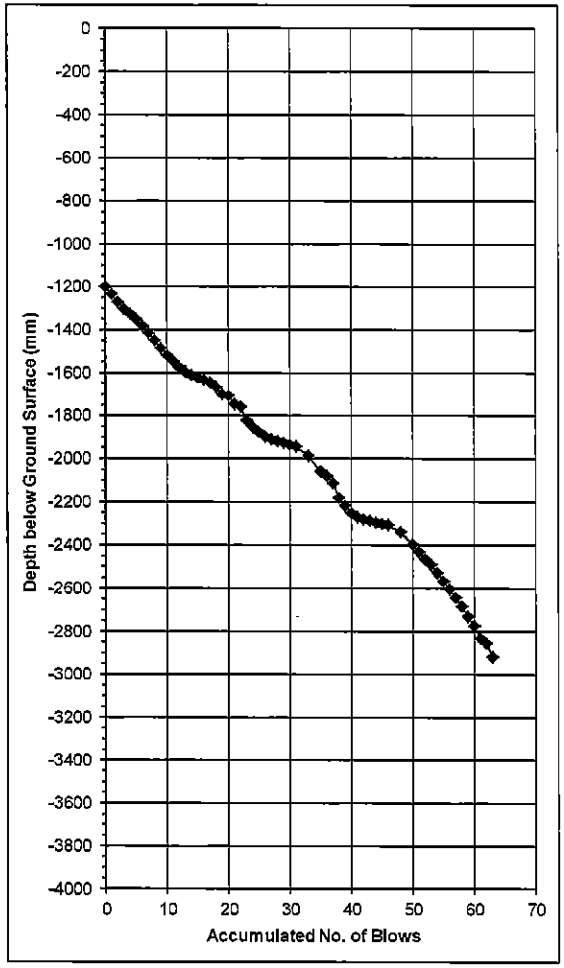
DYNAMIC CONE PENETROMETER RESULTS

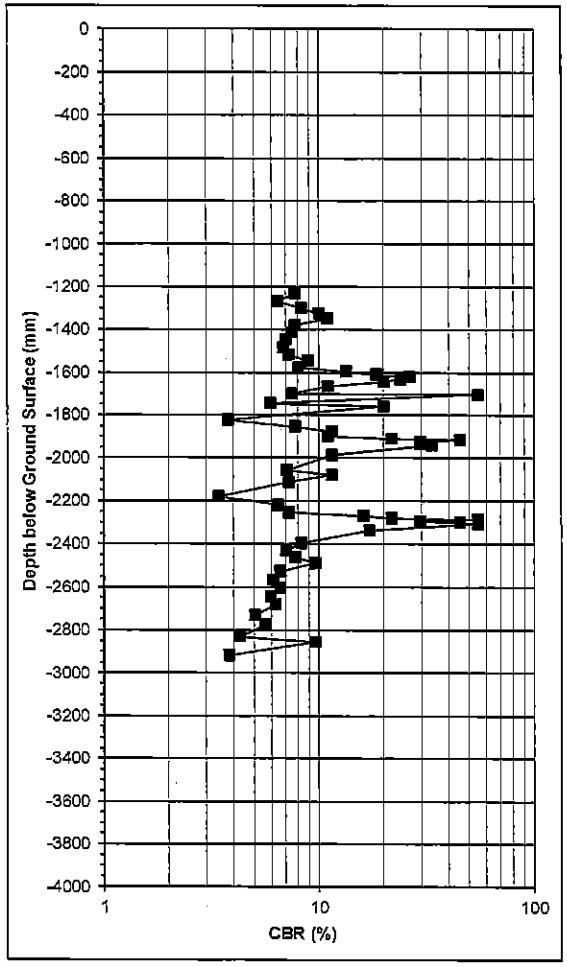
Job Number :	47064416
DCP/Core Number :	TP22
DCP Operator :	SL / BWH
Date Tested :	20/09/12
Plot Prepared By :	RS
Plot Checked By :	MT
Date Prepared :	17/09/12

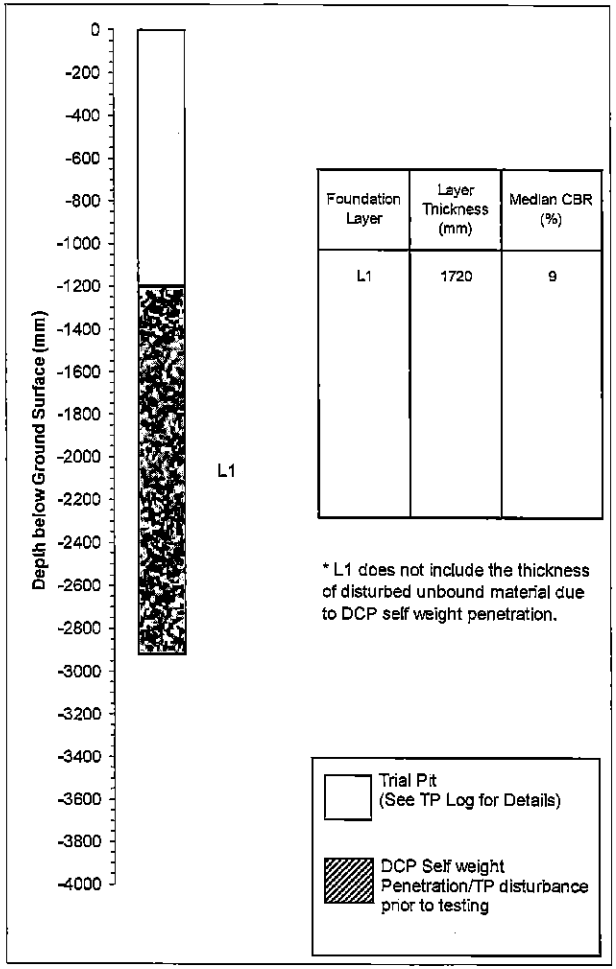
Location : Chesterton Interchange

Notes: DCP advanced through the base of TP22.

URS







Foundation Layer	Layer Thickness (mm)	Median CBR (%)
L1	1720	9

* L1 does not include the thickness of disturbed unbound material due to DCP self weight penetration.

Trial Pit
(See TP Log for Details)

DCP Self weight Penetration/TP disturbance prior to testing

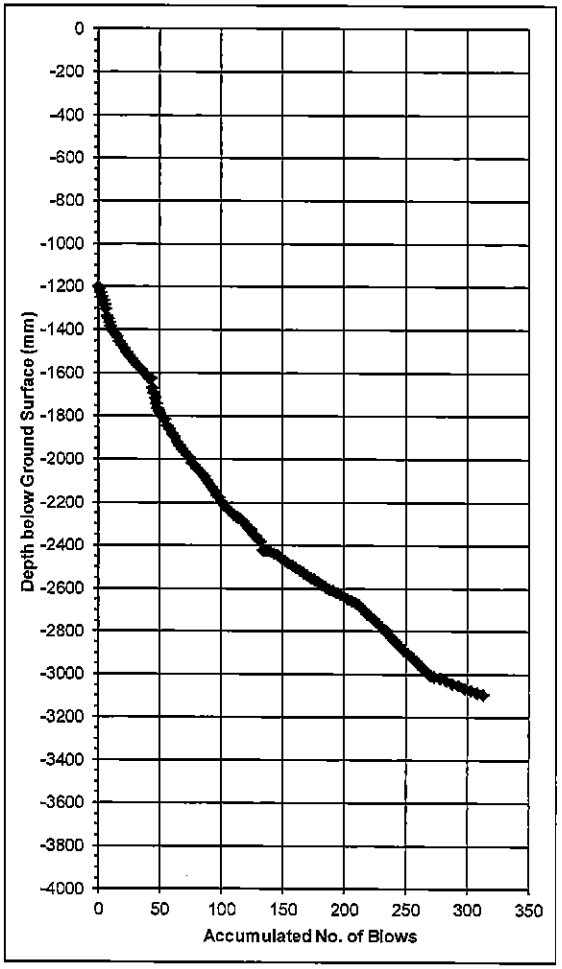
DYNAMIC CONE PENETROMETER RESULTS

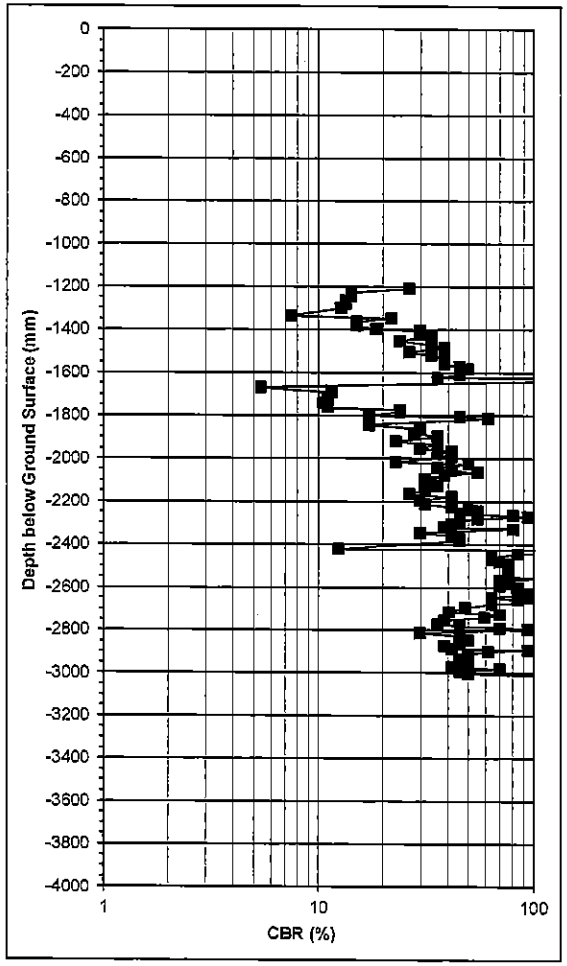
Job Number :	47064416
DCP/Core Number :	TP23
DCP Operator :	SL / BWH
Date Tested :	19/09/12
Plot Prepared By :	RS
Plot Checked By :	MT
Date Prepared :	17/09/12

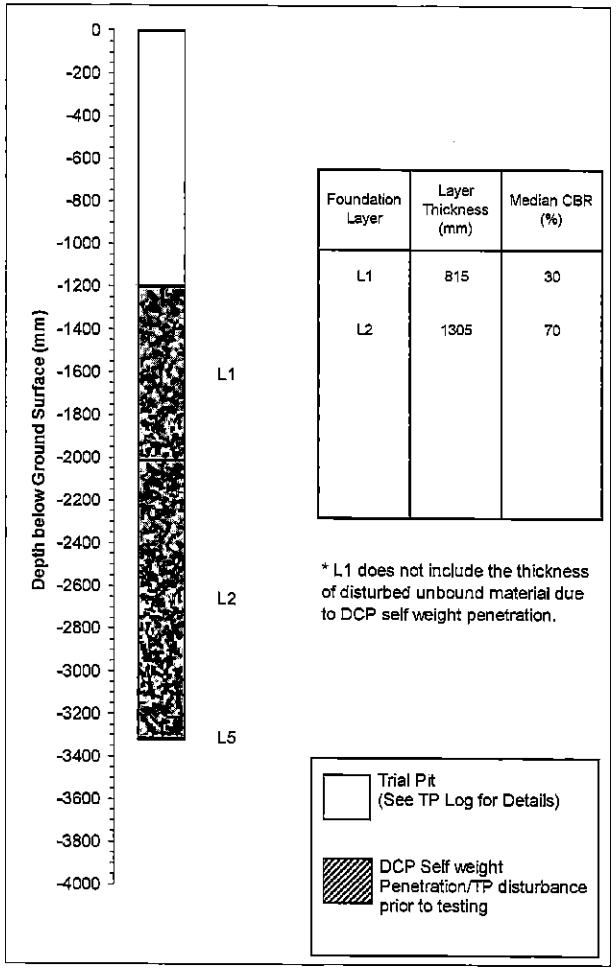
Location : Chesterton Interchange

Notes: DCP advanced through the base of TP023.

URS







Foundation Layer	Layer Thickness (mm)	Median CBR (%)
L1	815	30
L2	1305	70

* L1 does not include the thickness of disturbed unbound material due to DCP self weight penetration.

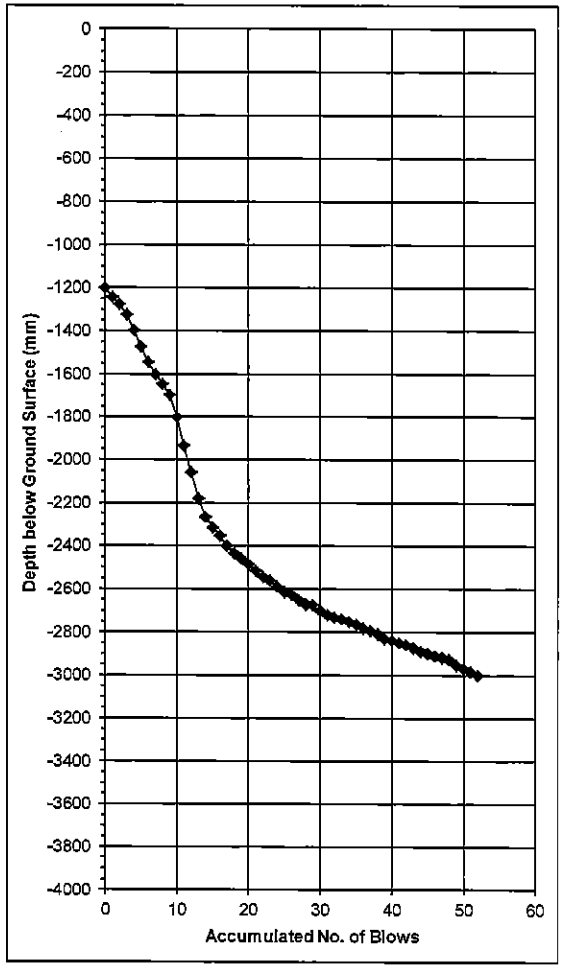
DYNAMIC CONE PENETROMETER RESULTS

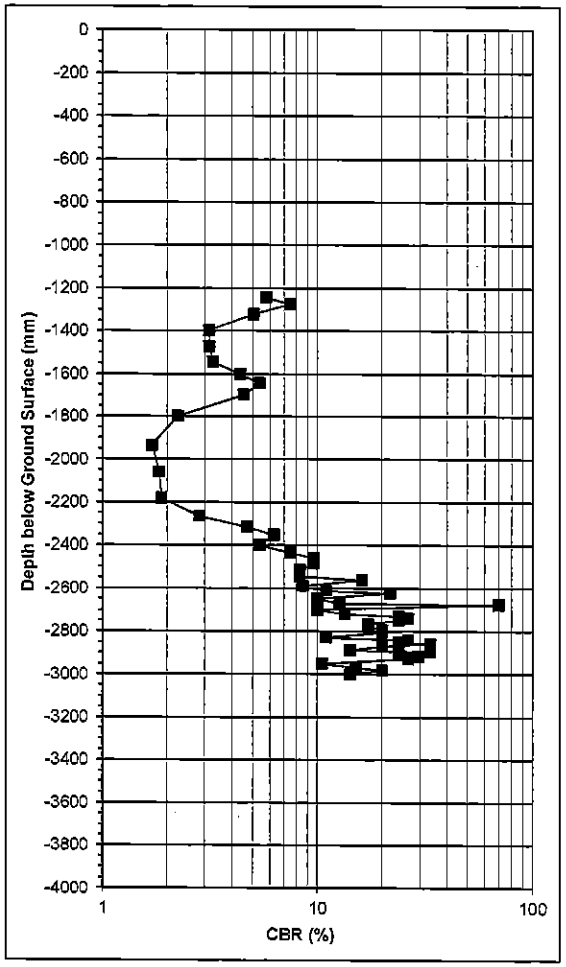
Job Number :	47064416
DCP/Core Number :	TP27
DCP Operator :	SL / BWH
Date Tested :	21/09/12
Plot Prepared By :	RS
Plot Checked By :	MT
Date Prepared :	17/09/12

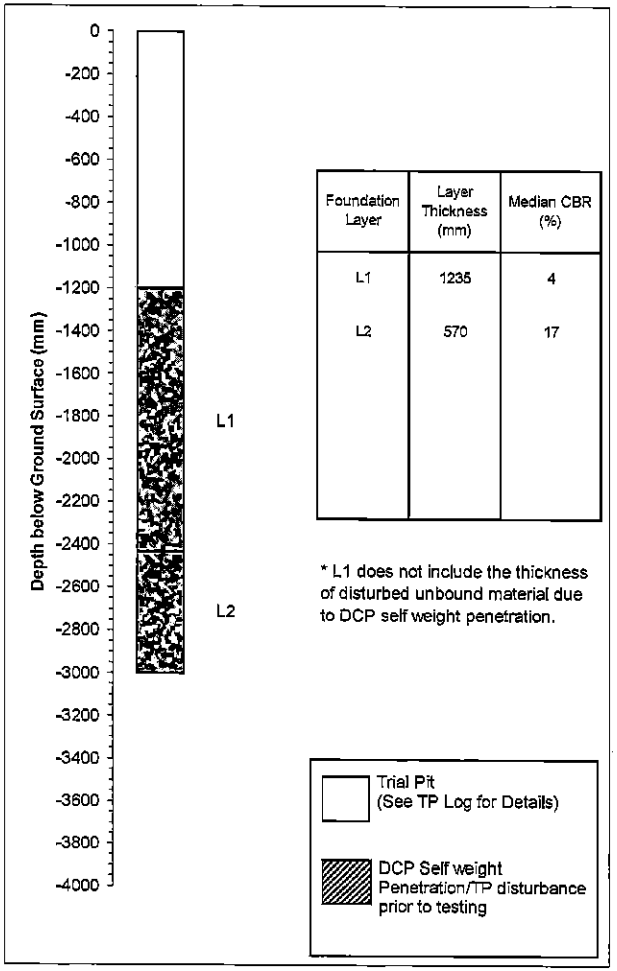
Location : Chesterton Interchange

Notes: DCP advanced through the base of TP27.

URS







Foundation Layer	Layer Thickness (mm)	Median CBR (%)
L1	1235	4
L2	570	17

* L1 does not include the thickness of disturbed unbound material due to DCP self weight penetration.

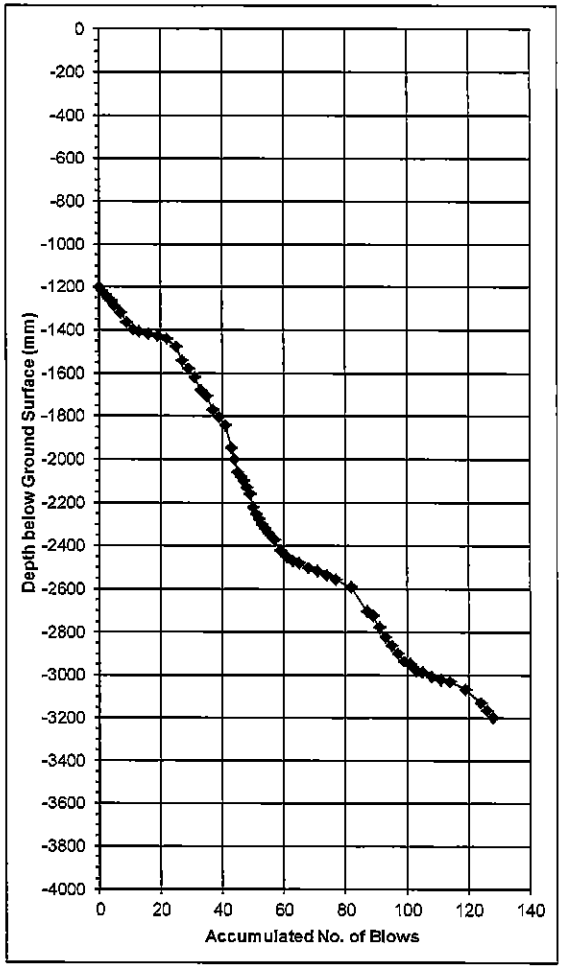
DYNAMIC CONE PENETROMETER RESULTS

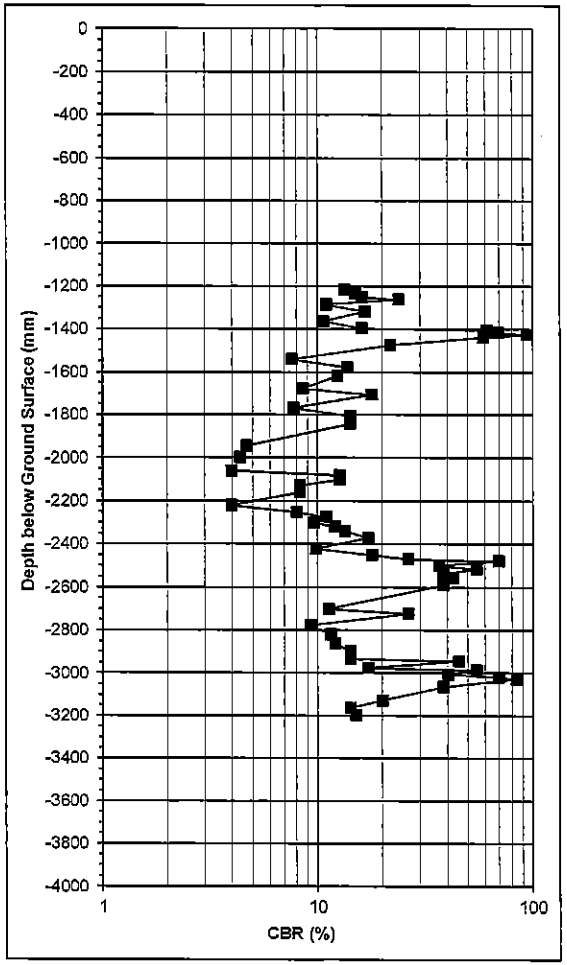
Job Number :	47064416
DCP/Core Number :	TP28A
DCP Operator :	SL / BWH
Date Tested :	07/01/13
Plot Prepared By :	RS
Plot Checked By :	MT
Date Prepared :	17/09/12

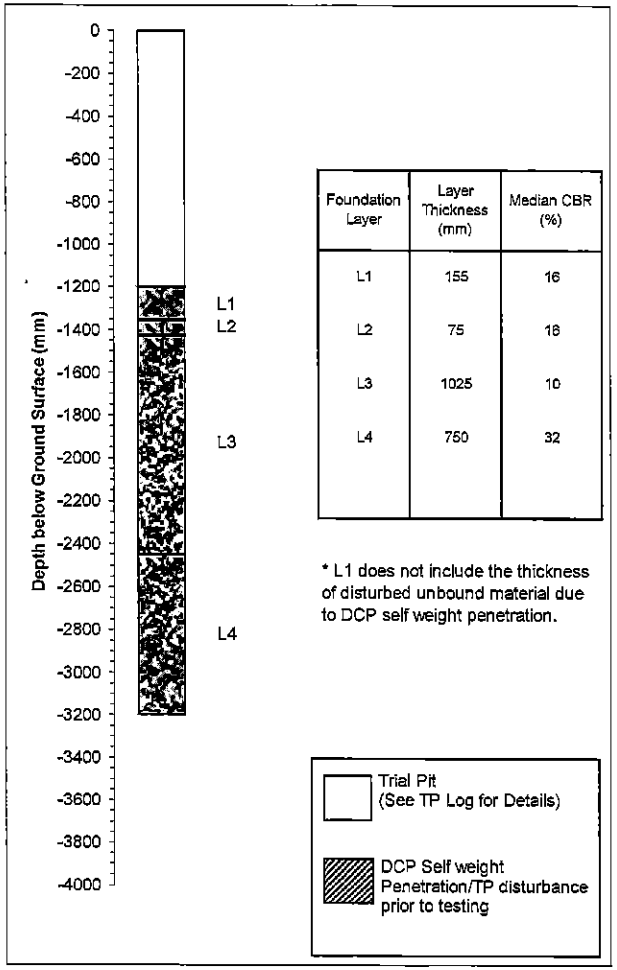
Location : Chesterton Interchange

Notes: DCP advanced through the base of TP28.

URS







Foundation Layer	Layer Thickness (mm)	Median CBR (%)
L1	155	16
L2	75	16
L3	1025	10
L4	750	32

* L1 does not include the thickness of disturbed unbound material due to DCP self weight penetration.

Trial Pit
(See TP Log for Details)

DCP Self weight Penetration/TP disturbance prior to testing

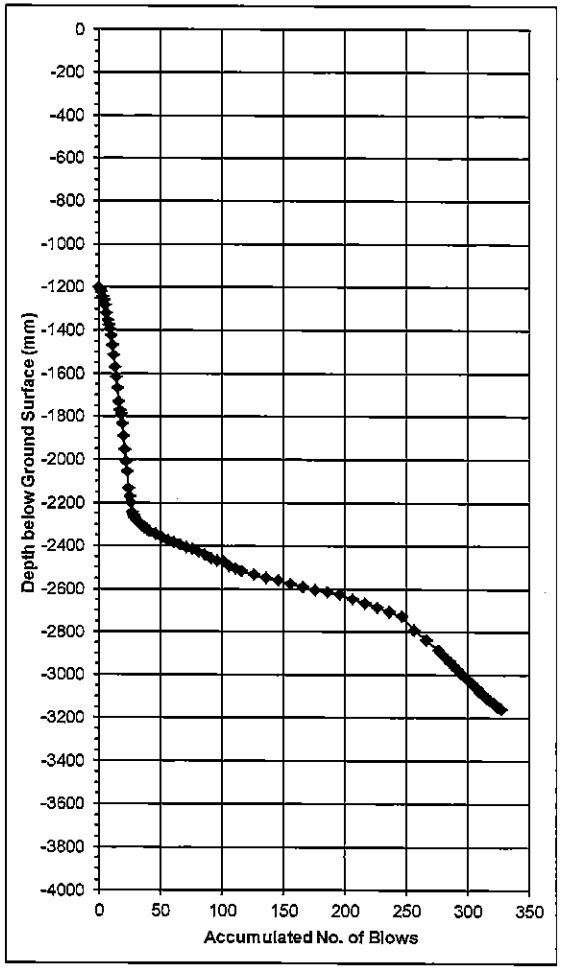
DYNAMIC CONE PENETROMETER RESULTS

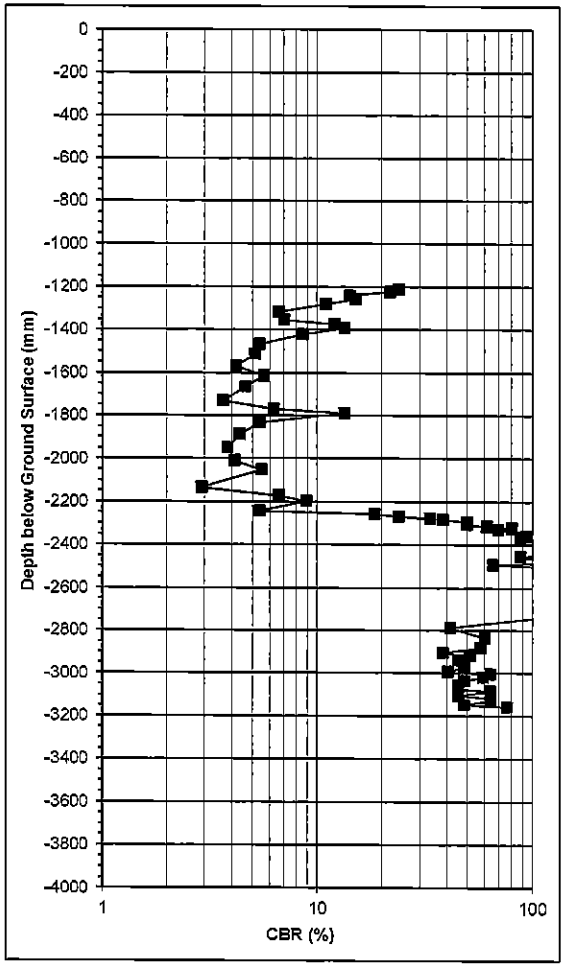
Job Number :	47064416
DCP/Core Number :	TP29
DCP Operator :	SL / BWH
Date Tested :	21/09/12
Plot Prepared By :	RS
Plot Checked By :	MT
Date Prepared :	17/09/12

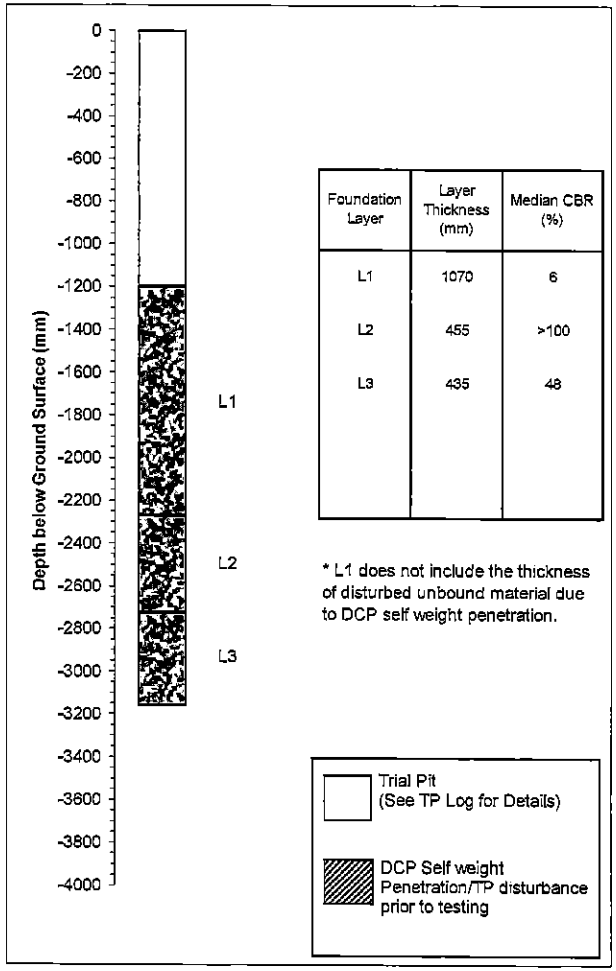
Location : Chesterton Interchange

Notes: DCP advanced through the base of TP29.

URS







Foundation Layer	Layer Thickness (mm)	Median CBR (%)
L1	1070	6
L2	455	>100
L3	435	48

* L1 does not include the thickness of disturbed unbound material due to DCP self weight penetration.

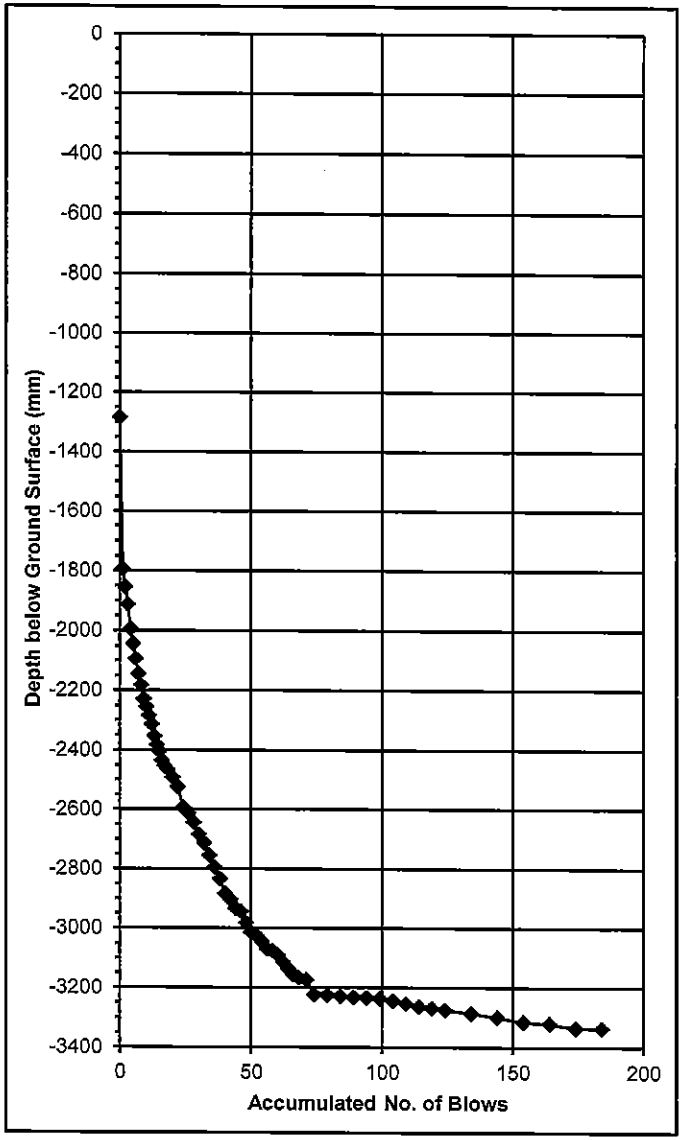
)YNAMIC CONE PENETROMETER RESULTS

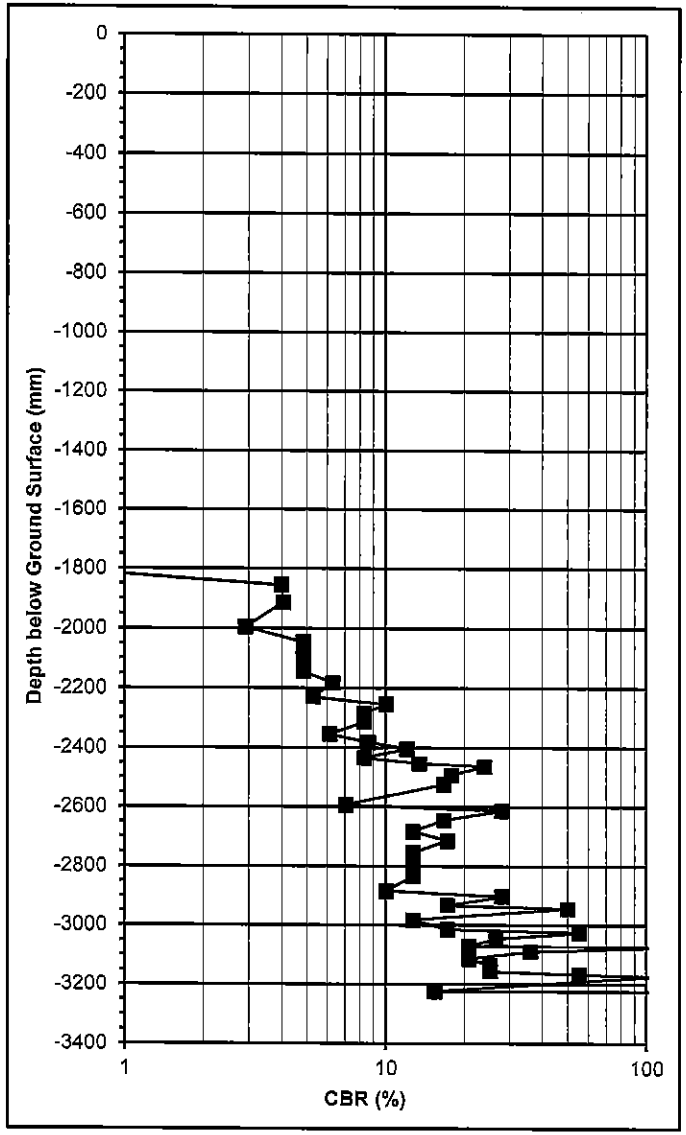
;b Number :	47064416
CP/Core Number :	TP30
CP Operator :	AP/SB
ate Tested :	30/06/13
ot Prepared By :	JB
ot Checked By :	MT
ate Prepared :	03/09/13

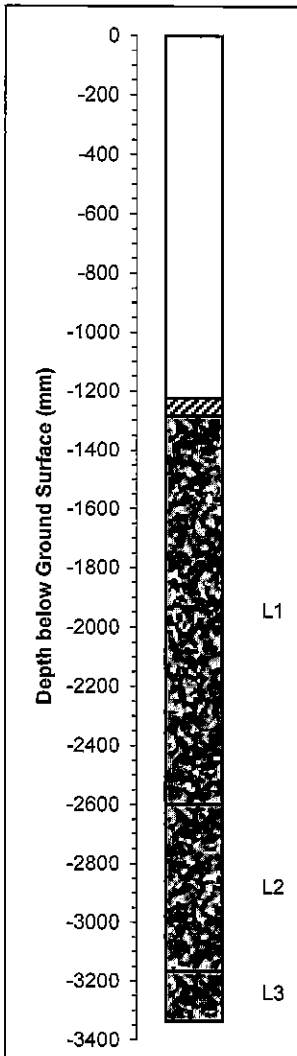
Location : Chesterton Interchange

Notes: DCP advanced through the base of TP30.

URS







Foundation Layer	Layer Thickness (mm)	Median CBR (%)
L1	1320	7
L2	570	19
L3	170	>100

* L1 does not include the thickness of disturbed unbound material due to DCP self weight penetration.

Buried Services Inspection pit (TP30 Log)

DCP Self weight Penetration/Coring disturbance prior to testing

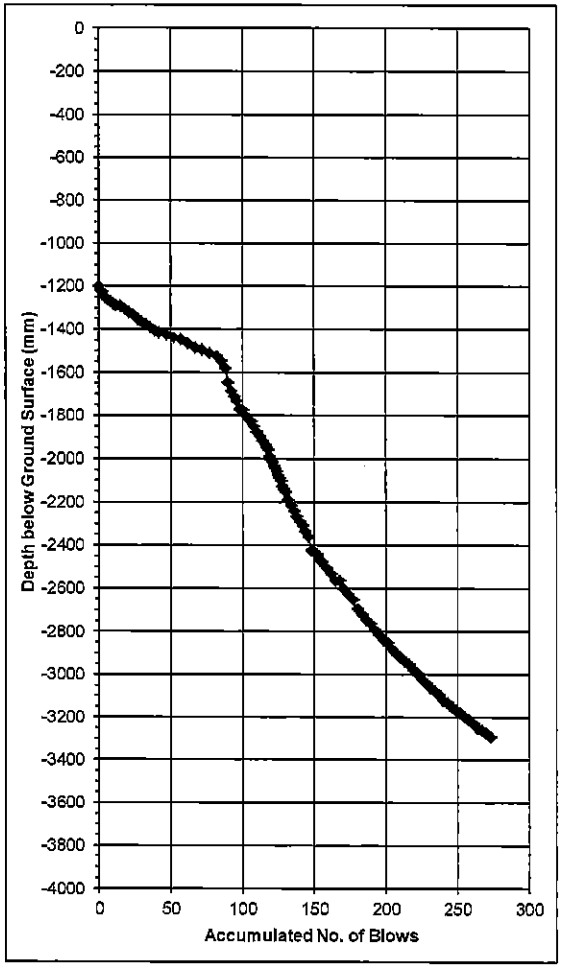
DYNAMIC CONE PENETROMETER RESULTS

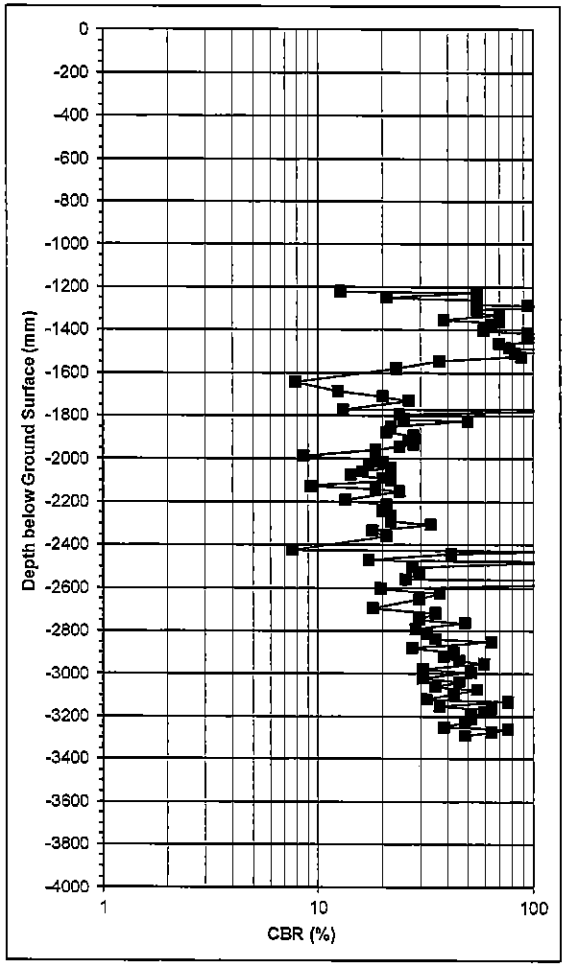
Job Number :	47064416
DCP/Core Number :	TP34
DCP Operator :	SL / BWH
Date Tested :	31/03/13
Plot Prepared By :	RS
Plot Checked By :	MT
Date Prepared :	17/09/12

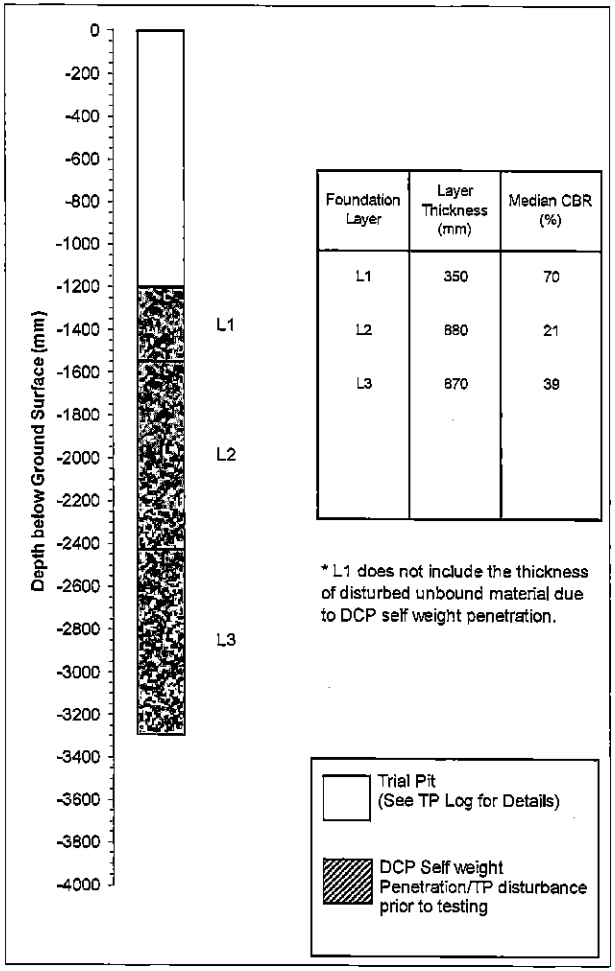
Location : Chesterton Interchange

Notes: DCP advanced through the base of TP34

URS







Foundation Layer	Layer Thickness (mm)	Median CBR (%)
L1	350	70
L2	880	21
L3	870	39

* L1 does not include the thickness of disturbed unbound material due to DCP self weight penetration.

DYNAMIC CONE PENETROMETER RESULTS

Job Number :	47064416
DCP/Core Number :	TP35A
DCP Operator :	SL / BWH
Date Tested :	31/03/13
Plot Prepared By :	RS
Plot Checked By :	MT
Date Prepared :	17/09/12

Location : Chesterton Interchange

Notes: DCP advanced through the base of TP35A

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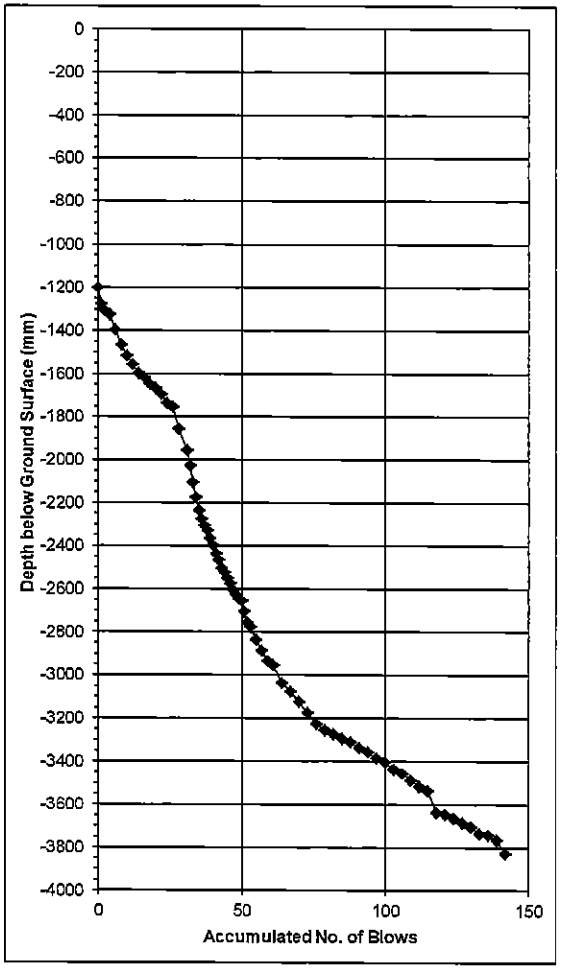

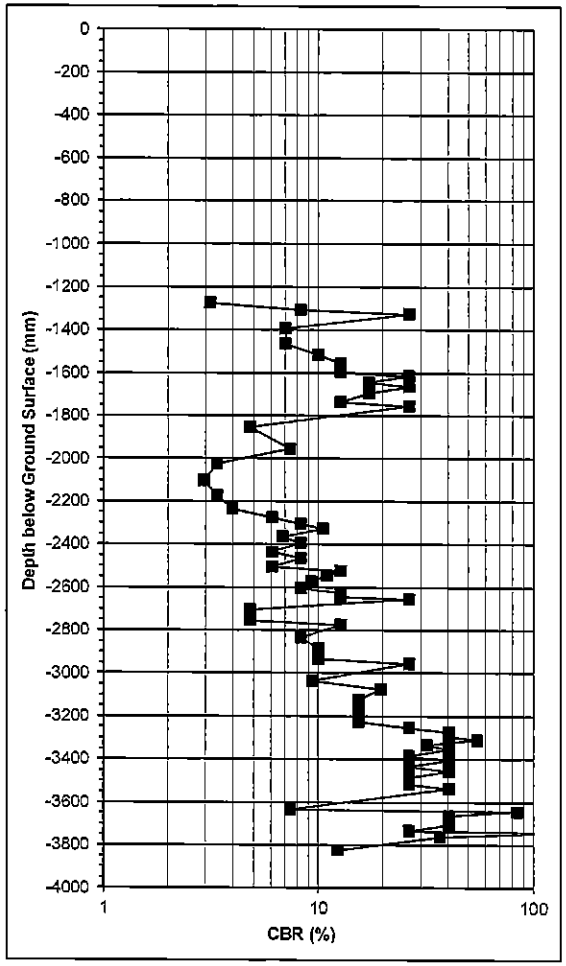

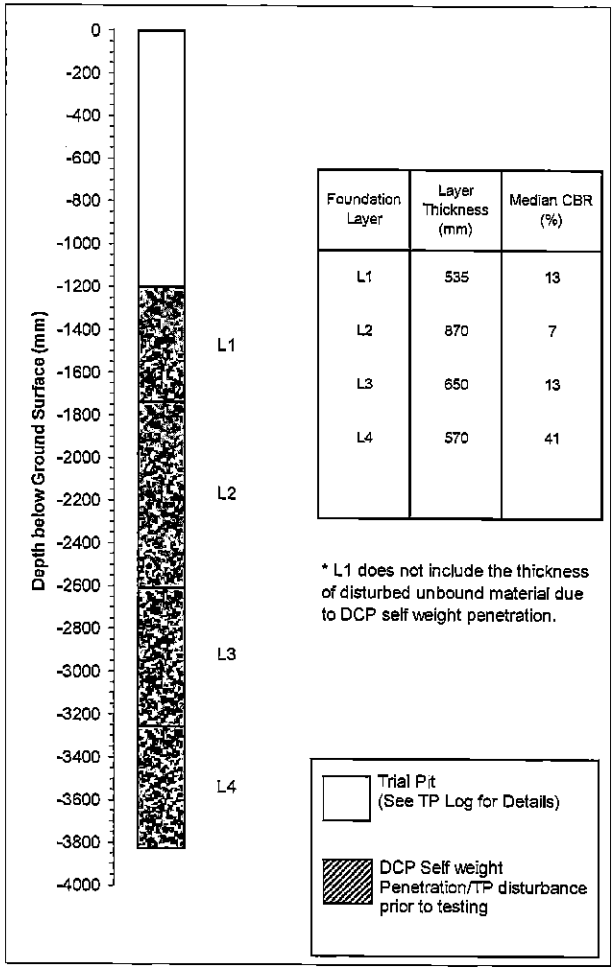

Foundation Layer	Layer Thickness (mm)	Median CBR (%)
L1	535	13
L2	870	7
L3	650	13
L4	570	41

* L1 does not include the thickness of disturbed unbound material due to DCP self weight penetration.

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Window Sampler Log No. WS01

Sheet: 1 of 2

Equipment & Methods: Hand Tools, Premier 110 Windowless Sampling Rig	Project Name: Chesterton Interchange Ground Investigation Project Location: Chesterton, Cambridge Project Client: Atkins Limited	Job No: 47064416
Co-ordinates: E: 547595.257 N: 260814.586	Ground Level (m): 5.88 AOD	Date Started:25/09/2012 Date Completed:25/09/2012

Depth (m)	No.	Type	Result	DESCRIPTION	Reduced Level (m)	Depth (Thick) (m)
0.10		E		MADE GROUND: Dark brown/black silty very sandy angular to subrounded fine to coarse gravel of clinker, limestone, igneous rock and refractory material with frequent rootlets. Sand is fine to coarse		
0.00- 1.00		D				
0.60		E		From 0.6m bgl: no roollets present		(1.50)
1.00		E W		At 1.0m bgl: becomes slightly moist		
1.20		SPT (S)	N=6 1,1/ 2,2,1,1			
1.20- 1.50		D				
1.20- 1.65		SS			4.38	1.50
1.50- 2.00		D		MADE GROUND: Black silty very sandy angular to subrounded fine to coarse gravel of clinker, brick, limestone and refractory material. Sand is fine to coarse N.B. Slight hydrocarbon odour and sheen observed.		
1.80		E				
2.00		SPT (S)	N=4 1,1/ 1,1,1,1			(1.35)
2.00- 2.45		SS				
2.00- 2.50		D				
2.50- 2.85		D				
2.70		E		From 2.7 to 2.8m bgl: becomes very clayey	3.03	2.85
3.00		SPT (S)	N=4 1,1/ 1,1,1,1	MADE GROUND: Black very sandy angular to subrounded fine to medium gravel of clinker and refractory material. Sand is fine to coarse		
3.00- 3.45		SS				
2.85- 4.00		D				(1.35)
3.80		E				
4.00		SPT (S)	N=7 2,4/ 3,2,1,1			
4.00- 4.45		SS			1.68	4.20
				MADE GROUND: Light brown/greenish brown medium to coarse sand with some black staining		(0.20)
					1.48	4.40
4.40- 4.65		D		Soft light grey/blue very sandy CLAY with some relict plant material and rare subrounded to rounded fine to coarse gravel of chert (ALLUVIUM)		(0.25)
4.70		E			1.23	4.65
4.65- 4.80		D		Light greenish brown slightly gravelly medium to coarse SAND. Gravel is subrounded to rounded fine to coarse of chert (ALLUVIUM)		(0.15)
					1.08	4.80
4.80- 5.00		D		Soft light grey/blue sandy CLAY with some relict plant material and rare subrounded to rounded fine to coarse gravel of chert		
5.00		D				

Backfill/Instrument: 1 ▽ 1 ▽

Water Strikes		Hole Diameter		Progress					Remarks
Strike Depth	Flow Remarks	Depth (m)	Hole Dia (mm)	Date	Time	Hole Depth (m)	Casing Depth (m)	Water Depth (m)	1. Windowless Sample Hole located within the disused sidings, adjacent to the Up and Down Main lines (ELR: BGK). 2. Buried Service Inspection pit excavated by hand to 1.20m bgl. 3. Topography: Grade. 4. Groundwater encountered at 3.0m bgl, rising to 1.0m after 20 minutes. 5. Windowless Sample Hole terminated at 7.0m bgl, as instructed by Client's Engineer. Granular material collapsing below bottom of maximum casing depth. 6. Hydrocarbon odour noted and sheen observed in wet material. 7. 50mm standpipe installed at 6.8m bgl.
3.00	Rising to 1.0m bgl after 20 minutes	0 1.2 5	Insp. Pit 128 113	25-09-2012	00:00	7.00	6.00	1.00	

Notes: For explanation of symbols and abbreviations, see Key Sheet. | Scale: | Logged By: JW | Checked By: NW

STANDARD WINDOW SAMPLER LOG - NOTTS CHESTERTON ALL V3.1.GPJ AGS3_1IKT.GDT 5/9/13

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Window Sampler Log No. WS01

Sheet: 2 of 2

Equipment & Methods: Hand Tools.
Premier 110 Windowless Sampling Rig

Project Name: Chesterton Interchange Ground Investigation

Project Location: Chesterton, Cambridge
Project Client: Atkins Limited

Job No: 47064416

Co-ordinates:
E: 547595.257
N: 260814.586

Ground Level (m): 5.88 AOD

Date Started:25/09/2012
Date Completed:25/09/2012

Samples and In situ Testing				DESCRIPTION	Reduced Level (m)	Legend	Depth (Thick) (m)	Backfill/ Instrument
Depth (m)	No.	Type	Result					
5.00		SPT (S)	N=9 1,1/ 2,2,2,3	(ALLUVIUM)				
5.00- 5.45		SS		From 5.0 to 5.45m bgl: becomes gravelly			(0.70)	
					0.38		5.50	
5.50- 5.80		D		Loose light grey clayey very sandy subrounded to rounded fine to medium GRAVEL of chert. Sand is medium to coarse (RIVER TERRACE DEPOSITS)			(0.30)	
				At 5.6m bgl: becomes clayey	0.08		5.80	
6.00		SPT (S)	N=18 1,1/ 3,6,4,5	Medium dense light brown/yellow gravelly very clayey medium to coarse SAND. Gravel is subrounded to rounded fine to coarse of chert (RIVER TERRACE DEPOSITS)				
6.00- 6.45		SS					(1.20)	
					-1.12		7.00	
				End of W/S 7.00 m (Thickness of basal layer not proven)				

Water Strikes		Hole Diameter		Progress					Remarks
Strike Depth	Flow Remarks	Depth (m)	Hole Dia (mm)	Date	Time	Hole Depth (m)	Casing Depth (m)	Water Depth (m)	1. Windowless Sample Hole located within the disused sidings, adjacent to the Up and Down Main lines (ELR: BGK). 2. Buried Service Inspection pit excavated by hand to 1.20m bgl. 3. Topography: Grade. 4. Groundwater encountered at 3.0m bgl, rising to 1.0m after 20 minutes. 5. Windowless Sample Hole terminated at 7.0m bgl, as instructed by Client's Engineer. Granular material collapsing below bottom of maximum casing depth. 6. Hydrocarbon odour noted and sheen observed in wet material. 7. 50mm standpipe installed at 6.8m bgl.
3.00	Rising to 1.0m bgl after 20 minutes	6	101	25-09-2012	00:00	7.00	6.00	1.00	

Notes: For explanation of symbols and abbreviations, see Key Sheet. | Scale: | Logged By: JW | Checked By: NW

STANDARD WINDOW SAMPLER LOG - NOTTS CHESTERTON ALL V3.1.GPJ AGS3_11KT.GDT 5/9/13

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Window Sampler Log No. WS02

Sheet: 1 of 2

Equipment & Methods: Hand Tools. Premier 110 Windowless Sampling Rig	Project Name: Chesterton Interchange Ground Investigation Project Location: Chesterton, Cambridge Project Client: Atkins Limited	Job No: 47064416
Co-ordinates: E: 547524.32 N: 260632.9	Ground Level (m): 6.15 AOD	Date Started:21/09/2012 Date Completed:25/09/2012

Samples and In situ Testing				DESCRIPTION	Reduced Level (m)	Legend	Depth (Thick) (m)	Backfill/ Instrument
Depth (m)	No.	Type	Result					
0.00- 0.20		B		MADE GROUND: Dark brown silty very sandy angular to subrounded fine to coarse gravel of limestone, igneous rock and clinker with frequent rootlets	5.95		(0.20)	
0.10		E					0.20	
				MADE GROUND: Dark brown silty very sandy angular to subrounded fine to coarse gravel of limestone, igneous rock and clinker	5.65		(0.30)	
0.60		E		MADE GROUND: Dark grey/dark brown silty very sandy angular to subrounded fine to coarse gravel of clinker and refractory material. Sand is fine to coarse			0.50	
0.50- 1.10		B					(0.60)	
1.10		E			5.05		1.10	
1.10- 1.30		D		At 1.0m bgl: with low cobble content. Cobbles are subangular of clinker			(0.20)	
1.20		SPT (S)	N=10 1,2/ 3,2,3,2		4.85		1.30	
1.20- 1.65		SS		MADE GROUND: Dark grey/blue/brown very sandy very gravelly clay. Gravel angular to subrounded fine to coarse clinker, brick and refractory material. Sand is fine to coarse				
1.60		E		MADE GROUND: Black/dark grey/dark brown very sandy angular to subrounded fine to coarse gravel of chert, clinker and brick. N.B. Hydrocarbon sheen observed throughout.				1
1.30- 2.00		B						
1.70		W						1
				From 1.30-2.0m bgl: becomes silty				
2.00		SPT (S)	N=4 1,1/ 1,1,1,1					
2.00- 2.45		SS						
2.45		D						
2.45- 3.00		B						
3.00		SPT (S)	N=4 1,1/ 1,1,1,1					
				From 3.0-5.0m bgl: No Sample Recovery			(3.70)	
3.00- 3.45		SS						
				From 4.0 - 4.45m bgl: No SPT attempted 4.0-4.45m, suspected lost sample at base of exploratory hole				
5.00		D			1.15		5.00	

Water Strikes		Hole Diameter		Progress					Remarks
Strike Depth	Flow Remarks	Depth (m)	Hole Dia (mm)	Date	Time	Hole Depth (m)	Casing Depth (m)	Water Depth (m)	1. Windowless Sample Hole located within the disused sidings, adjacent to the Up and Down Main lines (ELR: BGK). 2. Buried Service Inspection pit excavated by hand to 1.20m bgl. 3. Topography: Grade. 4. Groundwater encountered at 2.0m bgl, rising to 1.7m after 20 minutes. 5. Windowless Sample Hole complete at 8.45m bgl, as instructed by Client's Engineer. 6. Hydrocarbon odour noted in Made Ground layers and sheen observed in wet material. 7. 50mm standpipe installed at 4.5m bgl.
2.00	Rising to 1.7m bgl after 20 minutes.	0	Insp. Pit	21-09-2012	00:00	8.45	6.00	1.70	
		1.2	128	24-09-2012	00:00	8.45			
		5	113	25-09-2012	00:00	8.45			

Notes: For explanation of symbols and abbreviations, see Key Sheet. | Scale: | Logged By: JW | Checked By: NW

STANDARD WINDOW SAMPLER LOG - NOTTS CHESTERTON ALL V3.1.GPJ AGS3_1IKT.GDT 5/9/13

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Window Sampler Log No. WS02

Sheet: 2 of 2

Equipment & Methods: Hand Tools. Premier 110 Windowless Sampling Rig	Project Name: Chesterton Interchange Ground Investigation Project Location: Chesterton, Cambridge Project Client: Atkins Limited	Job No: 47064416
Co-ordinates: E: 547524.32 N: 260632.9	Ground Level (m): 6.15 AOD	Date Started:21/09/2012 Date Completed:25/09/2012

Samples and In situ Testing				DESCRIPTION	Reduced Level (m)	Legend	Depth (Thick) (m)	Backfill/ Instrument
Depth (m)	No.	Type	Result					
5.00		SPT (S)	N=11 7,11/ 3,2,2,4	Soft blue/grey silty CLAY with rare relict rootlets. Medium strength (GAULT CLAY)				
5.00- 5.45		SS						
				From 6.0 - 6.45m bgl: No SPT attempted 6.0-6.45m, suspected lost sample at base of exploratory hole				
				From 5.0-7.0m bgl: No Sample Recovery			(3.45)	
7.00		D						
7.00		SPT (S)	N=20 8,4/ 3,5,6,6	At 7.0m bgl: becomes firm. High strength				
7.00- 7.45		SS						
				At 7.5m bgl: becomes stiff. High strength				
7.50- 8.00		B						
8.00		SPT (S)	N=25 2,3/ 4,6,7,8					
8.00- 8.45		SS						
					-2.30		8.45	
				End of W/S 8.45 m (Thickness of basal layer not proven)				

Water Strikes		Hole Diameter		Progress					Remarks
Strike Depth	Flow Remarks	Depth (m)	Hole Dia (mm)	Date	Time	Hole Depth (m)	Casing Depth (m)	Water Depth (m)	1. Windowless Sample Hole located within the disused sidings, adjacent to the Up and Down Main lines (ELR: BGK). 2. Buried Service Inspection pit excavated by hand to 1.20m bgl. 3. Topography: Grade. 4. Groundwater encountered at 2.0m bgl, rising to 1.7m after 20 minutes. 5. Windowless Sample Hole complete at 8.45m bgl, as instructed by Client's Engineer. 6. Hydrocarbon odour noted in Made Ground layers and sheen observed in wet material. 7. 50mm standpipe installed at 4.5m bgl.
2.00	Rising to 1.7m bgl after 20 minutes.	6	101	21-09-2012	00:00	8.45	6.00	1.70	
		7	86	24-09-2012	00:00	8.45			
				25-09-2012	00:00	8.45			

Notes: For explanation of symbols and abbreviations, see Key Sheet. | Scale: | Logged By: JW | Checked By: NW

STANDARD WINDOW SAMPLER LOG - NOTTS CHESTERTON ALL V3.1.GPJ AGS3_1IKT.GDT 5/9/13

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Window Sampler Log No. WS03

Sheet: 1 of 1

Equipment & Methods: Hand Tools. Premier 110 Windowless Sampling Rig	Project Name: Chesterton Interchange Ground Investigation Project Location: Chesterton, Cambridge Project Client: Atkins Limited	Job No: 47064416
Co-ordinates: E: 547516.414609 N: 260549.609992	Ground Level (m):	Date Started:30/06/2013 Date Completed:30/06/2013

Samples and In situ Testing				DESCRIPTION	Reduced Level (m)	Legend	Depth (Thick) (m)	Backfill/ Instrument
Depth (m)	No.	Type	Result					
0.20		E		MADE GROUND: Black gravelly fine to coarse sand with some ash. Gravel is angular to subangular fine to coarse of igneous rock and clinker			(0.50)	
0.00- 0.50		B						
0.50		E			-0.50		0.50	
0.50- 0.75		B		Brown clayey slightly gravelly fine to coarse SAND. Gravel is angular to subangular fine to coarse of chert (RIVER TERRACE DEPOSITS)			(0.25)	
					-0.75		0.75	
0.75- 1.20		B		Orange/brown gravelly fine to coarse SAND. Gravel is angular to subrounded fine to coarse of chert (RIVER TERRACE DEPOSITS)			(0.45)	
1.00		E						
				End of W/S 1.20 m (Thickness of basal layer not proven)	-1.20		1.20	

Water Strikes		Hole Diameter		Progress					Remarks
Strike Depth	Flow Remarks	Depth (m)	Hole Dia (mm)	Date	Time	Hole Depth (m)	Casing Depth (m)	Water Depth (m)	
1.10	Seepage. Standing water at 1.10m, rising to 1.03m after 20 mins.	0	Insp. Pit						1. Windowless Sample Hole located in the cess of the Up Main line (ELR: BGK), offset 3.1m from the cess rail. 2. Buried Service Inspection pit excavated by hand to 1.20m bgl. 3. Topography: Grade. 4. Groundwater encountered at 1.10m bgl, rising to 1.03m after 20 minutes. 5. Windowless Sample Hole not attempted. 6. No visual or olfactory evidence of contamination. 7. Inspection pit backfilled with arisings on completion.

Notes: For explanation of symbols and abbreviations, see Key Sheet. | Scale: | Logged By: LR | Checked By: JW

STANDARD WINDOW SAMPLER LOG - NOTTS_CHESTERTON ALL V3.1.GPJ AGS3_1IKT.GDT 5/9/13

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Window Sampler Log No. WS07

Sheet: 1 of 1

Equipment & Methods: Hand Tools. Premier 110 Windowless Sampling Rig

Project Name: Chesterton Interchange Ground Investigation

Project Location: Chesterton, Cambridge

Project Client: Atkins Limited

Job No: 47064416

Co-ordinates:
E: 547453.123
N: 260984.284

Ground Level (m): 6.24 AOD

Date Started:17/09/2012

Date Completed:17/09/2012

Samples and In situ Testing				DESCRIPTION	Reduced Level (m)	Legend	Depth (Thick) (m)	Backfill/ Instrument
Depth (m)	No.	Type	Result					
0.10		E		MADE GROUND: Dark grey very sandy angular to subangular fine to coarse gravel of igneous rock, clinker, brick and chert. Sand is fine to coarse	5.94		(0.30) 0.30	
0.30- 0.80 0.60		B D E		MADE GROUND: Dark grey/black very gravelly fine to coarse sand with some rootlets. Gravel is angular to subangular fine to coarse of clinker, brick, chert and igneous rock				
0.90		W						1
1.00		E					(2.00)	1
1.50- 2.00		B D						
				MADE GROUND: Soft grey clay with rare rootlets	3.94		2.30	
2.50- 3.00		B D					(0.70)	
					3.24		3.00	
				End of W/S 3.00 m (Thickness of basal layer not proven)				

Water Strikes		Hole Diameter		Progress					Remarks
Strike Depth	Flow Remarks	Depth (m)	Hole Dia (mm)	Date	Time	Hole Depth (m)	Casing Depth (m)	Water Depth (m)	1. Windowless Sample Hole located adjacent to the Cowley Road access gate. 2. Buried Service Inspection pit excavated by hand to 1.20m bgl. 3. Topography: Grade. 4. Groundwater seepage encountered at 1.10m bgl, standing water at 0.90m after 20mins. 5. Windowless Sample Hole completed at 3.0m bgl, no obstruction encountered. 6. Slight sheen observed on standing water within inspection pit. 7. 50mm standpipe installed at 3.0m bgl.
1.10	Seepage. Rising to 0.9m after 20 minutes.	0 1.2 2	Insp. Pit 128 101	17-09-2012	00:00	3.00	2.00	0.90	

Notes: For explanation of symbols and abbreviations, see Key Sheet. | Scale: | Logged By: JW | Checked By: NW

STANDARD WINDOW SAMPLER LOG - NOTTS CHESTERTON ALL V3.1.GPJ AGS3_1IKT.GDT 5/9/13

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Window Sampler Log No. WS08

Sheet: 1 of 1

Equipment & Methods: Hand Tools. Premier 110 Windowless Sampling Rig	Project Name: Chesterton Interchange Ground Investigation Project Location: Chesterton, Cambridge Project Client: Atkins Limited	Job No: 47064416
Co-ordinates: E: 547489.014 N: 260801.412	Ground Level (m): 5.89 AOD	Date Started:18/09/2012 Date Completed:18/09/2012

Samples and In situ Testing				DESCRIPTION	Reduced Level (m)	Legend	Depth (Thick) (m)	Backfill/ Instrument
Depth (m)	No.	Type	Result					
0.10		E		MADE GROUND: Dark grey sandy angular to subangular fine to coarse gravel of igneous rock and limestone. Sand is fine to coarse	5.76		(0.13)	
				MADE GROUND: Reddish brown sandy angular to subangular fine to coarse gravel of igneous rock, limestone and refractory material with some wood fragments. Sand is fine to coarse	5.66		(0.10) 0.23	
0.40		B					(0.27)	
0.60		D E		MADE GROUND: Dark grey sandy angular to subangular fine to coarse gravel of igneous rock, limestone, clinker and brick. Sand is fine to coarse	5.39		0.50	
				MADE GROUND: Soft dark grey/blue grey slightly gravelly sandy clay. Gravel is subangular to subrounded fine to coarse of chert. Sand is fine to coarse			(0.40)	
1.00		E		Soft yellowish/greenish grey very sandy CLAY with rare subangular fine to medium gravel of chert and selenite nodules (ALLUVIUM)	4.99		0.90	
1.10		B D W					(0.40)	
1.30- 1.60		D		Light brown/greenish grey clayey very sandy angular to subangular fine to coarse GRAVEL of chert. Sand is fine to coarse (RIVER TERRACE GRAVEL DEPOSITS)	4.59		1.30	
1.60- 1.70		D					(0.40)	
1.70- 2.00		D		Firm dark blue/grey CLAY with rare subangular to subrounded fine to medium gravel of chert (GAULT CLAY)	4.19		1.70	
2.00		D						
2.00- 2.50		UT100					(1.30)	
2.50- 3.00		D		At 2.5m bgl: becomes slightly friable	2.89		3.00	
				End of W/S 3.00 m (Thickness of basal layer not proven)				

Water Strikes		Hole Diameter		Progress					Remarks
Strike Depth	Flow Remarks	Depth (m)	Hole Dia (mm)	Date	Time	Hole Depth (m)	Casing Depth (m)	Water Depth (m)	1. Windowless Sample Hole located adjacent to a disused sidings building. 2. Buried Service Inspection pit excavated by hand to 1.20m bgl. 3. Topography Grade. 4. Groundwater seepage encountered at 1.15m bgl, standing water at 1.15m after 20mins. 5. Windowless Sample Hole completed at 3.0m bgl, no obstruction encountered. 6. Slight hydrocarbon odour noted within Made Ground layers. 7. 50mm standpipe installed at 1.20m bgl.
1.15	Seepage. Standing water after 20 minutes.	0 1.2 2	Insp. Pit 128 101	18-09-0120	00:00	3.00	2.00	1.15	

Notes: For explanation of symbols and abbreviations, see Key Sheet. | Scale: | Logged By: JW | Checked By: NW

STANDARD WINDOW SAMPLER LOG - NOTTS CHESTERTON ALL V3.1.GPJ AGS3_1IKT.GDT 5/9/13

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Borehole No. BH03

Sheet: 1 of 3

Equipment & Methods: Dando 2000 Cable Percussion Rig	Project Name: Chesterton Interchange Ground Investigation Project Location: Chesterton, Cambridge Client: Atkins	Job No: 47064416
Co-ordinates: E: 547480.005 N: 260573.841	Ground Level (m): 6.20 AOD	Date Started:24/09/2012 Date Completed:25/09/2012

Samples and In situ Testing				DESCRIPTION	Reduced Level (m)	Legend	Depth (Thick) (m)	Backfill/ Instrument
Depth (m)	No.	Type	Result					
0.20		E		MADE GROUND: Black/brown sandy angular to subrounded fine to coarse gravel of clinker and refractory material with some ash and rootlets. Sand is fine to coarse				
0.00- 0.60		B						
0.50	DUPA8	E		From 0.40m bgl: Rootlets no longer present.				
0.60- 1.20		B						
1.00		E						
1.50		SPT (C)	N=3 2,2/ 1,1,1,0	From 1.50m to 2.50m bgl: poor sample recovery.			(3.00)	
1.80		W						
2.00		E						
2.50		SPT (C)	N=4 1,1/ 0,1,1,2					
2.50- 3.00		B						
3.00		E		MADE GROUND: Stiff grey clay with occasional anguar to subrounded fine to coarse gravel of clinker and refractory material	3.20		3.00	
3.40		D					(0.50)	
3.50		SPT (C)	N=8 1,1/ 1,2,2,3	Stiff blue grey fissured silty CLAY. High strength (GAULT CLAY)	2.70		3.50	
3.50- 3.95		ss						
4.00		D						
		E						
4.00- 4.50		B						
4.30		D						
4.50- 5.00		U UT100	38 blows					
5.00		D						
		E						
5.00- 5.50		B						
5.50		SPT (S)	N=18 2,2/ 3,4,5,6					
5.50- 5.95		ss						
6.00		E						

Water Strikes		Hole Diameter		Progress					Remarks
Strike Depth	Flow Remarks	Depth (m)	Hole Dia (mm)	Date	Time	Hole Depth (m)	Casing Depth (m)	Water Depth (m)	
1.80	Standing	0	Insp. Pit						1. Borehole located adjacent to proposed station building. 2. Buried Service Inspection pit completed to 1.20m bgl. 3. Topography: At grade. 4. Groundwater encountered at 1.80m bgl remaining static after 20 mins. 5. Bentonile seal installed from 3.00 to 4.00m bgl as instructed by Client's Engineer. 6. Borehole completed to 15.00m bgl. 7. No visual or olfactory evidence of contamination. 8. 50mm standpipe installed at 10.0m bgl, as instructed by Client's Engineer.
		1.2	200						
		4	150						
		6	130						

Notes: For explanation of symbols and abbreviations, see Key Sheet. | Scale: 1:30 | Logged By: MB | Checked By: NW

STANDARD BOREHOLE LOG - NOTTS CHESTERTON ALL V1.4 - INC GEOTECH & CHEM.GPJ AGS3_1.GDT 14/2/13

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Borehole No. BH03

Sheet: 2 of 3

Equipment & Methods: Dando 2000 Cable Percussion Rig	Project Name: Chesterton Interchange Ground Investigation Project Location: Chesterton, Cambridge Client: Atkins	Job No: 47064416
Co-ordinates: E: 547480.005 N: 260573.841	Ground Level (m): 6.20 AOD	Date Started:24/09/2012 Date Completed:25/09/2012

Samples and In situ Testing				DESCRIPTION	Reduced Level (m)	Legend	Depth (Thick) (m)	Backfill/ Instrument
Depth (m)	No.	Type	Result					
6.00- 6.50		B						
6.50		U UT100	40 blows					
7.00		D E						
7.00- 7.50		B						
7.50		SPT (S)	N=26 2,3/ 5,6,7,8					
7.50- 7.95		ss						
8.00		E						
8.00- 8.50		B						
8.50		U UT100	39 blows					
9.00		D E						
9.00- 9.50		B					(11.50)	
9.50		SPT (S)	N=24 2,3/ 4,6,7,7					
9.50- 9.95		ss						
10.00		E						
10.00- 10.50		B		At 10.00m bgl: becomes very stiff and no longer appears fissured.				
10.50		U UT100	42 blows	At 10.50m bgl: becomes very high strength				
11.00		D E						
11.00- 11.50		B						
11.50		SPT (S)	N=30 3,4/ 6,8,8,8					
11.50- 11.95		ss						
12.00		E						

Water Strikes		Hole Diameter		Progress				
Strike Depth	Flow Remarks	Depth (m)	Hole Dia (mm)	Date	Time	Hole Depth (m)	Casing Depth (m)	Water Depth (m)
1.80	Standing							

Remarks

1. Borehole located adjacent to proposed station building. 2. Buried Service Inspection pit completed to 1.20m bgl. 3. Topography: At grade. 4. Groundwater encountered at 1.80m bgl remaining static after 20 mins. 5. Bentonite seal installed from 3.00 to 4.00m bgl as instructed by Client's Engineer. 6. Borehole completed to 15.00m bgl. 7. No visual or olfactory evidence of contamination. 8. 50mm standpipe installed at 10.0m bgl, as instructed by Client's Engineer.

Notes: For explanation of symbols and abbreviations, see Key Sheet. | Scale: 1:30 | Logged By: MB | Checked By: NW

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Borehole No. BH03

Sheet: 3 of 3

Equipment & Methods: Dando 2000 Cable Percussion Rig	Project Name: Chesterton Interchange Ground Investigation Project Location: Chesterton, Cambridge Client: Atkins	Job No: 47064416
Co-ordinates: E: 547480.005 N: 260573.841	Ground Level (m): 6.20 AOD	Date Started:24/09/2012 Date Completed:25/09/2012

Samples and In situ Testing				DESCRIPTION	Reduced Level (m)	Legend	Depth (Thick) (m)	Backfill/ Instrument
Depth (m)	No.	Type	Result					
12.00-12.50		B						
12.50		U UT100	55 blows					
13.00		D E						
13.00-13.50		B						
13.50		SPT (S)	N=29 2,4/ 6,7,7,9					
13.50-13.95		ss						
14.00		E						
14.00-14.50		B						
14.50		B UT100	65 blows					
15.00		D E			-8.80		15.00	
				End of Borehole 15.00 m (Thickness of basal layer not proven)				

Water Strikes		Hole Diameter		Progress					Remarks
Strike Depth	Flow Remarks	Depth (m)	Hole Dia (mm)	Date	Time	Hole Depth (m)	Casing Depth (m)	Water Depth (m)	
1.80	Standing								1. Borehole located adjacent to proposed station building. 2. Buried Service Inspection pit completed to 1.20m bgl. 3. Topography: At grade. 4. Groundwater encountered at 1.80m bgl remaining static after 20 mins. 5. Bentonite seal installed from 3.00 to 4.00m bgl as instructed by Client's Engineer. 6. Borehole completed to 15.00m bgl. 7. No visual or olfactory evidence of contamination. 8. 50mm standpipe installed at 10.0m bgl, as instructed by Client's Engineer.

Notes: For explanation of symbols and abbreviations, see Key Sheet. | Scale: 1:30 | Logged By: MB | Checked By: NW

STANDARD BOREHOLE LOG - NOTTS CHESTERTON ALL V1.4 - INC GEOTECH & CHEM.GPJ AGS3_1.GDT 14/2/13

Technical note
Appendix B. Longitudinal Ground Profiles

Meterage/Mileage

South ← Design Ch. 660m — North → 1560m

720 | 780 | 840 | 900 | 960 | 1020 | 1080 | 1140 | 1200 | 1260 | 1320 | 1380 | 1440 | 1500

Drift Geology: River Terrace Gravels

Solid Geology: Gault Clay

Nearby Structures: Track lower (max 120mm) | Track lower (max 17mm) | Track lower (max 48mm)

Other Comments:

Elevation (m AOD): 6.0, 5.0, 4.0, 3.0, 2.0, 1.0, 0, -1.0, -2.0

sleeper bottom level

base of ballast (300mm)

TP34
MG a-sa, m-c GRAVEL of igneous rock.
MG sandy a-sa, f-c GRAVEL of igneous rock.
MG gravelly f-c SAND Gravel is a-sa, f-c of quartz, clinker and flint.
MG sandy a-sa, f-c GRAVEL of igneous flint. Sand is f-c.

TP35A
MG a, c GRAVEL of igneous rock.
MG sandy va-sa, f-c GRAVEL of igneous rock, limestone and clinker. Sand is f-c.
MG very sandy a-sr, f-c GRAVEL of clinker and limestone. Sand is f-c.

TP30
MG sandy a-sa, m-c GRAVEL of igneous rock and limestone. Sand is f-c.
S gravelly f-c SAND with ash. Gravel is sa-sr, f-c of igneous rock and limestone.
Gravelly f-c SAND. Gravel is a-sr, f-c of chert.
Soft s gravelly sandy CLAY. Gravel is a-sa, f c of chert.

TP29
MG sl. sandy a-sa, m-c GRAVEL of igneous rock
MG clayey sandy a-sr, f-c GRAVEL of igneous rock, clinker, quartz & flint with pockets of clay
Sl. gravelly f-c SAND (River Terrace)

TP28A
MG a-sa, m-c GRAVEL of igneous rock
MG a-sa, m-c GRAVEL of clinker with ash

TP27
MG gravelly f-c SAND with some ash and rootlets. Gravel is a-sa, f-c of igneous rock
MG v. gravelly f-c SAND with ash. Gravel is sa-sr, f-c of igneous rock and refractor
MG gravelly f-c SAND with ash. Gravel is a-sa, f-c
GRAVEL of igneous rock and clinker

WS03
Gravelly f-c SAND. Gravel is a-sr, f-c of chert (River Terrace Deposits)

WS02
MG silty very sandy a-sr, f-c GRAVEL of LST, igneous rock and clinker
MG v. gravelly f-c SAND. Gravel is a-sr, f-c of clinker and refractory material
MG Firm very sandy very gravelly CLAY. Gravel is a-sr, f-c clinker, brick and refractory material
MG sl. clayey v sandy a-sr, f-c GRAVEL of chert, clinker and brick, over soft, becoming firm and stiff Gault Clay (below 5mbgl)

TP22
MG sandy a-sr, f-c GRAVEL of clinker, LST and refractory material. Sand is f-m.
MG slightly gravelly f-c SAND with some ash. Gravel is a-sr, f-c of roof slate, brick, flint, LST and refractory material

TP18
MG gravelly f-c SAND, with some ash. Gravel is a-sr, f-c of clinker, brick and refractory material

WS01
MG v gravelly f-c SAND. Gravel is a-sr, f-c of
MG v gravelly f-c SAND. Gravel is a-sr, f-c of clinker, LST, igneous rock and refractory material
MG sl clayey v sandy a-sr, f-c GRAVEL of clinker, brick, LST and refractory material.
v gravelly f-c SAND. Gravel is a-sr, f-m of clinker and refractory material. Alluvium over terrace gravels from 4.2mbgl.

Legend to NR/SP/TRK/9039

- Clean ballast
- Slightly dirty ballast
- Dirty ballast
- Very dirty ballast (non-cohesive)
- Very dirty ballast (cohesive)
- Coarse sand
- Sand and gravel
- Clayey Sand and/or Gravel
- Soft clay/silt
- Firm clay/silt
- Stiff clay/silt
- w Water level
- g Geotextile separator (legend not to NR/SP/TRK/9039)

Notes:
1. Proposed trackbed treatments are formulated based on ground conditions derived from trial-pit results undertaken at various positions along the proposed works. The Contractor should inspect the formation surface during construction to verify the actual ground condition. If the ground at formation level is found to be different to that assumed in design, the trackbed designer should be informed for further advice.
2. Topography shown is approximate only.
3. Structure locations are obtained from Network Rail design specification.
4. This drawing is to be read along with drawing Figure A4 - Proposed Site Specific Trackbed Treatments Types.
5. Abbreviations:
OB - Overbridge, UB - Underbridge, FB - Footbridge, F - Fines, C - Clay, Si - Silt, S - Sand, G - Gravel, Cb - Cobbles, PI - Plasticity Index, MC - Moisture Content, HV - Hand Shear Vane
6. Proposed rail levels and design formation levels shown are only correct at the location of the GI only. Levels in between the GI locations are drawn based on linear interpolations thus will not represent the actual rail vertical alignment.

Not to Scale

Client: NetworkRail			ATKINS
Project: Chesterton Station Interchange			200 Broomielaw, Glasgow G1 4RU. Tel. (0141) 220 2200, Fax (0141) 220 2201
Title: Longitudinal Ground Profile along Main Line (Section 2)	Drawn: SG	Chk: KDP	Auth: IA
	Date: Aug-13	Date: Aug-13	Date: Aug-13
For Approval / Purpose of issue	Rev	Aug-13 Date	Authorised
Figure Number: Figure A2			Rev

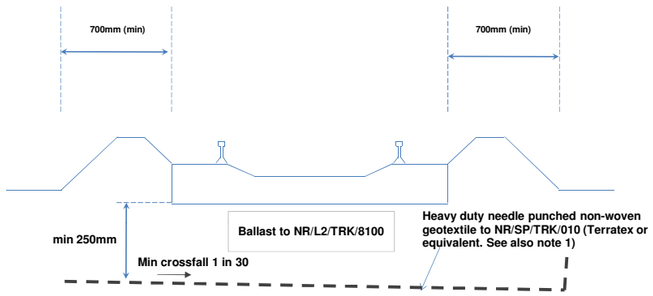
P:\GBGWA\DE2\Div71&72\511\5110967 Chesterton Interchange (KT)\4. Project Contract Documents\41. Design Calcs & Notes\AIP Design\Trackbed Design for AIP\Separate docs\Update July 13 sg\TBI long section update (Main Line Only)

Technical note

Appendix C. Proposed Trackbed Treatment Options

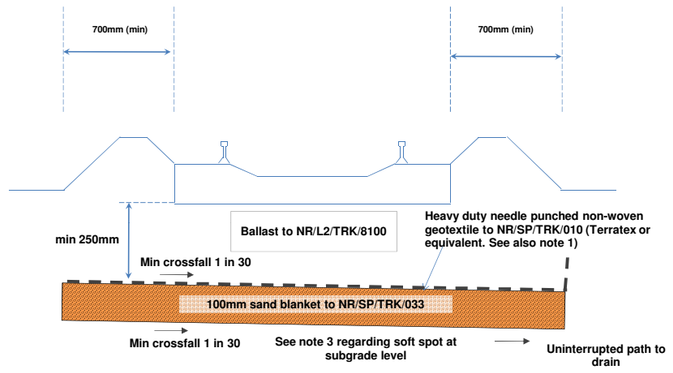
TREATMENT 1

T1 - min 250mm clean ballast + heavy duty needle punched non-woven geotextile



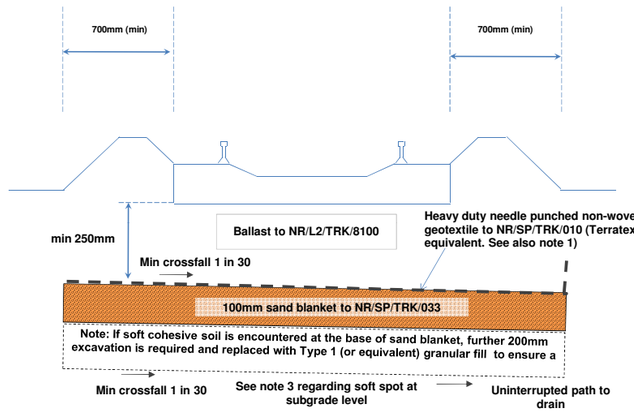
TREATMENT 2

T2 - min 250mm clean ballast + heavy duty needle punched non-woven geotextile + 100mm blanketing sand



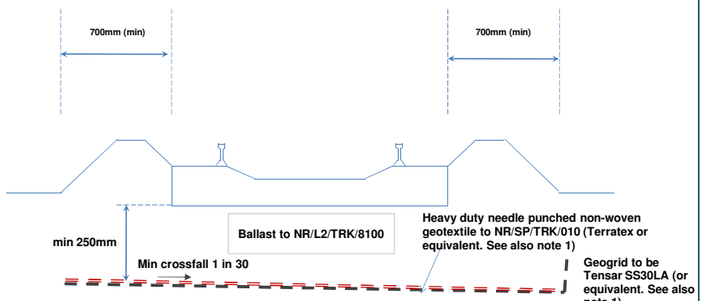
TREATMENT 3

T3 - min 250mm clean ballast + heavy duty needle punched non-woven geotextile + 100mm blanketing sand + 200mm sub-ballast



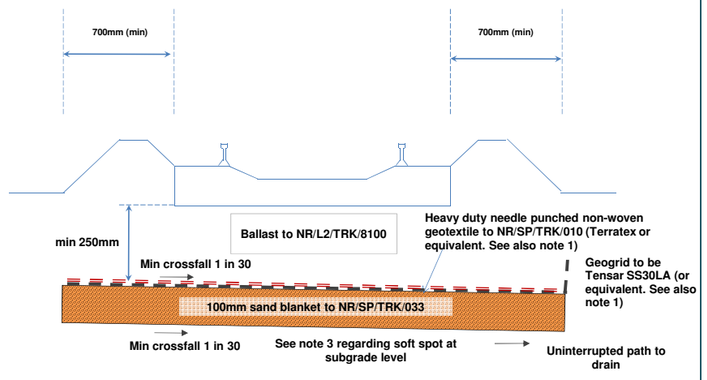
TREATMENT 1R

T1 - min 250mm clean ballast + heavy duty needle punched non-woven geotextile



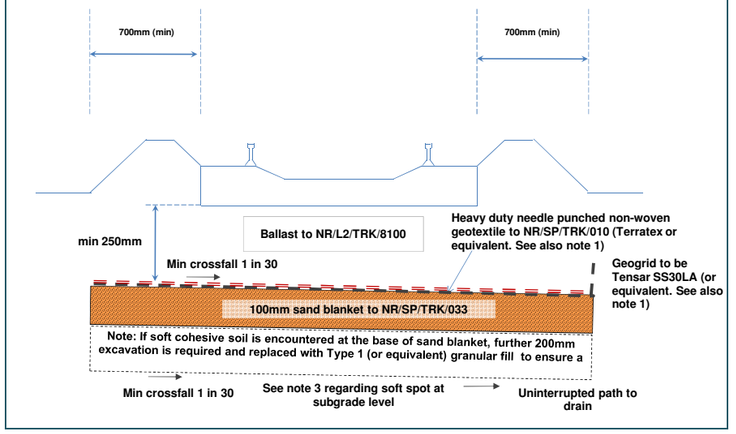
TREATMENT 2R

T2 - min 250mm clean ballast + heavy duty needle punched non-woven geotextile + 100mm blanketing sand



TREATMENT 3R

T3 - min 250mm clean ballast + heavy duty needle punched non-woven geotextile + 100mm blanketing sand + 200mm sub-ballast



N.T.S

Notes:
1. Geotextile separator should extend at least 0.7m beyond sleeper end, while geogrid reinforcement should extend at least 0.2m beyond sleeper ends if used.
2. An additional geotextile separator (Terram 1000 or equivalent) to be provided at the base of the sand blanket layer if underlain by ballast layer so as to prevent sand from migrating into ballast voids.
3. All bases of excavations should be visually inspected before construction of new formation layers. The new trackbed formation surface layer to be compacted with minimum 6 passes of over 1400kg per m width vibro-plate compactor. If localised soft spot is encountered at base of excavation, this soft material should be excavated and replaced with well compacted granular fill to satisfy stiffness criteria. Treatment 4 is proposed where soft spots are encountered.

Client	Network Rail		
Project	Chesterton Station Interchange		
Title	Proposed Trackbed Treatment Types		
For Information	A01	Aug-13	Aug-13
Purpose of issue	Rev	Date	Authorised

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Drawn	CKS	Chk	KDP	Auth	IA
Date	Aug-13	Date	Aug-13	Date	Aug-13

Figure Number: **Figure B1**

Rev **A01**