TONKIN & TAYLOR LTD

DRILL HOLE LOG

DRILL HOLE No: BH 2
Hole Location:

SHEET 2 OF 2

PROJECT: JACKS POINT - HENLEY DOWNS
LOCATION: WOOLSHED ROAD, QUEENSTOWN JOB No: 880054

CO-ORDINATES mN
mE

DRILL TYPE: UDR 650
DATUM:
R.L. GROUND: m
R.L. COLLAR: m

HOLE STARTED: 10/10/2007
HOLE FINISHED: 10/10/2007
DRILLED BY: McNEILL DRILLING
LOGGED BY: SCWW CHECKED:

DIRECTION: N/A °
ANGLE FROM HORIZ.: 90°, vertical

DESCRIPTION OF CORE

S.P.T - Logs.

GEOLOGICAL UNIT

ROCK OR SOIL TYPE, WEATHERING, HARDNESS, STRENGTH, COLOUR, LITHOLOGICAL FEATURES (bedding, cement, foliation, mineralogy, texture, etc...);

ROCK WEATHERING: UW SW MW HW

ROCK STRENGTH: R4 R3 R2 R1 R0

PT LOAD / UCS TEST (MPa)

CORE LOSS / LIFT (%): 3 10 30 100

METHOD, CORE & CASING

TEST SYMBOL

DEPTH (m)

GRAPHIC LOG

DEFECT LOG

FRACTURE LOG spacing of natural fractures (cm): 50 10 5 1

SIGNIFICANT JOINTS, BEDDING, CRUSHED AND SHEARED ZONES/SEAMS
DEFECT TYPE, SHAPE, ROUGHNESS, APERTURE, INFILLING, SPACING
ANGLES ARE NORMAL TO CORE AXIS

SPT LOGS

DATE / DEPTH

RQD (%)

WATER

DRILL WATER LOSS (%): 25 50 75

SPT RESULTS: 1 10 100

CORE BOX RL (m)

Lake Deposits

gravel. 9.5-10.0 = no sands and PP < 50kPa., SILT, dry, sl. plast, stiff very stiff pp = 50-150kPa, occasional rounded fine gravel, becoming more clayey. 10.0-11.0m (0.3m loss)

contact.

Core Run ⇒ 11.0-12.4m

11.0-11.5m pp = 50-150kPa grey brown SILT with minor clay + occasional sandy lenses
11.5-12.0m pp = 350kPa, silty SAND (f-c) with minor clay, sl. plast. thinly laminated
12.0-12.4m pp = 50-100kPa silty SAND, non plastic, non cohesive, laminated. (no loss)

core ends at 12.4 m

D.C. = SAND

D.C. = GRAVEL

D.C. = GRAVEL

GLACIAL TILL

END OF DRILLHOLE @ 15.45m.

core loss

HQTT

SPT

HQTT

SPT

HQTT

SPT

HQTT

SPT

10 sample

10 core

10 core

contact.

SPT @ 11.0m - brown sandy SILT, sl plastic, moist, firm to stiff.

SPT @ 12.4m - 10 sample.

SPT @ 13.5m - brown grey silty SAND with gravel sand = (f-c) gravel = (f-m)

SPT @ 15.0m - brown sandy SILT, stiff, moist, occasional gravels rounded (f-c).

SPT @ 11.0m
6, 7, 9, 10, 11, 7
N = 50 for 265mm

SPT @ 12.4m
10, 26, 19
N = 50 for 70mm

SPT @ 13.5m
5, 12, 15, 8
N = 50 for 150mm

SPT @ 15.0m
3, 5, 6, 7, 7, 7
N = 27

PP = pocket penetrometer test
D.C. = Drillers comment.

↑ SPT = standard penetration test
HQTT = core drilling.

Appendix D: CPT Logs

CPT ANALYSIS NOTES

Soil Type

Interpretation using chart of Robertson & Campanella (1983). This is a simple but well proven interpretation using cone tip resistance (q_C) and friction ratio (f_R) only. No normalisation for overburden stress is applied. Cone tip resistance measured with the piezocone is corrected with measured pore pressure (u_C).

- sand (and gravel)
- silt-sand
- silt
- clay-silt
- clay
- peat

Liquefaction Screening

The purpose of the screening is to highlight susceptible soils, that is sand and silt-sand in a relatively loose condition. This is not a full liquefaction risk assessment which requires knowledge of the particular earthquake risk at a site and additional analysis. The screening is based on the chart of Shibata and Teparaksa (1988).

- high susceptibility
- medium susceptibility
- low susceptibility

High susceptibility is here defined as requiring a shear stress ratio of 0.2 to cause liquefaction with D_{50} for sands assumed to be 0.25 mm and for silty sands to be 0.05 mm.

Medium susceptibility is here defined as requiring a shear stress ratio of 0.4 to cause liquefaction with D_{50} for sands assumed to be 0.25 mm and for silty sands to be 0.05 mm.

Low susceptibility is all other cases.

Relative Density (D_R)

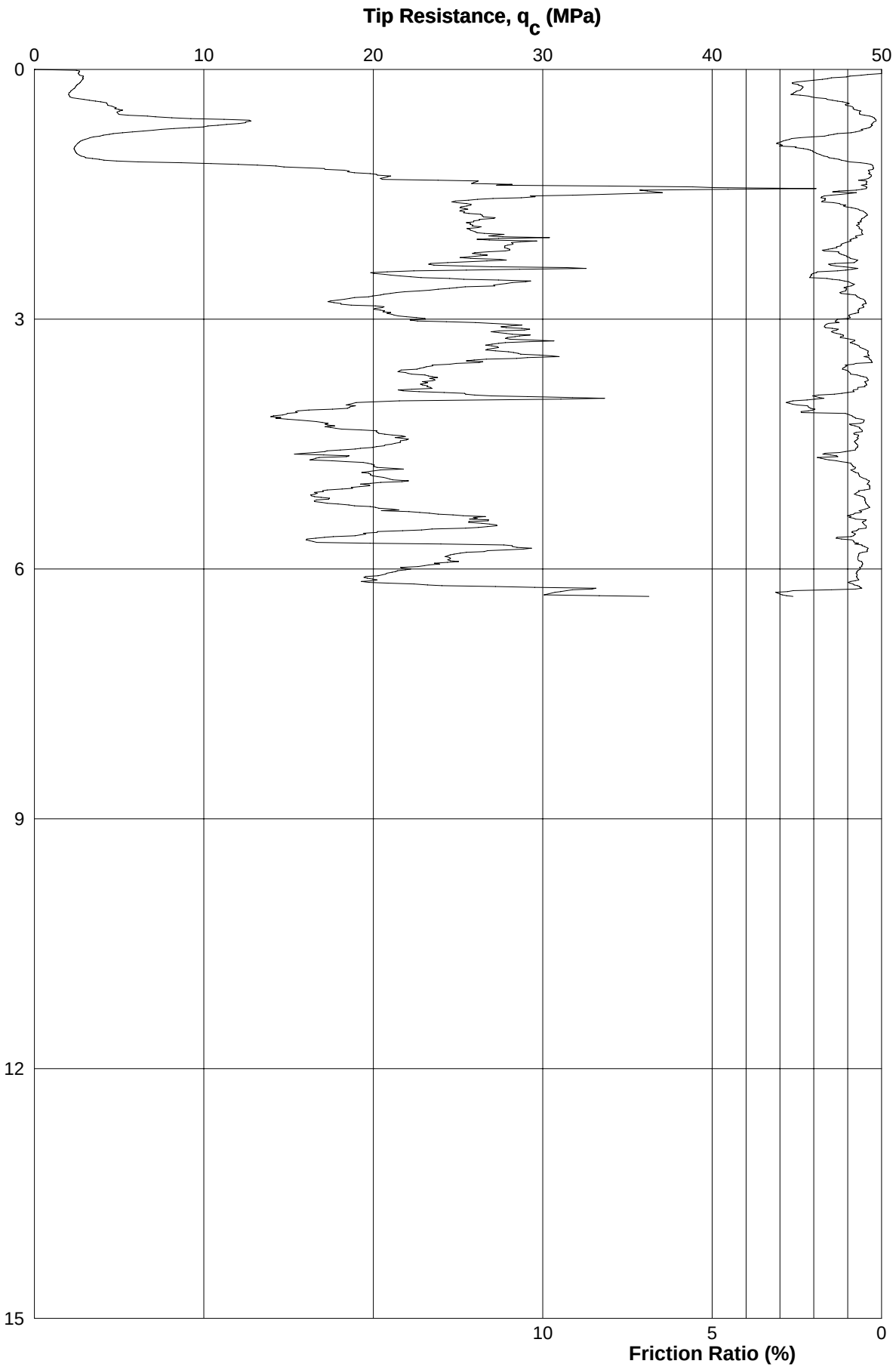
Based on the method of Baldi et. al. (1986) from data on normally consolidated sand.

Undrained Shear Strength (S_U)

Derived from the bearing capacity equation using $S_U = (q_C - \sigma_{VO})/15$.

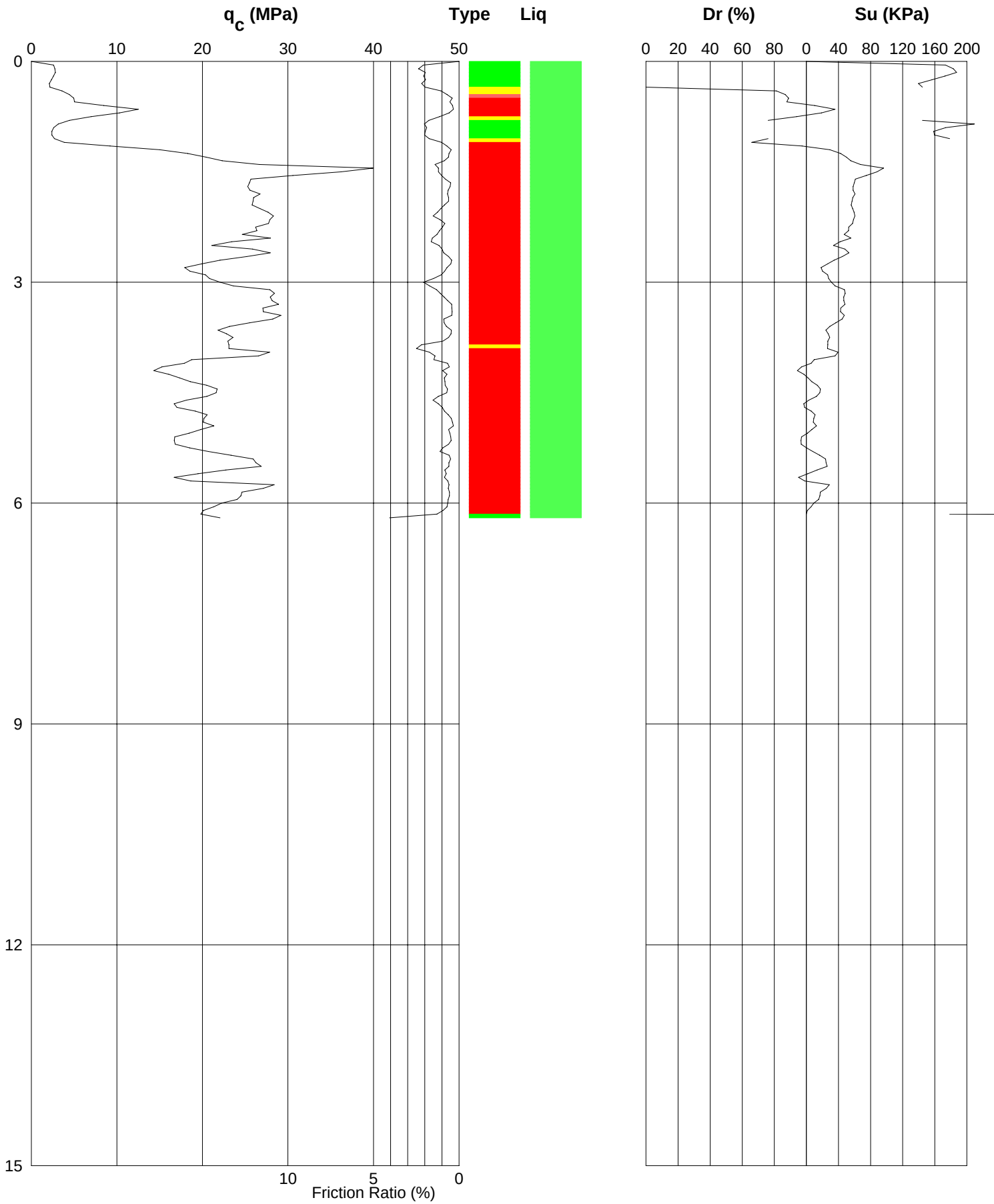
SITE INVESTIGATION LTD

STANDARD CONE PENETROMETER TEST (CPT) REPORT



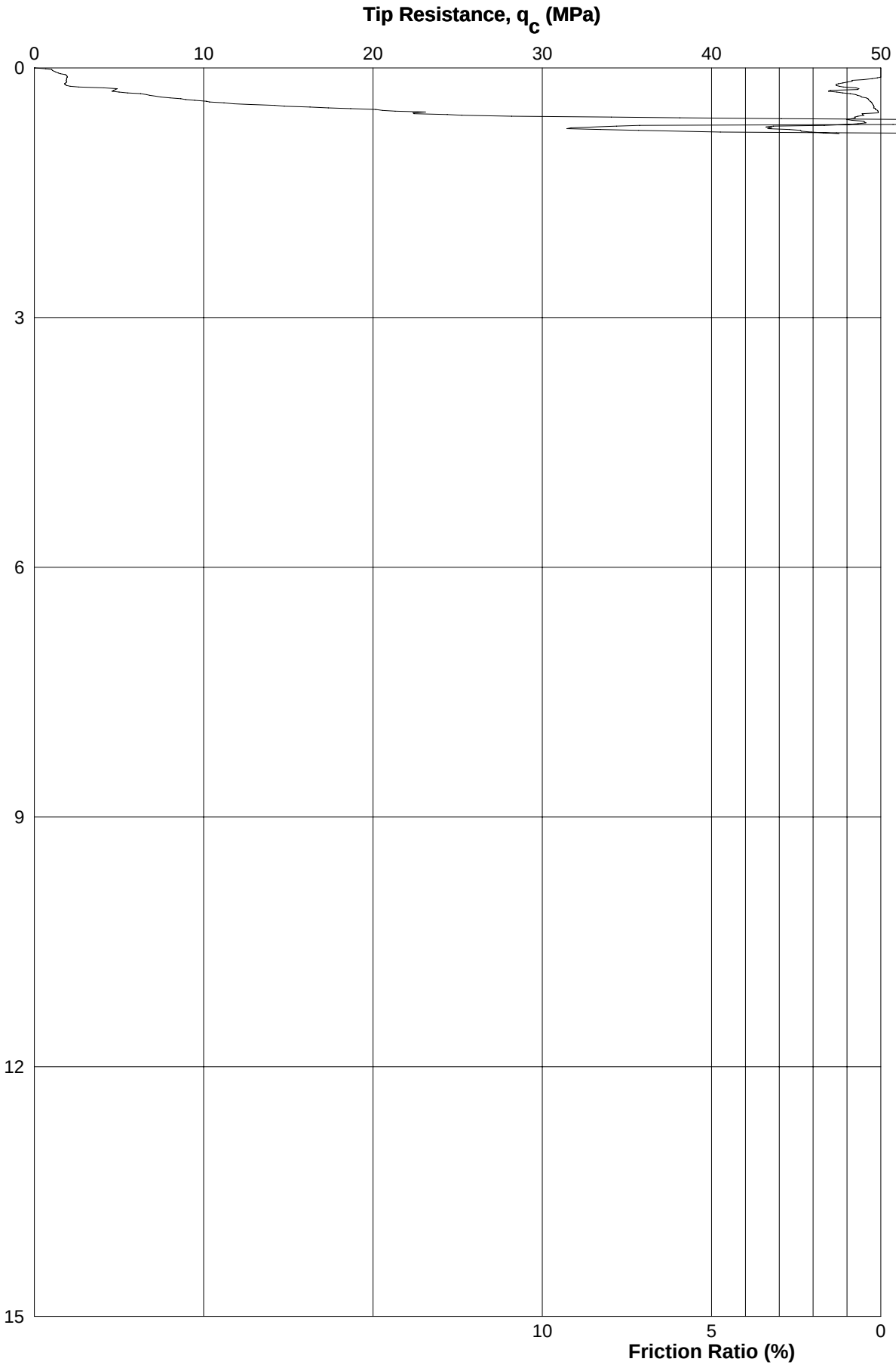
Job No:	4934		
CPT No:	201	Date:	26-9-07
Project:	Tonkin & Taylor Ltd	Operator:	J.Harvey
Location:	Jacks Point, Queenstown	Remark:	Effective Refusal

STANDARD CONE PENETROMETER TEST (CPT) INTERPRETIVE REPORT



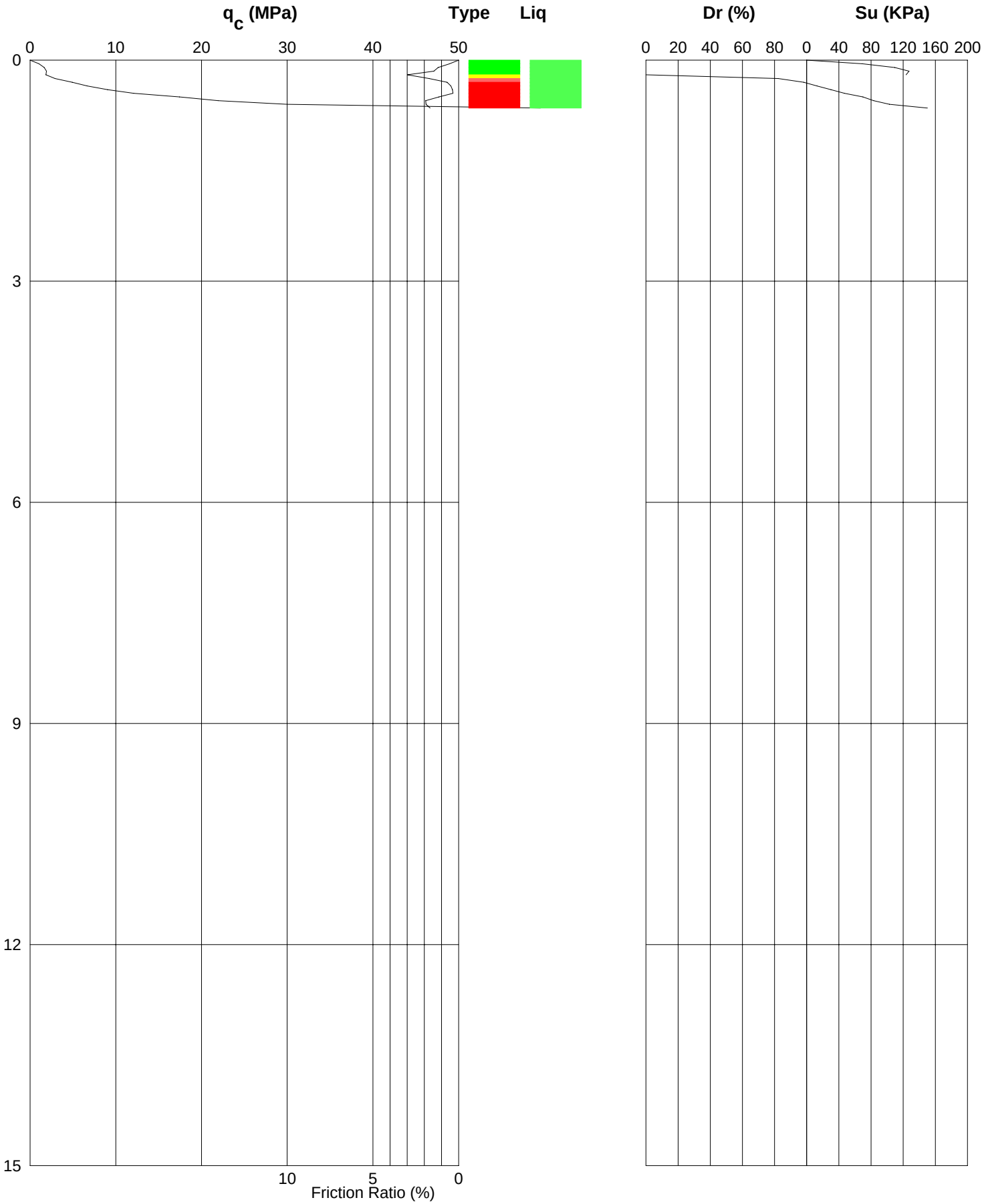
Job No:	4934		
CPT No:	201	Date:	26-9-07
Project:	Tonkin & Taylor Ltd	Operator:	J.Harvey
Location:	Jacks Point, Queenstown	Remark:	Effective Refusal

STANDARD CONE PENETROMETER TEST (CPT) REPORT



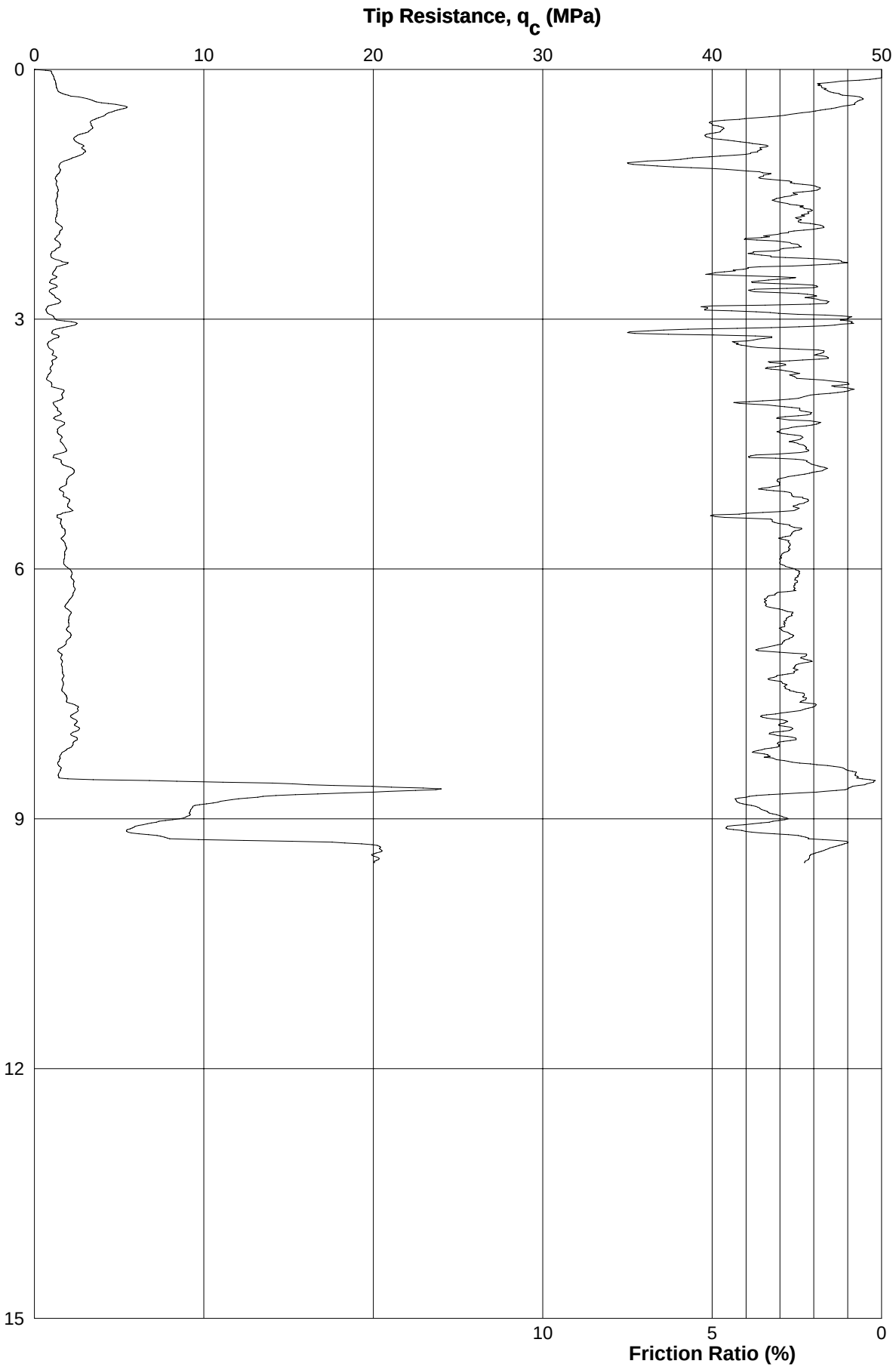
Job No:	4934		
CPT No:	202	Date:	27-9-07
Project:	Tonkin & Taylor Ltd	Operator:	J.Harvey
Location:	Jacks Point, Queenstown	Remark:	Effective Refusal

STANDARD CONE PENETROMETER TEST (CPT) INTERPRETIVE REPORT



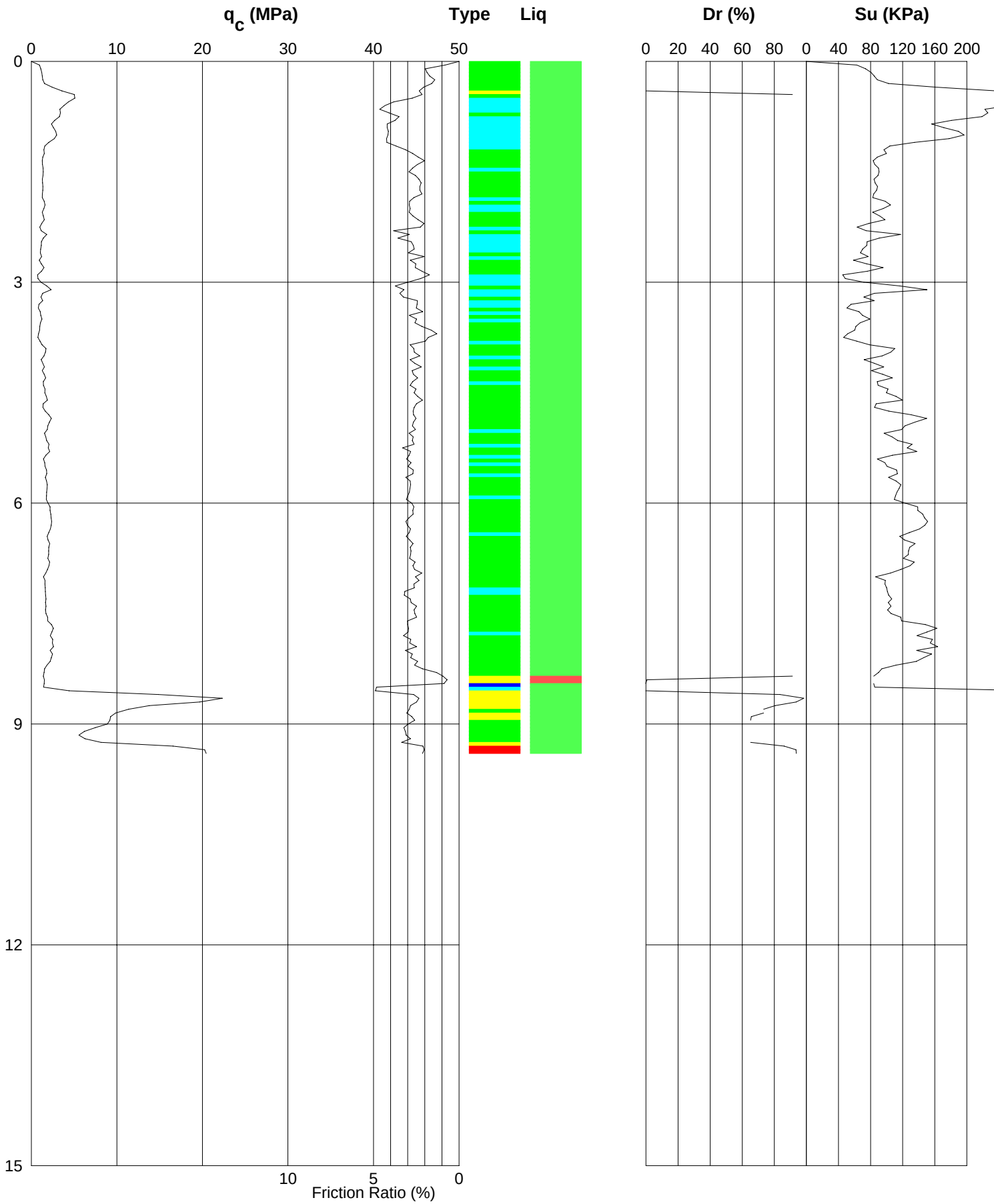
Job No:	4934		
CPT No:	202	Date:	27-9-07
Project:	Tonkin & Taylor Ltd	Operator:	J.Harvey
Location:	Jacks Point, Queenstown	Remark:	Effective Refusal

STANDARD CONE PENETROMETER TEST (CPT) REPORT



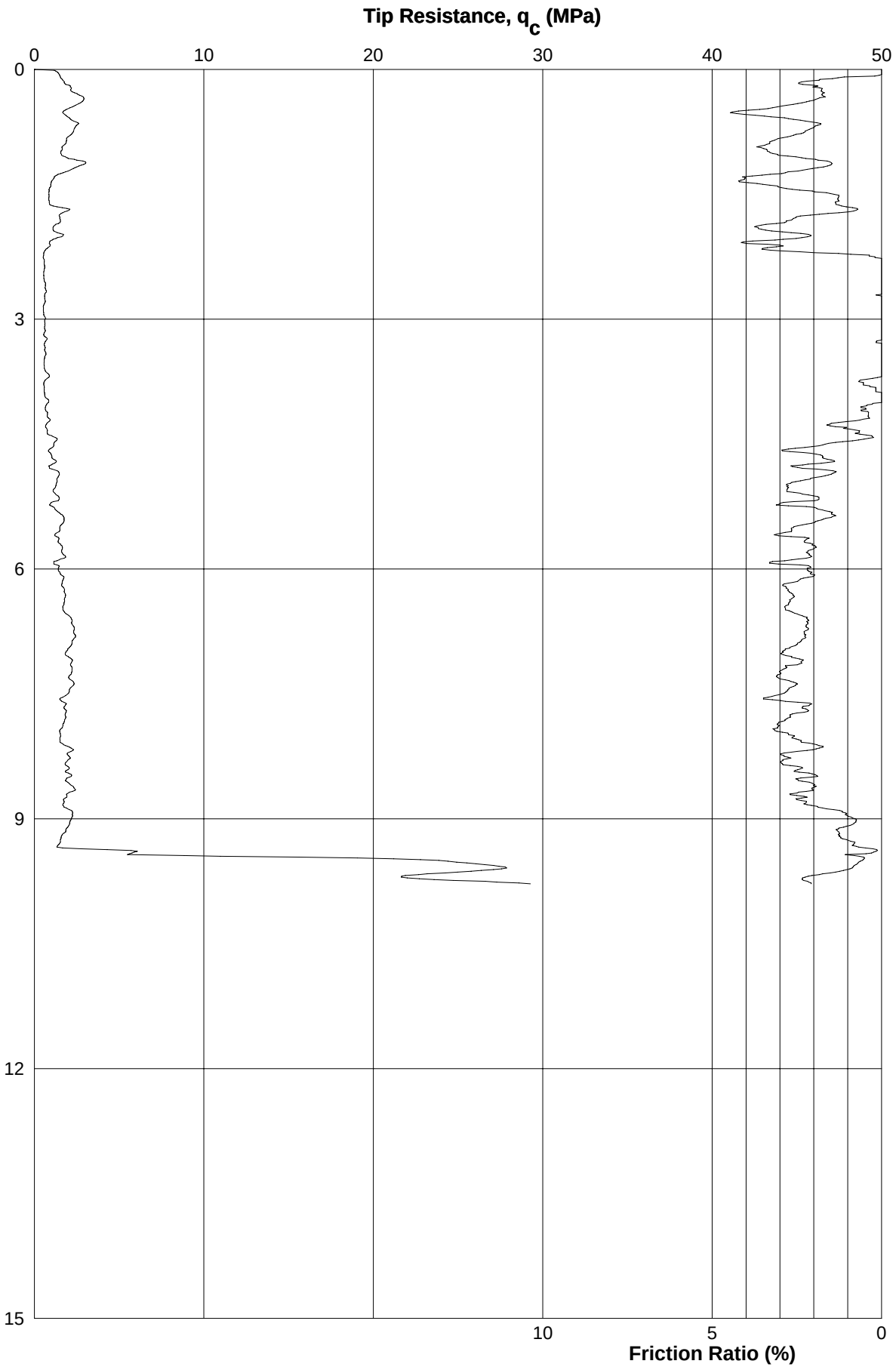
Job No:	4934		
CPT No:	203	Date:	27-9-07
Project:	Tonkin & Taylor Ltd	Operator:	J.Harvey
Location:	Jacks Point, Queenstown	Remark:	Effective Refusal

STANDARD CONE PENETROMETER TEST (CPT) INTERPRETIVE REPORT



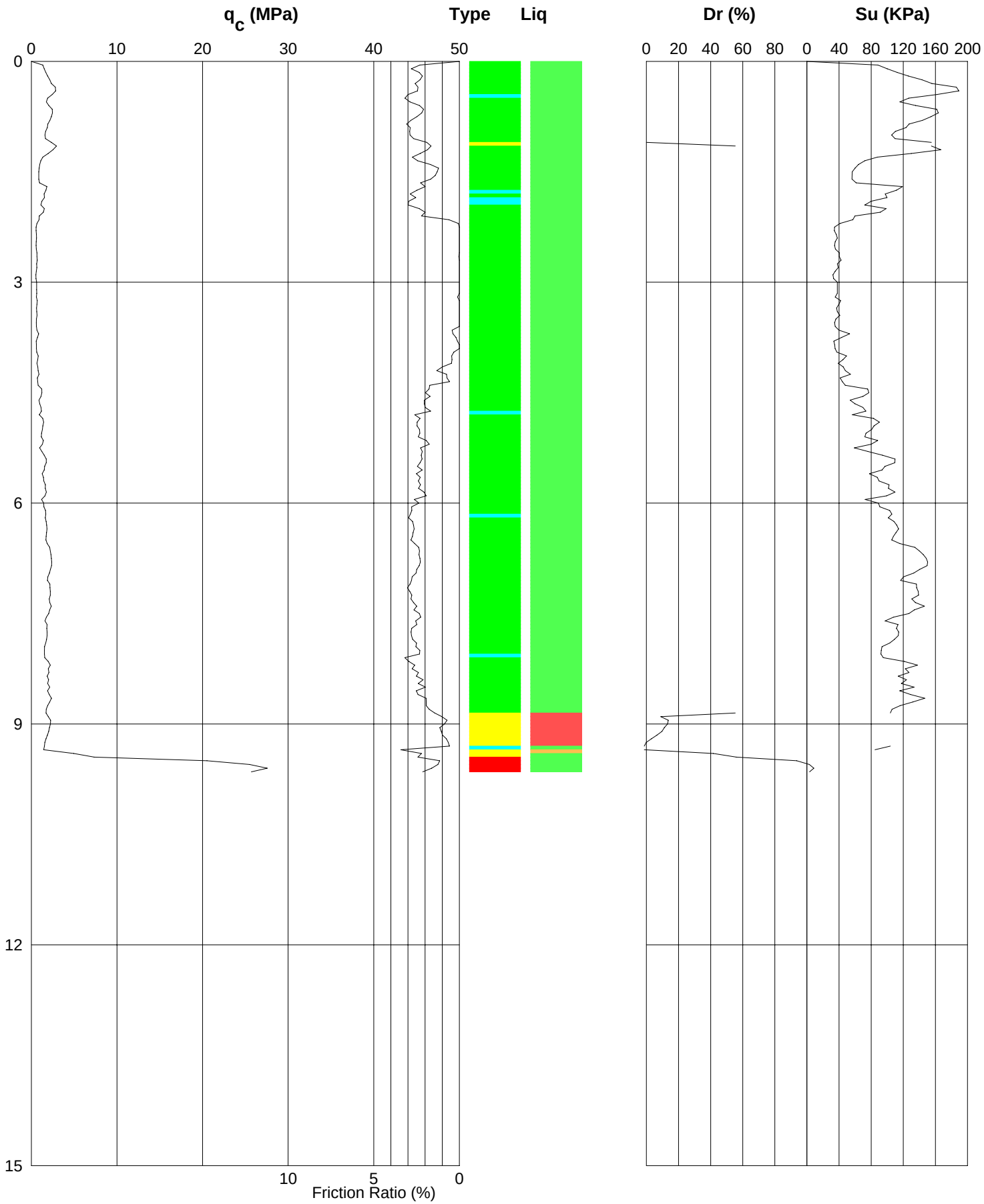
Job No:	4934		
CPT No:	203	Date:	27-9-07
Project:	Tonkin & Taylor Ltd	Operator:	J.Harvey
Location:	Jacks Point, Queenstown	Remark:	Effective Refusal

STANDARD CONE PENETROMETER TEST (CPT) REPORT



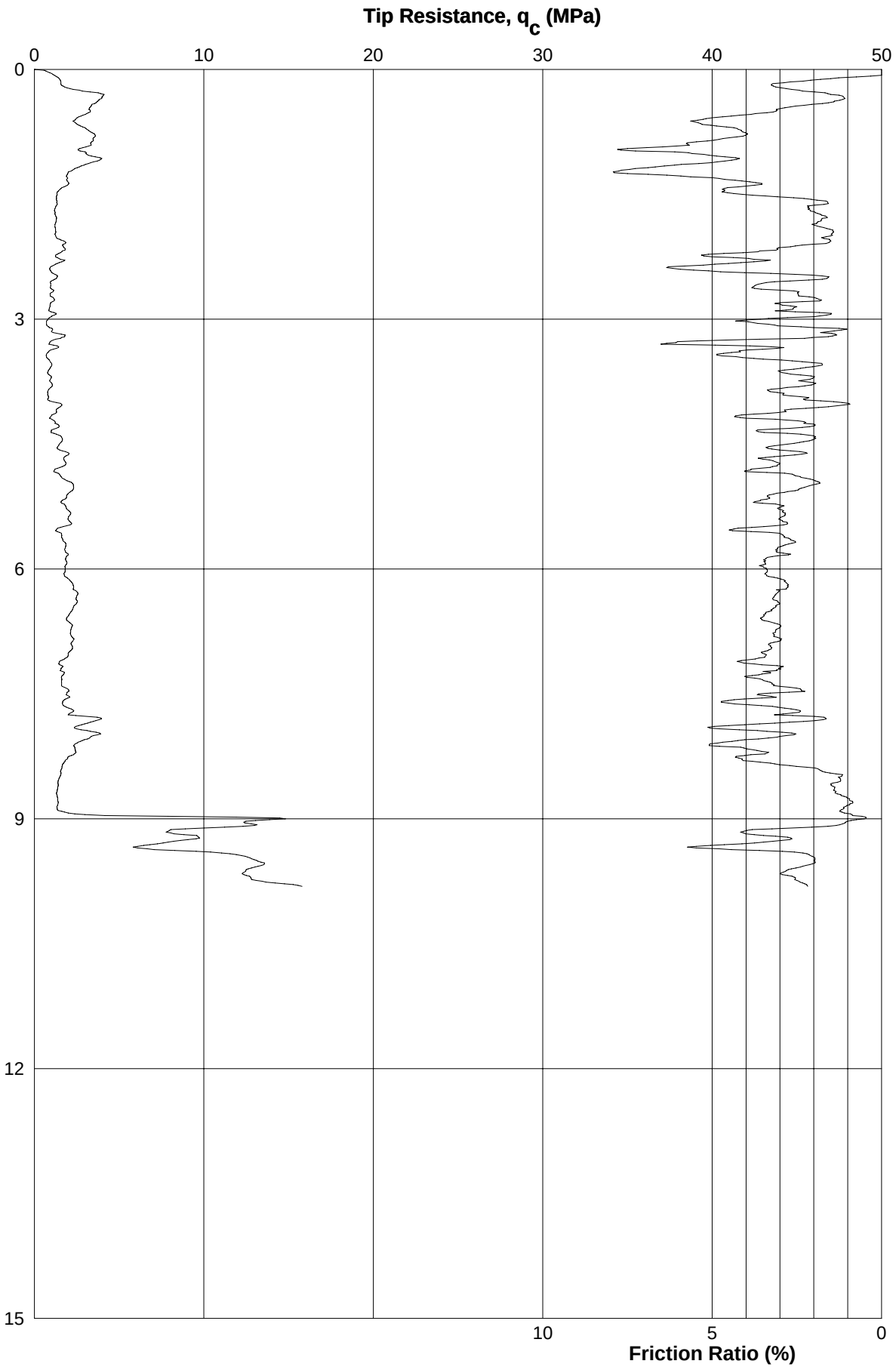
Job No:	4934		
CPT No:	204	Date:	27-9-07
Project:	Tonkin & Taylor Ltd	Operator:	J.Harvey
Location:	Jacks Point, Queenstown	Remark:	Effective Refusal

STANDARD CONE PENETROMETER TEST (CPT) INTERPRETIVE REPORT



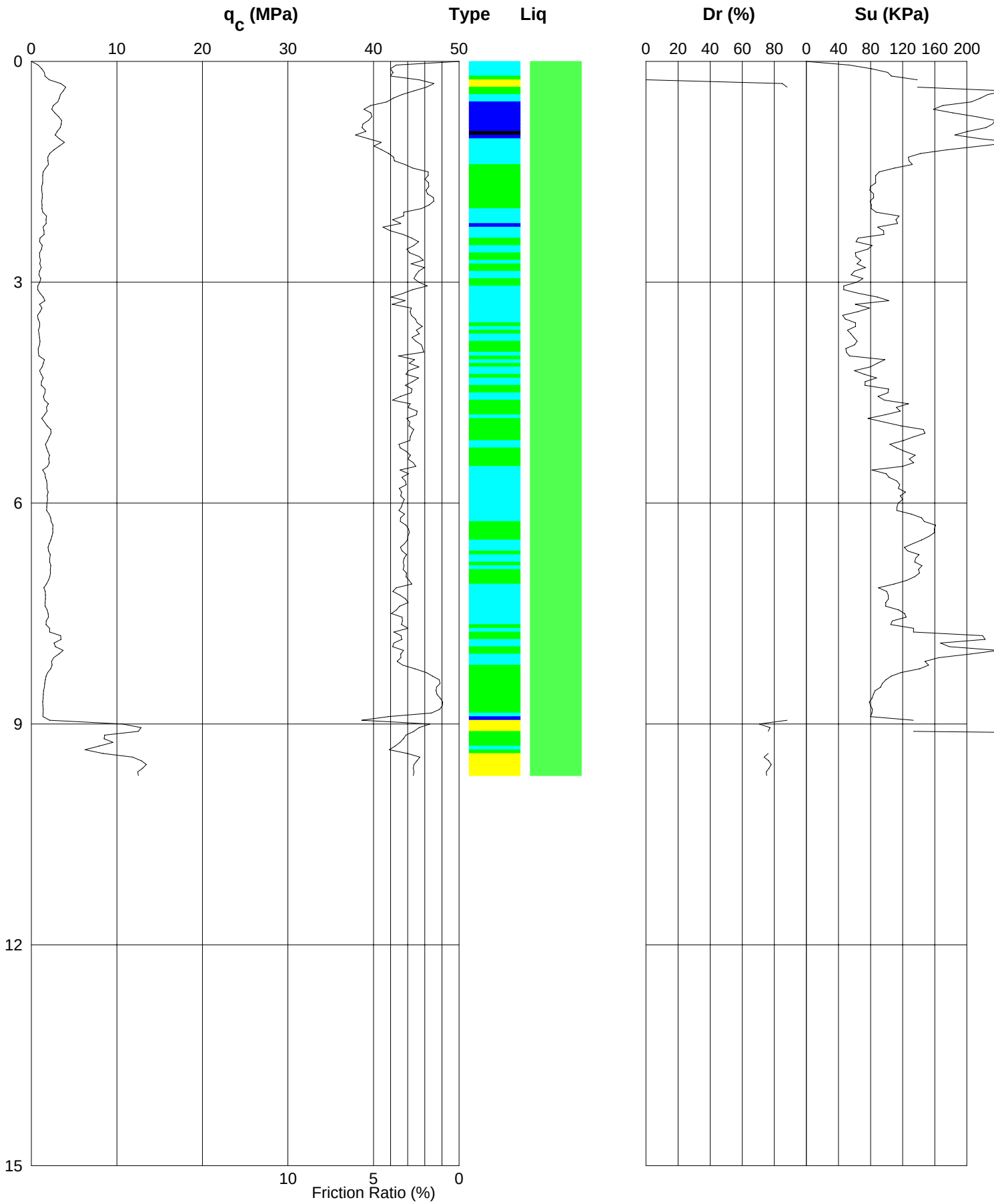
Job No:	4934		
CPT No:	204	Date:	27-9-07
Project:	Tonkin & Taylor Ltd	Operator:	J.Harvey
Location:	Jacks Point, Queenstown	Remark:	Effective Refusal

STANDARD CONE PENETROMETER TEST (CPT) REPORT



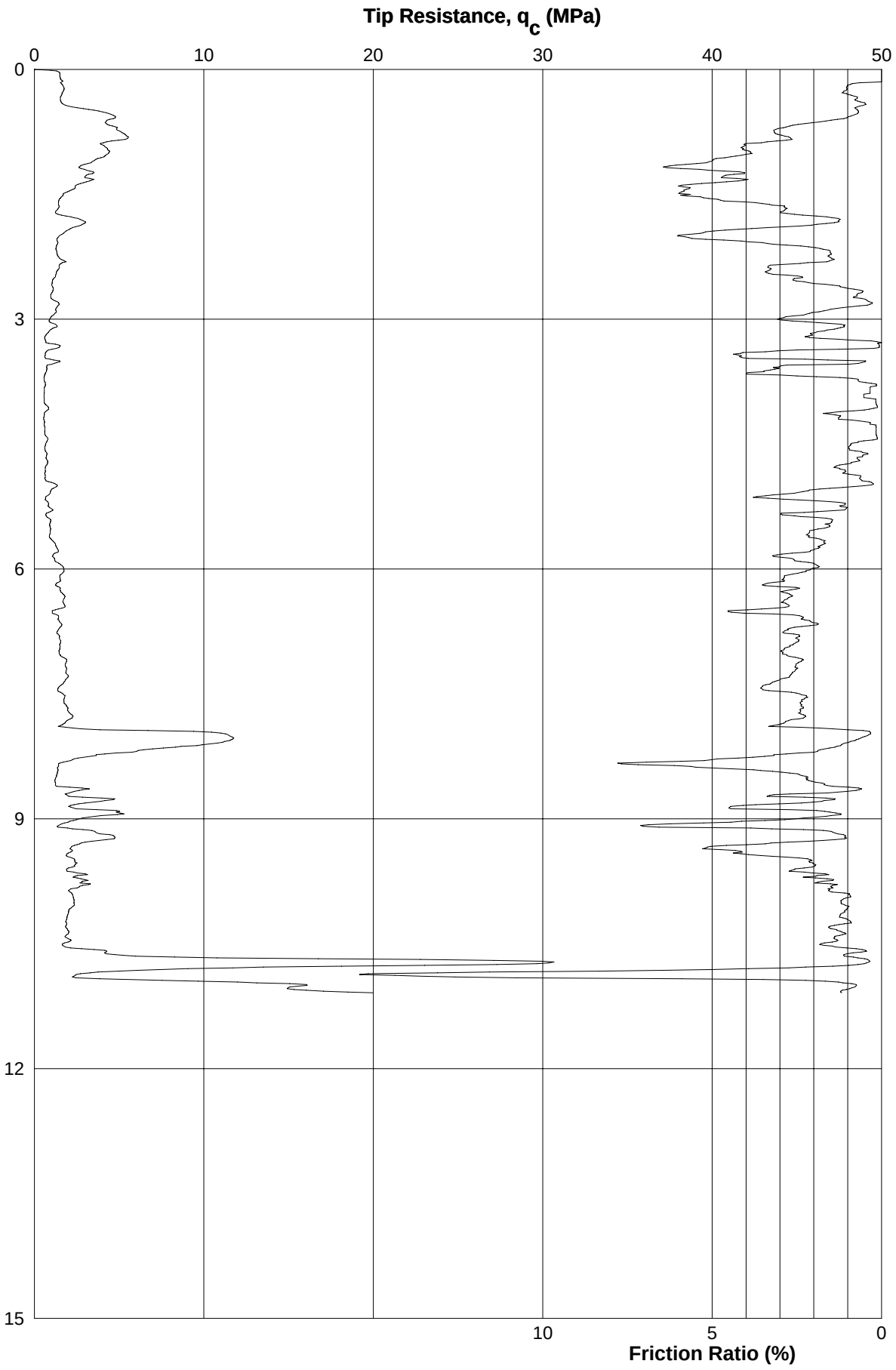
Job No:	4934		
CPT No:	205	Date:	27-9-07
Project:	Tonkin & Taylor Ltd	Operator:	J.Harvey
Location:	Jacks Point, Queenstown	Remark:	Effective Refusal

STANDARD CONE PENETROMETER TEST (CPT) INTERPRETIVE REPORT



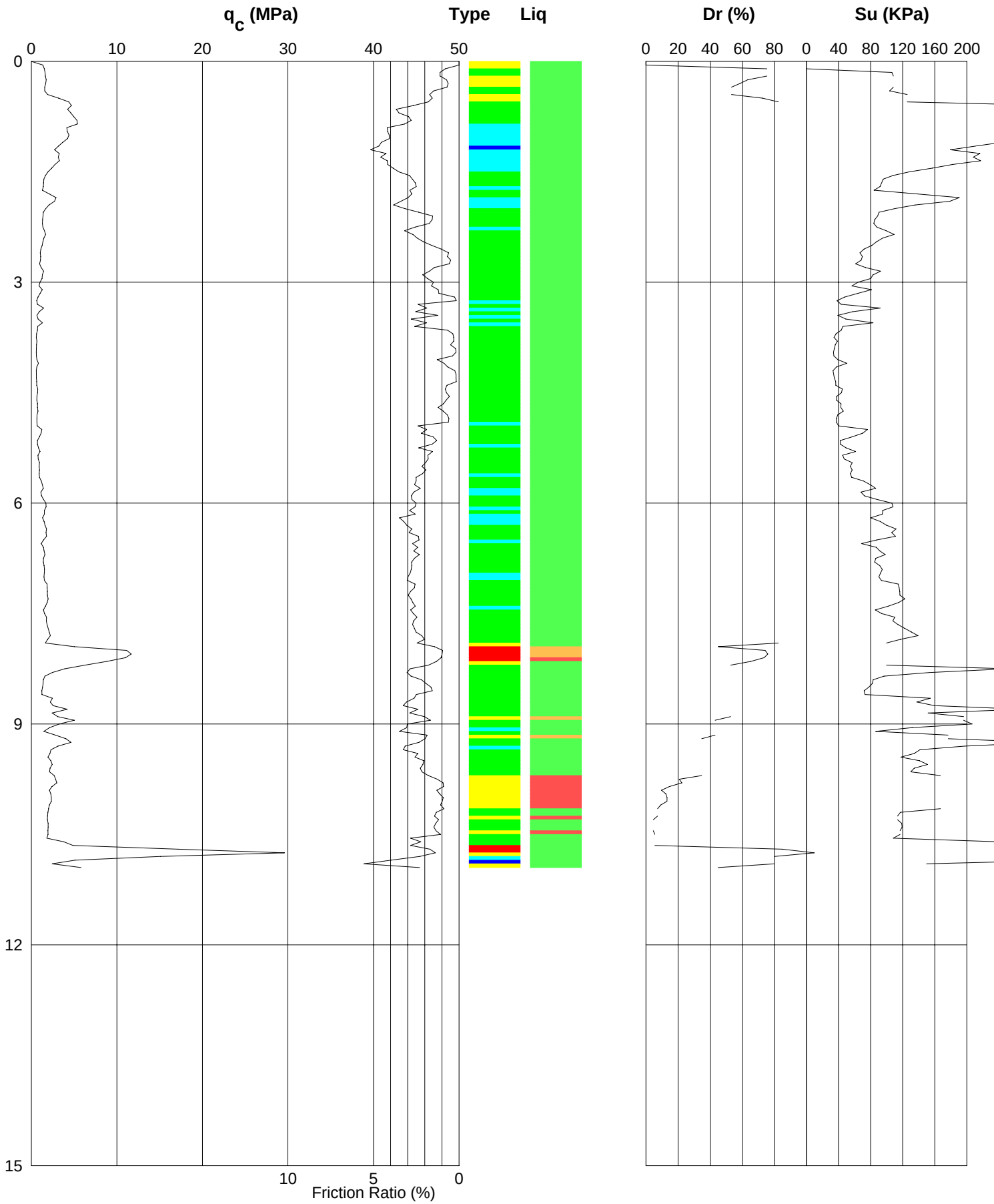
Job No:	4934		
CPT No:	205	Date:	27-9-07
Project:	Tonkin & Taylor Ltd	Operator:	J.Harvey
Location:	Jacks Point, Queenstown	Remark:	Effective Refusal

STANDARD CONE PENETROMETER TEST (CPT) REPORT



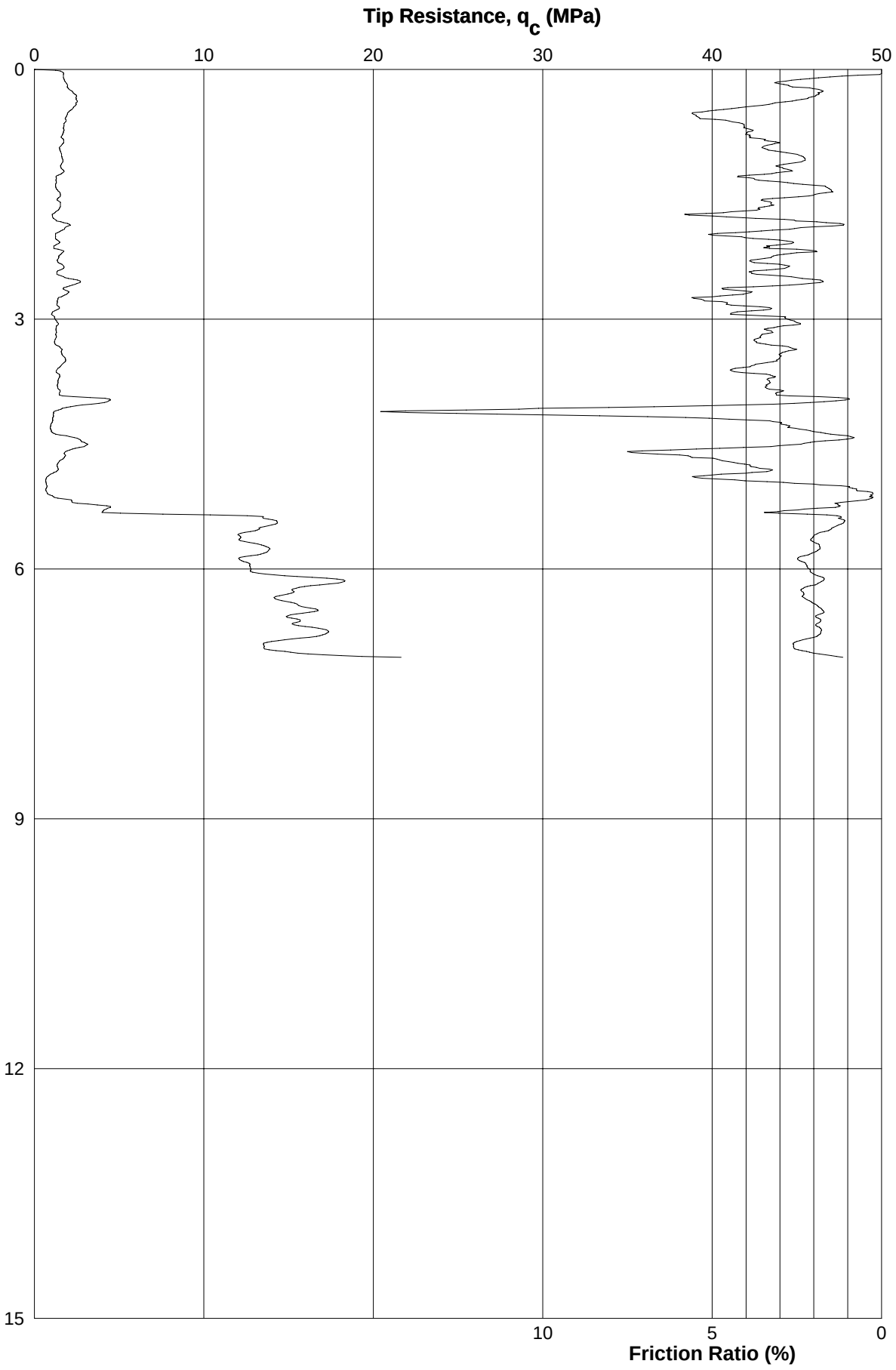
Job No:	4934		
CPT No:	206	Date:	27-9-07
Project:	Tonkin & Taylor Ltd	Operator:	J.Harvey
Location:	Jacks Point, Queenstown	Remark:	Effective Refusal

STANDARD CONE PENETROMETER TEST (CPT) INTERPRETIVE REPORT



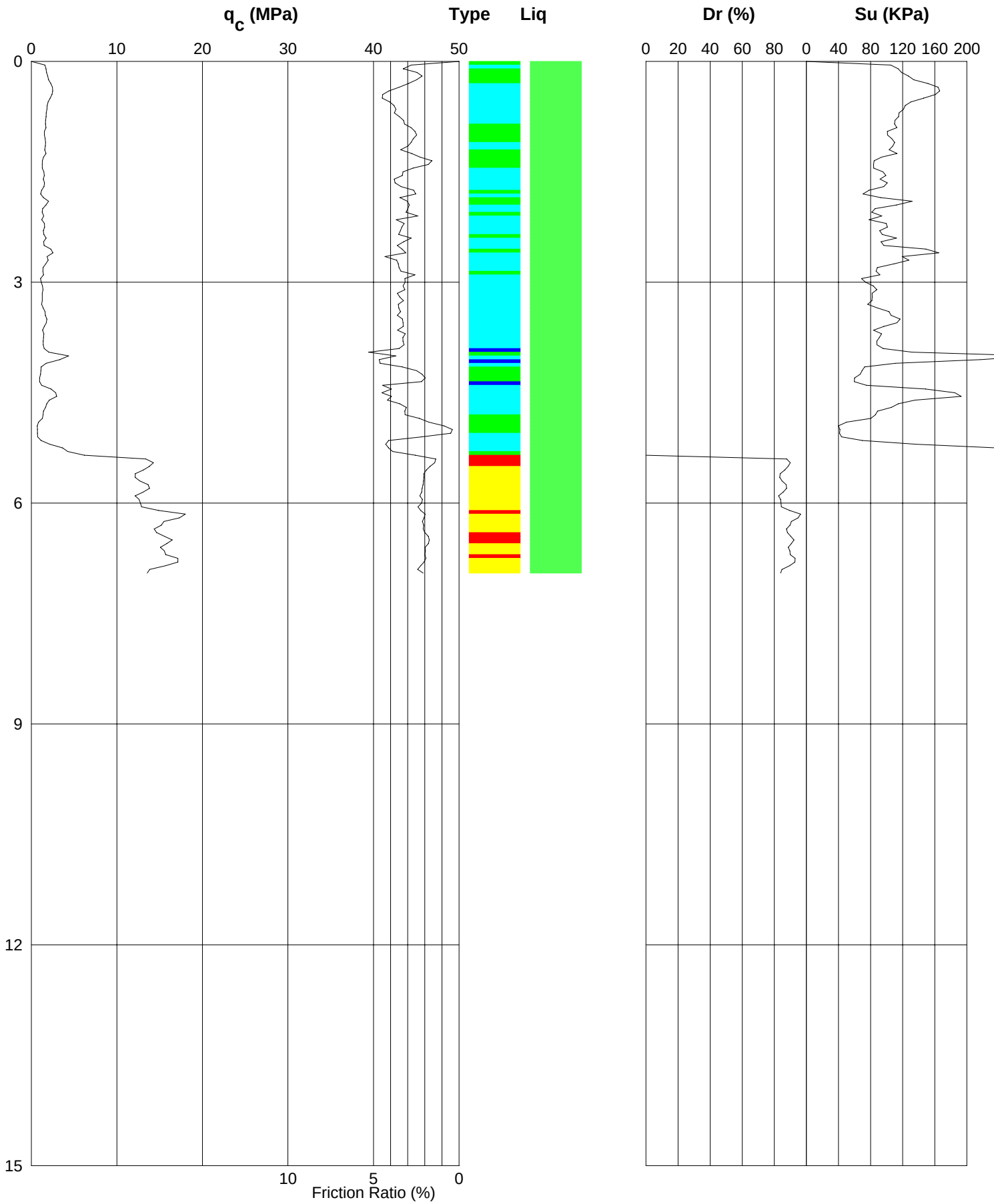
Job No:	4934		
CPT No:	206	Date:	27-9-07
Project:	Tonkin & Taylor Ltd	Operator:	J.Harvey
Location:	Jacks Point, Queenstown	Remark:	Effective Refusal

STANDARD CONE PENETROMETER TEST (CPT) REPORT



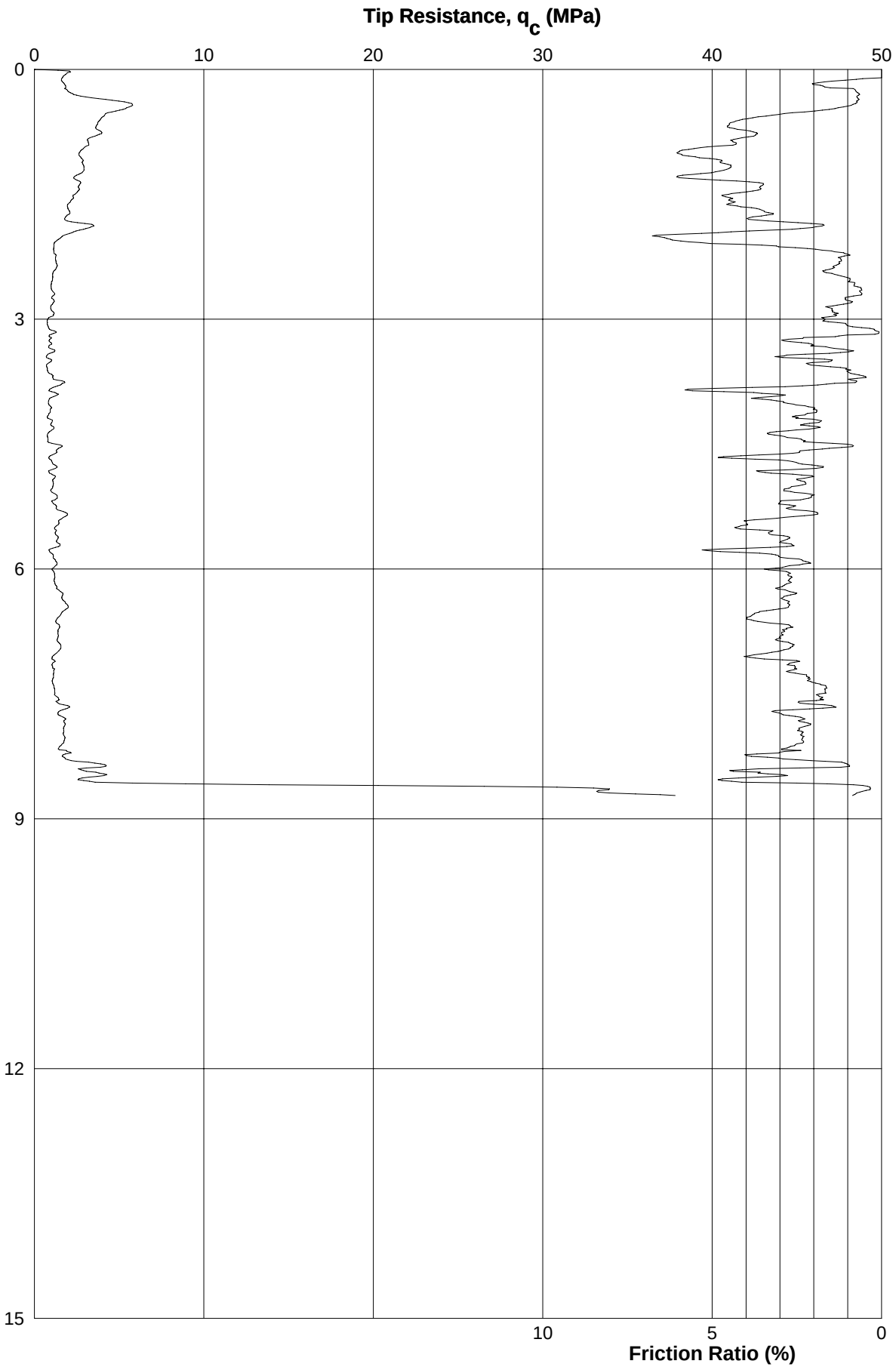
Job No:	4934		
CPT No:	207	Date:	27-9-07
Project:	Tonkin & Taylor Ltd	Operator:	J.Harvey
Location:	Jacks Point, Queenstown	Remark:	Effective Refusal

STANDARD CONE PENETROMETER TEST (CPT) INTERPRETIVE REPORT



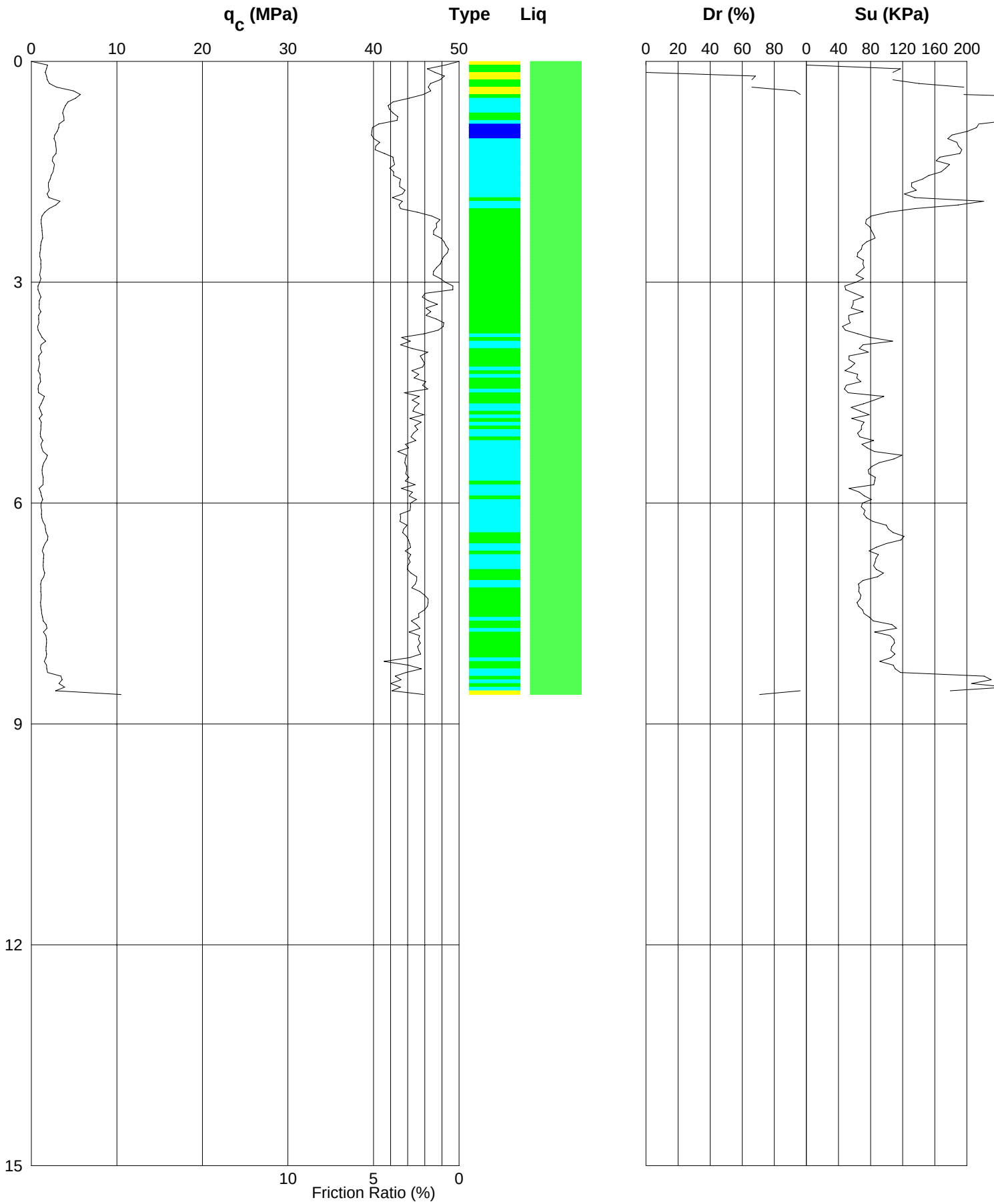
Job No:	4934		
CPT No:	207	Date:	27-9-07
Project:	Tonkin & Taylor Ltd	Operator:	J.Harvey
Location:	Jacks Point, Queenstown	Remark:	Effective Refusal

STANDARD CONE PENETROMETER TEST (CPT) REPORT



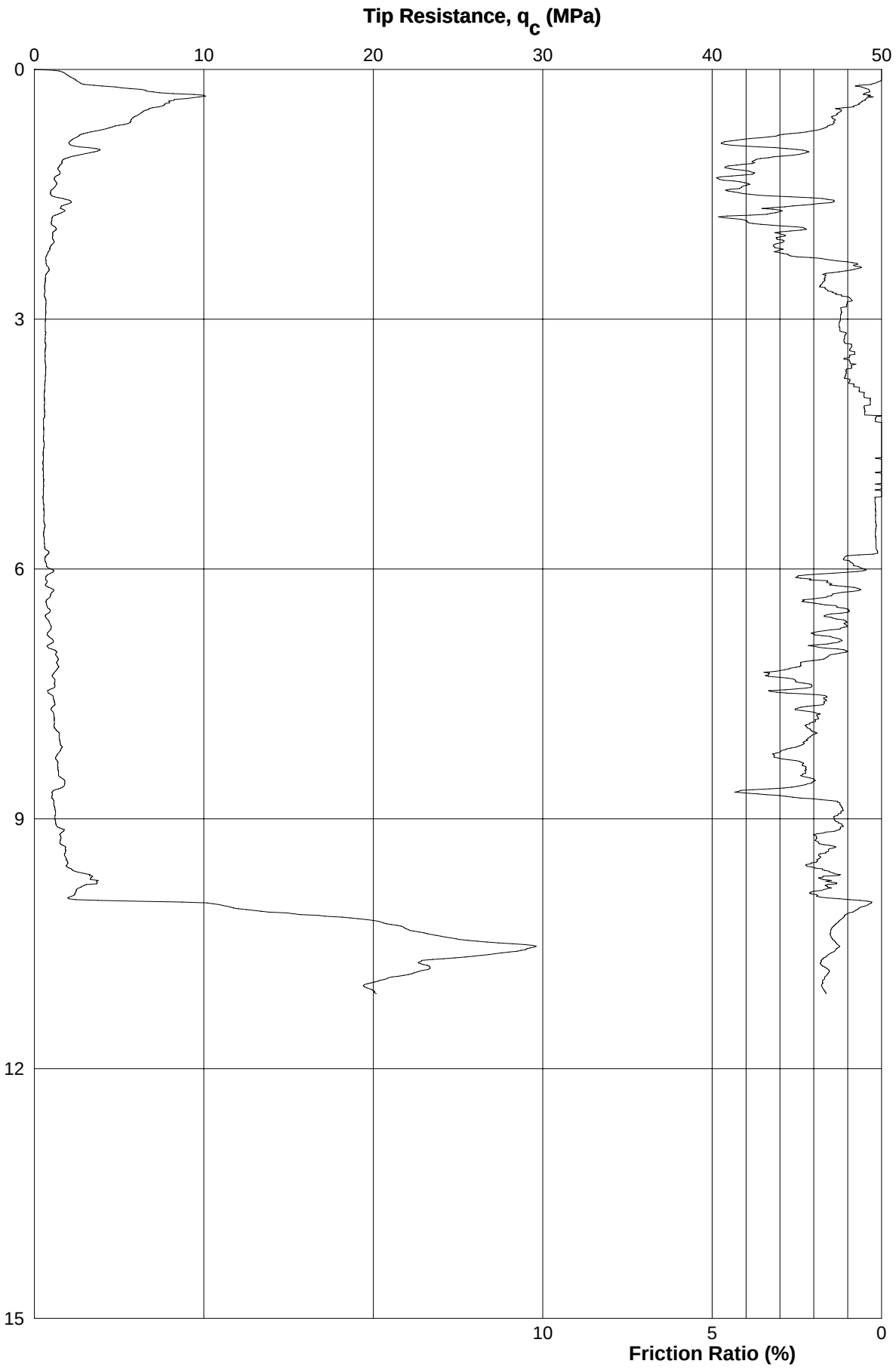
Job No:	4934		
CPT No:	208	Date:	27-9-07
Project:	Tonkin & Taylor Ltd	Operator:	J.Harvey
Location:	Jacks Point, Queenstown	Remark:	Effective Refusal

STANDARD CONE PENETROMETER TEST (CPT) INTERPRETIVE REPORT



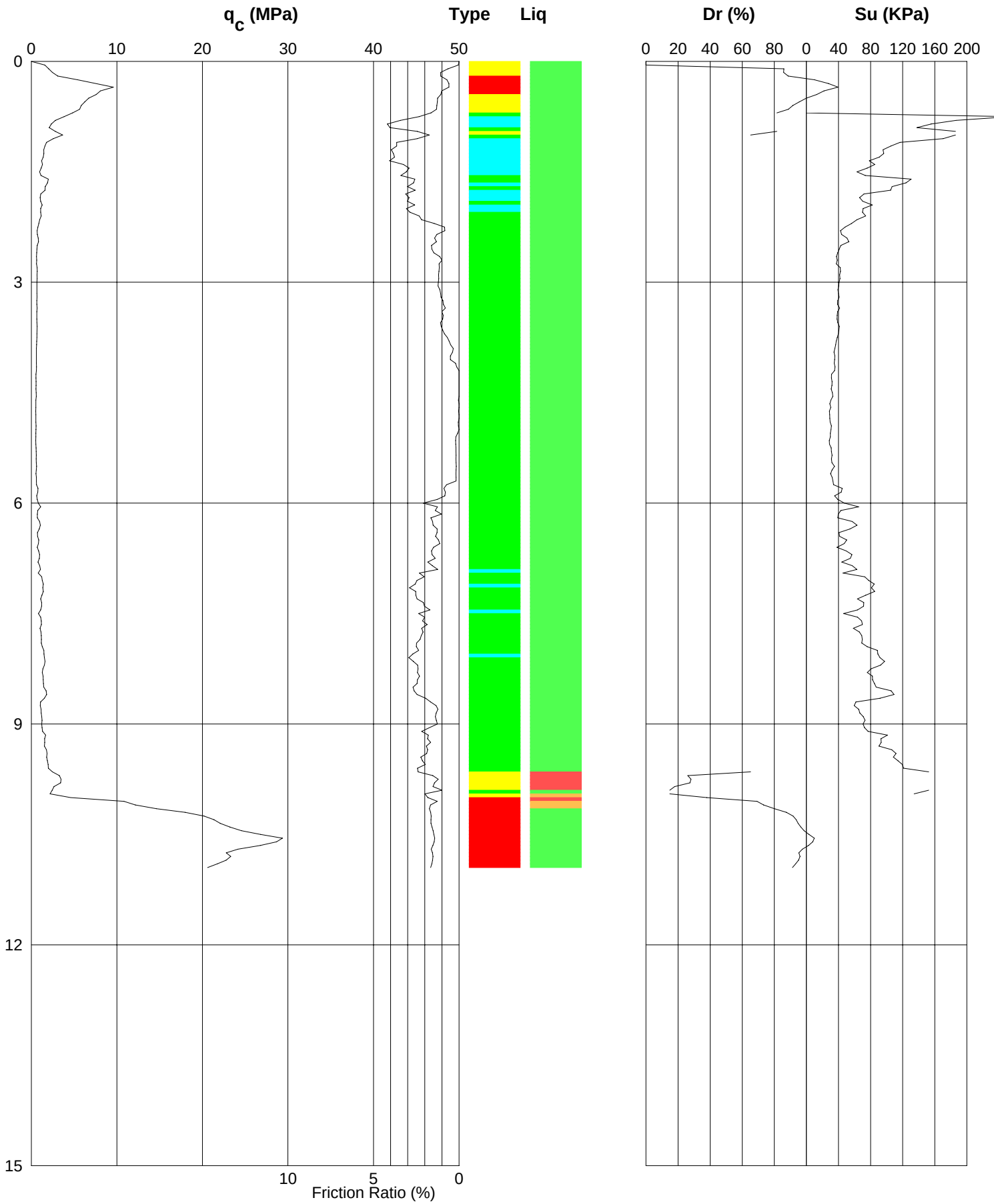
Job No:	4934		
CPT No:	208	Date:	27-9-07
Project:	Tonkin & Taylor Ltd	Operator:	J.Harvey
Location:	Jacks Point, Queenstown	Remark:	Effective Refusal

STANDARD CONE PENETROMETER TEST (CPT) REPORT



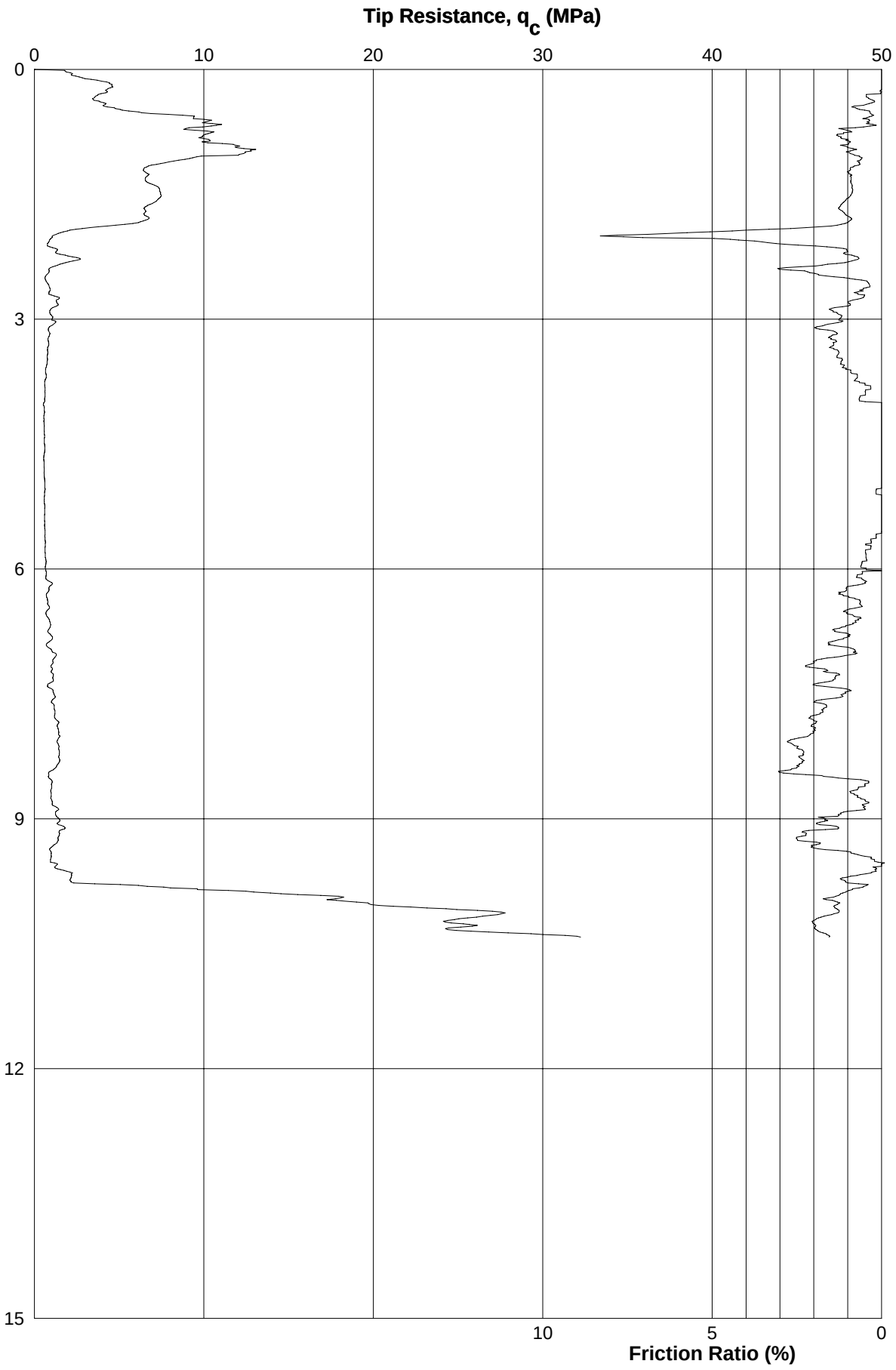
Job No:	4934		
CPT No:	209	Date:	27-9-07
Project:	Tonkin & Taylor Ltd	Operator:	J.Harvey
Location:	Jacks Point, Queenstown	Remark:	Effective Refusal

STANDARD CONE PENETROMETER TEST (CPT) INTERPRETIVE REPORT



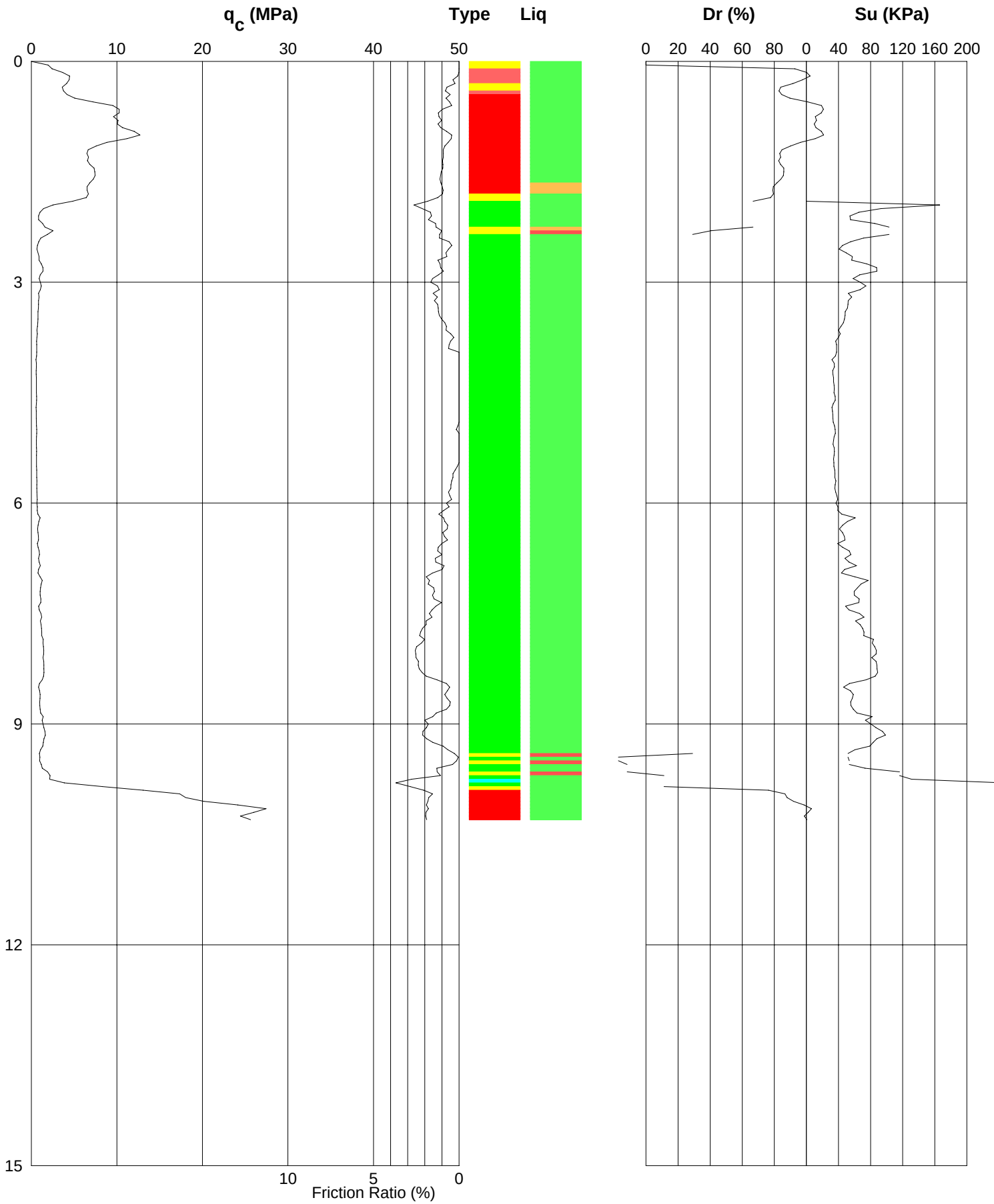
Job No:	4934		
CPT No:	209	Date:	27-9-07
Project:	Tonkin & Taylor Ltd	Operator:	J.Harvey
Location:	Jacks Point, Queenstown	Remark:	Effective Refusal

STANDARD CONE PENETROMETER TEST (CPT) REPORT



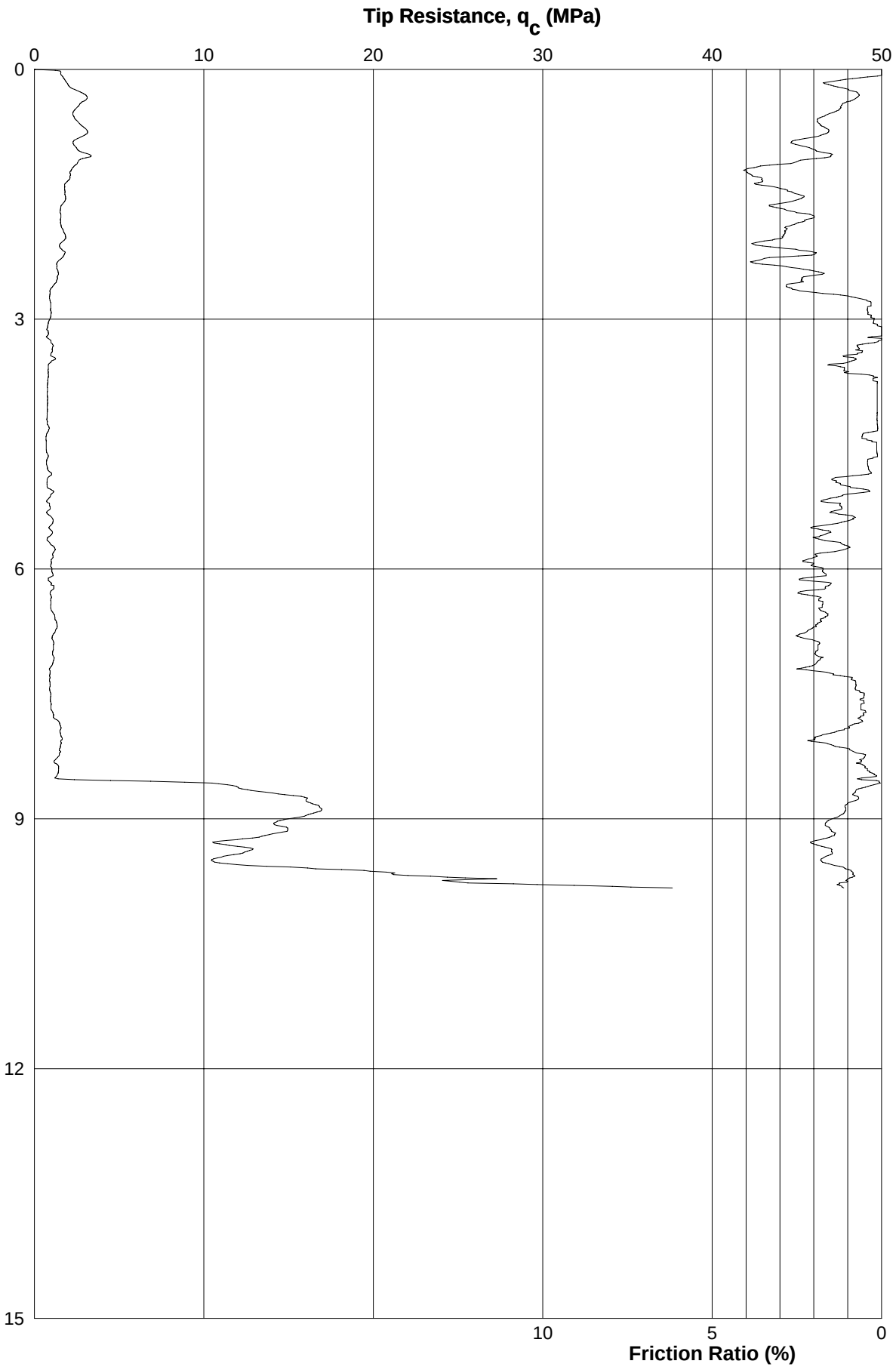
Job No:	4934		
CPT No:	210	Date:	26-9-07
Project:	Tonkin & Taylor Ltd	Operator:	J.Harvey
Location:	Jacks Point, Queenstown	Remark:	Effective Refusal

STANDARD CONE PENETROMETER TEST (CPT) INTERPRETIVE REPORT



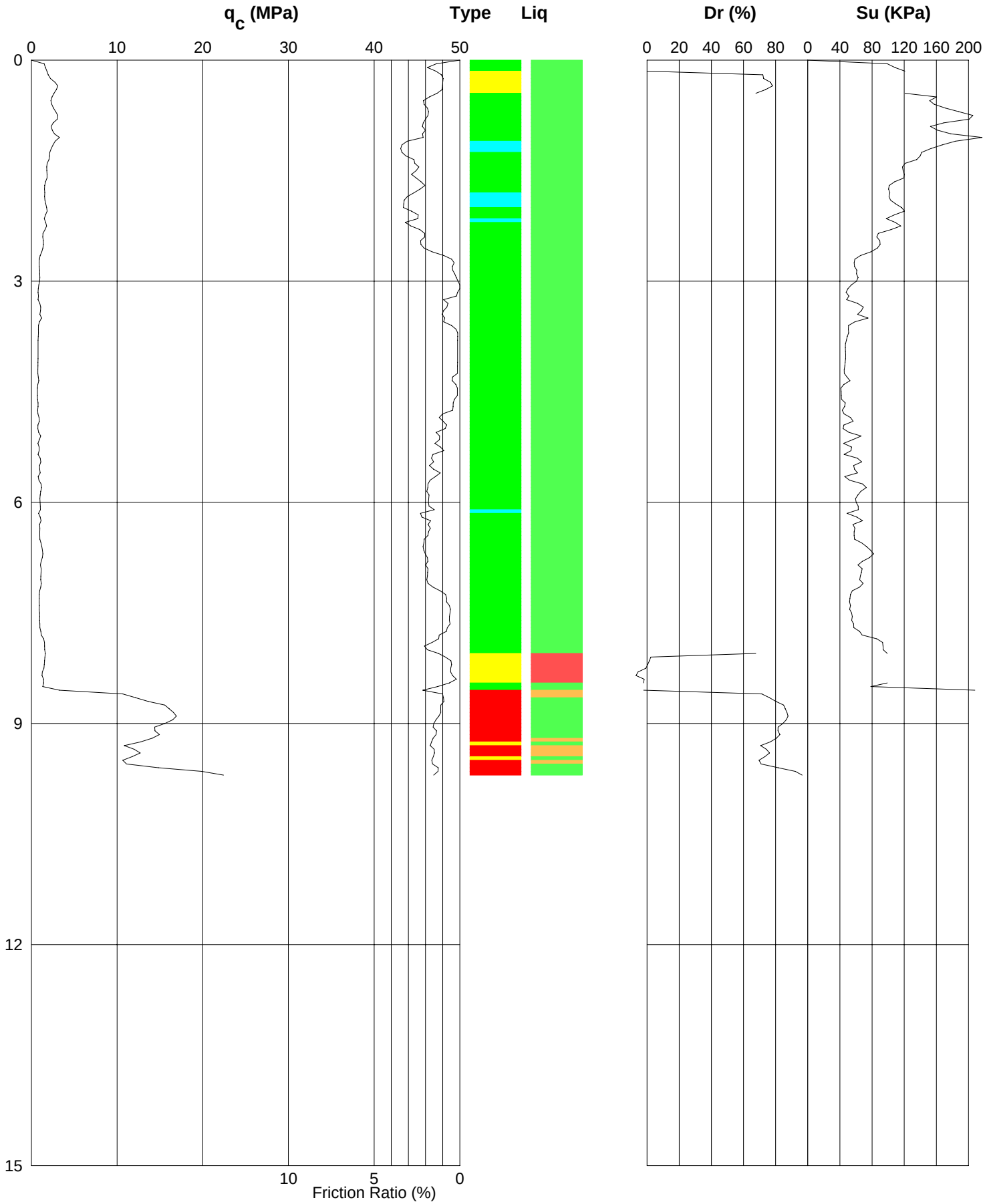
Job No:	4934		
CPT No:	210	Date:	26-9-07
Project:	Tonkin & Taylor Ltd	Operator:	J.Harvey
Location:	Jacks Point, Queenstown	Remark:	Effective Refusal

STANDARD CONE PENETROMETER TEST (CPT) REPORT



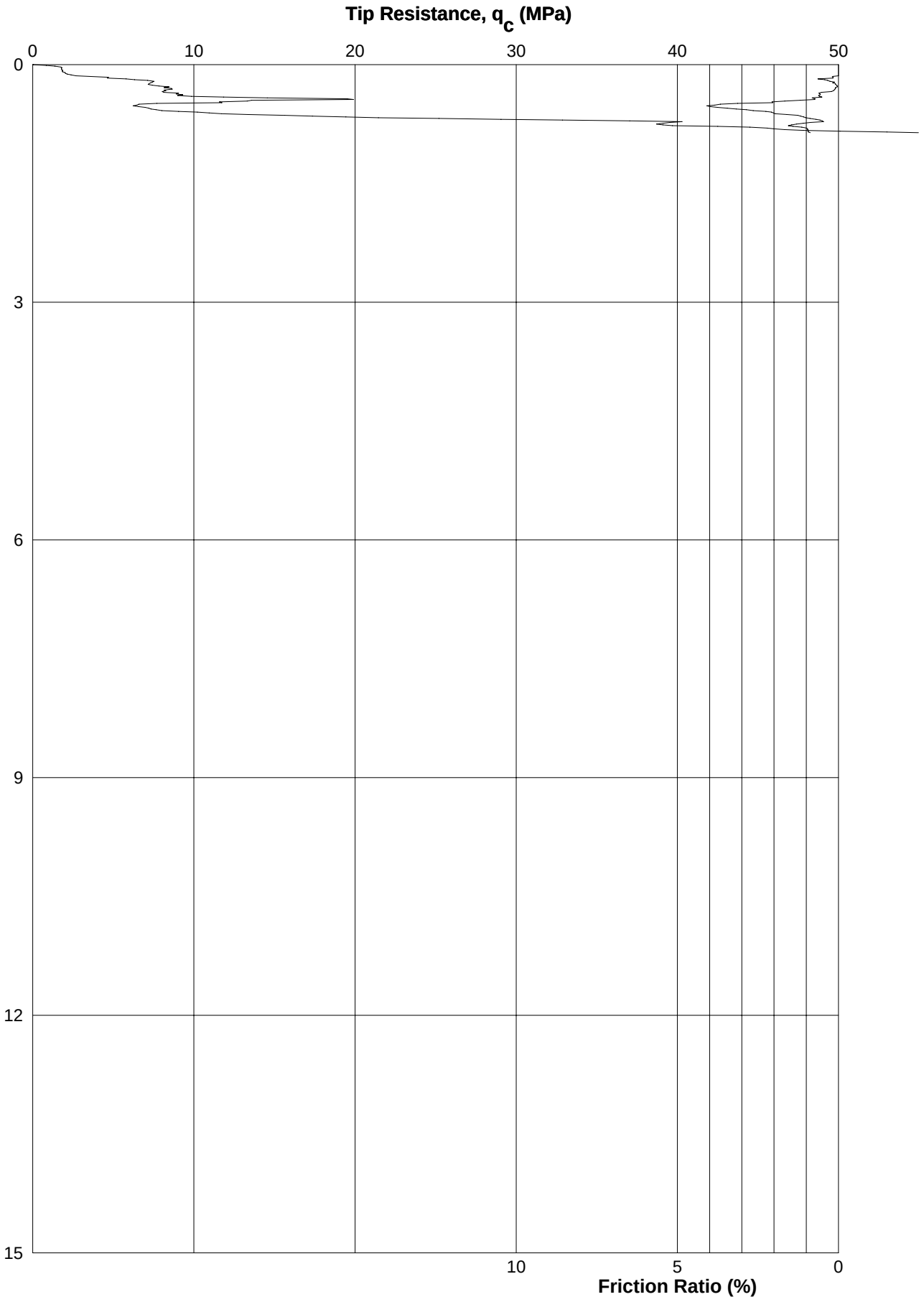
Job No:	4934		
CPT No:	211	Date:	27-9-07
Project:	Tonkin & Taylor Ltd	Operator:	J.Harvey
Location:	Jacks Point, Queenstown	Remark:	Effective Refusal

STANDARD CONE PENETROMETER TEST (CPT) INTERPRETIVE REPORT



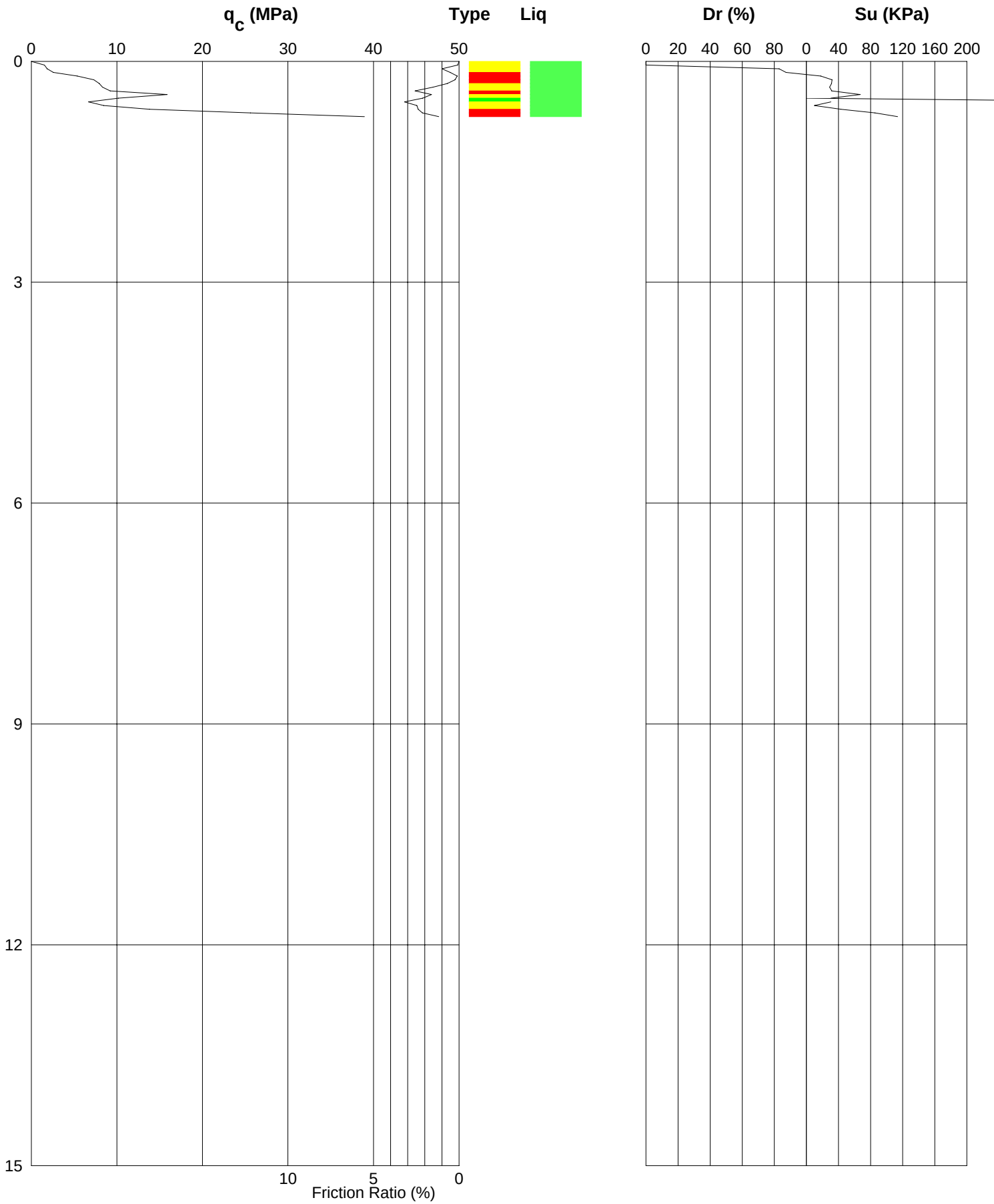
Job No:	4934		
CPT No:	211	Date:	27-9-07
Project:	Tonkin & Taylor Ltd	Operator:	J.Harvey
Location:	Jacks Point, Queenstown	Remark:	Effective Refusal

STANDARD CONE PENETROMETER TEST (CPT) REPORT



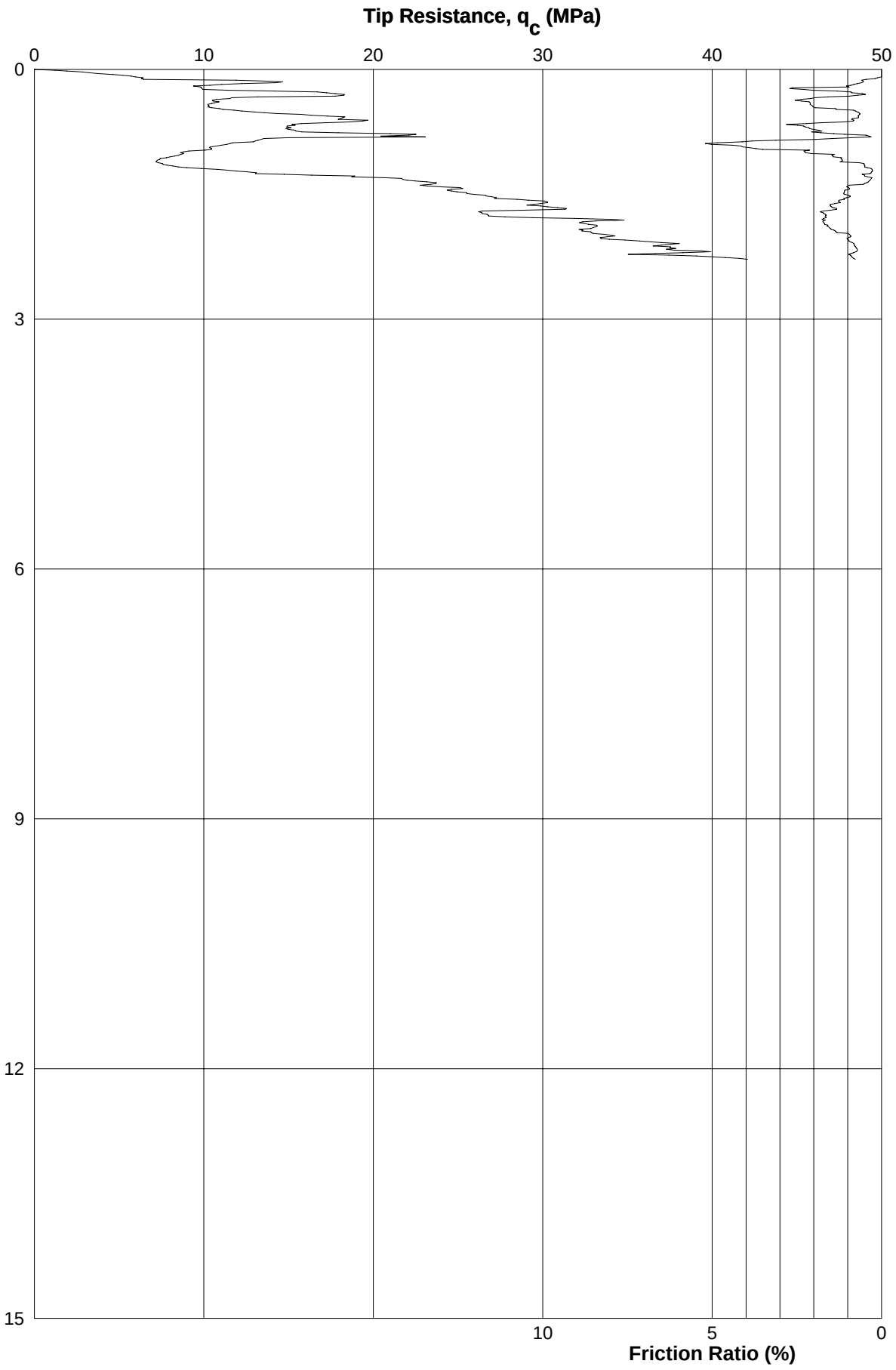
Job No:	4934		
CPT No:	212	Date:	26-9-07
Project:	Tonkin & Taylor Ltd	Operator:	J.Harvey
Location:	Jacks Point, Queenstown	Remark:	Effective Refusal

STANDARD CONE PENETROMETER TEST (CPT) INTERPRETIVE REPORT



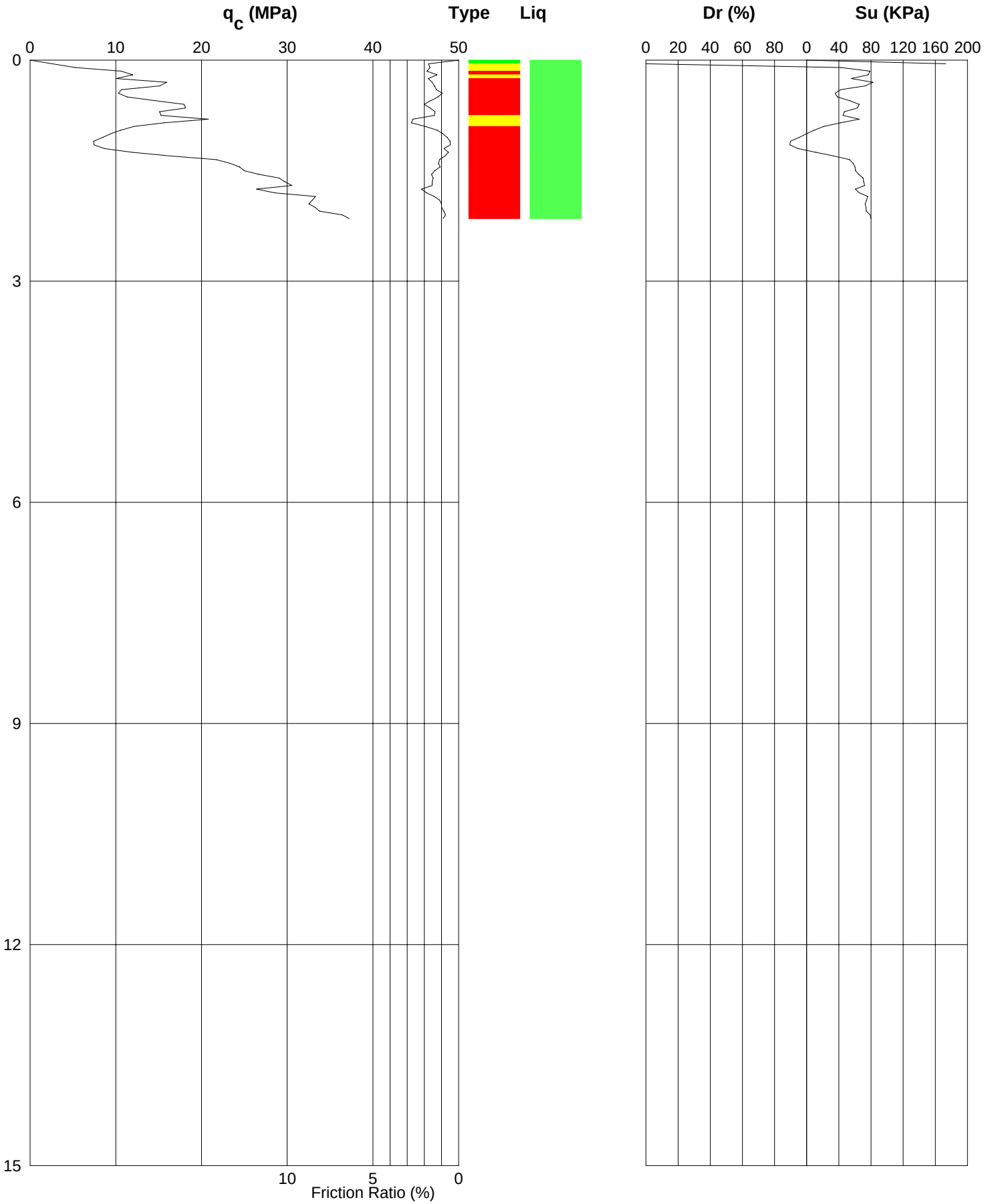
Job No:	4934		
CPT No:	212	Date:	26-9-07
Project:	Tonkin & Taylor Ltd	Operator:	J.Harvey
Location:	Jacks Point, Queenstown	Remark:	Effective Refusal

STANDARD CONE PENETROMETER TEST (CPT) REPORT



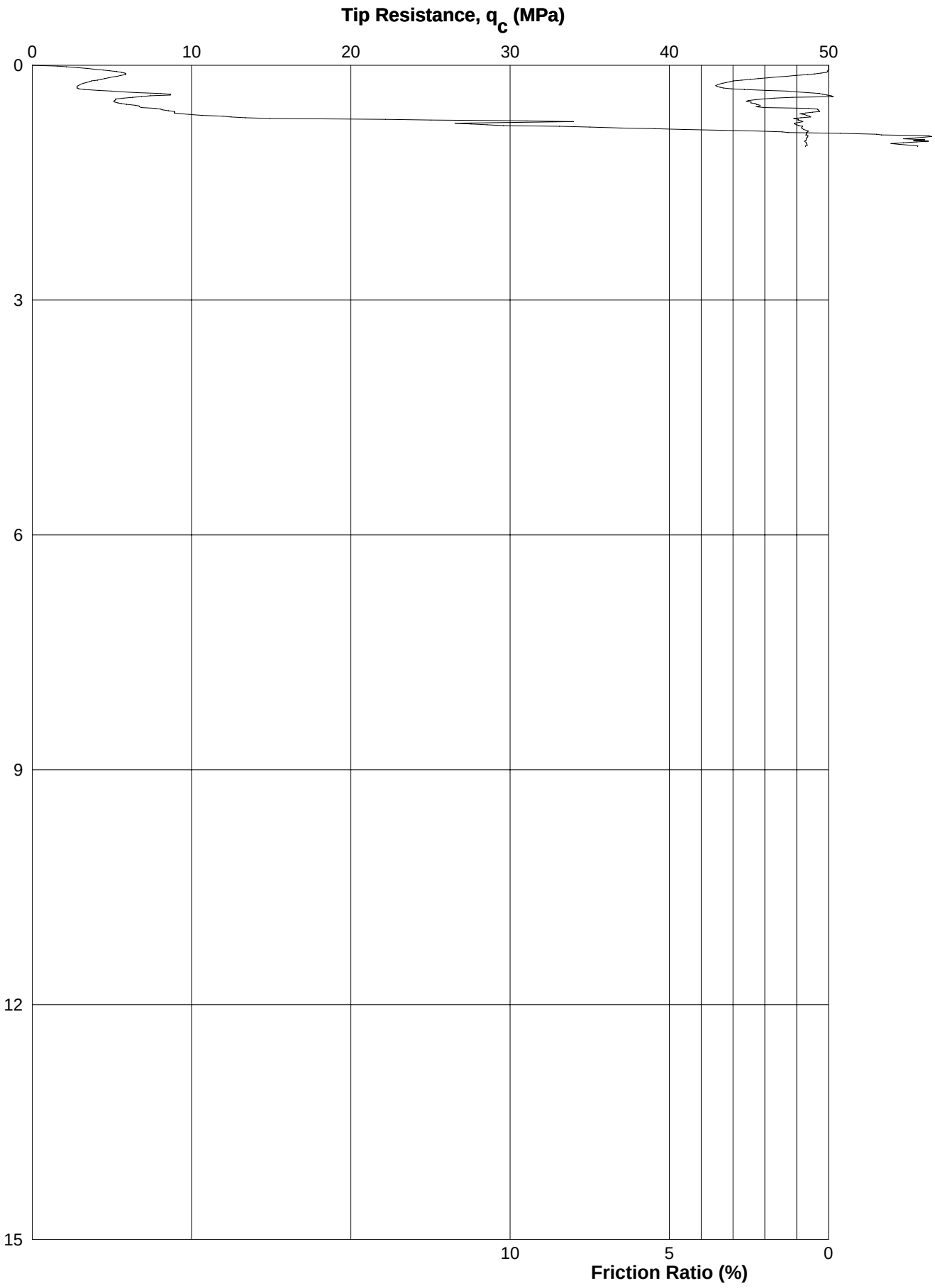
Job No:	4934		
CPT No:	213	Date:	27-9-07
Project:	Tonkin & Taylor Ltd	Operator:	J.Harvey
Location:	Jacks Point, Queenstown	Remark:	Effective Refusal

STANDARD CONE PENETROMETER TEST (CPT) INTERPRETIVE REPORT



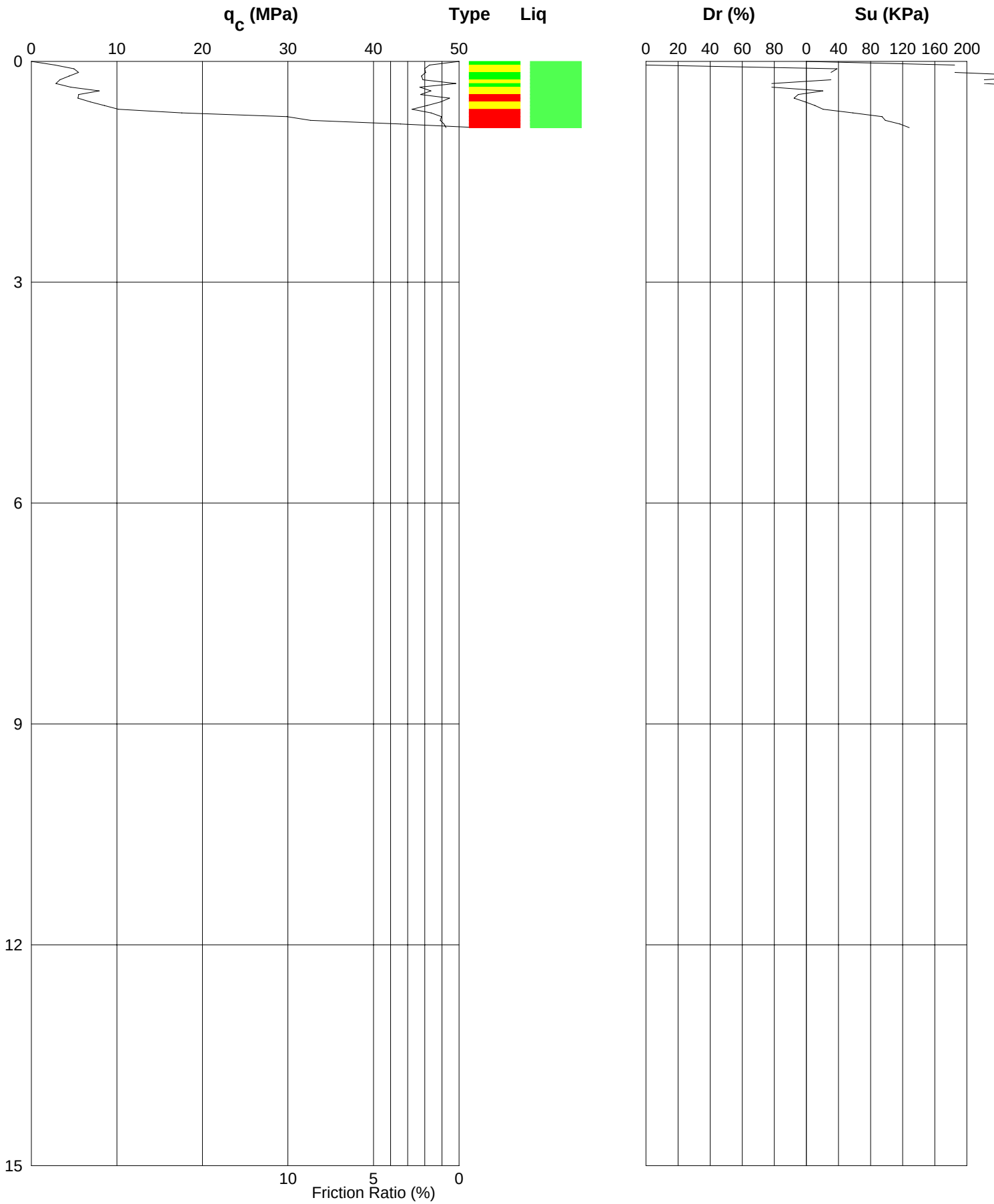
Job No:	4934		
CPT No:	213	Date:	27-9-07
Project:	Tonkin & Taylor Ltd	Operator:	J.Harvey
Location:	Jacks Point, Queenstown	Remark:	Effective Refusal

STANDARD CONE PENETROMETER TEST (CPT) REPORT



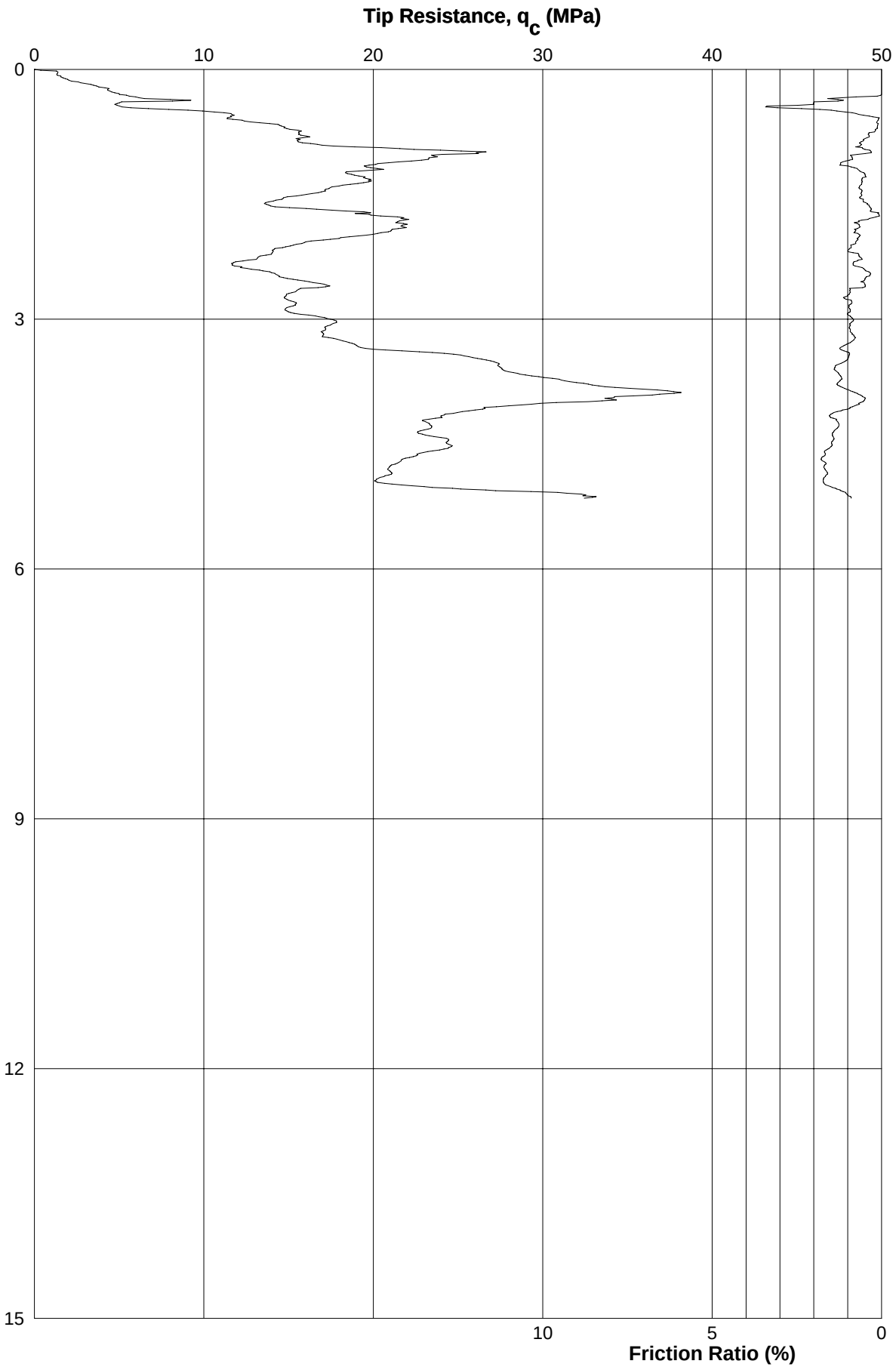
Job No:	4934		
CPT No:	214	Date:	27-9-07
Project:	Tonkin & Taylor Ltd	Operator:	J.Harvey
Location:	Jacks Point, Queenstown	Remark:	Effective Refusal

STANDARD CONE PENETROMETER TEST (CPT) INTERPRETIVE REPORT



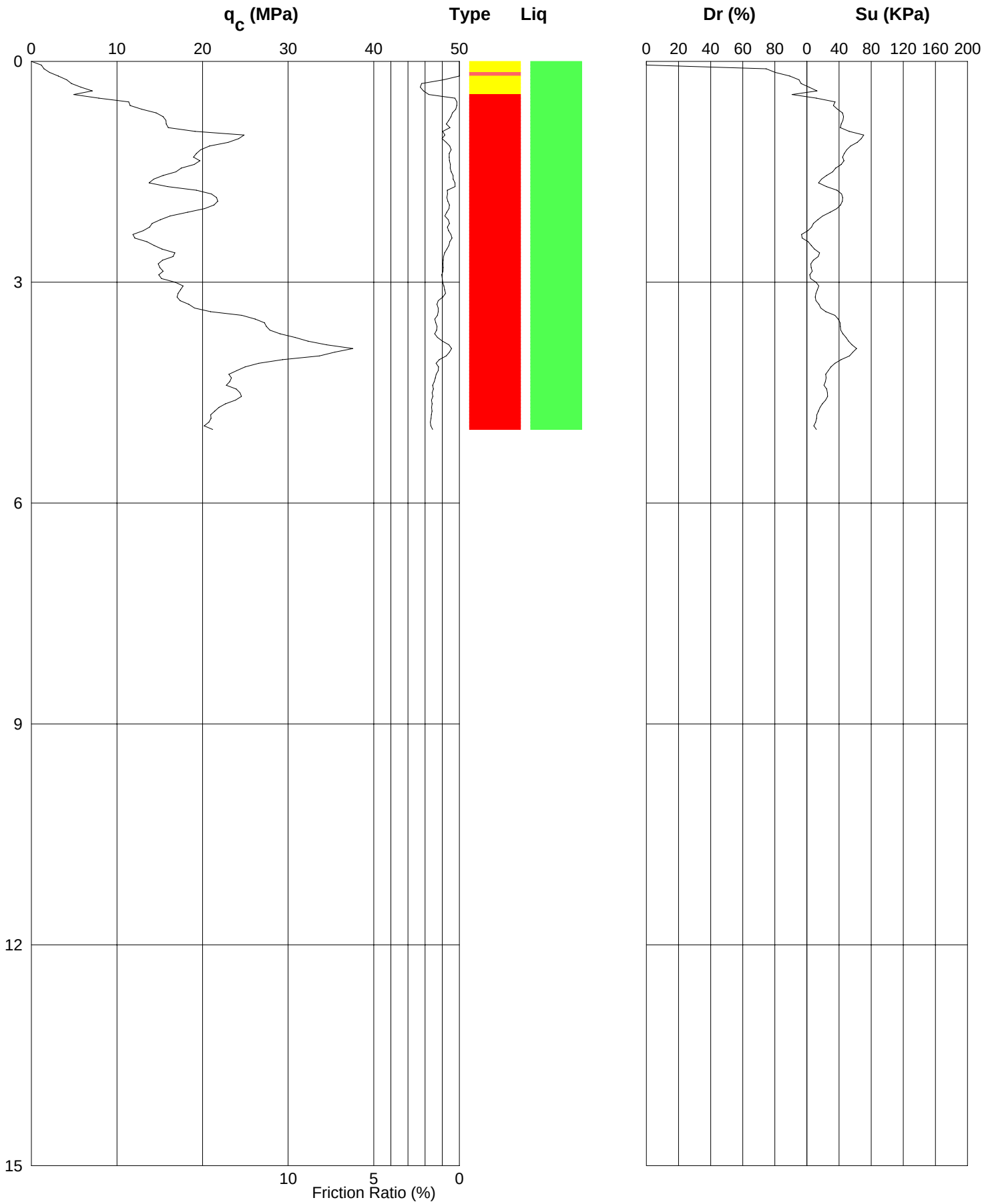
Job No:	4934		
CPT No:	214	Date:	27-9-07
Project:	Tonkin & Taylor Ltd	Operator:	J.Harvey
Location:	Jacks Point, Queenstown	Remark:	Effective Refusal

STANDARD CONE PENETROMETER TEST (CPT) REPORT



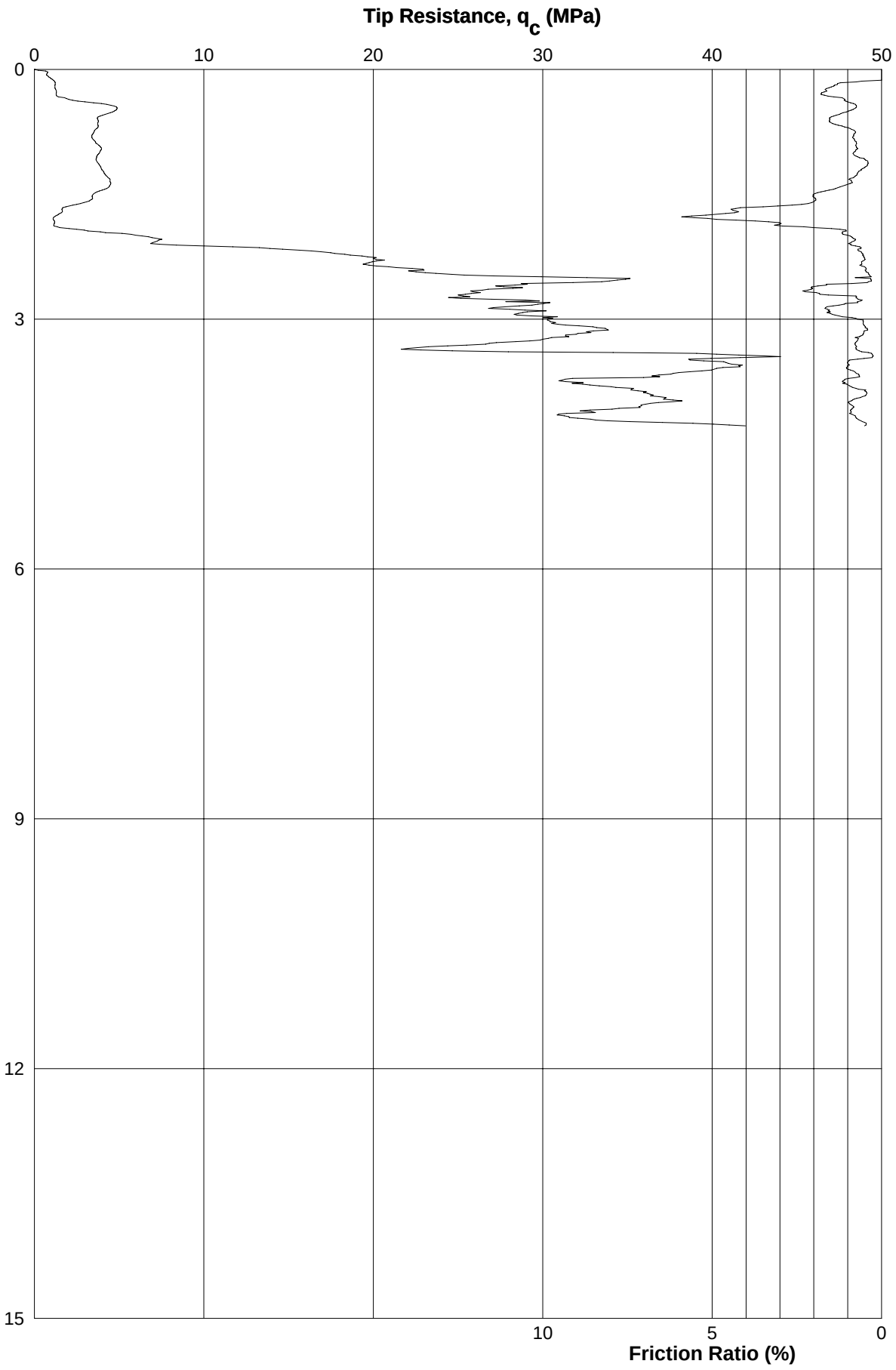
Job No:	4934		
CPT No:	215	Date:	26-9-07
Project:	Tonkin & Taylor Ltd	Operator:	J.Harvey
Location:	Jacks Point, Queenstown	Remark:	Effective Refusal

STANDARD CONE PENETROMETER TEST (CPT) INTERPRETIVE REPORT



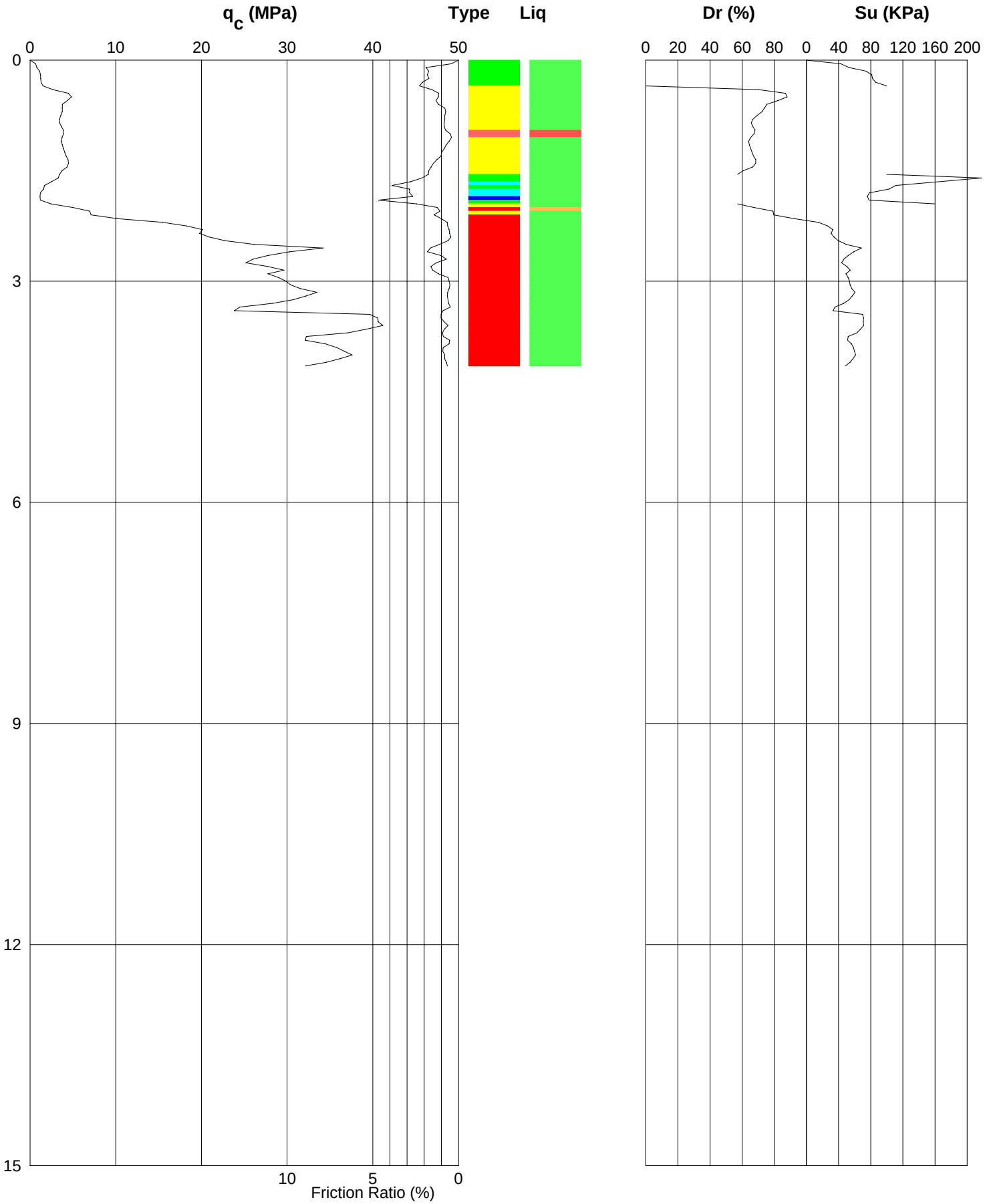
Job No:	4934		
CPT No:	215	Date:	26-9-07
Project:	Tonkin & Taylor Ltd	Operator:	J.Harvey
Location:	Jacks Point, Queenstown	Remark:	Effective Refusal

STANDARD CONE PENETROMETER TEST (CPT) REPORT



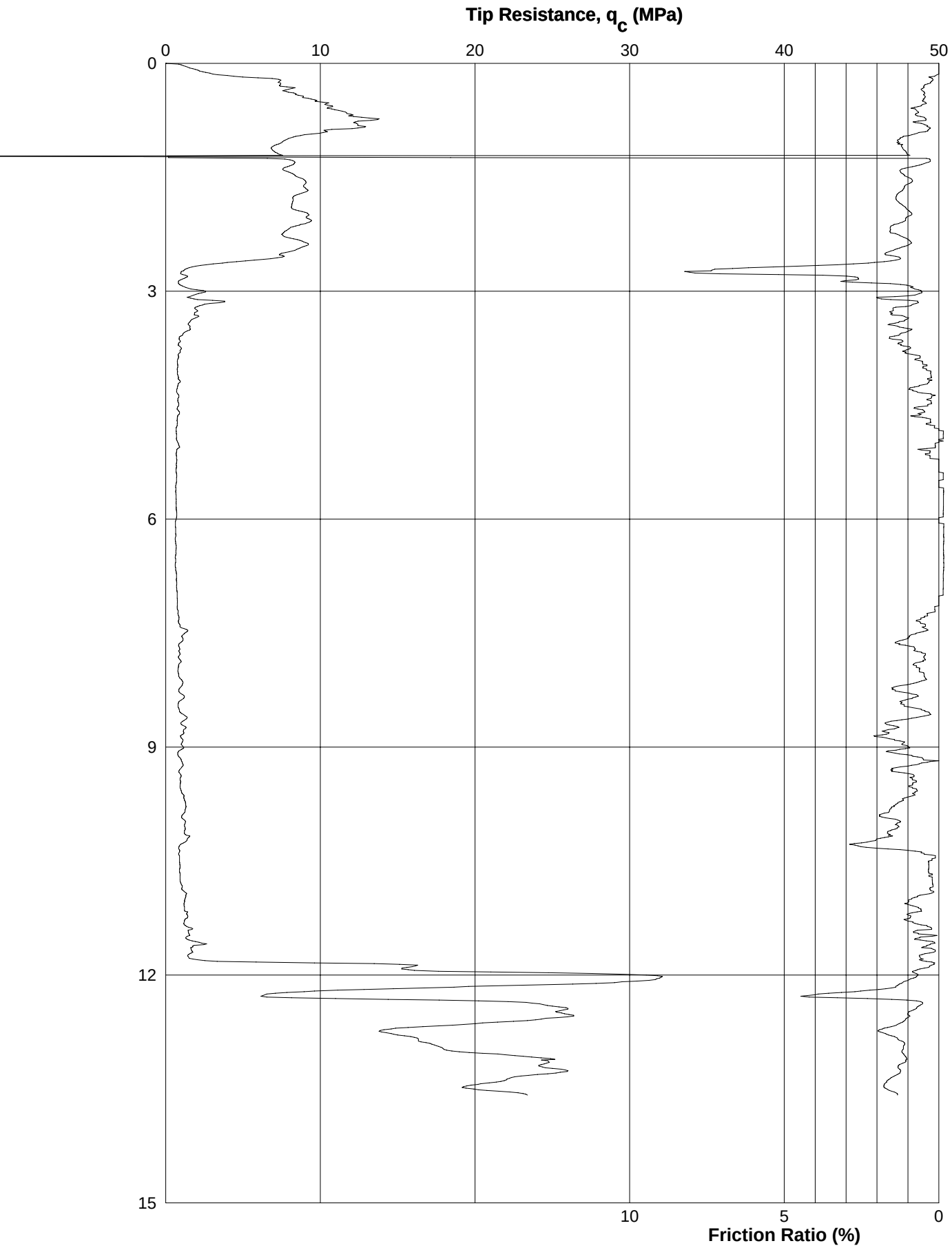
Job No:	4934		
CPT No:	216	Date:	26-9-07
Project:	Tonkin & Taylor Ltd	Operator:	J.Harvey
Location:	Jacks Point, Queenstown	Remark:	Effective Refusal

STANDARD CONE PENETROMETER TEST (CPT) INTERPRETIVE REPORT



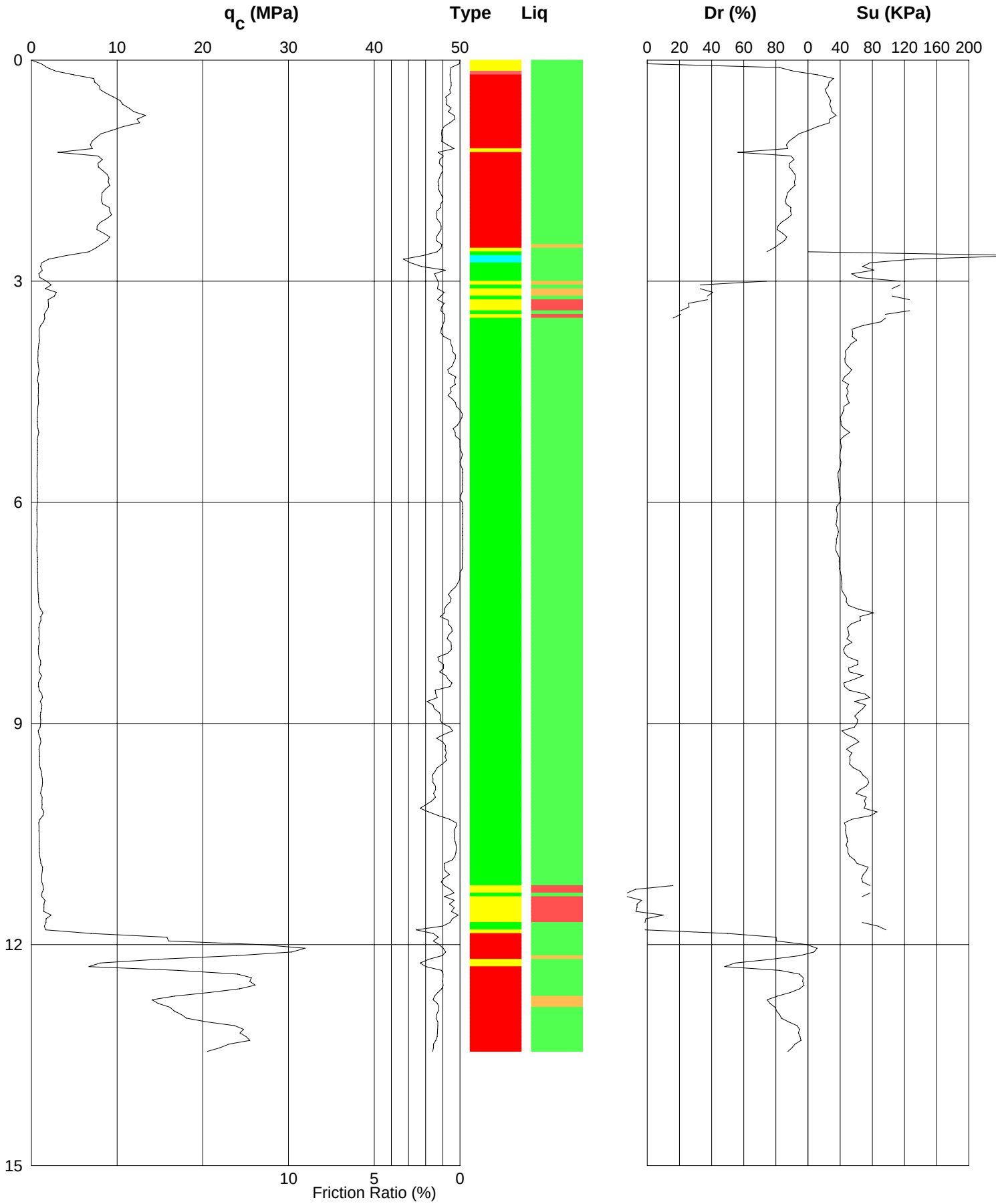
Job No:	4934		
CPT No:	216	Date:	26-9-07
Project:	Tonkin & Taylor Ltd	Operator:	J.Harvey
Location:	Jacks Point, Queenstown	Remark:	Effective Refusal

STANDARD CONE PENETROMETER TEST (CPT) REPORT



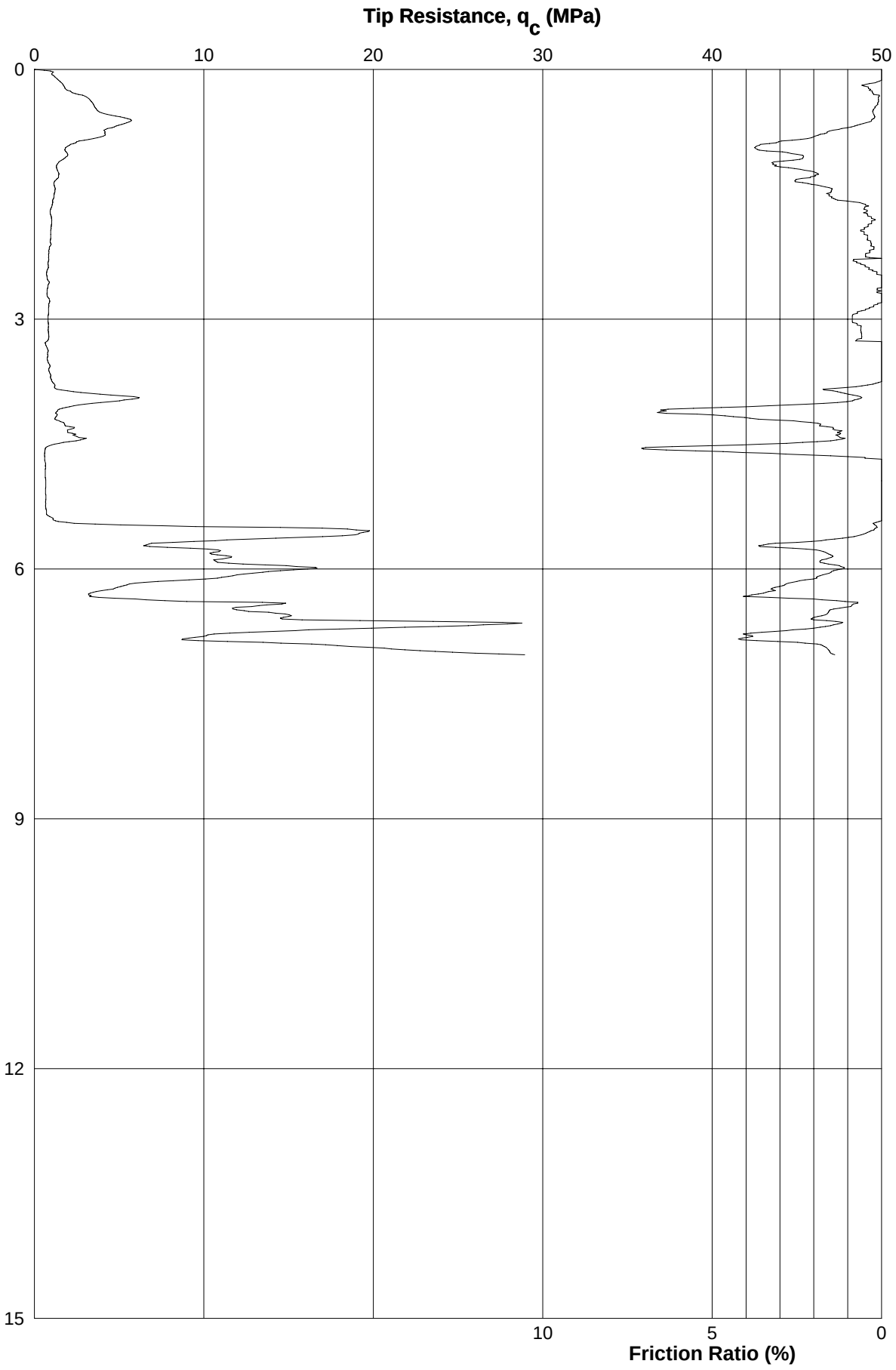
Job No:	4934		
CPT No:	217	Date:	26-9-07
Project:	Tonkin & Taylor Ltd	Operator:	J.Harvey
Location:	Jacks Point, Queenstown	Remark:	Effective Refusal

STANDARD CONE PENETROMETER TEST (CPT) INTERPRETIVE REPORT



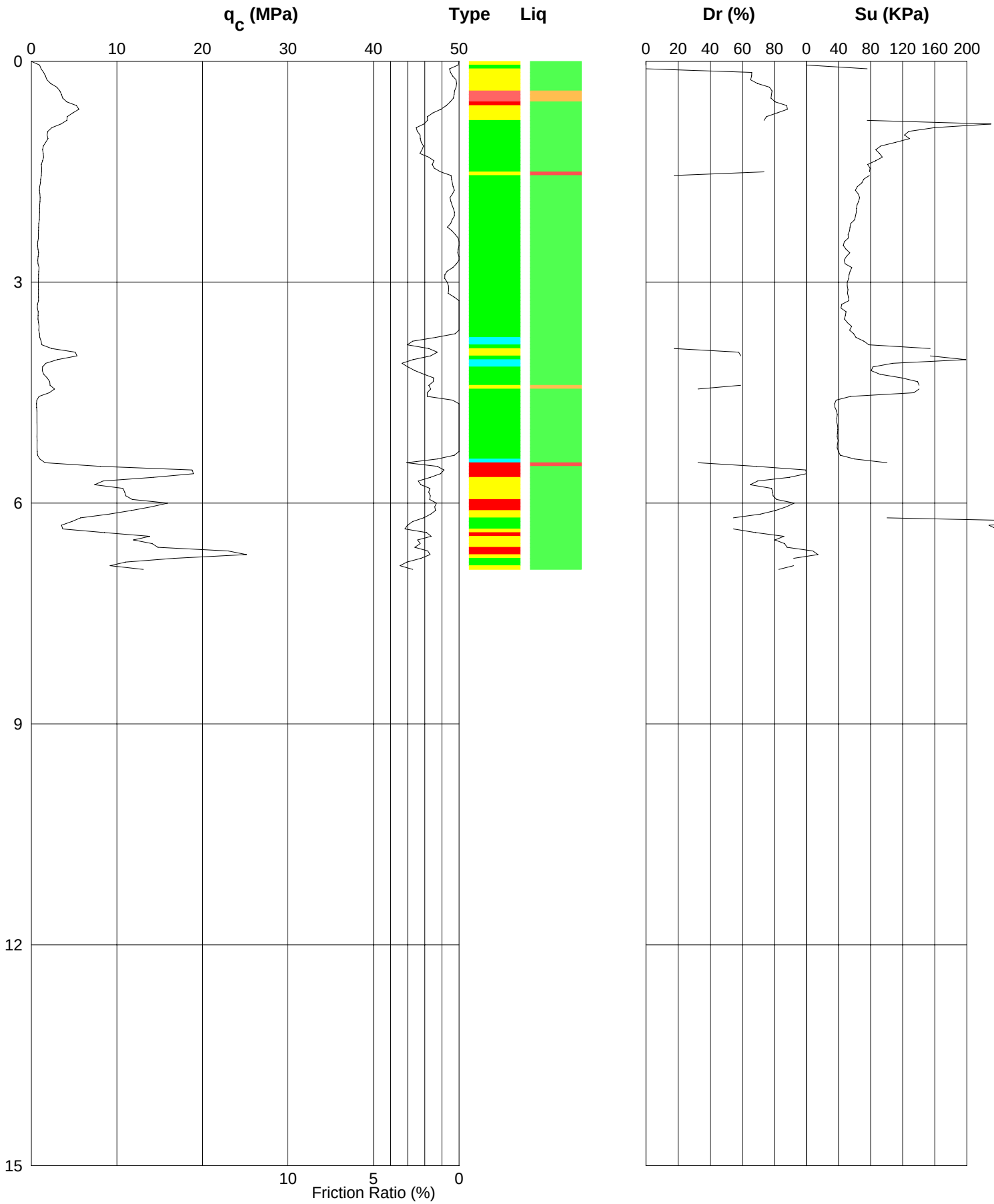
Job No:	4934		
CPT No:	217	Date:	26-9-07
Project:	Tonkin & Taylor Ltd	Operator:	J.Harvey
Location:	Jacks Point, Queenstown	Remark:	Effective Refusal

STANDARD CONE PENETROMETER TEST (CPT) REPORT



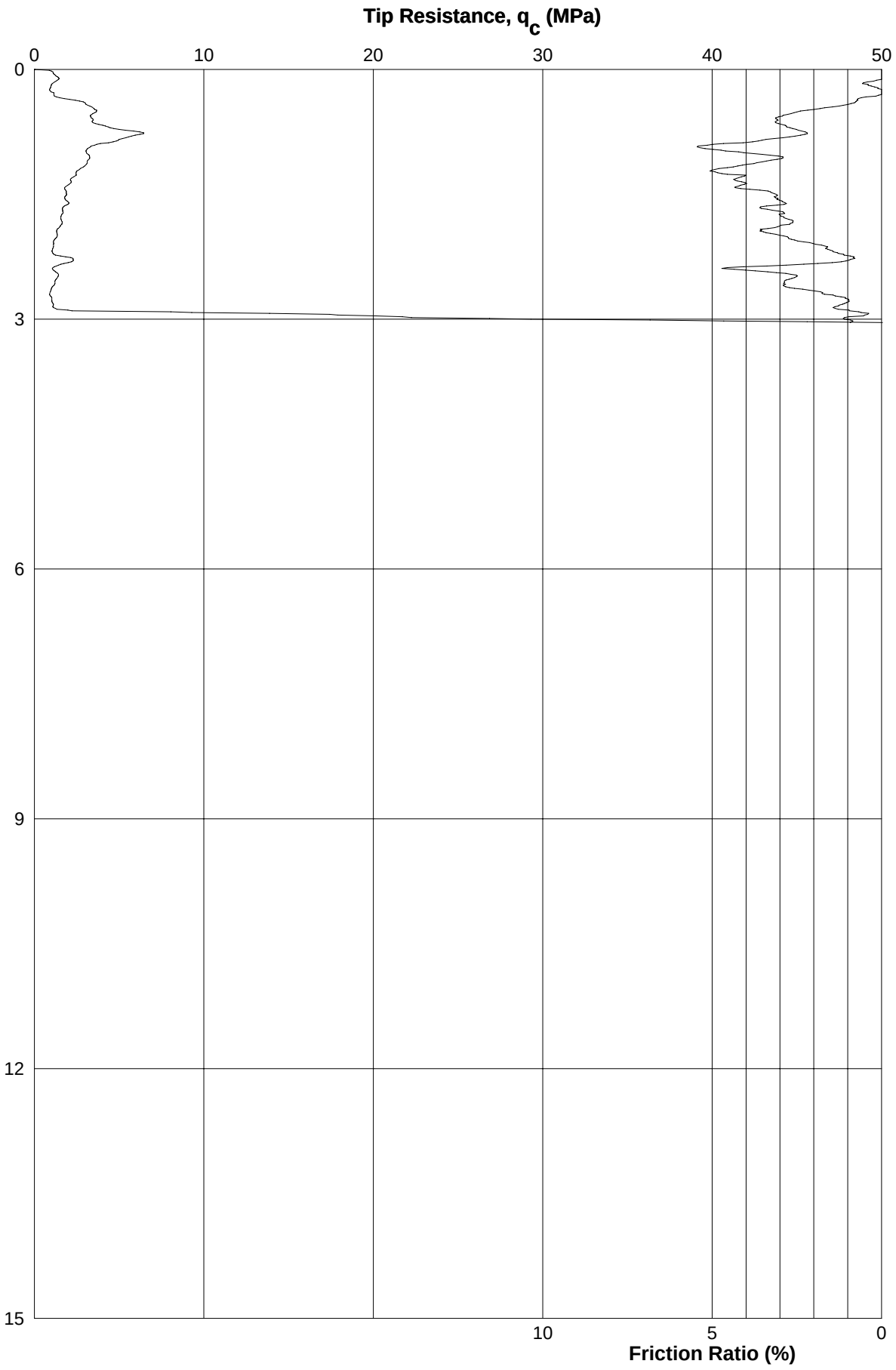
Job No:	4934		
CPT No:	218	Date:	26-9-07
Project:	Tonkin & Taylor Ltd	Operator:	J.Harvey
Location:	Jacks Point, Queenstown	Remark:	Effective Refusal

STANDARD CONE PENETROMETER TEST (CPT) INTERPRETIVE REPORT



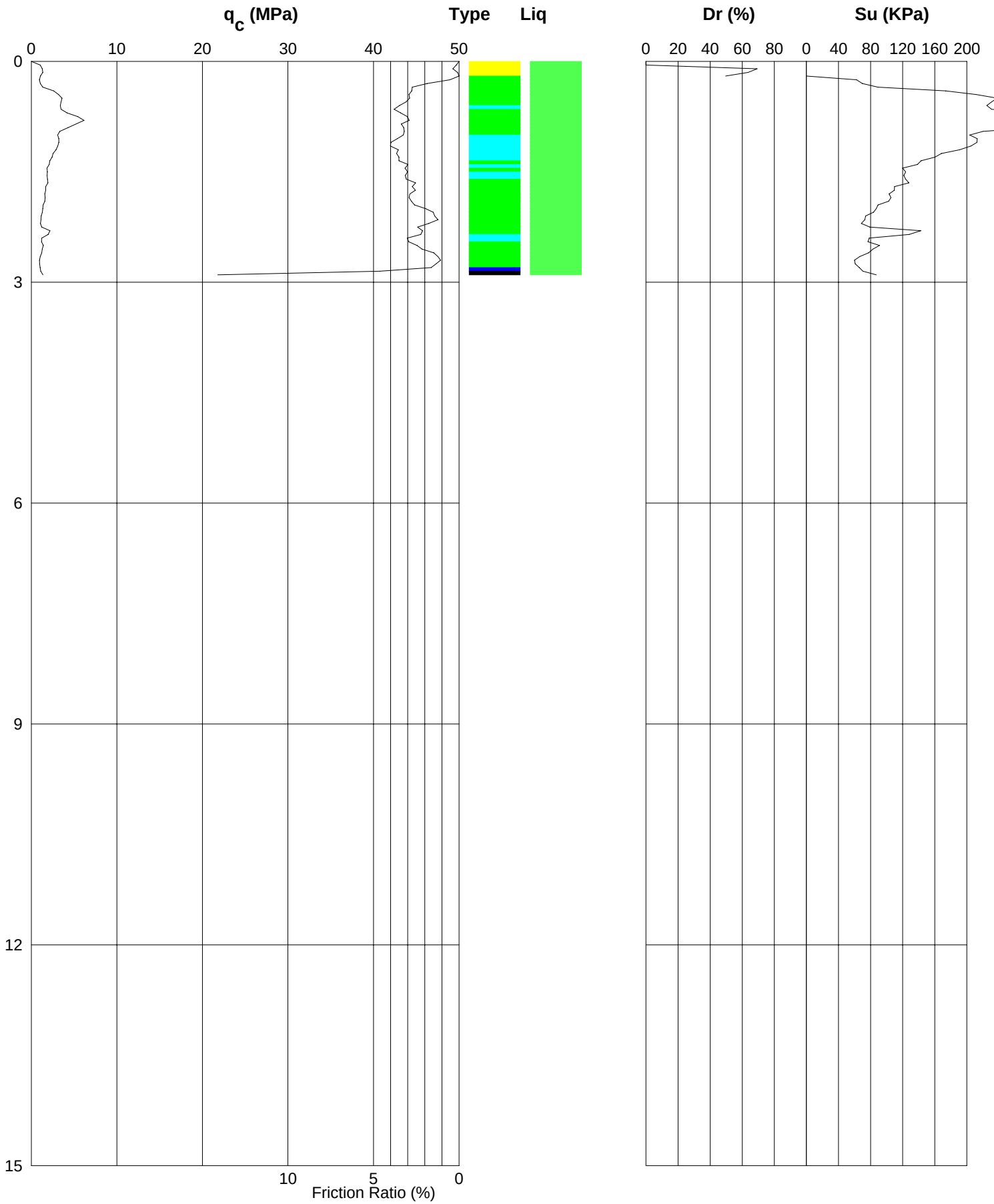
Job No:	4934		
CPT No:	218	Date:	26-9-07
Project:	Tonkin & Taylor Ltd	Operator:	J.Harvey
Location:	Jacks Point, Queenstown	Remark:	Effective Refusal

STANDARD CONE PENETROMETER TEST (CPT) REPORT



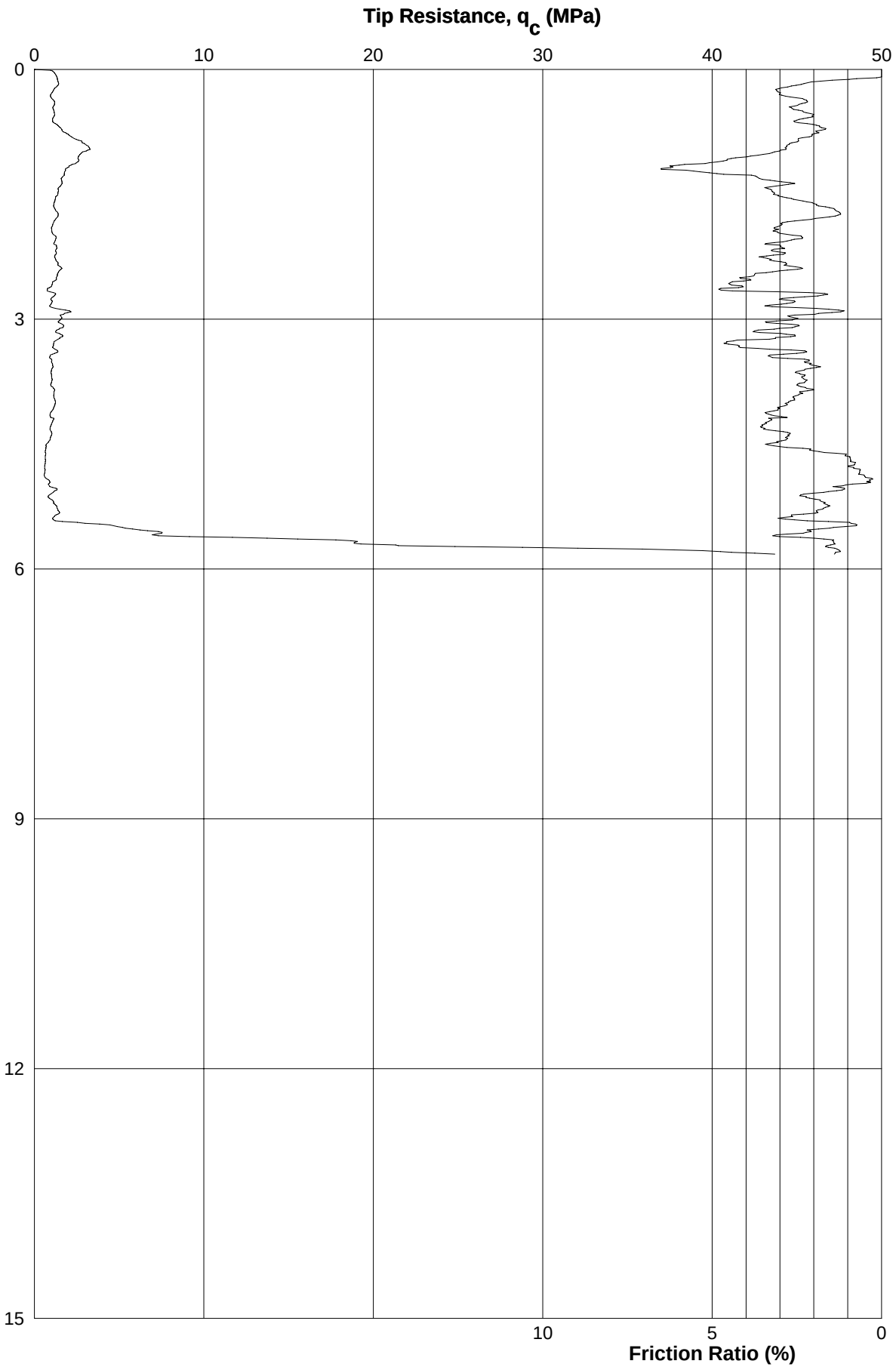
Job No:	4934		
CPT No:	219	Date:	26-9-07
Project:	Tonkin & Taylor Ltd	Operator:	J.Harvey
Location:	Jacks Point, Queenstown	Remark:	Effective Refusal

STANDARD CONE PENETROMETER TEST (CPT) INTERPRETIVE REPORT



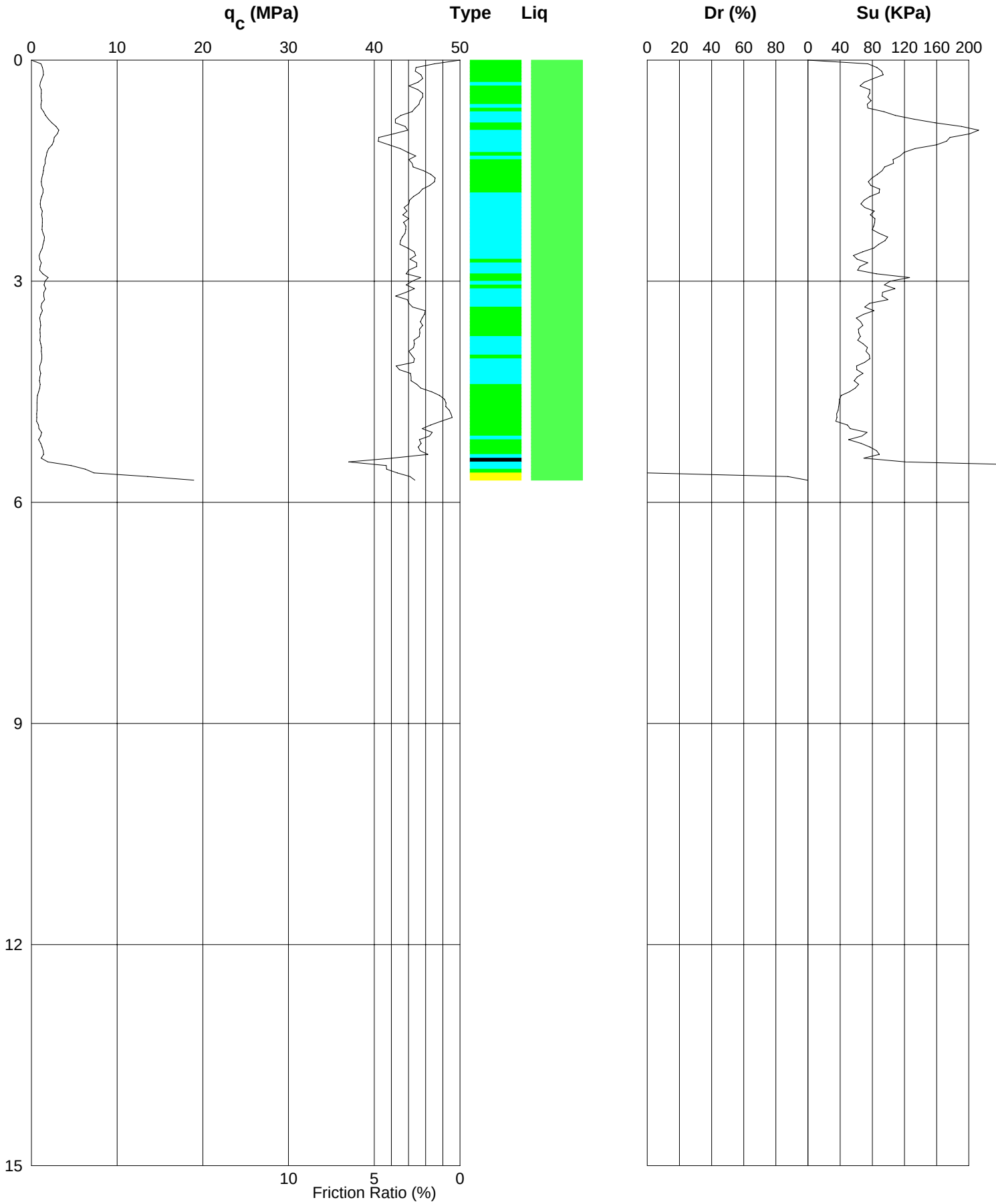
Job No:	4934		
CPT No:	219	Date:	26-9-07
Project:	Tonkin & Taylor Ltd	Operator:	J.Harvey
Location:	Jacks Point, Queenstown	Remark:	Effective Refusal

STANDARD CONE PENETROMETER TEST (CPT) REPORT



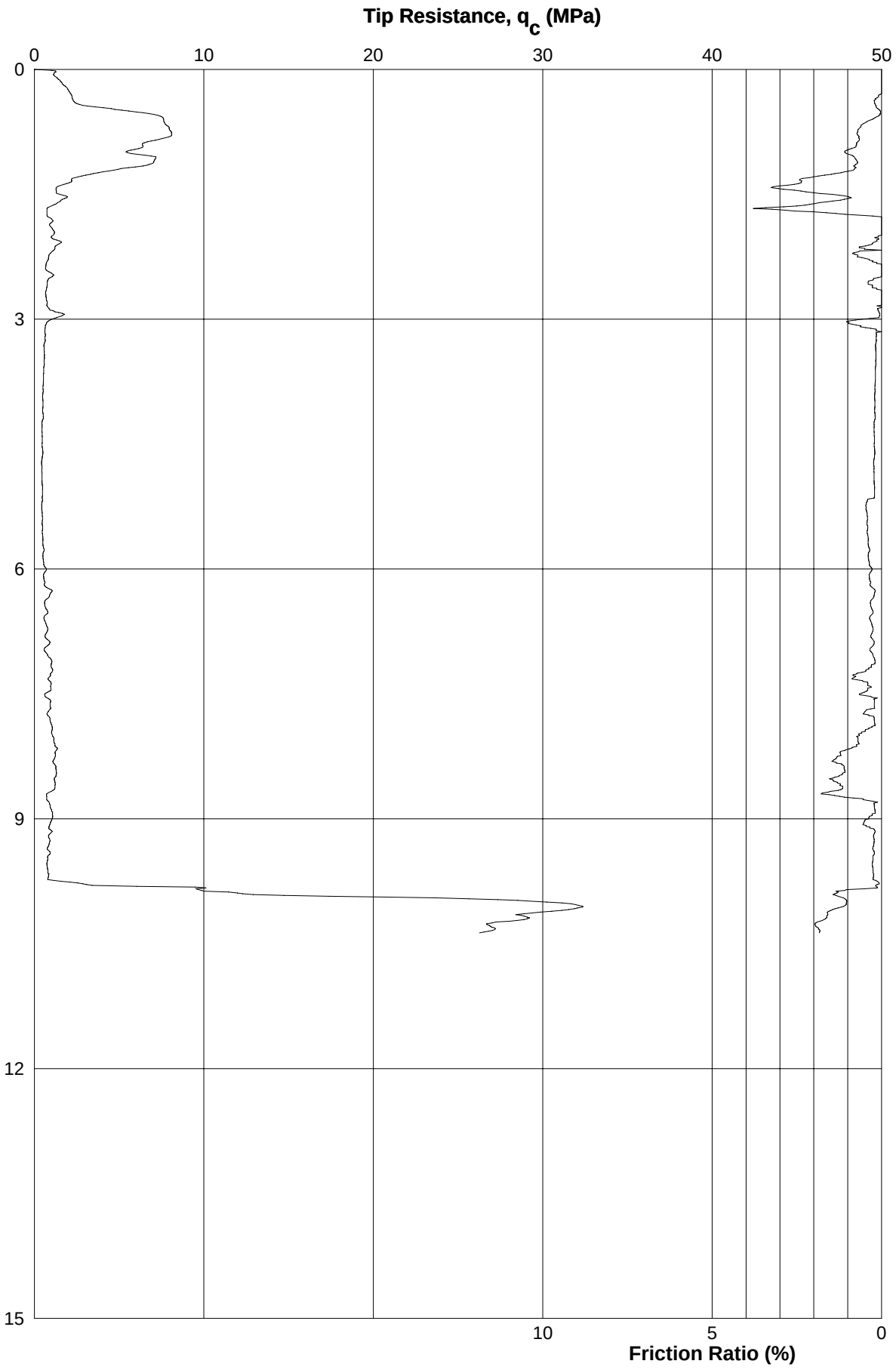
Job No:	4934		
CPT No:	220	Date:	27-9-07
Project:	Tonkin & Taylor Ltd	Operator:	J.Harvey
Location:	Jacks Point, Queenstown	Remark:	Effective Refusal

STANDARD CONE PENETROMETER TEST (CPT) INTERPRETIVE REPORT



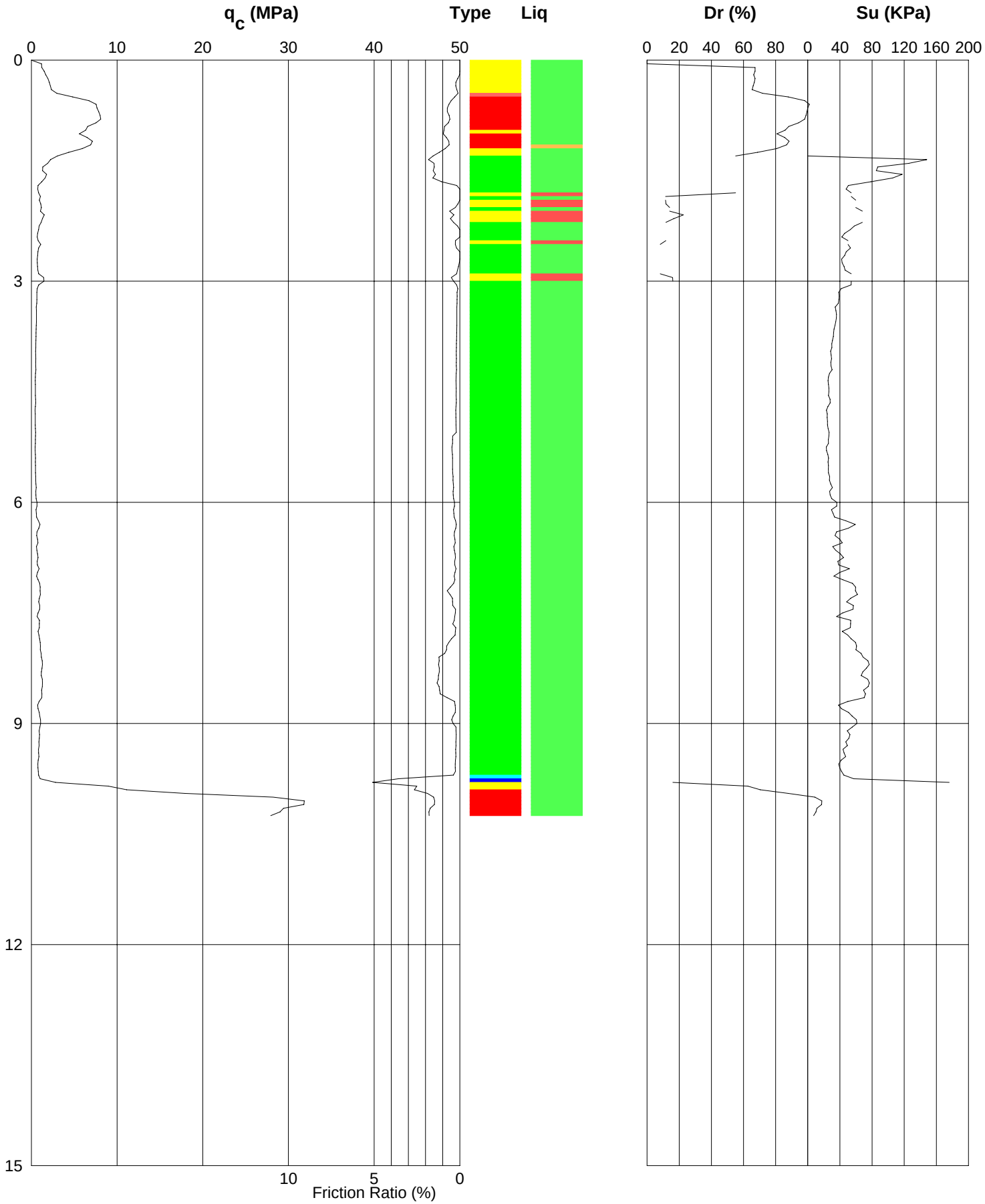
Job No:	4934		
CPT No:	220	Date:	27-9-07
Project:	Tonkin & Taylor Ltd	Operator:	J.Harvey
Location:	Jacks Point, Queenstown	Remark:	Effective Refusal

STANDARD CONE PENETROMETER TEST (CPT) REPORT



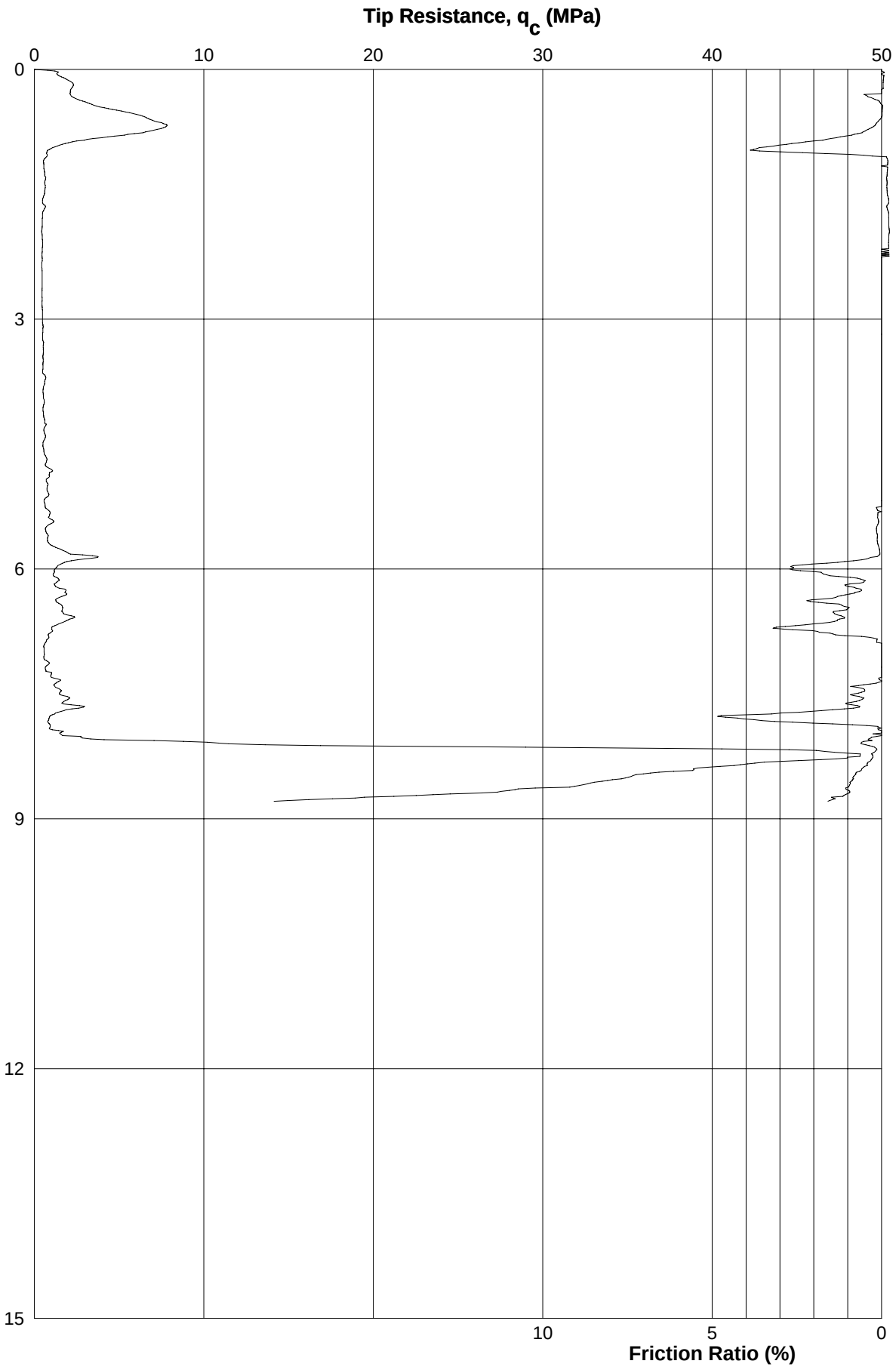
Job No:	4934		
CPT No:	221	Date:	27-9-07
Project:	Tonkin & Taylor Ltd	Operator:	J.Harvey
Location:	Jacks Point, Queenstown	Remark:	Effective Refusal

STANDARD CONE PENETROMETER TEST (CPT) INTERPRETIVE REPORT



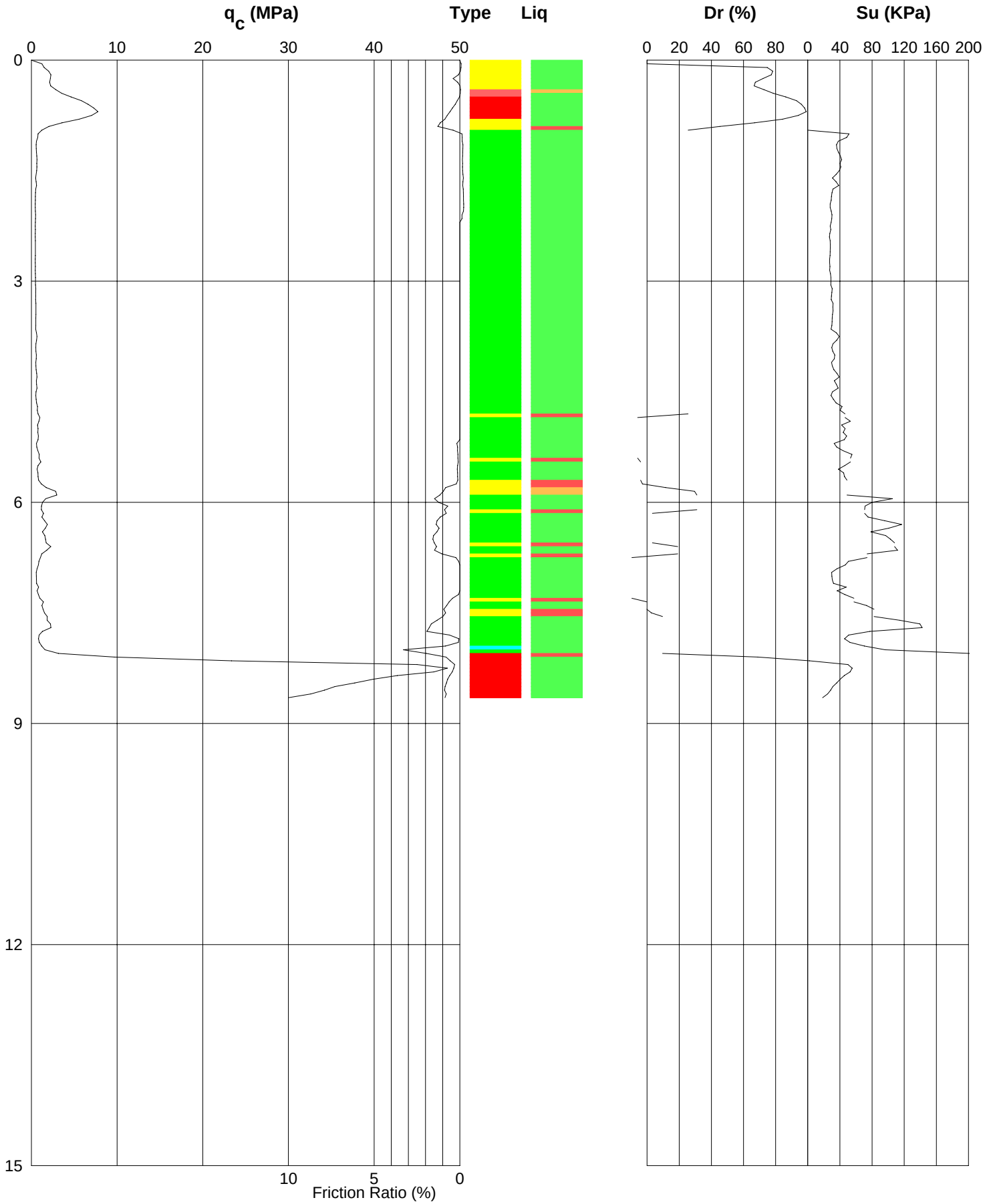
Job No:	4934		
CPT No:	221	Date:	27-9-07
Project:	Tonkin & Taylor Ltd	Operator:	J.Harvey
Location:	Jacks Point, Queenstown	Remark:	Effective Refusal

STANDARD CONE PENETROMETER TEST (CPT) REPORT



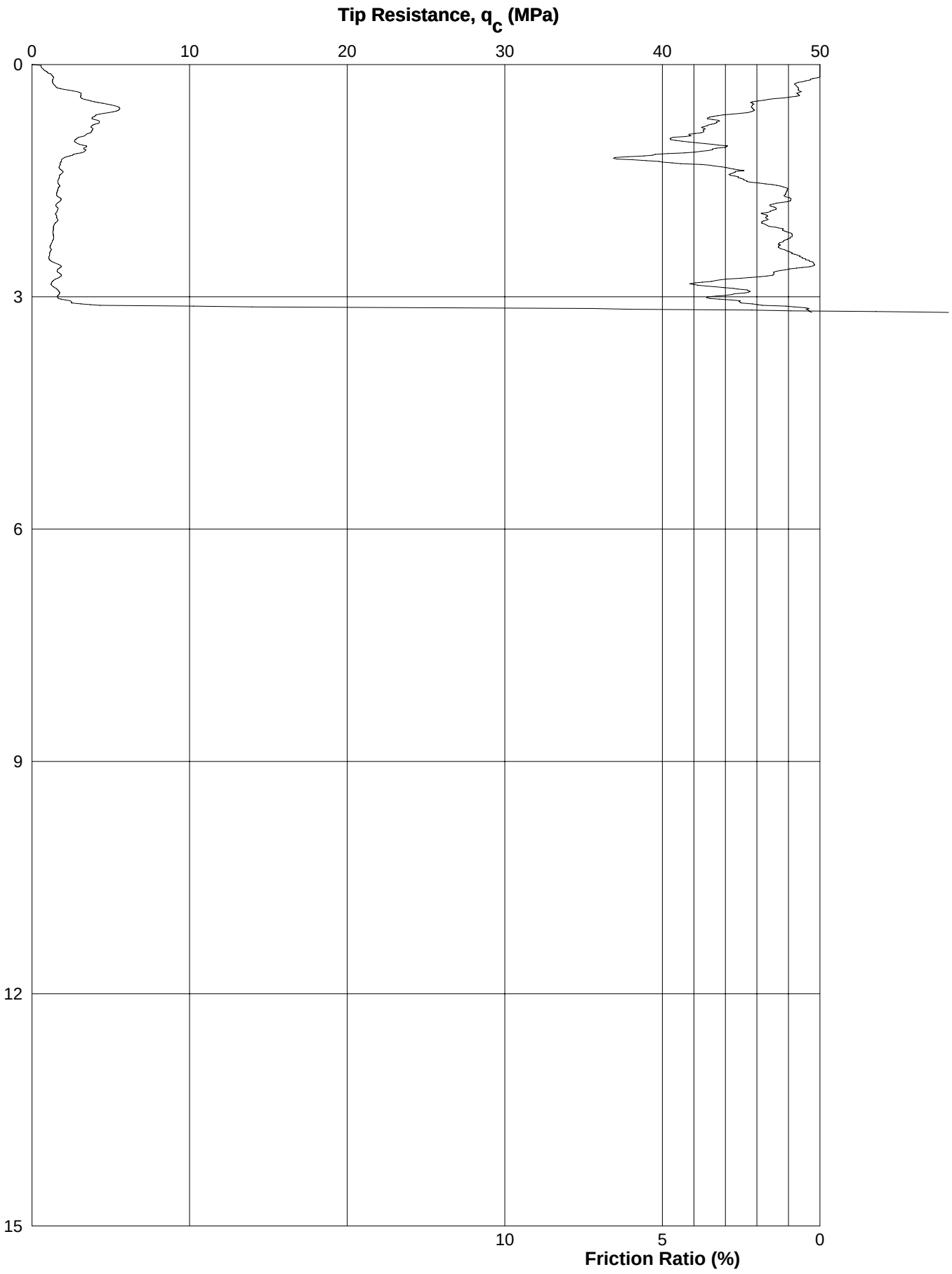
Job No:	4934		
CPT No:	222	Date:	28-9-07
Project:	Tonkin & Taylor Ltd	Operator:	J.Harvey
Location:	Jacks Point, Queenstown	Remark:	Effective Refusal

STANDARD CONE PENETROMETER TEST (CPT) INTERPRETIVE REPORT



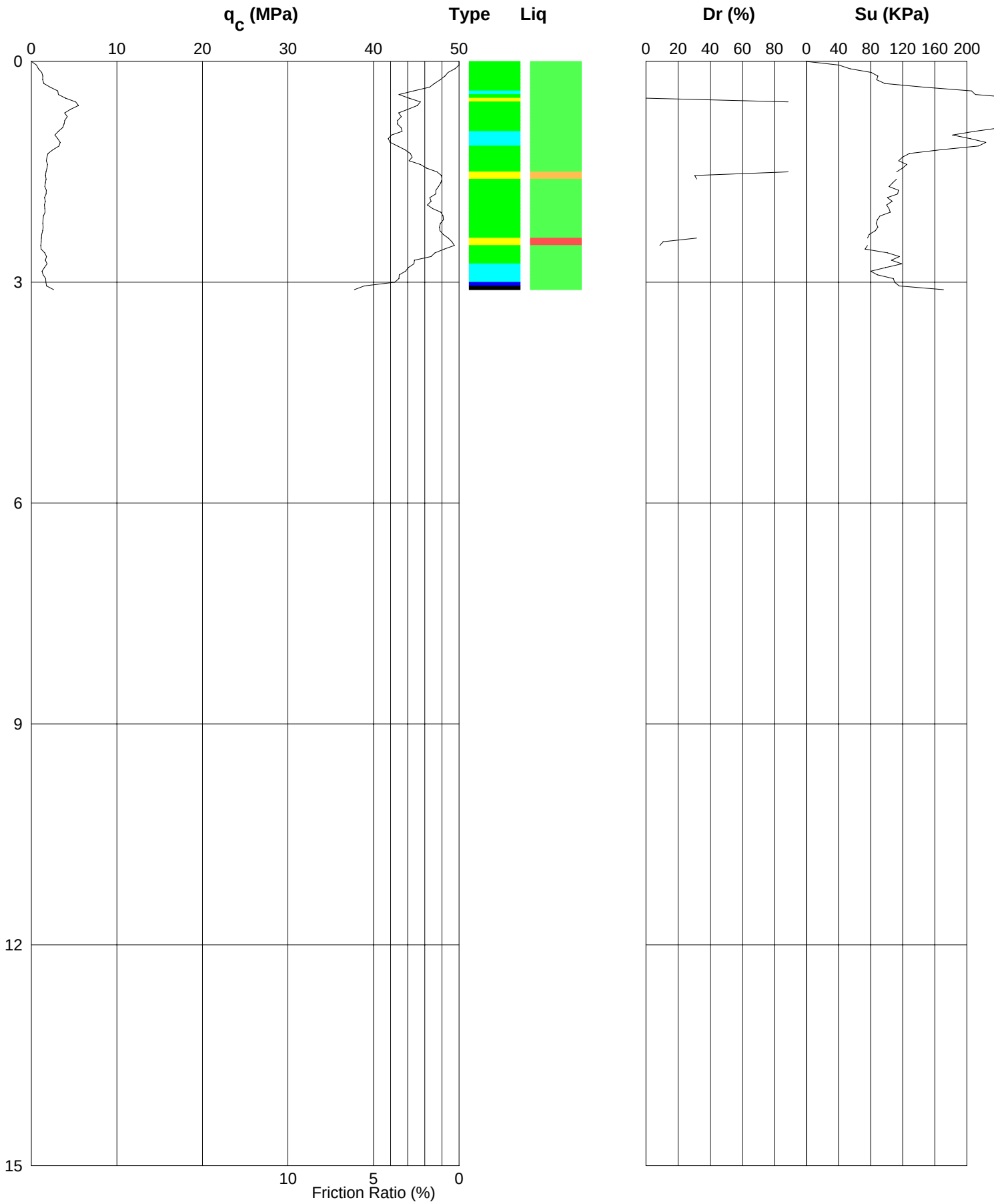
Job No:	4934		
CPT No:	222	Date:	28-9-07
Project:	Tonkin & Taylor Ltd	Operator:	J.Harvey
Location:	Jacks Point, Queenstown	Remark:	Effective Refusal

STANDARD CONE PENETROMETER TEST (CPT) REPORT



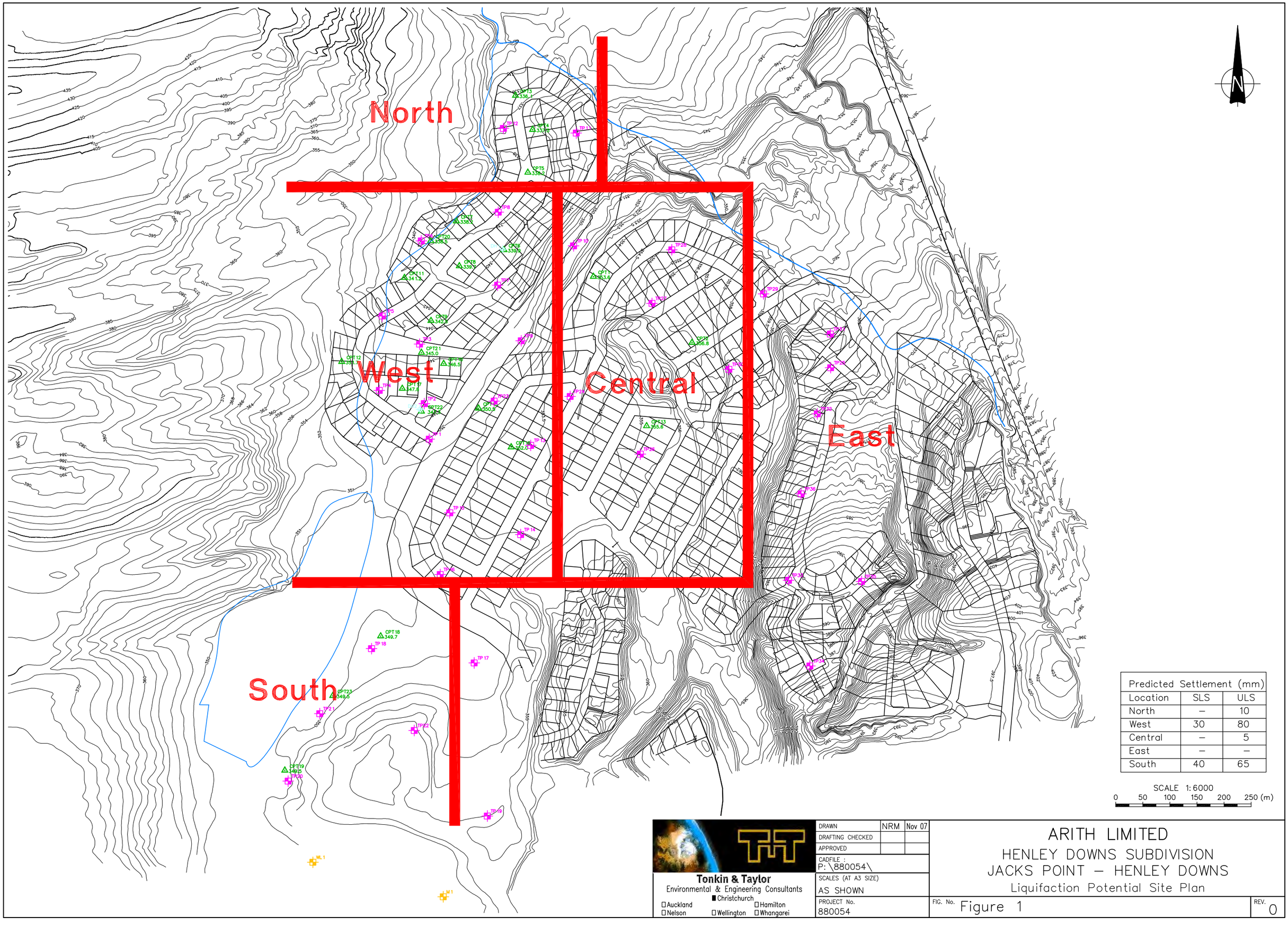
Job No:	4934		
CPT No:	223	Date:	28-9-07
Project:	Tonkin & Taylor Ltd	Operator:	J.Harvey
Location:	Jacks Point, Queenstown	Remark:	Effective Refusal

STANDARD CONE PENETROMETER TEST (CPT) INTERPRETIVE REPORT



Job No:	4934		
CPT No:	223	Date:	28-9-07
Project:	Tonkin & Taylor Ltd	Operator:	J.Harvey
Location:	Jacks Point, Queenstown	Remark:	Effective Refusal

Appendix E: Liquefaction Site Plan



Predicted Settlement (mm)		
Location	SLS	ULS
North	–	10
West	30	80
Central	–	5
East	–	–
South	40	65

SCALE 1:6000

0 50 100 150 200 250 (m)

Tonkin & Taylor
Environmental & Engineering Consultants
Christchurch
Auckland Hamilton
Nelson Wellington Whangarei

DRAWN	NRM	Nov 07
DRAFTING CHECKED		
APPROVED		
CADFILE : P:\880054\		
SCALES (AT A3 SIZE) AS SHOWN		
PROJECT No. 880054		

ARITH LIMITED

HENLEY DOWNS SUBDIVISION
JACKS POINT – HENLEY DOWNS

Liquifaction Potential Site Plan

FIG. No. Figure 1

REV. 0

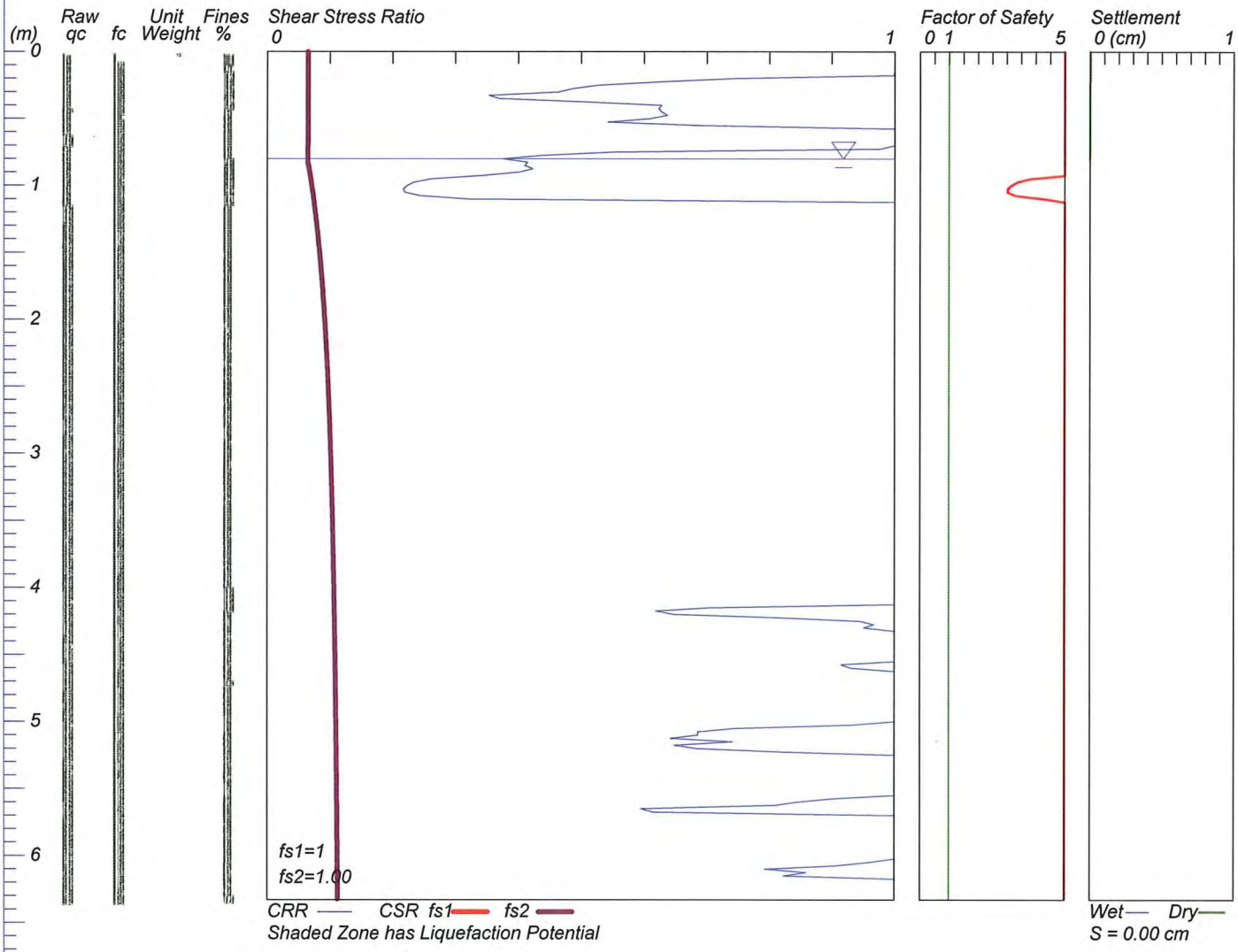
Appendix F: Liquefaction Analysis

LIQUEFACTION ANALYSIS

JACKS POINT - SLS

Hole No.=01 Water Depth=0.8 m Surface Elev.=353.6

Magnitude=7.0
Acceleration=0.10g



LIQUEFACTION ANALYSIS

JACKS POINT - SLS

Hole No.=02 Water Depth=0.8 m Surface Elev.=356.8

Magnitude=7.0
Acceleration=0.10g