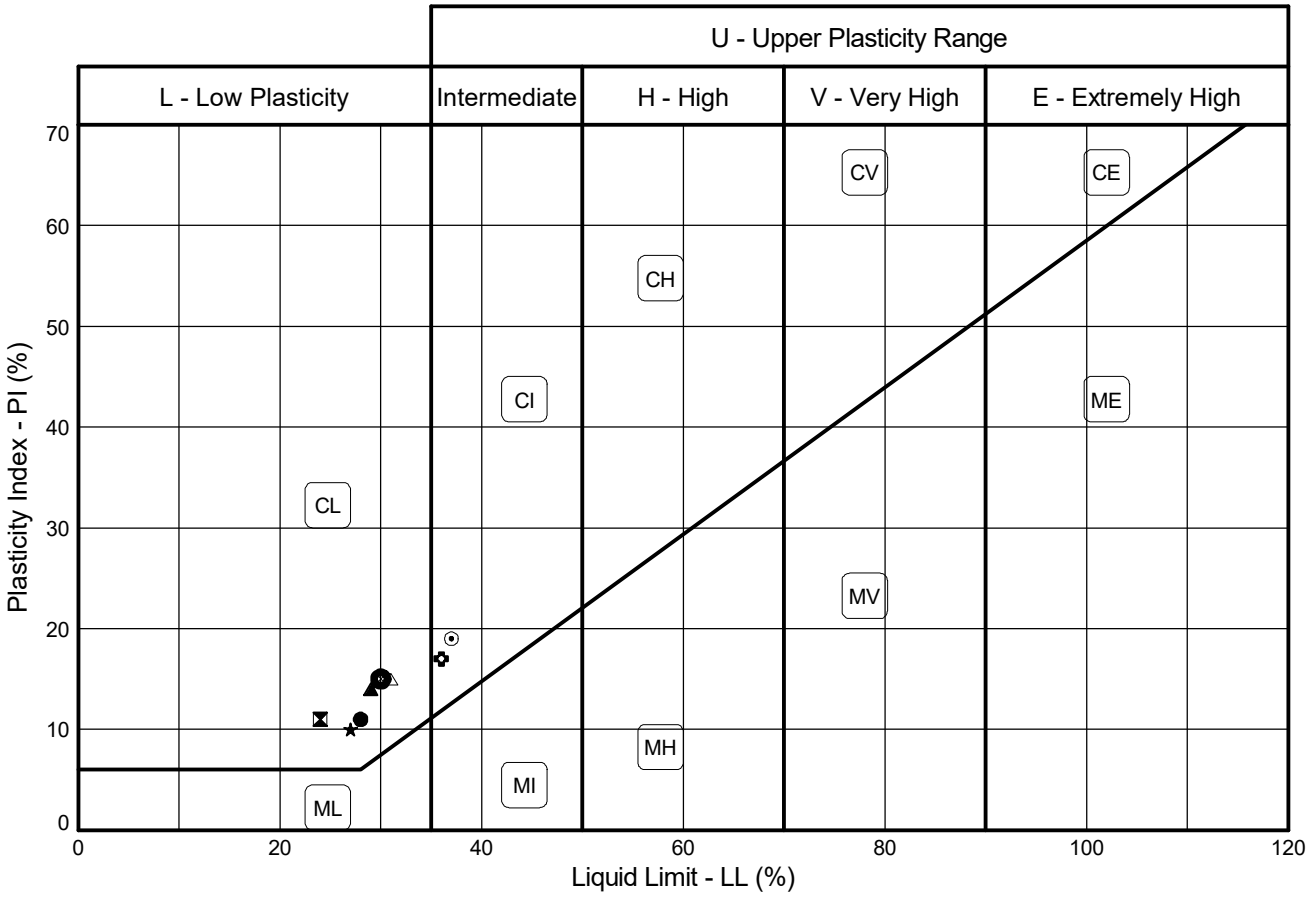
# PLASTICITY CHART - PI Vs LL

In accordance with BS5930:2015
Testing in accordance with BS1377-2:1990




| Sample Identification | | | | BS Test Method # | Preparation Method + | MC | LL | PL | PI | <425µm | Lab location | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Exploratory Position ID | Sample | Depth (m) | | | % | % | % | % | % | | |
| ● | CP101 | 20/09322/5B | 10.50 | 3.2/4.3/5.3/5.4 | 4.2.4 | 19 | 28 | 17 | 11 | 96 | C | |
| ⊠ | CP101 | 20/09322/10D | 21.00 | 3.2/4.3/5.3/5.4 | 4.2.4 | 14 | 24 | 13 | 11 | 91 | C | |
| ▲ | CP102 | 20/09322/13D | 5.00 | 3.2/4.3/5.3/5.4 | 4.2.4 | 18 | 29 | 15 | 14 | 92 | C | |
| ★ | CP103 | 20/09322/17D | 11.00 | 3.2/4.3/5.3/5.4 | 4.2.4 | 47 | 27 | 17 | 10 | 99 | C | |
| ⊙ | CP103 | 20/09322/20D | 25.50 | 3.2/4.3/5.3/5.4 | 4.2.4 | 16 | 37 | 18 | 19 | 95 | C | |
| ✿ | TP101 | 20/09322/24B | 1.30 | 3.2/4.3/5.3/5.4 | 4.2.4 | 17 | 36 | 19 | 17 | 97 | C | |
| ◉ | TP104 | 20/09322/30B | 1.60 | 3.2/4.3/5.3/5.4 | 4.2.4 | 17 | 30 | 15 | 15 | 93 | C | |
| △ | TP106 | 20/09322/33D | 1.00 | 3.2/4.3/5.3/5.4 | 4.2.4 | 19 | 31 | 16 | 15 | 95 | C | |
| ⊗ | WS101 | 20/09322/36D | 2.60 | 3.2/4.3/5.3/5.4 | 4.2.4 | 15 | 30 | 15 | 15 | 92 | C | |

# Tested in accordance with the following clauses of BS1377-2:1990.

3.2 - Moisture Content
4.3 - Cone Penetrometer Method
4.4 - One Point Cone Penetrometer Method
4.6 - One Point Casagrande Method
5.3 - Plastic Limit Method
5.4 - Plasticity Index

+ Tested in accordance with the following clauses of BS1377-2:1990.

4.2.3 - Natural State
4.2.4 - Wet Sieved

Key: * = Non-standard test, NP = Non plastic.

Lab location: B = Bristol (BS3 4AG), C = Castleford (WF10 1NJ), H = Hemel Hempstead (HP3 9RT), T = Tonbridge (TN11 9HU)


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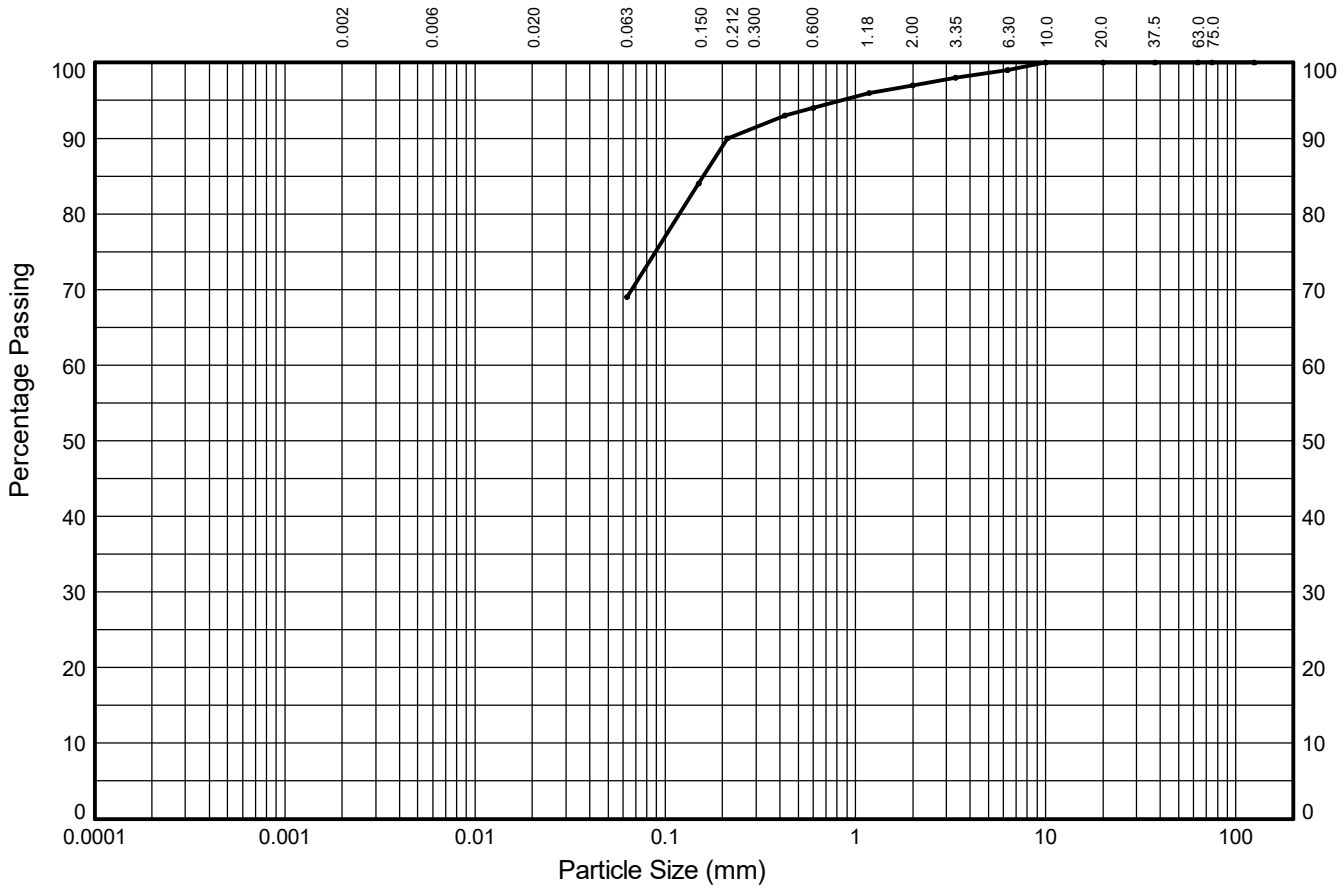
| Contract | Contract Ref: |
|---|---|
| 20/09322 | 784746 |


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# PARTICLE SIZE DISTRIBUTION TEST

In accordance with clauses 9.2 of BS1377:Part 2:1990

Position ID: **CP101** Sample Ref: **20/09322/3** Sample Type: **B** Depth (m): **6.00**




| CLAY | fine | medium | coarse | fine | medium | coarse | fine | medium | coarse | COBBLES |
|---|---|---|---|---|---|---|---|---|---|---|
| | - | - | - | 20% | 5% | 3% | 2% | 1% | 0% | |
| | SILT | | | SAND | | | GRAVEL | | | |
| 69% | | | | 28% | | | 3% | | | 0% |

| Test Sieve (mm) | Percent Passing (%) |
|---|---|
| 125.0 | **100** |
| 75.0 | **100** |
| 63.0 | **100** |
| 37.5 | **100** |
| 20.0 | **100** |
| 10.0 | **100** |
| 6.30 | **99** |
| 3.35 | **98** |
| 2.00 | **97** |
| 1.18 | **96** |
| 0.600 | **94** |
| 0.425 | **93** |
| 0.212 | **90** |
| 0.150 | **84** |
| 0.063 | **69** |

| Particle Diameter (mm) | Percent Passing (%) |
|---|---|
| | |

Sedimentation sample was not pre-treated

| Coefficients | |
|---|---|
| $D_{10}$ (mm) | **NA** |
| $D_{15}$ (mm) | **NA** |
| $D_{30}$ (mm) | **NA** |
| $D_{50}$ (mm) | **NA** |
| $D_{60}$ (mm) | **NA** |
| $D_{85}$ (mm) | **0.159** |
| $D_{90}$ (mm) | **0.212** |
| $C_U$ | **NA** |
| $C_C$ | **NA** |

Soil Description:

**Dark brown slightly gravelly slightly sandy CLAY**

Key: $C_U$ = Uniformity coefficient. $C_C$ = Coefficient of curvature as defined in BS EN ISO 14688-2


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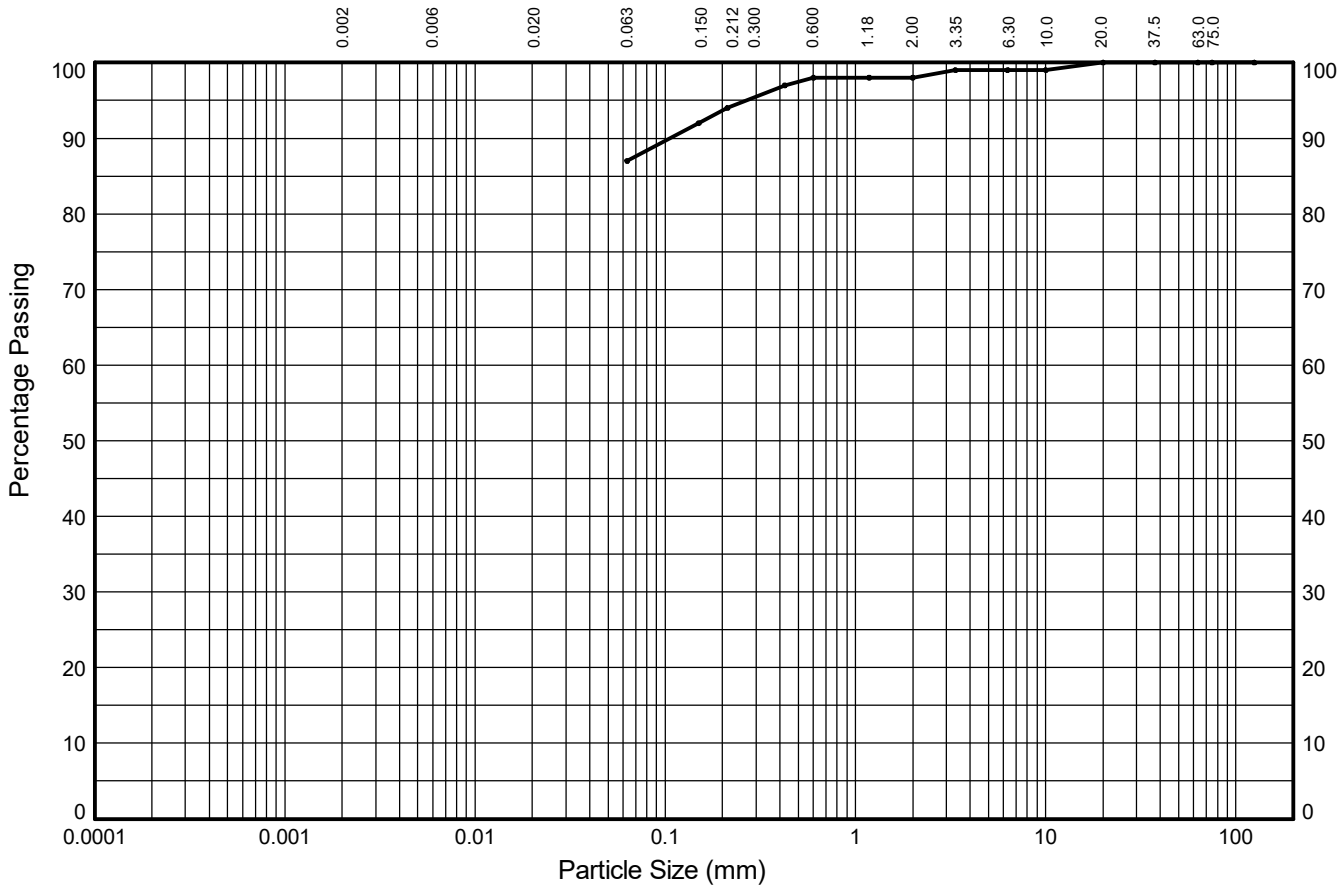
| Contract | Contract Ref: |
|---|---|
| 20/09322 | 784746 |


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# PARTICLE SIZE DISTRIBUTION TEST

In accordance with clauses 9.2 of BS1377:Part 2:1990

Position ID: **CP101** Sample Ref: **20/09322/5** Sample Type: **B** Depth (m): **10.50**




| CLAY | fine | medium | coarse | fine | medium | coarse | fine | medium | coarse | COBBLES |
|---|---|---|---|---|---|---|---|---|---|---|
| | - | - | - | 7% | 4% | 0% | 1% | 1% | 0% | |
| | SILT | | | SAND | | | GRAVEL | | | |
| 87% | | | | 11% | | | 2% | | | 0% |

| Test Sieve (mm) | Percent Passing (%) |
|---|---|
| 125.0 | **100** |
| 75.0 | **100** |
| 63.0 | **100** |
| 37.5 | **100** |
| 20.0 | **100** |
| 10.0 | **99** |
| 6.30 | **99** |
| 3.35 | **99** |
| 2.00 | **98** |
| 1.18 | **98** |
| 0.600 | **98** |
| 0.425 | **97** |
| 0.212 | **94** |
| 0.150 | **92** |
| 0.063 | **87** |

| Particle Diameter (mm) | Percent Passing (%) |
|---|---|
| | |

Sedimentation sample was not pre-treated

| Coefficients | |
|---|---|
| $D_{10}$ (mm) | **NA** |
| $D_{15}$ (mm) | **NA** |
| $D_{30}$ (mm) | **NA** |
| $D_{50}$ (mm) | **NA** |
| $D_{60}$ (mm) | **NA** |
| $D_{85}$ (mm) | **NA** |
| $D_{90}$ (mm) | **0.106** |
| $C_U$ | **NA** |
| $C_C$ | **NA** |

Soil Description:

**Brown slightly gravelly slightly sandy CLAY**

Key: $C_U$ = Uniformity coefficient. $C_C$ = Coefficient of curvature as defined in BS EN ISO 14688-2


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|---|---|
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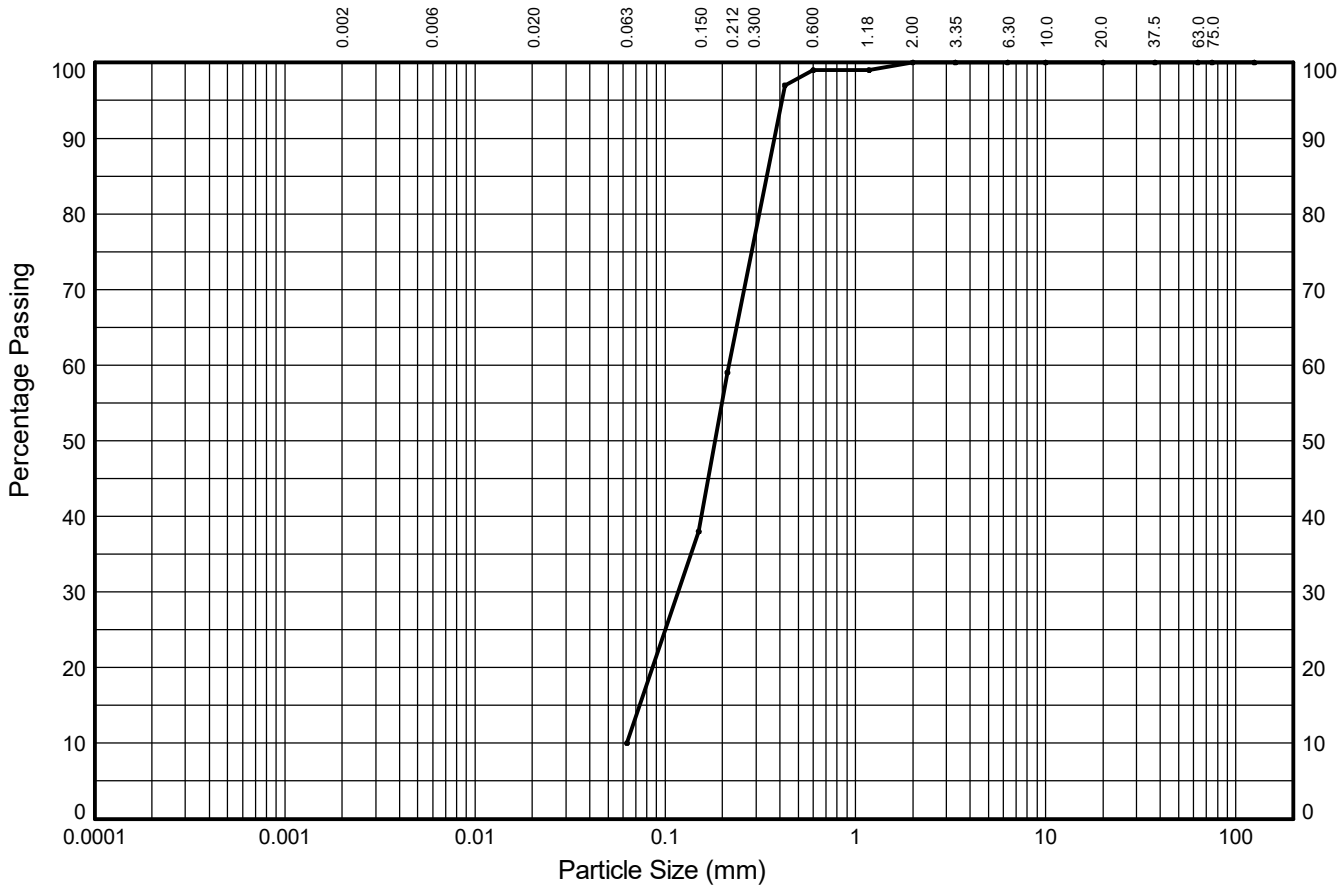
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# PARTICLE SIZE DISTRIBUTION TEST

In accordance with clauses 9.2 of BS1377:Part 2:1990

Position ID: **CP102** Sample Ref: **20/09322/12** Sample Type: **B** Depth (m): **15.00**




| CLAY | fine | medium | coarse | fine | medium | coarse | fine | medium | coarse | COBBLES |
|---|---|---|---|---|---|---|---|---|---|---|
| | - | - | - | 45% | 44% | 1% | 0% | 0% | 0% | |
| | SILT | | | SAND | | | GRAVEL | | | |
| 10% | | | | 90% | | | 0% | | | 0% |

| Test Sieve (mm) | Percent Passing (%) |
|---|---|
| 125.0 | **100** |
| 75.0 | **100** |
| 63.0 | **100** |
| 37.5 | **100** |
| 20.0 | **100** |
| 10.0 | **100** |
| 6.30 | **100** |
| 3.35 | **100** |
| 2.00 | **100** |
| 1.18 | **99** |
| 0.600 | **99** |
| 0.425 | **97** |
| 0.212 | **59** |
| 0.150 | **38** |
| 0.063 | **10** |

| Particle Diameter (mm) | Percent Passing (%) |
|---|---|
| | |

Sedimentation sample was not pre-treated

| Coefficients | |
|---|---|
| $D_{10}$ (mm) | **0.063** |
| $D_{15}$ (mm) | **0.074** |
| $D_{30}$ (mm) | **0.117** |
| $D_{50}$ (mm) | **0.183** |
| $D_{60}$ (mm) | **0.216** |
| $D_{85}$ (mm) | **0.341** |
| $D_{90}$ (mm) | **0.374** |
| $C_U$ | **3.4** |
| $C_C$ | **1.0** |

Soil Description:

**Dark brown clayey SAND**

Key: $C_U$ = Uniformity coefficient. $C_C$ = Coefficient of curvature as defined in BS EN ISO 14688-2


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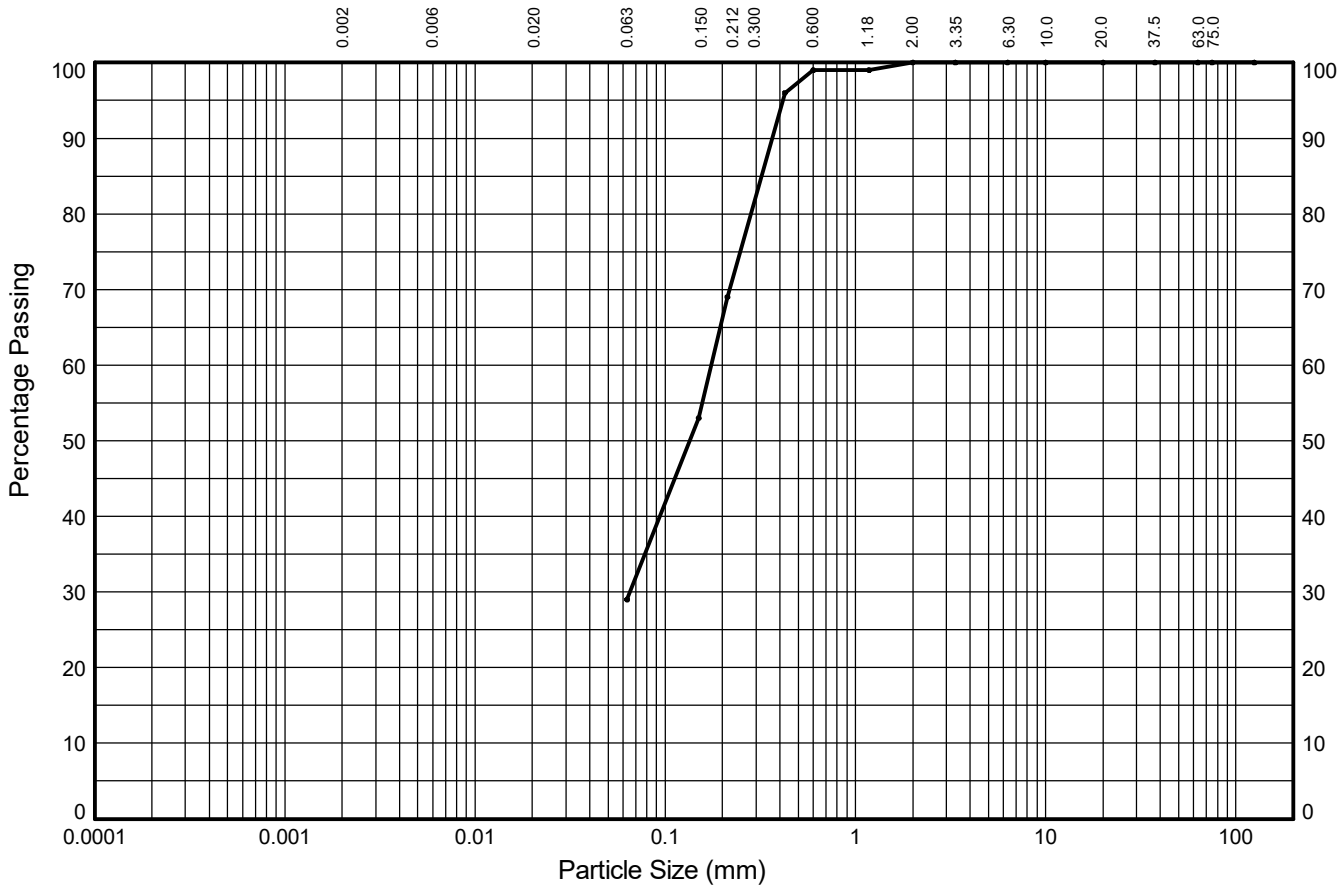
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# PARTICLE SIZE DISTRIBUTION TEST

In accordance with clauses 9.2 of BS1377:Part 2:1990

Position ID: **CP103** Sample Ref: **20/09322/22** Sample Type: **B** Depth (m): **15.00**




| CLAY | fine | medium | coarse | fine | medium | coarse | fine | medium | coarse | COBBLES |
|---|---|---|---|---|---|---|---|---|---|---|
| | - | - | - | 37% | 33% | 1% | 0% | 0% | 0% | |
| | SILT | | | SAND | | | GRAVEL | | | |
| 29% | | | | 71% | | | 0% | | | 0% |

| Test Sieve (mm) | Percent Passing (%) |
|---|---|
| 125.0 | **100** |
| 75.0 | **100** |
| 63.0 | **100** |
| 37.5 | **100** |
| 20.0 | **100** |
| 10.0 | **100** |
| 6.30 | **100** |
| 3.35 | **100** |
| 2.00 | **100** |
| 1.18 | **99** |
| 0.600 | **99** |
| 0.425 | **96** |
| 0.212 | **69** |
| 0.150 | **53** |
| 0.063 | **29** |

| Particle Diameter (mm) | Percent Passing (%) |
|---|---|
| | |

Sedimentation sample was not pre-treated

| Coefficients | |
|---|---|
| $D_{10}$ (mm) | **NA** |
| $D_{15}$ (mm) | **NA** |
| $D_{30}$ (mm) | **0.065** |
| $D_{50}$ (mm) | **0.135** |
| $D_{60}$ (mm) | **0.175** |
| $D_{85}$ (mm) | **0.320** |
| $D_{90}$ (mm) | **0.364** |
| $C_U$ | **NA** |
| $C_C$ | **NA** |

Soil Description:

**Dark brown very clayey SAND**

Key: $C_U$ = Uniformity coefficient. $C_C$ = Coefficient of curvature as defined in BS EN ISO 14688-2


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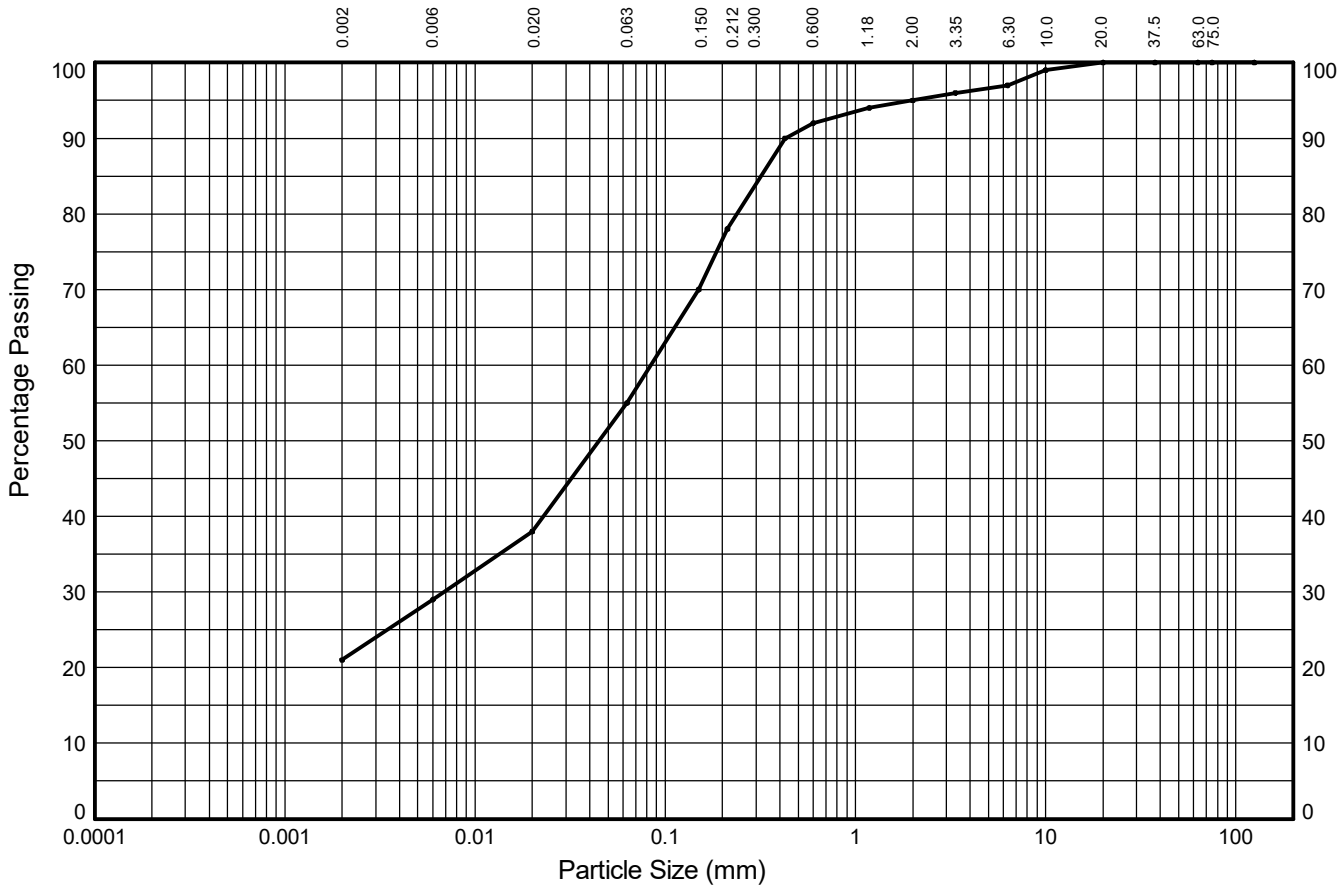
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| 20/09322 | 784746 |


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# PARTICLE SIZE DISTRIBUTION TEST

In accordance with clauses 9.2, 9.4 of BS1377:Part 2:1990

Trial Pit: **TP102** Sample Ref: **20/09322/26** Sample Type: **B** Depth (m): **1.70**




| CLAY | fine | medium | coarse | fine | medium | coarse | fine | medium | coarse | COBBLES |
|---|---|---|---|---|---|---|---|---|---|---|
| | 8% | 9% | 17% | 21% | 16% | 3% | 2% | 3% | 0% | |
| | SILT | | | SAND | | | GRAVEL | | | |
| 21% | 34% | | | 40% | | | 5% | | | 0% |

| Test Sieve (mm) | Percent Passing (%) |
|---|---|
| 125.0 | **100** |
| 75.0 | **100** |
| 63.0 | **100** |
| 37.5 | **100** |
| 20.0 | **100** |
| 10.0 | **99** |
| 6.30 | **97** |
| 3.35 | **96** |
| 2.00 | **95** |
| 1.18 | **94** |
| 0.600 | **92** |
| 0.425 | **90** |
| 0.212 | **78** |
| 0.150 | **70** |
| 0.063 | **55** |

| Particle Diameter (mm) | Percent Passing (%) |
|---|---|
| 0.02 | **38** |
| 0.006 | **29** |
| 0.002 | **21** |

Sedimentation sample was not pre-treated

| Coefficients | |
|---|---|
| $D_{10}$ (mm) | **NA** |
| $D_{15}$ (mm) | **NA** |
| $D_{30}$ (mm) | **0.007** |
| $D_{50}$ (mm) | **0.045** |
| $D_{60}$ (mm) | **0.084** |
| $D_{85}$ (mm) | **0.318** |
| $D_{90}$ (mm) | **0.425** |
| $C_U$ | **NA** |
| $C_C$ | **NA** |

Soil Description:

**Brown sandy slightly gravelly CLAY**

Key: $C_U$ = Uniformity coefficient. $C_C$ = Coefficient of curvature as defined in BS EN ISO 14688-2


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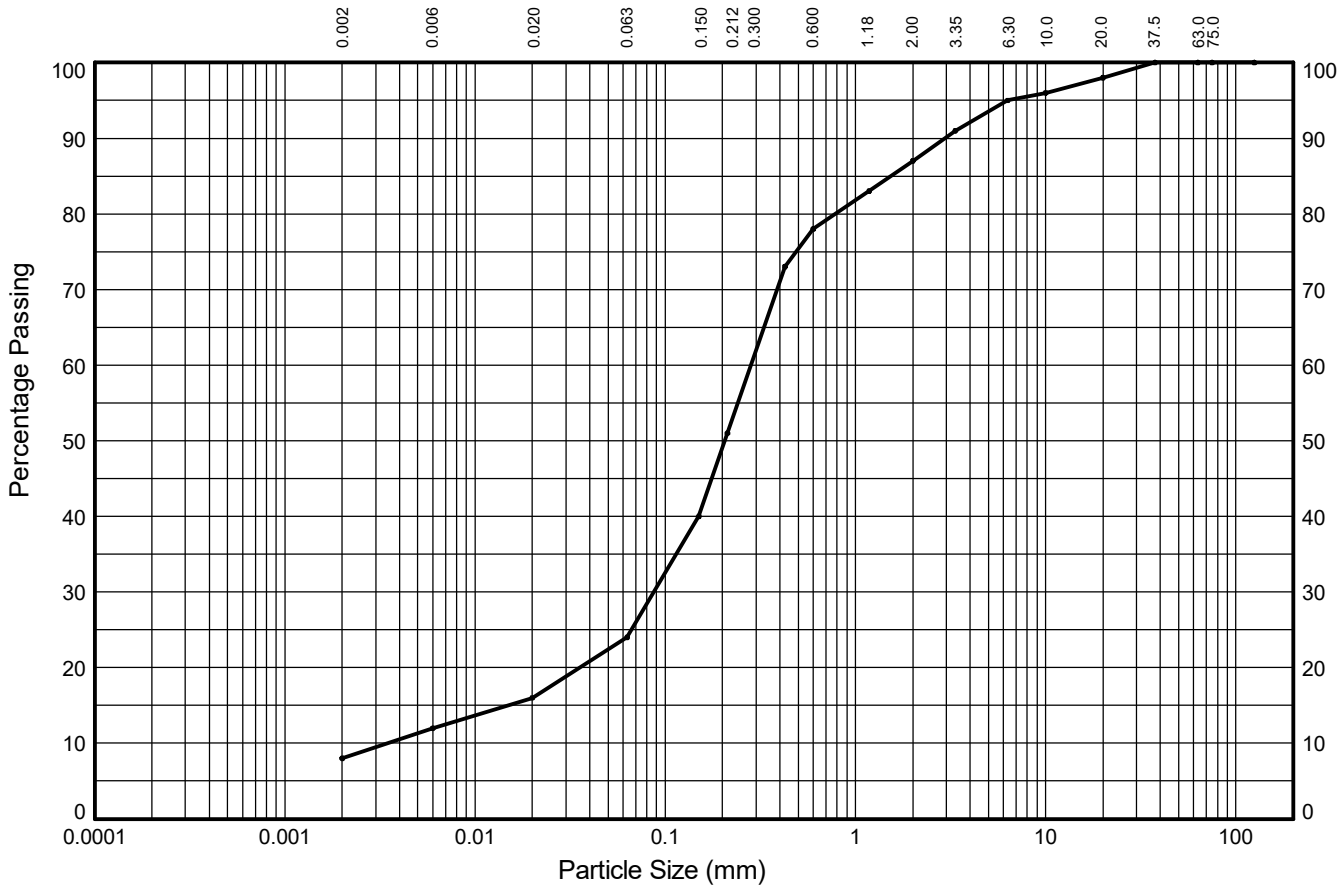
| Contract | Contract Ref: |
|---|---|
| 20/09322 | 784746 |


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# PARTICLE SIZE DISTRIBUTION TEST

In accordance with clauses 9.2, 9.4 of BS1377:Part 2:1990

Trial Pit: **TP103** Sample Ref: **20/09322/27** Sample Type: **B** Depth (m): **0.40**




| CLAY | fine | medium | coarse | fine | medium | coarse | fine | medium | coarse | COBBLES |
|---|---|---|---|---|---|---|---|---|---|---|
| | 4% | 4% | 8% | 25% | 29% | 9% | 8% | 3% | 2% | |
| | SILT | | | SAND | | | GRAVEL | | | |
| 8% | 16% | | | 63% | | | 13% | | | 0% |

| Test Sieve (mm) | Percent Passing (%) |
|---|---|
| 125.0 | **100** |
| 75.0 | **100** |
| 63.0 | **100** |
| 37.5 | **100** |
| 20.0 | **98** |
| 10.0 | **96** |
| 6.30 | **95** |
| 3.35 | **91** |
| 2.00 | **87** |
| 1.18 | **83** |
| 0.600 | **78** |
| 0.425 | **73** |
| 0.212 | **51** |
| 0.150 | **40** |
| 0.063 | **24** |

| Particle Diameter (mm) | Percent Passing (%) |
|---|---|
| 0.02 | **16** |
| 0.006 | **12** |
| 0.002 | **8** |

Sedimentation sample was not pre-treated

| Coefficients | |
|---|---|
| $D_{10}$ (mm) | **0.003** |
| $D_{15}$ (mm) | **0.015** |
| $D_{30}$ (mm) | **0.087** |
| $D_{50}$ (mm) | **0.205** |
| $D_{60}$ (mm) | **0.282** |
| $D_{85}$ (mm) | **1.536** |
| $D_{90}$ (mm) | **2.945** |
| $C_U$ | **81** |
| $C_C$ | **8** |

Soil Description:

**Light brown gravelly very clayey SAND**

Key: $C_U$ = Uniformity coefficient. $C_C$ = Coefficient of curvature as defined in BS EN ISO 14688-2


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| Contract | Contract Ref: |
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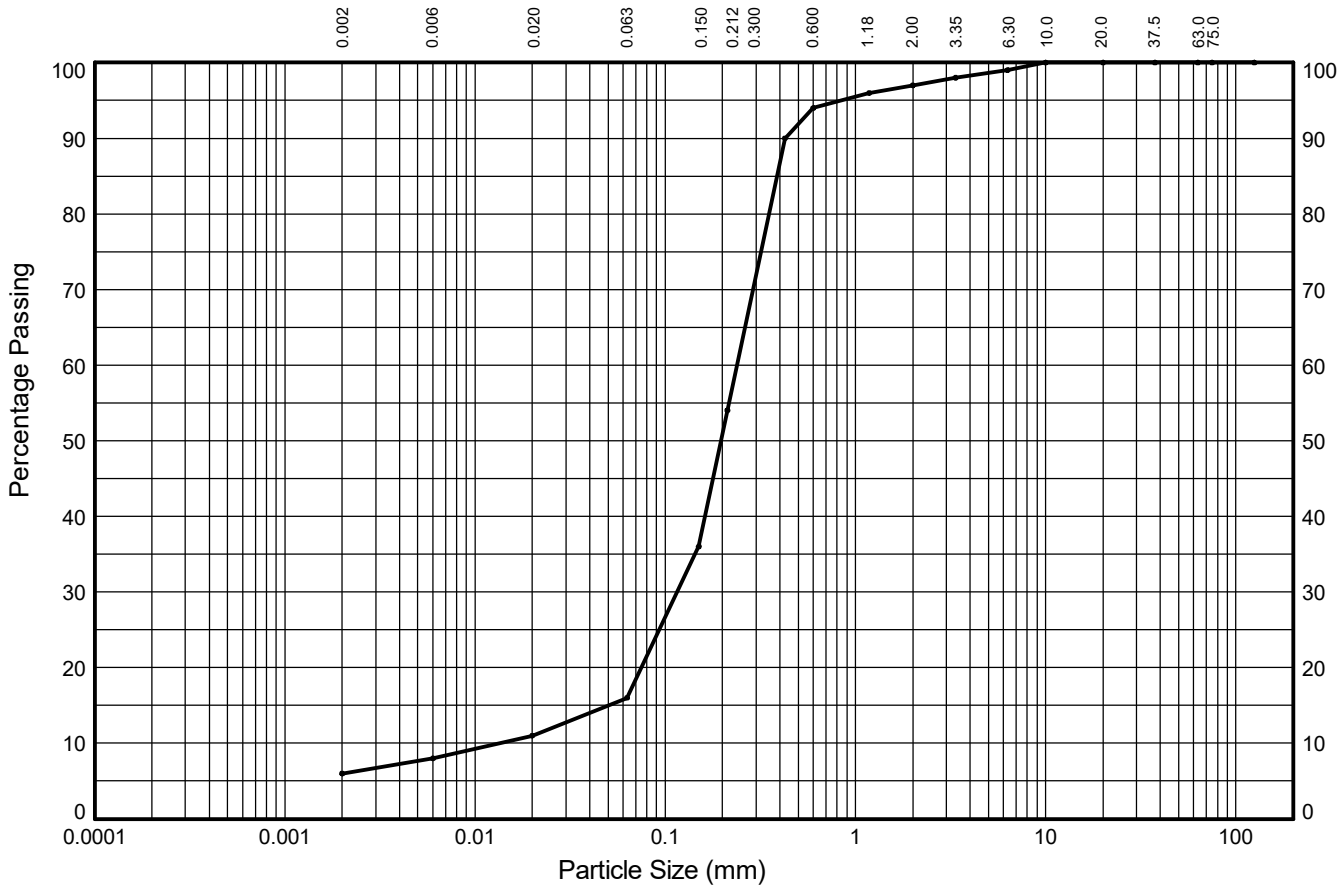
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# PARTICLE SIZE DISTRIBUTION TEST

In accordance with clauses 9.2, 9.4 of BS1377:Part 2:1990

Trial Pit: **TP103** Sample Ref: **20/09322/28** Sample Type: **B** Depth (m): **2.40**




| CLAY | fine | medium | coarse | fine | medium | coarse | fine | medium | coarse | COBBLES |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2% | 3% | 5% | 35% | 44% | 3% | 2% | 1% | 0% | |
| | SILT | | | SAND | | | GRAVEL | | | |
| 6% | 10% | | | 81% | | | 3% | | | 0% |

| Test Sieve (mm) | Percent Passing (%) |
|---|---|
| 125.0 | **100** |
| 75.0 | **100** |
| 63.0 | **100** |
| 37.5 | **100** |
| 20.0 | **100** |
| 10.0 | **100** |
| 6.30 | **99** |
| 3.35 | **98** |
| 2.00 | **97** |
| 1.18 | **96** |
| 0.600 | **94** |
| 0.425 | **90** |
| 0.212 | **54** |
| 0.150 | **36** |
| 0.063 | **16** |

| Particle Diameter (mm) | Percent Passing (%) |
|---|---|
| 0.02 | **11** |
| 0.006 | **8** |
| 0.002 | **6** |

Sedimentation sample was not pre-treated

| Coefficients | |
|---|---|
| $D_{10}$ (mm) | **0.013** |
| $D_{15}$ (mm) | **0.050** |
| $D_{30}$ (mm) | **0.116** |
| $D_{50}$ (mm) | **0.196** |
| $D_{60}$ (mm) | **0.238** |
| $D_{85}$ (mm) | **0.386** |
| $D_{90}$ (mm) | **0.425** |
| $C_U$ | **18** |
| $C_C$ | **4** |

Soil Description:

**Light brown slightly gravelly clayey SAND**

Key: $C_U$ = Uniformity coefficient. $C_C$ = Coefficient of curvature as defined in BS EN ISO 14688-2


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| **20/09322** | **784746** |


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# PARTICLE SIZE DISTRIBUTION TEST

In accordance with clauses 9.2, 9.4 of BS1377:Part 2:1990

Trial Pit: **TP104** Sample Ref: **20/09322/30** Sample Type: **B** Depth (m): **1.60**




| CLAY | fine | medium | coarse | fine | medium | coarse | fine | medium | coarse | COBBLES |
|---|---|---|---|---|---|---|---|---|---|---|
| | 10% | 10% | 16% | 18% | 13% | 2% | 2% | 2% | 0% | |
| | SILT | | | SAND | | | GRAVEL | | | |
| 27% | 36% | | | 33% | | | 4% | | | 0% |

| Test Sieve (mm) | Percent Passing (%) |
|---|---|
| 125.0 | **100** |
| 75.0 | **100** |
| 63.0 | **100** |
| 37.5 | **100** |
| 20.0 | **100** |
| 10.0 | **99** |
| 6.30 | **98** |
| 3.35 | **97** |
| 2.00 | **96** |
| 1.18 | **95** |
| 0.600 | **94** |
| 0.425 | **92** |
| 0.212 | **82** |
| 0.150 | **75** |
| 0.063 | **63** |

| Particle Diameter (mm) | Percent Passing (%) |
|---|---|
| 0.02 | **47** |
| 0.006 | **37** |
| 0.002 | **27** |

Sedimentation sample was not pre-treated

| Coefficients | |
|---|---|
| $D_{10}$ (mm) | **NA** |
| $D_{15}$ (mm) | **NA** |
| $D_{30}$ (mm) | **0.003** |
| $D_{50}$ (mm) | **0.025** |
| $D_{60}$ (mm) | **0.051** |
| $D_{85}$ (mm) | **0.261** |
| $D_{90}$ (mm) | **0.370** |
| $C_U$ | **NA** |
| $C_C$ | **NA** |

Soil Description:

**Dark brown slightly gravelly sandy CLAY**

Key: $C_U$ = Uniformity coefficient. $C_C$ = Coefficient of curvature as defined in BS EN ISO 14688-2


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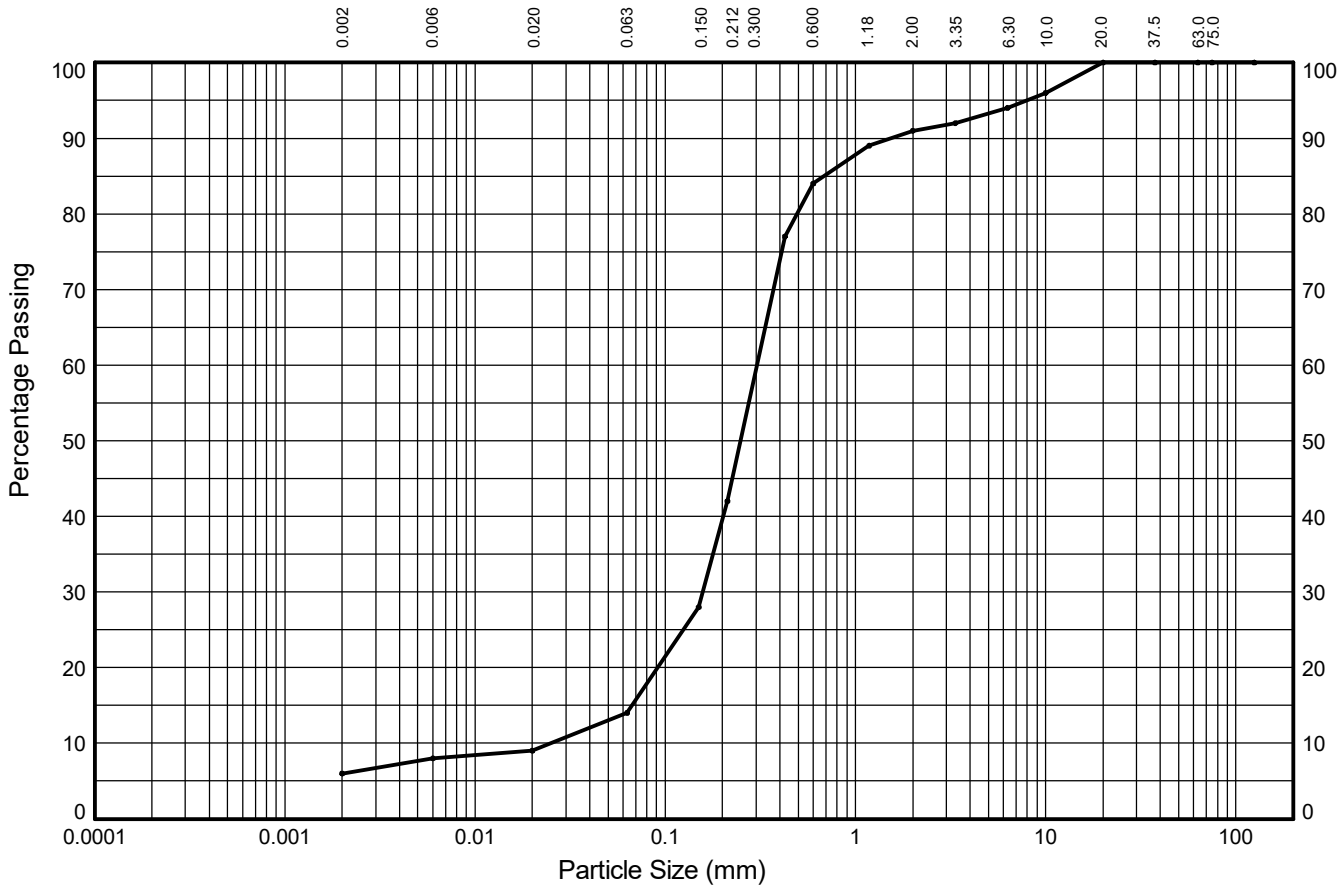
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|---|---|
| 20/09322 | 784746 |


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# PARTICLE SIZE DISTRIBUTION TEST

In accordance with clauses 9.2, 9.4 of BS1377:Part 2:1990

Trial Pit: **TP105** Sample Ref: **20/09322/31** Sample Type: **B** Depth (m): **0.40**




| CLAY | fine | medium | coarse | fine | medium | coarse | fine | medium | coarse | COBBLES |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2% | 1% | 5% | 25% | 45% | 7% | 3% | 6% | 0% | |
| | SILT | | | SAND | | | GRAVEL | | | |
| 6% | 8% | | | 77% | | | 9% | | | 0% |

| Test Sieve (mm) | Percent Passing (%) |
|---|---|
| 125.0 | **100** |
| 75.0 | **100** |
| 63.0 | **100** |
| 37.5 | **100** |
| 20.0 | **100** |
| 10.0 | **96** |
| 6.30 | **94** |
| 3.35 | **92** |
| 2.00 | **91** |
| 1.18 | **89** |
| 0.600 | **84** |
| 0.425 | **77** |
| 0.212 | **42** |
| 0.150 | **28** |
| 0.063 | **14** |

| Particle Diameter (mm) | Percent Passing (%) |
|---|---|
| 0.02 | **9** |
| 0.006 | **8** |
| 0.002 | **6** |

Sedimentation sample was not pre-treated

| Coefficients | |
|---|---|
| $D_{10}$ (mm) | **0.025** |
| $D_{15}$ (mm) | **0.067** |
| $D_{30}$ (mm) | **0.158** |
| $D_{50}$ (mm) | **0.249** |
| $D_{60}$ (mm) | **0.303** |
| $D_{85}$ (mm) | **0.687** |
| $D_{90}$ (mm) | **1.536** |
| $C_U$ | **12** |
| $C_C$ | **3** |

Soil Description:

**Light brown gravelly clayey SAND**

Key: $C_U$ = Uniformity coefficient. $C_C$ = Coefficient of curvature as defined in BS EN ISO 14688-2


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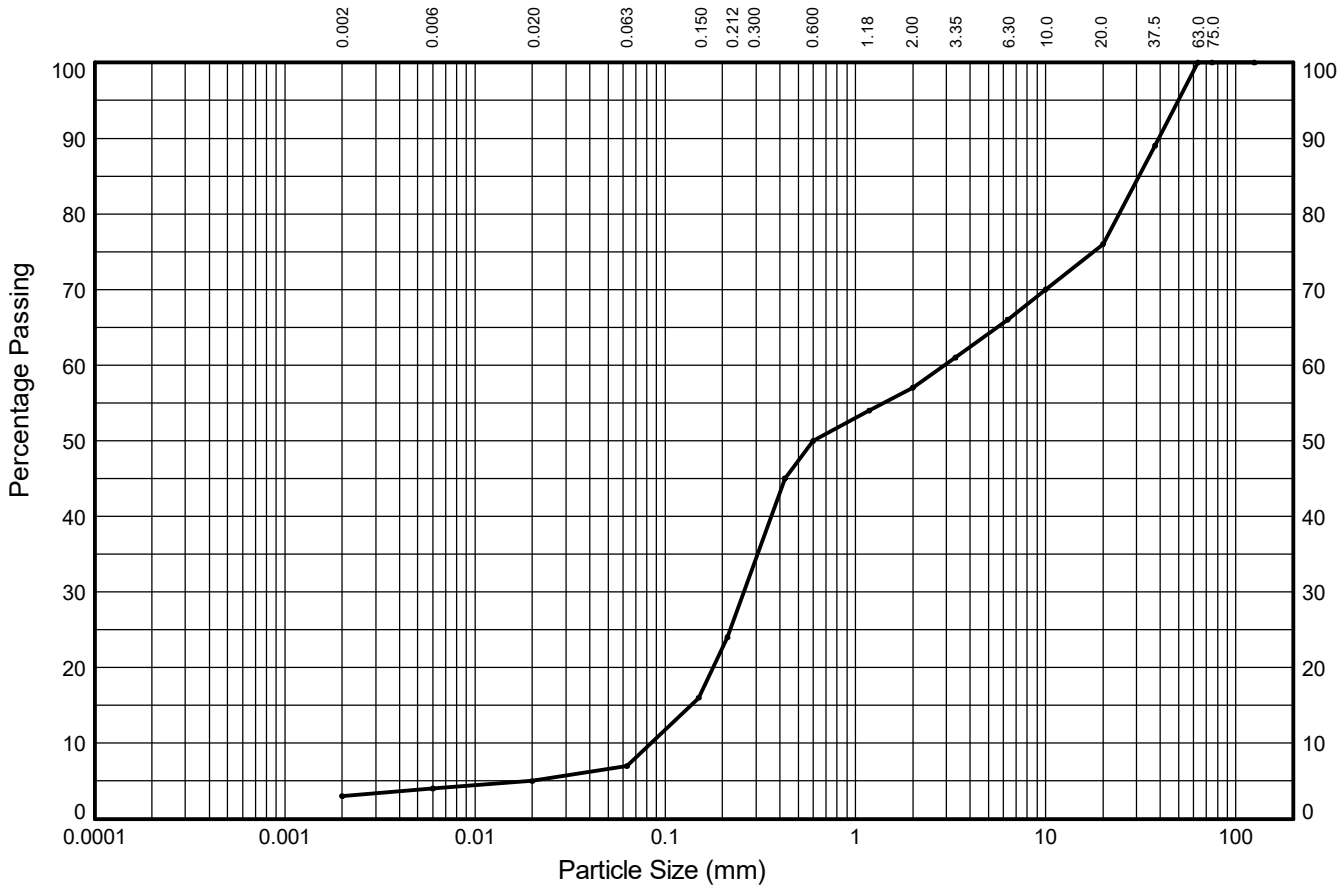
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# PARTICLE SIZE DISTRIBUTION TEST

In accordance with clauses 9.2, 9.4 of BS1377:Part 2:1990
NON-STANDARD TEST

Trial Pit: **TP108** Sample Ref: **20/09322/35** Sample Type: **B** Depth (m): **0.80**




| CLAY | fine | medium | coarse | fine | medium | coarse | fine | medium | coarse | COBBLES |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1% | 1% | 2% | 15% | 28% | 7% | 9% | 10% | 24% | |
| | SILT | | | SAND | | | GRAVEL | | | |
| 3% | 4% | | | 50% | | | 43% | | | 0% |

| Test Sieve (mm) | Percent Passing (%) |
|---|---|
| 125.0 | **100** |
| 75.0 | **100** |
| 63.0 | **100** |
| 37.5 | **89** |
| 20.0 | **76** |
| 10.0 | **70** |
| 6.30 | **66** |
| 3.35 | **61** |
| 2.00 | **57** |
| 1.18 | **54** |
| 0.600 | **50** |
| 0.425 | **45** |
| 0.212 | **24** |
| 0.150 | **16** |
| 0.063 | **7** |

| Particle Diameter (mm) | Percent Passing (%) |
|---|---|
| 0.02 | **5** |
| 0.006 | **4** |
| 0.002 | **3** |

Sedimentation sample was not pre-treated

| Coefficients | |
|---|---|
| $D_{10}$ (mm) | **0.084** |
| $D_{15}$ (mm) | **0.136** |
| $D_{30}$ (mm) | **0.259** |
| $D_{50}$ (mm) | **0.600** |
| $D_{60}$ (mm) | **2.945** |
| $D_{85}$ (mm) | **30.905** |
| $D_{90}$ (mm) | **39.311** |
| $C_U$ | **35** |
| $C_C$ | **0.27** |

Soil Description:

**Brown clayey very gravelly SAND**

Key: $C_U$ = Uniformity coefficient. $C_C$ = Coefficient of curvature as defined in BS EN ISO 14688-2


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# SUMMARY OF PARTICLE DENSITY TESTS

**In accordance with clause 8.2 & 8.3 of BS1377:Part 2**

| Exploratory Position ID | Sample Ref | Depth (m) | Sample Type | Particle Density ($Mg/m^3$) | Test Type | Measured Water Density ($Mg/m^3$) | Lab |
|---|---|---|---|---|---|---|---|
| **TP102** | **20/09322/25** | **0.40** | **B** | **2.62** | **GAS JAR** | **0.9982** | **C** |
| **TP103** | **20/09322/28** | **2.40** | **B** | **2.61** | **GAS JAR** | **0.9982** | **C** |
| **TP105** | **20/09322/31** | **0.40** | **B** | **2.61** | **GAS JAR** | **0.9982** | **C** |
| **TP106** | **20/09322/33** | **1.00** | **D** | **2.61** | **GAS JAR** | **0.9982** | **C** |
| **TP108** | **20/09322/35** | **0.80** | **B** | **2.63** | **GAS JAR** | **0.9982** | **C** |

Lab location: B = Bristol (BS3 4AG), C = Castleford (WF10 1NJ), H = Hemel Hempstead (HP3 9RT), T = Tonbridge (TN11 9HU)

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| **20/09322** | **784746** |

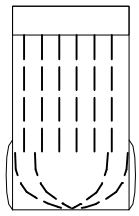
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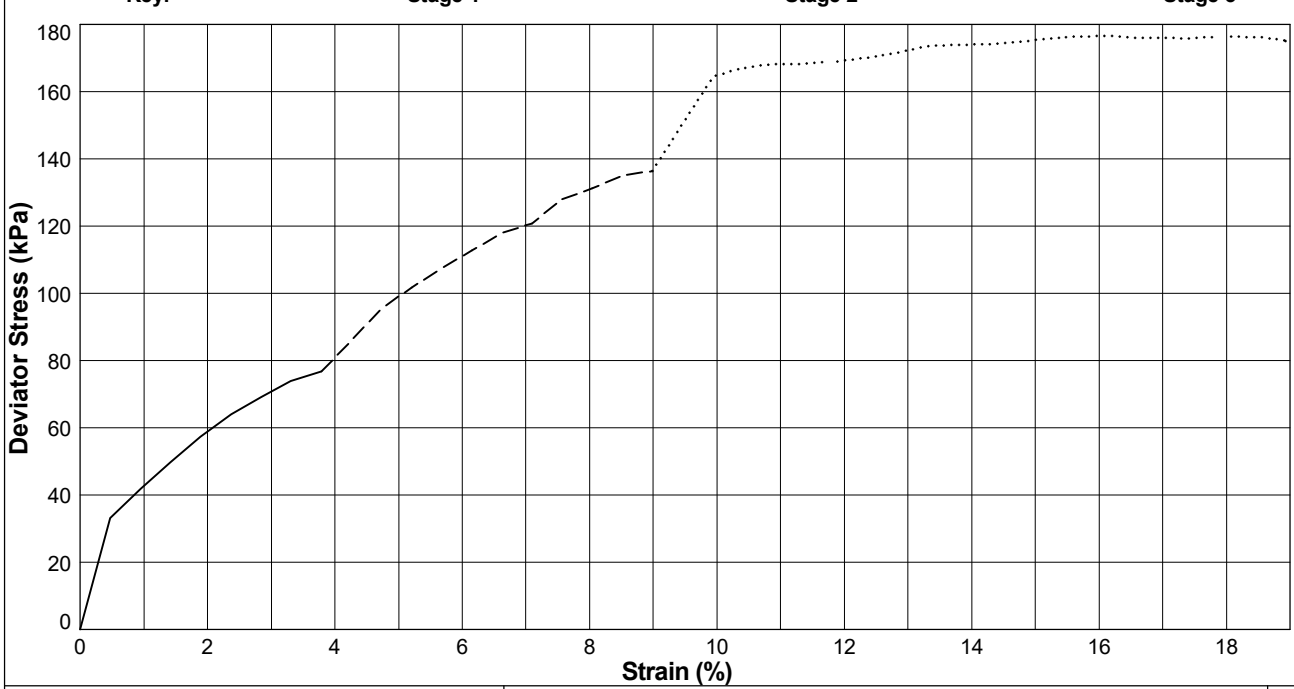
# UNCONSOLIDATED QUICK UNDRAINED (MULTI-STAGE) TRIAXIAL COMPRESSION TEST

In accordance with BS1377 Part 7 Clause 9

Position ID: **CP101** Sample Ref: **20/09322/6** Sample Type: **B** Depth (m): **12.00**

Description : **Dark brown slightly sandy slightly gravelly CLAY**

| STAGE NUMBER | | | 1 | 2 | 3 |
|---|---|---|---|---|---|
| SAMPLE DETAILS | Sample Condition | | Undisturbed | | |
| | Orientation of sample | | Vertical | | |
| | Diameter | (mm) | 102.33 | | |
| | Height | (mm) | 211.33 | | |
| | Moisture Content | (%) | 13 | | |
| | Bulk Density | ($Mg/m^3$) | 2.25 | | |
| | Dry Density | ($Mg/m^3$) | 1.98 | | |
| TEST DETAILS | Membrane Type | | Rubber | Rubber | Rubber |
| | Membrane Thickness | (mm) | 0.30 | 0.30 | 0.30 |
| | Rate of Axial Displacement | (%/min) | 2.00 | 2.00 | 2.00 |
| | Cell Pressure | (kPa) | 120 | 240 | 480 |
| | Membrane Correction | (kPa) | 0.30 | 0.62 | 0.95 |
| | Corrected Deviator Stress | (kPa) | 77 | 136 | 177 |
| | Undrained Shear Strength | (kPa) | 38 | 68 | 88 |
| FAILURE DETAILS | Strain at Failure | (%) | 3.8 | 9.0 | 16.1 |
| | Mode of Failure<br>**Semi-plastic (bulging, shear & axial splitting)** | | | |  |




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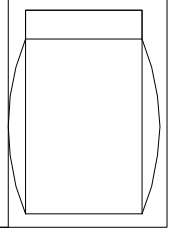
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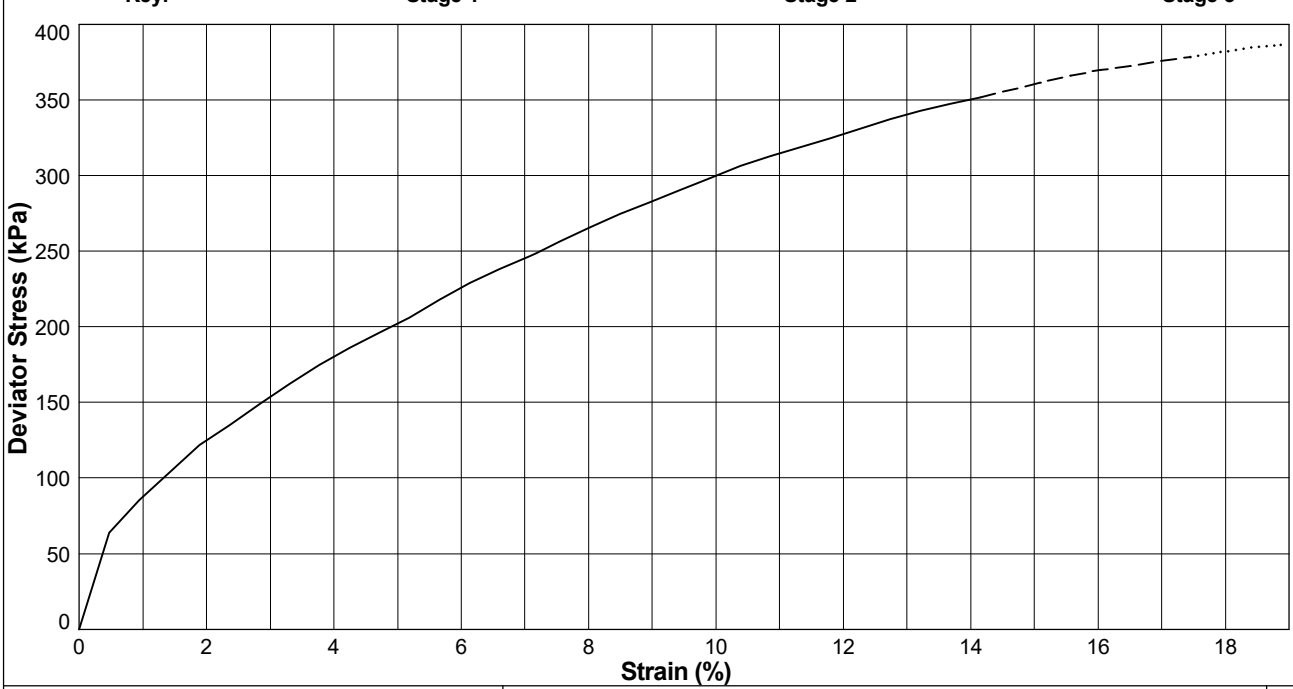
# UNCONSOLIDATED QUICK UNDRAINED (MULTI-STAGE) TRIAXIAL COMPRESSION TEST

In accordance with BS1377 Part 7 Clause 9

Position ID: **CP101** Sample Ref: **20/09322/8** Sample Type: **B** Depth (m): **16.50**

Description : **Dark brown slightly sandy slightly gravelly CLAY**

| STAGE NUMBER | | | 1 | 2 | 3 |
|---|---|---|---|---|---|
| SAMPLE DETAILS | Sample Condition | | Undisturbed | | |
| | Orientation of sample | | Vertical | | |
| | Diameter | (mm) | 101.83 | | |
| | Height | (mm) | 212.00 | | |
| | Moisture Content | (%) | 16 | | |
| | Bulk Density | ($Mg/m^3$) | 2.18 | | |
| | Dry Density | ($Mg/m^3$) | 1.88 | | |
| TEST DETAILS | Membrane Type | | Rubber | Rubber | Rubber |
| | Membrane Thickness | (mm) | 0.30 | 0.30 | 0.30 |
| | Rate of Axial Displacement | (%/min) | 2.00 | 2.00 | 2.00 |
| | Cell Pressure | (kPa) | 165 | 330 | 660 |
| | Membrane Correction | (kPa) | 0.87 | 1.01 | 1.07 |
| | Corrected Deviator Stress | (kPa) | 352 | 378 | 386 |
| | Undrained Shear Strength | (kPa) | 176 | 189 | 193 |
| FAILURE DETAILS | Strain at Failure | (%) | 14.2 | 17.4 | 18.9 |
| | Mode of Failure<br>**Plastic (Barrelling)** | | | |  |




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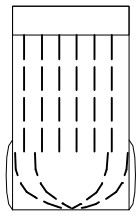
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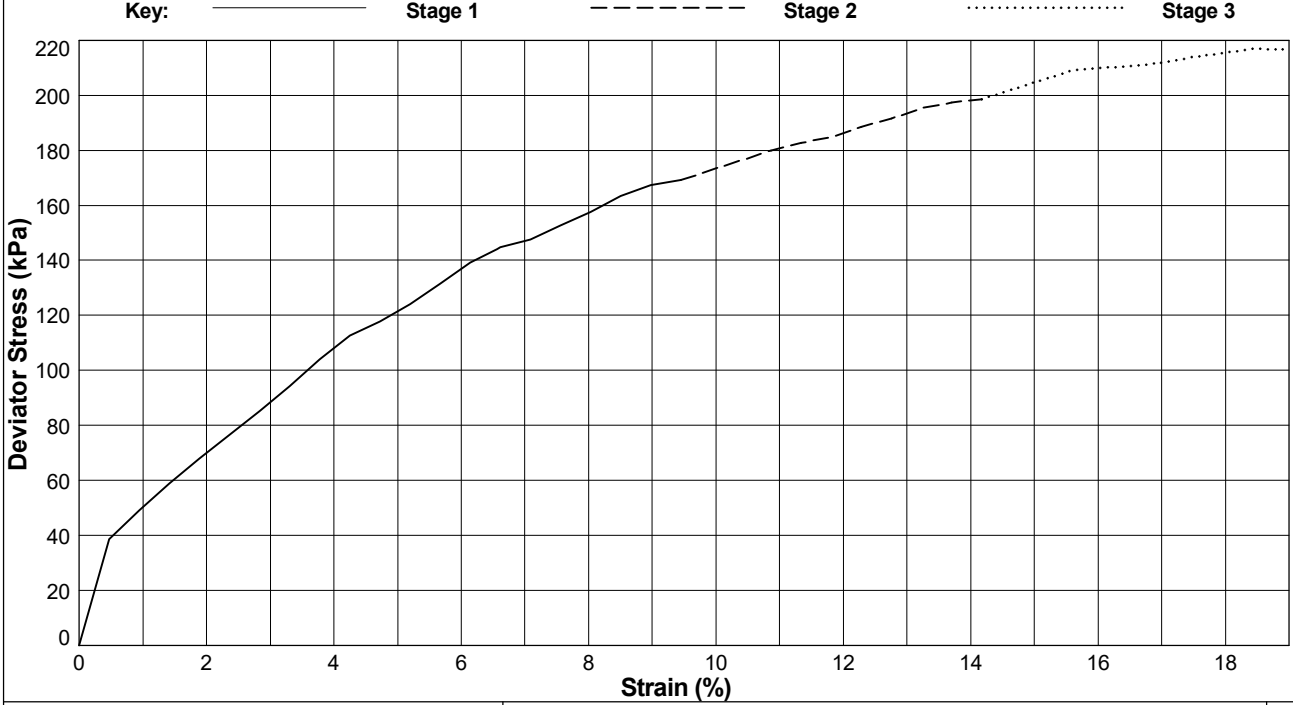
# UNCONSOLIDATED QUICK UNDRAINED (MULTI-STAGE) TRIAXIAL COMPRESSION TEST

In accordance with BS1377 Part 7 Clause 9

Position ID: **CP103** Sample Ref: **20/09322/23** Sample Type: **B** Depth (m): **24.00**

Description : **Dark brown slghtly gravelly CLAY**

| STAGE NUMBER | | | 1 | 2 | 3 |
|---|---|---|---|---|---|
| SAMPLE DETAILS | Sample Condition | | Undisturbed | | |
| | Orientation of sample | | Vertical | | |
| | Diameter | (mm) | 101.33 | | |
| | Height | (mm) | 211.67 | | |
| | Moisture Content | (%) | 19 | | |
| | Bulk Density | ($Mg/m^3$) | 2.16 | | |
| | Dry Density | ($Mg/m^3$) | 1.81 | | |
| TEST DETAILS | Membrane Type | | Rubber | Rubber | Rubber |
| | Membrane Thickness | (mm) | 0.30 | 0.30 | 0.30 |
| | Rate of Axial Displacement | (%/min) | 2.00 | 2.00 | 2.00 |
| | Cell Pressure | (kPa) | 240 | 480 | 960 |
| | Membrane Correction | (kPa) | 0.65 | 0.87 | 1.06 |
| | Corrected Deviator Stress | (kPa) | 169 | 198 | 217 |
| | Undrained Shear Strength | (kPa) | 85 | 99 | 108 |
| FAILURE DETAILS | Strain at Failure | (%) | 9.4 | 14.2 | 18.4 |
| | Mode of Failure<br>**Semi-plastic (bulging, shear & axial splitting)** | | | |  |




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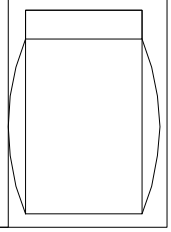
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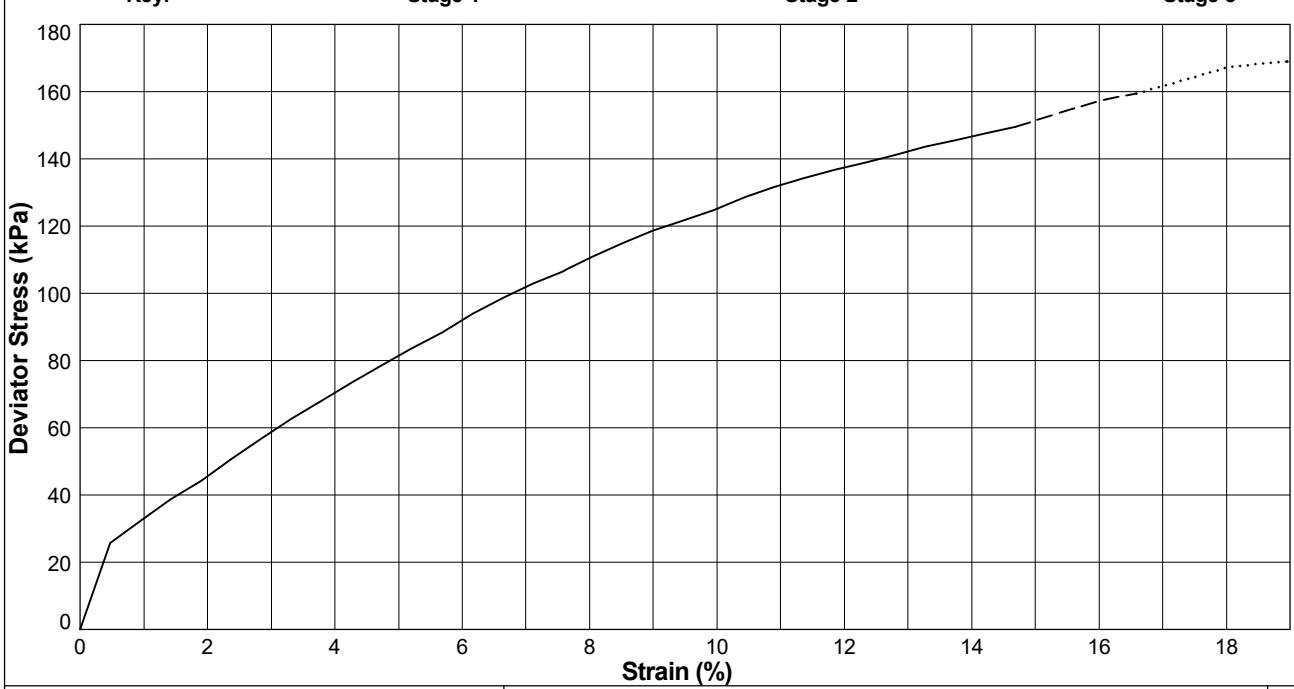
# UNCONSOLIDATED QUICK UNDRAINED (MULTI-STAGE) TRIAXIAL COMPRESSION TEST

In accordance with BS1377 Part 7 Clause 9

Trial Pit: **TP102** Sample Ref: **20/09322/26** Sample Type: **B** Depth (m): **1.70**

Description : **Brown sandy slightly gravelly CLAY**

| STAGE NUMBER | | | 1 | 2 | 3 |
|---|---|---|---|---|---|
| SAMPLE DETAILS | Sample Condition | | Undisturbed | | |
| | Orientation of sample | | Vertical | | |
| | Diameter | (mm) | 104.00 | | |
| | Height | (mm) | 211.00 | | |
| | Moisture Content | (%) | 16 | | |
| | Bulk Density | ($Mg/m^3$) | 2.15 | | |
| | Dry Density | ($Mg/m^3$) | 1.85 | | |
| TEST DETAILS | Membrane Type | | Rubber | Rubber | Rubber |
| | Membrane Thickness | (mm) | 0.30 | 0.30 | 0.30 |
| | Rate of Axial Displacement | (%/min) | 1.00 | 1.00 | 1.00 |
| | Cell Pressure | (kPa) | 17 | 34 | 68 |
| | Membrane Correction | (kPa) | 0.87 | 0.95 | 1.06 |
| | Corrected Deviator Stress | (kPa) | 149 | 159 | 169 |
| | Undrained Shear Strength | (kPa) | 75 | 80 | 85 |
| FAILURE DETAILS | Strain at Failure | (%) | 14.7 | 16.6 | 19.0 |
| | Mode of Failure<br>**Plastic (Barrelling)** | | | |  |




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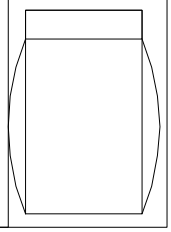
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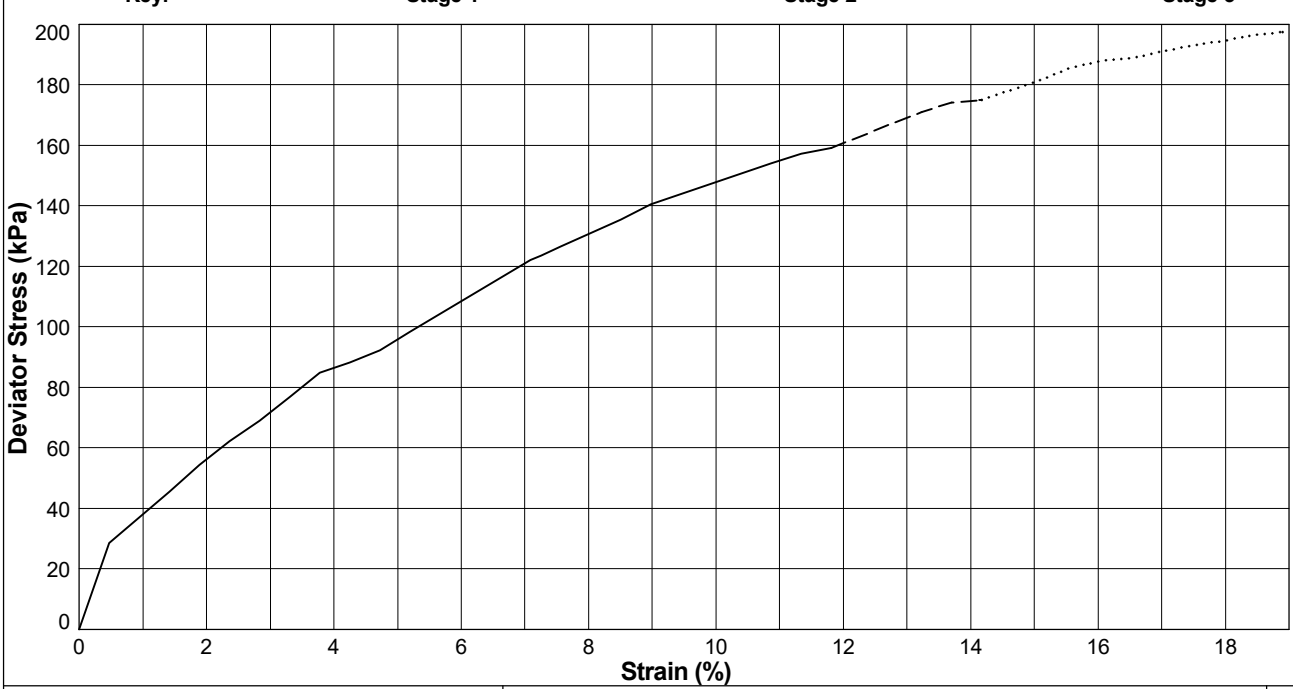
# UNCONSOLIDATED QUICK UNDRAINED (MULTI-STAGE) TRIAXIAL COMPRESSION TEST

In accordance with BS1377 Part 7 Clause 9

Trial Pit: **TP107** Sample Ref: **20/09322/34** Sample Type: **B** Depth (m): **0.80**

Description : **Brown slightly sandy slightly gravelly CLAY**

| STAGE NUMBER | | | 1 | 2 | 3 |
|---|---|---|---|---|---|
| SAMPLE DETAILS | Sample Condition | | Undisturbed | | |
| | Orientation of sample | | Vertical | | |
| | Diameter | (mm) | 103.83 | | |
| | Height | (mm) | 211.67 | | |
| | Moisture Content | (%) | 15 | | |
| | Bulk Density | ($Mg/m^3$) | 2.16 | | |
| | Dry Density | ($Mg/m^3$) | 1.87 | | |
| TEST DETAILS | Membrane Type | | Rubber | Rubber | Rubber |
| | Membrane Thickness | (mm) | 0.30 | 0.30 | 0.30 |
| | Rate of Axial Displacement | (%/min) | 1.00 | 1.00 | 1.00 |
| | Cell Pressure | (kPa) | 10 | 20 | 40 |
| | Membrane Correction | (kPa) | 0.75 | 0.85 | 1.06 |
| | Corrected Deviator Stress | (kPa) | 159 | 175 | 197 |
| | Undrained Shear Strength | (kPa) | 80 | 88 | 99 |
| FAILURE DETAILS | Strain at Failure | (%) | 11.8 | 14.2 | 18.9 |
| | Mode of Failure<br>**Plastic (Barrelling)** | | | |  |




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| LORNA WHITWORTH | 25/11/20 |

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# MOISTURE CONDITION VALUE CALIBRATION

**In accordance with clause 5.5 of BS1377:Part 4:1990**

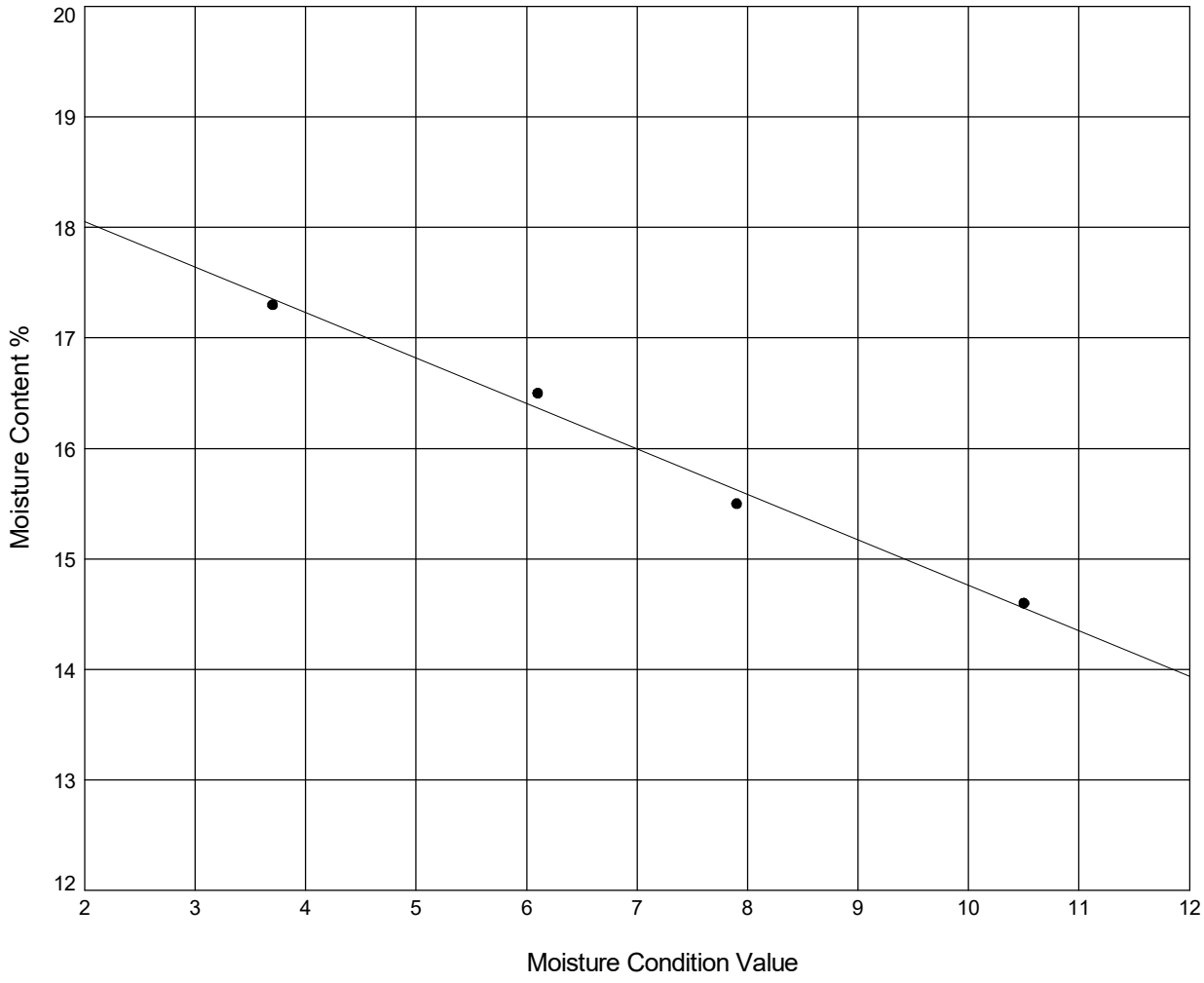
Trial Pit: **TP101** Sample Ref: **20/09322/24** Sample Type: **B** Depth (m): **1.30**

Percentage retained on 20mm sieve : **1**

Description : **Brown slightly sandy slightly silty CLAY**

Single/Separate Sample Used : **Separate**

| Test Number | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Moisture Content | 15.5 | 16.5 | 14.6 | 17.3 | - |
| MCV | 7.9 | 6.1 | 10.5 | 3.7 | - |
| Interpretation Method | Steepest straight line - Fig 9 | Steepest straight line - Fig 9 | Steepest straight line - Fig 9 | Steepest straight line - Fig 9 | - |




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|---|---|
| **20/09322** | **784746** |

AGS

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# MOISTURE CONDITION VALUE CALIBRATION

**In accordance with clause 5.5 of BS1377:Part 4:1990**

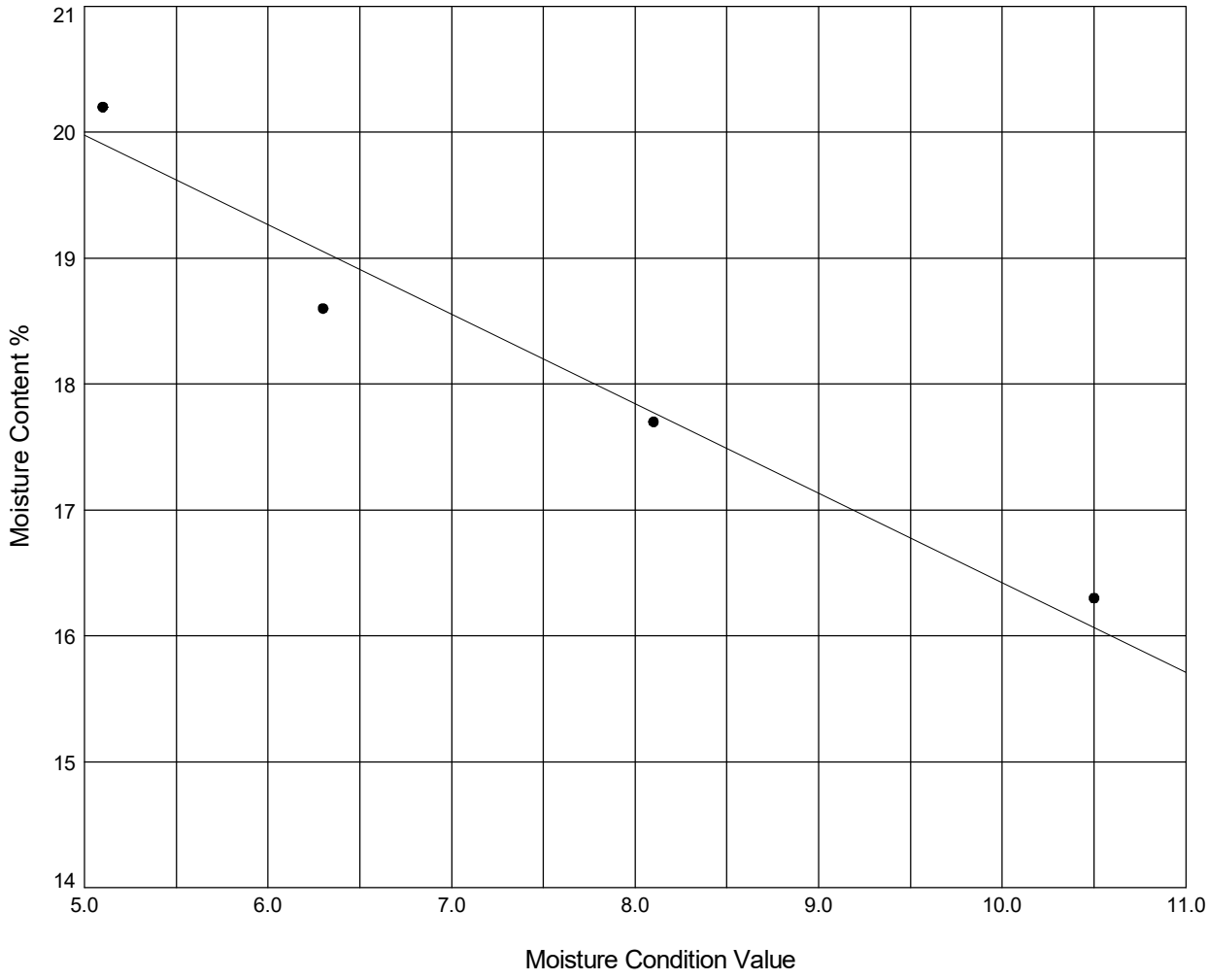
Trial Pit: **TP102** Sample Ref: **20/09322/25** Sample Type: **B** Depth (m): **0.40**

Percentage retained on 20mm sieve : **0**

Description : **Brownish grey slightly sandy slightly gravelly CLAY**

Single/Separate Sample Used : **Separate**

| Test Number | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Moisture Content | 20.2 | 18.6 | 17.7 | 16.3 | - |
| MCV | 5.1 | 6.3 | 8.1 | 10.5 | - |
| Interpretation Method | Steepest straight line - Fig 9 | Steepest straight line - Fig 9 | Steepest straight line - Fig 9 | Steepest straight line - Fig 9 | - |




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# MOISTURE CONDITION VALUE CALIBRATION

**In accordance with clause 5.5 of BS1377:Part 4:1990**

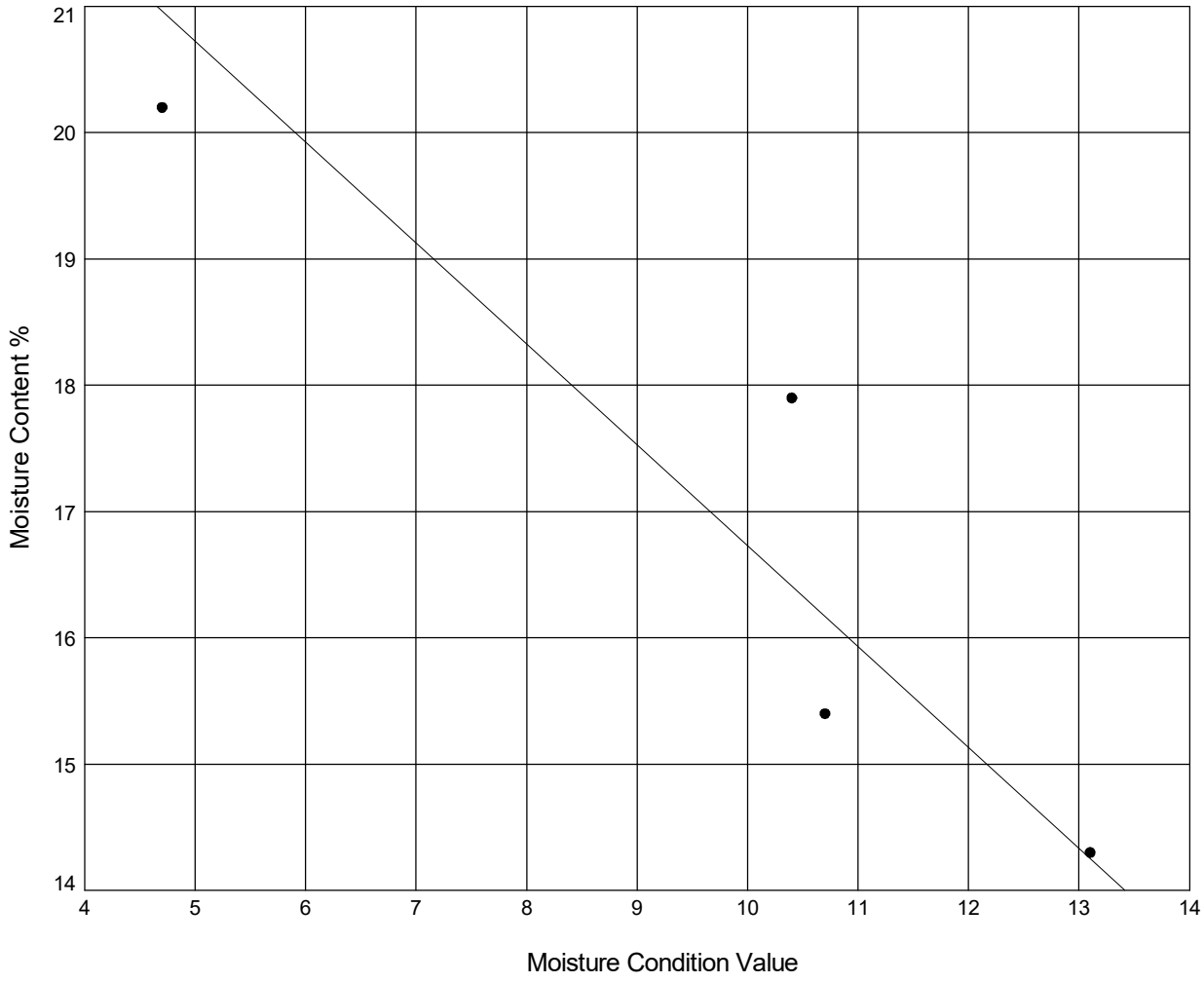
Trial Pit: **TP104** Sample Ref: **20/09322/29** Sample Type: **B** Depth (m): **0.40**

Percentage retained on 20mm sieve : **10**

Description : **Brown slightly gravelly sandy CLAY**

Single/Separate Sample Used : **Separate**

| Test Number | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Moisture Content | 20.2 | 17.9 | 15.4 | 14.3 | - |
| MCV | 4.7 | 10.4 | 10.7 | 13.1 | - |
| Interpretation Method | Steepest straight line - Fig 9 | Steepest straight line - Fig 9 | Steepest straight line - Fig 9 | Steepest straight line - Fig 9 | - |




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| Contract | Contract Ref: |
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GINT_LIBRARY_V10_01.GLB LibVersion: v8_07_001 PrjVersion: v8_07 | Graph L - MCV -3- CALIBRATION FINAL - A4P | 784746 - 20-09322.GPJ - v10_01
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# MOISTURE CONDITION VALUE CALIBRATION

**In accordance with clause 5.5 of BS1377:Part 4:1990**

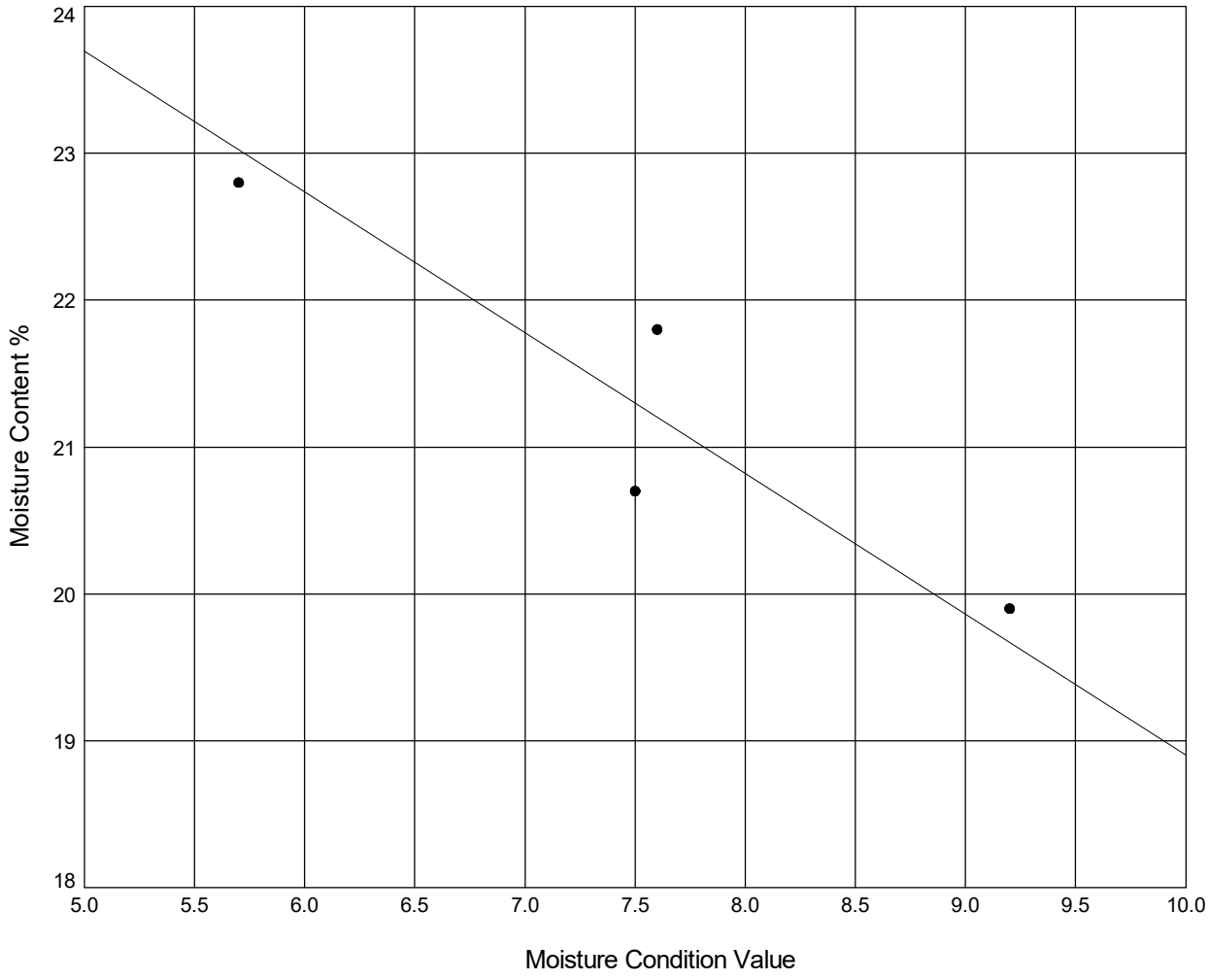
Trial Pit: **TP106** Sample Ref: **20/09322/32** Sample Type: **B** Depth (m): **0.30**

Percentage retained on 20mm sieve : **1**

Description : **Brown slightly sandy slightly gravelly CLAY**

Single/Separate Sample Used : **Separate**

| Test Number | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Moisture Content | 21.8 | 22.8 | 20.7 | 19.9 | - |
| MCV | 7.6 | 5.7 | 7.5 | 9.2 | - |
| Interpretation Method | Steepest straight line - Fig 9 | Steepest straight line - Fig 9 | Steepest straight line - Fig 9 | Steepest straight line - Fig 9 | - |




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| Contract | Contract Ref: |
|---|---|
| 20/09322 | 784746 |

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GINT_LIBRARY_V10_01.GLB LibVersion: v8_07_001 PrjVersion: v8_07 | Graph L - MCV -3- CALIBRATION FINAL - A4P | 784746 - 20-09322.GPJ - v10_01
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# MOISTURE CONDITION VALUE CALIBRATION

**In accordance with clause 5.5 of BS1377:Part 4:1990**

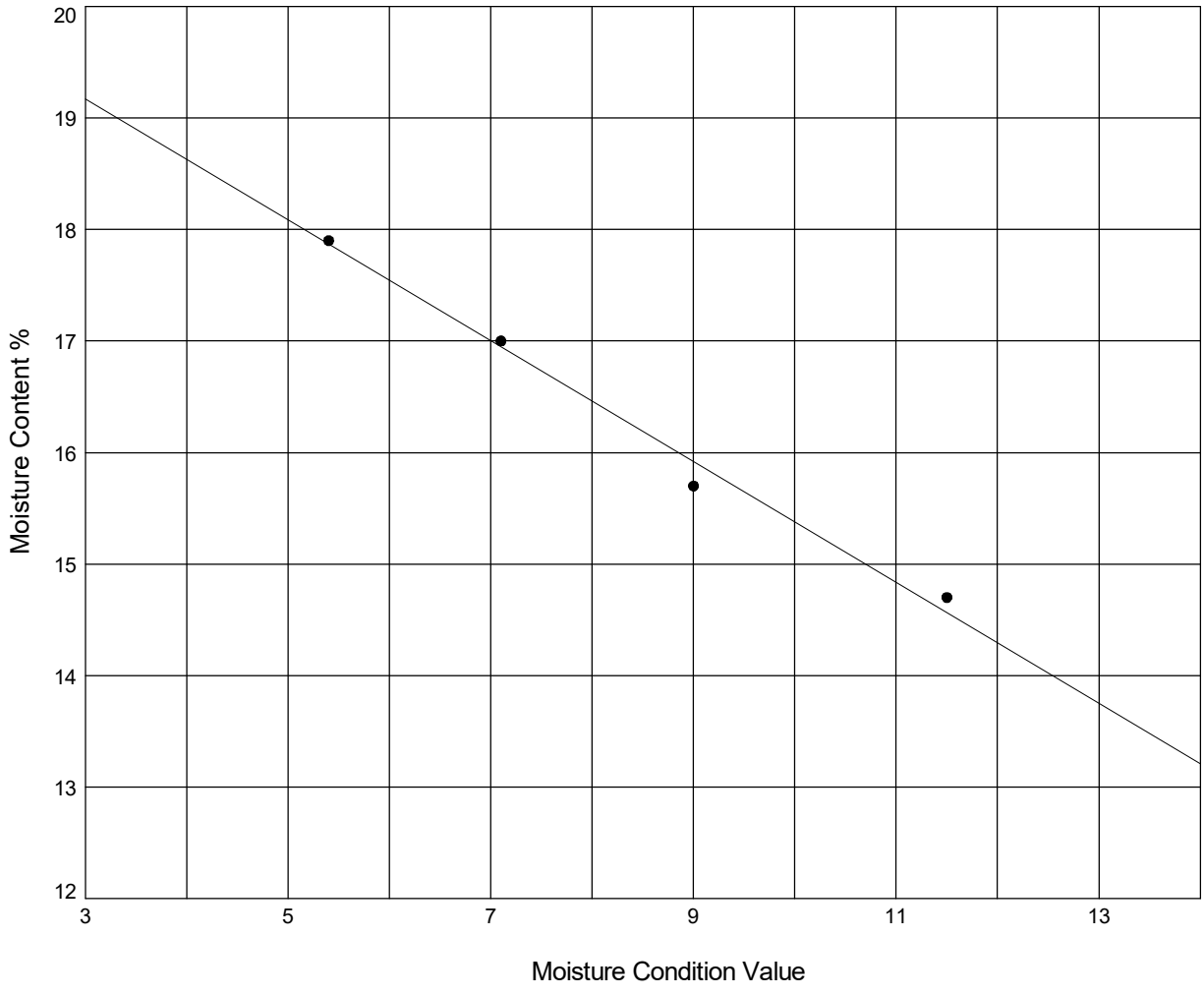
Trial Pit: **TP107** Sample Ref: **20/09322/34** Sample Type: **B** Depth (m): **0.80**

Percentage retained on 20mm sieve : **0**

Description : **Brown slightly sandy slightly gravelly CLAY**

Single/Separate Sample Used :

| Test Number | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Moisture Content | 15.7 | 17.0 | 14.7 | 17.9 | - |
| MCV | 9 | 7.1 | 11.5 | 5.4 | - |
| Interpretation Method | Steepest straight line - Fig 9 | Steepest straight line - Fig 9 | Steepest straight line - Fig 9 | Steepest straight line - Fig 9 | - |




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|---|---|
| **20/09322** | **784746** |

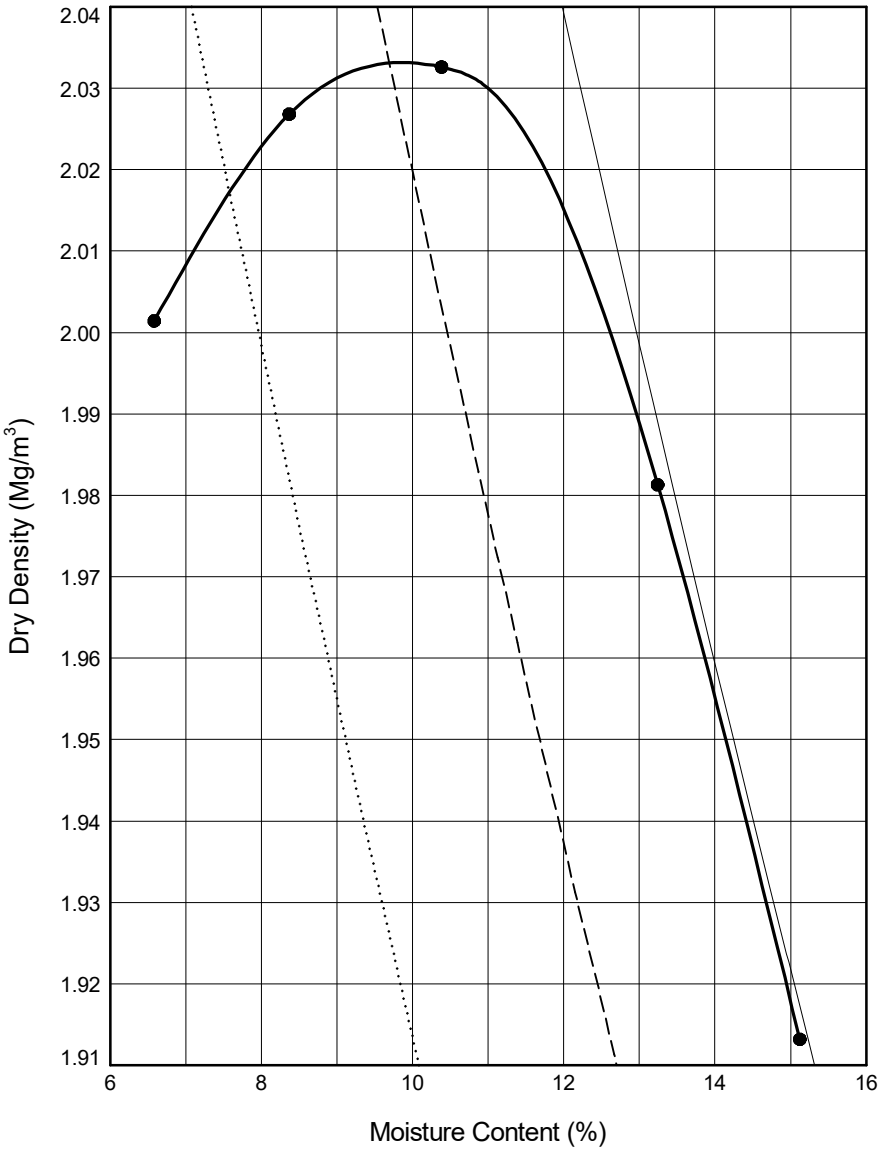
AGS

GINT_LIBRARY_V10_01.GLB LibVersion: v8_07_001 PrjVersion: v8_07 | Graph L - MCV -3- CALIBRATION FINAL - A4P | 784746 - 20-09322.GPJ - v10_01
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# DRY DENSITY / MOISTURE CONTENT RELATIONSHIP TEST

In accordance with clauses 3.3,3.4,3.5,3.6,3.7 of BS1377:Part 4:1990

Trial Pit: **TP101** Sample Ref: **20/09322/24** Sample Type: **B** Depth (m): **1.30**




| Initial Sample Conditions | | Test Details | Test Results |
|---|---|---|---|
| Initial Moisture Content (%) : **6.6** | | Compaction Type : **Heavy** | Maximum Dry Density (Mg/m$^3$) : **2.03** |
| % Retained on 37.5mm BS Sieve : **0** | | Mass of Rammer (kg): **4.5** | Optimum Moisture Content (%) : **10** |
| % Retained on 20.0mm BS Sieve : **1** | | Type of Mould : **1 LITRE** | Method Used: **Clause 3.3** |
| Particle Density - assumed (Mg/m$^3$) : **2.70** | | | Remarks: |
| Size of Soil Pieces : **<20mm** | | Single sample was used. | |

| Sample Description | Key to Air Voids Lines | | |
|---|---|---|---|
| **Brown slightly sandy slightly silty CLAY** | ——— 0% | – – – – 5% | ····· 10% |


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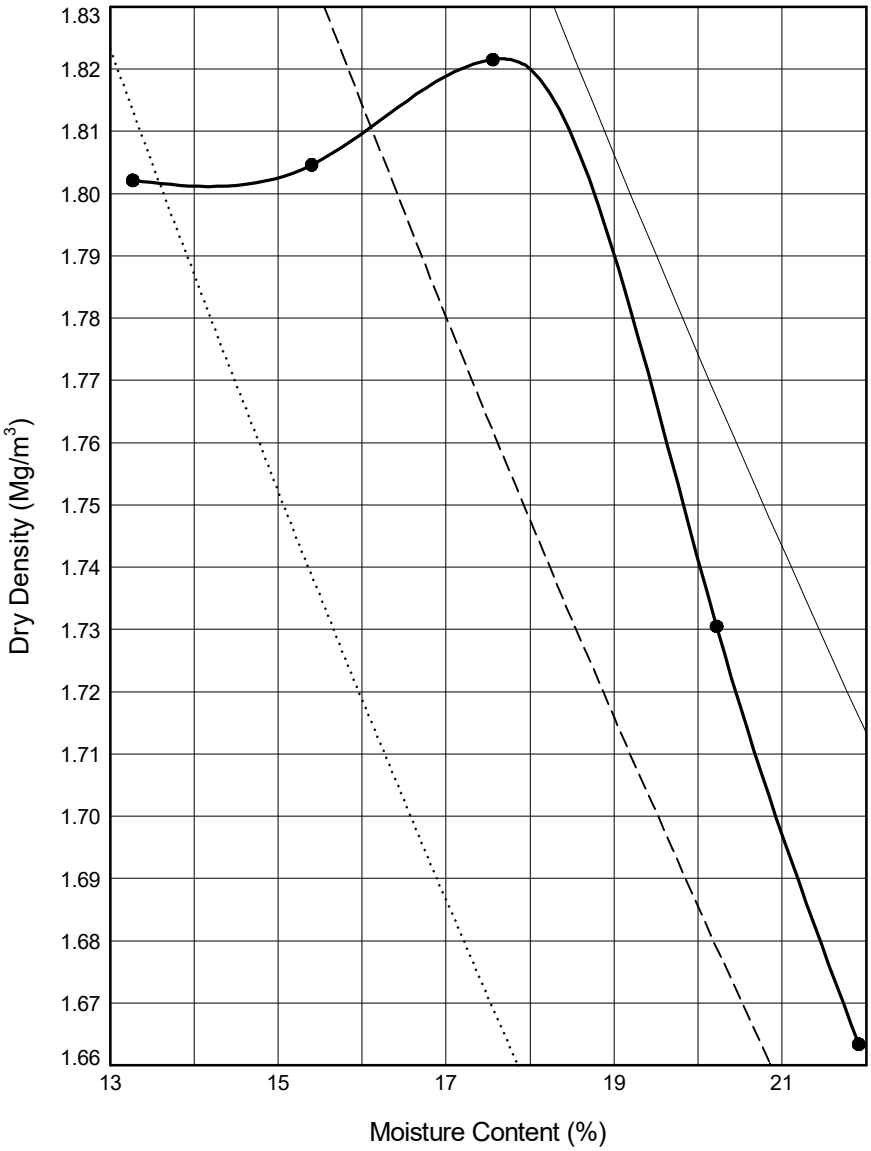
| Contract | Contract Ref: |
|---|---|
| **20/09322** | **784746** |


GINT_LIBRARY_V10_01.GLB LibVersion: v8_07_001 PrjVersion: v8_07 | Graph L - COMPACTIONS - A4P | 784746 - 20-09322.GPJ - v10_01.
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# DRY DENSITY / MOISTURE CONTENT RELATIONSHIP TEST

In accordance with clauses 3.3,3.4,3.5,3.6,3.7 of BS1377:Part 4:1990

Trial Pit: **TP102** Sample Ref: **20/09322/25** Sample Type: **B** Depth (m): **0.40**




| Initial Sample Conditions | | Test Details | Test Results |
|---|---|---|---|
| Initial Moisture Content (%) : **20** | | Compaction Type : **Light** | Maximum Dry Density (Mg/m$^3$) : **1.82** |
| % Retained on 37.5mm BS Sieve : **0** | | Mass of Rammer (kg): **2.5** | Optimum Moisture Content (%) : **17.6** |
| % Retained on 20.0mm BS Sieve : **0** | | Type of Mould : **1 LITRE** | Method Used: **Clause 3.3** |
| Particle Density - assumed (Mg/m$^3$) : **2.75** | | | Remarks: |
| Size of Soil Pieces : **<20mm** | | Separate samples were used. | |

| Sample Description | Key to Air Voids Lines | | |
|---|---|---|---|
| **Brownish grey slightly sandy slightly gravelly CLAY** | ——— 0% | – – – – 5% | ····· 10% |


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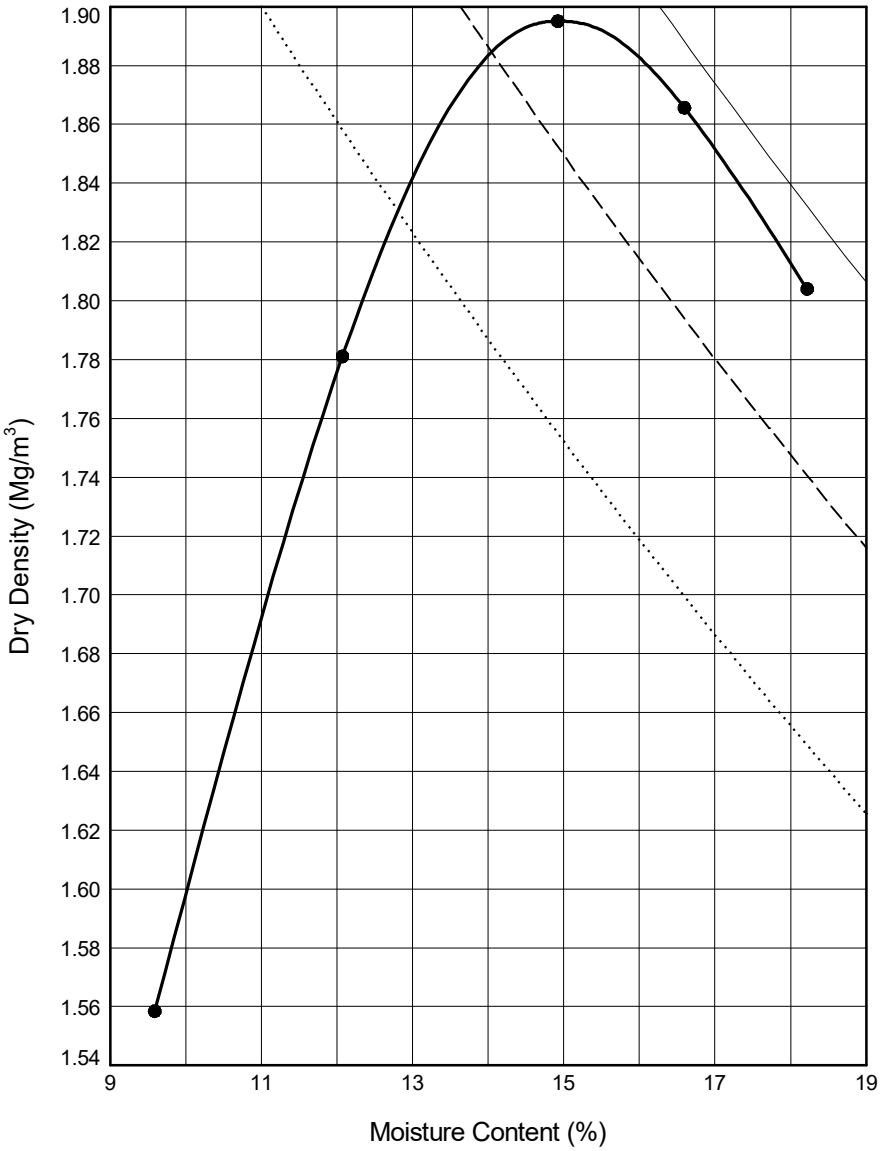
| Contract | Contract Ref: |
|---|---|
| **20/09322** | **784746** |


GINT_LIBRARY_V10_01.GLB LibVersion: v8_07_001 PrjVersion: v8_07 | Graph L - COMPACTIONS - A4P | 784746 - 20-09322.GPJ - v10_01.
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# DRY DENSITY / MOISTURE CONTENT RELATIONSHIP TEST

In accordance with clauses 3.3,3.4,3.5,3.6,3.7 of BS1377:Part 4:1990

Trial Pit: **TP102** Sample Ref: **20/09322/26** Sample Type: **B** Depth (m): **1.70**




| Initial Sample Conditions | | | Test Details | | Test Results | | |
|---|---|---|---|---|---|---|---|
| Initial Moisture Content (%) | : | **9.6** | Compaction Type | : **Light** | Maximum Dry Density (Mg/m$^3$) | : | **1.90** |
| % Retained on 37.5mm BS Sieve | : | **0** | Mass of Rammer (kg): | **2.5** | Optimum Moisture Content (%) | : | **15** |
| % Retained on 20.0mm BS Sieve | : | **2** | Type of Mould | : **1 LITRE** | Method Used: | | **Clause 3.3** |
| Particle Density - assumed (Mg/m$^3$) | : | **2.75** | | | Remarks: | | |
| Size of Soil Pieces | : | **<20mm** | Single sample was used. | | | | |

| Sample Description | Key to Air Voids Lines | | |
|---|---|---|---|
| **Brown sandy slightly gravelly CLAY** | ——— 0% | – – – – 5% | ····· 10% |


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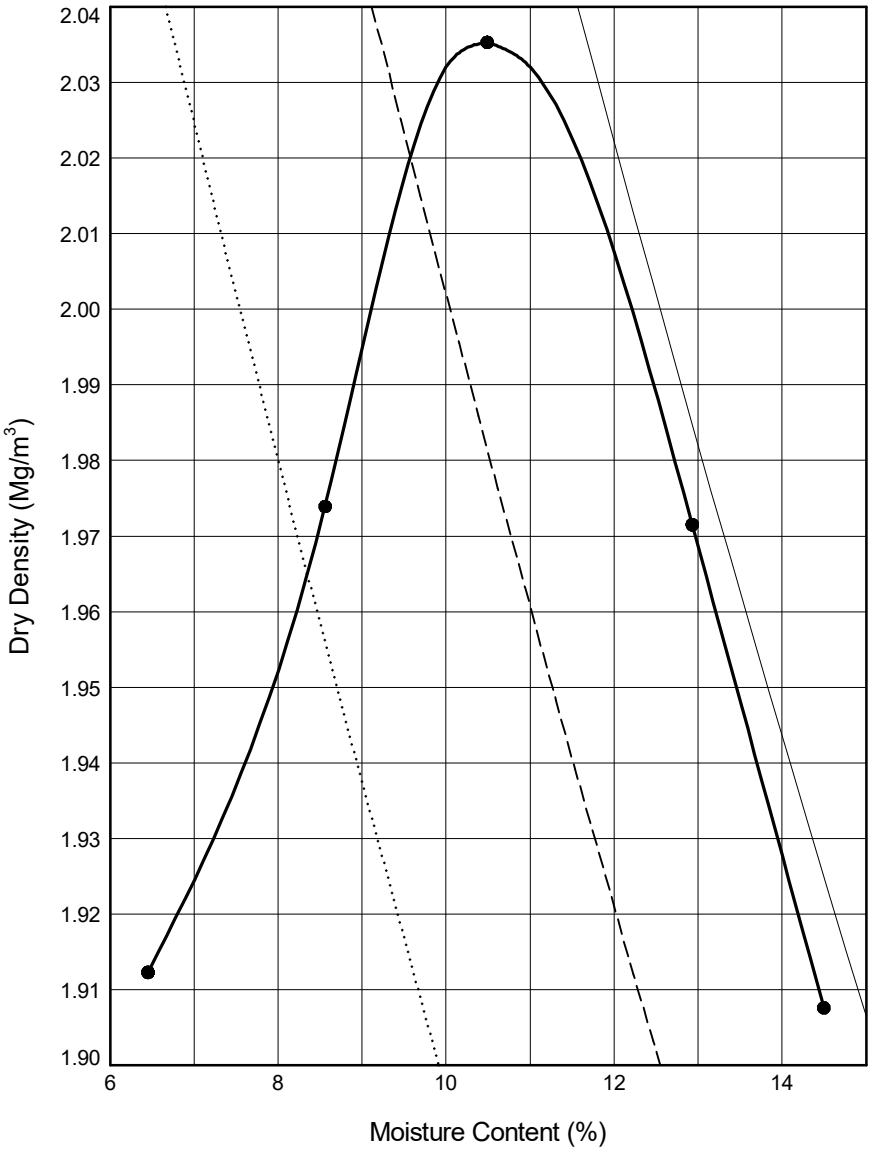
| Contract | Contract Ref: |
|---|---|
| **20/09322** | **784746** |


GINT_LIBRARY_V10_01.GLB LibVersion: v8_07_001 PrjVersion: v8_07 | Graph L - COMPACTIONS - A4P | 784746 - 20-09322.GPJ - v10_01.
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# DRY DENSITY / MOISTURE CONTENT RELATIONSHIP TEST

In accordance with clauses 3.3,3.4,3.5,3.6,3.7 of BS1377:Part 4:1990

Trial Pit: **TP103** Sample Ref: **20/09322/27** Sample Type: **B** Depth (m): **0.40**




| Initial Sample Conditions | | | Test Details | | Test Results | | |
|---|---|---|---|---|---|---|---|
| Initial Moisture Content (%) | : | **13** | Compaction Type | : **Light** | Maximum Dry Density (Mg/m$^3$) | : | **2.04** |
| % Retained on 37.5mm BS Sieve | : | **0** | Mass of Rammer (kg): | **2.5** | Optimum Moisture Content (%) | : | **10.5** |
| % Retained on 20.0mm BS Sieve | : | **11** | Type of Mould | : **1 LITRE** | Method Used: **Clause 3.3** | | |
| Particle Density - assumed (Mg/m$^3$) | : | **2.67** | | | Remarks: | | |
| Size of Soil Pieces | : | **<20mm** | Separate samples were used. | | | | |

| Sample Description | Key to Air Voids Lines | | |
|---|---|---|---|
| **Light brown gravelly very clayey SAND** | ——— 0% | – – – – 5% | ····· 10% |


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| Contract | Contract Ref: |
|---|---|
| **20/09322** | **784746** |

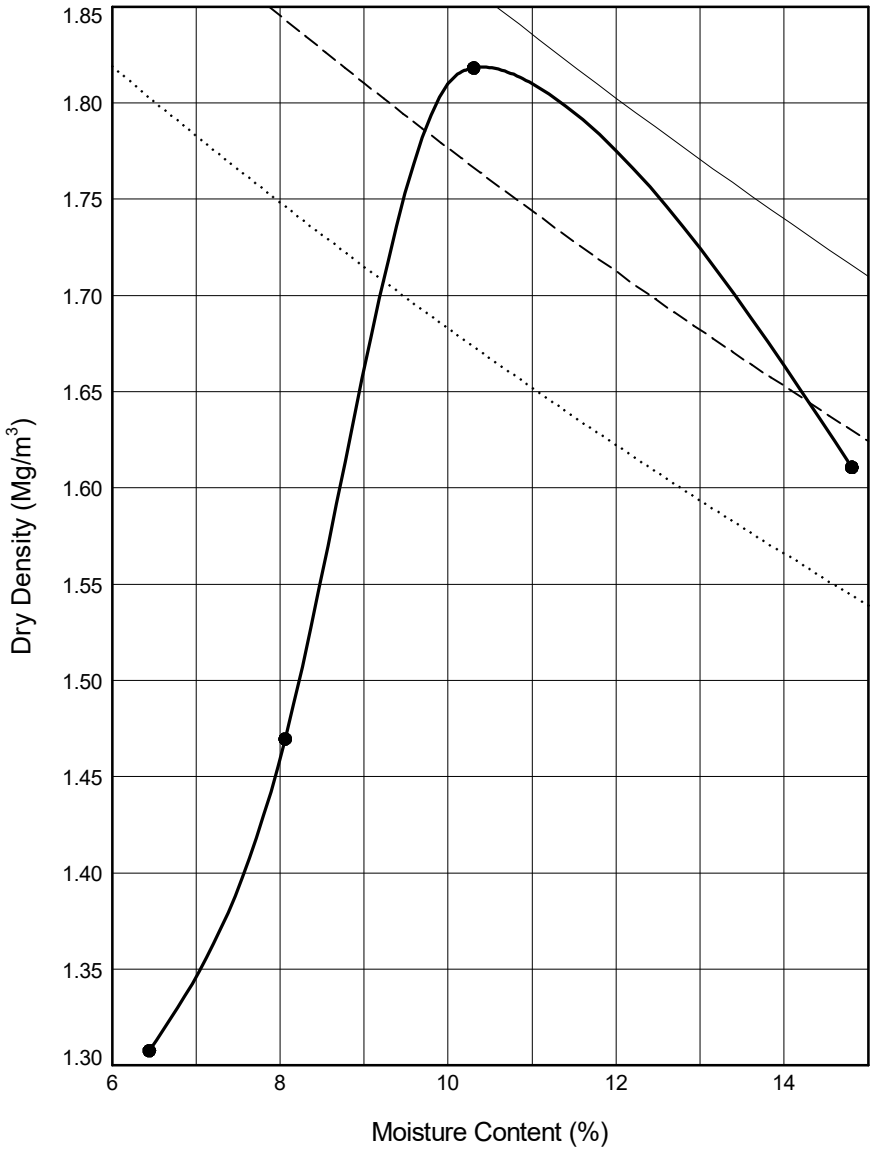
AGS


GINT_LIBRARY_V10_01.GLB LibVersion: v8_07_001 PrjVersion: v8_07 | Graph L - COMPACTIONS - A4P | 784746 - 20-09322.GPJ - v10_01.
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# DRY DENSITY / MOISTURE CONTENT RELATIONSHIP TEST

In accordance with clauses 3.3,3.4,3.5,3.6,3.7 of BS1377:Part 4:1990

Trial Pit: **TP103** Sample Ref: **20/09322/28** Sample Type: **B** Depth (m): **2.40**




| Initial Sample Conditions | | | Test Details | | Test Results | | |
|---|---|---|---|---|---|---|---|
| Initial Moisture Content (%) | : | **6.4** | Compaction Type | : **Heavy** | Maximum Dry Density (Mg/m$^3$) | : | **1.83** |
| % Retained on 37.5mm BS Sieve | : | **0** | Mass of Rammer (kg): | **4.5** | Optimum Moisture Content (%) | : | **12** |
| % Retained on 20.0mm BS Sieve | : | **1** | Type of Mould | : **1 LITRE** | Method Used: | | **Clause 3.5** |
| Particle Density - assumed (Mg/m$^3$) | : | **2.30** | | | Remarks: | | |
| Size of Soil Pieces | : | **<20mm** | Single sample was used. | | | | |

| Sample Description | Key to Air Voids Lines | | |
|---|---|---|---|
| **Light brown slightly gravelly clayey SAND** | ——— 0% | – – – – 5% | ····· 10% |


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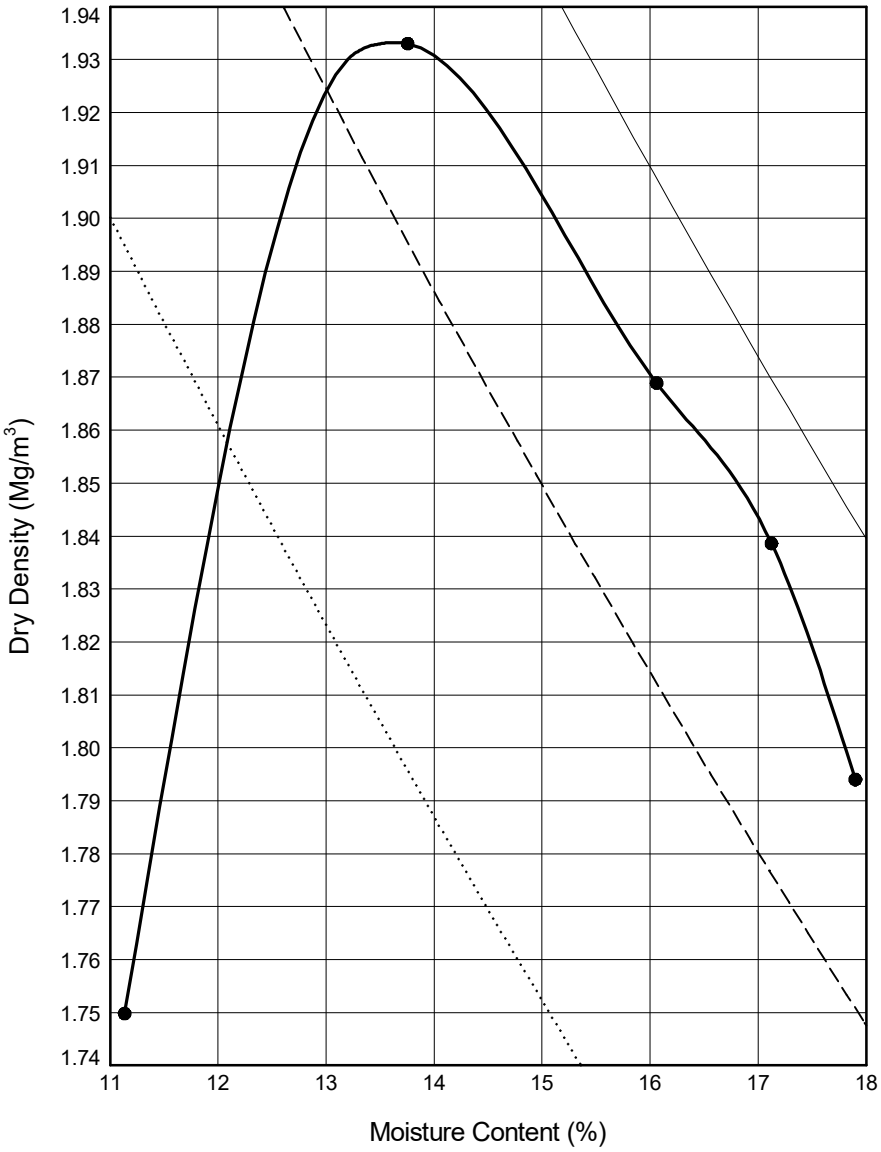
| Contract | Contract Ref: |
|---|---|
| **20/09322** | **784746** |


GINT_LIBRARY_V10_01.GLB LibVersion: v8_07_001 PrjVersion: v8_07 | Graph L - COMPACTIONS - A4P | 784746 - 20-09322.GPJ - v10_01.
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# DRY DENSITY / MOISTURE CONTENT RELATIONSHIP TEST

In accordance with clauses 3.3,3.4,3.5,3.6,3.7 of BS1377:Part 4:1990

Trial Pit: **TP104** Sample Ref: **20/09322/30** Sample Type: **B** Depth (m): **1.60**




| Initial Sample Conditions | | | Test Details | | Test Results | | |
|---|---|---|---|---|---|---|---|
| Initial Moisture Content (%) | : | **16** | Compaction Type | : **Light** | Maximum Dry Density (Mg/m$^3$) | : | **1.93** |
| % Retained on 37.5mm BS Sieve | : | **0** | Mass of Rammer (kg): | **2.5** | Optimum Moisture Content (%) | : | **13.8** |
| % Retained on 20.0mm BS Sieve | : | **1** | Type of Mould | : **1 LITRE** | Method Used: **Clause 3.3** | | |
| Particle Density - assumed (Mg/m$^3$) | : | **2.75** | | | Remarks: | | |
| Size of Soil Pieces | : | **<20mm** | Separate samples were used. | | | | |

| Sample Description | Key to Air Voids Lines | | |
|---|---|---|---|
| **Dark brown slightly gravelly sandy CLAY** | ——— 0% | – – – – 5% | ····· 10% |


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| Contract | Contract Ref: |
|---|---|
| **20/09322** | **784746** |

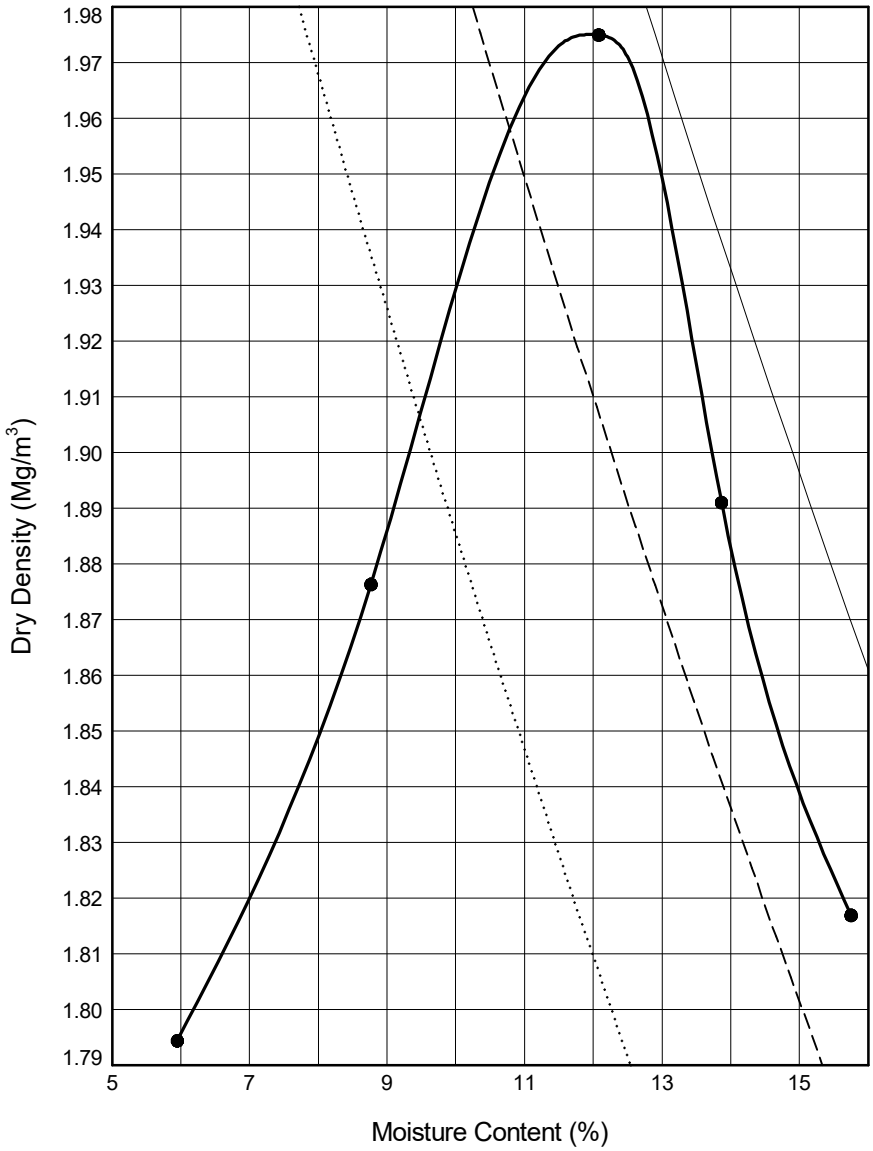
AGS


GINT_LIBRARY_V10_01.GLB LibVersion: v8_07_001 PrjVersion: v8_07 | Graph L - COMPACTIONS - A4P | 784746 - 20-09322.GPJ - v10_01.
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# DRY DENSITY / MOISTURE CONTENT RELATIONSHIP TEST

In accordance with clauses 3.3,3.4,3.5,3.6,3.7 of BS1377:Part 4:1990

Trial Pit: **TP105** Sample Ref: **20/09322/31** Sample Type: **B** Depth (m): **0.40**




| Initial Sample Conditions | | | Test Details | | Test Results | | |
|---|---|---|---|---|---|---|---|
| Initial Moisture Content (%) | : | **5.9** | Compaction Type | : **Light** | Maximum Dry Density (Mg/m$^3$) | : | **1.97** |
| % Retained on 37.5mm BS Sieve | : | **0** | Mass of Rammer (kg): | **2.5** | Optimum Moisture Content (%) | : | **12** |
| % Retained on 20.0mm BS Sieve | : | **5** | Type of Mould | : **1 LITRE** | Method Used: | | **Clause 3.3** |
| Particle Density - assumed (Mg/m$^3$) | : | **2.65** | | | Remarks: | | |
| Size of Soil Pieces | : | **<20mm** | Single sample was used. | | | | |

| Sample Description | Key to Air Voids Lines | | |
|---|---|---|---|
| **Light brown gravelly clayey SAND** | ——— 0% | – – – – 5% | ····· 10% |


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Pottery Street
Castleford
W. Yorkshire WF10 1NJ


| Compiled By | | Date |
|---|---|---|
| Francesca Bennett | **FRANCESCA BENNETT** | **27/11/20** |

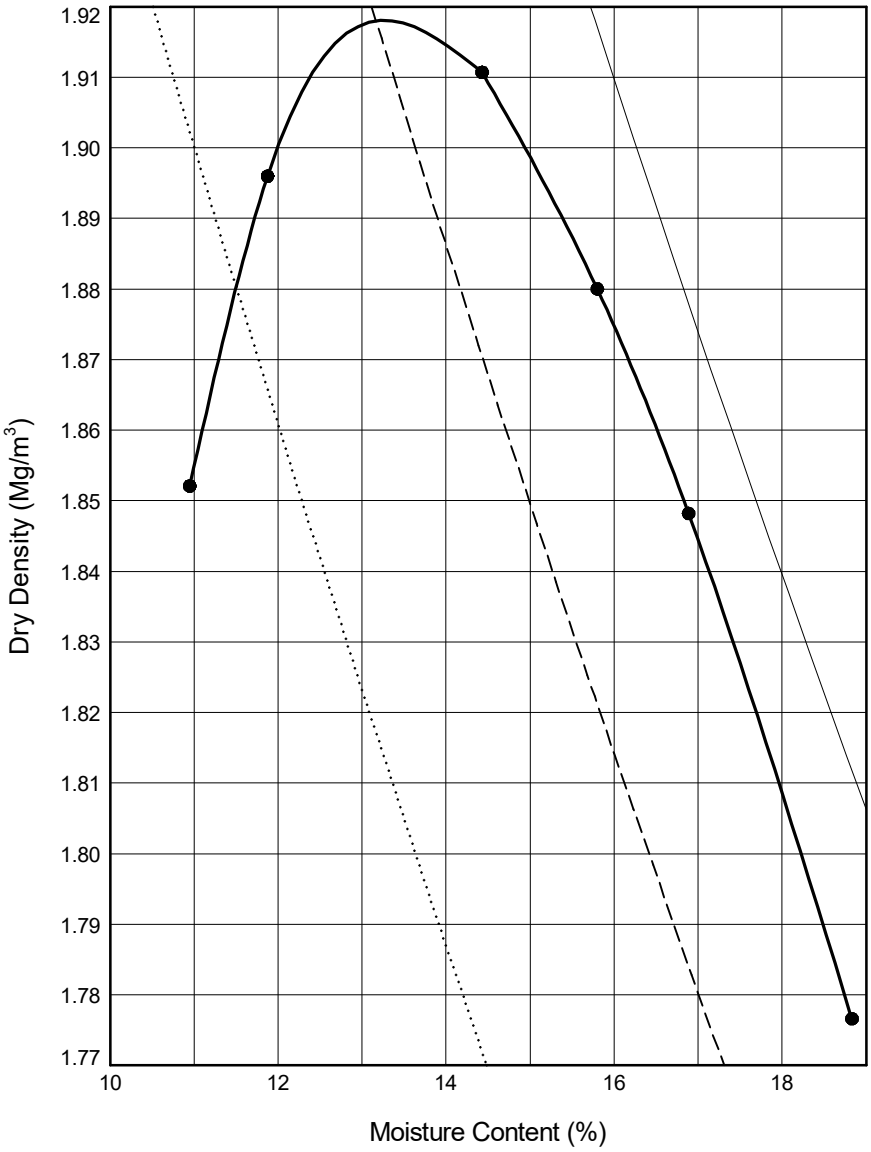
| Contract | Contract Ref: |
|---|---|
| **20/09322** | **784746** |


GINT_LIBRARY_V10_01.GLB LibVersion: v8_07_001 PrjVersion: v8_07 | Graph L - COMPACTIONS - A4P | 784746 - 20-09322.GPJ - v10_01.
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# DRY DENSITY / MOISTURE CONTENT RELATIONSHIP TEST

In accordance with clauses 3.3,3.4,3.5,3.6,3.7 of BS1377:Part 4:1990

Trial Pit: **TP106** Sample Ref: **20/09322/32** Sample Type: **B** Depth (m): **0.30**




| Initial Sample Conditions | | | Test Details | | Test Results | | |
|---|---|---|---|---|---|---|---|
| Initial Moisture Content (%) | : | **12** | Compaction Type | : **Heavy** | Maximum Dry Density (Mg/m$^3$) | : | **1.91** |
| % Retained on 37.5mm BS Sieve | : | **0** | Mass of Rammer (kg): | **4.5** | Optimum Moisture Content (%) | : | **13** |
| % Retained on 20.0mm BS Sieve | : | **1** | Type of Mould | : **1 LITRE** | Method Used: | | **Clause 3.5** |
| Particle Density - assumed (Mg/m$^3$) | : | **2.75** | | | Remarks: | | |
| Size of Soil Pieces | : | **<20mm** | Single sample was used. | | | | |

| Sample Description | Key to Air Voids Lines | | |
|---|---|---|---|
| **Brown slightly sandy slightly gravelly CLAY** | ——— 0% | – – – – 5% | ····· 10% |


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|---|---|---|
| Francesca Bennett | **FRANCESCA BENNETT** | **27/11/20** |

| Contract | Contract Ref: |
|---|---|
| **20/09322** | **784746** |

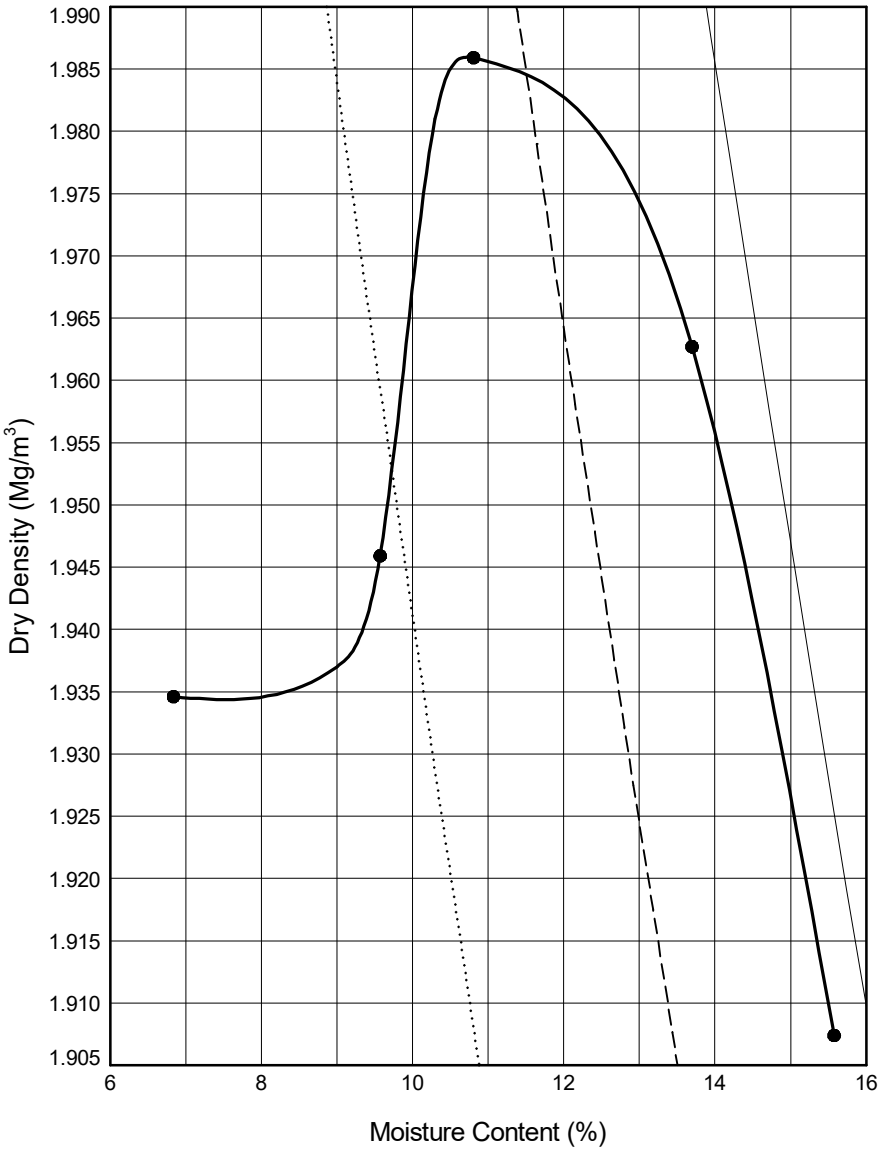
AGS


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# DRY DENSITY / MOISTURE CONTENT RELATIONSHIP TEST

In accordance with clauses 3.3,3.4,3.5,3.6,3.7 of BS1377:Part 4:1990

Trial Pit: **TP106** Sample Ref: **20/09322/33** Sample Type: **D** Depth (m): **1.00**




| Initial Sample Conditions | | | Test Details | | Test Results | | |
|---|---|---|---|---|---|---|---|
| Initial Moisture Content (%) | : | **6.8** | Compaction Type | : **Heavy** | Maximum Dry Density (Mg/m$^3$) | : | **10.80** |
| % Retained on 37.5mm BS Sieve | : | **0** | Mass of Rammer (kg): | **4.5** | Optimum Moisture Content (%) | : | **1.99** |
| % Retained on 20.0mm BS Sieve | : | **1** | Type of Mould | : **1 LITRE** | Method Used: | | **Clause 3.5** |
| Particle Density - assumed (Mg/m$^3$) | : | **2.75** | | | Remarks: | | |
| Size of Soil Pieces | : | **<20mm** | Single sample was used. | | | | |

| Sample Description | Key to Air Voids Lines | | |
|---|---|---|---|
| **Brown slightly sandy slightly gravelly CLAY** | ——— 0% | – – – – 5% | ····· 10% |


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W. Yorkshire WF10 1NJ


| Compiled By | | Date |
|---|---|---|
| Francesca Bennett | **FRANCESCA BENNETT** | **27/11/20** |

| Contract | Contract Ref: |
|---|---|
| **20/09322** | **784746** |

AGS


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# TESTING VERIFICATION CERTIFICATE

1774

The test results included in this report are certified as:-

ISSUE STATUS: **FINAL**

In accordance with the Structural Soils Ltd Laboratory Quality Management System, results sheets and summaries of results issued by the laboratory are checked by an approved signatory. The integrity of the test data and results are ensured by control of the computer system employed by the laboratory as part of the Software Verification Program as detailed in the Laboratory Quality Manual.

This testing verification certificate covers all testing compiled on or before the following datetime: **26/11/2020 11:31:15**.

Testing reported after this date is not covered by this Verification Certificate.



Approved Signatory
**Luke Fisher (Materials Laboratory Manager)**


(Head Office)
Bristol Laboratory
Unit 1A, Princess Street
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Tonbridge
TN11 9HU


| | | |
|---|---|---|
| **STRUCTURAL SOILS LTD** | Contract: **20/09322** | Job No: **784746** |


GINT_LIBRARY_V10_01.GLB LibVersion: v8_07_001 PrjVersion: v8_07 | GrfcText L - LAB VERIFICATION REPORT - V02 - A4P | 784746 - 20-09322.GPJ - v10_01.
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# Appendix E – Ground Gas and Groundwater Monitoring Results

- Gas Monitoring Visits 1-6
- Falling Head Test Results (WS104)

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Merchant Exchange, 17-19 Whitworth Street West, Manchester, M1 5WG
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Fax: 0161 228 7902

# GAS MONITORING LOG SHEET

| | | | |
|---|---|---|---|
| **Project:** | Edgar Wood Academy | **Date:** | 29/10/2020 |
| **Job Number:** | B077034 | **Visit:** | 1 |
| **Client:** | Wates Construction | **Weather:** | Rain |
| **Barometric State:** | Falling | **Ground Conditions:** | Very wet |

| Borehole Reference | Barometric Pressure mb | Flow l/hr | | Methane % | | Carbon Dioxide % | | Oxygen % | Hydrogen Sulphide ppm | Carbon Monoxide ppm | Water Level m AOD | Borehole Base m AOD | Note |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Max | SS | Max | SS | Max | SS | | | | | | |
| WS101 | 994 | -0.6 | -0.6 | 0.0 | 0.0 | 1.9 | 1.9 | 19.2 | 2 | 0 | 106.41 | 104.38 | |
| WS102 | 993 | -3.7 | -3.7 | 0.0 | 0.0 | 0.3 | 0.0 | 20.5 | 1 | 0 | Dry | 105.25 | |
| WS103 | 993 | 0.0 | 0.0 | - | - | - | - | - | - | - | 105.15 | 103.62 | **1** |
| CP101 | 994 | 0.0 | 0.0 | 0.0 | 0.0 | 7.4 | 5.2 | 10.5 | 2 | 10 | 104.00 | 97.93 | **2, 3** |
| CP102 | 994 | -4.8 | -3.4 | 0.0 | 0.0 | 0.6 | 0.6 | 16.9 | 5 | 50 | 100.82 | 89.14 | **3** |
| CP103 | 993 | -4.3 | -4.3 | 0.0 | 0.0 | 1.1 | 1.1 | 17.4 | 2 | 0 | 101.58 | 95.30 | |

**Notes**

**1** Tap left open, borehole not monitored
**2** Monitored for a period of 5mins, where the CO2 and O2 very gradually reduced
**3** Installation flooded

**Logged by**

SH

*1% gas volume = 10,000 ppm*
*Flow rate, methane and carbon dioxide reported as 'maximum' (max) and 'steady state' (SS) readings.*
*All other gases recorded at 'steady state' unless otherwise stated*

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# GAS MONITORING LOG SHEET

| | | | |
|---|---|---|---|
| **Project:** | Edgar Wood Academy | **Date:** | 10/11/2020 |
| **Job Number:** | B077034 | **Visit:** | 2 |
| **Client:** | Wates Construction | **Weather:** | Cloudy |
| **Barometric State:** | Steady | **Ground Conditions:** | Damp |

| Borehole Reference | Barometric Pressure mb | Flow l/hr | | Methane % | | Carbon Dioxide % | | Oxygen % | Hydrogen Sulphide ppm | Carbon Monoxide ppm | Water Level m AOD | Borehole Base m AOD | Note |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Max | SS | Max | SS | Max | SS | | | | | | |
| WS101 | 1011 | 0.0 | 0.0 | 0.0 | 0.0 | 2.0 | 2.0 | 18.40 | 0 | 0 | 105.90 | 104.46 | |
| WS102 | 1013 | -2.2 | -2.2 | 0.0 | 0.0 | 0.1 | 0.0 | 20.80 | 0 | 0 | 105.38 | 105.26 | |
| WS103 | 1013 | 0.0 | 0.0 | 0.0 | 0.0 | 1.1 | 1.1 | 20.00 | 0 | 0 | 105.34 | 103.62 | |
| CP101 | 1013 | 1.2 | 0.0 | 0.0 | 0.0 | 8.1 | 8.1 | 2.10 | 3 | 2 | 104.18 | 98.12 | |
| CP102 | 1013 | -5.6 | -3.7 | 0.0 | 0.0 | 1.1 | 1.0 | 16.2 | 10 | 50 | 99.85 | 89.53 | |
| CP103 | 1011 | -12.4 | -12.3 | 0.0 | 0.0 | 0.8 | 0.8 | 19.3 | 0 | 0 | 101.60 | 95.79 | |

**Notes**

**Logged by**

PN

*1% gas volume = 10,000 ppm*
*Flow rate, methane and carbon dioxide reported as 'maximum' (max) and 'steady state' (SS) readings.*
*All other gases recorded at 'steady state' unless otherwise stated*

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# GAS MONITORING LOG SHEET

| | | | |
|---|---|---|---|
| **Project:** | Edgar Wood Academy | **Date:** | 24/11/2020 |
| **Job Number:** | B077034 | **Visit:** | 3 |
| **Client:** | Wates Construction | **Weather:** | Cloudy |
| **Barometric State:** | Falling | **Ground Conditions:** | Damp |

| Borehole Reference | Barometric Pressure mb | Flow l/hr | | Methane % | | Carbon Dioxide % | | Oxygen % | Hydrogen Sulphide ppm | Carbon Monoxide ppm | Water Level m AOD | Borehole Base m AOD | Note |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Max | SS | Max | SS | Max | SS | | | | | | |
| WS101 | 1004 | 0.0 | 0.0 | 0.0 | 0.0 | 2.6 | 2.6 | 19.7 | 0 | 0 | 106.01 | 104.46 | |
| WS102 | 1002 | 0.0 | 0.0 | 0.0 | 0.0 | 1.2 | 1.2 | 19.8 | 0 | 0 | 105.45 | 105.25 | |
| WS103 | 1004 | 0.1 | 0.0 | 0.0 | 0.0 | 2.1 | 2.1 | 20.1 | 0 | 0 | 105.40 | 103.61 | |
| CP101 | 1002 | 0.0 | 0.0 | 0.0 | 0.0 | 4.6 | 1.4 | 11.6 | 2 | 1 | 104.36 | 98.17 | |
| CP102 | 1002 | 1.8 | 1.3 | 0.0 | 0.0 | 1.2 | 1.2 | 16.8 | 10 | 45 | 100.24 | 89.45 | **1** |
| CP103 | 1003 | 0.7 | 0.6 | 0.0 | 0.0 | 3.4 | 3.4 | 20.4 | 0 | 0 | 101.64 | 95.73 | **2** |

**Notes**

**Logged by**

**1** Monitored for 5 mins
**2** Flow fluctuating

*1% gas volume = 10,000 ppm*
*Flow rate, methane and carbon dioxide reported as 'maximum' (max) and 'steady state' (SS) readings.*
*All other gases recorded at 'steady state' unless otherwise stated*

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# GAS MONITORING LOG SHEET

| | | | |
|---|---|---|---|
| **Project:** | Edgar Wood Academy | **Date:** | 08/12/2020 |
| **Job Number:** | B077034 | **Visit:** | 4 |
| **Client:** | Wates Construction | **Weather:** | Rain |
| **Barometric State:** | Rising | **Ground Conditions:** | Wet |

| Borehole Reference | Barometric Pressure mb | Flow l/hr | | Methane % | | Carbon Dioxide % | | Oxygen % | Hydrogen Sulphide ppm | Carbon Monoxide ppm | Water Level m AOD | Borehole Base m AOD | Note |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Max | SS | Max | SS | Max | SS | | | | | | |
| WS101 | 964 | 0.1 | 0.0 | 0.0 | 0.0 | 2.4 | 2.4 | 18.0 | 0 | 13 | 105.84 | 104.43 | |
| WS102 | 965 | -0.6 | -0.3 | 0.0 | 0.0 | 0.1 | 0.1 | 19.9 | 0 | 13 | 105.31 | 105.25 | |
| WS103 | 966 | -0.1 | -0.1 | 0.0 | 0.0 | 1.7 | 1.7 | 18.6 | 0 | 10 | 105.43 | 103.72 | |
| CP101 | 965 | 0.2 | 0.0 | 0.0 | 0.0 | 4.6 | 0.8 | 13.2 | 0 | 13 | 104.25 | 98.00 | |
| CP102 | 967 | -0.1 | -0.1 | 0.0 | 0.0 | 1.2 | 1.2 | 16.4 | 0 | 10 | 100.90 | 89.17 | |
| CP103 | 965 | -1.7 | -1.7 | 0.0 | 0.0 | 0.9 | 0.9 | 18.5 | 0 | 10 | 101.65 | 95.66 | |

**Notes**

**1** Monitored for 5 mins

**Logged by**

SH

*1% gas volume = 10,000 ppm*
*Flow rate, methane and carbon dioxide reported as 'maximum' (max) and 'steady state' (SS) readings.*
*All other gases recorded at 'steady state' unless otherwise stated*

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# GAS MONITORING LOG SHEET

| | | | |
|---|---|---|---|
| **Project:** | Edgar Wood Academy | **Date:** | 16/12/2020 |
| **Job Number:** | B077034 | **Visit:** | 5 |
| **Client:** | Wates Construction | **Weather:** | Drizzling |
| **Barometric State:** | Rising | **Ground Conditions:** | Damp |

| Borehole Reference | Barometric Pressure mb | Flow l/hr | | Methane % | | Carbon Dioxide % | | Oxygen % | Hydrogen Sulphide ppm | Carbon Monoxide ppm | Water Level m AOD | Borehole Base m AOD | Note |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Max | SS | Max | SS | Max | SS | | | | | | |
| WS101 | 973 | 0.1 | 0.0 | 0.0 | 0.0 | 2.1 | 2.1 | 18.5 | 0 | 10 | 106.09 | 104.44 | |
| WS102 | 973 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 19.8 | 0 | 10 | 105.35 | 105.26 | |
| WS103 | 972 | -0.1 | -0.1 | 0.0 | 0.0 | 1.5 | 1.5 | 18.9 | 0 | 10 | 105.45 | 103.74 | |
| CP101 | 973 | 0.1 | 0.0 | 0.0 | 0.0 | 3.5 | 0.9 | 14.1 | 0 | 10 | 104.32 | 98.04 | |
| CP102 | 973 | -0.1 | -0.1 | 0.0 | 0.0 | 0.8 | 0.7 | 17.6 | 0 | 10 | 100.91 | 89.21 | |
| CP103 | 973 | -0.9 | -0.8 | 0.0 | 0.0 | 0.7 | 0.6 | 18.8 | 0 | 10 | 101.68 | 95.68 | |

**Notes**

**Logged by**

PN

*1% gas volume = 10,000 ppm*
*Flow rate, methane and carbon dioxide reported as 'maximum' (max) and 'steady state' (SS) readings.*
*All other gases recorded at 'steady state' unless otherwise stated*

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# GAS MONITORING LOG SHEET

| | | | |
|---|---|---|---|
| **Project:** | Edgar Wood Academy | **Date:** | 06/01/2021 |
| **Job Number:** | B077034 | **Visit:** | 6 |
| **Client:** | Wates Construction | **Weather:** | Cold, sunny |
| **Barometric State:** | Falling | **Ground Conditions:** | frozen / wet |

| Borehole Reference | Barometric Pressure mb | Flow l/hr | | Methane % | | Carbon Dioxide % | | Oxygen % | Hydrogen Sulphide ppm | Carbon Monoxide ppm | Water Level m AOD | Borehole Base m AOD | Note |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Max | SS | Max | SS | Max | SS | | | | | | |
| WS101 | 990 | 0.0 | 0.0 | 0.0 | 0.0 | 4.1 | 4.1 | 13.5 | 0 | 0 | 105.72 | 104.45 | |
| WS102 | 990 | 1.1 | 1.1 | 0.0 | 0.0 | 2.7 | 2.7 | 15.5 | 0 | 0 | Dry | 105.22 | |
| WS103 | 990 | 0.0 | 0.0 | 0.0 | 0.0 | 1.8 | 1.8 | 18.7 | 0 | 0 | 105.61 | 103.66 | |
| CP101 | 990 | 9.3 | 0.0 | 0.0 | 0.0 | 8.5 | 8.5 | 0.5 | 0 | 0 | 104.26 | 98.07 | |
| CP102 | 990 | 11.3 | 0.0 | 0.0 | 0.0 | 1.6 | 1.6 | 7.1 | 0 | 0 | 101.13 | 89.30 | |
| CP103 | 990 | 1.1 | 1.1 | 0.0 | 0.0 | 2.4 | 2.4 | 16.0 | 0 | 0 | 101.68 | 95.66 | |

**Notes**

**Logged by**

*1% gas volume = 10,000 ppm*
*Flow rate, methane and carbon dioxide reported as 'maximum' (max) and 'steady state' (SS) readings.*
*All other gases recorded at 'steady state' unless otherwise stated*

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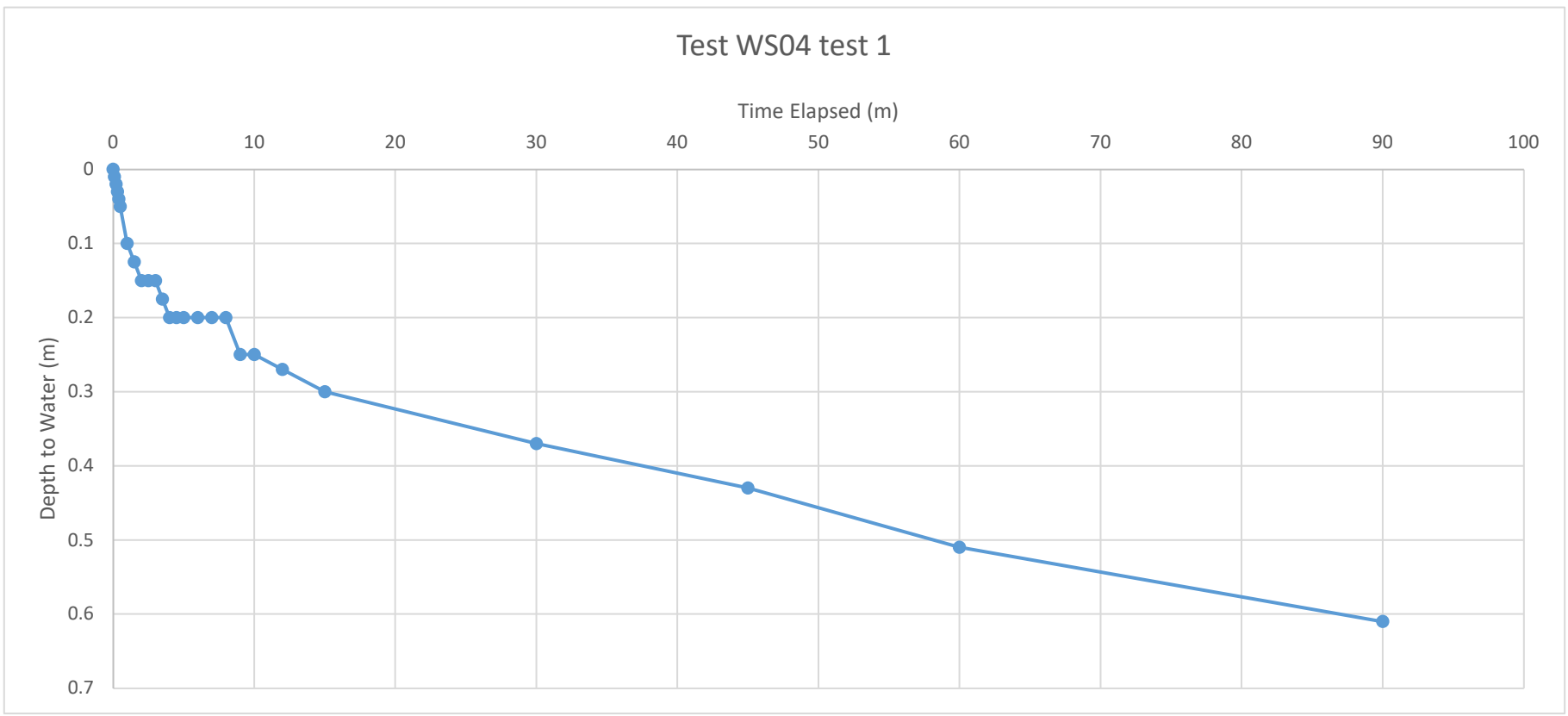
# CALCULATION SHEET - SOIL INFILTRATION RATE

| | |
|---|---|
| **Project:** | Edgar Wood Academy |
| **Job Number:** | 075856 |
| **Author:** | MH |
| **Test Ref.:** | WS04 Test 1 |
| **Test Date:** | 15/10/2020 |

## Raw Data

| Time elapsed (m) | Depth to water (m) | Head (m) | Stratum |
|---|---|---|---|
| 0 | 0 | 3 | Medium dense light brown fine and medium SAND & Medium dense slightly gravelly medium and coarse SAND. |
| 0.1 | 0.01 | 2.99 | |
| 0.2 | 0.02 | 2.98 | |
| 0.3 | 0.03 | 2.97 | |
| 0.4 | 0.04 | 2.96 | |
| 0.5 | 0.05 | 2.95 | |
| 1 | 0.1 | 2.9 | |
| 1.5 | 0.125 | 2.875 | |
| 2 | 0.15 | 2.85 | |
| 2.5 | 0.15 | 2.85 | |
| 3 | 0.15 | 2.85 | |
| 3.5 | 0.175 | 2.825 | |
| 4 | 0.2 | 2.8 | |
| 4.5 | 0.2 | 2.8 | |
| 5 | 0.2 | 2.8 | |
| 6 | 0.2 | 2.8 | |
| 7 | 0.2 | 2.8 | |
| 8 | 0.2 | 2.8 | |
| 9 | 0.25 | 2.75 | |
| 10 | 0.25 | 2.75 | |
| 12 | 0.27 | 2.73 | |
| 15 | 0.3 | 2.7 | |
| 30 | 0.37 | 2.63 | |
| 45 | 0.43 | 2.57 | |
| 60 | 0.51 | 2.49 | |
| 90 | 0.61 | 2.39 | |

| | | |
|---|---|---|
| 50.00 | mm | Internal borehole diameter |
| 3.00 | m | Depth (total) of borehole |
| 0.002 | $m^2$ | Area of borehole base |
| 2.39E-03 | | Linear regression line |
| 2.87 | | Shape factor |
| **1.67E-06** | **m/s** | **Permeability Coefficient (k)** |



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Tel: 0161 236 2394

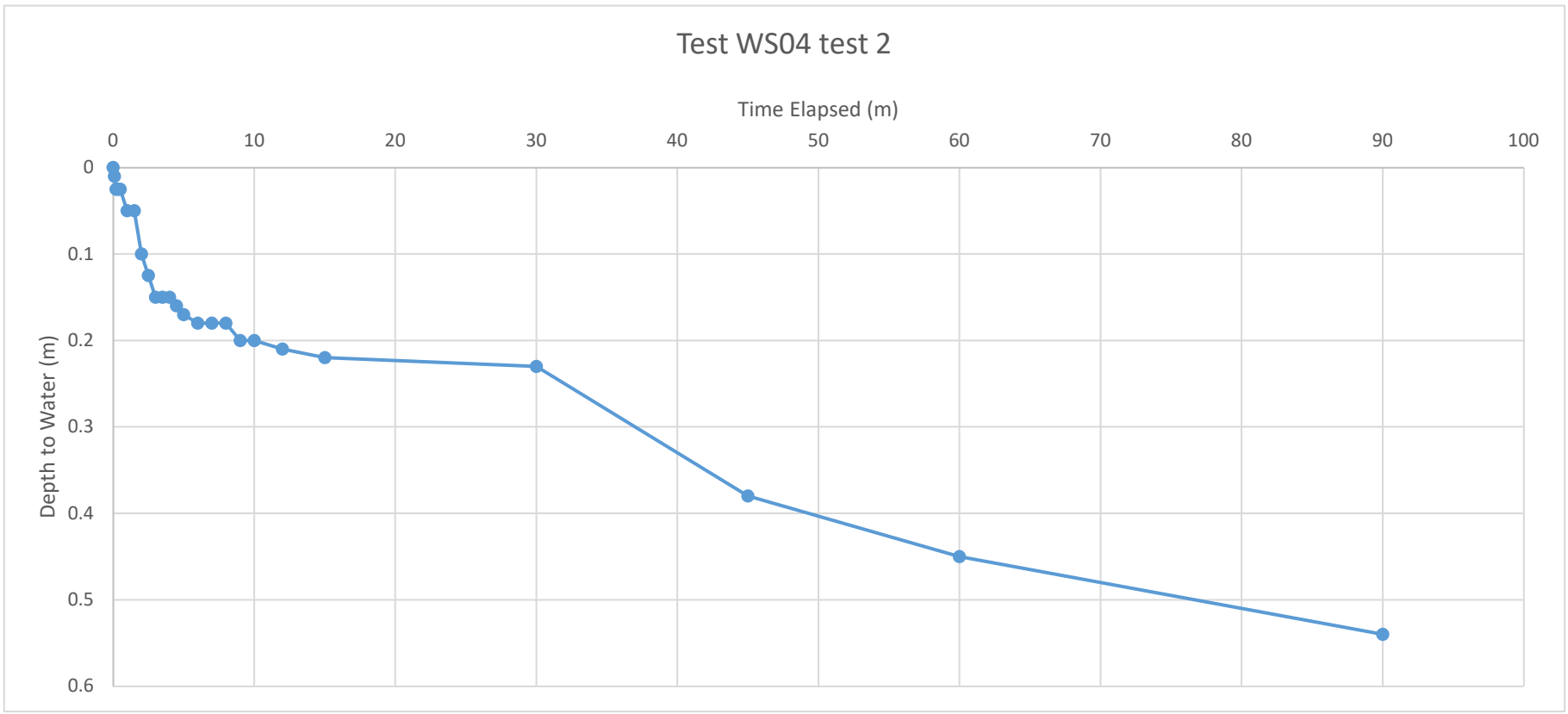
# CALCULATION SHEET - SOIL INFILTRATION RATE

| | |
|---|---|
| **Project:** | Edgar Wood Academy |
| **Job Number:** | 075856 |
| **Author:** | MH |
| **Test Ref.:** | WS04 Test 2 |
| **Test Date:** | 15/10/2020 |

## Raw Data

| Time elapsed (m) | Depth to water (m) | Head (m) | Stratum |
|---|---|---|---|
| 0 | 0 | 3 | Medium dense light brown fine and medium SAND & Medium dense slightly gravelly medium and coarse SAND. |
| 0.1 | 0.01 | 2.99 | |
| 0.2 | 0.025 | 2.975 | |
| 0.3 | 0.025 | 2.975 | |
| 0.4 | 0.025 | 2.975 | |
| 0.5 | 0.025 | 2.975 | |
| 1 | 0.05 | 2.95 | |
| 1.5 | 0.05 | 2.95 | |
| 2 | 0.1 | 2.9 | |
| 2.5 | 0.125 | 2.875 | |
| 3 | 0.15 | 2.85 | |
| 3.5 | 0.15 | 2.85 | |
| 4 | 0.15 | 2.85 | |
| 4.5 | 0.16 | 2.84 | |
| 5 | 0.17 | 2.83 | |
| 6 | 0.18 | 2.82 | |
| 7 | 0.18 | 2.82 | |
| 8 | 0.18 | 2.82 | |
| 9 | 0.2 | 2.8 | |
| 10 | 0.2 | 2.8 | |
| 12 | 0.21 | 2.79 | |
| 15 | 0.22 | 2.78 | |
| 30 | 0.23 | 2.77 | |
| 45 | 0.38 | 2.62 | |
| 60 | 0.45 | 2.55 | |
| 90 | 0.54 | 2.46 | |

| | | |
|---|---|---|
| 50.00 | mm | Internal borehole diameter |
| 3.00 | m | Depth (total) of borehole |
| 0.002 | $m^2$ | Area of borehole base |
| 2.09E-03 | | Linear regression line |
| 2.87 | | Shape factor |
| **1.46E-06** | **m/s** | **Permeability Coefficient (k)** |



# Appendix F – GAC Screening Thresholds

- Curtins GAC Thresholds for 1.0% SOM.
- Curtins GAC Thresholds for 2.5% SOM.

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# Adopted Soil Generic Assessment Criteria
## Sandy loam with 1% SOM

curtins

| Contaminants | Residential with home grown produce | Residential without home grown produce | Allotments | Commercial | Public open space near residential housing $POS_{resi}$ | Public park $POS_{park}$ |
|---|---|---|---|---|---|---|
| ***Metals*** | | | | | | |
| Beryllium | *1.7* | *1.7* | *35* | *12* | *2.2* | *63* |
| Boron | *290* | *11,000* | *45* | *240,000* | *21,000* | *46,000* |
| Cadmium | **10**[13] 22 | **85**[13] 150 | **1.8** 3.9 | **230** 410 | *120* 220 | *560* 880 |
| Chromium III | *910* | *910* | *18,000* | *8,600* | *1,500* | *33,000* |
| Chromium VI | *6* 21 | *6* 21 | *1.8* 170 | *33* 49 | *7.7* 21 | *220* 250 |
| Lead | 200 | 310 | 80 | 2,300 | 630 | 1,300 |
| Mercury *(elemental)* | **1** | **1** | **26** | **26** | *16* | **26**[8] *[30]* |
| *Mercury (inorganic)* | **170** | **240** | **80** | **3600** | *120* | *240* |
| Nickel | *130*[10] | *180*[10] | *53*[11] | *980*[10] | *230* | *800* |
| Vanadium | *410* | *1200* | *91* | *9000* | *2000* | *5000* |
| Copper | *2400* | *7100* | *520* | *68000* | *12000* | *44000* |
| Zinc | *3700* | *40000* | *620* | *730000* | *81000* | *170000* |
| ***Semi-Metals and non-metals*** | | | | | | |
| Arsenic | **32**[12] 37 | **35**[12] 40 | **43**[12] 49 | **640**[12] 640 | *79* 79 | *170* 170 |
| Antimony | | ***550*** | | ***7500*** | ***1500*** | ***3300*** |
| Selenium | **350** | **600** | **120** | **13000** | *1100* | *1800* |
| ***Inorganic chemicals*** | | | | | | |
| Cyanide | 34 | 34 | 34 | 34 | 34 | 34 |
| ***Organic contaminants*** | | | | | | |
| *Aliphatic risk banded hydrocarbons - TPHCWG method* | | | | | | |
| $EC_{>5}$ - $EC_6$ | *42* | *42* | *730* | *3200* | *570000* | *95000* |
| $EC_{>6}$ - $EC_8$ | *100* | *100* | *2300* | *7800* | *600000* | *150000* |
| $EC_{>8}$ - $EC_{10}$ | *27* | *27* | *320* | *2000* | *13000* | *14000* |
| $EC_{10}$-$EC_{12}$ | *130* | *130* | *2200* | *9700* | *13000* | *21000* |
| $EC_{12}$-$EC_{16}$ | *1100* | *1100* | *11000* | *59000* | *13000* | *25000* |
| $EC_{>16}$ - $EC_{35}$ | *65000* | *65000* | *260000* | *1600000* | *250000* | *450000* |
| $EC_{>35}$ - $EC_{44}$ | *65000* | *65000* | *260000* | *1600000* | *250000* | *450000* |
| *Aromatic risk banded hydrocarbons - TPHCWG method* | | | | | | |
| $EC_{>5}$ - $EC_7$ | *70* | *370* | *13* | *26000* | *56000* | *76000* |
| $EC_{>7}$ - $EC_8$ | *130* | *860* | *22* | *56000* | *56000* | *87000* |
| $EC_{>8}$ - $EC_{10}$ | *34* | *47* | *8.6* | *3500* | *5000* | *7200* |
| $EC_{10}$ - $EC_{12}$ | *74* | *250* | *13* | *16000* | *5000* | *9200* |
| $EC_{12}$ - $EC_{16}$ | *140* | *1800* | *23* | *36000* | *5100* | *10000* |
| $EC_{>16}$ - $EC_{21}$ | *260* | *1900* | *46* | *28000* | *3800* | *7600* |
| $EC_{>21}$ - $EC_{35}$ | *1100* | *1900* | *370* | *28000* | *3800* | *7800* |
| $EC_{>35}$ - $EC_{44}$ | *1100* | *1900* | *370* | *28000* | *3800* | *7800* |
| | | | | | | |
| Aliph + Arom EC >44-70 | *1600* | *1900* | *1200* | *28000* | 3800 | 7800 |
| *Aromatic* | | | | | | |
| Benzene | **0.08** | **0.3** | **0.017** | **28** | *72* | *90* |
| Ethyl benzene | **65** | **170** | **16** | **520**[8] [17000] | **520**[8] *[24000]* | **520**[8] *[17000]* |
| Toluene | **120** | **610** | **22** | **860**[8] [59000] | **860**[8] *[56000]* | **860**[8] *[87000]* |
| Xylene[9] | **41** | **53** | **28** | **480**[8] [69000] | **480**[8] *[41000]* | **480**[8] *[17000]* |
| Phenol | **180** | **310** | **66** | **760**[14] (31000) | **760**[14] *(10000)* | **760**[14] *(7600)* |
| *Polycyclic Aromatic Hydrocarbons (PAH)* | | | | | | |
| Naphthalene | *2.3* | *2.3* | *4.1* | *190* | *4900* | *1200* |
| Acenaphthylene | *170* | *2900* | *28* | *83000* | *15000* | *29000* |
| Acenaphthene | *210* | *3000* | *34* | *84000* | *15000* | *29000* |
| Fluorene | *170* | *2800* | *27* | *63000* | *9900* | *20000* |
| Phenanthrene | *95* | *1300* | *15* | *22000* | *3100* | *6200* |
| Anthracene | *2400* | *31000* | *380* | *520000* | *74000* | *150000* |
| Fluoranthene | *280* | *1500* | *52* | *23000* | *3100* | *6300* |
| Pyrene | *620* | *3700* | *110* | *54000* | *7400* | *15000* |
| Benz(a)anthracene | *7.2* | *11* | *2.9* | *170* | *29* | *49* |
| Chrysene | *15* | *30* | *4.1* | *350* | *57* | *93* |
| Benzo(b)fluoranthene | *2.6* | *3.9* | *0.99* | *44* | *7.1* | *13* |
| Benzo(k)fluoranthene | *77* | *110* | *37* | *1200* | *190* | *370* |
| Benzo(a)pyrene | *2.2* | *3.2* | *0.97* | *35* | *5.7* | *11* |
| Indeno(123cd)pyrene | *27* | *45* | *9.5* | *500* | *82* | *150* |
| Dibenzo(ah)anthracene | *0.24* | *0.31* | *0.14* | *3.5* | *0.57* | *1.1* |
| Benzo(ghi)perylene | *320* | *360* | *290* | *3900* | *640* | *1400* |
| ***Chlorinated Aliphatic Hydrocarbons*** | | | | | | |
| Vinyl chloride | *0.00064* | *0.00077* | *0.00055* | *0.059* | *3.5* | *4.8* |
| Trichloroethene (TCE) | *0.016* | *0.017* | *0.041* | *1.2* | *120* | *70* |
| 1,1,1,2 Tetrachlorethane | *1.2* | *1.5* | *0.79* | *110* | *1400* | *1500* |
| Tetrachlorethene (PCE) | *0.18* | *0.18* | *0.65* | *19* | *1400* | *810* |
| 1,1,1 Trichlorethane | *8.8* | *9* | *48* | *660* | *140000* | *57000* |

**Notes**

1. All values above are in mg/kg
2. **Numbers in bold are SGVs or GAC that are derived based on SGV report input parameters**, *numbers in italics are S4ULs*, ***numbers in bold-italics are based on EIC/AGS/CL:AIRE numbers & input parameters*** and underlined numbers are C4SLs
3. Soil organic matter (SOM) is assumed to be 1% - DEFAULT VALUE
4. Soil type is assumed to be sandy loam - DEFAULT SOIL TYPE
5. For residential, the building type is conservatively assumed to be a small terrace house where the development includes bungalows change to more conservative bungalow setting in computer model
6. For commercial, the building type is conservatively assumed to be a pre 1970s office building, where the proposed development comprises houses, flat with living spaces changes setting in model accordingly
7. For classrooms consider increasing the dust loading fator in the 'Soil and Building Data' of the CLEA 1.04 model from 50 to 100µg $m^{-3}$
8. Based on vapour saturation limt as suggested by EA / [ ] model value
9. Lowest of o-, m- and p-xylene
10. Based on comparison of inhalation exposure with inhalation TDI
11. Based on comparison of oral, dermal, and inhalation exposure with the oral TDI
12. Based on a comparison of oral and dermal soil exposure with oral Index Dose only
13. Averaged over and based on lifetime exposure
14. Based on critical concentration for skin irritation in humans arising from contact with phenol in aqueous solution (number in brackets based on health effects following long term exposure for illustration)
15. NA: Not applicable

# Adopted Soil Generic Assessment Criteria
## Sandy loam with 2.5% SOM

curtins

| Contaminants | Residential with home grown produce | Residential without home grown produce | Allotments | Commercial | Public open space near residential housing $POS_{resi}$ | Public park $POS_{park}$ |
|---|---|---|---|---|---|---|
| ***Metals*** | | | | | | |
| Beryllium | *1.7* | *1.7* | *35* | *12* | *2.2* | *63* |
| Boron | *290* | *11,000* | *45* | *240,000* | *21,000* | *46,000* |
| Cadmium | **10**[13] 22 | **85**[13] 150 | **1.8** 3.9 | **230** 410 | *120* 220 | *560* 880 |
| Chromium III | *910* | *910* | *18,000* | *8,600* | *1,500* | *33,000* |
| Chromium VI | *6* 21 | *6* 21 | *1.8* 170 | *33* 49 | *7.7* 21 | *220* 250 |
| Lead | 200 | 310 | 80 | 2,300 | 630 | 1,300 |
| Mercury *(elemental)* | **1** | **1** | **26** | **26** | *16* | **26**[8] [*30*] |
| *Mercury (inorganic)* | **170** | **240** | **80** | **3600** | *120* | *240* |
| Nickel | *130*[10] | *180*[10] | *53*[11] | *980*[10] | *230* | *800* |
| Vanadium | *410* | *1200* | *91* | *9000* | *2000* | *5000* |
| Copper | *2400* | *7100* | *520* | *68000* | *12000* | *44000* |
| Zinc | *3700* | *40000* | *620* | *730000* | *81000* | *170000* |
| ***Semi-Metals and non-metals*** | | | | | | |
| Arsenic | **32**[12] 37 | **35**[12] 40 | **43**[12] 49 | **640**[12] 640 | *79* 79 | *170* 170 |
| Antimony | | ***550*** | | ***7500*** | ***1500*** | ***3300*** |
| Selenium | **350** | **600** | **120** | **13000** | *1100* | *1800* |
| ***Inorganic chemicals*** | | | | | | |
| Cyanide | 34 | 34 | 34 | 34 | 34 | 34 |
| ***Organic contaminants*** | | | | | | |
| *Aliphatic risk banded hydrocarbons - TPHCWG method* | | | | | | |
| $EC_{>5}$ - $EC_6$ | *78* | *78* | *1700* | *5900* | *590000* | *130000* |
| $EC_{>6}$ - $EC_8$ | *230* | *230* | *5600* | *17000* | *610000* | *220000* |
| $EC_{>8}$ - $EC_{10}$ | *65* | *65* | *770* | *4800* | *13000* | *18000* |
| $EC_{10}$-$EC_{12}$ | *330* | *330* | *4400* | *23000* | *13000* | *23000* |
| $EC_{12}$-$EC_{16}$ | *2400* | *2400* | *13000* | *82000* | *13000* | *25000* |
| $EC_{>16}$ - $EC_{35}$ | *92000* | *92000* | *270000* | *1700000* | *250000* | *480000* |
| $EC>_{35}$ - $EC_{44}$ | *92000* | *92000* | *270000* | *1700000* | *250000* | *480000* |
| *Aromatic risk banded hydrocarbons - TPHCWG method* | | | | | | |
| $EC>_5$ - $EC_7$ | *140* | *690* | *27* | *46000* | *56000* | *84000* |
| $EC>_7$ - $EC_8$ | *290* | *1800* | *51* | *110000* | *56000* | *95000* |
| $EC_{>8}$ - $EC_{10}$ | *83* | *110* | *21* | *8100* | *5000* | *8500* |
| $EC_{10}$ - $EC_{12}$ | *180* | *590* | *31* | *28000* | *5000* | *9700* |
| $EC_{12}$ - $EC_{16}$ | *330* | *2300* | *57* | *37000* | *5100* | *10000* |
| $EC_{>16}$ - $EC_{21}$ | *540* | *1900* | *110* | *28000* | *3800* | *7700* |
| $EC_{>21}$ - $EC_{35}$ | *1500* | *1900* | *820* | *28000* | *3800* | *7800* |
| $EC>_{35}$ - $EC_{44}$ | *1500* | *1900* | *820* | *28000* | *3800* | *7800* |
| | | | | | | |
| Aliph + Arom EC >44-70 | *1800* | *1900* | *2100* | *28000* | 3800 | 7800 |
| *Aromatic* | | | | | | |
| Benzene | **0.16** | **0.49** | **0.035** | **50** | *72* | *100* |
| Ethyl benzene | **150** | **380** | **39** | **1200**[8] [35000] | **1200**[8] [*24000*] | **1200**[8] [*22000*] |
| Toluene | **270** | **1300** | **51** | **1900**[8] [110000] | **1900**[8] [*56000*] | **1900**[8] [*95000*] |
| Xylene[9] | **98** | **120** | **70** | **1200**[8] [14000] | **1200**[8] [*42000*] | **1200**[8] [*23000*] |
| Phenol | **290** | **420** | **140** | **1500**[14] (35000) | **1500**[14] (*10000*) | **1500**[14] (*8300*) |
| *Polycyclic Aromatic Hydrocarbons (PAH)* | | | | | | |
| Naphthalene | *5.6* | *5.6* | *10* | *460* | *4900* | *1900* |
| Acenaphthylene | *420* | *4600* | *69* | *97000* | *15000* | *30000* |
| Acenaphthene | *510* | *4700* | *85* | *97000* | *15000* | *30000* |
| Fluorene | *400* | *3800* | *67* | *68000* | *9900* | *20000* |
| Phenanthrene | *220* | *1500* | *38* | *22000* | *3100* | *6200* |
| Anthracene | *5400* | *35000* | *950* | *540000* | *74000* | *150000* |
| Fluoranthene | *560* | *1600* | *130* | *23000* | *3100* | *6300* |
| Pyrene | *1200* | *3800* | *270* | *54000* | *7400* | *15000* |
| Benz(a)anthracene | *11* | *14* | *6.5* | *170* | *29* | *56* |
| Chrysene | *22* | *31* | *9.4* | *350* | *57* | *110* |
| Benzo(b)fluoranthene | *3.3* | *4.0* | *2.1* | *44* | *7.2* | *15* |
| Benzo(k)fluoranthene | *93* | *110* | *75* | *1200* | *190* | *410* |
| Benzo(a)pyrene | *2.7* | *3.2* | *2* | *35* | *5.7* | *12* |
| Indeno(123cd)pyrene | *36* | *46* | *21* | *510* | *82* | *170* |
| Dibenzo(ah)anthracene | *0.28* | *0.32* | *0.27* | *3.6* | *0.57* | *1.3* |
| Benzo(ghi)perylene | *340* | *360* | *470* | *4000* | *640* | *1500* |
| ***Chlorinated Aliphatic Hydrocarbons*** | | | | | | |
| Vinyl chloride | *0.00087* | *0.001* | *0.001* | *0.077* | *3.5* | *5* |
| Trichloroethene (TCE) | *0.034* | *0.036* | *0.091* | *2.6* | *120* | *91* |
| 1,1,1,2 Tetrachlorethane | *2.8* | *3.5* | *1.9* | *250* | *1400* | *1800* |
| Tetrachlorethene (PCE) | *0.39* | *0.4* | *1.5* | *42* | *1400* | *1100* |
| 1,1,1 Trichlorethane | *18* | *18* | *110* | *1300* | *140000* | *76000* |

**Notes**

1. All values above are in mg/kg
2. **Numbers in bold are SGVs or GAC that are derived based on SGV report input parameters**, *numbers in italics are S4ULs*, ***numbers in bold-italics are based on EIC/AGS/CL:AIRE numbers & input parameters*** and underlined numbers are C4SLs
3. Soil organic matter (SOM) is assumed to be 2.5% - DEFAULT VALUE
4. Soil type is assumed to be sandy loam - DEFAULT SOIL TYPE
5. For residential, the building type is conservatively assumed to be a small terrace house where the development includes bungalows change to more conservative bungalow setting in computer model
6. For commercial, the building type is conservatively assumed to be a pre 1970s office building, where the proposed development comprises houses, flat with living spaces changes setting in model accordingly
7. For classrooms consider increasing the dust loading fator in the 'Soil and Building Data' of the CLEA 1.04 model from 50 to 100µg $m^{-3}$
8. Based on vapour saturation limt as suggested by EA / [ ] model value
9. Lowest of o-, m- and p-xylene
10. Based on comparison of inhalation exposure with inhalation TDI
11. Based on comparison of oral, dermal, and inhalation exposure with the oral TDI
12. Based on a comparison of oral and dermal soil exposure with oral Index Dose only
13. Averaged over and based on lifetime exposure
14. Based on critical concentration for skin irritation in humans arising from contact with phenol in aqueous solution (number in brackets based on health effects following long term exposure for illustration)
15. NA: Not applicable

# Appendix G – Risk Assessment Methodology

The site-specific risk assessment, presented in this report, follows the principle of establishing whether there is a viable linkage between a contaminant source to a potential receptor, via an exposure pathway.

The risk assessment corresponds with the total site area and incorporates both descriptive (qualitative) and, where available, numerical (quantitative) lines of evidence.

Risk assessment is the process of collating known information on a hazard or set of hazards to estimate actual or potential risk to receptors. The receptor may be humans, a water resource, a sensitive local ecosystem or future construction materials. Receptors can be connected to the source by one or several exposure pathways such as direct contact for example. Risks are generally managed by isolating the receptor or intercepting the exposure pathway or by isolating or removing the hazard.

Without the three essential components of a source, pathway and receptor there can be no risk. Therefore, the presence of contaminant source on a site does not necessarily mean there is a risk.

The risk assessment considers the likelihood of an event taking place (accounting for the presence of the source and receptor and the viability of the exposure pathway) in conjunction with the severity of the potential consequence (accounting for the potential severity of the hazard and the sensitivity of the receptor).

In the risk assessment, the consequence of the hazard has been classified as severe or medium or mild or minor and the probability (likelihood) of the circumstances occurring classified as high likelihood or likely or low likelihood or unlikely.

The consequences and probabilities are subsequently cross-correlated to give a qualitative estimation of the risk using Department of the Environment risk classifications as detailed in the table below and as referenced in CIRIA C552.

| | | **Consequence** | | | |
|---|---|---|---|---|---|
| | | **Severe** | **Medium** | **Mild** | **Minor** |
| **Probability (Likelihood)** | **High Likelihood** | Very High Risk | High Risk | Moderate Risk | Moderate/Low Risk |
| | **Likely** | High Risk | Moderate Risk | Moderate/Low Risk | Low Risk |
| | **Low Likelihood** | Moderate Risk | Moderate/Low Risk | Low Risk | Very Low Risk |
| | **Unlikely** | Moderate/Low Risk | Low Risk | Very Low Risk | Very Low Risk |

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In accordance with DoE guidance, the following categorisation of **consequence** has been developed.

| Classification | Definition | Examples |
|---|---|---|
| Severe | Short-term (acute) risk to human health likely to result in "significant harm" as defined by the Environment Protection Act 1990, Part IIA. Short-term risk of pollution of sensitive water resource. Catastrophic damage to buildings/property. A short-term risk to an ecosystem or organisation forming part of such ecosystem. | High concentrations of cyanide on the surface of an informal recreation area.<br><br>Major spillage of contaminants from site into controlled water.<br><br>Explosion, causing building collapse (can also equate to a short-term human health risk if buildings are occupied). |
| Medium | Chronic damage to Human Health. Pollution of sensitive water resources. A significant change in an ecosystem or organism forming part of such ecosystem. | Concentration of a contaminant from site exceeds the generic or site-specific assessment criteria.<br><br>Leaching of contaminants from a site to a Principal or Secondary A aquifer.<br><br>Death of a species within a designated nature reserve.<br><br>Lesser toxic and asphyxiate effects |
| Mild | Pollution of non-sensitive water resources. Significant damage to crops, buildings, structures and services. Damage to sensitive buildings/structures/services or the environment. | Pollution of non-classified groundwater (inc. Secondary B aquifers).<br><br>Damage to building rendering it unsafe to occupy (e.g. foundation damage resulting in instability). |
| Minor | Harm, although not necessarily significant harm, which may result in a financial loss or expenditure to resolve. Non-permanent health effects to human health (easily prevented by means such as personal protective clothing, etc). Easily repairable effects of damage to buildings, structures and services. | The presence of contaminants at such concentrations that protective equipment is required during site works.<br><br>The loss of plants in a landscaping scheme. Discoloration of concrete. |

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In accordance with DoE guidance, the following categorisation of **probability** has been developed.

| Classification | Definition |
|---|---|
| High Likelihood | There is a pollution linkage and an event that either appears very likely in the short term and almost inevitable over the long term or there is evidence at the receptor of harm or pollution. |
| Likely | There is a pollution linkage and all the elements are present and in the right place, which means that it is probable that an event will occur. Circumstances are such that an event is not inevitable, but possible in the short term and likely over the long term. |
| Low Likelihood | There is a pollution linkage and circumstances are possible under which an event could occur. However, it is by no means certain that even over a longer period such event would take place, and is less likely in the shorter term. |
| Unlikely | There is a pollution linkage but circumstances are such that it is improbable that an event would occur even in the very long term. |

In accordance with DoE guidance, the following categorisation of **risk** has been developed.

| Classification | Definition |
|---|---|
| **Very High Risk** | There is a *high probability* that *severe harm* could arise to a designated receptor from an identified hazard at the site without appropriate further action. |
| **High Risk** | *Harm* is *likely to arise* to a designated receptor from an identified hazard at the site without appropriate further action. |
| **Moderate Risk** | *It is possible* that without appropriate further action *harm could arise* to a designated receptor. It is relatively *unlikely* that any such harm would be *severe,* and if any harm were to occur it is *more likely* that such harm would be *relatively mild.* |
| **Low Risk** | *It is possible* that *harm could arise* to a designated receptor from an identified hazard. It is *likely* that, at worst, if any harm was realised any effects would be *mild.* |
| **Very Low Risk** | The presence of an identified hazard does not give rise to the potential to cause harm to a designated receptor. |

The term ‘risk’ in this instance refers to the risk that the source, pathway, receptor linkage for a given source of contamination is complete. It does not refer to immediate risk to individuals or features present on the site from potential contaminants and is intended to be used as a tool to assess the necessity of further investigation.

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