# BOREHOLE ENGINEERING LOG

**HOLE NO : CURVE 59_BH03**

| | | |
|---|---|---|
| CLIENT : TMR | POSITION : E: 358657, N: 8137028 (55 MGA94) | PAGE : 1 OF 4 |
| PROJECT : SAFER ROADS SOONER PROJECT | SURFACE ELEVATION : 317.6 (AHD) | DATE DRILLED : 4/8/13 TO 4/8/13 |
| JOB NO : CB24735.01 | DIP / AZIMUTH : 90° | LOGGED BY : JP |
| LOCATION : KENNEDY HWY (CAIRNS - MAREEBA) | | CHECKED BY : AJ |

DRILLING | MATERIAL

| PROGRESS: DRILLING & CASING | PROGRESS: WATER | DRILLING PENETRATION | GROUND WATER LEVELS | SAMPLES & FIELD TESTS | RL (m) | DEPTH (m) | GRAPHIC LOG | CLASSIFICATION SYMBOL | MATERIAL DESCRIPTION<br>Soil Type, Colour, Plasticity or Particle Characteristic<br>Secondary and Minor Components | MOISTURE CONDITION | CONSISTENCY | STRUCTURE<br>& Other Observations |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | VH | | 0.15m B | 317.6 | 0.0 | | | 0.10m ASPHALT: (0.10). | | | FILL |
| AD/T | 0% Water RETURN (from 1.30 m) | F | | | | | | | GRAVELLY SILT: Brown, grey brown, fine to coarse sand, with fine to medium grained angular gravel and clay, trace of cobbles. | D | | 0.15: Moisture Content (%) = 14.1, Liquid Limit (%) = 31, Plastic Limit (%) = 21, Plasticity Index (%) = 10, % Passing 2.36mm: 79, % Passing 0.425mm: 66, % Passing 0.075mm: 55, % Passing 0.002mm: 9, Max. Dry Density (t/m$^3$) = 1.86, OMC (%) = 14.5 |
| | | H | | 1.00m SPT 15, 4, 4 N=8 | 316.6 | 1.0 | | | From 0.80 m to 1.20 m with cobbles. | | | |
| | | | | 1.45m 1.50m | | | | | 1.50m | | | |
| | | F | NOT OBSERVED | 2.50m SPT 2, 2, 2 N=4 | 315.6 | 2.0 | | ML | CLAYEY SILT (ML): Red brown, medium plasticity, with fine to medium grained, sub-angular gravel, and fine to coarse grained sand, trace of organics, rootlets and cobbles. | | S - F | RESIDUAL SOIL<br>2.50: Moisture Content (%) = 24, Liquid Limit (%) = 44, Plastic Limit (%) = 24, Plasticity Index (%) = 20, Linear Shrinkage (%) = 9.5, % Passing 2.36mm: 79, % Passing 0.425mm: 71, % Passing 0.075mm: 63, % Passing 0.002mm: 20 |
| | | | | 2.95m | 314.6 | 3.0 | | | | | | |
| WB | | | | 4.00m SPT 3, 4, 6 N=10 | 313.6 | 4.0 | | | 4.00m<br>GNEISS: Orange brown, extremely weathered, extremely low to very low strength, appears as SANDY SILT (ML), comprised by fine to coarse grained sand, trace of fine to medium grained angular gravel. | | St | EXTREMELY WEATHERED ROCK<br>4.00: Moisture Content (%) = 21.2, Liquid Limit (%) = 33, Plastic Limit (%) = 26, Plasticity Index (%) = 7, Linear Shrinkage (%) = 3.5, % Passing 2.36mm: 87, % Passing 0.425mm: 75, % Passing 0.075mm: 56, % Passing 0.002mm: 5 |
| | | | | 4.45m | | | | | 4.50m<br>GNEISS: Orange brown and grey, extremely to highly weathered, extremely low to very low strength. | | | EXTREMELY WEATHERED ROCK<br>EXTREMELY TO HIGHLY WEATHERED ROCK |
| | | H | | 5.50m SPT 12, 16, 18 N=34 | 312.6 | 5.0 | | | | | | |
| | | | | 5.95m | 311.6 | 6.0 | | | | | | |

**DRILLING**

| | | | |
|---|---|---|---|
| HA | Hand Auger | RR | Rock Rolling |
| AS | Auger Screw | AT | Air Track |
| AD/T | Auger Drill TC-bit | HQ | HQ Coring |
| AD/V | Auger Drill V-bit | NQ | NQ Coring |
| WB | Washbore | NMLC | NMLC Coring |

DRILLING PENETRATION

VE Very Easy F Firm VH Very Hard
E Easy H Hard

GROUNDWATER SYMBOLS

▼ = Water level (static)
▽ = Water level (during drilling)

**SAMPLES & FIELD TESTS**

| | | | |
|---|---|---|---|
| DS | Disturbed Sample | SPT | Standard Penetration Test |
| ES | Env Soil Sample | U | Undisturbed Tube Sample |
| EW | Env Water Sample | W | Water Sample |

HP Hand Penetrometer
HV Hand Vane Shear
(P: Peak Su R: Residual Su)
N SPT blows per 300mm
HW SPT penetration by hammer weight
RW SPT penetration by rod weight

MOISTURE CONDITION
D = Dry M = Moist W = Wet

**DENSITY (SPT N-value)**

| | | |
|---|---|---|
| VL | Very Loose | 0 - 4 |
| L | Loose | 4 - 10 |
| MD | Medium Dense | 10 - 30 |
| D | Dense | 30 - 50 |
| VD | Very Dense | 50 - 100 |
| CO | Compact | >50/150mm |

**CONSISTENCY (Su) {N-value}**

| | | | |
|---|---|---|---|
| VS | Very Soft | < 12 kPa | {0-2} |
| S | Soft | 12 - 25 | {2-4} |
| F | Firm | 25 - 50 | {4-8} |
| St | Stiff | 50 - 100 | {8-15} |
| VSt | Very Stiff | 100 - 200 | {15-30} |
| H | Hard | > 200 kPa | {>30} |

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# BOREHOLE ENGINEERING LOG

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| PROJECT : SAFER ROADS SOONER PROJECT | SURFACE ELEVATION : 317.6 (AHD) | DATE DRILLED : 4/8/13 TO 4/8/13 |
| JOB NO : CB24735.01 | DIP / AZIMUTH : 90° | LOGGED BY : JP |
| LOCATION : KENNEDY HWY (CAIRNS - MAREEBA) | | CHECKED BY : AJ |

DRILLING | MATERIAL

| PROGRESS: DRILLING & CASING | PROGRESS: WATER | DRILLING PENETRATION | GROUND WATER LEVELS | SAMPLES & FIELD TESTS | RL (m) | DEPTH (m) | GRAPHIC LOG | CLASSIFICATION SYMBOL | MATERIAL DESCRIPTION<br>Soil Type, Colour, Plasticity or Particle Characteristic<br>Secondary and Minor Components | MOISTURE CONDITION | CONSISTENCY | STRUCTURE & Other Observations |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 311.6 | 6.0 | | | GNEISS: Orange brown and grey, extremely to highly weathered, extremely low to very low strength.<br>*(continued)* | | | EXTREMELY TO HIGHLY WEATHERED ROCK |
| | | H | | 7.00m<br>SPT<br>6, 0, 10<br>N=10<br>7.45m | 310.6 | 7.0 | | | 7.00m<br>GNEISS: Orange brown and grey, extremely weathered, extremely low strength, appears as SILTY CLAY (CL), low plasticity, trace of medium grained sand and fine to medium grained angular gravel. | | St - VSt | EXTREMELY WEATHERED ROCK |
| WB | | | | | 309.6 | 8.0 | | | | | | |
| | | VH | | 8.50m<br>SPT<br>15/40mm<br>N=R<br>8.54m | | | | | 8.55m<br>Continued as Cored Drill Hole | | VSt - H | |
| | | | | | 308.6 | 9.0 | | | | | | |
| | | | | | 307.6 | 10.0 | | | | | | |
| | | | | | 306.6 | 11.0 | | | | | | |
| | | | | | 305.6 | 12.0 | | | | | | |

**DRILLING**

| | | | |
|---|---|---|---|
| HA | Hand Auger | RR | Rock Rolling |
| AS | Auger Screw | AT | Air Track |
| AD/T | Auger Drill TC-bit | HQ | HQ Coring |
| AD/V | Auger Drill V-bit | NQ | NQ Coring |
| WB | Washbore | NMLC | NMLC Coring |

DRILLING PENETRATION

VE Very Easy F Firm VH Very Hard
E Easy H Hard

GROUNDWATER SYMBOLS

▼ = Water level (static)
▽ = Water level (during drilling)

**SAMPLES & FIELD TESTS**

| | | | |
|---|---|---|---|
| DS | Disturbed Sample | SPT | Standard Penetration Test |
| ES | Env Soil Sample | U | Undisturbed Tube Sample |
| EW | Env Water Sample | W | Water Sample |

HP Hand Penetrometer
HV Hand Vane Shear
(P: Peak Su R: Residual Su)
N SPT blows per 300mm
HW SPT penetration by hammer weight
RW SPT penetration by rod weight

MOISTURE CONDITION
D = Dry M = Moist W = Wet

**DENSITY (SPT N-value)**

| | | |
|---|---|---|
| VL | Very Loose | 0 - 4 |
| L | Loose | 4 - 10 |
| MD | Medium Dense | 10 - 30 |
| D | Dense | 30 - 50 |
| VD | Very Dense | 50 - 100 |
| CO | Compact | >50/150mm |

**CONSISTENCY (Su) {N-value}**

| | | |
|---|---|---|
| VS | Very Soft | < 12 kPa {0-2} |
| S | Soft | 12 - 25 {2-4} |
| F | Firm | 25 - 50 {4-8} |
| St | Stiff | 50 - 100 {8-15} |
| VSt | Very Stiff | 100 - 200 {15-30} |
| H | Hard | > 200 kPa {>30} |

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# CORED BOREHOLE ENGINEERING LOG

**HOLE NO : CURVE 59_BH03**

| | | |
|---|---|---|
| CLIENT : TMR | POSITION : E: 358657, N: 8137028 (55 MGA94) | PAGE : 3 OF 4 |
| PROJECT : SAFER ROADS SOONER PROJECT | SURFACE ELEVATION : 317.6 (AHD) | DATE DRILLED : 4/8/13 TO 4/8/13 |
| JOB NO : CB24735.01 | DIP / AZIMUTH : 90° | LOGGED BY : JP |
| LOCATION : KENNEDY HWY (CAIRNS - MAREEBA) | | CHECKED BY : AJ |

DRILLING | MATERIAL | DEFECTS & COMMENTS

| DRILLING | WATER DETAIL | TCR/RQD DRILL DEPTH | RL (m) | DEPTH (m) | GRAPHIC LOG | DESCRIPTION ROCK TYPE : Colour, Grain size, Structure (texture, fabric, mineral composition, hardness alteration, cementation, etc as applicable) | Weathering | ESTIMATED STRENGTH Is(50) ● - Axial ○ - Diametral EL -0.03, VL -0.1, L -0.3, M -1, H -3, VH -10, EH | DEFECT SPACING (mm) 20, 60, 200, 600, 2000 | Description of joints, seams, defects, additional observations and comments | GENERAL |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 311.6 | 6.0 | | START CORING AT 8.55m | | | | | |
| NMLC | | 100% TCR 45% RQD | 310.6 | 7.0 | | GNEISS: Dark grey, orange brown, grey brown, indistinct foliation. | MW | | | 8.59 JT 90° IR RF<br>8.71 JT 0° IR RF<br>8.74 JT 90° IR VR | JT 20° - 40° Fe CH IR-UN RF-VR |
| | | | 309.6 | 8.0 | | | | | | | |
| | | | 308.6 | 9.0 | | From 9.00 m to 11.05 m distinct foliation at 30° to 40°. | | | | 9.03 JT 90° IR RF<br>9.04 JT 0 - 5° IR RF<br>9.15 JT 90° UN RF<br>9.19 JT 60° IR RF<br>9.28 JT 60° IR VR<br>9.30 JT 60° IR VR<br>9.31 JT 60° IR VR<br>9.51 JT 60° PR RF<br>9.65 JT 90° IR VR<br>9.86 JT 0 - 5° IR VR<br>10.03 JT 10° UN RF<br>10.26 JT 90° Fe IR VR<br>10.32 JT 70° UN RF | |
| | | | 307.6 | 10.0 | | | | | | | |
| | | 11.00 | 306.6 | 11.0 | | From 11.05 m to 12.30 m orange brown, grey brown, indistinct foliation. | HW - MW | | | 11.09 JT 90° IR RF<br>11.12 JT 60° IR VR<br>11.16 JT 90° UN RF<br>11.27 JT 90° Fe IR RF<br>11.33 JT 5° IR RF<br>11.36 JT 80° IR RF<br>11.44 JT 90° UN RF<br>11.45 JT 70 - 90° ST RF<br>11.51 JT 70° IR RF | |
| | | 100% TCR 37% RQD | | | | | | | | | |
| | | | 305.6 | 12.0 | | | | | | 11.85 JT 90° IR RF<br>11.94 JT 70° IR RF | |

**DRILLING**

NMLC NMLC Coring; HQ HQ Coring
NQ NQ Coring; PQ PQ Coring

TCR % core run recovered
RQD % core run > 100mm long (rock fraction only measured)

GROUNDWATER SYMBOLS
▼ = Water level (static)
▽ = Water level (during drilling)

**SAMPLES & FIELD TESTS**

D Disturbed Sample; ES Env Soil Sample
W Water Sample; EW Env Water Sample
SPT SPT Sample
U Undisturbed Tube Sample

**DEFECT ABBREVIATIONS**

CS Crushed Seam; CZ Crushed Zone; DB Drill Break; FZ Fractured Zone; JT Joint; IS Infilled Seam; SZ Shear Zone; VN Vein
CN Clean; CT Coating; SN Stain; VR Veneer; POL Polished; RF Rough; S Smooth; SL Slickensided
Cu Curved; IR Irregular; PR Planar; ST Stepped; Un Undulated

**ROCK STRENGTH (Is50 MPa)**

| | |
|---|---|
| 0-0.03 | Extremely Low |
| 0.03-0.1 | Very Low |
| 0.1-0.3 | Low |
| 0.3-1.0 | Medium |
| 1.0-3.0 | High |
| 3.0-10 | Very High |

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# CORED BOREHOLE ENGINEERING LOG

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CLIENT : TMR | POSITION : E: 358657, N: 8137028 (55 MGA94) | PAGE : 4 OF 4

PROJECT : SAFER ROADS SOONER PROJECT | SURFACE ELEVATION : 317.6 (AHD) | DATE DRILLED : 4/8/13 TO 4/8/13

JOB NO : CB24735.01 | DIP / AZIMUTH : 90° | LOGGED BY : JP

LOCATION : KENNEDY HWY (CAIRNS - MAREEBA) | CHECKED BY : AJ

| DRILLING | | | | | MATERIAL | | | DEFECTS & COMMENTS | |
|---|---|---|---|---|---|---|---|---|---|
| DRILLING | WATER DETAIL | TCR/RQD DRILL DEPTH | RL (m) | DEPTH (m) | GRAPHIC LOG | DESCRIPTION<br>ROCK TYPE : Colour, Grain size, Structure<br>(texture, fabric, mineral composition, hardness alteration, cementation, etc as applicable) | Weathering | DEFECT SPACING (mm) | Description of joints, seams, defects, additional observations and comments |
| NMLC | | 100% TCR<br>37% RQD | 305.6 | 12.0 | | GNEISS: Dark grey, orange brown, grey brown, indistinct foliation. *(continued)* | HW - MW | | 11.99 JT 60° IR RF<br>12.20 JT 10° IR RF<br>12.26 CZ 10° CH-CG RF 60 mm |
| | | | | | | From 12.26 m CLAYEY GRAVEL (GC), fine to medium grained 60 mm thick. | SW | | 12.34 JT 90° IR RF<br>12.53 JT 60° PR RF<br>12.68 JT 70° Fe IR RF<br>12.78 CZ 50 - 70° GC IR RF 70 mm |
| | | | 304.6 | 13.0 | | From 12.78 m CLAYEY GRAVEL (GC), fine to medium grained 70 mm thick.<br>From 12.80 m to 13.20 m distinct foliation at 30° to 40°. | MW | | 12.88 JT 50° IR RF<br>12.94 JT 0° IR RF<br>12.95 JT 70° ST RF<br>13.05 JT 10° IR RF<br>13.06 JT 10° IR RF<br>13.13 JT 60° IR RF<br>13.17 JT 60° IR RF<br>13.24 JT 60° IR VR<br>13.28 CZ 20 - 60° CH-CG IR RF 50 mm |
| | | 13.60 | | | | From 13.20 m to 13.45 orange brown, grey brown.<br>From 13.28 m CLAYEY GRAVEL (GC), fine to medium grained 50 mm thick.<br>From 13.50 m to 13.60 m distinct foliation at 30° to 40°. | | | 13.41 JT 0 - 90° ST RF<br>13.44 JT 10° IR RF<br>13.49 JT 80° IR RF<br>13.50 JT 50° UN RF<br>13.56 JT 60° UN RF<br>13.60 JT 50° Fe IR RF |
| | | | | | | End of Cored Drill Hole at 13.60 m | | | |
| | | | 303.6 | 14.0 | | | | | |
| | | | 302.6 | 15.0 | | | | | |
| | | | 301.6 | 16.0 | | | | | |
| | | | 300.6 | 17.0 | | | | | |
| | | | 299.6 | 18.0 | | | | | |

ESTIMATED STRENGTH Is(50) — ● - Axial ○ - Diametral; EL -0.03, VL -0.1, L -0.3, M -1, H -3, VH -10, EH

DEFECT SPACING (mm): 20, 60, 200, 600, 2000

GENERAL: JT 20° - 40° Fe CH IR-UN RF-VR

## DRILLING

NMLC NMLC Coring | HQ HQ Coring
NQ NQ Coring | PQ PQ Coring

TCR % core run recovered
RQD % core run > 100mm long (rock fraction only measured)

GROUNDWATER SYMBOLS
▼ = Water level (static)
▽ = Water level (during drilling)

## SAMPLES & FIELD TESTS

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W Water Sample | EW Env Water Sample
SPT SPT Sample
U Undisturbed Tube Sample

## DEFECT ABBREVIATIONS

CS Crushed Seam | CN Clean | Cu Curved
CZ Crushed Zone | CT Coating | IR Irregular
DB Drill Break | SN Stain | PR Planar
FZ Fractured Zone | VR Veneer | ST Stepped
JT Joint | Un Undulated
IS Infilled Seam | POL Polished
SZ Shear Zone | RF Rough
VN Vein | S Smooth
SL Slickensided

## ROCK STRENGTH (Is50 MPa)

| | |
|---|---|
| 0-0.03 | Extremely Low |
| 0.03-0.1 | Very Low |
| 0.1-0.3 | Low |
| 0.3-1.0 | Medium |
| 1.0-3.0 | High |
| 3.0-10 | Very High |

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| | | | |
|---|---|---|---|
| SINCLAIR KNIGHT MERZ SKM | | Client: Transport and Main Roads | |
| drawn | AJ | Project: Safer Road Sooner | |
| date | 14/08/2013 | Core Photograph – Curve 59_BH03 | |
| scale | NTS | Project no. CB24735.01 | Photo No: Curve 59_BH03 1 of 1 |