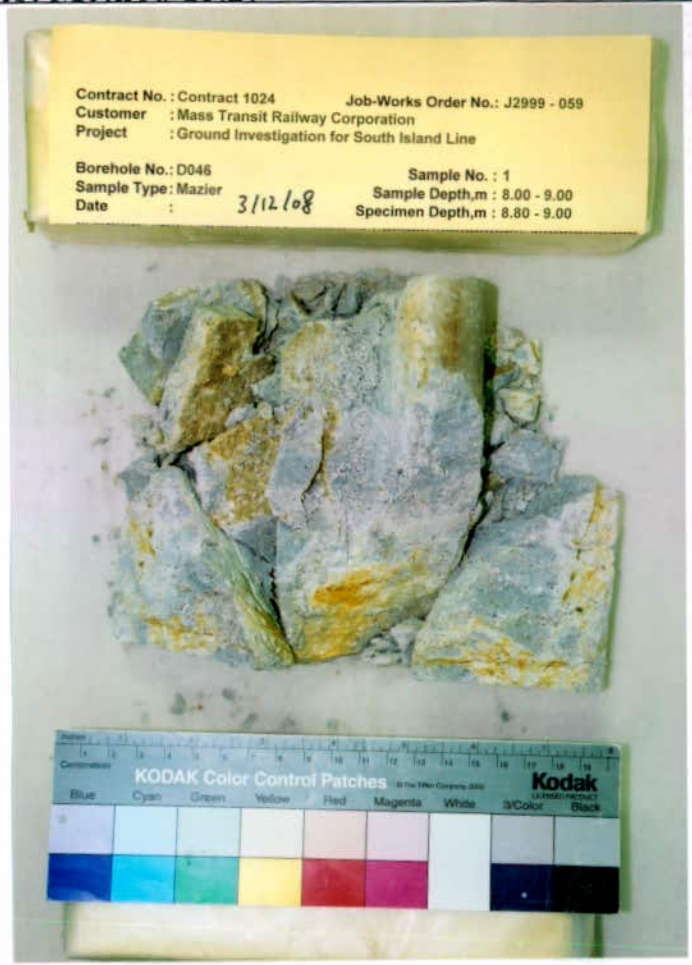
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT (GEOSPEC 3 : 2001 Test Method 15.2)



Description : Light grey, slightly gravelly, slightly sandy SILT/CLAY

Sample Origin : FILL ‡ ‡ Information provided by customer

Borehole No. : D046 Sample No. : 1 Sample Depth m:- 8.00 - 9.00 Specimen Depth m:- 8.80 - 9.00

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line

Contract No.: Contract 1024
Job No.: J2999
Works Order No.: 059

Compiled by W S Wat

Checked by H W Chung

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	D047		
Sample		no	1		
Sample Type			Mazier		
Stage		no	1		
Sample Depth		m	2.20 - 3.20		
Specimen Depth		m	2.80 - 3.00		
INITIAL CONDITIONS					
Diameter	(D_o)	mm	73.8		
Height	(H_o)	mm	145.0		
Moisture Content	(W_o)	%	24		
Bulk density	(ρ_o)	Mg/m^3	1.97		
Dry density	(ρ_d)	Mg/m^3	1.59		
Particle density	(ρ_s)		2.65		
Voids Ratio	(e_o)		0.67		
Degree of Saturation	(S_r)	%	96.2		
DRAINAGE CONDITIONS			ONE END		
SATURATION					
Final Pore Pressure Coefficient B			1.00		
CONSOLIDATION					
Cell Pressure	(σ_3)	kPa	235		
Back Pressure	(u_b)	kPa	215		
Effective Pressure	(σ'_3)	kPa	20		
Coefficient of Consolidation (t100)	(C_{vi})	m^2/Year	11.66		
Coefficient of Volume Compressibility	(m_{vi})	m^2/MN	1.12		
Coefficient of Permeability (k)		m/s	4.05E-09		
COMPRESSION TERMINATION CRITERION			MAXIMUM DEVIATOR STRESS		
COMPRESSION - INITIAL					
Moisture Content	(w)	%	23		
Pore Pressure at the End of Consolidation		kPa	215		
Effective Stress at the End of Consolidation		kPa	20		
Bulk density	(ρ_o)	Mg/m^3	1.99		
Dry density	(ρ_d)	Mg/m^3	1.62		
Voids Ratio	(e)		0.64		
Degree of Saturation	(S_r)	%	96.0		

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Report No. : J2999-059.11
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.:** 059

Technician : W S Wat
Checked By : Name : H W Chung Date : 02/01/2009
Approved By : Signatory : Lau Wai Cheong Date : 02/01/2009
Tested Date: 25/11/2008

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Form : GESR009.6 / Nov.10.06 / Issue 1 / Rev 1

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	D047		
Sample		no	1		
Sample Type			Mazier		
Stage		no	1		
Sample Depth		m	2.20 - 3.20		
Specimen Depth		m	2.80 - 3.00		
COMPRESSION - FAILURE					
Cell Pressure		kPa	235		
Rate of Strain		mm/min	0.048		
CONDITIONS MAXIMUM DEVIATOR STRESS					
Major Effective Principal Stress (σ'_1)		kPa	61		
Corrected Deviator Stress ($\sigma'_1 - \sigma'_3$)		kPa	50		
Minor Effective Principal Stress (σ'_3)		kPa	11		
$s' = (\sigma'_1 + \sigma'_3)/2$		kPa	36		
$t = (\sigma_1 - \sigma_3)/2$		kPa	25		
Expanded Uncertainty of s' ^		kPa	-		
Expanded Uncertainty of t ^		kPa	-		
Pore pressure parameter A_f			0.19		
Strain at Failure	(εf)	%	4.9		
COMPRESSION - FINAL					
Moisture Content	(W_f)	%	23		
Bulk density	(ρ_o)	Mg/m^3	1.99		
Dry density	(ρ_d)	Mg/m^3	1.62		
Voids Ratio	(e_f)		0.64		
Degree of Saturation	(S_f)	%	96.0		

Notes -
1. The method of specimen preparation was in accordance with GEOSPEC 3 : 2001 :- Test method 13.3 : test specimen from undisturbed soil samples.
2. Sample received date :29/09/2008
3. The determination of moisture content was in accordance with test method 5.2 of GEOSPEC 3 : 2001.
4. Particle density : 2.65 (Assumed)
5. Maximum and minimum temperature recorded over the period of testing 19.9 - 20.7 °C.
6. Unavoidable variations from specified procedure : none
7. Comment on observed or inferred sample disturbance : none
8. Percentage by mass of soil particles larger than 1/5 of the diameter of specimen (%) : Nil
9. The specimen was selected by the laboratory.
   Name : W S Wat Designation : Senior Laboratory Technician
10. Sampling History : As Received

* Delete as appropriate ^ Upon request

Customer : **Mass Transit Railway Corporation**
Project : **Ground Investigation for South Island Line**
Contract No.: Contract 1024
Job No.: **J2999** **Works Order No.: 059**

Compiled by W S Wat
Checked by H W Chung

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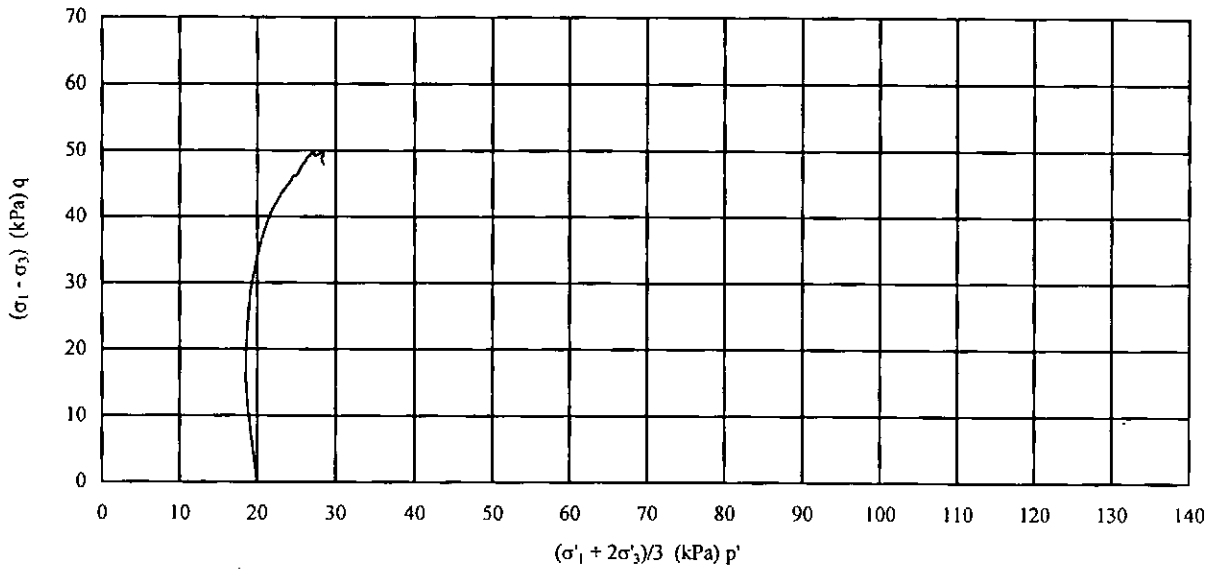
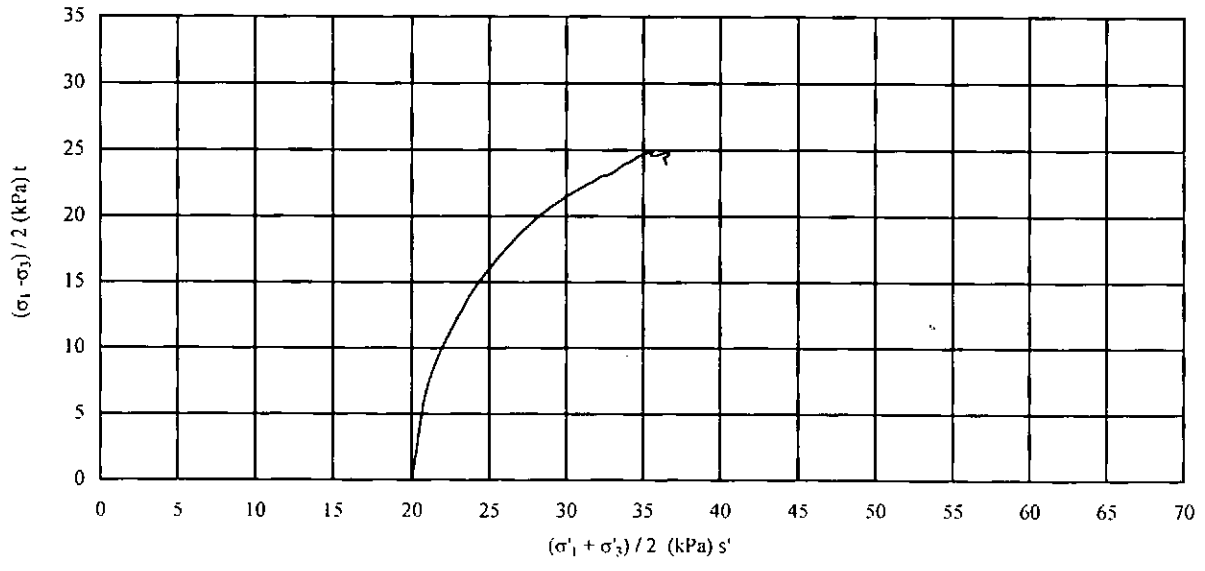
GEOSPEC 3 : 2001 Test Method 15.2

STRESS PATH PARAMETERS FOR EFFECTIVE STRESS

p' - q PLOT



s' - t PLOT



Borehole No. : D047	**Sample Depth m:-** 2.20 - 3.20
Sample No. : 1	**Specimen Depth m:-** 2.80 - 3.00
Customer : Mass Transit Railway Corporation	Compiled by: W S Wat
Project : Ground Investigation for South Island Line	
Contract No.: Contract 1024	Checked by: H W Chung
Job No.: J2999	**Works Order No.:** 059

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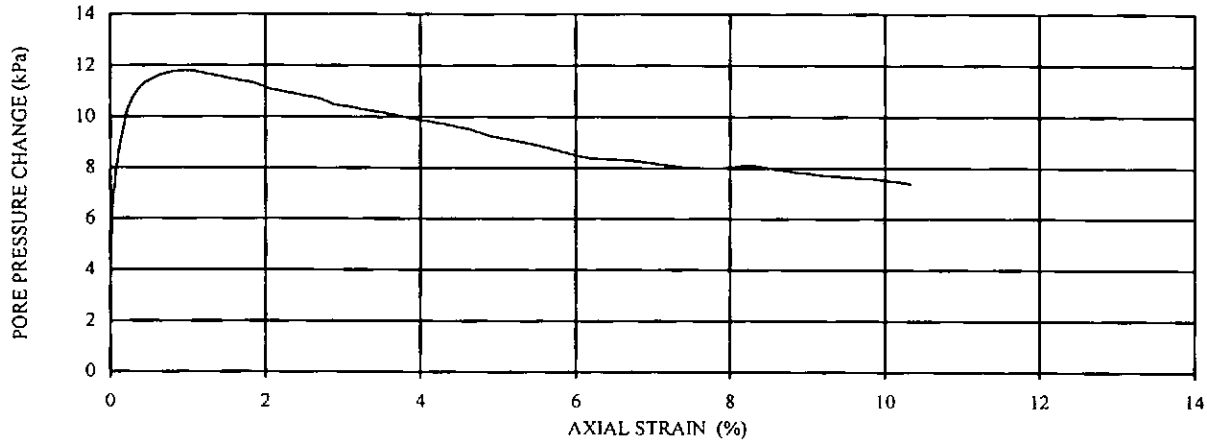
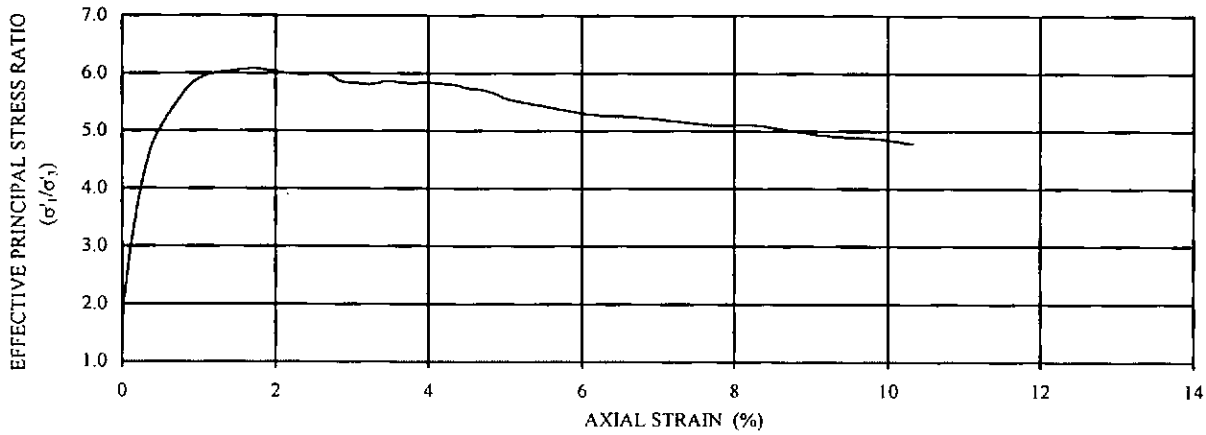
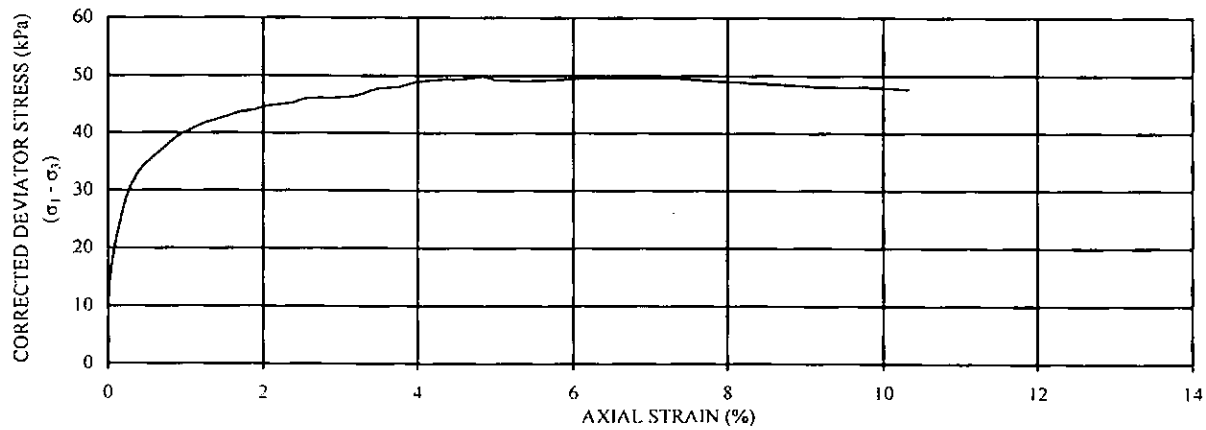
Form : GESR009.8 / Jun.02.03 / Issue 1 / Rev 0

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

COMPRESSION







Borehole No. : D047 — **Sample Depth m:-** 2.20 - 3.20
Sample No. : 1 — **Specimen Depth m:-** 2.80 - 3.00

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 — **Works Order No.:** 059

Compiled by: W S Wat
Checked by: H W Chung

Form : GESR009.9 / Jun.02.03 / Issue 1 / Rev 0

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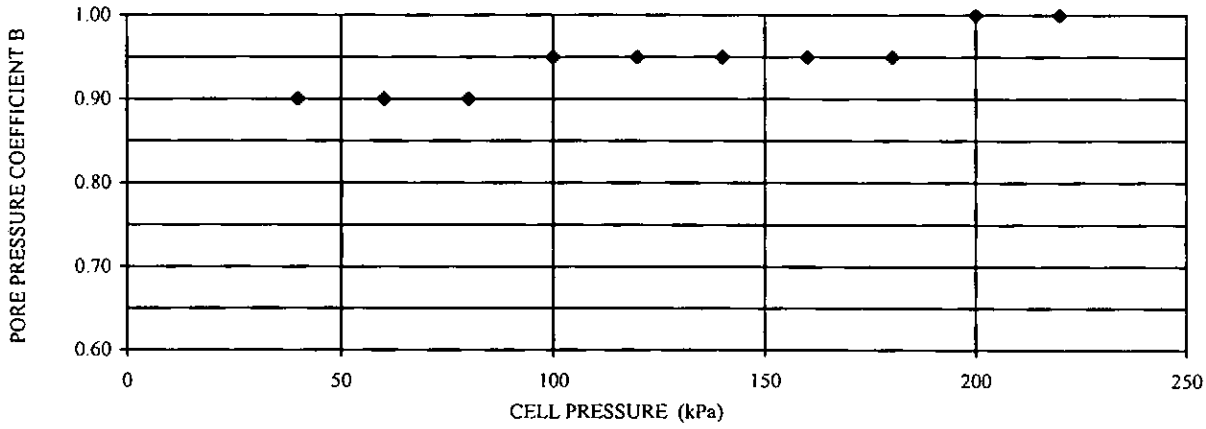
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

SATURATION



Date	Time	Cell Pressure kPa	Back Pressure kPa	Pore Pressure kPa	Cumulative Volume of Water cm^3	Pore Pressure Coefficient B
26/11/2008	08:36	0	0	-	0.0	
	08:44	20	-	19		-
	09:03	20	15	15	-4.1	
	09:10	40	-	33		0.90
	09:28	40	35	35	-3.8	
	09:36	60	-	53		0.90
	09:53	60	55	55	-3.6	
	10:01	80	-	73		0.90
	10:45	80	75	75	-2.8	
	10:50	100	-	94		0.95
	11:07	100	95	95	-2.4	
	11:14	120	-	114		0.95
	11:29	120	115	115	-2.1	
	11:35	140	-	134		0.95
	11:50	140	135	135	-1.7	
	11:57	160	-	154		0.95
	12:20	160	155	155	-1.5	
	12:27	180	-	174		0.95
	13:10	180	175	175	-1.4	
	13:18	200	-	195		1.00
	14:10	200	195	195	-0.8	
	14:19	220	-	215		1.00
27/11/2008	08:40	220	215	215	-0.2	

Borehole No. D047 — **Sample Depth m:-** 2.20 - 3.20
Sample No. : 1 — **Specimen Depth m:-** 2.80 - 3.00
Customer : Mass Transit Railway Corporation — Compiled by W S Wat
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024 — Checked by H W Chung
Job No.: J2999 — **Works Order No.:** 059

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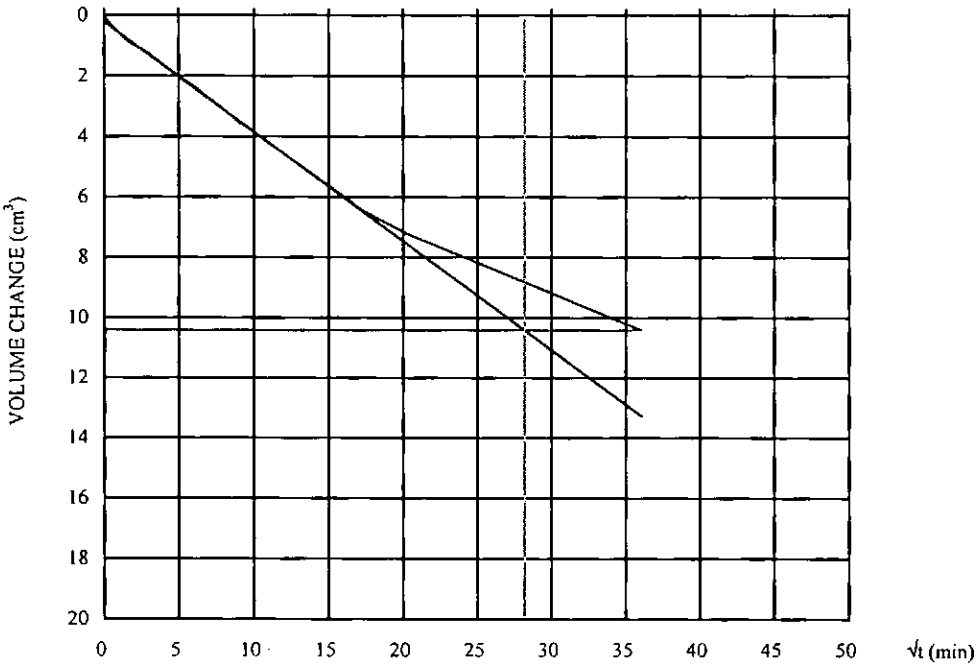
Form : GESR009.11 / Jun.02.03 / Issue 1 / Rev 0

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

CONSOLIDATION (DRAINED PHASE) - Stage 1

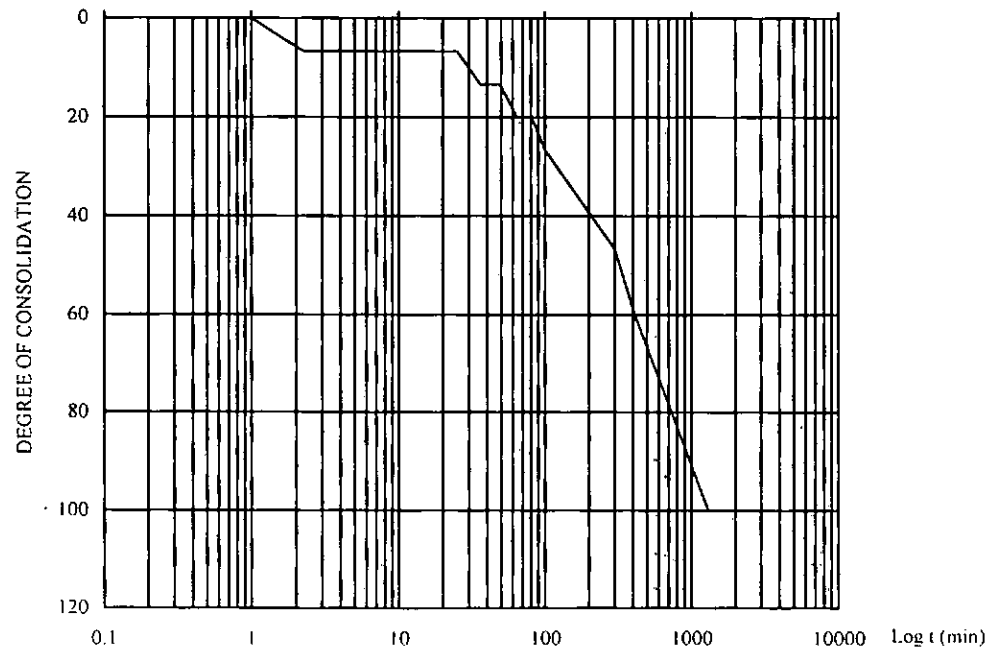


√t100 28.17 min

t100 793.758 min

tf 420.692 min

Calc. strain rate
0.051 mm/min



Borehole No. : D047 **Sample Depth m:-** 2.20 - 3.20

Sample No. : 1 **Specimen Depth m:-** 2.80 - 3.00

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.:** 059

Complied by
W S Wat

Checked by
H W Chung

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Single Stage				P.W.P,B.P				Effective Pressure		20			kPa
Side drains	No		Selected Machine Speed		0.048		mm/min	Rate of Strain		2.00			% per hr
FAILURE CRITERION													
Max. deviator Stress		☒		Max. Stress ratio		☐		Axial Strain %					☐
Stage :	1	Applied Pressure (kPa) - Cell :			235	Back :	215	P.R. factor		1.7589			kN/mm

Date	Time	Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
		Dial		P.R.No. 41	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
28/11	08:40	0.00	0.00	0.061	215	0.000	0.0	20.0	20.0	20.0	0.0	20.0	1.00
	08:45	0.05	0.03	0.097	221	0.009	15.0	28.6	13.6	21.1	7.5	18.6	2.10
	08:50	0.30	0.20	0.126	225	0.058	26.9	36.9	10.0	23.5	13.5	19.0	3.69
	08:55	0.54	0.37	0.140	226	0.107	32.6	41.5	8.9	25.2	16.3	19.8	4.67
	09:00	0.80	0.55	0.147	227	0.158	35.4	43.9	8.5	26.2	17.7	20.3	5.17
	09:05	1.03	0.72	0.152	227	0.205	37.4	45.7	8.3	27.0	18.7	20.8	5.50
	09:10	1.29	0.89	0.157	227	0.253	39.3	47.5	8.2	27.9	19.7	21.3	5.80
	09:15	1.52	1.05	0.160	227	0.297	40.5	48.7	8.2	28.4	20.2	21.7	5.93
	09:20	1.76	1.22	0.163	227	0.343	41.6	49.9	8.3	29.1	20.8	22.2	6.01
	09:25	2.00	1.38	0.165	227	0.386	42.3	50.7	8.4	29.5	21.1	22.5	6.03
	09:30	2.24	1.55	0.167	227	0.432	43.0	51.5	8.5	30.0	21.5	22.8	6.06
	09:35	2.47	1.71	0.169	226	0.474	43.7	52.3	8.6	30.4	21.8	23.2	6.08
	09:40	2.71	1.88	0.170	226	0.519	44.0	52.7	8.7	30.7	22.0	23.4	6.06
	09:45	2.95	2.05	0.172	226	0.563	44.7	53.6	8.9	31.2	22.3	23.8	6.02
	09:50	3.18	2.20	0.173	226	0.601	45.0	54.0	9.0	31.5	22.5	24.0	6.00
	09:55	3.43	2.38	0.174	226	0.647	45.3	54.4	9.1	31.7	22.6	24.2	5.97
	10:00	3.65	2.53	0.176	226	0.685	46.0	55.2	9.2	32.2	23.0	24.5	5.99
	10:05	3.91	2.71	0.177	226	0.730	46.2	55.5	9.3	32.4	23.1	24.7	5.97
	10:10	4.15	2.88	0.177	226	0.772	46.1	55.6	9.5	32.6	23.1	24.9	5.85
	10:15	4.46	3.10	0.178	225	0.826	46.3	55.9	9.6	32.8	23.2	25.0	5.83
	10:20	4.67	3.24	0.179	225	0.860	46.6	56.3	9.7	33.0	23.3	25.2	5.81
	10:25	4.99	3.46	0.182	225	0.912	47.7	57.5	9.8	33.6	23.8	25.7	5.87
	10:30	5.25	3.64	0.183	225	0.955	48.0	57.9	9.9	33.9	24.0	25.9	5.84
	10:35	5.47	3.80	0.184	225	0.992	48.2	58.2	10.0	34.1	24.1	26.1	5.82
	10:40	5.72	3.97	0.186	225	1.032	48.9	59.0	10.1	34.6	24.5	26.4	5.84
	10:45	6.01	4.17	0.187	225	1.078	49.2	59.4	10.2	34.8	24.6	26.6	5.82
	10:50	6.27	4.35	0.188	225	1.118	49.4	59.7	10.3	35.0	24.7	26.8	5.80
	10:55	6.47	4.49	0.188	225	1.150	49.3	59.7	10.4	35.1	24.7	26.8	5.74
	11:00	6.72	4.66	0.189	225	1.188	49.6	60.1	10.5	35.3	24.8	27.0	5.72
	11:05	**6.99**	**4.85**	**0.190**	**224**	**1.230**	**49.8**	**60.5**	**10.7**	**35.6**	**24.9**	**27.3**	**5.66**
	11:10	7.20	4.99	0.189	224	1.260	49.3	60.1	10.8	35.5	24.7	27.2	5.57
	11:15	7.45	5.16	0.189	224	1.297	49.2	60.1	10.9	35.5	24.6	27.3	5.51
	11:30	8.12	5.63	0.190	224	1.397	49.3	60.5	11.2	35.8	24.6	27.6	5.40
	11:45	8.86	6.15	0.192	223	1.505	49.7	61.3	11.6	36.4	24.8	28.2	5.28
	12:00	9.64	6.69	0.193	223	1.613	49.6	61.3	11.7	36.5	24.8	28.2	5.24
	12:15	10.44	7.24	0.194	223	1.721	49.6	61.5	11.9	36.7	24.8	28.4	5.17
	12:30	11.22	7.78	0.194	223	1.823	49.2	61.2	12.0	36.6	24.6	28.4	5.10
	12:45	11.89	8.25	0.194	223	1.910	48.9	60.8	11.9	36.3	24.4	28.2	5.11
	13:00	12.58	8.73	0.194	223	1.996	48.5	60.6	12.1	36.4	24.3	28.3	5.01

Borehole No. : D047 — **Sample Depth m:-** 2.20 - 3.20
Sample No. : 1 — **Specimen Depth m:-** 2.80 - 3.00

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 — **Works Order No.:** 059

Compiled by: W S Wat
Checked by: H W Chung

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TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2
Shearing Continuation

FAILURE CRITERION

Max. deviator Stress ☒ Max. Stress ratio ☐ Axial Strain % ☐

Stage :	1	Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
Date	Time	Dial		P.R.No. 41	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
28/11	13:15	13.39	9.29	0.194	223	2.095	48.1	60.4	12.3	36.4	24.1	28.3	4.91
	13:30	14.13	9.80	0.195	223	2.182	48.1	60.5	12.4	36.5	24.1	28.4	4.88
	13:45	14.89	10.33	0.195	222	2.271	47.7	60.3	12.6	36.5	23.9	28.5	4.79

Borehole No. : D047 Sample Depth m:- 2.20 - 3.20

Sample No. : 1 Specimen Depth m:- 2.80 - 3.00

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 Works Order No.: 059

Compiled by W S Wat

Checked by H W Chung

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Form : GESR009.15 / Dec.13.04 / Issue 1 / Rev 1

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT (GEOSPEC 3 : 2001 Test Method 15.2)

Description : Brown, silty, gravelly SAND Sample Origin : FILL‡ ‡ Information provided by customer

Borehole No. : D047	Sample No. : 1	Sample Depth m:- 2.20 - 3.20	Specimen Depth m:- 2.80 - 3.00	
Customer : Mass Transit Railway Corporation Project : Ground Investigation for South Island Line		Contract No. : Contract 1024 Job No. : J2999 Works Order No.: 059		Compiled by W S Wat Checked by H W Chung

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	D047		
Sample		no	1		
Sample Type			Mazier		
Stage		no	1		
Sample Depth		m	2.20 - 3.20		
Specimen Depth		m	3.00 -3.20		
INITIAL CONDITIONS					
Diameter	(D_o)	mm	73.8		
Height	(H_o)	mm	145.0		
Moisture Content	(W_o)	%	24		
Bulk density	(ρ_o)	Mg/m^3	1.97		
Dry density	(ρ_d)	Mg/m^3	1.58		
Particle density	(ρ_s)		2.65		
Voids Ratio	(e_o)		0.68		
Degree of Saturation	(S_r)	%	95.7		
DRAINAGE CONDITIONS			ONE END		
SATURATION					
Final Pore Pressure Coefficient B			1.00		
CONSOLIDATION					
Cell Pressure	(σ_3)	kPa	245		
Back Pressure	(u_b)	kPa	215		
Effective Pressure	(σ'_3)	kPa	30		
Coefficient of Consolidation (t100)	(C_{vi})	m^2/Year	14.25		
Coefficient of Volume Compressibility	(m_{vi})	m^2/MN	1.03		
Coefficient of Permeability (k)		m/s	4.57E-09		
COMPRESSION TERMINATION CRITERION			MAXIMUM DEVIATOR STRESS		
COMPRESSION - INITIAL					
Moisture Content	(w)	%	23		
Pore Pressure at the End of Consolidation		kPa	215		
Effective Stress at the End of Consolidation		kPa	30		
Bulk density	(ρ_o)	Mg/m^3	2.00		
Dry density	(ρ_d)	Mg/m^3	1.62		
Voids Ratio	(e)		0.63		
Degree of Saturation	(S_r)	%	97.8		

Customer : **Mass Transit Railway Corporation**
Project : **Ground Investigation for South Island Line**
Report No. : J2999-059.11
Contract No.: Contract 1024
Job No.: **J2999** **Works Order No.: 059**

Technician : W S Wat
Checked By : Name : H W Chung Date : 02/01/2009
Approved By : Signatory : **Lau Wai Cheong** Date : 02/01/2009
Tested Date: 25/11/2008

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Form : GESR009.6 / Nov.10.06 / Issue 1 / Rev 1

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	D047		
Sample		no	1		
Sample Type			Mazier		
Stage		no	1		
Sample Depth		m	2.20 - 3.20		
Specimen Depth		m	3.00 -3.20		
COMPRESSION - FAILURE					
Cell Pressure		kPa	245		
Rate of Strain		mm/min	0.035		
CONDITIONS MAXIMUM DEVIATOR STRESS					
Major Effective Principal Stress (σ'_1)		kPa	89		
Corrected Deviator Stress ($\sigma'_1 - \sigma'_3$)		kPa	73		
Minor Effective Principal Stress (σ'_3)		kPa	16		
$s' = (\sigma'_1 + \sigma'_3)/2$		kPa	52		
$t = (\sigma_1 - \sigma_3)/2$		kPa	36		
Expanded Uncertainty of s' ^		kPa	-		
Expanded Uncertainty of t ^		kPa	-		
Pore pressure parameter A_f			0.19		
Strain at Failure	(εf)	%	18.8		
COMPRESSION - FINAL					
Moisture Content	(W_f)	%	23		
Bulk density	(ρ_o)	Mg/m^3	2.00		
Dry density	(ρ_d)	Mg/m^3	1.62		
Voids Ratio	(e_f)		0.63		
Degree of Saturation	(S_f)	%	97.8		

Notes -
1. The method of specimen preparation was in accordance with GEOSPEC 3 : 2001 :- Test method 13.3 : test specimen from undisturbed soil samples.
2. Sample received date :29/09/2008
3. The determination of moisture content was in accordance with test method 5.2 of GEOSPEC 3 : 2001.
4. Particle density : 2.65 (Assumed)
5. Maximum and minimum temperature recorded over the period of testing 19.9 - 20.7 °C.
6. Unavoidable variations from specified procedure : none
7. Comment on observed or inferred sample disturbance : none
8. Percentage by mass of soil particles larger than 1/5 of the diameter of specimen (%) : Nil
9. The specimen was selected by the laboratory.
   Name : W S Wat Designation : Senior Laboratory Technician
10. Sampling History : As Received

* Delete as appropriate ^ Upon request

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.: 059**

Compiled by W S Wat
Checked by H W Chung

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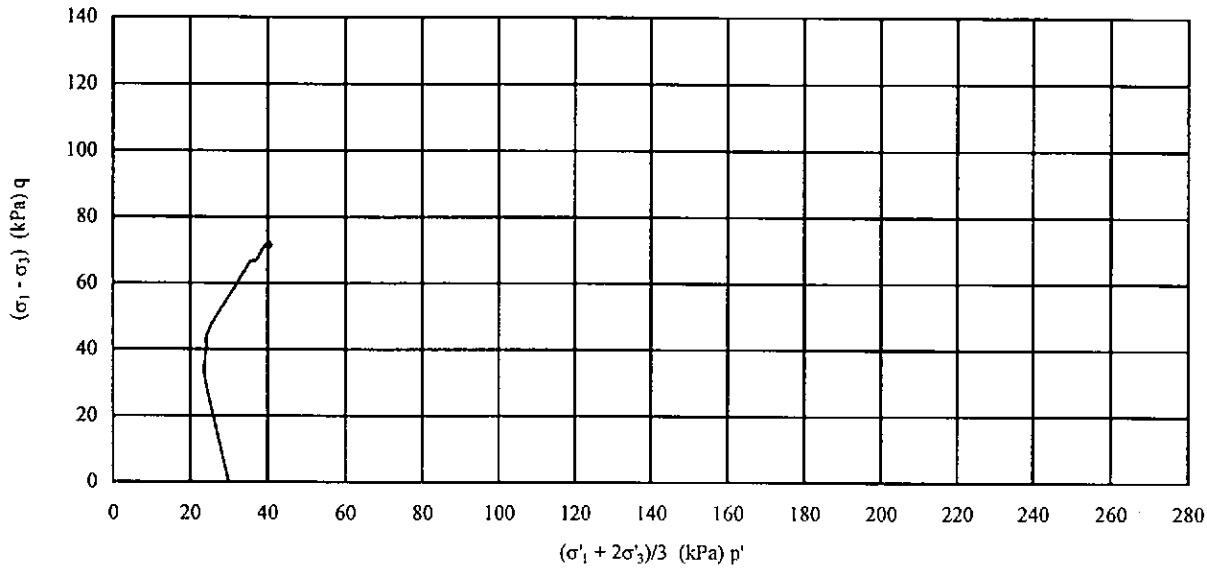
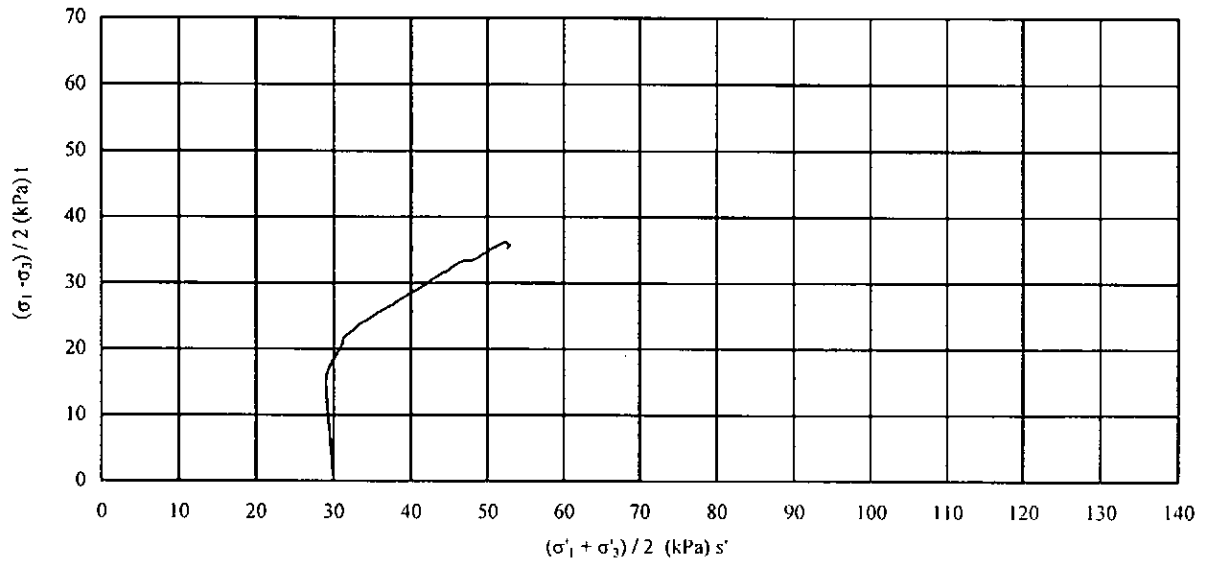
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

STRESS PATH PARAMETERS FOR EFFECTIVE STRESS

p' - q PLOT



s' - t PLOT



Borehole No. :	**D047**	**Sample Depth m:-**	**2.20 - 3.20**
Sample No. :	**1**	**Specimen Depth m:-**	**3.00 -3.20**
Customer :	**Mass Transit Railway Corporation**		Compiled by W S Wat
Project :	**Ground Investigation for South Island Line**		
		Contract No.:	**Contract 1024**
Job No.:	**J2999**	**Works Order No.:**	**059**
			Checked by H W Chung

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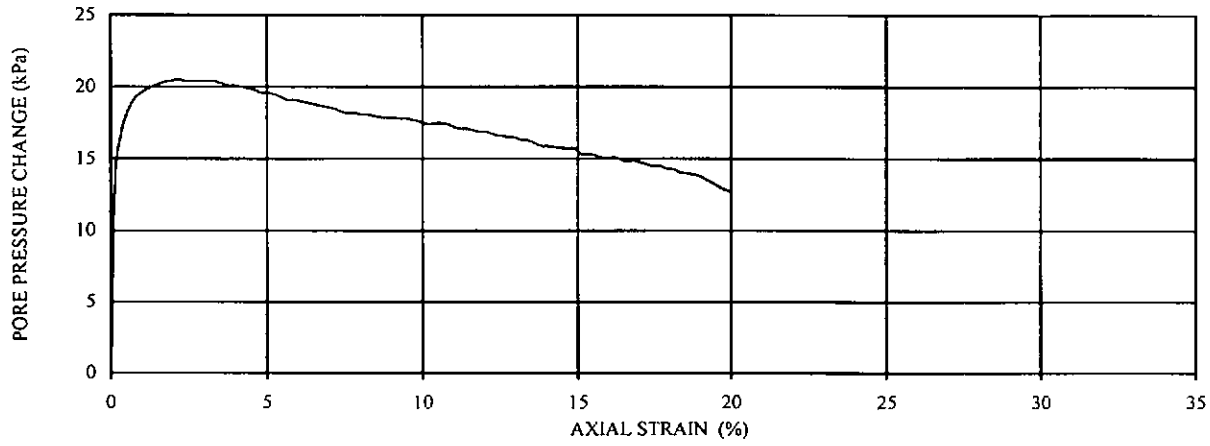
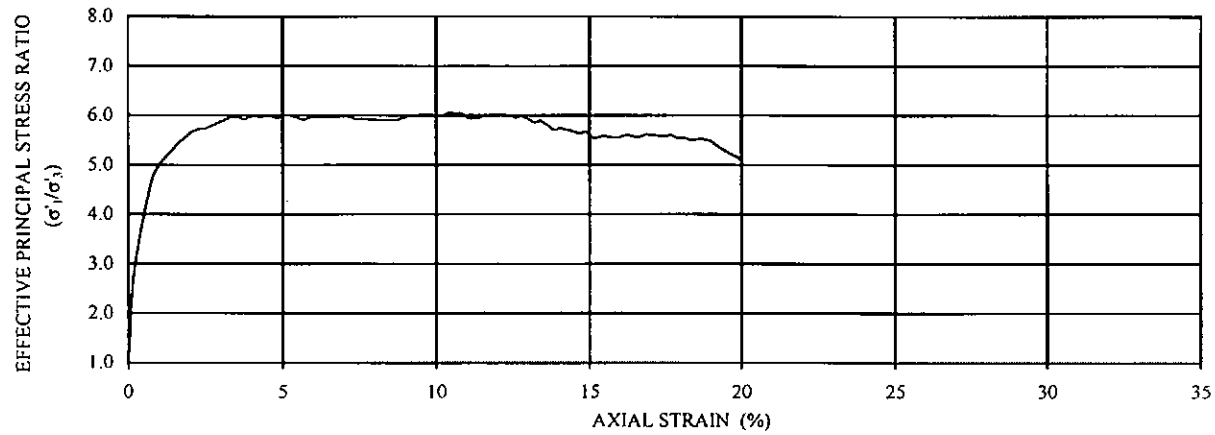
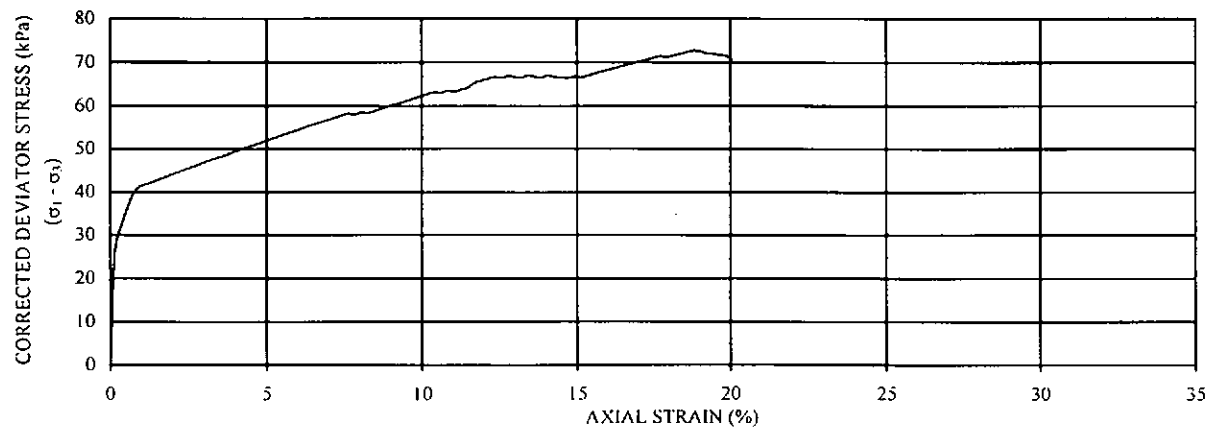
Form : GESR009.8 / Jun.02.03 / Issue 1 / Rev 0

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

COMPRESSION







Borehole No. :	**D047**	**Sample Depth m:-**	**2.20 - 3.20**
Sample No. :	**1**	**Specimen Depth m:-**	**3.00 -3.20**
Customer :	**Mass Transit Railway Corporation**		Compiled by W S Wat
Project :	**Ground Investigation for South Island Line**		
		Contract No.: Contract 1024	Checked by H W Chung
Job No.:	**J2999**	**Works Order No.: 059**	

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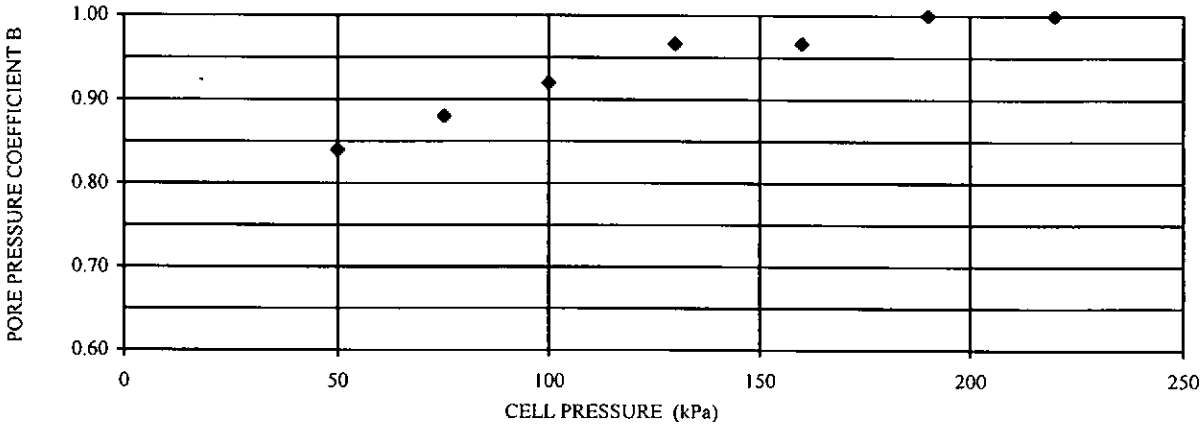
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

SATURATION



Date	Time	Cell Pressure kPa	Back Pressure kPa	Pore Pressure kPa	Cumulative Volume of Water cm^3	Pore Pressure Coefficient B
26/11/2008	08:30	0	0	-	0.0	
	08:40	25	-	24		-
	08:57	25	20	20	3.6	
	09:13	50	-	41		0.84
	09:27	50	45	45	4.1	
	09:33	75	-	67		0.88
	09:47	75	70	70	4.5	
	09:54	100	-	93		0.92
	11:06	100	95	95	4.6	
	11:10	130	-	124		0.97
	11:40	130	125	125	4.8	
	11:49	160	-	154		0.97
	12:20	160	155	155	5.1	
	12:30	190	-	185		1.00
	13:15	190	185	185	5.4	
	13:20	220	-	215		1.00
27/11/2008	08:30	220	215	215	5.6	

Borehole No. D047 — **Sample Depth m:-** 2.20 - 3.20
Sample No. : 1 — **Specimen Depth m:-** 3.00 -3.20
Customer : Mass Transit Railway Corporation — Compiled by W S Wat
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024 — Checked by H W Chung
Job No.: J2999 — **Works Order No.:** 059

Form : GESR009.11 / Jun.02.03 / Issue 1 / Rev 0

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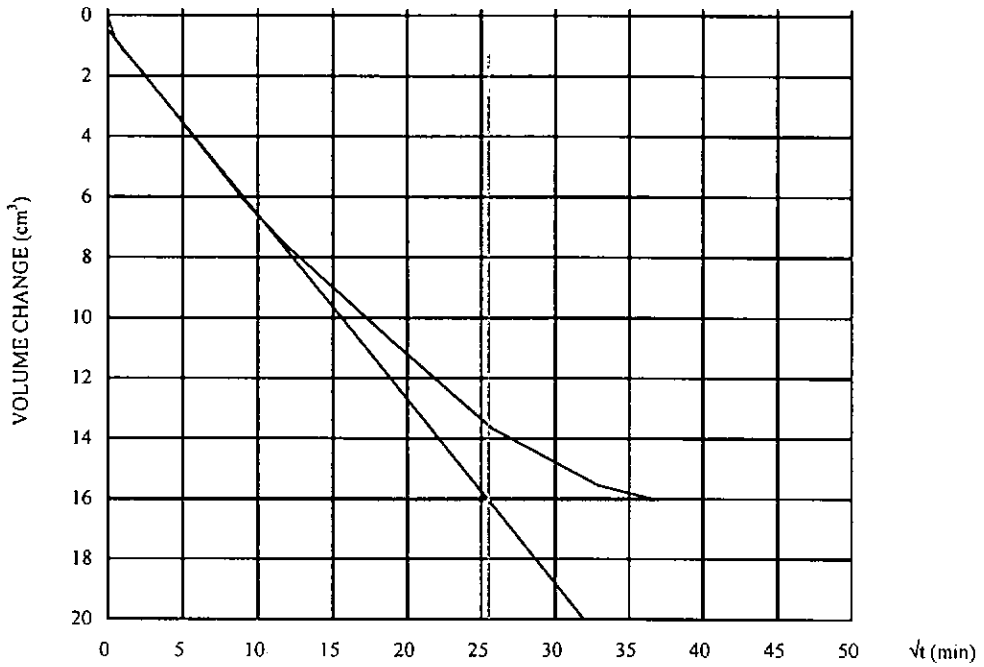
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

CONSOLIDATION (DRAINED PHASE) - Stage 1

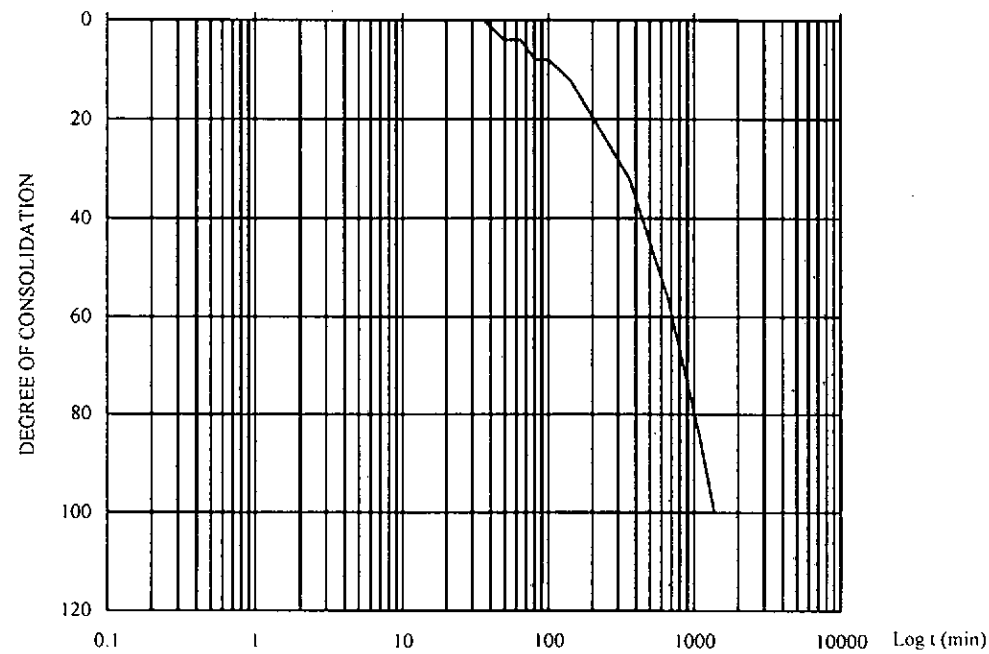


√t100 25.47 min

t100 648.624 min

tf 343.771 min

Calc. strain rate
0.063 mm/min



Borehole No. : D047 — **Sample Depth m:-** 2.20 - 3.20

Sample No. : 1 — **Specimen Depth m:-** 3.00 -3.20

Customer : Mass Transit Railway Corporation — Complied by W S Wat

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024 — Checked by H W Chung

Job No.: J2999 — **Works Order No.:** 059

Form : GESR009.13 / Jun.02.03 / Issue 1 / Rev 0

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Single Stage		P.W.P,B.P			Effective Pressure	30	kPa
Side drains	No	Selected Machine Speed	0.035	mm/min	Rate of Strain	1.46	% per hr

FAILURE CRITERION

Max. deviator Stress	☒	Max. Stress ratio	☐	Axial Strain %	☐
Stage : 1	Applied Pressure (kPa) - Cell :	245	Back : 215	P.R. factor	3.1043 kN/mm

Date	Time	Strain Dial	Strain	Load P.R.No. 3	Pore Pressure	Dev. stress Corr.	Dev. stress q $\sigma_1 - \sigma_3$	Effective Stress σ'_1	Effective Stress σ'_3	s' $(\sigma'_1+\sigma'_3)/2$	t $(\sigma_1-\sigma_3)/2$	p' $(\sigma'_1+2\sigma'_3)/3$	Stress Ratio σ'_1/σ'_3
		mm	%	mm	kPa	kPa							
28/11	15:15	0.00	0.00	0.053	215	0.000	0.0	30.0	30.0	30.0	0.0	30.0	1.00
	15:24	0.21	0.15	0.088	229	0.044	25.8	42.0	16.2	29.1	12.9	24.8	2.59
	15:33	0.51	0.36	0.097	232	0.104	32.3	45.3	13.0	29.1	16.1	23.8	3.48
	15:42	0.82	0.57	0.103	233	0.163	36.5	48.1	11.6	29.9	18.3	23.8	4.15
	15:51	1.12	0.78	0.108	234	0.222	40.1	50.9	10.8	30.8	20.0	24.2	4.71
	16:00	1.42	0.99	0.110	235	0.280	41.4	51.8	10.4	31.1	20.7	24.2	4.98
	16:09	1.74	1.21	0.111	235	0.340	42.0	52.1	10.1	31.1	21.0	24.1	5.15
	16:18	2.04	1.42	0.112	235	0.397	42.5	52.4	9.9	31.2	21.3	24.1	5.30
	16:27	2.34	1.63	0.113	235	0.453	43.1	52.8	9.7	31.3	21.6	24.1	5.44
	16:36	2.64	1.84	0.114	235	0.508	43.7	53.3	9.6	31.4	21.8	24.2	5.55
	16:45	2.94	2.05	0.115	236	0.562	44.3	53.8	9.5	31.6	22.1	24.3	5.66
	16:54	3.25	2.26	0.116	236	0.616	44.8	54.3	9.5	31.9	22.4	24.4	5.72
	17:03	3.56	2.48	0.117	235	0.672	45.4	55.0	9.6	32.3	22.7	24.7	5.73
	17:12	3.87	2.69	0.118	235	0.725	46.0	55.6	9.6	32.6	23.0	24.9	5.79
	17:21	4.17	2.90	0.119	235	0.776	46.5	56.1	9.6	32.9	23.3	25.1	5.85
	17:30	4.47	3.11	0.120	235	0.828	47.1	56.7	9.6	33.1	23.5	25.3	5.90
	17:39	4.78	3.32	0.121	235	0.878	47.6	57.2	9.6	33.4	23.8	25.5	5.96
	17:48	5.09	3.54	0.122	235	0.931	48.2	57.9	9.7	33.8	24.1	25.8	5.97
	17:57	5.40	3.76	0.123	235	0.982	48.7	58.6	9.9	34.3	24.4	26.1	5.92
	18:06	5.71	3.97	0.124	235	1.031	49.3	59.2	9.9	34.5	24.6	26.3	5.98
	18:15	6.01	4.18	0.125	235	1.079	49.8	59.8	10.0	34.9	24.9	26.6	5.98
	18:24	6.32	4.40	0.126	235	1.129	50.4	60.5	10.1	35.3	25.2	26.9	5.99
	18:33	6.63	4.61	0.127	235	1.176	50.9	61.1	10.2	35.7	25.5	27.2	5.99
	18:42	6.95	4.83	0.128	235	1.225	51.5	61.9	10.4	36.1	25.7	27.6	5.95
	18:51	7.25	5.04	0.129	235	1.270	52.0	62.4	10.4	36.4	26.0	27.7	6.00
	19:00	7.55	5.25	0.130	235	1.316	52.5	63.0	10.5	36.8	26.3	28.0	6.00
	19:09	7.85	5.46	0.131	234	1.360	53.1	63.8	10.7	37.2	26.5	28.4	5.96
	19:18	8.16	5.68	0.132	234	1.407	53.6	64.5	10.9	37.7	26.8	28.8	5.92
	19:27	8.47	5.89	0.133	234	1.450	54.1	65.0	10.9	38.0	27.1	28.9	5.96
	19:36	8.78	6.11	0.134	234	1.496	54.6	65.6	11.0	38.3	27.3	29.2	5.97
	19:45	9.08	6.32	0.135	234	1.538	55.2	66.3	11.1	38.7	27.6	29.5	5.97
	19:54	9.40	6.54	0.136	234	1.582	55.7	66.9	11.2	39.0	27.8	29.8	5.97
	20:03	9.70	6.75	0.137	234	1.624	56.2	67.5	11.3	39.4	28.1	30.0	5.97
	20:12	10.01	6.96	0.138	234	1.665	56.7	68.1	11.4	39.8	28.4	30.3	5.97
	20:21	10.32	7.18	0.139	234	1.708	57.2	68.7	11.5	40.1	28.6	30.6	5.98
	20:30	10.63	7.39	0.140	233	1.748	57.7	69.4	11.7	40.6	28.9	30.9	5.93
	20:39	10.93	7.61	0.141	233	1.790	58.2	70.0	11.8	40.9	29.1	31.2	5.93
	20:48	11.24	7.82	0.141	233	1.829	58.0	69.8	11.8	40.8	29.0	31.1	5.92
	20:57	11.55	8.04	0.142	233	1.870	58.5	70.4	11.9	41.2	29.3	31.4	5.92

Borehole No. : D047 **Sample Depth m:- 2.20 - 3.20**

Sample No. : 1 **Specimen Depth m:- 3.00 -3.20**

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.: 059**

Compiled by W S Wat

Checked by H W Chung

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Form : GESR009.14 / Dec.13.04 / Issue 1 / Rev 1

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2
Shearing Continuation

FAILURE CRITERION

Max. deviator Stress ☒ | Max. Stress ratio ☐ | Axial Strain % ☐

Stage :	1	Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
Date	Time	Dial		P.R.No. 3	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
28/11	21:06	11.87	8.26	0.142	233	1.911	58.4	70.3	11.9	41.1	29.2	31.4	5.90
	21:15	12.18	8.47	0.143	233	1.949	58.9	70.9	12.0	41.4	29.4	31.6	5.90
	21:24	12.48	8.68	0.144	233	1.986	59.4	71.5	12.1	41.8	29.7	31.9	5.91
	21:33	12.78	8.89	0.145	233	2.024	59.8	71.9	12.1	42.0	29.9	32.0	5.95
	21:42	13.09	9.11	0.146	233	2.062	60.3	72.4	12.1	42.3	30.2	32.2	5.99
	21:51	13.41	9.33	0.147	233	2.101	60.8	73.0	12.2	42.6	30.4	32.5	5.98
	22:00	13.71	9.54	0.148	233	2.137	61.3	73.5	12.2	42.8	30.6	32.6	6.02
	22:09	14.01	9.75	0.149	233	2.173	61.8	74.1	12.3	43.2	30.9	32.9	6.02
	22:18	14.32	9.96	0.150	233	2.208	62.3	74.7	12.4	43.6	31.1	33.2	6.00
	22:27	14.63	10.18	0.151	232	2.245	62.7	75.3	12.6	43.9	31.4	33.5	5.99
	22:36	14.93	10.39	0.152	233	2.280	63.2	75.7	12.5	44.1	31.6	33.6	6.06
	22:45	15.24	10.61	0.152	233	2.316	63.0	75.5	12.5	44.0	31.5	33.5	6.04
	22:54	15.55	10.82	0.153	232	2.350	63.5	76.1	12.6	44.3	31.7	33.8	6.04
	23:03	15.87	11.04	0.153	232	2.386	63.3	76.1	12.8	44.4	31.6	33.9	5.94
	23:12	16.17	11.25	0.154	232	2.419	63.7	76.6	12.9	44.8	31.9	34.1	5.94
	23:21	16.48	11.47	0.155	232	2.454	64.2	77.1	12.9	45.0	32.1	34.3	5.98
	23:30	16.80	11.69	0.157	232	2.489	65.3	78.3	13.0	45.7	32.7	34.8	6.01
	23:39	17.11	11.90	0.158	232	2.522	65.8	78.9	13.1	46.0	32.9	35.0	6.02
	23:48	17.41	12.11	0.159	232	2.554	66.2	79.4	13.2	46.3	33.1	35.2	6.03
	23:57	17.71	12.32	0.160	232	2.586	66.7	80.0	13.3	46.7	33.3	35.5	6.00
29/11	00:06	18.02	12.54	0.160	232	2.620	66.5	79.8	13.4	46.6	33.2	35.5	5.96
	00:15	18.33	12.76	0.161	232	2.653	66.9	80.3	13.5	46.9	33.4	35.7	5.97
	00:24	18.64	12.97	0.161	231	2.685	66.7	80.2	13.5	46.9	33.3	35.7	5.94
	00:33	18.94	13.18	0.161	231	2.716	66.5	80.2	13.7	46.9	33.2	35.9	5.86
	00:42	19.25	13.39	0.162	231	2.748	66.9	80.6	13.7	47.2	33.5	36.0	5.89
	00:51	19.55	13.61	0.162	231	2.780	66.7	80.6	13.9	47.2	33.4	36.1	5.81
	01:00	19.86	13.82	0.162	231	2.811	66.5	80.6	14.1	47.4	33.3	36.3	5.71
	01:09	20.17	14.03	0.163	231	2.842	67.0	81.1	14.1	47.6	33.5	36.4	5.75
	01:18	20.48	14.25	0.163	231	2.874	66.7	80.9	14.2	47.5	33.4	36.4	5.71
	01:27	20.79	14.46	0.163	231	2.904	66.5	80.8	14.2	47.5	33.3	36.4	5.68
	01:36	21.09	14.68	0.163	231	2.936	66.3	80.6	14.3	47.5	33.2	36.4	5.64
	01:45	21.41	14.89	0.164	231	2.966	66.8	81.1	14.3	47.7	33.4	36.5	5.67
	01:54	21.72	15.11	0.164	230	2.998	66.5	81.2	14.6	47.9	33.3	36.8	5.55
	02:03	22.03	15.33	0.165	230	3.029	67.0	81.6	14.6	48.1	33.5	37.0	5.57
	02:12	22.34	15.54	0.166	230	3.059	67.4	82.1	14.7	48.4	33.7	37.2	5.58
	02:21	22.64	15.75	0.167	230	3.088	67.8	82.7	14.9	48.8	33.9	37.5	5.56
	02:30	22.95	15.97	0.168	230	3.119	68.2	83.1	14.9	49.0	34.1	37.7	5.57
	02:39	23.26	16.19	0.169	230	3.150	68.6	83.5	14.9	49.2	34.3	37.8	5.61
	02:48	23.57	16.40	0.170	230	3.180	69.0	84.1	15.1	49.6	34.5	38.1	5.58
	02:57	23.87	16.61	0.171	230	3.209	69.4	84.6	15.2	49.9	34.7	38.3	5.57
	03:06	24.18	16.82	0.172	230	3.239	69.8	84.9	15.1	50.0	34.9	38.4	5.62

Borehole No. : D047 — **Sample Depth m:- 2.20 - 3.20**

Sample No. : 1 — **Specimen Depth m:- 3.00 -3.20**

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 — **Works Order No.: 059**

Compiled by: W S Wat

Checked by: H W Chung

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2
Shearing Continuation

FAILURE CRITERION

Max. deviator Stress ☒ | Max. Stress ratio ☐ | Axial Strain % ☐

Stage :	1	Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
Date	Time	Dial		P.R.No. 3	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
29/11	03:15	24.48	17.04	0.173	230	3.269	70.2	85.5	15.2	50.3	35.1	38.6	5.61
	03:24	24.79	17.25	0.174	230	3.299	70.6	86.0	15.4	50.7	35.3	38.9	5.60
	03:33	25.10	17.46	0.175	230	3.328	71.0	86.5	15.5	51.0	35.5	39.1	5.59
	03:42	25.41	17.68	0.176	230	3.359	71.4	86.9	15.5	51.2	35.7	39.3	5.61
	03:51	25.72	17.89	0.176	229	3.388	71.2	86.8	15.7	51.2	35.6	39.4	5.55
	04:00	26.03	18.11	0.177	229	3.419	71.5	87.2	15.7	51.5	35.8	39.6	5.55
	04:09	26.34	18.33	0.178	229	3.450	71.9	87.9	16.0	51.9	36.0	39.9	5.51
	04:18	26.65	18.54	0.179	229	3.479	72.3	88.3	16.0	52.1	36.1	40.1	5.52
	04:27	**26.97**	**18.76**	**0.180**	**229**	**3.510**	**72.6**	**88.7**	**16.1**	**52.4**	**36.3**	**40.3**	**5.52**
	04:36	27.28	18.98	0.180	229	3.541	72.6	88.8	16.2	52.5	36.3	40.4	5.48
	04:45	27.58	19.19	0.180	229	3.570	72.2	88.6	16.4	52.5	36.1	40.5	5.39
	04:54	27.88	19.40	0.180	228	3.600	72.0	88.6	16.7	52.6	36.0	40.7	5.32
	05:03	28.19	19.62	0.180	228	3.631	71.7	88.7	17.0	52.8	35.9	40.9	5.23
	05:12	28.50	19.83	0.180	228	3.661	71.5	88.6	17.1	52.9	35.7	41.0	5.17
	05:21	28.81	20.04	0.179	228	3.691	70.7	87.9	17.3	52.6	35.3	40.8	5.09

Borehole No. : D047 **Sample Depth m:-** 2.20 - 3.20
Sample No. : 1 **Specimen Depth m:-** 3.00 -3.20

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.:** 059

Compiled by: W S Wat
Checked by: H W Chung

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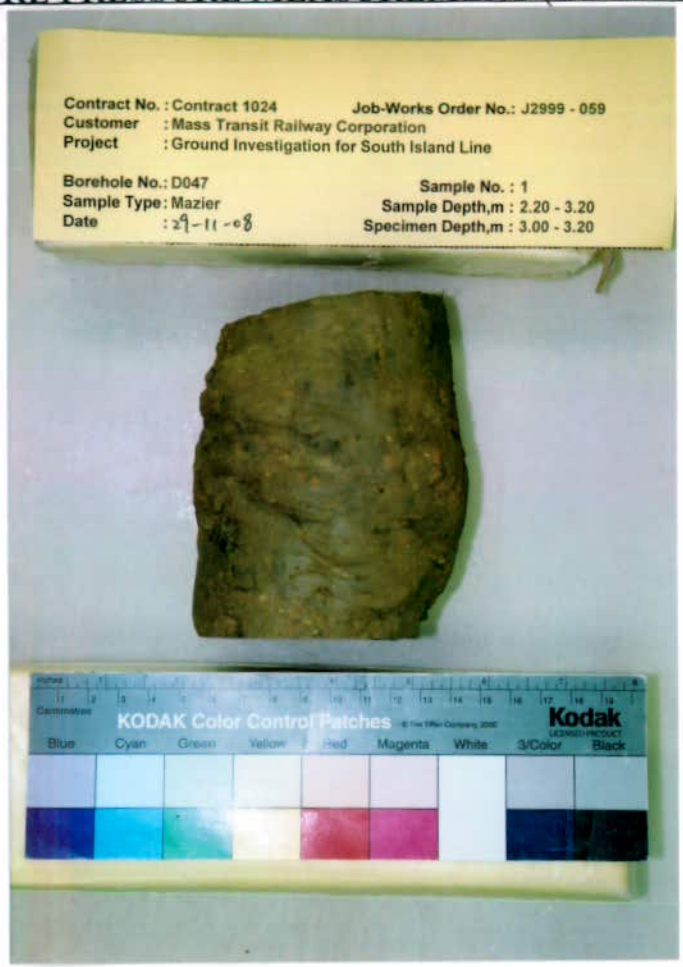
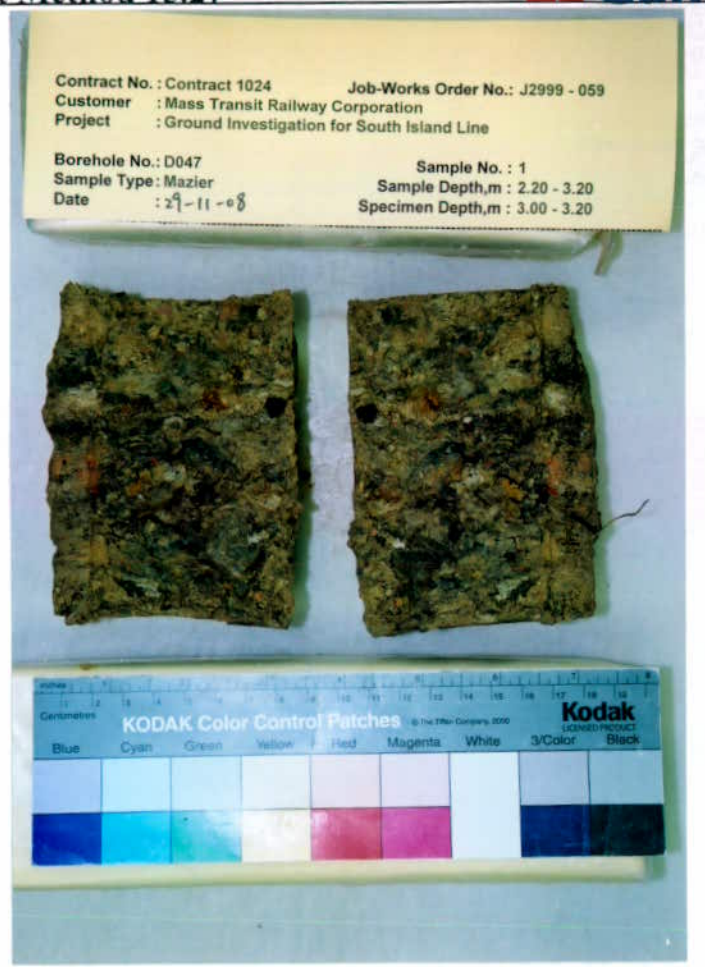
Form : GESR009.15 / Dec. 13.04 / Issue 17 / Rev 1

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT (GEOSPEC 3 : 2001 Test Method 15.2)





Description : Brown, silty, gravelly SAND Sample Origin : FILL‡ ‡ Information provided by customer

Borehole No. : D047 Sample No. : 1 Sample Depth m:- 2.20 - 3.20 Specimen Depth m:- 3.00 -3.20

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line

Contract No. : Contract 1024
Job No. : J2999
Works Order No.: 059

Compiled by W S Wat

Checked by H W Chung

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	D048		
Sample		no	8		
Sample Type			Mazier		
Stage		no	1		
Sample Depth		m	7.50 - 8.50		
Specimen Depth		m	8.10 - 8.30		
INITIAL CONDITIONS					
Diameter	(D_o)	mm	74.3		
Height	(H_o)	mm	145.0		
Moisture Content	(W_o)	%	10		
Bulk density	(ρ_o)	Mg/m^3	2.29		
Dry density	(ρ_d)	Mg/m^3	2.09		
Particle density	(ρ_s)		2.65		
Voids Ratio	(e_o)		0.27		
Degree of Saturation	(S_r)	%	95.8		
DRAINAGE CONDITIONS			ONE END		
SATURATION					
Final Pore Pressure Coefficient B			0.98		
CONSOLIDATION					
Cell Pressure	(σ_3)	kPa	295		
Back Pressure	(u_b)	kPa	220		
Effective Pressure	(σ'_3)	kPa	75		
Coefficient of Consolidation (t100) (C_{vi})		m^2/Year	180.61		
Coefficient of Volume Compressibility (m_{vi})		m^2/MN	0.27		
Coefficient of Permeability (k)		m/s	1.54E-08		
COMPRESSION TERMINATION CRITERION			MAXIMUM DEVIATOR STRESS		
COMPRESSION - INITIAL					
Moisture Content	(w)	%	9		
Pore Pressure at the End of Consolidation		kPa	220		
Effective Stress at the End of Consolidation		kPa	75		
Bulk density	(ρ_o)	Mg/m^3	2.32		
Dry density	(ρ_d)	Mg/m^3	2.13		
Voids Ratio	(e)		0.25		
Degree of Saturation	(S_r)	%	98.8		

Customer : **Mass Transit Railway Corporation**
Project : **Ground Investigation for South Island Line**
Report No. : J2999-059.11
Contract No.: Contract 1024
Job No.: **J2999** **Works Order No.: 059**

Technician : W S Wat Checked By : Approved By :
Name : H W Chung Signatory : **Lau Wai Cheong**
Tested Date: 24/11/2008 Date : 02/01/2009 Date : 02/01/2009

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Form : GESR009.6 / Nov.10.06 / Issue 1 / Rev 1

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	D048		
Sample		no	8		
Sample Type			Mazier		
Stage		no	1		
Sample Depth		m	7.50 - 8.50		
Specimen Depth		m	8.10 - 8.30		
COMPRESSION - FAILURE					
Cell Pressure		kPa	295		
Rate of Strain		mm/min	0.048		
CONDITIONS MAXIMUM DEVIATOR STRESS					
Major Effective Principal Stress (σ'_1)		kPa	2111		
Corrected Deviator Stress (σ'_1 - σ'_3)		kPa	1802		
Minor Effective Principal Stress (σ'_3)		kPa	309		
$s' = (\sigma'_1 + \sigma'_3)/2$		kPa	1210		
$t = (\sigma_1 - \sigma_3)/2$		kPa	901		
Expanded Uncertainty of s' ^		kPa	-		
Expanded Uncertainty of t ^		kPa	-		
Pore pressure parameter A_f			-0.13		
Strain at Failure	(εf)	%	4.5		
COMPRESSION - FINAL					
Moisture Content	(W_f)	%	9		
Bulk density	(ρ_o)	Mg/m^3	2.32		
Dry density	(ρ_d)	Mg/m^3	2.13		
Voids Ratio	(e_f)		0.25		
Degree of Saturation	(S_f)	%	98.8		

Notes -
1. The method of specimen preparation was in accordance with GEOSPEC 3 : 2001 :- Test method 13.3 : test specimen from undisturbed soil samples.
2. Sample received date :29/09/2008
3. The determination of moisture content was in accordance with test method 5.1 of GEOSPEC 3 : 2001.
4. Particle density : 2.65 (Assumed)
5. Maximum and minimum temperature recorded over the period of testing 19.9 - 20.7 °C.
6. Unavoidable variations from specified procedure : none
7. Comment on observed or inferred sample disturbance : none
8. Percentage by mass of soil particles larger than 1/5 of the diameter of specimen (%) : Nil
9. The specimen was selected by the laboratory.
   Name : W S Wat Designation : Senior Laboratory Technician
10. Sampling History : As Received

* Delete as appropriate ^ Upon request

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.: 059**

Compiled by W S Wat
Checked by H W Chung

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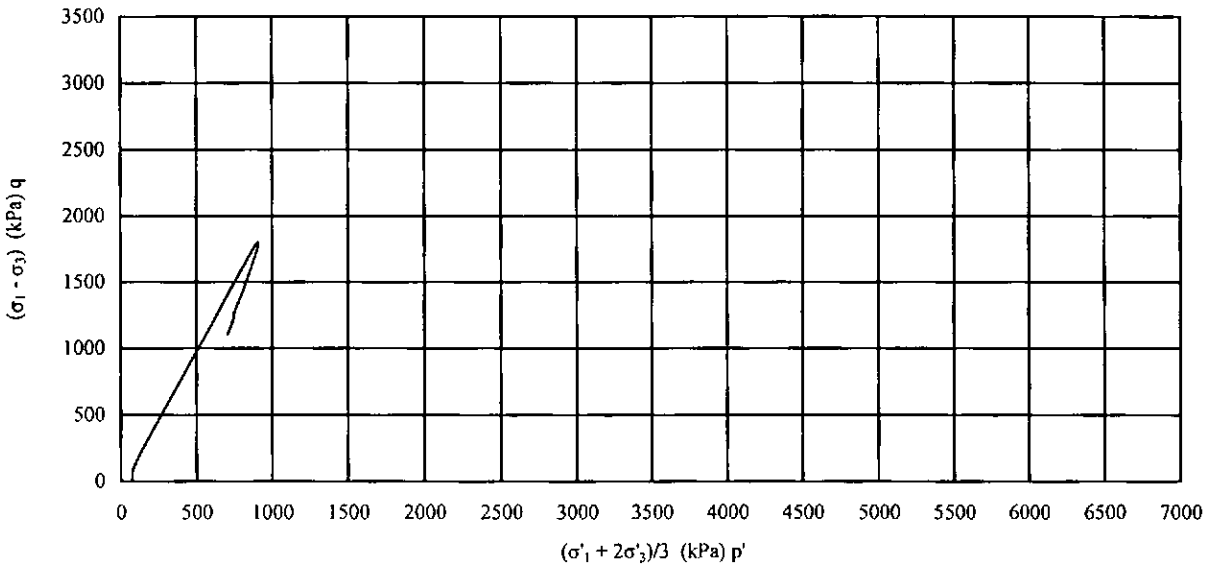
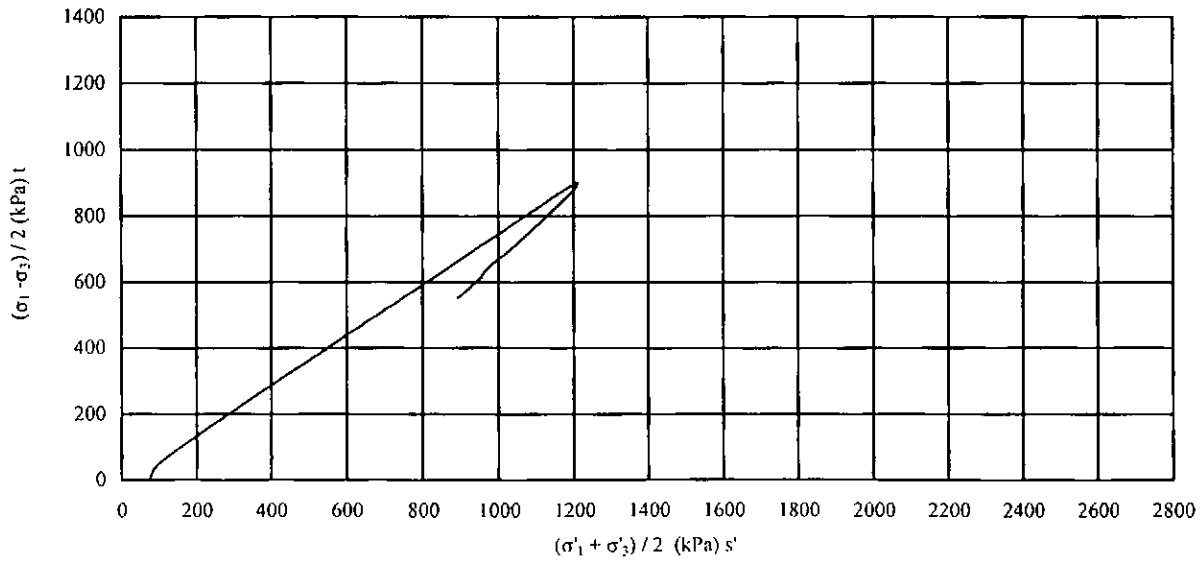
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

STRESS PATH PARAMETERS FOR EFFECTIVE STRESS

p' - q PLOT



s' - t PLOT



Borehole No. :	**D048**	**Sample Depth m:-**	**7.50 - 8.50**
Sample No. :	**8**	**Specimen Depth m:-**	**8.10 - 8.30**
Customer :	**Mass Transit Railway Corporation**		Compiled by W S Wat
Project :	**Ground Investigation for South Island Line**		
		Contract No.: Contract 1024	Checked by H W Chung
Job No.:	**J2999**	**Works Order No.: 059**	

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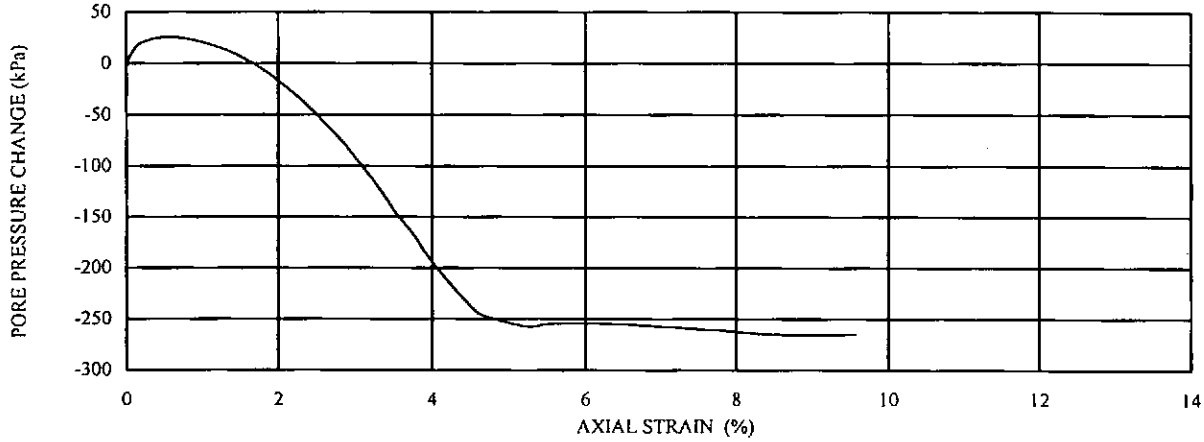
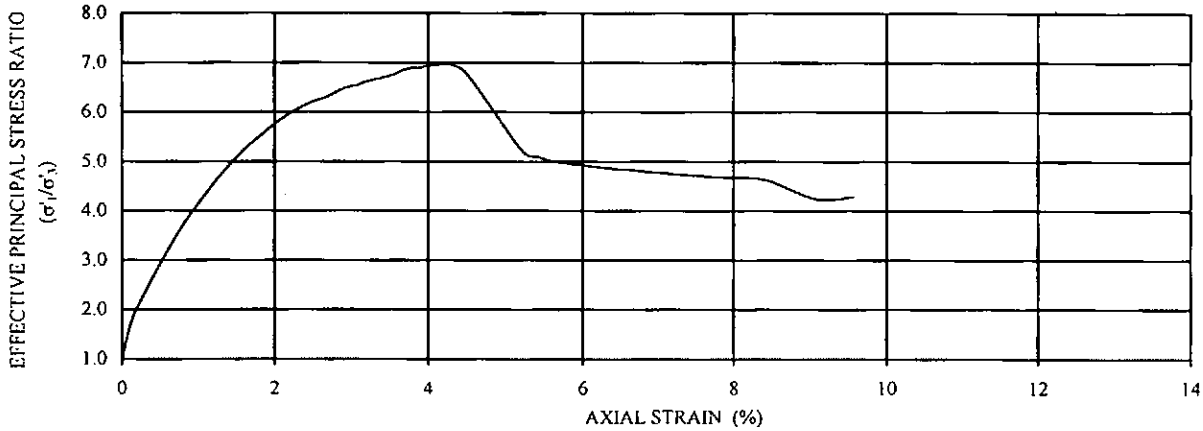
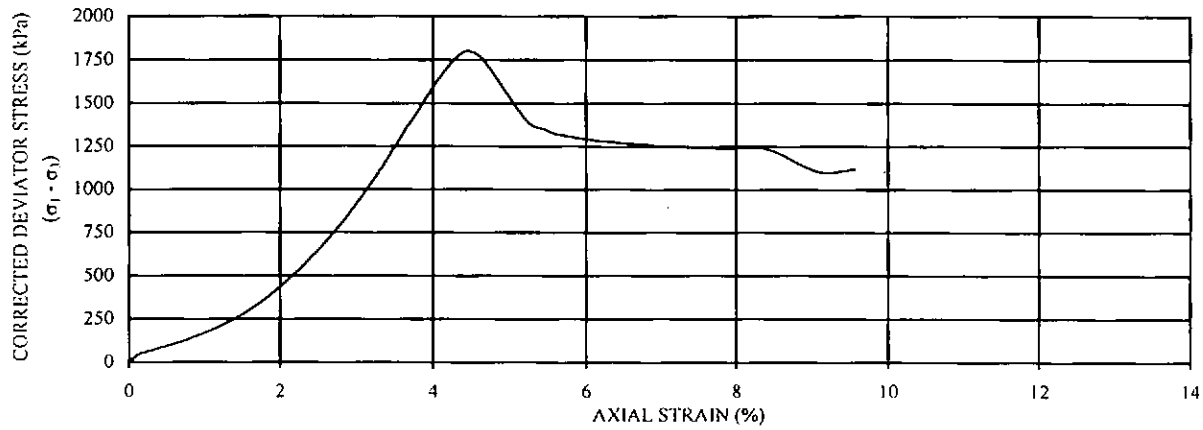
Form : GESR009.8 / Jun.02.03 / Issue 1 / Rev 0

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

COMPRESSION







Borehole No. :	**D048**	**Sample Depth m:-**	**7.50 - 8.50**
Sample No. :	**8**	**Specimen Depth m:-**	**8.10 - 8.30**
Customer :	**Mass Transit Railway Corporation**		Compiled by W S Wat
Project :	**Ground Investigation for South Island Line**		
		Contract No.:	**Contract 1024**
Job No.:	**J2999**	**Works Order No.:**	**059**
			Checked by H W Chung

Form : GESR009.9 / Jun.02.03 / Issue 1 / Rev 0

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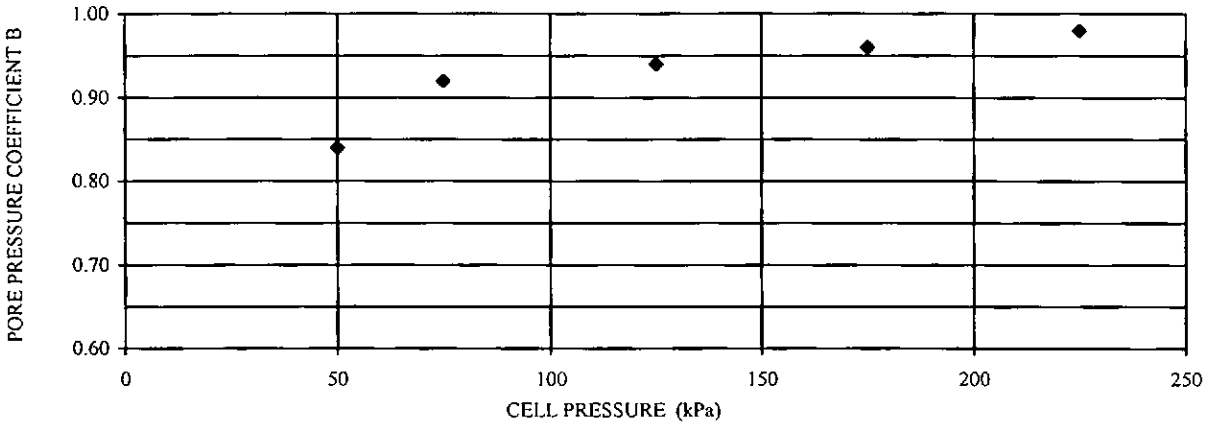
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

SATURATION



Date	Time	Cell Pressure kPa	Back Pressure kPa	Pore Pressure kPa	Cumulative Volume of Water cm^3	Pore Pressure Coefficient B
25/11/2008	08:32	0	0	-	0.0	
	08:38	25	-	22		-
	09:02	25	20	20	-1.5	
	09:07	50	-	41		0.84
	09:23	50	45	45	-0.4	
	09:29	75	-	68		0.92
	09:47	75	70	70	0.6	
	09:53	125	-	117		0.94
	10:23	125	120	120	1.9	
	10:31	175	-	168		0.96
	13:40	175	170	170	2.8	
	13:50	225	-	219		0.98
26/11/2008	08:55	225	220	220	4.2	

Borehole No. D048 — **Sample Depth m:-** 7.50 - 8.50
Sample No. : 8 — **Specimen Depth m:-** 8.10 - 8.30

Customer : Mass Transit Railway Corporation — Compiled by W S Wat
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024 — Checked by H W Chung
Job No.: J2999 — **Works Order No.:** 059

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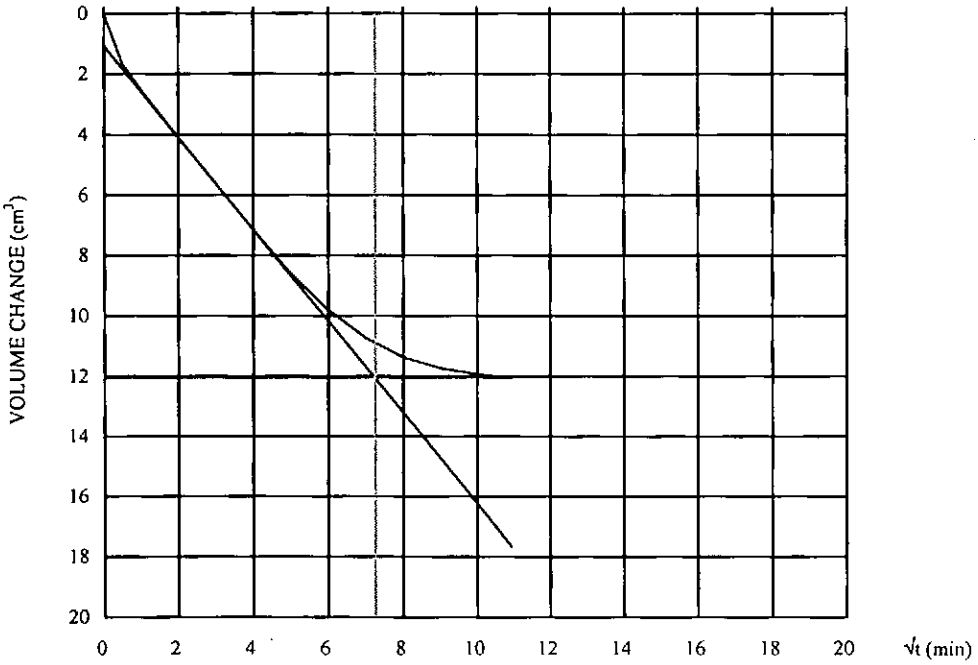
Form : GESR009.11 / Jun.02.03 / Issue 1 / Rev 0

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

CONSOLIDATION (DRAINED PHASE) - Stage 1

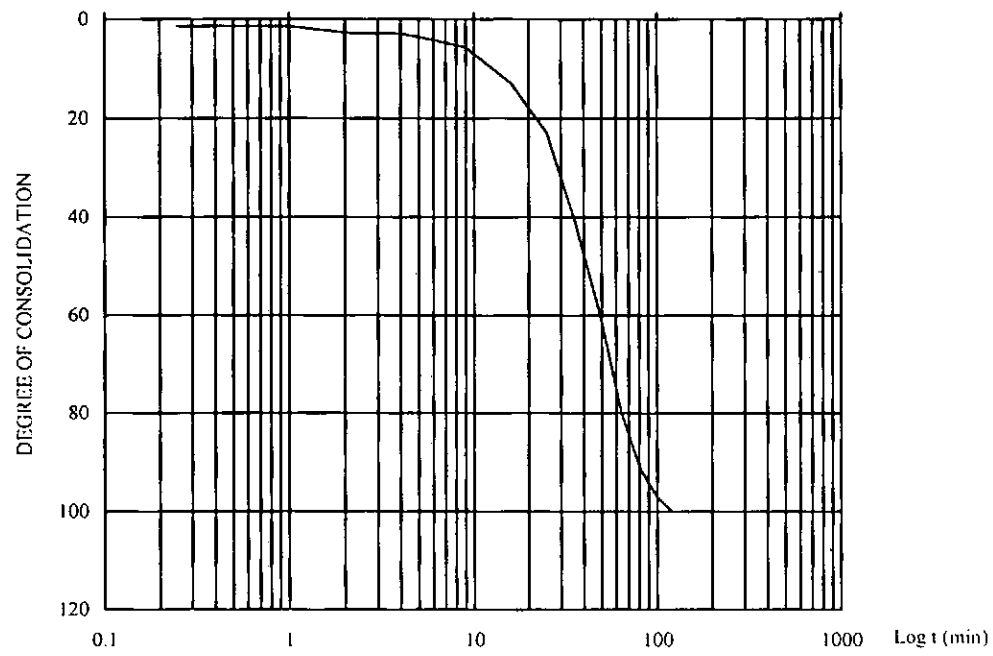


√t100 7.25 min

t100 52.500 min

tf 27.825 min

Calc. strain rate
0.362 mm/min



Borehole No. : D048 **Sample Depth m:-** 7.50 - 8.50

Sample No. : 8 **Specimen Depth m:-** 8.10 - 8.30

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.:** 059

Complied by: W S Wat

Checked by: H W Chung

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TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Single Stage				P.W.P,B.P					Effective Pressure	75			kPa
Side drains	No			Selected Machine Speed		0.048	mm/min		Rate of Strain	2.00			% per hr
FAILURE CRITERION													
Max. deviator Stress			☒	Max. Stress ratio			☐		Axial Strain %				☐
Stage :	1	Applied Pressure (kPa) - Cell :			295	Back :	220		P.R. factor		3.1659		kN/mm

Date	Time	Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
		Dial		P.R.No. 37	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
27/11	08:35	0.00	0.00	0.062	220	0.000	0.0	75.0	75.0	75.0	0.0	75.0	1.00
	08:40	0.19	0.13	0.126	236	0.038	47.3	106.0	58.7	82.3	23.6	74.5	1.81
	08:45	0.37	0.26	0.150	242	0.075	64.9	117.9	53.0	85.5	32.5	74.6	2.22
	08:50	0.56	0.39	0.173	245	0.112	81.8	132.0	50.2	91.1	40.9	77.5	2.63
	08:55	0.80	0.55	0.201	246	0.157	102.2	151.4	49.2	100.3	51.1	83.3	3.08
	09:00	1.05	0.73	0.236	245	0.207	127.7	177.8	50.1	113.9	63.8	92.7	3.55
	09:05	1.27	0.88	0.268	243	0.248	150.9	202.9	52.0	127.5	75.5	102.3	3.90
	09:10	1.49	1.03	0.303	240	0.289	176.3	231.2	54.9	143.1	88.2	113.7	4.21
	09:15	1.67	1.16	0.337	237	0.325	200.9	258.7	57.8	158.3	100.5	124.8	4.48
	09:20	1.86	1.29	0.375	234	0.360	228.4	289.7	61.3	175.5	114.2	137.4	4.73
	09:25	2.05	1.42	0.417	230	0.394	258.7	324.2	65.5	194.9	129.4	151.7	4.95
	09:30	2.23	1.54	0.461	225	0.426	290.5	360.4	69.9	215.1	145.2	166.7	5.16
	09:35	2.44	1.69	0.519	219	0.466	332.2	408.2	76.0	242.1	166.1	186.7	5.37
	09:40	2.61	1.81	0.569	213	0.497	368.1	449.7	81.6	265.7	184.1	204.3	5.51
	09:45	2.77	1.92	0.622	208	0.526	406.2	493.4	87.2	290.3	203.1	222.6	5.66
	09:50	3.03	2.10	0.718	197	0.572	475.0	572.6	97.6	335.1	237.5	255.9	5.87
	09:55	3.16	2.19	0.768	192	0.595	510.7	613.6	102.9	358.3	255.4	273.1	5.96
	10:00	3.28	2.28	0.819	186	0.618	547.1	655.7	108.6	382.2	273.6	291.0	6.04
	10:05	3.45	2.39	0.890	179	0.645	597.8	714.3	116.5	415.4	298.9	315.8	6.13
	10:10	3.61	2.51	0.963	170	0.676	649.8	774.5	124.7	449.6	324.9	341.3	6.21
	10:15	3.81	2.64	1.054	160	0.708	714.4	849.8	135.4	492.6	357.2	373.5	6.28
	10:20	3.97	2.76	1.141	150	0.738	776.2	921.0	144.8	532.9	388.1	403.5	6.36
	10:25	4.12	2.86	1.214	143	0.762	827.9	980.0	152.1	566.0	413.9	428.1	6.44
	10:30	4.27	2.96	1.303	133	0.786	890.9	1052.6	161.7	607.2	445.5	458.7	6.51
	10:35	4.42	3.07	1.394	123	0.813	955.2	1127.5	172.3	649.9	477.6	490.7	6.54
	10:40	4.58	3.18	1.494	112	0.840	1025.8	1208.8	183.0	695.9	512.9	524.9	6.61
	10:45	4.71	3.27	1.574	103	0.861	1082.1	1273.9	191.8	732.9	541.1	552.5	6.64
	10:50	4.87	3.38	1.680	91	0.887	1156.7	1360.3	203.6	782.0	578.4	589.2	6.68
	10:55	5.00	3.47	1.774	81	0.909	1222.8	1436.6	213.8	825.2	611.4	621.4	6.72
	11:00	5.13	3.56	1.863	72	0.930	1285.1	1508.3	223.2	865.8	642.6	651.6	6.76
	11:05	5.28	3.66	1.966	63	0.953	1357.2	1589.7	232.5	911.1	678.6	684.9	6.84
	11:10	5.44	3.78	2.082	51	0.981	1438.3	1682.4	244.1	963.2	719.1	723.5	6.89
	11:15	5.58	3.87	2.177	40	1.002	1504.5	1759.7	255.2	1007.4	752.2	756.7	6.90
	11:20	5.74	3.98	2.287	28	1.027	1580.9	1847.5	266.6	1057.0	790.4	793.6	6.93
	11:25	5.87	4.07	2.371	20	1.048	1639.1	1914.6	275.5	1095.1	819.6	821.9	6.95
	11:30	6.04	4.19	2.474	8	1.075	1710.1	1996.9	286.8	1141.9	855.1	856.8	6.96
	11:35	6.21	4.31	2.558	-2	1.102	1767.5	2064.6	297.1	1180.9	883.8	886.3	6.95
	11:40	**6.42**	**4.46**	**2.610**	**-14**	**1.136**	**1801.5**	**2110.6**	**309.1**	**1209.9**	**900.8**	**909.6**	**6.83**
	11:45	6.70	4.65	2.544	-26	1.178	1751.2	2072.3	321.1	1196.7	875.6	904.8	6.45

Borehole No. : D048 — **Sample Depth m:- 7.50 - 8.50**

Sample No. : 8 — **Specimen Depth m:- 8.10 - 8.30**

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 — **Works Order No.:** 059

Compiled by: W S Wat

Checked by: H W Chung

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Form : GESR009.14 / Dec.13.04 / Issue 1 / Rev 1

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2
Shearing Continuation

FAILURE CRITERION

Max. deviator Stress ☒ | Max. Stress ratio ☐ | Axial Strain % ☐

Stage :	I	Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
Date	Time	Dial		P.R.No. 37	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
27/11	11:50	7.52	5.22	2.051	-37	1.301	1394.6	1726.8	332.2	1029.5	697.3	797.1	5.20
	11:55	7.84	5.44	1.993	-35	1.348	1350.7	1681.0	330.3	1005.6	675.3	780.5	5.09
	12:00	8.09	5.61	1.953	-34	1.384	1320.2	1649.5	329.3	989.4	660.1	769.4	5.01
	12:15	8.92	6.19	1.909	-34	1.503	1281.5	1610.5	329.0	969.7	640.7	756.2	4.90
	12:30	9.77	6.78	1.892	-36	1.620	1261.5	1592.7	331.2	962.0	630.8	751.7	4.81
	12:45	10.56	7.33	1.881	-39	1.727	1246.5	1580.3	333.8	957.0	623.2	749.3	4.73
	13:00	11.31	7.85	1.879	-41	1.824	1238.0	1574.2	336.2	955.2	619.0	748.9	4.68
	13:15	12.13	8.42	1.883	-45	1.928	1233.0	1572.6	339.6	956.1	616.5	750.6	4.63
	13:30	13.07	9.07	1.706	-45	2.043	1104.9	1445.1	340.2	892.7	552.5	708.5	4.25
	13:45	13.79	9.57	1.733	-45	2.129	1116.8	1456.6	339.8	898.2	558.4	712.1	4.29

Borehole No. : D048 — **Sample Depth m:-** 7.50 - 8.50
Sample No. : 8 — **Specimen Depth m:-** 8.10 - 8.30

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 — **Works Order No.:** 059

Compiled by: W S Wat
Checked by: H W Chung

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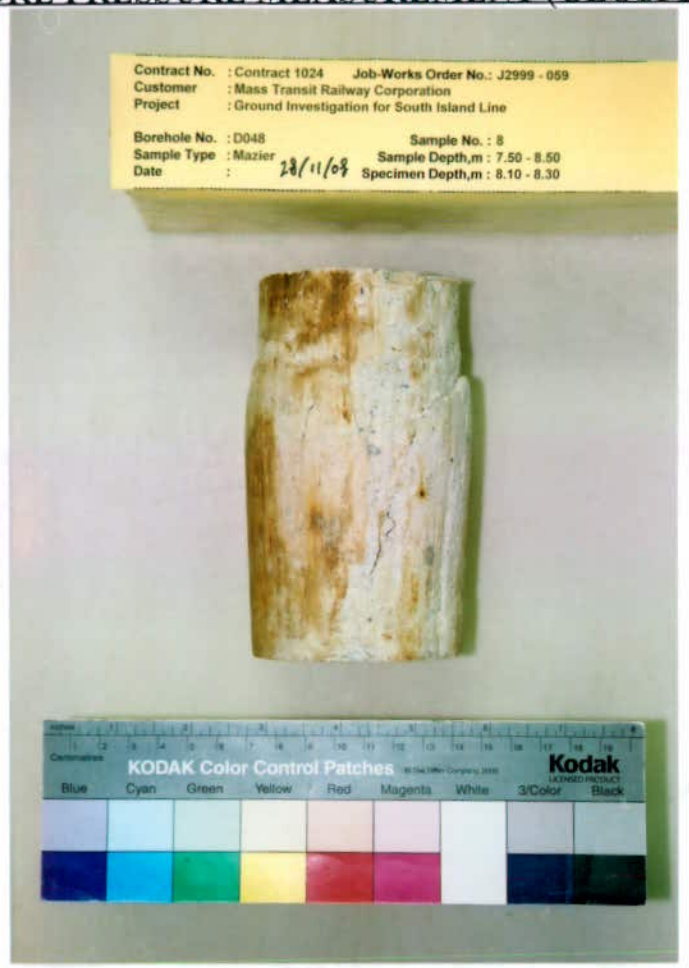
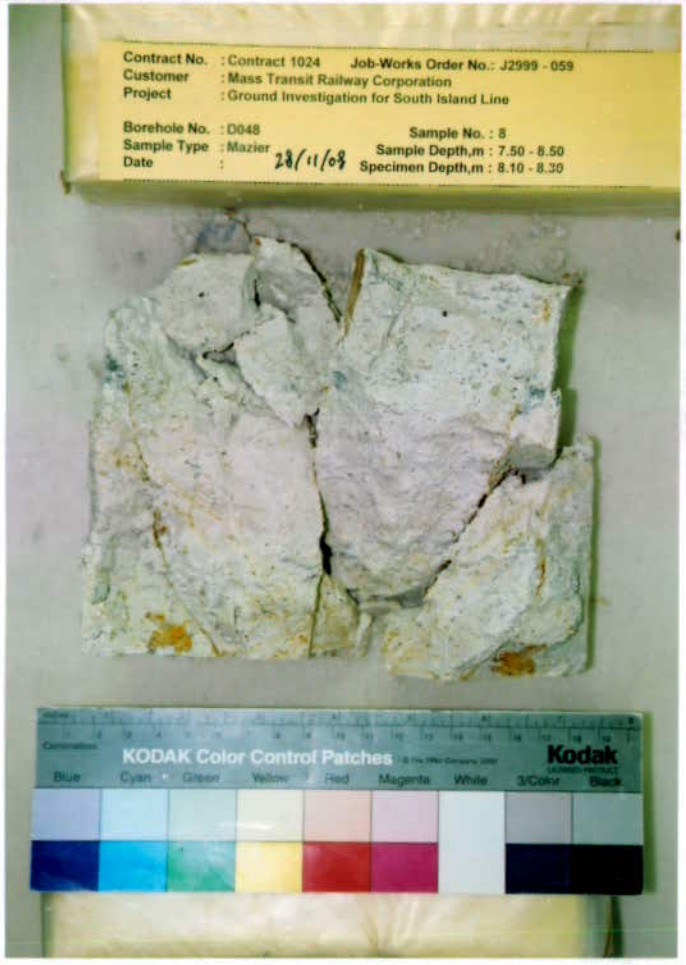
Form : GESR009.15 / Dec.13.04 / Issue 1 / Rev 1

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT (GEOSPEC 3 : 2001 Test Method 15.2)





Description : Whiteish brown, sandy SILT **Sample Origin :** CDT‡ ‡ Information provided by customer

Borehole No. : D048 **Sample No. :** 8 **Sample Depth m:-** 7.50 - 8.50 **Specimen Depth m:-** 8.10 - 8.30

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line

Contract No. : Contract 1024
Job No. : J2999
Works Order No.: 059

Compiled by: W S Wat
Checked by: H W Chung

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	D048	D048	D048
Sample		no	8	8	8
Sample Type			Mazier	Mazier	Mazier
Stage		no	1	2	3
Sample Depth		m	7.50 - 8.50	7.50 - 8.50	7.50 - 8.50
Specimen Depth		m	8.30 -8.50	8.30 -8.50	8.30 -8.50
INITIAL CONDITIONS					
Diameter	(D_o)	mm	74.3	75.0	75.5
Height	(H_o)	mm	145.0	140.8	138.2
Moisture Content	(W_o)	%	10	10	10
Bulk density	(ρ_o)	Mg/m^3	2.28	2.31	2.31
Dry density	(ρ_d)	Mg/m^3	2.07	2.09	2.10
Particle density	(ρ_s)		2.65	2.65	2.65
Voids Ratio	(e_o)		0.28	0.27	0.26
Degree of Saturation	(S_r)	%	98.7	101.5	101.5
DRAINAGE CONDITIONS			ONE END		
SATURATION					
Final Pore Pressure Coefficient B			1.00		
CONSOLIDATION					
Cell Pressure	(σ_3)	kPa	245	285	320
Back Pressure	(u_b)	kPa	210	210	210
Effective Pressure	(σ'_3)	kPa	35	75	110
Coefficient of Consolidation (t100) (C_{vi})		$m^2/Year$	97.83	227.90	332.87
Coefficient of Volume Compressibility (m_{vi})		m^2/MN	0.38	0.12	0.06
Coefficient of Permeability (k)		m/s	1.15E-08	8.72E-09	6.65E-09
COMPRESSION TERMINATION CRITERION			MAXIMUM STRESS RATIO		MAX ($\sigma'1 - \sigma'3$)
COMPRESSION - INITIAL					
Moisture Content	(w)	%	10	10	10
Pore Pressure at the End of Consolidation		kPa	210	210	210
Effective Stress at the End of Consolidation		kPa	35	75	110
Bulk density	(ρ_o)	Mg/m^3	2.31	2.31	2.31
Dry density	(ρ_d)	Mg/m^3	2.09	2.10	2.11
Voids Ratio	(e)		0.27	0.26	0.26
Degree of Saturation	(S_r)	%	101.5	101.5	101.6

Customer : **Mass Transit Railway Corporation**
Project : **Ground Investigation for South Island Line**
Report No. :
Contract No.: Contract 1024
Job No.: **J2999** **Works Order No.: 059**

Technician : W S Wat Checked By : Approved By :

Name : H W Chung Signatory : **Lau Wai Cheong**

Tested Date: 25/11/2008 Date : 02/01/2009 Date : 02/01/2009

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	D048	D048	D048
Sample		no	8	8	8
Sample Type			Mazier	Mazier	Mazier
Stage		no	1	2	3
Sample Depth		m	7.50 - 8.50	7.50 - 8.50	7.50 - 8.50
Specimen Depth		m	8.30 -8.50	8.30 -8.50	8.30 -8.50
COMPRESSION - FAILURE					
Cell Pressure		kPa	245	285	320
Rate of Strain		mm/min	0.048	0.046	0.046
CONDITIONS AT MAXIMUM STRESS RATIO					
Major Effective Principal Stress (σ'_1)		kPa	362	639	836
Corrected Deviator Stress ($\sigma'_1 - \sigma'_3$)		kPa	308	529	681
Minor Effective Principal Stress (σ'_3)		kPa	54	110	156
$s' = (\sigma'_1 + \sigma'_3)/2$		kPa	208	375	496
$t = (\sigma_1 - \sigma_3)/2$		kPa	154	265	340
Expanded Uncertainty of s' ^		kPa	-	-	-
Expanded Uncertainty of t ^		kPa	-	-	-
Pore pressure parameter A_f			-0.06	-0.07	-0.07
Strain at Failure	(εf)	%	2.3	4.2	5.9
COMPRESSION - FINAL					
Moisture Content	(W_f)	%	10	10	10
Bulk density	(ρ_o)	Mg/m^3	2.31	2.31	2.31
Dry density	(ρ_d)	Mg/m^3	2.09	2.10	2.11
Voids Ratio	(e_f)		0.27	0.26	0.26
Degree of Saturation	(S_f)	%	101.5	101.5	101.6

Notes -
1. The method of specimen preparation was in accordance with GEOSPEC 3 : 2001 :- Test method 13.3 : test specimen from undisturbed soil samples.
2. Sample received date :29/09/2008
3. The determination of moisture content was in accordance with test method 5.1 of GEOSPEC 3 : 2001.
4. Particle density : 2.65 (Assumed)
5. Maximum and minimum temperature recorded over the period of testing 19.9 - 20.7 °C.
6. Unavoidable variations from specified procedure : none
7. Comment on observed or inferred sample disturbance : none
8. Percentage by mass of soil particles larger than 1/5 of the diameter of specimen (%) : Nil
9. The specimen was selected by the laboratory.
   Name : W S Wat Designation : Senior Laboratory Technician
10. Sampling History : As Received

* Delete as appropriate ^ Upon request

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.: 059**

Compiled by W S Wat
Checked by H W Chung

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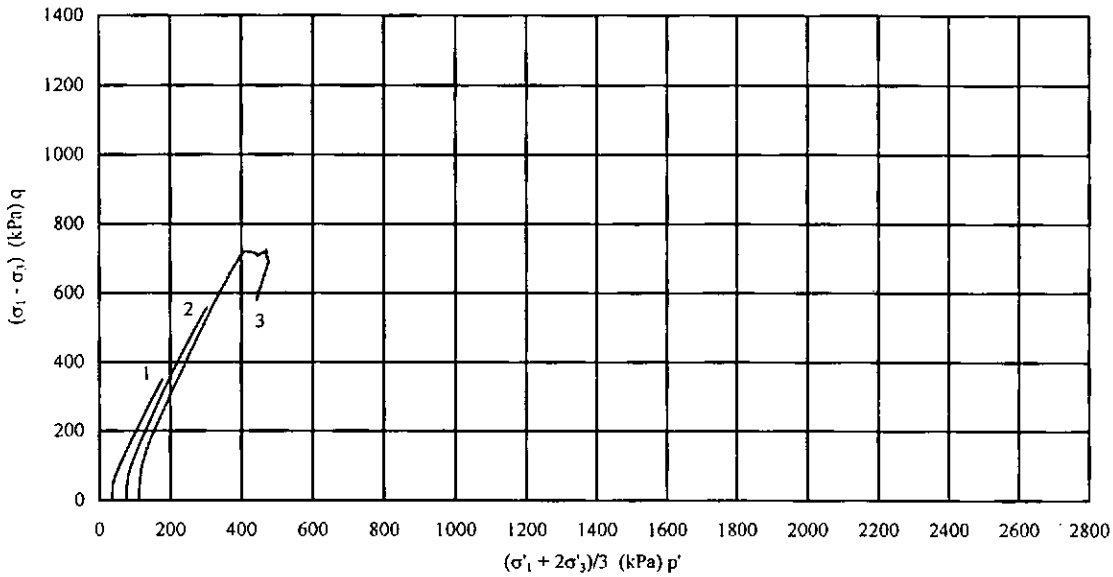
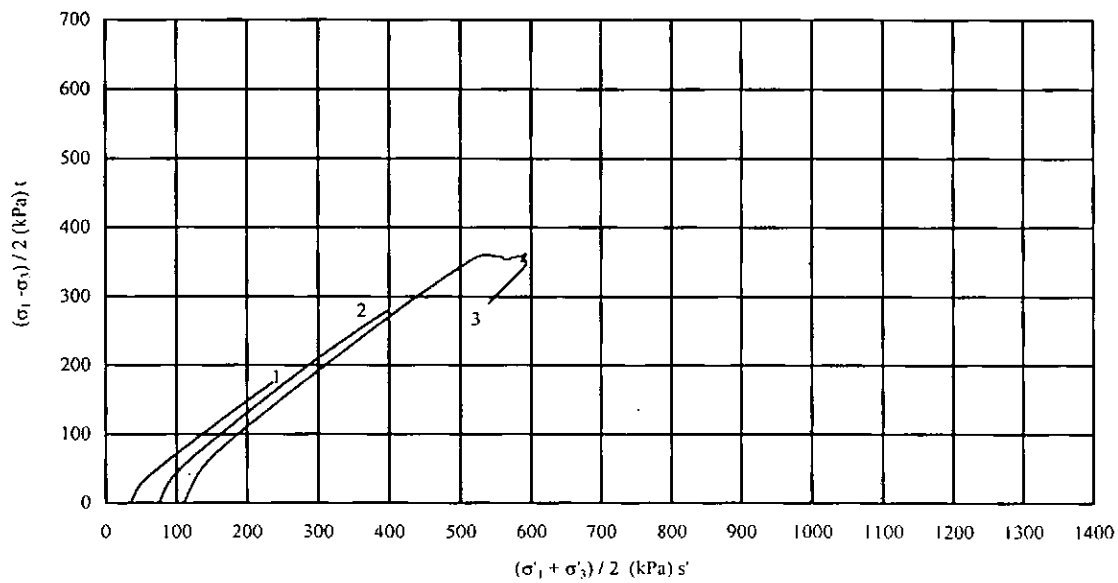
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

STRESS PATH PARAMETERS FOR EFFECTIVE STRESS

p' - q PLOT



s' - t PLOT



Borehole No. :	**D048**	**Sample Depth m:-**	**7.50 - 8.50**
Sample No. :	**8**	**Specimen Depth m:-**	**8.30 -8.50**
Customer :	**Mass Transit Railway Corporation**		Compiled by W S Wat
Project :	**Ground Investigation for South Island Line**		
		Contract No.: Contract 1024	Checked by H W Chung
Job No.:	**J2999**	**Works Order No.: 059**	

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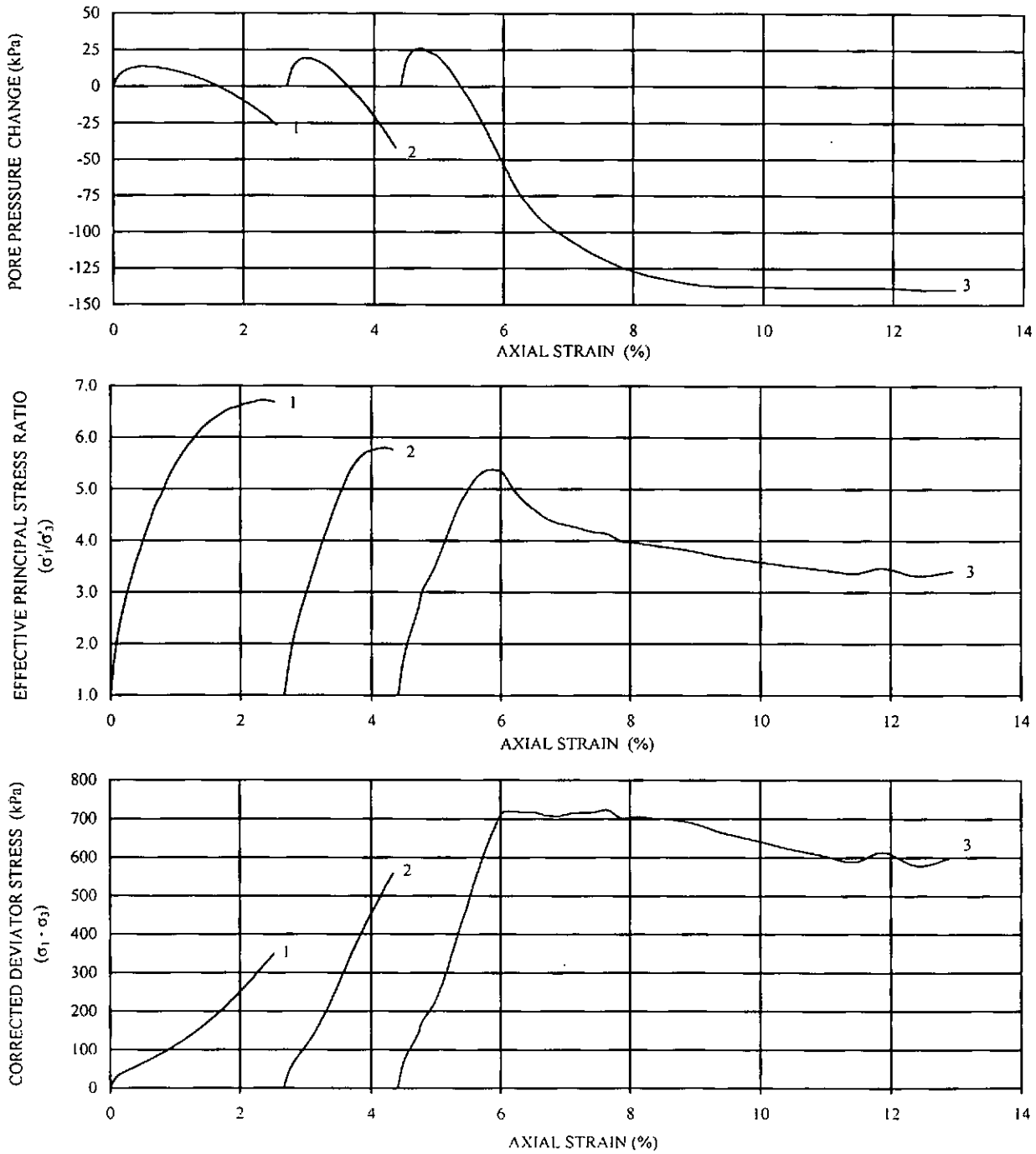
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

COMPRESSION



Borehole No. : D048	**Sample Depth m:-** 7.50 - 8.50
Sample No. : 8	**Specimen Depth m:-** 8.30 -8.50
Customer : Mass Transit Railway Corporation	Compiled by W S Wat
Project : Ground Investigation for South Island Line	
Contract No.: Contract 1024	Checked by H W Chung
Job No.: J2999 **Works Order No.:** 059	

Form : GESR009.9 / Jun.02.03 / Issue 1 / Rev 0

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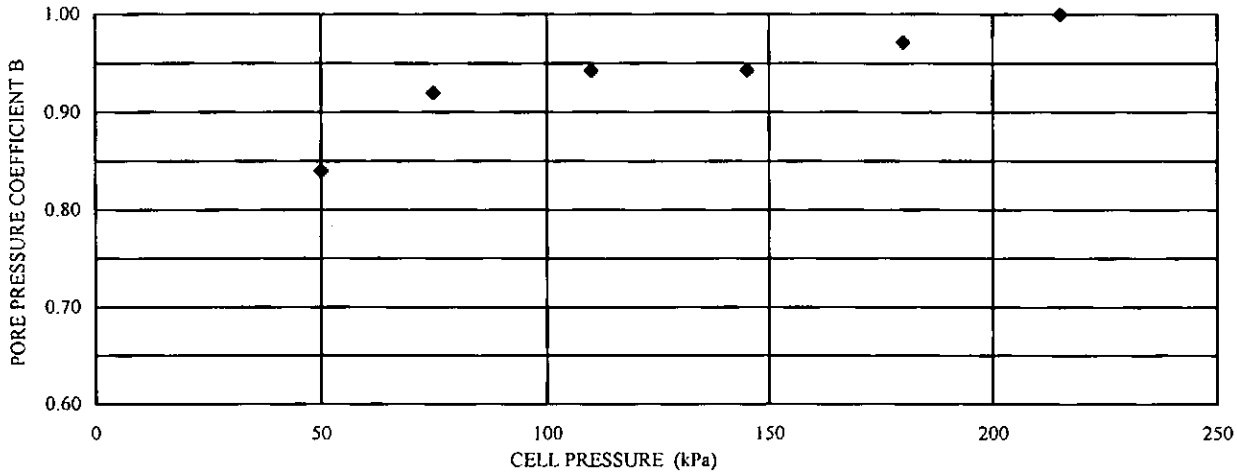
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

SATURATION



Date	Time	Cell Pressure kPa	Back Pressure kPa	Pore Pressure kPa	Cumulative Volume of Water cm^3	Pore Pressure Parameter B
25/11/2008	08:34	0	0	-	0.0	
	08:44	25	-	22		-
	09:00	25	20	20	-0.9	
	09:05	50	-	41		0.84
	09:23	50	45	45	-0.2	
	09:29	75	-	68		0.92
	09:48	75	70	70	0.6	
	09:53	110	-	103		0.94
	10:17	110	105	105	1.1	
	10:23	145	-	138		0.94
	11:06	145	140	140	2.3	
	11:14	180	-	174		0.97
	13:42	180	175	175	2.7	
	13:54	215	-	210		1.00
26/11/2008	08:35	215	210	210	3.7	

Borehole No. : D048 **Sample Depth m:-** 7.50 - 8.50
Sample No. : 8 **Specimen Depth m:-** 8.30 -8.50

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.:** 059

Compiled by W S Wat
Checked by H W Chung

Form : GESR009.11 / Jun.02.03 / Issue 1 / Rev 0

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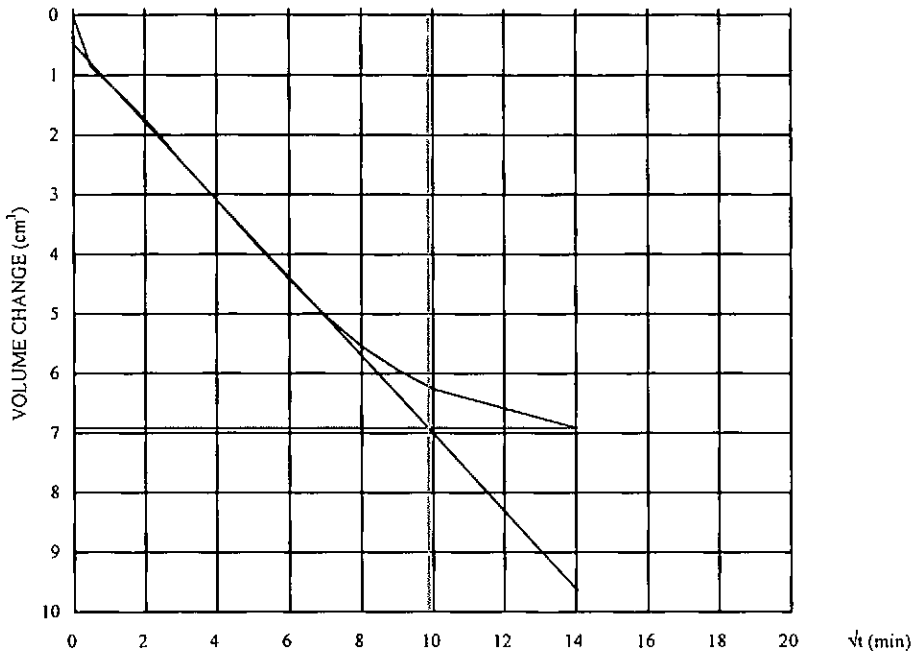
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

CONSOLIDATION (DRAINED PHASE) - Stage 1

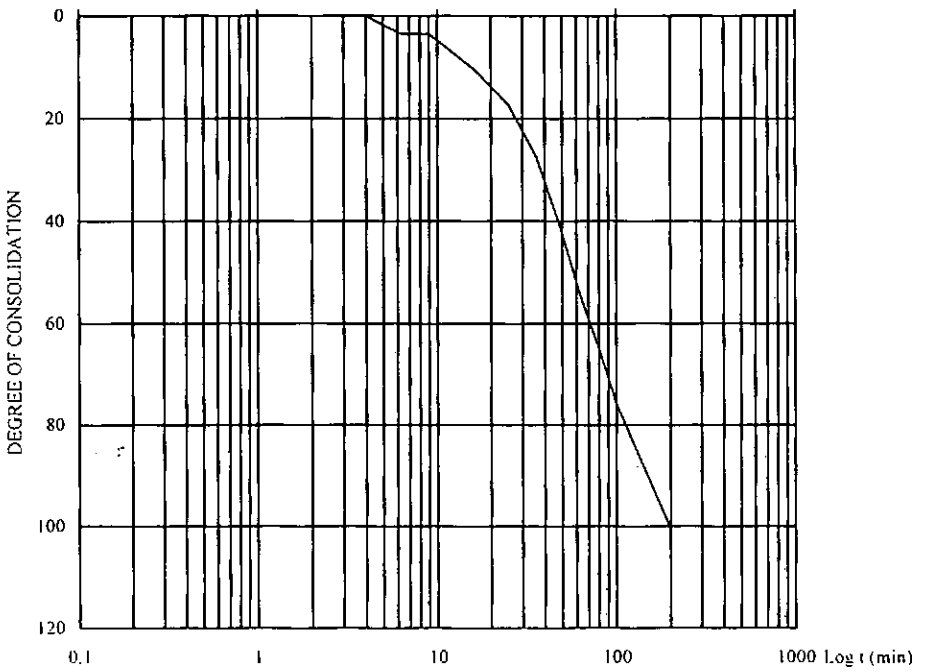


√t100 9.87 min

t100 97.35 min

tf 51.60 min

Calc. strain rate
0.196 mm/min



Borehole No. : D048 **Sample Depth m:-** 7.50 - 8.50

Sample No. : 8 **Specimen Depth m:-** 8.30 -8.50

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.:** 059

Complied by: W S Wat

Checked by: H W Chung

Form : GESR009.13 / Jun.02.03 / Issue 1 / Rev 0

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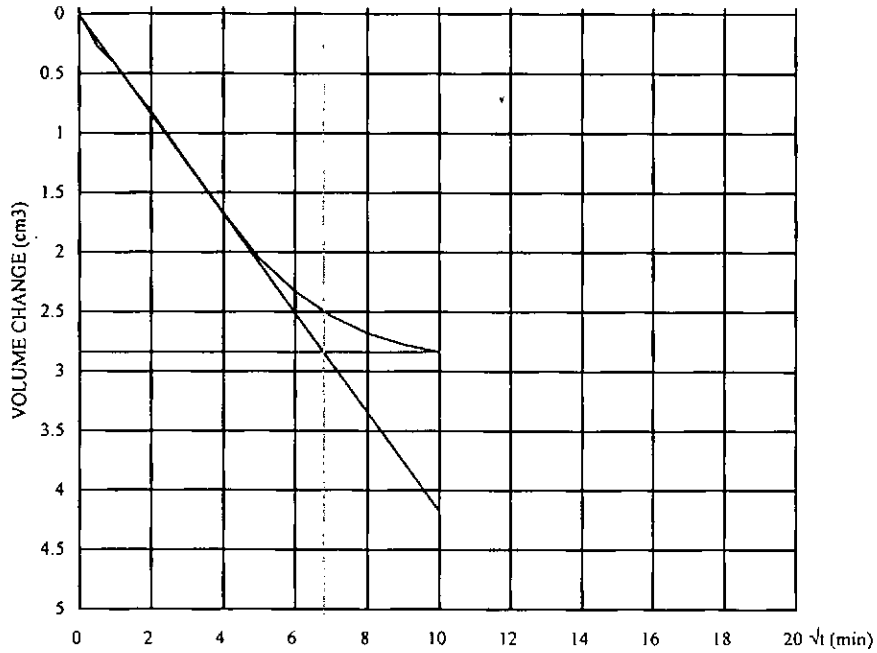
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

CONSOLIDATION (DRAINED PHASE) - Stage 2

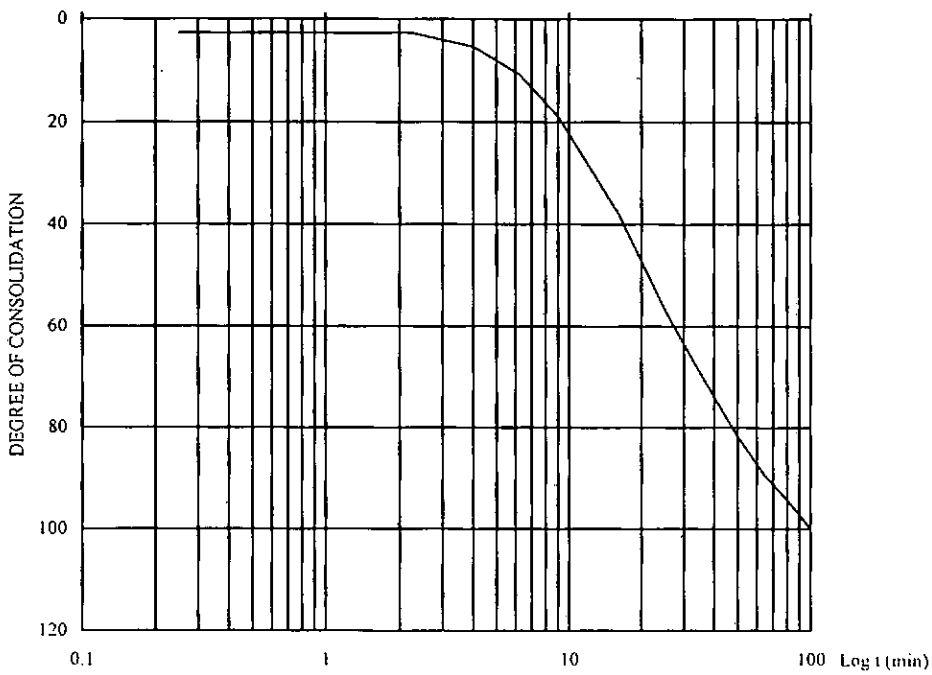


√t100 6.79 min

t100 46.05 min

tf 24.40 min

Calc. strain rate
0.403 mm/min



Borehole No. : D048 **Sample Depth m:-** 7.50 - 8.50

Sample No. : 8 **Specimen Depth m:-** 8.30 -8.50

Customer :	**Mass Transit Railway Corporation**	Complied by
Project :	**Ground Investigation for South Island Line**	W S Wat
	Contract No.: Contract 1024	Checked by
Job No.:	**J2999** **Works Order No.: 059**	H W Chung

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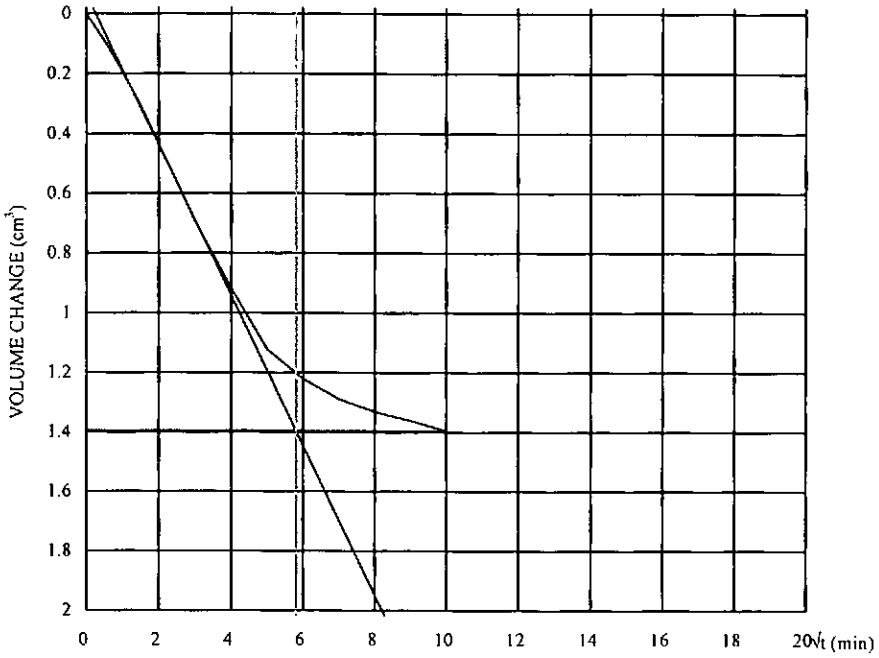
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

CONSOLIDATION (DRAINED PHASE) - Stage 3

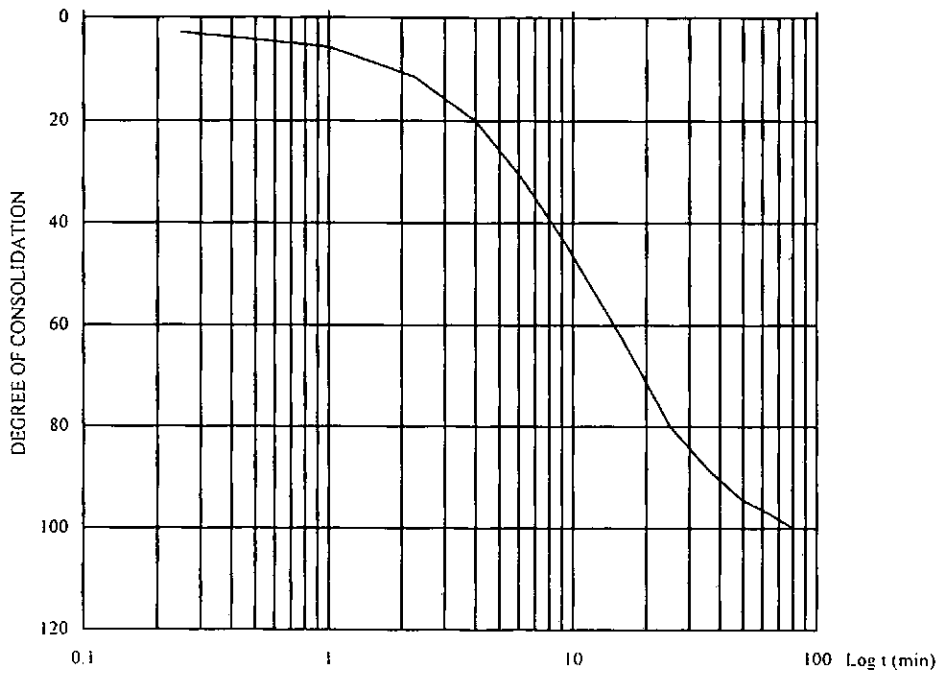


√t100 5.80 min

t100 33.69 min

tf 17.85 min

Calc. strain rate
0.541 mm/min



Borehole No. : D048 **Sample Depth m:-** 7.50 - 8.50

Sample No. : 8 **Specimen Depth m:-** 8.30 -8.50

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.:** 059

Complied by: W S Wat

Checked by: H W Chung

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Form : GESR009.13 / Jun.02.03 / Issue 1 / Rev 0

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Multi Stage		P.W.P,B.P			Effective Pressure	35	kPa
Side drains	No	Selected Machine Speed	0.048	mm/min	Rate of Strain	1.99	% per hr

FAILURE CRITERION

Max. deviator Stress	☐	Max. Stress ratio	☒		Axial Strain %		☐
Stage : 1	Applied Pressure (kPa) - Cell :	245	Back :	210	P.R. factor	1.6835	kN/mm

Date	Time	Strain		Load	Pore Pressure	Dev. stress		Effective Stress Parameters					
		Dial		P.R.No. 39		Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
26/11	12:40	0.00	0.00	0.059	210	0.000	0.0	35.0	35.0	35.0	0.0	35.0	1.00
	12:45	0.14	0.09	0.131	218	0.026	28.1	55.3	27.2	41.3	14.1	36.6	2.03
	12:50	0.33	0.23	0.170	222	0.066	43.3	66.5	23.2	44.8	21.6	37.6	2.87
	12:55	0.52	0.36	0.196	223	0.103	53.3	75.1	21.8	48.5	26.7	39.6	3.45
	13:00	0.68	0.47	0.218	224	0.134	61.8	83.3	21.5	52.4	30.9	42.1	3.87
	13:05	0.99	0.68	0.265	223	0.193	79.9	101.9	22.0	61.9	39.9	48.6	4.63
	13:10	1.14	0.79	0.289	222	0.223	89.1	111.9	22.8	67.3	44.5	52.5	4.91
	13:15	1.30	0.90	0.319	221	0.254	100.6	124.4	23.8	74.1	50.3	57.3	5.23
	13:20	1.48	1.02	0.352	220	0.287	113.2	138.3	25.1	81.7	56.6	62.8	5.51
	13:25	1.69	1.17	0.394	218	0.327	129.2	156.1	26.9	91.5	64.6	70.0	5.80
	13:30	1.91	1.32	0.442	216	0.368	147.5	176.8	29.3	103.1	73.8	78.5	6.04
	13:35	2.06	1.43	0.479	214	0.397	161.6	192.7	31.1	111.9	80.8	85.0	6.20
	13:40	2.25	1.56	0.527	211	0.431	179.9	213.6	33.7	123.6	89.9	93.7	6.34
	13:45	2.47	1.71	0.584	208	0.471	201.5	238.4	36.9	137.6	100.7	104.1	6.46
	13:50	2.65	1.83	0.637	205	0.502	221.6	261.5	39.9	150.7	110.8	113.8	6.55
	13:55	2.81	1.94	0.685	202	0.531	239.7	282.6	42.9	162.8	119.9	122.8	6.59
	14:00	2.97	2.06	0.740	199	0.562	260.5	306.6	46.1	176.3	130.2	132.9	6.65
	14:05	3.14	2.18	0.798	195	0.592	282.3	332.0	49.7	190.9	141.2	143.8	6.68
[redacted]	14:10	3.34	2.31	0.867	191	0.625	308.3	362.2	53.9	208.0	154.1	156.7	6.72
	14:15	3.51	2.43	0.930	187	0.655	331.9	390.0	58.1	224.1	166.0	168.7	6.71
	14:20	3.64	2.52	0.976	184	0.678	349.2	410.6	61.4	236.0	174.6	177.8	6.69

Borehole No. :	D048	Sample Depth m:- 7.50 - 8.50	
Sample No. :	8	Specimen Depth m:- 8.30 -8.50	
Customer :	Mass Transit Railway Corporation		Compiled by W S Wat
Project :	Ground Investigation for South Island Line	Contract No.: Contract 1024	Checked by H W Chung
Job No.:	J2999	Works Order No.: 059	

Form : GESR009.14 / Dec.13.04 / Issue 1 / Rev 1

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Multi Stage		P.W.P,B.P		Effective Pressure	75 kPa
Side drains	No	Selected Machine Speed	0.046 mm/min	Rate of Strain	1.96 % per hr

FAILURE CRITERION

Max. deviator Stress ☐	Max. Stress ratio ☒	Axial Strain % ☐

Stage : 2	Applied Pressure (kPa) - Cell : 285	Back : 210	P.R. factor 1.6835 kN/mm		

Date	Time	Strain Dial	Strain	Load P.R.No. 39	Pore Pressure	Dev. stress Corr.	Dev. stress q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
27/11	08:35	3.86	2.67	0.087	210	0.000	0.0	75.0	75.0	75.0	0.0	75.0	1.00
	08:40	3.96	2.74	0.193	222	0.732	39.8	103.3	63.5	83.4	19.9	76.8	1.63
	08:45	4.07	2.82	0.265	227	0.752	67.3	125.7	58.4	92.0	33.6	80.8	2.15
	08:50	4.19	2.90	0.316	229	0.772	86.6	142.6	56.0	99.3	43.3	84.9	2.55
	08:55	4.35	3.01	0.383	229	0.798	112.1	167.8	55.7	111.7	56.0	93.1	3.01
	09:00	4.52	3.13	0.464	228	0.827	142.8	200.1	57.3	128.7	71.4	104.9	3.49
	09:05	4.67	3.23	0.546	225	0.851	173.8	233.8	60.0	146.9	86.9	117.9	3.90
	09:10	4.81	3.33	0.629	222	0.875	205.1	268.2	63.1	165.7	102.6	131.5	4.25
	09:15	4.93	3.41	0.712	219	0.894	236.4	302.8	66.4	184.6	118.2	145.2	4.56
	09:20	5.04	3.49	0.793	215	0.913	267.0	336.8	69.8	203.3	133.5	158.8	4.82
	09:25	5.16	3.58	0.885	211	0.934	301.6	375.2	73.6	224.4	150.8	174.1	5.10
	09:30	5.29	3.66	0.975	208	0.953	335.4	412.9	77.5	245.2	167.7	189.3	5.33
	09:35	5.44	3.77	1.082	202	0.979	375.5	458.2	82.7	270.4	187.7	207.9	5.54
	09:40	5.57	3.86	1.167	198	0.999	407.2	494.6	87.4	291.0	203.6	223.1	5.66
	09:45	5.70	3.94	1.244	193	1.018	435.9	528.0	92.1	310.1	218.0	237.4	5.73
	09:50	5.91	4.09	1.371	184	1.052	483.1	584.1	101.0	342.6	241.6	262.0	5.78
	09:55	6.01	4.16	1.433	180	1.068	506.1	611.6	105.5	358.6	253.1	274.2	5.80
	10:00	**6.11**	**4.23**	**1.495**	**175**	**1.084**	**529.1**	**639.3**	**110.2**	**374.7**	**264.5**	**286.6**	**5.80**
	10:05	6.25	4.33	1.574	168	1.106	558.2	675.4	117.2	396.3	279.1	303.3	5.76

Borehole No. :	**D048**	**Sample Depth m:- 7.50 - 8.50**	
Sample No. :	**8**	**Specimen Depth m:- 8.30 -8.50**	
Customer :	**Mass Transit Railway Corporation**		Compiled by W S Wat
Project :	**Ground Investigation for South Island Line**	**Contract No.: Contract 1024**	Checked by H W Chung
Job No.:	**J2999**	**Works Order No.: 059**	

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Form : GESR009.14 / Dec.13.04 / Issue 1 / Rev 1

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Multi Stage		P.W.P,B.P		Effective Pressure 110	kPa
Side drains	No	Selected Machine Speed	0.046 mm/min	Rate of Strain 2.00	% per hr

FAILURE CRITERION

Max. deviator Stress ☐		Max. Stress ratio ☒		Axial Strain % ☐	
Stage : 3	Applied Pressure (kPa) - Cell : 320	Back : 210		P.R. factor 3.1043	kN/mm

Date	Time	Strain Dial	Strain	Load P.R.No. 3	Pore Pressure	Dev. stress Corr.	Dev. stress q $\sigma_1 - \sigma_3$	Effective Stress Parameters: Effective Stress σ'_1	Effective Stress σ'_3	s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio σ'_1/σ'_3
		mm	%	mm	kPa	kPa				2	2	3	
28/11	08:35	6.35	4.40	0.067	210	0.000	0.0	110.0	110.0	110.0	0.0	110.0	1.00
	08:40	6.47	4.48	0.157	226	1.140	61.3	155.1	93.8	124.5	30.7	114.2	1.65
	08:45	6.61	4.58	0.213	234	1.162	100.1	186.1	86.0	136.0	50.0	119.4	2.16
	08:50	6.81	4.71	0.271	236	1.191	140.1	223.7	83.6	153.6	70.0	130.3	2.68
	08:55	6.90	4.78	0.320	235	1.206	173.8	259.0	85.2	172.1	86.9	143.1	3.04
	09:00	7.14	4.95	0.382	231	1.243	216.3	304.9	88.6	196.8	108.2	160.7	3.44
	09:05	7.29	5.05	0.441	227	1.265	256.8	349.6	92.8	221.2	128.4	178.4	3.77
	09:10	7.45	5.16	0.514	222	1.288	306.8	405.3	98.5	251.9	153.4	200.8	4.11
	09:15	7.59	5.25	0.587	216	1.308	356.7	461.2	104.5	282.8	178.3	223.4	4.41
	09:20	7.74	5.35	0.668	209	1.329	412.0	523.3	111.3	317.3	206.0	248.6	4.70
	09:25	7.90	5.47	0.755	201	1.354	471.2	590.3	119.1	354.7	235.6	276.2	4.96
	09:30	8.05	5.57	0.839	193	1.375	528.3	655.3	127.0	391.2	264.2	303.1	5.16
	09:35	8.20	5.68	0.920	185	1.398	583.2	718.7	135.5	427.1	291.6	329.9	5.30
	09:40	8.37	5.79	0.996	175	1.421	634.5	779.7	145.2	462.4	317.2	356.7	5.37
[redacted]	09:45	8.54	5.91	1.065	165	1.446	680.8	836.3	155.5	495.9	340.4	382.4	5.38
	09:50	8.72	6.03	1.119	154	1.470	716.8	882.8	166.0	524.4	358.4	404.9	5.32
	09:55	8.98	6.21	1.124	139	1.507	718.8	899.9	181.1	540.5	359.4	420.7	4.97
	10:00	9.20	6.37	1.123	129	1.539	716.9	907.6	190.7	549.1	358.4	429.7	4.76
	10:05	9.45	6.54	1.124	120	1.573	716.2	915.8	199.6	557.7	358.1	438.3	4.59
	10:10	9.70	6.71	1.115	114	1.606	708.8	915.2	206.4	560.8	354.4	442.7	4.43
	10:15	9.96	6.90	1.115	108	1.643	707.3	919.2	211.9	565.6	353.7	447.7	4.34
	10:20	10.15	7.03	1.123	105	1.669	711.7	927.2	215.5	571.4	355.9	452.7	4.30
	10:25	10.42	7.22	1.132	99	1.705	716.3	937.1	220.8	578.9	358.1	459.6	4.24
	10:30	10.67	7.38	1.134	95	1.736	716.3	941.1	224.8	583.0	358.2	463.6	4.19
	10:35	10.85	7.51	1.140	92	1.760	719.3	947.1	227.8	587.5	359.7	467.6	4.16
	10:40	11.07	7.66	1.147	89	1.788	722.8	953.7	230.9	592.3	361.4	471.8	4.13
	10:45	11.37	7.87	1.118	85	1.827	701.7	936.6	234.9	585.8	350.9	468.8	3.99
	10:50	11.61	8.04	1.124	83	1.859	704.4	941.7	237.3	589.5	352.2	472.1	3.97
	10:55	11.82	8.18	1.126	81	1.884	704.7	944.0	239.3	591.6	352.3	474.2	3.94
	11:00	12.06	8.35	1.124	79	1.915	702.0	942.9	240.9	591.9	351.0	474.9	3.91
	11:15	12.82	8.88	1.116	74	2.009	692.6	938.2	245.6	591.9	346.3	476.5	3.82
	11:30	13.54	9.37	1.082	73	2.095	666.3	913.8	247.5	580.6	333.1	469.6	3.69
	11:45	14.29	9.89	1.057	72	2.183	646.0	893.6	247.6	570.6	323.0	462.9	3.61
	12:00	15.03	10.40	1.029	72	2.267	624.0	871.9	247.9	559.9	312.0	455.9	3.52
	12:15	15.77	10.91	1.008	72	2.350	606.8	855.0	248.2	551.6	303.4	450.5	3.44
	12:30	16.53	11.44	0.986	72	2.434	588.9	837.4	248.5	543.0	294.5	444.8	3.37
	12:45	17.16	11.88	1.029	72	2.503	613.4	861.6	248.2	554.9	306.7	452.7	3.47
	13:00	17.93	12.41	0.981	71	2.584	579.1	828.6	249.5	539.1	289.6	442.5	3.32
	13:15	18.70	12.95	1.022	70	2.665	601.4	851.2	249.8	550.5	300.7	450.3	3.41

Borehole No. :	**D048**	**Sample Depth m:- 7.50 - 8.50**	
Sample No. :	**8**	**Specimen Depth m:- 8.30 -8.50**	
Customer :	**Mass Transit Railway Corporation**		Compiled by
Project :	**Ground Investigation for South Island Line**		W S Wat
		Contract No.: Contract 1024	Checked by
Job No.:	**J2999**	**Works Order No.: 059**	H W Chung

Form : GESR009.14 / Dec.13.04 / Issue 1 / Rev I

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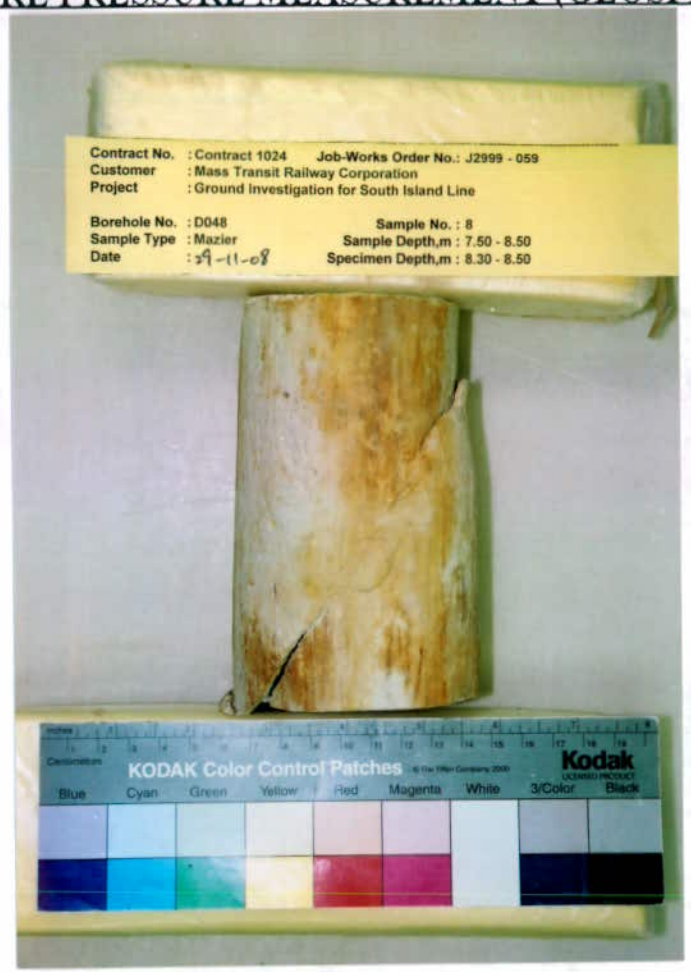
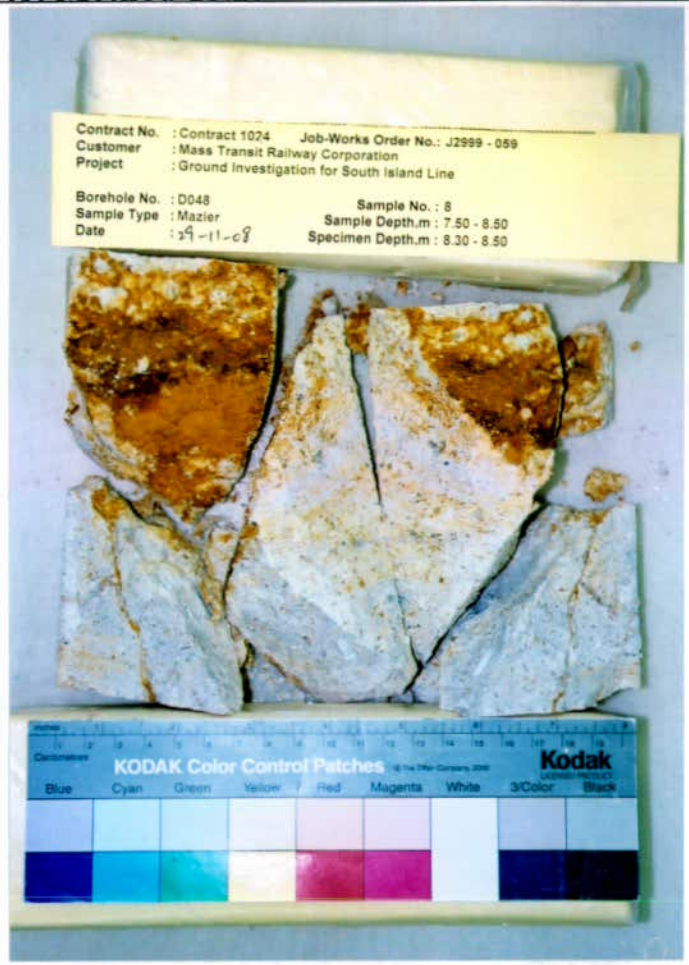
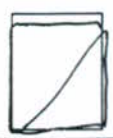
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT (GEOSPEC 3 : 2001 Test Method 15.2)







Description : Whiteish brown, sandy SILT

Sample Origin : CDT ‡ ‡ Information provided by customer

Borehole No. : D048	Sample No. : 8	Sample Depth m:- 7.50 - 8.50	Specimen Depth m:- 8.30 -8.50

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line

Contract No.: Contract 1024
Job No.: J2999
Works Order No.: 059

Compiled by: W S Wat
Checked by: H W Chung

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	D051		
Sample		no	1		
Sample Type			Mazier		
Stage		no	1		
Sample Depth		m	3.00 - 4.00		
Specimen Depth		m	3.60 - 3.80		
INITIAL CONDITIONS					
Diameter	(D_o)	mm	73.9		
Height	(H_o)	mm	145.0		
Moisture Content	(W_o)	%	26		
Bulk density	(ρ_o)	Mg/m^3	1.92		
Dry density	(ρ_d)	Mg/m^3	1.52		
Particle density	(ρ_s)		2.61		
Voids Ratio	(e_o)		0.71		
Degree of Saturation	(S_r)	%	94.3		
DRAINAGE CONDITIONS			ONE END		
SATURATION					
Final Pore Pressure Coefficient B			0.97		
CONSOLIDATION					
Cell Pressure	(σ_3)	kPa	255		
Back Pressure	(u_b)	kPa	220		
Effective Pressure	(σ'_3)	kPa	35		
Coefficient of Consolidation (t100) (C_{vi})		m^2/Year	1365.40		
Coefficient of Volume Compressibility (m_{vi})		m^2/MN	0.44		
Coefficient of Permeability (k)		m/s	1.84E-07		
COMPRESSION TERMINATION CRITERION			MAXIMUM DEVIATOR STRESS		
COMPRESSION - INITIAL					
Moisture Content	(w)	%	25		
Pore Pressure at the End of Consolidation		kPa	220		
Effective Stress at the End of Consolidation		kPa	35		
Bulk density	(ρ_o)	Mg/m^3	1.93		
Dry density	(ρ_d)	Mg/m^3	1.54		
Voids Ratio	(e)		0.69		
Degree of Saturation	(S_r)	%	95.1		

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Report No. : J2999-059.11
Contract No.: Contract 1024
Job No.: J2999
Works Order No.: 059

Technician : W S Wat
Tested Date: 03/12/2008

Checked By :
Name : H W Chung
Date : 02/01/2009

Approved By :
Signatory : **Lau Wai Cheong**
Date : 02/01/2009

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Form : GESR009.6 / Nov.10.06 / Issue 1 / Rev 1

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	D051		
Sample		no	1		
Sample Type			Mazier		
Stage		no	1		
Sample Depth		m	3.00 - 4.00		
Specimen Depth		m	3.60 - 3.80		
COMPRESSION - FAILURE					
Cell Pressure		kPa	255		
Rate of Strain		mm/min	0.048		
CONDITIONS MAXIMUM DEVIATOR STRESS					
Major Effective Principal Stress (σ'_1)		kPa	269		
Corrected Deviator Stress ($\sigma'_1 - \sigma'_3$)		kPa	208		
Minor Effective Principal Stress (σ'_3)		kPa	60		
$s' = (\sigma'_1 + \sigma'_3)/2$		kPa	164		
$t = (\sigma_1 - \sigma_3)/2$		kPa	104		
Expanded Uncertainty of s' ^		kPa	-		
Expanded Uncertainty of t ^		kPa	-		
Pore pressure parameter A_f			-0.12		
Strain at Failure	(εf)	%	17.4		
COMPRESSION - FINAL					
Moisture Content	(W_f)	%	25		
Bulk density	(ρ_o)	Mg/m^3	1.93		
Dry density	(ρ_d)	Mg/m^3	1.54		
Voids Ratio	(e_f)		0.69		
Degree of Saturation	(S_f)	%	95.1		

Notes -
1. The method of specimen preparation was in accordance with GEOSPEC 3 : 2001 :- Test method 13.3 : test specimen from undisturbed soil samples.
2. Sample received date :29/09/2008
3. The determination of moisture content was in accordance with test method 5.1 of GEOSPEC 3 : 2001.
4. Particle density : 2.61 (Determined)
5. Maximum and minimum temperature recorded over the period of testing 19.9 - 20.7 °C.
6. Unavoidable variations from specified procedure : none
7. Comment on observed or inferred sample disturbance : none
8. Percentage by mass of soil particles larger than 1/5 of the diameter of specimen (%) : Nil
9. The specimen was selected by the laboratory.
   Name : W S Wat Designation : Senior Laboratory Technician
10. Sampling History : As Received

* Delete as appropriate ^ Upon request

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.: 059**

Compiled by W S Wat
Checked by H W Chung

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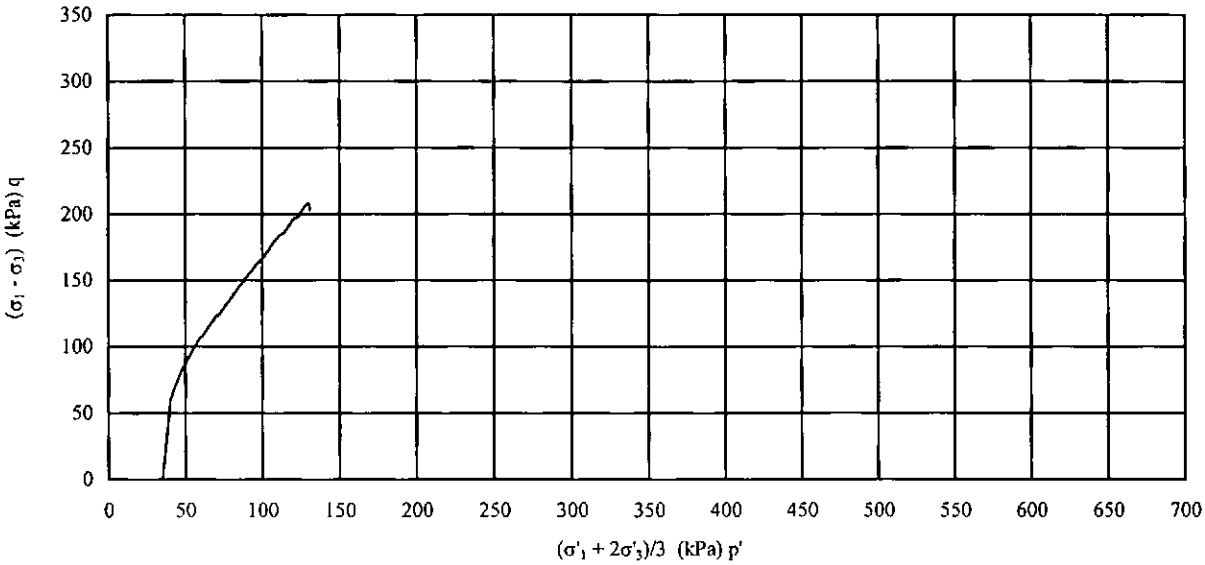
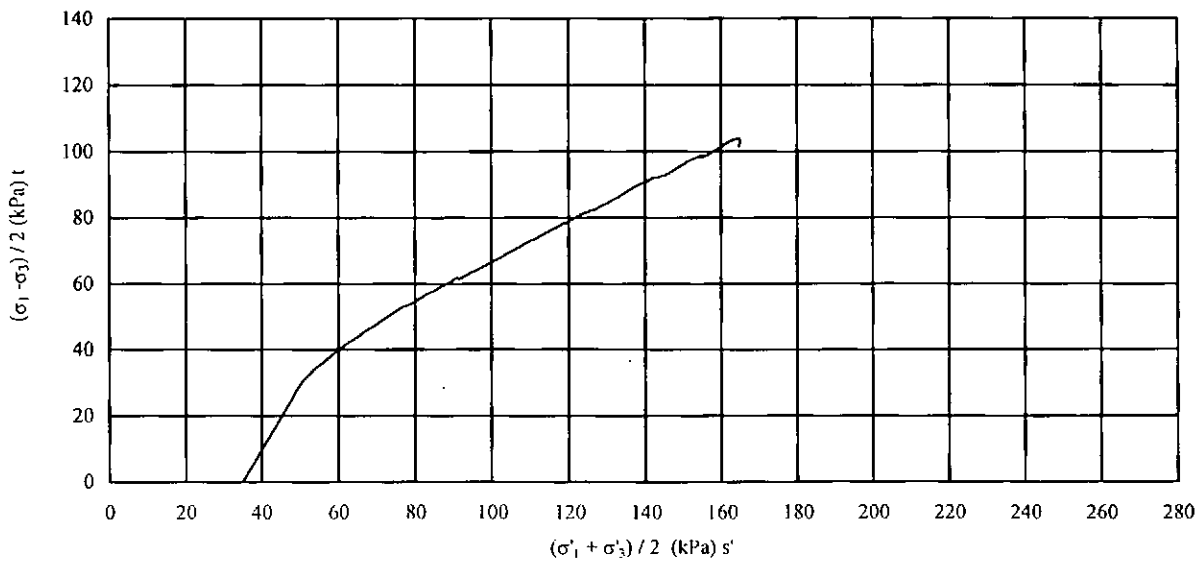
TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

STRESS PATH PARAMETERS FOR EFFECTIVE STRESS

p' - q PLOT



s' - t PLOT



Borehole No. :	**D051**	**Sample Depth m:-**	**3.00 - 4.00**
Sample No. :	**1**	**Specimen Depth m:-**	**3.60 - 3.80**
Customer :	**Mass Transit Railway Corporation**		Compiled by W S Wat
Project :	**Ground Investigation for South Island Line**		
		Contract No.: Contract 1024	Checked by H W Chung
Job No.:	**J2999**	**Works Order No.: 059**	

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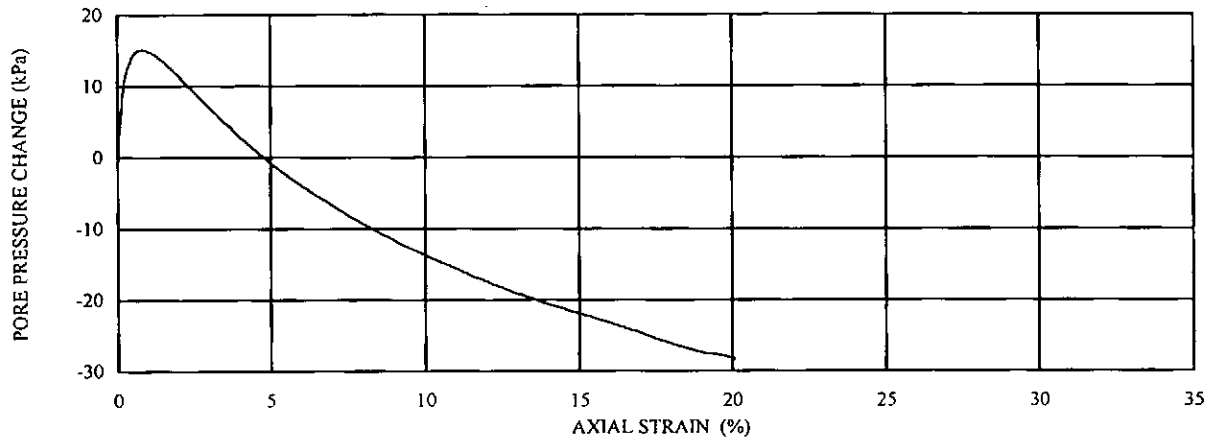
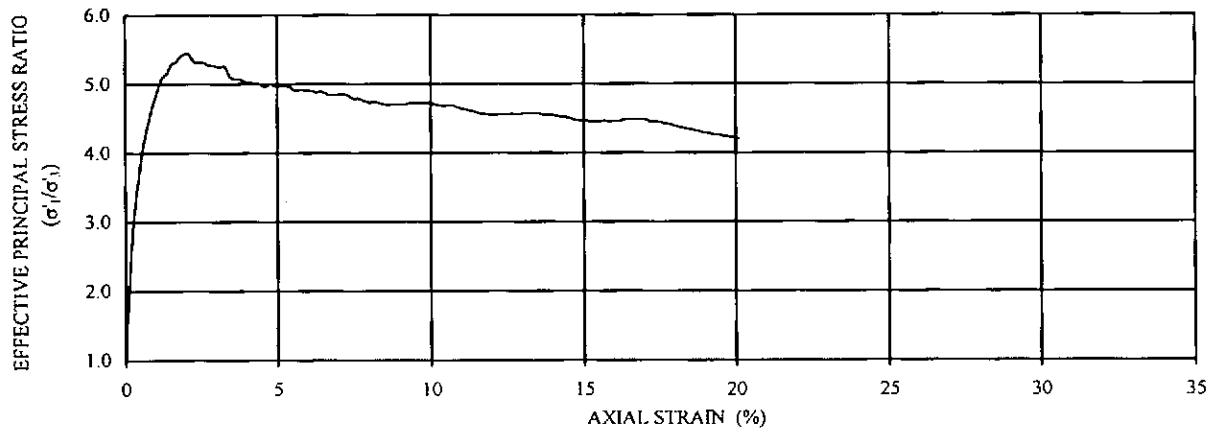
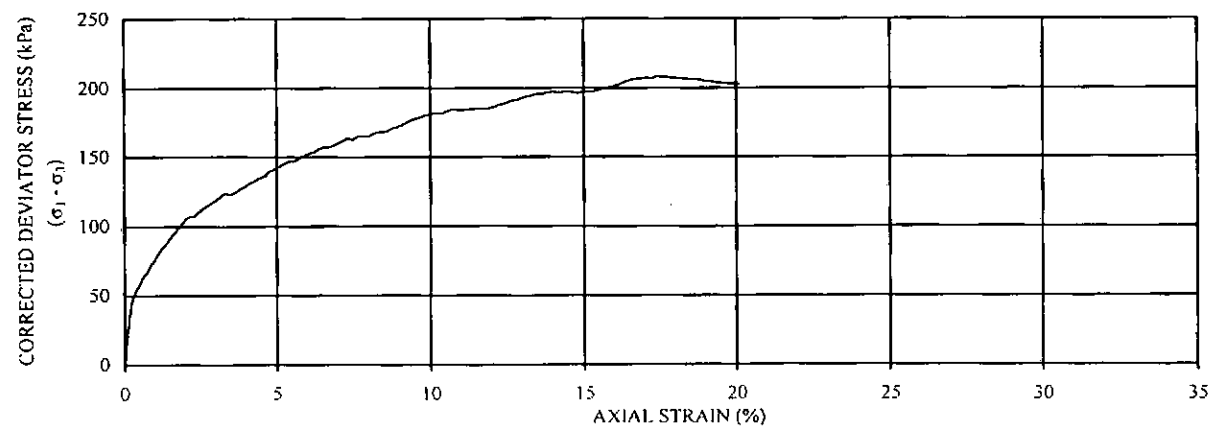
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

COMPRESSION







Borehole No. : D051 **Sample Depth m:-** 3.00 - 4.00
Sample No. : 1 **Specimen Depth m:-** 3.60 - 3.80

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.:** 059

Compiled by: W S Wat
Checked by: H W Chung

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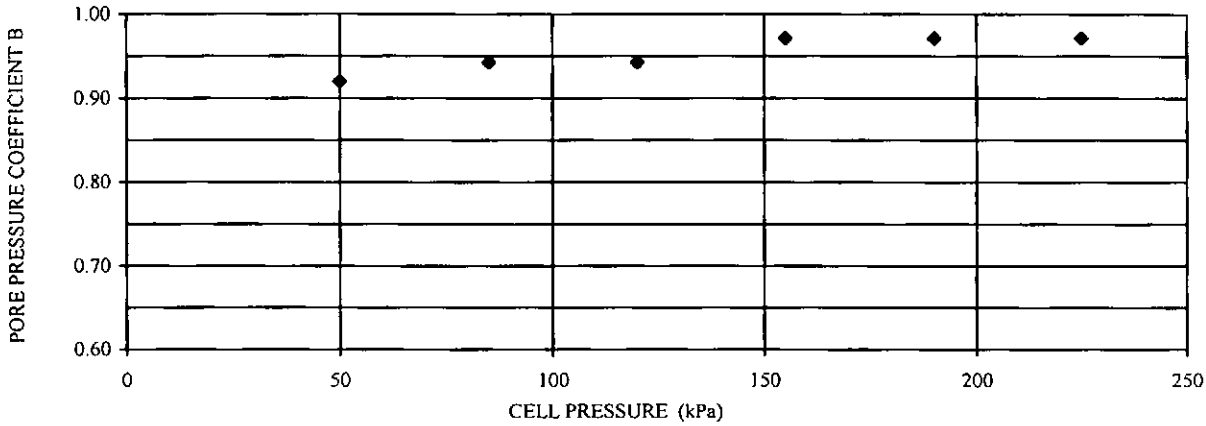
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

SATURATION



Date	Time	Cell Pressure kPa	Back Pressure kPa	Pore Pressure kPa	Cumulative Volume of Water cm^3	Pore Pressure Coefficient B
04/12/2008	08:30	0	0	-	0.0	
	08:40	25	-	24		-
	08:57	25	20	20	-7.5	
	09:03	50	-	43		0.92
	09:23	50	45	45	-5.2	
	09:30	85	-	78		0.94
	09:47	85	80	80	-3.7	
	09:53	120	-	113		0.94
	10:40	120	115	115	-1.3	
	10:49	155	-	149		0.97
	11:50	155	150	150	0.0	
	12:00	190	-	184		0.97
	13:54	190	185	185	0.7	
	14:06	225	-	219		0.97
05/12/2008	14:05	225	220	220	2.4	

Borehole No. D051 **Sample Depth m:-** 3.00 - 4.00
Sample No. : 1 **Specimen Depth m:-** 3.60 - 3.80
Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.:** 059

Compiled by: W S Wat
Checked by: H W Chung

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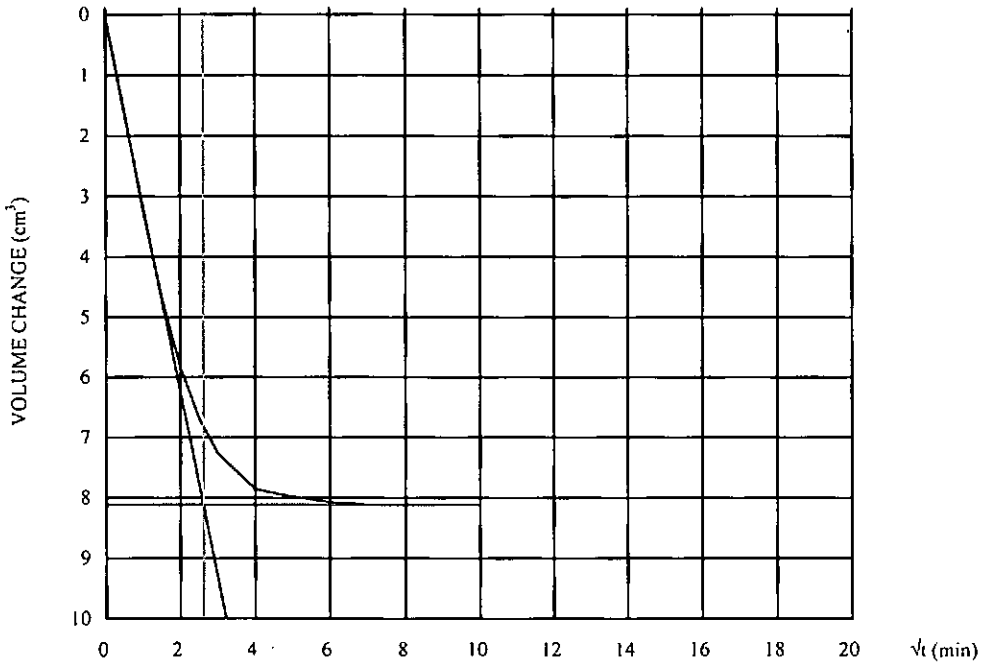
GEOSPEC 3 : 2001 Test Method 15.2

CONSOLIDATION (DRAINED PHASE) - Stage 1

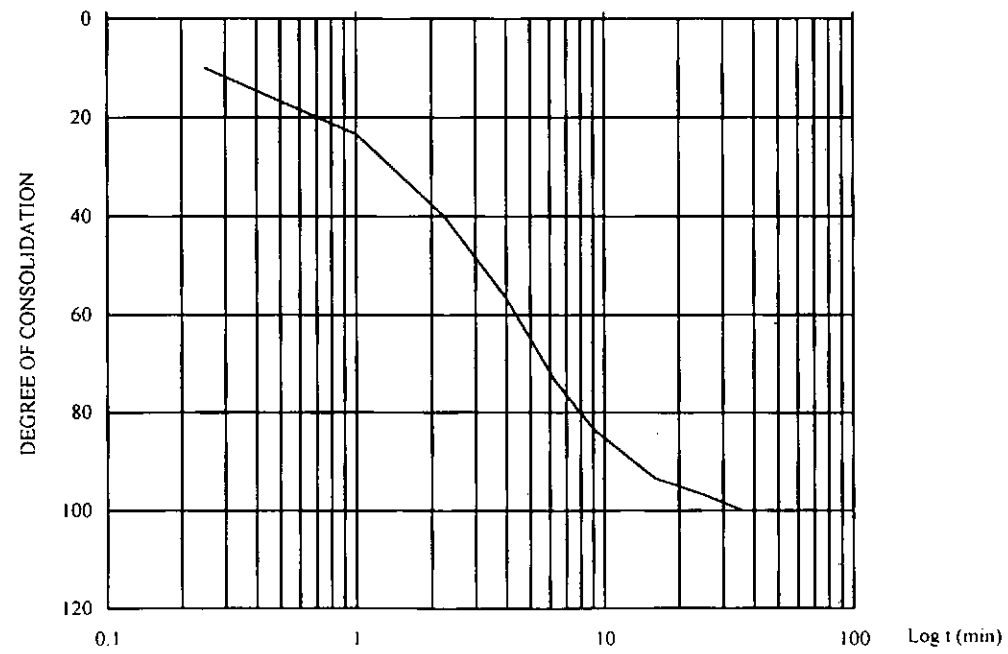


√t100 2.61 min

t100 6.821 min

tf 3.615 min

Calc. strain rate
2.795 mm/min



Borehole No. : D051 **Sample Depth m:-** 3.00 - 4.00
Sample No. : 1 **Specimen Depth m:-** 3.60 - 3.80

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line

Complied by: W S Wat
Checked by: H W Chung

Job No.: J2999 **Contract No.:** Contract 1024 **Works Order No.:** 059

Form : GESR009.13 / Jun.02.03 / Issue 1 / Rev 0

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TEST REPORT
DETERMINATION OF
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UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Single Stage				P.W.P,B.P					Effective Pressure	35			kPa
Side drains	No		Selected Machine Speed		0.048		mm/min		Rate of Strain	2.00			% per hr
FAILURE CRITERION													
Max. deviator Stress		☒		Max. Stress ratio		☐			Axial Strain %				☐
Stage :	1	Applied Pressure (kPa) - Cell :			255	Back :	220		P.R. factor	3.1101			kN/mm

Date	Time	Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
		Dial		P.R.No. 38	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
08/12	08:40	0.00	0.00	0.033	220	0.000	0.0	35.0	35.0	35.0	0.0	35.0	1.00
	08:45	0.32	0.22	0.093	231	0.064	43.8	68.2	24.4	46.3	21.9	39.0	2.79
	08:50	0.69	0.48	0.113	234	0.138	58.1	78.9	20.8	49.9	29.1	40.2	3.79
	08:55	0.90	0.62	0.121	235	0.177	63.8	83.9	20.1	52.0	31.9	41.4	4.18
	09:00	1.08	0.75	0.127	235	0.214	68.1	88.0	19.9	53.9	34.0	42.6	4.42
	09:05	1.24	0.86	0.133	235	0.244	72.3	92.2	19.9	56.1	36.2	44.0	4.63
	09:10	1.46	1.01	0.140	235	0.285	77.2	97.3	20.1	58.7	38.6	45.8	4.84
	09:15	1.72	1.19	0.149	235	0.335	83.6	104.1	20.5	62.3	41.8	48.4	5.08
	09:20	1.96	1.36	0.155	234	0.380	87.7	108.8	21.1	64.9	43.8	50.3	5.16
	09:25	2.18	1.51	0.162	233	0.421	92.6	114.2	21.6	67.9	46.3	52.5	5.29
	09:30	2.42	1.68	0.168	233	0.466	96.7	119.0	22.3	70.6	48.3	54.5	5.34
	09:35	2.70	1.87	0.176	232	0.515	102.2	125.3	23.1	74.2	51.1	57.2	5.42
	09:40	2.97	2.06	0.182	231	0.565	106.2	130.1	23.9	77.0	53.1	59.3	5.45
	09:45	3.27	2.26	0.184	230	0.616	107.4	132.2	24.8	78.5	53.7	60.6	5.33
	09:50	3.47	2.41	0.188	230	0.654	110.1	135.6	25.5	80.5	55.0	62.2	5.32
	09:55	3.76	2.60	0.193	229	0.702	113.4	139.7	26.3	83.0	56.7	64.1	5.31
	10:00	3.96	2.75	0.196	228	0.739	115.3	142.3	27.0	84.6	57.6	65.4	5.27
	10:05	4.18	2.90	0.200	227	0.776	117.9	145.5	27.6	86.6	59.0	66.9	5.27
	10:10	4.46	3.09	0.204	227	0.822	120.5	148.9	28.4	88.6	60.2	68.6	5.24
	10:15	4.71	3.27	0.209	226	0.866	123.7	152.8	29.1	91.0	61.9	70.3	5.25
	10:20	4.97	3.44	0.208	225	0.906	122.8	152.7	29.9	91.3	61.4	70.8	5.11
	10:25	5.25	3.64	0.211	224	0.953	124.6	155.2	30.6	92.9	62.3	72.1	5.07
	10:30	5.48	3.80	0.215	224	0.991	127.2	158.5	31.3	94.9	63.6	73.7	5.06
	10:35	5.71	3.95	0.218	223	1.026	129.0	161.0	32.0	96.5	64.5	75.0	5.03
	10:40	5.92	4.10	0.221	223	1.060	130.9	163.4	32.5	97.9	65.4	76.1	5.03
	10:45	6.16	4.27	0.224	222	1.099	132.7	165.8	33.1	99.5	66.4	77.3	5.01
	10:50	6.42	4.45	0.228	221	1.139	135.2	169.0	33.8	101.4	67.6	78.9	5.00
	10:55	6.65	4.61	0.230	221	1.175	136.4	170.8	34.4	102.6	68.2	79.9	4.96
	11:00	6.89	4.77	0.235	220	1.210	139.6	174.5	34.9	104.7	69.8	81.4	5.00
	11:05	7.14	4.95	0.238	219	1.250	141.4	177.0	35.6	106.3	70.7	82.7	4.97
	11:10	7.34	5.08	0.241	219	1.278	143.2	179.3	36.1	107.7	71.6	83.8	4.97
	11:15	7.56	5.23	0.244	219	1.310	145.0	181.5	36.5	109.0	72.5	84.8	4.97
	11:20	7.83	5.42	0.247	218	1.351	146.8	183.9	37.1	110.5	73.4	86.0	4.96
	11:25	8.09	5.60	0.248	217	1.389	147.1	184.8	37.7	111.3	73.6	86.7	4.90
	11:30	8.34	5.78	0.252	217	1.426	149.6	187.8	38.2	113.0	74.8	88.1	4.92
	11:35	8.58	5.94	0.255	216	1.460	151.4	190.1	38.7	114.4	75.7	89.2	4.91
	11:40	8.84	6.12	0.258	216	1.496	153.1	192.3	39.2	115.7	76.5	90.2	4.91
	11:45	9.07	6.28	0.260	215	1.529	154.2	193.9	39.7	116.8	77.1	91.1	4.88
	11:50	9.34	6.47	0.264	215	1.567	156.6	196.8	40.2	118.5	78.3	92.4	4.89

Borehole No. : D051 — **Sample Depth m:- 3.00 - 4.00**

Sample No. : 1 — **Specimen Depth m:- 3.60 - 3.80**

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 — **Works Order No.: 059**

Compiled by: W S Wat

Checked by: H W Chung

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Form : GESR009.14 / Dec.13.04 / Issue 1 / Rev 1

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2
Shearing Continuation

FAILURE CRITERION

Max. deviator Stress ☒ Max. Stress ratio ☐ Axial Strain % ☐

Stage :	1	Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
Date	Time	Dial		P.R.No. 38	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
08/12	11:55	9.54	6.61	0.265	214	1.595	157.0	197.6	40.6	119.1	78.5	92.9	4.87
	12:00	9.66	6.69	0.265	214	1.611	156.8	197.6	40.8	119.2	78.4	93.1	4.84
	12:05	10.00	6.93	0.269	214	1.658	159.1	200.5	41.4	121.0	79.6	94.4	4.84
	12:10	10.31	7.14	0.273	213	1.699	161.4	203.4	42.0	122.7	80.7	95.8	4.84
	12:15	10.56	7.32	0.276	213	1.734	163.1	205.6	42.5	124.0	81.5	96.9	4.84
	12:20	10.82	7.50	0.276	212	1.768	162.7	205.7	43.0	124.4	81.4	97.2	4.78
	12:25	11.06	7.66	0.279	212	1.798	164.4	207.8	43.4	125.6	82.2	98.2	4.79
	12:30	11.31	7.83	0.280	211	1.830	164.8	208.6	43.8	126.2	82.4	98.7	4.76
	12:35	11.58	8.02	0.281	211	1.865	165.1	209.4	44.3	126.8	82.5	99.3	4.73
	12:40	11.78	8.16	0.284	210	1.891	166.8	211.4	44.6	128.0	83.4	100.2	4.74
	12:45	11.99	8.31	0.286	210	1.918	167.9	212.9	45.0	128.9	83.9	101.0	4.73
	12:50	12.24	8.48	0.287	210	1.949	168.2	213.6	45.4	129.5	84.1	101.5	4.70
	12:55	12.47	8.64	0.289	209	1.978	169.2	215.0	45.8	130.4	84.6	102.2	4.69
	13:00	12.67	8.78	0.292	209	2.003	170.9	217.0	46.1	131.6	85.5	103.1	4.71
	13:05	13.00	9.01	0.295	208	2.043	172.4	219.0	46.6	132.8	86.2	104.1	4.70
	13:10	13.28	9.20	0.299	208	2.076	174.7	221.8	47.1	134.4	87.3	105.3	4.71
	13:15	13.49	9.35	0.302	208	2.102	176.4	223.8	47.4	135.6	88.2	106.2	4.72
	13:20	13.79	9.55	0.305	207	2.137	177.9	225.7	47.8	136.8	89.0	107.1	4.72
	13:25	14.00	9.70	0.307	207	2.162	178.9	227.0	48.1	137.6	89.5	107.7	4.72
	13:30	14.28	9.89	0.310	207	2.195	180.5	229.0	48.5	138.7	90.2	108.7	4.72
	13:35	14.55	10.08	0.312	206	2.226	181.4	230.3	48.9	139.6	90.7	109.4	4.71
	13:40	14.78	10.24	0.313	206	2.253	181.7	230.9	49.2	140.0	90.8	109.8	4.69
	13:45	15.03	10.41	0.314	206	2.281	182.0	231.5	49.5	140.5	91.0	110.2	4.68
	13:50	15.26	10.57	0.317	205	2.308	183.6	233.4	49.8	141.6	91.8	111.0	4.69
	13:55	15.51	10.74	0.319	205	2.335	184.5	234.6	50.1	142.3	92.2	111.6	4.68
	14:00	15.78	10.93	0.319	205	2.366	184.1	234.6	50.5	142.5	92.0	111.9	4.64
	14:05	16.00	11.08	0.320	204	2.390	184.4	235.1	50.7	142.9	92.2	112.2	4.64
	14:10	16.24	11.25	0.321	204	2.417	184.7	235.8	51.1	143.4	92.3	112.7	4.61
	14:15	16.49	11.42	0.322	204	2.444	184.9	236.3	51.4	143.9	92.5	113.0	4.60
	14:20	16.75	11.60	0.323	203	2.473	185.1	236.9	51.8	144.4	92.6	113.5	4.57
	14:25	16.97	11.76	0.324	203	2.498	185.4	237.4	52.0	144.7	92.7	113.8	4.57
	14:30	17.24	11.95	0.325	203	2.527	185.7	238.0	52.3	145.1	92.8	114.2	4.55
	14:35	17.47	12.10	0.327	202	2.551	186.6	239.2	52.6	145.9	93.3	114.8	4.55
	14:40	17.72	12.28	0.330	202	2.578	188.1	241.0	52.9	147.0	94.1	115.6	4.56
	14:45	17.98	12.46	0.332	202	2.606	189.0	242.2	53.2	147.7	94.5	116.2	4.55
	14:50	18.21	12.61	0.335	202	2.629	190.5	244.0	53.5	148.8	95.3	117.0	4.56
	14:55	18.44	12.78	0.337	201	2.654	191.4	245.2	53.8	149.5	95.7	117.6	4.56
	15:00	18.72	12.97	0.340	201	2.683	192.9	247.0	54.1	150.5	96.4	118.4	4.56
	15:05	18.92	13.11	0.342	201	2.704	193.8	248.0	54.2	151.1	96.9	118.8	4.58
	15:10	19.19	13.29	0.344	201	2.731	194.6	249.1	54.5	151.8	97.3	119.4	4.57
	15:15	19.42	13.45	0.346	200	2.754	195.5	250.2	54.7	152.5	97.8	119.9	4.57

Borehole No. : D051 **Sample Depth m:-** 3.00 - 4.00

Sample No. : 1 **Specimen Depth m:-** 3.60 - 3.80

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.:** 059

Compiled by: W S Wat

Checked by: H W Chung

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2
Shearing Continuation

FAILURE CRITERION

Max. deviator Stress ☒ | Max. Stress ratio ☐ | Axial Strain % ☐

Stage :	1	Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
Date	Time	Dial		P.R.No. 38	Pressure	Corr.	q $\sigma_1-\sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
08/12	15:20	19.64	13.61	0.347	200	2.778	195.8	250.8	55.0	152.9	97.9	120.3	4.56
	15:25	19.89	13.78	0.349	200	2.803	196.6	251.9	55.3	153.6	98.3	120.8	4.56
	15:30	20.18	13.98	0.351	199	2.832	197.4	253.0	55.6	154.3	98.7	121.4	4.55
	15:35	20.43	14.15	0.351	199	2.857	196.9	252.7	55.8	154.3	98.5	121.4	4.53
	15:40	20.66	14.31	0.352	199	2.880	197.2	253.2	56.0	154.6	98.6	121.7	4.52
	15:45	20.93	14.50	0.353	199	2.908	197.3	253.5	56.2	154.9	98.7	122.0	4.51
	15:50	21.17	14.67	0.353	199	2.932	196.9	253.4	56.5	155.0	98.5	122.1	4.49
	15:55	21.40	14.83	0.353	198	2.955	196.5	253.2	56.7	155.0	98.3	122.2	4.47
	16:00	21.64	14.99	0.355	198	2.978	197.4	254.3	56.9	155.6	98.7	122.7	4.47
	16:05	21.92	15.19	0.356	198	3.006	197.5	254.7	57.2	155.9	98.7	123.0	4.45
	16:10	22.13	15.33	0.357	198	3.026	197.8	255.1	57.3	156.2	98.9	123.2	4.45
	16:15	22.37	15.50	0.359	197	3.051	198.6	256.2	57.6	156.9	99.3	123.8	4.45
	16:20	22.62	15.67	0.362	197	3.075	200.0	257.8	57.8	157.8	100.0	124.5	4.46
	16:25	22.86	15.84	0.363	197	3.099	200.2	258.2	58.0	158.1	100.1	124.7	4.45
	16:30	23.13	16.02	0.366	197	3.124	201.5	259.7	58.2	159.0	100.8	125.4	4.46
	16:35	23.40	16.21	0.369	197	3.151	202.9	261.4	58.5	159.9	101.4	126.1	4.47
	16:40	23.61	16.36	0.372	196	3.172	204.3	263.0	58.7	160.9	102.2	126.8	4.48
	16:45	23.87	16.54	0.375	196	3.197	205.7	264.7	59.0	161.9	102.9	127.6	4.49
	16:50	24.17	16.74	0.377	196	3.225	206.4	265.7	59.3	162.5	103.2	128.1	4.48
	16:55	24.35	16.87	0.378	196	3.243	206.7	266.1	59.4	162.7	103.3	128.3	4.48
	17:00	24.62	17.06	0.380	195	3.270	207.4	267.1	59.7	163.4	103.7	128.8	4.47
	17:05	24.85	17.21	0.380	195	3.291	207.0	267.0	60.0	163.5	103.5	129.0	4.45
	17:10	**25.13**	**17.41**	**0.383**	**195**	**3.318**	**208.2**	**268.5**	**60.3**	**164.4**	**104.1**	**129.7**	**4.45**
	17:15	25.40	17.60	0.383	194	3.345	207.7	268.3	60.6	164.5	103.9	129.8	4.43
	17:20	25.63	17.76	0.384	194	3.367	207.9	268.7	60.8	164.8	104.0	130.1	4.42
	17:25	25.86	17.92	0.384	194	3.390	207.5	268.5	61.0	164.7	103.7	130.2	4.40
	17:30	26.14	18.11	0.384	194	3.416	206.9	268.2	61.3	164.8	103.5	130.3	4.38
	17:45	26.87	18.61	0.385	193	3.486	206.2	268.1	61.9	165.0	103.1	130.6	4.33
	18:00	27.63	19.14	0.385	193	3.560	204.8	267.3	62.5	164.9	102.4	130.8	4.28
	18:15	28.26	19.57	0.385	192	3.621	203.6	266.3	62.7	164.5	101.8	130.6	4.25
	18:30	29.00	20.09	0.386	192	3.695	202.7	266.0	63.3	164.7	101.4	130.9	4.20

Borehole No. : D051 — **Sample Depth m:- 3.00 - 4.00**
Sample No. : 1 — **Specimen Depth m:- 3.60 - 3.80**

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 — **Works Order No.: 059**

Compiled by: W S Wat
Checked by: H W Chung

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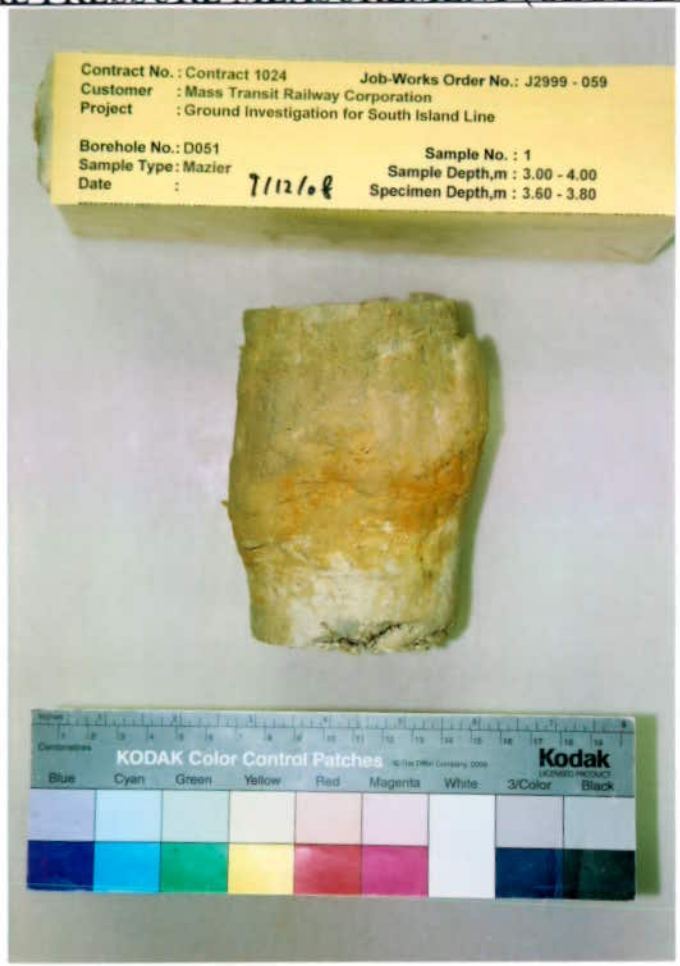
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT (GEOSPEC 3 : 2001 Test Method 15.2)



Description : Brown, slightly sandy, slightly gravelly SILT/CLAY **Sample Origin : HDV‡** ‡ Information provided by customer

Borehole No. : D051 **Sample No. :** 1 **Sample Depth m:-** 3.00 - 4.00 **Specimen Depth m:-** 3.60 - 3.80

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line

Contract No. : Contract 1024
Job No. : J2999
Works Order No.: 059

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	D051	D051	D051
Sample		no	1	1	1
Sample Type			Mazier	Mazier	Mazier
Stage		no	1	2	3
Sample Depth		m	3.00 - 4.00	3.00 - 4.00	3.00 - 4.00
Specimen Depth		m	3.80 - 4.00	3.80 - 4.00	3.80 - 4.00
INITIAL CONDITIONS					
Diameter	(D_o)	mm	73.9	74.4	74.7
Height	(H_o)	mm	145.0	142.4	140.3
Moisture Content	(W_o)	%	27	28	27
Bulk density	(ρ_o)	Mg/m^3	1.89	1.91	1.91
Dry density	(ρ_d)	Mg/m^3	1.49	1.49	1.50
Particle density	(ρ_s)		2.61	2.61	2.61
Voids Ratio	(e_o)		0.76	0.75	0.74
Degree of Saturation	(S_r)	%	94.1	96.3	96.2
DRAINAGE CONDITIONS			ONE END		
SATURATION					
Final Pore Pressure Coefficient B			1.00		
CONSOLIDATION					
Cell Pressure	(σ_3)	kPa	220	235	250
Back Pressure	(u_b)	kPa	205	205	205
Effective Pressure	(σ'_3)	kPa	15	30	45
Coefficient of Consolidation (t100) (C_{vi})		$m^2/Year$	8904.24	5917.19	8496.65
Coefficient of Volume Compressibility (m_{vi})		m^2/MN	0.45	0.31	0.22
Coefficient of Permeability (k)		m/s	1.23E-06	5.70E-07	5.87E-07
COMPRESSION TERMINATION CRITERION			MAXIMUM STRESS RATIO		MAX ($\sigma'1 - \sigma'3$)
COMPRESSION - INITIAL					
Moisture Content	(w)	%	28	27	27
Pore Pressure at the End of Consolidation		kPa	205	205	205
Effective Stress at the End of Consolidation		kPa	15	30	45
Bulk density	(ρ_o)	Mg/m^3	1.91	1.91	1.92
Dry density	(ρ_d)	Mg/m^3	1.49	1.50	1.51
Voids Ratio	(e)		0.75	0.74	0.73
Degree of Saturation	(S_r)	%	96.3	96.2	96.2

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Report No. : J2999-059.11
Contract No.: Contract 1024
Job No.: J2999
Works Order No.: 059

Technician : W S Wat
Checked By : Name : H W Chung Date : 02/01/2009
Approved By : Signatory : **Lau Wai Cheong** Date : 02/01/2009
Tested Date: 03/12/2008

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Form : GESR009.6 / Nov.10.06 / Issue 1 / Rev I

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	D051	D051	D051
Sample		no	1	1	1
Sample Type			Mazier	Mazier	Mazier
Stage		no	1	2	3
Sample Depth		m	3.00 - 4.00	3.00 - 4.00	3.00 - 4.00
Specimen Depth		m	3.80 - 4.00	3.80 - 4.00	3.80 - 4.00
COMPRESSION - FAILURE					
Cell Pressure		kPa	220	235	250
Rate of Strain		mm/min	0.048	0.047	0.046
CONDITIONS AT MAXIMUM STRESS RATIO					
Major Effective Principal Stress (σ'_1)		kPa	122	174	260
Corrected Deviator Stress ($\sigma'_1 - \sigma'_3$)		kPa	109	151	221
Minor Effective Principal Stress (σ'_3)		kPa	13	23	39
$s' = (\sigma'_1 + \sigma'_3)/2$		kPa	68	99	150
$t = (\sigma_1 - \sigma_3)/2$		kPa	55	76	110
Expanded Uncertainty of s' ^		kPa	-	-	-
Expanded Uncertainty of t ^		kPa	-	-	-
Pore pressure parameter A_f			0.02	0.05	0.03
Strain at Failure	(εf)	%	1.5	2.9	4.6
COMPRESSION - FINAL					
Moisture Content	(W_f)	%	28	27	27
Bulk density	(ρ_o)	Mg/m^3	1.91	1.91	1.92
Dry density	(ρ_d)	Mg/m^3	1.49	1.50	1.51
Voids Ratio	(e_f)		0.75	0.74	0.73
Degree of Saturation	(S_f)	%	96.3	96.2	96.2

Notes -
1. The method of specimen preparation was in accordance with GEOSPEC 3 : 2001 :- Test method 13.3 : test specimen from undisturbed soil samples.
2. Sample received date :29/09/2008
3. The determination of moisture content was in accordance with test method 5.1 of GEOSPEC 3 : 2001.
4. Particle density : 2.61 (Determined)
5. Maximum and minimum temperature recorded over the period of testing 19.9 - 20.7 °C.
6. Unavoidable variations from specified procedure : none
7. Comment on observed or inferred sample disturbance : none
8. Percentage by mass of soil particles larger than 1/5 of the diameter of specimen (%) : Nil
9. The specimen was selected by the laboratory.
   Name : W S Wat Designation : Senior Laboratory Technician
10. Sampling History : As Received

* Delete as appropriate ^ Upon request

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.: 059**

Compiled by W S Wat
Checked by H W Chung

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TEST REPORT
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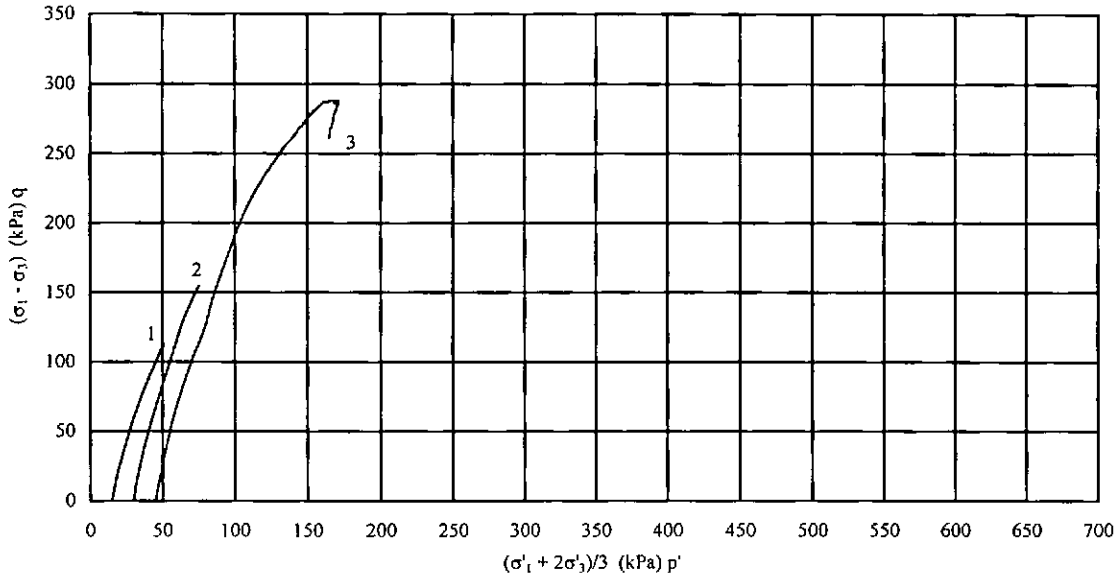
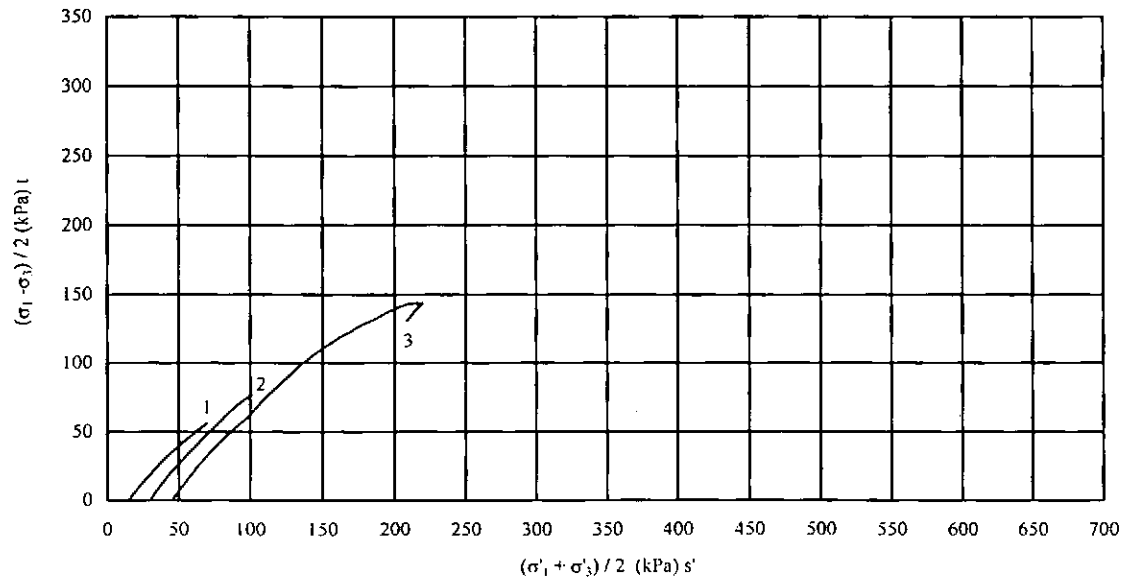
GEOSPEC 3 : 2001 Test Method 15.2

STRESS PATH PARAMETERS FOR EFFECTIVE STRESS

p' - q PLOT



s' - t PLOT



Borehole No. : D051	**Sample Depth m:-** 3.00 - 4.00
Sample No. : 1	**Specimen Depth m:-** 3.80 - 4.00
Customer : Mass Transit Railway Corporation	Compiled by W S Wat
Project : Ground Investigation for South Island Line	
Contract No.: Contract 1024	Checked by H W Chung
Job No.: J2999	**Works Order No.:** 059

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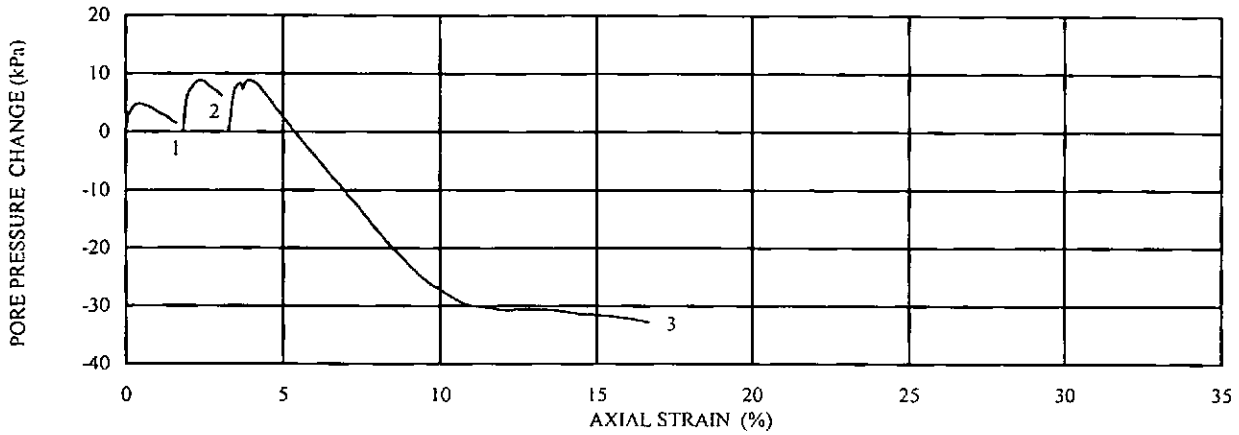
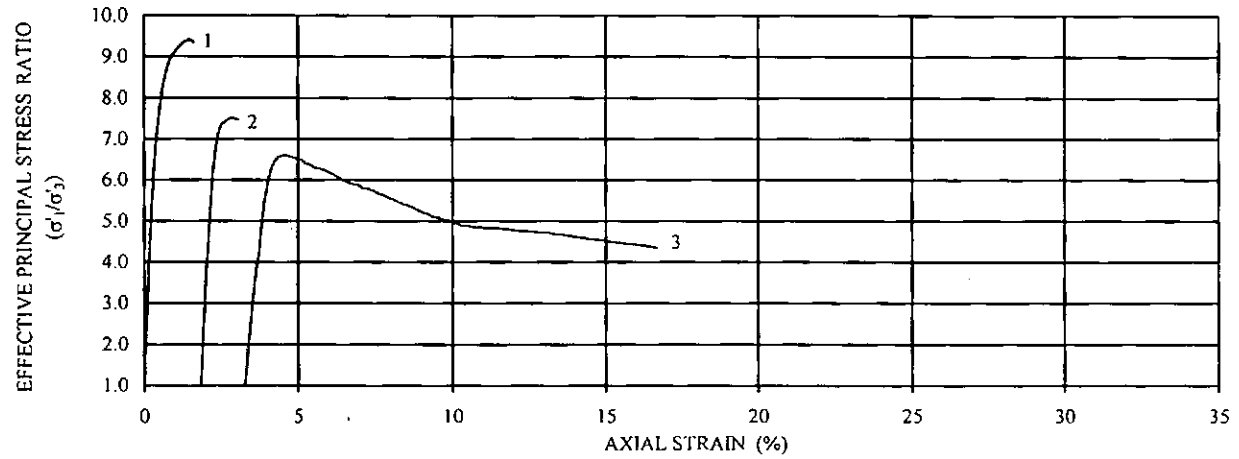
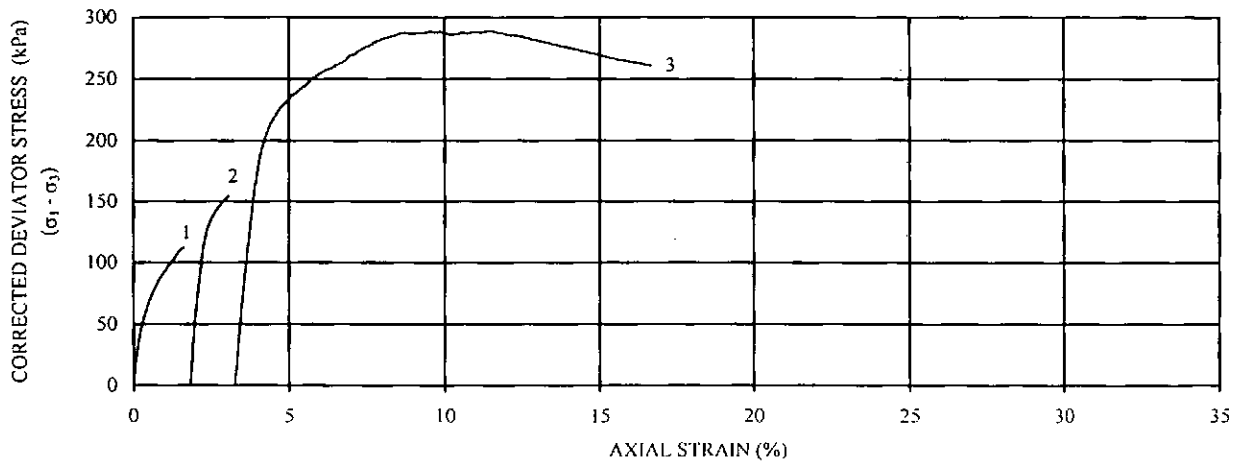
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

COMPRESSION







Borehole No. : D051 — **Sample Depth m:-** 3.00 - 4.00
Sample No. : 1 — **Specimen Depth m:-** 3.80 - 4.00

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 — **Works Order No.:** 059

Compiled by: W S Wat
Checked by: H W Chung

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TEST REPORT
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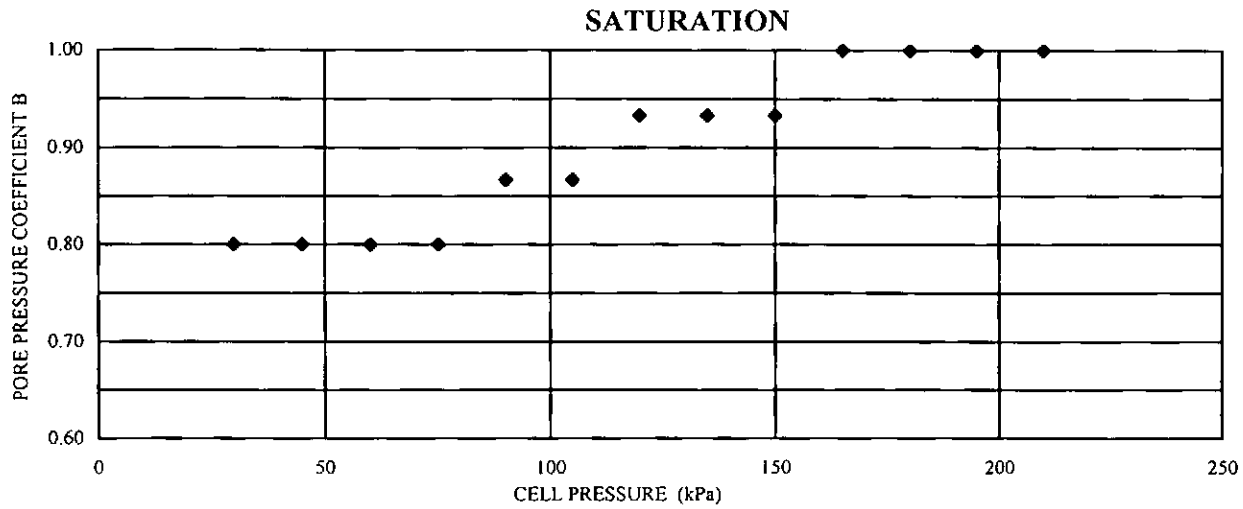
GEOSPEC 3 : 2001 Test Method 15.2



Date	Time	Cell Pressure kPa	Back Pressure kPa	Pore Pressure kPa	Cumulative Volume of Water cm^3	Pore Pressure Parameter B
04/12/2008	08:32	0	0	-	0.0	
	08:40	15	-	14		-
	08:53	15	10	10	-0.3	
	09:00	30	-	22		0.80
	09:17	30	25	25	0.5	
	09:24	45	-	37		0.80
	09:57	45	40	40	1.4	
	10:05	60	-	52		0.80
	12:00	60	55	55	1.9	
	12:10	75	-	67		0.80
	12:31	75	70	70	2.9	
	12:38	90	-	83		0.87
	13:03	90	85	85	3.3	
	13:10	105	-	98		0.87
	13:39	105	100	100	3.9	
	13:47	120	-	114		0.93
	14:04	120	115	115	4.6	
	14:14	135	-	129		0.93
	14:40	135	130	130	5.1	
	14:47	150	-	144		0.93
	15:10	150	145	145	5.1	
	15:17	165	-	160		1.00
	15:33	165	160	160	5.3	
	15:40	180	-	175		1.00
	16:00	180	175	175	5.6	

Borehole No. : D051 — **Sample Depth m:-** 3.00 - 4.00
Sample No. : 1 — **Specimen Depth m:-** 3.80 - 4.00
Customer : Mass Transit Railway Corporation — Compiled by W S Wat
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024 — Checked by H W Chung
Job No.: J2999 — **Works Order No.:** 059

Form : GESR009.11 / Jun.02.03 / Issue 1 / Rev 0

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2
Saturation Continuation

Date	Time	Cell Pressure kPa	Back Pressure kPa	Pore Pressure kPa	Cumulative Volume of Water cm^3	Pore Pressure Parameter B
04/12/2008	16:08	195	-	190		1.00
	16:27	195	190	190	5.8	
	16:39	210	-	205		1.00
05/12/2008	08:41	210	205	205	5.9	

Borehole No. : D051 **Sample Depth m:-** 3.00 - 4.00
Sample No. : 1 **Specimen Depth m:-** 3.80 - 4.00
Customer : Mass Transit Railway Corporation Compiled by W S Wat
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024 Checked by H W Chung
Job No.: J2999 **Works Order No.:** 059

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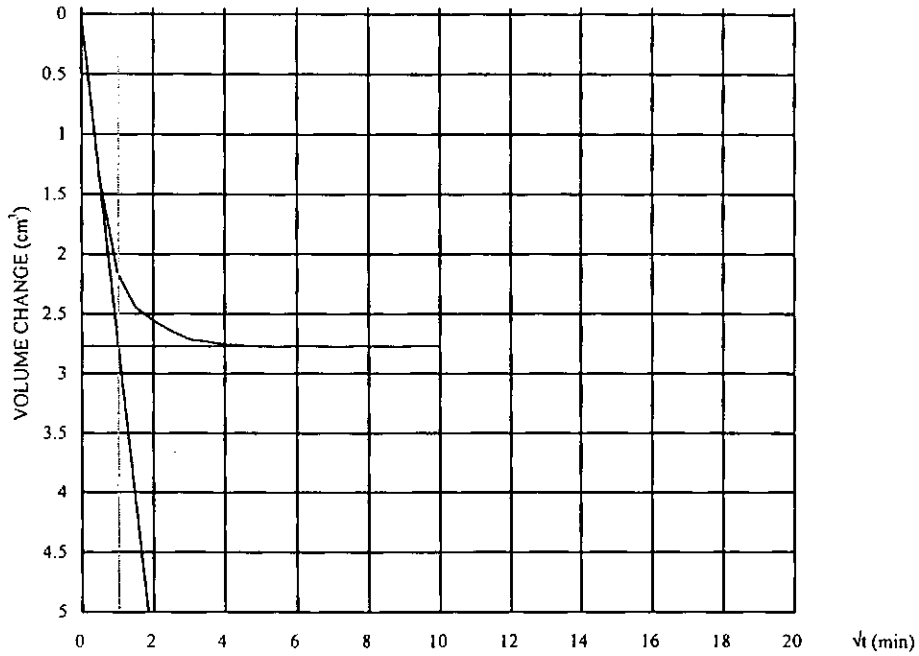
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

CONSOLIDATION (DRAINED PHASE) - Stage 1

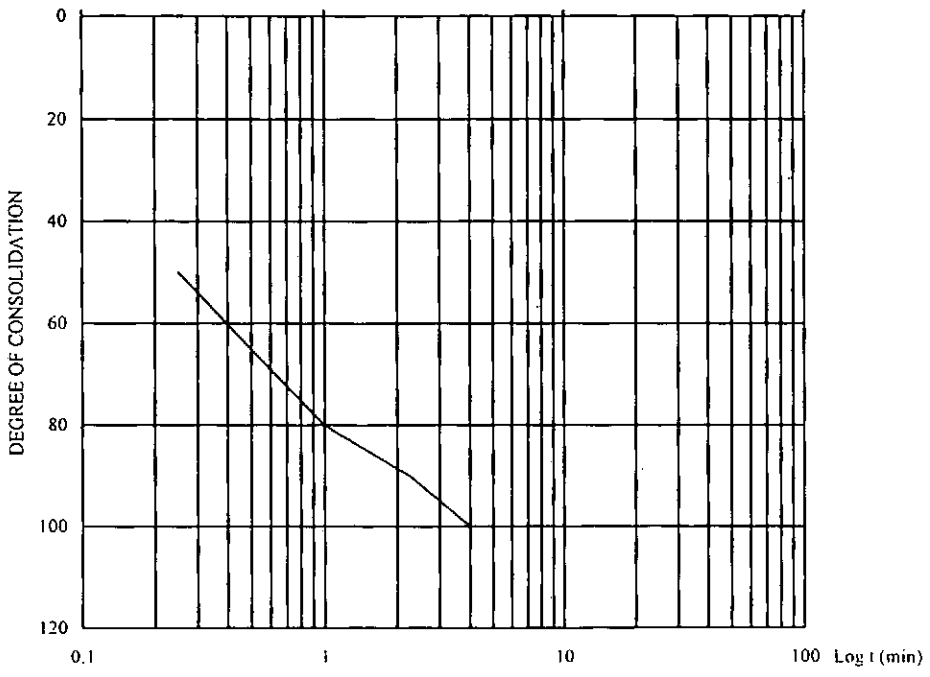


√t100 1.03 min

t100 1.05 min

tf 0.56 min

Calc. strain rate
18.179 mm/min



Borehole No. : D051 **Sample Depth m:-** 3.00 - 4.00

Sample No. : 1 **Specimen Depth m:-** 3.80 - 4.00

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.:** 059

Complied by: W S Wat

Checked by: H W Chung

Form : GESR009.13 / Jun.02.03 / Issue 1 / Rev 0

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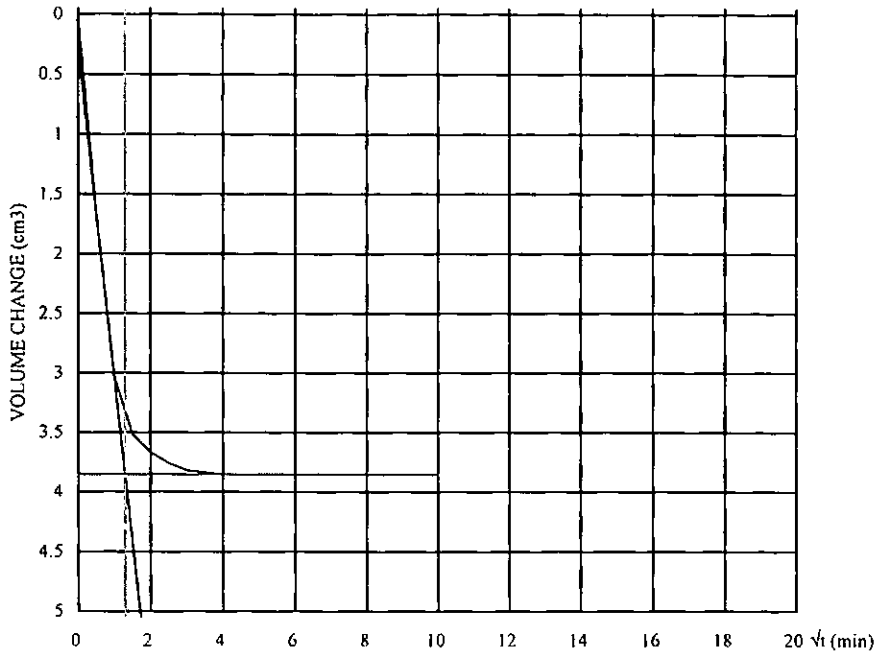
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

CONSOLIDATION (DRAINED PHASE) - Stage 2

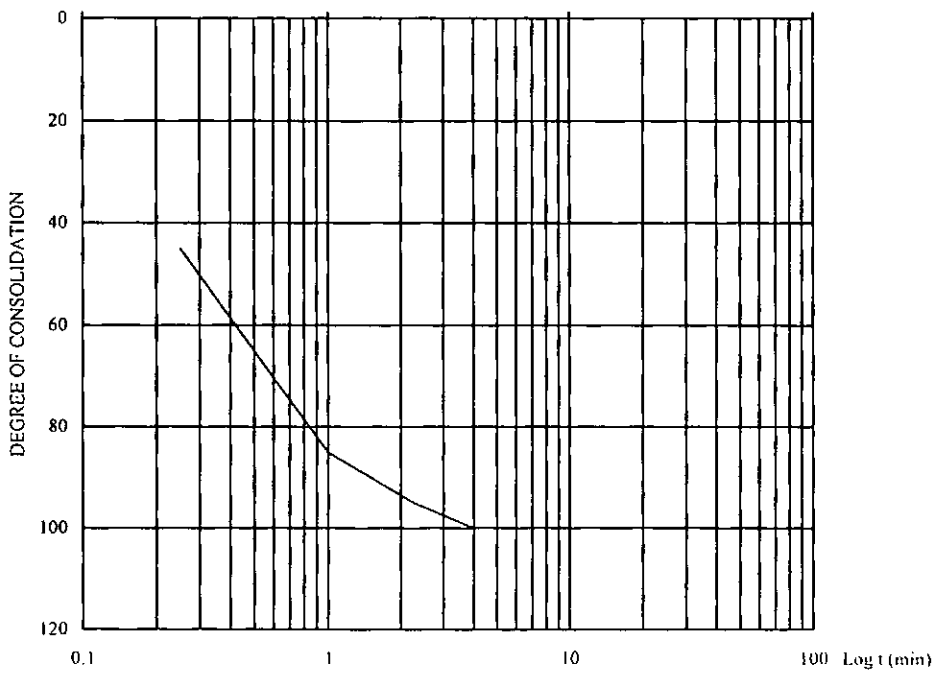


√t100 1.30 min

t100 1.68 min

tf 0.89 min

Calc. strain rate
11.148 mm/min



Borehole No. : D051 **Sample Depth m:-** 3.00 - 4.00

Sample No. : 1 **Specimen Depth m:-** 3.80 - 4.00

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.:** 059

Complied by: W S Wat

Checked by: H W Chung

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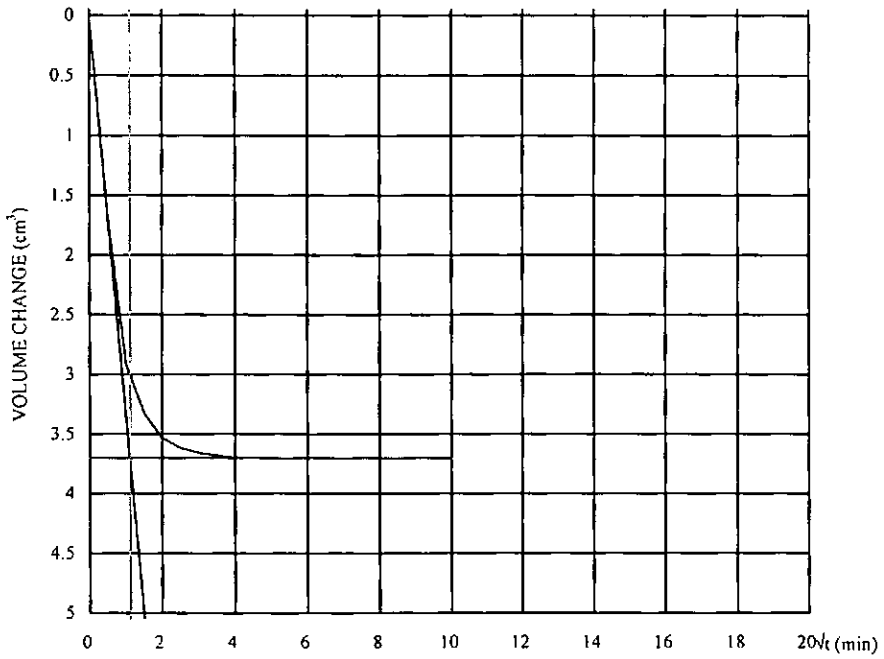
Form : GESR009.13 / Jun.02.03 / Issue 1 / Rev 0

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

CONSOLIDATION (DRAINED PHASE) - Stage 3

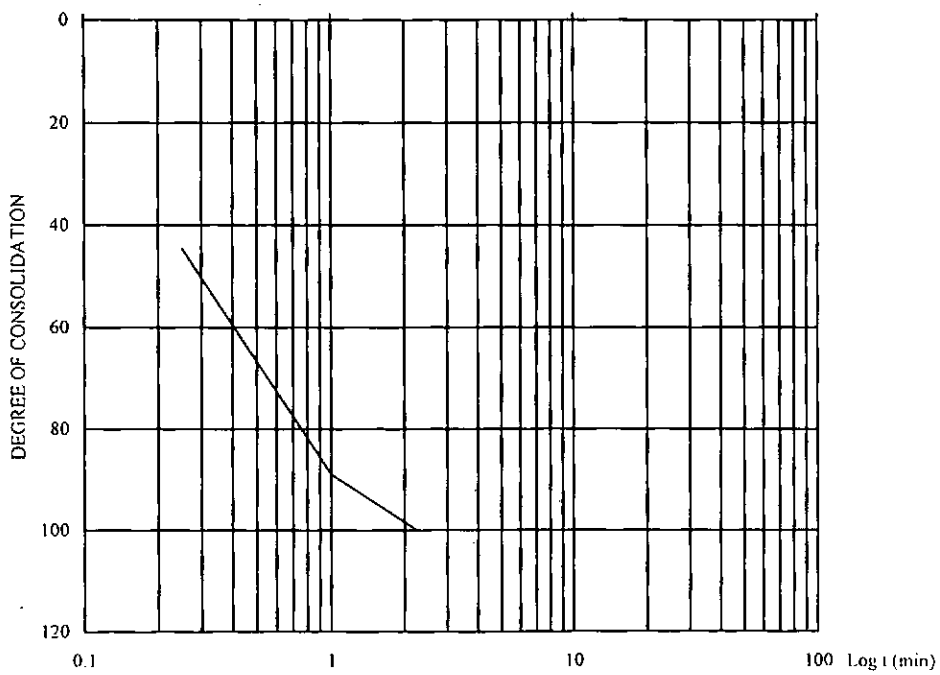


√t100 1.11 min

t100 1.23 min

tf 0.65 min

Calc. strain rate
15.058 mm/min



Borehole No. : D051 **Sample Depth m:-** 3.00 - 4.00

Sample No. : 1 **Specimen Depth m:-** 3.80 - 4.00

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.:** 059

Complied by: W S Wat

Checked by: H W Chung

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Gammon

HKAS HOKLAS 055

Multi Stage		P.W.P,B.P		Effective Pressure 15	kPa
Side drains	No	Selected Machine Speed	0.048 mm/min	Rate of Strain 1.99	% per hr
FAILURE CRITERION					
Max. deviator Stress ☐		Max. Stress ratio ☒		Axial Strain % ☐	
Stage : 1		Applied Pressure (kPa) - Cell : 220	Back : 205	P.R. factor 0.7018	kN/mm

Date	Time	Strain Dial	Strain	Load P.R.No. 26	Pore Pressure	Dev. stress Corr.	Dev. stress q $\sigma_1 - \sigma_3$	Effective Stress Parameters: Effective Stress σ'_1	Effective Stress σ'_3	s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio σ'_1/σ'_3
		mm	%	mm	kPa	kPa				2	2	3	
05/12	09:35	0.00	0.00	0.147	205	0.000	0.0	15.0	15.0	15.0	0.0	15.0	1.00
	09:40	0.10	0.07	0.261	208	0.020	18.7	31.1	12.4	21.7	9.3	18.6	2.51
	09:45	0.23	0.16	0.354	209	0.046	33.9	45.2	11.3	28.2	16.9	22.6	4.00
	09:50	0.36	0.25	0.433	209	0.072	46.7	57.3	10.6	34.0	23.4	26.2	5.41
	09:55	0.54	0.37	0.505	210	0.106	58.4	68.6	10.2	39.4	29.2	29.7	6.72
	10:00	0.70	0.48	0.556	210	0.138	66.6	76.8	10.2	43.5	33.3	32.4	7.53
	10:05	0.92	0.63	0.615	210	0.180	76.1	86.5	10.4	48.4	38.0	35.8	8.32
	10:10	1.11	0.77	0.659	209	0.219	83.1	93.8	10.7	52.3	41.6	38.4	8.77
	10:15	1.29	0.89	0.695	209	0.252	88.8	99.9	11.1	55.5	44.4	40.7	9.00
	10:20	1.48	1.02	0.725	209	0.288	93.5	105.0	11.5	58.3	46.8	42.7	9.13
	10:25	1.71	1.18	0.761	208	0.332	99.2	111.2	12.0	61.6	49.6	45.1	9.27
	10:30	1.91	1.32	0.790	208	0.369	103.7	116.1	12.4	64.3	51.9	47.0	9.36
	10:35	**2.13**	**1.47**	**0.826**	**207**	**0.410**	**109.3**	**122.3**	**13.0**	**67.7**	**54.7**	**49.4**	**9.41**
	10:40	2.35	1.62	0.848	207	0.449	112.7	126.2	13.5	69.8	56.3	51.1	9.35

Borehole No. :	**D051**	**Sample Depth m:- 3.00 - 4.00**	
Sample No. :	**1**	**Specimen Depth m:- 3.80 - 4.00**	
Customer :	**Mass Transit Railway Corporation**		Compiled by W S Wat
Project :	**Ground Investigation for South Island Line**		
		Contract No.: Contract 1024	Checked by H W Chung
Job No.:	**J2999**	**Works Order No.: 059**	

Form : GESR009.14 / Dec.13.04 / Issue 1 / Rev 1

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Gammon

Multi Stage		P.W.P,B.P		Effective Pressure 30	kPa
Side drains	No	Selected Machine Speed	0.047 mm/min	Rate of Strain 1.98	% per hr
FAILURE CRITERION					
Max. deviator Stress ☐		Max. Stress ratio ☒		Axial Strain % ☐	
Stage : 2	Applied Pressure (kPa) - Cell :	235	Back : 205	P.R. factor 0.7018	kN/mm

Date	Time	Strain Dial	Strain	Load P.R.No. 26	Pore Pressure	Dev. stress Corr.	Dev. stress q $\sigma_1 - \sigma_3$	Effective Stress Parameters: Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
05/12	11:25	2.65	1.83	0.173	205	0.000	0.0	30.0	30.0	30.0	0.0	30.0	1.00
	11:30	2.70	1.87	0.280	208	0.515	16.8	43.9	27.1	35.5	8.4	32.7	1.62
	11:35	2.79	1.93	0.424	211	0.531	40.1	64.5	24.4	44.4	20.0	37.8	2.64
	11:40	2.89	2.00	0.543	212	0.549	59.3	82.5	23.2	52.8	29.6	43.0	3.56
	11:45	3.03	2.09	0.678	213	0.572	81.0	103.4	22.4	62.9	40.5	49.4	4.62
	11:50	3.17	2.19	0.816	213	0.598	103.2	124.9	21.7	73.3	51.6	56.1	5.76
	11:55	3.26	2.25	0.883	214	0.613	113.9	135.3	21.4	78.4	57.0	59.4	6.32
	12:00	3.43	2.37	0.967	214	0.643	127.3	148.4	21.1	84.7	63.6	63.5	7.03
	12:05	3.61	2.50	1.020	214	0.676	135.6	157.0	21.4	89.2	67.8	66.6	7.34
	12:10	3.79	2.61	1.051	213	0.704	140.4	162.3	21.9	92.1	70.2	68.7	7.41
	12:15	4.03	2.78	1.093	212	0.746	146.9	169.5	22.6	96.0	73.4	71.6	7.50
	12:20	**4.23**	**2.92**	**1.121**	**212**	**0.780**	**151.1**	**174.3**	**23.2**	**98.8**	**75.6**	**73.6**	**7.51**
	12:25	4.43	3.06	1.144	211	0.814	154.5	178.4	23.9	101.2	77.3	75.4	7.47

Borehole No. : D051 **Sample Depth m:- 3.00 - 4.00**

Sample No. : 1 **Specimen Depth m:- 3.80 - 4.00**

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.: 059**

Compiled by: W S Wat

Checked by: H W Chung

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Gammon

Multi Stage		P.W.P,B.P			Effective Pressure	45	kPa
Side drains	No	Selected Machine Speed	0.046	mm/min	Rate of Strain	1.97	% per hr
FAILURE CRITERION							
Max. deviator Stress	☐	Max. Stress ratio	☒		Axial Strain %		☐
Stage : 3	Applied Pressure (kPa) - Cell :	250	Back :	205	P.R. factor	1.7999	kN/mm

Date	Time	Strain Dial	Strain	Load P.R.No. 13	Pore Pressure	Dev. stress Corr.	Dev. stress q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
08/12	08:40	4.71	3.26	0.072	205	0.000	0.0	45.0	45.0	45.0	0.0	45.0	1.00
	08:45	4.99	3.45	0.216	212	0.908	58.3	96.1	37.8	67.0	29.2	57.2	2.54
	08:50	5.24	3.62	0.316	213	0.948	99.2	135.8	36.6	86.2	49.6	69.7	3.71
	08:55	5.39	3.72	0.372	212	0.972	122.0	159.7	37.7	98.7	61.0	78.4	4.24
	09:00	5.51	3.81	0.419	214	0.993	141.2	177.6	36.4	107.0	70.6	83.5	4.88
	09:05	5.62	3.88	0.458	214	1.009	157.0	193.2	36.2	114.7	78.5	88.5	5.34
	09:10	5.78	3.99	0.505	214	1.034	176.0	212.2	36.2	124.2	88.0	94.9	5.86
	09:15	5.98	4.13	0.549	213	1.066	193.7	230.3	36.6	133.4	96.8	101.2	6.29
	09:20	6.19	4.28	0.579	213	1.100	205.6	243.0	37.4	140.2	102.8	105.9	6.50
	09:25	6.39	4.41	0.600	212	1.130	213.8	252.1	38.3	145.2	106.9	109.6	6.58
	09:30	**6.61**	**4.57**	**0.618**	**211**	**1.166**	**220.7**	**260.1**	**39.4**	**149.8**	**110.4**	**113.0**	**6.60**
	09:35	6.87	4.74	0.634	209	1.203	226.8	267.5	40.7	154.1	113.4	116.3	6.57
	09:40	7.12	4.92	0.647	208	1.243	231.6	273.5	41.9	157.7	115.8	119.1	6.53
	09:45	7.39	5.11	0.661	207	1.284	236.7	279.8	43.1	161.5	118.4	122.0	6.49
	09:50	7.59	5.24	0.667	206	1.312	238.8	282.9	44.1	163.5	119.4	123.7	6.41
	09:55	7.85	5.43	0.679	205	1.352	243.1	288.4	45.3	166.9	121.6	126.3	6.37
	10:00	8.05	5.56	0.685	204	1.380	245.1	291.4	46.3	168.9	122.6	128.0	6.29
	10:05	8.26	5.70	0.696	203	1.409	249.2	296.3	47.1	171.7	124.6	130.2	6.29
	10:10	8.51	5.88	0.706	202	1.446	252.7	300.9	48.2	174.5	126.3	132.4	6.24
	10:15	8.74	6.04	0.713	201	1.479	255.0	304.2	49.2	176.7	127.5	134.2	6.18
	10:20	8.98	6.20	0.720	200	1.512	257.3	307.5	50.2	178.9	128.7	136.0	6.13
	10:25	9.24	6.39	0.726	199	1.550	259.2	310.7	51.5	181.1	129.6	137.9	6.03
	10:30	9.44	6.52	0.732	198	1.576	261.2	313.6	52.4	183.0	130.6	139.5	5.98
	10:35	9.66	6.68	0.738	197	1.608	263.1	316.4	53.3	184.8	131.5	141.0	5.94
	10:40	9.87	6.82	0.744	196	1.636	265.0	319.1	54.1	186.6	132.5	142.4	5.90
	10:45	10.09	6.97	0.755	195	1.665	268.9	324.0	55.1	189.6	134.5	144.7	5.88
	10:50	10.33	7.14	0.759	194	1.698	270.0	326.3	56.3	191.3	135.0	146.3	5.80
	10:55	10.55	7.29	0.769	193	1.727	273.5	330.6	57.1	193.8	136.7	148.3	5.79
	11:00	10.82	7.48	0.777	192	1.763	276.0	334.3	58.3	196.3	138.0	150.3	5.73
	11:05	11.06	7.64	0.782	191	1.793	277.5	337.0	59.5	198.2	138.7	152.0	5.66
	11:10	11.25	7.77	0.789	190	1.818	279.8	340.1	60.3	200.2	139.9	153.6	5.64
	11:15	11.46	7.92	0.794	189	1.846	281.3	342.7	61.4	202.0	140.6	155.2	5.58
	11:20	11.72	8.10	0.800	188	1.879	283.0	345.5	62.5	204.0	141.5	156.8	5.53
	11:25	11.96	8.26	0.805	186	1.908	284.5	348.1	63.6	205.8	142.2	158.4	5.47
	11:30	12.21	8.43	0.809	185	1.939	285.4	350.0	64.6	207.3	142.7	159.7	5.42
	11:35	12.44	8.59	0.815	185	1.968	287.3	352.8	65.5	209.1	143.6	161.3	5.39
	11:40	12.69	8.77	0.817	184	2.000	287.4	353.9	66.5	210.2	143.7	162.3	5.32
	11:45	12.92	8.92	0.817	183	2.026	286.9	354.3	67.4	210.9	143.5	163.0	5.26
	11:50	13.17	9.10	0.819	182	2.058	287.1	355.5	68.4	212.0	143.6	164.1	5.20

Borehole No. : D051 **Sample Depth m:- 3.00 - 4.00**

Sample No. : 1 **Specimen Depth m:- 3.80 - 4.00**

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.: 059**

Compiled by W S Wat

Checked by H W Chung

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2
Shearing Continuation

Gammon

HKAS KOLAS 035

FAILURE CRITERION

Max. deviator Stress ☐ | Max. Stress ratio ☒ | Axial Strain % ☐

Stage :	3	Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
Date	Time	Dial		P.R.No. 13	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
08/12	11:55	13.36	9.23	0.822	181	2.080	287.8	356.8	69.0	212.9	143.9	164.9	5.17
	12:00	13.48	9.31	0.822	180	2.094	287.5	357.1	69.6	213.4	143.8	165.4	5.13
	12:05	13.81	9.54	0.826	180	2.134	288.3	358.8	70.5	214.7	144.2	166.6	5.09
	12:10	14.09	9.73	0.827	179	2.166	288.1	359.5	71.4	215.4	144.0	167.4	5.03
	12:15	14.33	9.90	0.829	178	2.195	288.3	360.2	71.9	216.0	144.1	168.0	5.01
	12:20	14.57	10.07	0.827	178	2.224	286.9	359.4	72.5	216.0	143.5	168.1	4.96
	12:25	14.82	10.24	0.826	177	2.252	286.0	359.1	73.1	216.1	143.0	168.4	4.91
	12:30	15.05	10.40	0.829	176	2.278	286.6	360.2	73.6	216.9	143.3	169.1	4.89
	12:35	15.30	10.57	0.834	176	2.306	287.9	362.0	74.1	218.0	143.9	170.1	4.89
	12:40	15.50	10.71	0.833	176	2.329	287.0	361.5	74.5	218.0	143.5	170.2	4.85
	12:45	15.70	10.85	0.837	175	2.352	288.1	362.8	74.7	218.7	144.0	170.7	4.86
	12:50	15.95	11.02	0.839	175	2.379	288.2	363.2	75.0	219.1	144.1	171.1	4.84
	12:55	16.17	11.17	0.839	175	2.403	287.7	362.9	75.2	219.1	143.9	171.1	4.83
	13:00	16.35	11.30	0.842	175	2.424	288.4	363.6	75.2	219.4	144.2	171.3	4.84
	13:05	16.67	11.52	0.844	175	2.459	288.4	363.7	75.3	219.5	144.2	171.4	4.83
	13:10	16.95	11.71	0.844	175	2.489	287.8	363.3	75.5	219.4	143.9	171.4	4.81
	13:15	17.17	11.86	0.843	174	2.512	286.9	362.5	75.6	219.0	143.4	171.2	4.79
	13:20	17.46	12.07	0.841	174	2.545	285.5	361.2	75.7	218.4	142.7	170.9	4.77
	13:25	17.66	12.20	0.842	174	2.565	285.3	361.0	75.7	218.4	142.7	170.8	4.77
	13:30	17.93	12.39	0.842	174	2.594	284.7	360.3	75.6	217.9	142.3	170.5	4.77
	13:45	18.65	12.89	0.839	174	2.669	281.9	357.5	75.6	216.5	140.9	169.6	4.73
	14:00	19.38	13.39	0.835	174	2.744	278.7	354.3	75.6	214.9	139.3	168.5	4.69
	14:15	20.07	13.87	0.832	174	2.815	275.9	351.8	75.9	213.9	138.0	167.9	4.64
	14:30	20.80	14.37	0.829	174	2.887	273.2	349.5	76.3	212.9	136.6	167.4	4.58
	14:45	21.52	14.87	0.826	174	2.959	270.4	346.9	76.5	211.7	135.2	166.6	4.53
	15:00	22.26	15.38	0.821	173	3.032	266.9	343.6	76.7	210.1	133.4	165.7	4.48
	15:15	22.93	15.84	0.820	173	3.097	265.0	342.0	77.0	209.5	132.5	165.3	4.44
	15:30	23.66	16.35	0.818	173	3.169	262.6	340.0	77.4	208.7	131.3	164.9	4.39
	15:40	24.14	16.67	0.817	172	3.213	261.1	338.9	77.8	208.4	130.6	164.8	4.36

Borehole No. : D051 — **Sample Depth m:- 3.00 - 4.00**

Sample No. : 1 — **Specimen Depth m:- 3.80 - 4.00**

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 — **Works Order No.: 059**

Compiled by: W S Wat

Checked by: H W Chung

Form : GESR009.15 / Dec.13.04 / Issue 1 / Rev 1

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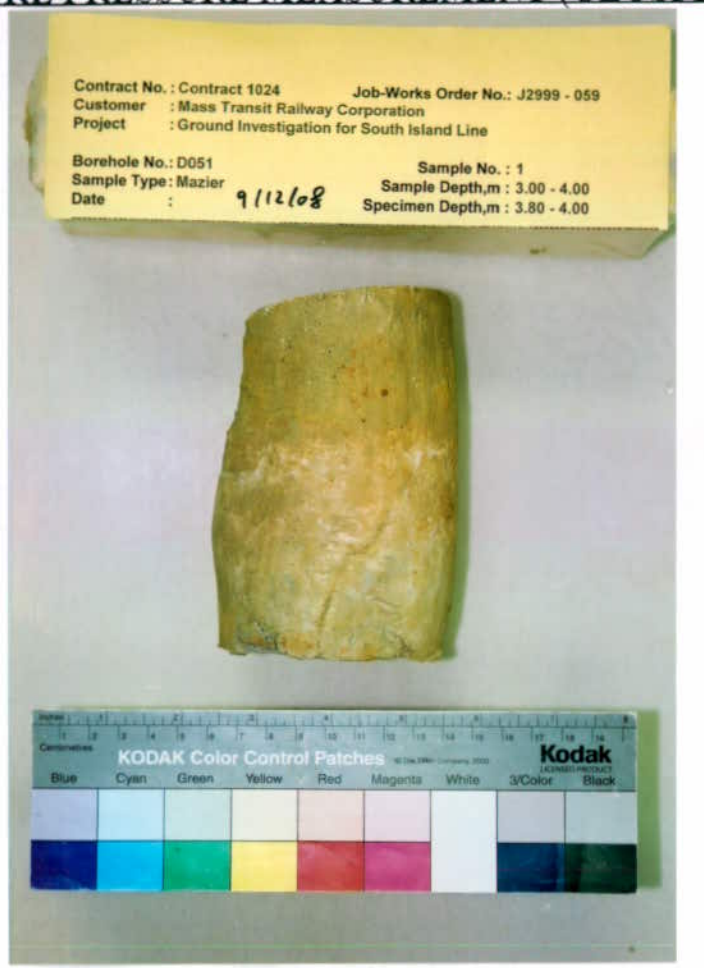
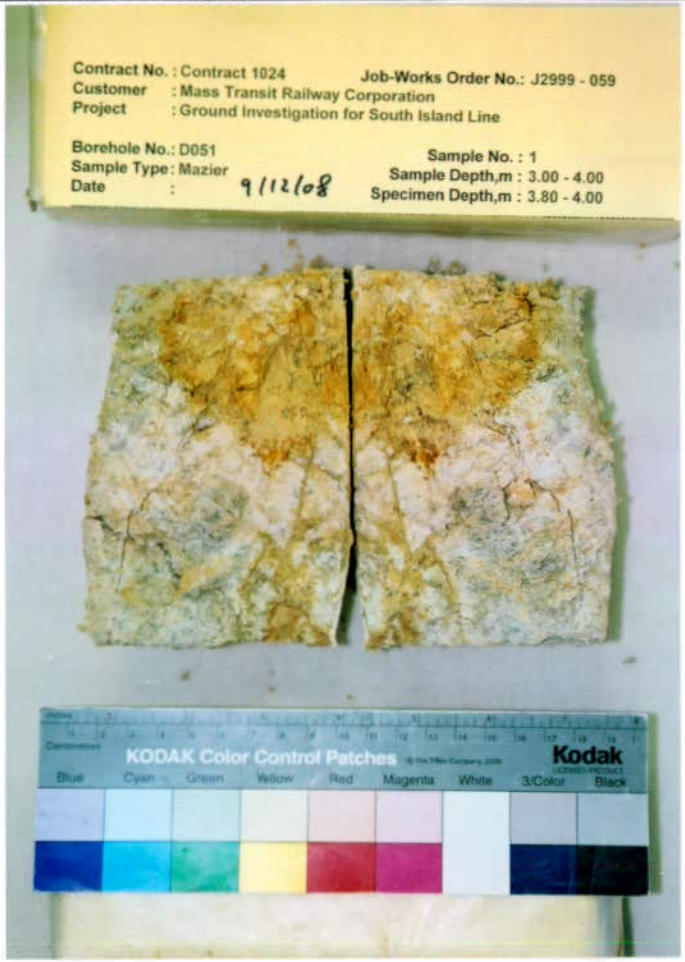
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT (GEOSPEC 3 : 2001 Test Method 15.2)





Description : Brown, slightly sandy, slightly gravelly SILT/CLAY

Sample Origin : HDV ‡ ‡ Information provided by customer

Borehole No. :	**D051**	**Sample No. : 1**	**Sample Depth m:-** 3.00 - 4.00 **Specimen Depth m:-** 3.80 - 4.00
Customer :	**Mass Transit Railway Corporation**	**Contract No.: Contract 1024**	Compiled by W S Wat
Project :	**Ground Investigation for South Island Line**	**Job No.: J2999**	
		Works Order No.: 059	Checked by H W Chung

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DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	D053		
Sample		no	5		
Sample Type			Mazier		
Stage		no	1		
Sample Depth		m	5.50 - 6.50		
Specimen Depth		m	6.10 - 6.30		
INITIAL CONDITIONS					
Diameter	(D_o)	mm	74.3		
Height	(H_o)	mm	145.0		
Moisture Content	(W_o)	%	14		
Bulk density	(ρ_o)	Mg/m^3	2.07		
Dry density	(ρ_d)	Mg/m^3	1.82		
Particle density	(ρ_s)		2.65		
Voids Ratio	(e_o)		0.46		
Degree of Saturation	(S_r)	%	79.3		
DRAINAGE CONDITIONS			ONE END		
SATURATION					
Final Pore Pressure Coefficient B			0.98		
CONSOLIDATION					
Cell Pressure	(σ_3)	kPa	305		
Back Pressure	(u_b)	kPa	245		
Effective Pressure	(σ'_3)	kPa	60		
Coefficient of Consolidation (t100) (C_{vi})		m^2/Year	21972.55		
Coefficient of Volume Compressibility (m_{vi})		m^2/MN	0.34		
Coefficient of Permeability (k)		m/s	2.31E-06		
COMPRESSION TERMINATION CRITERION			MAXIMUM DEVIATOR STRESS		
COMPRESSION - INITIAL					
Moisture Content	(w)	%	15		
Pore Pressure at the End of Consolidation		kPa	245		
Effective Stress at the End of Consolidation		kPa	60		
Bulk density	(ρ_o)	Mg/m^3	2.14		
Dry density	(ρ_d)	Mg/m^3	1.85		
Voids Ratio	(e)		0.43		
Degree of Saturation	(S_r)	%	95.3		

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Report No. : J2999-059.11
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.:** 059

Technician : W S Wat Checked By : Name : H W Chung Approved By : Signatory : **Lau Wai Cheong**

Tested Date: 25/11/2008 Date : 02/01/2009 Date : 02/01/2009

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Form : GESR009.6 / Nov.10.06 / Issue 1 / Rev 1

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	D053		
Sample		no	5		
Sample Type			Mazier		
Stage		no	1		
Sample Depth		m	5.50 - 6.50		
Specimen Depth		m	6.10 - 6.30		
COMPRESSION - FAILURE					
Cell Pressure		kPa	305		
Rate of Strain		mm/min	0.048		
CONDITIONS MAXIMUM DEVIATOR STRESS					
Major Effective Principal Stress (σ'_1)		kPa	793		
Corrected Deviator Stress (σ'_1 - σ'_3)		kPa	711		
Minor Effective Principal Stress (σ'_3)		kPa	82		
$s' = (\sigma'_1 + \sigma'_3)/2$		kPa	438		
$t = (\sigma_1 - \sigma_3)/2$		kPa	355		
Expanded Uncertainty of s' ^		kPa	-		
Expanded Uncertainty of t ^		kPa	-		
Pore pressure parameter A_f			-0.03		
Strain at Failure	(εf)	%	5.5		
COMPRESSION - FINAL					
Moisture Content	(W_f)	%	15		
Bulk density	(ρ_o)	Mg/m^3	2.14		
Dry density	(ρ_d)	Mg/m^3	1.85		
Voids Ratio	(e_f)		0.43		
Degree of Saturation	(S_f)	%	95.3		

Notes -
1. The method of specimen preparation was in accordance with GEOSPEC 3 : 2001 :- Test method 13.3 : test specimen from undisturbed soil samples.
2. Sample received date :29/09/2008
3. The determination of moisture content was in accordance with test method 5.1 of GEOSPEC 3 : 2001.
4. Particle density : 2.65 (Assumed)
5. Maximum and minimum temperature recorded over the period of testing 19.9 - 20.7 °C.
6. Unavoidable variations from specified procedure : none
7. Comment on observed or inferred sample disturbance : none
8. Percentage by mass of soil particles larger than 1/5 of the diameter of specimen (%) : Nil
9. The specimen was selected by the laboratory.
   Name : W S Wat Designation : Senior Laboratory Technician
10. Sampling History : As Received

* Delete as appropriate ^ Upon request

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.: 059**

Compiled by W S Wat
Checked by H W Chung

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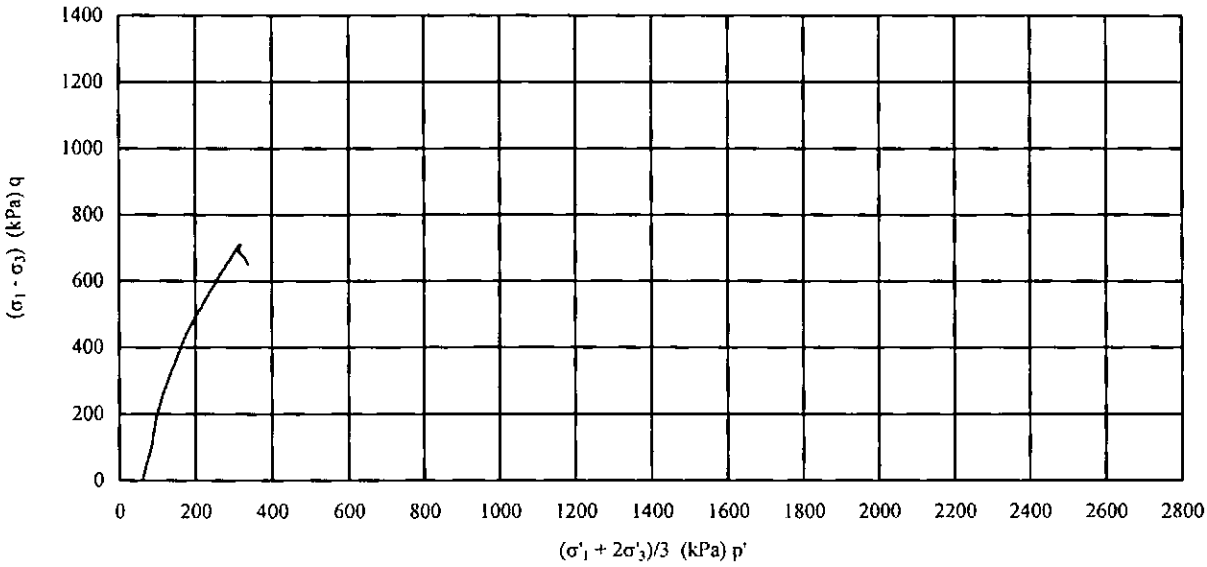
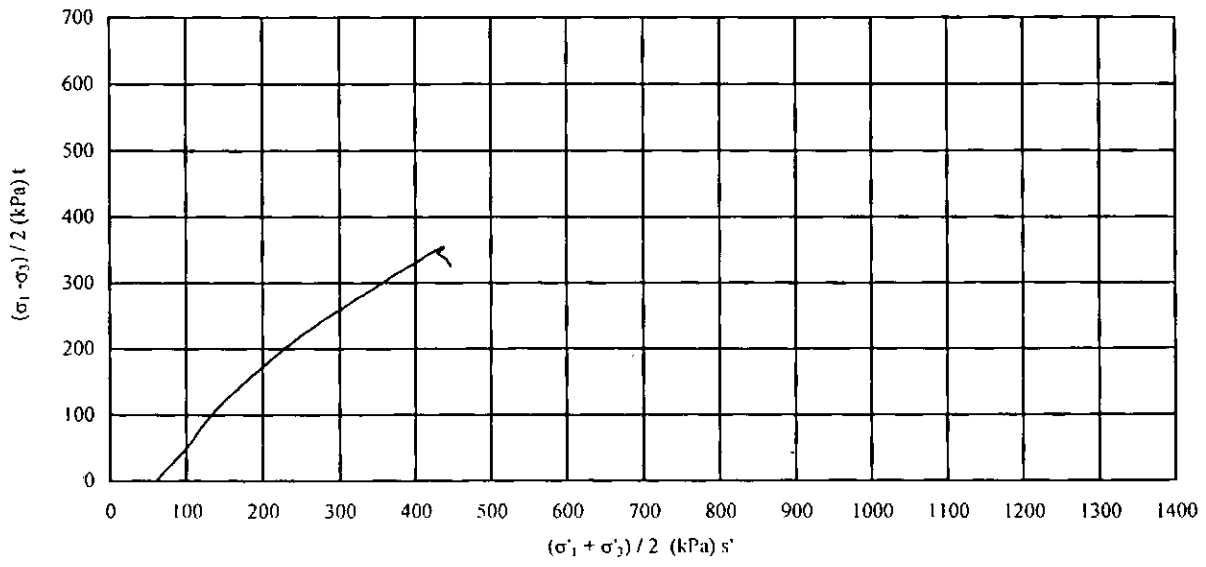
TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

STRESS PATH PARAMETERS FOR EFFECTIVE STRESS

p' - q PLOT



s' - t PLOT



Borehole No. : D053 — **Sample Depth m:-** 5.50 - 6.50
Sample No. : 5 — **Specimen Depth m:-** 6.10 - 6.30

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 — **Works Order No.:** 059

Compiled by: W S Wat
Checked by: H W Chung

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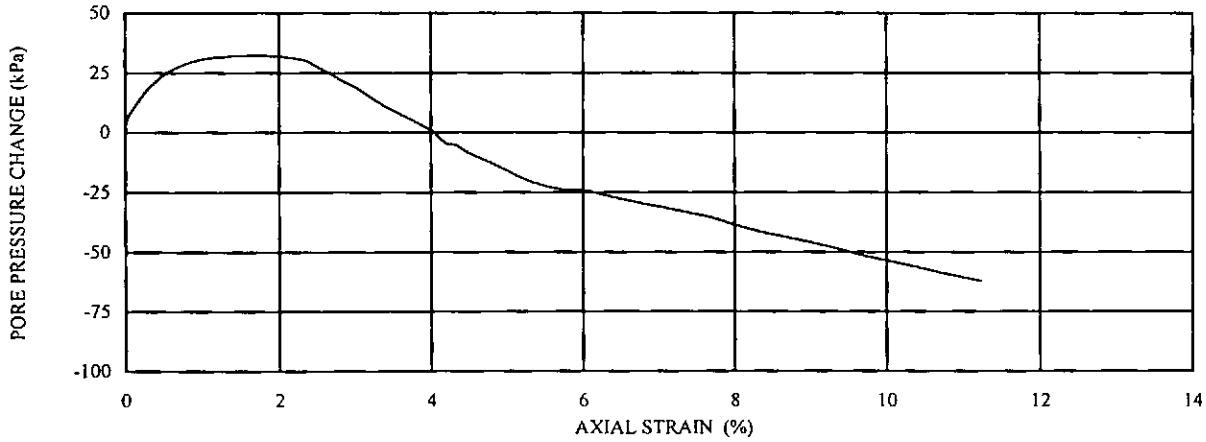
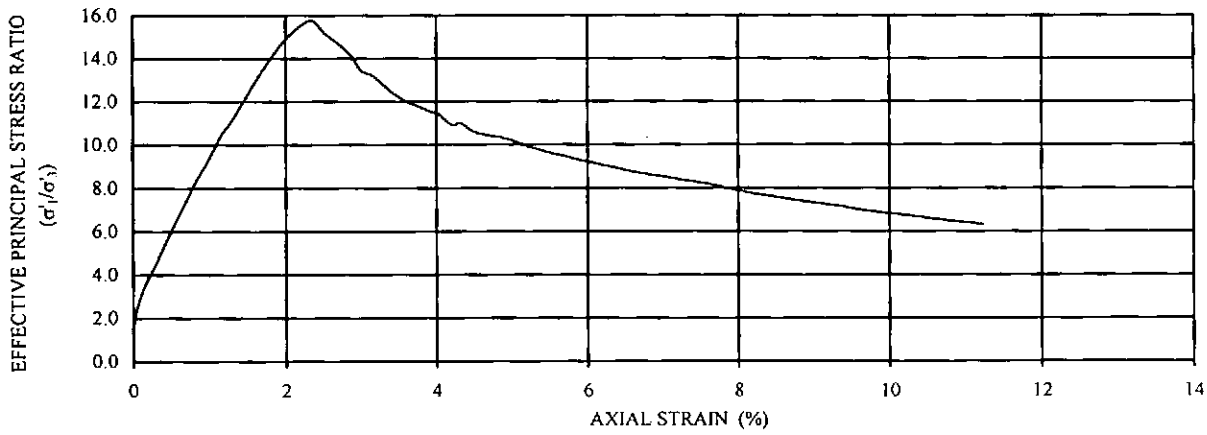
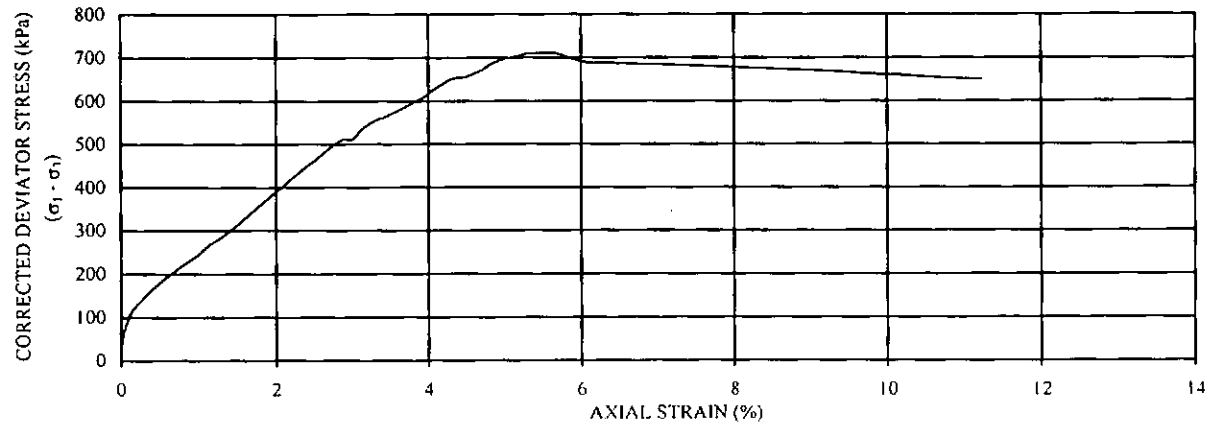
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

COMPRESSION







Borehole No. :	**D053**	**Sample Depth m:-**	**5.50 - 6.50**
Sample No. :	**5**	**Specimen Depth m:-**	**6.10 - 6.30**
Customer :	**Mass Transit Railway Corporation**		Compiled by W S Wat
Project :	**Ground Investigation for South Island Line**		
		Contract No.: Contract 1024	Checked by H W Chung
Job No.:	**J2999**	**Works Order No.: 059**	

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TEST REPORT
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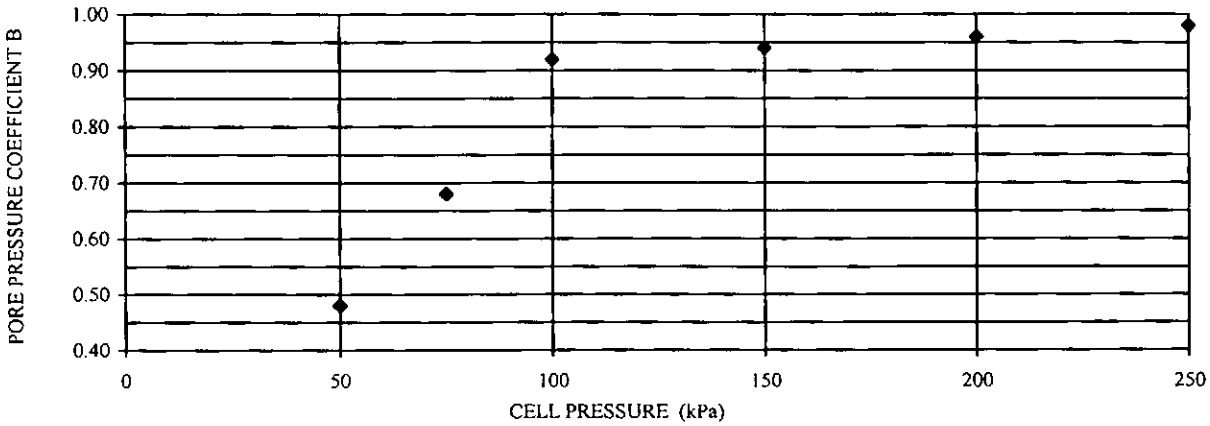
GEOSPEC 3 : 2001 Test Method 15.2

SATURATION



Date	Time	Cell Pressure kPa	Back Pressure kPa	Pore Pressure kPa	Cumulative Volume of Water cm^3	Pore Pressure Coefficient B
26/11/2008	08:32	0	0	-	0.0	
	08:39	25	-	15		-
	08:57	25	20	20	2.3	
	09:03	50	-	32		0.48
	09:18	50	45	45	10.3	
	09:24	75	-	62		0.68
	09:42	75	70	70	16.8	
	09:50	100	-	93		0.92
	10:20	100	95	95	21.2	
	10:30	150	-	142		0.94
	11:00	150	145	145	24.4	
	11:10	200	-	193		0.96
	11:43	200	195	195	28.3	
	11:50	250	-	244		0.98
27/11/2008	08:40	250	245	245	32.1	

Borehole No. D053 **Sample Depth m:-** 5.50 - 6.50
Sample No. : 5 **Specimen Depth m:-** 6.10 - 6.30

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.:** 059

Compiled by: W S Wat
Checked by: H W Chung

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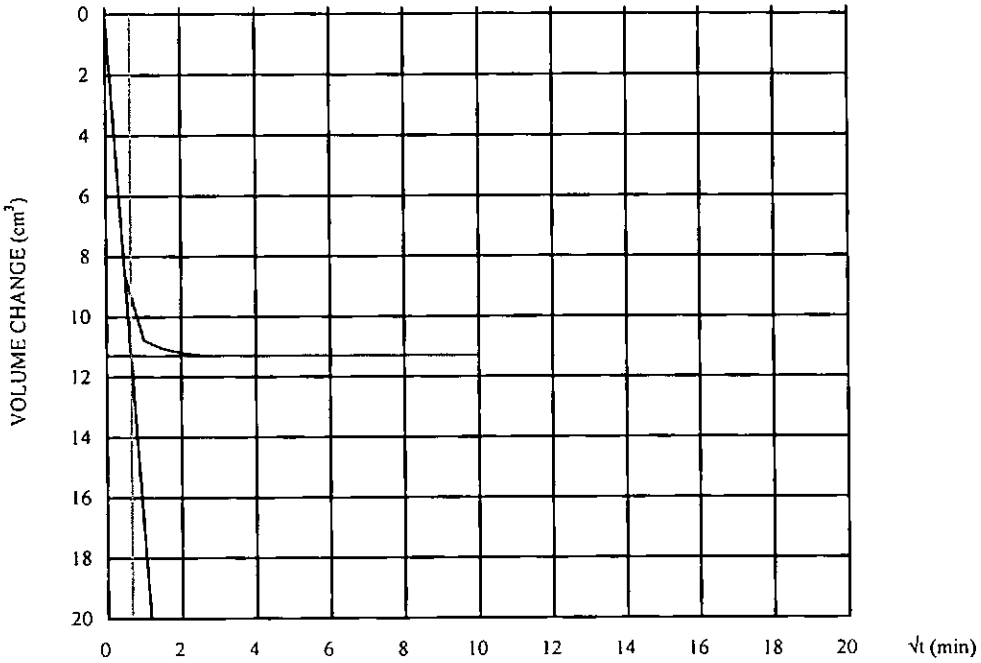
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

CONSOLIDATION (DRAINED PHASE) - Stage 1

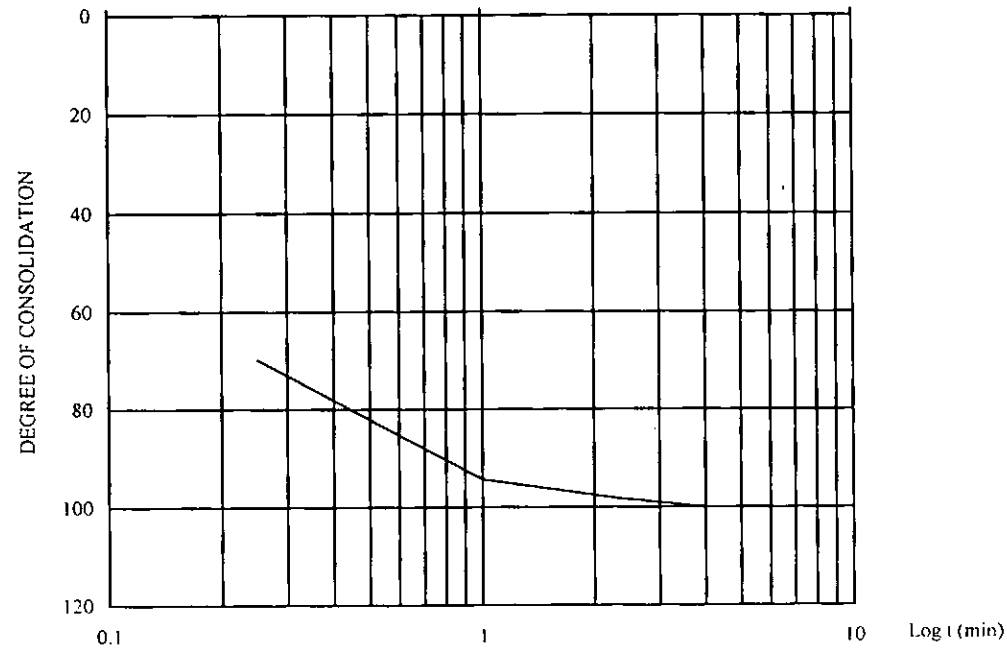


√t100 0.66 min

t100 0.433 min

tf 0.229 min

Calc. strain rate
43.967 mm/min



Borehole No. : D053 — **Sample Depth m:-** 5.50 - 6.50

Sample No. : 5 — **Specimen Depth m:-** 6.10 - 6.30

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 — **Works Order No.:** 059

Complied by: W S Wat

Checked by: H W Chung

Form : GESR009.13 / Jun.02.03 / Issue 1 / Rev 0

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Single Stage		P.W.P,B.P			Effective Pressure	60	kPa
Side drains	No	Selected Machine Speed	0.048	mm/min	Rate of Strain	2.00	% per hr

FAILURE CRITERION

Max. deviator Stress	☒	Max. Stress ratio	☐		Axial Strain %		☐
Stage : 1	Applied Pressure (kPa) - Cell :	305	Back :	245	P.R. factor	3.1341	kN/mm

Date	Time	Strain Dial	Strain	Load P.R.No. 2	Pore Pressure	Dev. stress Corr.	Dev. stress q $\sigma_1 - \sigma_3$	Effective Stress σ'_1	Effective Stress σ'_3	s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa				2	2	3	σ'_1/σ'_3
29/11	08:35	0.00	0.00	0.035	245	0.000	0.0	60.0	60.0	60.0	0.0	60.0	1.00
	08:40	0.03	0.02	0.105	250	0.006	51.2	106.4	55.2	80.8	25.6	72.3	1.93
	08:45	0.18	0.12	0.185	256	0.035	109.6	158.7	49.1	103.9	54.8	85.6	3.23
	08:50	0.40	0.28	0.232	263	0.080	143.7	186.0	42.3	114.1	71.8	90.2	4.40
	08:55	0.58	0.40	0.261	267	0.114	164.6	203.0	38.4	120.7	82.3	93.3	5.29
	09:00	0.80	0.55	0.294	270	0.157	188.3	223.0	34.7	128.8	94.1	97.5	6.43
	09:05	0.99	0.69	0.321	273	0.196	207.6	240.0	32.4	136.2	103.8	101.6	7.41
	09:10	1.22	0.84	0.348	275	0.237	226.8	257.3	30.5	143.9	113.4	106.1	8.44
	09:15	1.43	0.99	0.373	276	0.278	244.6	273.9	29.3	151.6	122.3	110.8	9.35
	09:20	1.63	1.13	0.404	276	0.316	266.6	295.2	28.6	161.9	133.3	117.5	10.32
	09:25	1.84	1.28	0.429	277	0.357	284.2	312.4	28.2	170.3	142.1	122.9	11.08
	09:30	2.09	1.45	0.461	277	0.402	306.8	334.6	27.8	181.2	153.4	130.1	12.03
	09:35	2.30	1.60	0.493	277	0.442	329.3	356.9	27.6	192.2	164.6	137.4	12.93
	09:40	2.51	1.74	0.524	277	0.479	351.1	378.8	27.7	203.2	175.5	144.7	13.67
	09:45	2.77	1.92	0.563	277	0.525	378.4	406.3	27.9	217.1	189.2	154.0	14.56
	09:50	2.96	2.06	0.591	277	0.561	397.9	426.1	28.2	227.1	198.9	160.8	15.11
	09:55	3.19	2.21	0.624	276	0.600	420.8	449.7	28.9	239.3	210.4	169.2	15.56
	10:00	3.41	2.36	0.656	275	0.638	443.0	473.0	30.0	251.5	221.5	177.7	15.77
	10:05	3.63	2.52	0.687	272	0.678	464.3	497.1	32.8	265.0	232.2	187.6	15.16
	10:10	3.85	2.67	0.719	270	0.715	486.4	521.7	35.3	278.5	243.2	197.4	14.78
	10:15	4.12	2.86	0.755	266	0.762	511.0	549.8	38.8	294.3	255.5	209.1	14.17
	10:20	4.32	3.00	0.757	264	0.796	511.6	552.7	41.1	296.9	255.8	211.6	13.45
	10:25	4.53	3.14	0.794	261	0.830	537.0	580.9	43.9	312.4	268.5	222.9	13.23
	10:30	4.76	3.31	0.823	258	0.870	556.6	604.0	47.4	325.7	278.3	232.9	12.74
	10:35	4.93	3.42	0.833	256	0.896	563.0	612.4	49.4	330.9	281.5	237.1	12.40
	10:40	5.22	3.62	0.859	252	0.943	580.1	632.9	52.8	342.8	290.0	246.2	11.99
	10:45	5.40	3.75	0.877	250	0.974	592.0	646.8	54.8	350.8	296.0	252.1	11.80
	10:50	5.67	3.94	0.904	247	1.018	609.8	667.8	58.0	362.9	304.9	261.3	11.51
	10:55	5.80	4.02	0.921	246	1.036	621.1	680.6	59.5	370.1	310.6	266.5	11.44
	11:00	6.05	4.20	0.951	241	1.077	641.0	705.5	64.5	385.0	320.5	278.2	10.94
	11:05	6.23	4.32	0.968	240	1.104	652.0	717.2	65.2	391.2	326.0	282.5	11.00
	11:10	6.46	4.48	0.975	237	1.140	655.8	724.0	68.2	396.1	327.9	286.8	10.62
	11:15	6.78	4.71	1.002	234	1.190	673.0	744.5	71.5	408.0	336.5	295.8	10.41
	11:20	6.92	4.80	1.019	232	1.210	684.1	757.0	72.9	415.0	342.1	300.9	10.38
	11:25	7.20	5.00	1.041	229	1.254	698.0	773.9	75.9	424.9	349.0	308.6	10.20
	11:30	7.45	5.17	1.052	226	1.290	704.3	782.9	78.6	430.8	352.2	313.4	9.96
	11:35	7.65	5.31	1.062	225	1.320	710.2	790.7	80.5	435.6	355.1	317.2	9.82
	11:40	**7.92**	**5.50**	**1.065**	**223**	**1.360**	**710.8**	**793.2**	**82.4**	**437.8**	**355.4**	**319.3**	**9.63**
	11:45	8.23	5.71	1.064	221	1.404	708.5	792.2	83.7	437.9	354.2	319.9	9.46

Borehole No. :	**D053**	**Sample Depth m:- 5.50 - 6.50**	
Sample No. :	**5**	**Specimen Depth m:- 6.10 - 6.30**	
Customer :	**Mass Transit Railway Corporation**		Compiled by W S Wat
Project :	**Ground Investigation for South Island Line**		
		Contract No.: Contract 1024	Checked by H W Chung
Job No.:	**J2999**	**Works Order No.: 059**	

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TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2
Shearing Continuation

FAILURE CRITERION

Max. deviator Stress ☒ Max. Stress ratio ☐ Axial Strain % ☐

Stage :	1	Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
Date	Time	Dial		P.R.No. 2	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
29/11	11:50	8.48	5.88	1.049	221	1.439	696.8	780.8	84.0	432.4	348.4	316.3	9.30
	11:55	8.75	6.07	1.041	221	1.478	689.9	774.3	84.4	429.3	344.9	314.4	9.17
	12:00	8.95	6.21	1.040	220	1.506	688.1	773.6	85.5	429.6	344.1	314.9	9.05
	12:15	9.69	6.72	1.043	216	1.608	686.3	775.6	89.3	432.5	343.2	318.1	8.69
	12:30	10.51	7.29	1.044	212	1.718	682.7	775.4	92.7	434.0	341.3	320.3	8.36
	12:45	11.10	7.71	1.045	209	1.797	680.2	775.8	95.6	435.7	340.1	322.3	8.12
	13:00	11.80	8.19	1.045	205	1.886	676.6	776.8	100.2	438.5	338.3	325.7	7.75
	13:15	12.58	8.73	1.046	201	1.982	673.2	777.3	104.1	440.7	336.6	328.5	7.47
	13:30	13.34	9.25	1.046	197	2.073	669.2	776.8	107.6	442.2	334.6	330.7	7.22
	13:45	13.99	9.71	1.043	194	2.152	663.7	775.2	111.5	443.4	331.9	332.7	6.95
	14:00	14.87	10.32	1.042	189	2.254	658.5	774.1	115.6	444.9	329.3	335.1	6.70
	14:15	15.42	10.70	1.040	186	2.316	654.3	772.9	118.6	445.7	327.1	336.7	6.52
	14:30	16.18	11.23	1.039	183	2.401	649.7	771.9	122.2	447.0	324.8	338.8	6.32

Borehole No. : D053 **Sample Depth m:-** 5.50 - 6.50

Sample No. : 5 **Specimen Depth m:-** 6.10 - 6.30

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.:** 059

Compiled by: W S Wat

Checked by: H W Chung

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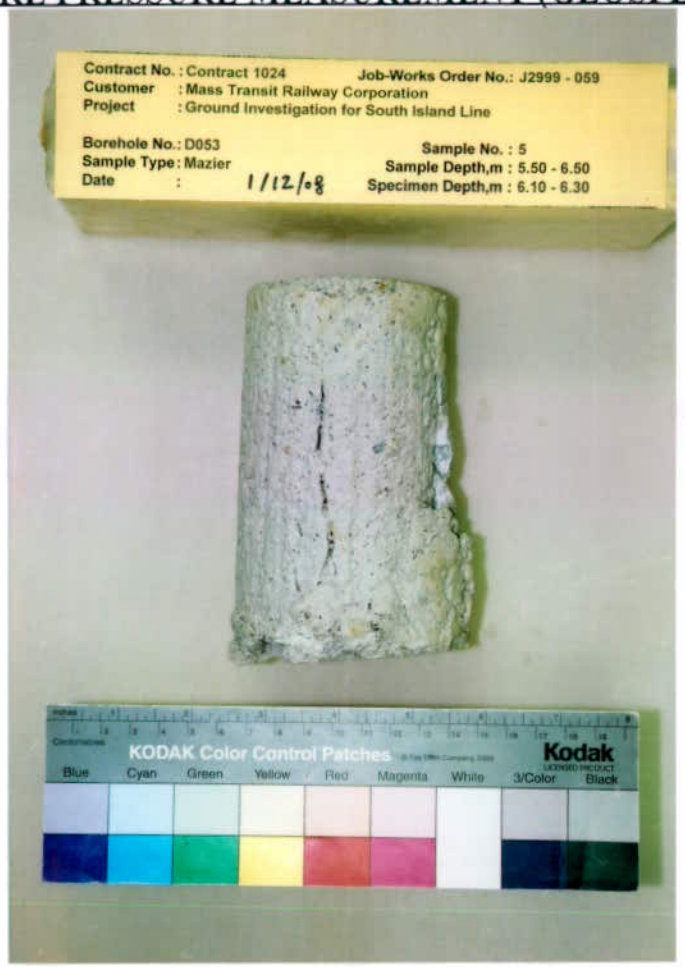
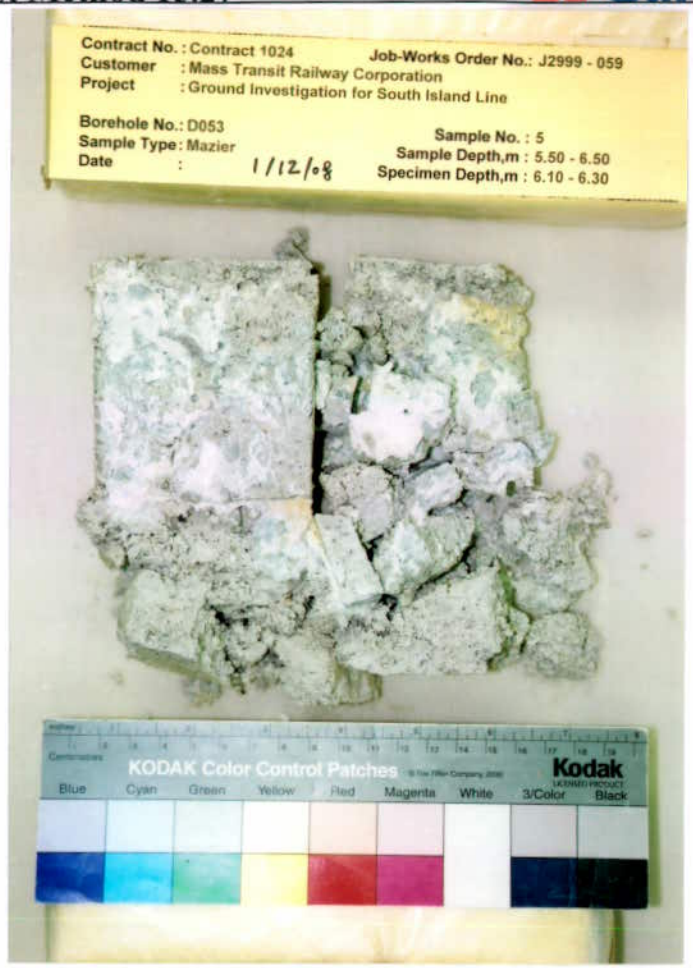
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT (GEOSPEC 3 : 2001 Test Method 15.2)





Description : Light grey, gravelly, silty SAND **Sample Origin :** CDT‡ ‡ Information provided by customer

Borehole No. : D053 **Sample No. :** 5 **Sample Depth m:-** 5.50 - 6.50 **Specimen Depth m:-** 6.10 - 6.30

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line

Contract No. : Contract 1024
Job No. : J2999
Works Order No.: 059

Compiled by: W S Wat
Checked by: H W Chung

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	D053	D053	D053
Sample		no	5	5	5
Sample Type			Mazier	Mazier	Mazier
Stage		no	1	2	3
Sample Depth		m	5.50 - 6.50	5.50 - 6.50	5.50 - 6.50
Specimen Depth		m	6.30 - 6.50	6.30 - 6.50	6.30 - 6.50
INITIAL CONDITIONS					
Diameter	(D_o)	mm	74.3	74.8	75.2
Height	(H_o)	mm	145.0	141.5	139.2
Moisture Content	(W_o)	%	13	13	13
Bulk density	(ρ_o)	Mg/m^3	2.22	2.24	2.25
Dry density	(ρ_d)	Mg/m^3	1.96	1.99	2.00
Particle density	(ρ_s)		2.65	2.65	2.65
Voids Ratio	(e_o)		0.35	0.33	0.33
Degree of Saturation	(S_r)	%	98.8	102.9	103.0
DRAINAGE CONDITIONS			ONE END		
SATURATION					
Final Pore Pressure Coefficient B			0.97		
CONSOLIDATION					
Cell Pressure	(σ_3)	kPa	235	260	290
Back Pressure	(u_b)	kPa	205	205	205
Effective Pressure	(σ'_3)	kPa	30	55	85
Coefficient of Consolidation (t100)	(C_{vi})	m^2/Year	26764.96	24141.34	32111.87
Coefficient of Volume Compressibility	(m_{vi})	m^2/MN	0.44	0.16	0.09
Coefficient of Permeability (k)		m/s	3.67E-06	1.19E-06	8.58E-07
COMPRESSION TERMINATION CRITERION			MAXIMUM STRESS RATIO		MAX ($\sigma'1 - \sigma'3$)
COMPRESSION - INITIAL					
Moisture Content	(w)	%	13	13	13
Pore Pressure at the End of Consolidation		kPa	205	205	205
Effective Stress at the End of Consolidation		kPa	30	55	85
Bulk density	(ρ_o)	Mg/m^3	2.24	2.25	2.25
Dry density	(ρ_d)	Mg/m^3	1.99	2.00	2.00
Voids Ratio	(e)		0.33	0.33	0.33
Degree of Saturation	(S_r)	%	102.9	103.0	103.0

Customer : **Mass Transit Railway Corporation**
Project : **Ground Investigation for South Island Line**
Report No. : J2999-059.11
Contract No.: Contract 1024
Job No.: **J2999** **Works Order No.: 059**

Technician : W S Wat Checked By : Approved By :
Name : H W Chung Signatory : **Lau Wai Cheong**
Tested Date: 25/11/2008 Date : 02/01/2009 Date : 02/01/2009

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Form : GESR009.6 / Nov.10.06 / Issue 1 / Rev 1

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	D053	D053	D053
Sample		no	5	5	5
Sample Type			Mazier	Mazier	Mazier
Stage		no	1	2	3
Sample Depth		m	5.50 - 6.50	5.50 - 6.50	5.50 - 6.50
Specimen Depth		m	6.30 - 6.50	6.30 - 6.50	6.30 - 6.50
COMPRESSION - FAILURE					
Cell Pressure		kPa	235	260	290
Rate of Strain		mm/min	0.048	0.047	0.046
CONDITIONS AT MAXIMUM STRESS RATIO					
Major Effective Principal Stress (σ'_1)		kPa	454	629	776
Corrected Deviator Stress ($\sigma'_1 - \sigma'_3$)		kPa	437	583	690
Minor Effective Principal Stress (σ'_3)		kPa	17	47	86
$s' = (\sigma'_1 + \sigma'_3)/2$		kPa	235	338	431
$t = (\sigma_1 - \sigma_3)/2$		kPa	219	291	345
Expanded Uncertainty of s' ^		kPa	-	-	-
Expanded Uncertainty of t ^		kPa	-	-	-
Pore pressure parameter A_f			0.03	0.01	0.00
Strain at Failure	(εf)	%	1.7	3.3	4.6
COMPRESSION - FINAL					
Moisture Content	(W_f)	%	13	13	13
Bulk density	(ρ_o)	Mg/m^3	2.24	2.25	2.25
Dry density	(ρ_d)	Mg/m^3	1.99	2.00	2.00
Voids Ratio	(e_f)		0.33	0.33	0.33
Degree of Saturation	(S_f)	%	102.9	103.0	103.0

Notes -
1. The method of specimen preparation was in accordance with GEOSPEC 3 : 2001 :- Test method 13.3 : test specimen from undisturbed soil samples.
2. Sample received date :29/09/2008
3. The determination of moisture content was in accordance with test method 5.1 of GEOSPEC 3 : 2001.
4. Particle density : 2.65 (Assumed)
5. Maximum and minimum temperature recorded over the period of testing 19.9 - 20.7 °C.
6. Unavoidable variations from specified procedure : none
7. Comment on observed or inferred sample disturbance : none
8. Percentage by mass of soil particles larger than 1/5 of the diameter of specimen (%) : Nil
9. The specimen was selected by the laboratory.
   Name : W S Wat Designation : Senior Laboratory Technician
10. Sampling History : As Received

* Delete as appropriate ^ Upon request

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.:** 059

Compiled by W S Wat
Checked by H W Chung

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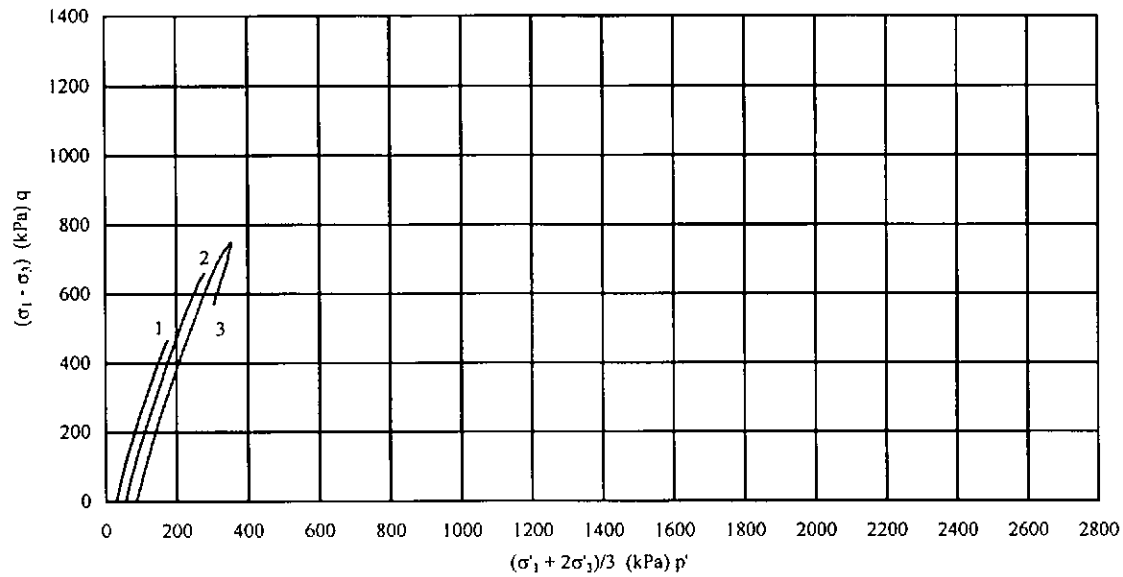
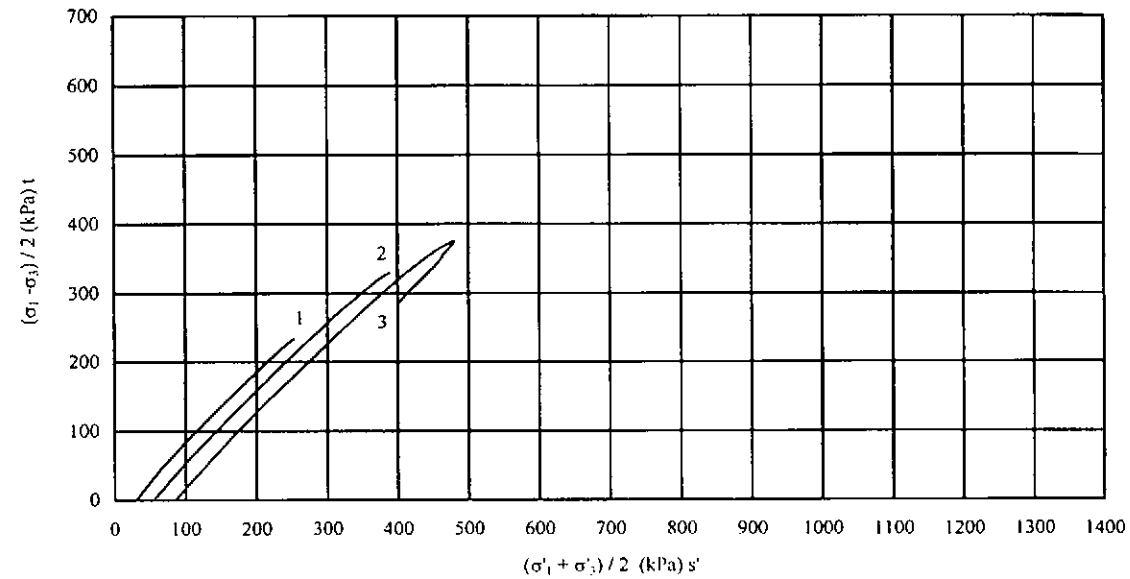
TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

STRESS PATH PARAMETERS FOR EFFECTIVE STRESS

p' - q PLOT



s' - t PLOT



Borehole No. :	**D053**	**Sample Depth m:-**	**5.50 - 6.50**
Sample No. :	**5**	**Specimen Depth m:-**	**6.30 - 6.50**
Customer :	**Mass Transit Railway Corporation**		Compiled by W S Wat
Project :	**Ground Investigation for South Island Line**		
		Contract No.: Contract 1024	Checked by H W Chung
Job No.:	**J2999**	**Works Order No.: 059**	

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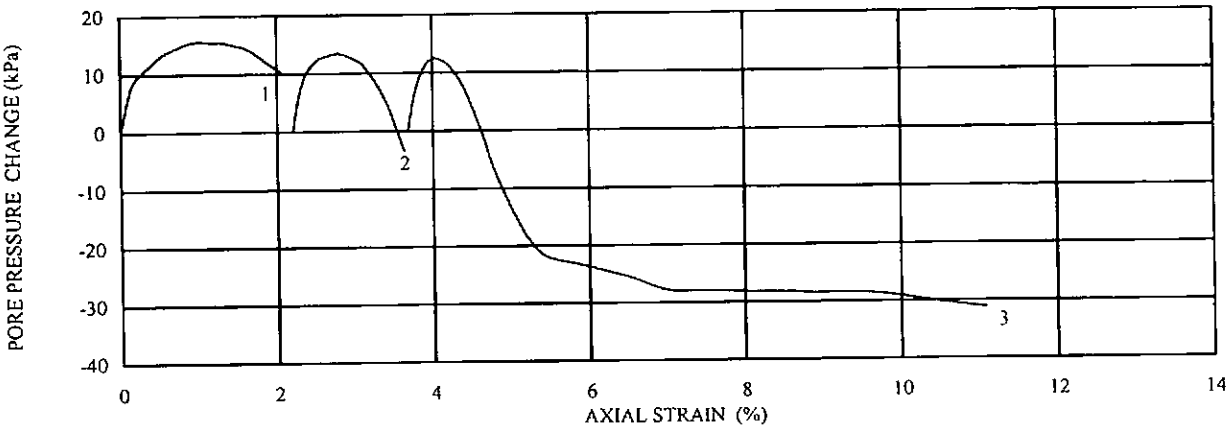
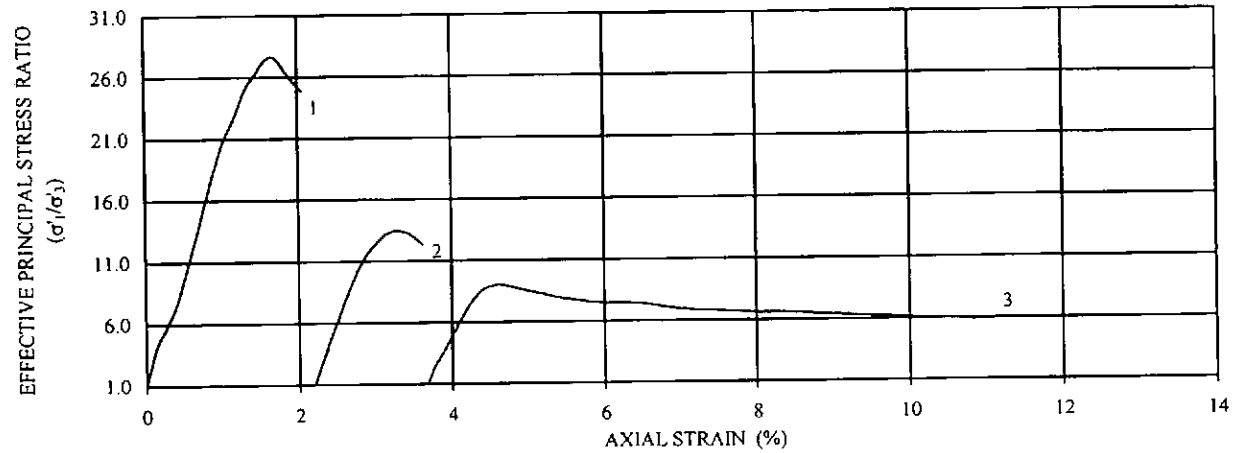
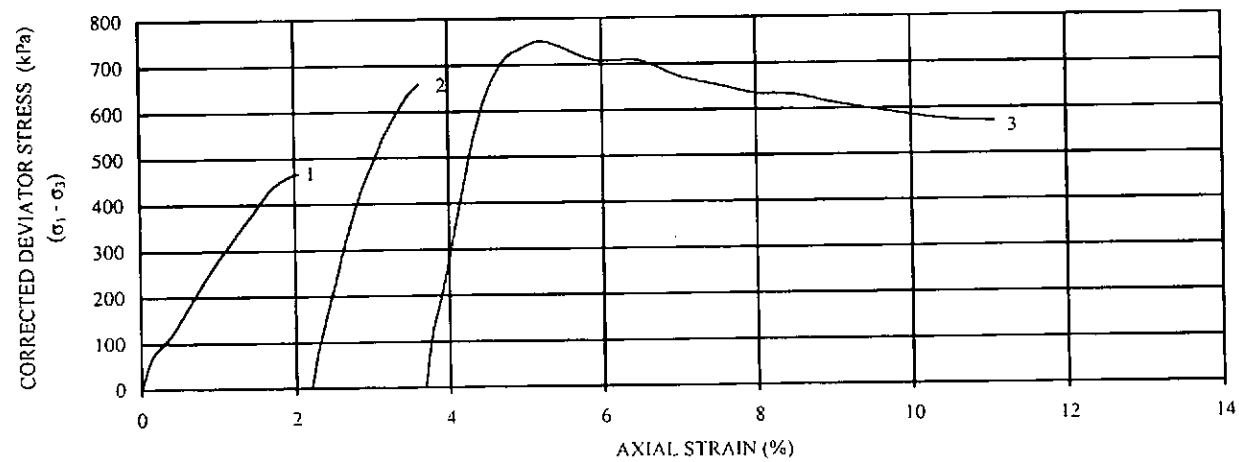
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

COMPRESSION







Borehole No. : D053 — **Sample Depth m:-** 5.50 - 6.50
Sample No. : 5 — **Specimen Depth m:-** 6.30 - 6.50

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Works Order No.: 059
Job No.: J2999

Compiled by: W S Wat
Checked by: H W Chung

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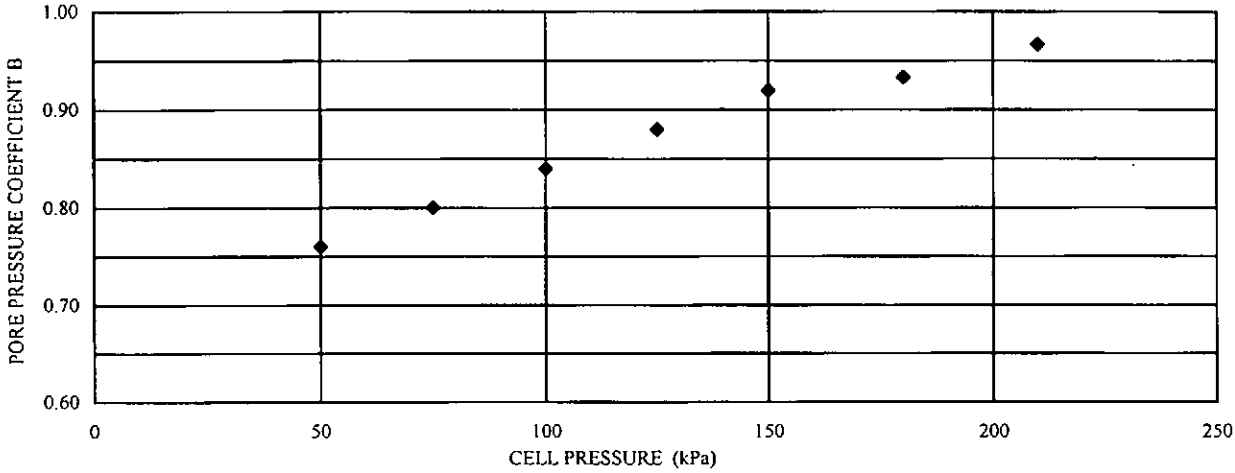
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

SATURATION



Date	Time	Cell Pressure kPa	Back Pressure kPa	Pore Pressure kPa	Cumulative Volume of Water cm^3	Pore Pressure Parameter B
26/11/2008	08:32	0	0	-	0.0	
	08:39	25	-	24		-
	08:52	25	20	20	-11.3	
	08:57	50	-	39		0.76
	09:16	50	45	45	-7.8	
	09:22	75	-	65		0.80
	09:40	75	70	70	-5.7	
	09:48	100	-	91		0.84
	10:03	100	95	95	-3.6	
	10:08	125	-	117		0.88
	10:30	125	120	120	-0.6	
	10:40	150	-	143		0.92
	11:00	150	145	145	1.5	
	11:07	180	-	173		0.93
	13:14	180	175	175	3.4	
	13:26	210	-	204		0.97
27/11/2008	08:40	210	205	205	6.5	

Borehole No. : D053 **Sample Depth m:-** 5.50 - 6.50
Sample No. : 5 **Specimen Depth m:-** 6.30 - 6.50

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.:** 059

Compiled by W S Wat
Checked by H W Chung

Form : GESR009.11 / Jun.02.03 / Issue 1 / Rev 0

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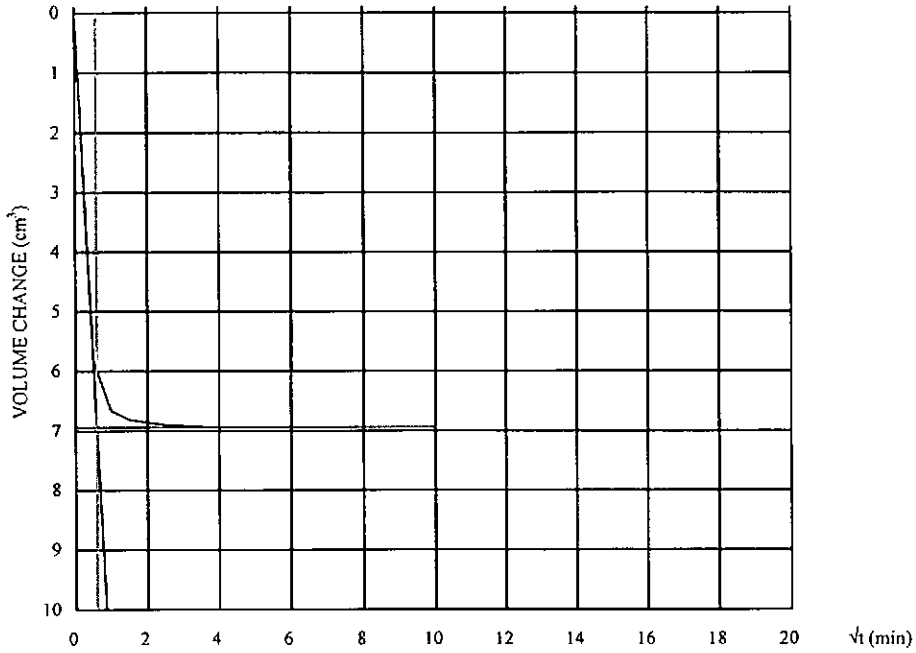
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

CONSOLIDATION (DRAINED PHASE) - Stage 1

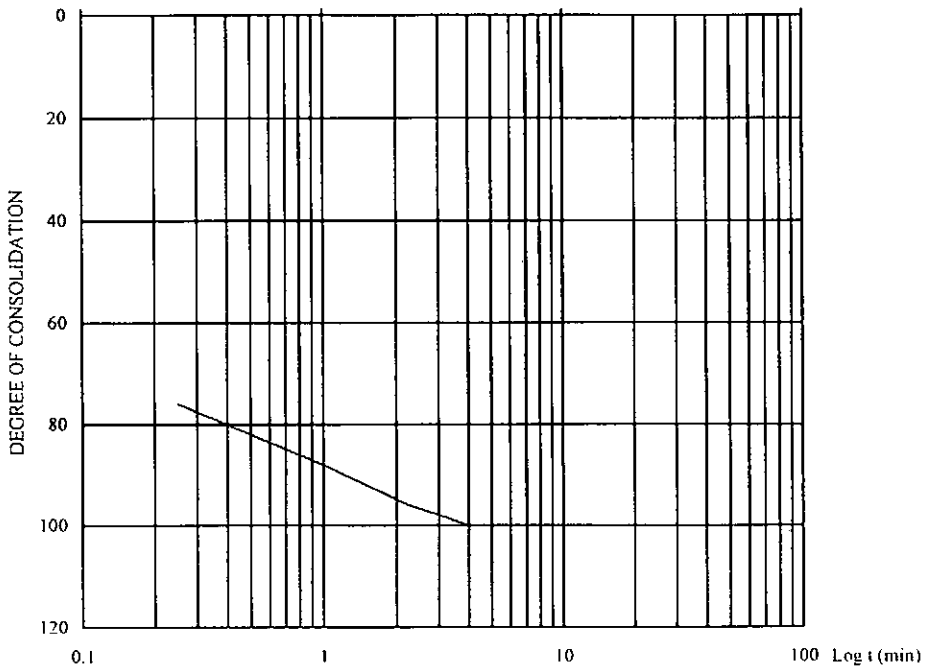


√t100 0.60 min

t100 0.36 min

tf 0.19 min

Calc. strain rate
53.716 mm/min



Borehole No. : D053 **Sample Depth m:-** 5.50 - 6.50

Sample No. : 5 **Specimen Depth m:-** 6.30 - 6.50

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.:** 059

Complied by: W S Wat

Checked by: H W Chung

Form : GESR009.13 / Jun.02.03 / Issue 1 / Rev 0

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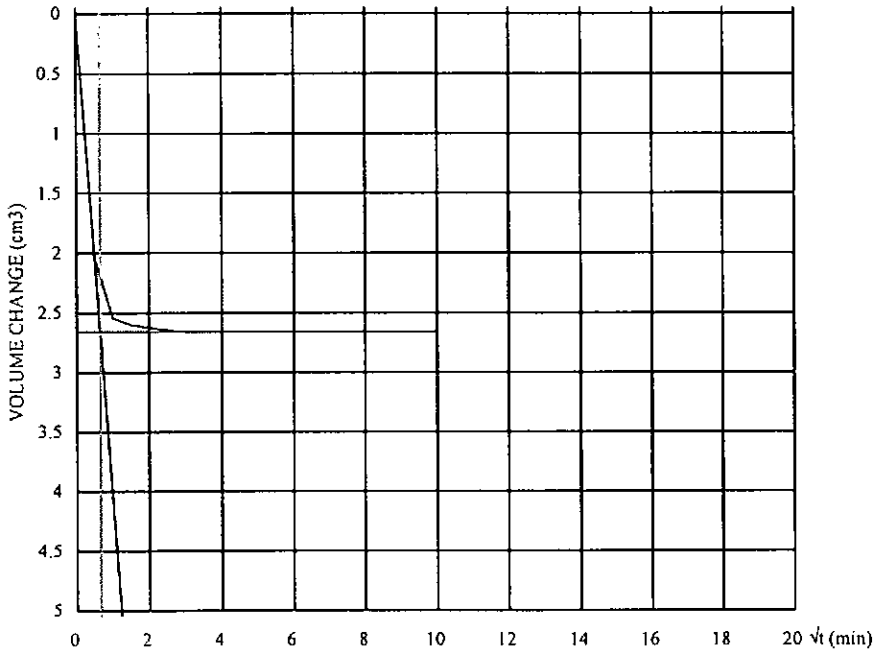
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

CONSOLIDATION (DRAINED PHASE) - Stage 2

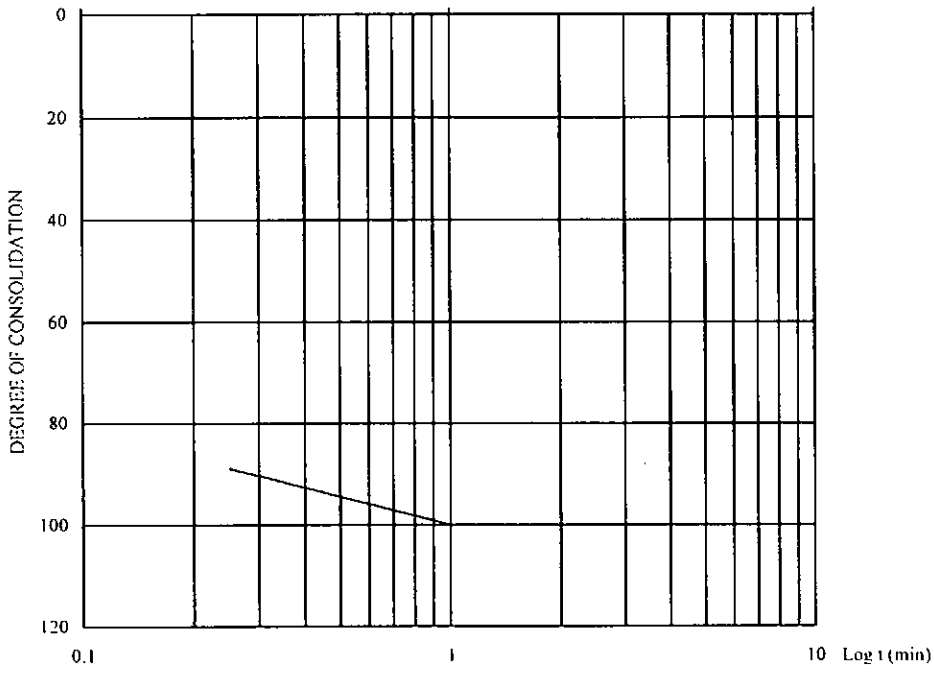


√t100 0.65 min

t100 0.43 min

tf 0.23 min

Calc. strain rate
43.825 mm/min



Borehole No. : D053 **Sample Depth m:-** 5.50 - 6.50

Sample No. : 5 **Specimen Depth m:-** 6.30 - 6.50

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.:** 059

Complied by: W S Wat

Checked by: H W Chung

Form : GESR009.13 / Jun.02.03 / Issue 1 / Rev 0

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TEST REPORT
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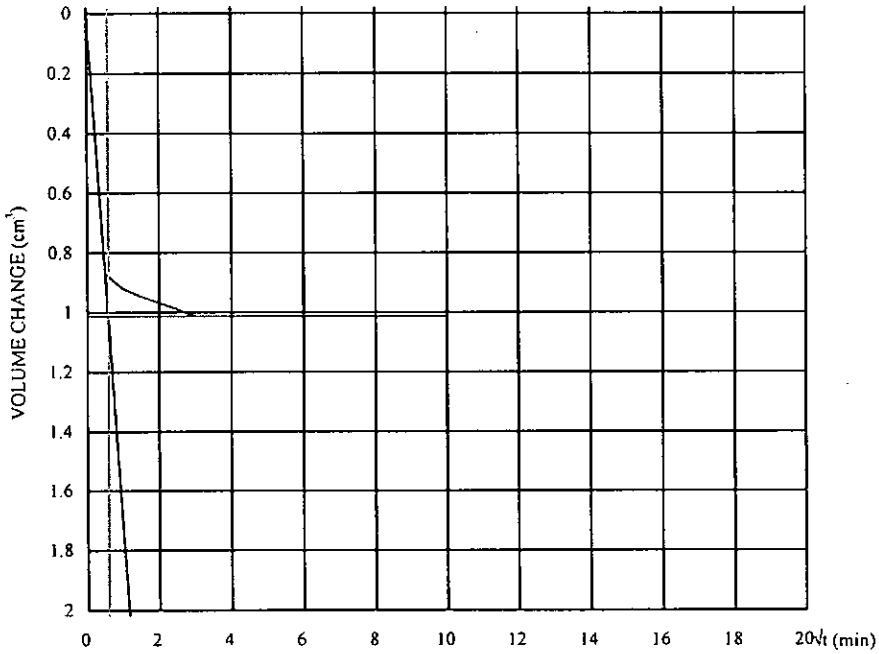
GEOSPEC 3 : 2001 Test Method 15.2

CONSOLIDATION (DRAINED PHASE) - Stage 3

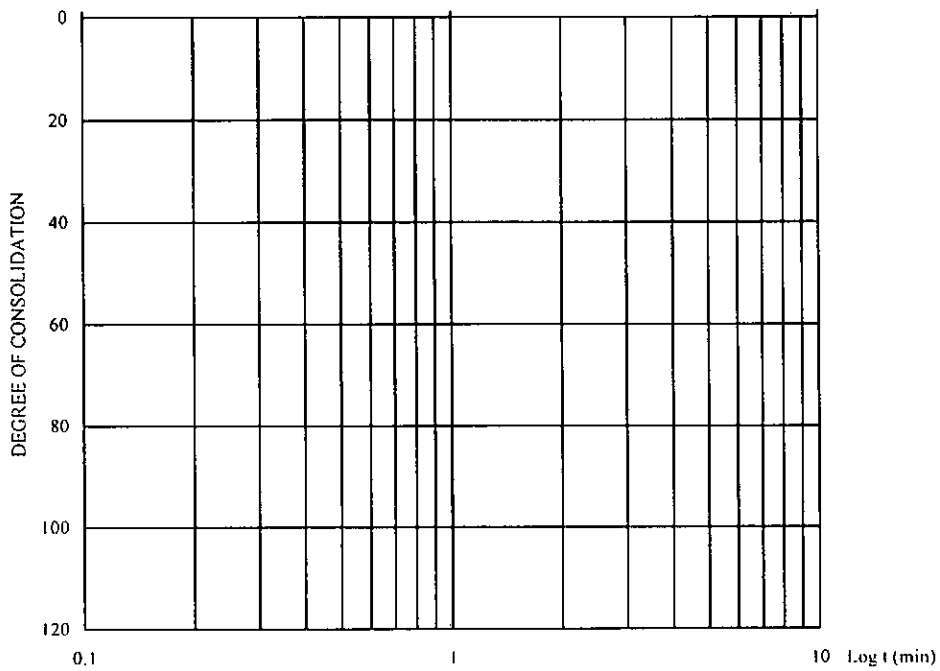


√t100 0.58 min

t100 0.34 min

tf 0.18 min

Calc. strain rate
54.241 mm/min



Borehole No. : D053 **Sample Depth m:-** 5.50 - 6.50

Sample No. : 5 **Specimen Depth m:-** 6.30 - 6.50

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.:** 059

Complied by: W S Wat

Checked by: H W Chung

Form : GESR009.13 / Jun.02.03 / Issue 1 / Rev 0

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Gammon

Multi Stage		P.W.P,B.P		Effective Pressure 30	kPa
Side drains	No	Selected Machine Speed	0.048 mm/min	Rate of Strain 1.99	% per hr
FAILURE CRITERION					
Max. deviator Stress ☐		Max. Stress ratio ☒		Axial Strain % ☐	
Stage : 1	Applied Pressure (kPa) - Cell : 235		Back : 205	P.R. factor 3.1341	kN/mm

Date	Time	Strain Dial	Strain	Load P.R.No. 2	Pore Pressure	Dev. stress Corr.	Dev. stress q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
28/11	08:45	0.00	0.00	0.038	205	0.000	0.0	30.0	30.0	30.0	0.0	30.0	1.00
	08:50	0.20	0.14	0.133	213	0.040	69.1	91.3	22.2	56.8	34.6	45.2	4.11
	08:55	0.39	0.27	0.168	215	0.078	94.4	114.3	19.9	67.1	47.2	51.4	5.75
	09:00	0.57	0.40	0.203	217	0.114	119.7	138.0	18.3	78.1	59.8	58.2	7.54
	09:05	0.74	0.51	0.242	218	0.146	147.8	164.7	16.9	90.8	73.9	66.2	9.75
	09:10	0.96	0.66	0.300	219	0.187	189.5	205.3	15.8	110.6	94.8	79.0	13.00
	09:15	1.12	0.78	0.347	220	0.221	223.3	238.4	15.1	126.7	111.6	89.5	15.79
	09:20	1.28	0.89	0.386	220	0.251	251.2	265.8	14.6	140.2	125.6	98.3	18.20
	09:25	1.49	1.03	0.434	221	0.289	285.4	299.8	14.4	157.1	142.7	109.5	20.82
	09:30	1.69	1.17	0.478	220	0.327	316.7	331.3	14.6	172.9	158.3	120.2	22.69
	09:35	1.91	1.32	0.526	220	0.368	350.7	365.3	14.6	189.9	175.3	131.5	25.02
	09:40	2.10	1.45	0.565	220	0.402	378.2	393.2	15.0	204.1	189.1	141.1	26.21
	09:45	2.30	1.59	0.610	220	0.440	409.9	425.4	15.5	220.5	205.0	152.1	27.45
	09:50	**2.49**	**1.72**	**0.649**	**219**	**0.474**	**437.3**	**453.8**	**16.5**	**235.1**	**218.6**	**162.3**	**27.50**
	09:55	2.75	1.90	0.678	217	0.520	457.2	475.5	18.3	246.9	228.6	170.7	25.98
	10:00	2.98	2.06	0.693	215	0.562	467.1	486.7	19.6	253.2	233.6	175.3	24.83

Borehole No. :	**D053**	**Sample Depth m:- 5.50 - 6.50**	
Sample No. :	**5**	**Specimen Depth m:- 6.30 - 6.50**	
Customer :	**Mass Transit Railway Corporation**		Compiled by W S Wat
Project :	**Ground Investigation for South Island Line**	**Contract No.: Contract 1024**	Checked by H W Chung
Job No.:	**J2999**	**Works Order No.: 059**	

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Gammon

HKLAS 035

Multi Stage		P.W.P.B.P		Effective Pressure 55	kPa
Side drains	No	Selected Machine Speed	0.047 mm/min	Rate of Strain 2.00	% per hr

FAILURE CRITERION

Max. deviator Stress ☐	Max. Stress ratio ☒	Axial Strain % ☐

Stage : 2	Applied Pressure (kPa) - Cell : 260	Back : 205	P.R. factor 3.1341	kN/mm

Date	Time	Strain Dial	Strain	Load P.R.No. 2	Pore Pressure	Dev. stress Corr.	Dev. stress q $\sigma_1 - \sigma_3$	Effective Stress Parameters: Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
28/11	12:45	3.18	2.20	0.054	205	0.000	0.0	55.0	55.0	55.0	0.0	55.0	1.00
	12:50	3.29	2.28	0.156	211	0.618	72.4	121.3	48.9	85.1	36.2	73.0	2.48
	12:55	3.38	2.34	0.214	214	0.633	113.8	160.0	46.2	103.1	56.9	84.1	3.46
	13:00	3.49	2.41	0.280	216	0.651	160.8	205.1	44.3	124.7	80.4	97.9	4.63
	13:05	3.65	2.53	0.386	217	0.681	236.2	278.8	42.6	160.7	118.1	121.3	6.55
	13:10	3.80	2.63	0.477	218	0.705	300.8	342.9	42.1	192.5	150.4	142.4	8.15
	13:15	4.00	2.77	0.588	218	0.740	379.4	421.0	41.6	231.3	189.7	168.1	10.12
	13:20	4.09	2.83	0.631	218	0.755	409.7	451.4	41.7	246.6	204.9	178.3	10.83
	13:25	4.23	2.92	0.689	218	0.777	450.5	492.6	42.1	267.4	225.3	192.3	11.70
	13:30	4.44	3.08	0.775	217	0.816	510.8	554.0	43.2	298.6	255.4	213.5	12.82
	13:35	4.55	3.15	0.816	216	0.832	539.5	583.8	44.3	314.0	269.7	224.1	13.18
	13:40	**4.74**	**3.28**	**0.878**	**213**	**0.864**	**582.6**	**629.4**	**46.8**	**338.1**	**291.3**	**241.0**	**13.45**
	13:45	4.94	3.42	0.933	210	0.897	620.7	671.2	50.5	360.8	310.3	257.4	13.29
	13:50	5.08	3.52	0.967	206	0.920	644.0	698.1	54.1	376.1	322.0	268.8	12.90
	13:55	5.24	3.63	0.991	202	0.946	660.2	718.6	58.4	388.5	330.1	278.5	12.30

Borehole No. : D053 **Sample Depth m:-** 5.50 - 6.50

Sample No. : 5 **Specimen Depth m:-** 6.30 - 6.50

Customer : Mass Transit Railway Corporation — Compiled by W S Wat

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024 — Checked by H W Chung

Job No.: J2999 **Works Order No.:** 059

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Gammon

HKLAS 035

Multi Stage			P.W.P,B.P				Effective Pressure	85			kPa
Side drains	No		Selected Machine Speed	0.046	mm/min		Rate of Strain	1.98			% per hr
FAILURE CRITERION											
Max. deviator Stress		☐	Max. Stress ratio		☒		Axial Strain %				☐
Stage :	3	Applied Pressure (kPa) - Cell :		290	Back :	205	P.R. factor	5.2891			kN/mm

Date	Time	Strain		Load	Pore Pressure	Dev. stress		Effective Stress Paramcters					
		Dial		P.R.No. 4		Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
29/11	08:35	5.32	3.68	0.032	205	0.000	0.0	85.0	85.0	85.0	0.0	85.0	1.00
	08:40	5.44	3.77	0.127	212	0.979	112.2	190.6	78.4	134.5	56.1	115.8	2.43
	08:45	5.62	3.89	0.196	216	1.007	194.1	268.2	74.1	171.1	97.0	138.8	3.62
	08:50	5.79	4.01	0.276	218	1.034	288.8	361.3	72.5	216.9	144.4	168.8	4.98
	08:55	5.92	4.09	0.335	217	1.052	358.6	431.3	72.7	252.0	179.3	192.2	5.93
	09:00	6.07	4.20	0.410	216	1.077	447.1	520.7	73.6	297.1	223.5	222.6	7.07
	09:05	6.20	4.29	0.472	215	1.098	520.1	595.3	75.2	335.2	260.0	248.6	7.92
	09:10	6.36	4.40	0.532	212	1.122	590.5	668.1	77.6	372.8	295.2	274.4	8.61
	09:15	6.54	4.52	0.582	208	1.149	648.7	730.3	81.6	406.0	324.4	297.8	8.95
	09:20	6.71	4.64	0.618	204	1.176	690.4	776.5	86.1	431.3	345.2	316.2	9.02
	09:25	6.89	4.77	0.643	199	1.204	718.9	810.4	91.5	450.9	359.4	331.1	8.86
	09:30	7.13	4.93	0.657	193	1.239	734.1	830.7	96.6	463.7	367.1	341.3	8.60
	09:35	7.34	5.08	0.668	189	1.271	745.8	846.5	100.7	473.6	372.9	349.3	8.41
	09:40	7.55	5.22	0.673	186	1.301	750.5	854.4	103.9	479.2	375.3	354.1	8.22
	09:45	7.84	5.43	0.666	183	1.346	740.7	847.5	106.8	477.2	370.4	353.7	7.94
	10:00	8.56	5.93	0.641	182	1.450	707.6	816.1	108.5	462.3	353.8	344.4	7.52
	10:15	9.36	6.48	0.645	180	1.561	707.9	818.3	110.4	464.4	354.0	346.4	7.41
	10:30	10.11	7.00	0.618	177	1.663	672.8	785.6	112.8	449.2	336.4	337.1	6.96
	10:45	10.81	7.48	0.605	177	1.755	654.3	767.2	112.9	440.1	327.2	331.0	6.80
	11:00	11.55	7.99	0.592	177	1.850	635.8	748.9	113.1	431.0	317.9	325.0	6.62
	11:15	12.28	8.50	0.591	177	1.942	631.1	744.3	113.2	428.7	315.5	323.6	6.57
	11:30	12.96	8.97	0.579	177	2.026	614.2	727.6	113.4	420.5	307.1	318.1	6.42
	11:45	13.72	9.49	0.569	177	2.116	599.4	712.8	113.4	413.1	299.7	313.2	6.29
	12:00	14.43	9.99	0.560	176	2.200	586.0	700.1	114.1	407.1	293.0	309.4	6.14
	12:15	15.19	10.51	0.553	175	2.286	574.7	689.9	115.2	402.6	287.4	306.8	5.99
	12:30	16.01	11.08	0.552	174	2.378	569.9	686.0	116.1	401.0	284.9	306.1	5.91

Borehole No. :	D053	**Sample Depth m:-** 5.50 - 6.50	
Sample No. :	5	**Specimen Depth m:-** 6.30 - 6.50	
Customer :	Mass Transit Railway Corporation		Compiled by
Project :	Ground Investigation for South Island Line		W S Wat
		Contract No.: Contract 1024	Checked by
Job No.:	J2999	**Works Order No.:** 059	H W Chung

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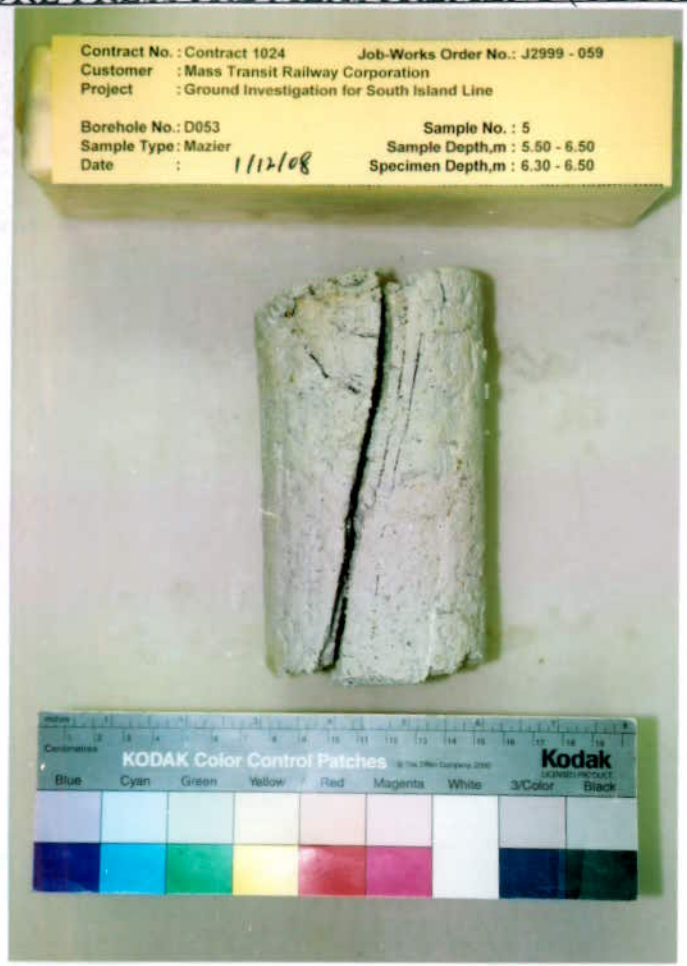
Tseung Kwan O, N.T. Tel :26991980, Fax : 26917547

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT (GEOSPEC 3 : 2001 Test Method 15.2)



Description : Light grey, gravelly, silty SAND **Sample Origin : CDT** ‡ ‡ Information provided by customer

Borehole No. : D053 **Sample No. :** 5 **Sample Depth m:-** 5.50 - 6.50 **Specimen Depth m:-** 6.30 - 6.50

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line

Contract No.: Contract 1024
Job No.: J2999
Works Order No.: 059

Compiled by: W S Wat
Checked by: H W Chung

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	D054		
Sample		no	1		
Sample Type			Mazier		
Stage		no	1		
Sample Depth		m	3.00 - 4.00		
Specimen Depth		m	3.60 - 3.80		
INITIAL CONDITIONS					
Diameter	(D_o)	mm	73.9		
Height	(H_o)	mm	145.0		
Moisture Content	(W_o)	%	26		
Bulk density	(ρ_o)	Mg/m^3	1.96		
Dry density	(ρ_d)	Mg/m^3	1.55		
Particle density	(ρ_s)		2.69		
Voids Ratio	(e_o)		0.73		
Degree of Saturation	(S_r)	%	96.0		
DRAINAGE CONDITIONS			ONE END		
SATURATION					
Final Pore Pressure Coefficient B			1.00		
CONSOLIDATION					
Cell Pressure	(σ_3)	kPa	235		
Back Pressure	(u_b)	kPa	215		
Effective Pressure	(σ'_3)	kPa	20		
Coefficient of Consolidation (t100) (C_{vi})		m^2/Year	128.38		
Coefficient of Volume Compressibility (m_{vi})		m^2/MN	0.81		
Coefficient of Permeability (k)		m/s	3.21E-08		
COMPRESSION TERMINATION CRITERION			MAXIMUM DEVIATOR STRESS		
COMPRESSION - INITIAL					
Moisture Content	(w)	%	26		
Pore Pressure at the End of Consolidation		kPa	215		
Effective Stress at the End of Consolidation		kPa	20		
Bulk density	(ρ_o)	Mg/m^3	1.98		
Dry density	(ρ_d)	Mg/m^3	1.57		
Voids Ratio	(e)		0.71		
Degree of Saturation	(S_r)	%	97.4		

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Report No. : J2999-059.11
Job No.: J2999
Works Order No.: 059

Technician : W S Wat
Checked By : Name : H W Chung Date : 09/01/2009
Approved By : Signatory : **Lau Wai Cheong** Date : 09/01/2009
Tested Date: 17/12/2008

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Form : GESR009.6 / Nov.10.06 / Issue 1 / Rev 1

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	D054		
Sample		no	1		
Sample Type			Mazier		
Stage		no	1		
Sample Depth		m	3.00 - 4.00		
Specimen Depth		m	3.60 - 3.80		
COMPRESSION - FAILURE					
Cell Pressure		kPa	235		
Rate of Strain		mm/min	0.048		
CONDITIONS MAXIMUM DEVIATOR STRESS					
Major Effective Principal Stress (σ'_1)		kPa	198		
Corrected Deviator Stress (σ'_1 - σ'_3)		kPa	138		
Minor Effective Principal Stress (σ'_3)		kPa	60		
$s' = (\sigma'_1 + \sigma'_3)/2$		kPa	129		
$t = (\sigma_1 - \sigma_3)/2$		kPa	69		
Expanded Uncertainty of s' ^		kPa	-		
Expanded Uncertainty of t ^		kPa	-		
Pore pressure parameter A_f			-0.29		
Strain at Failure	(εf)	%	17.2		
COMPRESSION - FINAL					
Moisture Content	(W_f)	%	26		
Bulk density	(ρ_o)	Mg/m^3	1.98		
Dry density	(ρ_d)	Mg/m^3	1.57		
Voids Ratio	(e_f)		0.71		
Degree of Saturation	(S_f)	%	97.4		

Notes -
1. The method of specimen preparation was in accordance with GEOSPEC 3 : 2001 :- Test method 13.3 : test specimen from undisturbed soil samples.
2. Sample received date :29/09/2008
3. The determination of moisture content was in accordance with test method 5.1 of GEOSPEC 3 : 2001.
4. Particle density : 2.69 (Determined)
5. Maximum and minimum temperature recorded over the period of testing 19.9 - 20.7 °C.
6. Unavoidable variations from specified procedure : none
7. Comment on observed or inferred sample disturbance : none
8. Percentage by mass of soil particles larger than 1/5 of the diameter of specimen (%) : Nil
9. The specimen was selected by the laboratory.
   Name : W S Wat Designation : Senior Laboratory Technician
10. Sampling History : As Received

* Delete as appropriate ^ Upon request

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 Works Order No.: 059

Compiled by W S Wat
Checked by H W Chung

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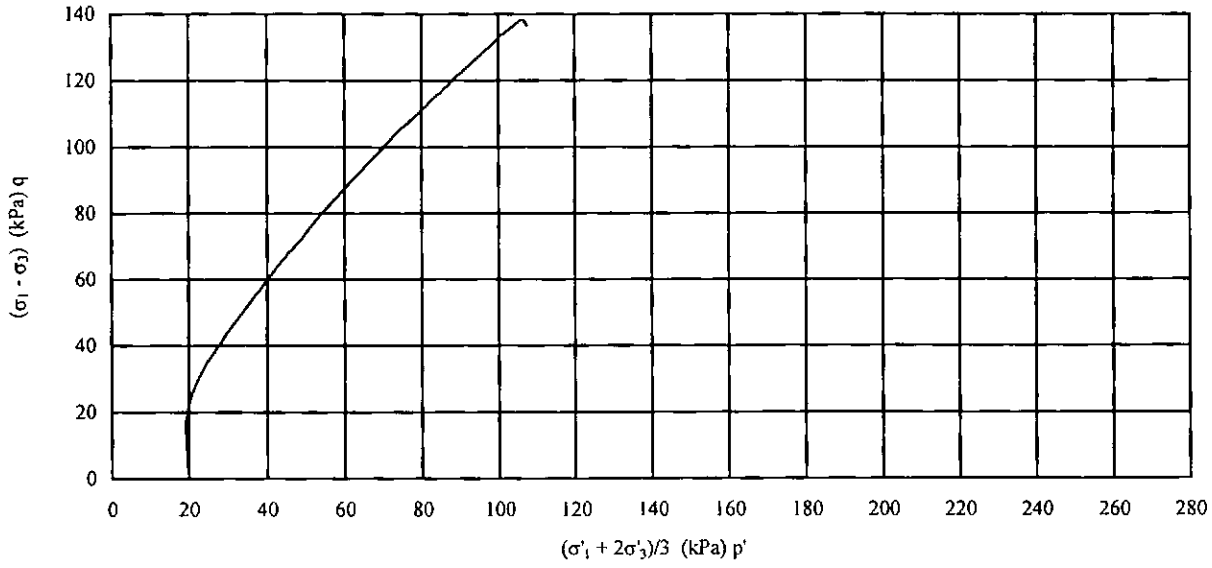
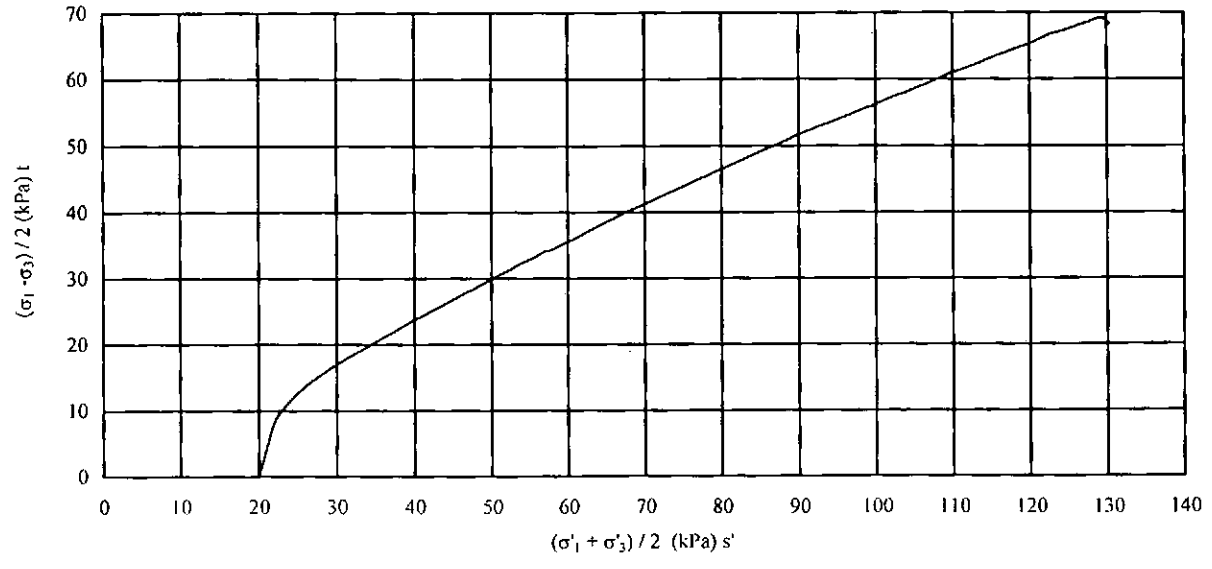
TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

STRESS PATH PARAMETERS FOR EFFECTIVE STRESS

p' - q PLOT



s' - t PLOT



Borehole No. : D054 **Sample Depth m:-** 3.00 - 4.00
Sample No. : 1 **Specimen Depth m:-** 3.60 - 3.80

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.:** 059

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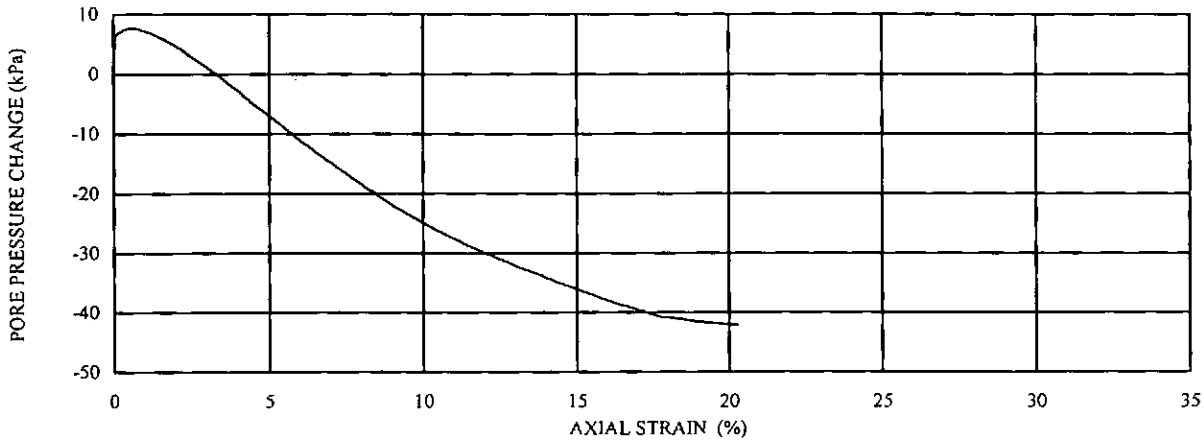
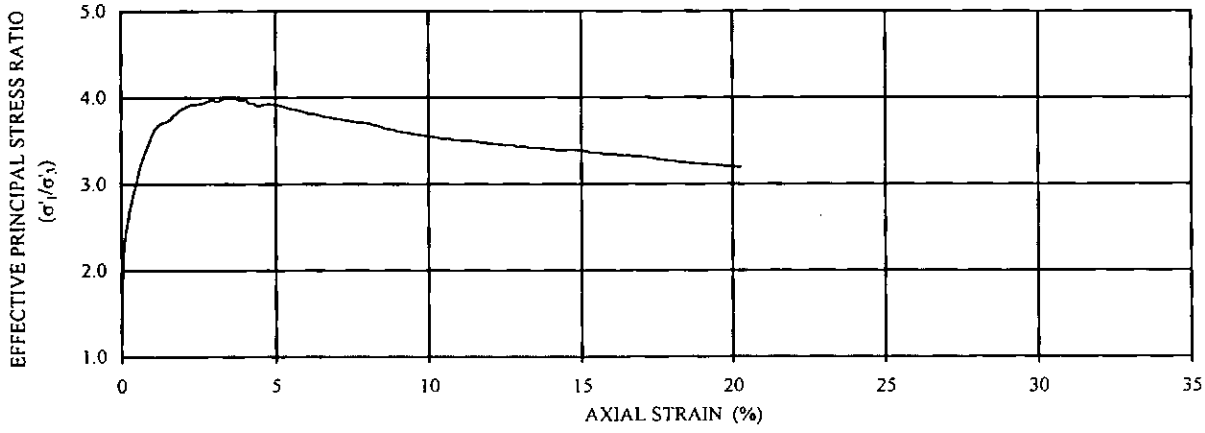
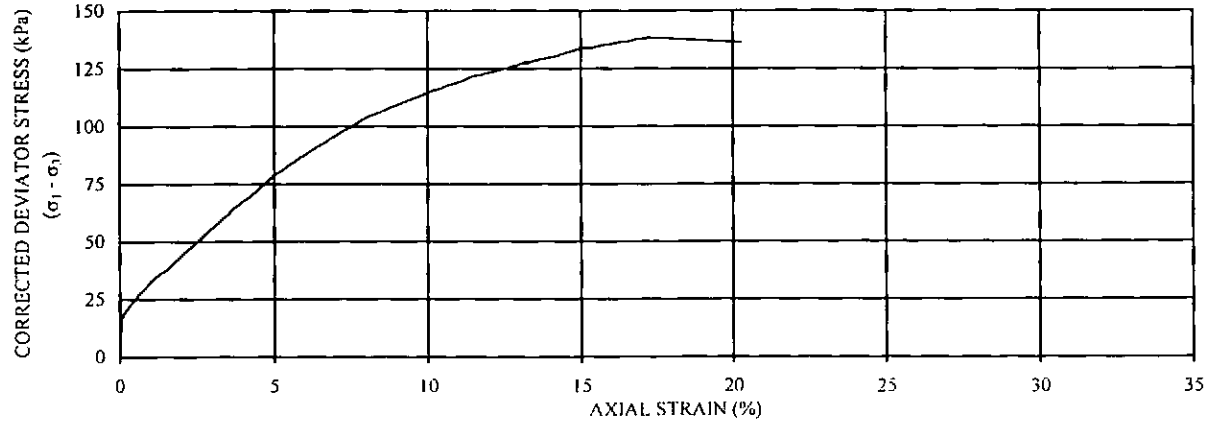
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

COMPRESSION







Borehole No. : D054 **Sample Depth m:-** 3.00 - 4.00
Sample No. : 1 **Specimen Depth m:-** 3.60 - 3.80

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.:** 059

Compiled by: W S Wat
Checked by: H W Chung

Form : GESR009.9 / Jun.02.03 / Issue 1 / Rev 0

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TEST REPORT
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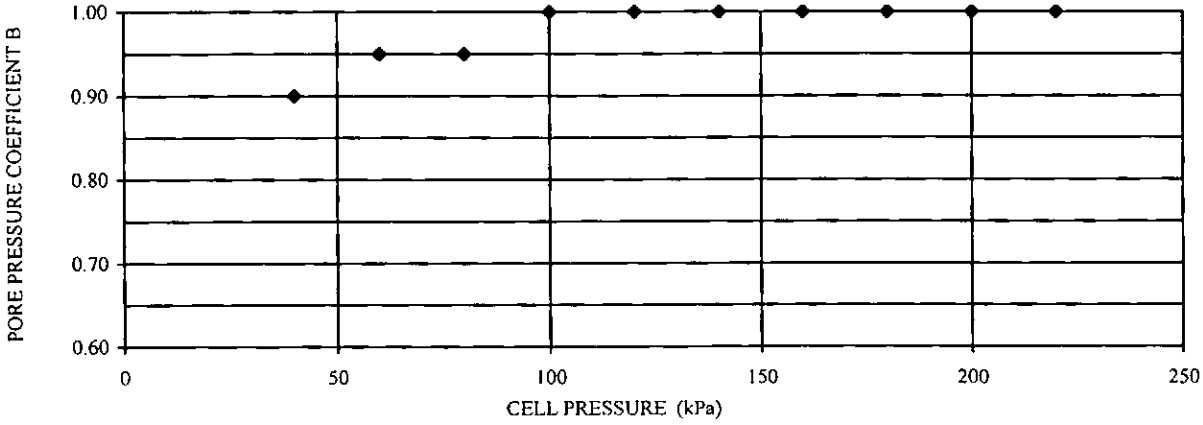
GEOSPEC 3 : 2001 Test Method 15.2

SATURATION



Date	Time	Cell Pressure kPa	Back Pressure kPa	Pore Pressure kPa	Cumulative Volume of Water cm^3	Pore Pressure Coefficient B
18/12/2008	10:02	0	0	-	0.0	
	10:09	20	-	20		-
	10:30	20	15	15	-0.4	
	10:37	40	-	33		0.90
	10:51	40	35	35	0.9	
	10:57	60	-	54		0.95
	11:13	60	55	55	1.4	
	11:19	80	-	74		0.95
	11:40	80	75	75	2.2	
	11:48	100	-	95		1.00
	12:10	100	95	95	2.7	
	12:18	120	-	115		1.00
	12:43	120	115	115	3.0	
	12:50	140	-	135		1.00
	13:10	140	135	135	3.2	
	13:17	160	-	155		1.00
	13:42	160	155	155	3.5	
	13:50	180	-	175		1.00
	14:10	180	175	175	3.7	
	14:20	200	-	195		1.00
	14:51	200	195	195	3.9	
	14:59	220	-	215		1.00
19/12/2008	09:30	220	215	215	4.0	

Borehole No. D054 — **Sample Depth m:-** 3.00 - 4.00
Sample No. : 1 — **Specimen Depth m:-** 3.60 - 3.80

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line

Compiled by: W S Wat
Checked by: H W Chung

Contract No.: Contract 1024
Job No.: J2999 — **Works Order No.:** 059

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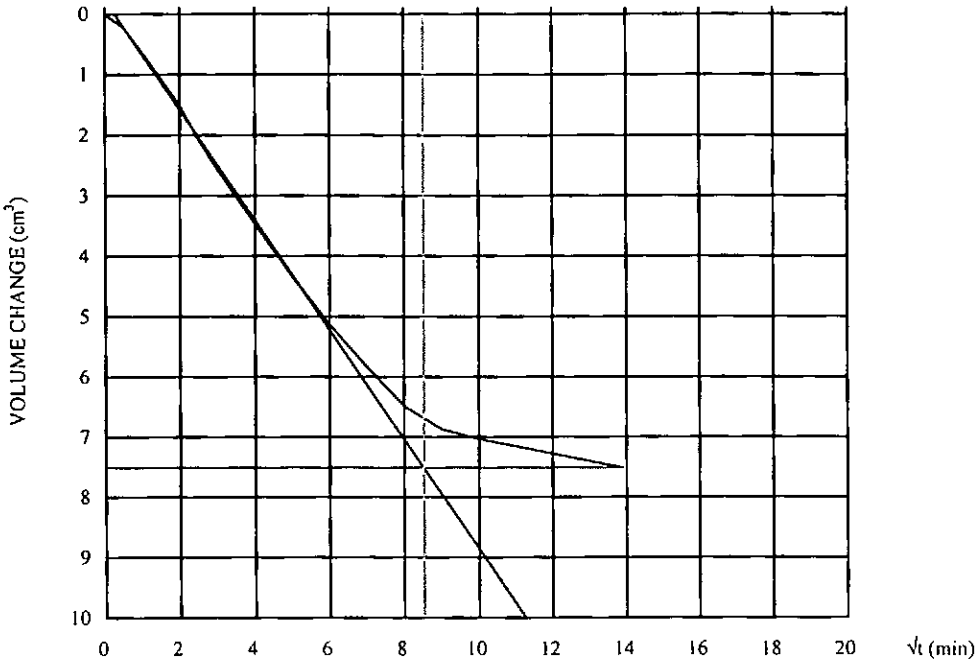
GEOSPEC 3 : 2001 Test Method 15.2

CONSOLIDATION (DRAINED PHASE) - Stage 1

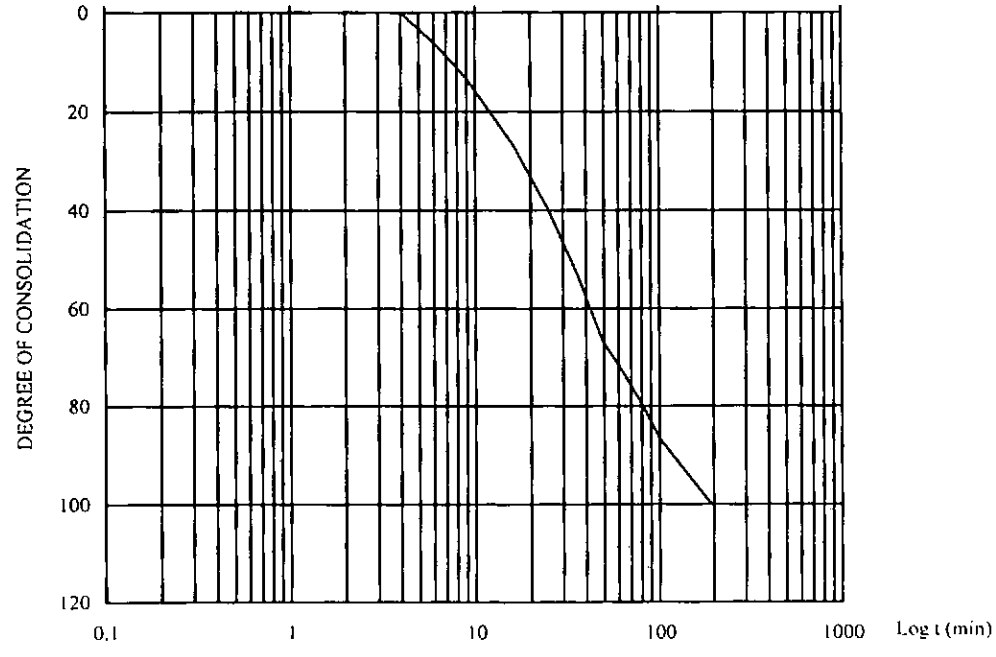


√t100 8.52 min

t100 72.584 min

tf 38.469 min

Calc. strain rate
0.263 mm/min



Borehole No. : D054 **Sample Depth m:-** 3.00 - 4.00

Sample No. : 1 **Specimen Depth m:-** 3.60 - 3.80

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.:** 059

Complied by: W S Wat

Checked by: H W Chung

Form : GESR009.13 / Jun.02.03 / Issue 1 / Rev 0

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UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Single Stage			P.W.P,B.P				Effective Pressure	20	kPa				
Side drains	No	Selected Machine Speed	0.048	mm/min	Rate of Strain	1.99	% per hr						
FAILURE CRITERION													
Max. deviator Stress	☒	Max. Stress ratio	☐		Axial Strain %	☐							
Stage : 1	Applied Pressure (kPa) - Cell :	235	Back :	215	P.R. factor	1.6949	kN/mm						

Date	Time	Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
		Dial		P.R.No. 11	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
22/12	08:50	0.00	0.00	0.079	215	0.000	0.0	20.0	20.0	20.0	0.0	20.0	1.00
	08:55	0.09	0.06	0.119	221	0.017	15.9	29.8	13.9	21.9	8.0	19.2	2.15
	09:00	0.37	0.25	0.132	222	0.072	21.0	33.8	12.8	23.3	10.5	19.8	2.64
	09:05	0.67	0.46	0.141	223	0.132	24.5	36.9	12.4	24.6	12.2	20.6	2.97
	09:10	0.87	0.60	0.147	223	0.172	26.8	39.1	12.3	25.7	13.4	21.2	3.18
	09:15	1.14	0.79	0.154	223	0.225	29.4	41.8	12.4	27.1	14.7	22.2	3.37
	09:20	1.33	0.92	0.159	222	0.261	31.3	43.9	12.6	28.3	15.7	23.0	3.49
	09:25	1.51	1.04	0.164	222	0.294	33.2	46.0	12.8	29.4	16.6	23.9	3.60
	09:30	1.79	1.24	0.170	222	0.348	35.5	48.7	13.2	30.9	17.7	25.0	3.69
	09:35	2.03	1.41	0.174	221	0.394	36.9	50.5	13.6	32.1	18.5	25.9	3.72
	09:40	2.26	1.57	0.178	221	0.436	38.4	52.4	14.0	33.2	19.2	26.8	3.74
	09:45	2.51	1.74	0.184	221	0.481	40.6	55.1	14.5	34.8	20.3	28.0	3.80
	09:50	2.78	1.92	0.190	220	0.528	42.9	57.9	15.0	36.4	21.4	29.3	3.86
	09:55	2.99	2.07	0.195	220	0.567	44.7	60.2	15.5	37.9	22.4	30.4	3.88
	10:00	3.25	2.25	0.201	219	0.613	46.9	63.0	16.1	39.6	23.5	31.7	3.91
	10:05	3.47	2.41	0.206	218	0.654	48.8	65.5	16.7	41.1	24.4	33.0	3.92
	10:10	3.79	2.63	0.213	218	0.709	51.3	68.8	17.5	43.2	25.7	34.6	3.93
	10:15	4.09	2.83	0.220	217	0.759	53.9	72.1	18.2	45.1	26.9	36.2	3.96
	10:20	4.31	2.98	0.225	216	0.795	55.7	74.4	18.7	46.5	27.8	37.3	3.98
	10:25	4.51	3.12	0.229	216	0.829	57.1	76.4	19.3	47.8	28.5	38.3	3.96
	10:30	4.81	3.33	0.237	215	0.880	60.0	80.1	20.1	50.1	30.0	40.1	3.99
	10:35	5.08	3.52	0.243	214	0.925	62.1	82.9	20.8	51.9	31.1	41.5	3.99
	10:40	5.34	3.70	0.250	213	0.968	64.7	86.3	21.6	53.9	32.3	43.2	3.99
	10:45	5.63	3.90	0.255	213	1.014	66.4	88.8	22.4	55.6	33.2	44.5	3.96
	10:50	5.83	4.04	0.260	212	1.046	68.2	91.1	22.9	57.0	34.1	45.6	3.98
	10:55	5.98	4.14	0.262	212	1.069	68.9	92.4	23.5	57.9	34.4	46.5	3.93
	11:00	6.21	4.30	0.267	211	1.106	70.6	94.7	24.1	59.4	35.3	47.6	3.93
	11:05	6.41	4.44	0.271	210	1.137	72.0	96.8	24.8	60.8	36.0	48.8	3.90
	11:10	6.68	4.63	0.278	210	1.179	74.5	100.0	25.5	62.7	37.2	50.3	3.92
	11:15	6.95	4.81	0.284	209	1.219	76.6	102.8	26.2	64.5	38.3	51.7	3.92
	11:20	7.17	4.96	0.289	208	1.252	78.3	105.1	26.8	65.9	39.1	52.9	3.92
	11:25	7.42	5.14	0.294	208	1.291	80.0	107.5	27.5	67.5	40.0	54.2	3.91
	11:30	7.69	5.33	0.299	207	1.332	81.7	110.0	28.3	69.1	40.8	55.5	3.89
	11:35	7.90	5.47	0.303	206	1.361	83.0	111.9	28.9	70.4	41.5	56.6	3.87
	11:40	8.12	5.62	0.307	206	1.393	84.4	113.9	29.5	71.7	42.2	57.6	3.86
	11:45	8.43	5.84	0.313	205	1.439	86.4	116.8	30.4	73.6	43.2	59.2	3.84
	11:50	8.70	6.02	0.318	204	1.476	88.1	119.3	31.2	75.2	44.0	60.6	3.82
	11:55	8.86	6.14	0.321	203	1.501	89.0	120.6	31.6	76.1	44.5	61.3	3.82
	12:00	9.04	6.26	0.324	203	1.525	90.0	122.0	32.0	77.0	45.0	62.0	3.81

Borehole No. : D054 — **Sample Depth m:- 3.00 - 4.00**

Sample No. : 1 — **Specimen Depth m:- 3.60 - 3.80**

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 — **Works Order No.: 059**

Compiled by: W S Wat

Checked by: H W Chung

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DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2
Shearing Continuation

FAILURE CRITERION

Max. deviator Stress ☒ | Max. Stress ratio ☐ | Axial Strain % ☐

Stage :	1	Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
Date	Time	Dial		P.R.No. 11	Pressure	Corr.	q $\sigma_1-\sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
22/12	12:05	9.39	6.50	0.330	202	1.573	92.0	125.0	33.0	79.0	46.0	63.7	3.79
	12:10	9.63	6.67	0.334	201	1.607	93.3	126.9	33.6	80.2	46.6	64.7	3.78
	12:15	9.90	6.85	0.339	201	1.643	94.9	129.2	34.3	81.7	47.4	65.9	3.77
	12:20	10.14	7.03	0.343	200	1.678	96.2	131.1	34.9	83.0	48.1	67.0	3.76
	12:25	10.37	7.18	0.347	200	1.707	97.4	132.9	35.5	84.2	48.7	68.0	3.74
	12:30	10.61	7.35	0.351	199	1.739	98.7	134.8	36.1	85.5	49.4	69.0	3.73
	12:35	10.85	7.52	0.355	198	1.772	100.0	136.7	36.7	86.7	50.0	70.0	3.72
	12:40	11.15	7.72	0.360	198	1.809	101.6	139.1	37.5	88.3	50.8	71.4	3.71
	12:45	11.41	7.90	0.365	197	1.843	103.2	141.3	38.1	89.7	51.6	72.5	3.71
	12:50	11.63	8.06	0.369	196	1.872	104.4	143.1	38.7	90.9	52.2	73.5	3.70
	12:55	11.88	8.23	0.372	196	1.904	105.3	144.6	39.3	91.9	52.6	74.4	3.68
	13:00	12.05	8.35	0.374	195	1.925	105.8	145.4	39.6	92.5	52.9	74.9	3.67
	13:05	12.37	8.57	0.378	195	1.965	107.0	147.5	40.5	94.0	53.5	76.2	3.64
	13:10	12.64	8.76	0.382	194	1.999	108.2	149.3	41.1	95.2	54.1	77.2	3.63
	13:15	12.91	8.94	0.385	193	2.031	109.0	150.7	41.7	96.2	54.5	78.0	3.61
	13:20	13.36	9.25	0.391	192	2.085	110.8	153.5	42.7	98.1	55.4	79.6	3.59
	13:25	13.51	9.36	0.393	192	2.104	111.3	154.3	43.0	98.7	55.7	80.1	3.59
	13:30	13.69	9.48	0.395	192	2.125	111.9	155.3	43.4	99.3	55.9	80.7	3.58
	13:35	13.84	9.59	0.397	191	2.144	112.5	156.2	43.7	99.9	56.2	81.2	3.57
	13:40	14.15	9.80	0.401	191	2.179	113.6	157.9	44.3	101.1	56.8	82.2	3.56
	13:45	14.43	10.00	0.405	190	2.213	114.7	159.6	44.9	102.3	57.4	83.1	3.56
	13:50	14.75	10.22	0.409	190	2.250	115.8	161.3	45.5	103.4	57.9	84.1	3.55
	13:55	14.90	10.32	0.410	189	2.266	116.1	161.9	45.8	103.8	58.0	84.5	3.53
	14:00	15.21	10.54	0.414	189	2.303	117.2	163.6	46.4	105.0	58.6	85.5	3.53
	14:05	15.35	10.63	0.416	188	2.317	117.7	164.3	46.6	105.5	58.9	85.8	3.53
	14:10	15.64	10.83	0.419	188	2.350	118.5	165.7	47.2	106.4	59.2	86.7	3.51
	14:15	15.92	11.03	0.422	187	2.382	119.3	166.9	47.6	107.2	59.6	87.4	3.51
	14:20	16.20	11.22	0.426	187	2.413	120.4	168.5	48.1	108.3	60.2	88.2	3.50
	14:25	16.39	11.35	0.429	187	2.433	121.2	169.7	48.5	109.1	60.6	88.9	3.50
	14:30	16.68	11.55	0.432	186	2.465	122.0	170.9	48.9	109.9	61.0	89.6	3.49
	14:35	16.94	11.73	0.434	186	2.493	122.4	171.8	49.4	110.6	61.2	90.2	3.48
	14:40	17.22	11.93	0.437	185	2.524	123.2	173.0	49.8	111.4	61.6	90.9	3.47
	14:45	17.43	12.07	0.439	185	2.546	123.6	173.7	50.1	111.9	61.8	91.3	3.47
	14:50	17.65	12.22	0.441	185	2.569	124.1	174.5	50.4	112.4	62.0	91.8	3.46
	14:55	17.94	12.42	0.444	184	2.600	124.8	175.7	50.9	113.3	62.4	92.5	3.45
	15:00	18.16	12.58	0.446	184	2.624	125.3	176.5	51.2	113.8	62.6	93.0	3.45
	15:05	18.36	12.72	0.449	184	2.645	126.1	177.6	51.5	114.5	63.0	93.5	3.45
	15:10	18.63	12.90	0.451	183	2.672	126.5	178.4	51.9	115.1	63.2	94.1	3.44
	15:15	18.93	13.11	0.455	183	2.704	127.5	179.9	52.4	116.2	63.8	94.9	3.43
	15:20	19.15	13.26	0.456	182	2.726	127.6	180.3	52.7	116.5	63.8	95.2	3.42
	15:25	19.40	13.44	0.459	182	2.753	128.4	181.4	53.0	117.2	64.2	95.8	3.42

Borehole No. : D054 — **Sample Depth m:-** 3.00 - 4.00
Sample No. : 1 — **Specimen Depth m:-** 3.60 - 3.80

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 — **Works Order No.:** 059

Compiled by: W S Wat
Checked by: H W Chung

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Technology Centre
21 Chun Wang Street, Tseung Kwan O Industrial Estate,
Tseung Kwan O, N.T. Tel :26991980, Fax : 26917547

TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2
Shearing Continuation

FAILURE CRITERION

Max. deviator Stress ☒ | Max. Stress ratio ☐ | Axial Strain % ☐

Stage :	1	Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
Date	Time	Dial		P.R.No. 11	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
22/12	15:30	19.64	13.60	0.461	182	2.777	128.8	182.1	53.3	117.7	64.4	96.2	3.42
	15:35	19.93	13.81	0.464	181	2.807	129.5	183.2	53.7	118.4	64.7	96.9	3.41
	15:40	20.16	13.96	0.466	181	2.829	129.9	184.0	54.1	119.0	64.9	97.4	3.40
	15:45	20.42	14.14	0.468	181	2.856	130.3	184.7	54.4	119.5	65.1	97.8	3.39
	15:50	20.72	14.35	0.472	180	2.886	131.3	186.2	54.9	120.5	65.6	98.7	3.39
	15:55	20.98	14.53	0.475	180	2.912	132.0	187.2	55.2	121.2	66.0	99.2	3.39
	16:00	21.15	14.65	0.477	180	2.929	132.5	187.9	55.4	121.6	66.2	99.6	3.39
	16:05	21.41	14.83	0.480	179	2.955	133.2	188.9	55.7	122.3	66.6	100.1	3.39
	16:10	21.61	14.97	0.482	179	2.975	133.6	189.6	56.0	122.8	66.8	100.5	3.39
	16:15	21.91	15.18	0.484	179	3.005	133.9	190.3	56.4	123.4	67.0	101.0	3.37
	16:20	22.14	15.33	0.485	178	3.026	134.0	190.7	56.7	123.7	67.0	101.4	3.36
	16:25	22.41	15.52	0.488	178	3.053	134.7	191.7	57.0	124.3	67.3	101.9	3.36
	16:30	22.69	15.71	0.490	178	3.080	135.0	192.4	57.4	124.9	67.5	102.4	3.35
	16:35	22.91	15.87	0.492	177	3.103	135.4	193.1	57.7	125.4	67.7	102.8	3.35
	16:40	23.14	16.03	0.494	177	3.125	135.8	193.8	58.0	125.9	67.9	103.3	3.34
	16:45	23.35	16.17	0.496	177	3.145	136.2	194.4	58.2	126.3	68.1	103.6	3.34
	16:50	23.73	16.44	0.499	176	3.183	136.7	195.4	58.7	127.1	68.4	104.3	3.33
	16:55	23.90	16.55	0.500	176	3.198	136.8	195.6	58.8	127.2	68.4	104.4	3.33
	17:00	24.22	16.78	0.503	176	3.231	137.4	196.6	59.2	127.9	68.7	105.0	3.32
	17:05	24.43	16.92	0.505	176	3.250	137.8	197.2	59.4	128.3	68.9	105.3	3.32
	17:10	24.69	17.10	0.507	175	3.275	138.2	197.9	59.7	128.8	69.1	105.8	3.31
	17:15	24.86	17.22	0.508	175	3.292	138.3	198.2	59.9	129.0	69.1	106.0	3.31
	17:20	25.21	17.46	0.509	175	3.325	138.1	198.4	60.3	129.4	69.1	106.3	3.29
	17:25	25.42	17.61	0.510	175	3.346	138.2	198.7	60.5	129.6	69.1	106.6	3.28
	17:30	25.70	17.80	0.511	174	3.373	138.2	199.0	60.8	129.9	69.1	106.9	3.27
	17:45	26.41	18.29	0.512	174	3.441	137.6	198.6	61.0	129.8	68.8	106.9	3.26
	18:00	27.13	18.79	0.514	174	3.511	137.3	198.7	61.4	130.0	68.6	107.2	3.24
	18:15	27.85	19.29	0.516	173	3.581	137.0	198.7	61.7	130.2	68.5	107.4	3.22
	18:30	28.57	19.79	0.518	173	3.652	136.7	198.6	61.9	130.3	68.4	107.5	3.21
	18:45	29.29	20.28	0.520	173	3.722	136.4	198.5	62.1	130.3	68.2	107.6	3.20

Borehole No. : D054 — **Sample Depth m:-** 3.00 - 4.00
Sample No. : 1 — **Specimen Depth m:-** 3.60 - 3.80

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 — **Works Order No.:** 059

Compiled by: W S Wat
Checked by: H W Chung

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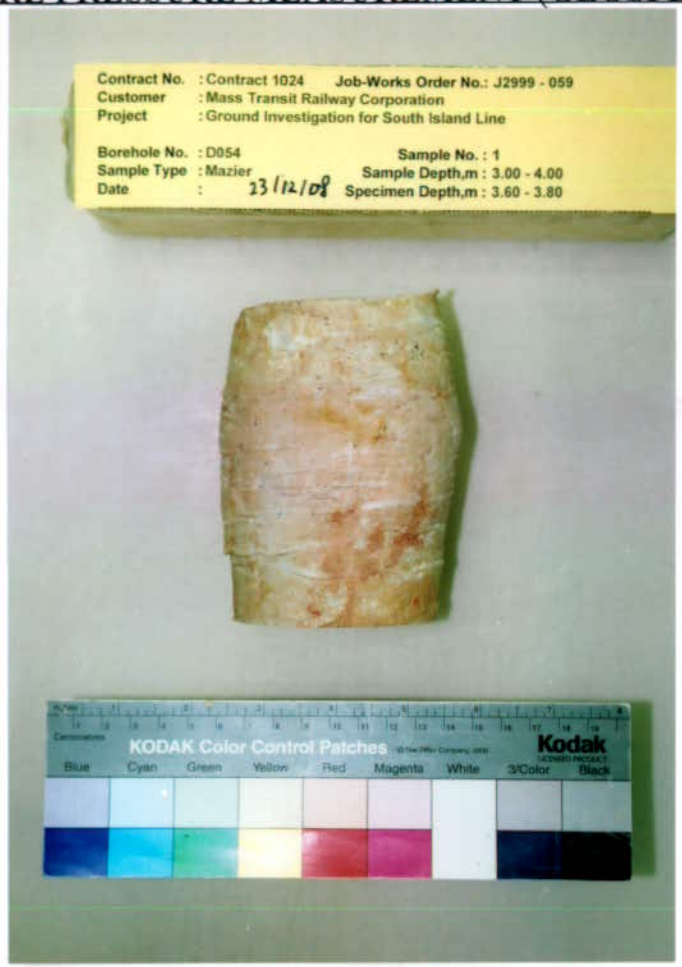
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT (GEOSPEC 3 : 2001 Test Method 15.2)



Description : Greyish brown, slightly sandy SILT/CLAY

Sample Origin : CDT‡ ‡ Information provided by customer

Borehole No. : D054 Sample No. : 1 Sample Depth m:- 3.00 - 4.00 Specimen Depth m:- 3.60 - 3.80

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line

Contract No. : Contract 1024
Job No. : J2999
Works Order No.: 059

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	D054		
Sample		no	1		
Sample Type			Mazier		
Stage		no	1		
Sample Depth		m	3.00 - 4.00		
Specimen Depth		m	3.80 - 4.00		
INITIAL CONDITIONS					
Diameter	(D_o)	mm	74.0		
Height	(H_o)	mm	145.0		
Moisture Content	(W_o)	%	26		
Bulk density	(ρ_o)	Mg/m^3	1.99		
Dry density	(ρ_d)	Mg/m^3	1.58		
Particle density	(ρ_s)		2.69		
Voids Ratio	(e_o)		0.70		
Degree of Saturation	(S_r)	%	98.3		
DRAINAGE CONDITIONS			ONE END		
SATURATION					
Final Pore Pressure Coefficient B			1.00		
CONSOLIDATION					
Cell Pressure	(σ_3)	kPa	245		
Back Pressure	(u_b)	kPa	205		
Effective Pressure	(σ'_3)	kPa	40		
Coefficient of Consolidation (t100) (C_{vi})		m^2/Year	553.50		
Coefficient of Volume Compressibility (m_{vi})		m^2/MN	0.86		
Coefficient of Permeability (k)		m/s	1.47E-07		
COMPRESSION TERMINATION CRITERION			MAXIMUM DEVIATOR STRESS		
COMPRESSION - INITIAL					
Moisture Content	(w)	%	24		
Pore Pressure at the End of Consolidation		kPa	205		
Effective Stress at the End of Consolidation		kPa	40		
Bulk density	(ρ_o)	Mg/m^3	2.02		
Dry density	(ρ_d)	Mg/m^3	1.63		
Voids Ratio	(e)		0.65		
Degree of Saturation	(S_r)	%	98.4		

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Report No. : J2999-059.11
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.:** 059

Technician : W S Wat Checked By : Approved By :
Name : H W Chung Signatory : Lau Wai Cheong
Tested Date: 17/12/2008 Date : 09/01/2009 Date : 09/01/2009

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Form : GESR009.6 / Nov.10.06 / Issue 1 / Rev 1

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	D054		
Sample		no	1		
Sample Type			Mazier		
Stage		no	1		
Sample Depth		m	3.00 - 4.00		
Specimen Depth		m	3.80 - 4.00		
COMPRESSION - FAILURE					
Cell Pressure		kPa	245		
Rate of Strain		mm/min	0.047		
CONDITIONS MAXIMUM DEVIATOR STRESS					
Major Effective Principal Stress (σ'_1)		kPa	168		
Corrected Deviator Stress ($\sigma'_1 - \sigma'_3$)		kPa	135		
Minor Effective Principal Stress (σ'_3)		kPa	33		
$s' = (\sigma'_1 + \sigma'_3)/2$		kPa	100		
$t = (\sigma_1 - \sigma_3)/2$		kPa	67		
Expanded Uncertainty of s' ^		kPa	-		
Expanded Uncertainty of t ^		kPa	-		
Pore pressure parameter A_f			0.05		
Strain at Failure	(εf)	%	5.0		
COMPRESSION - FINAL					
Moisture Content	(W_f)	%	24		
Bulk density	(ρ_o)	Mg/m^3	2.02		
Dry density	(ρ_d)	Mg/m^3	1.63		
Voids Ratio	(e_f)		0.65		
Degree of Saturation	(S_f)	%	98.4		

Notes -
1. The method of specimen preparation was in accordance with GEOSPEC 3 : 2001 :- Test method 13.3 : test specimen from undisturbed soil samples.
2. Sample received date :29/09/2008
3. The determination of moisture content was in accordance with test method 5.1 of GEOSPEC 3 : 2001.
4. Particle density : 2.69 (Determined)
5. Maximum and minimum temperature recorded over the period of testing 19.9 - 20.7 °C.
6. Unavoidable variations from specified procedure : none
7. Comment on observed or inferred sample disturbance : none
8. Percentage by mass of soil particles larger than 1/5 of the diameter of specimen (%) : Nil
9. The specimen was selected by the laboratory.
   Name : W S Wat Designation : Senior Laboratory Technician
10. Sampling History : As Received

* Delete as appropriate ^ Upon request

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.: 059**

Compiled by W S Wat
Checked by H W Chung

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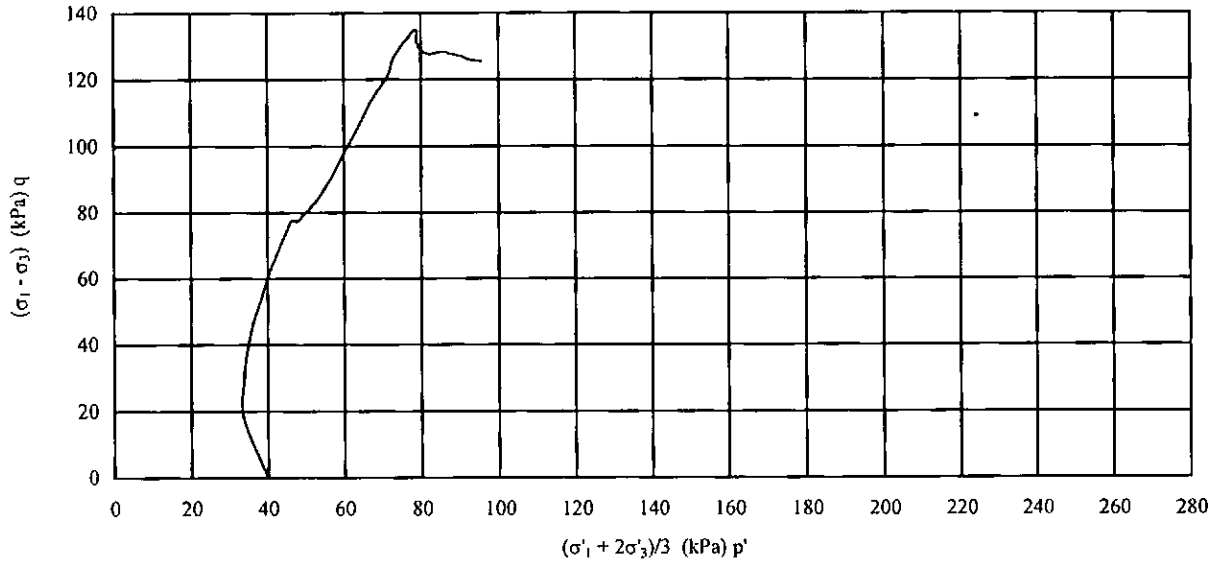
Form : GESR009.7 / Nov.10.06 / Issue 1 / Rev 1

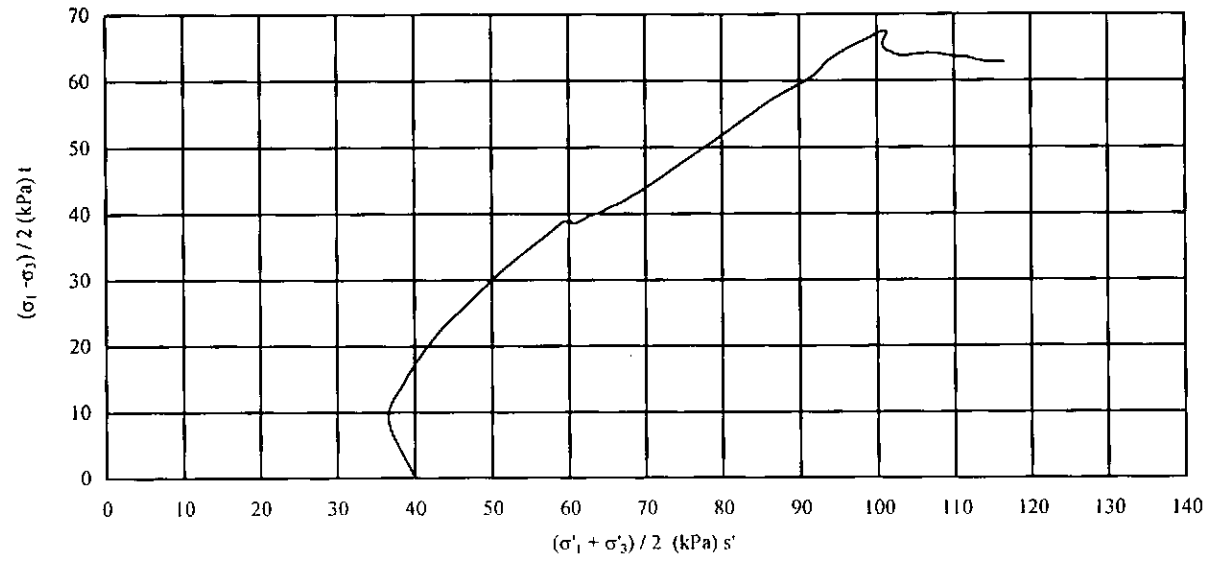
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

STRESS PATH PARAMETERS FOR EFFECTIVE STRESS

p' - q PLOT



s' - t PLOT



Borehole No. : D054 — Sample Depth m:- 3.00 - 4.00
Sample No. : 1 — Specimen Depth m:- 3.80 - 4.00

Customer : Mass Transit Railway Corporation — Compiled by W S Wat
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024 — Checked by H W Chung
Job No.: J2999 — Works Order No.: 059

Form : GESR009.8 / Jun.02.03 / Issue 1 / Rev 0

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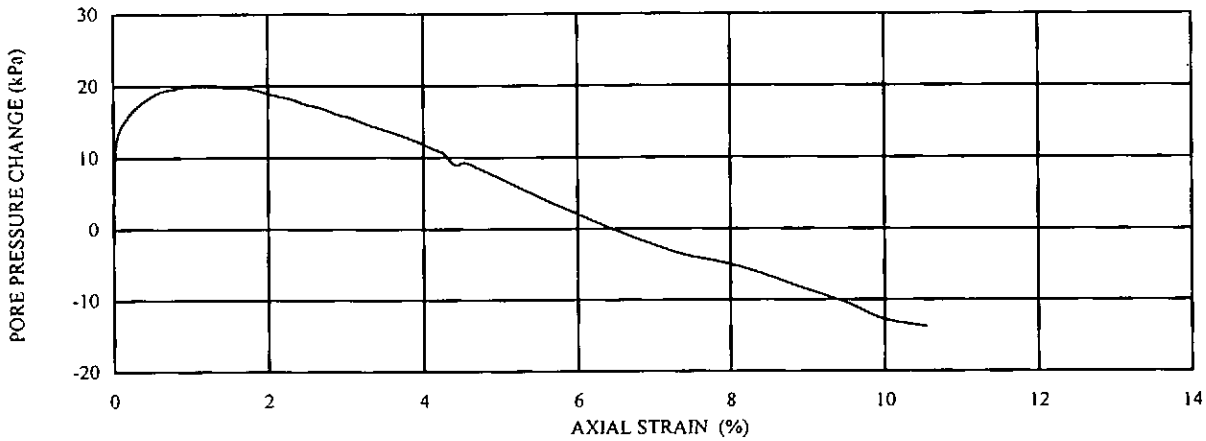
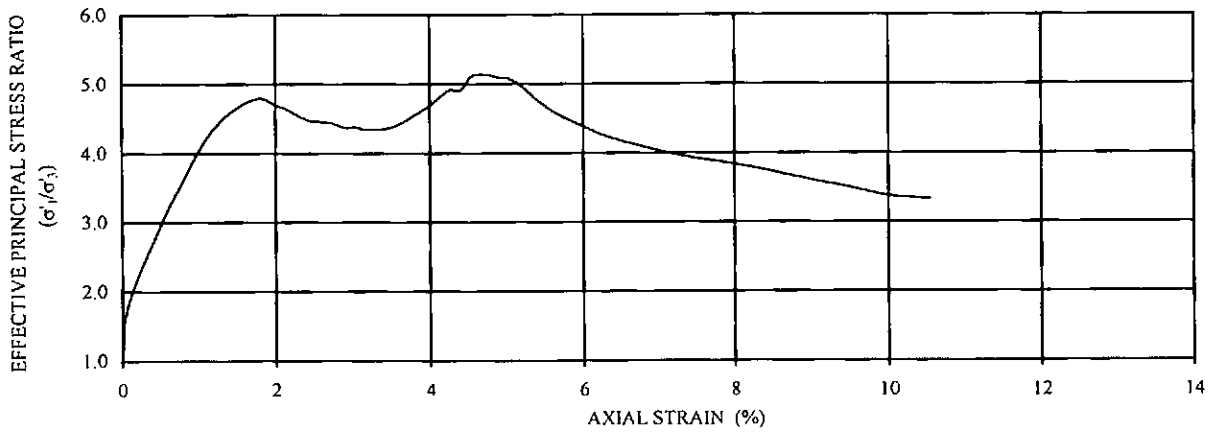
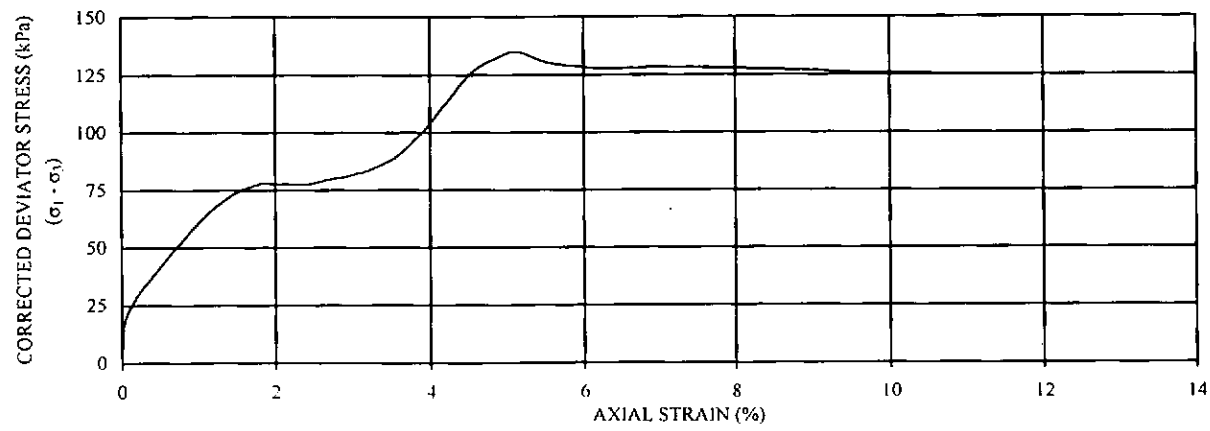
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

COMPRESSION







Borehole No. :	**D054**	**Sample Depth m:-**	**3.00 - 4.00**
Sample No. :	**1**	**Specimen Depth m:-**	**3.80 - 4.00**
Customer :	**Mass Transit Railway Corporation**		Compiled by W S Wat
Project :	**Ground Investigation for South Island Line**		
		Contract No.: Contract 1024	Checked by H W Chung
Job No.:	**J2999**	**Works Order No.: 059**	

Form : GESR009.9 / Jun.02.03 / Issue 1 / Rev 0

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TEST REPORT
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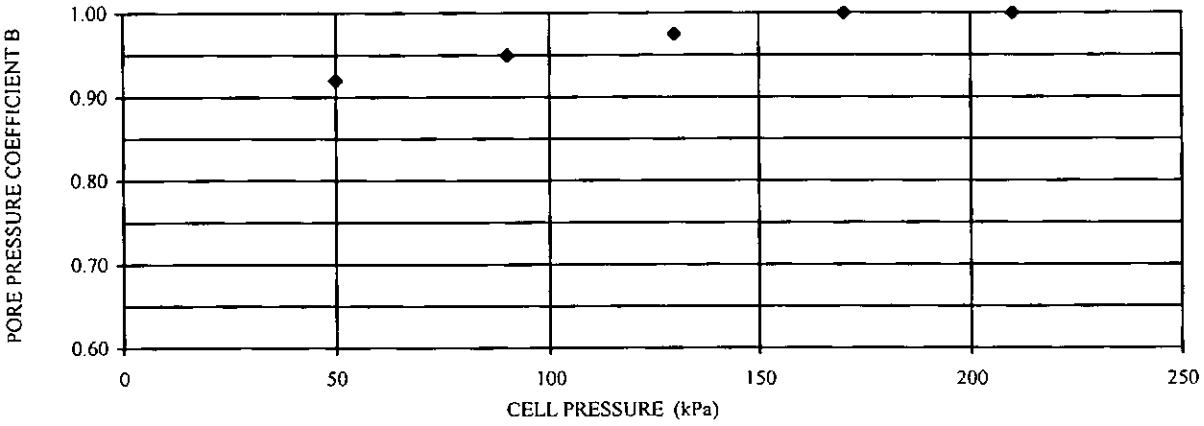
GEOSPEC 3 : 2001 Test Method 15.2

SATURATION



Date	Time	Cell Pressure kPa	Back Pressure kPa	Pore Pressure kPa	Cumulative Volume of Water cm^3	Pore Pressure Coefficient B
18/12/2008	08:37	0	0	-	0.0	
	08:48	25	-	24		-
	10:06	25	20	20	-5.6	
	10:12	50	-	43		0.92
	10:50	50	45	45	-5.3	
	10:58	90	-	83		0.95
	11:20	90	85	85	-5.2	
	11:29	130	-	124		0.98
	11:53	130	125	125	-4.8	
	12:00	170	-	165		1.00
	13:20	170	165	165	-4.5	
	13:28	210	-	205		1.00
19/12/2008	08:40	210	205	205	0.6	

Borehole No. D054 — **Sample Depth m:-** 3.00 - 4.00
Sample No. : 1 — **Specimen Depth m:-** 3.80 - 4.00

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 — **Works Order No.:** 059

Compiled by: W S Wat
Checked by: H W Chung

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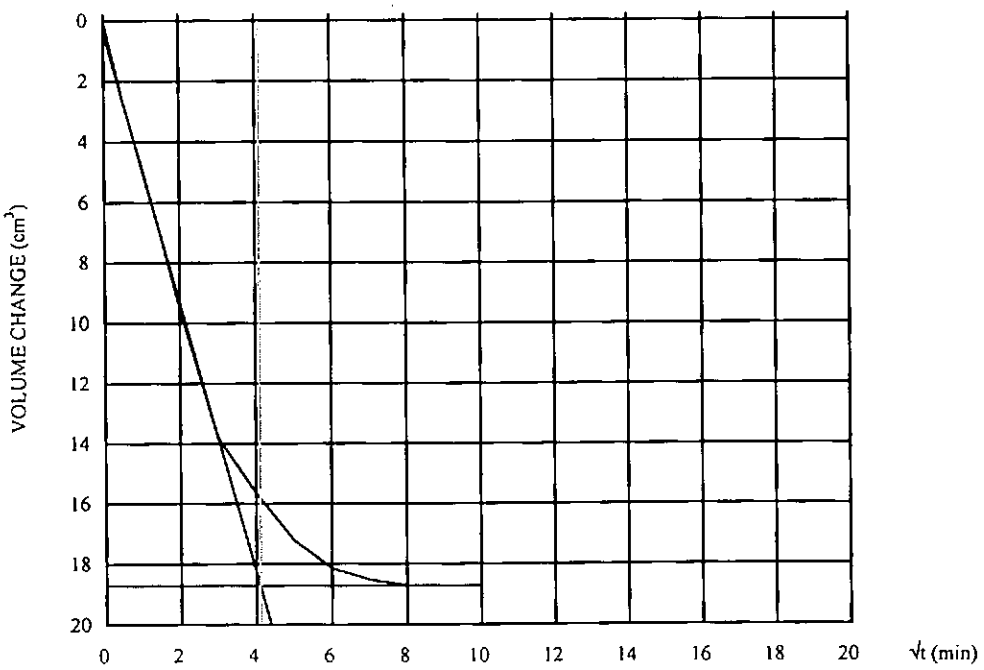
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

CONSOLIDATION (DRAINED PHASE) - Stage 1

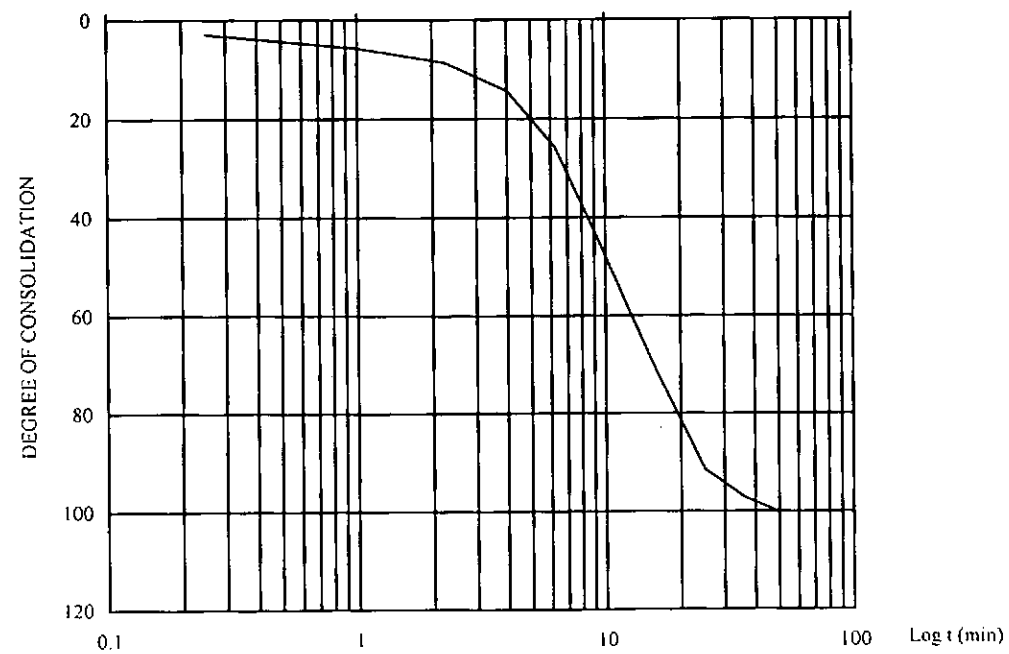


√t100 4.11 min

t100 16.863 min

tf 8.937 min

Calc. strain rate
1.124 mm/min



Borehole No. : D054 **Sample Depth m:-** 3.00 - 4.00

Sample No. : 1 **Specimen Depth m:-** 3.80 - 4.00

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.:** 059

Complied by: W S Wat

Checked by: H W Chung

Form : GESR009.13 / Jun.02.03 / Issue 1 / Rev 0

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TEST REPORT
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GEOSPEC 3 : 2001 Test Method 15.2

Single Stage		P.W.P,B.P			Effective Pressure	40	kPa
Side drains	No	Selected Machine Speed	0.047	mm/min	Rate of Strain	1.97	% per hr
FAILURE CRITERION							
Max. deviator Stress	☒	Max. Stress ratio	☐		Axial Strain %		☐
Stage : 1	Applied Pressure (kPa) - Cell :	245	Back :	205	P.R. factor	1.7511	kN/mm

Date	Time	Strain Dial	Strain	Load P.R.No. 33	Pore Pressure	Dev. stress Corr.	Dev. stress q $\sigma_1-\sigma_3$	Effective Stress σ'_1	Effective Stress σ'_3	s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa				2	2	3	σ'_1/σ'_3
22/12	08:45	0.00	0.00	0.080	205	0.000	0.0	40.0	40.0	40.0	0.0	40.0	1.00
	08:50	0.06	0.04	0.123	217	0.012	17.8	45.5	27.7	36.6	8.9	33.6	1.64
	08:55	0.28	0.20	0.150	221	0.058	29.0	53.1	24.1	38.6	14.5	33.8	2.20
	09:00	0.57	0.40	0.171	223	0.115	37.5	59.6	22.1	40.9	18.8	34.6	2.70
	09:05	0.87	0.61	0.192	224	0.174	46.1	66.9	20.8	43.8	23.0	36.2	3.21
	09:10	1.08	0.75	0.205	225	0.213	51.3	71.8	20.5	46.2	25.7	37.6	3.50
	09:15	1.34	0.93	0.222	225	0.263	58.2	78.3	20.1	49.2	29.1	39.5	3.89
	09:20	1.52	1.06	0.233	225	0.299	62.6	82.5	19.9	51.2	31.3	40.8	4.14
	09:25	1.70	1.18	0.243	225	0.331	66.6	86.6	20.0	53.3	33.3	42.2	4.33
	09:30	1.96	1.37	0.255	225	0.382	71.3	91.4	20.1	55.7	35.6	43.9	4.55
	09:35	2.18	1.52	0.263	225	0.422	74.4	94.7	20.3	57.5	37.2	45.1	4.67
	09:40	2.39	1.67	0.268	225	0.462	76.3	96.6	20.3	58.5	38.2	45.7	4.76
	09:45	2.63	1.83	0.272	225	0.504	77.8	98.3	20.5	59.4	38.9	46.4	4.79
	09:50	2.88	2.01	0.272	224	0.551	77.6	98.6	21.0	59.8	38.8	46.9	4.69
	09:55	3.09	2.15	0.273	224	0.587	77.8	99.2	21.4	60.3	38.9	47.3	4.64
	10:00	3.34	2.33	0.272	223	0.632	77.2	99.1	21.9	60.5	38.6	47.6	4.53
	10:05	3.56	2.48	0.274	223	0.670	77.9	100.4	22.5	61.4	38.9	48.5	4.46
	10:10	3.87	2.70	0.279	222	0.725	79.7	102.8	23.1	62.9	39.8	49.7	4.45
	10:15	4.15	2.89	0.282	221	0.772	80.7	104.6	23.9	64.2	40.3	50.8	4.38
	10:20	4.36	3.04	0.286	221	0.808	82.1	106.4	24.3	65.4	41.1	51.7	4.38
	10:25	4.56	3.18	0.289	220	0.842	83.2	108.1	24.9	66.5	41.6	52.6	4.34
	10:30	4.86	3.39	0.297	219	0.893	86.2	111.9	25.7	68.8	43.1	54.4	4.35
	10:35	5.14	3.58	0.307	219	0.938	90.0	116.4	26.4	71.4	45.0	56.4	4.41
	10:40	5.41	3.77	0.322	218	0.982	95.7	122.8	27.1	75.0	47.9	59.0	4.53
	10:45	5.70	3.97	0.340	217	1.028	102.7	130.7	28.0	79.3	51.3	62.2	4.67
	10:50	5.90	4.11	0.356	216	1.060	108.8	137.5	28.7	83.1	54.4	65.0	4.79
	10:55	6.10	4.25	0.371	216	1.092	114.6	143.9	29.3	86.6	57.3	67.5	4.91
	11:00	6.32	4.40	0.388	214	1.126	121.1	152.1	31.0	91.6	60.6	71.4	4.91
	11:05	6.51	4.54	0.401	214	1.157	126.1	156.8	30.7	93.8	63.1	72.7	5.11
	11:10	6.77	4.72	0.412	214	1.197	130.2	161.7	31.5	96.6	65.1	74.9	5.13
	11:15	7.02	4.89	0.419	213	1.234	132.7	165.1	32.4	98.7	66.3	76.6	5.09
	11:20	**7.23**	**5.04**	**0.425**	**212**	**1.267**	**134.8**	**167.9**	**33.1**	**100.5**	**67.4**	**78.0**	**5.07**
	11:25	7.46	5.20	0.425	211	1.301	134.5	168.5	34.0	101.3	67.3	78.8	4.96
	11:30	7.72	5.38	0.419	210	1.340	131.9	166.8	34.9	100.8	65.9	78.9	4.78
	11:35	7.92	5.52	0.416	209	1.369	130.5	166.1	35.6	100.8	65.2	79.1	4.66
	11:40	8.15	5.68	0.414	209	1.403	129.4	165.8	36.4	101.1	64.7	79.5	4.56
	11:45	8.42	5.87	0.413	208	1.442	128.7	166.0	37.3	101.7	64.4	80.2	4.45
	12:00	9.04	6.30	0.412	206	1.530	127.7	167.0	39.3	103.1	63.8	81.9	4.25
	12:15	9.89	6.89	0.416	203	1.647	128.3	170.1	41.8	105.9	64.1	84.6	4.07

Borehole No. : D054 — **Sample Depth m:- 3.00 - 4.00**

Sample No. : 1 — **Specimen Depth m:- 3.80 - 4.00**

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 — **Works Order No.: 059**

Compiled by: W S Wat

Checked by: H W Chung

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TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2
Shearing Continuation

FAILURE CRITERION													
Max. deviator Stress ☒				Max. Stress ratio ☐			Axial Strain % ☐						
Stage : 1		Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
Date	Time	Dial		P.R.No. 33	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
22/12	12:30	10.61	7.39	0.418	201	1.744	128.2	171.8	43.6	107.7	64.1	86.3	3.94
	12:45	11.38	7.93	0.419	200	1.845	127.8	172.6	44.8	108.7	63.9	87.4	3.85
	13:00	11.99	8.35	0.420	199	1.922	127.5	173.6	46.1	109.8	63.7	88.6	3.77
	13:15	12.84	8.95	0.421	197	2.029	126.9	175.3	48.4	111.9	63.5	90.7	3.62
	13:30	13.60	9.48	0.421	195	2.121	126.1	176.4	50.3	113.3	63.0	92.3	3.51
	13:45	14.33	9.98	0.422	192	2.206	125.6	178.3	52.7	115.5	62.8	94.6	3.38
	14:00	15.12	10.54	0.424	191	2.298	125.5	179.3	53.8	116.6	62.8	95.6	3.33

Borehole No. : D054 **Sample Depth m:-** 3.00 - 4.00
Sample No. : 1 **Specimen Depth m:-** 3.80 - 4.00

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.:** 059

Compiled by: W S Wat
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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT (GEOSPEC 3 : 2001 Test Method 15.2)

Description : Greyish brown, slightly sandy SILT/CLAY **Sample Origin : CDT‡** ‡ Information provided by customer

Borehole No. : D054 **Sample No. :** 1 **Sample Depth m:-** 3.00 - 4.00 **Specimen Depth m:-** 3.80 - 4.00

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line

Contract No. : Contract 1024
Job No. : J2999
Works Order No.: 059

Compiled by: W S Wat
Checked by: H W Chung

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	D055		
Sample		no	1		
Sample Type			Mazier		
Stage		no	1		
Sample Depth		m	3.00 - 4.00		
Specimen Depth		m	3.80 - 4.00		
INITIAL CONDITIONS					
Diameter	(D_o)	mm	73.8		
Height	(H_o)	mm	145.0		
Moisture Content	(W_o)	%	24		
Bulk density	(ρ_o)	Mg/m^3	1.86		
Dry density	(ρ_d)	Mg/m^3	1.50		
Particle density	(ρ_s)		2.62		
Voids Ratio	(e_o)		0.75		
Degree of Saturation	(S_r)	%	83.5		
DRAINAGE CONDITIONS			ONE END		
SATURATION					
Final Pore Pressure Coefficient B			0.96		
CONSOLIDATION					
Cell Pressure	(σ_3)	kPa	320		
Back Pressure	(u_b)	kPa	270		
Effective Pressure	(σ'_3)	kPa	50		
Coefficient of Consolidation (t100) (C_{vi})		$m^2/Year$	26429.91		
Coefficient of Volume Compressibility (m_{vi})		m^2/MN	0.12		
Coefficient of Permeability (k)		m/s	9.78E-07		
COMPRESSION TERMINATION CRITERION			MAXIMUM DEVIATOR STRESS		
COMPRESSION - INITIAL					
Moisture Content	(w)	%	28		
Pore Pressure at the End of Consolidation		kPa	270		
Effective Stress at the End of Consolidation		kPa	50		
Bulk density	(ρ_o)	Mg/m^3	1.93		
Dry density	(ρ_d)	Mg/m^3	1.51		
Voids Ratio	(e)		0.74		
Degree of Saturation	(S_r)	%	98.4		

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Report No. : J2999-059.11
Job No.: J2999
Works Order No.: 059

Technician : W S Wat
Checked By : Name : H W Chung Date : 08/01/2009
Approved By : Signatory : Lau Wai Cheong Date : 08/01/2009
Tested Date: 12/12/2008

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Form : GESR0009.6 / Nov.10.06 / Issue 1 / Rev 1

TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	D055		
Sample		no	1		
Sample Type			Mazier		
Stage		no	1		
Sample Depth		m	3.00 - 4.00		
Specimen Depth		m	3.80 - 4.00		
COMPRESSION - FAILURE					
Cell Pressure		kPa	320		
Rate of Strain		mm/min	0.048		
CONDITIONS MAXIMUM DEVIATOR STRESS					
Major Effective Principal Stress (σ'_1)		kPa	540		
Corrected Deviator Stress ($\sigma'_1 - \sigma'_3$)		kPa	424		
Minor Effective Principal Stress (σ'_3)		kPa	115		
$s' = (\sigma'_1 + \sigma'_3)/2$		kPa	328		
$t = (\sigma_1 - \sigma_3)/2$		kPa	212		
Expanded Uncertainty of s' ^		kPa	-		
Expanded Uncertainty of t ^		kPa	-		
Pore pressure parameter A_f			-0.15		
Strain at Failure	(εf)	%	16.4		
COMPRESSION - FINAL					
Moisture Content	(W_f)	%	28		
Bulk density	(ρ_o)	Mg/m^3	1.93		
Dry density	(ρ_d)	Mg/m^3	1.51		
Voids Ratio	(e_f)		0.74		
Degree of Saturation	(S_f)	%	98.4		

Notes -
1. The method of specimen preparation was in accordance with GEOSPEC 3 : 2001 :- Test method 13.3 : test specimen from undisturbed soil samples.
2. Sample received date : 29/9/2008
3. The determination of moisture content was in accordance with test method 5.1 of GEOSPEC 3 : 2001.
4. Particle density : 2.62 (Determined)
5. Maximum and minimum temperature recorded over the period of testing 19.5 - 20.7 °C.
6. Unavoidable variations from specified procedure : none
7. Comment on observed or inferred sample disturbance : none
8. Percentage by mass of soil particles larger than 1/5 of the diameter of specimen (%) : Nil
9. The specimen was selected by the laboratory.
   Name : W S Wat Designation : Senior Laboratory Technician
10. Sampling History : As Received

* Delete as appropriate ^ Upon request

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.: 059**

Compiled by W S Wat
Checked by H W Chung

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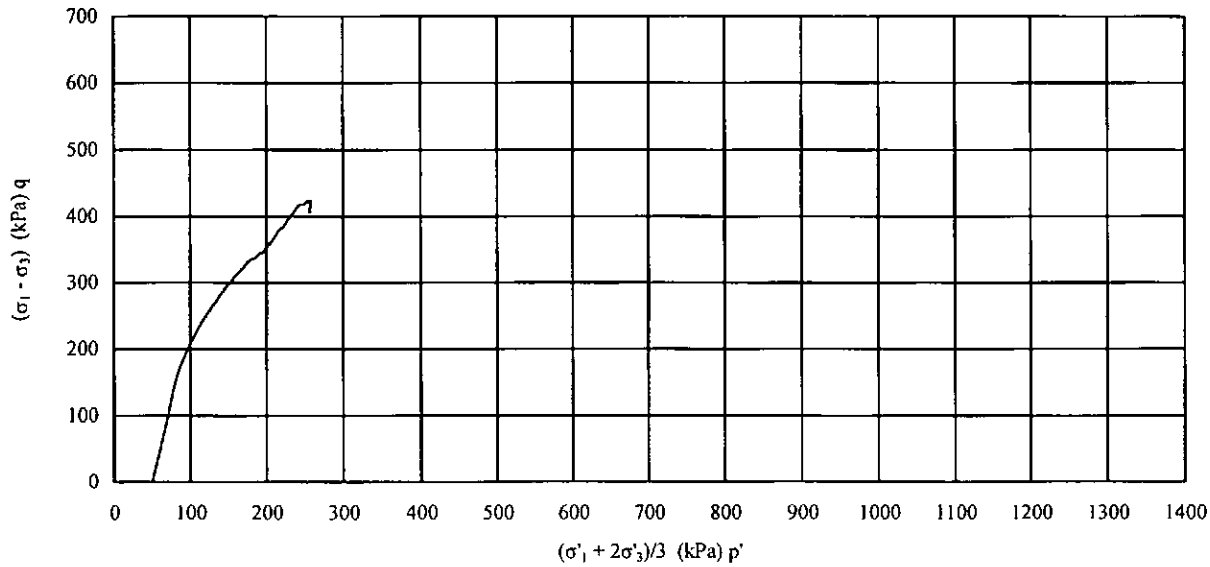
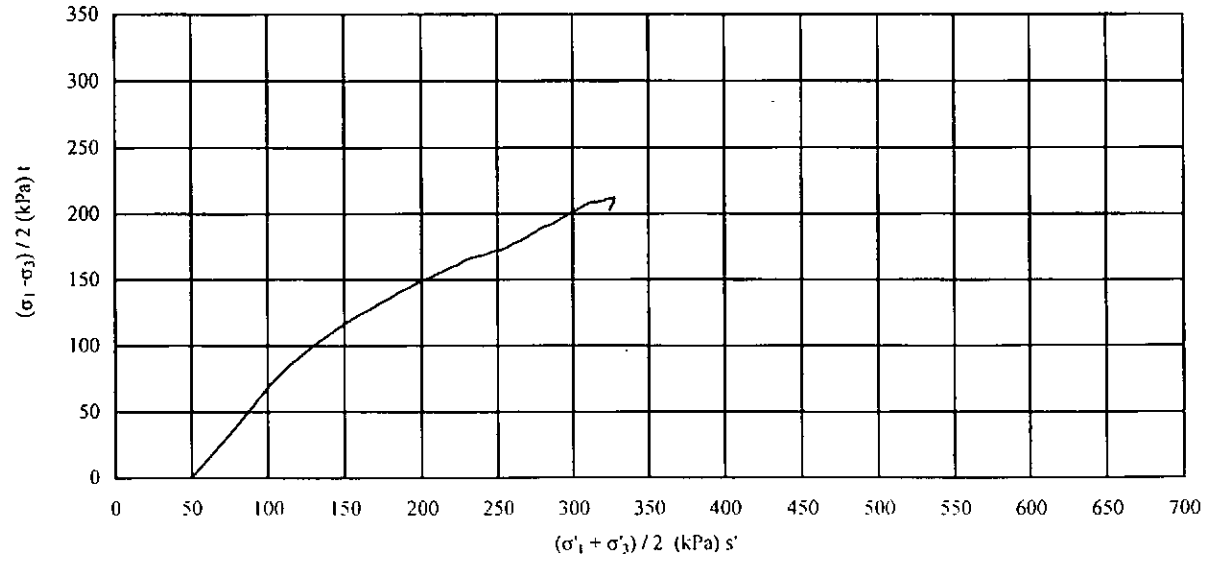
TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

STRESS PATH PARAMETERS FOR EFFECTIVE STRESS

p' - q PLOT



s' - t PLOT



Borehole No. :	**D055**	**Sample Depth m:-**	**3.00 - 4.00**
Sample No. :	**1**	**Specimen Depth m:-**	**3.80 - 4.00**
Customer :	**Mass Transit Railway Corporation**		Compiled by W S Wat
Project :	**Ground Investigation for South Island Line**		
		Contract No.: Contract 1024	Checked by H W Chung
Job No.:	**J2999**	**Works Order No.: 059**	

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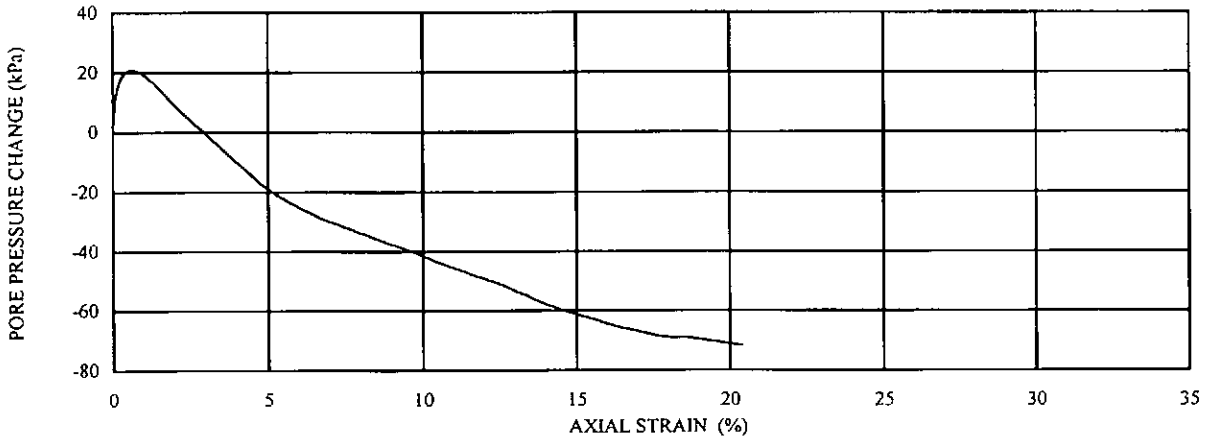
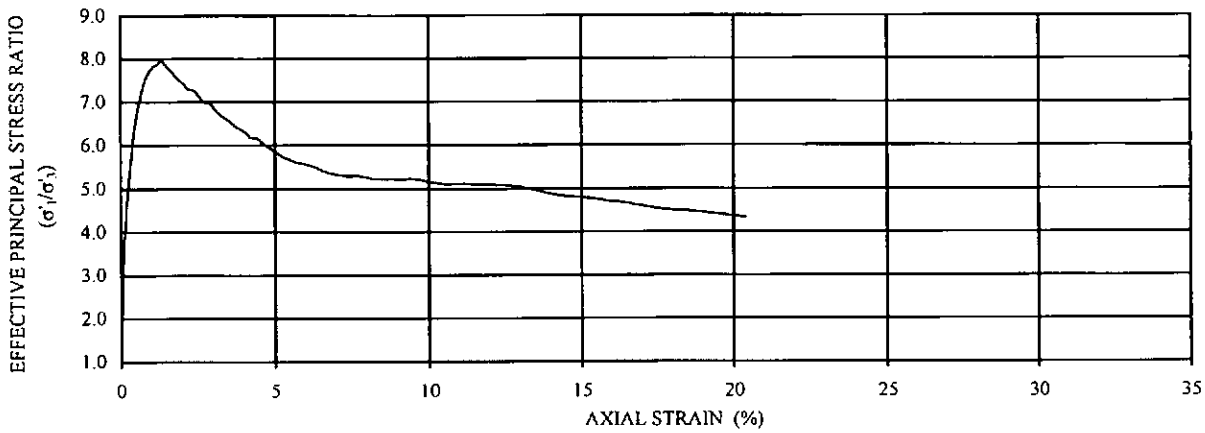
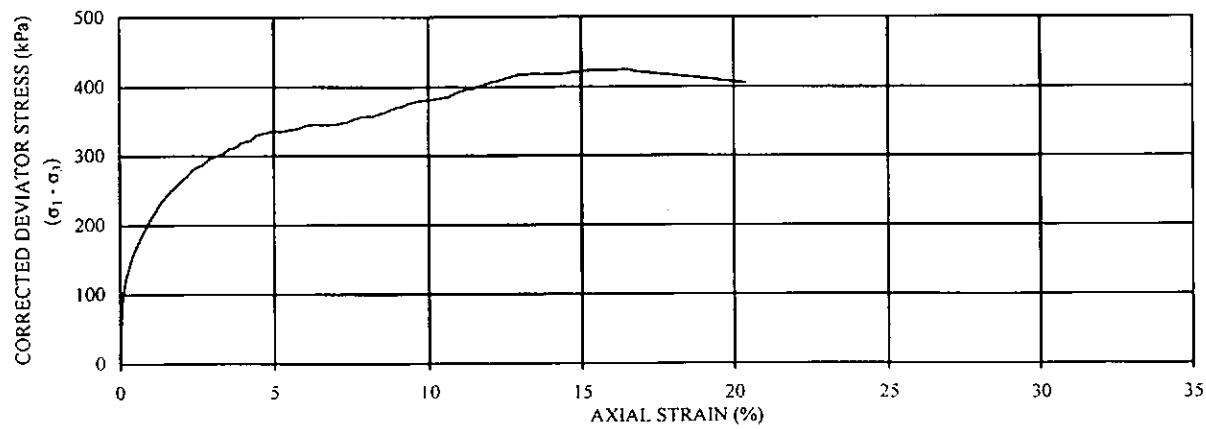
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

COMPRESSION







Borehole No. :	**D055**	**Sample Depth m:-**	**3.00 - 4.00**
Sample No. :	**1**	**Specimen Depth m:-**	**3.80 - 4.00**
Customer :	**Mass Transit Railway Corporation**		Compiled by W S Wat
Project :	**Ground Investigation for South Island Line**		
		Contract No.: Contract 1024	Checked by H W Chung
Job No.:	**J2999**	**Works Order No.: 059**	

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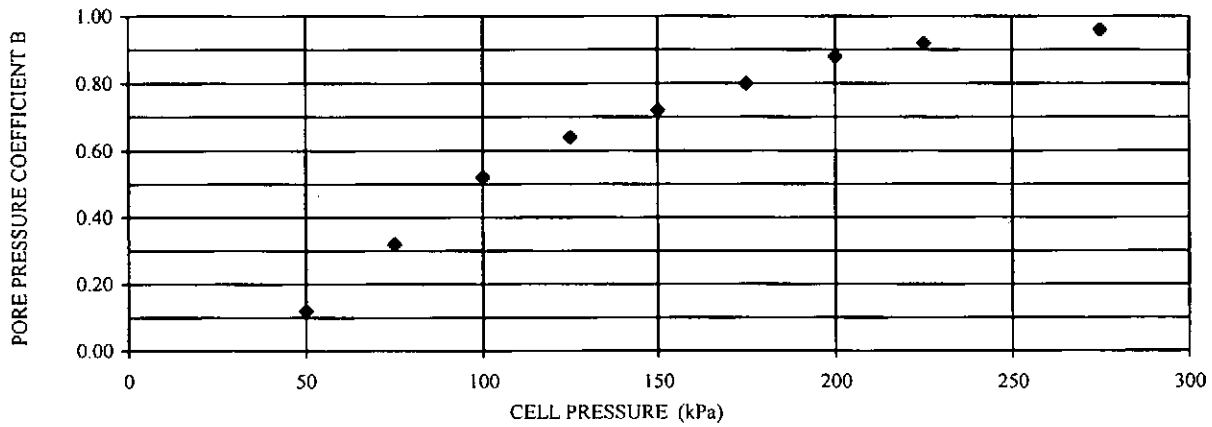
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

SATURATION



Date	Time	Cell Pressure kPa	Back Pressure kPa	Pore Pressure kPa	Cumulative Volume of Water cm^3	Pore Pressure Coefficient B
15/12/2008	08:40	0	0	-	0.0	
	08:49	25	-	4		-
	09:25	25	20	20	17.5	
	09:30	50	-	23		0.12
	10:26	50	45	45	25.4	
	10:36	75	-	53		0.32
	11:20	75	70	70	28.5	
	11:26	100	-	83		0.52
	12:13	100	95	95	31.3	
	12:18	125	-	111		0.64
16/12/2008	10:10	125	120	120	33.2	
	10:18	150	-	138		0.72
	11:06	150	145	145	34.4	
	11:12	175	-	165		0.80
	13:05	175	170	170	35.5	
	13:10	200	-	192		0.88
	13:50	200	195	195	36.5	
	13:56	225	-	218		0.92
	14:50	225	220	220	37.0	
	15:00	275	-	268		0.96
17/12/2008	12:30	275	270	270	39.5	

Borehole No. D055 — **Sample Depth m:-** 3.00 - 4.00
Sample No. : 1 — **Specimen Depth m:-** 3.80 - 4.00

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line

Compiled by: W S Wat
Checked by: H W Chung

Contract No.: Contract 1024
Job No.: J2999 — **Works Order No.:** 059

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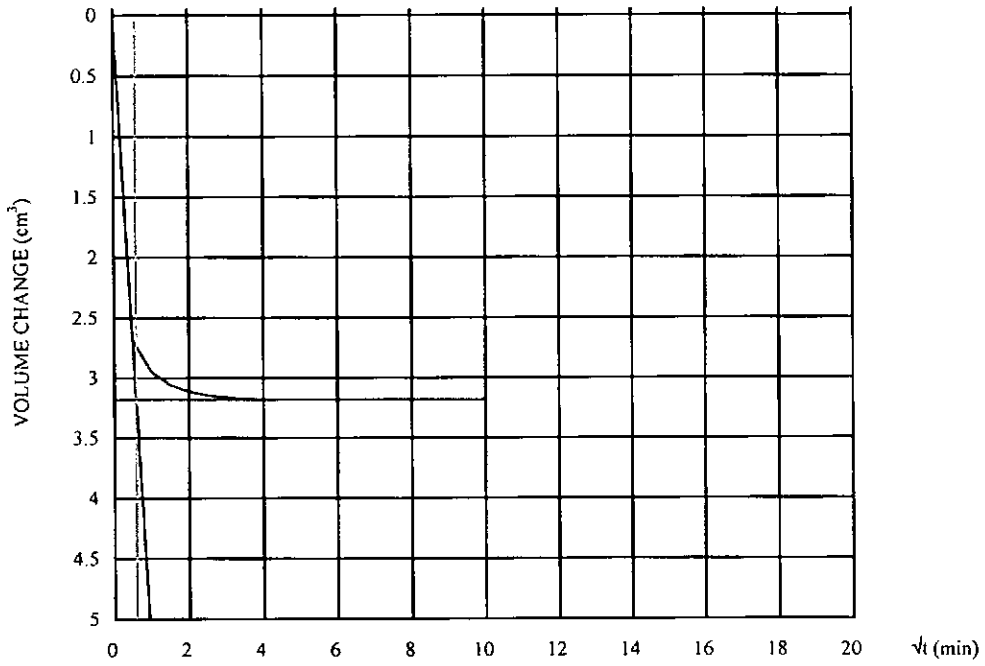
Form : GESR009.11 / Jun.02.03 / Issue 1 / Rev 0

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

CONSOLIDATION (DRAINED PHASE) - Stage 1

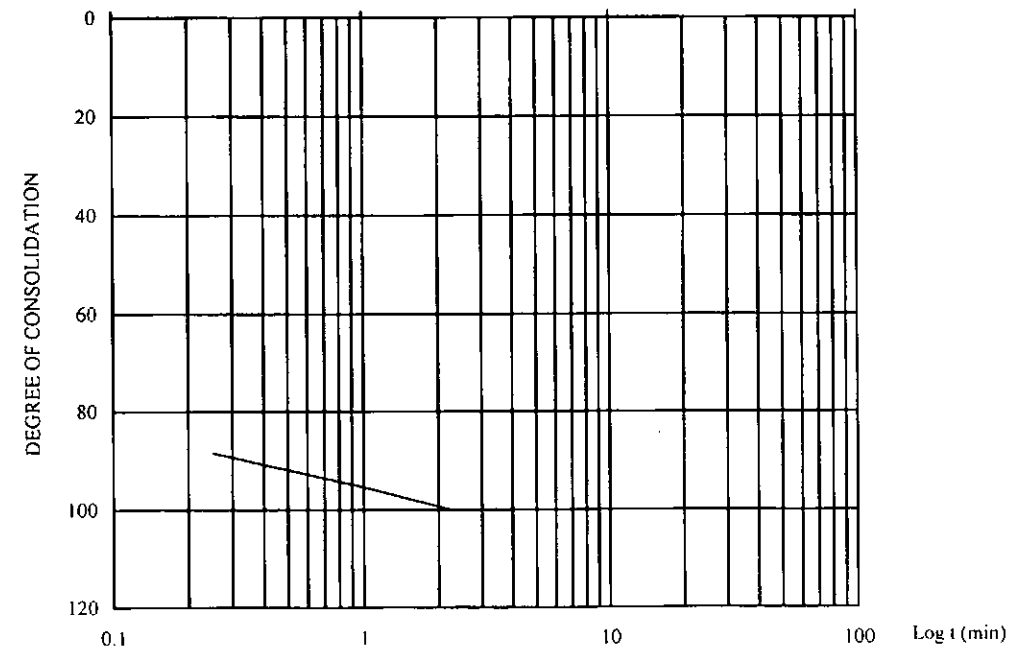


√t100 0.59 min

t100 0.351 min

tf 0.186 min

Calc. strain rate
54.416 mm/min



Borehole No. : D055 **Sample Depth m:-** 3.00 - 4.00

Sample No. : 1 **Specimen Depth m:-** 3.80 - 4.00

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.:** 059

Complied by: W S Wat

Checked by: H W Chung

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TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Single Stage			P.W.P,B.P				Effective Pressure	50				kPa
Side drains	No	Selected Machine Speed	0.048	mm/min	Rate of Strain	1.99	% per hr					
FAILURE CRITERION												
Max. deviator Stress	☒	Max. Stress ratio	☐		Axial Strain %	☐						
Stage : 1	Applied Pressure (kPa) - Cell :	320	Back :	270	P.R. factor	3.1659	kN/mm					

Date	Time	Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
		Dial		P.R.No. 37	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
18/12	08:35	0.00	0.00	0.053	270	0.000	0.0	50.0	50.0	50.0	0.0	50.0	1.00
	08:40	0.11	0.07	0.165	280	0.020	83.1	123.0	39.9	81.5	41.6	67.6	3.08
	08:45	0.27	0.19	0.215	286	0.055	120.1	154.3	34.2	94.2	60.0	74.2	4.51
	08:50	0.45	0.31	0.243	289	0.090	140.6	171.9	31.3	101.6	70.3	78.2	5.49
	08:55	0.68	0.47	0.271	290	0.135	161.1	190.7	29.6	110.1	80.5	83.3	6.44
	09:00	0.89	0.62	0.290	291	0.177	174.8	204.0	29.2	116.6	87.4	87.5	6.99
	09:05	1.14	0.79	0.312	291	0.225	190.7	220.2	29.5	124.9	95.4	93.1	7.46
	09:10	1.36	0.94	0.329	290	0.267	202.9	233.2	30.3	131.7	101.4	97.9	7.70
	09:15	1.56	1.08	0.344	289	0.305	213.6	244.9	31.3	138.1	106.8	102.5	7.82
	09:20	1.77	1.22	0.359	287	0.343	224.3	256.9	32.6	144.7	112.1	107.4	7.88
	09:25	1.95	1.35	0.371	287	0.378	232.7	266.2	33.5	149.9	116.4	111.1	7.95
	09:30	2.23	1.54	0.386	284	0.429	243.2	279.0	35.8	157.4	121.6	116.9	7.79
	09:35	2.47	1.70	0.397	283	0.471	250.8	288.3	37.5	162.9	125.4	121.1	7.69
	09:40	2.74	1.89	0.408	280	0.521	258.3	297.9	39.6	168.7	129.1	125.7	7.52
	09:45	3.01	2.08	0.421	278	0.571	267.2	308.8	41.6	175.2	133.6	130.7	7.42
	09:50	3.19	2.20	0.426	277	0.601	270.4	313.3	42.9	178.1	135.2	133.0	7.30
	09:55	3.47	2.40	0.440	275	0.652	280.0	324.7	44.7	184.7	140.0	138.0	7.26
	10:00	3.74	2.58	0.448	273	0.698	285.2	331.8	46.6	189.2	142.6	141.7	7.12
	10:05	3.95	2.73	0.452	272	0.735	287.7	335.6	47.9	191.7	143.8	143.8	7.01
	10:10	4.22	2.92	0.464	271	0.782	295.7	345.2	49.5	197.4	147.9	148.1	6.97
	10:15	4.45	3.07	0.468	269	0.818	298.1	349.2	51.2	200.2	149.0	150.5	6.83
	10:20	4.66	3.22	0.472	267	0.855	300.5	353.1	52.6	202.8	150.2	152.8	6.71
	10:25	4.89	3.38	0.478	266	0.893	304.2	358.2	54.0	206.1	152.1	155.4	6.63
	10:30	5.14	3.55	0.487	264	0.934	310.1	365.9	55.8	210.8	155.0	159.2	6.56
	10:35	5.41	3.74	0.491	263	0.978	312.3	369.7	57.4	213.6	156.2	161.5	6.44
	10:40	5.68	3.92	0.500	261	1.020	318.1	377.4	59.3	218.3	159.0	165.3	6.36
	10:45	5.90	4.08	0.505	259	1.057	321.1	381.8	60.7	221.3	160.6	167.7	6.29
	10:50	6.13	4.23	0.506	258	1.091	321.3	383.3	62.0	222.6	160.6	169.1	6.18
	10:55	6.39	4.42	0.519	256	1.134	329.8	393.6	63.8	228.7	164.9	173.7	6.17
	11:00	6.64	4.59	0.523	255	1.172	332.0	397.5	65.5	231.5	166.0	176.2	6.07
	11:05	6.83	4.71	0.525	253	1.199	333.0	399.7	66.7	233.2	166.5	177.7	5.99
	11:10	7.06	4.88	0.529	252	1.236	335.2	403.2	68.0	235.6	167.6	179.7	5.93
	11:15	7.32	5.06	0.530	251	1.275	335.2	404.4	69.2	236.8	167.6	180.9	5.84
	11:20	7.61	5.25	0.531	249	1.316	335.2	405.9	70.7	238.3	167.6	182.4	5.74
	11:25	7.84	5.41	0.534	248	1.351	336.7	408.4	71.7	240.1	168.4	183.9	5.70
	11:30	8.11	5.60	0.537	247	1.391	338.1	411.0	72.9	241.9	169.0	185.6	5.64
	11:35	8.36	5.77	0.540	246	1.426	339.6	413.4	73.8	243.6	169.8	187.0	5.60
	11:40	8.58	5.92	0.544	245	1.457	341.8	416.4	74.6	245.5	170.9	188.5	5.58
	11:45	8.79	6.07	0.548	244	1.488	344.0	419.6	75.6	247.6	172.0	190.3	5.55

Borehole No. : D055 **: Depth m:- 3.00 - 4.00**

Sample No. : 1 **Specimen Depth m:- 3.80 - 4.00**

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.: 059**

Compiled by W S Wat

Checked by H W Chung

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TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2
Shearing Continuation

FAILURE CRITERION

Max. deviator Stress ☒ | Max. Stress ratio ☐ | Axial Strain % ☐

Stage : 1

Date	Time	Strain Dial	Strain	Load P.R.No. 37	Pore Pressure	Dev. stress Corr.	Dev. stress q $\sigma_1 - \sigma_3$	Effective Stress Parameters: Effective Stress σ'_1	Effective Stress σ'_3	s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa				2	2	3	σ'_1/σ'_3
18/12	11:50	9.14	6.31	0.551	243	1.537	345.1	421.8	76.7	249.3	172.6	191.7	5.50
	11:55	9.25	6.39	0.551	243	1.553	344.8	421.9	77.1	249.5	172.4	192.0	5.47
	12:00	9.40	6.50	0.551	242	1.575	344.4	422.1	77.7	249.9	172.2	192.5	5.43
	12:05	9.68	6.69	0.552	241	1.613	344.4	423.1	78.7	250.9	172.2	193.5	5.38
	12:10	9.98	6.89	0.554	241	1.653	345.0	424.5	79.5	252.0	172.5	194.5	5.34
	12:15	10.22	7.06	0.557	240	1.686	346.4	426.6	80.2	253.4	173.2	195.7	5.32
	12:20	10.42	7.20	0.559	239	1.713	347.2	427.9	80.7	254.3	173.6	196.4	5.30
	12:25	10.69	7.38	0.563	239	1.747	349.2	430.6	81.4	256.0	174.6	197.8	5.29
	12:30	10.95	7.56	0.569	238	1.782	352.6	434.6	82.0	258.3	176.3	199.5	5.30
	12:35	11.17	7.72	0.573	237	1.812	354.8	437.4	82.6	260.0	177.4	200.9	5.29
	12:40	11.40	7.87	0.577	237	1.840	356.9	440.3	83.4	261.8	178.4	202.4	5.28
	12:45	11.68	8.07	0.579	236	1.877	357.4	441.5	84.1	262.8	178.7	203.2	5.25
	12:50	11.90	8.22	0.580	235	1.904	357.5	442.1	84.6	263.3	178.7	203.8	5.23
	12:55	12.23	8.45	0.587	234	1.946	361.3	446.9	85.6	266.3	180.7	206.0	5.22
	13:00	12.43	8.58	0.590	234	1.970	362.8	448.8	86.0	267.4	181.4	206.9	5.22
	13:05	12.72	8.79	0.597	233	2.007	366.7	453.5	86.8	270.1	183.3	209.0	5.22
	13:10	12.92	8.92	0.601	233	2.030	368.8	456.2	87.4	271.8	184.4	210.3	5.22
	13:15	13.24	9.14	0.606	232	2.069	371.3	459.4	88.1	273.7	185.6	211.9	5.21
	13:20	13.45	9.29	0.611	231	2.095	374.0	462.6	88.6	275.6	187.0	213.3	5.22
	13:25	13.63	9.42	0.616	231	2.117	376.8	465.9	89.1	277.5	188.4	214.7	5.23
	13:30	13.94	9.63	0.620	230	2.153	378.6	468.5	89.9	279.2	189.3	216.1	5.21
	13:35	14.12	9.76	0.623	230	2.176	380.0	470.4	90.4	280.4	190.0	217.1	5.20
	13:40	14.38	9.94	0.625	229	2.206	380.6	471.9	91.3	281.6	190.3	218.2	5.17
	13:45	14.68	10.14	0.628	228	2.240	381.7	473.8	92.1	282.9	190.8	219.3	5.14
	13:50	14.89	10.29	0.631	227	2.265	383.0	475.8	92.8	284.3	191.5	220.5	5.13
	13:55	15.15	10.46	0.634	227	2.293	384.3	477.8	93.5	285.6	192.1	221.6	5.11
	14:00	15.42	10.65	0.637	226	2.324	385.4	479.6	94.2	286.9	192.7	222.7	5.09
	14:05	15.61	10.78	0.643	225	2.345	388.8	483.5	94.7	289.1	194.4	224.3	5.11
	14:10	15.90	10.98	0.650	225	2.377	392.5	488.0	95.5	291.8	196.3	226.3	5.11
	14:15	16.19	11.18	0.656	224	2.409	395.5	491.7	96.2	294.0	197.8	228.0	5.11
	14:20	16.43	11.35	0.659	223	2.437	396.8	493.6	96.8	295.2	198.4	229.1	5.10
	14:25	16.62	11.48	0.662	223	2.457	398.1	495.5	97.4	296.5	199.1	230.1	5.09
	14:30	16.95	11.71	0.669	222	2.493	401.6	499.8	98.2	299.0	200.8	232.1	5.09
	14:35	17.19	11.87	0.674	221	2.518	404.1	502.9	98.8	300.9	202.1	233.5	5.09
	14:40	17.41	12.02	0.678	221	2.542	406.0	505.3	99.3	302.3	203.0	234.6	5.09
	14:45	17.61	12.16	0.681	220	2.563	407.3	507.1	99.8	303.5	203.7	235.6	5.08
	14:50	17.83	12.32	0.685	220	2.588	409.2	509.5	100.3	304.9	204.6	236.7	5.08
	14:55	18.13	12.52	0.691	219	2.618	412.1	513.2	101.1	307.1	206.0	238.5	5.08
	15:00	18.31	12.65	0.695	218	2.638	414.0	515.7	101.7	308.7	207.0	239.7	5.07
	15:05	18.64	12.88	0.701	217	2.673	416.8	519.5	102.7	311.1	208.4	241.6	5.06
	15:10	18.79	12.98	0.703	217	2.688	417.6	520.8	103.2	312.0	208.8	242.4	5.05

Borehole No. : D055 — **Sample Depth m:-** 3.00 - 4.00

Sample No. : 1 — **Specimen Depth m:-** 3.80 - 4.00

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 — **Works Order No.:** 059

Compiled by: W S Wat

Checked by: H W Chung

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WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2
Shearing Continuation

FAILURE CRITERION													
Max. deviator Stress ☒				Max. Stress ratio ☐			Axial Strain % ☐						
Stage : 1		Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
Date	Time	Dial		P.R.No. 37	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
18/12	15:15	19.07	13.17	0.704	216	2.716	417.3	521.4	104.1	312.8	208.7	243.2	5.01
	15:20	19.35	13.37	0.707	215	2.746	418.2	523.1	104.9	314.0	209.1	244.3	4.99
	15:25	19.53	13.49	0.708	215	2.764	418.3	523.8	105.5	314.6	209.1	244.9	4.96
	15:30	19.84	13.70	0.709	214	2.795	417.9	524.3	106.4	315.3	208.9	245.7	4.93
	15:35	20.00	13.82	0.710	213	2.813	417.9	524.9	107.0	316.0	209.0	246.3	4.91
	15:40	20.29	14.01	0.712	212	2.840	418.2	526.0	107.8	316.9	209.1	247.2	4.88
	15:45	20.50	14.16	0.713	212	2.862	418.1	526.5	108.4	317.4	209.0	247.8	4.86
	15:50	20.77	14.35	0.715	211	2.890	418.4	527.5	109.1	318.3	209.2	248.6	4.84
	15:55	21.01	14.51	0.717	210	2.913	418.9	528.6	109.7	319.1	209.4	249.3	4.82
	16:00	21.22	14.66	0.720	210	2.935	420.0	530.2	110.2	320.2	210.0	250.2	4.81
	16:05	21.53	14.87	0.723	209	2.965	420.8	531.6	110.8	321.2	210.4	251.1	4.80
	16:10	21.70	14.99	0.726	209	2.982	422.1	533.3	111.2	322.3	211.1	251.9	4.80
	16:15	21.97	15.17	0.728	208	3.008	422.4	534.2	111.8	323.0	211.2	252.6	4.78
	16:20	22.21	15.34	0.731	208	3.032	423.5	535.7	112.2	323.9	211.7	253.4	4.77
	16:25	22.45	15.51	0.732	207	3.056	423.2	535.9	112.7	324.3	211.6	253.8	4.76
	16:30	22.69	15.67	0.733	207	3.079	423.0	536.2	113.2	324.7	211.5	254.2	4.74
	16:35	22.95	15.85	0.735	206	3.104	423.3	537.2	113.9	325.6	211.7	255.0	4.72
	16:40	23.21	16.03	0.736	206	3.130	423.0	537.4	114.4	325.9	211.5	255.4	4.70
	16:45	23.50	16.23	0.739	205	3.158	423.8	538.8	115.0	326.9	211.9	256.3	4.69
	16:50	**23.69**	**16.36**	**0.741**	**205**	**3.176**	**424.4**	**539.8**	**115.4**	**327.6**	**212.2**	**256.9**	**4.68**
	16:55	23.94	16.54	0.742	204	3.201	424.1	539.9	115.8	327.9	212.1	257.2	4.66
	17:00	24.21	16.73	0.741	204	3.228	422.5	538.8	116.3	327.5	211.2	257.1	4.63
	17:05	24.45	16.89	0.740	203	3.250	421.0	537.6	116.6	327.1	210.5	256.9	4.61
	17:10	24.69	17.06	0.740	203	3.274	420.1	537.1	117.0	327.1	210.1	257.0	4.59
	17:15	24.93	17.22	0.741	203	3.296	419.9	537.3	117.4	327.3	209.9	257.4	4.58
	17:20	25.65	17.72	0.741	202	3.366	417.3	535.8	118.5	327.1	208.6	257.6	4.52
	17:25	26.42	18.25	0.742	201	3.440	415.1	534.1	119.0	326.5	207.5	257.4	4.49
	17:30	27.15	18.76	0.743	201	3.512	413.0	532.1	119.1	325.6	206.5	256.8	4.47
	17:35	27.94	19.30	0.744	200	3.588	410.8	530.8	120.0	325.4	205.4	256.9	4.42
	17:40	28.78	19.88	0.744	199	3.670	407.7	528.5	120.8	324.7	203.9	256.7	4.38
	17:45	29.53	20.40	0.745	198	3.744	405.5	527.1	121.6	324.4	202.8	256.8	4.34

Borehole No. : D055 **Sample Depth m:- 3.00 - 4.00**

Sample No. : 1 **Specimen Depth m:- 3.80 - 4.00**

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.: 059**

Compiled by: W S Wat

Checked by: H W Chung

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT (GEOSPEC 3 : 2001 Test Method 15.2)

Description : Brown, slightly gravelly, sandy SILT/CLAY Sample Origin : CDT‡ ‡ Information provided by customer

Borehole No. : D055 Sample No. : 1 Sample Depth m:- 3.00 - 4.00 Specimen Depth m:- 3.80 - 4.00

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line

Contract No. : Contract 1024
Job No. : J2999
Works Order No.: 059

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DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	D059		
Sample		no	1		
Sample Type			Mazier		
Stage		no	1		
Sample Depth		m	3.50 - 4.50		
Specimen Depth		m	4.10 - 4.30		
INITIAL CONDITIONS					
Diameter	(D_o)	mm	73.5		
Height	(H_o)	mm	145.0		
Moisture Content	(W_o)	%	29		
Bulk density	(ρ_o)	Mg/m^3	1.83		
Dry density	(ρ_d)	Mg/m^3	1.42		
Particle density	(ρ_s)		2.64		
Voids Ratio	(e_o)		0.86		
Degree of Saturation	(S_r)	%	89.2		
DRAINAGE CONDITIONS			ONE END		
SATURATION					
Final Pore Pressure Coefficient B			1.00		
CONSOLIDATION					
Cell Pressure	(σ_3)	kPa	270		
Back Pressure	(u_b)	kPa	230		
Effective Pressure	(σ'_3)	kPa	40		
Coefficient of Consolidation (t100) (C_{vi})		m^2/Year	645.43		
Coefficient of Volume Compressibility (m_{vi})		m^2/MN	0.33		
Coefficient of Permeability (k)		m/s	6.60E-08		
COMPRESSION TERMINATION CRITERION			MAXIMUM DEVIATOR STRESS		
COMPRESSION - INITIAL					
Moisture Content	(w)	%	31		
Pore Pressure at the End of Consolidation		kPa	230		
Effective Stress at the End of Consolidation		kPa	40		
Bulk density	(ρ_o)	Mg/m^3	1.88		
Dry density	(ρ_d)	Mg/m^3	1.43		
Voids Ratio	(e)		0.84		
Degree of Saturation	(S_r)	%	98.3		

Customer : **Mass Transit Railway Corporation**
Project : **Ground Investigation for South Island Line**
Report No. : J2999-059.11
Contract No.: Contract 1024
Job No.: **J2999** **Works Order No.: 059**

Technician : W S Wat Checked By : Name : H W Chung Approved By : Signatory : **Lau Wai Cheong**
Tested Date: 24/11/2008 Date : 02/01/2009 Date : 02/01/2009

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	D059		
Sample		no	1		
Sample Type			Mazier		
Stage		no	1		
Sample Depth		m	3.50 - 4.50		
Specimen Depth		m	4.10 - 4.30		
COMPRESSION - FAILURE					
Cell Pressure		kPa	270		
Rate of Strain		mm/min	0.048		
CONDITIONS MAXIMUM DEVIATOR STRESS					
Major Effective Principal Stress (σ'_1)		kPa	201		
Corrected Deviator Stress ($\sigma'_1 - \sigma'_3$)		kPa	159		
Minor Effective Principal Stress (σ'_3)		kPa	42		
$s' = (\sigma'_1 + \sigma'_3)/2$		kPa	121		
$t = (\sigma_1 - \sigma_3)/2$		kPa	80		
Expanded Uncertainty of s' ^		kPa	-		
Expanded Uncertainty of t ^		kPa	-		
Pore pressure parameter A_f			-0.01		
Strain at Failure	(εf)	%	7.4		
COMPRESSION - FINAL					
Moisture Content	(W_f)	%	31		
Bulk density	(ρ_o)	Mg/m^3	1.88		
Dry density	(ρ_d)	Mg/m^3	1.43		
Voids Ratio	(e_f)		0.84		
Degree of Saturation	(S_f)	%	98.3		

Notes -
1. The method of specimen preparation was in accordance with GEOSPEC 3 : 2001 :- Test method 13.3 : test specimen from undisturbed soil samples.
2. Sample received date : 29/9/2008
3. The determination of moisture content was in accordance with test method 5.1 of GEOSPEC 3 : 2001.
4. Particle density : 2.64 (Determined)
5. Maximum and minimum temperature recorded over the period of testing 19.5 - 20.7 °C.
6. Unavoidable variations from specified procedure : none
7. Comment on observed or inferred sample disturbance : none
8. Percentage by mass of soil particles larger than 1/5 of the diameter of specimen (%) : Nil
9. The specimen was selected by the laboratory.
   Name : W S Wat Designation : Senior Laboratory Technician
10. Sampling History : As Received

* Delete as appropriate ^ Upon request

Customer : **Mass Transit Railway Corporation**
Project : **Ground Investigation for South Island Line**
Contract No.: Contract 1024
Job No.: **J2999** **Works Order No.: 059**

Compiled by W S Wat
Checked by H W Chung

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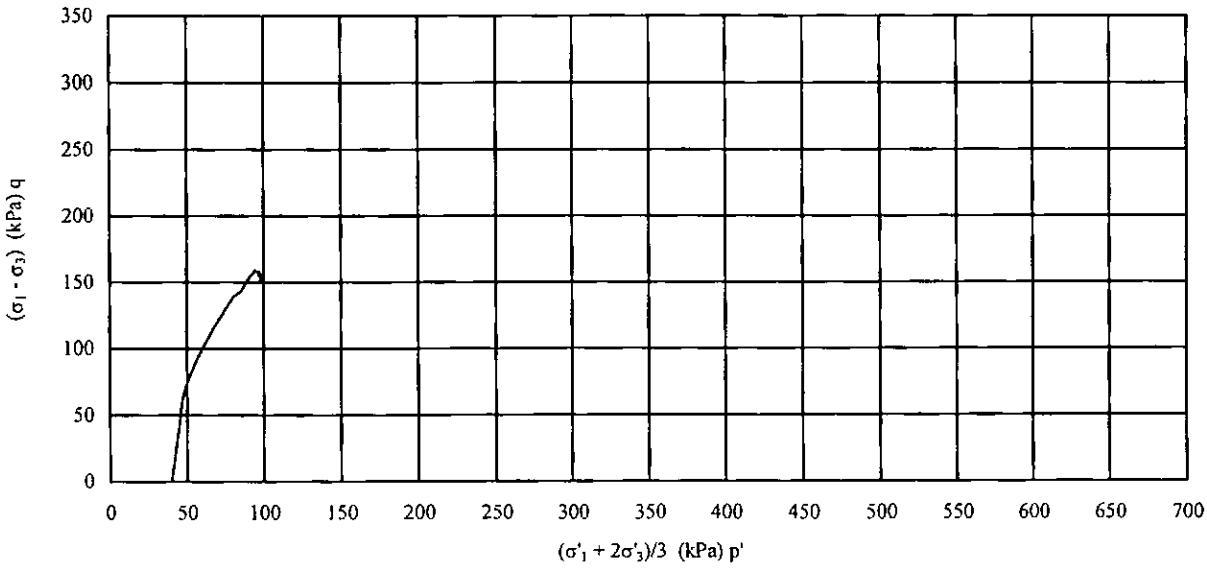
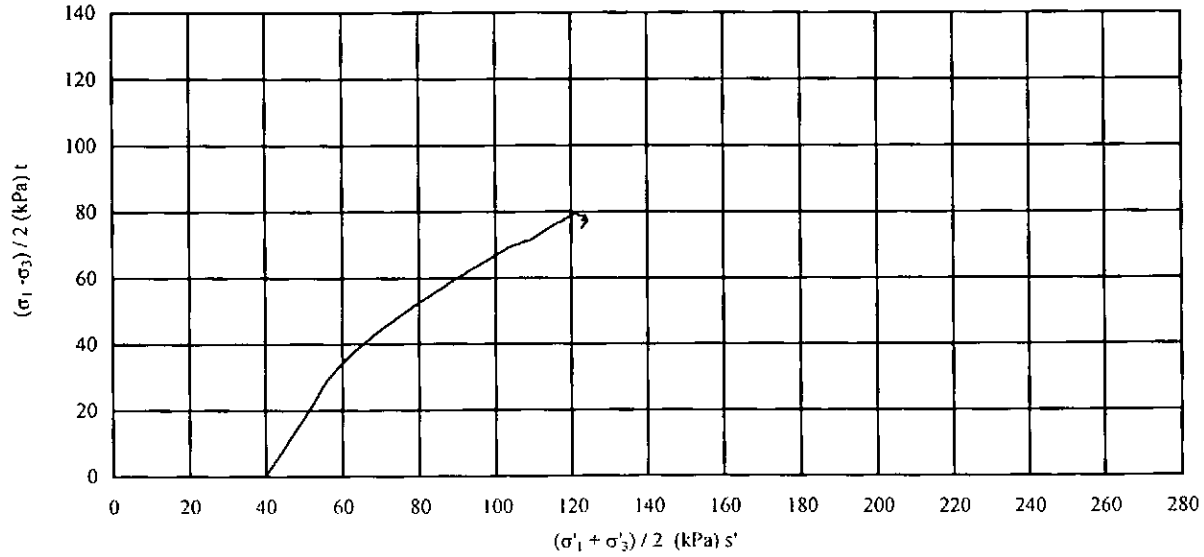
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

STRESS PATH PARAMETERS FOR EFFECTIVE STRESS

p' - q PLOT



s' - t PLOT



Borehole No. : D059 **Sample Depth m:-** 3.50 - 4.50
Sample No. : 1 **Specimen Depth m:-** 4.10 - 4.30

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.:** 059

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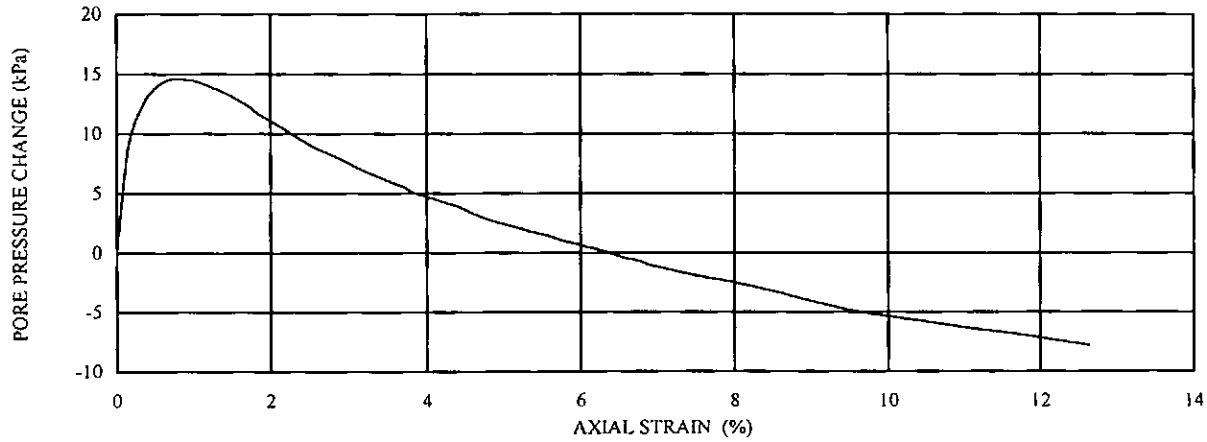
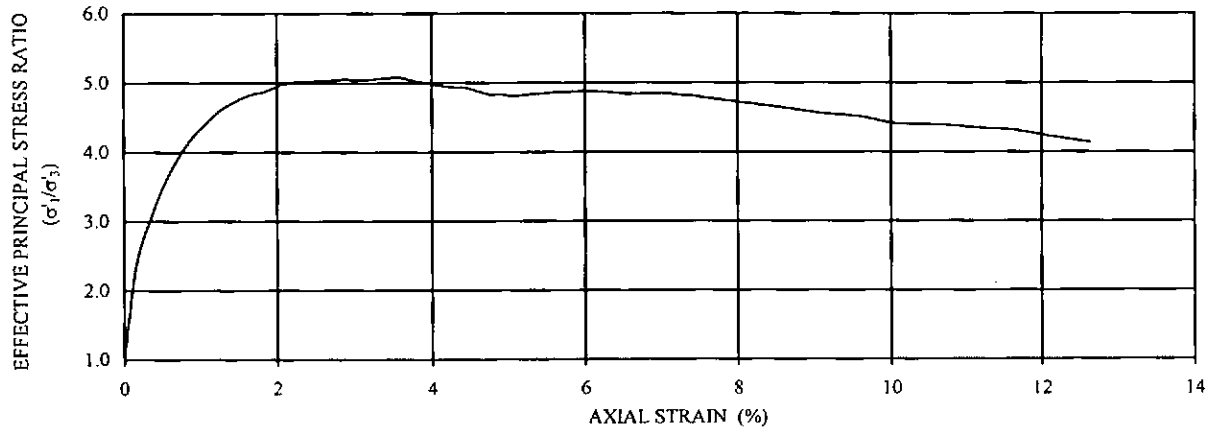
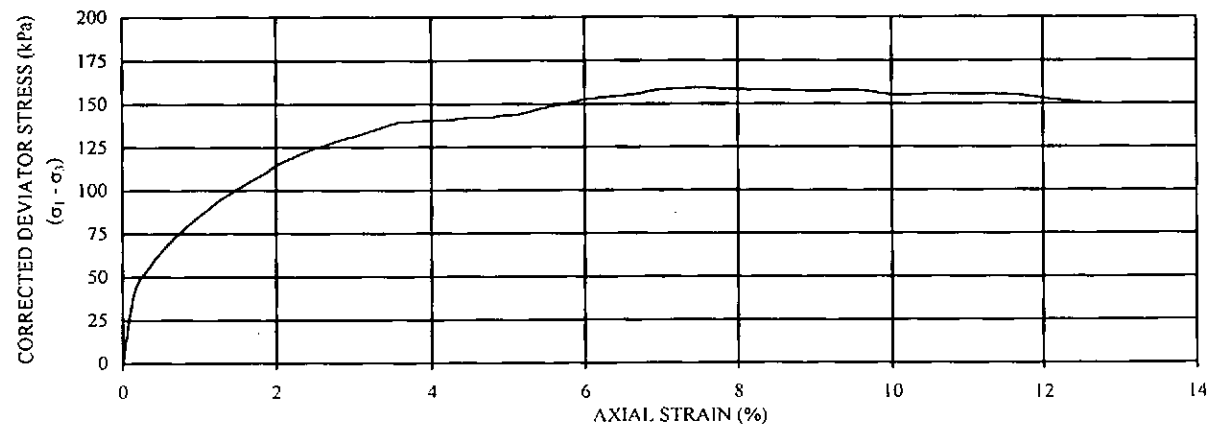
Form : GESR009.8 / Jun.02.03 / Issue 1 / Rev 0

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

COMPRESSION







Borehole No. : D059 — **Sample Depth m:-** 3.50 - 4.50
Sample No. : 1 — **Specimen Depth m:-** 4.10 - 4.30

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 — **Works Order No.:** 059

Compiled by: W S Wat
Checked by: H W Chung

Form : GESR009.9 / Jun.02.03 / Issue 1 / Rev 0

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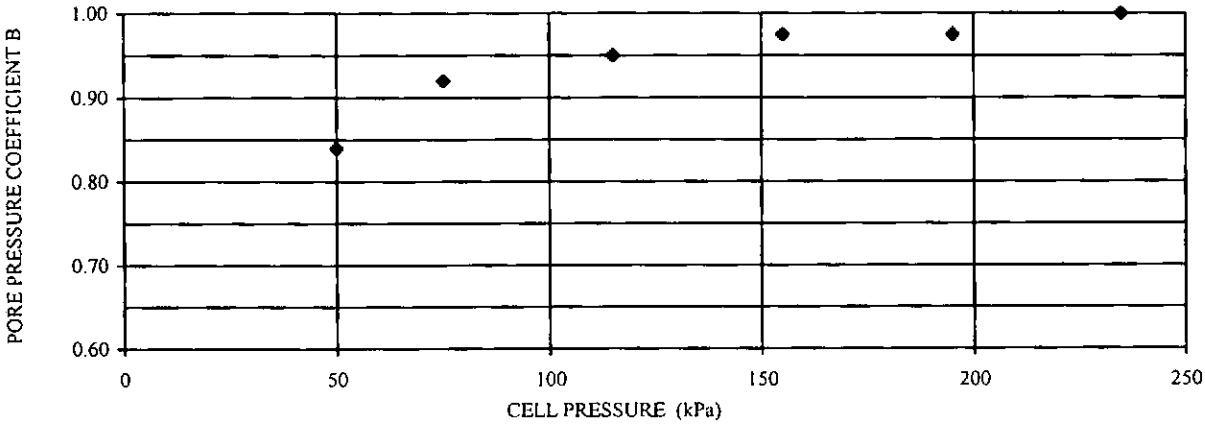
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

SATURATION



Date	Time	Cell Pressure kPa	Back Pressure kPa	Pore Pressure kPa	Cumulative Volume of Water cm^3	Pore Pressure Coefficient B
24/11/2008	15:16	0	0	-	0.0	
	15:27	25	-	20		-
	15:53	25	20	20	-0.1	
	16:02	50	-	41		0.84
25/11/2008	08:33	50	45	45	3.6	
	08:41	75	-	68		0.92
	08:59	75	70	70	5.7	
	09:07	115	-	108		0.95
	09:50	115	110	110	7.7	
	09:57	155	-	149		0.98
	10:19	155	150	150	9.2	
	10:27	195	-	189		0.98
	13:40	195	190	190	11.1	
	13:47	235	-	230		1.00
26/11/2008	08:50	235	230	230	26.2	

Borehole No. D059 — **Sample Depth m:-** 3.50 - 4.50
Sample No. : I — **Specimen Depth m:-** 4.10 - 4.30
Customer : Mass Transit Railway Corporation — Compiled by W S Wat
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024 — Checked by H W Chung
Job No.: J2999 — **Works Order No.:** 059

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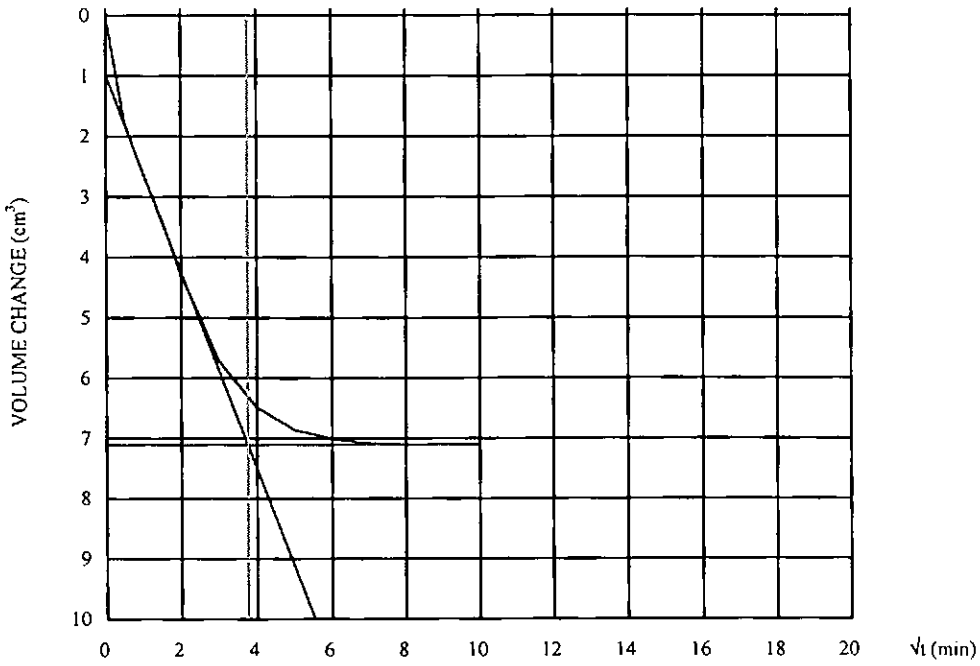
TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

CONSOLIDATION (DRAINED PHASE) - Stage 1

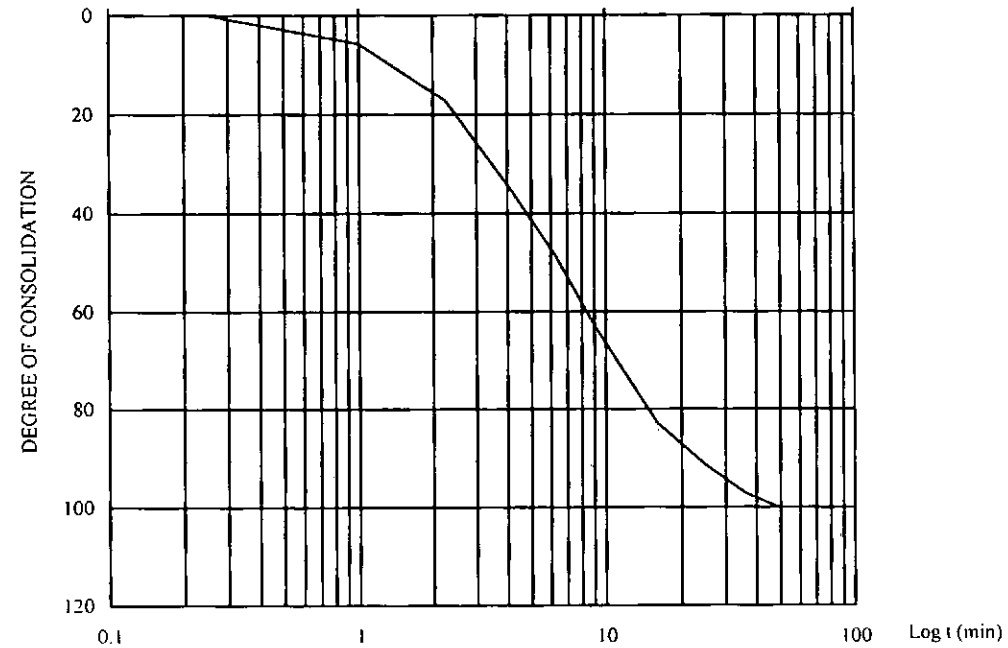


√t100 3.76 min

t100 14.155 min

tf 7.502 min

Calc. strain rate
1.348 mm/min



Borehole No. : D059 **Sample Depth m:-** 3.50 - 4.50
Sample No. : 1 **Specimen Depth m:-** 4.10 - 4.30

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.:** 059

Complied by: W S Wat
Checked by: H W Chung

Form : GESR009.13 / Jun.02.03 / Issue 1 / Rev 0

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Single Stage			P.W.P.B.P				Effective Pressure	40	kPa				
Side drains	No		Selected Machine Speed	0.048	mm/min		Rate of Strain	1.99	% per hr				
FAILURE CRITERION													
Max. deviator Stress		☒	Max. Stress ratio		☐		Axial Strain %		☐				
Stage : 1	Applied Pressure (kPa) - Cell :		270	Back :	230		P.R. factor	3.1069	kN/mm				
		Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
Date	Time	Dial		P.R.No. 24	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
27/11	08:35	0.00	0.00	0.041	230	0.000	0.0	40.0	40.0	40.0	0.0	40.0	1.00
	08:40	0.23	0.16	0.098	239	0.047	41.9	72.8	30.9	51.9	21.0	44.9	2.36
	08:45	0.50	0.35	0.117	243	0.101	55.8	83.3	27.5	55.4	27.9	46.1	3.03
	08:50	0.72	0.50	0.129	244	0.144	64.4	90.6	26.2	58.4	32.2	47.7	3.46
	08:55	0.97	0.67	0.140	245	0.192	72.3	97.8	25.5	61.7	36.2	49.6	3.84
	09:00	1.24	0.86	0.151	245	0.245	80.2	105.6	25.4	65.5	40.1	52.1	4.16
	09:05	1.50	1.04	0.160	244	0.295	86.6	112.2	25.6	68.9	43.3	54.5	4.38
	09:10	1.80	1.24	0.170	244	0.350	93.6	119.7	26.1	72.9	46.8	57.3	4.59
	09:15	2.00	1.39	0.176	244	0.390	97.8	124.3	26.5	75.4	48.9	59.1	4.69
	09:20	2.22	1.54	0.182	243	0.431	102.0	129.0	27.0	78.0	51.0	61.0	4.78
	09:25	2.45	1.70	0.188	242	0.473	106.1	133.7	27.6	80.7	53.1	63.0	4.84
	09:30	2.66	1.84	0.193	242	0.510	109.5	137.8	28.3	83.1	54.8	64.8	4.87
	09:35	2.93	2.03	0.201	241	0.560	115.1	144.1	29.0	86.5	57.5	67.4	4.97
	09:40	3.15	2.18	0.206	240	0.598	118.4	148.0	29.6	88.8	59.2	69.1	5.00
	09:45	3.39	2.35	0.211	240	0.642	121.8	152.1	30.3	91.2	60.9	70.9	5.02
	09:50	3.74	2.59	0.217	239	0.702	125.7	156.9	31.2	94.1	62.9	73.1	5.03
	09:55	3.95	2.73	0.220	238	0.737	127.7	159.3	31.6	95.4	63.8	74.2	5.04
	10:00	4.13	2.86	0.223	238	0.770	129.6	161.6	32.0	96.8	64.8	75.2	5.05
	10:05	4.36	3.02	0.226	238	0.809	131.5	164.0	32.5	98.3	65.8	76.3	5.05
	10:10	4.62	3.20	0.230	237	0.853	134.1	167.2	33.1	100.1	67.0	77.8	5.05
	10:15	4.89	3.38	0.234	236	0.896	136.6	170.2	33.6	101.9	68.3	79.1	5.07
	10:20	5.14	3.56	0.238	236	0.939	139.2	173.3	34.1	103.7	69.6	80.5	5.08
	10:25	5.37	3.72	0.239	236	0.977	139.6	174.1	34.5	104.3	69.8	81.0	5.05
	10:30	5.52	3.82	0.240	235	1.000	140.2	175.1	34.9	105.0	70.1	81.6	5.02
	10:35	5.89	4.07	0.241	235	1.058	140.4	175.8	35.4	105.6	70.2	82.2	4.97
	10:40	6.14	4.25	0.242	234	1.100	140.8	176.6	35.8	106.2	70.4	82.7	4.93
	10:45	6.36	4.41	0.244	234	1.136	142.0	178.1	36.1	107.1	71.0	83.4	4.93
	10:50	6.64	4.60	0.245	233	1.179	142.4	179.1	36.7	107.9	71.2	84.2	4.88
	10:55	6.87	4.76	0.245	233	1.214	142.1	179.2	37.1	108.1	71.0	84.5	4.83
	11:00	7.08	4.90	0.247	233	1.245	143.2	180.6	37.4	109.0	71.6	85.1	4.83
	11:05	7.32	5.07	0.248	232	1.282	143.6	181.3	37.7	109.5	71.8	85.6	4.81
	11:10	7.59	5.25	0.251	232	1.321	145.4	183.4	38.0	110.7	72.7	86.5	4.83
	11:15	7.81	5.41	0.254	232	1.355	147.2	185.5	38.3	111.9	73.6	87.4	4.84
	11:20	8.08	5.59	0.257	231	1.394	149.0	187.6	38.6	113.1	74.5	88.3	4.86
	11:25	8.27	5.72	0.259	231	1.421	150.2	189.1	38.9	114.0	75.1	89.0	4.86
	11:30	8.55	5.92	0.262	231	1.463	151.9	191.1	39.2	115.1	75.9	89.8	4.87
	11:35	8.78	6.08	0.264	231	1.496	153.0	192.5	39.5	116.0	76.5	90.5	4.87
	11:40	9.06	6.27	0.266	230	1.534	154.0	193.8	39.8	116.8	77.0	91.1	4.87
	11:45	9.28	6.42	0.267	230	1.565	154.4	194.5	40.1	117.3	77.2	91.6	4.85

Borehole No. : D059 **Sample Depth m:- 3.50 - 4.50**

Sample No. : 1 **Specimen Depth m:- 4.10 - 4.30**

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.: 059**

Compiled by: W S Wat

Checked by: H W Chung

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Form : GESR009.14 / Dec.13.04 / Issue 1 / Rev I

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2
Shearing Continuation

FAILURE CRITERION

Max. deviator Stress ☒ | Max. Stress ratio ☐ | Axial Strain % ☐

Stage :	1	Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
Date	Time	Dial		P.R.No. 24	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
27/11	11:50	9.56	6.62	0.269	230	1.605	155.4	195.9	40.5	118.2	77.7	92.3	4.84
	11:55	9.80	6.78	0.271	229	1.637	156.5	197.2	40.7	118.9	78.2	92.9	4.84
	12:00	9.95	6.89	0.273	229	1.658	157.7	198.7	41.0	119.8	78.8	93.6	4.85
	12:05	10.24	7.09	0.275	229	1.698	158.7	200.0	41.3	120.6	79.3	94.2	4.84
	12:10	10.53	7.29	0.276	228	1.736	158.9	200.5	41.6	121.1	79.5	94.6	4.82
	12:15	**10.74**	**7.43**	**0.277**	**228**	**1.763**	**159.4**	**201.2**	**41.8**	**121.5**	**79.7**	**94.9**	**4.81**
	12:20	11.05	7.65	0.277	228	1.805	158.9	201.0	42.1	121.6	79.5	95.1	4.78
	12:25	11.32	7.84	0.277	228	1.841	158.6	200.9	42.3	121.6	79.3	95.2	4.75
	12:30	11.58	8.01	0.277	228	1.872	158.2	200.7	42.5	121.6	79.1	95.2	4.72
	12:45	12.36	8.56	0.278	227	1.973	157.9	201.2	43.3	122.2	78.9	95.9	4.65
	13:00	13.11	9.08	0.279	226	2.066	157.5	201.7	44.2	123.0	78.8	96.7	4.56
	13:15	13.83	9.57	0.281	225	2.151	157.9	202.8	44.9	123.9	79.0	97.5	4.52
	13:30	14.55	10.07	0.278	225	2.236	155.0	200.4	45.4	122.9	77.5	97.1	4.41
	13:45	15.31	10.60	0.281	224	2.324	155.9	201.8	45.9	123.9	78.0	97.9	4.40
	14:00	16.07	11.13	0.282	224	2.410	155.6	202.0	46.4	124.2	77.8	98.3	4.35
	14:15	16.82	11.64	0.283	223	2.491	155.2	202.0	46.8	124.4	77.6	98.5	4.32
	14:30	17.55	12.15	0.280	223	2.571	152.3	199.6	47.3	123.4	76.1	98.1	4.22
	14:45	18.26	12.64	0.278	222	2.646	150.1	197.9	47.8	122.8	75.0	97.8	4.14

Borehole No. : D059 — **Sample Depth m:-** 3.50 - 4.50
Sample No. : 1 — **Specimen Depth m:-** 4.10 - 4.30

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 — **Works Order No.:** 059

Compiled by: W S Wat
Checked by: H W Chung

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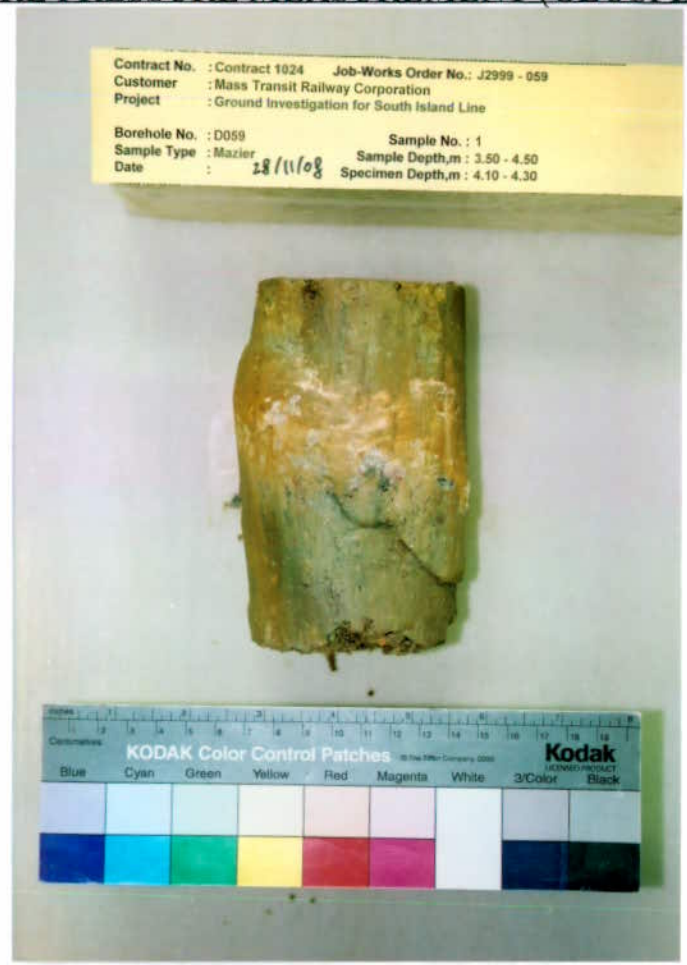
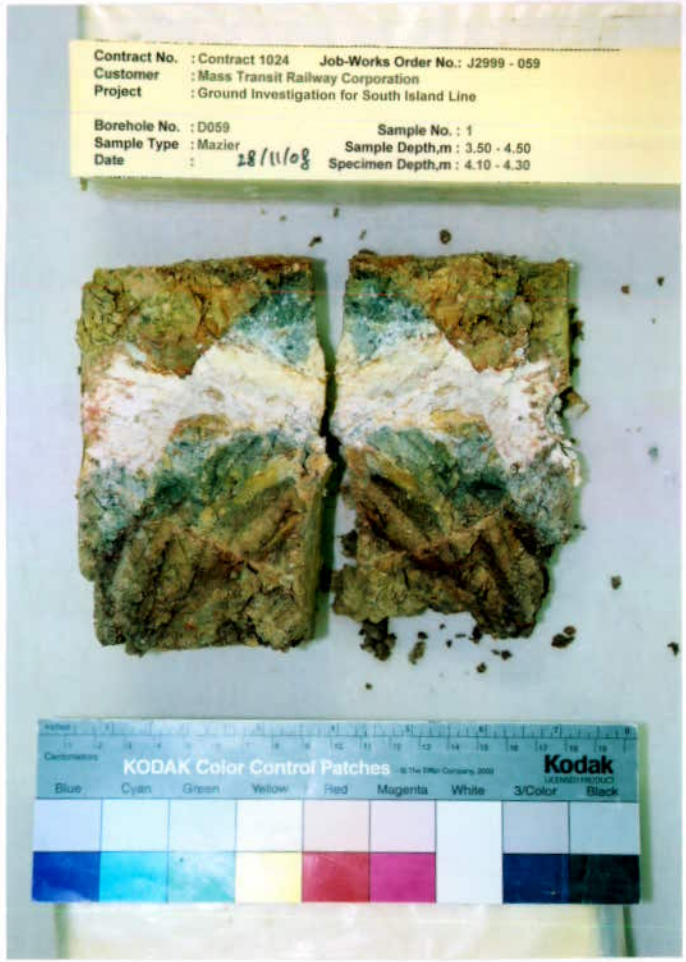
Form : GESR009.15 / Dec.13.04 / Issue 1 / Rev 1

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT (GEOSPEC 3 : 2001 Test Method 15.2)





Description : Dark brown, slightly gravelly, sandy SILT/CLAY

Sample Origin : CDT‡ ‡ Information provided by customer

Borehole No. :	D059	Sample No. : 1	Sample Depth m:-	3.50 - 4.50	Specimen Depth m:- 4.10 - 4.30

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line

Contract No. : Contract 1024
Job No. : J2999
Works Order No.: 059

Compiled by W S Wat

Checked by H W Chung

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	D059	D059	D059
Sample		no	1	1	1
Sample Type			Mazier	Mazier	Mazier
Stage		no	1	2	3
Sample Depth		m	3.50 - 4.50	3.50 - 4.50	3.50 - 4.50
Specimen Depth		m	4.30 - 4.50	4.30 - 4.50	4.30 - 4.50
INITIAL CONDITIONS					
Diameter	(D_o)	mm	73.5	73.9	74.1
Height	(H_o)	mm	145.0	143.0	141.4
Moisture Content	(W_o)	%	27	27	27
Bulk density	(ρ_o)	Mg/m^3	1.90	1.92	1.92
Dry density	(ρ_d)	Mg/m^3	1.50	1.50	1.51
Particle density	(ρ_s)		2.64	2.64	2.64
Voids Ratio	(e_o)		0.76	0.76	0.75
Degree of Saturation	(S_r)	%	93.1	96.0	95.9
DRAINAGE CONDITIONS			ONE END		
SATURATION					
Final Pore Pressure Coefficient B			1.00		
CONSOLIDATION					
Cell Pressure	(σ_3)	kPa	220	240	255
Back Pressure	(u_b)	kPa	205	205	205
Effective Pressure	(σ'_3)	kPa	15	35	50
Coefficient of Consolidation (t100) (C_{vi})		m^2/Year	2763.26	3221.81	4135.35
Coefficient of Volume Compressibility (m_{vi})		m^2/MN	0.30	0.25	0.14
Coefficient of Permeability (k)		m/s	2.53E-07	2.53E-07	1.78E-07
COMPRESSION TERMINATION CRITERION			MAXIMUM STRESS RATIO		MAX ($\sigma'1 - \sigma'3$)
COMPRESSION - INITIAL					
Moisture Content	(w)	%	27	27	27
Pore Pressure at the End of Consolidation		kPa	205	205	205
Effective Stress at the End of Consolidation		kPa	15	35	50
Bulk density	(ρ_o)	Mg/m^3	1.92	1.92	1.93
Dry density	(ρ_d)	Mg/m^3	1.50	1.51	1.52
Voids Ratio	(e)		0.76	0.75	0.74
Degree of Saturation	(S_r)	%	96.0	95.9	95.9

Customer : **Mass Transit Railway Corporation**
Project : **Ground Investigation for South Island Line**
Report No. : J2999-059.11
Contract No.: Contract 1024
Job No.: **J2999** **Works Order No.: 059**

Technician : W S Wat Checked By : Name : H W Chung Approved By : Signatory : **Lau Wai Cheong**
Tested Date: 24/11/2008 Date : 08/01/2009 Date : 08/01/2009

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Form : GESR009.6 / Nov.10.06 / Issue 1 / Rev 1

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	D059	D059	D059
Sample		no	1	1	1
Sample Type			Mazier	Mazier	Mazier
Stage		no	1	2	3
Sample Depth		m	3.50 - 4.50	3.50 - 4.50	3.50 - 4.50
Specimen Depth		m	4.30 - 4.50	4.30 - 4.50	4.30 - 4.50
COMPRESSION - FAILURE					
Cell Pressure		kPa	220	240	255
Rate of Strain		mm/min	0.048	0.047	0.047
CONDITIONS AT MAXIMUM STRESS RATIO					
Major Effective Principal Stress (σ'_1)		kPa	119	182	257
Corrected Deviator Stress ($\sigma'_1 - \sigma'_3$)		kPa	102	153	215
Minor Effective Principal Stress (σ'_3)		kPa	16	29	42
$s' = (\sigma'_1 + \sigma'_3)/2$		kPa	67	106	150
$t = (\sigma_1 - \sigma_3)/2$		kPa	51	76	107
Expanded Uncertainty of s' ^		kPa	-	-	-
Expanded Uncertainty of t ^		kPa	-	-	-
Pore pressure parameter A_f			-0.01	0.04	0.04
Strain at Failure	(εf)	%	1.1	2.2	3.8
COMPRESSION - FINAL					
Moisture Content	(W_f)	%	27	27	27
Bulk density	(ρ_o)	Mg/m^3	1.92	1.92	1.93
Dry density	(ρ_d)	Mg/m^3	1.50	1.51	1.52
Voids Ratio	(e_f)		0.76	0.75	0.74
Degree of Saturation	(S_f)	%	96.0	95.9	95.9

Notes -
1. The method of specimen preparation was in accordance with GEOSPEC 3 : 2001 :- Test method 13.3 : test specimen from undisturbed soil samples.
2. Sample received date : 29/9/2008
3. The determination of moisture content was in accordance with test method 5.1 of GEOSPEC 3 : 2001.
4. Particle density : 2.64 (Determined)
5. Maximum and minimum temperature recorded over the period of testing 19.5 - 20.7 °C.
6. Unavoidable variations from specified procedure : none
7. Comment on observed or inferred sample disturbance : none
8. Percentage by mass of soil particles larger than 1/5 of the diameter of specimen (%) : Nil
9. The specimen was selected by the laboratory.
   Name : W S Wat Designation : Senior Laboratory Technician
10. Sampling History : As Received

* Delete as appropriate ^ Upon request

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 Works Order No.: 059

Compiled by W S Wat
Checked by H W Chung

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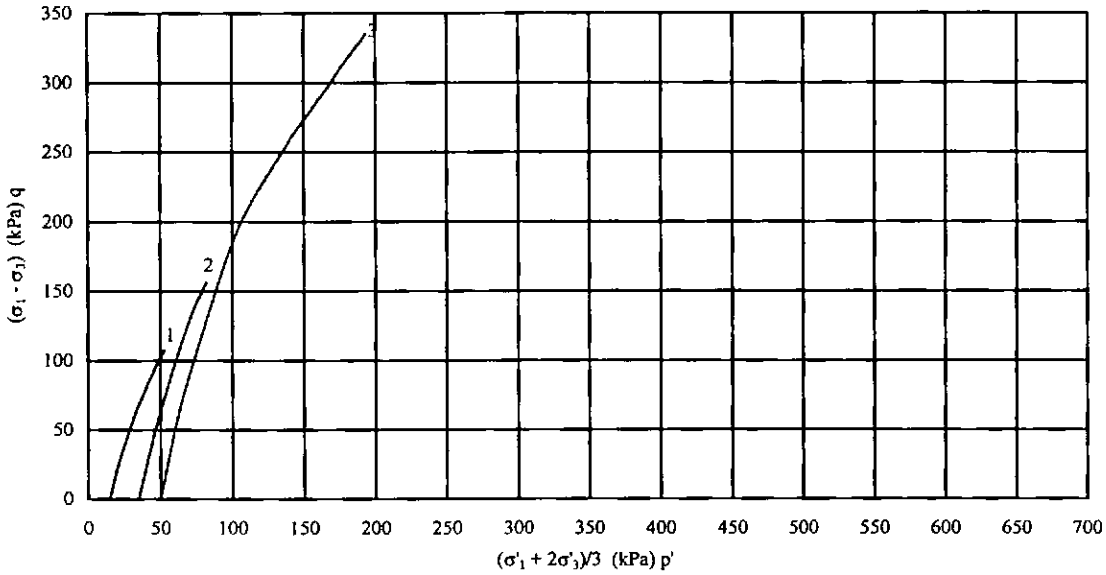
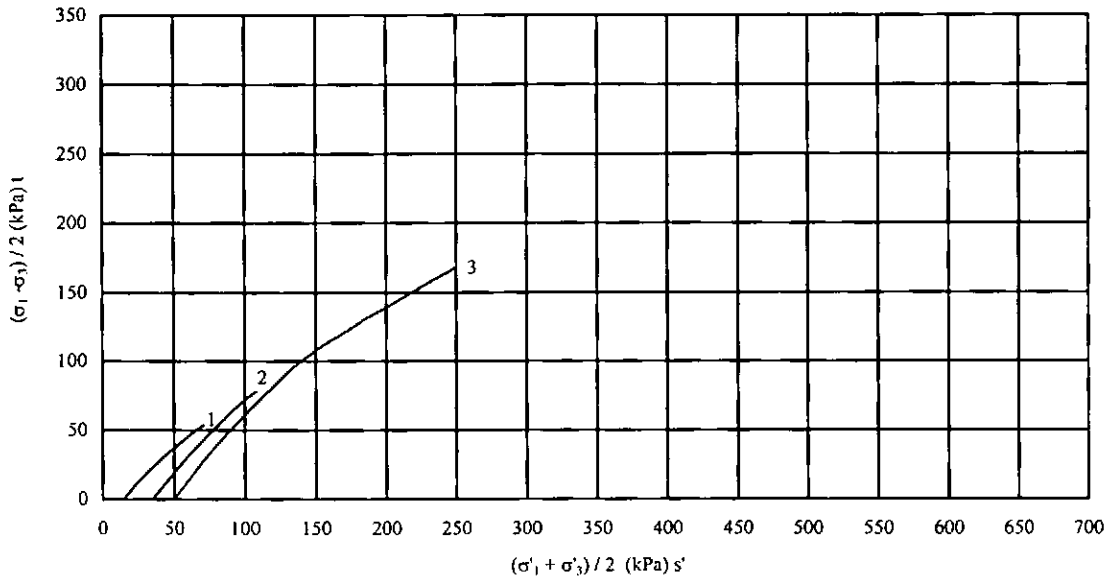
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

STRESS PATH PARAMETERS FOR EFFECTIVE STRESS

p' - q PLOT



s' - t PLOT



Borehole No. : D059 **Sample Depth m:-** 3.50 - 4.50

Sample No. : 1 **Specimen Depth m:-** 4.30 - 4.50

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.:** 059

Compiled by: W S Wat

Checked by: H W Chung

Form : GESR009.8 / Jun.02.03 / Issue 1 / Rev 0

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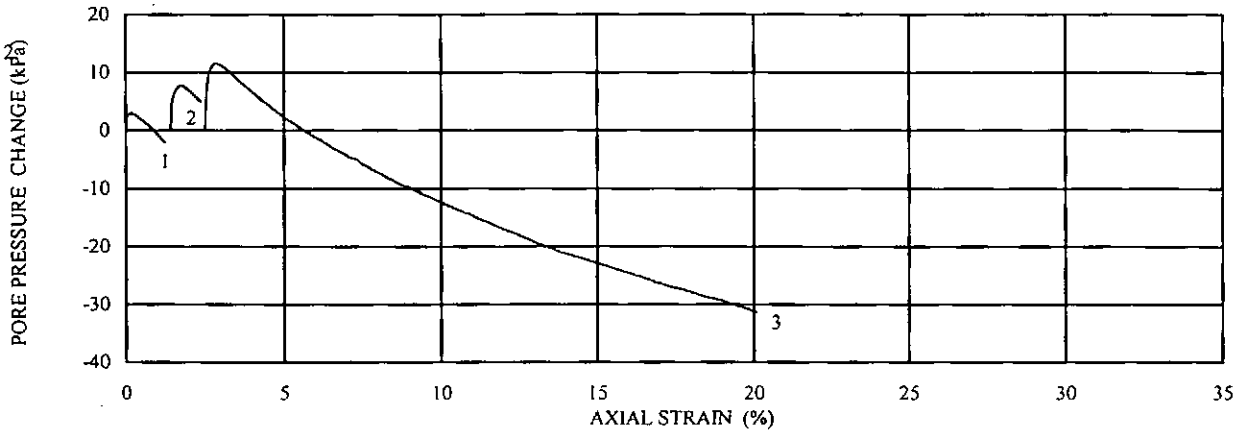
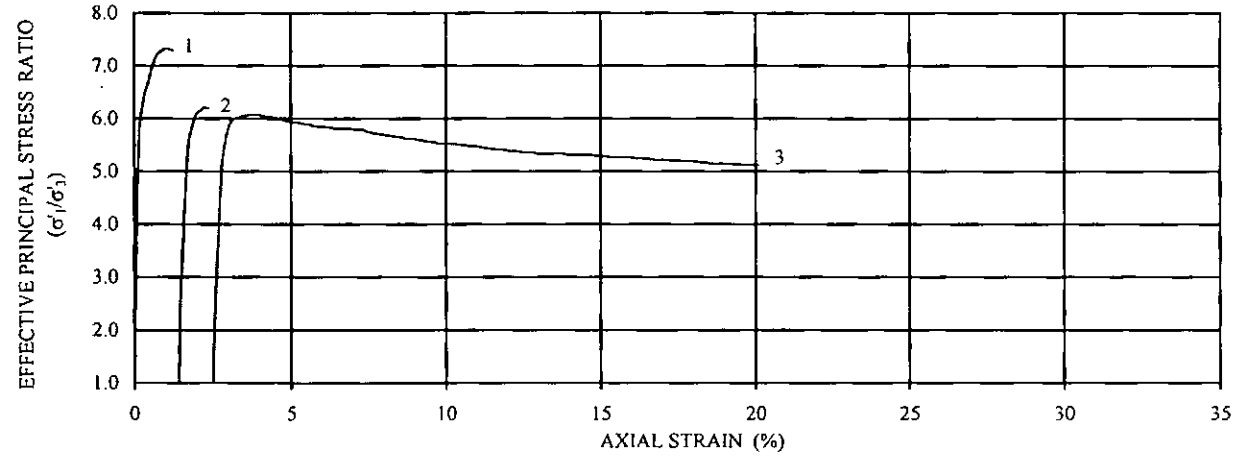
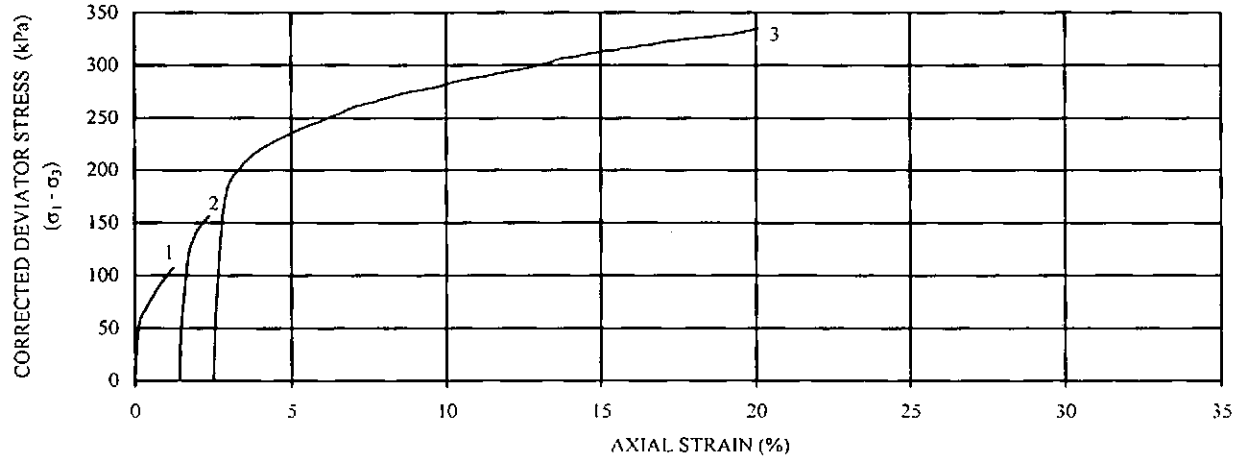
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

COMPRESSION







Borehole No. : D059 — **Sample Depth m:-** 3.50 - 4.50
Sample No. : 1 — **Specimen Depth m:-** 4.30 - 4.50

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 — **Works Order No.:** 059

Compiled by: W S Wat
Checked by: H W Chung

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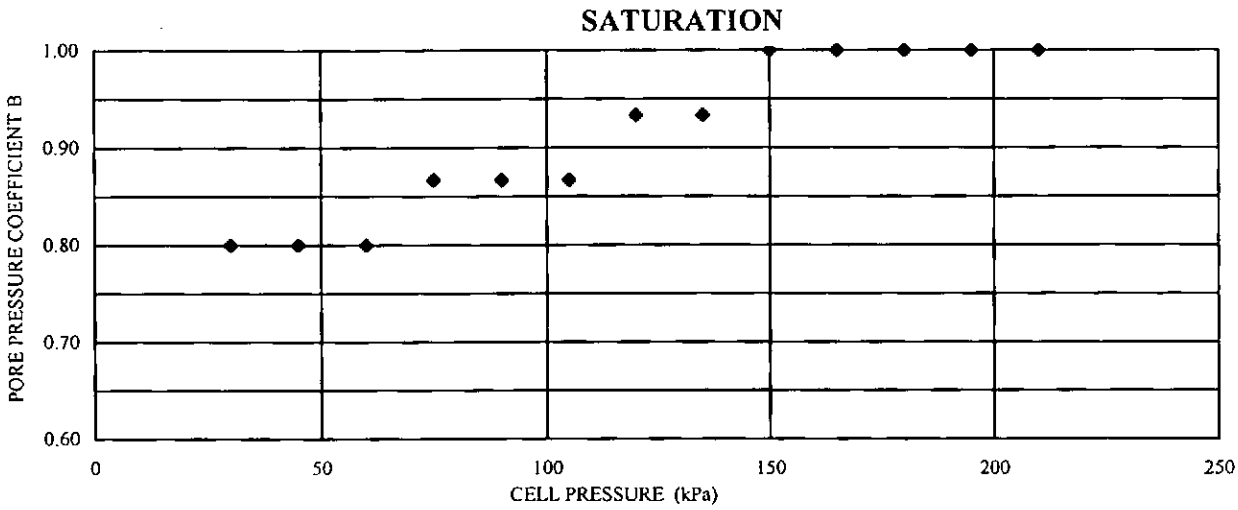
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2



Date	Time	Cell Pressure kPa	Back Pressure kPa	Pore Pressure kPa	Cumulative Volume of Water cm^3	Pore Pressure Parameter B
25/11/2008	08:30	0	0	-	0.0	
	08:37	15	-	11		-
	08:50	15	10	10	0.0	
	08:56	30	-	22		0.80
	09:09	30	25	25	0.4	
	09:15	45	-	37		0.80
	09:31	45	40	40	1.2	
	09:36	60	-	52		0.80
	09:53	60	55	55	2.2	
	10:00	75	-	68		0.87
	10:15	75	70	70	2.9	
	10:23	90	-	83		0.87
	10:45	90	85	85	3.6	
	10:51	105	-	98		0.87
	11:09	105	100	100	4.2	
	11:14	120	-	114		0.93
	11:40	120	115	115	5.4	
	11:48	135	-	129		0.93
	12:20	135	130	130	5.8	
	12:30	150	-	145		1.00
	12:50	150	145	145	6.0	
	13:00	165	-	160		1.00
	13:20	165	160	160	6.3	
	13:30	180	-	175		1.00
	14:04	180	175	175	6.4	

Borehole No. : D059 — **Sample Depth m:-** 3.50 - 4.50
Sample No. : 1 — **Specimen Depth m:-** 4.30 - 4.50

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 — **Works Order No.:** 059

Compiled by: W S Wat
Checked by: H W Chung

Form : GESR009.11 / Jun.02.03 / Issue 1 / Rev 0

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2
Saturation Continuation

Date	Time	Cell Pressure kPa	Back Pressure kPa	Pore Pressure kPa	Cumulative Volume of Water cm^3	Pore Pressure Parameter B
25/11/2008	14:10	195	-	190		1.00
	14:50	195	190	190	6.5	
	15:00	210	-	205		1.00
26/11/2008	08:45	210	205	205	7.6	

Borehole No. : D059 **Sample Depth m:-** 3.50 - 4.50
Sample No. : 1 **Specimen Depth m:-** 4.30 - 4.50
Customer : Mass Transit Railway Corporation — Compiled by W S Wat
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024 — Checked by H W Chung
Job No.: J2999 **Works Order No.:** 059

Form : GESR009.12 / Jul.22.02 / Issue 1 / Rev 0

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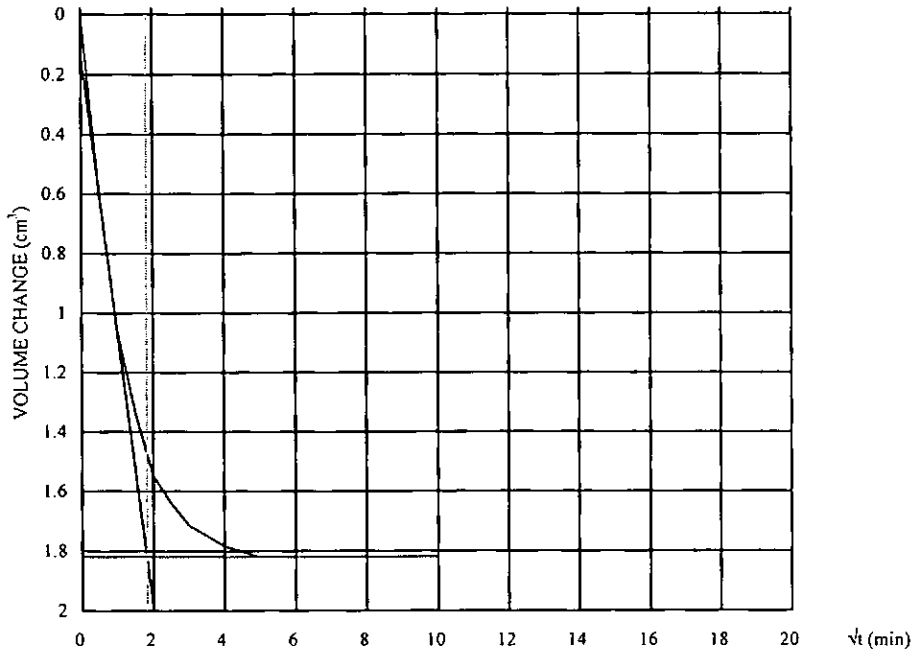
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

CONSOLIDATION (DRAINED PHASE) - Stage 1

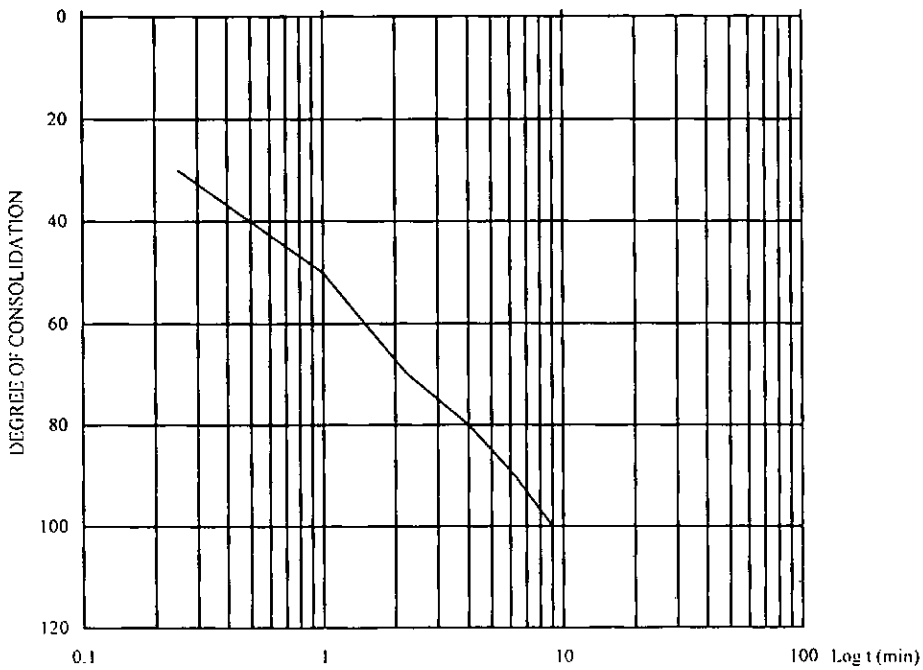


√t100 1.82 min

t100 3.31 min

tf 1.76 min

Calc. strain rate
5.774 mm/min



Borehole No. :	**D059**	**Sample Depth m:-**	**3.50 - 4.50**
Sample No. :	**1**	**Specimen Depth m:-**	**4.30 - 4.50**
Customer :	**Mass Transit Railway Corporation**		Complied by: W S Wat
Project :	**Ground Investigation for South Island Line**		
		Contract No.: Contract 1024	Checked by: H W Chung
Job No.:	**J2999**	**Works Order No.: 059**	

Form : GESR009.13 / Jun.02.03 / Issue 1 / Rev 0

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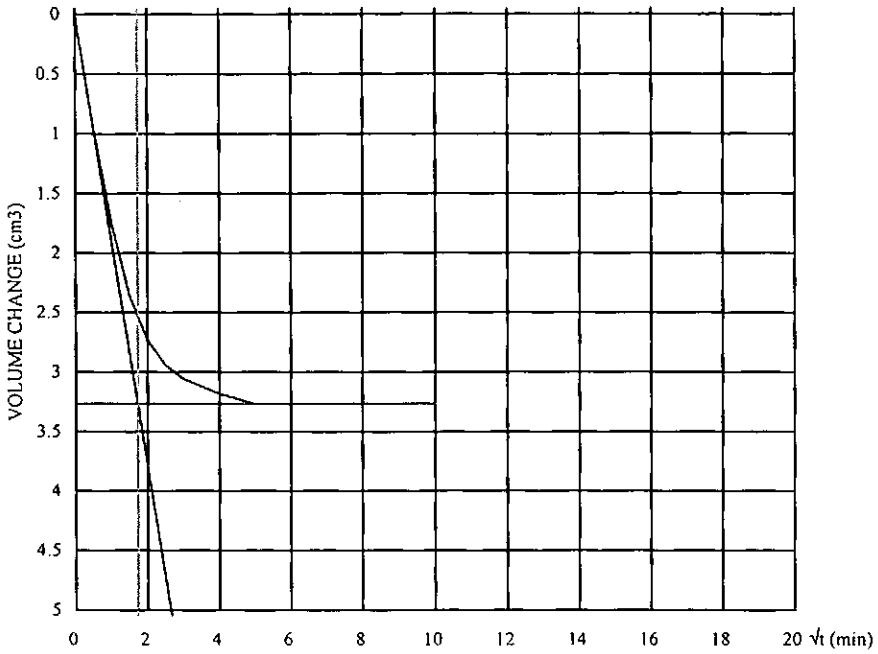
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

CONSOLIDATION (DRAINED PHASE) - Stage 2

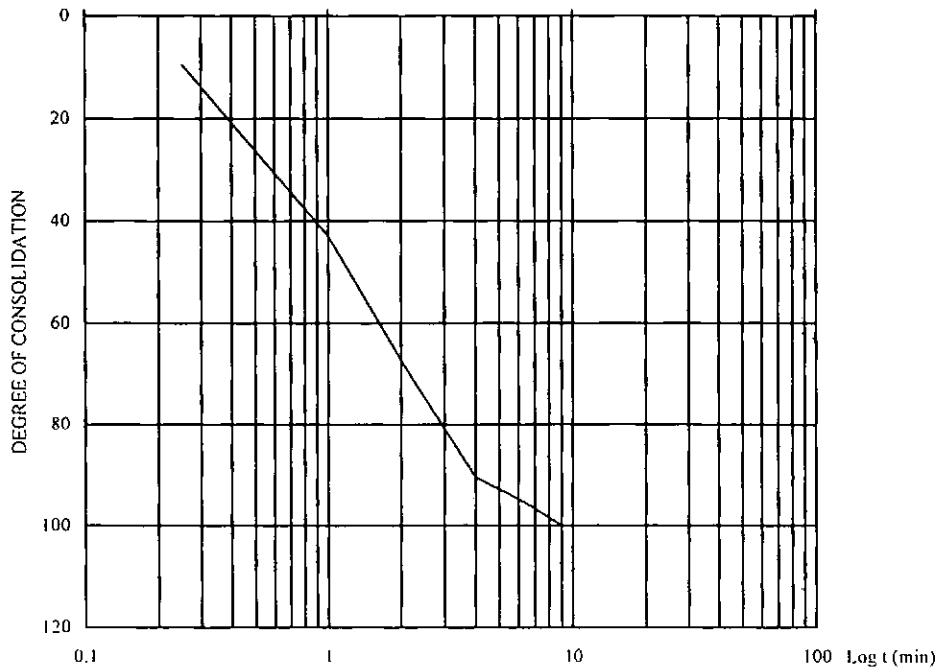


√t100 1.73 min

t100 2.98 min

tf 1.58 min

Calc. strain rate
6.327 mm/min



Borehole No. : D059 **Sample Depth m:-** 3.50 - 4.50

Sample No. : 1 **Specimen Depth m:-** 4.30 - 4.50

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.:** 059

Complied by: W S Wat

Checked by: H W Chung

Form : GESR009.13 / Jun.02.03 / Issue 1 / Rev.0

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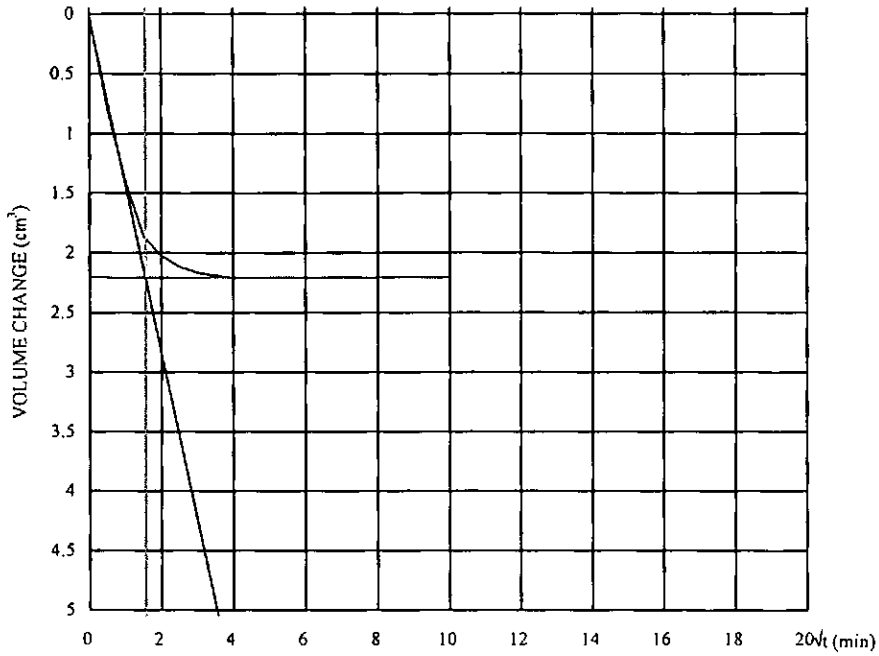
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

CONSOLIDATION (DRAINED PHASE) - Stage 3

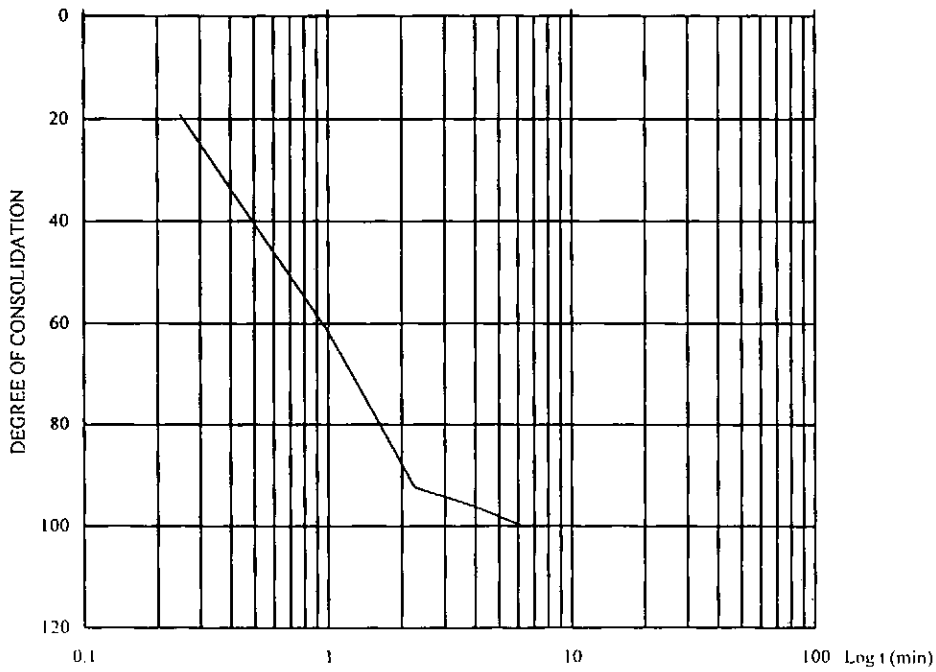


√t100 1.55 min

t100 2.41 min

tf 1.28 min

Calc. strain rate
7.750 mm/min



Borehole No. : D059 **Sample Depth m:-** 3.50 - 4.50

Sample No. : 1 **Specimen Depth m:-** 4.30 - 4.50

Customer :	**Mass Transit Railway Corporation**	Complied by
Project :	**Ground Investigation for South Island Line**	W S Wat
	Contract No.: Contract 1024	Checked by
Job No.:	**J2999** **Works Order No.: 059**	H W Chung

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Multi Stage				P.W.P,B.P					Effective Pressure	15			kPa
Side drains	No		Selected Machine Speed		0.048		mm/min		Rate of Strain	1.99			% per hr
FAILURE CRITERION													
Max. deviator Stress			☐		Max. Stress ratio		☒		Axial Strain %				☐
Stage :	1		Applied Pressure (kPa) - Cell :		220		Back :	205	P.R. factor	1.7606			kN/mm

Date	Time	Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
		Dial		P.R.No. 14	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio σ'_1/σ'_3
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	
26/11	09:35	0.00	0.00	0.060	205	0.000	0.0	15.0	15.0	15.0	0.0	15.0	1.00
	09:40	0.06	0.04	0.119	207	0.012	24.5	37.1	12.6	24.9	12.3	20.8	2.95
	09:45	0.24	0.16	0.194	208	0.047	55.6	67.6	12.0	39.8	27.8	30.5	5.63
	09:50	0.44	0.31	0.220	208	0.090	66.2	78.5	12.3	45.4	33.1	34.4	6.38
	09:55	0.67	0.46	0.239	207	0.133	73.9	86.9	13.0	50.0	37.0	37.6	6.69
	10:00	0.89	0.62	0.259	206	0.178	82.1	95.7	13.6	54.6	41.0	41.0	7.03
	10:05	1.10	0.76	0.276	206	0.217	88.9	103.2	14.3	58.8	44.5	43.9	7.22
	10:10	1.37	0.94	0.295	205	0.268	96.5	111.8	15.3	63.6	48.3	47.5	7.31
	10:15	**1.59**	**1.10**	**0.310**	**204**	**0.312**	**102.5**	**118.7**	**16.2**	**67.4**	**51.2**	**50.4**	**7.33**
	10:20	1.81	1.25	0.323	203	0.353	107.6	124.7	17.1	70.9	53.8	53.0	7.29

Borehole No. :	**D059**	**Sample Depth m:- 3.50 - 4.50**	
Sample No. :	**1**	**Specimen Depth m:- 4.30 - 4.50**	
Customer :	**Mass Transit Railway Corporation**		Compiled by
Project :	**Ground Investigation for South Island Line**		W S Wat
		Contract No.: Contract 1024	Checked by
Job No.:	**J2999**	**Works Order No.: 059**	H W Chung

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

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Multi Stage		P.W.P,B.P			Effective Pressure	35	kPa
Side drains	No	Selected Machine Speed	0.047	mm/min	Rate of Strain	1.98	% per hr
FAILURE CRITERION							
Max. deviator Stress	☐	Max. Stress ratio	☒		Axial Strain %		☐
Stage : 2	Applied Pressure (kPa) - Cell :	240	Back :	205	P.R. factor	1.7606	kN/mm

Date	Time	Strain Dial	Strain	Load P.R.No. 14	Pore Pressure	Dev. stress Corr.	Dev. stress q $\sigma_1 - \sigma_3$	Effective Stress Parameters: Effective Stress σ'_1	Effective Stress σ'_3	s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio σ'_1/σ'_3
		mm	%	mm	kPa	kPa				2	2	3	
26/11	12:40	2.07	1.43	0.073	205	0.000	0.0	35.0	35.0	35.0	0.0	35.0	1.00
	12:45	2.14	1.47	0.181	210	0.412	44.1	74.6	30.5	52.5	22.0	45.2	2.44
	12:50	2.28	1.57	0.263	212	0.439	77.7	106.0	28.3	67.2	38.9	54.2	3.75
	12:55	2.42	1.67	0.334	213	0.465	106.8	134.3	27.5	80.9	53.4	63.1	4.88
	13:00	2.56	1.76	0.379	213	0.489	125.2	152.4	27.2	89.8	62.6	68.9	5.60
	13:05	2.88	1.99	0.422	212	0.549	142.4	170.4	28.0	99.2	71.2	75.5	6.09
	13:10	3.05	2.11	0.434	211	0.580	147.1	175.7	28.6	102.2	73.6	77.6	6.14
[redacted]	**13:15**	**3.25**	**2.24**	**0.448**	**211**	**0.614**	**152.6**	**181.9**	**29.3**	**105.6**	**76.3**	**80.2**	**6.21**
	13:20	3.45	2.38	0.458	210	0.650	156.4	186.5	30.1	108.3	78.2	82.2	6.20

Borehole No. : D059 — **Sample Depth m:-** 3.50 - 4.50
Sample No. : 1 — **Specimen Depth m:-** 4.30 - 4.50

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 — **Works Order No.:** 059

Compiled by: W S Wat
Checked by: H W Chung

Form : GESR009.14 / Dec.13.04 / Issue 1 / Rev 1

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

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HKAS HOKLAS 035

Multi Stage		P.W.P,B.P		Effective Pressure	50 kPa
Side drains	No	Selected Machine Speed	0.047 mm/min	Rate of Strain	2.00 % per hr
FAILURE CRITERION					
Max. deviator Stress	☐	Max. Stress ratio	☒	Axial Strain %	☐
Stage : 3	Applied Pressure (kPa) - Cell :	255	Back : 205	P.R. factor	1.7606 kN/mm

Date	Time	Strain Dial	Strain %	Load P.R.No. 14	Pore Pressure	Dev. stress Corr.	Dev. stress q $\sigma_1 - \sigma_3$	Effective Stress σ'_1	Effective Stress σ'_3	s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio σ'_1/σ'_3
		mm	%	mm	kPa	kPa				2	2	3	
27/11	08:35	3.62	2.50	0.089	205	0.000	0.0	50.0	50.0	50.0	0.0	50.0	1.00
	08:40	3.70	2.56	0.218	212	0.695	52.0	95.3	43.3	69.3	26.0	60.6	2.20
	08:45	3.81	2.63	0.306	215	0.713	87.9	128.3	40.4	84.4	44.0	69.7	3.18
	08:50	3.93	2.71	0.395	216	0.733	124.2	163.4	39.2	101.3	62.1	80.6	4.17
	08:55	4.09	2.82	0.488	217	0.760	161.9	200.3	38.4	119.4	81.0	92.4	5.22
	09:00	4.31	2.98	0.545	216	0.799	184.8	223.5	38.7	131.1	92.4	100.3	5.78
	09:05	4.55	3.14	0.570	216	0.839	194.6	233.8	39.2	136.5	97.3	104.1	5.96
	09:10	4.79	3.31	0.586	215	0.880	200.7	240.7	40.0	140.4	100.4	106.9	6.02
	09:15	5.01	3.46	0.600	214	0.916	206.0	246.8	40.8	143.8	103.0	109.5	6.05
	09:20	5.24	3.62	0.612	213	0.954	210.5	252.1	41.6	146.9	105.3	111.8	6.06
	09:25	**5.47**	**3.78**	**0.624**	**213**	**0.991**	**215.0**	**257.3**	**42.3**	**149.8**	**107.5**	**114.0**	**6.08**
	09:30	5.70	3.94	0.634	212	1.029	218.6	261.7	43.1	152.4	109.3	116.0	6.07
	09:35	5.98	4.13	0.644	211	1.072	222.1	266.1	44.0	155.1	111.1	118.0	6.05
	09:40	6.21	4.29	0.652	210	1.109	224.9	269.6	44.7	157.2	112.5	119.7	6.03
	09:45	6.43	4.44	0.659	210	1.143	227.4	272.7	45.3	159.0	113.7	121.1	6.02
	09:50	6.81	4.70	0.670	209	1.201	231.1	277.5	46.4	161.9	115.5	123.4	5.98
	09:55	6.99	4.83	0.676	208	1.230	233.1	280.1	47.0	163.6	116.6	124.7	5.96
	10:00	7.17	4.95	0.681	208	1.256	234.8	282.3	47.5	164.9	117.4	125.8	5.94
	10:05	7.42	5.12	0.688	207	1.293	237.1	285.2	48.1	166.7	118.6	127.1	5.93
	10:10	7.66	5.29	0.695	206	1.330	239.4	288.1	48.7	168.4	119.7	128.5	5.92
	10:15	7.93	5.48	0.702	206	1.371	241.7	291.1	49.4	170.3	120.9	130.0	5.89
	10:20	8.18	5.65	0.709	205	1.407	244.0	294.0	50.0	172.0	122.0	131.3	5.88
	10:25	8.39	5.79	0.713	205	1.436	245.2	295.7	50.5	173.1	122.6	132.2	5.85
	10:30	8.62	5.95	0.719	204	1.469	247.1	298.1	51.0	174.5	123.5	133.4	5.84
	10:35	8.87	6.12	0.726	204	1.504	249.4	300.9	51.5	176.2	124.7	134.6	5.84
	10:40	9.11	6.29	0.733	203	1.539	251.6	303.7	52.1	177.9	125.8	136.0	5.83
	10:45	9.32	6.43	0.738	202	1.567	253.2	305.8	52.6	179.2	126.6	137.0	5.81
	10:50	9.59	6.62	0.746	202	1.605	255.8	309.0	53.2	181.1	127.9	138.5	5.81
	10:55	9.81	6.77	0.753	201	1.635	258.1	311.7	53.6	182.6	129.0	139.6	5.81
	11:00	10.03	6.93	0.759	201	1.667	259.9	314.0	54.1	184.1	130.0	140.7	5.80
	11:05	10.28	7.10	0.765	200	1.700	261.8	316.5	54.7	185.6	130.9	142.0	5.79
	11:10	10.55	7.29	0.770	200	1.737	263.1	318.0	54.9	186.5	131.6	142.6	5.79
	11:15	10.79	7.45	0.774	199	1.767	264.2	319.9	55.7	187.8	132.1	143.8	5.74
	11:20	11.06	7.64	0.779	199	1.803	265.6	321.8	56.2	189.0	132.8	144.7	5.73
	11:25	11.27	7.78	0.784	198	1.830	267.1	323.8	56.7	190.2	133.5	145.7	5.71
	11:30	11.53	7.96	0.789	198	1.864	268.4	325.6	57.2	191.4	134.2	146.7	5.69
	11:35	11.79	8.14	0.794	197	1.897	269.8	327.5	57.7	192.6	134.9	147.6	5.68
	11:40	12.04	8.31	0.799	197	1.928	271.2	329.4	58.2	193.8	135.6	148.6	5.66
	11:45	12.26	8.47	0.804	196	1.957	272.6	331.2	58.6	194.9	136.3	149.5	5.65

Borehole No. : D059 — Sample Depth m:- 3.50 - 4.50

Sample No. : 1 — Specimen Depth m:- 4.30 - 4.50

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 — Works Order No.: 059

Compiled by: W S Wat

Checked by: H W Chung

Form : GESR009.14 / Dec.13.04 / Issue 1 / Rev I

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2
Shearing Continuation

Gammon

HKAS HOKLAS 058

FAILURE CRITERION

Max. deviator Stress ☐ | Max. Stress ratio ☒ | Axial Strain % ☐

Stage : 3		Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
Date	Time	Dial		P.R.No. 14	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
27/11	11:50	12.51	8.64	0.808	196	1.988	273.6	332.7	59.1	195.9	136.8	150.3	5.63
	11:55	12.74	8.80	0.813	196	2.016	275.0	334.5	59.5	197.0	137.5	151.2	5.62
	12:00	12.98	8.96	0.815	195	2.045	275.2	334.9	59.7	197.3	137.6	151.4	5.61
	12:05	13.19	9.11	0.820	195	2.071	276.7	336.9	60.2	198.5	138.3	152.4	5.60
	12:10	13.46	9.29	0.824	194	2.103	277.6	338.2	60.6	199.4	138.8	153.1	5.58
	12:15	13.66	9.43	0.827	194	2.127	278.3	339.3	61.0	200.1	139.1	153.8	5.56
	12:20	13.94	9.63	0.831	194	2.162	279.1	340.5	61.4	201.0	139.6	154.4	5.55
	12:25	14.21	9.81	0.836	193	2.192	280.4	342.3	61.9	202.1	140.2	155.4	5.53
	12:30	14.45	9.97	0.841	193	2.219	281.8	344.1	62.3	203.2	140.9	156.2	5.52
	12:35	14.69	10.14	0.847	192	2.248	283.5	346.2	62.7	204.4	141.7	157.2	5.52
	12:40	14.94	10.31	0.852	192	2.276	284.8	347.9	63.1	205.5	142.4	158.0	5.51
	12:45	15.18	10.48	0.856	192	2.305	285.7	349.2	63.5	206.4	142.9	158.7	5.50
	12:50	15.42	10.64	0.860	191	2.331	286.7	350.5	63.8	207.1	143.3	159.4	5.49
	12:55	15.67	10.82	0.865	191	2.360	288.0	352.3	64.3	208.3	144.0	160.3	5.48
	13:00	15.87	10.96	0.868	191	2.383	288.6	353.1	64.5	208.8	144.3	160.7	5.47
	13:05	16.13	11.13	0.872	190	2.411	289.5	354.5	65.0	209.7	144.7	161.5	5.45
	13:10	16.38	11.31	0.876	190	2.439	290.4	355.8	65.4	210.6	145.2	162.2	5.44
	13:15	16.71	11.54	0.882	189	2.476	291.8	357.7	65.9	211.8	145.9	163.2	5.43
	13:20	16.90	11.67	0.885	189	2.497	292.5	358.8	66.3	212.5	146.2	163.8	5.41
	13:25	17.13	11.83	0.889	188	2.522	293.4	360.0	66.6	213.3	146.7	164.4	5.41
	13:30	17.42	12.03	0.894	188	2.553	294.5	361.6	67.1	214.4	147.3	165.3	5.39
	13:35	17.66	12.19	0.898	188	2.578	295.4	362.8	67.4	215.1	147.7	165.9	5.38
	13:40	17.88	12.35	0.902	187	2.602	296.4	364.1	67.7	215.9	148.2	166.5	5.38
	13:45	18.13	12.52	0.905	187	2.628	296.9	365.0	68.1	216.5	148.4	167.1	5.36
	13:50	18.34	12.66	0.909	187	2.650	297.8	366.2	68.4	217.3	148.9	167.7	5.35
	13:55	18.59	12.84	0.914	186	2.677	299.0	367.8	68.8	218.3	149.5	168.5	5.35
	14:00	18.85	13.02	0.920	186	2.704	300.5	369.8	69.3	219.6	150.3	169.5	5.34
	14:05	19.06	13.16	0.924	185	2.725	301.5	371.1	69.6	220.3	150.7	170.1	5.33
	14:10	19.32	13.34	0.929	185	2.752	302.6	372.5	69.9	221.2	151.3	170.8	5.33
	14:15	19.58	13.52	0.936	185	2.779	304.5	374.8	70.3	222.6	152.3	171.8	5.33
	14:20	19.80	13.67	0.942	184	2.801	306.1	376.7	70.6	223.7	153.1	172.6	5.34
	14:25	20.06	13.85	0.946	184	2.828	306.9	377.9	71.0	224.4	153.4	173.3	5.32
	14:30	20.33	14.04	0.951	184	2.856	308.0	379.3	71.3	225.3	154.0	174.0	5.32
	14:35	20.61	14.23	0.955	183	2.883	308.7	380.3	71.6	226.0	154.4	174.5	5.31
	14:40	20.86	14.40	0.960	183	2.908	309.9	381.8	71.9	226.8	154.9	175.2	5.31
	14:45	21.07	14.55	0.964	183	2.930	310.8	382.9	72.1	227.5	155.4	175.7	5.31
	14:50	21.31	14.71	0.968	183	2.953	311.5	383.9	72.4	228.2	155.8	176.2	5.30
	14:55	21.56	14.88	0.972	182	2.978	312.3	385.0	72.7	228.9	156.2	176.8	5.30
	15:00	21.77	15.03	0.976	182	2.999	313.2	386.1	72.9	229.5	156.6	177.3	5.30
	15:05	22.01	15.20	0.979	182	3.023	313.6	386.8	73.2	230.0	156.8	177.7	5.28
	15:10	22.25	15.36	0.981	182	3.046	313.7	387.2	73.5	230.3	156.8	178.1	5.27

Borehole No. : D059 — **Sample Depth m:-** 3.50 - 4.50

Sample No. : 1 — **Specimen Depth m:-** 4.30 - 4.50

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 — **Works Order No.:** 059

Compiled by: W S Wat

Checked by: H W Chung

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21 Chun Wang Street, Tseung Kwan O Industrial Estate,
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TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2
Shearing Continuation

Gammon

HKAS

FAILURE CRITERION

Max. deviator Stress ☐ | Max. Stress ratio ☒ | Axial Strain % ☐

Stage : 3		Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
Date	Time	Dial		P.R.No. 14	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
27/11	15:15	22.51	15.54	0.986	181	3.072	314.8	388.6	73.8	231.2	157.4	178.7	5.26
	15:20	22.77	15.72	0.992	181	3.098	316.2	390.3	74.1	232.2	158.1	179.5	5.27
	15:25	23.00	15.88	0.995	181	3.120	316.6	391.0	74.4	232.7	158.3	179.9	5.26
	15:30	23.30	16.08	1.000	180	3.149	317.6	392.3	74.7	233.5	158.8	180.6	5.25
	15:35	23.51	16.23	1.004	180	3.170	318.4	393.4	75.0	234.2	159.2	181.1	5.25
	15:40	23.72	16.38	1.008	180	3.191	319.2	394.4	75.2	234.8	159.6	181.6	5.24
	15:45	23.94	16.53	1.011	180	3.212	319.6	395.1	75.5	235.3	159.8	182.0	5.23
	15:50	24.18	16.70	1.015	179	3.236	320.4	396.2	75.8	236.0	160.2	182.6	5.23
	15:55	24.43	16.86	1.020	179	3.258	321.4	397.6	76.2	236.9	160.7	183.3	5.22
	16:00	24.68	17.04	1.025	179	3.284	322.5	398.9	76.4	237.6	161.2	183.9	5.22
	16:05	24.92	17.20	1.028	178	3.306	322.8	399.6	76.8	238.2	161.4	184.4	5.20
	16:10	25.17	17.37	1.032	178	3.330	323.5	400.5	77.0	238.8	161.8	184.8	5.20
	16:15	25.46	17.58	1.037	178	3.359	324.4	401.6	77.2	239.4	162.2	185.3	5.20
	16:20	25.75	17.78	1.040	178	3.387	324.7	402.2	77.5	239.8	162.3	185.7	5.19
	16:25	25.92	17.89	1.043	177	3.403	325.2	402.9	77.7	240.3	162.6	186.1	5.19
	16:30	26.15	18.06	1.047	177	3.427	325.9	403.9	78.0	240.9	162.9	186.6	5.18
	16:35	26.43	18.25	1.052	177	3.453	326.8	405.1	78.3	241.7	163.4	187.2	5.17
	16:40	26.65	18.40	1.054	176	3.474	326.9	405.5	78.6	242.0	163.4	187.6	5.16
	16:45	26.90	18.57	1.057	176	3.498	327.2	406.0	78.8	242.4	163.6	187.9	5.15
	16:50	27.15	18.75	1.061	176	3.524	327.8	406.8	79.0	242.9	163.9	188.3	5.15
	16:55	27.37	18.90	1.066	176	3.545	328.9	408.1	79.2	243.6	164.4	188.8	5.15
	17:00	27.72	19.14	1.070	175	3.579	329.2	408.9	79.7	244.3	164.6	189.4	5.13
	17:05	27.91	19.27	1.074	175	3.597	330.0	409.9	79.9	244.9	165.0	189.9	5.13
	17:10	28.11	19.41	1.078	175	3.617	330.8	410.9	80.1	245.5	165.4	190.4	5.13
	17:15	28.45	19.64	1.085	175	3.650	332.1	412.6	80.5	246.6	166.1	191.2	5.13
	17:20	28.63	19.77	1.089	174	3.668	332.9	413.6	80.7	247.2	166.5	191.7	5.13
	17:25	28.84	19.91	1.094	174	3.688	334.0	415.0	81.0	248.0	167.0	192.3	5.12
	17:30	29.08	20.08	1.099	174	3.712	334.9	416.2	81.3	248.8	167.5	192.9	5.12

Borehole No. : D059 — **Sample Depth m:- 3.50 - 4.50**

Sample No. : 1 — **Specimen Depth m:- 4.30 - 4.50**

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 — **Works Order No.: 059**

Compiled by: W S Wat

Checked by: H W Chung

Form : GESR009.15 / Dec.13.04 / Issue 1 / Rev 1

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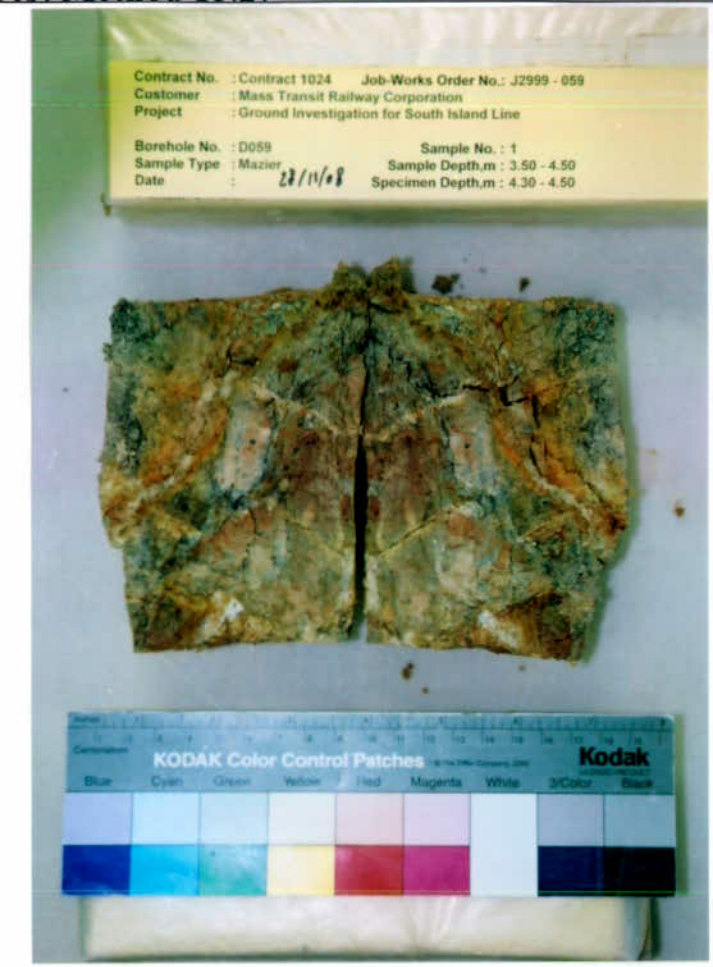
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT (GEOSPEC 3 : 2001 Test Method 15.2)



Description : Dark brown, slightly gravelly, sandy SILT/CLAY

Sample Origin : CDT ‡ ‡ Information provided by customer

Borehole No. : D059	Sample No. : 1	Sample Depth m:- 3.50 - 4.50	Specimen Depth m:- 4.30 - 4.50	
Customer : Mass Transit Railway Corporation Project : Ground Investigation for South Island Line		Contract No.: Contract 1024 Job No.: J2999 Works Order No.: 059		Compiled by W S Wat Checked by H W Chung

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	D060		
Sample		no	3		
Sample Type			Mazier		
Stage		no	1		
Sample Depth		m	5.20 - 6.20		
Specimen Depth		m	6.00 - 6.20		
INITIAL CONDITIONS					
Diameter	(D_o)	mm	74.1		
Height	(H_o)	mm	145.0		
Moisture Content	(W_o)	%	21		
Bulk density	(ρ_o)	Mg/m^3	1.96		
Dry density	(ρ_d)	Mg/m^3	1.62		
Particle density	(ρ_s)		2.65		
Voids Ratio	(e_o)		0.63		
Degree of Saturation	(S_r)	%	87.9		
DRAINAGE CONDITIONS			ONE END		
SATURATION					
Final Pore Pressure Coefficient B			0.98		
CONSOLIDATION					
Cell Pressure	(σ_3)	kPa	305		
Back Pressure	(u_b)	kPa	245		
Effective Pressure	(σ'_3)	kPa	60		
Coefficient of Consolidation (t100) (C_{vi})		m^2/Year	205.19		
Coefficient of Volume Compressibility (m_{vi})		m^2/MN	0.36		
Coefficient of Permeability (k)		m/s	2.32E-08		
COMPRESSION TERMINATION CRITERION			MAXIMUM DEVIATOR STRESS		
COMPRESSION - INITIAL					
Moisture Content	(w)	%	22		
Pore Pressure at the End of Consolidation		kPa	245		
Effective Stress at the End of Consolidation		kPa	60		
Bulk density	(ρ_o)	Mg/m^3	2.01		
Dry density	(ρ_d)	Mg/m^3	1.65		
Voids Ratio	(e)		0.60		
Degree of Saturation	(S_r)	%	95.8		

Customer : **Mass Transit Railway Corporation**

Project : **Ground Investigation for South Island Line**

Report No. : J2999-059.11

Contract No.: Contract 1024

Job No.: **J2999** **Works Order No.: 059**

Technician : W S Wat

Checked By : Name : H W Chung Date : 08/01/2009

Approved By : Signatory : **Lau Wai Cheong** Date : 08/01/2009

Tested Date: 17/12/2008

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Form : GESR009.6 / Nov.10.06 / Issue 1 / Rev 1

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	D060		
Sample		no	3		
Sample Type			Mazier		
Stage		no	1		
Sample Depth		m	5.20 - 6.20		
Specimen Depth		m	6.00 - 6.20		
COMPRESSION - FAILURE					
Cell Pressure		kPa	305		
Rate of Strain		mm/min	0.048		
CONDITIONS MAXIMUM DEVIATOR STRESS					
Major Effective Principal Stress (σ'_1)		kPa	263		
Corrected Deviator Stress ($\sigma'_1 - \sigma'_3$)		kPa	207		
Minor Effective Principal Stress (σ'_3)		kPa	57		
$s' = (\sigma'_1 + \sigma'_3)/2$		kPa	160		
$t = (\sigma_1 - \sigma_3)/2$		kPa	103		
Expanded Uncertainty of s' ^		kPa	-		
Expanded Uncertainty of t ^		kPa	-		
Pore pressure parameter A_f			0.02		
Strain at Failure	(εf)	%	5.6		
COMPRESSION - FINAL					
Moisture Content	(W_f)	%	22		
Bulk density	(ρ_o)	Mg/m^3	2.01		
Dry density	(ρ_d)	Mg/m^3	1.65		
Voids Ratio	(e_f)		0.60		
Degree of Saturation	(S_f)	%	95.8		

Notes -
1. The method of specimen preparation was in accordance with GEOSPEC 3 : 2001 :- Test method 13.3 : test specimen from undisturbed soil samples.
2. Sample received date : 29/9/2008
3. The determination of moisture content was in accordance with test method 5.1 of GEOSPEC 3 : 2001.
4. Particle density : 2.65 (Assumed)
5. Maximum and minimum temperature recorded over the period of testing 19.5 - 20.7 °C.
6. Unavoidable variations from specified procedure : none
7. Comment on observed or inferred sample disturbance : none
8. Percentage by mass of soil particles larger than 1/5 of the diameter of specimen (%) : Nil
9. The specimen was selected by the laboratory.
   Name : W S Wat Designation : Senior Laboratory Technician
10. Sampling History : As Received

* Delete as appropriate ^ Upon request

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.: 059**

Compiled by W S Wat
Checked by H W Chung

Form : GESR009.7 / Nov.10.06 / Issue 1 / Rev 1

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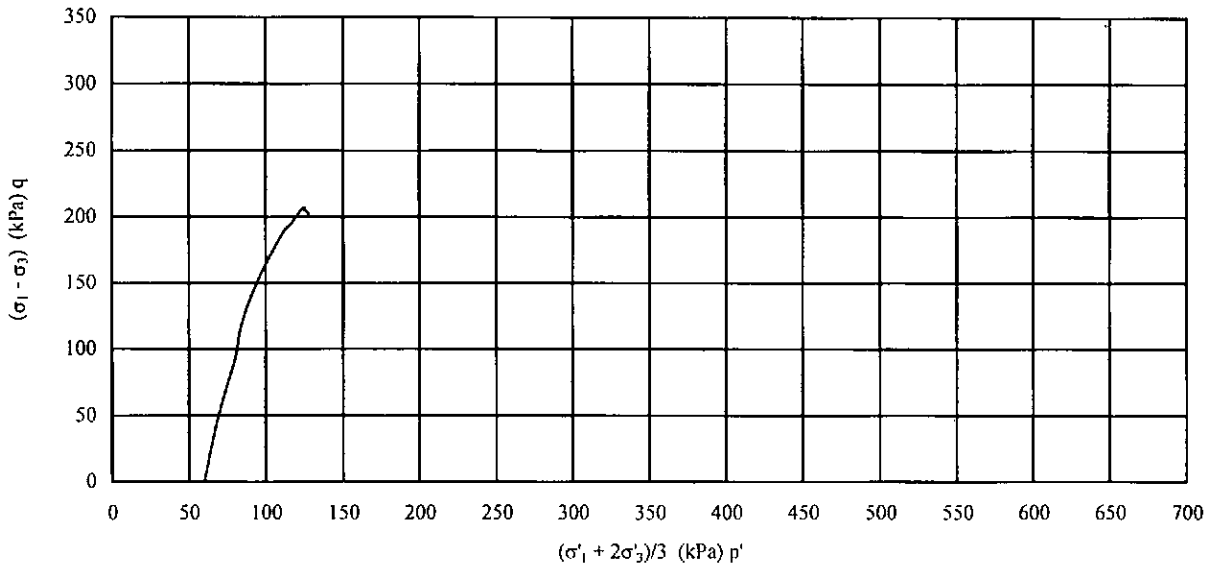
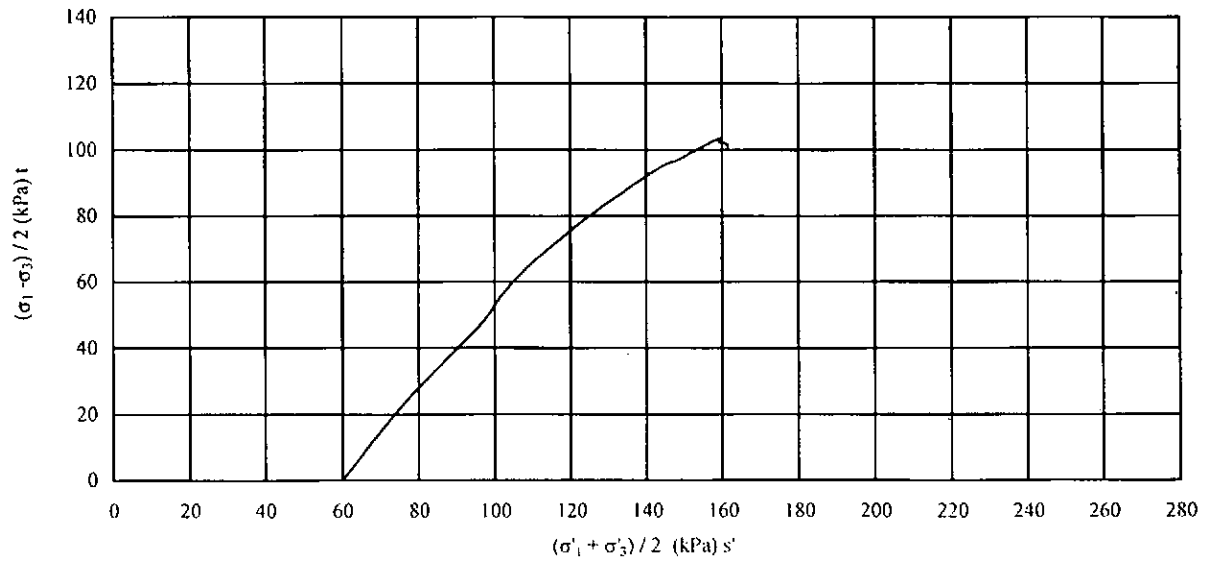
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

STRESS PATH PARAMETERS FOR EFFECTIVE STRESS

p' - q PLOT



s' - t PLOT



Borehole No. : D060 **Sample Depth m:-** 5.20 - 6.20
Sample No. : 3 **Specimen Depth m:-** 6.00 - 6.20

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.:** 059

Compiled by: W S Wat
Checked by: H W Chung

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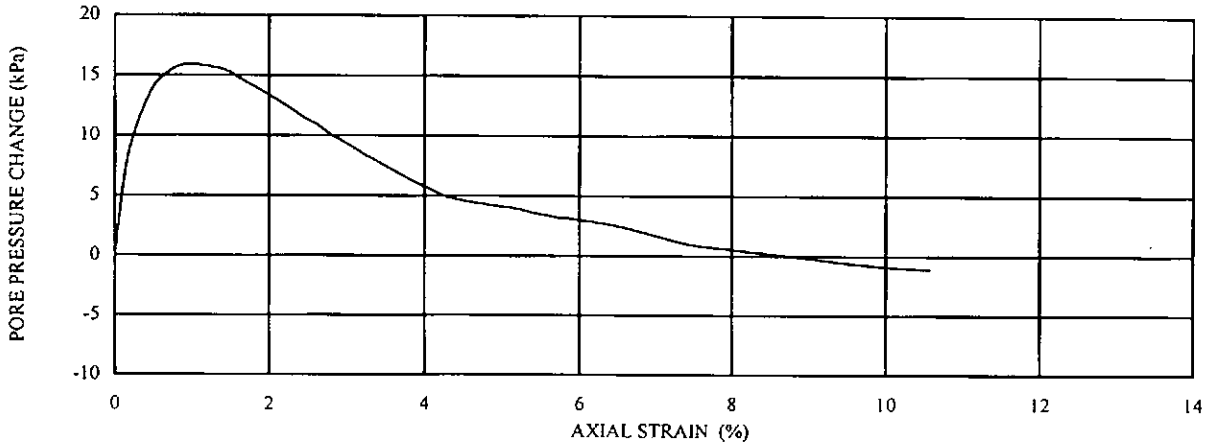
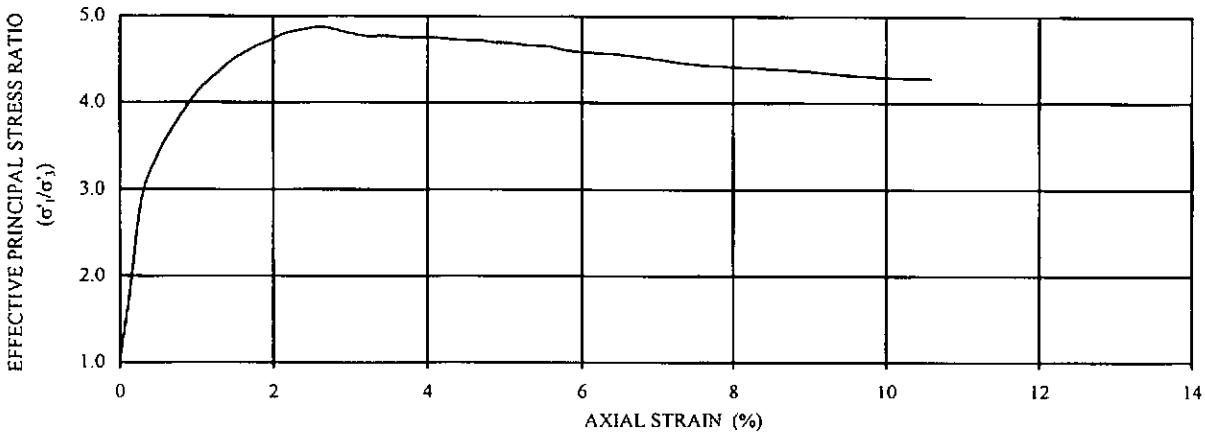
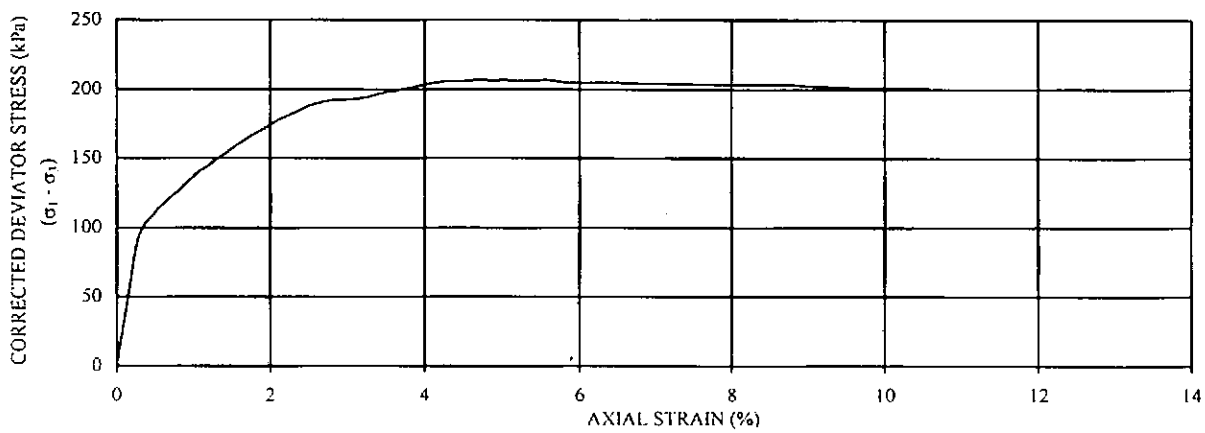
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

COMPRESSION







Borehole No. :	**D060**	**Sample Depth m:-**	**5.20 - 6.20**
Sample No. :	**3**	**Specimen Depth m:-**	**6.00 - 6.20**
Customer :	**Mass Transit Railway Corporation**		Compiled by W S Wat
Project :	**Ground Investigation for South Island Line**		
		Contract No.: Contract 1024	Checked by H W Chung
Job No.:	**J2999**	**Works Order No.: 059**	

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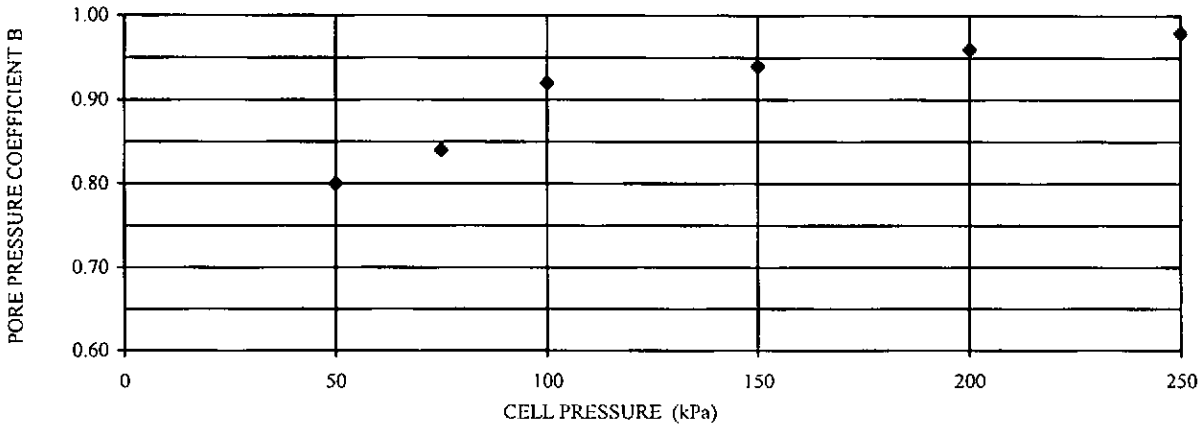
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

SATURATION



Date	Time	Cell Pressure kPa	Back Pressure kPa	Pore Pressure kPa	Cumulative Volume of Water cm^3	Pore Pressure Coefficient B
18/12/2008	08:34	0	0	-	0.0	
	08:45	25	-	24		-
	09:36	25	20	20	-1.1	
	09:42	50	-	40		0.80
	10:07	50	45	45	1.5	
	10"15	75	-	66		0.84
	11:04	75	70	70	5.8	
	11:17	100	-	93		0.92
	11:50	100	95	95	7.9	
	12:00	150	-	142		0.94
	13:10	150	145	145	9.9	
	13:18	200	-	193		0.96
	14:20	200	195	195	11.4	
	14:30	250	-	244		0.98
19/12/2008	09:12	250	245	245	19.8	

Borehole No. D060 **Sample Depth m:-** 5.20 - 6.20
Sample No. : 3 **Specimen Depth m:-** 6.00 - 6.20

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.:** 059

Compiled by: W S Wat
Checked by: H W Chung

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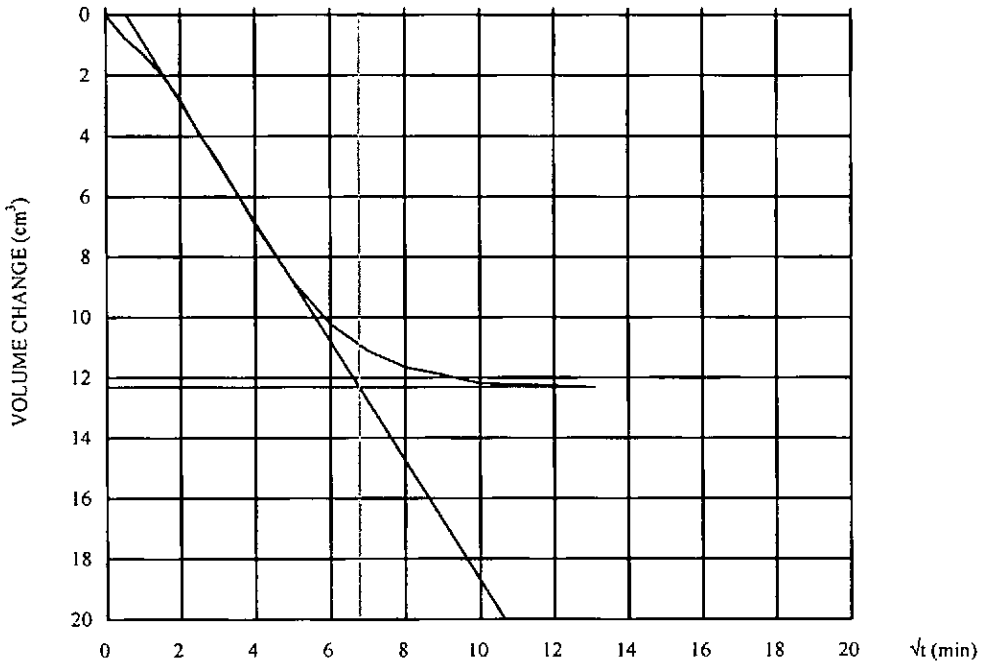
Form : GESR009.11 / Jun.02.03 / Issue 1 / Rev 0

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

CONSOLIDATION (DRAINED PHASE) - Stage 1

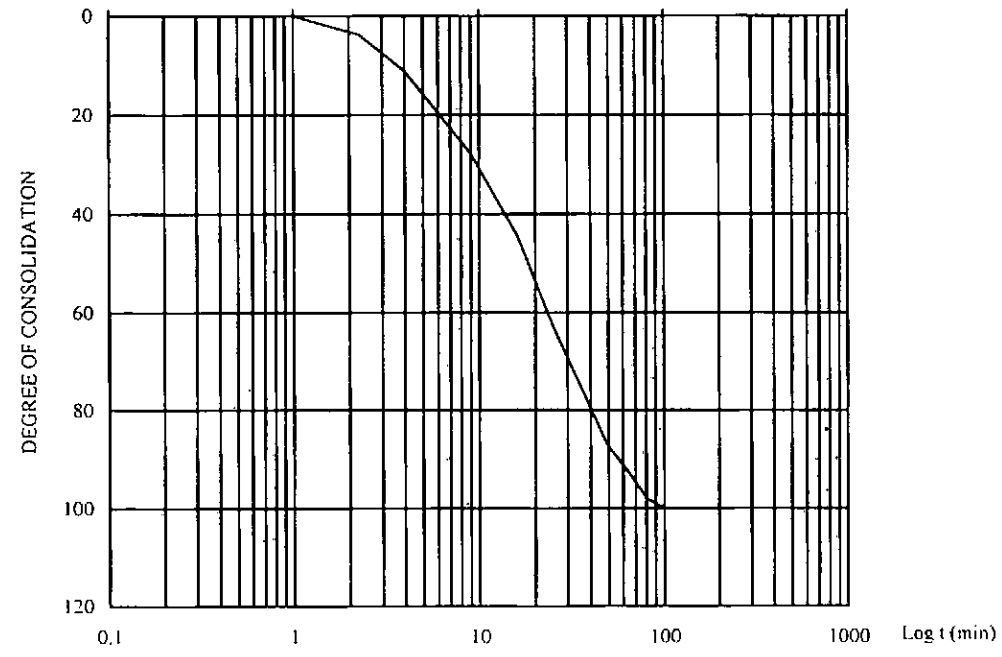


√t100 6.77 min

t100 45.806 min

tf 24.277 min

Calc. strain rate
0.415 mm/min



Borehole No. : D060 **Sample Depth m:-** 5.20 - 6.20

Sample No. : 3 **Specimen Depth m:-** 6.00 - 6.20

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.:** 059

Complied by: W S Wat

Checked by: H W Chung

Form : GESR009.13 / Jun.02.03 / Issue 1 / Rev 0

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DETERMINATION OF
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UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Single Stage				P.W.P.B.P				Effective Pressure	60				kPa
Side drains	No		Selected Machine Speed		0.048		mm/min	Rate of Strain	2.00				% per hr
FAILURE CRITERION													
Max. deviator Stress			☒	Max. Stress ratio			☐	Axial Strain %					☐
Stage :	1	Applied Pressure (kPa) - Cell :			305	Back :	245	P.R. factor			3.1283		kN/mm

Date	Time	Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
		Dial		P.R.No. 7	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
22/12	08:35	0.00	0.00	0.039	245	0.000	0.0	60.0	60.0	60.0	0.0	60.0	1.00
	08:40	0.20	0.14	0.103	252	0.040	46.9	99.7	52.8	76.3	23.5	68.4	1.89
	08:45	0.41	0.29	0.167	256	0.083	93.7	142.8	49.1	96.0	46.9	80.3	2.91
	08:50	0.71	0.49	0.190	259	0.140	110.3	156.4	46.1	101.3	55.2	82.9	3.39
	08:55	0.92	0.64	0.202	260	0.182	118.9	163.9	45.0	104.4	59.4	84.6	3.64
	09:00	1.21	0.84	0.216	261	0.238	128.8	173.0	44.2	108.6	64.4	87.1	3.91
	09:05	1.49	1.03	0.230	261	0.290	138.7	182.8	44.1	113.4	69.3	90.3	4.14
	09:10	1.69	1.17	0.238	261	0.328	144.2	188.4	44.2	116.3	72.1	92.3	4.26
	09:15	1.95	1.35	0.248	261	0.377	151.2	195.6	44.4	120.0	75.6	94.8	4.40
	09:20	2.14	1.49	0.256	260	0.414	156.7	201.4	44.7	123.1	78.4	96.9	4.51
	09:25	2.32	1.61	0.263	260	0.446	161.6	206.8	45.2	126.0	80.8	99.1	4.57
	09:30	2.60	1.81	0.273	259	0.498	168.4	214.3	45.9	130.1	84.2	102.0	4.67
	09:35	2.83	1.97	0.280	259	0.540	173.1	219.6	46.5	133.1	86.6	104.2	4.72
	09:40	3.06	2.12	0.288	258	0.578	178.6	225.7	47.1	136.4	89.3	106.6	4.79
	09:45	3.31	2.30	0.295	257	0.624	183.2	231.0	47.8	139.4	91.6	108.9	4.83
	09:50	3.57	2.48	0.302	256	0.670	187.9	236.5	48.6	142.5	93.9	111.2	4.87
	09:55	3.79	2.63	0.306	256	0.707	190.4	239.5	49.1	144.3	95.2	112.6	4.88
	10:00	4.03	2.80	0.309	255	0.749	192.2	242.1	49.9	146.0	96.1	114.0	4.85
	10:05	4.26	2.96	0.310	255	0.788	192.5	243.0	50.5	146.8	96.3	114.7	4.81
	10:10	4.64	3.22	0.313	254	0.851	194.1	245.6	51.5	148.5	97.0	116.2	4.77
	10:15	4.87	3.38	0.317	253	0.889	196.6	248.7	52.1	150.4	98.3	117.6	4.77
	10:20	5.08	3.52	0.320	252	0.922	198.4	251.0	52.6	151.8	99.2	118.7	4.77
	10:25	5.27	3.66	0.322	252	0.955	199.5	252.6	53.1	152.8	99.7	119.6	4.76
	10:30	5.56	3.86	0.326	251	1.002	201.8	255.6	53.8	154.7	100.9	121.1	4.75
	10:35	5.84	4.06	0.330	251	1.048	204.2	258.6	54.4	156.5	102.1	122.5	4.75
	10:40	6.13	4.25	0.333	250	1.091	205.8	260.8	55.0	157.9	102.9	123.6	4.74
	10:45	6.37	4.42	0.334	250	1.129	206.1	261.4	55.3	158.4	103.1	124.0	4.73
	10:50	6.61	4.59	0.335	250	1.167	206.4	261.9	55.5	158.7	103.2	124.3	4.72
	10:55	6.80	4.72	0.336	249	1.196	206.8	262.4	55.6	159.0	103.4	124.5	4.72
	11:00	7.03	4.88	0.336	249	1.231	206.4	262.2	55.8	159.0	103.2	124.6	4.70
	11:05	7.24	5.03	0.337	249	1.263	206.8	262.7	55.9	159.3	103.4	124.8	4.70
	11:10	7.52	5.22	0.337	249	1.304	206.3	262.4	56.1	159.3	103.2	124.9	4.68
	11:15	7.78	5.40	0.338	249	1.343	206.6	263.0	56.4	159.7	103.3	125.3	4.66
	11:20	**8.02**	**5.57**	**0.339**	**248**	**1.378**	**206.9**	**263.5**	**56.6**	**160.0**	**103.4**	**125.6**	**4.66**
	11:25	8.26	5.73	0.338	248	1.412	205.8	262.6	56.8	159.7	102.9	125.4	4.62
	11:30	8.50	5.90	0.337	248	1.447	204.7	261.6	56.9	159.2	102.3	125.1	4.60
	11:45	9.24	6.42	0.339	248	1.553	204.8	262.2	57.4	159.8	102.4	125.7	4.57
	12:00	9.84	6.83	0.340	247	1.634	204.5	262.5	58.0	160.3	102.3	126.2	4.53
	12:15	10.69	7.42	0.341	246	1.747	203.8	262.8	59.0	160.9	101.9	126.9	4.45

Borehole No. : D060 **Sample Depth m:- 5.20 - 6.20**

Sample No. : 3 **Specimen Depth m:- 6.00 - 6.20**

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.: 059**

Compiled by: W S Wat

Checked by: H W Chung

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Form : GESR009.14 / Dec.13.04 / Issue 1 / Rev 1

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2
Shearing Continuation

FAILURE CRITERION

Max. deviator Stress ☒ | Max. Stress ratio ☐ | Axial Strain % ☐

Stage :	1	Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
Date	Time	Dial		P.R.No. 7	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
22/12	12:30	11.40	7.91	0.342	246	1.839	203.3	262.7	59.4	161.0	101.6	127.2	4.42
	12:45	12.20	8.47	0.344	245	1.941	203.3	263.1	59.8	161.4	101.6	127.6	4.40
	13:00	12.80	8.89	0.345	245	2.016	202.9	263.0	60.1	161.6	101.5	127.7	4.38
	13:15	13.73	9.53	0.345	244	2.127	201.4	262.0	60.6	161.3	100.7	127.7	4.32
	13:30	14.48	10.05	0.346	244	2.215	200.8	261.7	60.9	161.3	100.4	127.8	4.30
	13:45	15.23	10.57	0.348	244	2.301	200.8	261.9	61.1	161.5	100.4	128.0	4.29

Borehole No. : D060 — **Sample Depth m:-** 5.20 - 6.20
Sample No. : 3 — **Specimen Depth m:-** 6.00 - 6.20

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 — **Works Order No.:** 059

Compiled by: W S Wat
Checked by: H W Chung

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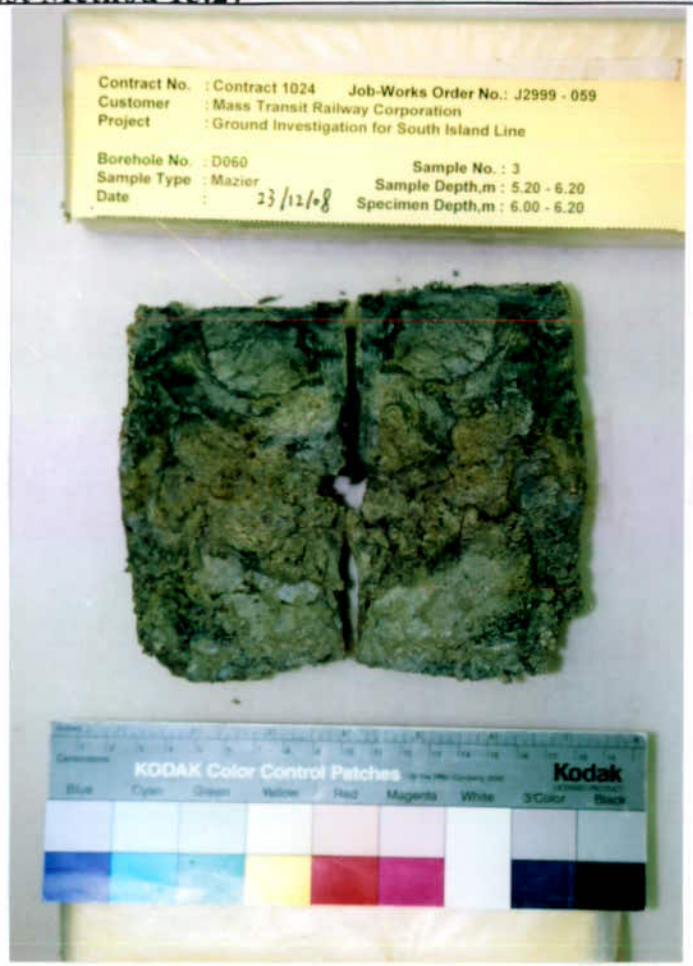
Form : GESR009.15 / Dec.13.04 / Issue 1 / Rev 1

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT (GEOSPEC 3 : 2001 Test Method 15.2)



Description : Grey, silty, gravelly SAND **Sample Origin :** ALL‡ ‡ Information provided by customer

Borehole No. :	**D060**	**Sample No. : 3**	**Sample Depth m:-**	**5.20 - 6.20**	**Specimen Depth m:- 6.00 - 6.20**

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line

Contract No. : Contract 1024
Job No. : J2999
Works Order No.: 059

Compiled by: W S Wat
Checked by: H W Chung

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	D065		
Sample		no	8		
Sample Type			Mazier		
Stage		no	1		
Sample Depth		m	4.50 - 5.50		
Specimen Depth		m	5.10 - 5.30		
INITIAL CONDITIONS					
Diameter	(D_o)	mm	74.2		
Height	(H_o)	mm	145.0		
Moisture Content	(W_o)	%	23		
Bulk density	(ρ_o)	Mg/m^3	1.97		
Dry density	(ρ_d)	Mg/m^3	1.61		
Particle density	(ρ_s)		2.63		
Voids Ratio	(e_o)		0.64		
Degree of Saturation	(S_r)	%	93.5		
DRAINAGE CONDITIONS			ONE END		
SATURATION					
Final Pore Pressure Coefficient B			0.96		
CONSOLIDATION					
Cell Pressure	(σ_3)	kPa	270		
Back Pressure	(u_b)	kPa	220		
Effective Pressure	(σ'_3)	kPa	50		
Coefficient of Consolidation (t100)	(C_{vi})	m^2/Year	389.05		
Coefficient of Volume Compressibility	(m_{vi})	m^2/MN	0.29		
Coefficient of Permeability (k)		m/s	3.45E-08		
COMPRESSION TERMINATION CRITERION			MAXIMUM DEVIATOR STRESS		
COMPRESSION - INITIAL					
Moisture Content	(w)	%	22		
Pore Pressure at the End of Consolidation		kPa	220		
Effective Stress at the End of Consolidation		kPa	50		
Bulk density	(ρ_o)	Mg/m^3	1.99		
Dry density	(ρ_d)	Mg/m^3	1.63		
Voids Ratio	(e)		0.61		
Degree of Saturation	(S_r)	%	95.8		

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Report No. : J2999-059.11
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.:** 059

Technician : W S Wat Checked By : Name : H W Chung Approved By : Signatory : Lau Wai Cheong
Tested Date: 22/11/2008 Date : 08/01/2009 Date : 08/01/2009

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	D065		
Sample		no	8		
Sample Type			Mazier		
Stage		no	1		
Sample Depth		m	4.50 - 5.50		
Specimen Depth		m	5.10 - 5.30		
COMPRESSION - FAILURE					
Cell Pressure		kPa	270		
Rate of Strain		mm/min	0.048		
CONDITIONS MAXIMUM DEVIATOR STRESS					
Major Effective Principal Stress (σ'_1)		kPa	273		
Corrected Deviator Stress ($\sigma'_1 - \sigma'_3$)		kPa	223		
Minor Effective Principal Stress (σ'_3)		kPa	50		
$s' = (\sigma'_1 + \sigma'_3)/2$		kPa	161		
$t = (\sigma_1 - \sigma_3)/2$		kPa	111		
Expanded Uncertainty of s' ^		kPa	-		
Expanded Uncertainty of t ^		kPa	-		
Pore pressure parameter A_f			0.00		
Strain at Failure	(εf)	%	8.4		
COMPRESSION - FINAL					
Moisture Content	(W_f)	%	22		
Bulk density	(ρ_o)	Mg/m^3	1.99		
Dry density	(ρ_d)	Mg/m^3	1.63		
Voids Ratio	(e_f)		0.61		
Degree of Saturation	(S_f)	%	95.8		

Notes -
1. The method of specimen preparation was in accordance with GEOSPEC 3 : 2001 :- Test method 13.3 : test specimen from undisturbed soil samples.
2. Sample received date : 29/9/2008
3. The determination of moisture content was in accordance with test method 5.1 of GEOSPEC 3 : 2001.
4. Particle density : 2.63 (Determined)
5. Maximum and minimum temperature recorded over the period of testing 19.5 - 20.7 °C.
6. Unavoidable variations from specified procedure : none
7. Comment on observed or inferred sample disturbance : none
8. Percentage by mass of soil particles larger than 1/5 of the diameter of specimen (%) : Nil
9. The specimen was selected by the laboratory.
   Name : W S Wat Designation : Senior Laboratory Technician
10. Sampling History : As Received

* Delete as appropriate ^ Upon request

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.: 059**

Compiled by W S Wat
Checked by H W Chung

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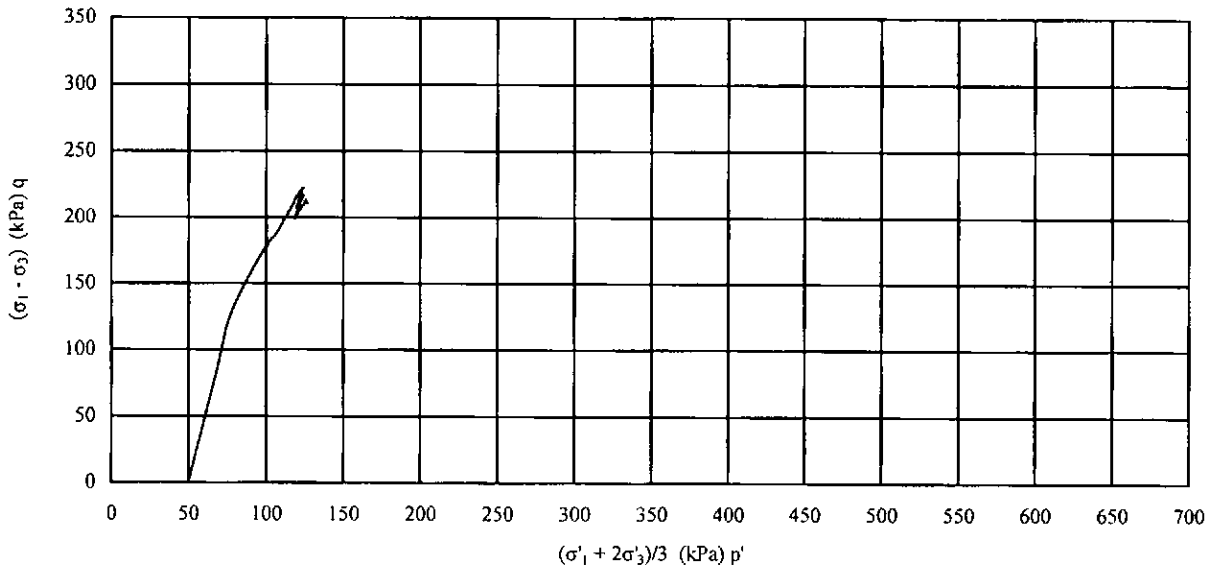
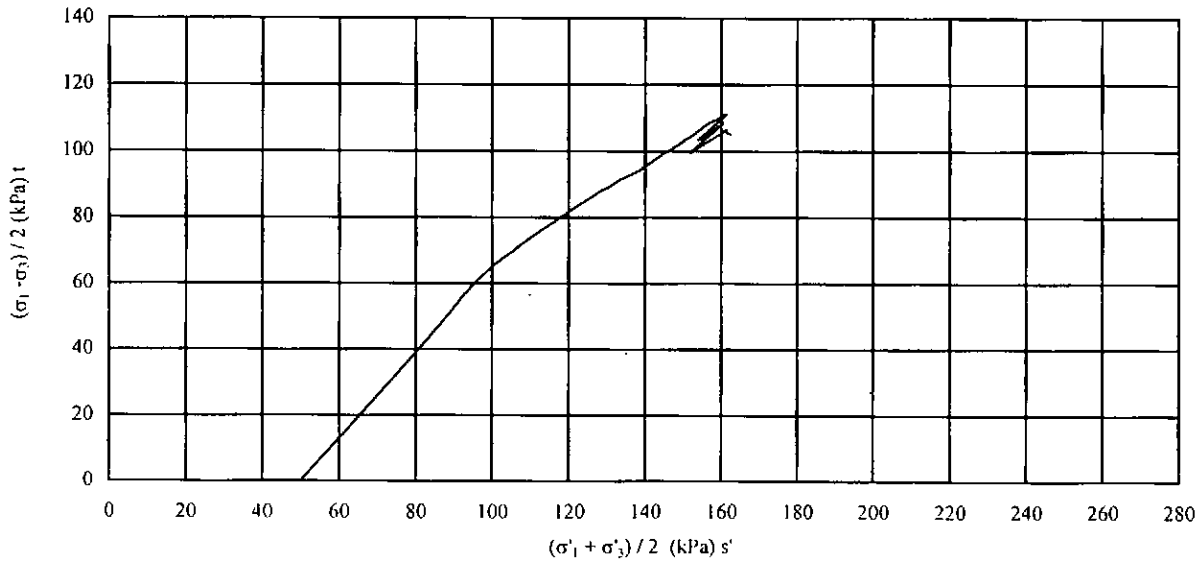
TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

STRESS PATH PARAMETERS FOR EFFECTIVE STRESS

p' - q PLOT



s' - t PLOT



Borehole No. : D065 **Sample Depth m:-** 4.50 - 5.50
Sample No. : 8 **Specimen Depth m:-** 5.10 - 5.30

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.:** 059

Compiled by: W S Wat
Checked by: H W Chung

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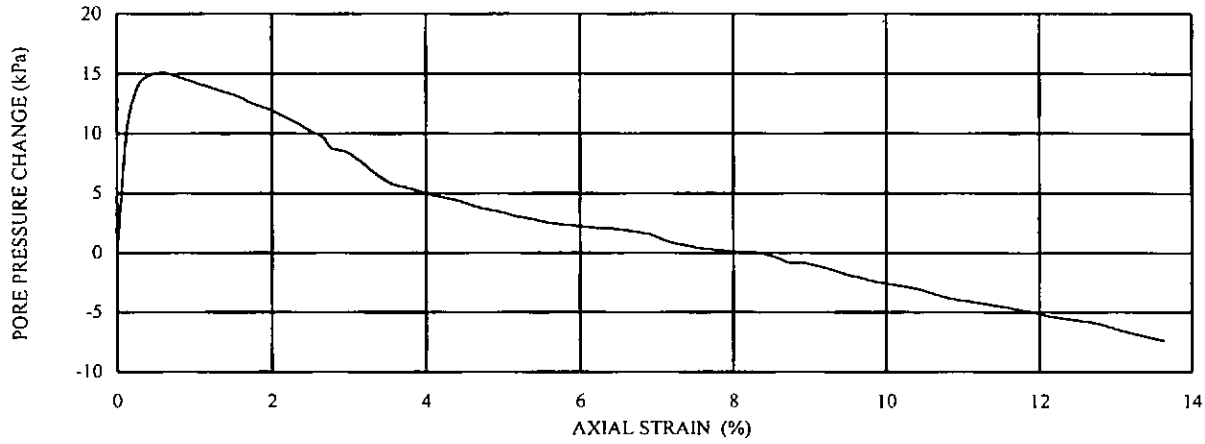
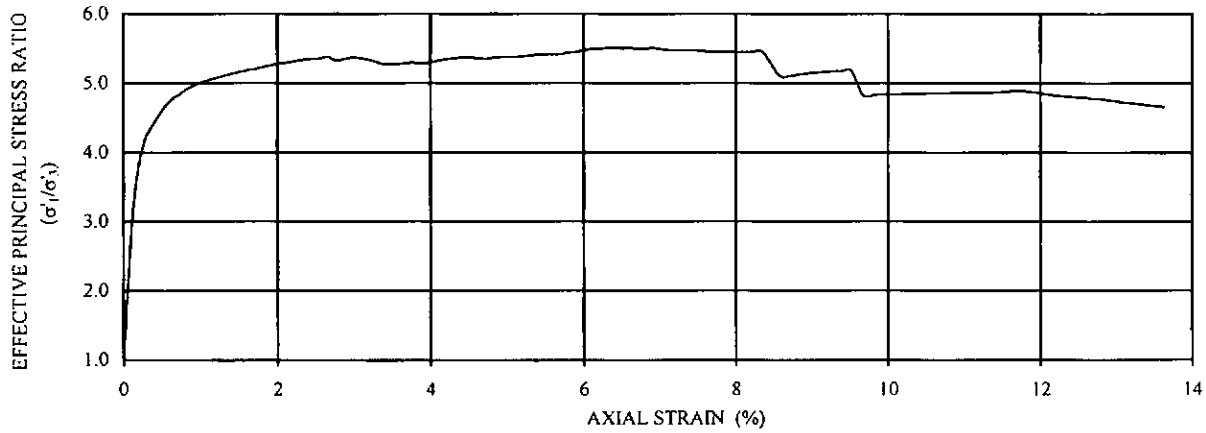
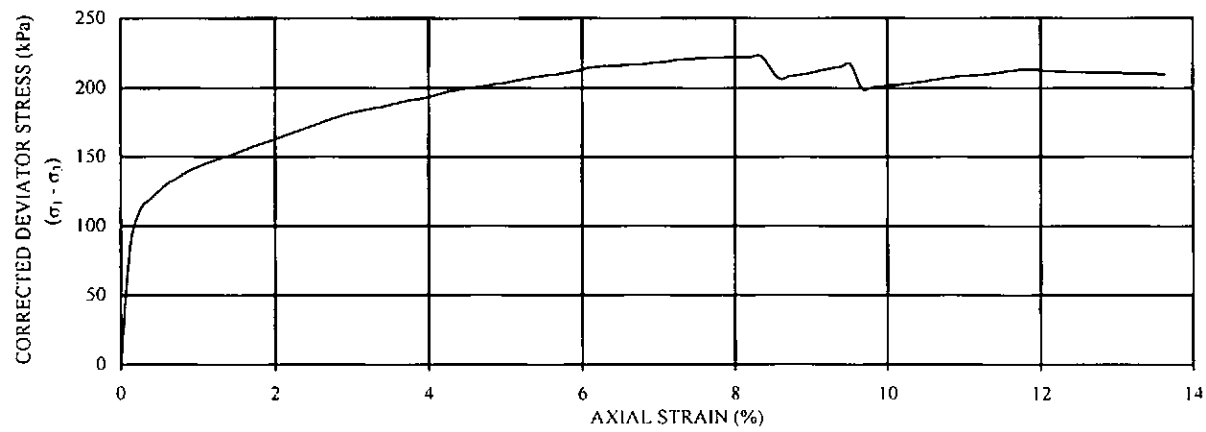
Form : GESR009.8 / Jun.02.03 / Issue 1 / Rev 0

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

COMPRESSION







Borehole No. :	**D065**	**Sample Depth m:-**	**4.50 - 5.50**
Sample No. :	**8**	**Specimen Depth m:-**	**5.10 - 5.30**
Customer :	**Mass Transit Railway Corporation**		Compiled by W S Wat
Project :	**Ground Investigation for South Island Line**		
		Contract No.: Contract 1024	Checked by H W Chung
Job No.:	**J2999**	**Works Order No.: 059**	

Form : GESR009.9 / Jun.02.03 / Issue 1 / Rev 0

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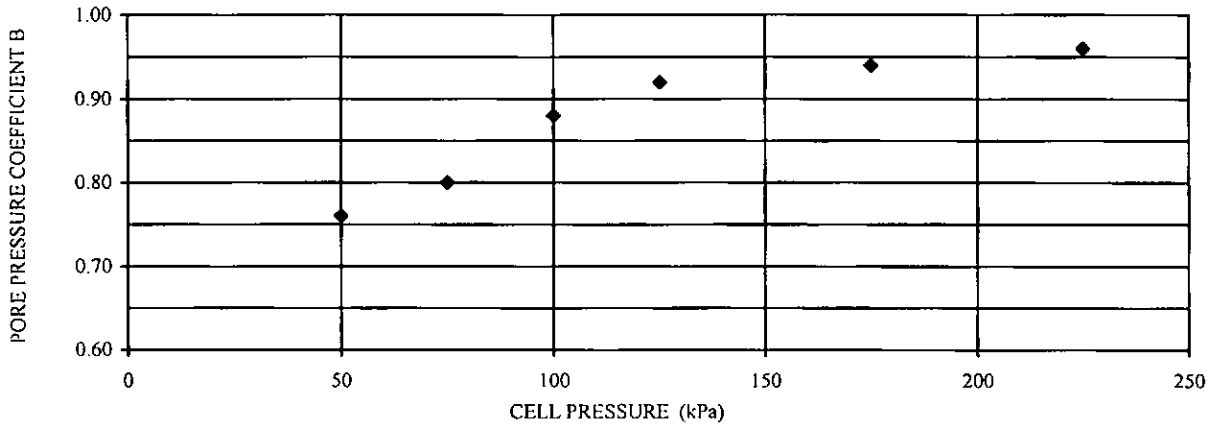
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

SATURATION



Date	Time	Cell Pressure kPa	Back Pressure kPa	Pore Pressure kPa	Cumulative Volume of Water cm^3	Pore Pressure Coefficient B
23/11/2008	08:40	0	0	-	0.0	
	08:44	25	-	24		-
	09:23	25	20	20	-0.3	
	09:30	50	-	39		0.76
	10:06	50	45	45	0.2	
	10:10	75	-	65		0.80
	10:51	75	70	70	1.3	
	11:00	100	-	92		0.88
	12:17	100	95	95	2.0	
	12:23	125	-	118		0.92
	14:08	125	120	120	3.2	
	14:19	175	-	167		0.94
	15:38	175	170	170	4.2	
	15:45	225	-	218		0.96
24/11/2008	08:40	225	220	220	6.0	

Borehole No. D065 **Sample Depth m:-** 4.50 - 5.50
Sample No. : 8 **Specimen Depth m:-** 5.10 - 5.30

Customer : Mass Transit Railway Corporation — Compiled by W S Wat
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024 — Checked by H W Chung
Job No.: J2999 **Works Order No.:** 059

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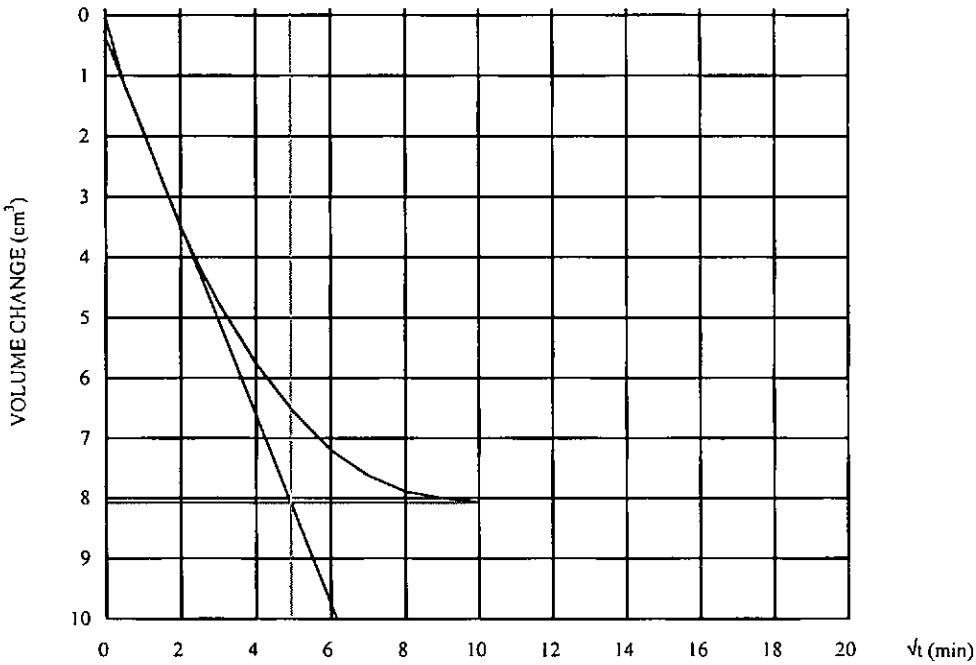
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

CONSOLIDATION (DRAINED PHASE) - Stage 1

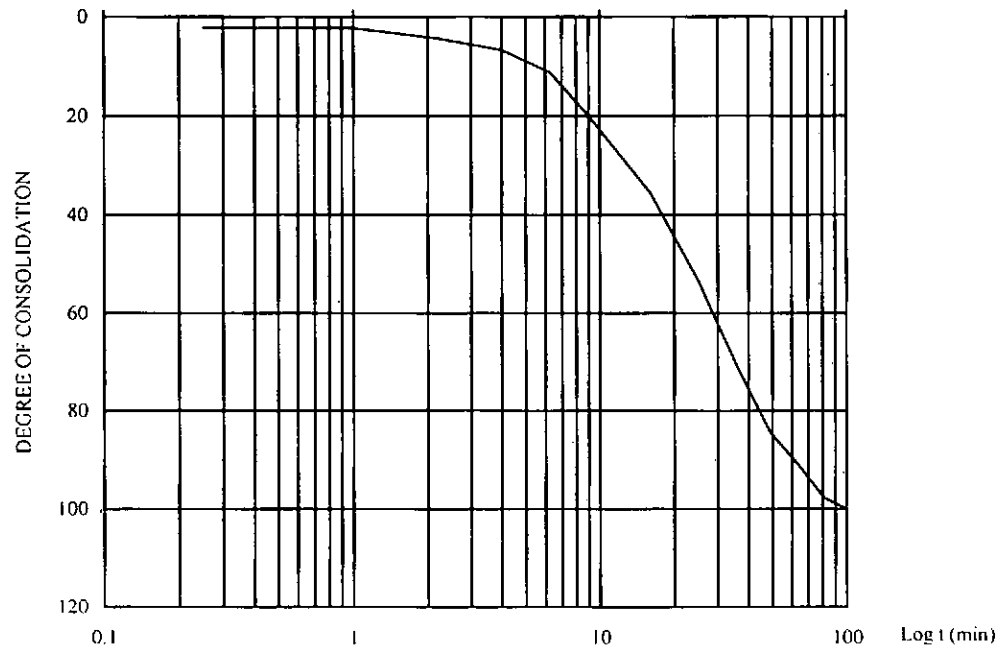


√t100 4.93 min

t100 24.340 min

tf 12.900 min

Calc. strain rate
0.783 mm/min



Borehole No. : D065 **Sample Depth m:-** 4.50 - 5.50

Sample No. : 8 **Specimen Depth m:-** 5.10 - 5.30

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.:** 059

Complied by: W S Wat

Checked by: H W Chung

Form : GESR009.13 / Jun.02.03 / Issue 1 / Rev 0

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Single Stage		P.W.P,B.P			Effective Pressure	50	kPa
Side drains	No	Selected Machine Speed	0.048	mm/min	Rate of Strain	2.00	% per hr

FAILURE CRITERION

Max. deviator Stress	☒	Max. Stress ratio	☐	Axial Strain %	☐
Stage : 1	Applied Pressure (kPa) - Cell :	270	Back : 220	P.R. factor	3.0328 kN/mm

Date	Time	Strain Dial	Strain	Load P.R.No. 25	Pore Pressure	Dev. stress Corr.	Dev. stress q $\sigma_1 - \sigma_3$	Effective Stress σ'_1	Effective Stress σ'_3	s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa				2	2	3	σ'_1/σ'_3
25/11	08:35	0.00	0.00	0.047	220	0.000	0.0	50.0	50.0	50.0	0.0	50.0	1.00
	08:40	0.19	0.13	0.171	230	0.038	87.6	127.4	39.8	83.6	43.8	69.0	3.20
	08:45	0.38	0.26	0.206	234	0.075	112.2	148.4	36.2	92.3	56.1	73.6	4.10
	08:50	0.57	0.40	0.218	235	0.115	120.4	155.6	35.2	95.4	60.2	75.3	4.42
	08:55	0.85	0.59	0.232	235	0.168	130.0	164.9	34.9	99.9	65.0	78.2	4.73
	09:00	1.02	0.71	0.238	235	0.202	134.0	169.1	35.1	102.1	67.0	79.8	4.82
	09:05	1.26	0.87	0.246	235	0.246	139.4	174.8	35.4	105.1	69.7	81.9	4.94
	09:10	1.51	1.04	0.253	234	0.292	144.0	179.8	35.8	107.8	72.0	83.8	5.02
	09:15	1.79	1.24	0.259	234	0.347	147.9	184.1	36.2	110.1	73.9	85.5	5.08
	09:20	2.08	1.44	0.265	233	0.400	151.7	188.3	36.6	112.4	75.8	87.2	5.14
	09:25	2.26	1.57	0.269	233	0.435	154.2	191.1	36.9	114.0	77.1	88.3	5.18
	09:30	2.49	1.73	0.274	233	0.477	157.4	194.8	37.4	116.1	78.7	89.9	5.21
	09:35	2.67	1.85	0.278	232	0.508	160.0	197.7	37.7	117.7	80.0	91.0	5.24
	09:40	2.85	1.98	0.282	232	0.542	162.5	200.5	38.0	119.3	81.3	92.2	5.28
	09:45	3.14	2.17	0.288	231	0.590	166.3	204.9	38.6	121.7	83.1	94.0	5.31
	09:50	3.39	2.35	0.294	231	0.636	170.1	209.3	39.2	124.2	85.0	95.9	5.34
	09:55	3.63	2.51	0.299	230	0.676	173.2	213.0	39.8	126.4	86.6	97.5	5.35
	10:00	3.85	2.67	0.304	230	0.716	176.4	216.7	40.3	128.5	88.2	99.1	5.38
	10:05	4.01	2.77	0.307	229	0.741	178.2	219.4	41.2	130.3	89.1	100.6	5.33
	10:10	4.27	2.96	0.312	229	0.787	181.2	222.7	41.5	132.1	90.6	101.9	5.37
	10:15	4.51	3.13	0.316	228	0.828	183.6	225.8	42.2	134.0	91.8	103.4	5.35
	10:20	4.74	3.28	0.319	227	0.864	185.4	228.4	43.0	135.7	92.7	104.8	5.31
	10:25	4.90	3.40	0.321	226	0.893	186.5	230.1	43.6	136.8	93.2	105.8	5.28
	10:30	5.14	3.56	0.325	226	0.931	188.8	233.0	44.2	138.6	94.4	107.1	5.27
	10:35	5.39	3.74	0.329	226	0.973	191.2	235.7	44.5	140.1	95.6	108.2	5.30
	10:40	5.61	3.89	0.331	225	1.008	192.2	237.0	44.8	140.9	96.1	108.9	5.29
	10:45	5.85	4.06	0.335	225	1.047	194.5	239.6	45.1	142.4	97.3	109.9	5.31
	10:50	6.08	4.21	0.339	225	1.081	196.9	242.2	45.3	143.7	98.4	110.9	5.35
	10:55	6.29	4.36	0.342	225	1.115	198.6	244.1	45.5	144.8	99.3	111.7	5.36
	11:00	6.52	4.51	0.345	224	1.148	200.3	246.1	45.8	145.9	100.1	112.6	5.37
	11:05	6.79	4.71	0.347	224	1.192	201.2	247.4	46.2	146.8	100.6	113.3	5.35
	11:10	7.01	4.86	0.350	224	1.225	202.8	249.2	46.4	147.8	101.4	114.0	5.37
	11:15	7.21	5.00	0.352	223	1.256	203.8	250.4	46.6	148.5	101.9	114.5	5.37
	11:20	7.44	5.15	0.355	223	1.288	205.5	252.4	46.9	149.6	102.7	115.4	5.38
	11:25	7.73	5.35	0.359	223	1.331	207.7	254.8	47.1	150.9	103.8	116.3	5.41
	11:30	7.91	5.48	0.361	223	1.358	208.7	256.0	47.3	151.7	104.4	116.9	5.41
	11:35	8.15	5.64	0.363	223	1.392	209.7	257.2	47.5	152.3	104.8	117.4	5.41
	11:40	8.37	5.80	0.366	222	1.425	211.3	258.9	47.6	153.2	105.6	118.0	5.44
	11:45	8.53	5.91	0.368	222	1.448	212.3	260.0	47.7	153.9	106.2	118.5	5.45

Borehole No. : D065 **Sample Depth m:-** 4.50 - 5.50
Sample No. : 8 **Specimen Depth m:-** 5.10 - 5.30

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.:** 059

Compiled by: W S Wat
Checked by: H W Chung

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2
Shearing Continuation

FAILURE CRITERION

Max. deviator Stress ☒ | Max. Stress ratio ☐ | Axial Strain % ☐

Stage :	1	Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
Date	Time	Dial		P.R.No. 25	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
25/11	11:50	8.76	6.07	0.372	222	1.480	214.6	262.4	47.8	155.1	107.3	119.3	5.49
	11:55	8.99	6.23	0.374	222	1.513	215.5	263.4	47.9	155.7	107.8	119.7	5.50
	12:00	9.16	6.35	0.375	222	1.537	215.9	263.8	47.9	155.8	107.9	119.9	5.51
	12:05	9.52	6.59	0.377	222	1.585	216.6	264.7	48.1	156.4	108.3	120.3	5.50
	12:10	9.82	6.80	0.379	222	1.626	217.4	265.7	48.3	157.0	108.7	120.8	5.50
	12:15	10.01	6.93	0.381	222	1.651	218.4	266.9	48.5	157.7	109.2	121.3	5.50
	12:20	10.28	7.12	0.383	221	1.688	219.2	268.2	49.0	158.6	109.6	122.1	5.47
	12:25	10.46	7.24	0.385	221	1.711	220.2	269.4	49.2	159.3	110.1	122.6	5.48
	12:30	10.69	7.41	0.387	221	1.744	221.1	270.5	49.4	160.0	110.6	123.1	5.48
	12:35	10.91	7.56	0.388	220	1.772	221.4	271.0	49.6	160.3	110.7	123.4	5.46
	12:40	11.14	7.72	0.389	220	1.802	221.6	271.3	49.7	160.5	110.8	123.6	5.46
	12:45	11.31	7.84	0.390	220	1.824	221.9	271.7	49.8	160.8	111.0	123.8	5.46
	12:50	11.62	8.05	0.391	220	1.863	222.0	271.9	49.9	160.9	111.0	123.9	5.45
	12:55	11.85	8.21	0.392	220	1.892	222.3	272.2	49.9	161.0	111.1	124.0	5.45
[redacted]	**13:00**	**12.06**	**8.35**	**0.393**	**220**	**1.918**	**222.5**	**272.5**	**50.0**	**161.3**	**111.3**	**124.2**	**5.45**
	13:05	12.36	8.57	0.370	220	1.957	207.1	257.5	50.4	153.9	103.5	119.4	5.11
	13:10	12.59	8.72	0.373	219	1.984	208.6	259.4	50.8	155.1	104.3	120.3	5.11
	13:15	12.84	8.90	0.376	219	2.016	210.1	260.9	50.8	155.9	105.1	120.8	5.14
	13:20	13.05	9.04	0.379	219	2.040	211.7	262.7	51.0	156.9	105.9	121.6	5.15
	13:25	13.31	9.22	0.383	219	2.071	213.8	265.1	51.3	158.2	106.9	122.6	5.17
	13:30	13.53	9.38	0.386	218	2.099	215.4	267.0	51.6	159.3	107.7	123.4	5.17
	13:35	13.74	9.52	0.389	218	2.123	216.9	268.8	51.9	160.4	108.5	124.2	5.18
	13:40	13.95	9.67	0.362	218	2.149	199.3	251.4	52.1	151.7	99.6	118.5	4.82
	13:45	14.20	9.84	0.365	218	2.177	200.8	253.2	52.4	152.8	100.4	119.3	4.83
	14:00	14.98	10.38	0.372	217	2.267	203.9	256.9	53.0	155.0	102.0	121.0	4.85
	14:15	15.62	10.82	0.380	216	2.339	207.9	261.7	53.8	157.7	103.9	123.1	4.86
	14:30	16.32	11.31	0.385	216	2.417	209.8	264.1	54.3	159.2	104.9	124.2	4.86
	14:45	16.96	11.75	0.392	215	2.486	213.0	267.8	54.8	161.3	106.5	125.8	4.89
	15:00	17.59	12.19	0.392	215	2.554	211.9	267.3	55.4	161.3	105.9	126.0	4.82
	15:15	18.37	12.73	0.393	214	2.636	211.1	267.0	55.9	161.5	105.6	126.3	4.78
	15:30	19.01	13.17	0.394	213	2.702	210.6	267.3	56.7	162.0	105.3	126.9	4.71
	15:45	19.68	13.63	0.395	213	2.770	210.0	267.4	57.4	162.4	105.0	127.4	4.66

Borehole No. : D065 — **Sample Depth m:-** 4.50 - 5.50

Sample No. : 8 — **Specimen Depth m:-** 5.10 - 5.30

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 — **Works Order No.:** 059

Compiled by: W S Wat

Checked by: H W Chung

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Form : GESR009.15 / Dec.13.04 / Issue 1 / Rev 1

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT (GEOSPEC 3 : 2001 Test Method 15.2)

Description : Brown, slightly sandy, gravelly SILT/CLAY **Sample Origin : HDT‡** ‡ Information provided by customer

Borehole No. : D065 **Sample No. :** 8 **Sample Depth m:-** 4.50 - 5.50 **Specimen Depth m:-** 5.10 - 5.30

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line

Contract No. : Contract 1024
Job No. : J2999
Works Order No.: 059

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	D065	D065	D065
Sample		no	8	8	8
Sample Type			Mazier	Mazier	Mazier
Stage		no	1	2	3
Sample Depth		m	4.50 - 5.50	4.50 - 5.50	4.50 - 5.50
Specimen Depth		m	5.30 - 5.50	5.30 - 5.50	5.30 - 5.50
INITIAL CONDITIONS					
Diameter	(D_o)	mm	74.2	74.6	74.8
Height	(H_o)	mm	145.0	143.0	141.1
Moisture Content	(W_o)	%	21	22	22
Bulk density	(ρ_o)	Mg/m^3	1.99	2.01	2.02
Dry density	(ρ_d)	Mg/m^3	1.64	1.65	1.66
Particle density	(ρ_s)		2.63	2.63	2.63
Voids Ratio	(e_o)		0.60	0.59	0.58
Degree of Saturation	(S_r)	%	91.7	97.5	97.5
DRAINAGE CONDITIONS			ONE END		
SATURATION					
Final Pore Pressure Coefficient B			0.95		
CONSOLIDATION					
Cell Pressure	(σ_3)	kPa	235	260	285
Back Pressure	(u_b)	kPa	215	215	215
Effective Pressure	(σ'_3)	kPa	20	45	70
Coefficient of Consolidation (t100) (C_{vi})		$m^2/Year$	22451.23	6350.71	24873.15
Coefficient of Volume Compressibility (m_{vi})		m^2/MN	0.32	0.26	0.11
Coefficient of Permeability (k)		m/s	2.25E-06	5.09E-07	8.50E-07
COMPRESSION TERMINATION CRITERION			MAXIMUM STRESS RATIO		MAX ($\sigma'1 - \sigma'3$)
COMPRESSION - INITIAL					
Moisture Content	(w)	%	22	22	21
Pore Pressure at the End of Consolidation		kPa	215	215	215
Effective Stress at the End of Consolidation		kPa	20	45	70
Bulk density	(ρ_o)	Mg/m^3	2.01	2.02	2.02
Dry density	(ρ_d)	Mg/m^3	1.65	1.66	1.67
Voids Ratio	(e)		0.59	0.58	0.58
Degree of Saturation	(S_r)	%	97.5	97.5	97.4

Customer : **Mass Transit Railway Corporation**
Project : **Ground Investigation for South Island Line**
Report No. : J2999-059.11
Contract No.: Contract 1024
Job No.: **J2999** **Works Order No.: 059**

Technician : W S Wat Checked By : Name : H W Chung Approved By : Signatory : **Lau Wai Cheong**
Tested Date: 22/11/2008 Date : 08/01/2009 Date : 08/01/2009

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Form : GESR009.6 / Nov.10.06 / Issue 1 / Rev 1

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	D065	D065	D065
Sample		no	8	8	8
Sample Type			Mazier	Mazier	Mazier
Stage		no	1	2	3
Sample Depth		m	4.50 - 5.50	4.50 - 5.50	4.50 - 5.50
Specimen Depth		m	5.30 - 5.50	5.30 - 5.50	5.30 - 5.50
COMPRESSION - FAILURE					
Cell Pressure		kPa	235	260	285
Rate of Strain		mm/min	0.048	0.047	0.046
CONDITIONS AT MAXIMUM STRESS RATIO					
Major Effective Principal Stress (σ'_1)		kPa	409	675	822
Corrected Deviator Stress ($\sigma'_1 - \sigma'_3$)		kPa	400	636	756
Minor Effective Principal Stress (σ'_3)		kPa	9	39	66
$s' = (\sigma'_1 + \sigma'_3)/2$		kPa	209	357	444
$t = (\sigma_1 - \sigma_3)/2$		kPa	200	318	378
Expanded Uncertainty of s' ^		kPa	-	-	-
Expanded Uncertainty of t ^		kPa	-	-	-
Pore pressure parameter A_f			0.03	0.01	0.01
Strain at Failure	(εf)	%	1.0	2.4	3.2
COMPRESSION - FINAL					
Moisture Content	(W_f)	%	22	22	21
Bulk density	(ρ_o)	Mg/m^3	2.01	2.02	2.02
Dry density	(ρ_d)	Mg/m^3	1.65	1.66	1.67
Voids Ratio	(e_f)		0.59	0.58	0.58
Degree of Saturation	(S_f)	%	97.5	97.5	97.4

Notes -
1. The method of specimen preparation was in accordance with GEOSPEC 3 : 2001 :- Test method 13.3 : test specimen from undisturbed soil samples.
2. Sample received date : 29/9/2008
3. The determination of moisture content was in accordance with test method 5.1 of GEOSPEC 3 : 2001.
4. Particle density : 2.63 (Determined)
5. Maximum and minimum temperature recorded over the period of testing 19.5 - 20.7 °C.
6. Unavoidable variations from specified procedure : none
7. Comment on observed or inferred sample disturbance : none
8. Percentage by mass of soil particles larger than 1/5 of the diameter of specimen (%) : Nil
9. The specimen was selected by the laboratory.
   Name : W S Wat Designation : Senior Laboratory Technician
10. Sampling History : As Received

* Delete as appropriate ^ Upon request

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.:** 059

Compiled by W S Wat
Checked by H W Chung

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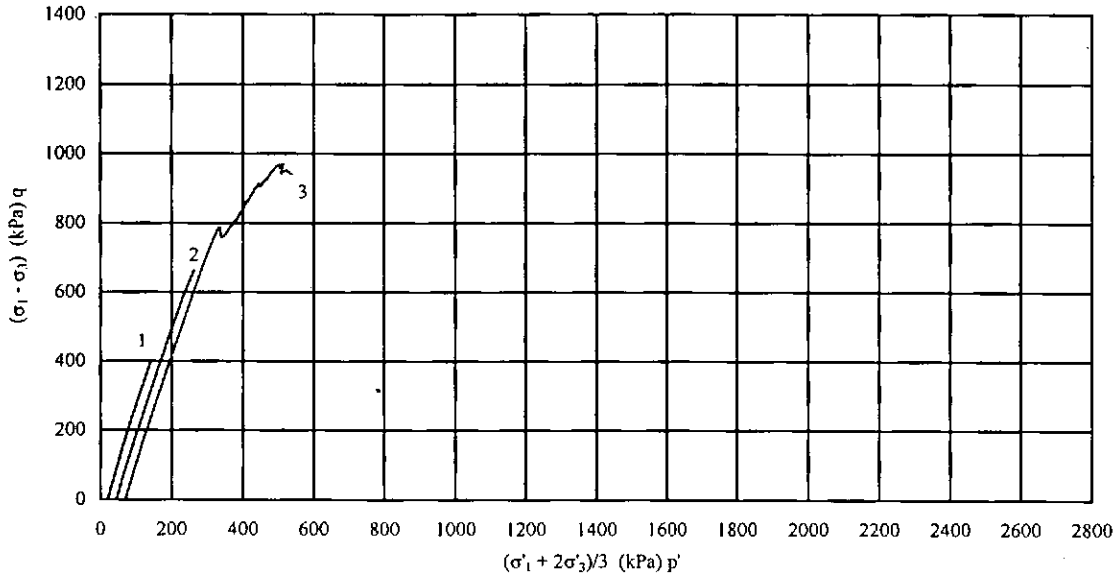
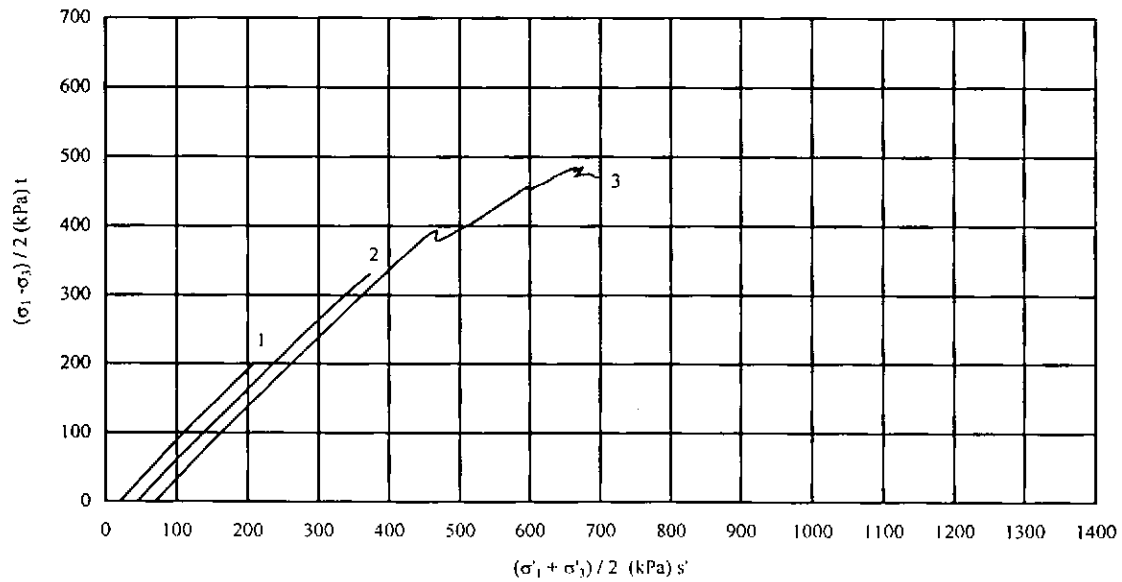
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

STRESS PATH PARAMETERS FOR EFFECTIVE STRESS

p' - q PLOT



s' - t PLOT



Borehole No. :	**D065**	**Sample Depth m:-**	**4.50 - 5.50**
Sample No. :	**8**	**Specimen Depth m:-**	**5.30 - 5.50**
Customer :	**Mass Transit Railway Corporation**		Compiled by W S Wat
Project :	**Ground Investigation for South Island Line**		
		Contract No.: Contract 1024	Checked by H W Chung
Job No.:	**J2999**	**Works Order No.: 059**	

Form : GESR009.8 / Jun.02.03 / Issue 1 / Rev 0

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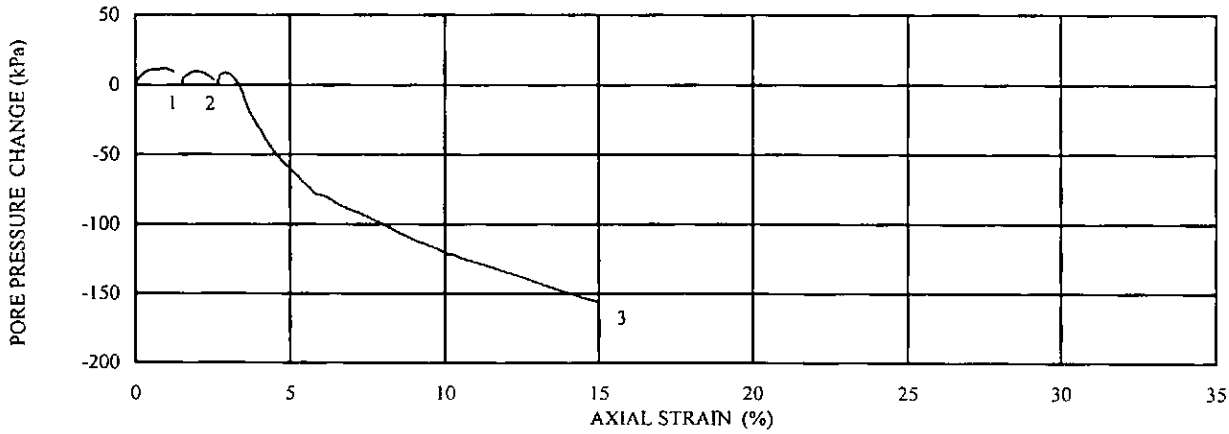
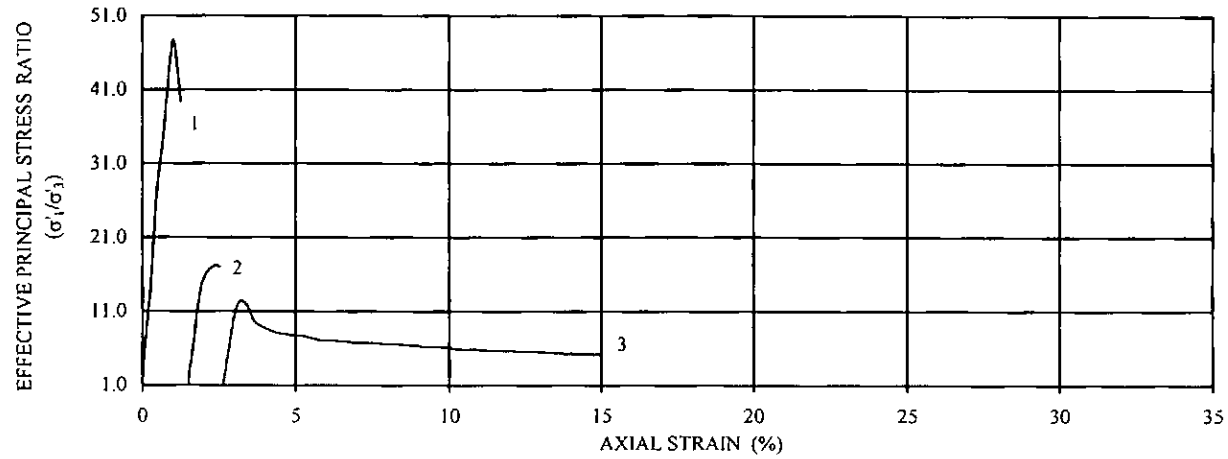
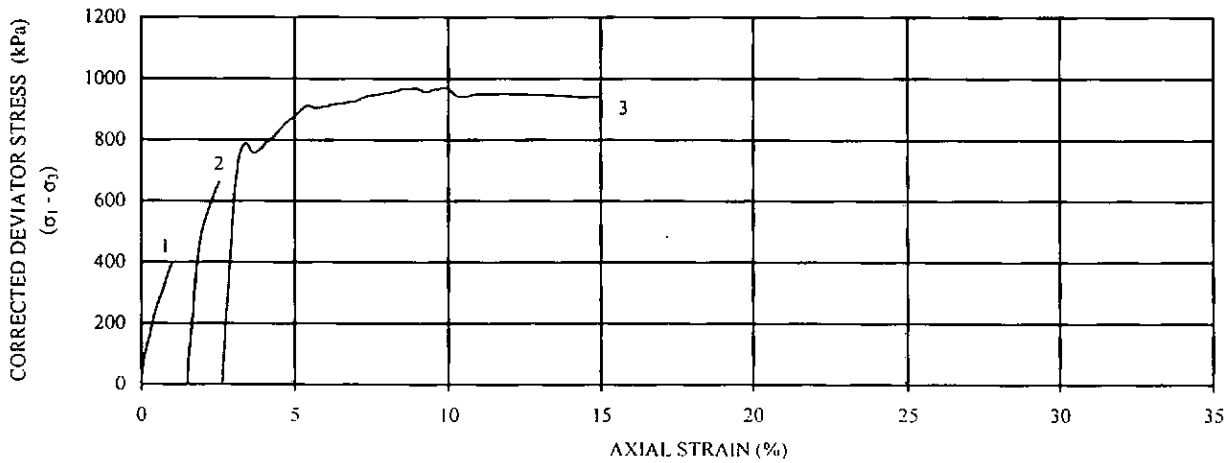
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

COMPRESSION







Borehole No. : D065 — **Sample Depth m:-** 4.50 - 5.50
Sample No. : 8 — **Specimen Depth m:-** 5.30 - 5.50

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 — **Works Order No.:** 059

Compiled by: W S Wat
Checked by: H W Chung

Form : GESR009.9 / Jun.02.03 / Issue 1 / Rev 0

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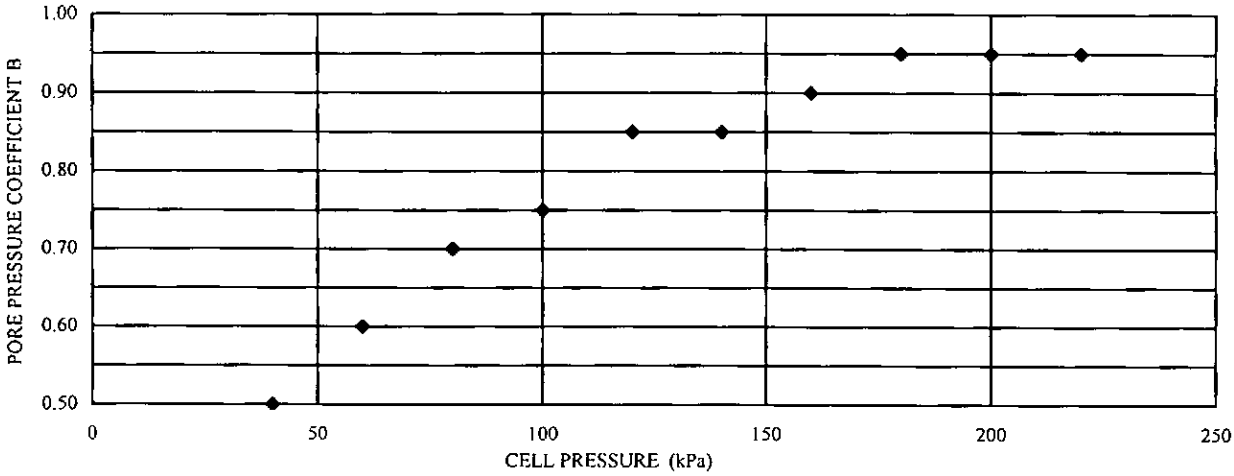
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

SATURATION



Date	Time	Cell Pressure kPa	Back Pressure kPa	Pore Pressure kPa	Cumulative Volume of Water cm^3	Pore Pressure Parameter B
23/11/2008	08:40	0	0	-	0.0	
	08:47	20	-	20		-
	09:32	20	15	15	-3.3	
	09:37	40	-	25		0.50
	10:33	40	35	35	-1.4	
	10:39	60	-	47		0.60
	11:14	60	55	55	1.5	
	11:17	80	-	69		0.70
	11:51	80	75	75	3.6	
	11:55	100	-	90		0.75
	13:14	100	95	95	5.9	
	13:20	120	-	112		0.85
	14:56	120	115	115	7.7	
	15:03	140	-	132		0.85
	16:09	140	135	135	9.3	
	16:16	160	-	153		0.90
	16:40	160	155	155	9.6	
	16:42	180	-	174		0.95
	17:06	180	175	175	9.7	
	17:09	200	-	194		0.95
	17:18	200	195	195	10.0	
	17:20	220	-	214		0.95
24/11/2008	08:35	220	215	215	13.8	

Borehole No. : D065 **Sample Depth m:-** 4.50 - 5.50
Sample No. : 8 **Specimen Depth m:-** 5.30 - 5.50

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.:** 059

Compiled by W S Wat
Checked by H W Chung

Form : GESR009.11 / Jun.02.03 / Issue 1 / Rev 0

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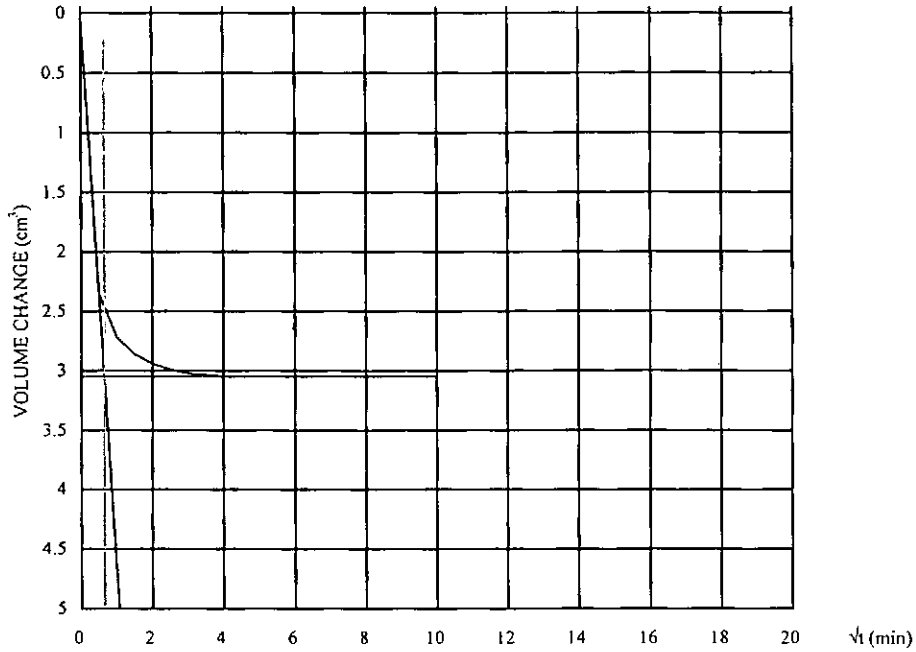
TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

CONSOLIDATION (DRAINED PHASE) - Stage 1

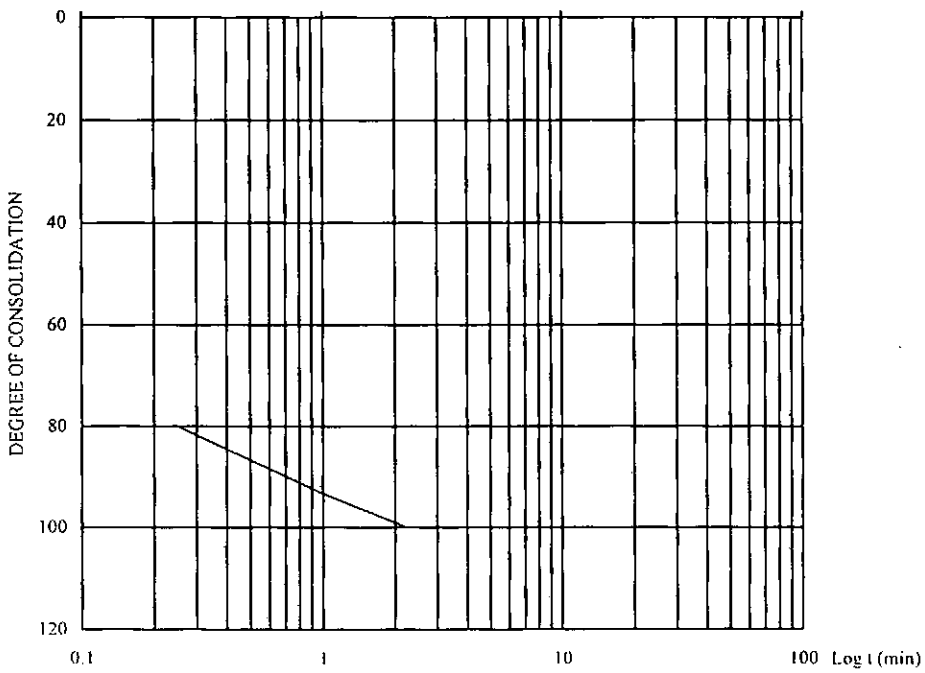


√t100 0.65 min

t100 0.42 min

tf 0.22 min

Calc. strain rate
45.156 mm/min



Borehole No. : D065 **Sample Depth m:-** 4.50 - 5.50

Sample No. : 8 **Specimen Depth m:-** 5.30 - 5.50

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.:** 059

Complied by: W S Wat

Checked by: H W Chung

Form : GESR009.13 / Jun.02.03 / Issue 1 / Rev 0

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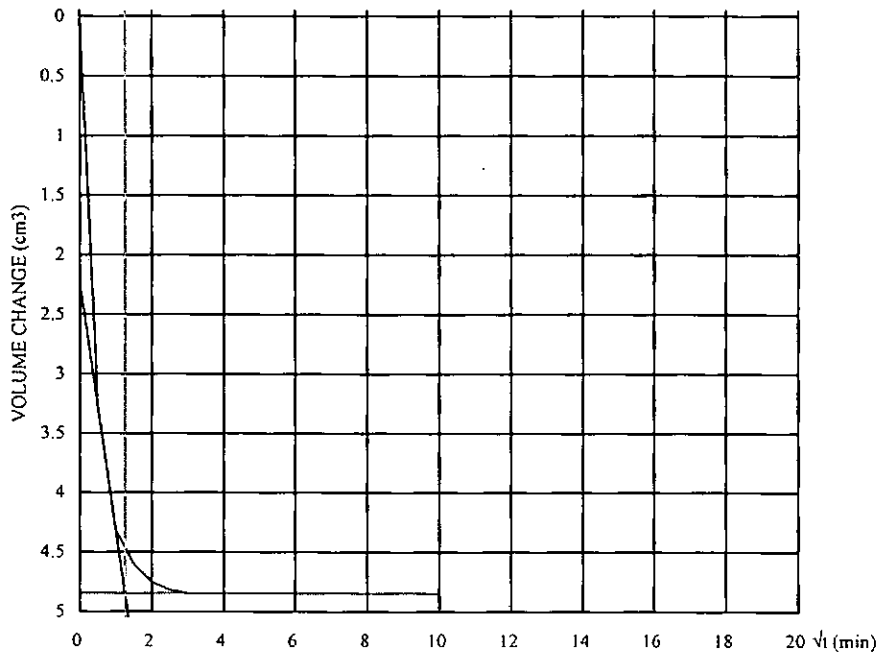
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

CONSOLIDATION (DRAINED PHASE) - Stage 2

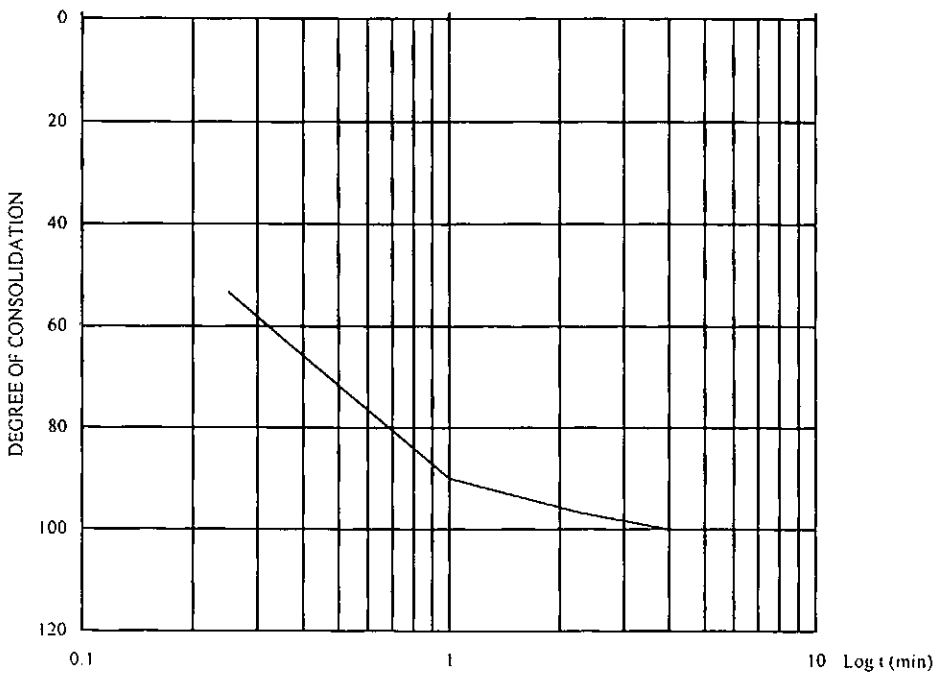


√t100 1.25 min

t100 1.57 min

tf 0.83 min

Calc. strain rate
12.014 mm/min



Borehole No. : D065 **Sample Depth m:-** 4.50 - 5.50

Sample No. : 8 **Specimen Depth m:-** 5.30 - 5.50

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.:** 059

Complied by: W S Wat

Checked by: H W Chung

Form : GESR009.13 / Jun.02.03 / Issue 1 / Rev 0

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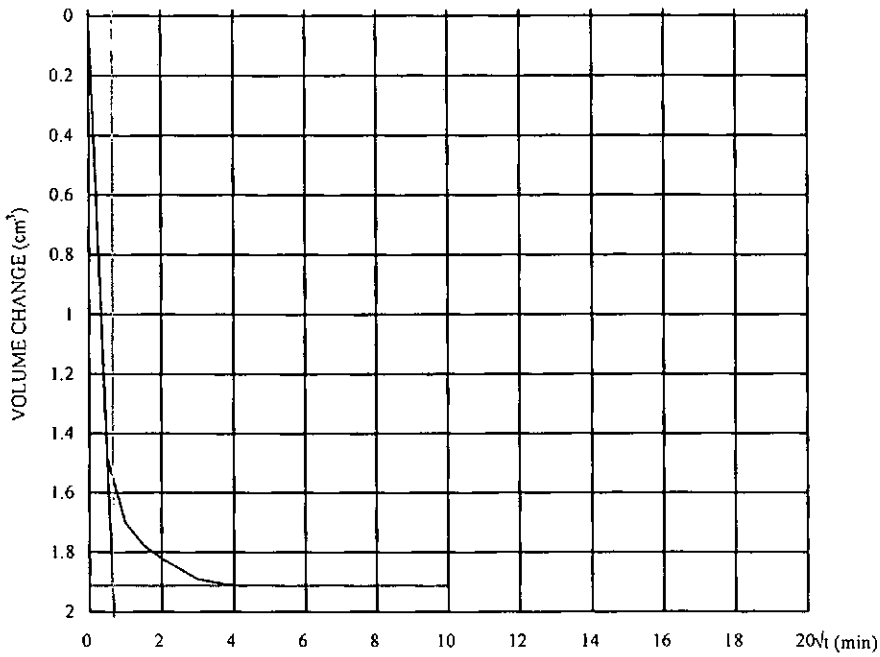
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

CONSOLIDATION (DRAINED PHASE) - Stage 3

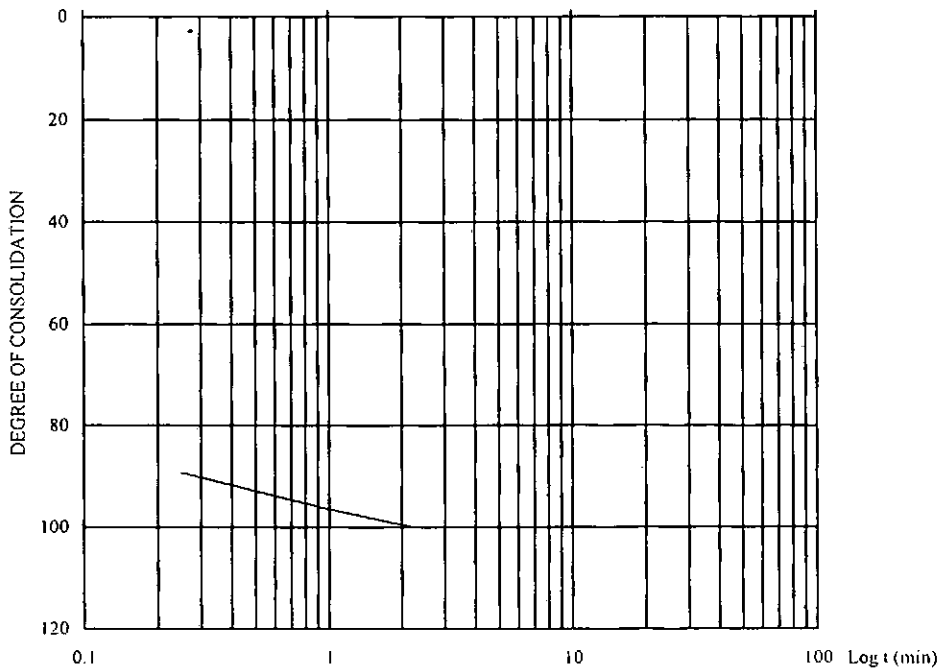


√t100 0.64 min

t100 0.42 min

tf 0.22 min

Calc. strain rate
44.756 mm/min



Borehole No. : D065 **Sample Depth m:-** 4.50 - 5.50

Sample No. : 8 **Specimen Depth m:-** 5.30 - 5.50

Customer :	**Mass Transit Railway Corporation**	Complied by
Project :	**Ground Investigation for South Island Line**	W S Wat
	Contract No.: Contract 1024	Checked by
Job No.:	**J2999** **Works Order No.: 059**	H W Chung

Form : GESR009.13 / Jun.02.03 / Issue 1 / Rev 0

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Multi Stage			P.W.P.B.P					Effective Pressure	20				kPa
Side drains	No		Selected Machine Speed		0.048		mm/min	Rate of Strain	1.99				% per hr
FAILURE CRITERION													
Max. deviator Stress		☐	Max. Stress ratio		☒			Axial Strain %					☐
Stage :	1	Applied Pressure (kPa) - Cell :		235	Back :	215		P.R. factor	1.7257				kN/mm

Date	Time	Strain		Load	Pore Pressure	Dev. stress		Effective Stress Parameters					
		Dial		P.R.No. 35		Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
24/11	09:15	0.00	0.00	0.067	215	0.000	0.0	20.0	20.0	20.0	0.0	20.0	1.00
	09:20	0.07	0.05	0.212	218	0.014	58.0	75.4	17.4	46.4	29.0	36.7	4.33
	09:25	0.20	0.13	0.323	220	0.038	102.3	116.9	14.6	65.7	51.1	48.7	8.00
	09:30	0.37	0.26	0.456	223	0.075	155.2	167.2	12.0	89.6	77.6	63.7	13.93
	09:35	0.48	0.33	0.537	224	0.095	187.4	198.2	10.8	104.5	93.7	73.3	18.35
	09:40	0.64	0.44	0.654	225	0.126	233.7	243.3	9.6	126.5	116.9	87.5	25.35
	09:45	0.79	0.55	0.742	226	0.157	268.5	277.7	9.2	143.4	134.2	98.7	30.18
	09:50	1.00	0.69	0.836	226	0.196	305.4	314.5	9.1	161.8	152.7	110.9	34.56
	09:55	1.16	0.80	0.932	226	0.226	343.1	351.8	8.7	180.3	171.6	123.1	40.44
	10:00	1.32	0.91	1.012	227	0.257	374.5	383.0	8.5	195.7	187.2	133.3	45.06
	10:05	**1.51**	**1.04**	**1.078**	**226**	**0.292**	**400.1**	**408.7**	**8.6**	**208.6**	**200.0**	**142.0**	**47.52**
	10:10	1.81	1.25	1.076	225	0.349	398.4	408.8	10.4	209.6	199.2	143.2	39.30

Borehole No. :	**D065**	**Sample Depth m:- 4.50 - 5.50**	
Sample No. :	**8**	**Specimen Depth m:- 5.30 - 5.50**	
Customer :	**Mass Transit Railway Corporation**		Compiled by
Project :	**Ground Investigation for South Island Line**		W S Wat
		Contract No.: Contract 1024	Checked by
Job No.:	**J2999**	**Works Order No.: 059**	H W Chung

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TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Multi Stage			P.W.P,B.P					Effective Pressure	45				kPa
Side drains	No		Selected Machine Speed		0.047		mm/min	Rate of Strain	1.98				% per hr
FAILURE CRITERION													
Max. deviator Stress			☐		Max. Stress ratio		☒	Axial Strain %					☐
Stage :	2	Applied Pressure (kPa) - Cell :			260	Back :	215	P.R. factor			3.1069		kN/mm

Date	Time	Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
		Dial		P.R.No. 24	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
24/11	12:05	2.18	1.51	0.065	215	0.000	0.0	45.0	45.0	45.0	0.0	45.0	1.00
	12:10	2.24	1.54	0.178	219	0.427	80.4	121.2	40.8	81.0	40.2	67.6	2.97
	12:15	2.33	1.61	0.276	221	0.445	150.3	189.4	39.1	114.2	75.1	89.2	4.84
	12:20	2.46	1.70	0.423	222	0.469	255.0	292.7	37.7	165.2	127.5	122.7	7.77
	12:25	2.57	1.78	0.559	224	0.490	351.8	388.3	36.5	212.4	175.9	153.8	10.64
	12:30	2.71	1.87	0.684	224	0.513	440.5	476.1	35.6	255.9	220.3	182.4	13.37
	12:35	2.85	1.97	0.767	225	0.539	499.1	534.5	35.4	285.0	249.6	201.8	15.10
	12:40	3.06	2.11	0.838	224	0.575	548.8	584.6	35.8	310.2	274.4	218.7	16.33
	12:45	3.30	2.28	0.907	223	0.618	596.8	634.0	37.2	335.6	298.4	236.1	17.04
	12:50	**3.50**	**2.42**	**0.963**	**221**	**0.653**	**635.6**	**674.7**	**39.1**	**356.9**	**317.8**	**251.0**	**17.26**
	12:55	3.68	2.54	1.002	219	0.683	662.4	703.9	41.5	372.7	331.2	262.3	16.96

Borehole No. :	**D065**	**Sample Depth m:- 4.50 - 5.50**	
Sample No. :	**8**	**Specimen Depth m:- 5.30 - 5.50**	
Customer :	**Mass Transit Railway Corporation**		Compiled by
Project :	**Ground Investigation for South Island Line**		W S Wat
		Contract No.: Contract 1024	Checked by
Job No.:	**J2999**	**Works Order No.: 059**	H W Chung

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Form : GESR009.14 / Dec.13.04 / Issue 1 / Rev i

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Multi Stage		P.W.P,B.P		Effective Pressure	70 kPa
Side drains	No	Selected Machine Speed	0.046 mm/min	Rate of Strain	1.96 % per hr
FAILURE CRITERION					
Max. deviator Stress	☐	Max. Stress ratio	☒	Axial Strain %	☐
Stage : 3	Applied Pressure (kPa) - Cell :	285	Back : 215	P.R. factor	5.2891 kN/mm

Date	Time	Strain Dial	Strain	Load P.R.No. 4	Pore Pressure	Dev. stress Corr.	Dev. stress q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
25/11	08:35	3.82	2.64	0.047	215	0.000	0.0	70.0	70.0	70.0	0.0	70.0	1.00
	08:40	3.97	2.74	0.197	222	0.733	180.2	243.3	63.1	153.2	90.1	123.2	3.86
	08:45	4.09	2.83	0.307	223	0.755	312.5	374.1	61.6	217.9	156.3	165.8	6.07
	08:50	4.21	2.91	0.411	224	0.775	437.4	498.5	61.1	279.8	218.7	206.9	8.16
	08:55	4.37	3.02	0.546	223	0.801	599.2	660.8	61.6	361.2	299.6	261.3	10.73
	09:00	4.49	3.10	0.615	222	0.821	681.6	744.3	62.7	403.5	340.8	289.9	11.87
	09:05	**4.68**	**3.23**	**0.678**	**219**	**0.852**	**756.2**	**822.2**	**66.0**	**444.1**	**378.1**	**318.1**	**12.46**
	09:10	4.95	3.42	0.706	212	0.897	788.3	860.9	72.6	466.7	394.1	335.4	11.86
	09:15	5.28	3.65	0.683	199	0.951	758.9	845.3	86.4	465.8	379.4	339.4	9.78
	09:20	5.67	3.91	0.695	188	1.012	771.0	868.2	97.2	482.7	385.5	354.2	8.93
	09:25	5.85	4.04	0.710	183	1.042	787.8	889.5	101.7	495.6	393.9	364.3	8.75
	09:30	6.07	4.19	0.719	177	1.076	797.2	905.0	107.8	506.4	398.6	373.5	8.40
	09:35	6.34	4.38	0.736	171	1.118	815.8	930.0	114.2	522.1	407.9	386.1	8.14
	09:40	6.54	4.52	0.752	167	1.150	833.5	951.7	118.2	534.9	416.7	396.0	8.05
	09:45	6.82	4.71	0.772	162	1.192	855.4	978.9	123.5	551.2	427.7	408.6	7.93
	09:50	7.07	4.89	0.785	157	1.231	869.1	996.7	127.6	562.2	434.6	417.3	7.81
	09:55	7.39	5.10	0.800	153	1.276	884.7	1016.7	132.0	574.4	442.4	426.9	7.70
	10:00	7.61	5.26	0.816	150	1.311	902.0	1037.5	135.5	586.5	451.0	436.2	7.66
	10:05	7.85	5.42	0.827	145	1.345	913.3	1053.0	139.7	596.4	456.7	444.1	7.54
	10:10	8.17	5.64	0.822	141	1.391	905.3	1049.6	144.3	597.0	452.7	446.1	7.27
	10:15	8.41	5.81	0.825	137	1.426	907.2	1055.1	147.9	601.5	453.6	450.3	7.13
	10:20	8.73	6.03	0.829	136	1.471	909.7	1058.8	149.1	603.9	454.8	452.3	7.10
	10:25	8.94	6.17	0.835	135	1.500	915.2	1065.3	150.1	607.7	457.6	455.2	7.10
	10:30	9.22	6.37	0.840	132	1.540	919.1	1071.9	152.8	612.3	459.5	459.2	7.02
	10:35	9.51	6.57	0.845	129	1.580	922.8	1078.4	155.6	617.0	461.4	463.2	6.93
	10:40	9.80	6.77	0.849	127	1.619	925.5	1083.3	157.8	620.6	462.8	466.3	6.87
	10:45	10.08	6.96	0.853	125	1.656	928.1	1087.9	159.8	623.9	464.1	469.2	6.81
	10:50	10.34	7.14	0.861	124	1.691	935.5	1096.5	161.0	628.8	467.8	472.8	6.81
	10:55	10.56	7.29	0.868	123	1.720	942.0	1104.4	162.4	633.4	471.0	476.4	6.80
	11:00	10.84	7.49	0.874	121	1.758	946.9	1111.3	164.4	637.8	473.4	480.0	6.76
	11:05	11.13	7.69	0.878	118	1.795	949.3	1116.0	166.7	641.4	474.7	483.1	6.69
	11:10	11.42	7.89	0.883	116	1.833	953.0	1121.8	168.8	645.3	476.5	486.5	6.65
	11:15	11.64	8.04	0.887	115	1.860	955.9	1126.3	170.4	648.4	478.0	489.0	6.61
	11:20	11.91	8.23	0.892	113	1.895	959.6	1132.1	172.5	652.3	479.8	492.4	6.56
	11:25	12.24	8.45	0.899	110	1.935	965.1	1140.3	175.2	657.8	482.6	496.9	6.51
	11:30	12.45	8.60	0.902	108	1.961	967.0	1144.0	177.0	660.5	483.5	499.3	6.46
	11:35	12.73	8.79	0.904	106	1.995	967.2	1146.2	179.0	662.6	483.6	501.4	6.40
	11:40	13.00	8.98	0.907	104	2.029	968.5	1149.4	180.9	665.2	484.3	503.7	6.35
	11:45	13.21	9.12	0.902	103	2.053	961.4	1143.6	182.2	662.9	480.7	502.7	6.28

Borehole No. :	**D065**	**Sample Depth m:- 4.50 - 5.50**	
Sample No. :	**8**	**Specimen Depth m:- 5.30 - 5.50**	
Customer :	**Mass Transit Railway Corporation**		Compiled by W S Wat
Project :	**Ground Investigation for South Island Line**	**Contract No.: Contract 1024**	Checked by H W Chung
Job No.:	**J2999**	**Works Order No.: 059**	

Form : GESR009.14 / Dec.13.04 / Issue 1 / Rev 1

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2
Shearing Continuation

Gammon

HKAS HOKLAS 055

FAILURE CRITERION

Max. deviator Stress ☐ | Max. Stress ratio ☒ | Axial Strain % ☐

Stage : 3		Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
Date	Time	Dial		P.R.No. 4	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
25/11	11:50	13.47	9.31	0.901	101	2.086	958.3	1141.9	183.6	662.7	479.1	503.0	6.22
	11:55	13.76	9.50	0.909	100	2.118	965.1	1150.4	185.3	667.9	482.6	507.0	6.21
	12:00	13.95	9.63	0.912	98	2.141	967.0	1153.6	186.6	670.1	483.5	508.9	6.18
	12:05	14.35	9.91	0.918	96	2.188	970.7	1160.2	189.5	674.8	485.3	513.1	6.12
	12:10	14.60	10.08	0.910	94	2.216	959.9	1151.4	191.5	671.5	480.0	511.5	6.01
	12:15	14.88	10.28	0.898	93	2.249	944.5	1136.3	191.8	664.0	472.2	506.6	5.92
	12:20	15.23	10.52	0.899	91	2.289	943.0	1137.2	194.2	665.7	471.5	508.5	5.86
	12:25	15.45	10.67	0.902	90	2.313	944.7	1139.9	195.2	667.6	472.4	510.1	5.84
	12:30	15.72	10.85	0.908	89	2.342	949.3	1145.6	196.3	671.0	474.7	512.7	5.84
	12:45	16.50	11.40	0.913	85	2.430	949.0	1149.2	200.2	674.7	474.5	516.5	5.74
	13:00	17.31	11.95	0.920	81	2.516	950.5	1154.6	204.1	679.4	475.3	520.9	5.66
	13:15	18.21	12.58	0.926	76	2.612	950.2	1159.0	208.8	683.9	475.1	525.5	5.55
	13:30	19.03	13.14	0.930	72	2.696	948.2	1161.4	213.2	687.3	474.1	529.3	5.45
	13:45	19.82	13.69	0.933	68	2.777	945.4	1162.7	217.3	690.0	472.7	532.4	5.35
	14:00	20.77	14.34	0.936	63	2.871	941.3	1163.3	222.0	692.6	470.6	535.8	5.24
	14:15	21.60	14.92	0.942	60	2.954	941.2	1166.5	225.3	695.9	470.6	539.0	5.18

Borehole No. : D065 — Sample Depth m:- 4.50 - 5.50

Sample No. : 8 — Specimen Depth m:- 5.30 - 5.50

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 — Works Order No.: 059

Compiled by: W S Wat

Checked by: H W Chung

Form : GESR009.15 / Dec.13.04 / Issue 1 / Rev 1

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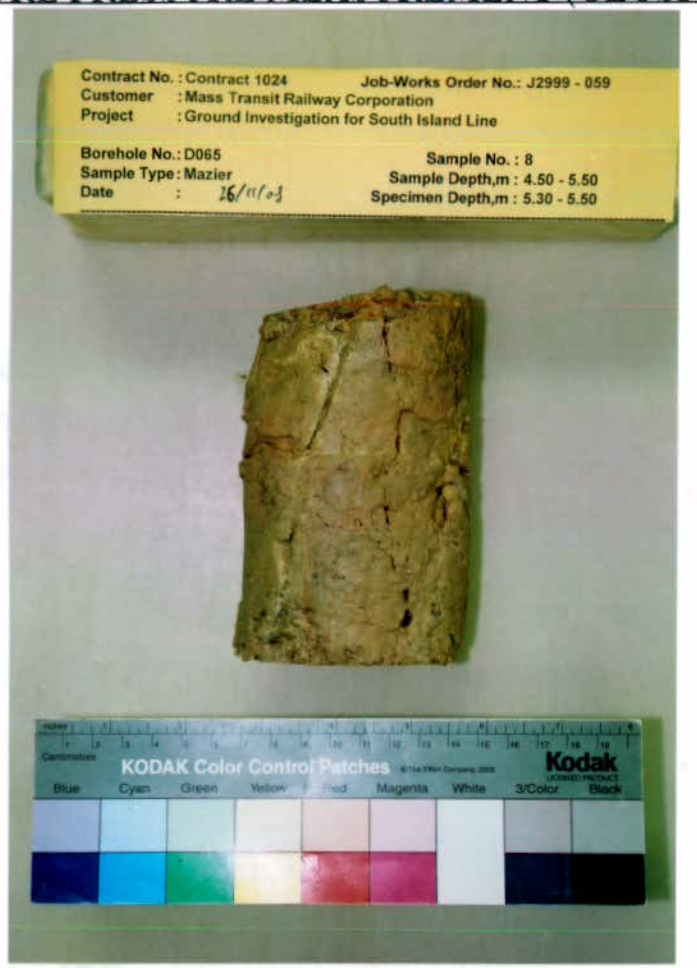
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT (GEOSPEC 3 : 2001 Test Method 15.2)



Description : Brown, slightly sandy, gravelly SILT/CLAY

Sample Origin : HDT ‡ ‡ Information provided by customer

Borehole No. : D065	**Sample No. :** 8	**Sample Depth m:-** 4.50 - 5.50	**Specimen Depth m:-** 5.30 - 5.50

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line

Contract No.: Contract 1024
Job No.: J2999
Works Order No.: 059

Compiled by W S Wat
Checked by H W Chung

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	D071		
Sample		no	1		
Sample Type			Mazier		
Stage		no	1		
Sample Depth		m	3.00 - 4.00		
Specimen Depth		m	3.80 - 4.00		
INITIAL CONDITIONS					
Diameter	(D_o)	mm	73.7		
Height	(H_o)	mm	145.0		
Moisture Content	(W_o)	%	40		
Bulk density	(ρ_o)	Mg/m^3	1.79		
Dry density	(ρ_d)	Mg/m^3	1.28		
Particle density	(ρ_s)		2.65		
Voids Ratio	(e_o)		1.07		
Degree of Saturation	(S_r)	%	99.3		
DRAINAGE CONDITIONS			ONE END		
SATURATION					
Final Pore Pressure Coefficient B			1.00		
CONSOLIDATION					
Cell Pressure	(σ_3)	kPa	245		
Back Pressure	(u_b)	kPa	215		
Effective Pressure	(σ'_3)	kPa	30		
Coefficient of Consolidation (t100) (C_{vi})		m^2/Year	382.84		
Coefficient of Volume Compressibility (m_{vi})		m^2/MN	0.62		
Coefficient of Permeability (k)		m/s	7.34E-08		
COMPRESSION TERMINATION CRITERION			MAXIMUM DEVIATOR STRESS		
COMPRESSION - INITIAL					
Moisture Content	(w)	%	39		
Pore Pressure at the End of Consolidation		kPa	215		
Effective Stress at the End of Consolidation		kPa	30		
Bulk density	(ρ_o)	Mg/m^3	1.80		
Dry density	(ρ_d)	Mg/m^3	1.30		
Voids Ratio	(e)		1.04		
Degree of Saturation	(S_r)	%	98.5		

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Report No. : J2999-059.11
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.:** 059

Technician : W S Wat Checked By : Name : H W Chung Approved By : Signatory : Lau Wai Cheong

Tested Date: 23/11/2008 Date : 08/01/2009 Date : 08/01/2009

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DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	D071		
Sample		no	1		
Sample Type			Mazier		
Stage		no	1		
Sample Depth		m	3.00 - 4.00		
Specimen Depth		m	3.80 - 4.00		
COMPRESSION - FAILURE					
Cell Pressure		kPa	245		
Rate of Strain		mm/min	0.048		
CONDITIONS MAXIMUM DEVIATOR STRESS					
Major Effective Principal Stress (σ'_1)		kPa	187		
Corrected Deviator Stress (σ'_1 - σ'_3)		kPa	128		
Minor Effective Principal Stress (σ'_3)		kPa	58		
$s' = (\sigma'_1 + \sigma'_3)/2$		kPa	123		
$t = (\sigma_1 - \sigma_3)/2$		kPa	64		
Expanded Uncertainty of s' ^		kPa	-		
Expanded Uncertainty of t ^		kPa	-		
Pore pressure parameter A_f			-0.22		
Strain at Failure	(εf)	%	12.6		
COMPRESSION - FINAL					
Moisture Content	(W_f)	%	39		
Bulk density	(ρ_o)	Mg/m^3	1.80		
Dry density	(ρ_d)	Mg/m^3	1.30		
Voids Ratio	(e_f)		1.04		
Degree of Saturation	(S_f)	%	98.5		

Notes -
1. The method of specimen preparation was in accordance with GEOSPEC 3 : 2001 :- Test method 13.3 : test specimen from undisturbed soil samples.
2. Sample received date : 29/9/2008
3. The determination of moisture content was in accordance with test method 5.1 of GEOSPEC 3 : 2001.
4. Particle density : 2.65 (Assumed)
5. Maximum and minimum temperature recorded over the period of testing 19.5 - 20.7 °C.
6. Unavoidable variations from specified procedure : none
7. Comment on observed or inferred sample disturbance : none
8. Percentage by mass of soil particles larger than 1/5 of the diameter of specimen (%) : Nil
9. The specimen was selected by the laboratory.
   Name : W S Wat Designation : Senior Laboratory Technician
10. Sampling History : As Received

* Delete as appropriate ^ Upon request

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.: 059**

Compiled by W S Wat
Checked by H W Chung

Form : GESR009.7 / Nov. i0.06 / Issue 1 / Rev 1

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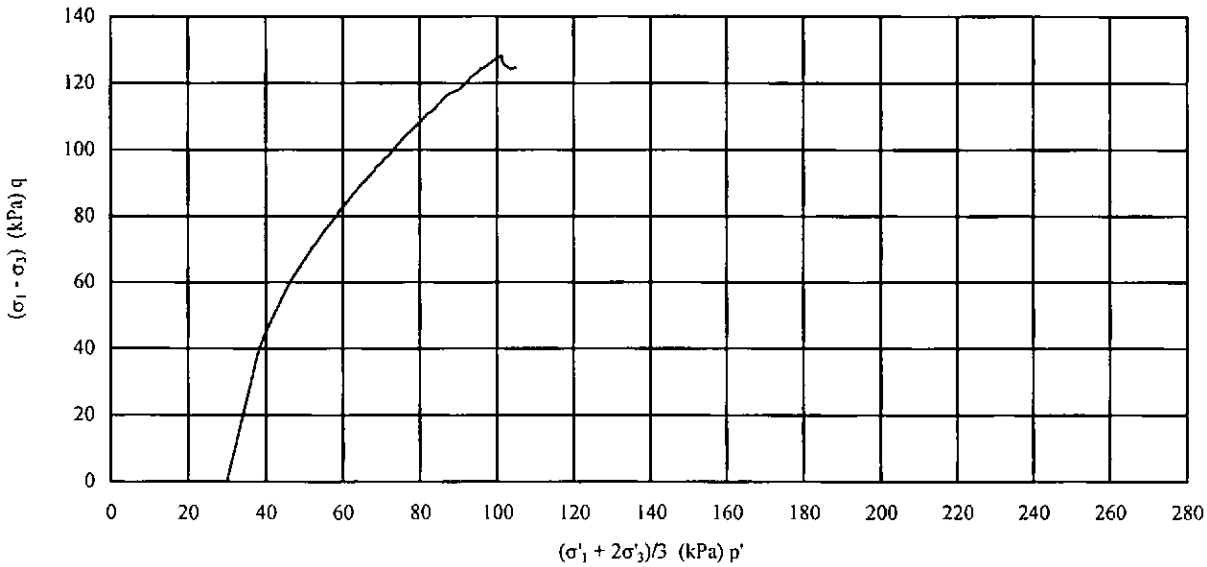
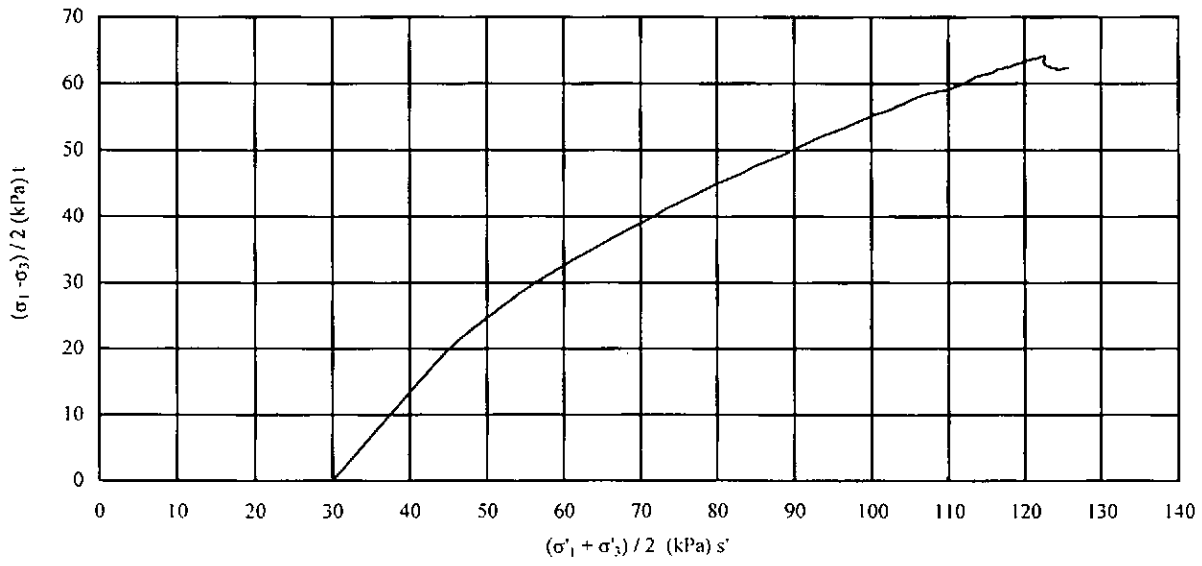
TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

STRESS PATH PARAMETERS FOR EFFECTIVE STRESS

p' - q PLOT



s' - t PLOT



Borehole No. : D071 — Sample Depth m:- 3.00 - 4.00
Sample No. : 1 — Specimen Depth m:- 3.80 - 4.00

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 — Works Order No.: 059

Compiled by: W S Wat
Checked by: H W Chung

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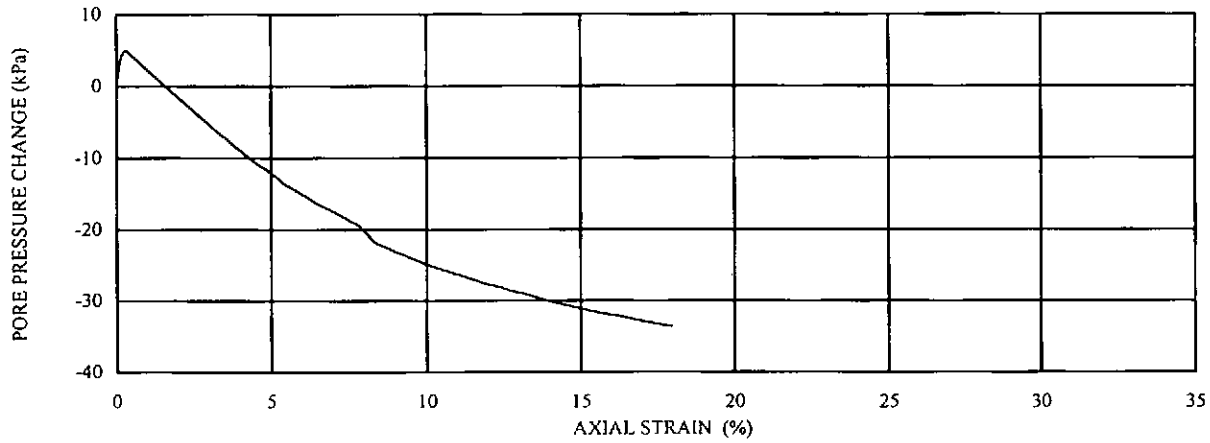
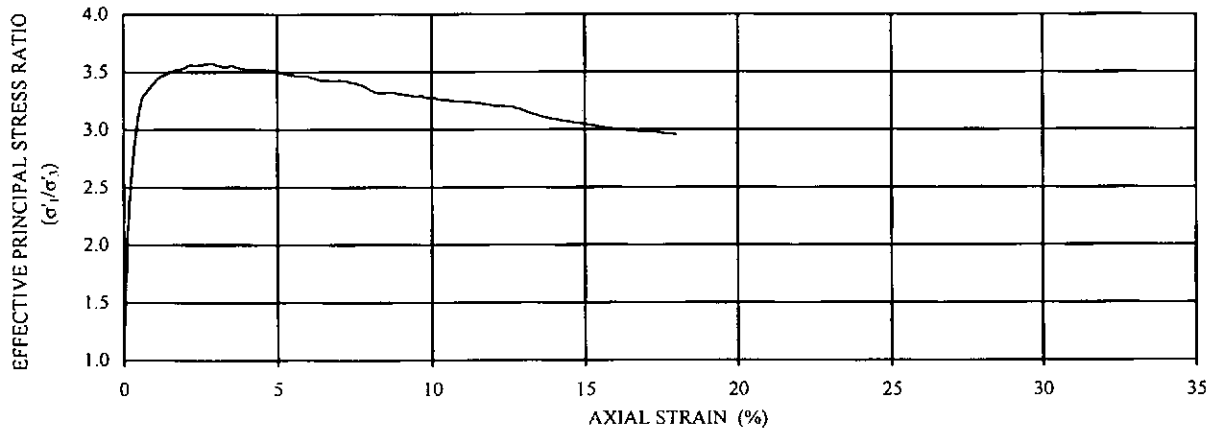
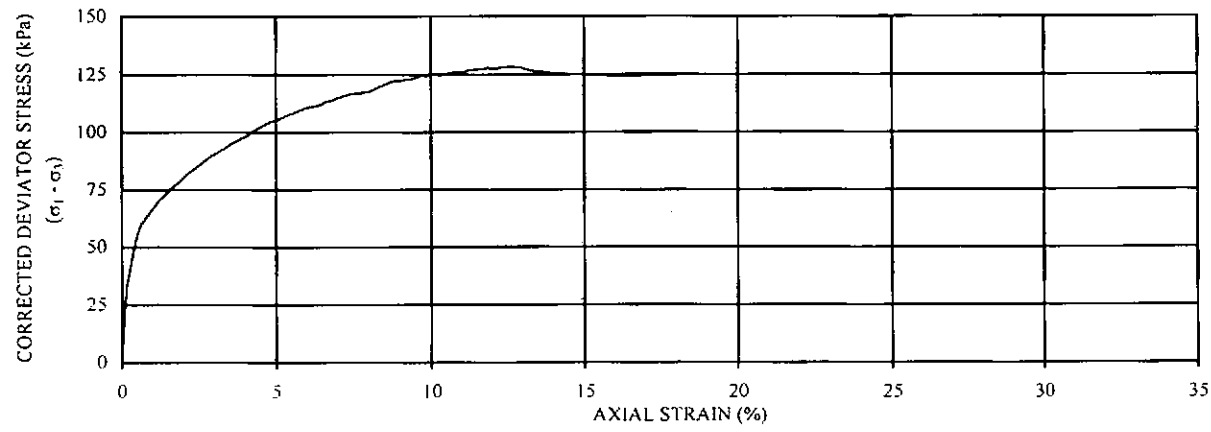
Form : GESR009.8 / Jun.02.03 / Issue 1 / Rev 0

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

COMPRESSION







Borehole No. :	**D071**	**Sample Depth m:-**	**3.00 - 4.00**
Sample No. :	**1**	**Specimen Depth m:-**	**3.80 - 4.00**
Customer :	**Mass Transit Railway Corporation**		Compiled by W S Wat
Project :	**Ground Investigation for South Island Line**		
		Contract No.: Contract 1024	Checked by H W Chung
Job No.:	**J2999**	**Works Order No.: 059**	

Form : GESR009.9 / Jun.02.03 / Issue 1 / Rev 0

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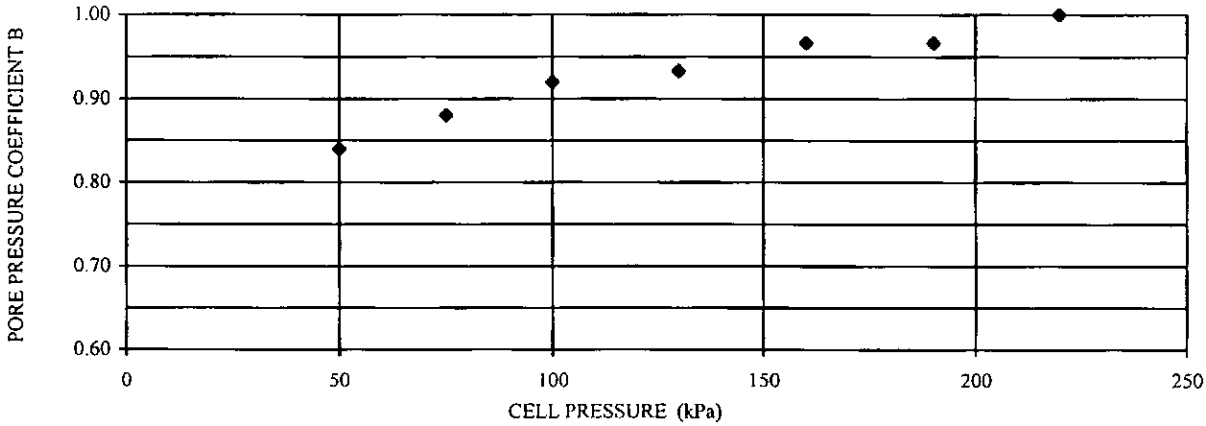
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

SATURATION



Date	Time	Cell Pressure kPa	Back Pressure kPa	Pore Pressure kPa	Cumulative Volume of Water cm^3	Pore Pressure Coefficient B
24/11/2008	08:36	0	0	-	0.0	
	08:45	25	-	23		-
	09:10	25	20	20	-7.0	
	09:17	50	-	41		0.84
	09:32	50	45	45	-6.7	
	09:38	75	-	67		0.88
	10:10	75	70	70	-6.4	
	10:20	100	-	93		0.92
	11:24	100	95	95	-5.2	
	11:32	130	-	123		0.93
	12:03	130	125	125	-4.5	
	12:15	160	-	154		0.97
	12:53	160	155	155	-4.4	
	13:01	190	-	184		0.97
	14:10	190	185	185	-4.0	
	14:19	220	-	215		1.00
25/11/2008	08:40	220	215	215	-2.5	

Borehole No. D071 **Sample Depth m:-** 3.00 - 4.00
Sample No. : 1 **Specimen Depth m:-** 3.80 - 4.00
Customer : Mass Transit Railway Corporation — Compiled by W S Wat
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024 — Checked by H W Chung
Job No.: J2999 **Works Order No.:** 059

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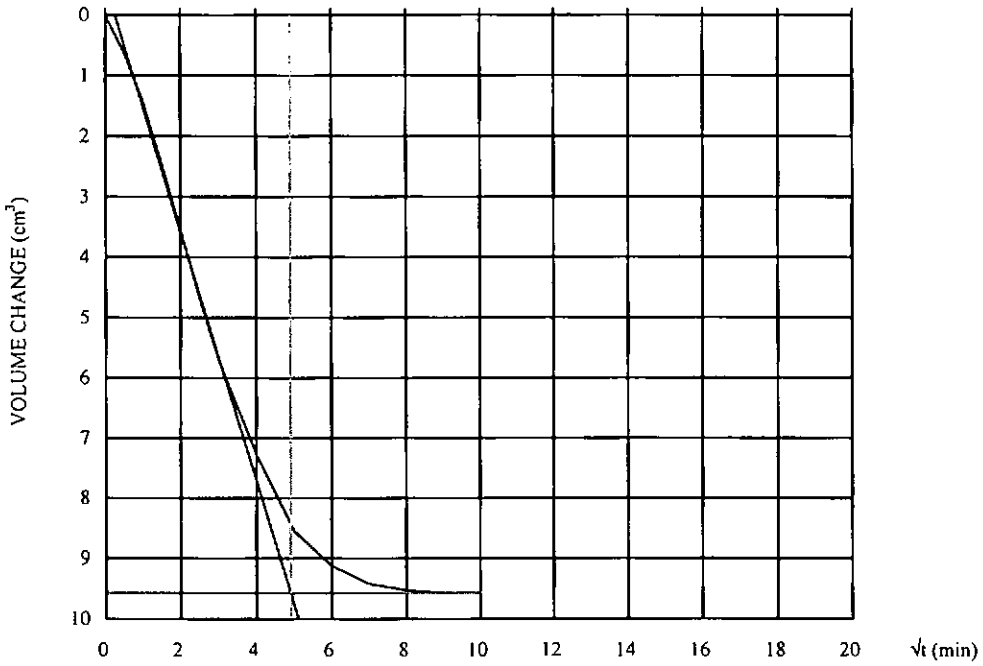
GEOSPEC 3 : 2001 Test Method 15.2

CONSOLIDATION (DRAINED PHASE) - Stage 1

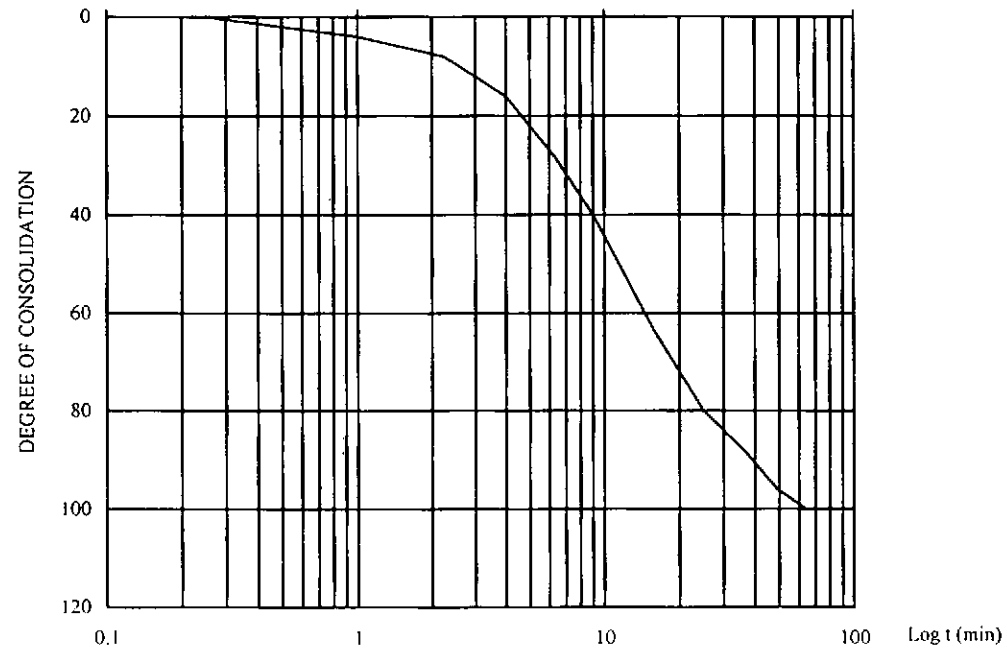


√t100 4.91 min

t100 24.099 min

tf 12.773 min

Calc. strain rate
0.790 mm/min



Borehole No. : D071 **Sample Depth m:-** 3.00 - 4.00

Sample No. : 1 **Specimen Depth m:-** 3.80 - 4.00

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.:** 059

Complied by: W S Wat

Checked by: H W Chung

Form : GESR009.13 / Jun.02.03 / Issue 1 / Rev 0

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Single Stage			P.W.P,B.P				Effective Pressure	30				kPa
Side drains	No	Selected Machine Speed	0.048	mm/min	Rate of Strain	2.00	% per hr					
FAILURE CRITERION												
Max. deviator Stress	☒	Max. Stress ratio	☐	Axial Strain %	☐							
Stage : 1	Applied Pressure (kPa) - Cell :	245	Back :	215	P.R. factor	3.1341	kN/mm					

Date	Time	Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
		Dial		P.R.No. 2	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
26/11	08:40	0.00	0.00	0.052	215	0.000	0.0	30.0	30.0	30.0	0.0	30.0	1.00
	08:45	0.20	0.14	0.092	219	0.041	29.6	55.8	26.2	41.0	14.8	36.1	2.13
	08:50	0.40	0.28	0.108	220	0.081	41.4	66.4	25.0	45.7	20.7	38.8	2.65
	08:55	0.67	0.46	0.124	219	0.132	53.0	78.6	25.6	52.1	26.5	43.3	3.07
	09:00	0.90	0.62	0.133	219	0.178	59.5	85.7	26.2	56.0	29.8	46.0	3.27
	09:05	1.05	0.73	0.136	218	0.208	61.7	88.3	26.6	57.4	30.8	47.2	3.32
	09:10	1.43	0.99	0.143	217	0.281	66.6	94.3	27.7	61.0	33.3	49.9	3.40
	09:15	1.73	1.20	0.148	217	0.338	70.0	98.5	28.5	63.5	35.0	51.8	3.46
	09:20	1.98	1.37	0.151	216	0.384	72.1	101.2	29.1	65.1	36.0	53.1	3.48
	09:25	2.26	1.56	0.155	215	0.435	74.8	104.7	29.9	67.3	37.4	54.8	3.50
	09:30	2.48	1.72	0.158	215	0.477	76.8	107.3	30.5	68.9	38.4	56.1	3.52
	09:35	2.82	1.95	0.162	214	0.537	79.5	110.9	31.4	71.1	39.7	57.9	3.53
	09:40	3.10	2.15	0.166	213	0.589	82.2	114.3	32.1	73.2	41.1	59.5	3.56
	09:45	3.40	2.36	0.169	212	0.643	84.1	117.0	32.9	75.0	42.1	60.9	3.56
	09:50	3.68	2.55	0.172	211	0.691	86.1	119.7	33.6	76.6	43.0	62.3	3.56
	09:55	4.02	2.79	0.176	211	0.750	88.7	123.2	34.5	78.8	44.3	64.1	3.57
	10:00	4.23	2.93	0.178	210	0.785	90.0	125.0	35.0	80.0	45.0	65.0	3.57
	10:05	4.49	3.11	0.180	209	0.829	91.2	126.9	35.7	81.3	45.6	66.1	3.55
	10:10	4.84	3.35	0.183	208	0.887	93.0	129.6	36.6	83.1	46.5	67.6	3.54
	10:15	5.10	3.54	0.186	208	0.932	95.0	132.2	37.2	84.7	47.5	68.9	3.55
	10:20	5.37	3.72	0.188	207	0.974	96.2	134.1	37.9	86.0	48.1	70.0	3.54
	10:25	5.61	3.89	0.190	207	1.014	97.4	135.9	38.5	87.2	48.7	71.0	3.53
	10:30	5.90	4.09	0.192	206	1.060	98.6	137.8	39.2	88.5	49.3	72.1	3.51
	10:35	6.17	4.27	0.195	205	1.101	100.5	140.3	39.8	90.0	50.2	73.3	3.52
	10:40	6.49	4.50	0.198	204	1.153	102.3	142.9	40.6	91.7	51.1	74.7	3.52
	10:45	6.75	4.68	0.200	204	1.193	103.5	144.6	41.1	92.8	51.7	75.6	3.52
	10:50	6.99	4.85	0.202	203	1.231	104.7	146.3	41.6	93.9	52.3	76.5	3.52
	10:55	7.23	5.01	0.203	203	1.266	105.1	147.2	42.1	94.7	52.6	77.1	3.50
	11:00	7.51	5.21	0.205	202	1.309	106.3	149.0	42.7	95.8	53.1	78.1	3.49
	11:05	7.75	5.37	0.207	202	1.343	107.5	150.9	43.4	97.1	53.7	79.2	3.48
	11:10	8.08	5.60	0.209	201	1.392	108.6	152.6	44.0	98.3	54.3	80.2	3.47
	11:15	8.37	5.80	0.211	201	1.434	109.7	154.2	44.5	99.3	54.8	81.1	3.46
	11:20	8.63	5.98	0.213	200	1.471	110.8	155.8	45.0	100.4	55.4	81.9	3.46
	11:25	8.92	6.18	0.214	200	1.512	111.3	156.8	45.5	101.1	55.6	82.6	3.45
	11:30	9.31	6.45	0.216	199	1.567	112.3	158.6	46.3	102.4	56.1	83.7	3.42
	11:35	9.55	6.62	0.218	198	1.601	113.4	160.1	46.7	103.4	56.7	84.5	3.43
	11:40	9.78	6.78	0.219	198	1.632	113.9	160.9	47.0	103.9	56.9	85.0	3.42
	11:45	10.06	6.97	0.221	198	1.670	115.0	162.4	47.4	104.9	57.5	85.7	3.43
	11:50	10.36	7.18	0.223	197	1.710	116.0	163.9	47.9	105.9	58.0	86.6	3.42

Borehole No. : D071 — **Sample Depth m:- 3.00 - 4.00**

Sample No. : 1 — **Specimen Depth m:- 3.80 - 4.00**

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 — **Works Order No.: 059**

Compiled by: W S Wat

Checked by: H W Chung

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2
Shearing Continuation

FAILURE CRITERION													
Max. deviator Stress ☒					Max. Stress ratio ☐			Axial Strain % ☐					
Stage : 1		Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
Date	Time	Dial		P.R.No. 2	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
26/11	11:55	10.60	7.35	0.224	197	1.743	116.5	164.8	48.3	106.5	58.2	87.1	3.41
	12:00	10.80	7.49	0.225	196	1.770	117.0	165.7	48.7	107.2	58.5	87.7	3.40
	12:05	11.17	7.75	0.226	196	1.819	117.3	166.5	49.2	107.8	58.6	88.3	3.38
	12:10	11.43	7.92	0.227	195	1.851	117.7	167.6	49.9	108.8	58.9	89.1	3.36
	12:15	11.69	8.10	0.228	194	1.884	118.1	168.8	50.7	109.8	59.1	90.1	3.33
	12:20	12.00	8.32	0.231	193	1.924	119.8	171.6	51.8	111.7	59.9	91.7	3.31
	12:25	12.28	8.51	0.233	193	1.959	120.9	173.1	52.2	112.6	60.4	92.5	3.32
	12:30	12.55	8.70	0.235	193	1.993	122.0	174.5	52.5	113.5	61.0	93.2	3.32
	12:35	12.86	8.92	0.236	192	2.032	122.3	175.3	53.0	114.2	61.2	93.8	3.31
	12:40	13.13	9.10	0.237	192	2.063	122.7	176.0	53.3	114.7	61.4	94.2	3.30
	12:45	13.41	9.30	0.238	191	2.098	123.1	176.7	53.6	115.1	61.5	94.6	3.30
	12:50	13.68	9.48	0.239	191	2.129	123.5	177.5	54.0	115.7	61.7	95.2	3.29
	12:55	13.94	9.67	0.241	191	2.162	124.5	178.8	54.3	116.6	62.3	95.8	3.29
	13:00	14.17	9.82	0.241	190	2.188	124.3	178.9	54.6	116.7	62.1	96.0	3.28
	13:05	14.60	10.12	0.243	190	2.238	125.1	180.2	55.1	117.7	62.6	96.8	3.27
	13:10	14.83	10.28	0.243	190	2.265	124.9	180.2	55.3	117.7	62.4	96.9	3.26
	13:15	15.12	10.48	0.244	189	2.298	125.2	180.8	55.6	118.2	62.6	97.3	3.25
	13:20	15.32	10.62	0.245	189	2.321	125.7	181.5	55.8	118.6	62.8	97.7	3.25
	13:25	15.61	10.82	0.246	189	2.353	126.0	182.1	56.1	119.1	63.0	98.1	3.25
	13:30	15.97	11.07	0.247	189	2.394	126.3	182.7	56.4	119.5	63.1	98.5	3.24
	13:35	16.16	11.20	0.248	188	2.415	126.7	183.3	56.6	120.0	63.4	98.8	3.24
	13:40	16.45	11.40	0.249	188	2.446	127.0	183.9	56.9	120.4	63.5	99.2	3.23
	13:45	16.80	11.64	0.250	188	2.484	127.3	184.5	57.2	120.9	63.7	99.6	3.23
	13:50	17.05	11.82	0.251	188	2.513	127.7	185.2	57.5	121.3	63.8	100.1	3.22
	13:55	17.30	11.99	0.251	187	2.539	127.4	185.1	57.7	121.4	63.7	100.2	3.21
	14:00	17.60	12.20	0.252	187	2.572	127.7	185.6	57.9	121.8	63.9	100.5	3.21
	14:05	17.84	12.37	0.253	187	2.598	128.1	186.2	58.1	122.1	64.0	100.8	3.20
	14:10	**18.15**	**12.58**	**0.254**	**187**	**2.630**	**128.4**	**186.8**	**58.4**	**122.6**	**64.2**	**101.2**	**3.20**
	14:15	18.48	12.81	0.254	186	2.665	128.0	186.7	58.7	122.7	64.0	101.4	3.18
	14:20	18.65	12.93	0.254	186	2.683	127.8	186.6	58.8	122.7	63.9	101.4	3.17
	14:25	19.05	13.21	0.253	186	2.725	126.7	185.8	59.1	122.5	63.4	101.3	3.14
	14:30	19.27	13.36	0.253	186	2.747	126.5	185.8	59.3	122.5	63.2	101.5	3.13
	14:45	20.08	13.92	0.253	185	2.830	125.5	185.5	60.0	122.8	62.8	101.8	3.09
	15:00	20.92	14.50	0.254	184	2.914	125.2	185.8	60.6	123.2	62.6	102.3	3.07
	15:15	21.76	15.09	0.255	184	2.999	124.9	186.1	61.2	123.6	62.4	102.8	3.04
	15:30	22.64	15.70	0.256	183	3.085	124.5	186.3	61.8	124.1	62.3	103.3	3.01
	15:45	23.49	16.28	0.257	183	3.167	124.2	186.4	62.2	124.3	62.1	103.6	3.00
	16:00	24.28	16.83	0.259	182	3.244	124.5	187.2	62.7	124.9	62.2	104.2	2.99
	16:15	25.10	17.40	0.261	182	3.324	124.8	188.0	63.2	125.6	62.4	104.8	2.97
	16:30	25.93	17.98	0.262	181	3.405	124.4	188.0	63.6	125.8	62.2	105.1	2.96

Borehole No. : D071 **Sample Depth m:- 3.00 - 4.00**

Sample No. : 1 **Specimen Depth m:- 3.80 - 4.00**

Customer : Mass Transit Railway Corporation — Compiled by W S Wat

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024 — Checked by H W Chung

Job No.: J2999 **Works Order No.: 059**

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT (GEOSPEC 3 : 2001 Test Method 15.2)

Description : Greyish brown, very Sandy SILT

Sample Origin : CDT‡

‡ Information provided by customer

Borehole No. : D071 Sample No. : 1 Sample Depth m:- 3.00 - 4.00 Specimen Depth m:- 3.80 - 4.00

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No. : Contract 1024

Job No. : J2999

Works Order No.: 059

Compiled by
W S Wat

Checked by
H W Chung

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DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	D071		
Sample		no	9		
Sample Type			Mazier		
Stage		no	1		
Sample Depth		m	8.00 - 9.00		
Specimen Depth		m	8.60 - 8.80		
INITIAL CONDITIONS					
Diameter	(D_o)	mm	73.8		
Height	(H_o)	mm	145.0		
Moisture Content	(W_o)	%	33		
Bulk density	(ρ_o)	Mg/m^3	1.88		
Dry density	(ρ_d)	Mg/m^3	1.42		
Particle density	(ρ_s)		2.65		
Voids Ratio	(e_o)		0.87		
Degree of Saturation	(S_r)	%	100.0		
DRAINAGE CONDITIONS			ONE END		
SATURATION					
Final Pore Pressure Coefficient B			1.00		
CONSOLIDATION					
Cell Pressure	(σ_3)	kPa	330		
Back Pressure	(u_b)	kPa	245		
Effective Pressure	(σ'_3)	kPa	85		
Coefficient of Consolidation (t100) (C_{vi})		m^2/Year	883.77		
Coefficient of Volume Compressibility (m_{vi})		m^2/MN	0.33		
Coefficient of Permeability (k)		m/s	9.06E-08		
COMPRESSION TERMINATION CRITERION			MAXIMUM DEVIATOR STRESS		
COMPRESSION - INITIAL					
Moisture Content	(w)	%	31		
Pore Pressure at the End of Consolidation		kPa	245		
Effective Stress at the End of Consolidation		kPa	85		
Bulk density	(ρ_o)	Mg/m^3	1.91		
Dry density	(ρ_d)	Mg/m^3	1.46		
Voids Ratio	(e)		0.82		
Degree of Saturation	(S_t)	%	99.5		

Customer : **Mass Transit Railway Corporation**

Project : **Ground Investigation for South Island Line**

Report No. : J2999-059.11

Contract No.: Contract 1024

Job No.: **J2999** **Works Order No.: 059**

Technician : W S Wat Checked By : Approved By :

Name : H W Chung Signatory : **Lau Wai Cheong**

Tested Date: 19/12/2008 Date : 08/01/2009 Date : 08/01/2009

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Form : GESR009.6 / Nov.10.06 / Issue 1 / Rev 1

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	D071		
Sample		no	9		
Sample Type			Mazier		
Stage		no	1		
Sample Depth		m	8.00 - 9.00		
Specimen Depth		m	8.60 - 8.80		
COMPRESSION - FAILURE					
Cell Pressure		kPa	330		
Rate of Strain		mm/min	0.048		
CONDITIONS MAXIMUM DEVIATOR STRESS					
Major Effective Principal Stress (σ'_1)		kPa	383		
Corrected Deviator Stress ($\sigma'_1 - \sigma'_3$)		kPa	286		
Minor Effective Principal Stress (σ'_3)		kPa	97		
$s' = (\sigma'_1 + \sigma'_3)/2$		kPa	240		
$t = (\sigma_1 - \sigma_3)/2$		kPa	143		
Expanded Uncertainty of s' ^		kPa	-		
Expanded Uncertainty of t ^		kPa	-		
Pore pressure parameter A_f			-0.04		
Strain at Failure	(εf)	%	12.1		
COMPRESSION - FINAL					
Moisture Content	(W_f)	%	31		
Bulk density	(ρ_o)	Mg/m^3	1.91		
Dry density	(ρ_d)	Mg/m^3	1.46		
Voids Ratio	(e_f)		0.82		
Degree of Saturation	(S_f)	%	99.5		

Notes -
1. The method of specimen preparation was in accordance with GEOSPEC 3 : 2001 :- Test method 13.3 : test specimen from undisturbed soil samples.
2. Sample received date : 29/9/2008
3. The determination of moisture content was in accordance with test method 5.1 of GEOSPEC 3 : 2001.
4. Particle density : 2.65 (Determined)
5. Maximum and minimum temperature recorded over the period of testing 19.5 - 20.7 °C.
6. Unavoidable variations from specified procedure : none
7. Comment on observed or inferred sample disturbance : none
8. Percentage by mass of soil particles larger than 1/5 of the diameter of specimen (%) : Nil
9. The specimen was selected by the laboratory.
   Name : W S Wat Designation : Senior Laboratory Technician
10. Sampling History : As Received

* Delete as appropriate ^ Upon request

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.: 059**

Compiled by W S Wat
Checked by H W Chung

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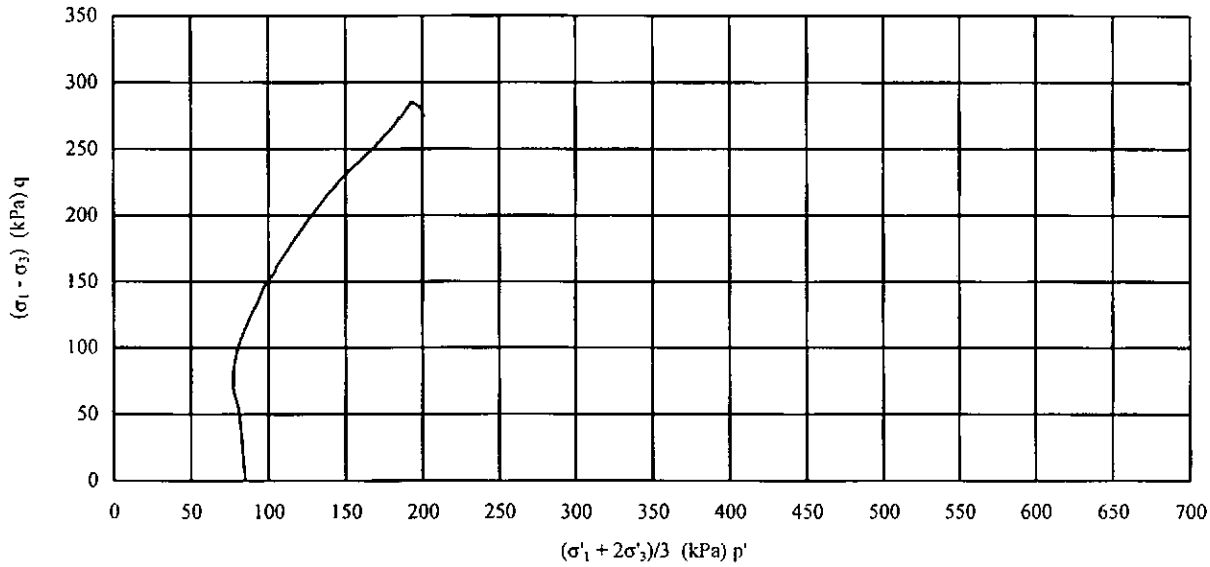
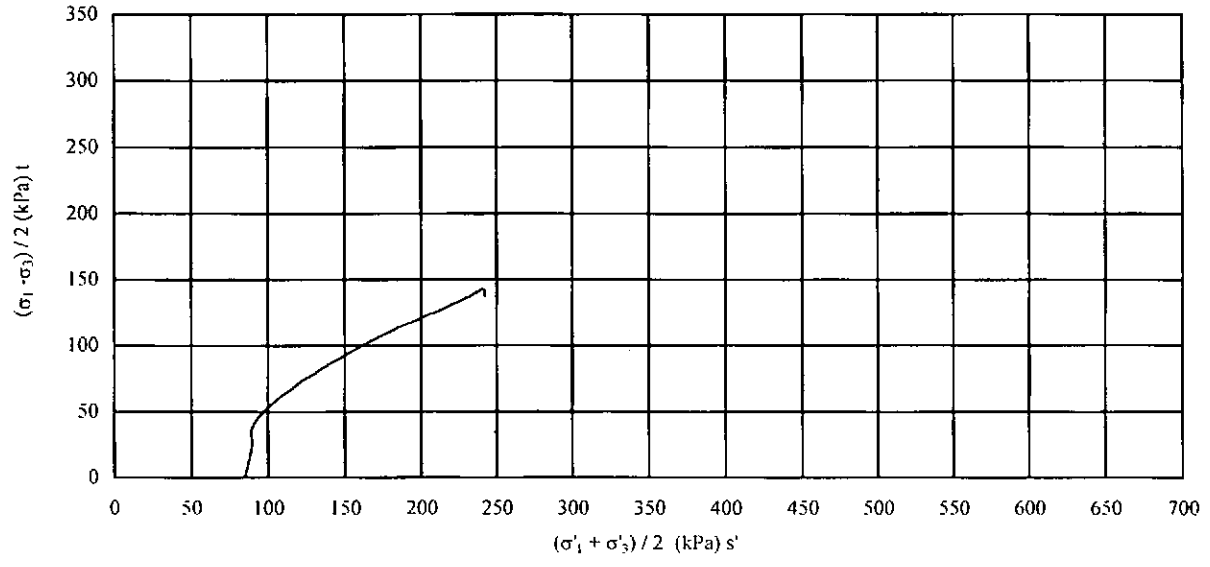
TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

STRESS PATH PARAMETERS FOR EFFECTIVE STRESS

p' - q PLOT



s' - t PLOT



Borehole No. : D071 — **Sample Depth m:-** 8.00 - 9.00
Sample No. : 9 — **Specimen Depth m:-** 8.60 - 8.80

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 — **Works Order No.:** 059

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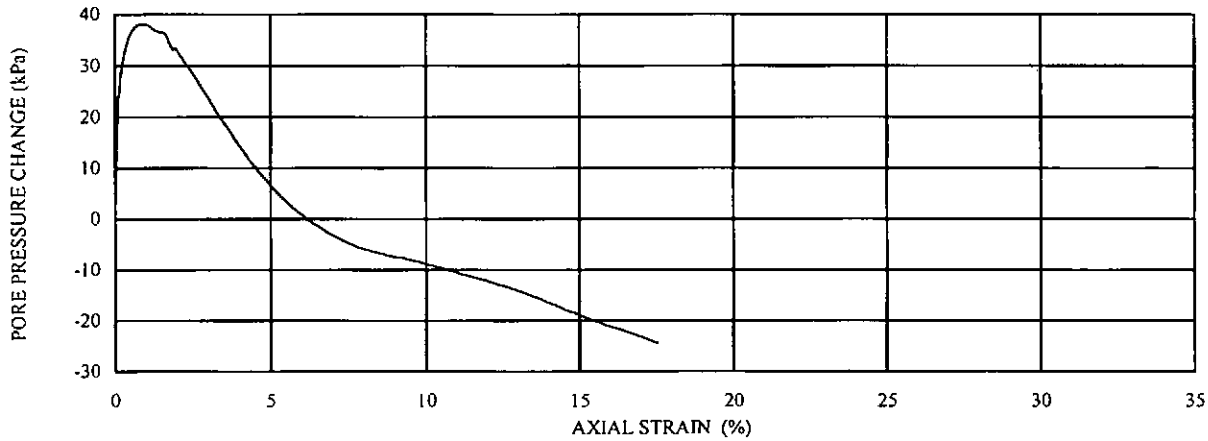
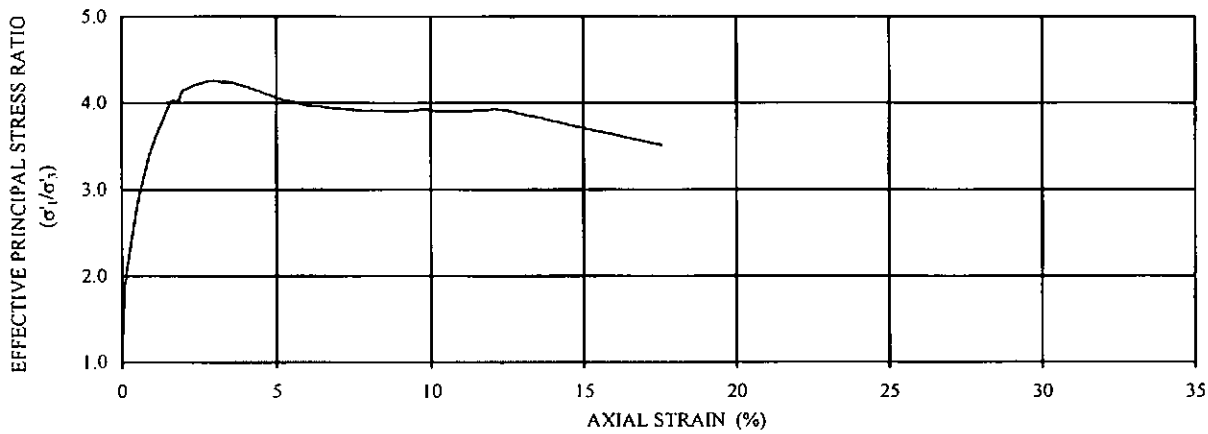
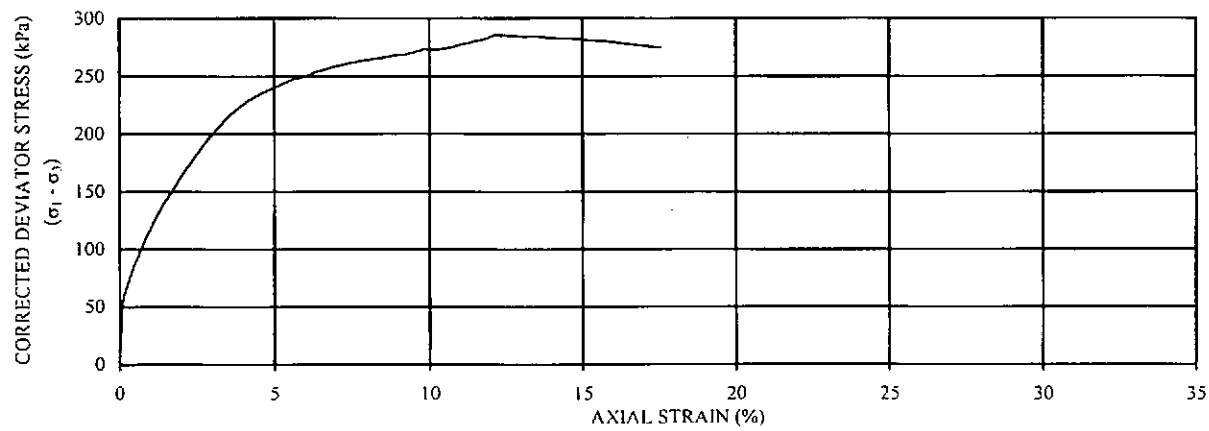
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

COMPRESSION







Borehole No. : D071 **Sample Depth m:-** 8.00 - 9.00
Sample No. : 9 **Specimen Depth m:-** 8.60 - 8.80

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.:** 059

Compiled by: W S Wat
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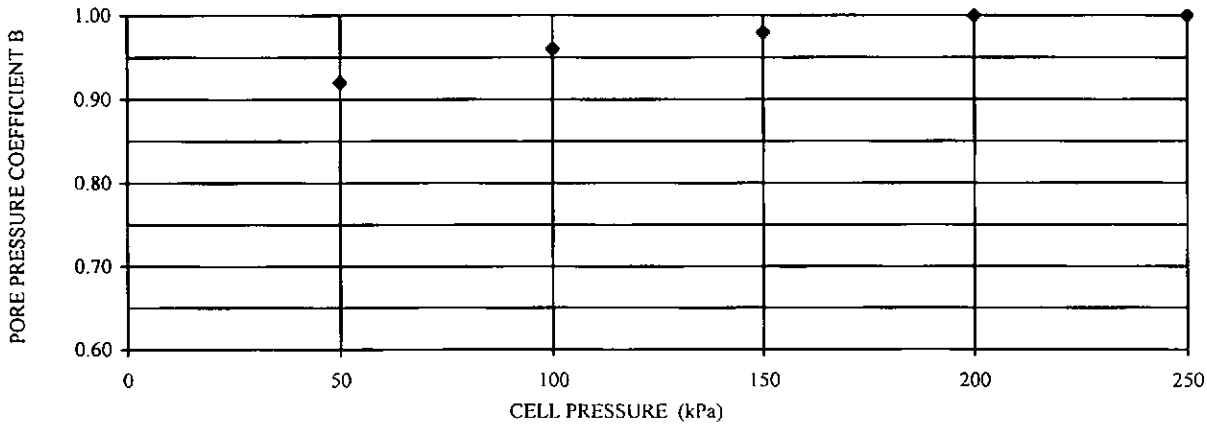
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

SATURATION



Date	Time	Cell Pressure kPa	Back Pressure kPa	Pore Pressure kPa	Cumulative Volume of Water cm^3	Pore Pressure Coefficient B
22/12/2008	08:36	0	0	-	0.0	
	08:45	25	-	24		-
	09:04	25	20	20	-2.4	
	09:12	50	-	43		0.92
	09:40	50	45	45	-2.0	
	09:48	100	-	93		0.96
	10:12	100	95	95	-1.8	
	10:19	150	-	144		0.98
	10:38	150	145	145	-1.5	
	10:42	200	-	195		1.00
	12:50	200	195	195	-1.4	
	12:57	250	-	245		1.00
29/12/2008	08:41	250	245	245	-1.4	

Borehole No. D071 **Sample Depth m:-** 8.00 - 9.00
Sample No. : 9 **Specimen Depth m:-** 8.60 - 8.80
Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.:** 059

Compiled by: W S Wat
Checked by: H W Chung

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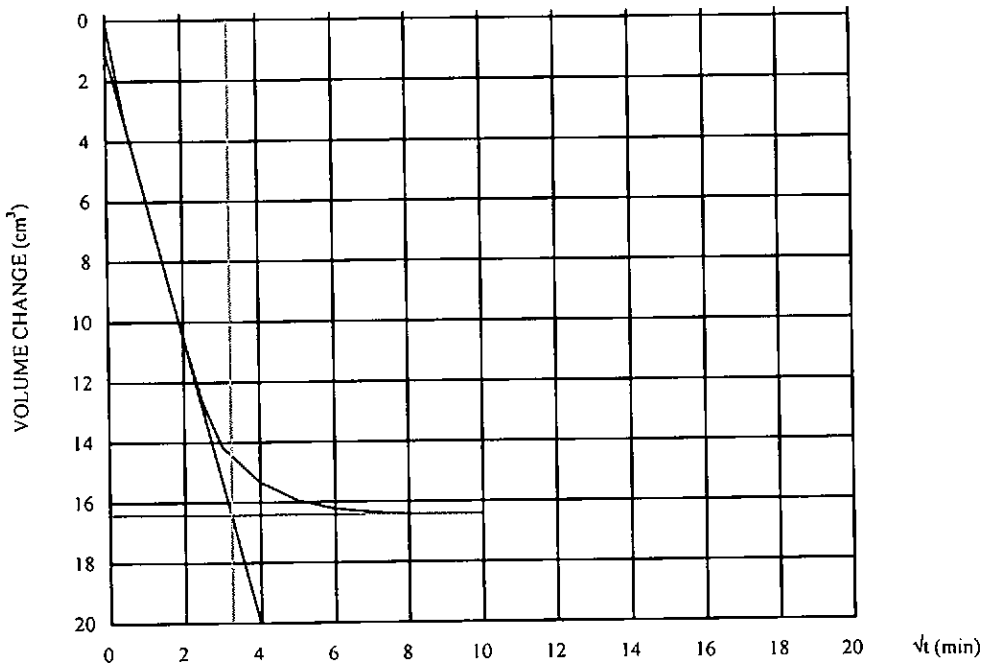
Form : GESR009.11 / Jun.02.03 / Issue 1 / Rev 0

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

CONSOLIDATION (DRAINED PHASE) - Stage 1

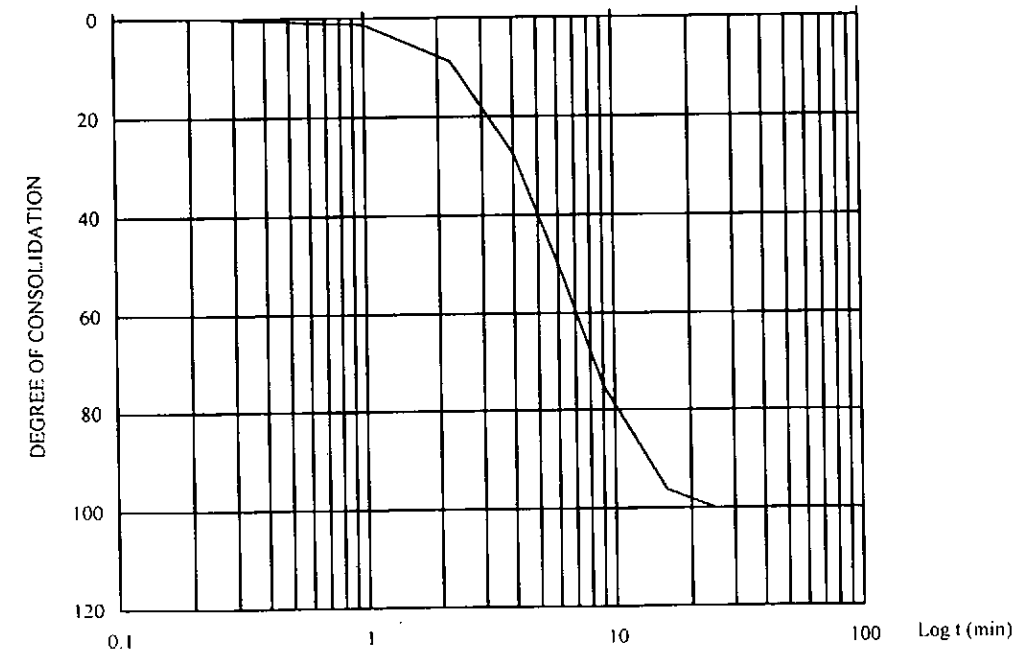


√t100 3.24 min

t100 10.471 min

tf 5.550 min

Calc. strain rate
1.812 mm/min



Borehole No. : D071
Sample No. : 9

Sample Depth m:- 8.00 - 9.00
Specimen Depth m:- 8.60 - 8.80

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line

Contract No.: Contract 1024
Works Order No.: 059

Job No.: J2999

Complied by: W S Wat
Checked by: H W Chung

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TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Single Stage				P.W.P,B.P				Effective Pressure		85			kPa
Side drains	No		Selected Machine Speed			0.048	mm/min	Rate of Strain		2.00			% per hr
FAILURE CRITERION													
Max. deviator Stress			☒	Max. Stress ratio			☐	Axial Strain %					☐
Stage :	1	Applied Pressure (kPa) - Cell :			330	Back :	245	P.R. factor		1.6835			kN/mm

Date	Time	Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
		Dial		P.R.No. 39	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
30/12	08:35	0.00	0.00	0.086	245	0.000	0.0	85.0	85.0	85.0	0.0	85.0	1.00
	08:40	0.11	0.08	0.213	266	0.023	50.8	115.2	64.4	89.8	25.4	81.3	1.79
	08:45	0.33	0.23	0.254	275	0.067	67.0	122.3	55.3	88.8	33.5	77.6	2.21
	08:50	0.57	0.40	0.287	279	0.115	80.0	130.6	50.6	90.6	40.0	77.3	2.58
	08:55	0.80	0.55	0.314	282	0.158	90.6	138.9	48.3	93.6	45.3	78.5	2.88
	09:00	1.05	0.73	0.342	283	0.208	101.5	148.6	47.1	97.9	50.8	80.9	3.16
	09:05	1.27	0.88	0.366	283	0.250	110.8	157.7	46.9	102.3	55.4	83.8	3.36
	09:10	1.45	1.01	0.383	283	0.286	117.4	164.3	46.9	105.6	58.7	86.0	3.50
	09:15	1.68	1.17	0.406	283	0.329	126.2	173.6	47.4	110.5	63.1	89.5	3.66
	09:20	1.89	1.31	0.424	282	0.367	133.1	181.2	48.1	114.7	66.6	92.5	3.77
	09:25	2.13	1.48	0.445	282	0.413	141.1	189.5	48.4	119.0	70.6	95.4	3.92
	09:30	2.36	1.64	0.461	281	0.455	147.2	195.9	48.7	122.3	73.6	97.8	4.02
	09:35	2.69	1.87	0.487	278	0.516	157.0	208.8	51.8	130.3	78.5	104.1	4.03
	09:40	2.84	1.97	0.499	278	0.542	161.5	213.1	51.6	132.3	80.7	105.4	4.13
	09:45	3.07	2.13	0.516	277	0.583	167.8	220.8	53.0	136.9	83.9	108.9	4.17
	09:50	3.31	2.30	0.533	276	0.626	174.2	228.7	54.5	141.6	87.1	112.6	4.20
	09:55	3.54	2.46	0.549	274	0.667	180.1	236.1	56.0	146.0	90.0	116.0	4.22
	10:00	3.78	2.63	0.565	273	0.709	186.0	243.5	57.5	150.5	93.0	119.5	4.23
	10:05	4.02	2.80	0.582	271	0.752	192.2	251.3	59.1	155.2	96.1	123.2	4.25
	10:10	4.26	2.97	0.598	269	0.793	198.0	258.8	60.8	159.8	99.0	126.8	4.26
	10:15	4.46	3.11	0.610	268	0.827	202.4	264.6	62.2	163.4	101.2	129.7	4.25
	10:20	4.69	3.26	0.623	266	0.864	207.0	270.8	63.8	167.3	103.5	132.8	4.25
	10:25	4.92	3.42	0.636	265	0.902	211.7	277.0	65.3	171.1	105.8	135.9	4.24
	10:30	5.17	3.60	0.650	263	0.945	216.7	283.6	66.9	175.2	108.3	139.1	4.24
	10:35	5.42	3.77	0.660	262	0.984	220.1	288.5	68.4	178.4	110.0	141.8	4.22
	10:40	5.64	3.92	0.671	260	1.019	223.9	293.8	69.9	181.9	112.0	144.5	4.20
	10:45	5.87	4.09	0.681	259	1.058	227.3	298.6	71.3	185.0	113.7	147.1	4.19
	10:50	6.13	4.27	0.690	257	1.099	230.3	303.2	72.9	188.1	115.2	149.7	4.16
	10:55	6.46	4.50	0.701	255	1.151	233.9	308.6	74.7	191.7	117.0	152.7	4.13
	11:00	6.64	4.62	0.706	254	1.178	235.5	311.2	75.7	193.4	117.7	154.2	4.11
	11:05	6.88	4.79	0.713	253	1.215	237.7	314.6	76.9	195.8	118.9	156.1	4.09
	11:10	7.12	4.96	0.719	252	1.253	239.5	317.6	78.1	197.9	119.8	157.9	4.07
	11:15	7.39	5.15	0.726	251	1.294	241.7	321.1	79.4	200.2	120.8	160.0	4.04
	11:20	7.62	5.30	0.733	250	1.326	243.9	324.3	80.4	202.3	121.9	161.7	4.03
	11:25	7.88	5.49	0.740	249	1.366	246.0	327.5	81.5	204.5	123.0	163.5	4.02
	11:30	8.10	5.64	0.745	248	1.398	247.5	329.8	82.3	206.0	123.7	164.8	4.01
	11:35	8.36	5.82	0.749	247	1.436	248.5	331.8	83.3	207.5	124.2	166.1	3.98
	11:40	8.60	5.99	0.754	246	1.471	249.9	334.0	84.1	209.0	124.9	167.4	3.97
	11:45	8.84	6.15	0.760	245	1.503	251.7	336.6	84.9	210.7	125.8	168.8	3.96

Borehole No. : D071 — **Sample Depth m:-** 8.00 - 9.00
Sample No. : 9 — **Specimen Depth m:-** 8.60 - 8.80

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 — **Works Order No.:** 059

Compiled by: W S Wat
Checked by: H W Chung

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Form : GESR009.14 / Dec.13.04 / Issue 1 / Rev 1

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2
Shearing Continuation

FAILURE CRITERION

Max. deviator Stress ☒ | Max. Stress ratio ☐ | Axial Strain % ☐

Stage :	I	Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
Date	Time	Dial		P.R.No. 39	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
30/12	11:50	9.08	6.32	0.767	244	1.538	253.8	339.4	85.6	212.5	126.9	170.2	3.96
	11:55	9.31	6.48	0.771	244	1.570	254.8	341.0	86.2	213.6	127.4	171.1	3.96
	12:00	9.55	6.65	0.776	243	1.604	256.2	343.1	86.9	215.0	128.1	172.3	3.95
	12:05	9.80	6.82	0.781	242	1.638	257.5	345.1	87.6	216.4	128.8	173.4	3.94
	12:10	10.05	7.00	0.786	242	1.673	258.9	347.1	88.2	217.6	129.4	174.5	3.94
	12:15	10.29	7.16	0.790	241	1.704	259.9	348.6	88.7	218.6	129.9	175.3	3.93
	12:20	10.61	7.38	0.796	241	1.746	261.4	350.8	89.4	220.1	130.7	176.5	3.92
	12:25	10.77	7.49	0.798	240	1.767	261.8	351.5	89.7	220.6	130.9	177.0	3.92
	12:30	11.00	7.66	0.802	240	1.799	262.8	352.9	90.1	221.5	131.4	177.7	3.92
	12:35	11.28	7.85	0.806	239	1.835	263.7	354.3	90.6	222.5	131.9	178.5	3.91
	12:40	11.51	8.01	0.809	239	1.864	264.3	355.1	90.8	223.0	132.2	178.9	3.91
	12:45	11.78	8.20	0.813	239	1.899	265.2	356.4	91.2	223.8	132.6	179.6	3.91
	12:50	12.04	8.38	0.817	239	1.932	266.1	357.6	91.5	224.6	133.1	180.2	3.91
	12:55	12.26	8.53	0.819	238	1.959	266.4	358.1	91.7	224.9	133.2	180.5	3.90
	13:00	12.48	8.69	0.823	238	1.988	267.3	359.3	92.0	225.7	133.7	181.1	3.91
	13:05	12.80	8.91	0.827	238	2.027	268.1	360.4	92.3	226.4	134.1	181.7	3.90
	13:10	13.10	9.12	0.830	238	2.064	268.6	361.1	92.5	226.8	134.3	182.0	3.90
	13:15	13.37	9.31	0.834	237	2.097	269.4	362.1	92.7	227.4	134.7	182.5	3.91
	13:20	13.52	9.41	0.837	237	2.114	270.2	363.1	92.9	228.0	135.1	183.0	3.91
	13:25	13.78	9.59	0.843	237	2.145	271.8	364.9	93.1	229.0	135.9	183.7	3.92
	13:30	14.14	9.84	0.850	237	2.187	273.5	367.0	93.5	230.2	136.7	184.7	3.93
	13:35	14.29	9.95	0.850	236	2.206	273.1	366.8	93.7	230.3	136.6	184.7	3.92
	13:40	14.49	10.08	0.851	236	2.228	273.1	367.0	93.9	230.4	136.5	184.9	3.91
	13:45	14.81	10.31	0.854	236	2.266	273.4	367.7	94.3	231.0	136.7	185.4	3.90
	13:50	15.00	10.44	0.857	236	2.287	274.1	368.6	94.5	231.5	137.0	185.9	3.90
	13:55	15.25	10.61	0.860	235	2.315	274.6	369.4	94.8	232.1	137.3	186.3	3.90
	14:00	15.47	10.77	0.864	235	2.341	275.5	370.6	95.1	232.9	137.8	186.9	3.90
	14:05	15.66	10.90	0.868	235	2.362	276.5	371.8	95.3	233.5	138.2	187.5	3.90
	14:10	15.93	11.09	0.874	234	2.393	278.0	373.7	95.7	234.7	139.0	188.4	3.90
	14:15	16.21	11.28	0.878	234	2.423	278.8	374.8	96.0	235.4	139.4	188.9	3.90
	14:20	16.43	11.43	0.883	234	2.447	280.1	376.3	96.2	236.2	140.0	189.6	3.91
	14:25	16.64	11.58	0.887	234	2.471	281.0	377.5	96.5	237.0	140.5	190.2	3.91
	14:30	16.91	11.77	0.892	233	2.501	282.1	378.9	96.8	237.9	141.1	190.8	3.91
	14:35	17.19	11.96	0.899	233	2.530	283.9	381.0	97.1	239.1	142.0	191.7	3.92
	14:40	**17.40**	**12.11**	**0.905**	**233**	**2.553**	**285.5**	**382.9**	**97.4**	**240.2**	**142.8**	**192.6**	**3.93**
	14:45	17.68	12.31	0.906	232	2.584	285.2	383.0	97.8	240.4	142.6	192.9	3.92
	14:50	17.90	12.46	0.908	232	2.607	285.4	383.4	98.0	240.7	142.7	193.1	3.91
	14:55	18.15	12.63	0.909	232	2.633	285.2	383.5	98.3	240.9	142.6	193.4	3.90
	15:00	18.37	12.79	0.910	231	2.657	285.0	383.7	98.7	241.2	142.5	193.7	3.89
	15:05	18.63	12.96	0.910	231	2.683	284.3	383.3	99.0	241.2	142.2	193.8	3.87
	15:10	19.12	13.31	0.912	230	2.735	283.9	383.7	99.8	241.7	141.9	194.4	3.84

Borehole No. : D071 — **Sample Depth m:- 8.00 - 9.00**

Sample No. : 9 — **Specimen Depth m:- 8.60 - 8.80**

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 — **Works Order No.: 059**

Compiled by: W S Wat

Checked by: H W Chung

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2
Shearing Continuation

FAILURE CRITERION													
Max. deviator Stress ☒					Max. Stress ratio ☐				Axial Strain % ☐				
Stage : 1		Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
Date	Time	Dial		P.R.No. 39	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
30/12	15:15	19.12	13.31	0.913	230	2.735	284.2	384.0	99.8	241.9	142.1	194.5	3.85
	15:20	19.36	13.48	0.914	230	2.760	284.0	384.2	100.2	242.2	142.0	194.9	3.83
	15:25	19.61	13.65	0.915	230	2.785	283.7	384.2	100.5	242.4	141.9	195.1	3.82
	15:30	19.90	13.85	0.916	229	2.815	283.4	384.5	101.1	242.8	141.7	195.6	3.80
	15:35	20.14	14.02	0.917	229	2.840	283.1	384.6	101.5	243.1	141.6	195.9	3.79
	15:40	20.41	14.20	0.918	228	2.866	282.8	384.7	101.9	243.3	141.4	196.2	3.78
	15:45	20.66	14.38	0.919	228	2.892	282.6	385.0	102.4	243.7	141.3	196.6	3.76
	15:50	20.85	14.51	0.920	227	2.911	282.4	385.2	102.8	244.0	141.2	196.9	3.75
	15:55	21.09	14.68	0.921	227	2.935	282.2	385.4	103.2	244.3	141.1	197.3	3.73
	16:00	21.34	14.85	0.922	227	2.960	281.9	385.4	103.5	244.5	141.0	197.5	3.72
	16:05	21.59	15.02	0.923	226	2.984	281.7	385.7	104.0	244.8	140.8	197.9	3.71
	16:10	21.86	15.21	0.923	226	3.011	281.0	385.4	104.4	244.9	140.5	198.1	3.69
	16:15	22.11	15.39	0.924	225	3.037	280.7	385.5	104.8	245.2	140.4	198.4	3.68
	16:20	22.37	15.57	0.925	225	3.062	280.4	385.5	105.1	245.3	140.2	198.6	3.67
	16:25	22.55	15.70	0.926	225	3.080	280.3	385.8	105.5	245.7	140.2	198.9	3.66
	16:30	22.83	15.89	0.927	224	3.107	280.0	385.9	105.9	245.9	140.0	199.2	3.64
	16:45	23.63	16.45	0.927	223	3.186	278.0	385.0	107.0	246.0	139.0	199.7	3.60
	17:00	24.47	17.03	0.928	222	3.267	276.3	384.5	108.2	246.4	138.2	200.3	3.55
	17:45	25.21	17.55	0.929	221	3.340	274.8	384.2	109.4	246.8	137.4	201.0	3.51

Borehole No. : D071 — **Sample Depth m:-** 8.00 - 9.00
Sample No. : 9 — **Specimen Depth m:-** 8.60 - 8.80

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 — **Works Order No.:** 059

Compiled by: W S Wat
Checked by: H W Chung

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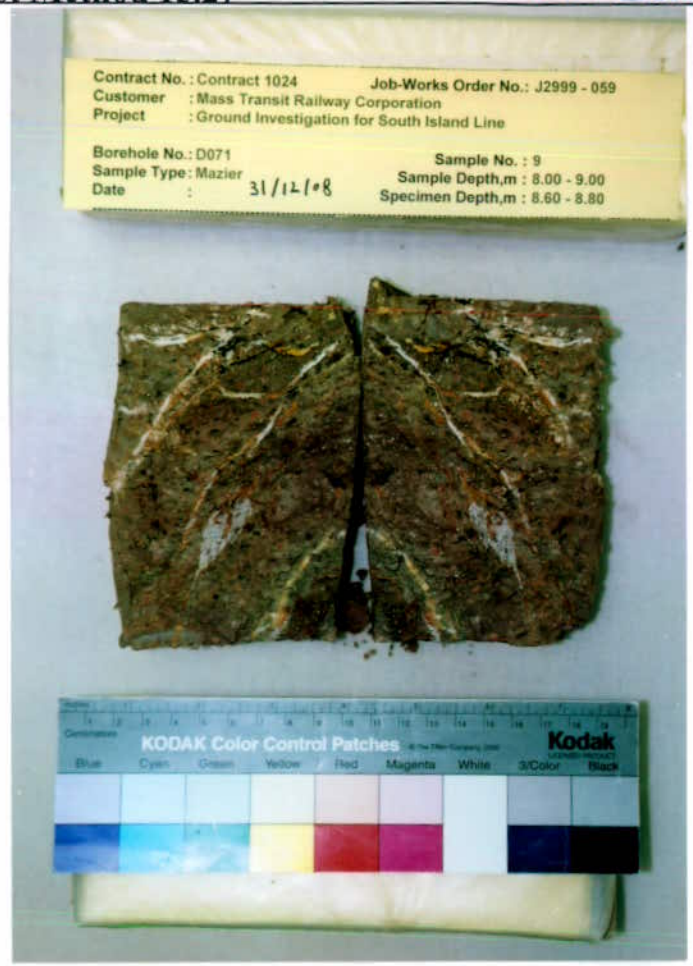
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT (GEOSPEC 3 : 2001 Test Method 15.2)



Description : Dark brown, slightly sandy SILT/CLAY **Sample Origin : CDT‡** ‡ Information provided by customer

Borehole No. : D071	**Sample No. : 9**	**Sample Depth m:-** 8.00 - 9.00	**Specimen Depth m:-** 8.60 - 8.80

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line

Contract No. : Contract 1024
Job No. : J2999
Works Order No.: 059

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	D071	D071	D071
Sample		no	9	9	9
Sample Type			Mazier	Mazier	Mazier
Stage		no	1	2	3
Sample Depth		m	8.00 - 9.00	8.00 - 9.00	8.00 - 9.00
Specimen Depth		m	8.80 - 9.00	8.80 - 9.00	8.80 - 9.00
INITIAL CONDITIONS					
Diameter	(D_o)	mm	73.8	74.3	75.4
Height	(H_o)	mm	145.0	141.1	136.2
Moisture Content	(W_o)	%	33	32	31
Bulk density	(ρ_o)	Mg/m^3	1.89	1.90	1.91
Dry density	(ρ_d)	Mg/m^3	1.43	1.45	1.46
Particle density	(ρ_s)		2.65	2.65	2.65
Voids Ratio	(e_o)		0.86	0.83	0.82
Degree of Saturation	(S_r)	%	100.8	100.7	100.7
DRAINAGE CONDITIONS			ONE END		
SATURATION					
Final Pore Pressure Coefficient B			1.00		
CONSOLIDATION					
Cell Pressure	(σ_3)	kPa	245	285	325
Back Pressure	(u_b)	kPa	205	205	205
Effective Pressure	(σ'_3)	kPa	40	80	120
Coefficient of Consolidation (t100) (C_{vi})		$m^2/Year$	1454.93	3162.75	3906.59
Coefficient of Volume Compressibility (m_{vi})		m^2/MN	0.38	0.12	0.08
Coefficient of Permeability (k)		m/s	1.69E-07	1.19E-07	9.61E-08
COMPRESSION TERMINATION CRITERION			MAXIMUM STRESS RATIO		MAX ($\sigma'1 - \sigma'3$)
COMPRESSION - INITIAL					
Moisture Content	(w)	%	32	31	31
Pore Pressure at the End of Consolidation		kPa	205	205	205
Effective Stress at the End of Consolidation		kPa	40	80	120
Bulk density	(ρ_o)	Mg/m^3	1.90	1.91	1.91
Dry density	(ρ_d)	Mg/m^3	1.45	1.46	1.46
Voids Ratio	(c)		0.83	0.82	0.81
Degree of Saturation	(S_r)	%	100.7	100.7	100.7

Customer : **Mass Transit Railway Corporation**
Project : **Ground Investigation for South Island Line**
Contract No.: Contract 1024
Report No. : J2999-059.11
Job No.: **J2999**
Works Order No.: 059

Technician : W S Wat
Checked By : Name : H W Chung Date : 08/01/2009
Approved By : Signatory : **Lau Wai Cheong** Date : 08/01/2009
Tested Date: 19/12/2008

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Form : GESR009.6 / Nov.10.06 / Issue 1 / Rev 1

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	D071	D071	D071
Sample		no	9	9	9
Sample Type			Mazier	Mazier	Mazier
Stage		no	1	2	3
Sample Depth		m	8.00 - 9.00	8.00 - 9.00	8.00 - 9.00
Specimen Depth		m	8.80 - 9.00	8.80 - 9.00	8.80 - 9.00
COMPRESSION - FAILURE					
Cell Pressure		kPa	245	285	325
Rate of Strain		mm/min	0.048	0.047	0.045
CONDITIONS AT MAXIMUM STRESS RATIO					
Major Effective Principal Stress (σ'_1)		kPa	179	264	344
Corrected Deviator Stress ($\sigma'_1 - \sigma'_3$)		kPa	155	226	286
Minor Effective Principal Stress (σ'_3)		kPa	24	38	58
$s' = (\sigma'_1 + \sigma'_3)/2$		kPa	101	151	201
$t = (\sigma_1 - \sigma_3)/2$		kPa	78	113	143
Expanded Uncertainty of s' ^		kPa	-	-	-
Expanded Uncertainty of t ^		kPa	-	-	-
Pore pressure parameter A_f			0.10	0.18	0.22
Strain at Failure	(εf)	%	2.1	5.4	8.1
COMPRESSION - FINAL					
Moisture Content	(W_f)	%	32	31	31
Bulk density	(ρ_o)	Mg/m^3	1.90	1.91	1.91
Dry density	(ρ_d)	Mg/m^3	1.45	1.46	1.46
Voids Ratio	(e_f)		0.83	0.82	0.81
Degree of Saturation	(S_f)	%	100.7	100.7	100.7

Notes -
1. The method of specimen preparation was in accordance with GEOSPEC 3 : 2001 :- Test method 13.3 : test specimen from undisturbed soil samples.
2. Sample received date : 29/9/2008
3. The determination of moisture content was in accordance with test method 5.1 of GEOSPEC 3 : 2001.
4. Particle density : 2.65 (Determined)
5. Maximum and minimum temperature recorded over the period of testing 19.5 - 20.7 °C.
6. Unavoidable variations from specified procedure : none
7. Comment on observed or inferred sample disturbance : none
8. Percentage by mass of soil particles larger than 1/5 of the diameter of specimen (%) : Nil
9. The specimen was selected by the laboratory.
   Name : W S Wat Designation : Senior Laboratory Technician
10. Sampling History : As Received

* Delete as appropriate ^ Upon request

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.: 059**

Compiled by W S Wat
Checked by H W Chung

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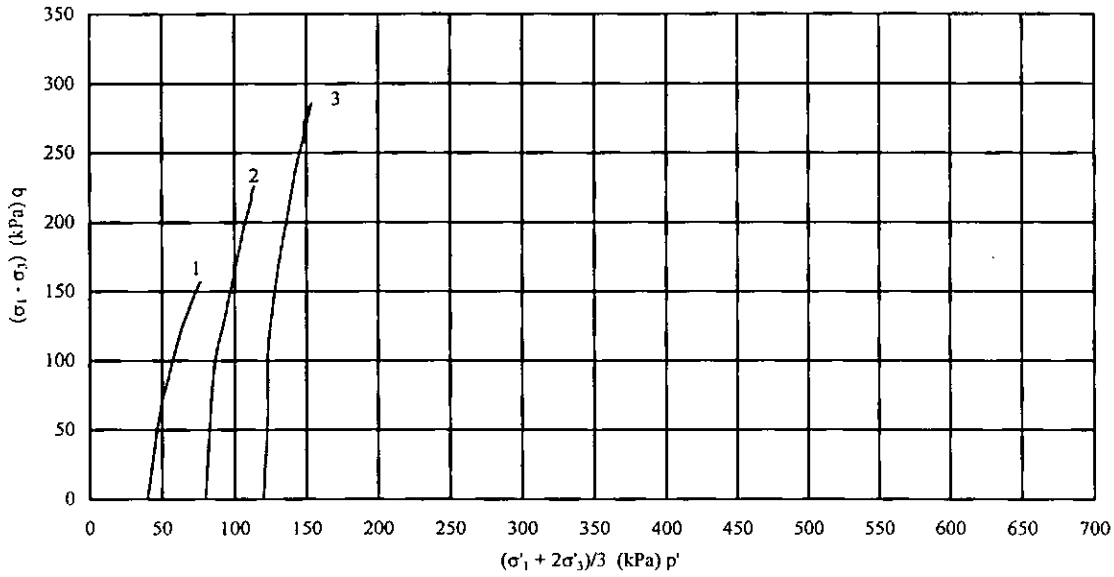
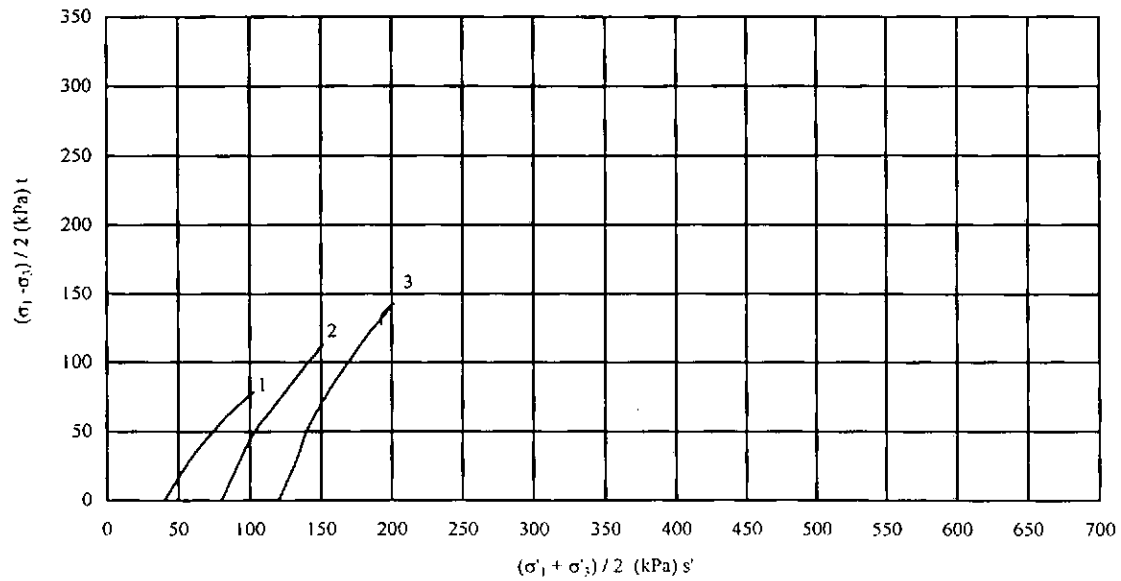
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

STRESS PATH PARAMETERS FOR EFFECTIVE STRESS

p' - q PLOT



s' - t PLOT



Borehole No. : D071 **Sample Depth m:-** 8.00 - 9.00

Sample No. : 9 **Specimen Depth m:-** 8.80 - 9.00

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.:** 059

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Checked by H W Chung

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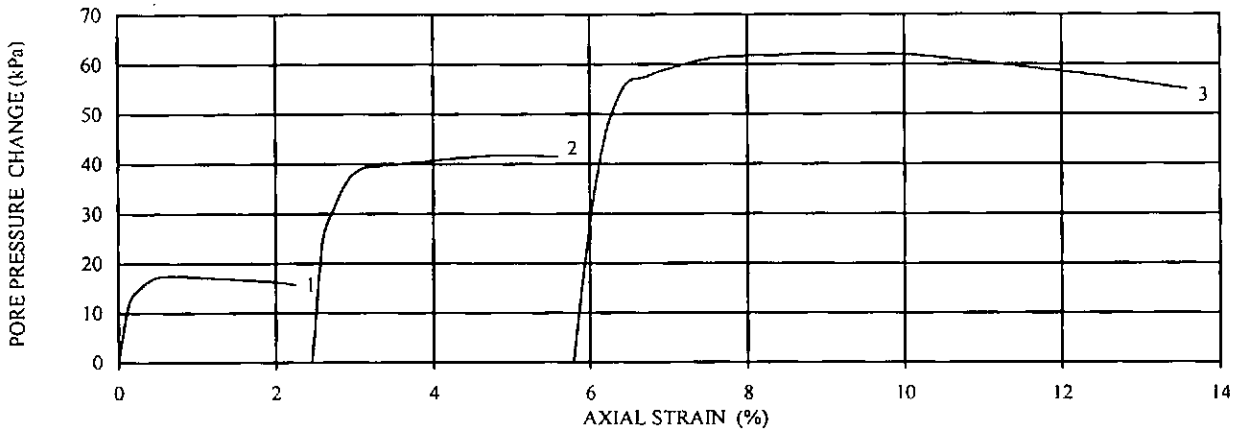
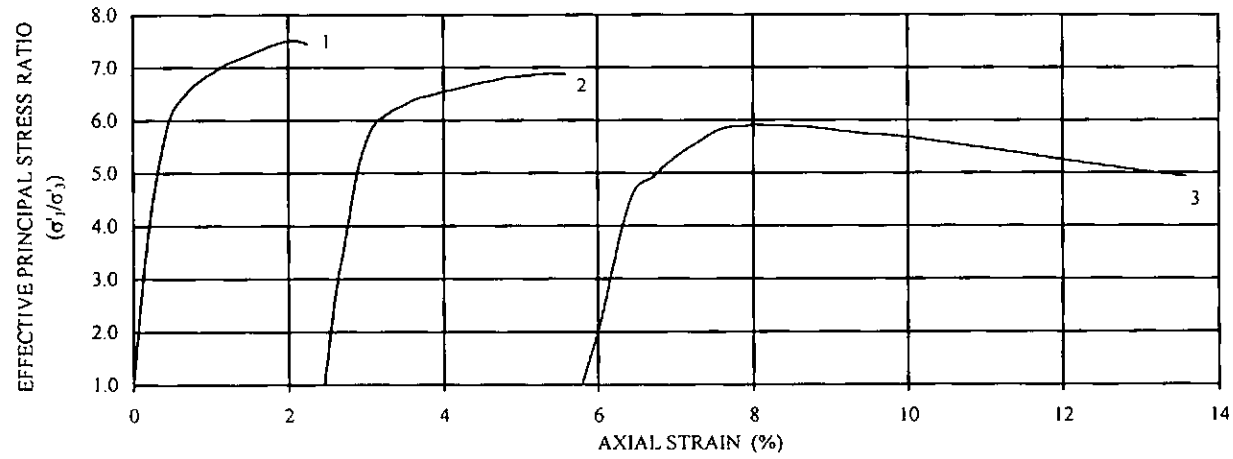
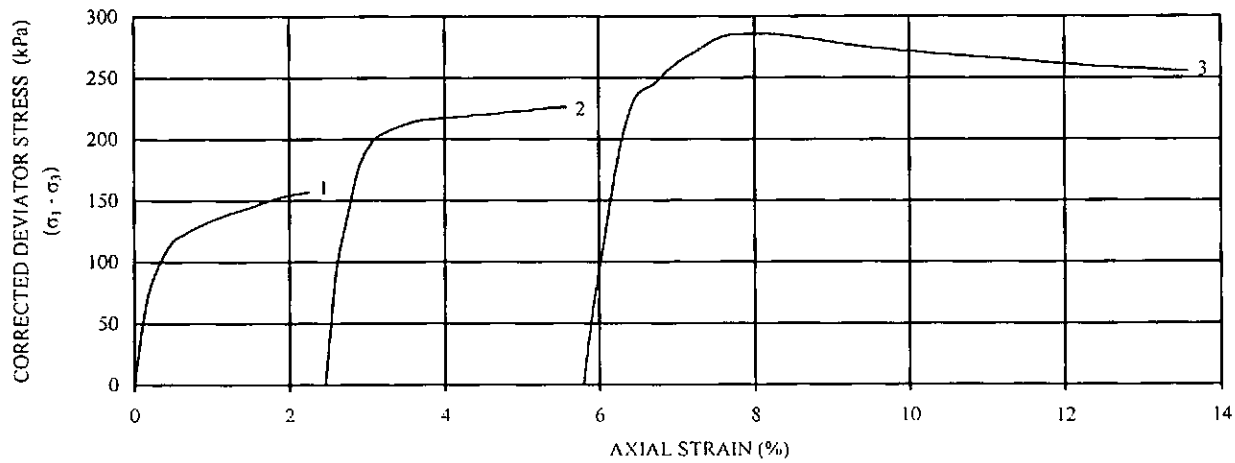
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

COMPRESSION







Borehole No. : D071 — **Sample Depth m:-** 8.00 - 9.00
Sample No. : 9 — **Specimen Depth m:-** 8.80 - 9.00

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 — **Works Order No.:** 059

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Checked by: H W Chung

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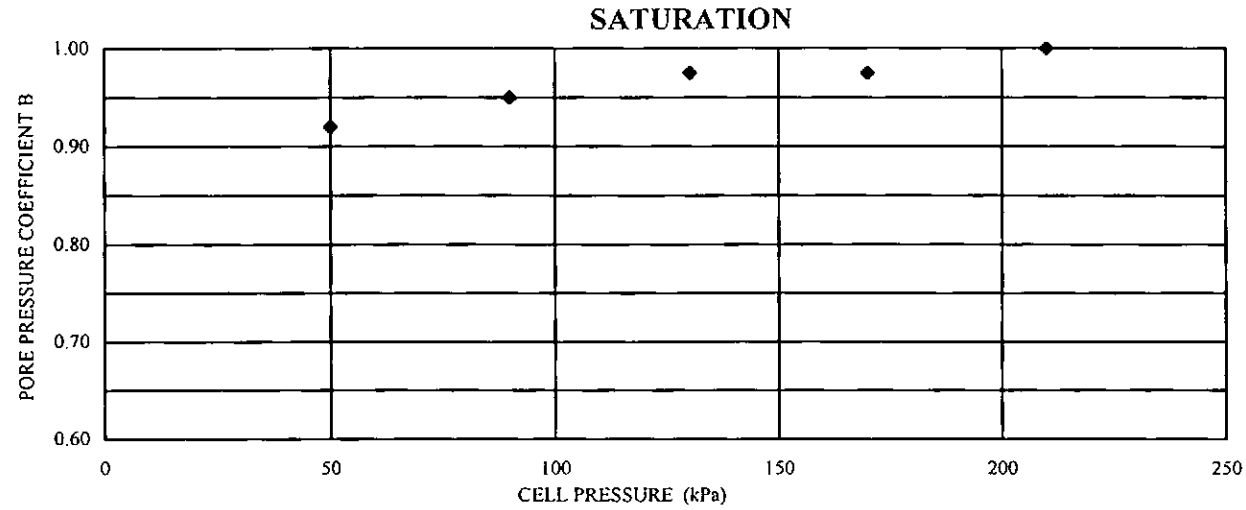
GEOSPEC 3 : 2001 Test Method 15.2



Date	Time	Cell Pressure kPa	Back Pressure kPa	Pore Pressure kPa	Cumulative Volume of Water cm^3	Pore Pressure Parameter B
22/12/2008	08:46	0	0	-	0.0	
	08:54	25	-	23		-
	09:20	25	20	20	-4.6	
	09:28	50	-	43		0.92
	09:50	50	45	45	-3.8	
	09:57	90	-	83		0.95
	10:20	90	85	85	-3.4	
	10:29	130	-	124		0.98
	11:20	130	125	125	-2.0	
	11:30	170	-	164		0.98
	13:08	170	165	165	-1.2	
	13:20	210	-	205		1.00
23/12/2008	08:40	210	205	205	-0.3	

Borehole No. : D071 **Sample Depth m:-** 8.00 - 9.00
Sample No. : 9 **Specimen Depth m:-** 8.80 - 9.00

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.:** 059

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Form : GESR009.11 / Jun.02.03 / Issue 1 / Rev 0

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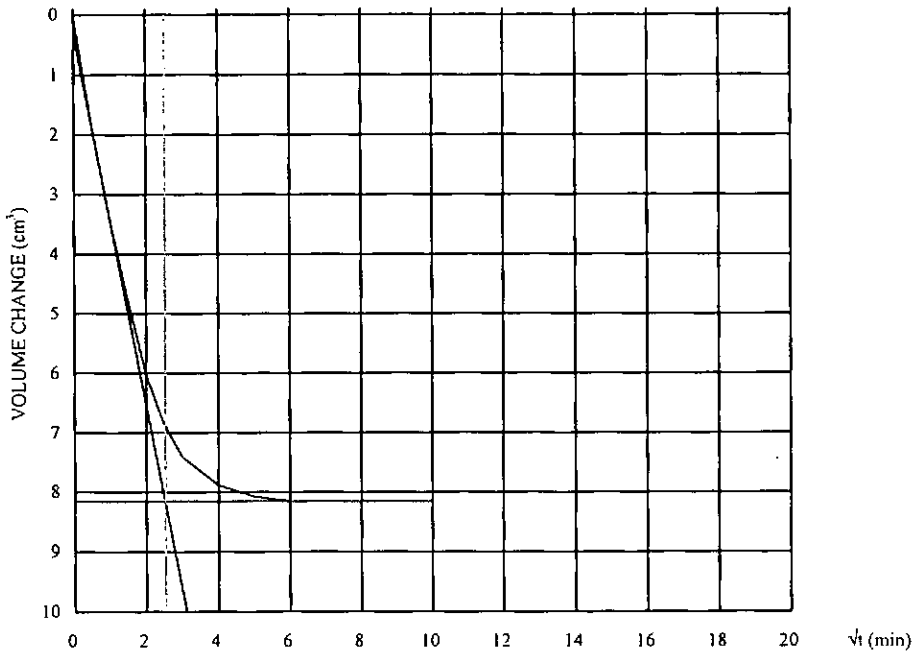
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

CONSOLIDATION (DRAINED PHASE) - Stage 1

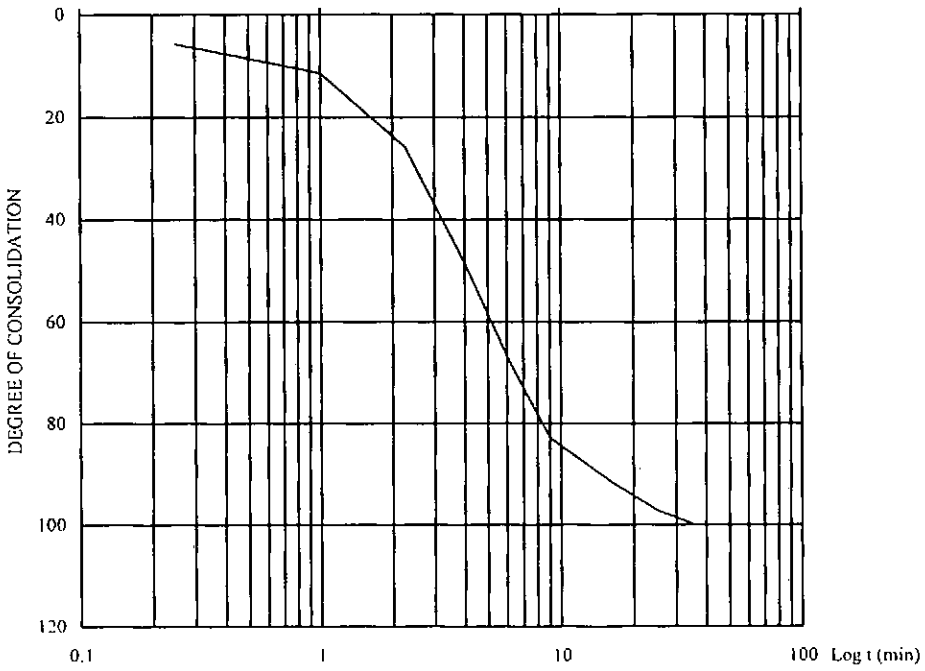


√t100 2.52 min

t100 6.37 min

tf 3.38 min

Calc. strain rate
2.993 mm/min



Borehole No. : D071 **Sample Depth m:-** 8.00 - 9.00

Sample No. : 9 **Specimen Depth m:-** 8.80 - 9.00

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.:** 059

Complied by: W S Wat

Checked by: H W Chung

Form : GESR009.13 / Jun.02.03 / Issue 1 / Rev 0

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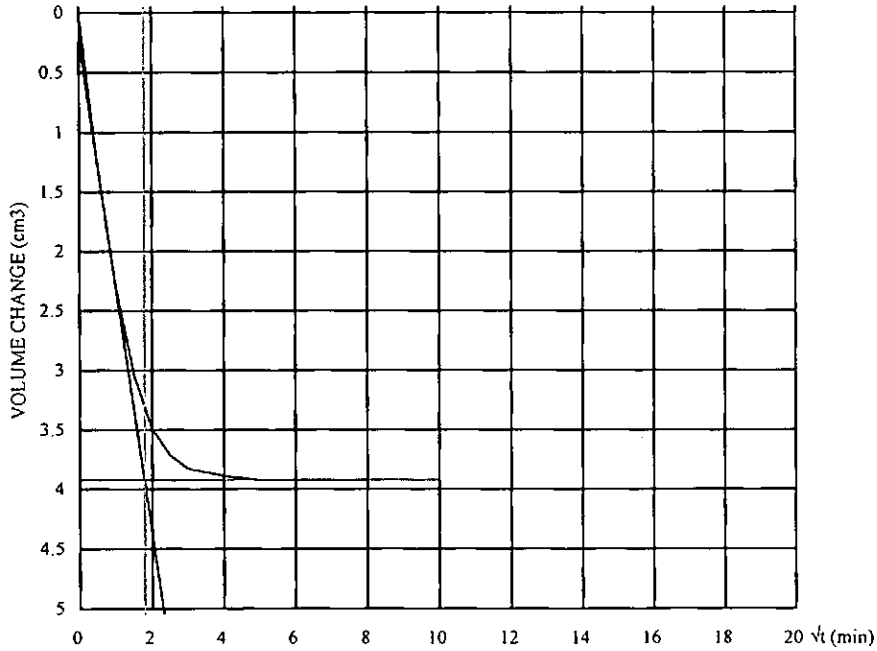
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

CONSOLIDATION (DRAINED PHASE) - Stage 2

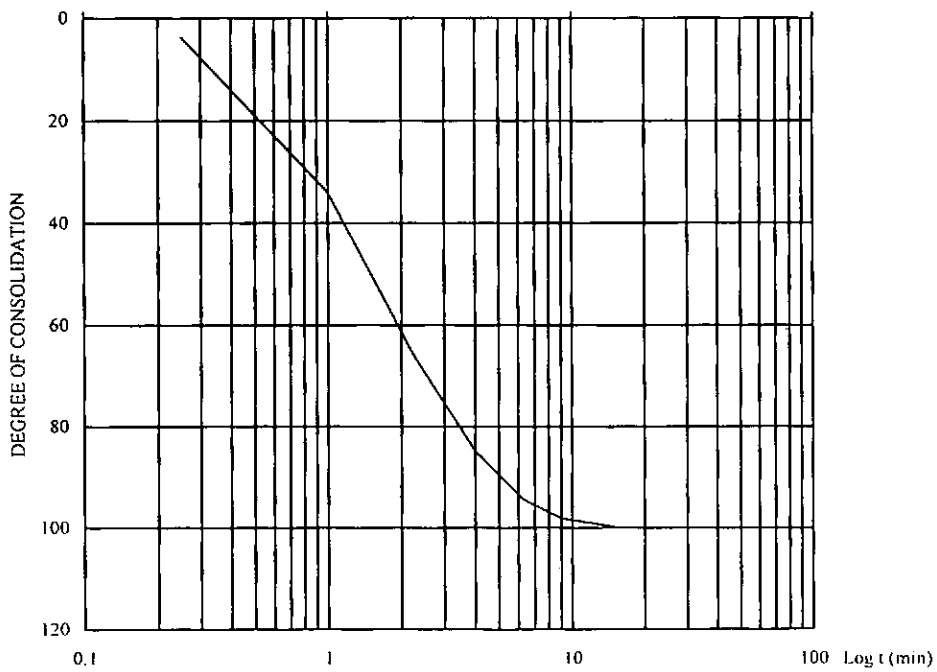


√t100 1.79 min

t100 3.19 min

tf 1.69 min

Calc. strain rate
5.833 mm/min



Borehole No. : D071 **Sample Depth m:-** 8.00 - 9.00

Sample No. : 9 **Specimen Depth m:-** 8.80 - 9.00

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.:** 059

Complied by: W S Wat

Checked by: H W Chung

Form : GESR009.13 / Jun.02.03 / Issue 1 / Rev 0

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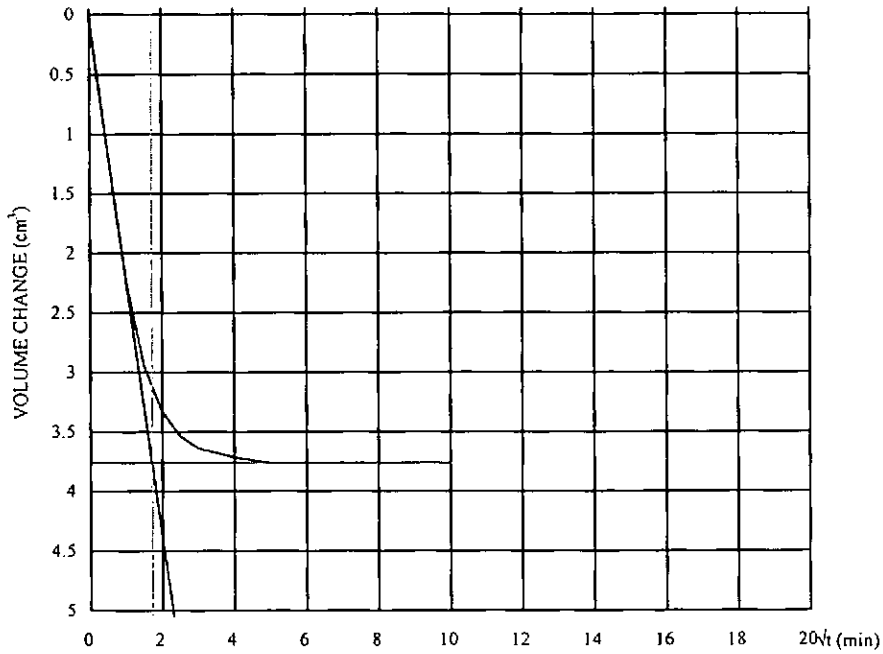
TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

CONSOLIDATION (DRAINED PHASE) - Stage 3

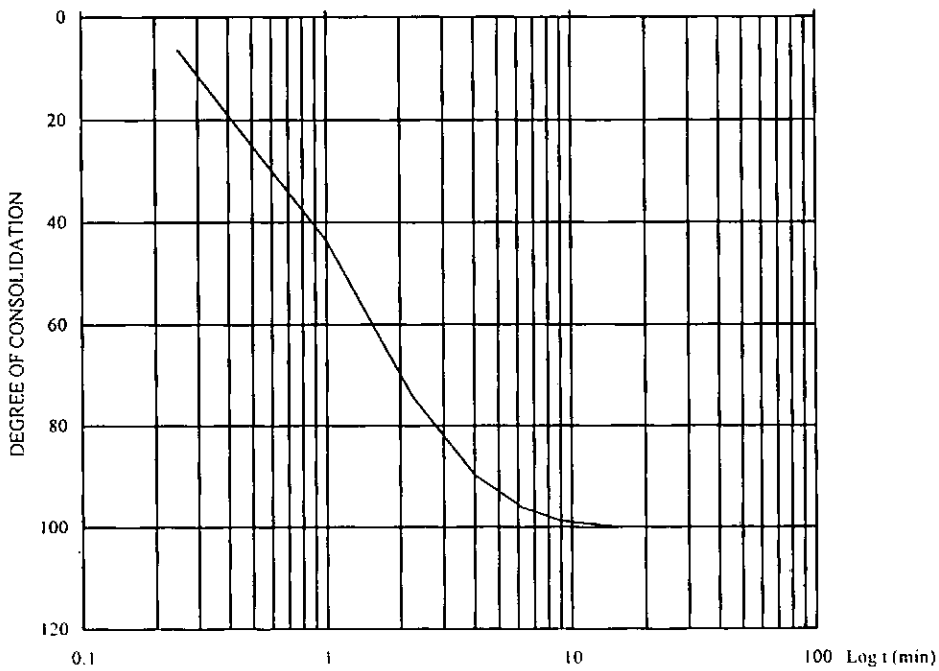


√t100 1.71 min

t100 2.93 min

tf 1.55 min

Calc. strain rate
6.131 mm/min



Borehole No. : D071 **Sample Depth m:-** 8.00 - 9.00

Sample No. : 9 **Specimen Depth m:-** 8.80 - 9.00

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.:** 059

Complied by: W S Wat

Checked by: H W Chung

Form : GESR009.13 / Jun.02.03 / Issue 1 / Rev 0

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Multi Stage			P.W.P.B.P					Effective Pressure	40				kPa
Side drains	No		Selected Machine Speed		0.048		mm/min	Rate of Strain	2.00				% per hr
FAILURE CRITERION													
Max. deviator Stress			☐		Max. Stress ratio		☒	Axial Strain %					☐
Stage :	1	Applied Pressure (kPa) - Cell :			245	Back :	205	P.R. factor			3.1341		kN/mm

Date	Time	Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
		Dial		P.R.No. 2	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio σ'_1/σ'_3
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	
23/12	09:45	0.00	0.00	0.054	205	0.000	0.0	40.0	40.0	40.0	0.0	40.0	1.00
	09:50	0.21	0.14	0.137	217	0.041	61.3	89.4	28.1	58.7	30.6	48.5	3.18
	09:55	0.39	0.27	0.176	220	0.078	89.9	115.0	25.1	70.1	45.0	55.1	4.58
	10:00	0.68	0.47	0.210	222	0.135	114.7	137.6	22.9	80.2	57.3	61.1	6.01
	10:05	0.93	0.64	0.221	222	0.183	122.5	145.1	22.6	83.9	61.3	63.4	6.42
	10:10	1.23	0.85	0.231	222	0.242	129.5	152.1	22.6	87.4	64.8	65.8	6.73
	10:15	1.51	1.05	0.239	222	0.297	135.1	157.9	22.8	90.3	67.5	67.8	6.92
	10:20	1.76	1.22	0.245	222	0.343	139.2	162.1	22.9	92.5	69.6	69.3	7.08
	10:25	2.06	1.43	0.251	222	0.400	143.2	166.3	23.1	94.7	71.6	70.8	7.20
	10:30	2.41	1.67	0.259	222	0.464	148.6	172.0	23.4	97.7	74.3	72.9	7.35
	10:35	2.61	1.81	0.263	222	0.500	151.3	174.8	23.5	99.1	75.6	73.9	7.44
	10:40	**2.98**	**2.06**	**0.269**	**221**	**0.565**	**155.2**	**179.0**	**23.8**	**101.4**	**77.6**	**75.5**	**7.52**
	10:45	3.25	2.25	0.272	221	0.614	157.0	181.3	24.3	102.8	78.5	76.6	7.46

Borehole No. : D071 — **Sample Depth m:-** 8.00 - 9.00

Sample No. : 9 — **Specimen Depth m:-** 8.80 - 9.00

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 — **Works Order No.:** 059

Compiled by: W S Wat

Checked by: H W Chung

Form : GESR009.14 / Dec.13.04 / Issue 1 / Rev 1

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TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Multi Stage		P.W.P,B.P		Effective Pressure 80	kPa
Side drains	No	Selected Machine Speed	0.047 mm/min	Rate of Strain 2.00	% per hr

FAILURE CRITERION

Max. deviator Stress	☐	Max. Stress ratio	☒	Axial Strain %	☐
Stage : 2	Applied Pressure (kPa) - Cell : 285	Back : 205		P.R. factor 3.1341	kN/mm

Date	Time	Strain Dial	Strain %	Load P.R.No. 2	Pore Pressure	Dev. stress Corr.	Dev. stress q $\sigma_1 - \sigma_3$	Effective Stress σ'_1	Effective Stress σ'_3	s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio σ'_1/σ'_3
		mm	%	mm	kPa	kPa				2	2	3	
23/12	13:10	3.55	2.46	0.048	205	0.000	0.0	80.0	80.0	80.0	0.0	80.0	1.00
	13:15	3.76	2.60	0.174	230	0.703	90.6	145.9	55.3	100.6	45.3	85.5	2.64
	13:20	3.94	2.73	0.232	236	0.735	132.5	181.9	49.4	115.6	66.2	93.6	3.68
	13:25	4.18	2.90	0.294	241	0.777	177.0	220.7	43.7	132.2	88.5	102.7	5.05
	13:30	4.45	3.08	0.324	244	0.821	198.3	239.3	41.0	140.1	99.1	107.1	5.84
	13:35	4.73	3.27	0.336	245	0.867	206.5	246.9	40.4	143.6	103.2	109.2	6.11
	13:40	4.97	3.44	0.343	245	0.907	211.1	251.3	40.2	145.8	105.6	110.6	6.25
	13:45	5.25	3.64	0.349	245	0.955	214.9	254.7	39.8	147.3	107.5	111.4	6.40
	13:50	5.52	3.82	0.352	245	0.997	216.6	256.2	39.6	147.9	108.3	111.8	6.47
	13:55	5.81	4.03	0.354	246	1.045	217.6	256.8	39.2	148.0	108.8	111.7	6.55
	14:00	6.10	4.22	0.356	246	1.089	218.5	257.4	38.9	148.1	109.2	111.7	6.62
	14:05	6.43	4.45	0.359	246	1.141	220.0	258.6	38.6	148.6	110.0	111.9	6.70
	14:10	6.71	4.65	0.361	247	1.186	221.0	259.4	38.4	148.9	110.5	112.1	6.75
	14:15	6.94	4.81	0.364	247	1.221	222.7	261.0	38.3	149.6	111.3	112.5	6.81
	14:20	7.25	5.02	0.366	247	1.267	223.5	261.8	38.3	150.1	111.8	112.8	6.84
	14:25	7.56	5.24	0.369	247	1.314	225.1	263.4	38.3	150.9	112.6	113.3	6.88
	14:30	**7.81**	**5.41**	**0.371**	**247**	**1.351**	**226.1**	**264.5**	**38.4**	**151.4**	**113.0**	**113.8**	**6.89**
	14:35	8.07	5.59	0.372	247	1.389	226.3	264.8	38.5	151.6	113.1	113.9	6.88

Borehole No. : D071 **Sample Depth m:- 8.00 - 9.00**

Sample No. : 9 **Specimen Depth m:- 8.80 - 9.00**

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.: 059**

Compiled by W S Wat

Checked by H W Chung

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Multi Stage			P.W.P,B.P					Effective Pressure	120				kPa
Side drains	No		Selected Machine Speed		0.045		mm/min	Rate of Strain	1.99				% per hr
FAILURE CRITERION													
Max. deviator Stress		☐	Max. Stress ratio			☒		Axial Strain %				☐	
Stage :	3	Applied Pressure (kPa) - Cell :		325	Back :	205		P.R. factor	3.1341				kN/mm

Date	Time	Strain		Load	Pore Pressure	Dev. stress		Effective Stress Parameters					
		Dial		P.R.No. 2		Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
29/12	08:40	8.36	5.79	0.055	205	0.000	0.0	120.0	120.0	120.0	0.0	120.0	1.00
	08:45	8.53	5.91	0.142	222	1.455	59.9	162.9	103.0	132.9	29.9	123.0	1.58
	08:50	8.71	6.04	0.211	238	1.482	108.3	195.5	87.2	141.4	54.2	123.3	2.24
	08:55	8.93	6.19	0.294	250	1.513	166.4	241.2	74.8	158.0	83.2	130.3	3.22
	09:00	9.14	6.33	0.355	257	1.541	208.9	276.8	67.9	172.4	104.5	137.5	4.08
	09:05	9.37	6.49	0.394	262	1.573	235.8	299.3	63.5	181.4	117.9	142.1	4.71
	09:10	9.68	6.71	0.408	263	1.617	245.0	307.5	62.5	185.0	122.5	144.2	4.92
	09:15	9.95	6.89	0.425	264	1.653	256.2	317.6	61.4	189.5	128.1	146.8	5.17
	09:20	10.22	7.08	0.439	265	1.690	265.6	326.1	60.5	193.3	132.8	149.0	5.39
	09:25	10.53	7.29	0.451	265	1.730	273.2	332.8	59.6	196.2	136.6	150.7	5.58
	09:30	10.80	7.49	0.463	266	1.768	280.9	339.8	58.9	199.4	140.5	152.5	5.77
	09:35	11.10	7.69	0.470	267	1.806	285.1	343.6	58.5	201.1	142.6	153.5	5.87
	09:40	11.42	7.91	0.472	267	1.847	285.8	344.2	58.4	201.3	142.9	153.7	5.89
	09:45	**11.71**	**8.11**	**0.473**	**267**	**1.884**	**285.8**	**344.0**	**58.2**	**201.1**	**142.9**	**153.5**	**5.91**
	09:50	12.02	8.33	0.473	267	1.924	285.1	343.3	58.2	200.7	142.5	153.2	5.90
	09:55	12.42	8.60	0.471	267	1.973	282.8	340.8	58.0	199.4	141.4	152.3	5.88
	10:00	12.65	8.76	0.470	267	2.002	281.6	339.5	57.9	198.7	140.8	151.8	5.86
	10:15	13.57	9.40	0.464	267	2.114	275.4	333.4	58.0	195.7	137.7	149.8	5.75
	10:30	14.46	10.02	0.461	267	2.219	271.5	329.6	58.1	193.9	135.8	148.6	5.67
	10:45	15.30	10.60	0.459	266	2.316	268.2	327.1	58.9	193.0	134.1	148.3	5.55
	11:00	16.15	11.19	0.458	265	2.411	265.6	325.5	59.9	192.7	132.8	148.4	5.43
	11:15	17.03	11.80	0.456	264	2.507	262.4	323.5	61.1	192.3	131.2	148.6	5.29
	11:30	17.90	12.40	0.454	263	2.600	259.2	321.4	62.2	191.8	129.6	148.6	5.17
	11:45	18.72	12.97	0.454	261	2.687	257.4	321.0	63.6	192.3	128.7	149.4	5.05
	12:00	19.59	13.58	0.454	260	2.777	255.5	320.5	65.0	192.7	127.7	150.2	4.93

Borehole No. : D071 — **Sample Depth m:- 8.00 - 9.00**

Sample No. : 9 — **Specimen Depth m:- 8.80 - 9.00**

Customer : Mass Transit Railway Corporation — Compiled by: W S Wat

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 — **Works Order No.: 059** — Checked by: H W Chung

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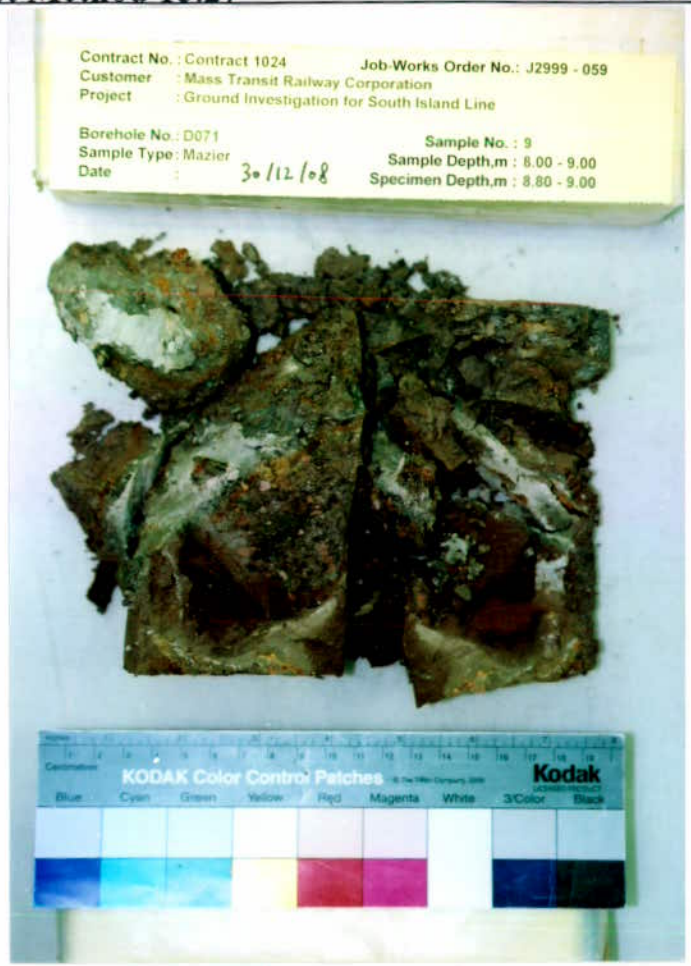
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT (GEOSPEC 3 : 2001 Test Method 15.2)



Description : Dark brown, slightly sandy SILT/CLAY

Sample Origin : CDT ‡ ‡ Information provided by customer

Borehole No. : D071	Sample No. : 9	Sample Depth m:- 8.00 - 9.00	Specimen Depth m:- 8.80 - 9.00

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line

Contract No.: Contract 1024
Job No.: J2999
Works Order No.: 059

Compiled by: W S Wat
Checked by: H W Chung

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	D090		
Sample		no	2		
Sample Type			Mazier		
Stage		no	1		
Sample Depth		m	4.00 - 5.00		
Specimen Depth		m	4.60 - 4.80		
INITIAL CONDITIONS					
Diameter	(D_o)	mm	74.2		
Height	(H_o)	mm	145.0		
Moisture Content	(W_o)	%	18		
Bulk density	(ρ_o)	Mg/m^3	2.04		
Dry density	(ρ_d)	Mg/m^3	1.74		
Particle density	(ρ_s)		2.68		
Voids Ratio	(e_o)		0.54		
Degree of Saturation	(S_r)	%	86.5		
DRAINAGE CONDITIONS			ONE END		
SATURATION					
Final Pore Pressure Coefficient B			1.00		
CONSOLIDATION					
Cell Pressure	(σ_3)	kPa	270		
Back Pressure	(u_b)	kPa	225		
Effective Pressure	(σ'_3)	kPa	45		
Coefficient of Consolidation (t100) (C_{vi})		m^2/Year	836.94		
Coefficient of Volume Compressibility (m_{vi})		m^2/MN	0.43		
Coefficient of Permeability (k)		m/s	1.12E-07		
COMPRESSION TERMINATION CRITERION			MAXIMUM DEVIATOR STRESS		
COMPRESSION - INITIAL					
Moisture Content	(w)	%	18		
Pore Pressure at the End of Consolidation		kPa	225		
Effective Stress at the End of Consolidation		kPa	45		
Bulk density	(ρ_o)	Mg/m^3	2.09		
Dry density	(ρ_d)	Mg/m^3	1.77		
Voids Ratio	(e)		0.52		
Degree of Saturation	(S_r)	%	94.8		

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Report No. : J2999-059.11
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.:** 059

Technician : W S Wat
Checked By : Name : H W Chung Date : 08/01/2009
Approved By : Signatory : Lau Wai Cheong Date : 08/01/2009
Tested Date: 01/12/2008

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Form : GESR009.6 / Nov.10.06 / Issue 1 / Rev 1

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	D090		
Sample		no	2		
Sample Type			Mazier		
Stage		no	1		
Sample Depth		m	4.00 - 5.00		
Specimen Depth		m	4.60 - 4.80		
COMPRESSION - FAILURE					
Cell Pressure		kPa	270		
Rate of Strain		mm/min	0.048		
CONDITIONS MAXIMUM DEVIATOR STRESS					
Major Effective Principal Stress (σ'_1)		kPa	535		
Corrected Deviator Stress (σ'_1 - σ'_3)		kPa	459		
Minor Effective Principal Stress (σ'_3)		kPa	77		
$s' = (\sigma'_1 + \sigma'_3)/2$		kPa	306		
$t = (\sigma_1 - \sigma_3)/2$		kPa	229		
Expanded Uncertainty of s' ^		kPa	-		
Expanded Uncertainty of t ^		kPa	-		
Pore pressure parameter A_f			-0.07		
Strain at Failure	(εf)	%	8.1		
COMPRESSION - FINAL					
Moisture Content	(W_f)	%	18		
Bulk density	(ρ_o)	Mg/m^3	2.09		
Dry density	(ρ_d)	Mg/m^3	1.77		
Voids Ratio	(e_f)		0.52		
Degree of Saturation	(S_f)	%	94.8		

Notes -
1. The method of specimen preparation was in accordance with GEOSPEC 3 : 2001 :- Test method 13.3 : test specimen from undisturbed soil samples.
2. Sample received date : 29/9/2008
3. The determination of moisture content was in accordance with test method 5.1 of GEOSPEC 3 : 2001.
4. Particle density : 2.68 (Determined)
5. Maximum and minimum temperature recorded over the period of testing 19.5 - 20.7 °C.
6. Unavoidable variations from specified procedure : none
7. Comment on observed or inferred sample disturbance : none
8. Percentage by mass of soil particles larger than 1/5 of the diameter of specimen (%) : Nil
9. The specimen was selected by the laboratory.
   Name : W S Wat Designation : Senior Laboratory Technician
10. Sampling History : As Received

* Delete as appropriate ^ Upon request

Customer : **Mass Transit Railway Corporation**
Project : **Ground Investigation for South Island Line**
Contract No.: Contract 1024
Job No.: **J2999** **Works Order No.: 059**

Compiled by W S Wat
Checked by H W Chung

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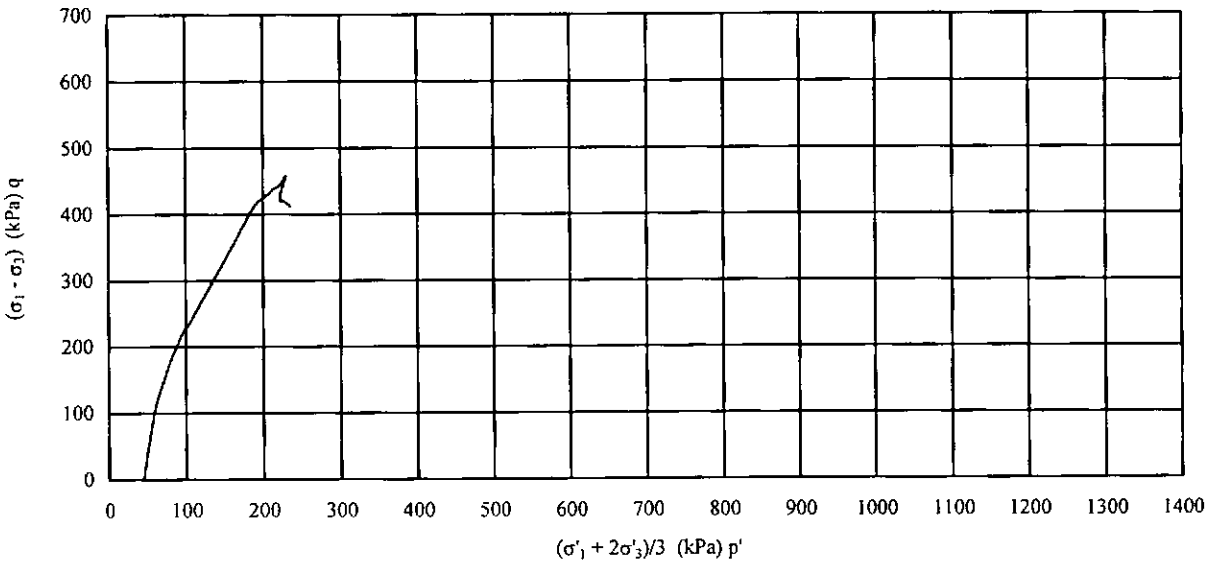
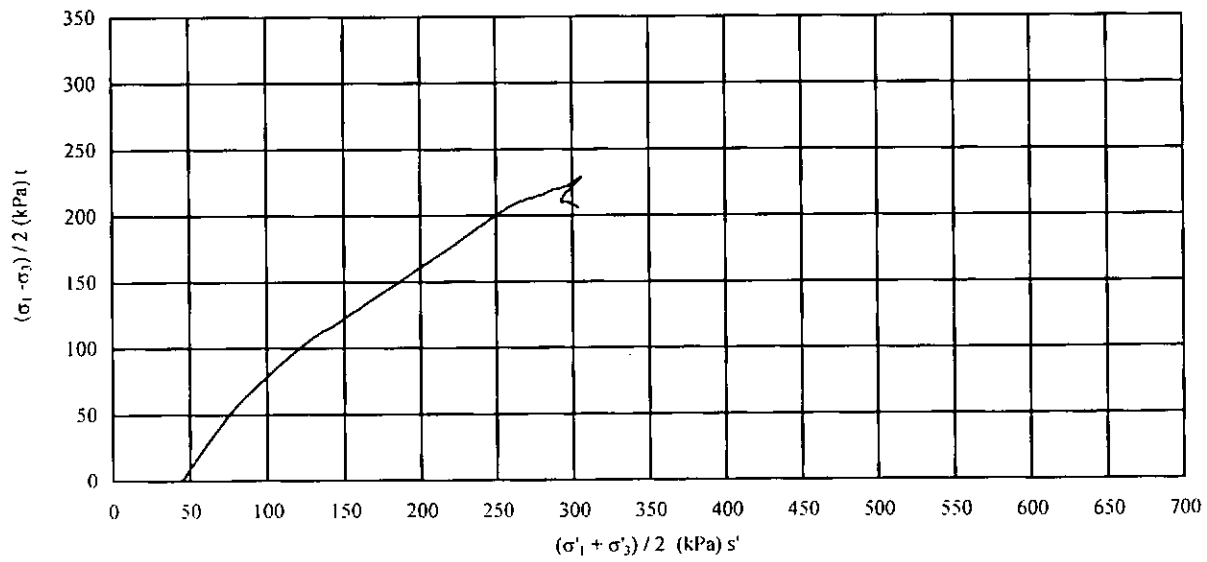
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

STRESS PATH PARAMETERS FOR EFFECTIVE STRESS

p' - q PLOT



s' - t PLOT



Borehole No. : D090 **Sample Depth m:-** 4.00 - 5.00
Sample No. : 2 **Specimen Depth m:-** 4.60 - 4.80

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.:** 059

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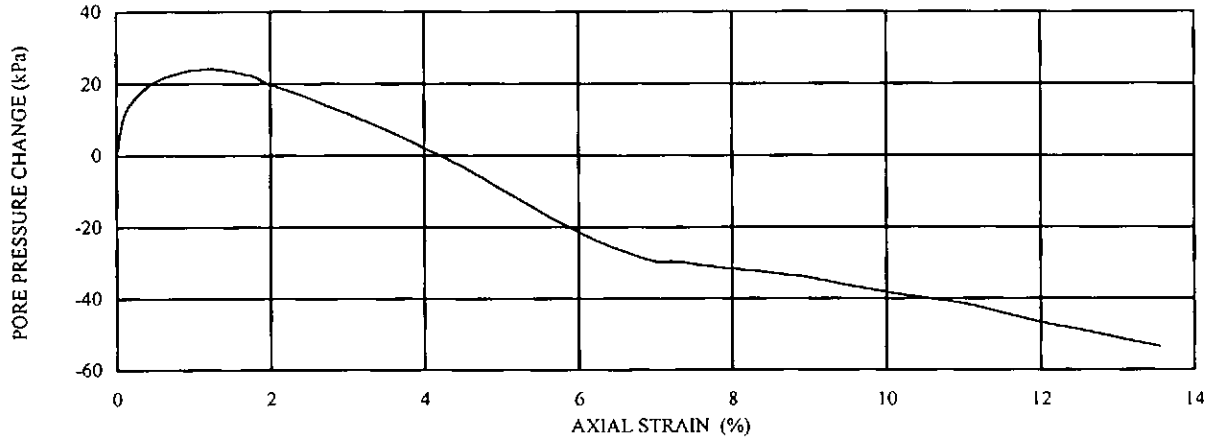
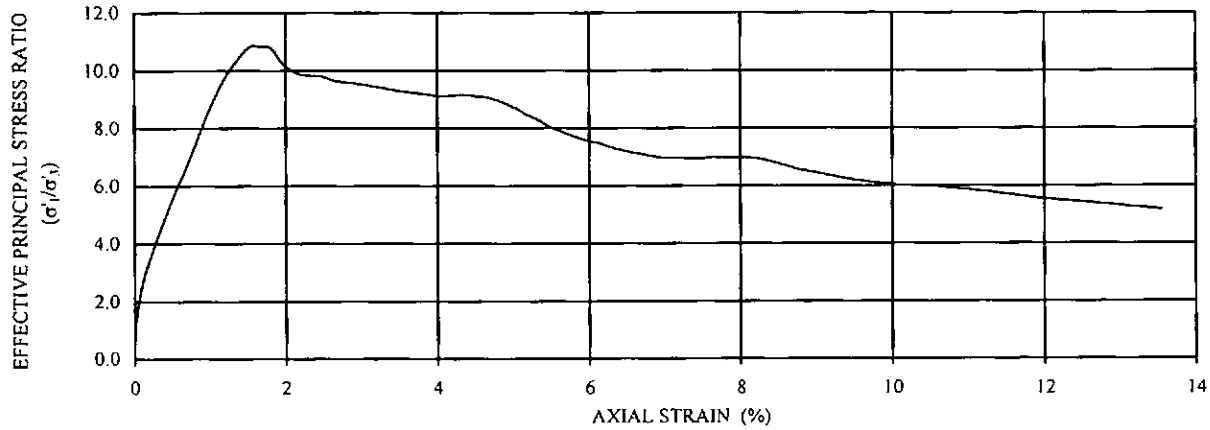
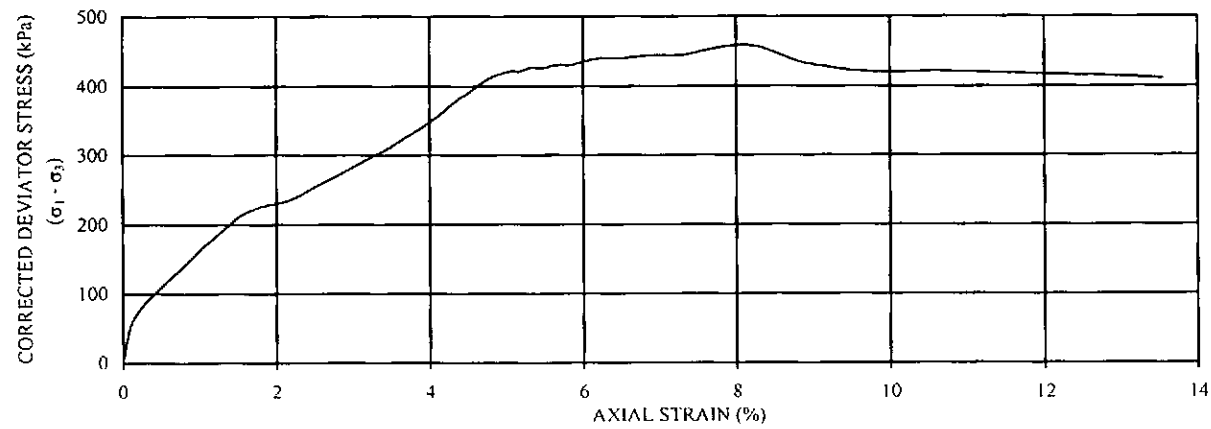
GEOSPEC 3 : 2001 Test Method 15.2

COMPRESSION







Borehole No. : D090 — **Sample Depth m:-** 4.00 - 5.00
Sample No. : 2 — **Specimen Depth m:-** 4.60 - 4.80

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line

Compiled by: W S Wat
Checked by: H W Chung

Contract No.: Contract 1024
Job No.: J2999 — **Works Order No.:** 059

Form : GESR009.9 / Jun.02.03 / Issue 1 / Rev 0

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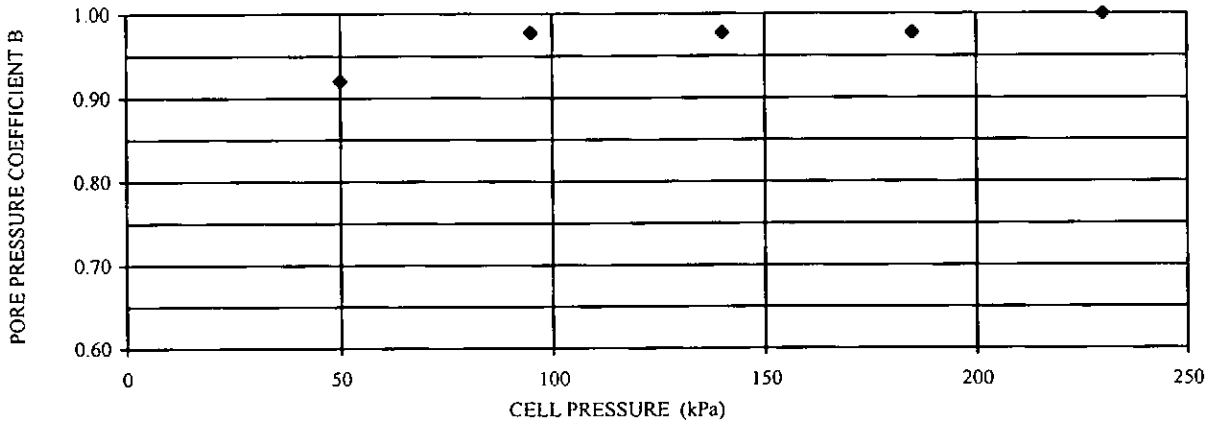
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

SATURATION



Date	Time	Cell Pressure kPa	Back Pressure kPa	Pore Pressure kPa	Cumulative Volume of Water cm^3	Pore Pressure Coefficient B
01/12/2008	16:16	0	0	-	0.0	
	16:25	25	-	24		-
02/12/2008	08:36	25	20	20	-3.1	
	08:43	50	-	43		0.92
	09:02	50	45	45	-2.5	
	09:08	95	-	89		0.98
	09:34	95	90	90	-1.9	
	09:41	140	-	134		0.98
	10:05	140	135	135	-0.8	
	10:13	185	-	179		0.98
	10:43	185	180	180	0.6	
	10:50	230	-	225		1.00
03/12/2008	13:10	230	225	225	18.8	

Borehole No. D090 **Sample Depth m:-** 4.00 - 5.00
Sample No. : 2 **Specimen Depth m:-** 4.60 - 4.80

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line

Compiled by: W S Wat
Checked by: H W Chung

Contract No.: Contract 1024
Job No.: J2999 **Works Order No.:** 059

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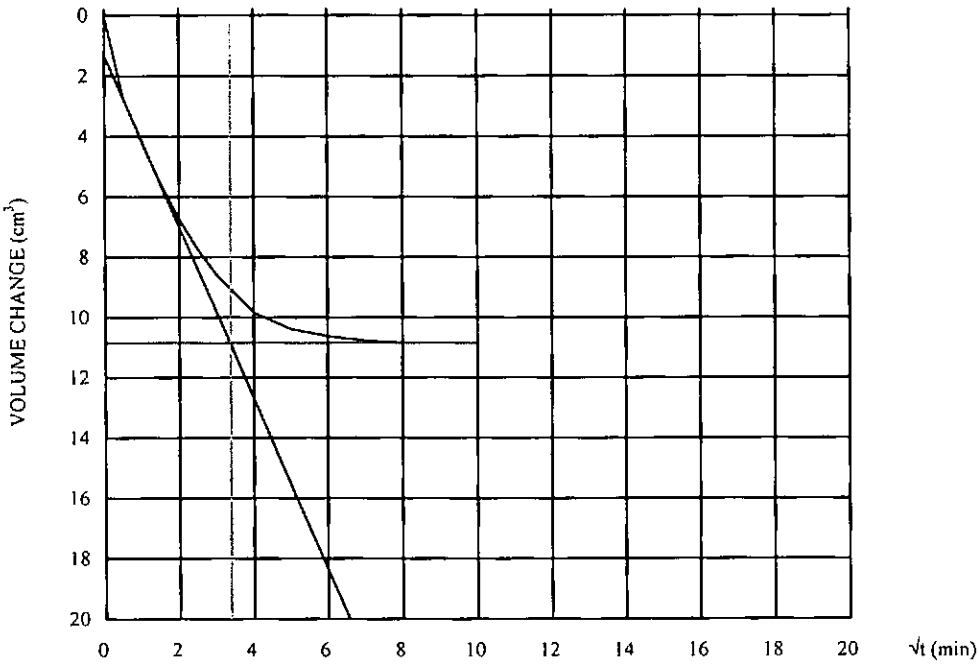
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

CONSOLIDATION (DRAINED PHASE) - Stage 1

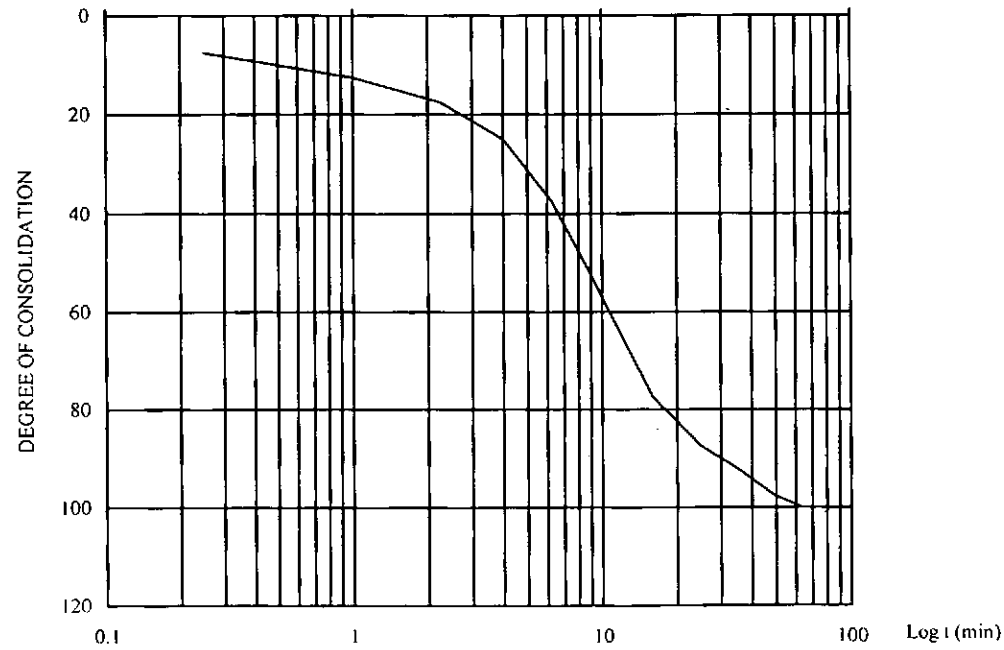


√t100 3.36 min

t100 11.282 min

tf 5.979 min

Calc. strain rate
1.687 mm/min



Borehole No. : D090 **Sample Depth m:-** 4.00 - 5.00

Sample No. : 2 **Specimen Depth m:-** 4.60 - 4.80

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.:** 059

Complied by: W S Wat

Checked by: H W Chung

Form : GESR009.13 / Jun.02.03 / Issue 1 / Rev 0

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GEOSPEC 3 : 2001 Test Method 15.2

Single Stage		P.W.P.B.P			Effective Pressure	45	kPa
Side drains	No	Selected Machine Speed	0.048	mm/min	Rate of Strain	2.00	% per hr

FAILURE CRITERION

Max. deviator Stress	☒	Max. Stress ratio	☐		Axial Strain %		☐
Stage : 1	Applied Pressure (kPa) - Cell :	270	Back :	225	P.R. factor	3.0328	kN/mm

Date	Time	Strain Dial	Strain	Load P.R.No. 25	Pore Pressure	Dev. stress Corr.	Dev. stress q $\sigma_1 - \sigma_3$	Effective Stress σ'_1	Effective Stress σ'_3	s' $(\sigma'_1+\sigma'_3)$ 2	t $(\sigma_1-\sigma_3)$ 2	p' $(\sigma'_1+2\sigma'_3)$ 3	Stress Ratio σ'_1/σ'_3
		mm	%	mm	kPa	kPa							
04/12	08:40	0.00	0.00	0.030	225	0.000	0.0	45.0	45.0	45.0	0.0	45.0	1.00
	08:45	0.15	0.10	0.106	236	0.029	53.9	87.8	33.9	60.9	27.0	51.9	2.59
	08:50	0.37	0.26	0.147	241	0.075	82.8	111.5	28.7	70.1	41.4	56.3	3.89
	08:55	0.58	0.40	0.171	244	0.115	99.6	125.4	25.8	75.6	49.8	59.0	4.86
	09:00	0.79	0.55	0.193	246	0.157	115.0	138.7	23.7	81.2	57.5	62.0	5.85
	09:05	1.05	0.73	0.219	248	0.207	133.1	155.6	22.5	89.0	66.5	66.9	6.91
	09:10	1.28	0.89	0.244	249	0.251	150.4	171.9	21.5	96.7	75.2	71.6	8.00
	09:15	1.49	1.03	0.267	249	0.290	166.3	187.4	21.1	104.3	83.2	76.5	8.88
	09:20	1.70	1.18	0.287	249	0.331	180.1	200.9	20.8	110.8	90.0	80.8	9.66
	09:25	1.93	1.34	0.309	249	0.374	195.2	216.2	21.0	118.6	97.6	86.1	10.29
	09:30	2.20	1.52	0.334	248	0.422	212.2	233.8	21.6	127.7	106.1	92.3	10.83
	09:35	2.40	1.67	0.346	248	0.461	220.3	242.7	22.4	132.5	110.1	95.8	10.83
	09:40	2.61	1.81	0.355	247	0.498	226.2	249.3	23.1	136.2	113.1	98.5	10.79
	09:45	2.83	1.96	0.360	245	0.537	229.3	254.1	24.8	139.4	114.6	101.2	10.25
	09:50	3.11	2.15	0.368	244	0.586	234.3	260.6	26.3	143.5	117.2	104.4	9.91
	09:55	3.33	2.31	0.380	243	0.626	242.2	269.6	27.4	148.5	121.1	108.1	9.84
	10:00	3.57	2.48	0.396	241	0.669	252.9	281.6	28.7	155.1	126.4	113.0	9.81
	10:05	3.81	2.64	0.409	240	0.709	261.4	291.6	30.2	160.9	130.7	117.3	9.66
	10:10	4.07	2.82	0.426	238	0.753	272.6	304.3	31.7	168.0	136.3	122.6	9.60
	10:15	4.31	2.99	0.441	237	0.795	282.4	315.5	33.1	174.3	141.2	127.2	9.53
	10:20	4.47	3.10	0.451	236	0.821	289.0	323.1	34.1	178.6	144.5	130.4	9.47
	10:25	4.74	3.29	0.468	234	0.867	300.0	335.7	35.7	185.7	150.0	135.7	9.40
	10:30	4.97	3.45	0.482	233	0.905	309.1	346.3	37.2	191.7	154.5	140.2	9.31
	10:35	5.18	3.60	0.498	231	0.940	319.6	358.3	38.7	198.5	159.8	145.2	9.26
	10:40	5.48	3.80	0.520	229	0.987	333.9	374.6	40.7	207.6	166.9	152.0	9.20
	10:45	5.68	3.94	0.535	228	1.019	343.6	385.8	42.2	214.0	171.8	156.7	9.14
	10:50	5.90	4.09	0.553	226	1.054	355.2	399.0	43.8	221.4	177.6	162.2	9.11
	10:55	6.17	4.28	0.580	224	1.097	372.9	418.6	45.7	232.1	186.4	170.0	9.16
	11:00	6.31	4.38	0.594	223	1.119	382.0	428.8	46.8	237.8	191.0	174.1	9.16
	11:05	6.51	4.52	0.609	222	1.151	391.6	439.9	48.3	244.1	195.8	178.8	9.11
	11:10	6.74	4.68	0.630	220	1.186	405.1	455.4	50.3	252.8	202.5	185.3	9.05
	11:15	7.00	4.85	0.646	218	1.223	415.1	467.6	52.5	260.1	207.6	190.9	8.91
	11:20	7.28	5.05	0.657	215	1.267	421.6	476.6	55.0	265.8	210.8	195.5	8.67
	11:25	7.44	5.16	0.657	214	1.290	421.1	477.4	56.3	266.9	210.6	196.7	8.48
	11:30	7.67	5.32	0.666	212	1.325	426.4	484.8	58.4	271.6	213.2	200.5	8.30
	11:35	7.89	5.47	0.666	210	1.356	425.7	485.9	60.2	273.0	212.8	202.1	8.07
	11:40	8.14	5.64	0.674	208	1.392	430.3	492.8	62.5	277.6	215.1	205.9	7.88
	11:45	8.41	5.84	0.676	206	1.433	430.7	495.2	64.5	279.8	215.3	208.1	7.68
	11:50	8.63	5.98	0.684	204	1.462	435.3	501.5	66.2	283.9	217.7	211.3	7.58

Borehole No. : D090 — **Sample Depth m:- 4.00 - 5.00**

Sample No. : 2 — **Specimen Depth m:- 4.60 - 4.80**

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 — **Works Order No.: 059**

Compiled by: W S Wat

Checked by: H W Chung

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2
Shearing Continuation

FAILURE CRITERION

Max. deviator Stress ☒ | Max. Stress ratio ☐ | Axial Strain % ☐

Stage :	1	Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
Date	Time	Dial		P.R.No. 25	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
04/12	11:55	8.83	6.13	0.690	202	1.493	438.6	506.3	67.7	287.0	219.3	213.9	7.48
	12:00	9.01	6.25	0.693	201	1.517	440.0	509.0	69.0	289.0	220.0	215.7	7.38
	12:05	9.35	6.49	0.695	199	1.565	440.2	511.2	71.0	291.1	220.1	217.7	7.20
	12:10	9.59	6.65	0.699	198	1.597	442.0	514.2	72.2	293.2	221.0	219.5	7.12
	12:15	9.90	6.87	0.704	196	1.640	444.3	518.2	73.9	296.0	222.1	222.0	7.01
	12:20	10.14	7.04	0.706	195	1.673	444.7	519.4	74.7	297.1	222.4	222.9	6.95
	12:25	10.42	7.23	0.707	195	1.710	444.4	519.1	74.7	296.9	222.2	222.8	6.95
	12:30	10.67	7.40	0.712	195	1.742	446.9	521.9	75.0	298.4	223.4	224.0	6.96
	12:35	10.89	7.55	0.719	195	1.771	450.7	526.2	75.5	300.8	225.3	225.7	6.97
	12:40	11.09	7.69	0.725	194	1.797	453.9	529.8	75.9	302.9	227.0	227.2	6.98
	12:45	11.42	7.92	0.733	193	1.840	458.0	534.6	76.6	305.6	229.0	229.3	6.98
	12:50	**11.63**	**8.07**	**0.735**	**193**	**1.867**	**458.5**	**535.3**	**76.8**	**306.1**	**229.3**	**229.6**	**6.97**
	12:55	11.83	8.20	0.735	193	1.891	457.8	534.9	77.1	306.0	228.9	229.7	6.94
	13:00	12.03	8.35	0.731	193	1.918	454.5	531.9	77.4	304.6	227.2	228.9	6.87
	13:05	12.40	8.60	0.717	192	1.963	444.1	522.2	78.1	300.1	222.0	226.1	6.69
	13:10	12.63	8.76	0.708	192	1.991	437.4	515.9	78.5	297.2	218.7	224.3	6.57
	13:15	12.89	8.94	0.701	191	2.023	432.0	510.9	78.9	294.9	216.0	222.9	6.48
	13:30	13.70	9.50	0.691	189	2.120	422.8	504.1	81.3	292.7	211.4	222.2	6.20
	13:45	14.46	10.03	0.690	187	2.210	419.6	502.9	83.3	293.1	209.8	223.2	6.04
	14:00	15.17	10.52	0.697	185	2.291	421.7	506.5	84.8	295.6	210.8	225.4	5.97
	14:15	15.93	11.05	0.699	183	2.376	420.3	506.9	86.6	296.8	210.2	226.7	5.85
	14:30	16.58	11.50	0.700	181	2.448	418.7	507.7	89.0	298.4	209.4	228.6	5.70
	14:45	17.29	12.00	0.701	178	2.526	416.9	508.6	91.7	300.2	208.5	230.7	5.55
	15:00	18.03	12.51	0.703	176	2.604	415.7	509.4	93.7	301.5	207.8	232.3	5.44
	15:15	18.79	13.04	0.704	174	2.683	413.7	509.9	96.2	303.0	206.8	234.1	5.30
	15:30	19.54	13.55	0.704	172	2.759	411.1	509.5	98.4	304.0	205.6	235.4	5.18

Borehole No. : D090 — **Sample Depth m:- 4.00 - 5.00**

Sample No. : 2 — **Specimen Depth m:- 4.60 - 4.80**

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 — **Works Order No.: 059**

Compiled by: W S Wat

Checked by: H W Chung

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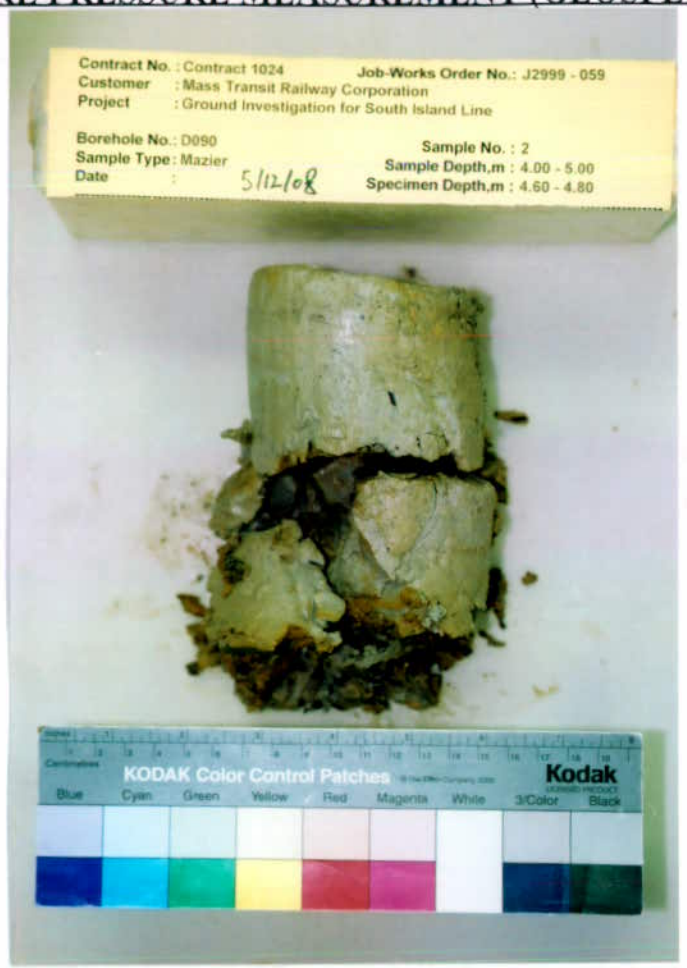
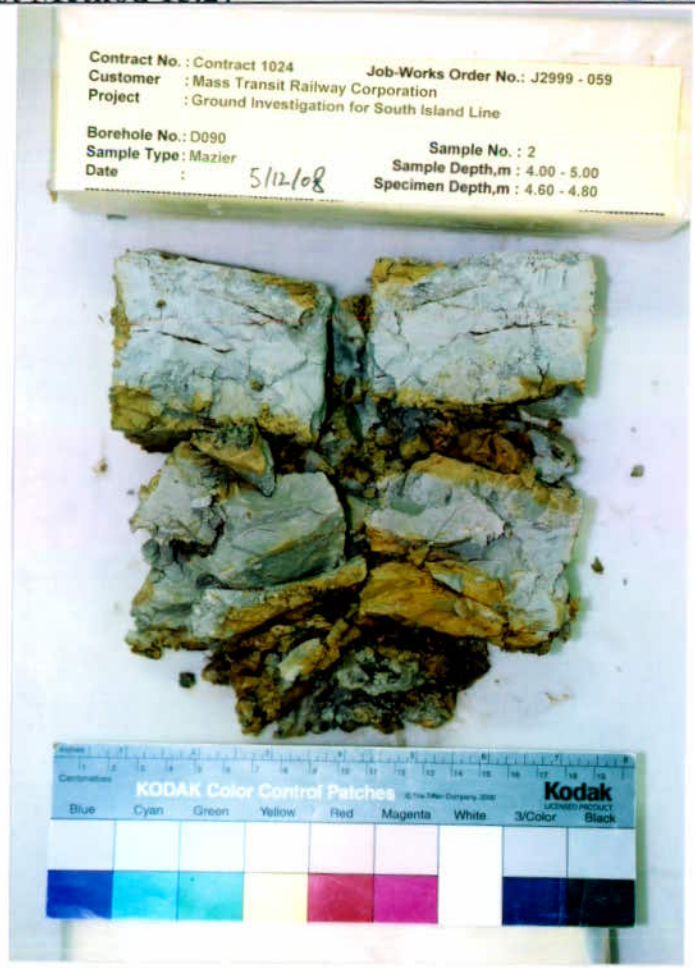
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT (GEOSPEC 3 : 2001 Test Method 15.2)





Description : Dark brown, slightly sandy, gravelly SILT/CLAY **Sample Origin : CDT‡** ‡ Information provided by customer

Borehole No. :	**D090**	**Sample No. : 2**	**Sample Depth m:-**	**4.00 - 5.00**	**Specimen Depth m:- 4.60 - 4.80**

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line

Contract No. : Contract 1024
Job No. : J2999
Works Order No.: 059

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	D090	D090	D090
Sample		no	2	2	2
Sample Type			Mazier	Mazier	Mazier
Stage		no	1	2	3
Sample Depth		m	4.00 - 5.00	4.00 - 5.00	4.00 - 5.00
Specimen Depth		m	4.80 - 5.00	4.80 - 5.00	4.80 - 5.00
INITIAL CONDITIONS					
Diameter	(D_o)	mm	74.2	74.5	75.2
Height	(H_o)	mm	145.0	142.6	139.3
Moisture Content	(W_o)	%	16	17	17
Bulk density	(ρ_o)	Mg/m^3	2.11	2.13	2.13
Dry density	(ρ_d)	Mg/m^3	1.81	1.82	1.83
Particle density	(ρ_s)		2.68	2.68	2.68
Voids Ratio	(e_o)		0.48	0.47	0.46
Degree of Saturation	(S_r)	%	91.6	95.9	95.9
DRAINAGE CONDITIONS			ONE END		
SATURATION					
Final Pore Pressure Coefficient B			1.00		
CONSOLIDATION					
Cell Pressure	(σ_3)	kPa	235	255	275
Back Pressure	(u_b)	kPa	215	215	215
Effective Pressure	(σ'_3)	kPa	20	40	60
Coefficient of Consolidation (t100) (C_{vi})		m^2/Year	2946.83	3712.83	5408.78
Coefficient of Volume Compressibility (m_{vi})		m^2/MN	0.48	0.22	0.15
Coefficient of Permeability (k)		m/s	4.36E-07	2.57E-07	2.48E-07
COMPRESSION TERMINATION CRITERION			MAXIMUM STRESS RATIO		MAX ($\sigma'1 - \sigma'3$)
COMPRESSION - INITIAL					
Moisture Content	(w)	%	17	17	16
Pore Pressure at the End of Consolidation		kPa	215	215	215
Effective Stress at the End of Consolidation		kPa	20	40	60
Bulk density	(ρ_o)	Mg/m^3	2.13	2.13	2.14
Dry density	(ρ_d)	Mg/m^3	1.82	1.83	1.84
Voids Ratio	(e)		0.47	0.46	0.46
Degree of Saturation	(S_r)	%	95.9	95.9	95.8

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Report No. : J2999-059.11
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.:** 059

Technician : W S Wat
Checked By : Name : H W Chung Date : 08/01/2009
Approved By : Signatory : Lau Wai Cheong Date : 08/01/2009
Tested Date: 01/12/2008

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	D090	D090	D090
Sample		no	2	2	2
Sample Type			Mazier	Mazier	Mazier
Stage		no	1	2	3
Sample Depth		m	4.00 - 5.00	4.00 - 5.00	4.00 - 5.00
Specimen Depth		m	4.80 - 5.00	4.80 - 5.00	4.80 - 5.00
COMPRESSION - FAILURE					
Cell Pressure		kPa	235	255	275
Rate of Strain		mm/min	0.048	0.047	0.046
CONDITIONS AT MAXIMUM STRESS RATIO					
Major Effective Principal Stress (σ'_1)		kPa	88	147	202
Corrected Deviator Stress ($\sigma'_1 - \sigma'_3$)		kPa	73	118	159
Minor Effective Principal Stress (σ'_3)		kPa	14	29	43
$s' = (\sigma'_1 + \sigma'_3)/2$		kPa	51	88	123
$t = (\sigma_1 - \sigma_3)/2$		kPa	37	59	80
Expanded Uncertainty of s' ^		kPa	-	-	-
Expanded Uncertainty of t ^		kPa	-	-	-
Pore pressure parameter A_f			0.08	0.09	0.11
Strain at Failure	(εf)	%	1.3	3.4	5.0
COMPRESSION - FINAL					
Moisture Content	(W_f)	%	17	17	16
Bulk density	(ρ_o)	Mg/m^3	2.13	2.13	2.14
Dry density	(ρ_d)	Mg/m^3	1.82	1.83	1.84
Voids Ratio	(e_f)		0.47	0.46	0.46
Degree of Saturation	(S_f)	%	95.9	95.9	95.8

Notes -
1. The method of specimen preparation was in accordance with GEOSPEC 3 : 2001 :- Test method 13.3 : test specimen from undisturbed soil samples.
2. Sample received date : 29/9/2008
3. The determination of moisture content was in accordance with test method 5.1 of GEOSPEC 3 : 2001.
4. Particle density : 2.68 (Determined)
5. Maximum and minimum temperature recorded over the period of testing 19.5 - 20.7 °C.
6. Unavoidable variations from specified procedure : none
7. Comment on observed or inferred sample disturbance : none
8. Percentage by mass of soil particles larger than 1/5 of the diameter of specimen (%) : Nil
9. The specimen was selected by the laboratory.
   Name : W S Wat Designation : Senior Laboratory Technician
10. Sampling History : As Received

* Delete as appropriate ^ Upon request

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.: 059**

Compiled by W S Wat
Checked by H W Chung

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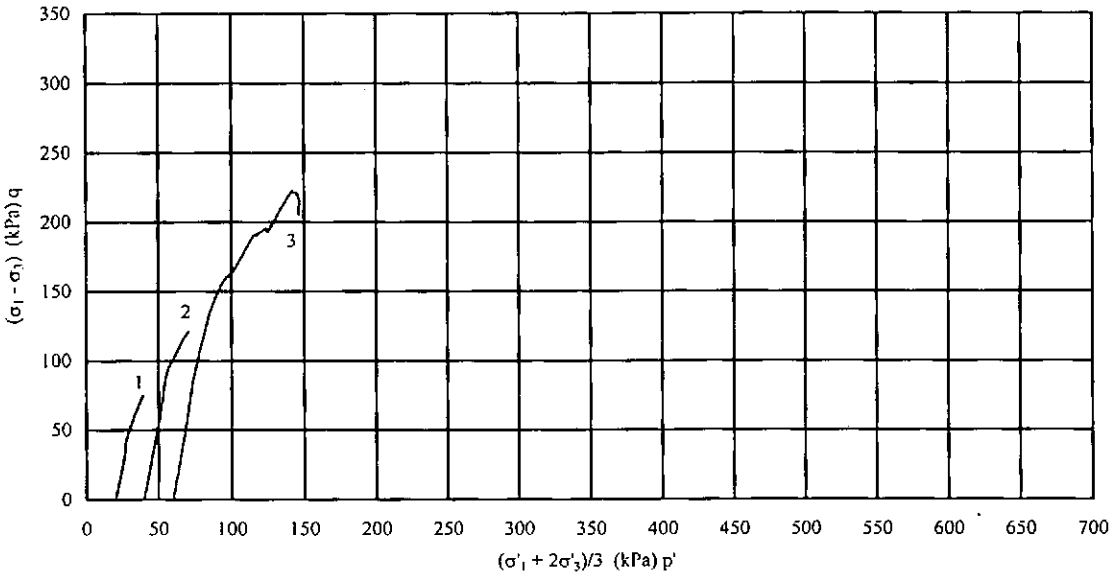
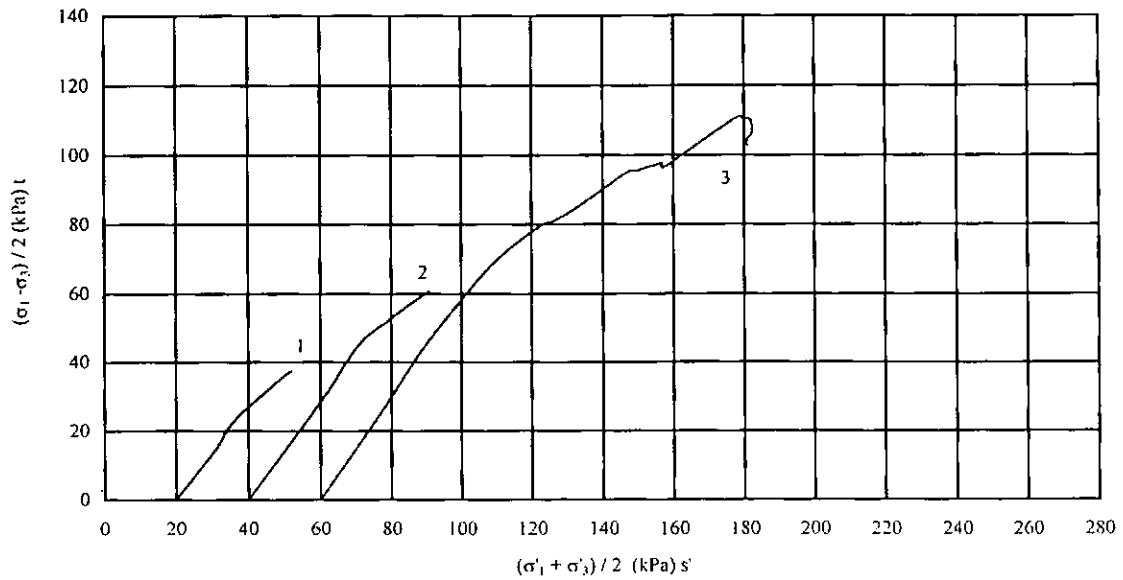
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

STRESS PATH PARAMETERS FOR EFFECTIVE STRESS

p' - q PLOT



s' - t PLOT



Borehole No. :	**D090**	**Sample Depth m:-**	**4.00 - 5.00**
Sample No. :	**2**	**Specimen Depth m:-**	**4.80 - 5.00**
Customer :	**Mass Transit Railway Corporation**		Compiled by W S Wat
Project :	**Ground Investigation for South Island Line**		
		Contract No.: Contract 1024	Checked by H W Chung
Job No.:	**J2999**	**Works Order No.: 059**	

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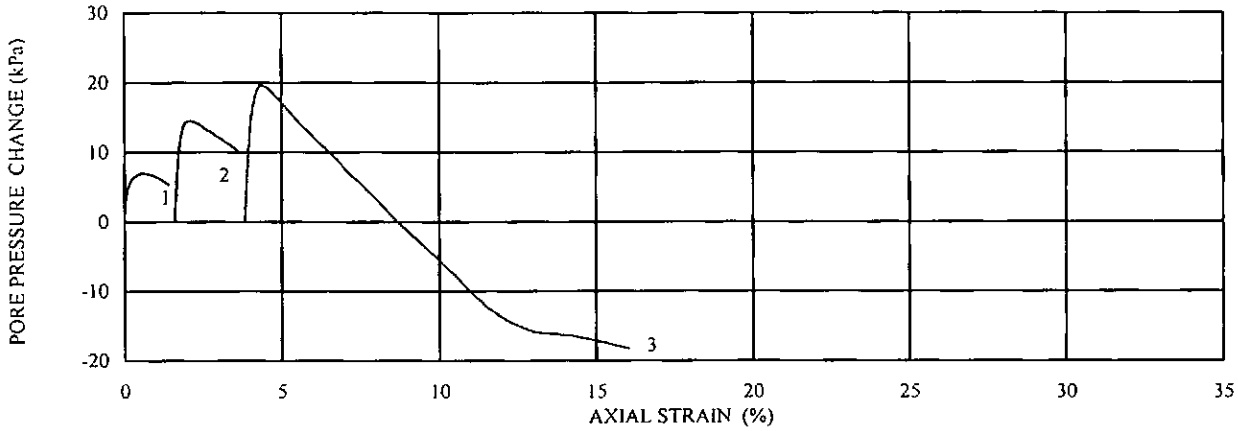
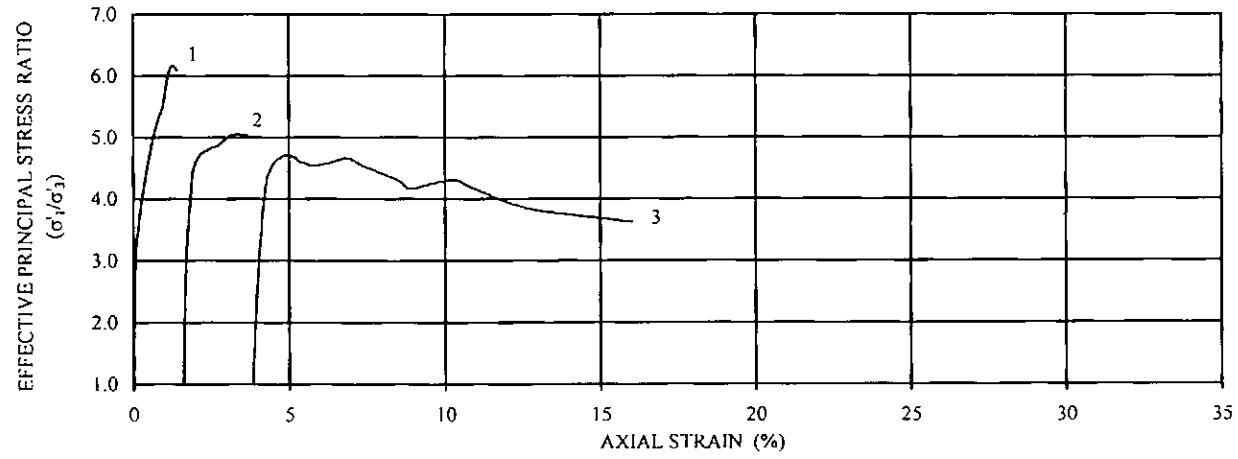
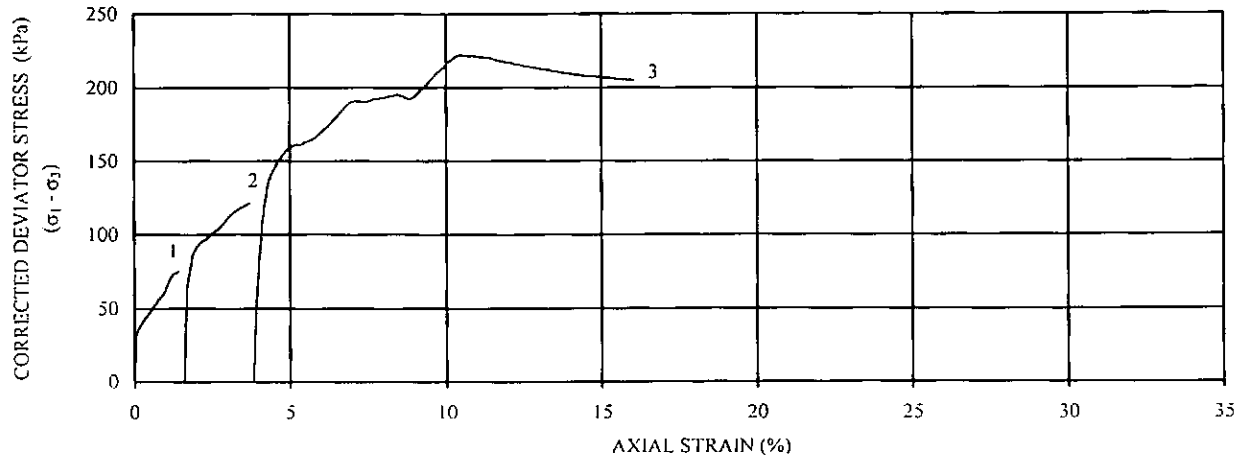
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

COMPRESSION







Borehole No. :	**D090**	**Sample Depth m:-**	**4.00 - 5.00**
Sample No. :	**2**	**Specimen Depth m:-**	**4.80 - 5.00**
Customer :	**Mass Transit Railway Corporation**		Compiled by W S Wat
Project :	**Ground Investigation for South Island Line**		
		Contract No.: Contract 1024	Checked by H W Chung
Job No.:	**J2999**	**Works Order No.: 059**	

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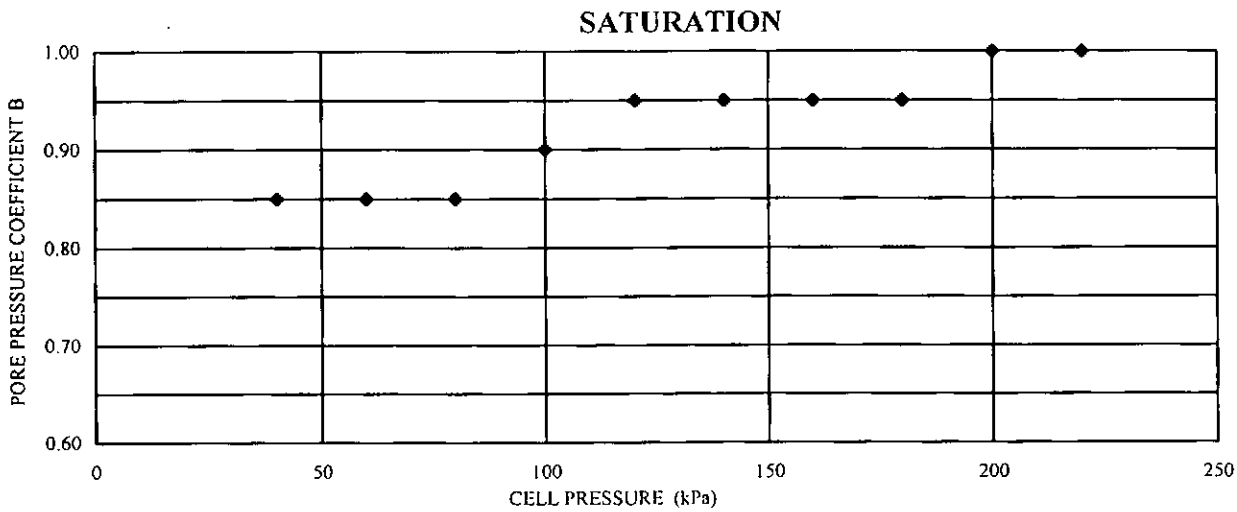
TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2



Date	Time	Cell Pressure kPa	Back Pressure kPa	Pore Pressure kPa	Cumulative Volume of Water cm^3	Pore Pressure Parameter B
01/12/2008	16:30	0	0	-	0.0	
	16:38	20	-	17		-
02/12/2008	08:36	20	15	15	-2.2	
	08:42	40	-	32		0.85
	09:00	40	35	35	-0.5	
	09:06	60	-	52		0.85
	09:29	60	55	55	1.0	
	09:35	80	-	72		0.85
	09:57	80	75	75	2.1	
	10:05	100	-	93		0.90
	10:19	100	95	95	3.2	
	10:25	120	-	114		0.95
	10:45	120	115	115	4.1	
	10:51	140	-	134		0.95
	11:51	140	135	135	5.3	
	11:59	160	-	154		0.95
	13:20	160	155	155	6.0	
	13:28	180	-	174		0.95
	14:20	180	175	175	6.3	
	14:29	200	-	195		1.00
	15:50	200	195	195	6.8	
	16:02	220	-	215		1.00
04/12/2008	09:05	220	215	215	9.1	

Borehole No. : D090 **Sample Depth m:-** 4.00 - 5.00
Sample No. : 2 **Specimen Depth m:-** 4.80 - 5.00

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.:** 059

Compiled by W S Wat
Checked by H W Chung

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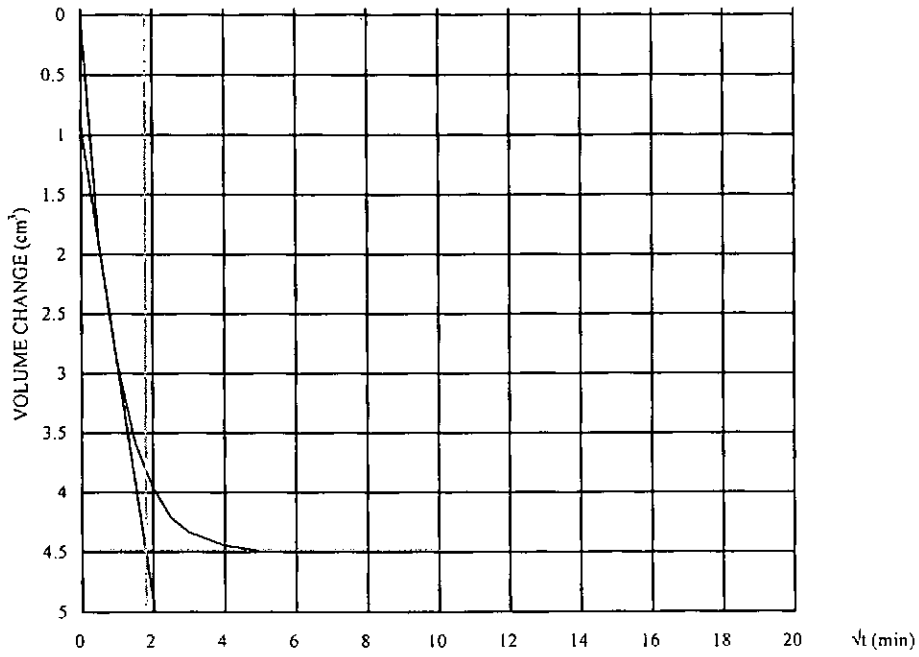
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

CONSOLIDATION (DRAINED PHASE) - Stage 1

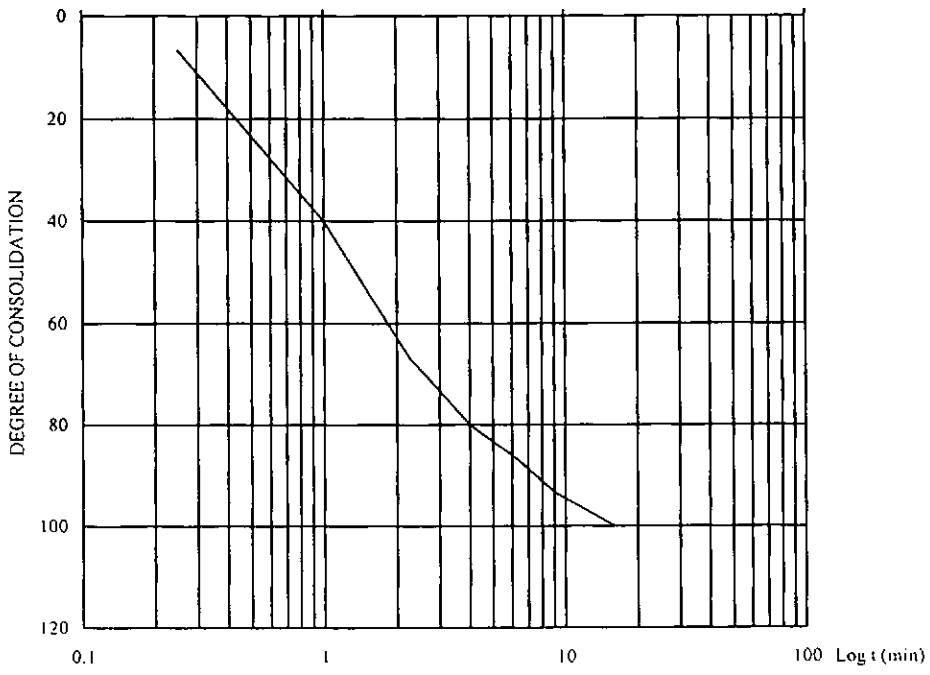


√t100 1.79 min

t100 3.22 min

tf 1.70 min

Calc. strain rate
5.941 mm/min



Borehole No. : D090 **Sample Depth m:-** 4.00 - 5.00

Sample No. : 2 **Specimen Depth m:-** 4.80 - 5.00

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.:** 059

Complied by: W S Wat

Checked by: H W Chung

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TEST REPORT
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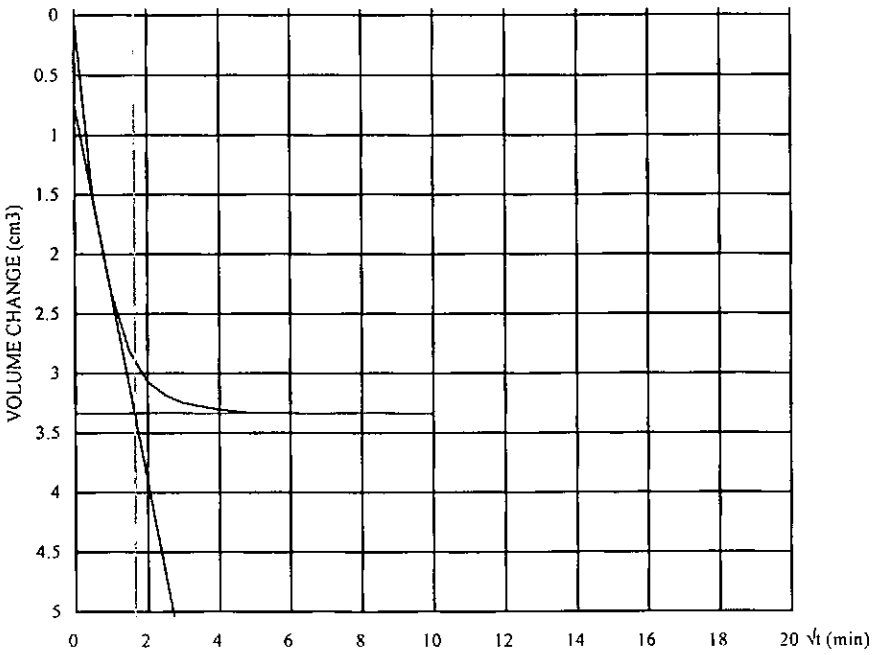
GEOSPEC 3 : 2001 Test Method 15.2

CONSOLIDATION (DRAINED PHASE) - Stage 2

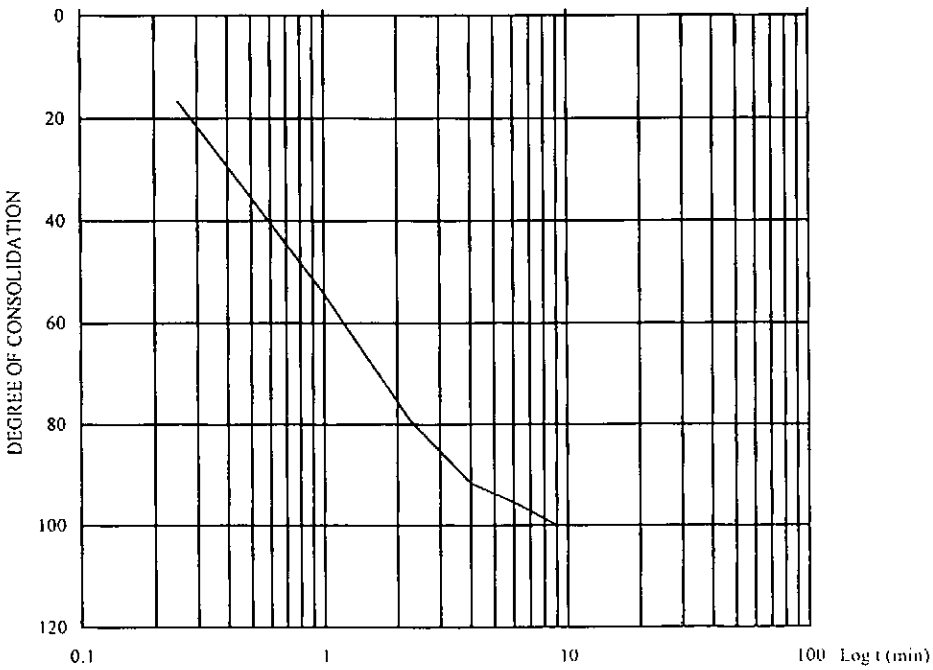


√t100 1.64 min

t100 2.69 min

tf 1.43 min

Calc. strain rate
6.984 mm/min



Borehole No. : D090 **Sample Depth m:-** 4.00 - 5.00

Sample No. : 2 **Specimen Depth m:-** 4.80 - 5.00

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.:** 059

Complied by: W S Wat

Checked by: H W Chung

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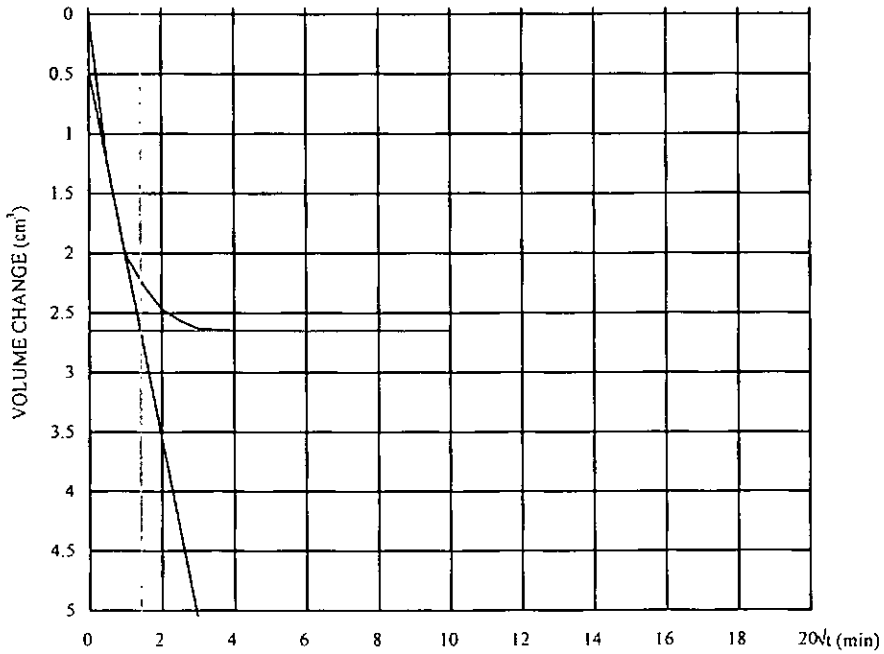
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

CONSOLIDATION (DRAINED PHASE) - Stage 3

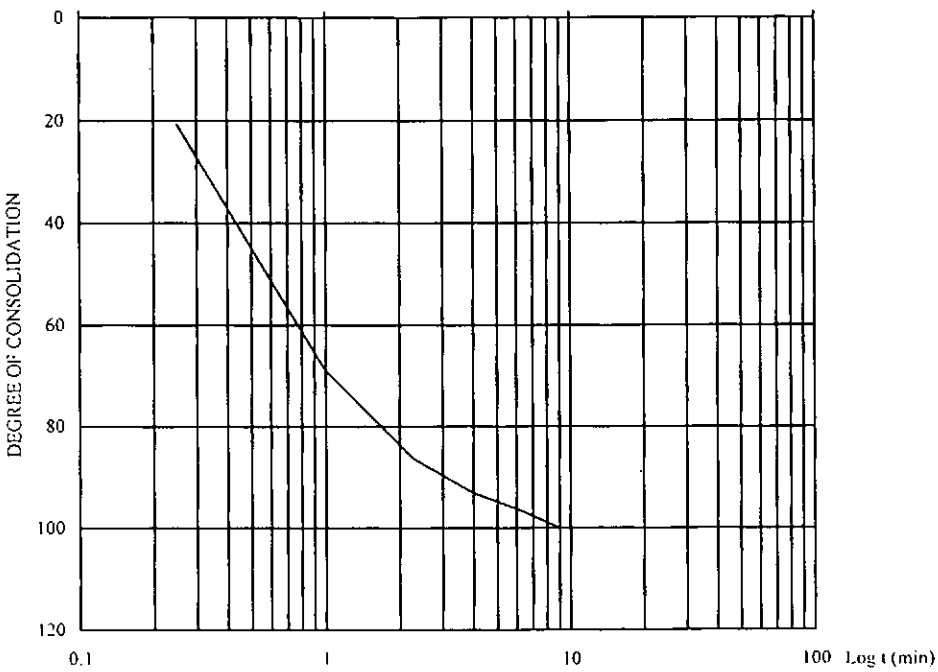


√t100 1.42 min

t100 2.01 min

tf 1.06 min

Calc. strain rate
9.153 mm/min



Borehole No. : D090 **Sample Depth m:-** 4.00 - 5.00

Sample No. : 2 **Specimen Depth m:-** 4.80 - 5.00

Customer : Mass Transit Railway Corporation | Complied by: W S Wat

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024 | Checked by: H W Chung

Job No.: J2999 **Works Order No.:** 059

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Gammon

Multi Stage		P.W.P,B.P		Effective Pressure 20	kPa
Side drains	No	Selected Machine Speed	0.048 mm/min	Rate of Strain 1.99	% per hr
FAILURE CRITERION					
Max. deviator Stress ☐		Max. Stress ratio ☒		Axial Strain % ☐	
Stage : 1	Applied Pressure (kPa) - Cell : 235		Back : 215	P.R. factor 1.7257	kN/mm

Date	Time	Strain Dial	Strain	Load P.R.No. 35	Pore Pressure	Dev. stress Corr.	Dev. stress q $\sigma_1 - \sigma_3$	Effective Stress σ'_1	Effective Stress σ'_3	s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio σ'_1/σ'_3
		mm	%	mm	kPa	kPa				2	2	3	
04/12	11:35	0.00	0.00	0.064	215	0.000	0.0	20.0	20.0	20.0	0.0	20.0	1.00
	11:40	0.09	0.06	0.140	219	0.017	30.5	46.7	16.2	31.4	15.2	26.4	2.88
	11:45	0.32	0.22	0.161	221	0.063	38.8	52.9	14.1	33.5	19.4	27.0	3.75
	11:50	0.52	0.36	0.173	222	0.103	43.5	56.9	13.4	35.1	21.7	27.9	4.25
	11:55	0.70	0.49	0.182	222	0.140	47.0	60.1	13.1	36.6	23.5	28.8	4.59
	12:00	0.87	0.60	0.191	222	0.171	50.5	63.5	13.0	38.3	25.3	29.8	4.88
	12:05	1.18	0.81	0.207	222	0.229	56.7	69.9	13.2	41.6	28.4	32.1	5.30
	12:10	1.38	0.96	0.217	222	0.271	60.6	74.0	13.4	43.7	30.3	33.6	5.52
	12:15	1.64	1.13	0.239	221	0.317	69.1	82.9	13.8	48.4	34.6	36.8	6.01
	12:20	**1.81**	**1.25**	**0.250**	**221**	**0.349**	**73.4**	**87.6**	**14.2**	**50.9**	**36.7**	**38.7**	**6.17**
	12:25	2.06	1.42	0.254	220	0.395	74.8	89.5	14.7	52.1	37.4	39.6	6.09

Borehole No. : D090 **Sample Depth m:- 4.00 - 5.00**

Sample No. : 2 **Specimen Depth m:- 4.80 - 5.00**

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.: 059**

Compiled by: W S Wat

Checked by: H W Chung

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Gammon

Multi Stage		P.W.P,B.P		Effective Pressure 40	kPa
Side drains	No	Selected Machine Speed	0.047 mm/min	Rate of Strain 1.98	% per hr
FAILURE CRITERION					
Max. deviator Stress ☐		Max. Stress ratio ☒		Axial Strain % ☐	
Stage : 2	Applied Pressure (kPa) - Cell :	255	Back : 215	P.R. factor 1.7257	kN/mm

Date	Time	Strain Dial	Strain	Load P.R.No. 35	Pore Pressure	Dev. stress Corr.	Dev. stress q $\sigma_1 - \sigma_3$	Effective Stress σ'_1	Effective Stress σ'_3	s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio σ'_1/σ'_3
		mm	%	mm	kPa	kPa				2	2	3	
04/12	13:25	2.32	1.60	0.066	215	0.000	0.0	40.0	40.0	40.0	0.0	40.0	1.00
	13:30	2.46	1.70	0.222	224	0.469	61.4	92.4	31.0	61.7	30.7	51.5	2.98
	13:35	2.62	1.81	0.264	227	0.498	78.0	105.6	27.6	66.6	39.0	53.6	3.82
	13:40	2.79	1.93	0.292	229	0.529	88.9	114.7	25.8	70.3	44.5	55.4	4.45
	13:45	3.09	2.14	0.307	230	0.583	94.6	120.1	25.5	72.8	47.3	57.0	4.71
	13:50	3.34	2.31	0.314	229	0.626	97.2	123.0	25.8	74.4	48.6	58.2	4.77
	13:55	3.55	2.46	0.322	229	0.664	100.1	126.3	26.2	76.3	50.1	59.6	4.82
	14:00	3.78	2.61	0.329	228	0.701	102.7	129.4	26.7	78.0	51.3	60.9	4.85
	14:05	3.97	2.74	0.334	228	0.734	104.5	131.5	27.0	79.2	52.2	61.8	4.87
	14:10	4.23	2.92	0.346	227	0.778	108.9	136.5	27.6	82.1	54.5	63.9	4.95
	14:15	4.51	3.12	0.359	227	0.826	113.7	141.9	28.2	85.1	56.9	66.1	5.03
	14:20	4.70	3.25	0.365	226	0.858	115.9	144.5	28.6	86.5	57.9	67.2	5.05
	14:25	**4.90**	**3.39**	**0.370**	**226**	**0.891**	**117.6**	**146.6**	**29.0**	**87.8**	**58.8**	**68.2**	**5.06**
	14:30	5.13	3.55	0.376	225	0.929	119.7	149.3	29.6	89.5	59.9	69.5	5.05
	14:35	5.34	3.69	0.381	225	0.962	121.5	151.6	30.1	90.8	60.7	70.6	5.04

Borehole No. : D090 **Sample Depth m:- 4.00 - 5.00**

Sample No. : 2 **Specimen Depth m:- 4.80 - 5.00**

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.: 059**

Compiled by W S Wat

Checked by H W Chung

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Multi Stage			P.W.P.B.P					Effective Pressure	60				kPa
Side drains	No		Selected Machine Speed		0.046		mm/min	Rate of Strain	1.98				% per hr
FAILURE CRITERION													
Max. deviator Stress			☐	Max. Stress ratio			☒	Axial Strain %					☐
Stage :	3	Applied Pressure (kPa) - Cell :			275	Back :	215	P.R. factor			1.7257		kN/mm

Date	Time	Strain		Load	Pore Pressure	Dev. stress		Effective Stress Parameters					
		Dial		P.R.No. 35		Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
05/12	08:35	5.54	3.83	0.069	215	0.000	0.0	60.0	60.0	60.0	0.0	60.0	1.00
	08:40	5.67	3.92	0.206	224	1.015	52.3	103.7	51.4	77.6	26.2	68.8	2.02
	08:45	5.82	4.02	0.291	230	1.038	85.3	130.7	45.4	88.1	42.7	73.8	2.88
	08:50	5.99	4.14	0.361	233	1.065	112.4	154.6	42.2	98.4	56.2	79.7	3.66
	08:55	6.19	4.28	0.413	235	1.097	132.4	172.9	40.5	106.7	66.2	84.6	4.27
	09:00	6.40	4.43	0.438	235	1.131	141.8	182.3	40.5	111.4	70.9	87.8	4.50
	09:05	6.58	4.55	0.452	234	1.157	147.0	187.8	40.8	114.3	73.5	89.8	4.60
	09:10	6.84	4.73	0.468	233	1.197	152.9	194.5	41.6	118.0	76.4	92.6	4.68
	09:15	7.03	4.86	0.478	233	1.226	156.5	198.7	42.2	120.4	78.2	94.4	4.71
	09:20	**7.25**	**5.01**	**0.486**	**232**	**1.258**	**159.3**	**202.2**	**42.9**	**122.5**	**79.6**	**96.0**	**4.71**
	09:25	7.51	5.20	0.492	231	1.299	161.3	205.2	43.9	124.5	80.6	97.7	4.67
	09:30	7.71	5.33	0.492	230	1.327	161.0	205.6	44.6	125.1	80.5	98.3	4.61
	09:35	7.96	5.50	0.498	230	1.363	163.0	208.4	45.4	126.9	81.5	99.7	4.59
	09:40	8.20	5.67	0.502	229	1.398	164.2	210.5	46.3	128.4	82.1	101.0	4.55
	09:45	8.43	5.83	0.508	228	1.431	166.1	213.0	46.9	130.0	83.1	102.3	4.54
	09:50	8.65	5.98	0.517	227	1.462	169.3	216.9	47.6	132.2	84.6	104.0	4.56
	09:55	8.92	6.17	0.528	227	1.501	173.1	221.6	48.5	135.0	86.5	106.2	4.57
	10:00	9.14	6.32	0.537	226	1.531	176.2	225.3	49.1	137.2	88.1	107.8	4.59
	10:05	9.43	6.52	0.551	225	1.571	181.1	231.1	50.0	140.5	90.5	110.4	4.62
	10:10	9.67	6.68	0.562	224	1.603	184.9	235.6	50.7	143.1	92.4	112.3	4.65
	10:15	9.88	6.83	0.572	224	1.632	188.3	239.7	51.4	145.6	94.2	114.2	4.66
	10:20	10.10	6.98	0.579	223	1.662	190.6	242.8	52.2	147.5	95.3	115.7	4.65
	10:25	10.36	7.16	0.581	222	1.696	191.0	244.1	53.1	148.6	95.5	116.8	4.60
	10:30	10.57	7.31	0.581	221	1.725	190.6	244.3	53.7	149.0	95.3	117.2	4.55
	10:35	10.80	7.47	0.582	221	1.755	190.7	245.0	54.3	149.6	95.3	117.9	4.51
	10:40	11.05	7.64	0.587	220	1.787	192.1	247.2	55.1	151.2	96.1	119.1	4.49
	10:45	11.26	7.79	0.589	219	1.815	192.5	248.3	55.8	152.1	96.3	120.0	4.45
	10:50	11.49	7.94	0.592	219	1.843	193.3	249.8	56.5	153.2	96.7	120.9	4.42
	10:55	11.71	8.10	0.595	218	1.873	194.1	251.3	57.2	154.2	97.0	121.9	4.39
	11:00	11.91	8.24	0.597	217	1.898	194.5	252.4	57.9	155.1	97.2	122.7	4.36
	11:05	12.17	8.41	0.601	216	1.929	195.6	254.4	58.8	156.6	97.8	124.0	4.33
	11:10	12.40	8.57	0.600	216	1.958	194.8	254.3	59.5	156.9	97.4	124.4	4.27
	11:15	12.67	8.76	0.595	215	1.991	192.5	252.9	60.4	156.7	96.3	124.6	4.19
	11:20	12.89	8.91	0.598	214	2.018	193.3	254.3	61.0	157.7	96.7	125.4	4.17
	11:25	13.09	9.05	0.605	213	2.042	195.6	257.2	61.6	159.4	97.8	126.8	4.17
	11:30	13.31	9.20	0.616	213	2.069	199.3	261.5	62.2	161.8	99.6	128.6	4.20
	11:35	13.55	9.37	0.626	212	2.098	202.5	265.4	62.9	164.2	101.3	130.4	4.22
	11:40	13.78	9.53	0.637	211	2.125	206.2	269.8	63.6	166.7	103.1	132.3	4.24
	11:45	14.06	9.72	0.650	211	2.158	210.5	274.9	64.4	169.6	105.2	134.6	4.27

Borehole No. : D090 **Sample Depth m:- 4.00 - 5.00**

Sample No. : 2 **Specimen Depth m:- 4.80 - 5.00**

Customer : Mass Transit Railway Corporation — Compiled by: W S Wat

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024 — Checked by: H W Chung

Job No.: J2999 **Works Order No.: 059**

Form : GESR009.14 / Dec.13.04 / Issue 1 / Rev I

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2
Shearing Continuation

FAILURE CRITERION

Max. deviator Stress ☐ | Max. Stress ratio ☒ | Axial Strain % ☐

Stage : 3		Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
Date	Time	Dial		P.R.No. 35	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
05/12	11:50	14.34	9.92	0.661	210	2.191	214.0	279.2	65.2	172.2	107.0	136.5	4.28
	11:55	14.51	10.03	0.669	209	2.210	216.6	282.3	65.7	174.0	108.3	137.9	4.30
	12:00	14.76	10.21	0.679	209	2.240	219.8	286.3	66.5	176.4	109.9	139.8	4.30
	12:05	15.00	10.37	0.686	208	2.266	221.9	289.1	67.2	178.1	110.9	141.2	4.30
	12:10	15.19	10.51	0.688	207	2.289	222.3	290.1	67.8	178.9	111.1	141.9	4.28
	12:15	15.47	10.70	0.687	206	2.320	221.4	290.1	68.7	179.4	110.7	142.5	4.22
	12:20	15.70	10.86	0.688	206	2.346	221.3	290.8	69.5	180.2	110.7	143.3	4.18
	12:25	15.92	11.01	0.689	205	2.370	221.3	291.4	70.1	180.7	110.6	143.9	4.16
	12:30	16.19	11.19	0.689	204	2.399	220.8	291.7	70.9	181.3	110.4	144.5	4.11
	12:35	16.37	11.32	0.689	204	2.419	220.5	291.9	71.4	181.6	110.2	144.9	4.09
	12:40	16.62	11.49	0.689	203	2.446	220.0	292.2	72.2	182.2	110.0	145.5	4.05
	12:45	16.83	11.63	0.687	202	2.468	218.9	291.5	72.6	182.0	109.4	145.6	4.02
	13:00	17.44	12.06	0.685	201	2.535	217.1	291.0	73.9	182.4	108.5	146.3	3.94
	13:15	18.19	12.58	0.682	200	2.614	214.6	289.7	75.1	182.4	107.3	146.6	3.86
	13:30	18.94	13.10	0.681	199	2.692	212.9	288.8	75.9	182.3	106.4	146.9	3.80
	13:45	19.70	13.62	0.679	199	2.769	210.8	286.9	76.1	181.5	105.4	146.4	3.77
	14:00	20.36	14.08	0.678	199	2.836	209.3	285.6	76.3	180.9	104.6	146.1	3.74
	14:15	21.07	14.57	0.678	198	2.907	208.0	284.7	76.7	180.7	104.0	146.0	3.71
	14:30	21.75	15.04	0.679	198	2.974	207.1	284.2	77.1	180.7	103.6	146.1	3.69
	14:45	22.48	15.54	0.680	197	3.045	206.1	283.8	77.7	180.8	103.1	146.4	3.65
	15:00	23.19	16.04	0.681	197	3.115	205.2	283.4	78.2	180.8	102.6	146.6	3.62

Borehole No. : D090 **Sample Depth m:-** 4.00 - 5.00
Sample No. : 2 **Specimen Depth m:-** 4.80 - 5.00

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.:** 059

Compiled by: W S Wat
Checked by: H W Chung

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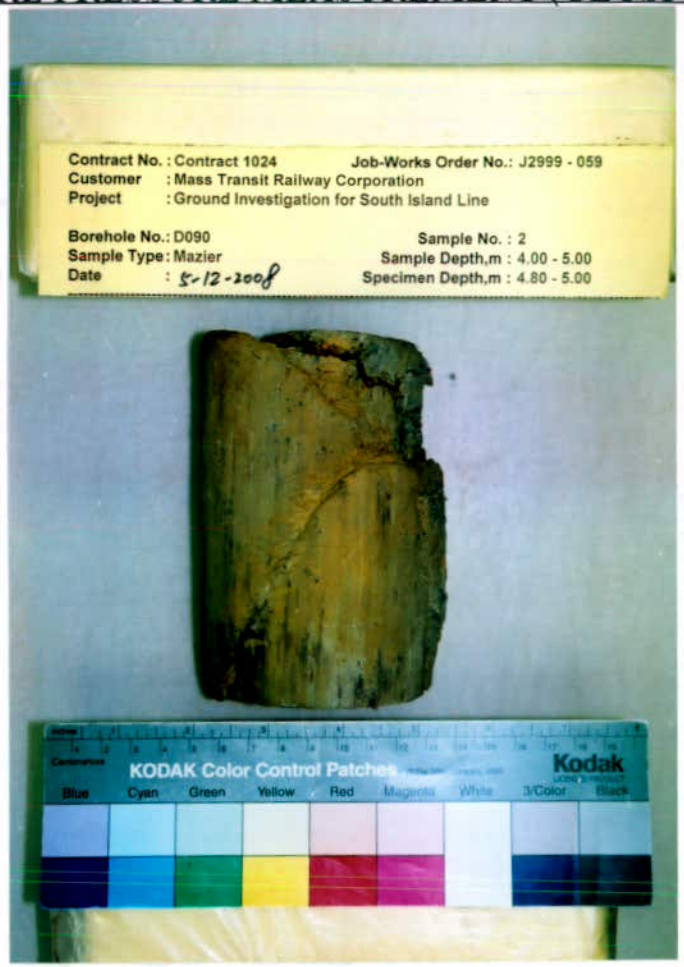
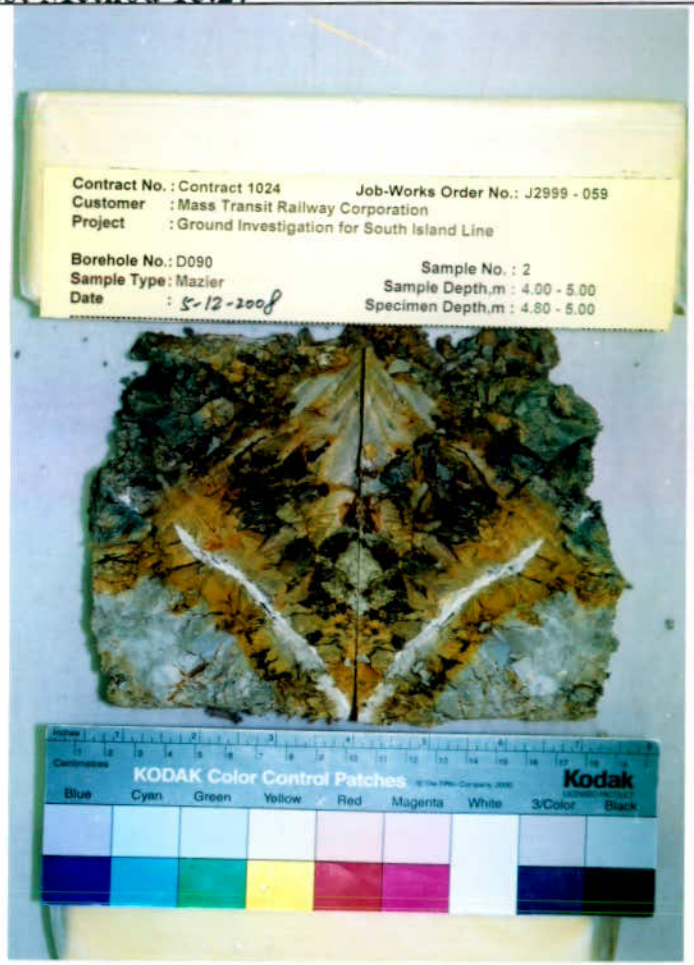
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT (GEOSPEC 3 : 2001 Test Method 15.2)





Description : Dark brown, slightly sandy, gravelly SILT/CLAY

Sample Origin : CDT ‡ ‡ Information provided by customer

Borehole No. : D090	Sample No. : 2	Sample Depth m:- 4.00 - 5.00	Specimen Depth m:- 4.80 - 5.00

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line

Contract No.: Contract 1024
Job No.: J2999
Works Order No.: 059

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DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	D090		
Sample		no	10		
Sample Type			Mazier		
Stage		no	1		
Sample Depth		m	14.00 - 15.00		
Specimen Depth		m	14.60 - 14.80		
INITIAL CONDITIONS					
Diameter	(D_o)	mm	74.2		
Height	(H_o)	mm	145.0		
Moisture Content	(W_o)	%	19		
Bulk density	(ρ_o)	Mg/m^3	2.08		
Dry density	(ρ_d)	Mg/m^3	1.75		
Particle density	(ρ_s)		2.65		
Voids Ratio	(e_o)		0.52		
Degree of Saturation	(S_r)	%	96.2		
DRAINAGE CONDITIONS			ONE END		
SATURATION					
Final Pore Pressure Coefficient B			0.98		
CONSOLIDATION					
Cell Pressure	(σ_3)	kPa	360		
Back Pressure	(u_b)	kPa	220		
Effective Pressure	(σ'_3)	kPa	140		
Coefficient of Consolidation (t100)	(C_{vi})	m^2/Year	2133.80		
Coefficient of Volume Compressibility	(m_{vi})	m^2/MN	0.21		
Coefficient of Permeability (k)		m/s	1.36E-07		
COMPRESSION TERMINATION CRITERION			MAXIMUM DEVIATOR STRESS		
COMPRESSION - INITIAL					
Moisture Content	(w)	%	18		
Pore Pressure at the End of Consolidation		kPa	220		
Effective Stress at the End of Consolidation		kPa	140		
Bulk density	(ρ_o)	Mg/m^3	2.12		
Dry density	(ρ_d)	Mg/m^3	1.80		
Voids Ratio	(e)		0.47		
Degree of Saturation	(S_r)	%	99.8		

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Report No. : J2999-059.11
Job No.: J2999
Works Order No.: 059

Technician : W S Wat
Checked By : Name : H W Chung Date : 08/01/2009
Approved By : Signatory : Lau Wai Cheong Date : 08/01/2009
Tested Date: 25/11/2008

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DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	D090		
Sample		no	10		
Sample Type			Mazier		
Stage		no	1		
Sample Depth		m	14.00 - 15.00		
Specimen Depth		m	14.60 - 14.80		
COMPRESSION - FAILURE					
Cell Pressure		kPa	360		
Rate of Strain		mm/min	0.048		
CONDITIONS MAXIMUM DEVIATOR STRESS					
Major Effective Principal Stress (σ'_1)		kPa	1118		
Corrected Deviator Stress ($\sigma'_1 - \sigma'_3$)		kPa	876		
Minor Effective Principal Stress (σ'_3)		kPa	242		
$s' = (\sigma'_1 + \sigma'_3)/2$		kPa	680		
$t = (\sigma_1 - \sigma_3)/2$		kPa	438		
Expanded Uncertainty of s' ^		kPa	-		
Expanded Uncertainty of t ^		kPa	-		
Pore pressure parameter A_f			-0.12		
Strain at Failure	(εf)	%	10.6		
COMPRESSION - FINAL					
Moisture Content	(W_f)	%	18		
Bulk density	(ρ_o)	Mg/m^3	2.12		
Dry density	(ρ_d)	Mg/m^3	1.80		
Voids Ratio	(e_f)		0.47		
Degree of Saturation	(S_f)	%	99.8		

Notes -
1. The method of specimen preparation was in accordance with GEOSPEC 3 : 2001 :- Test method 13.3 : test specimen from undisturbed soil samples.
2. Sample received date : 29/9/2008
3. The determination of moisture content was in accordance with test method 5.1 of GEOSPEC 3 : 2001.
4. Particle density : 2.65 (Assumed)
5. Maximum and minimum temperature recorded over the period of testing 19.5 - 20.7 °C.
6. Unavoidable variations from specified procedure : none
7. Comment on observed or inferred sample disturbance : none
8. Percentage by mass of soil particles larger than 1/5 of the diameter of specimen (%) : Nil
9. The specimen was selected by the laboratory.
   Name : W S Wat Designation : Senior Laboratory Technician
10. Sampling History : As Received

* Delete as appropriate ^ Upon request

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.: 059**

Compiled by W S Wat
Checked by H W Chung

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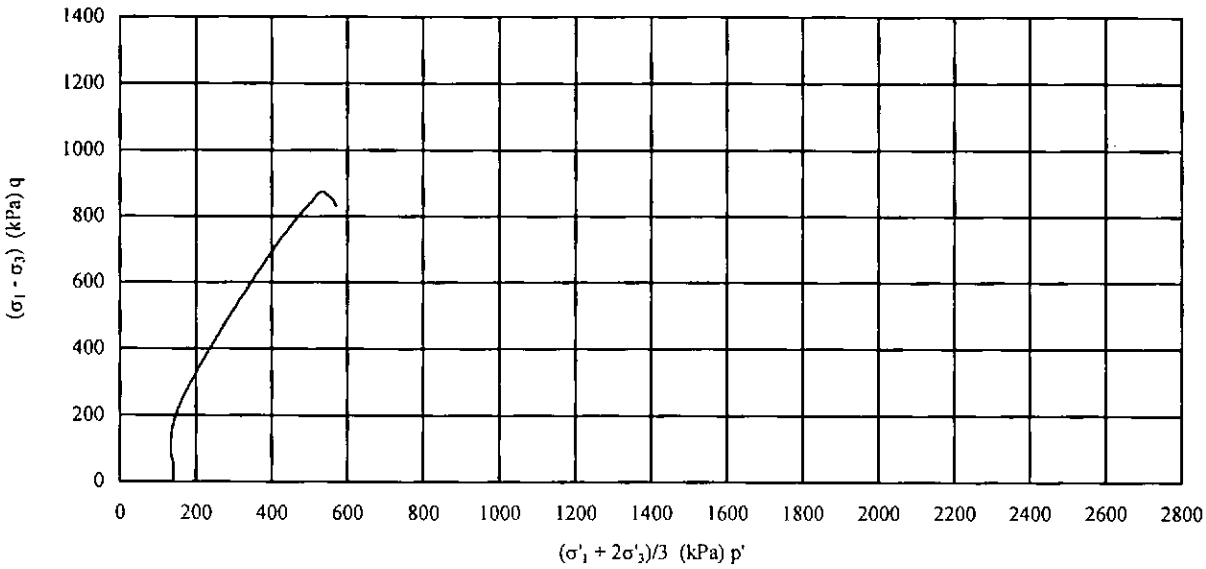
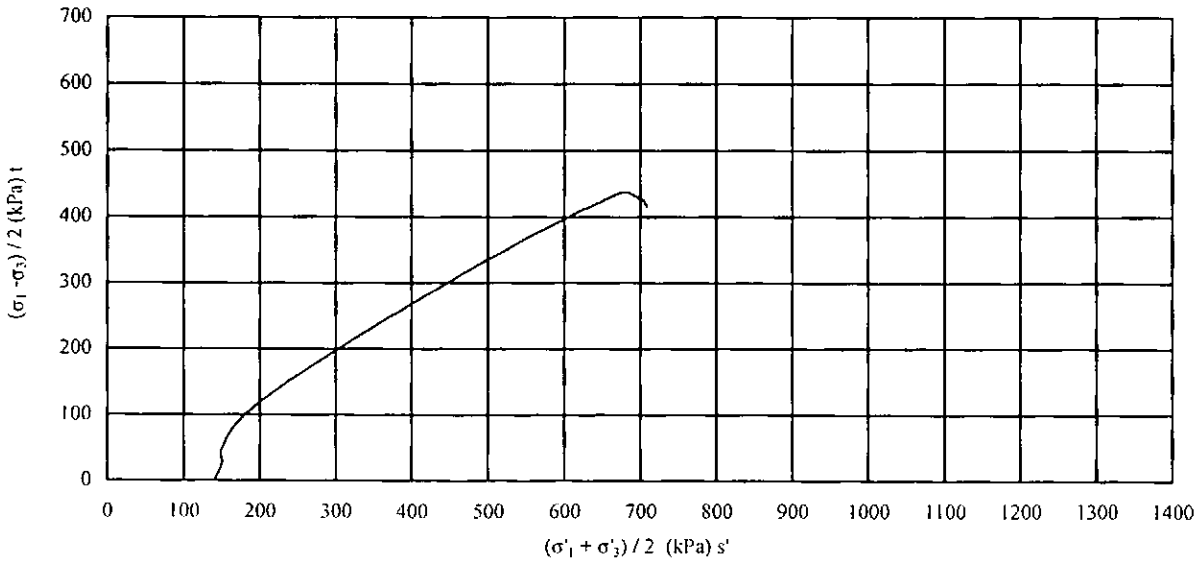
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

STRESS PATH PARAMETERS FOR EFFECTIVE STRESS

p' - q PLOT



s' - t PLOT



Borehole No. : D090 **Sample Depth m:-** 14.00 - 15.00
Sample No. : 10 **Specimen Depth m:-** 14.60 - 14.80

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.:** 059

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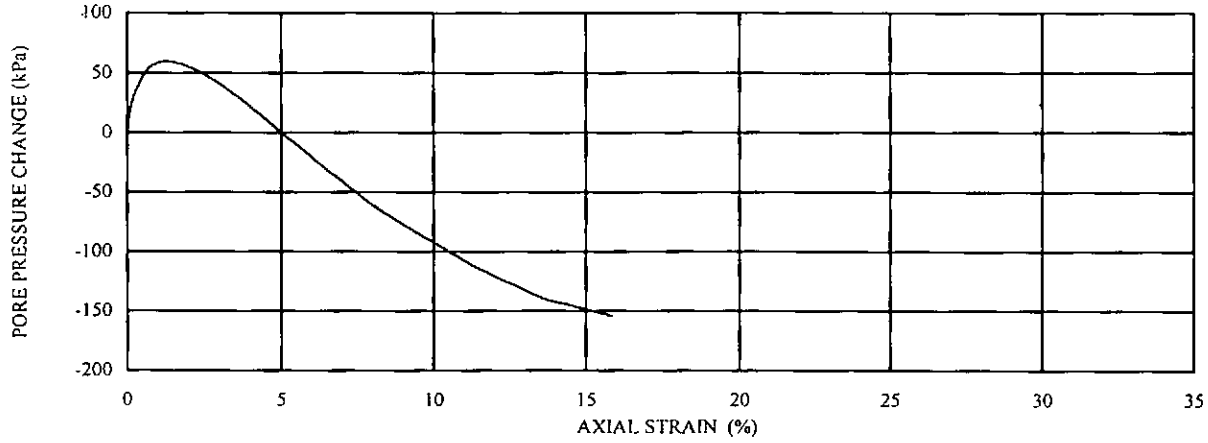
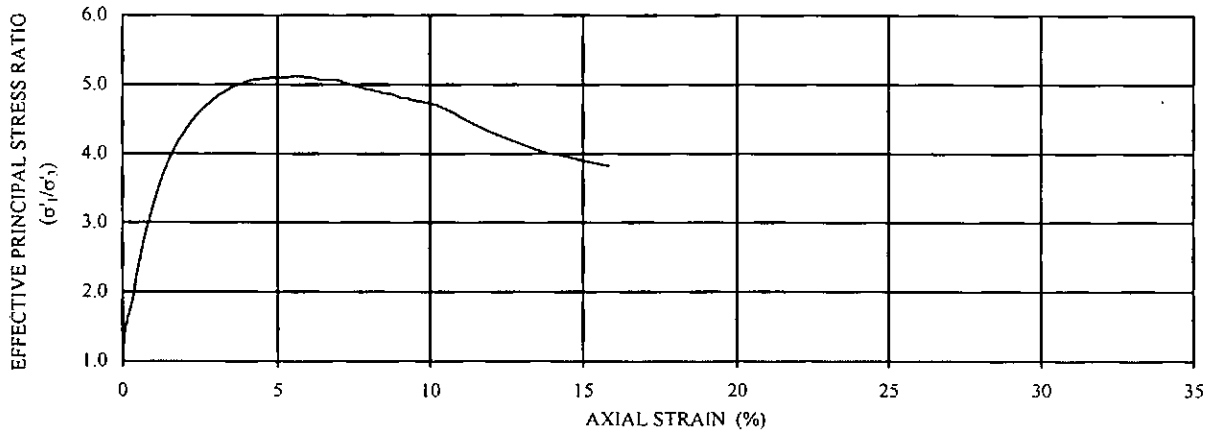
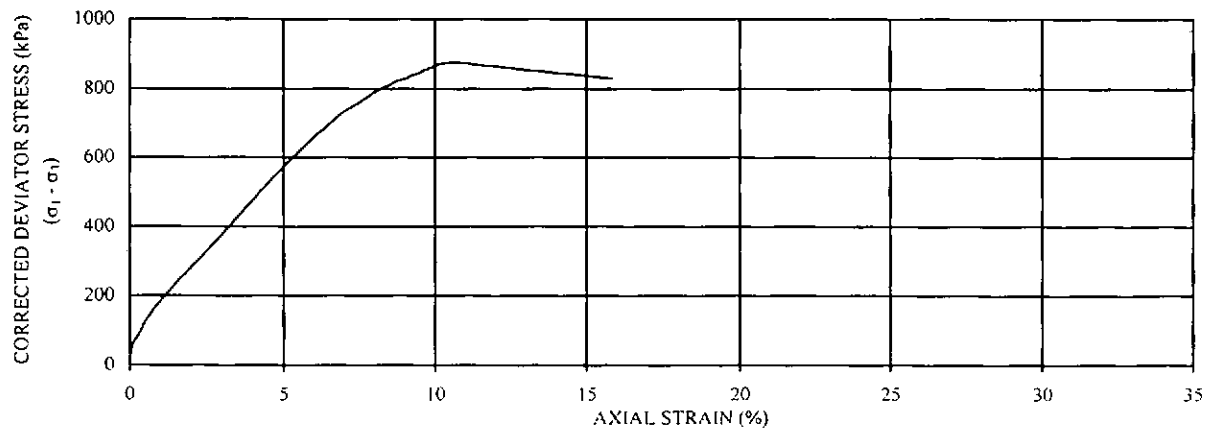
Form : GESR009.8 / Jun.02.03 / Issue 1 / Rev 0

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

COMPRESSION







Borehole No. :	**D090**	**Sample Depth m:-**	**14.00 - 15.00**
Sample No. :	**10**	**Specimen Depth m:-**	**14.60 - 14.80**
Customer :	**Mass Transit Railway Corporation**		Compiled by W S Wat
Project :	**Ground Investigation for South Island Line**		
		Contract No.: Contract 1024	Checked by H W Chung
Job No.:	**J2999**	**Works Order No.: 059**	

Form : GESR009.9 / Jun.02.03 / Issue 1 / Rev 0

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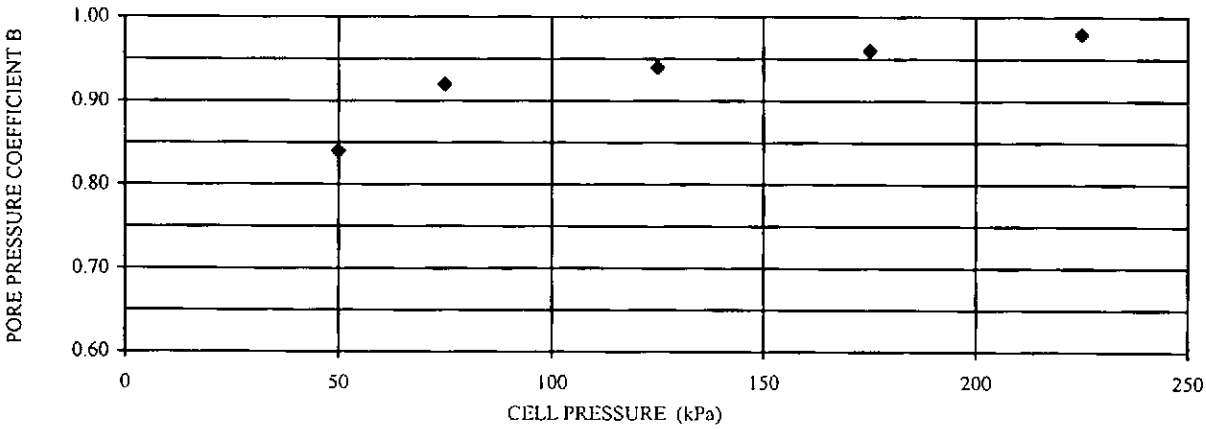
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

SATURATION



Date	Time	Cell Pressure kPa	Back Pressure kPa	Pore Pressure kPa	Cumulative Volume of Water cm^3	Pore Pressure Coefficient B
26/11/2008	08:36	0	0	-	0.0	
	08:43	25	-	23		-
	09:02	25	20	20	-1.4	
	09:10	50	-	41		0.84
	09:30	50	45	45	-0.9	
	09:39	75	-	68		0.92
	09:57	75	70	70	-0.1	
	10:06	125	-	117		0.94
	10:48	125	120	120	0.8	
	10:55	175	-	168		0.96
	13:20	175	170	170	1.9	
	13:30	225	-	219		0.98
28/11/2008	08:30	225	220	220	7.8	

Borehole No. D090 — **Sample Depth m:-** 14.00 - 15.00
Sample No. : 10 — **Specimen Depth m:-** 14.60 - 14.80
Customer : Mass Transit Railway Corporation — Compiled by W S Wat
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024 — Checked by H W Chung
Job No.: J2999 — **Works Order No.:** 059

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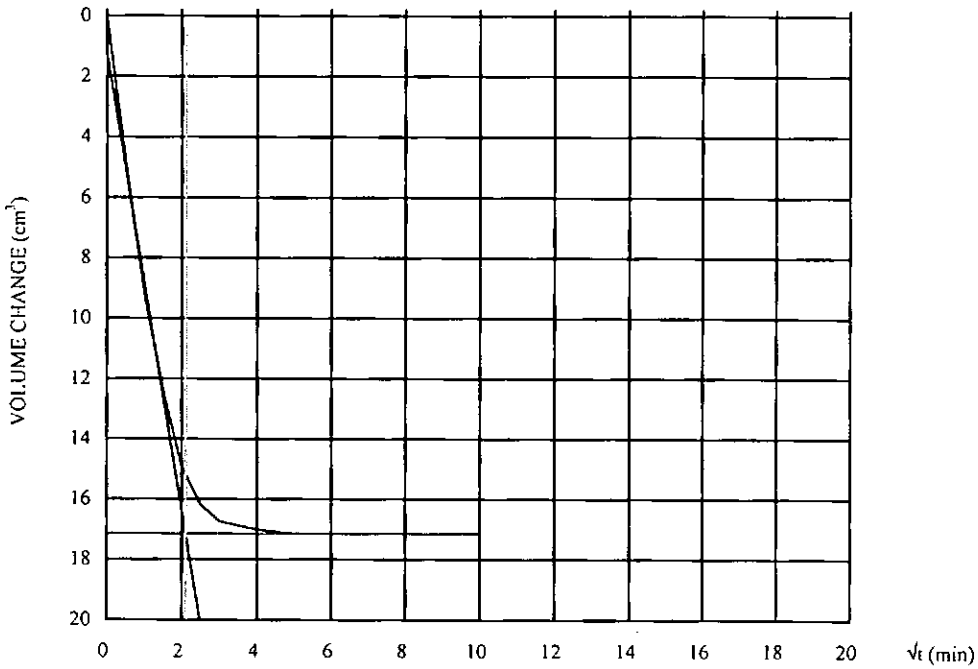
Form : GESR009.11 / Jun.02.03 / Issue 1 / Rev 0

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

CONSOLIDATION (DRAINED PHASE) - Stage 1

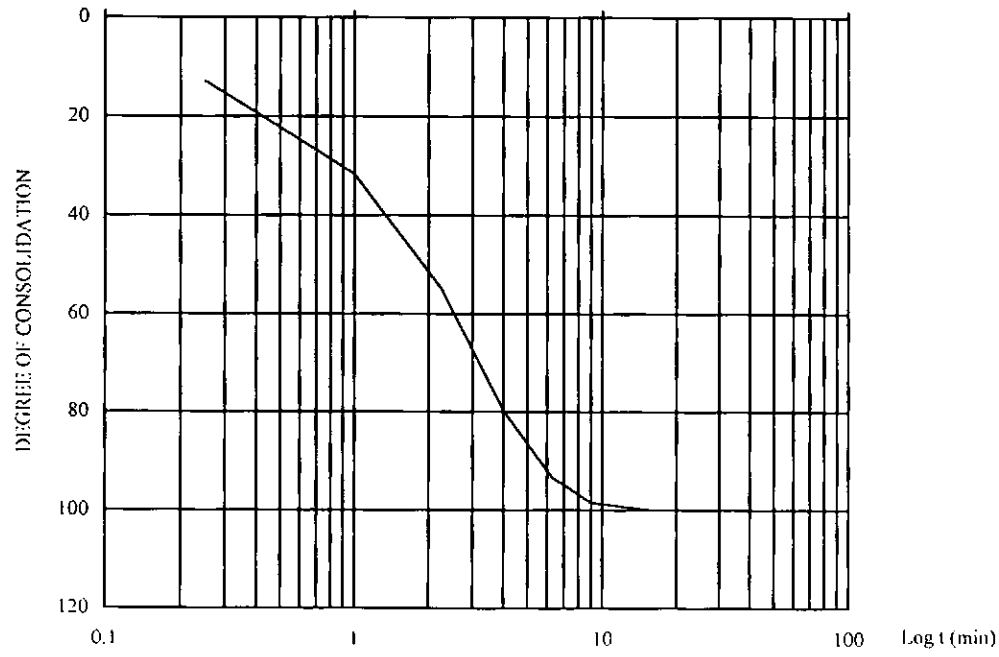


√t100 2.10 min

t100 4.415 min

tf 2.340 min

Calc. strain rate
4.297 mm/min



Borehole No. : D090 **Sample Depth m:-** 14.00 - 15.00

Sample No. : 10 **Specimen Depth m:-** 14.60 - 14.80

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.:** 059

Complied by: W S Wat

Checked by: H W Chung

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GEOSPEC 3 : 2001 Test Method 15.2

Single Stage				P.W.P,B.P				Effective Pressure	140				kPa
Side drains	No		Selected Machine Speed		0.048		mm/min	Rate of Strain	2.00				% per hr
FAILURE CRITERION													
Max. deviator Stress			☒	Max. Stress ratio			☐	Axial Strain %					☐
Stage :	1	Applied Pressure (kPa) - Cell :			360	Back :	220	P.R. factor		3.1043			kN/mm

Date	Time	Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
		Dial		P.R.No. 3	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
29/11	08:30	0.00	0.00	0.070	220	0.000	0.0	140.0	140.0	140.0	0.0	140.0	1.00
	08:35	0.10	0.07	0.139	235	0.020	50.4	175.5	125.1	150.3	25.2	141.9	1.40
	08:40	0.21	0.15	0.164	245	0.043	68.6	184.1	115.5	149.8	34.3	138.4	1.59
	08:45	0.44	0.30	0.192	256	0.086	88.9	193.2	104.3	148.8	44.5	133.9	1.85
	08:50	0.67	0.47	0.237	266	0.134	121.5	216.0	94.5	155.2	60.7	135.0	2.29
	08:55	0.86	0.60	0.261	271	0.171	138.8	228.2	89.4	158.8	69.4	135.7	2.55
	09:00	1.08	0.75	0.287	275	0.213	157.4	242.5	85.1	163.8	78.7	137.6	2.85
	09:05	1.28	0.89	0.309	277	0.251	173.1	256.0	82.9	169.4	86.5	140.6	3.09
	09:10	1.50	1.04	0.332	279	0.292	189.4	270.7	81.3	176.0	94.7	144.4	3.33
	09:15	1.74	1.21	0.357	280	0.339	207.1	287.6	80.5	184.1	103.6	149.5	3.57
	09:20	1.96	1.37	0.380	280	0.382	223.3	303.8	80.5	192.2	111.7	154.9	3.77
	09:25	2.18	1.52	0.401	279	0.421	238.1	319.2	81.1	200.1	119.0	160.5	3.94
	09:30	2.43	1.69	0.423	278	0.466	253.5	335.6	82.1	208.8	126.7	166.6	4.09
	09:35	2.65	1.84	0.443	277	0.505	267.4	350.8	83.4	217.1	133.7	172.5	4.21
	09:40	2.85	1.98	0.461	275	0.542	279.9	364.7	84.8	224.7	139.9	178.1	4.30
	09:45	3.12	2.17	0.487	273	0.590	297.9	384.7	86.8	235.8	149.0	186.1	4.43
	09:50	3.31	2.31	0.506	272	0.626	311.0	399.5	88.5	244.0	155.5	192.2	4.51
	09:55	3.55	2.47	0.528	269	0.666	326.2	416.9	90.7	253.8	163.1	199.4	4.60
	10:00	3.77	2.62	0.549	267	0.704	340.6	433.6	93.0	263.3	170.3	206.5	4.66
	10:05	4.00	2.78	0.571	265	0.743	355.6	451.1	95.5	273.3	177.8	214.0	4.72
	10:10	4.21	2.93	0.592	262	0.780	370.0	467.8	97.8	282.8	185.0	221.1	4.78
	10:15	4.52	3.14	0.623	259	0.831	391.1	492.5	101.4	296.9	195.5	231.8	4.86
	10:20	4.70	3.27	0.642	256	0.862	404.0	507.9	103.9	305.9	202.0	238.6	4.89
	10:25	4.93	3.43	0.666	253	0.900	420.2	527.0	106.8	316.9	210.1	246.9	4.93
	10:30	5.18	3.61	0.692	250	0.943	437.8	547.8	110.0	328.9	218.9	255.9	4.98
	10:35	5.34	3.72	0.708	248	0.968	448.5	560.8	112.3	336.6	224.3	261.8	4.99
	10:40	5.63	3.92	0.738	244	1.015	468.6	585.0	116.4	350.7	234.3	272.6	5.03
	10:45	5.81	4.04	0.757	241	1.042	481.3	600.3	119.0	359.7	240.7	279.4	5.04
	10:50	6.09	4.24	0.787	237	1.088	501.3	624.4	123.1	373.8	250.7	290.2	5.07
	10:55	6.23	4.34	0.800	235	1.110	509.9	635.2	125.3	380.2	254.9	295.3	5.07
	11:00	6.49	4.52	0.827	231	1.150	527.7	656.9	129.2	393.1	263.9	305.1	5.08
	11:05	6.68	4.65	0.847	228	1.179	540.9	673.1	132.2	402.6	270.4	312.5	5.09
	11:10	6.89	4.80	0.867	225	1.212	554.0	689.2	135.2	412.2	277.0	319.9	5.10
	11:15	7.19	5.01	0.896	220	1.258	572.9	712.8	139.9	426.3	286.4	330.9	5.09
	11:20	7.35	5.11	0.911	218	1.279	582.6	724.8	142.2	433.5	291.3	336.4	5.10
	11:25	7.60	5.29	0.935	214	1.318	598.1	744.0	145.9	445.0	299.1	345.3	5.10
	11:30	7.82	5.45	0.956	211	1.352	611.6	760.3	148.7	454.5	305.8	352.6	5.11
	11:35	8.02	5.58	0.974	209	1.379	623.2	774.5	151.3	462.9	311.6	359.0	5.12
	11:40	8.26	5.75	0.998	205	1.414	638.6	793.7	155.1	474.4	319.3	368.0	5.12

Borehole No. :	D090	Sample Depth m:- 14.00 - 15.00	
Sample No. :	10	Specimen Depth m:- 14.60 - 14.80	
Customer :	Mass Transit Railway Corporation		Compiled by W S Wat
Project :	Ground Investigation for South Island Line		
		Contract No.: Contract 1024	Checked by H W Chung
Job No.:	J2999	Works Order No.: 059	

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TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2
Shearing Continuation

FAILURE CRITERION

Max. deviator Stress ☒ | Max. Stress ratio ☐ | Axial Strain % ☐

Stage :	1	Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
Date	Time	Dial		P.R.No. 3	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
29/11	11:45	8.51	5.93	1.022	201	1.452	653.8	812.9	159.1	486.0	326.9	377.0	5.11
	11:50	8.74	6.08	1.043	197	1.482	667.2	829.8	162.6	496.2	333.6	385.0	5.10
	11:55	8.94	6.23	1.059	194	1.513	677.1	842.8	165.7	504.2	338.5	391.4	5.09
	12:00	9.18	6.39	1.078	191	1.545	688.9	858.2	169.3	513.7	344.4	398.9	5.07
	12:05	9.39	6.53	1.097	188	1.573	700.8	873.1	172.3	522.7	350.4	405.9	5.07
	12:10	9.65	6.72	1.120	184	1.610	715.1	890.8	175.7	533.2	357.5	414.1	5.07
	12:15	9.88	6.88	1.140	181	1.642	727.5	906.4	178.9	542.6	363.7	421.4	5.07
	12:20	10.07	7.01	1.154	179	1.667	735.9	917.3	181.4	549.3	367.9	426.7	5.06
	12:25	10.35	7.21	1.173	174	1.706	747.2	932.9	185.7	559.3	373.6	434.8	5.02
	12:30	10.67	7.43	1.193	170	1.747	758.9	949.0	190.1	569.6	379.5	443.1	4.99
	12:35	10.87	7.57	1.207	167	1.774	767.2	960.0	192.8	576.4	383.6	448.5	4.98
	12:40	11.05	7.69	1.218	165	1.796	773.6	968.8	195.2	582.0	386.8	453.1	4.96
	12:45	11.29	7.86	1.235	161	1.828	783.6	982.3	198.7	590.5	391.8	459.9	4.94
	12:50	11.51	8.01	1.248	159	1.856	791.0	992.3	201.3	596.8	395.5	465.0	4.93
	12:55	11.71	8.15	1.260	156	1.881	797.8	1001.5	203.7	602.6	398.9	469.6	4.92
	13:00	11.94	8.31	1.273	154	1.910	805.1	1011.6	206.5	609.1	402.6	474.9	4.90
	13:05	12.21	8.50	1.286	151	1.945	812.2	1021.7	209.5	615.6	406.1	480.2	4.88
	13:10	12.43	8.66	1.300	148	1.973	820.1	1032.1	212.0	622.1	410.1	485.4	4.87
	13:15	12.63	8.79	1.309	146	1.996	824.9	1039.0	214.1	626.5	412.4	489.1	4.85
	13:20	12.99	9.05	1.321	142	2.042	830.5	1048.6	218.1	633.4	415.3	494.9	4.81
	13:25	13.21	9.20	1.335	140	2.068	838.4	1058.8	220.4	639.6	419.2	499.9	4.80
	13:30	13.50	9.40	1.345	137	2.103	843.2	1066.7	223.5	645.1	421.6	504.6	4.77
	13:35	13.71	9.54	1.357	134	2.126	849.7	1075.3	225.6	650.5	424.9	508.8	4.77
	13:40	13.92	9.69	1.368	132	2.152	855.6	1083.3	227.7	655.5	427.8	512.9	4.76
	13:45	14.14	9.84	1.378	130	2.177	860.7	1090.7	230.0	660.3	430.3	516.9	4.74
	13:50	14.43	10.05	1.392	127	2.212	867.9	1101.0	233.1	667.1	434.0	522.4	4.72
	13:55	14.64	10.19	1.401	125	2.236	872.4	1107.6	235.2	671.4	436.2	526.0	4.71
	14:00	14.89	10.37	1.406	122	2.265	873.9	1111.7	237.8	674.8	437.0	529.1	4.68
	14:05	15.08	10.49	1.410	120	2.285	875.3	1115.1	239.8	677.4	437.6	531.6	4.65
	14:10	**15.29**	**10.64**	**1.413**	**118**	**2.310**	**875.8**	**1117.9**	**242.1**	**680.0**	**437.9**	**534.0**	**4.62**
	14:15	15.52	10.80	1.415	116	2.336	875.5	1119.8	244.3	682.0	437.7	536.1	4.58
	14:20	15.79	10.99	1.416	113	2.366	874.2	1121.4	247.2	684.3	437.1	538.6	4.54
	14:25	15.95	11.10	1.416	111	2.384	873.2	1122.0	248.8	685.4	436.6	539.9	4.51
	14:30	16.21	11.28	1.415	109	2.412	870.7	1122.2	251.5	686.8	435.3	541.7	4.46
	14:45	16.94	11.79	1.415	102	2.492	865.6	1123.8	258.2	691.0	432.8	546.7	4.35
	15:00	17.69	12.31	1.416	95	2.572	861.0	1125.6	264.6	695.1	430.5	551.6	4.25
	15:15	18.38	12.80	1.416	90	2.647	856.2	1126.0	269.8	697.9	428.1	555.2	4.17
	15:30	19.09	13.29	1.418	84	2.720	852.6	1128.7	276.1	702.4	426.3	560.3	4.09
	15:45	19.82	13.79	1.419	79	2.793	848.1	1129.1	281.0	705.1	424.1	563.7	4.02
	16:00	20.57	14.32	1.420	76	2.870	843.5	1127.2	283.7	705.4	421.7	564.9	3.97
	16:15	21.28	14.81	1.421	73	2.940	839.2	1126.5	287.3	706.9	419.6	567.0	3.92

Borehole No. : D090 — **Sample Depth m:-** 14.00 - 15.00

Sample No. : 10 — **Specimen Depth m:-** 14.60 - 14.80

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 — **Works Order No.:** 059

Compiled by: W S Wat

Checked by: H W Chung

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TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2
Shearing Continuation

FAILURE CRITERION

Max. deviator Stress ☒ | Max. Stress ratio ☐ | Axial Strain % ☐

Stage :	1	Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
Date	Time	Dial		P.R.No. 3	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
29/11	16:30	22.03	15.34	1.422	69	3.016	834.5	1125.3	290.8	708.1	417.3	569.0	3.87
	16:45	22.75	15.84	1.423	66	3.086	830.1	1124.2	294.1	709.2	415.1	570.8	3.82

Borehole No. : D090 — Sample Depth m:- 14.00 - 15.00

Sample No. : 10 — Specimen Depth m:- 14.60 - 14.80

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 — Works Order No.: 059

Compiled by: W S Wat

Checked by: H W Chung

Form : GESR009.15 / Dec.13.04 / Issue 1 / Rev 1

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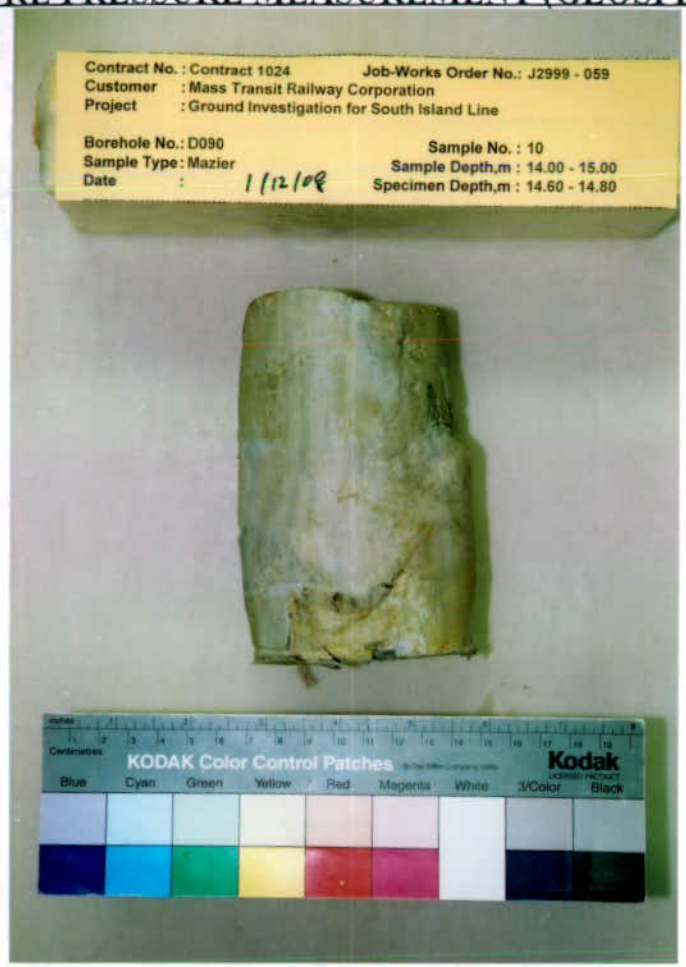
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT (GEOSPEC 3 : 2001 Test Method 15.2)



Description : Light greyish brown, sandy SILT **Sample Origin :** CDT‡ ‡ Information provided by customer

Borehole No. :	**D090**	**Sample No. : 10**	**Sample Depth m:-**	**14.00 - 15.00**
Specimen Depth m:-	**14.60 - 14.80**			

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line

Contract No. : Contract 1024
Job No. : J2999
Works Order No.: 059

Compiled by: W S Wat
Checked by: H W Chung

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	D090	D090	D090
Sample		no	10	10	10
Sample Type			Mazier	Mazier	Mazier
Stage		no	1	2	3
Sample Depth		m	14.00 - 15.00	14.00 - 15.00	14.00 - 15.00
Specimen Depth		m	14.80 - 15.00	14.80 - 15.00	14.80 - 15.00
INITIAL CONDITIONS					
Diameter	(D_o)	mm	74.2	74.3	74.8
Height	(H_o)	mm	145.0	141.1	137.8
Moisture Content	(W_o)	%	18	18	17
Bulk density	(ρ_o)	Mg/m^3	2.09	2.13	2.14
Dry density	(ρ_d)	Mg/m^3	1.77	1.81	1.83
Particle density	(ρ_s)		2.65	2.65	2.65
Voids Ratio	(e_o)		0.50	0.46	0.44
Degree of Saturation	(S_r)	%	95.1	100.6	100.7
DRAINAGE CONDITIONS			ONE END		
SATURATION					
Final Pore Pressure Coefficient B			0.98		
CONSOLIDATION					
Cell Pressure	(σ_3)	kPa	290	360	430
Back Pressure	(u_b)	kPa	220	220	220
Effective Pressure	(σ'_3)	kPa	70	140	210
Coefficient of Consolidation (t100)	(C_{vi})	m^2/Year	637.20	628.31	1030.50
Coefficient of Volume Compressibility	(m_{vi})	m^2/MN	0.36	0.12	0.07
Coefficient of Permeability (k)		m/s	7.09E-08	2.38E-08	2.18E-08
COMPRESSION TERMINATION CRITERION			MAXIMUM STRESS RATIO		MAX ($\sigma'1 - \sigma'3$)
COMPRESSION - INITIAL					
Moisture Content	(w)	%	18	17	16
Pore Pressure at the End of Consolidation		kPa	220	220	220
Effective Stress at the End of Consolidation		kPa	70	140	210
Bulk density	(ρ_o)	Mg/m^3	2.13	2.14	2.15
Dry density	(ρ_d)	Mg/m^3	1.81	1.83	1.85
Voids Ratio	(e)		0.46	0.44	0.43
Degree of Saturation	(S_r)	%	100.6	100.7	100.7

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Report No. : J2999-059.11
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.:** 059

Technician : W S Wat Checked By : Name : H W Chung Date : 08/01/2009
Approved By : Signatory : **Lau Wai Cheong** Date : 08/01/2009
Tested Date: 25/11/2008

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Form : GESR009.6 / Nov.10.06 / Issue 1 / Rev 1

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	D090	D090	D090
Sample		no	10	10	10
Sample Type			Mazier	Mazier	Mazier
Stage		no	1	2	3
Sample Depth		m	14.00 - 15.00	14.00 - 15.00	14.00 - 15.00
Specimen Depth		m	14.80 - 15.00	14.80 - 15.00	14.80 - 15.00
COMPRESSION - FAILURE					
Cell Pressure		kPa	290	360	430
Rate of Strain		mm/min	0.048	0.046	0.045
CONDITIONS AT MAXIMUM STRESS RATIO					
Major Effective Principal Stress (σ'_1)		kPa	177	377	564
Corrected Deviator Stress ($\sigma'_1 - \sigma'_3$)		kPa	143	290	423
Minor Effective Principal Stress (σ'_3)		kPa	34	87	141
$s' = (\sigma'_1 + \sigma'_3)/2$		kPa	106	232	353
$t = (\sigma_1 - \sigma_3)/2$		kPa	72	145	212
Expanded Uncertainty of s' ^		kPa	-	-	-
Expanded Uncertainty of t ^		kPa	-	-	-
Pore pressure parameter A_f			0.25	0.18	0.16
Strain at Failure	(εf)	%	1.8	4.1	5.9
COMPRESSION - FINAL					
Moisture Content	(W_f)	%	18	17	16
Bulk density	(ρ_o)	Mg/m^3	2.13	2.14	2.15
Dry density	(ρ_d)	Mg/m^3	1.81	1.83	1.85
Voids Ratio	(e_f)		0.46	0.44	0.43
Degree of Saturation	(S_f)	%	100.6	100.7	100.7

Notes -
1. The method of specimen preparation was in accordance with GEOSPEC 3 : 2001 :- Test method 13.3 : test specimen from undisturbed soil samples.
2. Sample received date : 29/9/2008
3. The determination of moisture content was in accordance with test method 5.1 of GEOSPEC 3 : 2001.
4. Particle density : 2.65 (Assumed)
5. Maximum and minimum temperature recorded over the period of testing 19.5 - 20.7 °C.
6. Unavoidable variations from specified procedure : none
7. Comment on observed or inferred sample disturbance : none
8. Percentage by mass of soil particles larger than 1/5 of the diameter of specimen (%) : Nil
9. The specimen was selected by the laboratory.
   Name : W S Wat Designation : Senior Laboratory Technician
10. Sampling History : As Received

* Delete as appropriate ^ Upon request

Customer : **Mass Transit Railway Corporation**
Project : **Ground Investigation for South Island Line**
Contract No.: Contract 1024
Job No.: **J2999** **Works Order No.: 059**

Compiled by W S Wat
Checked by H W Chung

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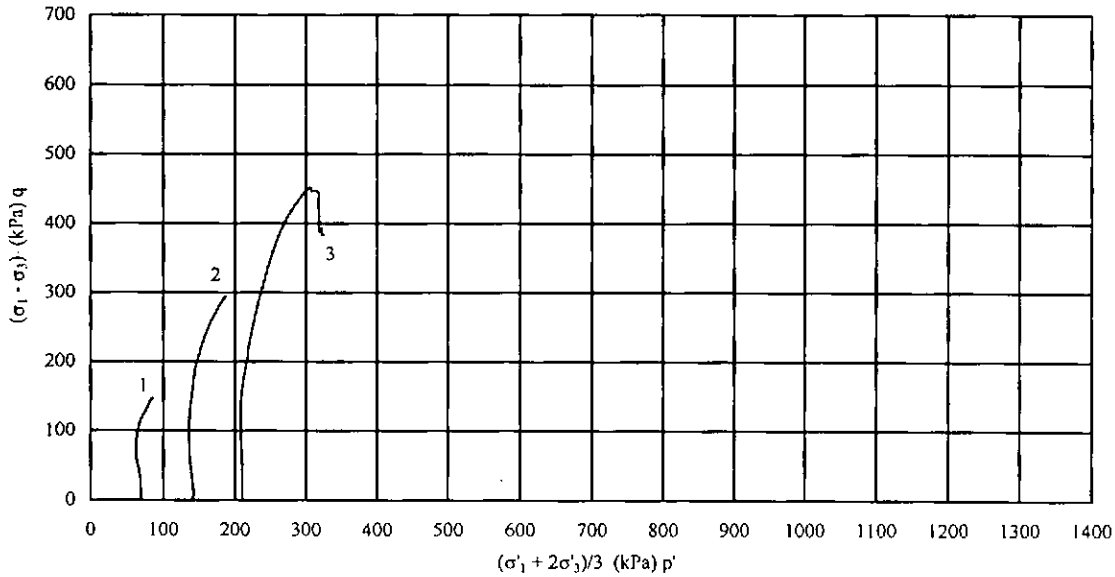
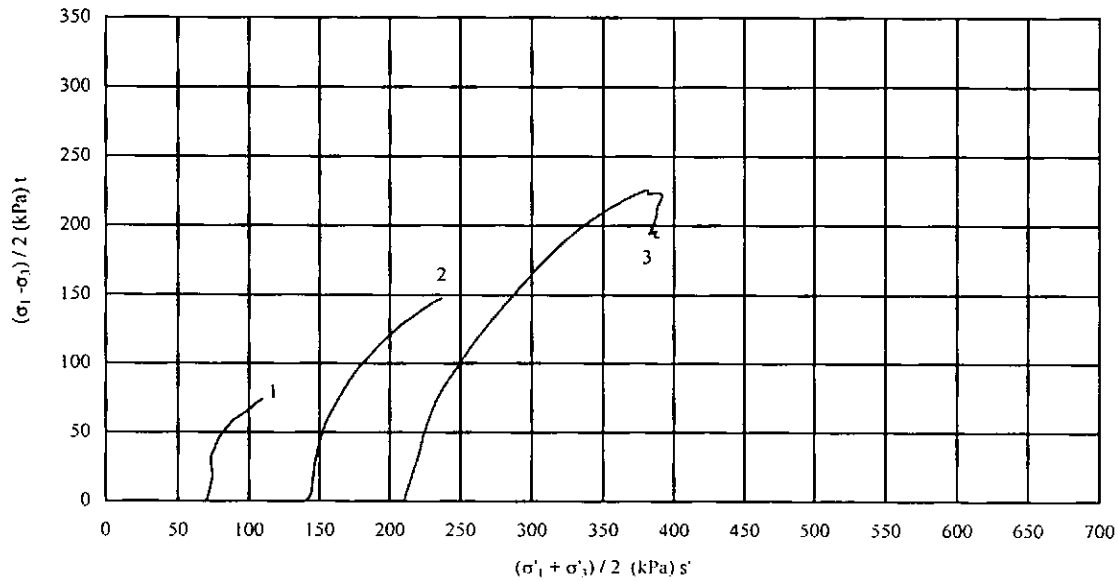
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

STRESS PATH PARAMETERS FOR EFFECTIVE STRESS

p' - q PLOT



s' - t PLOT



Borehole No. :	**D090**	**Sample Depth m:-**	**14.00 - 15.00**
Sample No. :	**10**	**Specimen Depth m:-**	**14.80 - 15.00**
Customer :	**Mass Transit Railway Corporation**		Compiled by W S Wat
Project :	**Ground Investigation for South Island Line**		
		Contract No.: Contract 1024	Checked by H W Chung
Job No.:	**J2999**	**Works Order No.: 059**	

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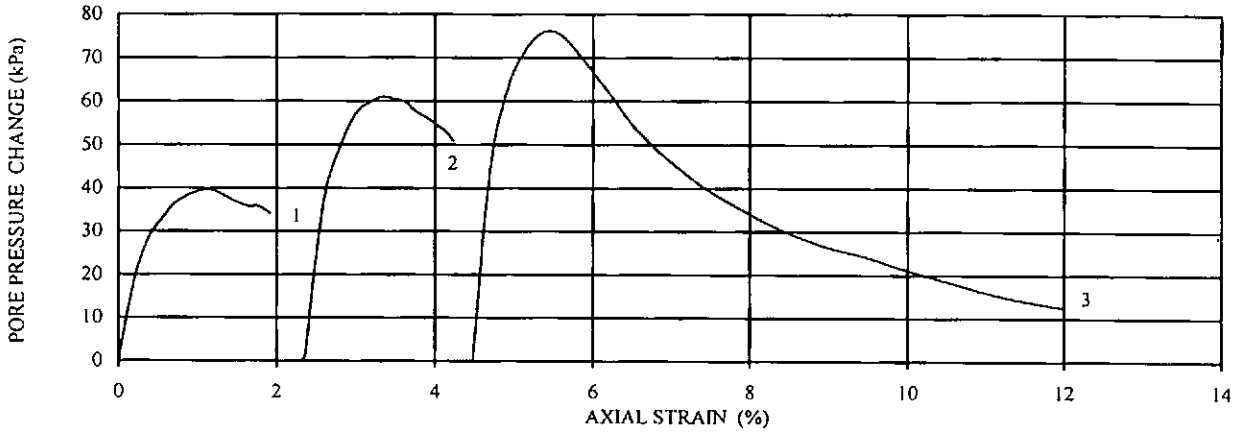
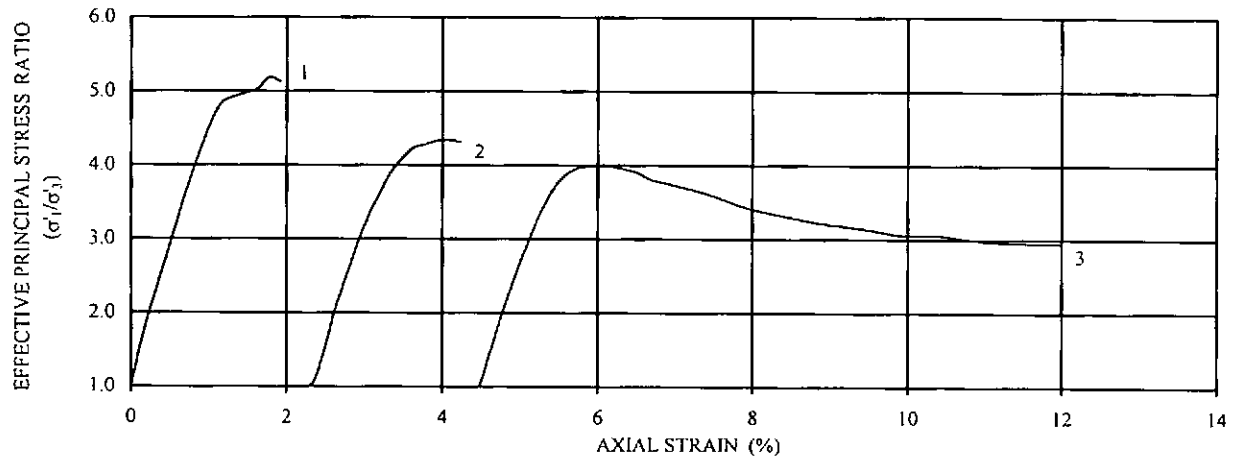
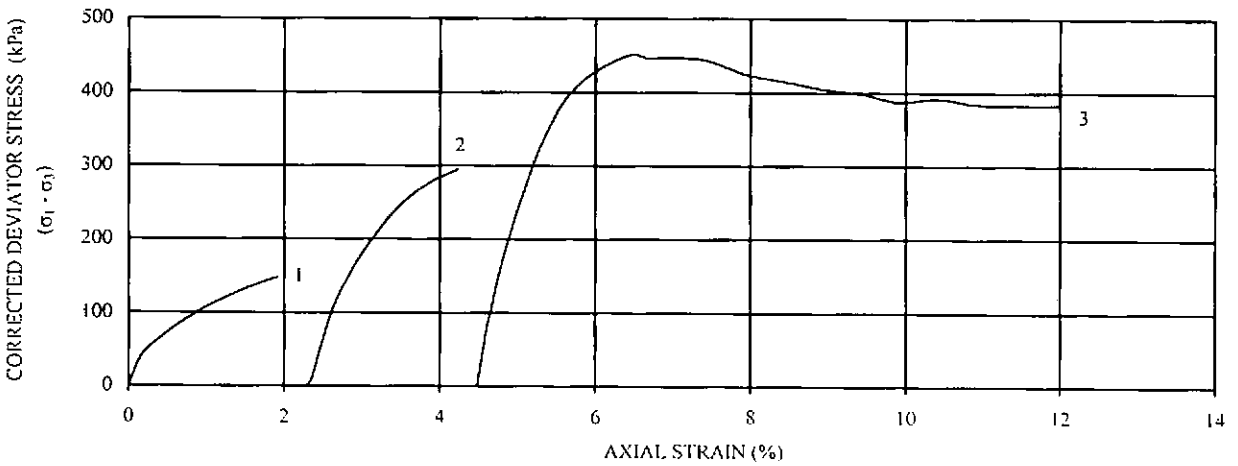
Form : GESR009.8 / Jun.02.03 / Issue 1 / Rev 0

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

COMPRESSION







Borehole No. : D090 — **Sample Depth m:-** 14.00 - 15.00
Sample No. : 10 — **Specimen Depth m:-** 14.80 - 15.00

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line

Compiled by: W S Wat
Checked by: H W Chung

Job No.: J2999 — **Contract No.:** Contract 1024 — **Works Order No.:** 059

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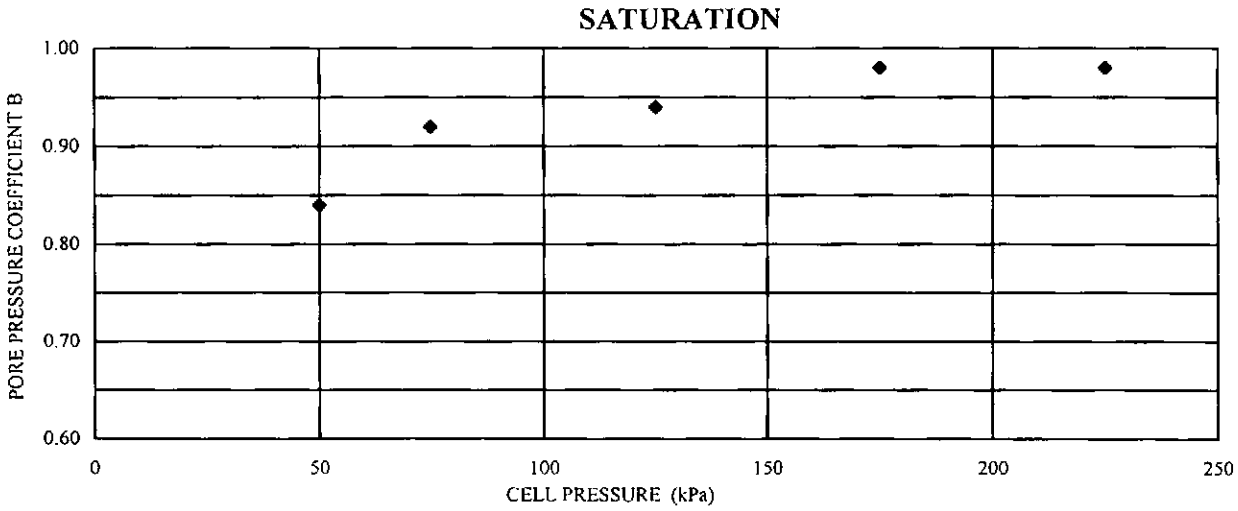
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2



Date	Time	Cell Pressure kPa	Back Pressure kPa	Pore Pressure kPa	Cumulative Volume of Water cm^3	Pore Pressure Parameter B
26/11/2008	08:34	0	0	-	0.0	
	08:44	25	-	20		-
	08:59	25	20	20	-0.4	
	09:07	50	-	41		0.84
	09:32	50	45	45	1.8	
	09:37	75	-	68		0.92
	10:20	75	70	70	6.3	
	10:28	125	-	117		0.94
	11:08	125	120	120	8.3	
	11:16	175	-	169		0.98
	13:40	175	170	170	9.6	
	13:48	225	-	219		0.98
28/11/2008	09:15	225	220	220	11.4	

Borehole No. : D090 **Sample Depth m:-** 14.00 - 15.00
Sample No. : 10 **Specimen Depth m:-** 14.80 - 15.00

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.:** 059

Compiled by W S Wat
Checked by H W Chung

Form : GESR009.11 / Jun.02.03 / Issue 1 / Rev 0

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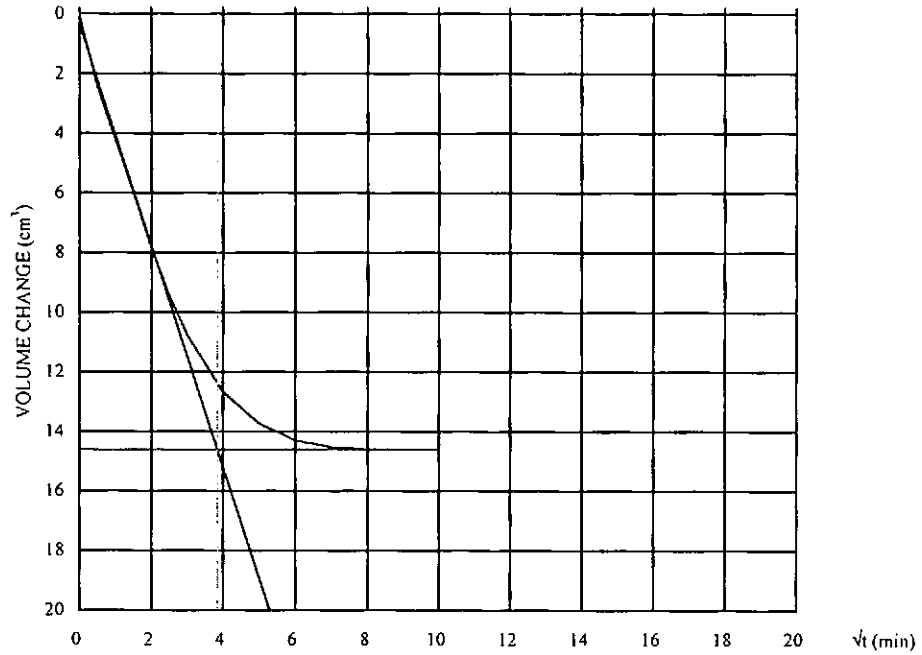
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

CONSOLIDATION (DRAINED PHASE) - Stage 1

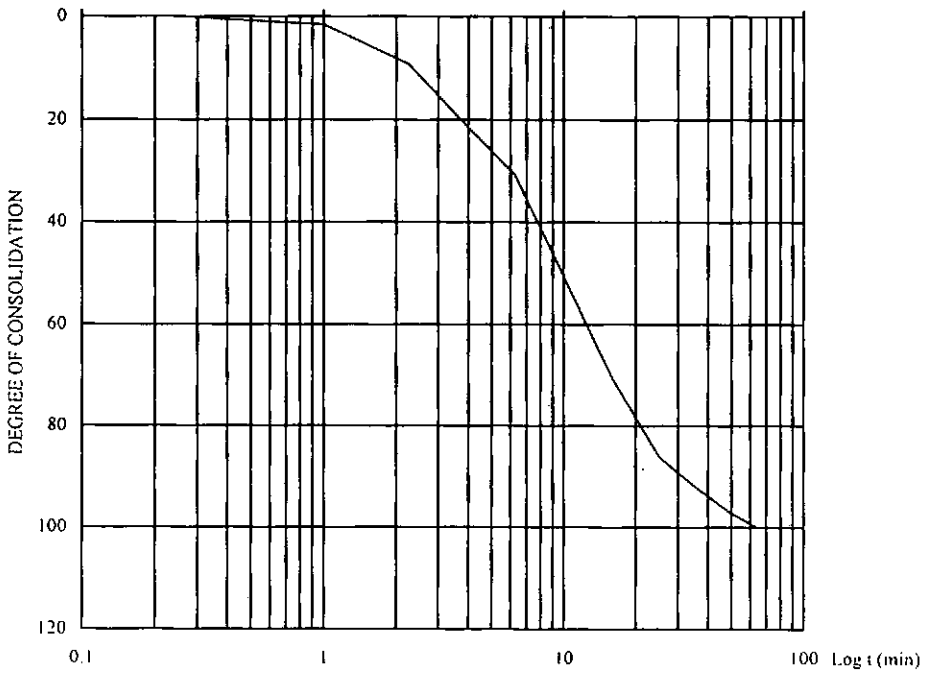


√t100 3.85 min

t100 14.79 min

tf 7.84 min

Calc. strain rate
1.285 mm/min



Borehole No. : D090 **Sample Depth m:-** 14.00 - 15.00

Sample No. : 10 **Specimen Depth m:-** 14.80 - 15.00

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.:** 059

Complied by: W S Wat

Checked by: H W Chung

Form : GESR009.13 / Jun.02.03 / Issue 1 / Rev 0

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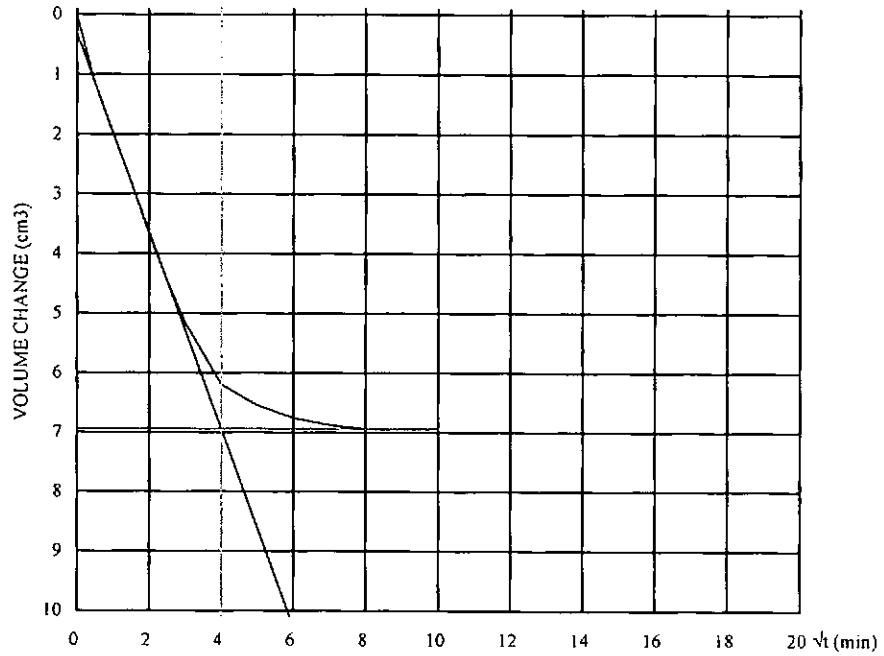
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

CONSOLIDATION (DRAINED PHASE) - Stage 2

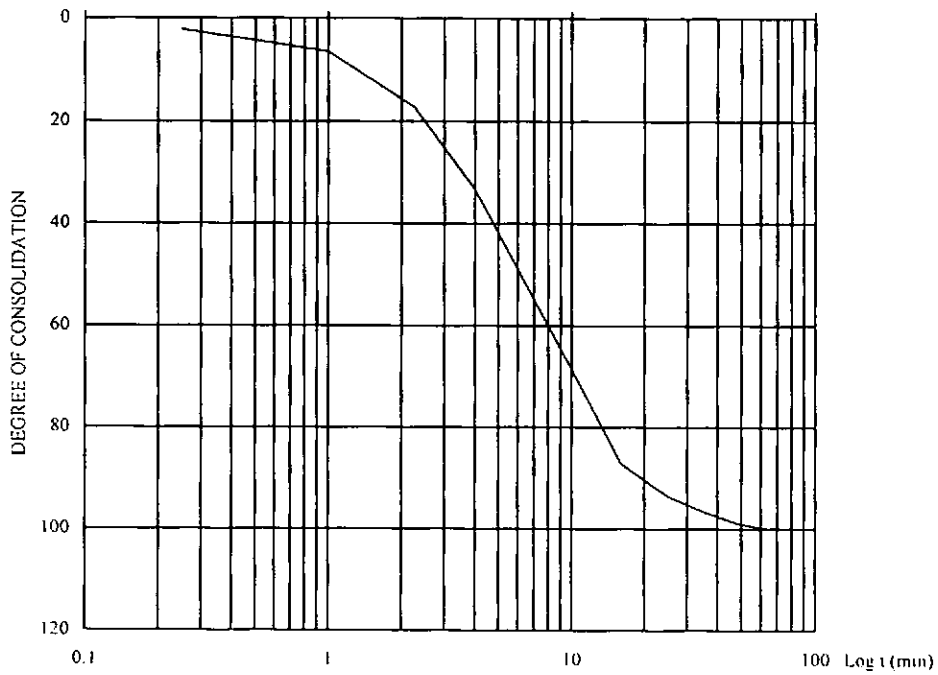


√t100 4.00 min

t100 16.02 min

tf 8.49 min

Calc. strain rate
1.159 mm/min



Borehole No. : D090 **Sample Depth m:-** 14.00 - 15.00

Sample No. : 10 **Specimen Depth m:-** 14.80 - 15.00

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.:** 059

Complied by: W S Wat

Checked by: H W Chung

Form : GESR009.13 / Jun.02.03 / Issue 1 / Rev 0

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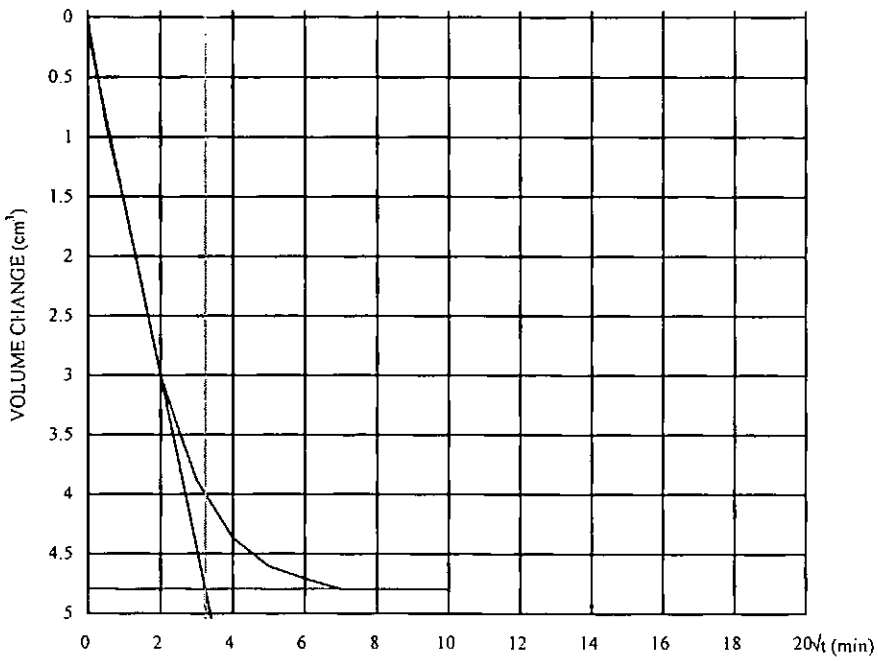
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

CONSOLIDATION (DRAINED PHASE) - Stage 3

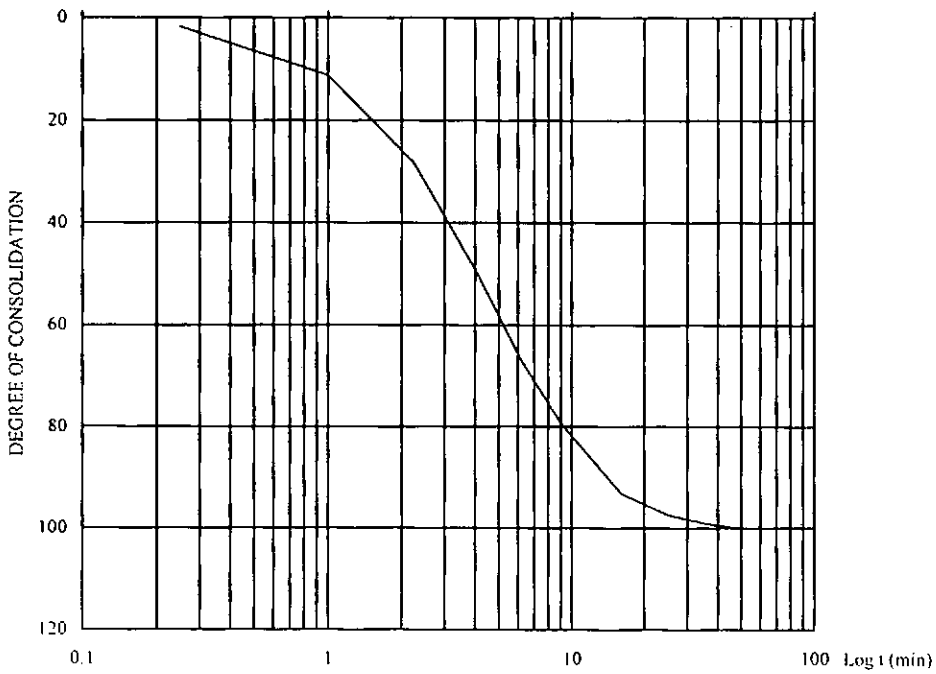


√t100 3.24 min

t100 10.51 min

tf 5.57 min

Calc. strain rate
1.726 mm/min



Borehole No. : D090 — **Sample Depth m:-** 14.00 - 15.00

Sample No. : 10 — **Specimen Depth m:-** 14.80 - 15.00

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 — **Works Order No.:** 059

Complied by: W S Wat

Checked by: H W Chung

Form : GESR009.13 / Jun.02.03 / Issue 1 / Rev 0

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Gammon

Multi Stage		P.W.P,B.P		Effective Pressure	70 kPa
Side drains	No	Selected Machine Speed	0.048 mm/min	Rate of Strain	2.00 % per hr

FAILURE CRITERION

Max. deviator Stress	☐	Max. Stress ratio	☒	Axial Strain %	☐

Stage : 1	Applied Pressure (kPa) - Cell :	290	Back : 220	P.R. factor	3.1101 kN/mm

Date	Time	Strain Dial	Strain	Load P.R.No. 38	Pore Pressure	Dev. stress Corr.	Dev. stress q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
28/11	10:45	0.00	0.00	0.058	220	0.000	0.0	70.0	70.0	70.0	0.0	70.0	1.00
	10:50	0.19	0.13	0.104	233	0.038	33.6	90.8	57.2	74.0	16.8	68.4	1.59
	10:55	0.37	0.25	0.128	242	0.072	51.0	99.0	48.0	73.5	25.5	65.0	2.06
	11:00	0.58	0.40	0.147	249	0.115	64.7	105.6	40.9	73.3	32.4	62.5	2.58
	11:05	0.84	0.58	0.168	254	0.165	79.8	116.2	36.4	76.3	39.9	63.0	3.19
	11:10	1.01	0.70	0.180	256	0.199	88.4	122.1	33.7	77.9	44.2	63.2	3.62
	11:15	1.25	0.87	0.196	258	0.246	99.8	131.5	31.7	81.6	49.9	65.0	4.15
	11:20	1.47	1.02	0.209	259	0.287	109.0	139.6	30.6	85.1	54.5	66.9	4.56
	11:25	1.65	1.15	0.219	260	0.322	116.1	146.4	30.3	88.3	58.0	69.0	4.83
	11:30	1.87	1.30	0.229	259	0.363	123.1	154.5	31.4	92.9	61.5	72.4	4.92
	11:35	2.15	1.49	0.242	257	0.414	132.2	165.4	33.2	99.3	66.1	77.3	4.98
	11:40	2.35	1.63	0.250	256	0.451	137.7	171.8	34.1	102.9	68.8	80.0	5.04
	11:45	**2.55**	**1.77**	**0.258**	**256**	**0.487**	**143.2**	**177.4**	**34.2**	**105.8**	**71.6**	**81.9**	**5.19**
	11:50	2.77	1.92	0.265	254	0.526	148.0	183.8	35.8	109.8	74.0	85.1	5.13

Borehole No. : D090 **Sample Depth m:- 14.00 - 15.00**

Sample No. : 10 **Specimen Depth m:- 14.80 - 15.00**

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.:** 059

Compiled by: W S Wat

Checked by: H W Chung

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Multi Stage		P.W.P,B.P			Effective Pressure	140	kPa
Side drains	No	Selected Machine Speed	0.046	mm/min	Rate of Strain	1.96	% per hr

FAILURE CRITERION

Max. deviator Stress	☐	Max. Stress ratio	☒	Axial Strain % ☐

Stage :	2	Applied Pressure (kPa) - Cell :	360	Back :	220	P.R. factor	3.1101 kN/mm

Date	Time	Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
		Dial		P.R.No. 38	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
28/11	14:05	3.30	2.29	0.064	220	0.000	0.0	140.0	140.0	140.0	0.0	140.0	1.00
	14:10	3.40	2.36	0.079	221	0.639	10.2	149.1	138.9	144.0	5.1	142.3	1.07
	14:15	3.56	2.48	0.142	241	0.669	55.6	174.7	119.1	146.9	27.8	137.6	1.47
	14:20	3.76	2.61	0.205	258	0.701	100.9	202.8	101.9	152.3	50.4	135.5	1.99
	14:25	3.92	2.72	0.242	266	0.729	127.4	221.8	94.4	158.1	63.7	136.9	2.35
	14:30	4.20	2.92	0.298	275	0.778	167.3	252.8	85.5	169.1	83.6	141.3	2.96
	14:35	4.40	3.06	0.330	279	0.812	190.0	271.5	81.5	176.5	95.0	144.8	3.33
	14:40	4.54	3.16	0.351	280	0.836	204.8	285.3	80.5	182.9	102.4	148.8	3.54
	14:45	4.76	3.31	0.380	281	0.872	225.2	304.2	79.0	191.6	112.6	154.1	3.85
	14:50	4.94	3.43	0.401	281	0.900	239.9	319.1	79.2	199.1	119.9	159.2	4.03
	14:55	5.20	3.61	0.427	280	0.943	257.9	337.9	80.0	209.0	129.0	166.0	4.22
	15:00	5.40	3.75	0.443	278	0.976	268.9	351.1	82.2	216.7	134.5	171.8	4.27
	15:05	5.66	3.94	0.461	276	1.019	281.1	365.4	84.3	224.9	140.6	178.0	4.33
	15:10	**5.92**	**4.12**	**0.474**	**273**	**1.061**	**289.8**	**376.6**	**86.8**	**231.7**	**144.9**	**183.4**	**4.34**
	15:15	6.08	4.23	0.482	271	1.086	295.1	384.2	89.1	236.6	147.5	187.5	4.31

Borehole No. :	**D090**	**Sample Depth m:- 14.00 - 15.00**	
Sample No. :	**10**	**Specimen Depth m:- 14.80 - 15.00**	
Customer :	**Mass Transit Railway Corporation**		Compiled by
Project :	**Ground Investigation for South Island Line**		W S Wat
		Contract No.: Contract 1024	Checked by
Job No.:	**J2999**	**Works Order No.: 059**	H W Chung

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Form : GESR009.14 / Dec.13.04 / Issue 1 / Rev 1

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Multi Stage			P.W.P.B.P					Effective Pressure	210				kPa
Side drains	No		Selected Machine Speed		0.045		mm/min	Rate of Strain	1.97				% per hr
FAILURE CRITERION													
Max. deviator Stress			☐	Max. Stress ratio			☒	Axial Strain %					☐
Stage :	3	Applied Pressure (kPa) - Cell :			430	Back :	220	P.R. factor			3.1101		kN/mm

Date	Time	Strain		Load	Pore Pressure	Dev. stress		Effective Stress Parameters					
		Dial		P.R.No. 38		Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
29/11	08:30	6.45	4.48	0.075	220	0.000	0.0	210.0	210.0	210.0	0.0	210.0	1.00
	08:35	6.59	4.58	0.172	243	1.164	67.9	254.7	186.8	220.7	33.9	209.4	1.36
	08:40	6.67	4.64	0.217	255	1.177	99.8	274.5	174.7	224.6	49.9	208.0	1.57
	08:45	6.83	4.75	0.289	271	1.201	150.8	309.6	158.8	234.2	75.4	209.1	1.95
	08:50	7.02	4.88	0.361	281	1.230	201.6	350.8	149.2	250.0	100.8	216.4	2.35
	08:55	7.17	4.98	0.411	287	1.252	236.8	380.1	143.3	261.7	118.4	222.2	2.65
	09:00	7.35	5.11	0.467	291	1.280	276.1	415.1	139.0	277.1	138.1	231.0	2.99
	09:05	7.50	5.21	0.511	294	1.301	306.9	443.3	136.4	289.8	153.4	238.7	3.25
	09:10	7.69	5.34	0.558	296	1.329	339.6	473.9	134.3	304.1	169.8	247.5	3.53
	09:15	7.89	5.48	0.601	296	1.358	369.4	503.2	133.8	318.5	184.7	256.9	3.76
	09:20	8.08	5.62	0.634	295	1.388	392.1	527.3	135.2	331.2	196.0	265.9	3.90
	09:25	8.29	5.76	0.659	292	1.417	409.0	546.8	137.8	342.3	204.5	274.1	3.97
	09:30	**8.51**	**5.92**	**0.680**	**289**	**1.450**	**423.0**	**564.4**	**141.4**	**352.9**	**211.5**	**282.4**	**3.99**
	09:35	8.72	6.06	0.695	285	1.479	432.9	577.7	144.8	361.2	216.4	289.1	3.99
	09:40	8.92	6.20	0.707	282	1.507	440.6	588.5	147.9	368.2	220.3	294.8	3.98
	09:45	9.18	6.38	0.720	278	1.543	448.8	601.3	152.5	376.9	224.4	302.1	3.94
	09:50	9.38	6.52	0.725	274	1.571	451.6	607.3	155.7	381.5	225.8	306.2	3.90
	09:55	9.62	6.69	0.718	271	1.605	445.8	604.7	158.9	381.8	222.9	307.5	3.81
	10:00	9.85	6.85	0.721	268	1.636	447.1	608.8	161.7	385.3	223.6	310.7	3.77
	10:15	10.65	7.40	0.721	260	1.742	444.3	613.9	169.6	391.8	222.2	317.7	3.62
	10:30	11.41	7.93	0.697	255	1.841	425.2	600.4	175.2	387.8	212.6	316.9	3.43
	10:45	12.10	8.41	0.687	250	1.929	416.1	595.8	179.7	387.7	208.0	318.4	3.32
	11:00	12.85	8.93	0.675	247	2.021	405.5	588.8	183.3	386.0	202.7	318.5	3.21
	11:15	13.59	9.45	0.668	244	2.112	398.3	584.0	185.7	384.9	199.2	318.5	3.15
	11:30	14.26	9.91	0.656	242	2.190	388.1	576.5	188.4	382.5	194.1	317.8	3.06
	11:45	14.97	10.41	0.666	239	2.273	392.6	583.6	191.0	387.3	196.3	321.9	3.06
	12:00	15.69	10.91	0.658	237	2.354	385.0	578.5	193.5	386.0	192.5	321.8	2.99
	12:15	16.43	11.42	0.659	234	2.435	383.3	579.0	195.7	387.4	191.7	323.5	2.96
	12:30	17.25	11.99	0.664	233	2.524	384.0	581.5	197.5	389.5	192.0	325.5	2.94

Borehole No. :	D090	**Sample Depth m:-**	14.00 - 15.00
Sample No. :	10	**Specimen Depth m:-**	14.80 - 15.00
Customer :	Mass Transit Railway Corporation		Compiled by W S Wat
Project :	Ground Investigation for South Island Line		
		Contract No.: Contract 1024	Checked by H W Chung
Job No.:	J2999	**Works Order No.:** 059	

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Form : GESR009.14 / Dec.13.04 / Issue 1 / Rev 1

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT (GEOSPEC 3 : 2001 Test Method 15.2)

Description : Light greyish brown, sandy SILT

Sample Origin : CDT ‡ ‡ Information provided by customer

Borehole No. : D090	Sample No. : 10	Sample Depth m:- 14.00 - 15.00	Specimen Depth m:- 14.80 - 15.00

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line

Contract No.: Contract 1024
Job No.: J2999
Works Order No.: 059

Compiled by W S Wat

Checked by H W Chung

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	D092		
Sample		no	1		
Sample Type			Mazier		
Stage		no	1		
Sample Depth		m	13.00 - 14.00		
Specimen Depth		m	13.60 - 13.80		
INITIAL CONDITIONS					
Diameter	(D_o)	mm	74.0		
Height	(H_o)	mm	145.0		
Moisture Content	(W_o)	%	15		
Bulk density	(ρ_o)	Mg/m^3	1.96		
Dry density	(ρ_d)	Mg/m^3	1.70		
Particle density	(ρ_s)		2.60		
Voids Ratio	(e_o)		0.53		
Degree of Saturation	(S_r)	%	75.1		
DRAINAGE CONDITIONS			ONE END		
SATURATION					
Final Pore Pressure Coefficient B			1.00		
CONSOLIDATION					
Cell Pressure	(σ_3)	kPa	380		
Back Pressure	(u_b)	kPa	245		
Effective Pressure	(σ'_3)	kPa	135		
Coefficient of Consolidation (t100) (C_{vi})		m^2/Year	6185.08		
Coefficient of Volume Compressibility (m_{vi})		m^2/MN	0.18		
Coefficient of Permeability (k)		m/s	3.44E-07		
COMPRESSION TERMINATION CRITERION			MAXIMUM DEVIATOR STRESS		
COMPRESSION - INITIAL					
Moisture Content	(w)	%	18		
Pore Pressure at the End of Consolidation		kPa	245		
Effective Stress at the End of Consolidation		kPa	135		
Bulk density	(ρ_o)	Mg/m^3	2.06		
Dry density	(ρ_d)	Mg/m^3	1.75		
Voids Ratio	(e)		0.49		
Degree of Saturation	(S_r)	%	94.9		

Customer : **Mass Transit Railway Corporation**
Project : **Ground Investigation for South Island Line**
Contract No.: Contract 1024
Report No. : J2999-059.11
Job No.: **J2999**
Works Order No.: 059

Technician : W S Wat
Checked By : Name : H W Chung Date : 08/01/2009
Approved By : Signatory : **Lau Wai Cheong** Date : 08/01/2009
Tested Date: 16/12/2008

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Form : GESR009.6 / Nov.10.06 / Issue 1 / Rev 1

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	D092		
Sample		no	1		
Sample Type			Mazier		
Stage		no	1		
Sample Depth		m	13.00 - 14.00		
Specimen Depth		m	13.60 - 13.80		
COMPRESSION - FAILURE					
Cell Pressure		kPa	380		
Rate of Strain		mm/min	0.048		
CONDITIONS MAXIMUM DEVIATOR STRESS					
Major Effective Principal Stress (σ'_1)		kPa	845		
Corrected Deviator Stress ($\sigma'_1 - \sigma'_3$)		kPa	667		
Minor Effective Principal Stress (σ'_3)		kPa	178		
$s' = (\sigma'_1 + \sigma'_3)/2$		kPa	511		
$t = (\sigma_1 - \sigma_3)/2$		kPa	334		
Expanded Uncertainty of s' ^		kPa	-		
Expanded Uncertainty of t ^		kPa	-		
Pore pressure parameter A_f			-0.06		
Strain at Failure	(εf)	%	11.0		
COMPRESSION - FINAL					
Moisture Content	(W_f)	%	18		
Bulk density	(ρ_o)	Mg/m^3	2.06		
Dry density	(ρ_d)	Mg/m^3	1.75		
Voids Ratio	(e_f)		0.49		
Degree of Saturation	(S_f)	%	94.9		

Notes -
1. The method of specimen preparation was in accordance with GEOSPEC 3 : 2001 :- Test method 13.3 : test specimen from undisturbed soil samples.
2. Sample received date : 29/9/2008
3. The determination of moisture content was in accordance with test method 5.1 of GEOSPEC 3 : 2001.
4. Particle density : 2.60 (Determined)
5. Maximum and minimum temperature recorded over the period of testing 19.5 - 20.7 °C.
6. Unavoidable variations from specified procedure : none
7. Comment on observed or inferred sample disturbance : none
8. Percentage by mass of soil particles larger than 1/5 of the diameter of specimen (%) : Nil
9. The specimen was selected by the laboratory.
   Name : W S Wat Designation : Senior Laboratory Technician
10. Sampling History : As Received

* Delete as appropriate ^ Upon request

Customer :	**Mass Transit Railway Corporation**	Compiled by W S Wat
Project :	**Ground Investigation for South Island Line**	
	Contract No.: Contract 1024	Checked by H W Chung
Job No.:	**J2999** **Works Order No.: 059**	

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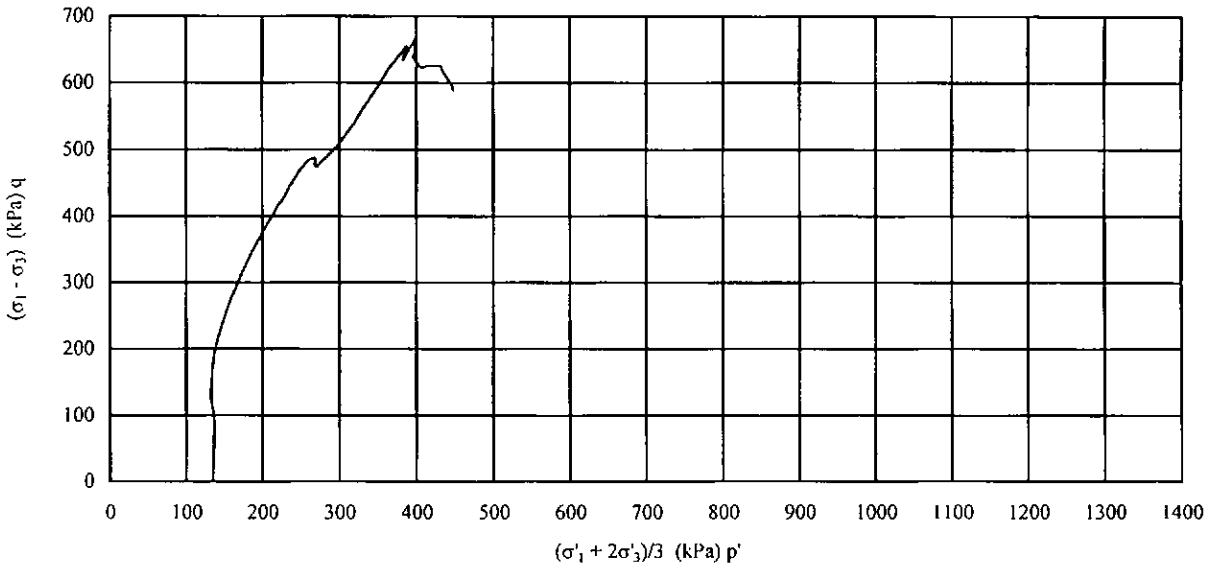
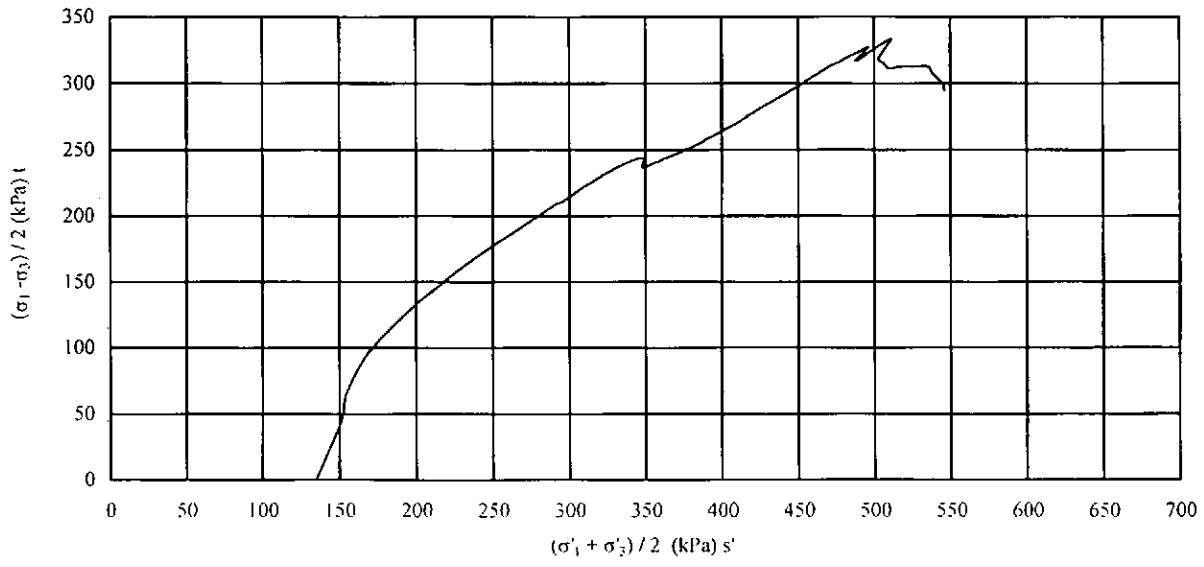
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

STRESS PATH PARAMETERS FOR EFFECTIVE STRESS

p' - q PLOT



s' - t PLOT



Borehole No. : D092 — **Sample Depth m:-** 13.00 - 14.00
Sample No. : 1 — **Specimen Depth m:-** 13.60 - 13.80

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 — **Works Order No.:** 059

Compiled by: W S Wat
Checked by: H W Chung

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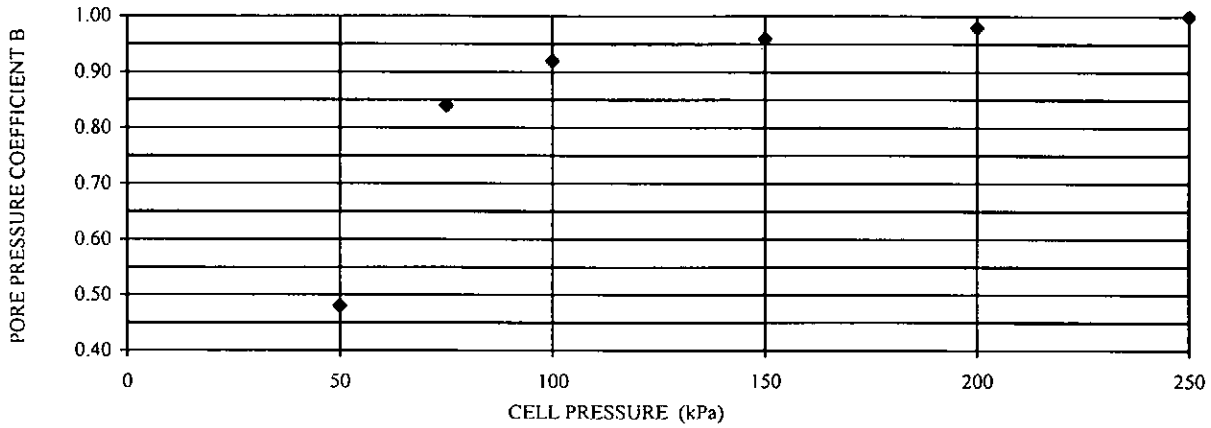
Form : GESR009.8 / Jun.02.03 / Issue 1 / Rev 0

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

SATURATION



Date	Time	Cell Pressure kPa	Back Pressure kPa	Pore Pressure kPa	Cumulative Volume of Water cm^3	Pore Pressure Coefficient B
17/12/2008	16:39	0	0	-	0.0	
	16:56	25	-	20		-
18/12/2008	08:46	25	20	20	8.5	
	08:54	50	-	32		0.48
	11:20	50	45	45	13.7	
	11:30	75	-	66		0.84
	12:00	75	70	70	17.9	
	12:10	100	-	93		0.92
	13:10	100	95	95	19.1	
	13:18	150	-	143		0.96
	13:54	150	145	145	21.7	
	14:02	200	-	194		0.98
	14:39	200	195	195	22.8	
	14:47	250	-	245		1.00
22/12/2008	13:11	250	245	245	43.2	

Borehole No. D092 — **Sample Depth m:-** 13.00 - 14.00
Sample No. : 1 — **Specimen Depth m:-** 13.60 - 13.80

Customer : Mass Transit Railway Corporation — Compiled by W S Wat
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024 — Checked by H W Chung
Job No.: J2999 — **Works Order No.:** 059

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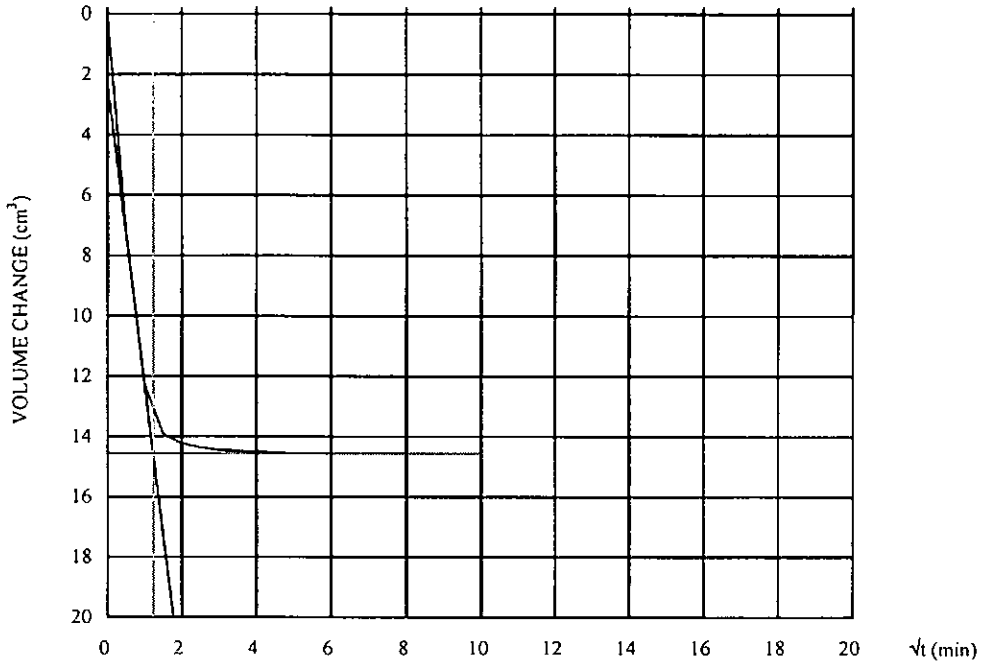
Form : GESR009.11 / Jun.02 03 / Issue 1 / Rev 0

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

CONSOLIDATION (DRAINED PHASE) - Stage 1

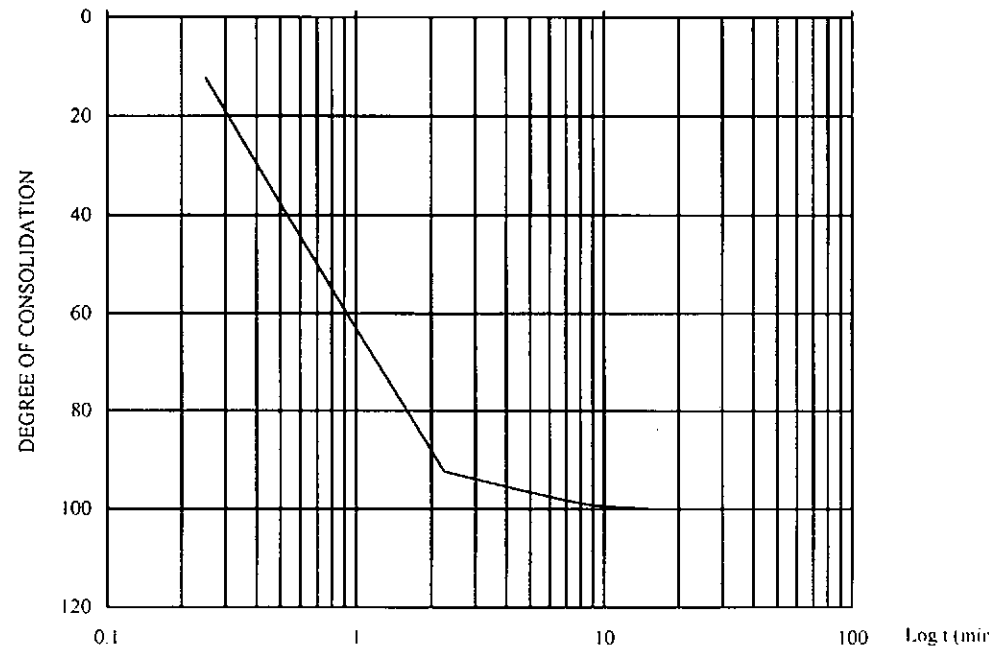


√t100 1.23 min

t100 1.509 min

tf 0.800 min

Calc. strain rate
12.592 mm/min



Borehole No. : D092 **Sample Depth m:-** 13.00 - 14.00
Sample No. : 1 **Specimen Depth m:-** 13.60 - 13.80

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.:** 059

Complied by: W S Wat
Checked by: H W Chung

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Form : GESR009.13 / Jun.02.03 / Issue 1 / Rev 0

TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Single Stage				P.W.P,B.P				Effective Pressure	135				kPa
Side drains	No		Selected Machine Speed		0.048	mm/min		Rate of Strain	2.00				% per hr
FAILURE CRITERION													
Max. deviator Stress			☒	Max. Stress ratio			□	Axial Strain %					□
Stage :	1	Applied Pressure (kPa) - Cell :			380	Back :	245	P.R. factor	3.1043				kN/mm

Date	Time	Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
		Dial		P.R.No. 3	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
23/12	08:35	0.00	0.00	0.058	245	0.000	0.0	135.0	135.0	135.0	0.0	135.0	1.00
	08:40	0.15	0.10	0.181	274	0.029	90.1	196.4	106.3	151.4	45.1	136.3	1.85
	08:45	0.33	0.23	0.225	288	0.066	122.2	214.5	92.3	153.4	61.1	133.0	2.32
	08:50	0.51	0.35	0.261	297	0.101	148.3	231.8	83.5	157.7	74.2	132.9	2.78
	08:55	0.75	0.52	0.299	304	0.149	175.7	251.9	76.2	164.1	87.9	134.8	3.31
	09:00	0.95	0.66	0.323	308	0.188	192.9	265.4	72.5	169.0	96.5	136.8	3.66
	09:05	1.20	0.83	0.359	311	0.235	218.7	288.2	69.5	178.9	109.4	142.4	4.15
	09:10	1.38	0.96	0.389	312	0.271	240.2	308.3	68.1	188.2	120.1	148.2	4.53
	09:15	1.54	1.07	0.410	313	0.301	255.2	322.5	67.3	194.9	127.6	152.4	4.79
	09:20	1.79	1.24	0.433	313	0.348	271.4	338.3	66.9	202.6	135.7	157.4	5.06
	09:25	2.03	1.41	0.457	313	0.393	288.2	355.3	67.1	211.2	144.1	163.2	5.30
	09:30	2.30	1.60	0.449	312	0.444	281.8	349.5	67.7	208.6	140.9	161.6	5.16
	09:35	2.50	1.73	0.489	312	0.478	310.2	378.4	68.2	223.3	155.1	171.6	5.55
	09:40	2.79	1.94	0.519	310	0.533	331.1	400.8	69.7	235.3	165.6	180.1	5.75
	09:45	2.98	2.07	0.538	309	0.566	344.3	415.2	70.9	243.0	172.1	185.7	5.86
	09:50	3.24	2.26	0.561	307	0.615	360.1	433.1	73.0	253.0	180.0	193.0	5.93
	09:55	3.43	2.38	0.576	305	0.645	370.3	444.9	74.6	259.8	185.2	198.0	5.96
	10:00	3.71	2.58	0.601	303	0.696	387.4	464.6	77.2	270.9	193.7	206.3	6.02
	10:05	3.91	2.72	0.619	301	0.730	399.7	479.0	79.3	279.1	199.8	212.5	6.04
	10:10	4.15	2.88	0.646	298	0.770	418.2	500.2	82.0	291.1	209.1	221.4	6.10
	10:15	4.39	3.05	0.653	295	0.811	422.4	507.1	84.7	295.9	211.2	225.5	5.99
	10:20	4.58	3.18	0.680	293	0.843	441.0	527.7	86.7	307.2	220.5	233.7	6.09
	10:25	4.80	3.34	0.700	291	0.881	454.4	543.8	89.4	316.6	227.2	240.9	6.08
	10:30	5.06	3.52	0.722	287	0.924	469.1	561.9	92.8	327.3	234.5	249.2	6.05
	10:35	5.22	3.63	0.731	285	0.950	474.9	569.7	94.8	332.2	237.4	253.1	6.01
	10:40	5.52	3.84	0.744	281	0.999	483.0	581.6	98.6	340.1	241.5	259.6	5.90
	10:45	5.78	4.02	0.751	278	1.040	487.0	588.7	101.7	345.2	243.5	264.0	5.79
	10:50	5.93	4.12	0.752	276	1.063	487.1	590.7	103.6	347.1	243.5	266.0	5.70
	10:55	6.20	4.31	0.753	274	1.106	486.8	593.3	106.5	349.9	243.4	268.8	5.57
	11:00	6.47	4.50	0.742	271	1.149	478.1	587.1	109.0	348.0	239.0	268.4	5.39
	11:05	6.81	4.73	0.737	268	1.200	473.4	585.0	111.6	348.3	236.7	269.4	5.24
	11:10	7.02	4.88	0.740	267	1.233	474.7	587.8	113.1	350.4	237.3	271.3	5.20
	11:15	7.24	5.03	0.747	265	1.265	478.8	593.6	114.8	354.2	239.4	274.4	5.17
	11:20	7.49	5.20	0.753	263	1.302	482.0	598.6	116.6	357.6	241.0	277.3	5.13
	11:25	7.72	5.37	0.759	262	1.338	485.3	603.2	117.9	360.6	242.7	279.7	5.12
	11:30	8.00	5.56	0.765	260	1.379	488.4	608.4	120.0	364.2	244.2	282.8	5.07
	11:35	8.23	5.72	0.771	259	1.412	491.7	613.1	121.4	367.3	245.9	285.3	5.05
	11:40	8.48	5.89	0.775	257	1.447	493.6	616.6	123.0	369.8	246.8	287.5	5.01
	11:45	8.76	6.09	0.781	255	1.488	496.6	621.3	124.7	373.0	248.3	290.2	4.98

Borehole No. :	D092	Sample Depth m:- 13.00 - 14.00	
Sample No. :	1	Specimen Depth m:- 13.60 - 13.80	
Customer :	Mass Transit Railway Corporation		Compiled by W S Wat
Project :	Ground Investigation for South Island Line		
		Contract No.: Contract 1024	Checked by H W Chung
Job No.:	J2999	Works Order No.: 059	

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TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2
Shearing Continuation

FAILURE CRITERION

Max. deviator Stress ☒ | Max. Stress ratio ☐ | Axial Strain % ☐

Stage :	1	Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
Date	Time	Dial		P.R.No. 3	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
23/12	11:50	8.97	6.24	0.789	254	1.519	501.3	627.2	125.9	376.6	250.7	293.0	4.98
	11:55	9.20	6.40	0.793	253	1.551	503.2	630.6	127.4	379.0	251.6	295.1	4.95
	12:00	9.33	6.48	0.795	252	1.567	504.1	632.2	128.1	380.1	252.0	296.1	4.93
	12:05	9.63	6.70	0.806	250	1.611	510.4	640.9	130.5	385.7	255.2	300.6	4.91
	12:10	9.93	6.91	0.816	248	1.652	516.0	647.8	131.8	389.8	258.0	303.8	4.92
	12:15	10.20	7.09	0.823	247	1.687	519.8	653.1	133.3	393.2	259.9	306.6	4.90
	12:20	10.39	7.22	0.833	245	1.712	525.8	660.4	134.6	397.5	262.9	309.9	4.91
	12:25	10.62	7.38	0.841	244	1.743	530.3	666.4	136.1	401.3	265.2	312.9	4.90
	12:30	10.83	7.53	0.849	242	1.771	534.9	672.5	137.6	405.0	267.4	315.9	4.89
	12:35	11.10	7.72	0.858	241	1.807	539.8	679.3	139.5	409.4	269.9	319.4	4.87
	12:40	11.27	7.84	0.871	239	1.829	547.9	688.6	140.7	414.6	273.9	323.3	4.89
	12:45	11.57	8.04	0.889	237	1.866	558.8	701.5	142.7	422.1	279.4	329.0	4.92
	12:50	11.81	8.21	0.902	236	1.897	566.5	710.9	144.4	427.6	283.2	333.2	4.92
	12:55	12.02	8.36	0.911	234	1.925	571.6	717.7	146.1	431.9	285.8	336.6	4.91
	13:00	12.24	8.51	0.921	233	1.952	577.3	724.7	147.4	436.0	288.6	339.8	4.92
	13:05	12.53	8.71	0.937	230	1.987	586.7	736.4	149.7	443.1	293.4	345.3	4.92
	13:10	12.78	8.89	0.950	229	2.019	594.2	745.7	151.5	448.6	297.1	349.6	4.92
	13:15	13.11	9.11	0.972	226	2.058	607.4	761.3	153.9	457.6	303.7	356.4	4.95
	13:20	13.31	9.25	0.984	225	2.082	614.4	769.8	155.4	462.6	307.2	360.2	4.95
	13:25	13.59	9.45	1.001	223	2.117	624.3	781.8	157.5	469.7	312.2	365.6	4.96
	13:30	13.82	9.61	1.011	221	2.144	629.9	789.3	159.4	474.3	314.9	369.4	4.95
	13:35	14.03	9.76	1.019	219	2.170	634.1	795.3	161.2	478.2	317.0	372.6	4.93
	13:40	14.24	9.90	1.029	217	2.193	639.7	802.6	162.9	482.7	319.8	376.1	4.93
	13:45	14.47	10.06	1.037	215	2.220	643.8	808.7	164.9	486.8	321.9	379.5	4.90
	13:50	14.68	10.21	1.047	213	2.245	649.3	816.0	166.7	491.3	324.6	383.1	4.89
	13:55	14.92	10.37	1.057	211	2.272	654.6	823.5	168.9	496.2	327.3	387.1	4.88
	14:00	15.16	10.54	1.027	209	2.300	633.7	804.7	171.0	487.8	316.8	382.2	4.71
	14:05	15.44	10.73	1.055	206	2.331	650.6	824.2	173.6	498.9	325.3	390.5	4.75
	14:10	15.67	10.89	1.074	204	2.356	661.8	837.6	175.8	506.7	330.9	396.4	4.76
	14:15	**15.86**	**11.02**	**1.084** *	**203** *	**2.377**	**667.4**	**844.9**	**177.5**	**511.2**	**333.7**	**400.0**	**4.76**
	14:20	16.11	11.20	1.068	200	2.406	655.6	835.6	180.0	507.8	327.8	398.5	4.64
	14:25	16.36	11.37	1.054	198	2.433	645.2	827.5	182.3	504.9	322.6	397.4	4.54
	14:30	16.57	11.52	1.043	196	2.457	636.9	821.1	184.2	502.7	318.5	396.5	4.46
	14:45	17.28	12.01	1.039	189	2.533	630.7	821.3	190.6	506.0	315.4	400.8	4.31
	15:00	18.02	12.53	1.033	182	2.613	623.1	821.2	198.1	509.6	311.5	405.8	4.15
	15:15	18.72	13.01	1.042	175	2.685	625.3	830.8	205.5	518.1	312.6	413.9	4.04
	15:30	19.42	13.50	1.048	167	2.758	625.5	838.7	213.2	526.0	312.8	421.7	3.93
	15:45	20.25	14.08	1.055	157	2.843	625.6	848.2	222.6	535.4	312.8	431.1	3.81
	16:00	20.83	14.48	1.046	151	2.901	617.0	846.1	229.1	537.6	308.5	434.8	3.69
	16:15	21.59	15.01	1.038	143	2.977	608.1	845.2	237.1	541.1	304.0	439.8	3.56
	16:30	22.32	15.52	1.030	135	3.049	599.4	844.8	245.4	545.1	299.7	445.2	3.44

Borehole No. : D092 — **Sample Depth m:-** 13.00 - 14.00

Sample No. : 1 — **Specimen Depth m:-** 13.60 - 13.80

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 — **Works Order No.:** 059

Compiled by: W S Wat

Checked by: H W Chung

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Form : GESR009.15 / Dec.13.04 / Issue 1 / Rev 1

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2
Shearing Continuation

FAILURE CRITERION

Max. deviator Stress ☒ | Max. Stress ratio ☐ | Axial Strain % ☐

Stage :	1	Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
Date	Time	Dial		P.R.No. 3	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
23/12	16:45	23.11	16.06	1.019	128	3.125	588.7	840.4	251.7	546.0	294.3	447.9	3.34

Borehole No. : D092 — **Sample Depth m:-** 13.00 - 14.00
Sample No. : 1 — **Specimen Depth m:-** 13.60 - 13.80

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 — **Works Order No.:** 059

Compiled by: W S Wat
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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT (GEOSPEC 3 : 2001 Test Method 15.2)

Description : Brown, slightly gravelly, sandy SILT/CLAY

Sample Origin : CDT‡ ‡ Information provided by customer

Borehole No. :	D092	Sample No. : 1	Sample Depth m:-	13.00 - 14.00	Specimen Depth m:- 13.60 - 13.80

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line

Contract No. : Contract 1024
Job No. : J2999
Works Order No.: 059

Compiled by W S Wat

Checked by H W Chung

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	D092	D092	D092
Sample		no	1	1	1
Sample Type			Mazier	Mazier	Mazier
Stage		no	1	2	3
Sample Depth		m	13.00 - 14.00	13.00 - 14.00	13.00 - 14.00
Specimen Depth		m	13.80 - 14.00	13.80 - 14.00	13.80 - 14.00
INITIAL CONDITIONS					
Diameter	(D_o)	mm	74.0	74.5	74.8
Height	(H_o)	mm	145.0	140.6	137.8
Moisture Content	(W_o)	%	15	18	17
Bulk density	(ρ_o)	Mg/m^3	2.00	2.09	2.10
Dry density	(ρ_d)	Mg/m^3	1.74	1.77	1.79
Particle density	(ρ_s)		2.60	2.60	2.60
Voids Ratio	(e_o)		0.49	0.47	0.45
Degree of Saturation	(S_r)	%	76.8	100.2	100.2
DRAINAGE CONDITIONS			ONE END		
SATURATION					
Final Pore Pressure Coefficient B			0.98		
CONSOLIDATION					
Cell Pressure	(σ_3)	kPa	285	350	415
Back Pressure	(u_b)	kPa	220	220	220
Effective Pressure	(σ'_3)	kPa	65	130	195
Coefficient of Consolidation (t100)	(C_{vi})	m^2/Year	4327.45	5330.82	5959.84
Coefficient of Volume Compressibility	(m_{vi})	m^2/MN	0.28	0.10	0.05
Coefficient of Permeability (k)		m/s	3.78E-07	1.73E-07	9.92E-08
COMPRESSION TERMINATION CRITERION			MAXIMUM STRESS RATIO		MAX ($\sigma'1 - \sigma'3$)
COMPRESSION - INITIAL					
Moisture Content	(w)	%	18	17	17
Pore Pressure at the End of Consolidation		kPa	220	220	220
Effective Stress at the End of Consolidation		kPa	65	130	195
Bulk density	(ρ_o)	Mg/m^3	2.09	2.10	2.11
Dry density	(ρ_d)	Mg/m^3	1.77	1.79	1.80
Voids Ratio	(e)		0.47	0.45	0.45
Degree of Saturation	(S_r)	%	100.2	100.2	100.2

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Report No. : J2999-059.11
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.:** 059

Technician : W S Wat Checked By : Name : H W Chung Approved By : Signatory : **Lau Wai Cheong**
Tested Date: 16/12/2008 Date : 08/01/2009 Date : 08/01/2009

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	D092	D092	D092
Sample		no	1	1	1
Sample Type			Mazier	Mazier	Mazier
Stage		no	1	2	3
Sample Depth		m	13.00 - 14.00	13.00 - 14.00	13.00 - 14.00
Specimen Depth		m	13.80 - 14.00	13.80 - 14.00	13.80 - 14.00
COMPRESSION - FAILURE					
Cell Pressure		kPa	285	350	415
Rate of Strain		mm/min	0.048	0.046	0.045
CONDITIONS AT MAXIMUM STRESS RATIO					
Major Effective Principal Stress (σ'_1)		kPa	269	612	1215
Corrected Deviator Stress ($\sigma'_1 - \sigma'_3$)		kPa	235	512	1005
Minor Effective Principal Stress (σ'_3)		kPa	33	100	210
$s' = (\sigma'_1 + \sigma'_3)/2$		kPa	151	356	713
$t = (\sigma_1 - \sigma_3)/2$		kPa	118	256	503
Expanded Uncertainty of s' ^		kPa	-	-	-
Expanded Uncertainty of t ^		kPa	-	-	-
Pore pressure parameter A_f			0.13	0.06	-0.01
Strain at Failure	(εf)	%	2.3	4.2	6.9
COMPRESSION - FINAL					
Moisture Content	(W_f)	%	18	17	17
Bulk density	(ρ_o)	Mg/m^3	2.09	2.10	2.11
Dry density	(ρ_d)	Mg/m^3	1.77	1.79	1.80
Voids Ratio	(e_f)		0.47	0.45	0.45
Degree of Saturation	(S_f)	%	100.2	100.2	100.2

Notes -
1. The method of specimen preparation was in accordance with GEOSPEC 3 : 2001 :- Test method 13.3 : test specimen from undisturbed soil samples.
2. Sample received date : 29/9/2008
3. The determination of moisture content was in accordance with test method 5.1 of GEOSPEC 3 : 2001.
4. Particle density : 2.60 (Determined)
5. Maximum and minimum temperature recorded over the period of testing 19.5 - 20.7 °C.
6. Unavoidable variations from specified procedure : none
7. Comment on observed or inferred sample disturbance : none
8. Percentage by mass of soil particles larger than 1/5 of the diameter of specimen (%) : Nil
9. The specimen was selected by the laboratory.
   Name : W S Wat Designation : Senior Laboratory Technician
10. Sampling History : As Received

* Delete as appropriate ^ Upon request

Customer : **Mass Transit Railway Corporation**
Project : **Ground Investigation for South Island Line**
Contract No.: Contract 1024
Job No.: **J2999** **Works Order No.: 059**

Compiled by W S Wat
Checked by H W Chung

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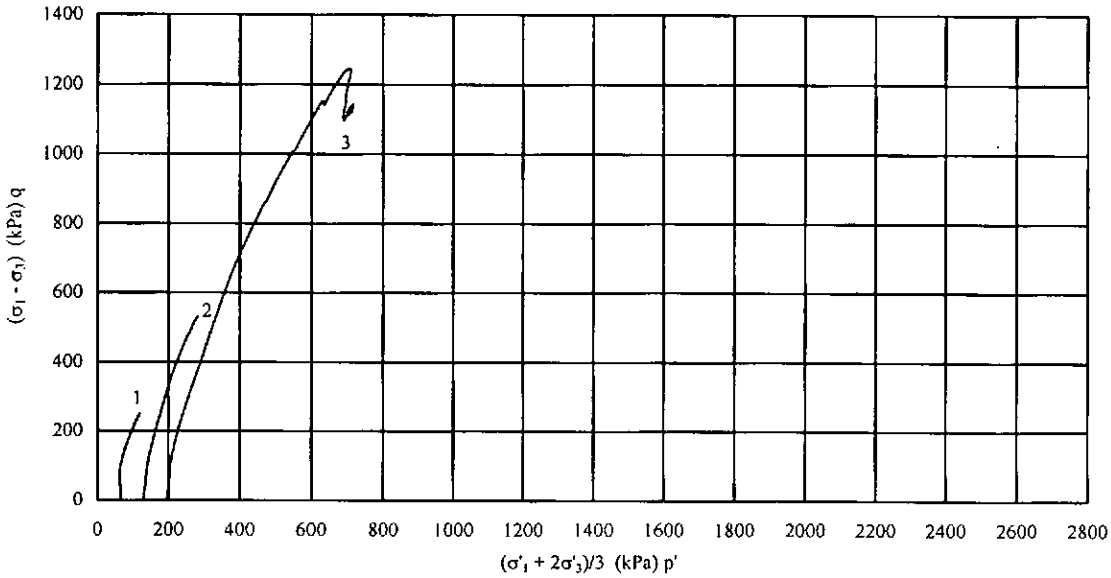
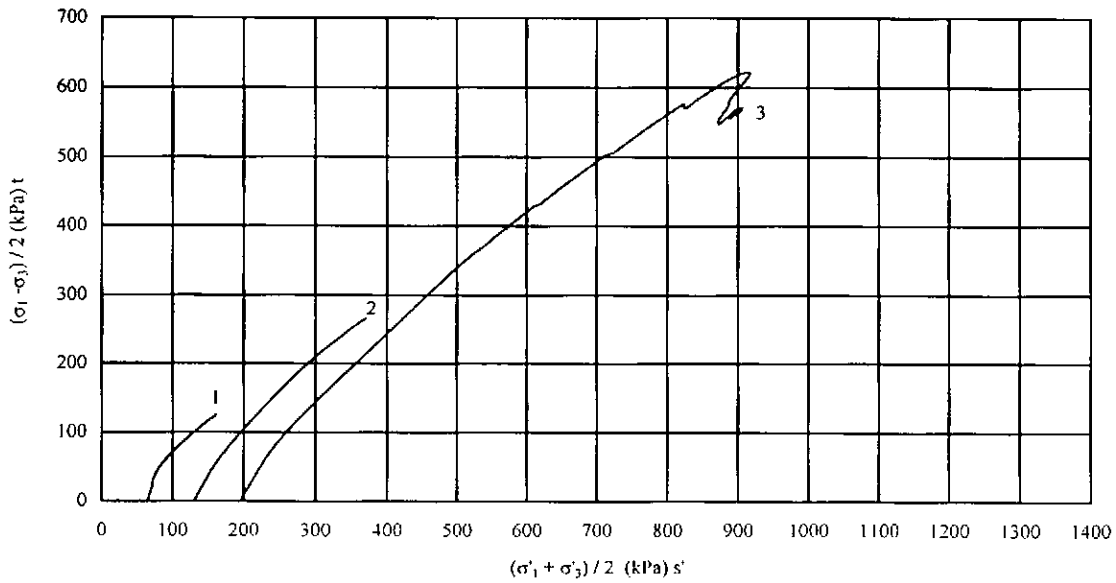
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

STRESS PATH PARAMETERS FOR EFFECTIVE STRESS

p' - q PLOT



s' - t PLOT



Borehole No. : D092 — **Sample Depth m:-** 13.00 - 14.00

Sample No. : 1 — **Specimen Depth m:-** 13.80 - 14.00

Customer : Mass Transit Railway Corporation — Compiled by W S Wat

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024 — Checked by H W Chung

Job No.: J2999 — **Works Order No.:** 059

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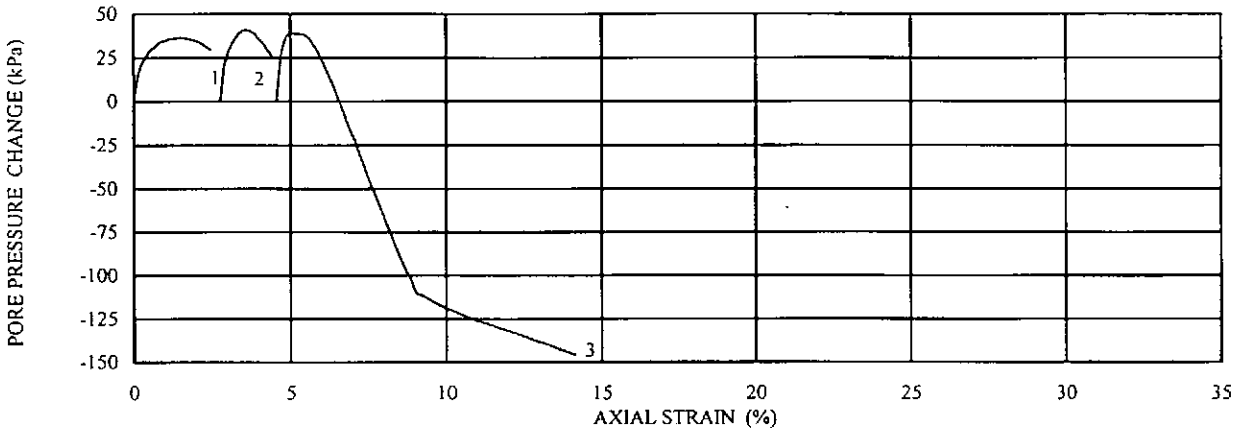
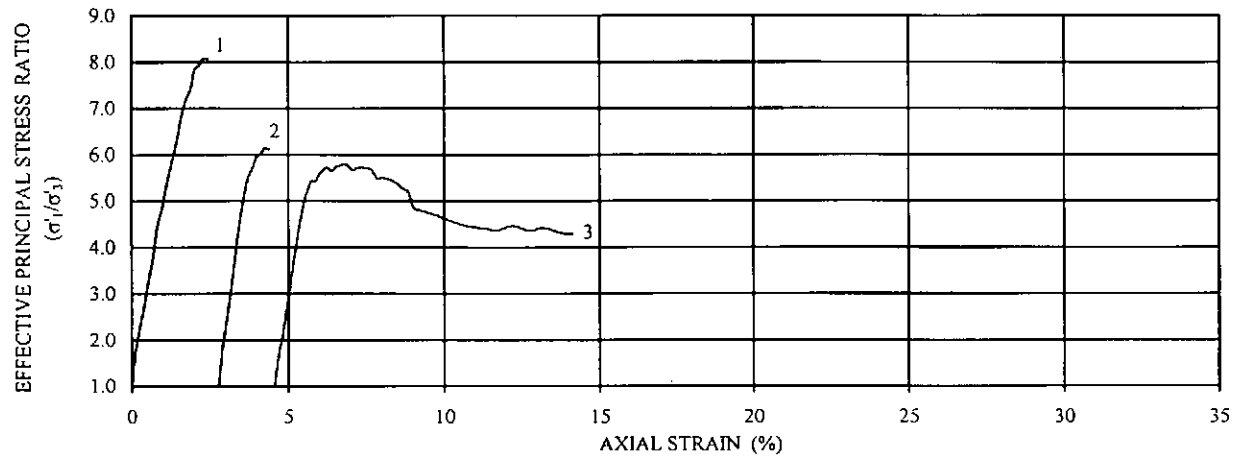
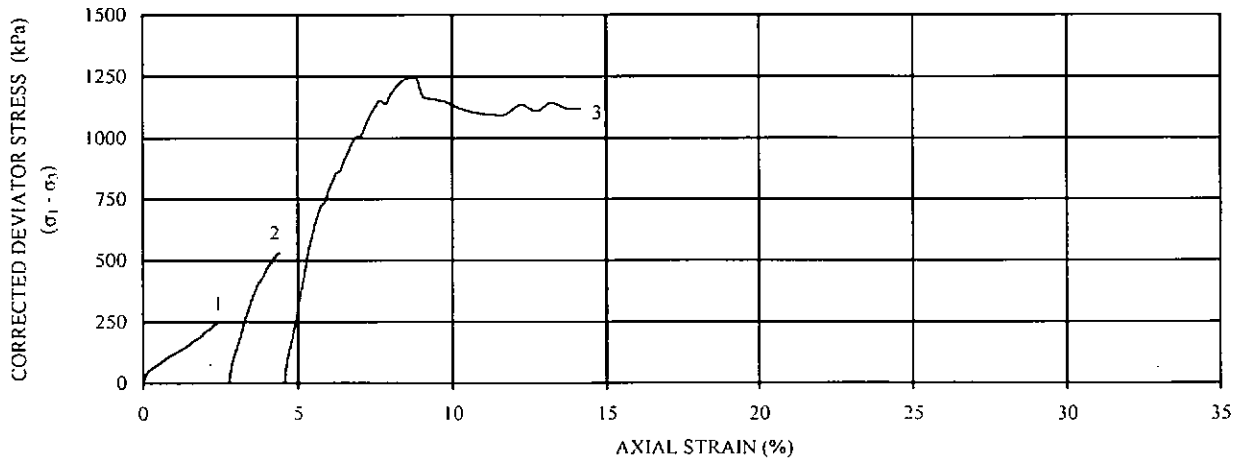
Form : GESR009.8 / Jun.02.03 / Issue 1 / Rev 0

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

COMPRESSION







Borehole No. :	**D092**	**Sample Depth m:-**	**13.00 - 14.00**
Sample No. :	**1**	**Specimen Depth m:-**	**13.80 - 14.00**
Customer :	**Mass Transit Railway Corporation**		Compiled by W S Wat
Project :	**Ground Investigation for South Island Line**		
		Contract No.: Contract 1024	Checked by H W Chung
Job No.:	**J2999**	**Works Order No.: 059**	

Form : GESR009.9 / Jun.02.03 / Issue 1 / Rev 0

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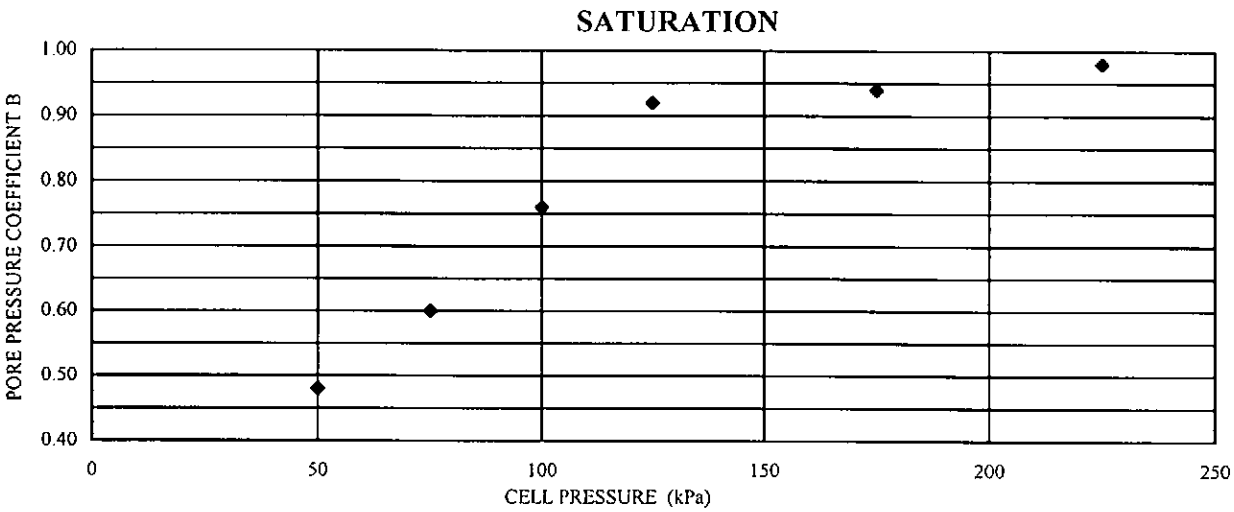
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2



Date	Time	Cell Pressure kPa	Back Pressure kPa	Pore Pressure kPa	Cumulative Volume of Water cm^3	Pore Pressure Parameter B
17/12/2008	16:45	0	0	-	0.0	
	16:59	25	-	23		-
18/12/2008	08:59	25	20	20	-1.6	
	09:10	50	-	32		0.48
	09:40	50	45	45	4.0	
	09:48	75	-	60		0.60
	10:30	75	70	70	7.9	
	10:40	100	-	89		0.76
	12:20	100	95	95	12.3	
	12:30	125	-	118		0.92
	14:49	125	120	120	14.3	
	14:57	175	-	167		0.94
	16:38	175	170	170	24.9	
	16:42	225	-	219		0.98
22/12/2008	13:08	225	220	220	47.9	

Borehole No. : D092 — **Sample Depth m:-** 13.00 - 14.00
Sample No. : 1 — **Specimen Depth m:-** 13.80 - 14.00

Customer : Mass Transit Railway Corporation — Compiled by W S Wat
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024 — Checked by H W Chung
Job No.: J2999 — **Works Order No.:** 059

Form : GESR009.11 / Jun.02.03 / Issue 1 / Rev 0

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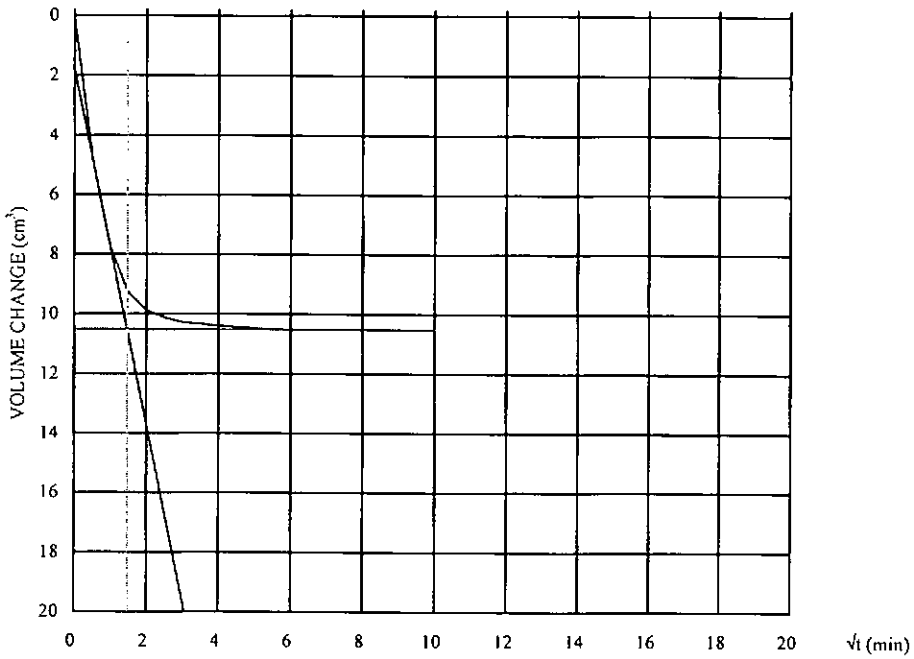
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

CONSOLIDATION (DRAINED PHASE) - Stage 1

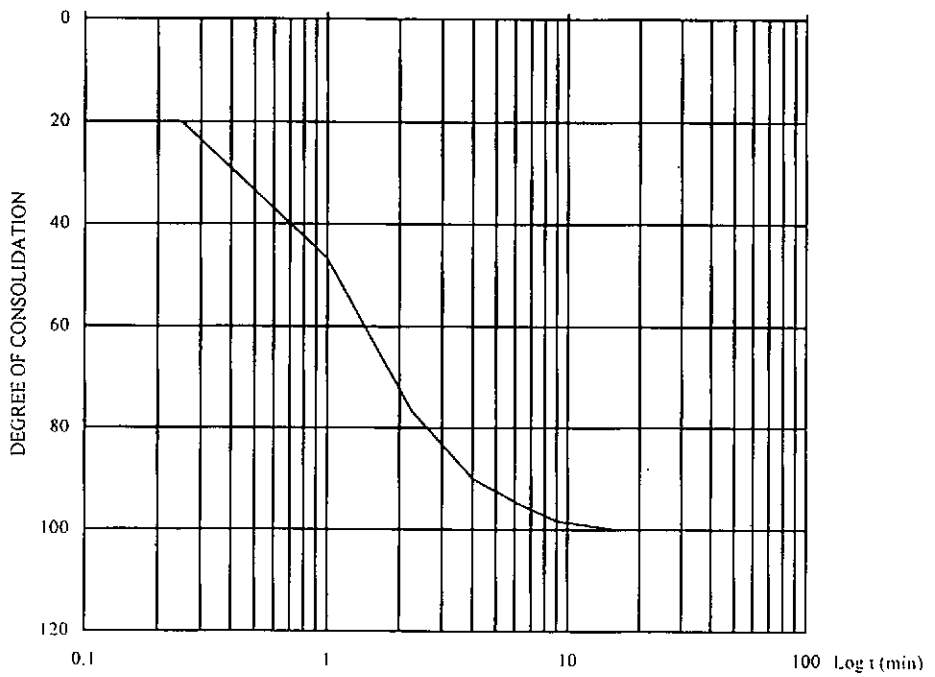


√t100 1.47 min

t100 2.16 min

tf 1.14 min

Calc. strain rate
8.816 mm/min



Borehole No. : D092 **Sample Depth m:-** 13.00 - 14.00

Sample No. : 1 **Specimen Depth m:-** 13.80 - 14.00

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.:** 059

Complied by: W S Wat

Checked by: H W Chung

Form : GESR009.13 / Jun.02.03 / Issue 1 / Rev 0

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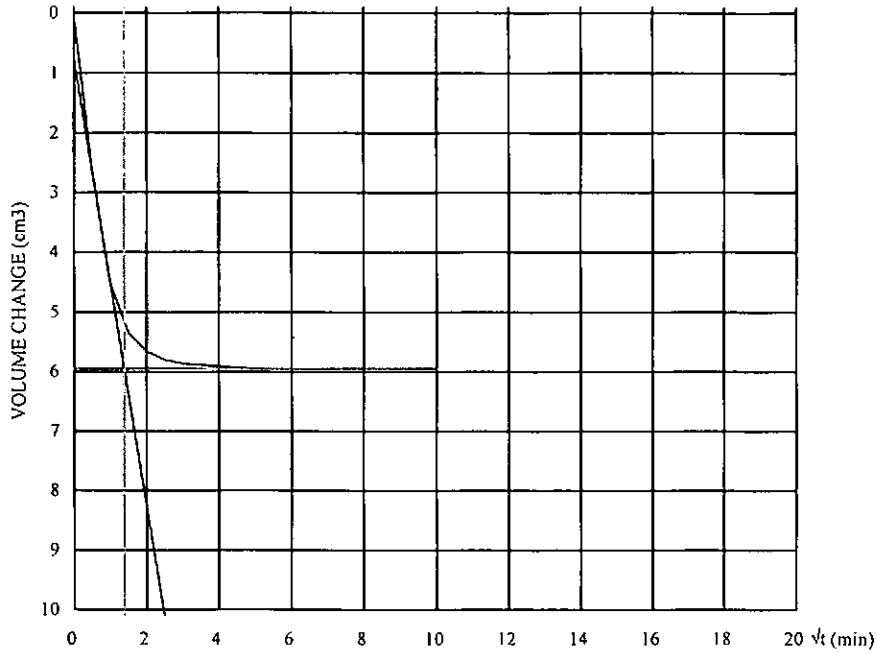
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

CONSOLIDATION (DRAINED PHASE) - Stage 2

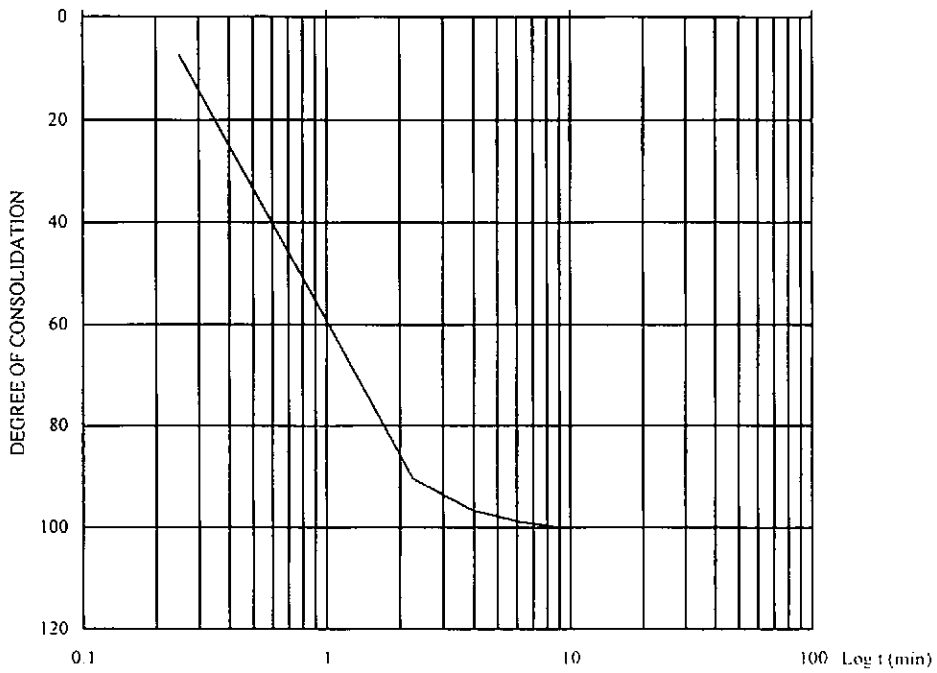


√t100 1.39 min

t100 1.92 min

tf 1.02 min

Calc. strain rate
9.648 mm/min



Borehole No. : D092 **Sample Depth m:-** 13.00 - 14.00

Sample No. : 1 **Specimen Depth m:-** 13.80 - 14.00

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.:** 059

Complied by: W S Wat

Checked by: H W Chung

Form : GESR009.13 / Jun.02.03 / Issue 1 / Rev 0

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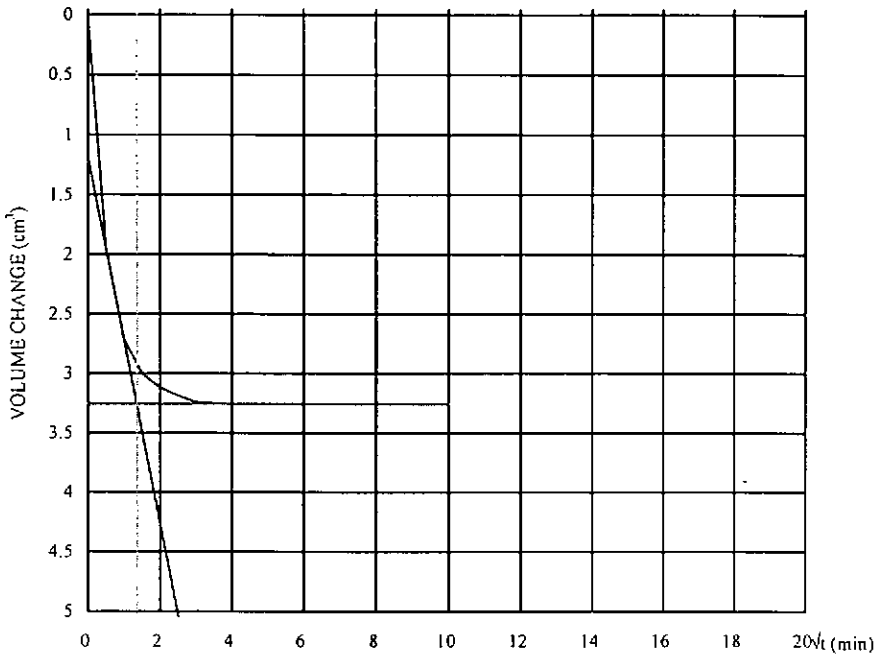
GEOSPEC 3 : 2001 Test Method 15.2

CONSOLIDATION (DRAINED PHASE) - Stage 3

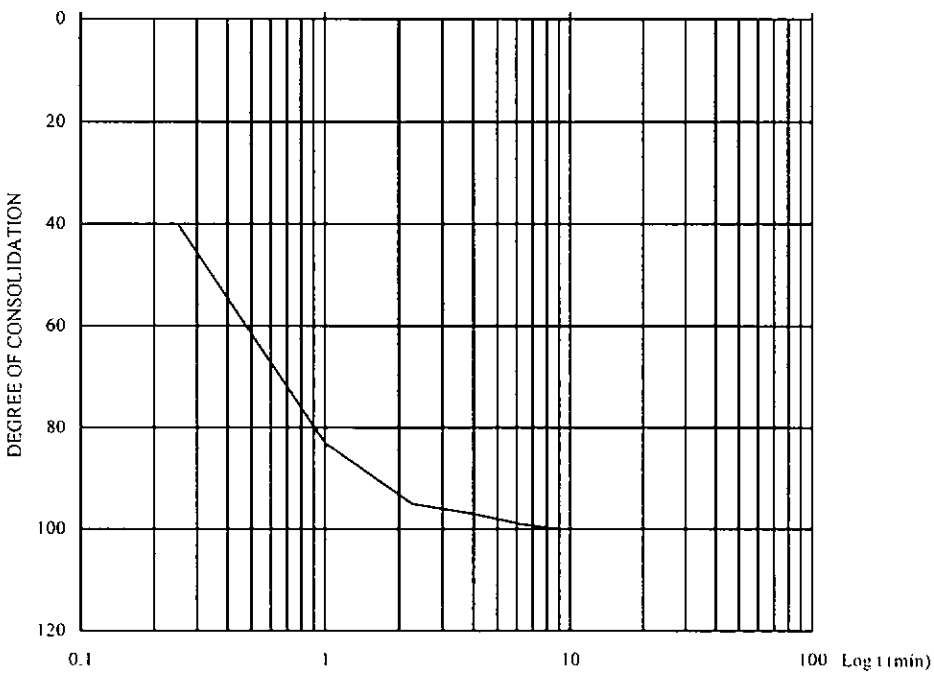


√t100 1.35 min

t100 1.83 min

tf 0.97 min

Calc. strain rate
9.944 mm/min



Borehole No. : D092 **Sample Depth m:-** 13.00 - 14.00

Sample No. : I **Specimen Depth m:-** 13.80 - 14.00

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.:** 059

Complied by: W S Wat

Checked by: H W Chung

Form : GESR009.13 / Jun.02.03 / Issue 1 / Rev 0

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Gammon

HKAS HOKLAS 015

Multi Stage		P.W.P,B.P		Effective Pressure	65 kPa
Side drains	No	Selected Machine Speed	0.048 mm/min	Rate of Strain	2.00 % per hr
FAILURE CRITERION					
Max. deviator Stress	☐	Max. Stress ratio	☒	Axial Strain %	☐
Stage : 1	Applied Pressure (kPa) - Cell :	285	Back : 220	P.R. factor	3.1069 kN/mm

Date	Time	Strain		Load	Pore Pressure	Dev. stress		Effective Stress Parameters					
		Dial		P.R.No. 24		Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
23/12	08:35	0.00	0.00	0.046	220	0.000	0.0	65.0	65.0	65.0	0.0	65.0	1.00
	08:40	0.20	0.14	0.104	235	0.041	42.3	92.4	50.1	71.3	21.2	64.2	1.84
	08:45	0.38	0.26	0.123	241	0.075	56.1	100.0	43.9	71.9	28.0	62.6	2.28
	08:50	0.56	0.39	0.140	245	0.112	68.4	108.1	39.7	73.9	34.2	62.5	2.72
	08:55	0.80	0.55	0.160	249	0.157	82.8	118.5	35.7	77.1	41.4	63.3	3.32
	09:00	0.98	0.68	0.175	251	0.194	93.5	127.1	33.6	80.4	46.8	64.8	3.78
	09:05	1.17	0.81	0.194	254	0.230	107.1	138.6	31.5	85.1	53.6	67.2	4.40
	09:10	1.43	0.99	0.210	255	0.280	118.5	148.9	30.4	89.6	59.2	69.9	4.90
	09:15	1.59	1.10	0.222	255	0.310	127.0	156.7	29.7	93.2	63.5	72.0	5.28
	09:20	1.83	1.27	0.240	256	0.356	139.7	168.8	29.1	99.0	69.9	75.7	5.80
	09:25	2.06	1.43	0.256	256	0.399	151.0	179.8	28.8	104.3	75.5	79.1	6.24
	09:30	2.27	1.58	0.278	256	0.439	166.6	195.4	28.8	112.1	83.3	84.3	6.78
	09:35	2.47	1.71	0.294	256	0.473	177.8	206.8	29.0	117.9	88.9	88.3	7.13
	09:40	2.73	1.89	0.314	255	0.520	191.8	221.6	29.8	125.7	95.9	93.7	7.44
	09:45	2.90	2.01	0.337	255	0.551	208.0	238.5	30.5	134.5	104.0	99.8	7.82
	09:50	3.13	2.17	0.356	253	0.592	221.2	253.1	31.9	142.5	110.6	105.6	7.94
	09:55	**3.29**	**2.28**	**0.376**	**252**	**0.620**	**235.2**	**268.5**	**33.3**	**150.9**	**117.6**	**111.7**	**8.064**
	10:00	3.53	2.45	0.398	250	0.663	250.5	286.0	35.5	160.7	125.2	119.0	8.056

Borehole No. :	**D092**	**Sample Depth m:- 13.00 - 14.00**	
Sample No. :	**1**	**Specimen Depth m:- 13.80 - 14.00**	
Customer :	**Mass Transit Railway Corporation**		Compiled by
Project :	**Ground Investigation for South Island Line**		W S Wat
		Contract No.: Contract 1024	Checked by
Job No.:	**J2999**	**Works Order No.: 059**	H W Chung

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Multi Stage		P.W.P,B.P			Effective Pressure	130	kPa
Side drains	No	Selected Machine Speed	0.046	mm/min	Rate of Strain	1.97	% per hr

FAILURE CRITERION

Max. deviator Stress	☐	Max. Stress ratio	☒		Axial Strain %		☐
Stage : 2	Applied Pressure (kPa) - Cell :	350	Back :	220	P.R. factor	3.1069	kN/mm

Date	Time	Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
		Dial		P.R.No. 24	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
23/12	13:10	3.99	2.77	0.067	220	0.000	0.0	130.0	130.0	130.0	0.0	130.0	1.00
	13:15	4.14	2.87	0.178	238	0.768	78.9	190.8	111.9	151.3	39.4	138.2	1.70
	13:20	4.27	2.96	0.231	245	0.790	116.8	221.7	104.9	163.3	58.4	143.8	2.11
	13:25	4.46	3.10	0.309	252	0.824	172.4	270.9	98.5	184.7	86.2	156.0	2.75
	13:30	4.61	3.20	0.368	255	0.848	214.4	309.5	95.1	202.3	107.2	166.6	3.25
	13:35	4.76	3.30	0.434	258	0.872	261.2	353.6	92.4	223.0	130.6	179.5	3.83
	13:40	4.89	3.39	0.483	259	0.893	296.0	386.8	90.8	238.8	148.0	189.5	4.26
	13:45	5.04	3.50	0.540	260	0.919	336.2	425.8	89.6	257.7	168.1	201.7	4.75
	13:50	5.19	3.60	0.588	261	0.943	370.0	459.2	89.2	274.2	185.0	212.5	5.15
	13:55	5.37	3.72	0.637	260	0.971	404.4	494.3	89.9	292.1	202.2	224.7	5.50
	14:00	5.56	3.86	0.674	259	1.004	430.0	521.4	91.4	306.4	215.0	234.7	5.71
	14:05	5.77	4.00	0.727	256	1.036	466.9	561.1	94.2	327.7	233.5	249.8	5.96
	14:10	5.96	4.14	0.759	253	1.068	488.9	586.0	97.1	341.6	244.5	260.1	6.04
	14:15	**6.11**	**4.24**	**0.793**	**250**	**1.091**	**512.4**	**612.1**	**99.7**	**355.9**	**256.2**	**270.5**	**6.14**
	14:20	6.34	4.40	0.821	246	1.127	531.3	635.2	103.9	369.5	265.6	281.0	6.11

Borehole No. : D092 — **Sample Depth m:-** 13.00 - 14.00

Sample No. : I — **Specimen Depth m:-** 13.80 - 14.00

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 — **Works Order No.:** 059

Compiled by: W S Wat

Checked by: H W Chung

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Gammon

Multi Stage		P.W.P,B.P		Effective Pressure	195 kPa
Side drains	No	Selected Machine Speed	0.045 mm/min	Rate of Strain	1.96 % per hr
FAILURE CRITERION					
Max. deviator Stress	☐	Max. Stress ratio	☒	Axial Strain %	☐
Stage : 3	Applied Pressure (kPa) - Cell :	415	Back : 220	P.R. factor	3.1069 kN/mm

Date	Time	Strain Dial	Strain	Load P.R.No. 24	Pore Pressure	Dev. stress Corr.	Dev. stress q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
29/12	08:35	6.59	4.57	0.076	220	0.000	0.0	195.0	195.0	195.0	0.0	195.0	1.00
	08:40	6.66	4.62	0.162	233	1.176	59.7	241.8	182.1	212.0	29.9	202.0	1.33
	08:45	6.77	4.70	0.248	246	1.194	120.5	289.5	169.0	229.3	60.3	209.2	1.71
	08:50	6.91	4.80	0.318	253	1.216	169.9	331.8	161.9	246.8	84.9	218.5	2.05
	08:55	7.05	4.89	0.395	257	1.235	224.1	381.8	157.7	269.7	112.0	232.4	2.42
	09:00	7.19	4.98	0.479	259	1.255	283.1	439.3	156.2	297.7	141.5	250.6	2.81
	09:05	7.29	5.06	0.553	259	1.272	335.0	491.1	156.1	323.6	167.5	267.8	3.15
	09:10	7.43	5.15	0.648	259	1.292	401.6	557.9	156.3	357.1	200.8	290.2	3.57
	09:15	7.55	5.24	0.734	259	1.311	461.7	618.1	156.4	387.3	230.9	310.3	3.95
	09:20	7.67	5.32	0.818	259	1.328	520.4	676.8	156.4	416.6	260.2	329.9	4.33
	09:25	7.82	5.43	0.905	258	1.352	580.9	737.6	156.7	447.1	290.4	350.3	4.71
	09:30	7.96	5.52	0.977	257	1.371	630.8	788.4	157.6	473.0	315.4	367.9	5.00
	09:35	8.12	5.63	1.042	256	1.394	675.6	835.1	159.5	497.3	337.8	384.7	5.24
	09:40	8.29	5.75	1.107	252	1.419	720.1	882.9	162.8	522.9	360.1	402.8	5.42
	09:45	8.49	5.89	1.136	248	1.448	739.3	906.2	166.9	536.6	369.7	413.3	5.43
	09:50	8.65	6.00	1.200	244	1.470	783.1	954.1	171.0	562.6	391.6	432.0	5.58
	09:55	8.88	6.16	1.271	238	1.503	831.3	1008.6	177.3	592.9	415.6	454.4	5.69
	10:00	9.02	6.26	1.311	233	1.523	858.2	1039.8	181.6	610.7	429.1	467.7	5.73
	10:05	9.19	6.38	1.323	229	1.547	865.4	1051.6	186.2	618.9	432.7	474.7	5.65
	10:10	9.40	6.52	1.392	222	1.576	912.0	1104.8	192.8	648.8	456.0	496.8	5.73
	10:15	9.59	6.65	1.446	216	1.601	948.1	1146.9	198.8	672.8	474.0	514.8	5.77
	10:20	9.73	6.75	1.486	211	1.621	974.7	1178.5	203.8	691.2	487.4	528.7	5.78
	10:25	**9.92**	**6.88**	**1.532**	**205**	**1.647**	**1005.2**	**1215.2**	**210.0**	**712.6**	**502.6**	**545.1**	**5.79**
	10:30	10.18	7.06	1.548	198	1.682	1014.2	1231.7	217.5	724.6	507.1	555.6	5.66
	10:35	10.32	7.16	1.596	193	1.701	1046.2	1268.7	222.5	745.6	523.1	571.2	5.70
	10:40	10.51	7.29	1.648	186	1.726	1080.5	1309.3	228.8	769.1	540.3	589.0	5.72
	10:45	10.68	7.41	1.690	180	1.749	1108.0	1342.8	234.8	788.8	554.0	604.1	5.72
	10:50	10.84	7.52	1.725	175	1.770	1130.7	1370.8	240.1	805.4	565.3	617.0	5.71
	10:55	11.03	7.65	1.761	169	1.794	1153.7	1399.9	246.2	823.1	576.9	630.8	5.69
	11:00	11.31	7.85	1.746	160	1.832	1141.0	1395.7	254.7	825.2	570.5	635.0	5.48
	11:05	11.47	7.96	1.788	156	1.852	1168.3	1427.8	259.5	843.7	584.2	648.9	5.50
	11:10	11.67	8.09	1.830	149	1.876	1195.2	1461.2	266.0	863.6	597.6	664.4	5.49
	11:15	11.88	8.24	1.864	142	1.903	1216.4	1489.0	272.6	880.8	608.2	678.1	5.46
	11:20	12.06	8.36	1.889	137	1.925	1231.8	1510.1	278.3	894.2	615.9	688.9	5.43
	11:25	12.29	8.52	1.908	130	1.954	1242.5	1527.7	285.2	906.5	621.3	699.4	5.36
	11:30	12.53	8.69	1.914	123	1.984	1244.2	1536.1	291.9	914.0	622.1	706.6	5.26
	11:35	12.75	8.85	1.914	118	2.013	1242.1	1539.0	296.9	918.0	621.1	710.9	5.18
	11:40	13.00	9.02	1.816	110	2.043	1173.5	1478.2	304.7	891.5	586.8	695.9	4.85
	11:45	13.32	9.24	1.804	109	2.081	1162.5	1469.0	306.5	887.8	581.3	694.0	4.79

Borehole No. : D092 **Sample Depth m:- 13.00 - 14.00**

Sample No. : 1 **Specimen Depth m:- 13.80 - 14.00**

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.: 059**

Compiled by: W S Wat

Checked by: H W Chung

Form : GESR009.14 / Dec.13.04 / Issue 1 / Rev 1

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TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2
Shearing Continuation

Gammon

HKAS HOKLAS

FAILURE CRITERION													
Max. deviator Stress ☐				Max. Stress ratio ☒				Axial Strain % ☐					
Stage : 3		Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
Date	Time	Dial		P.R.No. 24	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
29/12	12:00	14.08	9.77	1.795	103	2.172	1149.7	1461.5	311.8	886.6	574.8	695.0	4.69
	12:15	14.78	10.26	1.762	99	2.254	1121.4	1437.2	315.8	876.5	560.7	689.6	4.55
	12:30	15.55	10.79	1.745	95	2.341	1103.3	1423.0	319.7	871.4	551.7	687.5	4.45
	12:45	16.19	11.23	1.748	93	2.412	1099.8	1422.0	322.2	872.1	549.9	688.8	4.41
	13:00	16.86	11.69	1.751	90	2.484	1095.9	1421.1	325.2	873.1	547.9	690.5	4.37
	13:15	17.59	12.20	1.824	87	2.563	1137.1	1465.1	328.0	896.5	568.5	707.0	4.47
	13:30	18.35	12.73	1.795	83	2.644	1111.4	1443.0	331.6	887.3	555.7	702.1	4.35
	13:45	19.00	13.18	1.854	81	2.711	1143.6	1477.8	334.2	906.0	571.8	715.4	4.42
	14:00	19.76	13.71	1.830	77	2.790	1121.2	1459.3	338.1	898.7	560.6	711.8	4.32
	14:15	20.37	14.13	1.836	74	2.851	1119.4	1460.0	340.6	900.3	559.7	713.7	4.29

Borehole No. : D092 **Sample Depth m:-** 13.00 - 14.00
Sample No. : 1 **Specimen Depth m:-** 13.80 - 14.00

Customer : Mass Transit Railway Corporation — Compiled by W S Wat
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024 — Checked by H W Chung
Job No.: J2999 **Works Order No.:** 059

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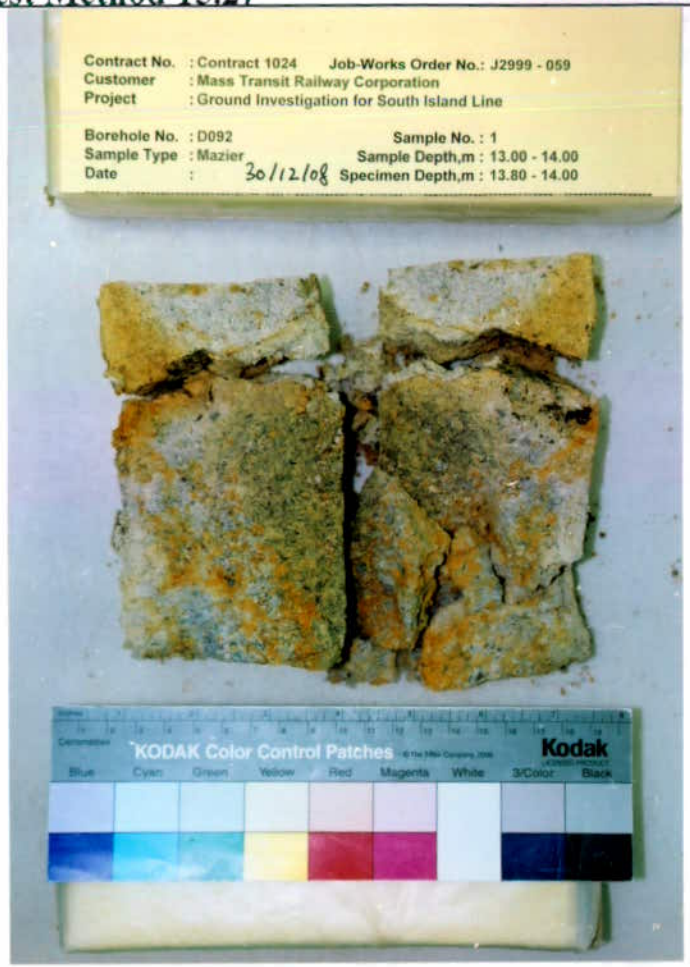
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT (GEOSPEC 3 : 2001 Test Method 15.2)



Description : Brown, slightly gravelly, sandy SILT/CLAY

Sample Origin : CDT ‡ ‡ Information provided by customer

Borehole No. : D092 **Sample No. :** 1 **Sample Depth m:-** 13.00 - 14.00 **Specimen Depth m:-** 13.80 - 14.00

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line

Contract No.: Contract 1024
Job No.: J2999
Works Order No.: 059

Compiled by: W S Wat
Checked by: H W Chung

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CONTRACT NO. CONTRACT NEX 1024
GROUND INVESTIGATION FOR SOUTH ISLAND LINE
LABORATORY ORDER NO. 1
COMPILATION OF FINAL LABORATORY TESTING REPORT
VOLUME 3 OF 4

CONTRACTOR
GAMMON CONSTRUCTION LIMITED
28th Floor Devon House
Taikoo Place
979 King's Road
Hong Kong

CUSTOMER
MASS TRANSIT RAILWAY CORPORATION

INTRODUCTION

This document contains a compilation of reports of tests for which the laboratory was accredited by HOKLAS at the date of testing and reports of tests for which it was not. The two individual series of reports are separated by a yellow divider sheet and presented in sequential order following the original works instruction. The document comprises of four volumes of test reports where volume 1 to volume 3 contain HOKLAS reports and volume 4 contains HOKLAS & NON-HOKLAS reports.

The laboratory did not know the sampling history of the samples prior to receipt at the laboratory. The results presented relate only to the samples in the condition as received.

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Reliance should only be given to test reports given in the original or certified true copy of test certificates/reports.

For the determination of Moisture Content, Bulk Density, Atterberg Limits, Particle Density, Particle Size Distribution & Triaxial Compression Tests. Some of these tests were subcontracted to FT Laboratories Limited. These results are clearly annoted as being conducted by this testing house, within this document.

CUSTOMER

MASS TRANSIT RAILWAY CORPORATION

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Approved Signatory : ~~J Fowler~~ / W C Lau
(~~Laboratory Quality Manager~~ /Deputy Laboratory Manager)

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Section 1
HOKLAS Endorsed Test Certificates

Section 1.1
Summary of Triaxial Tests

TEST CERTIFICATE
SUMMARY OF TRIAXIAL TEST RESULTS
GEOSPEC 3 : 2001

Gammon

Report No.: J2999-059.1T

Customer : Mass Transit Railway Corporation

Job No. : J2999

Works Order No. : 059

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Date : 08/09/2008

Borehole No.	Sample			Δ Initial Moisture Content	Initial Bulk Density	Initial Dry Density	Particle Density		Triaxial Test					Failure Mode	Description	Sample Origin
	No.	Type	Depth (m)	(%)	(Mg/m^3)	(Mg/m^3)	+ Test Method	(Mg/m^3)	* Test Method	Axial Strain (%)	Corrected Deviator Stress (kN/m^2)	s' (kN/m^2)	t (kN/m^2)			
WCH-BH01	5	M	7.00 - 8.00	37A	1.76	1.28			2S	12.3	191	157	96	B	Brown, slightly gravelly, sandy SILT/CLAY	CDM‡
WCH-BH01	5	M	7.00 - 8.00	35A	1.81	1.34			2MU	1.4 4.7 10.1	95 156 246	69 118 193	47 78 123	B	Brown, slightly gravelly, sandy SILT/CLAY	CDM‡
WCH-BH01	9	M	9.00 - 10.00	31A	1.90	1.45			2S	11.7	257	209	129	B	Brown, silty, gravelly SAND	CDM‡
WCH-BH01	9	M	9.00 - 10.00	32A	1.88	1.42			2MU	3.7 7.5 11.3	100 205 292	75 161 234	50 103 146	B	Brown, silty, gravelly SAND	CDM‡
WCH-BH01	13	M	11.00 - 12.00	23A	1.90	1.54			2S	11.8	451	349	226	B	Brown, silty, gravelly SAND	CDM‡
WCH-BH01	13	M	11.00 - 12.00	23A	1.94	1.58			2MU	3.8 7.1 9.9	252 426 590	175 306 442	126 213 295	B	Brown, silty, gravelly SAND	CDM‡

Legend : Δ = Test Method in accordance with GEOSPEC 3 : 2001 Test 5.1 Moisture Content at 45°C ± 5°C (A), Test 5.2 Moisture Content at 105°C ± 5°C (B), Test 5.3 Comparative Moisture Content 45/105°C± 5°C (C)
+ = Test Method in accordance with GEOSPEC3 : 2001 Test 7.1 Gas Jar Method (1), Test 7.2 Small Pykometer Method (2)
• = Test Method in accordance with GEOSPEC3 : 2001 Test 15.1 Unconsolidation Undrained Method (1), Test 15.2 Consolidation Undrained Triaxial Method (2), Test 15.3 Consolidation Drained Triaxial Method (3)

Symbols : U - Undisturbed Sample; LB - Large Disturbed Sample; BLK - Block Sample; PT - Portable triple tube Sample; P - Piston Sample; M - Mazier Sample; D - Small Disturbed Sample; IN = Intermediate Failure; S = Single Stage; MU = Multi - Stage; B = Brittle Failure; PL = Plastic Failure; Sampling History - Refer the Individual Test Report; Estimated Uncertainty - Refer the Individual Test Report. ‡ - Information provided by customer

Checked by : H W Chung

Approved By : Lau Wai Cheong

Date : 08/01/2009

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TEST CERTIFICATE
SUMMARY OF TRIAXIAL TEST RESULTS
GEOSPEC 3 : 2001

Gammon

Report No.: J2999-059.1

Customer : Mass Transit Railway Corporation

Job No. : J2999

Works Order No. : 059

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Date : 08/09/2008

Borehole No.	Sample			Δ Initial Moisture Content	Initial Bulk Density	Initial Dry Density	Particle Density		Triaxial Test					Failure Mode	Description	Sample Origin
	No.	Type	Depth (m)	(%)	(Mg/m³)	(Mg/m³)	+ Test Method	(Mg/m³)	* Test Method	Axial Strain (%)	Corrected Deviator Stress (kN/m²)	s' (kN/m²)	t (kN/m²)			
WCH-BH02	1	M	4.00 - 5.00	21B	1.95	1.62	1	2.64	2S	12.1	156	123	78	IN	Dark brown, clayey, very silty, very sandy GRAVEL	FILL‡
WCH-BH02	1	M	4.00 - 5.00	19B	1.94	1.62			2MU	1.5 4.2 9.1	62 110 192	45 86 150	31 55 96	IN	Dark brown, clayey, very silty, very sandy GRAVEL	FILL‡
WCH-BH02	5	M	6.50 - 7.50	26A	1.97	1.56	2	2.62	2S	12.1	175	141	87	PL	Dark grey, slightly gravelly, slightly sandy SILT/CLAY	ALL‡
WCH-BH02	5	M	6.50 - 7.50	24A	2.00	1.61			2MU	2.0 4.6 8.2	69 143 250	51 116 211	34 72 125	PL	Dark grey, slightly gravelly, slightly sandy SILT/CLAY	ALL‡

Legend : Δ = Test Method in accordance with GEOSPEC 3 : 2001 Test 5.1 Moisture Content at 45°C ± 5°C (A), Test 5.2 Moisture Content at 105°C ± 5°C (B), Test 5.3 Comparative Moisture Content 45/105°C± 5°C (C)
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Symbols :
U - Undisturbed Sample; LB - Large Disturbed Sample; BLK - Block Sample; PT - Portable triple tube Sample;
P - Piston Sample; M - Mazier Sample; D - Small Disturbed Sample; IN = Intermediate Failure
S = Single Stage; MU = Multi - Stage; B = Brittle Failure PL = Plastic Failure
Sampling History - Refer the Individual Test Report; Estimated Uncertainty - Refer the Individual Test Report; ‡ - Information provided by customer

Checked by : H W Ching

Approved By : Lau Wai Cheong

Date : 08/01/2009

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TEST CERTIFICATE
SUMMARY OF TRIAXIAL TEST RESULTS
GEOSPEC 3 : 2001

Gammon

Report No.: J2999-059.1

Customer : Mass Transit Railway Corporation

Job No. : J2999

Works Order No. : 059

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Date : 08/09/2008

Borehole No.	Sample			Δ Initial Moisture Content	Initial Bulk Density	Initial Dry Density	Particle Density		Triaxial Test					Failure Mode	Description	Sample Origin
	No.	Type	Depth (m)	(%)	(Mg/m³)	(Mg/m³)	+ Test Method	(Mg/m³)	* Test Method	Axial Strain (%)	Corrected Deviator Stress (kN/m²)	s' (kN/m²)	t (kN/m²)			
WCH-BH03	1	M	4.00 - 5.00	30A	1.85	1.42			2S	11.0	213	144	106	B	Greyish brown, gravelly, silty SAND	CDT‡
WCH-BH03	1	M	4.00 - 5.00	30A	1.87	1.44			2MU	1.0 3.6 6.3	52 90 116	37 75 101	26 45 58	B	Greyish brown, gravelly, silty SAND	CDT‡
WCH-BH03	4	M	6.00 - 6.90	33A	1.91	1.44			2S	20.1	234	214	117	B	Brown, gravelly, silty SAND	HDT‡
WCH-BH03	4	M	6.00 - 6.90	34A	1.78	1.33			2MU	2.5 5.6 8.8	78 125 169	56 99 140	39 62 84	B	Brown, gravelly, silty SAND	HDT‡

Legend : Δ = Test Method in accordance with GEOSPEC 3 : 2001 Test 5.1 Moisture Content at 45°C ± 5°C (A), Test 5.2 Moisture Content at 105°C ± 5°C (B), Test 5.3 Comparative Moisture Content 45/105°C± 5°C (C)
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Checked by : H W Chung

Approved By : Lau Wai Cheong

Date : 08/01/2009

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TEST CERTIFICATE
SUMMARY OF TRIAXIAL TEST RESULTS
GEOSPEC 3 : 2001

Gammon

Report No.: J2999-059.11

Customer : Mass Transit Railway Corporation | Job No. : J2999 | Works Order No. : 059

Project : Ground Investigation for South Island Line | Contract No.: Contract 1024 | Date : 08/09/2008

Borehole No.	Sample			Δ Initial Moisture Content	Initial Bulk Density	Initial Dry Density	Particle Density		Triaxial Test					Failure Mode	Description	Sample Origin
	No.	Type	Depth (m)	(%)	(Mg/m^3)	(Mg/m^3)	+ Test Method	(Mg/m^3)	* Test Method	Axial Strain (%)	Corrected Deviator Stress (kN/m^2)	s' (kN/m^2)	t (kN/m^2)			
WCH-BH09	1	M	3.00 - 4.00	22A	1.99	1.63			2S	20.1	244	200	122	B	Orangish brown, slightly gravelly, slightly sandy SILT/CLAY	COL‡
WCH-BH09	1	M	3.00 - 4.00	23A	1.97	1.60			2S	8.2	207	162	103	B	Orangish brown, slightly gravelly, slightly sandy SILT/CLAY	COL‡
WCH-BH09	5	M	5.00 - 6.00	26A	1.95	1.54			2S	20.1	283	251	141	B	Brown, gravelly, very silty SAND	CDT‡
WCH-BH09	5	M	5.00 - 6.00	26A	1.97	1.57			2MU	2.6 4.6 6.8	130 194 267	97 141 209	65 97 133	B	Brown, gravelly, very silty SAND	CDT‡
WCH-BH09	9	M	7.00 - 8.00	24A	1.97	1.59			2S	18.7	514	469	257	B	Brown, sandy SILT	CDT‡
WCH-BH09	9	M	7.00 - 8.00	17A	2.15	1.84			2MU	1.9 3.4 4.9	140 235 353	105 180 278	70 117 176	B	Brown, sandy SILT	CDT‡

Legend :
Δ = Test Method in accordance with GEOSPEC 3 : 2001 Test 5.1 Moisture Content at 45°C ± 5°C (A), Test 5.2 Moisture Content at 105°C ± 5°C (B), Test 5.3 Comparative Moisture Content 45/105°C± 5°C (C)
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* = Test Method in accordance with GEOSPEC3 : 2001 Test 15.1 Unconsolidation Undrained Method (1), Test 15.2 Consolidation Undrained Triaxial Method (2), Test 15.3 Consolidation Drained Triaxial Method (3)

Symbols :
U - Undisturbed Sample; P - Piston Sample; S = Single Stage; Sampling History - Refer the Individual Test Report;
LB - Large Disturbed Sample; M - Mazier Sample; MU = Multi - Stage; Estimated Uncertainty - Refer the Individual Test Report.
BLK - Block Sample; D - Small Disturbed Sample; B = Brittle Failure ‡ - Information provided by customer
DT - Portable triple tube Sample; IN = Intermediate Failure PL = Plastic Failure

Checked by : H W Chung | Approved By : Lau Wai Cheong | Date : 08/01/2009

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TEST CERTIFICATE
SUMMARY OF TRIAXIAL TEST RESULTS
GEOSPEC 3 : 2001

Gammon

Report No.: J2999-059.1

Customer : Mass Transit Railway Corporation | Job No. : J2999 | Works Order No. : 059

Project : Ground Investigation for South Island Line | Contract No.: Contract 1024 | Date : 08/09/2008

Borehole No.	Sample			Δ Initial Moisture Content	Initial Bulk Density	Initial Dry Density	Particle Density		Triaxial Test					Failure Mode	Description	Sample Origin
	No.	Type	Depth (m)	(%)	(Mg/m^3)	(Mg/m^3)	+ Test Method	(Mg/m^3)	* Test Method	Axial Strain (%)	Corrected Deviator Stress (kN/m^2)	s' (kN/m^2)	t (kN/m^2)			
WCH-BH10	1	M	3.00 - 4.00	23A	1.97	1.60	2	2.68	2S	9.8	240	178	120	B	Orangish brown, slightly gravelly, slightly sandy SILT/CLAY	COL‡
WCH-BH10	1	M	3.00 - 4.00	26A	1.95	1.55			2S	20.1	245	209	122	B	Orangish brown, slightly gravelly, slightly sandy SILT/CLAY	COL‡
WCH-BH10	5	M	5.00 - 6.00	16A	2.16	1.87			2S	18.2	650	521	325	B	Light grey, slightly gravelly, sandy SILT/CLAY	CDT‡
WCH-BH10	5	M	5.00 - 6.00	13A	2.22	1.96			2MU	1.5 2.8 4.0	148 228 315	98 158 225	74 114 157	B	Light grey, slightly gravelly, sandy SILT/CLAY	CDT‡
WCH-BH10	9	M	7.00 - 8.00	17A	2.11	1.81			2S	15.8	438	373	219	B	Light brown, silty, gravelly SAND	HDT‡
WCH-BH10	9	M	7.00 - 8.00	18A	2.07	1.75			2MU	1.8 3.9 5.8	126 192 255	90 146 204	63 96 127	B	Light brown, silty, gravelly SAND	HDT‡
WCH-BH10	13	M	9.00 - 10.00	16A	2.07	1.78			2S	20.1	415	332	207	B	Dark brown, slightly clayey, very silty, very sandy GRAVEL	CDT‡
WCH-BH10	13	M	9.00 - 10.00	13A	2.17	1.92			2MU	1.9 3.9 5.9	220 415 632	133 265 420	110 207 316	B	Dark brown, slightly clayey, very silty, very sandy GRAVEL	CDT‡

Legend : Δ = Test Method in accordance with GEOSPEC 3 : 2001 Test 5.1 Moisture Content at 45°C ± 5°C (A), Test 5.2 Moisture Content at 105°C ± 5°C (B), Test 5.3 Comparative Moisture Content 45/105°C± 5°C (C)

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TEST CERTIFICATE
SUMMARY OF TRIAXIAL TEST RESULTS
GEOSPEC 3 : 2001

Gammon

Report No.: J2999-059.11

Customer : Mass Transit Railway Corporation | Job No. : J2999 | Works Order No. : 059

Project : Ground Investigation for South Island Line | Contract No.: Contract 1024 | Date : 08/09/2008

Borehole No.	Sample			Δ Initial Moisture Content	Initial Bulk Density	Initial Dry Density	Particle Density		Triaxial Test					Failure Mode	Description	Sample Origin
	No.	Type	Depth (m)	(%)	(Mg/m^3)	(Mg/m^3)	+ Test Method	(Mg/m^3)	* Test Method	Axial Strain (%)	Corrected Deviator Stress (kN/m^2)	s' (kN/m^2)	t (kN/m^2)			
WCH-BH11	1	M	3.00 - 4.00	33A	1.87	1.41			2S	18.7	179	150	89	B	Orangish brown, slightly gravelly, sandy SILT/CLAY	CDT‡
WCH-BH11	1	M	3.00 - 4.00	28A	1.91	1.49			2S	6.6	104	84	52	B	Orangish brown, slightly gravelly, sandy SILT/CLAY	CDT‡
WCH-BH11	5	M	5.00 - 6.00	30A	1.88	1.44			2S	15.7	220	171	110	B	Light grey, slightly sandy SILT	CDT‡
WCH-BH11	5	M	5.00 - 6.00	27A	1.91	1.50			2MU	2.2 4.6 8.8	89 137 201	61 104 157	44 68 101	B	Light grey, slightly sandy SILT	CDT‡

Legend : Δ = Test Method in accordance with GEOSPEC 3 : 2001 Test 5.1 Moisture Content at 45°C ± 5°C (A), Test 5.2 Moisture Content at 105°C ± 5°C (B), Test 5.3 Comparative Moisture Content 45/105°C± 5°C (C)
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TEST CERTIFICATE
SUMMARY OF TRIAXIAL TEST RESULTS
GEOSPEC 3 : 2001

Gammon

HOKLAS 055

Report No.: J2999-059.11

Customer : Mass Transit Railway Corporation

Job No. : J2999

Works Order No. : 059

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Date : 08/09/2008

Borehole No.	Sample			Δ Initial Moisture Content	Initial Bulk Density	Initial Dry Density	Particle Density		Triaxial Test					Failure Mode	Description	Sample Origin
	No.	Type	Depth (m)	(%)	(Mg/m³)	(Mg/m³)	+ Test Method	(Mg/m³)	* Test Method	Axial Strain (%)	Corrected Deviator Stress (kN/m²)	s' (kN/m²)	t (kN/m²)			
WCH-BH12	1	M	3.00 - 4.00	20A	2.09	1.74			2S	11.4	136	115	68	B	Greyish brown, sandy SILT/CLAY	CDT‡
WCH-BH12	1	M	3.00 - 4.00	17A	2.15	1.83			2S	20.1	235	213	118	B	Greyish brown, sandy SILT/CLAY	CDT‡
WCH-BH12	9	M	7.00 - 8.00	31A	1.88	1.43	1	2.66	2S	10.3	184	155	92	B	Reddish brown, slightly gravelly, slightly sandy SILT/CLAY	CDT‡
WCH-BH12	9	M	7.00 - 8.00	31A	1.90	1.45			2MU	3.5 7.5 10.2	88 164 210	67 131 174	44 82 105	B	Reddish brown, slightly gravelly, slightly sandy SILT/CLAY	CDT‡
WCH-BH12	17	M	11.00 - 12.00	24A	1.96	1.58			2S	15.7	353	303	176	B	Light grey, slightly gravelly, slightly sandy SILT/CLAY	CDT‡
WCH-BH12	17	M	11.00 - 12.00	20A	2.02	1.68			2MU	1.7 3.6 5.5	121 201 283	90 159 230	61 101 142	B	Light grey, slightly gravelly, slightly sandy SILT/CLAY	CDT‡

Legend : Δ = Test Method in accordance with GEOSPEC 3 : 2001 Test 5.1 Moisture Content at 45°C ± 5°C (A), Test 5.2 Moisture Content at 105°C ± 5°C (B), Test 5.3 Comparative Moisture Content 45/105°C± 5°C (C)
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Symbols : U - Undisturbed Sample; LB - Large Disturbed Sample; BLK - Block Sample; PT - Portable triple tube Sample; P - Piston Sample; M - Mazier Sample; D - Small Disturbed Sample; IN = Intermediate Failure; S = Single Stage; MU = Multi - Stage; B = Brittle Failure; PL = Plastic Failure; Sampling History - Refer the Individual Test Report; Estimated Uncertainty - Refer the Individual Test Report; ‡ - Information provided by customer

Checked by : H W Chung

Approved By : Lau Wai Cheong

Date : 08/01/2009

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Section 2
HOKLAS Endorsed Test Reports

Section 2.1
Determination of Particle Density – GEOSPEC 3 : 2001 Test Method 7.1/7.2

TEST REPORT DETERMINATION OF PARTICLE DENSITY BY GAS JAR METHOD GEOSPEC 3 : 2001 Test Method 7.1

Report No.: J2999-059.11

Contract No. : Contract 1024 Job/W.O. No.: J2999-059 BH / ~~TP~~ * No. : WCH-BH02

Customer : Mass Transit Railway Corporation Sample No. : 1

Project : Ground Investigation for South Island Line Sample Depth : 4.00 - 5.00 m

Date Received : 29/09/2008 Sample Type : Mazier Specimen Depth : 4.00 - 4.60 m

Description : Dark brown, clayey, very silty, very sandy GRAVEL Tested Date: 18/12/2008

Sample Origin : FILL‡

Sampling History : As Received	
Type of Drying	Oven Dried, 45±5°C
Average Value of Particle Density (Mg/m^3)	2.64
Calculated Uncertainty of Particle Density (U) ^	-

Remark :

1. Observed or inferred sample disturbance - none.
2. Unavoidable variations from specified procedure - none.

* Delete as appropriate ^ Upon request

‡ Information provided by customer

Technician : K W Lau Checked By : Approved By :

Name : H W Chung Signatory : Lau Wai Cheong

Date : 18/12/2008 Date : 09/01/2009 Date : 09/01/2009

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Form : GESR002.2 / Nov.30.04 / Issue 1 / Rev 1

TEST REPORT DETERMINATION OF PARTICLE DENSITY BY SMALL PYKNOMETER METHOD GEOSPEC 3 : 2001 Test Method 7.2

Report No.: J2999-059.11

Contract No. : Contract 1024 Job/W.O. No.: J2999-059 BH / ~~TP~~ * No. : WCH-BH02

Customer : Mass Transit Railway Corporation Sample No. : 5

Project : Ground Investigation for South Island Line Sample Depth : 6.50 - 7.50 m

Date Received : 29/09/2008 Sample Type : Mazier Specimen Depth : 6.50 - 7.10 m

Description : Dark grey, slightly gravelly, slightly sandy SILT/CLAY Tested Date : 05/12/2008

Sample Origin : ALL‡

Sampling History : As Received	
Type of Drying	Oven Dried, 45±5°C
Average Value of Particle Density (Mg/m^3)	2.62
Calculated Uncertainty of Particle Density (U) ^	-

Remark :

Liquid used : ~~Distilled water~~ / Kerosene / ~~White spirit~~ *

1. Observed or inferred sample disturbance - none.
2. Unavoidable variations from specified procedure - none.

* Delete as appropriate ^ Upon request

‡ Information provided by customer

Technician : K W Lau Checked By : Name : H W Chung Approved By : Signatory : Lau Wai Cheong

Date : 05/12/2008 Date : 09/01/2009 Date : 09/01/2009

Form : GESR002.3 / Nov.30.04 / Issue 1 / Rev I

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TEST REPORT DETERMINATION OF PARTICLE DENSITY BY SMALL PYKNOMETER METHOD GEOSPEC 3 : 2001 Test Method 7.2

Report No.: J2999-059.11

Contract No. : Contract 1024 Job/W.O. No.: J2999-059 BH / ~~TP~~ * No. : WCH-BH10

Customer : Mass Transit Railway Corporation Sample No. : 1

Project : Ground Investigation for South Island Line Sample Depth : 3.00 - 4.00 m

Date Received : 29/09/2008 Sample Type : Mazier Specimen Depth : 3.00 - 3.60 m

Description : Orangish brown, slightly gravelly, slightly sandy SILT/CLAY Tested Date : 02/12/2008

Sample Origin : COL‡

Sampling History : As Received	
Type of Drying	Oven Dried, 45±5°C
Average Value of Particle Density (Mg/m^3)	2.68
Calculated Uncertainty of Particle Density (U) ^	-

Remark :

Liquid used : Distilled water / ~~Kerosene / White spirit~~ *

1. Observed or inferred sample disturbance - none.
2. Unavoidable variations from specified procedure - none.

* Delete as appropriate ^ Upon request

‡ Information provided by customer

Technician : K W Lau Checked By : Name : H W Chung Approved By : Signatory : Lau Wai Cheong

Date : 02/12/2008 Date : 09/01/2009 Date : 09/01/2009

Form : GESR002.3 / Nov.30.04 / Issue 1 / Rev 1

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TEST REPORT DETERMINATION OF PARTICLE DENSITY BY GAS JAR METHOD GEOSPEC 3 : 2001 Test Method 7.1

Report No.: J2999-059.11

Contract No. : Contract 1024 Job/W.O. No.: J2999-059 BH / ~~TP~~ * No. : WCH-BH12

Customer : Mass Transit Railway Corporation Sample No. : 9

Project : Ground Investigation for South Island Line Sample Depth : 7.00 - 8.00 m

Date Received : 29/09/2008 Sample Type : Mazier Specimen Depth : 7.00 - 7.60 m

Description : Reddish brown, slightly gravelly, slightly sandy SILT/CLAY Tested Date: 15/12/2008

Sample Origin : CDT‡

Sampling History : As Received	
Type of Drying	Oven Dried, 45±5°C
Average Value of Particle Density (Mg/m^3)	2.66
Calculated Uncertainty of Particle Density (U) ^	-

Remark :

1. Observed or inferred sample disturbance - none.
2. Unavoidable variations from specified procedure - none.

* Delete as appropriate ^ Upon request

‡ Information provided by customer

Technician : K W Lau Checked By : Approved By :

Name : H W Chung Signatory : Lau Wai Cheong

Date : 15/12/2008 Date : 09/01/2009 Date : 09/01/2009

Form : GESR002.2 / Nov.30.04 / Issue 1 / Rev 1

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Section 2.2
Determination of Triaxial Compression – GEOSPEC 3 : 2001 Test Method 15.2

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	WCH-BH01		
Sample		no	5		
Sample Type			Mazier		
Stage		no	1		
Sample Depth		m	7.00 - 8.00		
Specimen Depth		m	7.80 - 8.00		
INITIAL CONDITIONS					
Diameter	(D_o)	mm	73.8		
Height	(H_o)	mm	145.0		
Moisture Content	(W_o)	%	37		
Bulk density	(ρ_o)	Mg/m^3	1.76		
Dry density	(ρ_d)	Mg/m^3	1.28		
Particle density	(ρ_s)		2.65		
Voids Ratio	(e_o)		1.07		
Degree of Saturation	(S_r)	%	92.6		
DRAINAGE CONDITIONS			ONE END		
SATURATION					
Final Pore Pressure Coefficient B			0.98		
CONSOLIDATION					
Cell Pressure	(σ_3)	kPa	295		
Back Pressure	(u_b)	kPa	220		
Effective Pressure	(σ'_3)	kPa	75		
Coefficient of Consolidation (t100) (C_{vi})		m^2/Year	325.58		
Coefficient of Volume Compressibility (m_{vi})		m^2/MN	0.56		
Coefficient of Permeability (k)		m/s	5.62E-08		
COMPRESSION TERMINATION CRITERION			MAXIMUM DEVIATOR STRESS		
COMPRESSION - INITIAL					
Moisture Content	(w)	%	35		
Pore Pressure at the End of Consolidation		kPa	220		
Effective Stress at the End of Consolidation		kPa	75		
Bulk density	(ρ_o)	Mg/m^3	1.81		
Dry density	(ρ_d)	Mg/m^3	1.33		
Voids Ratio	(e)		0.99		
Degree of Saturation	(S_r)	%	94.8		

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999
Works Order No.: 059
Report No. : J2999-059.11

Technician : W S Wat
Checked By : Name : H W Chung Date : 22/12/2008
Approved By : Signatory : Lau Wai Cheong Date : 22/12/2008
Tested Date: 12/12/2008

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Form : GESR009.6 / Nov.10.06 / Issue 1 / Rev 1

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	WCH-BH01		
Sample		no	5		
Sample Type			Mazier		
Stage		no	1		
Sample Depth		m	7.00 - 8.00		
Specimen Depth		m	7.80 - 8.00		
COMPRESSION - FAILURE					
Cell Pressure		kPa	295		
Rate of Strain		mm/min	0.047		
CONDITIONS MAXIMUM DEVIATOR STRESS					
Major Effective Principal Stress (σ'_1)		kPa	253		
Corrected Deviator Stress ($\sigma'_1 - \sigma'_3$)		kPa	191		
Minor Effective Principal Stress (σ'_3)		kPa	61		
$s' = (\sigma'_1 + \sigma'_3)/2$		kPa	157		
$t = (\sigma_1 - \sigma_3)/2$		kPa	96		
Expanded Uncertainty of s' ^		kPa	-		
Expanded Uncertainty of t ^		kPa	-		
Pore pressure parameter A_f			0.07		
Strain at Failure	(εf)	%	12.3		
COMPRESSION - FINAL					
Moisture Content	(W_f)	%	35		
Bulk density	(ρ_o)	Mg/m^3	1.81		
Dry density	(ρ_d)	Mg/m^3	1.33		
Voids Ratio	(e_f)		0.99		
Degree of Saturation	(S_f)	%	94.8		

Notes -
1. The method of specimen preparation was in accordance with GEOSPEC 3 : 2001 :- Test method 13.3 : test specimen from undisturbed soil samples.
2. Sample received date :29/09/2008
3. The determination of moisture content was in accordance with test method 5.1 of GEOSPEC 3 : 2001.
4. Particle density : 2.65 (Assumed)
5. Maximum and minimum temperature recorded over the period of testing 19.9 - 20.7 °C.
6. Unavoidable variations from specified procedure : none
7. Comment on observed or inferred sample disturbance : none
8. Percentage by mass of soil particles larger than 1/5 of the diameter of specimen (%) : Nil
9. The specimen was selected by the laboratory.
   Name : W S Wat Designation : Senior Laboratory Technician
10. Sampling History : As Received

* Delete as appropriate ^ Upon request

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.: 059**

Compiled by W S Wat
Checked by H W Chung

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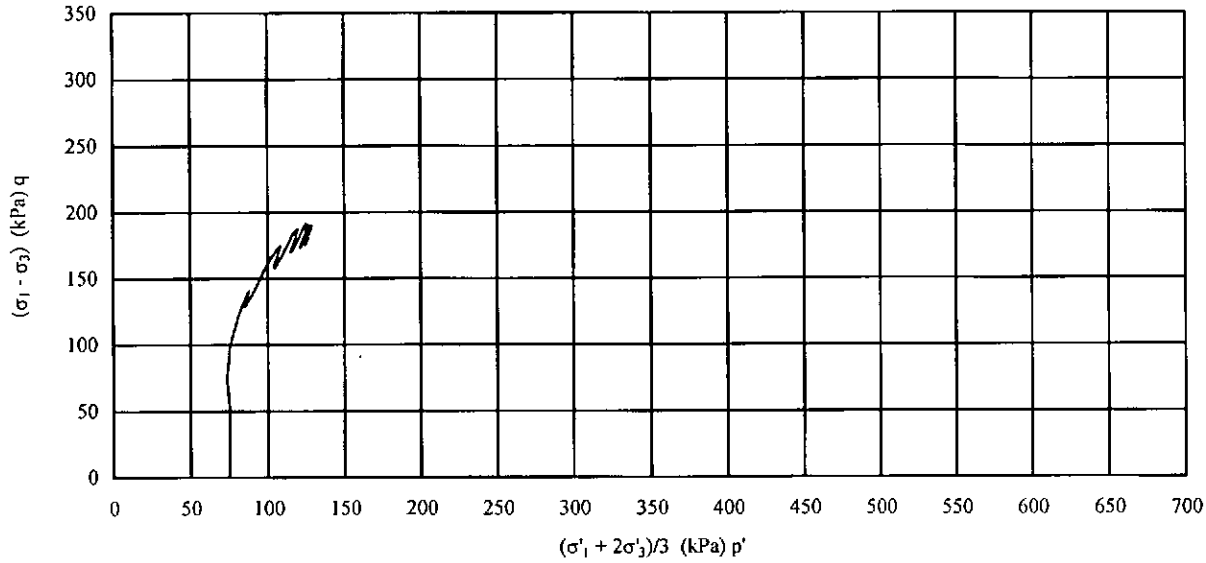
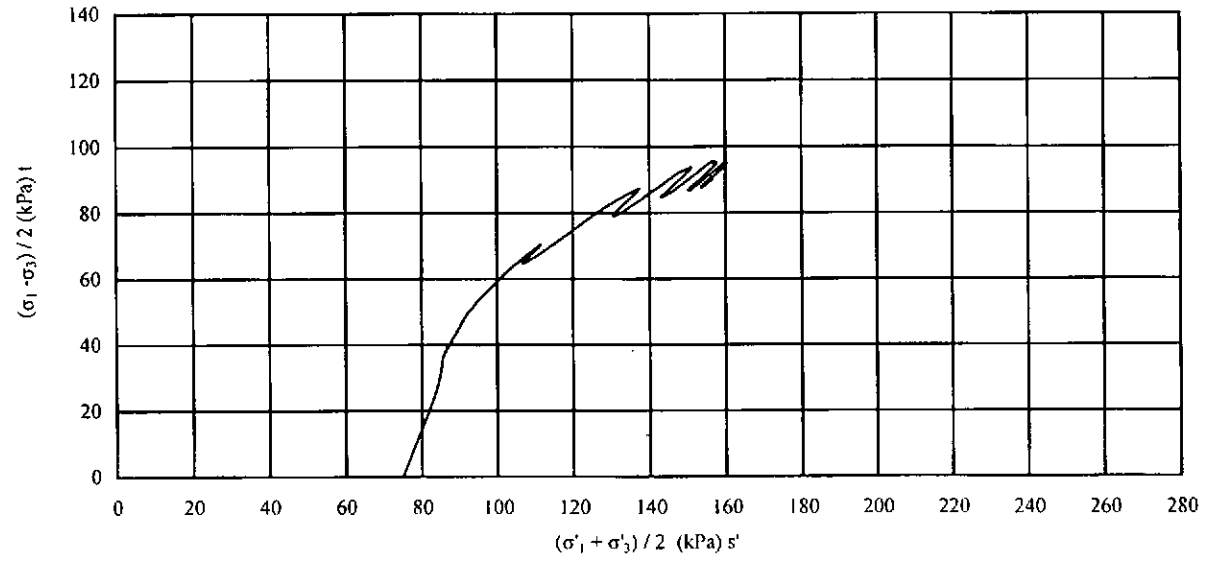
TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

STRESS PATH PARAMETERS FOR EFFECTIVE STRESS

p' - q PLOT



s' - t PLOT



Borehole No. : WCH-BH01 **Sample Depth m:-** 7.00 - 8.00
Sample No. : 5 **Specimen Depth m:-** 7.80 - 8.00

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.:** 059

Compiled by: W S Wat
Checked by: H W Chung

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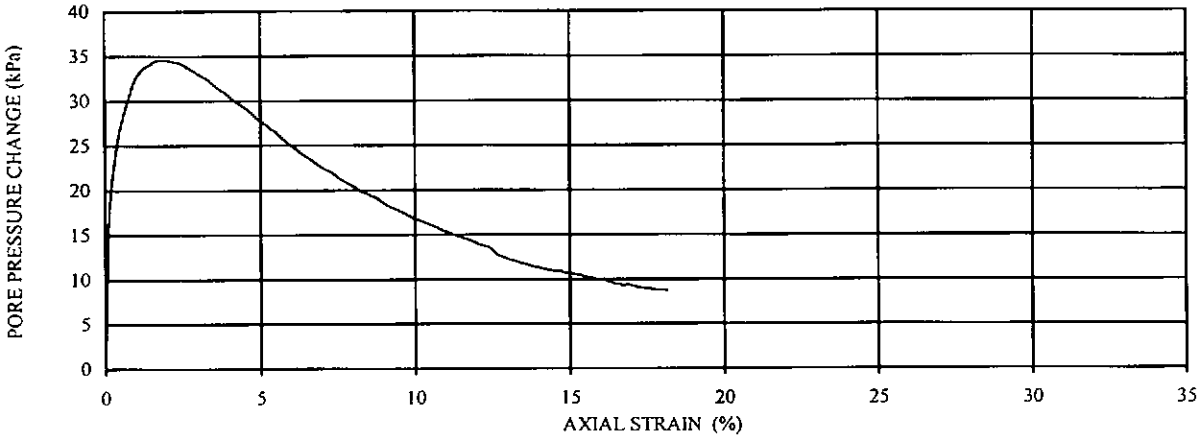
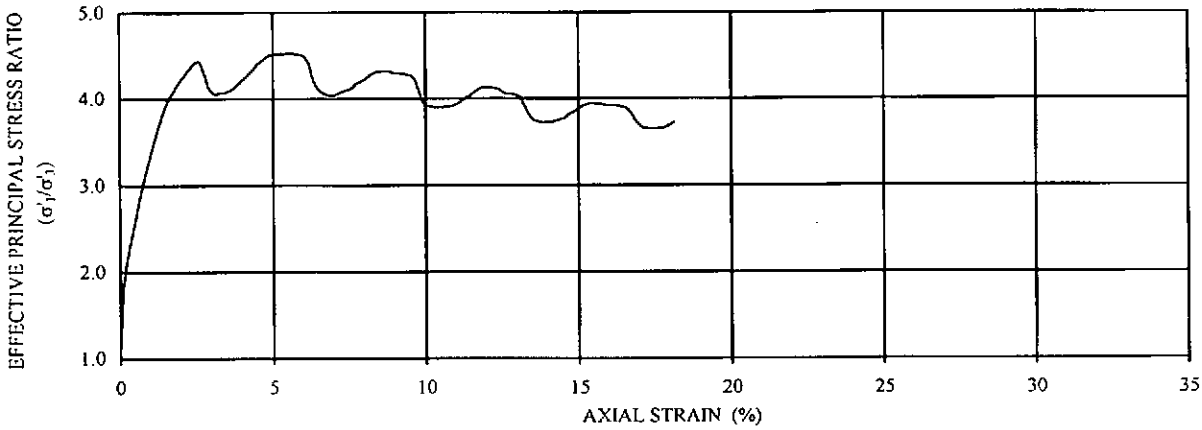
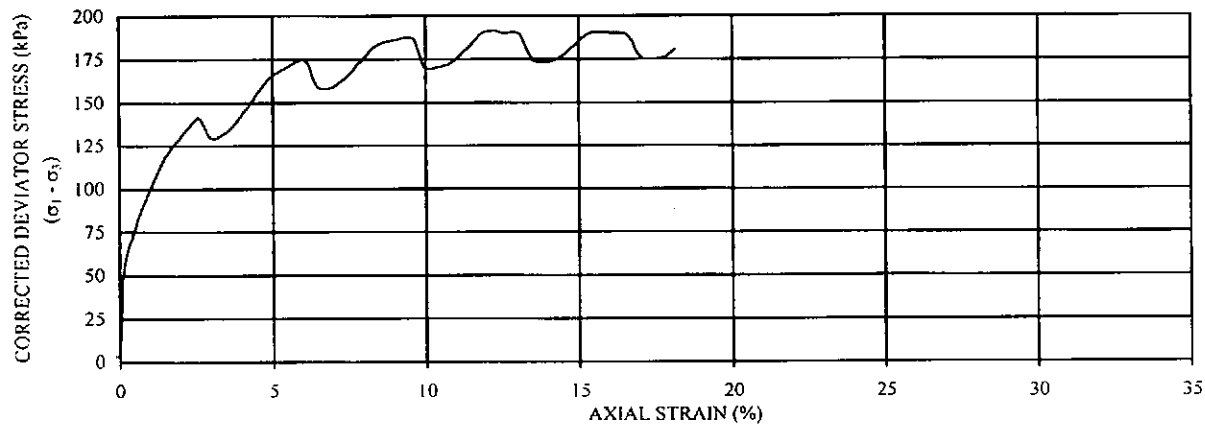
TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

COMPRESSION







Borehole No. : WCH-BH01 **Sample Depth m:-** 7.00 - 8.00
Sample No. : 5 **Specimen Depth m:-** 7.80 - 8.00

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line

Compiled by: W S Wat
Checked by: H W Chung

Contract No.: Contract 1024
Job No.: J2999 **Works Order No.:** 059

Form : GESR009.9 / Jun.02.03 / Issue 1 / Rev 0

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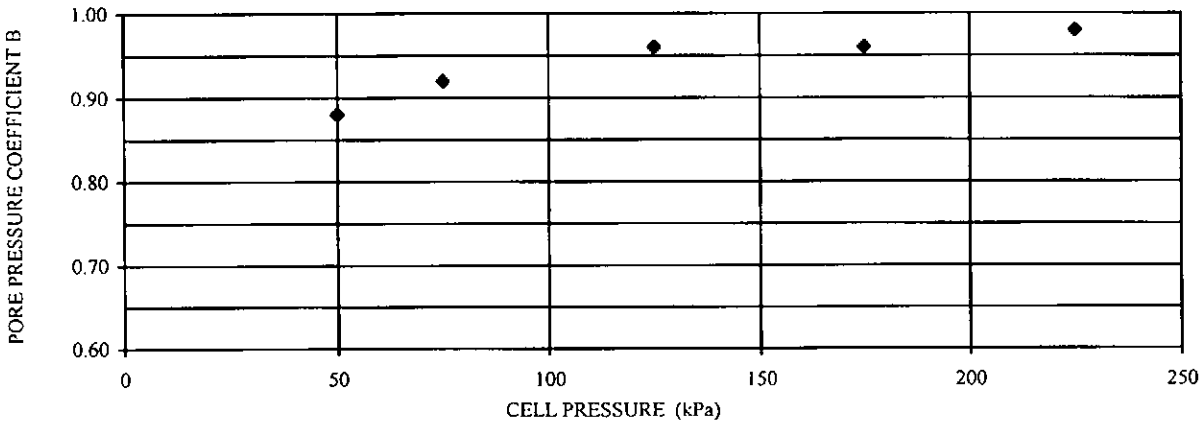
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

SATURATION



Date	Time	Cell Pressure kPa	Back Pressure kPa	Pore Pressure kPa	Cumulative Volume of Water cm^3	Pore Pressure Coefficient B
12/12/2008	16:42	0	0	-	0.0	
	16:50	25	-	24		-
15/12/2008	09:11	25	20	20	-1.1	
	09:18	50	-	42		0.88
	10:06	50	45	45	-0.9	
	10:10	75	-	68		0.92
	10:55	75	70	70	-0.1	
	11:07	125	-	118		0.96
	13:16	125	120	120	0.5	
	13:22	175	-	168		0.96
	14:09	175	170	170	0.7	
	14:20	225	-	219		0.98
18/12/2008	13:10	225	220	220	8.5	

Borehole No. WCH-BH01 **Sample Depth m:-** 7.00 - 8.00
Sample No. : 5 **Specimen Depth m:-** 7.80 - 8.00
Customer : Mass Transit Railway Corporation Compiled by W S Wat
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024 Checked by H W Chung
Job No.: J2999 **Works Order No.:** 059

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

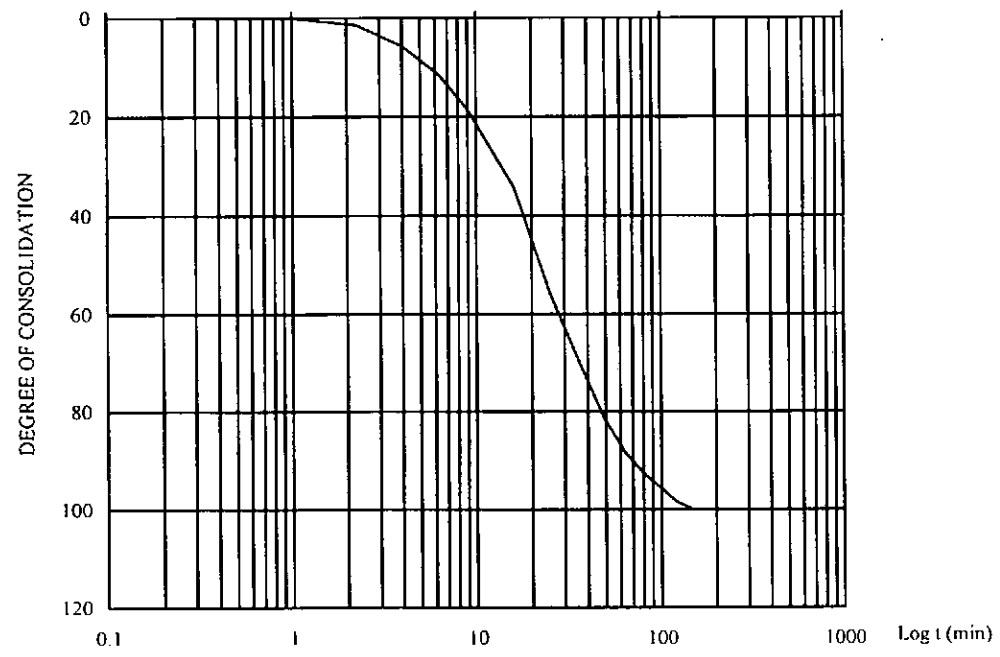
CONSOLIDATION (DRAINED PHASE) - Stage 1

√t100 5.31 min

t100 28.232 min

tf 14.963 min

Calc. strain rate
0.669 mm/min



Borehole No. : WCH-BH01 **Sample Depth m:-** 7.00 - 8.00

Sample No. : 5 **Specimen Depth m:-** 7.80 - 8.00

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.:** 059

Complied by: W S Wat

Checked by: H W Chung

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Single Stage		P.W.P,B.P			Effective Pressure	75	kPa
Side drains	No	Selected Machine Speed	0.047	mm/min	Rate of Strain	1.97	% per hr

FAILURE CRITERION

Max. deviator Stress	☒	Max. Stress ratio	☐		Axial Strain %		☐
Stage : 1	Applied Pressure (kPa) - Cell :	295	Back :	220	P.R. factor	1.7511	kN/mm

Date	Time	Strain Dial	Strain	Load P.R.No. 33	Pore Pressure	Dev. stress Corr.	Dev. stress q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
19/12	08:45	0.00	0.00	0.080	220	0.000	0.0	75.0	75.0	75.0	0.0	75.0	1.00
	08:50	0.16	0.11	0.195	236	0.032	48.3	107.4	59.1	83.2	24.1	75.2	1.82
	08:55	0.38	0.27	0.234	242	0.078	64.5	117.4	52.9	85.1	32.2	74.4	2.22
	09:00	0.63	0.44	0.255	246	0.127	73.1	122.2	49.1	85.7	36.6	73.5	2.49
	09:05	0.88	0.62	0.280	249	0.177	83.4	129.8	46.4	88.1	41.7	74.2	2.80
	09:10	1.11	0.77	0.297	250	0.219	90.3	135.1	44.8	89.9	45.1	74.9	3.02
	09:15	1.33	0.93	0.313	252	0.264	96.8	139.8	43.0	91.4	48.4	75.3	3.25
	09:20	1.56	1.09	0.329	253	0.308	103.2	145.2	42.0	93.6	51.6	76.4	3.46
	09:25	1.83	1.28	0.348	254	0.359	110.9	152.2	41.3	96.7	55.4	78.3	3.68
	09:30	2.11	1.47	0.366	254	0.410	118.0	158.9	40.9	99.9	59.0	80.2	3.89
	09:35	2.33	1.63	0.376	255	0.453	121.9	162.4	40.5	101.5	61.0	81.1	4.01
	09:40	2.55	1.78	0.385	255	0.492	125.4	165.8	40.4	103.1	62.7	82.2	4.10
	09:45	2.75	1.92	0.393	255	0.529	128.5	168.9	40.4	104.7	64.3	83.2	4.18
	09:50	2.97	2.08	0.402	255	0.570	132.0	172.5	40.5	106.5	66.0	84.5	4.26
	09:55	3.21	2.24	0.411	254	0.611	135.4	176.0	40.6	108.3	67.7	85.7	4.34
	10:00	3.49	2.44	0.421	254	0.662	139.2	180.0	40.8	110.4	69.6	87.2	4.41
	10:05	3.71	2.59	0.426	254	0.700	141.0	182.1	41.1	111.6	70.5	88.1	4.43
	10:10	3.99	2.79	0.413	254	0.750	135.3	176.8	41.5	109.2	67.7	86.6	4.26
	10:15	4.14	2.90	0.402	253	0.777	130.7	172.4	41.7	107.0	65.3	85.3	4.13
	10:20	4.44	3.10	0.399	253	0.825	129.1	171.3	42.2	106.8	64.6	85.2	4.06
	10:25	4.68	3.27	0.403	253	0.867	130.5	173.0	42.5	107.7	65.2	86.0	4.07
	10:30	4.91	3.43	0.408	252	0.905	132.2	175.2	43.0	109.1	66.1	87.1	4.08
	10:35	5.16	3.61	0.415	252	0.947	134.8	178.3	43.5	110.9	67.4	88.4	4.10
	10:40	5.42	3.79	0.424	251	0.990	138.1	182.0	43.9	113.0	69.1	89.9	4.15
	10:45	5.78	4.04	0.440	250	1.047	144.2	188.8	44.6	116.7	72.1	92.7	4.23
	10:50	5.92	4.14	0.446	250	1.070	146.4	191.3	44.9	118.1	73.2	93.7	4.26
	10:55	6.29	4.40	0.463	250	1.129	152.8	198.3	45.5	121.9	76.4	96.4	4.36
	11:00	6.46	4.51	0.472	249	1.154	156.2	202.0	45.8	123.9	78.1	97.9	4.41
	11:05	6.67	4.66	0.480	249	1.187	159.1	205.3	46.2	125.8	79.6	99.2	4.44
	11:10	6.93	4.84	0.492	248	1.227	163.6	210.4	46.8	128.6	81.8	101.3	4.50
	11:15	7.19	5.02	0.499	248	1.266	166.0	213.3	47.3	130.3	83.0	102.6	4.51
	11:20	7.39	5.17	0.504	247	1.299	167.7	215.3	47.6	131.5	83.9	103.5	4.52
	11:25	7.63	5.33	0.509	247	1.333	169.4	217.5	48.1	132.8	84.7	104.6	4.52
	11:30	7.88	5.51	0.514	247	1.371	171.0	219.5	48.5	134.0	85.5	105.5	4.53
	11:35	8.09	5.65	0.519	246	1.401	172.7	221.7	49.0	135.4	86.4	106.6	4.52
	11:40	8.34	5.83	0.523	246	1.438	173.9	223.4	49.5	136.5	87.0	107.5	4.51
	11:45	8.58	5.99	0.526	245	1.471	174.8	224.8	50.0	137.4	87.4	108.3	4.50
	11:50	8.83	6.17	0.520	245	1.508	172.0	222.4	50.4	136.4	86.0	107.7	4.41
	11:55	9.04	6.32	0.500	244	1.539	163.9	214.7	50.8	132.7	81.9	105.4	4.23

Borehole No. : WCH-BH01 — **Sample Depth m:- 7.00 - 8.00**

Sample No. : 5 — **Specimen Depth m:- 7.80 - 8.00**

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 — **Works Order No.: 059**

Compiled by: W S Wat

Checked by: H W Chung

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2
Shearing Continuation

FAILURE CRITERION

Max. deviator Stress ☒ | Max. Stress ratio ☐ | Axial Strain % ☐

Stage :	1	Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
Date	Time	Dial		P.R.No. 33	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
19/12	12:00	9.28	6.48	0.489	244	1.571	159.2	210.4	51.2	130.8	79.6	104.3	4.11
	12:05	9.57	6.69	0.487	243	1.613	158.0	209.7	51.7	130.7	79.0	104.4	4.06
	12:10	9.80	6.85	0.489	243	1.644	158.5	210.6	52.1	131.4	79.3	104.9	4.04
	12:15	10.05	7.02	0.493	243	1.678	159.7	212.2	52.5	132.4	79.9	105.7	4.04
	12:20	10.37	7.25	0.502	242	1.722	162.8	215.7	52.9	134.3	81.4	107.2	4.08
	12:25	10.56	7.38	0.507	242	1.747	164.5	217.7	53.2	135.4	82.2	108.0	4.09
	12:30	10.83	7.57	0.516	241	1.783	167.6	221.3	53.7	137.5	83.8	109.6	4.12
	12:35	11.07	7.73	0.527	241	1.813	171.6	225.6	54.0	139.8	85.8	111.2	4.18
	12:40	11.32	7.91	0.535	241	1.847	174.3	228.7	54.4	141.5	87.1	112.5	4.20
	12:45	11.55	8.07	0.544	240	1.876	177.4	232.1	54.7	143.4	88.7	113.8	4.24
	12:50	11.80	8.25	0.555	240	1.909	181.3	236.4	55.1	145.7	90.6	115.5	4.29
	12:55	12.03	8.41	0.561	240	1.938	183.3	238.6	55.3	146.9	91.6	116.4	4.31
	13:00	12.26	8.57	0.565	239	1.967	184.4	240.0	55.6	147.8	92.2	117.1	4.32
	13:05	12.49	8.73	0.568	239	1.996	185.2	241.0	55.8	148.4	92.6	117.5	4.32
	13:10	12.78	8.93	0.571	239	2.031	185.9	242.2	56.3	149.3	93.0	118.3	4.30
	13:15	12.96	9.06	0.573	238	2.054	186.4	243.0	56.6	149.8	93.2	118.7	4.29
	13:20	13.27	9.27	0.577	238	2.091	187.5	244.5	57.0	150.7	93.7	119.5	4.29
	13:25	13.46	9.41	0.578	238	2.115	187.5	244.7	57.2	151.0	93.8	119.7	4.28
	13:30	13.73	9.60	0.577	238	2.148	186.7	244.2	57.5	150.9	93.4	119.7	4.25
	13:35	13.96	9.76	0.560	237	2.175	179.9	237.7	57.8	147.8	90.0	117.8	4.11
	13:40	14.21	9.93	0.539	237	2.204	171.6	229.7	58.1	143.9	85.8	115.3	3.95
	13:45	14.46	10.11	0.535	237	2.234	169.7	228.0	58.3	143.1	84.8	114.9	3.91
	14:00	15.24	10.65	0.543	236	2.323	171.6	230.7	59.1	144.9	85.8	116.3	3.90
	14:05	15.57	10.88	0.550	236	2.361	173.7	233.2	59.5	146.4	86.9	117.4	3.92
	14:10	15.79	11.04	0.556	235	2.386	175.6	235.3	59.7	147.5	87.8	118.2	3.94
	14:15	16.10	11.25	0.568	235	2.420	179.6	239.6	60.0	149.8	89.8	119.9	3.99
	14:20	16.35	11.42	0.576	235	2.447	182.2	242.4	60.2	151.3	91.1	120.9	4.03
	14:25	16.58	11.59	0.586	235	2.474	185.6	246.0	60.4	153.2	92.8	122.3	4.07
	14:30	16.85	11.78	0.597	234	2.504	189.2	249.8	60.6	155.2	94.6	123.7	4.12
	14:35	17.10	11.95	0.602	234	2.530	190.7	251.6	60.9	156.2	95.3	124.5	4.13
	14:40	17.29	12.08	0.604	234	2.550	191.1	252.2	61.1	156.7	95.6	124.8	4.13
	14:45	**17.54**	**12.26**	**0.606**	**234**	**2.578**	**191.4**	**252.7**	**61.3**	**157.0**	**95.7**	**125.1**	**4.12**
	14:50	17.79	12.43	0.605	234	2.604	190.6	252.1	61.5	156.8	95.3	125.0	4.10
	14:55	18.03	12.60	0.604	233	2.630	189.9	252.0	62.1	157.0	94.9	125.4	4.06
	15:00	18.27	12.77	0.607	233	2.656	190.6	253.0	62.4	157.7	95.3	125.9	4.05
	15:05	18.49	12.93	0.608	232	2.680	190.6	253.2	62.6	157.9	95.3	126.1	4.04
	15:10	18.73	13.09	0.605	232	2.704	189.1	251.9	62.8	157.3	94.5	125.8	4.01
	15:15	18.99	13.27	0.586	232	2.731	181.7	244.7	63.0	153.9	90.9	123.6	3.88
	15:20	19.29	13.48	0.568	232	2.762	174.7	237.9	63.2	150.6	87.4	121.4	3.76
	15:25	19.46	13.60	0.566	232	2.780	173.7	237.0	63.3	150.2	86.9	121.2	3.74
	15:30	19.81	13.84	0.566	231	2.815	173.2	236.8	63.6	150.2	86.6	121.3	3.72

Borehole No. : WCH-BH01 — **Sample Depth m:-** 7.00 - 8.00

Sample No. : 5 — **Specimen Depth m:-** 7.80 - 8.00

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 — **Works Order No.:** 059

Compiled by: W S Wat

Checked by: H W Chung

Form : GESR009.15 / Dec.13.04 / Issue 1 / Rev 1

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TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2
Shearing Continuation

FAILURE CRITERION

Max. deviator Stress ☒ | Max. Stress ratio ☐ | Axial Strain % ☐

Stage :	1	Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
Date	Time	Dial		P.R.No. 33	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
19/12	15:35	19.96	13.95	0.567	231	2.831	173.3	236.9	63.6	150.3	86.7	121.4	3.73
	15:40	20.28	14.17	0.571	231	2.863	174.3	238.1	63.8	150.9	87.1	121.9	3.73
	15:45	20.56	14.37	0.577	231	2.892	176.0	239.9	63.9	151.9	88.0	122.6	3.75
	15:50	20.83	14.56	0.584	231	2.919	178.1	242.2	64.1	153.1	89.0	123.5	3.78
	15:55	21.05	14.71	0.593	231	2.941	181.0	245.1	64.1	154.6	90.5	124.4	3.82
	16:00	21.29	14.88	0.601	231	2.965	183.5	247.8	64.3	156.0	91.7	125.5	3.85
	16:05	21.48	15.02	0.608	231	2.985	185.6	249.9	64.3	157.1	92.8	126.2	3.89
	16:10	21.78	15.22	0.618	231	3.014	188.7	253.2	64.5	158.9	94.4	127.4	3.93
	16:15	22.05	15.41	0.624	230	3.041	190.4	255.0	64.6	159.8	95.2	128.1	3.95
	16:20	22.24	15.54	0.625	230	3.059	190.4	255.2	64.8	160.0	95.2	128.3	3.94
	16:25	22.44	15.69	0.626	230	3.081	190.4	255.2	64.8	160.0	95.2	128.3	3.94
	16:30	22.69	15.86	0.627	230	3.105	190.4	255.4	65.0	160.2	95.2	128.5	3.93
	16:35	22.97	16.06	0.628	230	3.133	190.2	255.3	65.1	160.2	95.1	128.5	3.92
	16:40	23.22	16.23	0.629	230	3.157	190.2	255.4	65.2	160.3	95.1	128.6	3.92
	16:45	23.43	16.38	0.630	230	3.178	190.2	255.6	65.4	160.5	95.1	128.8	3.91
	16:50	23.68	16.55	0.629	230	3.202	189.4	254.9	65.5	160.2	94.7	128.6	3.89
	16:55	23.92	16.72	0.620	229	3.226	185.8	251.5	65.7	158.6	92.9	127.6	3.83
	17:00	24.14	16.87	0.603	229	3.247	179.5	245.1	65.6	155.4	89.8	125.4	3.74
	17:05	24.40	17.06	0.593	229	3.273	175.6	241.4	65.8	153.6	87.8	124.3	3.67
	17:10	24.65	17.23	0.593	229	3.297	175.2	241.1	65.9	153.5	87.6	124.3	3.66
	17:15	24.90	17.41	0.594	229	3.322	175.1	241.1	66.0	153.6	87.6	124.4	3.65
	17:20	25.20	17.61	0.597	229	3.350	175.7	241.8	66.1	154.0	87.9	124.7	3.66
	17:25	25.43	17.77	0.599	229	3.372	176.0	242.2	66.2	154.2	88.0	124.9	3.66
	17:30	25.72	17.98	0.608	229	3.402	178.6	244.8	66.2	155.5	89.3	125.7	3.70
	17:35	25.94	18.13	0.616	229	3.423	181.0	247.3	66.3	156.8	90.5	126.6	3.73

Borehole No. : WCH-BH01 — **Sample Depth m:-** 7.00 - 8.00

Sample No. : 5 — **Specimen Depth m:-** 7.80 - 8.00

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 — **Works Order No.:** 059

Compiled by: W S Wat

Checked by: H W Chung

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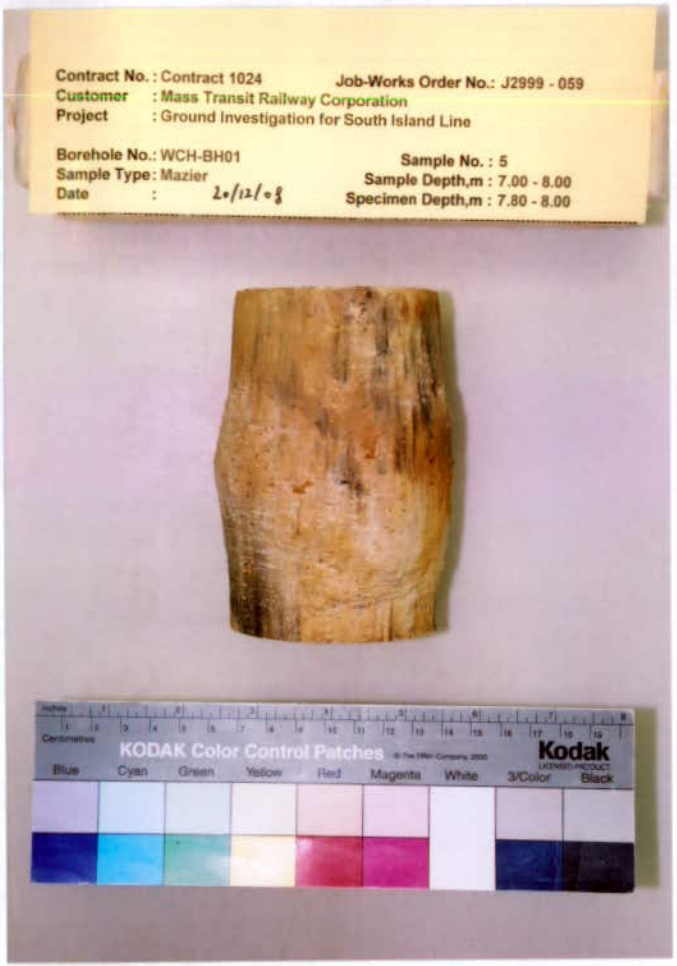
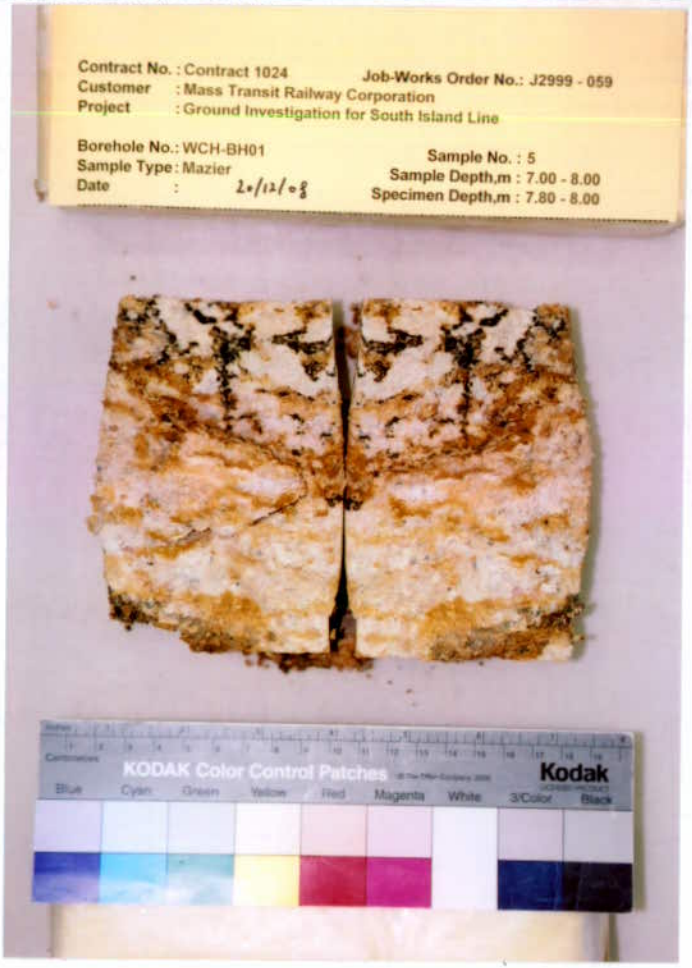
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT (GEOSPEC 3 : 2001 Test Method 15.2)





Description : Brown, slightly gravelly, sandy SILT/CLAY

Sample Origin : CDM‡ ‡ Information provided by customer

Borehole No. : WCH-BH01	Sample No. : 5	Sample Depth m:- 7.00 - 8.00	Specimen Depth m:- 7.80 - 8.00

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line

Contract No. : Contract 1024
Job No. : J2999
Works Order No.: 059

Compiled by W S Wat

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	WCH-BH01	WCH-BH01	WCH-BH01
Sample		no	5	5	5
Sample Type			Mazier	Mazier	Mazier
Stage		no	1	2	3
Sample Depth		m	7.00 - 8.00	7.00 - 8.00	7.00 - 8.00
Specimen Depth		m	7.60 - 7.80	7.60 - 7.80	7.60 - 7.80
INITIAL CONDITIONS					
Diameter	(D_o)	mm	73.8	73.9	74.6
Height	(H_o)	mm	145.0	141.9	137.1
Moisture Content	(W_o)	%	35	36	35
Bulk density	(ρ_o)	Mg/m^3	1.81	1.85	1.86
Dry density	(ρ_d)	Mg/m^3	1.34	1.36	1.38
Particle density	(ρ_s)		2.65	2.65	2.65
Voids Ratio	(e_o)		0.98	0.94	0.91
Degree of Saturation	(S_r)	%	94.6	100.6	100.6
DRAINAGE CONDITIONS			ONE END		
SATURATION					
Final Pore Pressure Coefficient B			1.00		
CONSOLIDATION					
Cell Pressure	(σ_3)	kPa	260	300	330
Back Pressure	(u_b)	kPa	225	225	225
Effective Pressure	(σ'_3)	kPa	35	75	105
Coefficient of Consolidation (t100) (C_{vi})		$m^2/Year$	377.83	587.40	810.79
Coefficient of Volume Compressibility (m_{vi})		m^2/MN	0.61	0.26	0.18
Coefficient of Permeability (k)		m/s	7.17E-08	4.79E-08	4.61E-08
COMPRESSION TERMINATION CRITERION			MAXIMUM STRESS RATIO		MAX ($\sigma'1 - \sigma'3$)
COMPRESSION - INITIAL					
Moisture Content	(w)	%	36	35	34
Pore Pressure at the End of Consolidation		kPa	225	225	225
Effective Stress at the End of Consolidation		kPa	35	75	105
Bulk density	(ρ_o)	Mg/m^3	1.85	1.86	1.88
Dry density	(ρ_d)	Mg/m^3	1.36	1.38	1.40
Voids Ratio	(e)		0.94	0.91	0.89
Degree of Saturation	(S_r)	%	100.6	100.6	100.6

Customer : **Mass Transit Railway Corporation**
Project : **Ground Investigation for South Island Line**
Report No. : J2999-059.11
Contract No.: Contract 1024
Job No.: **J2999** **Works Order No.: 059**

Technician : W S Wat Checked By : Name : H W Chung Approved By : Signatory : **Lau Wai Cheong**

Tested Date: 12/12/2008 Date : 20/12/2008 Date : 20/12/2008

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Form : GESR009.6 / Nov.10.06 / Issue 1 / Rev 1

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	WCH-BH01	WCH-BH01	WCH-BH01
Sample		no	5	5	5
Sample Type			Mazier	Mazier	Mazier
Stage		no	1	2	3
Sample Depth		m	7.00 - 8.00	7.00 - 8.00	7.00 - 8.00
Specimen Depth		m	7.60 - 7.80	7.60 - 7.80	7.60 - 7.80
COMPRESSION - FAILURE					
Cell Pressure		kPa	260	300	330
Rate of Strain		mm/min	0.048	0.047	0.045
CONDITIONS AT MAXIMUM STRESS RATIO					
Major Effective Principal Stress (σ'_1)		kPa	116	196	316
Corrected Deviator Stress ($\sigma'_1 - \sigma'_3$)		kPa	95	156	246
Minor Effective Principal Stress (σ'_3)		kPa	21	40	70
$s' = (\sigma'_1 + \sigma'_3)/2$		kPa	69	118	193
$t = (\sigma_1 - \sigma_3)/2$		kPa	47	78	123
Expanded Uncertainty of s' ^		kPa	-	-	-
Expanded Uncertainty of t ^		kPa	-	-	-
Pore pressure parameter A_f			0.15	0.22	0.14
Strain at Failure	(εf)	%	1.4	4.7	10.1
COMPRESSION - FINAL					
Moisture Content	(W_f)	%	36	35	34
Bulk density	(ρ_o)	Mg/m^3	1.85	1.86	1.88
Dry density	(ρ_d)	Mg/m^3	1.36	1.38	1.40
Voids Ratio	(e_f)		0.94	0.91	0.89
Degree of Saturation	(S_f)	%	100.6	100.6	100.6

Notes -
1. The method of specimen preparation was in accordance with GEOSPEC 3 : 2001 :- Test method 13.3 : test specimen from undisturbed soil samples.
2. Sample received date :29/09/2008
3. The determination of moisture content was in accordance with test method 5.1 of GEOSPEC 3 : 2001.
4. Particle density : 2.65 (Assumed)
5. Maximum and minimum temperature recorded over the period of testing 19.9 - 20.7 °C.
6. Unavoidable variations from specified procedure : none
7. Comment on observed or inferred sample disturbance : none
8. Percentage by mass of soil particles larger than 1/5 of the diameter of specimen (%) : Nil
9. The specimen was selected by the laboratory.
   Name : W S Wat Designation : Senior Laboratory Technician
10. Sampling History : As Received

* Delete as appropriate ^ Upon request

Customer : **Mass Transit Railway Corporation**
Project : **Ground Investigation for South Island Line**
Contract No.: Contract 1024
Job No.: **J2999** **Works Order No.: 059**

Compiled by W S Wat
Checked by H W Chung

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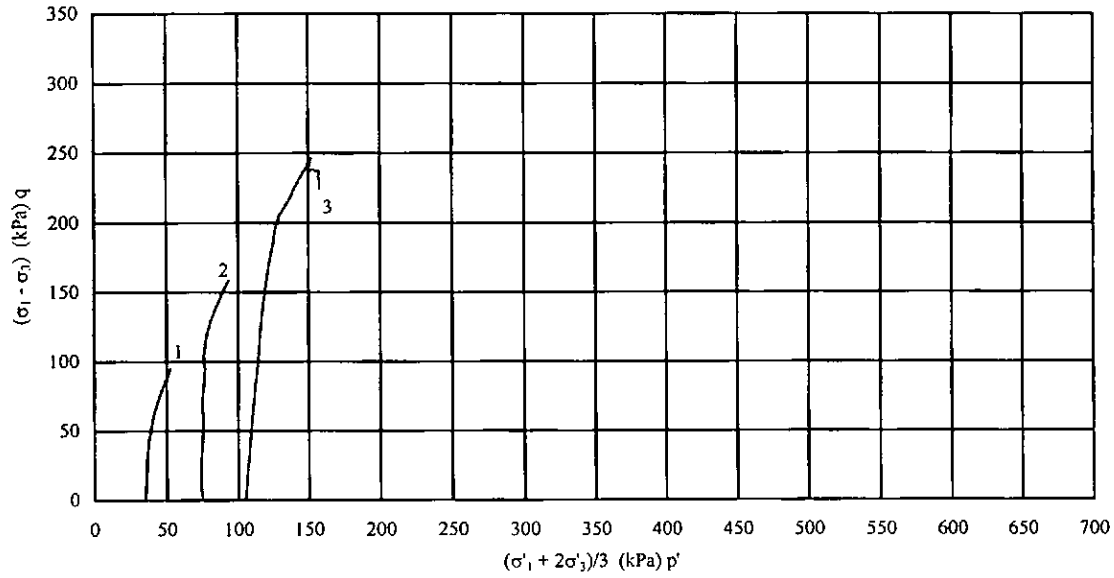
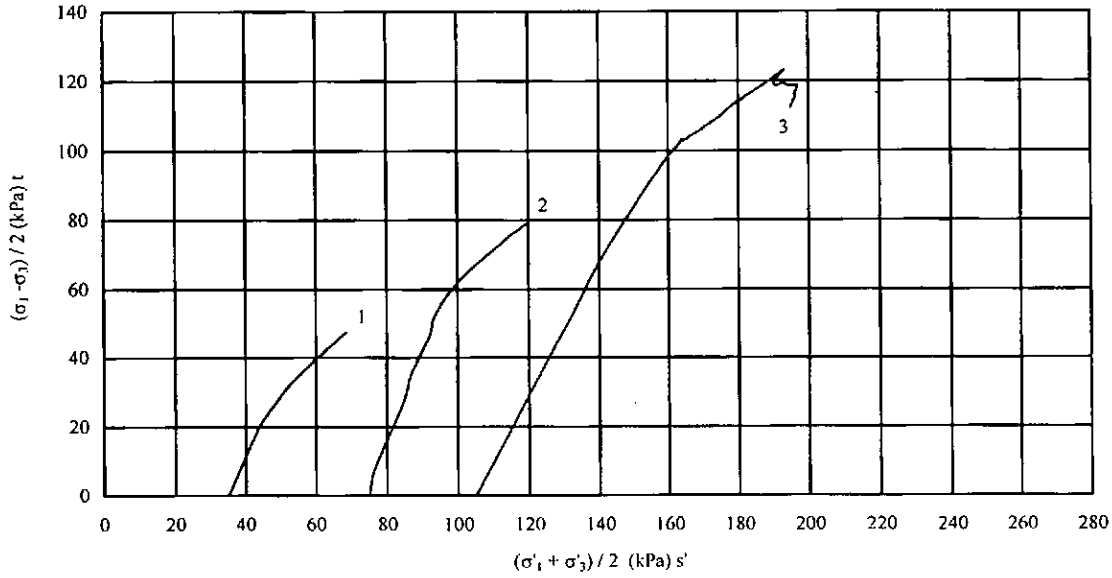
TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

STRESS PATH PARAMETERS FOR EFFECTIVE STRESS

p' - q PLOT



s' - t PLOT



Borehole No. :	**WCH-BH01**	**Sample Depth m:-**	**7.00 - 8.00**
Sample No. :	**5**	**Specimen Depth m:-**	**7.60 - 7.80**
Customer :	**Mass Transit Railway Corporation**		Compiled by W S Wat
Project :	**Ground Investigation for South Island Line**		
		Contract No.: Contract 1024	Checked by H W Chung
Job No.:	**J2999**	**Works Order No.: 059**	

Form : GESR009.8 / Jun.02.03 / Issue 1 / Rev 0

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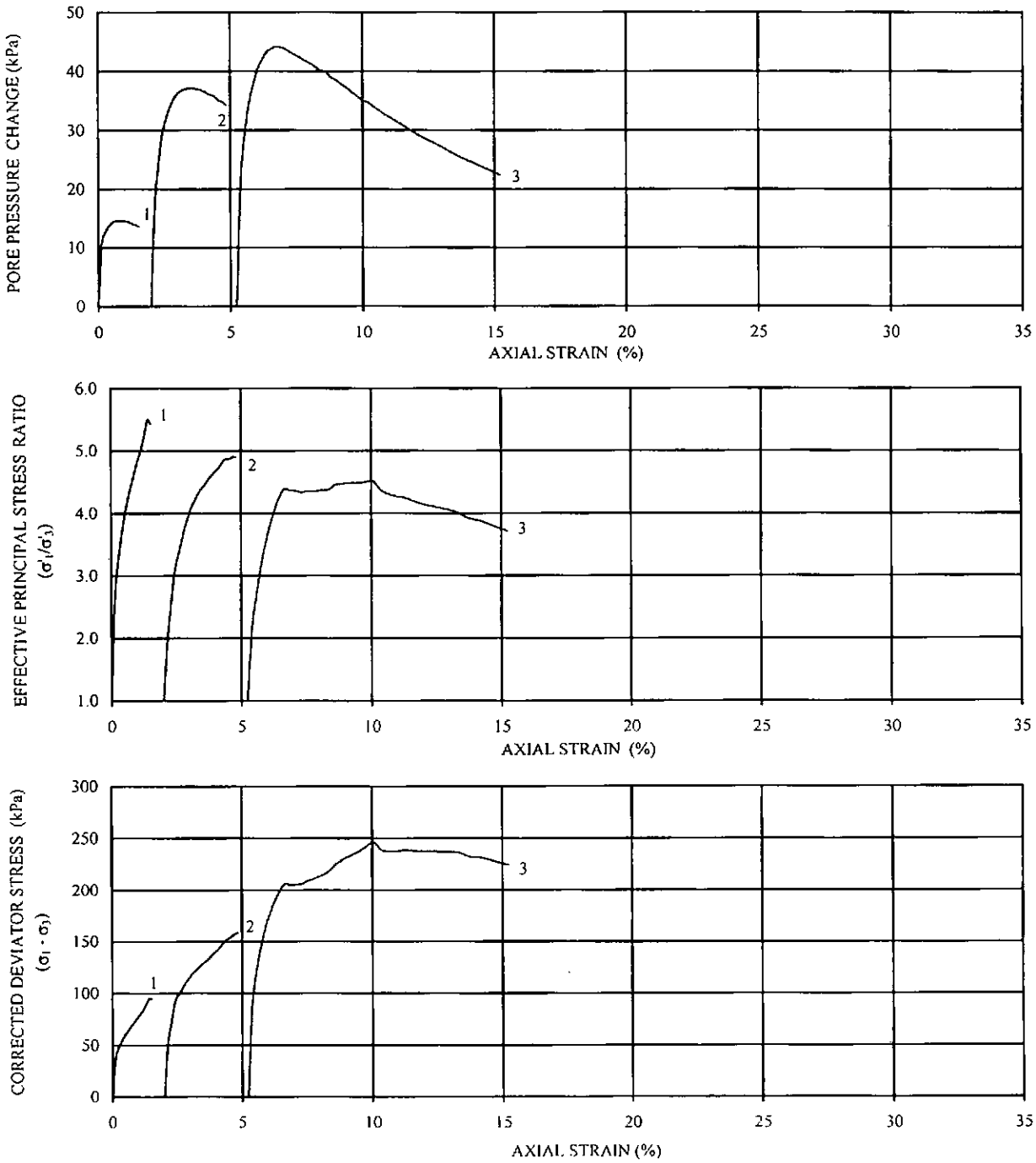
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

COMPRESSION



Borehole No. : WCH-BH01 **Sample Depth m:-** 7.00 - 8.00
Sample No. : 5 **Specimen Depth m:-** 7.60 - 7.80

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.:** 059

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Checked by H W Chung

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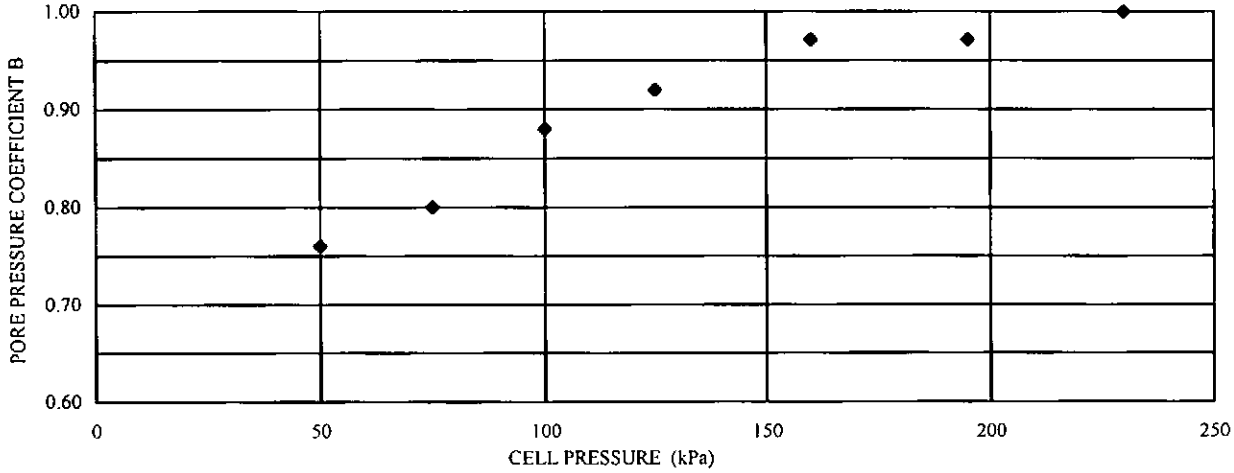
TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

SATURATION



Date	Time	Cell Pressure kPa	Back Pressure kPa	Pore Pressure kPa	Cumulative Volume of Water cm^3	Pore Pressure Parameter B
12/12/2008	15:47	0	0	-	0.0	
	16:10	25	-	24		-
15/12/2008	09:11	25	20	20	-3.7	
	09:20	50	-	39		0.76
	10:10	50	45	45	-2.3	
	10:16	75	-	65		0.80
	10:55	75	70	70	4.2	
	11:06	100	-	92		0.88
	11:55	100	95	95	7.2	
	12:07	125	-	118		0.92
	12:50	125	120	120	17.4	
	13:00	160	-	154		0.97
	14:11	160	155	155	17.7	
	14:26	195	-	189		0.97
	14:35	195	190	190	18.1	
	14:47	230	-	225		1.00
17/12/2008	09:05	230	225	225	18.2	

Borehole No. : WCH-BH01 **Sample Depth m:-** 7.00 - 8.00
Sample No. : 5 **Specimen Depth m:-** 7.60 - 7.80

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.:** 059

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Checked by H W Chung

Form : GESR009.11 / Jun.02.03 / Issue 1 / Rev 0

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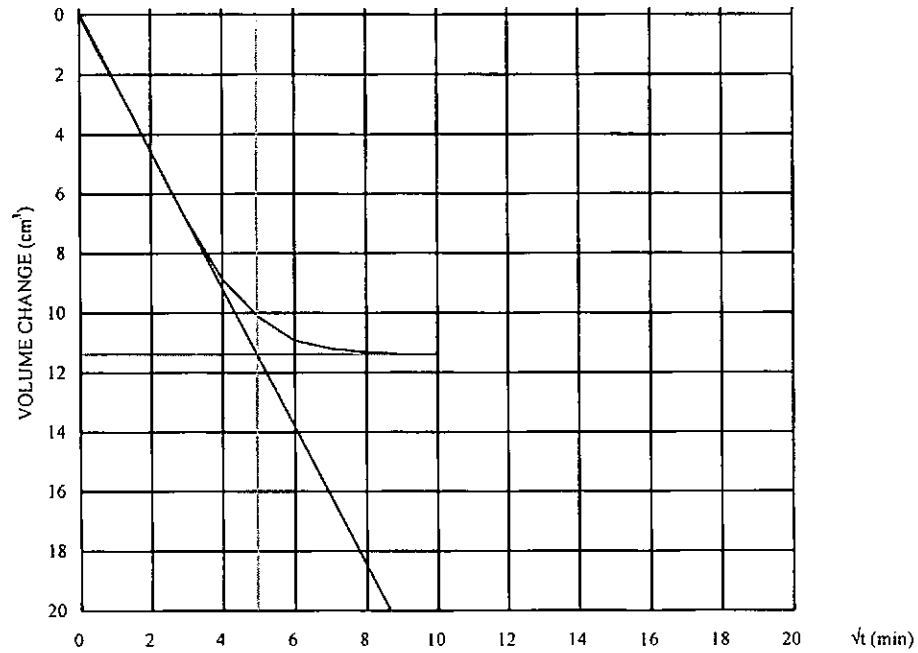
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

CONSOLIDATION (DRAINED PHASE) - Stage 1

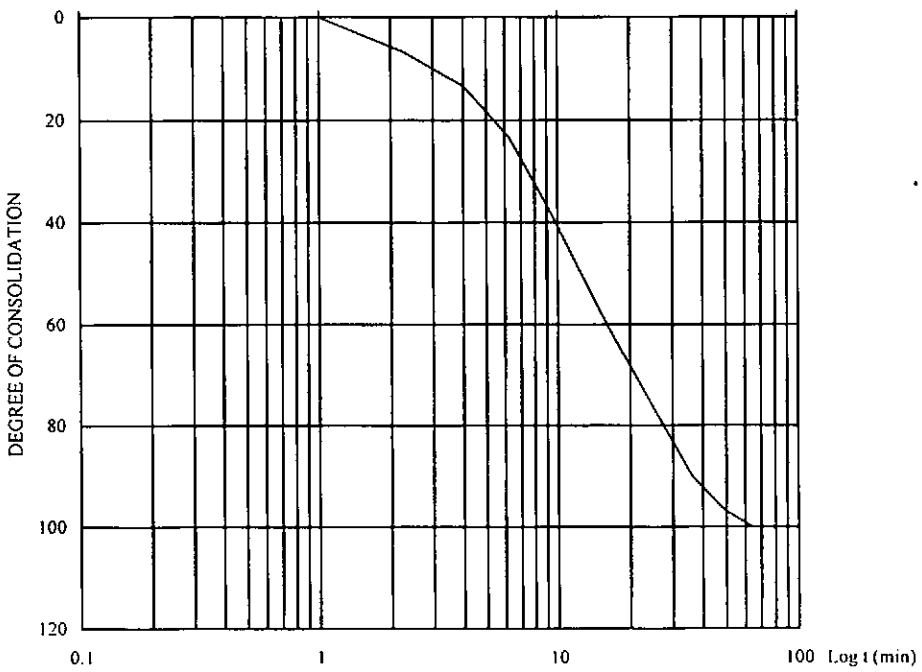


√t100 4.95 min

t100 24.47 min

tf 12.97 min

Calc. strain rate
0.778 mm/min



Borehole No. : WCH-BH01 **Sample Depth m:-** 7.00 - 8.00

Sample No. : 5 **Specimen Depth m:-** 7.60 - 7.80

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.:** 059

Complied by: W S Wat

Checked by: H W Chung

Form : GESR009.13 / Jun.02.03 / Issue 1 / Rev 0

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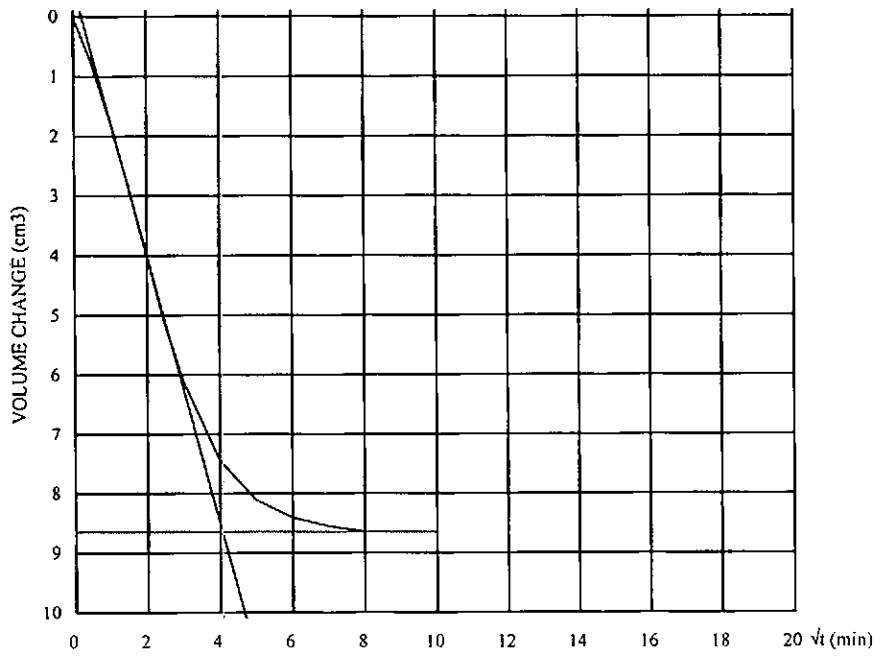
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

CONSOLIDATION (DRAINED PHASE) - Stage 2

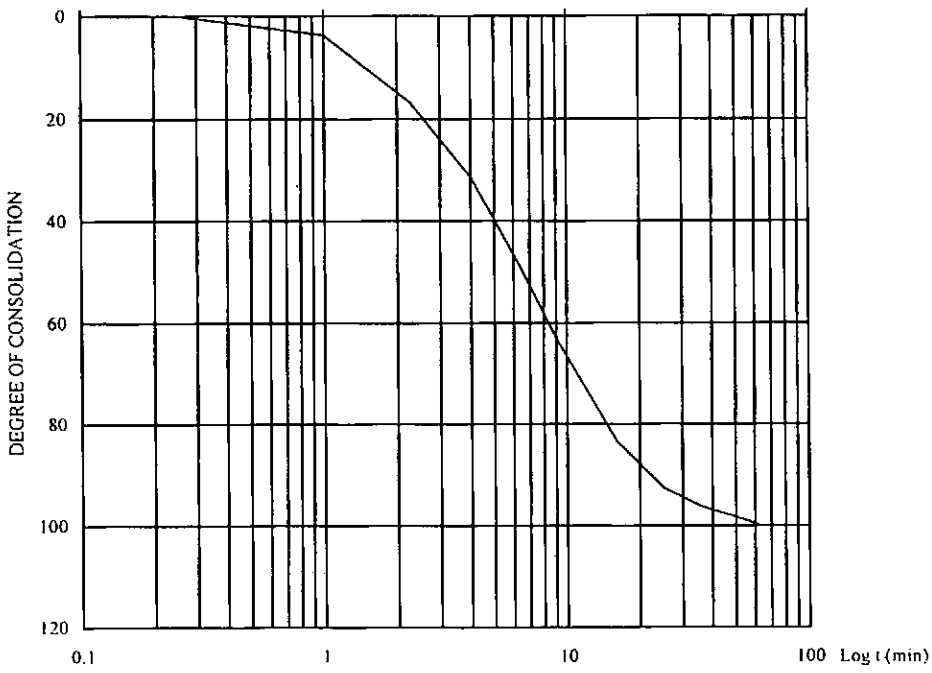


√t100 4.07 min

t100 16.56 min

tf 8.78 min

Calc. strain rate
1.126 mm/min



Borehole No. : WCH-BH01 **Sample Depth m:-** 7.00 - 8.00

Sample No. : 5 **Specimen Depth m:-** 7.60 - 7.80

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.:** 059

Complied by: W S Wat

Checked by: H W Chung

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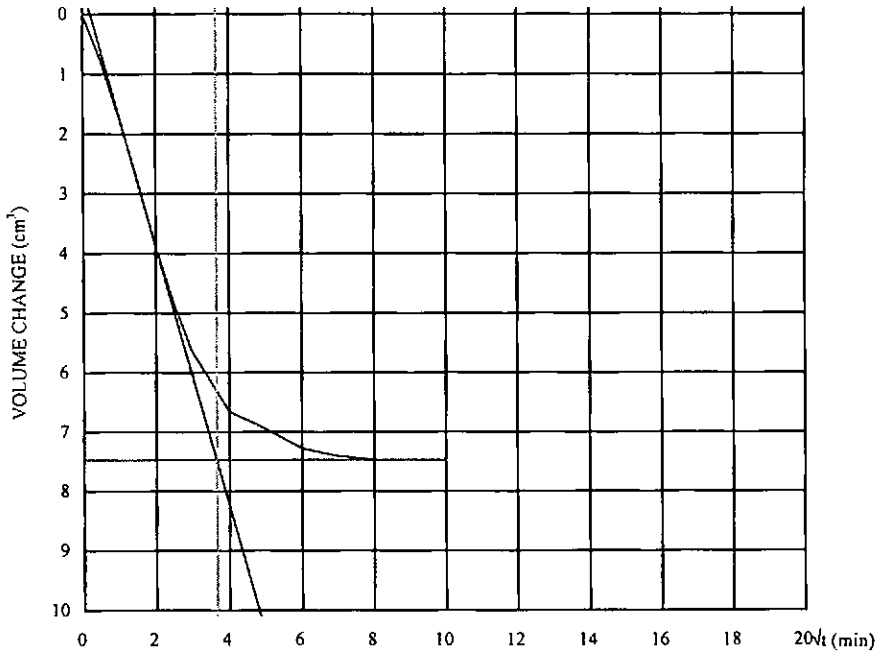
TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

CONSOLIDATION (DRAINED PHASE) - Stage 3

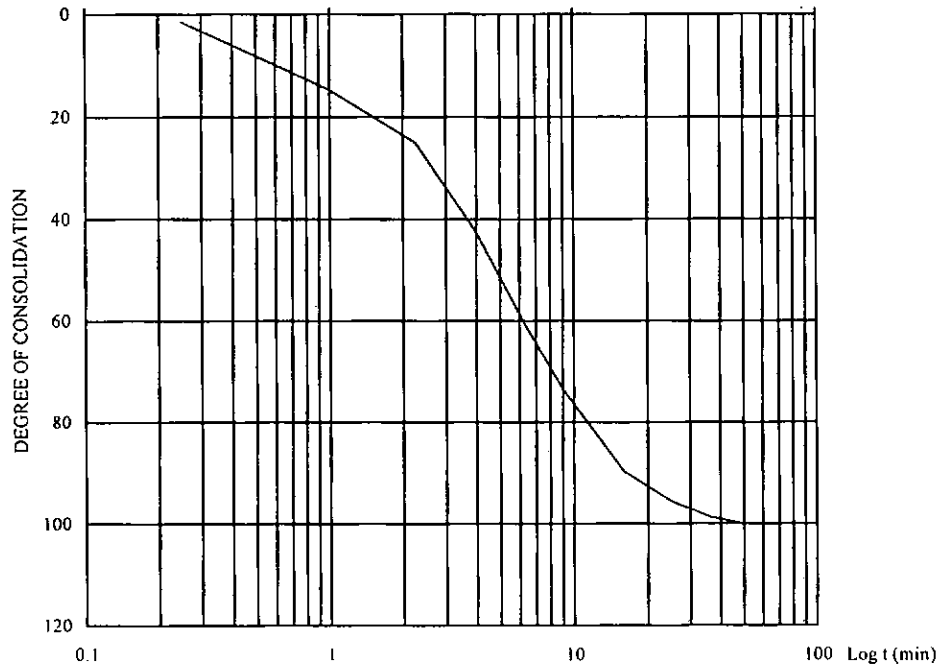


√t100 3.66 min

t100 13.37 min

tf 7.09 min

Calc. strain rate
1.349 mm/min



Borehole No. : WCH-BH01 **Sample Depth m:-** 7.00 - 8.00

Sample No. : 5 **Specimen Depth m:-** 7.60 - 7.80

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.:** 059

Complied by: W S Wat

Checked by: H W Chung

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Multi Stage		P.W.P,B.P		Effective Pressure 35	kPa
Side drains	No	Selected Machine Speed	0.048 mm/min	Rate of Strain 2.00	% per hr

FAILURE CRITERION

Max. deviator Stress ☐	Max. Stress ratio ☒	Axial Strain % ☐

Stage : 1	Applied Pressure (kPa) - Cell : 260	Back : 225	P.R. factor 1.7511	kN/mm

Date	Time	Strain Dial	Strain	Load P.R.No. 33	Pore Pressure	Dev. stress Corr.	Dev. stress q $\sigma_1 - \sigma_3$	Effective Stress σ'_1	Effective Stress σ'_3	s' $(\sigma'_1+\sigma'_3)$ 2	t $(\sigma_1-\sigma_3)$ 2	p' $(\sigma'_1+2\sigma'_3)$ 3	Stress Ratio σ'_1/σ'_3
		mm	%	mm	kPa	kPa							
17/12	10:50	0.00	0.00	0.083	225	0.000	0.0	35.0	35.0	35.0	0.0	35.0	1.00
	10:55	0.17	0.12	0.174	236	0.035	37.7	62.2	24.5	43.3	18.8	37.1	2.54
	11:00	0.31	0.22	0.195	237	0.064	46.3	69.0	22.7	45.8	23.1	38.1	3.04
	11:05	0.58	0.40	0.220	239	0.115	56.5	77.8	21.3	49.5	28.2	40.1	3.65
	11:10	0.79	0.55	0.234	239	0.158	62.1	82.7	20.6	51.7	31.1	41.3	4.02
	11:15	1.00	0.69	0.247	240	0.197	67.3	87.7	20.4	54.1	33.7	42.8	4.30
	11:20	1.20	0.83	0.258	240	0.236	71.7	92.1	20.4	56.3	35.9	44.3	4.52
	11:25	1.45	1.00	0.273	240	0.283	77.7	98.1	20.4	59.3	38.9	46.3	4.81
	11:30	1.65	1.15	0.285	239	0.324	82.5	103.1	20.6	61.8	41.2	48.1	5.00
	11:35	1.85	1.28	0.300	239	0.359	88.5	109.4	20.9	65.1	44.2	50.4	5.23
	11:40	**2.05**	**1.42**	**0.316**	**239**	**0.397**	**94.8**	**115.9**	**21.1**	**68.5**	**47.4**	**52.7**	**5.50**
	11:45	2.21	1.53	0.316	239	0.426	94.7	116.1	21.4	68.8	47.4	53.0	5.43

Borehole No. : WCH-BH01 **Sample Depth m:-** 7.00 - 8.00

Sample No. : 5 **Specimen Depth m:-** 7.60 - 7.80

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.:** 059

Compiled by: W S Wat

Checked by: H W Chung

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Multi Stage			P.W.P,B.P					Effective Pressure	75				kPa
Side drains	No		Selected Machine Speed		0.047	mm/min		Rate of Strain	2.00				% per hr
FAILURE CRITERION													
Max. deviator Stress		☐	Max. Stress ratio			☒		Axial Strain %					☐
Stage :	2	Applied Pressure (kPa) - Cell :		300	Back :	225		P.R. factor		1.7511			kN/mm

Date	Time	Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
		Dial		P.R.No. 33	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
17/12	13:55	2.88	2.00	0.091	225	0.000	0.0	75.0	75.0	75.0	0.0	75.0	1.00
	14:00	2.93	2.03	0.129	231	0.558	15.1	83.9	68.8	76.4	7.6	73.8	1.22
	14:05	3.08	2.14	0.224	243	0.586	54.2	111.7	57.5	84.6	27.1	75.6	1.94
	14:10	3.24	2.25	0.263	248	0.614	70.1	121.8	51.7	86.8	35.1	75.1	2.36
	14:15	3.44	2.39	0.311	253	0.650	89.7	136.3	46.6	91.4	44.8	76.5	2.92
	14:20	3.56	2.47	0.326	255	0.670	95.7	140.4	44.7	92.6	47.9	76.6	3.14
	14:25	3.78	2.63	0.341	258	0.710	101.7	143.8	42.1	92.9	50.8	76.0	3.42
	14:30	4.00	2.77	0.358	260	0.745	108.5	149.0	40.5	94.7	54.2	76.7	3.68
	14:35	4.19	2.91	0.370	261	0.779	113.2	152.5	39.3	95.9	56.6	77.0	3.88
	14:40	4.41	3.06	0.383	262	0.816	118.3	156.8	38.5	97.6	59.1	77.9	4.07
	14:45	4.66	3.24	0.395	262	0.860	122.9	161.0	38.1	99.5	61.4	79.1	4.23
	14:50	4.95	3.44	0.408	262	0.907	127.9	165.8	37.9	101.8	63.9	80.5	4.37
	14:55	5.20	3.61	0.417	262	0.948	131.2	169.1	37.9	103.5	65.6	81.6	4.46
	15:00	5.40	3.75	0.426	262	0.981	134.7	172.7	38.0	105.3	67.3	82.9	4.54
	15:05	5.65	3.92	0.437	262	1.020	138.8	177.0	38.2	107.6	69.4	84.5	4.63
	15:10	5.90	4.09	0.448	261	1.059	143.0	181.6	38.6	110.1	71.5	86.3	4.70
	15:15	6.11	4.24	0.460	261	1.093	147.5	186.5	39.0	112.8	73.8	88.2	4.78
	15:20	6.31	4.38	0.470	261	1.125	151.3	190.5	39.2	114.9	75.7	89.6	4.86
	15:25	6.62	4.59	0.480	260	1.172	154.9	194.9	40.0	117.5	77.5	91.6	4.87
	15:30	**6.74**	**4.68**	**0.484**	**260**	**1.192**	**156.4**	**196.5**	**40.1**	**118.3**	**78.2**	**92.2**	**4.90**
	15:35	6.96	4.83	0.490	259	1.225	158.5	199.2	40.7	120.0	79.3	93.5	4.89

Borehole No. :	**WCH-BH01**	**Sample Depth m:- 7.00 - 8.00**	
Sample No. :	**5**	**Specimen Depth m:- 7.60 - 7.80**	
Customer :	**Mass Transit Railway Corporation**		Compiled by
Project :	**Ground Investigation for South Island Line**		W S Wat
		Contract No.: Contract 1024	Checked by
Job No.:	**J2999**	**Works Order No.: 059**	H W Chung

Form : GESR009.14 / Dec.13.04 / Issue 1 / Rev 1

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Multi Stage		P.W.P,B.P		Effective Pressure 105	kPa
Side drains	No	Selected Machine Speed	0.045 mm/min	Rate of Strain 1.98	% per hr

FAILURE CRITERION

Max. deviator Stress ☐	Max. Stress ratio ☒	Axial Strain % ☐

Stage : 3	Applied Pressure (kPa) - Cell : 330	Back : 225	P.R. factor 1.7511	kN/mm

Date	Time	Strain Dial	Strain %	Load P.R.No. 33	Pore Pressure	Dev. stress Corr.	Dev. stress q $\sigma_1 - \sigma_3$	Effective Stress σ'_1	Effective Stress σ'_3	s' $(\sigma'_1+\sigma'_3)$ 2	t $(\sigma_1-\sigma_3)$ 2	p' $(\sigma'_1+2\sigma'_3)$ 3	Stress Ratio σ'_1/σ'_3
		mm	%	mm	kPa	kPa							
18/12	08:40	7.53	5.23	0.119	225	0.000	0.0	105.0	105.0	105.0	0.0	105.0	1.00
	08:45	7.73	5.37	0.320	244	1.342	79.7	165.4	85.7	125.5	39.8	112.3	1.93
	08:50	7.87	5.46	0.384	250	1.361	105.4	185.1	79.7	132.4	52.7	114.8	2.32
	08:55	8.05	5.59	0.436	256	1.389	126.1	200.4	74.3	137.3	63.0	116.3	2.70
	09:00	8.23	5.71	0.478	259	1.414	142.8	213.4	70.6	142.0	71.4	118.2	3.02
	09:05	8.44	5.86	0.520	262	1.445	159.4	227.0	67.6	147.3	79.7	120.7	3.36
	09:10	8.63	5.99	0.550	265	1.472	171.1	236.6	65.5	151.1	85.6	122.5	3.61
	09:15	8.81	6.12	0.573	266	1.499	180.1	244.0	63.9	153.9	90.0	123.9	3.82
	09:20	9.00	6.24	0.593	267	1.523	187.8	250.7	62.9	156.8	93.9	125.5	3.99
	09:25	9.18	6.37	0.611	268	1.549	194.7	256.5	61.8	159.1	97.3	126.7	4.15
	09:30	9.44	6.55	0.634	269	1.585	203.4	264.6	61.2	162.9	101.7	129.0	4.32
	09:35	9.63	6.68	0.643	269	1.611	206.7	267.6	60.9	164.2	103.3	129.8	4.39
	09:40	9.87	6.85	0.640	269	1.645	205.1	266.0	60.9	163.4	102.5	129.3	4.37
	09:45	10.13	7.03	0.642	269	1.680	205.4	266.5	61.1	163.8	102.7	129.6	4.36
	09:50	10.31	7.15	0.644	269	1.703	205.9	267.3	61.4	164.4	103.0	130.0	4.35
	09:55	10.56	7.33	0.647	268	1.738	206.7	268.6	61.9	165.2	103.3	130.8	4.34
	10:00	10.81	7.50	0.654	268	1.770	209.0	271.3	62.3	166.8	104.5	132.0	4.36
	10:05	11.03	7.65	0.658	267	1.799	210.2	272.9	62.7	167.8	105.1	132.8	4.35
	10:10	11.30	7.85	0.665	267	1.836	212.5	275.8	63.3	169.5	106.2	134.1	4.36
	10:15	11.53	8.00	0.670	266	1.864	214.1	277.7	63.6	170.6	107.0	135.0	4.37
	10:20	11.75	8.15	0.675	266	1.891	215.6	279.6	64.0	171.8	107.8	135.9	4.37
	10:25	11.97	8.31	0.682	265	1.921	218.0	282.6	64.6	173.6	109.0	137.3	4.37
	10:30	12.22	8.48	0.693	265	1.952	221.8	286.8	65.0	175.9	110.9	138.9	4.41
	10:35	12.43	8.63	0.704	265	1.978	225.7	290.9	65.2	178.1	112.9	140.4	4.46
	10:40	12.72	8.83	0.714	264	2.014	229.1	295.2	66.1	180.6	114.5	142.5	4.47
	10:45	12.93	8.97	0.721	264	2.039	231.4	297.8	66.4	182.1	115.7	143.5	4.48
	10:50	13.12	9.11	0.726	263	2.063	232.9	299.8	66.9	183.4	116.5	144.5	4.48
	10:55	13.40	9.30	0.734	263	2.097	235.5	303.0	67.5	185.3	117.8	146.0	4.49
	11:00	13.63	9.46	0.739	262	2.124	237.0	305.0	68.0	186.5	118.5	147.0	4.49
	11:05	13.81	9.58	0.745	262	2.145	239.0	307.5	68.5	188.0	119.5	148.2	4.49
	11:10	14.03	9.74	0.753	261	2.172	241.6	310.6	69.0	189.8	120.8	149.5	4.50
	11:15	14.26	9.90	0.762	260	2.199	244.6	314.2	69.6	191.9	122.3	151.1	4.51
	11:20	**14.49**	**10.05**	**0.768**	**260**	**2.224**	**246.4**	**316.4**	**70.0**	**193.2**	**123.2**	**152.1**	**4.52**
	11:25	14.70	10.20	0.760	260	2.250	242.9	313.1	70.2	191.7	121.5	151.2	4.46
	11:30	14.93	10.36	0.750	259	2.276	238.7	309.5	70.8	190.1	119.3	150.4	4.37
	11:35	15.19	10.54	0.749	259	2.306	237.8	309.2	71.4	190.3	118.9	150.7	4.33
	11:40	15.39	10.68	0.749	258	2.329	237.4	309.2	71.8	190.5	118.7	150.9	4.31
	11:45	15.62	10.84	0.750	258	2.355	237.3	309.6	72.3	190.9	118.6	151.4	4.28
	12:00	16.22	11.26	0.757	257	2.422	238.7	312.1	73.4	192.8	119.4	153.0	4.25

Borehole No. : WCH-BH01 **Sample Depth m:- 7.00 - 8.00**

Sample No. : 5 **Specimen Depth m:- 7.60 - 7.80**

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.: 059**

Compiled by W S Wat

Checked by H W Chung

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2
Shearing Continuation

FAILURE CRITERION

Max. deviator Stress ☐ | Max. Stress ratio ☒ | Axial Strain % ☐

Stage : 3		Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
Date	Time	Dial		P.R.No. 33	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
18/12	12:15	17.03	11.82	0.758	255	2.511	237.5	312.5	75.0	193.8	118.8	154.2	4.17
	12:30	17.70	12.28	0.762	254	2.582	237.7	313.9	76.2	195.0	118.8	155.4	4.12
	12:45	18.38	12.76	0.765	253	2.655	237.4	314.6	77.2	195.9	118.7	156.3	4.08
	13:00	19.08	13.24	0.768	252	2.727	237.1	315.5	78.4	197.0	118.6	157.4	4.02
	13:15	19.80	13.74	0.760	250	2.801	232.7	312.3	79.6	196.0	116.4	157.2	3.92
	13:30	20.48	14.21	0.761	250	2.870	231.7	312.2	80.5	196.4	115.9	157.7	3.88
	13:45	21.21	14.72	0.755	248	2.943	228.1	309.7	81.6	195.6	114.0	157.6	3.80
	14:00	21.94	15.23	0.749	247	3.016	224.5	307.1	82.6	194.8	112.2	157.4	3.72

Borehole No. : WCH-BH01 **Sample Depth m:- 7.00 - 8.00**

Sample No. : 5 **Specimen Depth m:- 7.60 - 7.80**

Customer : Mass Transit Railway Corporation | Compiled by W S Wat

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024 | Checked by H W Chung

Job No.: J2999 **Works Order No.: 059**

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT (GEOSPEC 3 : 2001 Test Method 15.2)

Description : Brown, slightly gravelly, sandy SILT/CLAY

Sample Origin : CDM ‡ ‡ Information provided by customer

Borehole No. : WCH-BH01	Sample No. : 5	Sample Depth m:- 7.00 - 8.00	Specimen Depth m:- 7.60 - 7.80

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line

Contract No.: Contract 1024
Job No.: J2999
Works Order No.: 059

Compiled by W S Wat

Checked by H W Chung

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	WCH-BH01		
Sample		no	9		
Sample Type			Mazier		
Stage		no	1		
Sample Depth		m	9.00 - 10.00		
Specimen Depth		m	9.60 - 9.80		
INITIAL CONDITIONS					
Diameter	(D_o)	mm	74.0		
Height	(H_o)	mm	145.0		
Moisture Content	(W_o)	%	31		
Bulk density	(ρ_o)	Mg/m^3	1.90		
Dry density	(ρ_d)	Mg/m^3	1.45		
Particle density	(ρ_s)		2.65		
Voids Ratio	(e_o)		0.83		
Degree of Saturation	(S_r)	%	100.1		
DRAINAGE CONDITIONS			ONE END		
SATURATION					
Final Pore Pressure Coefficient B			1.00		
CONSOLIDATION					
Cell Pressure	(σ_3)	kPa	340		
Back Pressure	(u_b)	kPa	245		
Effective Pressure	(σ'_3)	kPa	95		
Coefficient of Consolidation (t100) (C_{vi})		m^2/Year	3682.60		
Coefficient of Volume Compressibility (m_{vi})		m^2/MN	0.42		
Coefficient of Permeability (k)		m/s	4.77E-07		
COMPRESSION TERMINATION CRITERION			MAXIMUM DEVIATOR STRESS		
COMPRESSION - INITIAL					
Moisture Content	(w)	%	29		
Pore Pressure at the End of Consolidation		kPa	245		
Effective Stress at the End of Consolidation		kPa	95		
Bulk density	(ρ_o)	Mg/m^3	1.94		
Dry density	(ρ_d)	Mg/m^3	1.50		
Voids Ratio	(e)		0.76		
Degree of Saturation	(S_r)	%	100.5		

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Report No. : J2999-059.11
Contract No.: Contract 1024
Job No.: J2999
Works Order No.: 059

Technician : W S Wat
Checked By : Name : H W Chung Date : 09/01/2009
Approved By : Signatory : **Lau Wai Cheong** Date : 09/01/2009
Tested Date: 23/12/2009

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DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	WCH-BH01		
Sample		no	9		
Sample Type			Mazier		
Stage		no	1		
Sample Depth		m	9.00 - 10.00		
Specimen Depth		m	9.60 - 9.80		
COMPRESSION - FAILURE					
Cell Pressure		kPa	340		
Rate of Strain		mm/min	0.047		
CONDITIONS MAXIMUM DEVIATOR STRESS					
Major Effective Principal Stress (σ'_1)		kPa	338		
Corrected Deviator Stress ($\sigma'_1 - \sigma'_3$)		kPa	257		
Minor Effective Principal Stress (σ'_3)		kPa	81		
$s' = (\sigma'_1 + \sigma'_3)/2$		kPa	209		
$t = (\sigma_1 - \sigma_3)/2$		kPa	129		
Expanded Uncertainty of s' ^		kPa	-		
Expanded Uncertainty of t ^		kPa	-		
Pore pressure parameter A_f			0.05		
Strain at Failure	(εf)	%	11.7		
COMPRESSION - FINAL					
Moisture Content	(W_f)	%	29		
Bulk density	(ρ_o)	Mg/m^3	1.94		
Dry density	(ρ_d)	Mg/m^3	1.50		
Voids Ratio	(e_f)		0.76		
Degree of Saturation	(S_f)	%	100.5		

Notes -
1. The method of specimen preparation was in accordance with GEOSPEC 3 : 2001 :- Test method 13.3 : test specimen from undisturbed soil samples.
2. Sample received date :29/09/2008
3. The determination of moisture content was in accordance with test method 5.1 of GEOSPEC 3 : 2001.
4. Particle density : 2.65 (Assumed)
5. Maximum and minimum temperature recorded over the period of testing 19.9 - 20.7 °C.
6. Unavoidable variations from specified procedure : none
7. Comment on observed or inferred sample disturbance : none
8. Percentage by mass of soil particles larger than 1/5 of the diameter of specimen (%) : Nil
9. The specimen was selected by the laboratory.
   Name : W S Wat Designation : Senior Laboratory Technician
10. Sampling History : As Received

* Delete as appropriate ^ Upon request

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.: 059**

Compiled by W S Wat
Checked by H W Chung

Form : GESR009.7 / Nov.10.06 / Issue 1 / Rev 1

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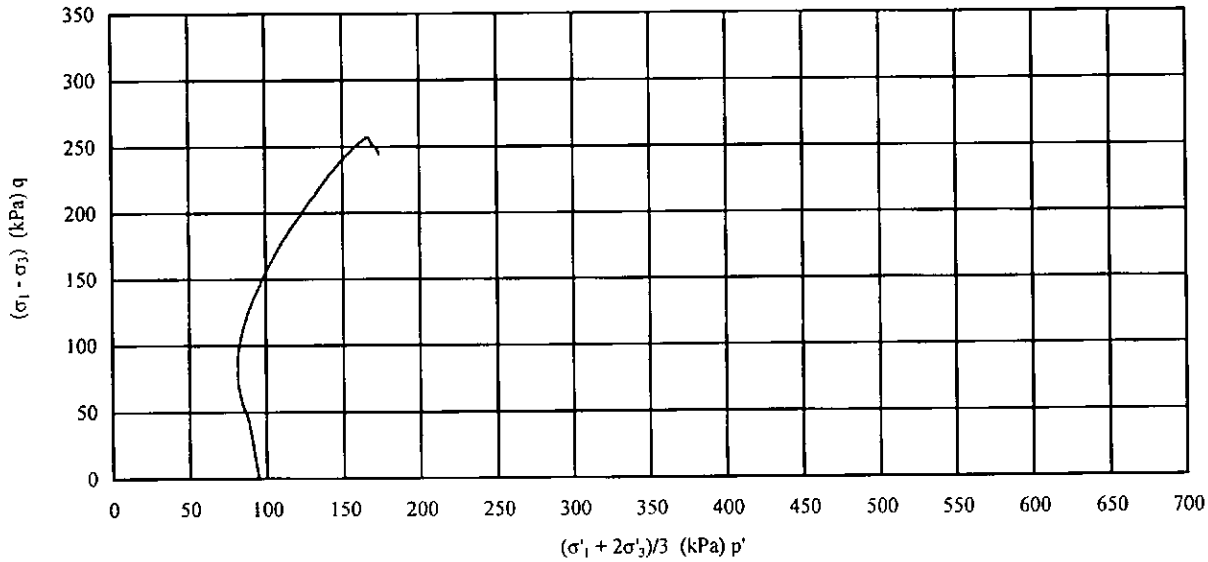
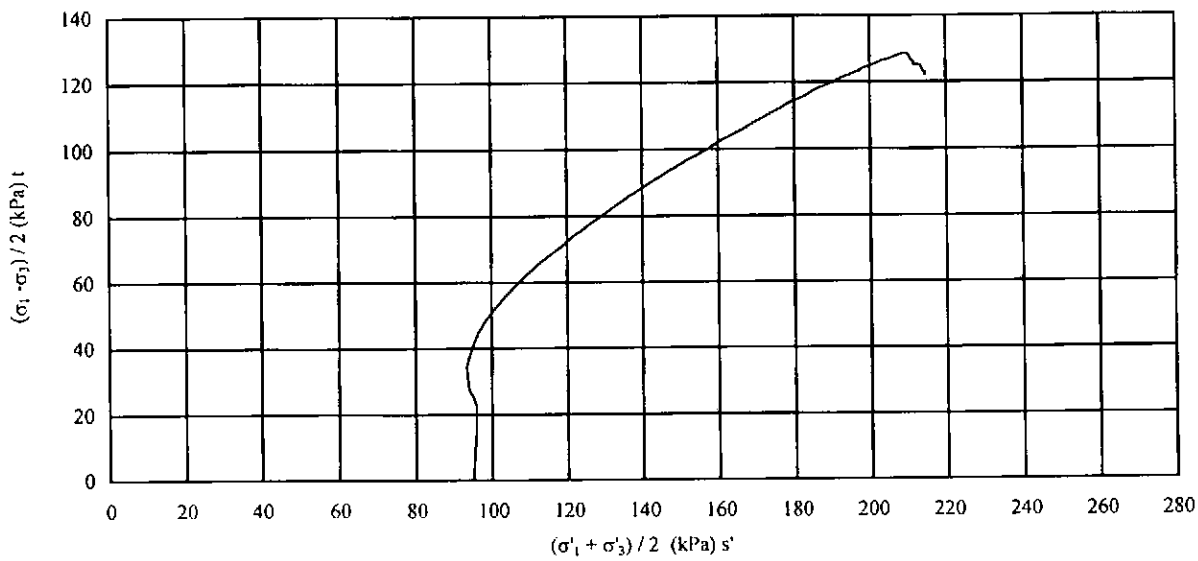
TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

STRESS PATH PARAMETERS FOR EFFECTIVE STRESS

p' - q PLOT



s' - t PLOT



Borehole No. : WCH-BH01 **Sample Depth m:-** 9.00 - 10.00
Sample No. : 9 **Specimen Depth m:-** 9.60 - 9.80

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.:** 059

Compiled by: W S Wat
Checked by: H W Chung

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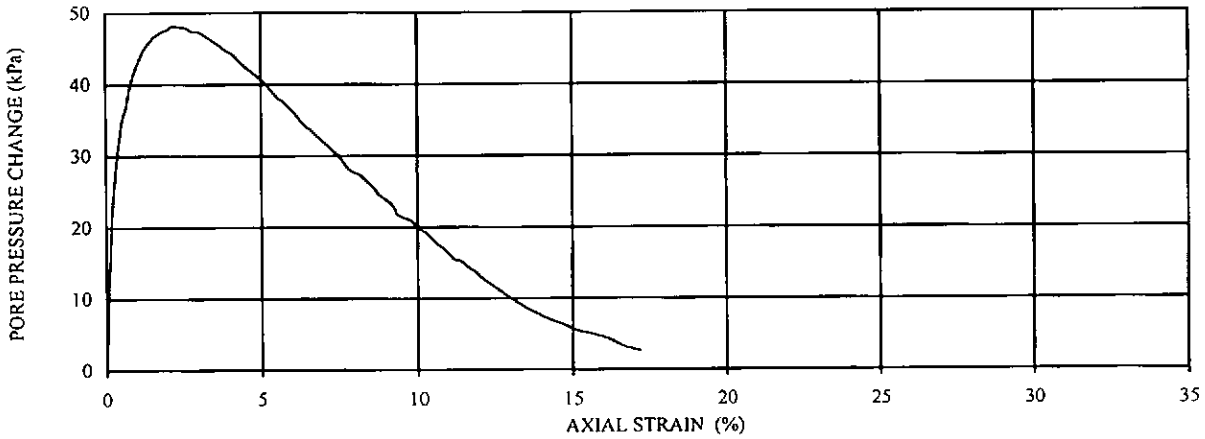
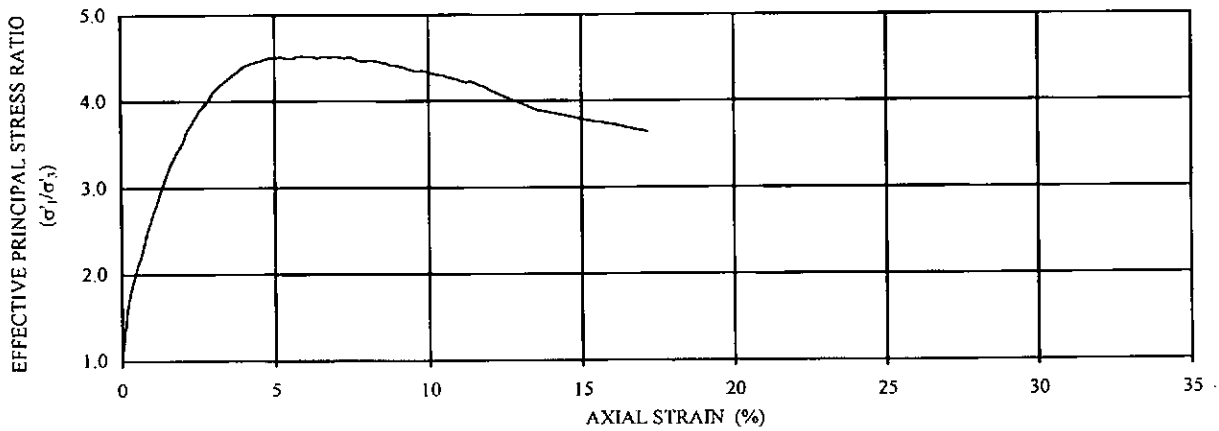
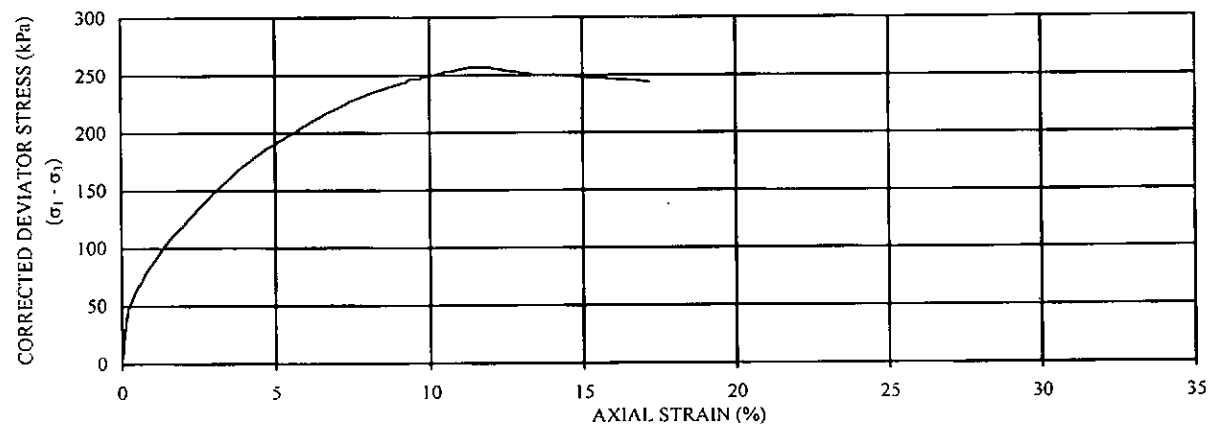
Form : GESR009.8 / Jun.02.03 / Issue 1 / Rev 0

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

COMPRESSION







Borehole No. :	**WCH-BH01**	**Sample Depth m:-**	**9.00 - 10.00**
Sample No. :	**9**	**Specimen Depth m:-**	**9.60 - 9.80**
Customer :	**Mass Transit Railway Corporation**		Compiled by W S Wat
Project :	**Ground Investigation for South Island Line**		
		Contract No.: Contract 1024	Checked by H W Chung
Job No.:	**J2999**	**Works Order No.: 059**	

Form : GESR009.9 / Jun.02.03 / Issue 1 / Rev 0

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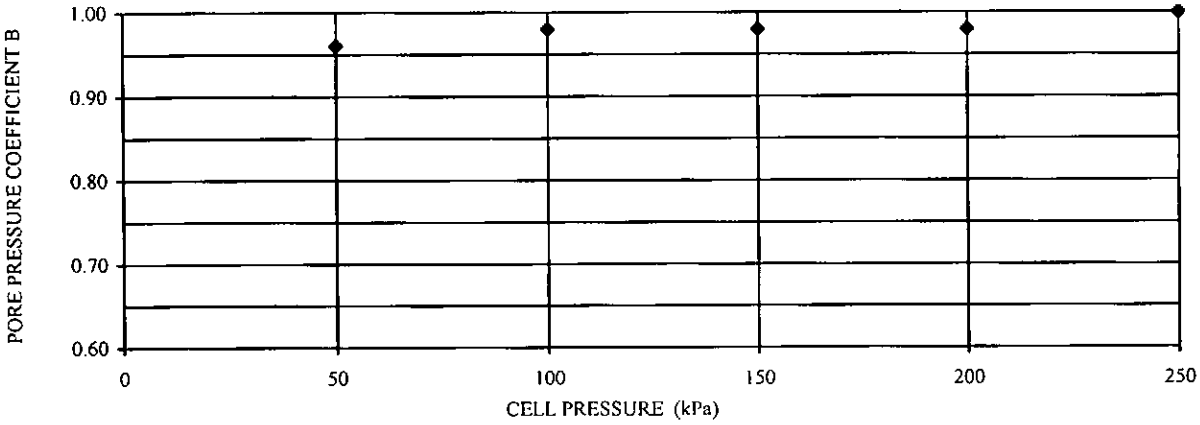
TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

SATURATION



Date	Time	Cell Pressure kPa	Back Pressure kPa	Pore Pressure kPa	Cumulative Volume of Water cm^3	Pore Pressure Coefficient B
31/12/2009	08:46	0	0	-	0.0	
	08:53	25	-	24		-
	09:47	25	20	20	-1.7	
	09:55	50	-	44		0.96
	10:44	50	45	45	-1.5	
	10:48	100	-	94		0.98
	11:52	100	95	95	-1.1	
	11:59	150	-	144		0.98
02/01/2009	08:57	150	145	145	-0.1	
	09:03	200	-	194		0.98
	11:17	200	195	195	0.4	
	11:25	250	-	245		1.00
03/01/2009	09:16	250	245	245	1.1	

Borehole No. WCH-BH01 **Sample Depth m:-** 9.00 - 10.00
Sample No. : 9 **Specimen Depth m:-** 9.60 - 9.80

Customer : Mass Transit Railway Corporation — Compiled by W S Wat
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024 — Checked by H W Chung
Job No.: J2999 **Works Order No.:** 059

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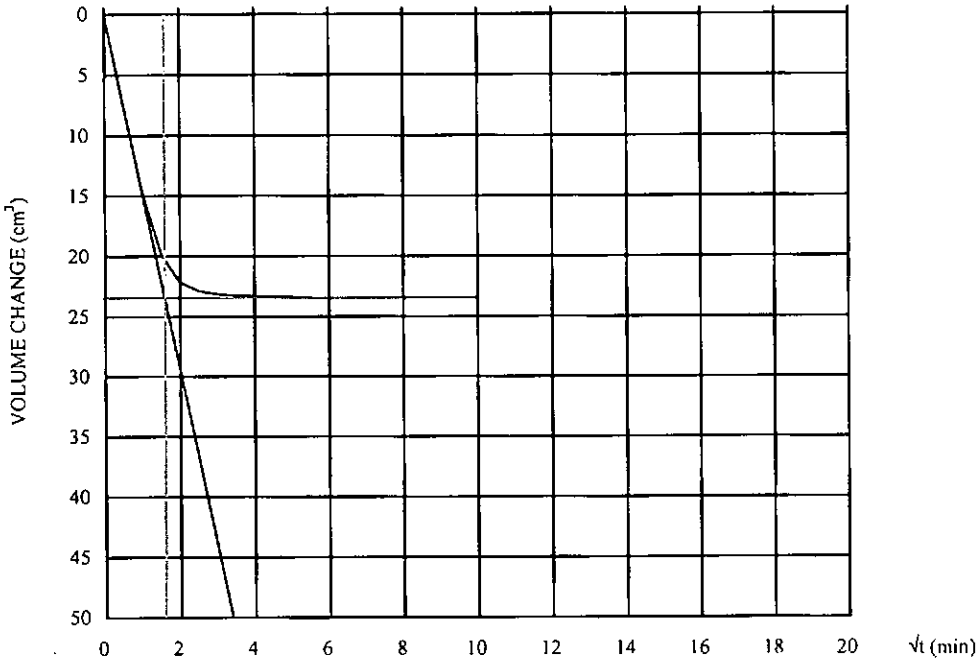
Form : GESR009.11 / Jun.02.03 / Issue 1 / Rev 0

TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

CONSOLIDATION (DRAINED PHASE) - Stage 1

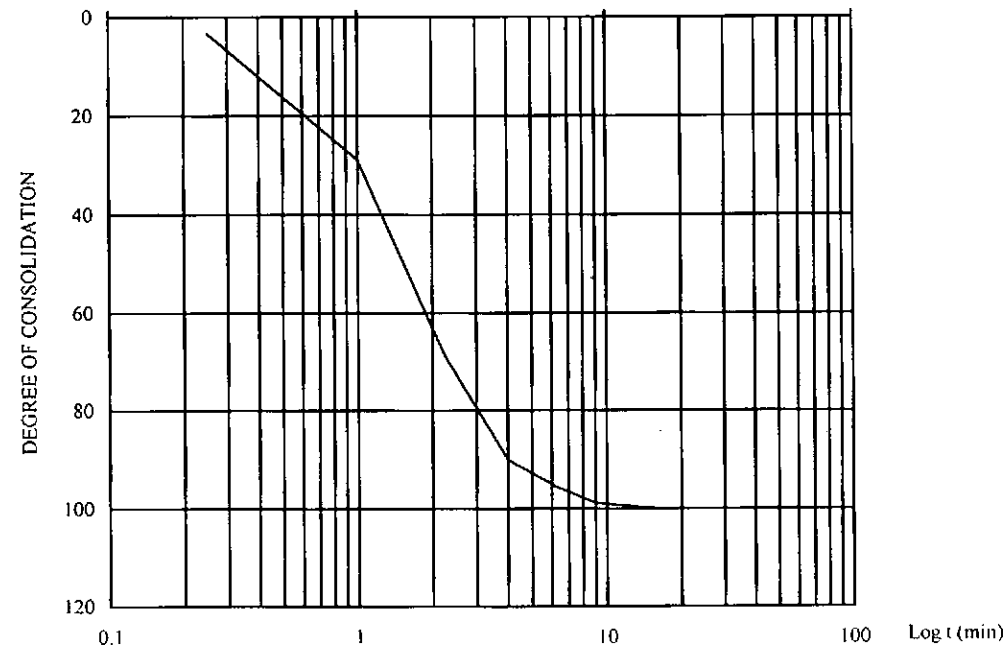


√t100 1.59 min

t100 2.522 min

tf 1.337 min

Calc. strain rate
7.497 mm/min



Borehole No. : WCH-BH01 **Sample Depth m:-** 9.00 - 10.00

Sample No. : 9 **Specimen Depth m:-** 9.60 - 9.80

Customer : Mass Transit Railway Corporation | Complied by W S Wat

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024 | Checked by H W Chung

Job No.: J2999 **Works Order No.:** 059

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TEST REPORT
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GEOSPEC 3 : 2001 Test Method 15.2

Single Stage		P.W.P,B.P			Effective Pressure	95	kPa
Side drains	No	Selected Machine Speed	0.047	mm/min	Rate of Strain	1.97	% per hr
FAILURE CRITERION							
Max. deviator Stress	☒	Max. Stress ratio	☐		Axial Strain %		☐
Stage : 1	Applied Pressure (kPa) - Cell :	340	Back :	245	P.R. factor	3.1043	kN/mm

Date	Time	Strain Dial	Strain	Load P.R.No. 3	Pore Pressure	Dev. stress Corr.	Dev. stress q $\sigma_1-\sigma_3$	Effective Stress σ'_1	Effective Stress σ'_3	s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio σ'_1/σ'_3
		mm	%	mm	kPa	kPa				2	2	3	
05/01	08:35	0.00	0.00	0.065	245	0.000	0.0	95.0	95.0	95.0	0.0	95.0	1.00
	08:40	0.27	0.19	0.124	266	0.055	43.6	117.7	74.1	95.9	21.8	88.6	1.59
	08:45	0.48	0.34	0.140	274	0.098	55.3	121.7	66.4	94.0	27.6	84.8	1.83
	08:50	0.74	0.52	0.155	280	0.149	66.2	126.6	60.4	93.5	33.1	82.5	2.10
	08:55	0.93	0.65	0.161	282	0.185	70.5	128.8	58.3	93.5	35.2	81.8	2.21
	09:00	1.17	0.81	0.173	285	0.230	79.1	134.2	55.1	94.7	39.6	81.5	2.44
	09:05	1.42	0.99	0.183	287	0.280	86.3	139.0	52.7	95.8	43.1	81.5	2.64
	09:10	1.64	1.15	0.191	289	0.323	92.0	143.0	51.0	97.0	46.0	81.7	2.80
	09:15	1.84	1.28	0.198	290	0.358	96.9	146.8	49.9	98.4	48.5	82.2	2.94
	09:20	2.13	1.49	0.209	291	0.415	104.7	153.4	48.7	101.0	52.3	83.6	3.15
	09:25	2.35	1.64	0.216	292	0.454	109.6	157.7	48.1	102.9	54.8	84.6	3.28
	09:30	2.61	1.82	0.223	292	0.502	114.4	162.0	47.6	104.8	57.2	85.7	3.40
	09:35	2.87	2.01	0.230	293	0.551	119.2	166.5	47.3	106.9	59.6	87.0	3.52
	09:40	3.10	2.16	0.237	293	0.589	124.1	170.9	46.8	108.8	62.0	88.2	3.65
	09:45	3.37	2.35	0.245	293	0.638	129.6	176.5	46.9	111.7	64.8	90.1	3.76
	09:50	3.59	2.51	0.252	293	0.678	134.4	181.4	47.0	114.2	67.2	91.8	3.86
	09:55	3.82	2.67	0.258	293	0.718	138.4	185.6	47.2	116.4	69.2	93.3	3.93
	10:00	4.04	2.82	0.264	292	0.755	142.5	190.1	47.6	118.9	71.3	95.1	3.99
	10:05	4.31	3.01	0.272	292	0.802	147.9	195.5	47.6	121.6	74.0	96.9	4.11
	10:10	4.51	3.15	0.277	292	0.836	151.3	199.3	48.0	123.6	75.6	98.4	4.15
	10:15	4.77	3.33	0.284	292	0.879	156.0	204.5	48.5	126.5	78.0	100.5	4.22
	10:20	5.03	3.52	0.291	291	0.924	160.6	209.7	49.1	129.4	80.3	102.6	4.27
	10:25	5.28	3.69	0.297	290	0.964	164.6	214.2	49.6	131.9	82.3	104.5	4.32
	10:30	5.57	3.89	0.305	290	1.010	169.9	220.2	50.3	135.2	84.9	106.9	4.38
	10:35	5.77	4.03	0.309	289	1.043	172.4	223.0	50.6	136.8	86.2	108.1	4.41
	10:40	6.00	4.19	0.314	289	1.079	175.7	226.9	51.2	139.0	87.8	109.8	4.43
	10:45	6.26	4.37	0.320	288	1.120	179.5	231.5	52.0	141.8	89.8	111.8	4.45
	10:50	6.51	4.55	0.325	287	1.160	182.7	235.4	52.7	144.1	91.4	113.6	4.47
	10:55	6.78	4.74	0.331	287	1.202	186.5	239.9	53.4	146.7	93.3	115.6	4.49
	11:00	6.97	4.87	0.334	286	1.231	188.4	242.2	53.8	148.0	94.2	116.6	4.50
	11:05	7.24	5.06	0.339	285	1.272	191.5	246.1	54.6	150.3	95.7	118.4	4.51
	11:10	7.51	5.25	0.344	285	1.313	194.5	249.9	55.4	152.7	97.3	120.2	4.51
	11:15	7.69	5.37	0.347	284	1.338	196.4	252.5	56.1	154.3	98.2	121.6	4.50
	11:20	7.97	5.57	0.352	283	1.381	199.4	256.4	57.0	156.7	99.7	123.5	4.50
	11:25	8.19	5.72	0.356	283	1.412	201.9	259.3	57.4	158.3	100.9	124.7	4.52
	11:30	8.46	5.91	0.362	282	1.451	205.6	263.9	58.3	161.1	102.8	126.8	4.53
	11:35	8.67	6.05	0.365	281	1.480	207.3	266.2	58.9	162.6	103.7	128.0	4.52
	11:40	8.90	6.22	0.370	280	1.515	210.4	270.2	59.8	165.0	105.2	129.9	4.52
	11:45	9.16	6.40	0.374	279	1.551	212.7	273.4	60.7	167.1	106.4	131.6	4.50

Borehole No. : WCH-BH01 — **Sample Depth m:-** 9.00 - 10.00
Sample No. : 9 — **Specimen Depth m:-** 9.60 - 9.80

Customer : Mass Transit Railway Corporation — Compiled by: W S Wat
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024 — Checked by: H W Chung
Job No.: J2999 — **Works Order No.:** 059

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Form : GESR009.14 / Dec.13.04 / Issue 1 / Rev I

TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2
Shearing Continuation

FAILURE CRITERION

Max. deviator Stress ☒ Max. Stress ratio ☐ Axial Strain % ☐

Stage : 1

Date	Time	Strain: Dial	Strain:	Load: P.R.No. 3	Pore Pressure	Dev. stress: Corr.	Dev. stress: q $\sigma_1 - \sigma_3$	Effective Stress Parameters: Effective Stress σ'_1	Effective Stress σ'_3	s' $(\sigma'_1+\sigma'_3)/2$	t $(\sigma_1-\sigma_3)/2$	p' $(\sigma'_1+2\sigma'_3)/3$	Stress Ratio σ'_1/σ'_3
		mm	%	mm	kPa	kPa							
05/01	11:50	9.42	6.58	0.379	279	1.587	215.7	277.0	61.3	169.2	107.9	133.2	4.52
	11:55	9.67	6.76	0.383	278	1.623	218.1	280.2	62.1	171.1	109.0	134.8	4.51
	12:00	9.90	6.92	0.387	277	1.654	220.4	283.1	62.7	172.9	110.2	136.2	4.52
	12:05	10.16	7.10	0.391	277	1.689	222.7	286.1	63.4	174.7	111.3	137.6	4.51
	12:10	10.40	7.26	0.395	276	1.720	225.0	289.2	64.2	176.7	112.5	139.2	4.50
	12:15	10.67	7.46	0.400	275	1.758	227.9	292.8	64.9	178.9	114.0	140.9	4.51
	12:20	10.89	7.61	0.403	274	1.786	229.6	295.3	65.7	180.5	114.8	142.2	4.49
	12:25	11.13	7.77	0.406	273	1.816	231.2	297.9	66.7	182.3	115.6	143.8	4.47
	12:30	11.39	7.96	0.410	273	1.851	233.4	300.7	67.3	184.0	116.7	145.1	4.47
	12:35	11.62	8.12	0.413	272	1.881	235.0	302.6	67.6	185.1	117.5	145.9	4.48
	12:40	11.86	8.29	0.416	272	1.912	236.6	304.8	68.2	186.5	118.3	147.1	4.47
	12:45	12.14	8.48	0.419	271	1.946	238.1	307.1	69.0	188.0	119.0	148.4	4.45
	12:50	12.35	8.63	0.422	270	1.973	239.7	309.4	69.7	189.5	119.8	149.6	4.44
	12:55	12.57	8.78	0.424	270	2.000	240.6	311.1	70.5	190.8	120.3	150.7	4.41
	13:00	12.80	8.94	0.427	269	2.028	242.2	313.2	71.0	192.1	121.1	151.7	4.41
	13:05	13.08	9.14	0.430	268	2.063	243.6	315.3	71.7	193.5	121.8	152.9	4.40
	13:10	13.28	9.27	0.432	268	2.086	244.6	317.0	72.4	194.7	122.3	153.9	4.38
	13:15	13.37	9.34	0.435	267	2.098	246.4	319.6	73.2	196.4	123.2	155.3	4.37
	13:20	13.78	9.63	0.437	266	2.148	246.9	320.7	73.8	197.3	123.5	156.1	4.35
	13:25	14.02	9.79	0.440	266	2.175	248.4	322.5	74.1	198.3	124.2	156.9	4.35
	13:30	14.32	10.01	0.443	265	2.212	249.8	324.9	75.1	200.0	124.9	158.4	4.33
	13:35	14.59	10.19	0.445	264	2.242	250.6	326.2	75.6	200.9	125.3	159.1	4.31
	13:40	14.78	10.33	0.447	264	2.265	251.5	327.6	76.1	201.9	125.8	159.9	4.31
	13:45	15.02	10.49	0.450	263	2.291	253.0	329.8	76.8	203.3	126.5	161.1	4.29
	13:50	15.22	10.64	0.451	263	2.316	253.2	330.6	77.4	204.0	126.6	161.8	4.27
	13:55	15.47	10.80	0.453	262	2.342	254.1	332.0	77.9	204.9	127.0	162.6	4.26
	14:00	15.79	11.03	0.456	261	2.379	255.3	334.2	78.9	206.6	127.7	164.0	4.24
	14:05	16.02	11.19	0.458	260	2.405	256.2	335.8	79.6	207.7	128.1	165.0	4.22
	14:10	16.26	11.36	0.460	260	2.432	257.0	336.7	79.7	208.2	128.5	165.4	4.22
	14:15	16.52	11.54	0.461	260	2.460	257.1	337.4	80.3	208.8	128.5	166.0	4.20
	14:20	**16.78**	**11.72**	**0.462**	**259**	**2.488**	**257.2**	**338.1**	**80.9**	**209.5**	**128.6**	**166.6**	**4.18**
	14:25	16.97	11.86	0.462	259	2.510	256.7	338.0	81.3	209.7	128.4	166.9	4.16
	14:30	17.26	12.06	0.462	258	2.541	256.1	338.2	82.1	210.2	128.1	167.5	4.12
	14:45	18.03	12.59	0.461	256	2.622	253.8	337.5	83.7	210.6	126.9	168.3	4.03
	15:00	18.79	13.13	0.461	255	2.703	252.2	337.5	85.3	211.4	126.1	169.4	3.96
	15:15	19.34	13.51	0.460	254	2.760	250.3	336.7	86.4	211.6	125.2	169.8	3.90
	15:30	20.22	14.12	0.463	252	2.849	250.4	338.1	87.7	212.9	125.2	171.2	3.85
	15:45	20.89	14.60	0.464	252	2.918	249.5	338.0	88.5	213.3	124.8	171.7	3.82
	16:00	21.69	15.15	0.465	251	2.997	248.5	338.0	89.5	213.7	124.2	172.3	3.78
	16:15	22.40	15.65	0.466	250	3.068	247.5	337.5	90.0	213.8	123.8	172.5	3.75
	16:30	23.21	16.22	0.467	249	3.148	246.4	337.2	90.8	214.0	123.2	172.9	3.71

Borehole No. : WCH-BH01 **Sample Depth m:- 9.00 - 10.00**

Sample No. : 9 **Specimen Depth m:- 9.60 - 9.80**

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.: 059**

Compiled by W S Wat

Checked by H W Chung

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2
Shearing Continuation

FAILURE CRITERION

Max. deviator Stress ☒ | Max. Stress ratio ☐ | Axial Strain % ☐

Stage :	1	Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
Date	Time	Dial		P.R.No. 3	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
05/01	16:45	23.89	16.69	0.468	248	3.214	245.5	337.3	91.8	214.6	122.8	173.6	3.67
	17:00	24.59	17.18	0.468	248	3.282	244.0	336.4	92.4	214.4	122.0	173.7	3.64

Borehole No. : WCH-BH01 **Sample Depth m:- 9.00 - 10.00**
Sample No. : 9 **Specimen Depth m:- 9.60 - 9.80**

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.:** 059

Compiled by: W S Wat
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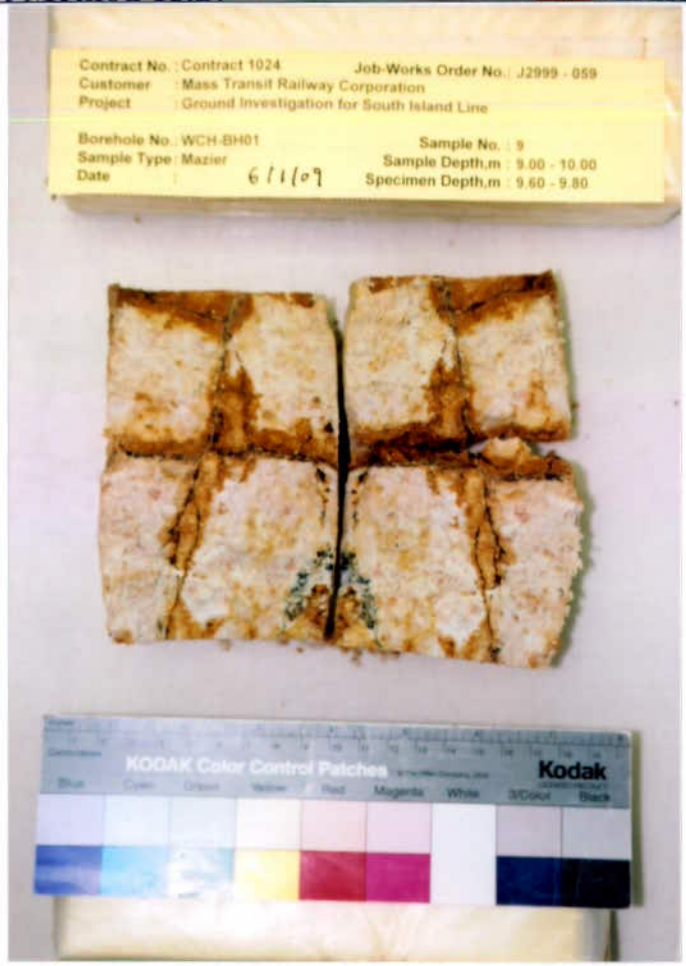
Form : GESR009.15 / Dec.13.04 / Issue 1 / Rev 1

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT (GEOSPEC 3 : 2001 Test Method 15.2)



Description : Brown, silty, gravelly SAND **Sample Origin : CDM‡** ‡ Information provided by customer

Borehole No. : WCH-BH01 **Sample No. :** 9 **Sample Depth m:-** 9.00 - 10.00 **Specimen Depth m:-** 9.60 - 9.80

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line

Contract No. : Contract 1024
Job No. : J2999
Works Order No.: 059

Compiled by: W S Wat
Checked by: H W Chung

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	WCH-BH01	WCH-BH01	WCH-BH01
Sample		no	9	9	9
Sample Type			Mazier	Mazier	Mazier
Stage		no	1	2	3
Sample Depth		m	9.00 - 10.00	9.00 - 10.00	9.00 - 10.00
Specimen Depth		m	9.80 - 10.00	9.80 - 10.00	9.80 - 10.00
INITIAL CONDITIONS					
Diameter	(D_o)	mm	74.0	75.0	75.7
Height	(H_o)	mm	145.0	138.2	133.0
Moisture Content	(W_o)	%	32	30	29
Bulk density	(ρ_o)	Mg/m^3	1.88	1.89	1.91
Dry density	(ρ_d)	Mg/m^3	1.42	1.45	1.48
Particle density	(ρ_s)		2.65	2.65	2.65
Voids Ratio	(e_o)		0.86	0.82	0.79
Degree of Saturation	(S_r)	%	99.0	97.7	97.6
DRAINAGE CONDITIONS			ONE END		
SATURATION					
Final Pore Pressure Coefficient B			0.96		
CONSOLIDATION					
Cell Pressure	(σ_3)	kPa	275	320	365
Back Pressure	(u_b)	kPa	230	230	230
Effective Pressure	(σ'_3)	kPa	45	90	135
Coefficient of Consolidation (t100) (C_{vi})		$m^2/Year$	3129.88	5948.22	7762.18
Coefficient of Volume Compressibility (m_{vi})		m^2/MN	0.50	0.26	0.14
Coefficient of Permeability (k)		m/s	4.82E-07	4.85E-07	3.44E-07
COMPRESSION TERMINATION CRITERION			MAXIMUM STRESS RATIO		MAX ($\sigma'1 - \sigma'3$)
COMPRESSION - INITIAL					
Moisture Content	(w)	%	30	29	28
Pore Pressure at the End of Consolidation		kPa	230	230	230
Effective Stress at the End of Consolidation		kPa	45	90	135
Bulk density	(ρ_o)	Mg/m^3	1.89	1.91	1.92
Dry density	(ρ_d)	Mg/m^3	1.45	1.48	1.50
Voids Ratio	(e)		0.82	0.79	0.77
Degree of Saturation	(S_r)	%	97.7	97.6	97.5

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999
Works Order No.: 059
Report No. : J2999-059.11

Technician : W S Wat
Checked By : Name : H W Chung Date : 09/01/2009
Approved By : Signatory : **Lau Wai Cheong** Date : 09/01/2009
Tested Date: 23/12/2008

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Form : GESR009.6 / Nov.10.06 / Issue 1 / Rev 1

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	WCH-BH01	WCH-BH01	WCH-BH01
Sample		no	9	9	9
Sample Type			Mazier	Mazier	Mazier
Stage		no	1	2	3
Sample Depth		m	9.00 - 10.00	9.00 - 10.00	9.00 - 10.00
Specimen Depth		m	9.80 - 10.00	9.80 - 10.00	9.80 - 10.00
COMPRESSION - FAILURE					
Cell Pressure		kPa	275	320	365
Rate of Strain		mm/min	0.048	0.045	0.044
CONDITIONS AT MAXIMUM STRESS RATIO					
Major Effective Principal Stress (σ'_1)		kPa	125	264	380
Corrected Deviator Stress ($\sigma'_1 - \sigma'_3$)		kPa	100	205	292
Minor Effective Principal Stress (σ'_3)		kPa	25	58	88
$s' = (\sigma'_1 + \sigma'_3)/2$		kPa	75	161	234
$t = (\sigma_1 - \sigma_3)/2$		kPa	50	103	146
Expanded Uncertainty of s' ^		kPa	-	-	-
Expanded Uncertainty of t ^		kPa	-	-	-
Pore pressure parameter A_f			0.20	0.15	0.16
Strain at Failure	(εf)	%	3.7	7.5	11.3
COMPRESSION - FINAL					
Moisture Content	(W_f)	%	30	29	28
Bulk density	(ρ_o)	Mg/m^3	1.89	1.91	1.92
Dry density	(ρ_d)	Mg/m^3	1.45	1.48	1.50
Voids Ratio	(e_f)		0.82	0.79	0.77
Degree of Saturation	(S_f)	%	97.7	97.6	97.5

Notes -
1. The method of specimen preparation was in accordance with GEOSPEC 3 : 2001 :- Test method 13.3 : test specimen from undisturbed soil samples.
2. Sample received date :29/09/2008
3. The determination of moisture content was in accordance with test method 5.1 of GEOSPEC 3 : 2001.
4. Particle density : 2.65 (Assumed)
5. Maximum and minimum temperature recorded over the period of testing 19.9 - 20.7 °C.
6. Unavoidable variations from specified procedure : none
7. Comment on observed or inferred sample disturbance : none
8. Percentage by mass of soil particles larger than 1/5 of the diameter of specimen (%) : Nil
9. The specimen was selected by the laboratory.
   Name : W S Wat Designation : Senior Laboratory Technician
10. Sampling History : As Received

* Delete as appropriate ^ Upon request

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 Works Order No.: 059

Compiled by W S Wat
Checked by H W Chung

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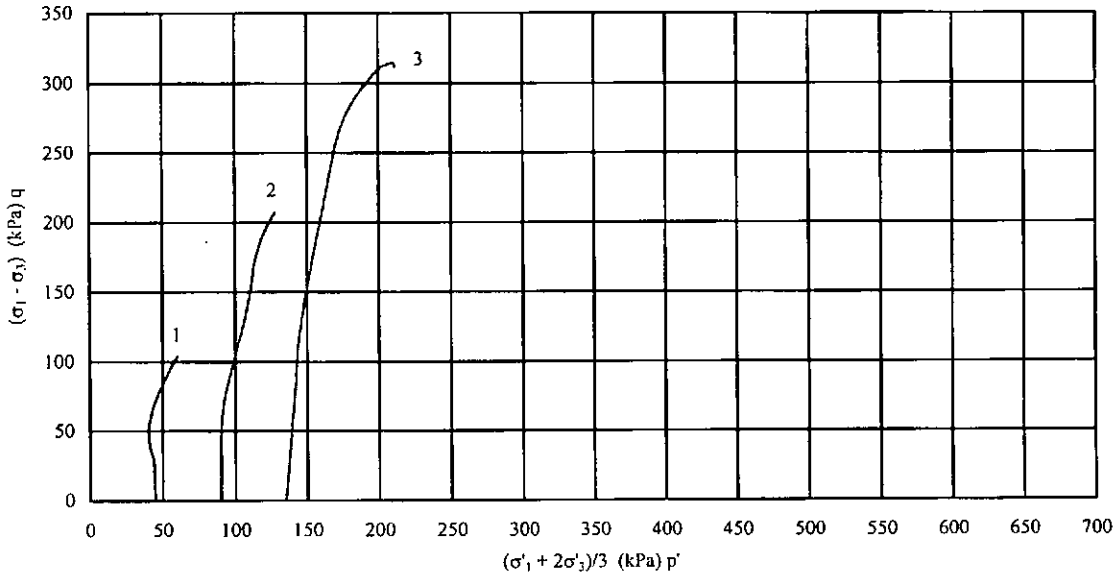
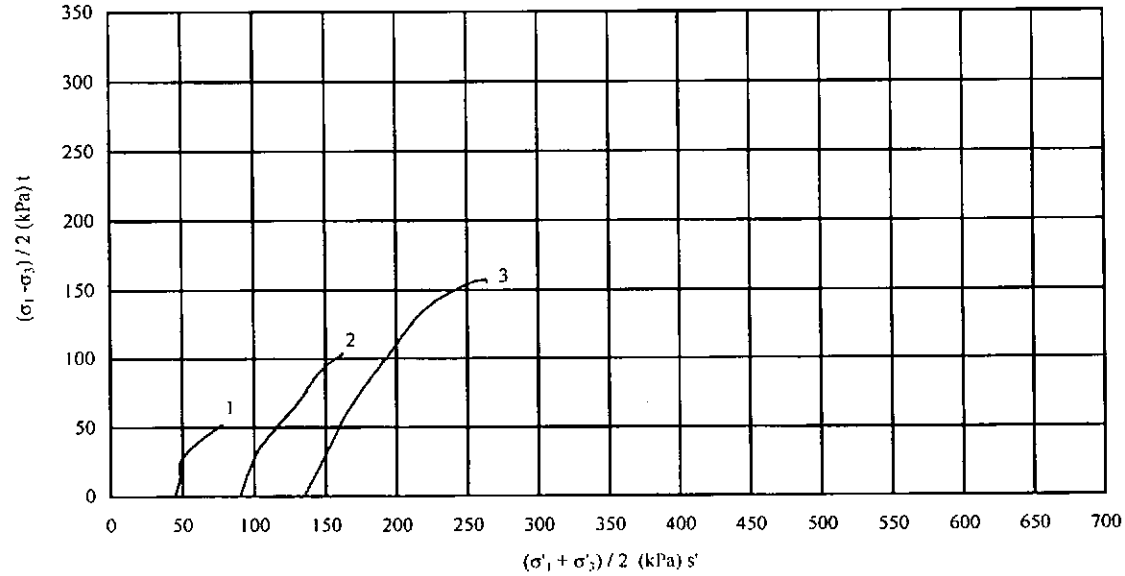
TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

STRESS PATH PARAMETERS FOR EFFECTIVE STRESS

p' - q PLOT



s' - t PLOT



Borehole No. : WCH-BH01	**Sample Depth m:-** 9.00 - 10.00
Sample No. : 9	**Specimen Depth m:-** 9.80 - 10.00
Customer : Mass Transit Railway Corporation	Compiled by W S Wat
Project : Ground Investigation for South Island Line	
	Contract No.: Contract 1024
Job No.: J2999	**Works Order No.:** 059
	Checked by H W Chung

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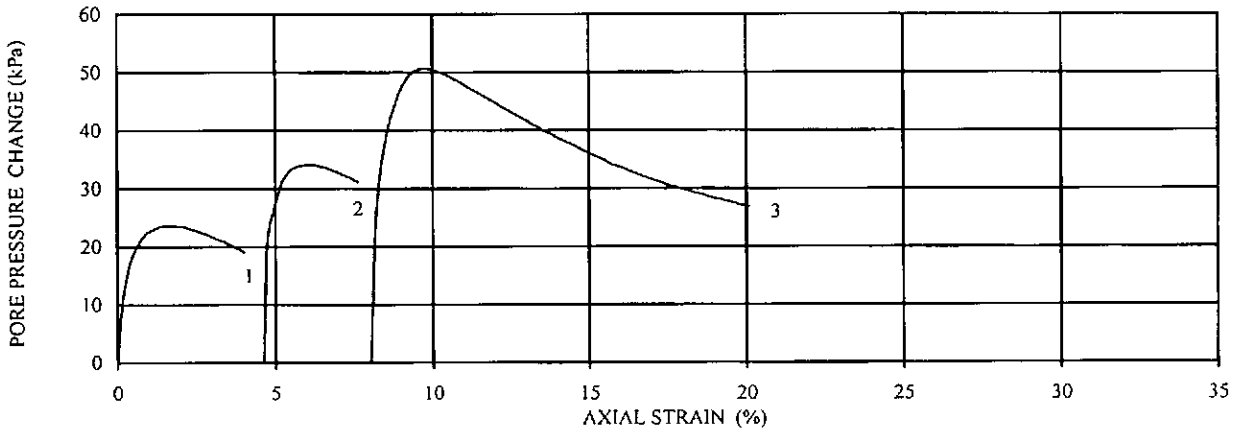
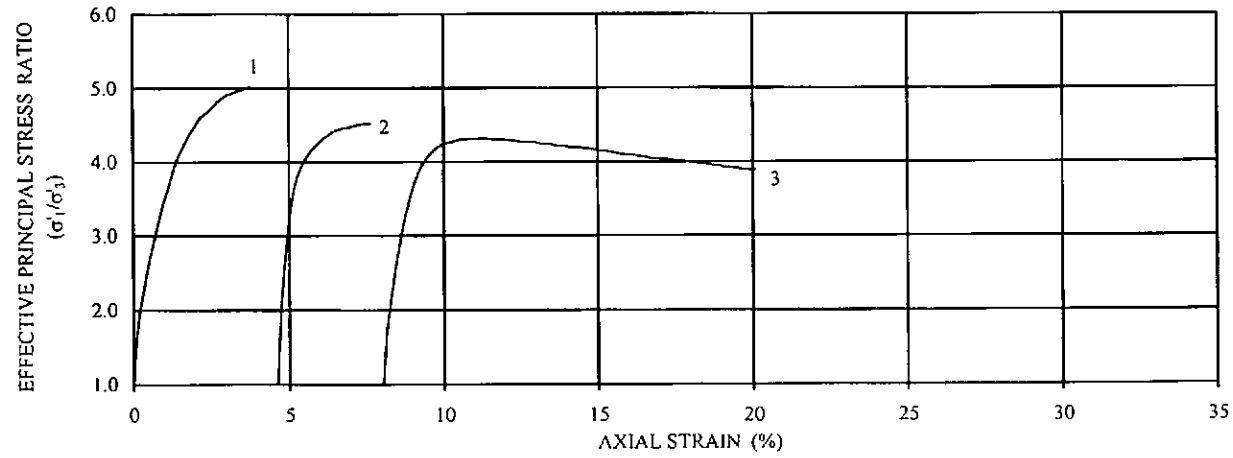
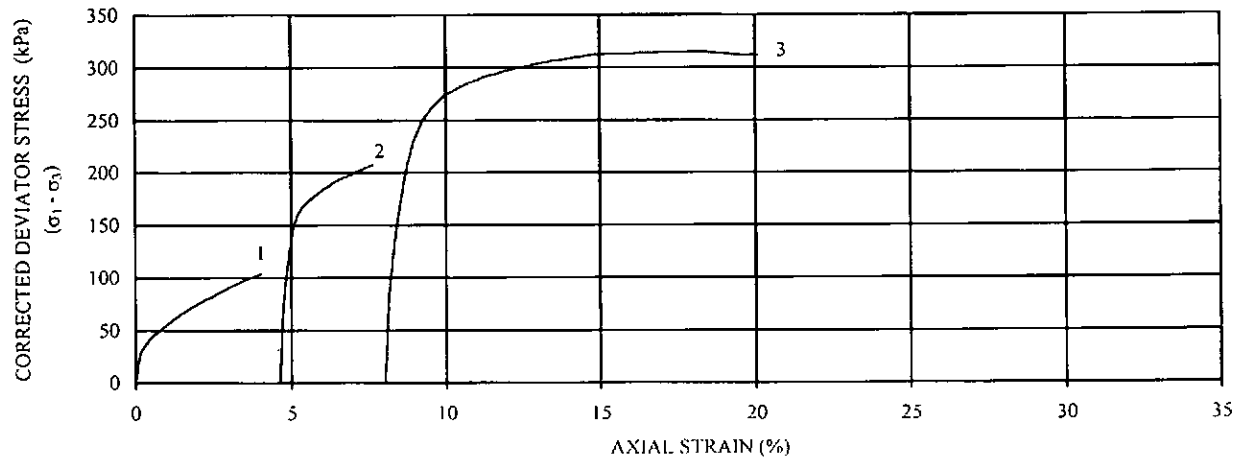
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

COMPRESSION







Borehole No. : WCH-BH01 — **Sample Depth m:-** 9.00 - 10.00
Sample No. : 9 — **Specimen Depth m:-** 9.80 - 10.00

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 — **Works Order No.:** 059

Compiled by W S Wat
Checked by H W Chung

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21 Chun Wang Street, Tseung Kwan O Industrial Estate,
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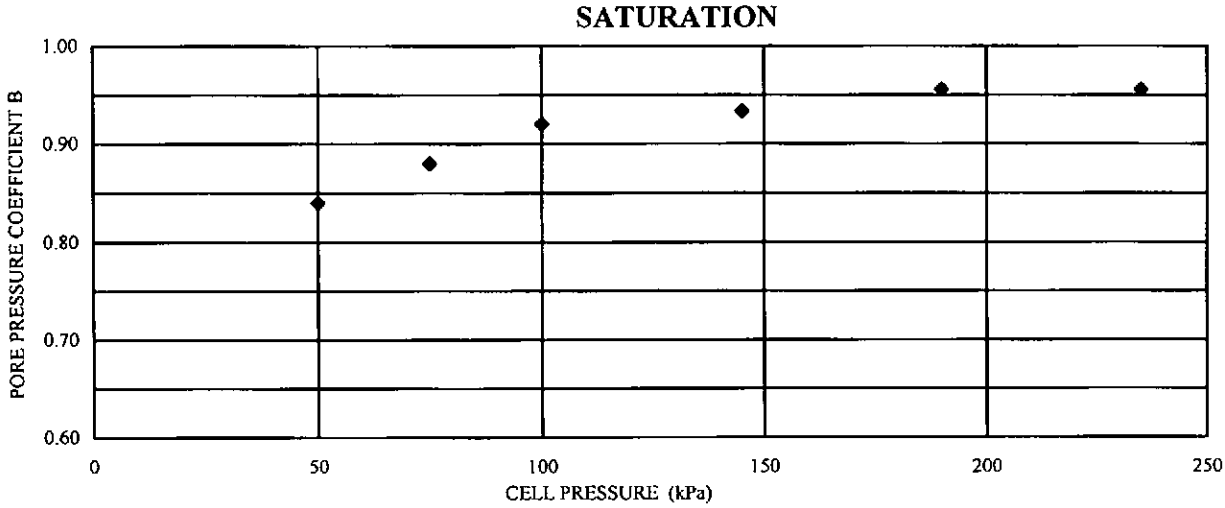
TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2



Date	Time	Cell Pressure kPa	Back Pressure kPa	Pore Pressure kPa	Cumulative Volume of Water cm^3	Pore Pressure Parameter B
29/12/2008	09:24	0	0	-	0.0	
	09:40	25	-	23		-
	11:08	25	20	20	-7.7	
	11:16	50	-	41		0.84
	12:37	50	45	45	-6.5	
	12:46	75	-	67		0.88
	14:17	75	70	70	-5.5	
	14:26	100	-	93		0.92
30/12/2008	09:47	100	95	95	-4.9	
	09:54	145	-	137		0.93
	10:57	145	140	140	-3.7	
	11:08	190	-	183		0.96
	13:22	190	185	185	-3.1	
	13:27	235	-	228		0.96
31/12/2008	10:49	235	230	230	-2.7	

Borehole No. : WCH-BH01 **Sample Depth m:-** 9.00 - 10.00
Sample No. : 9 **Specimen Depth m:-** 9.80 - 10.00

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.:** 059

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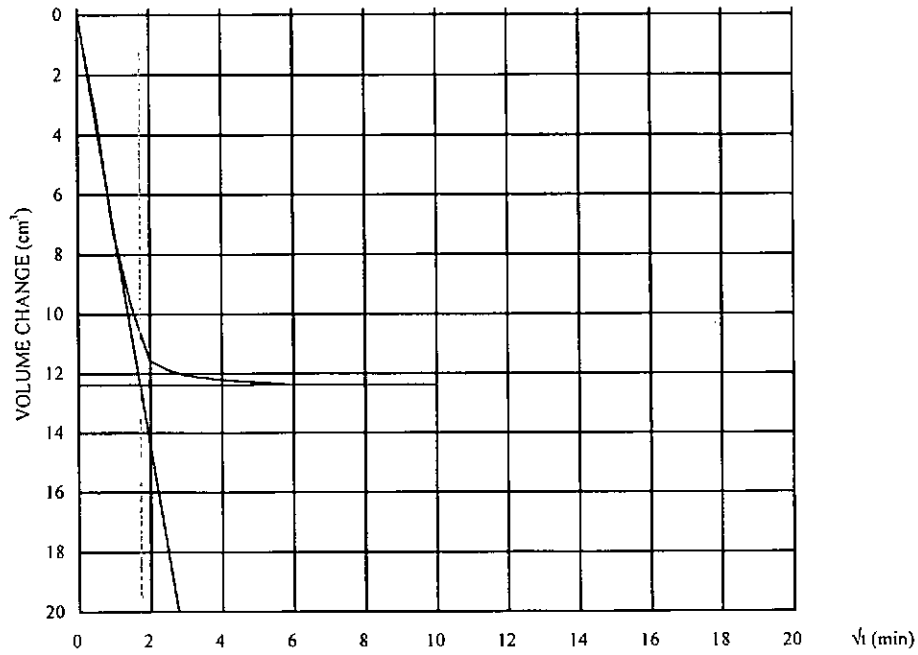
Form : GESR009.11 / Jun.02.03 / Issue 1 / Rev 0

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

CONSOLIDATION (DRAINED PHASE) - Stage 1

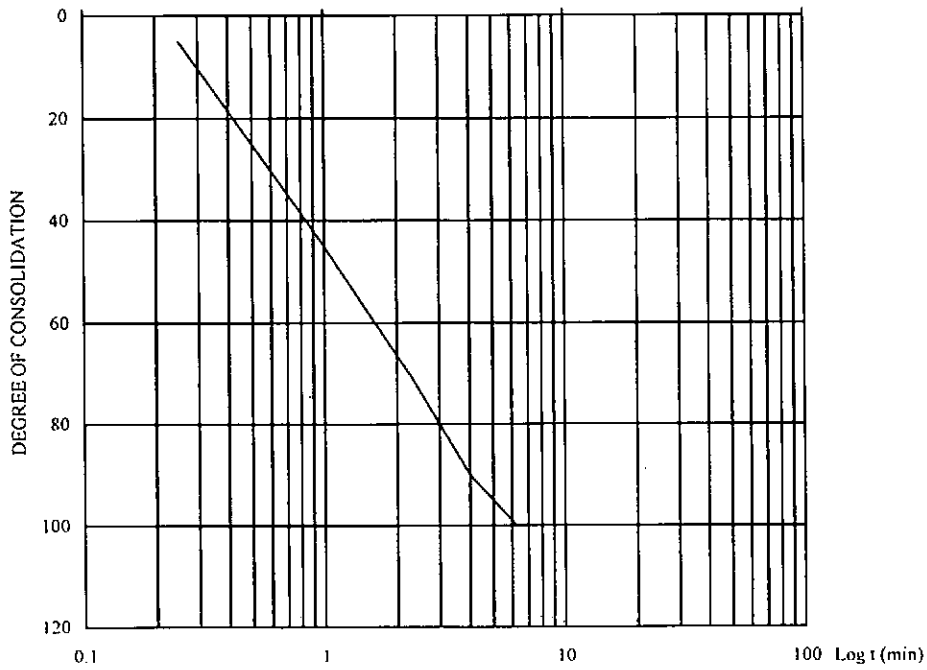


√t100 1.73 min

t100 2.98 min

tf 1.58 min

Calc. strain rate
6.379 mm/min



Borehole No. : WCH-BH01 **Sample Depth m:-** 9.00 - 10.00

Sample No. : 9 **Specimen Depth m:-** 9.80 - 10.00

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.:** 059

Complied by: W S Wat

Checked by: H W Chung

Form : GESR009.13 / Jun.02.03 / Issue 1 / Rev 0

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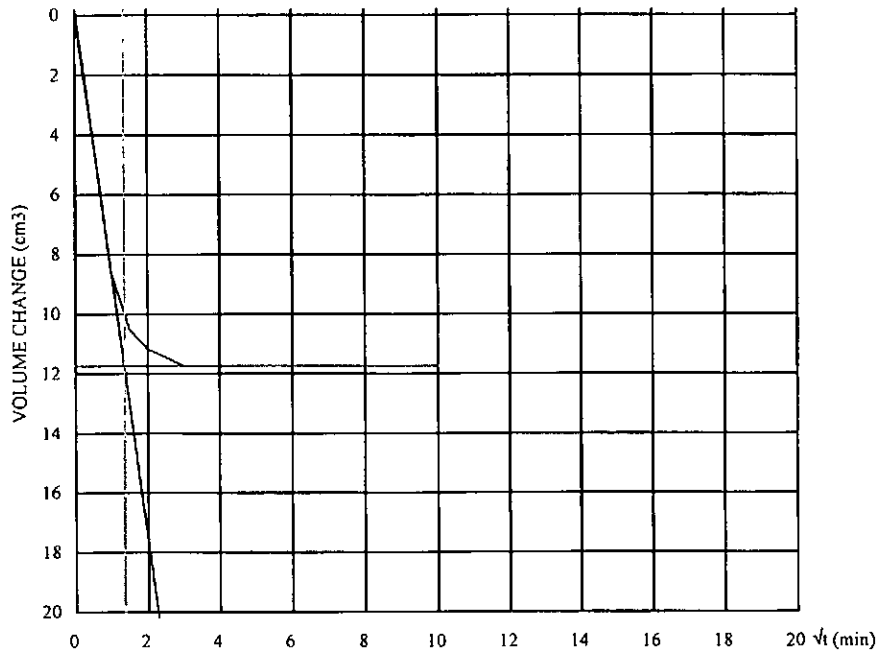
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

CONSOLIDATION (DRAINED PHASE) - Stage 2

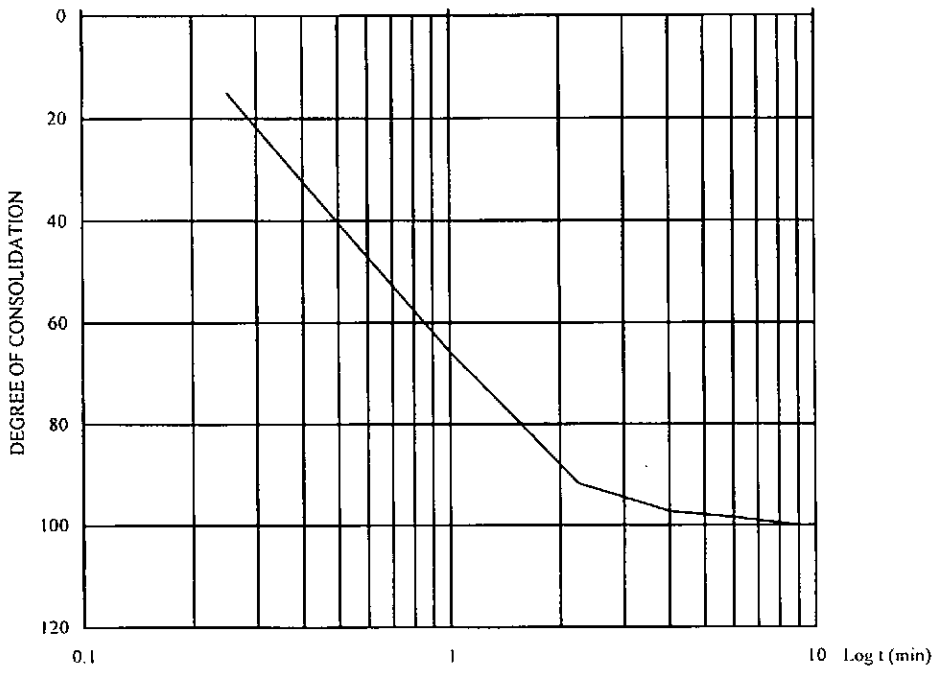


√t100 1.35 min

t100 1.82 min

tf 0.97 min

Calc. strain rate
9.943 mm/min



Borehole No. : WCH-BH01 **Sample Depth m:-** 9.00 - 10.00

Sample No. : 9 **Specimen Depth m:-** 9.80 - 10.00

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.:** 059

Complied by: W S Wat

Checked by: H W Chung

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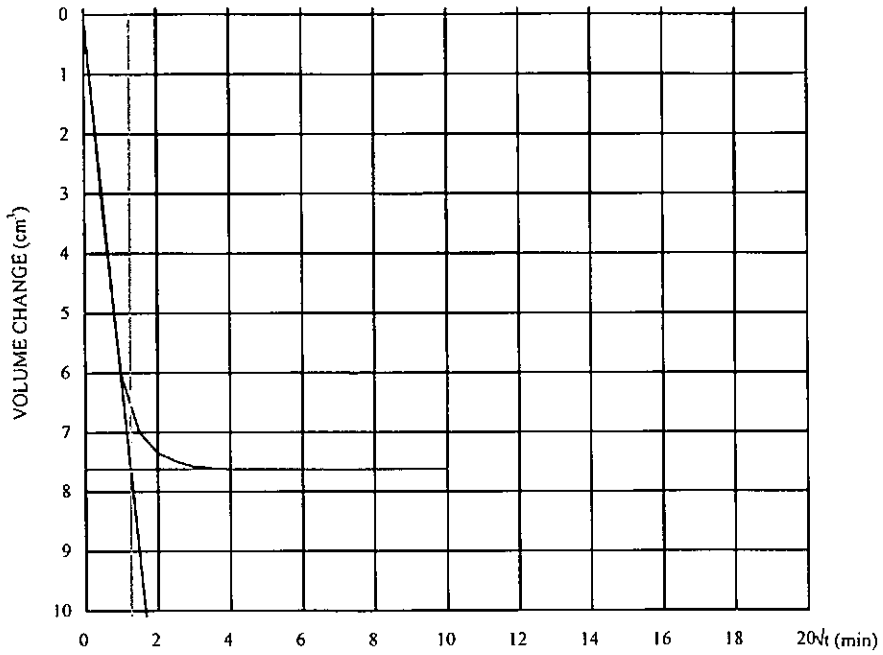
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

CONSOLIDATION (DRAINED PHASE) - Stage 3

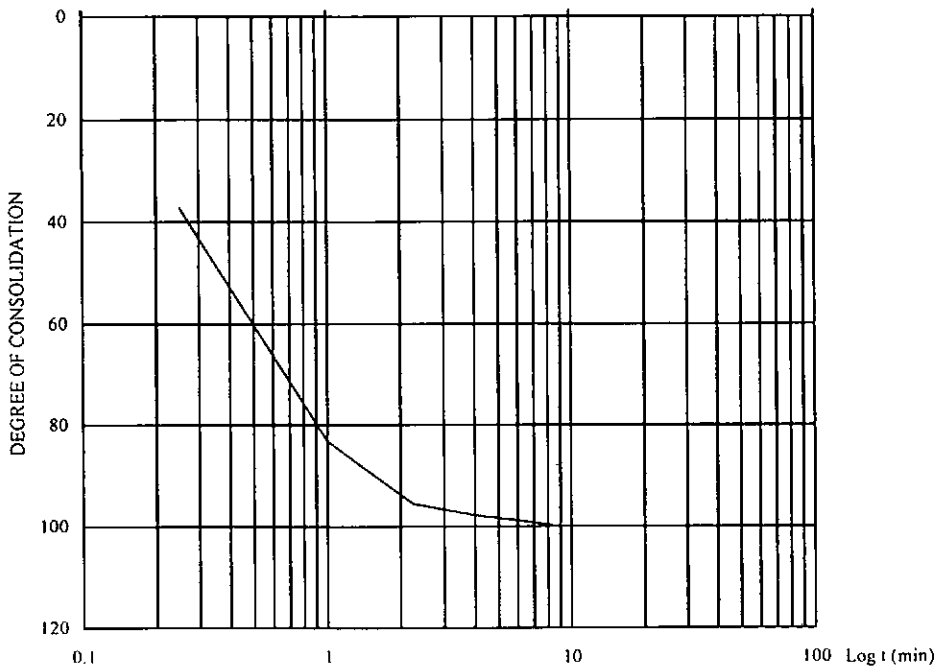


√t100 1.25 min

t100 1.57 min

tf 0.83 min

Calc. strain rate
11.134 mm/min



Borehole No. : WCH-BH01 **Sample Depth m:-** 9.00 - 10.00

Sample No. : 9 **Specimen Depth m:-** 9.80 - 10.00

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.:** 059

Complied by: W S Wat

Checked by: H W Chung

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Multi Stage		P.W.P,B.P			Effective Pressure	45	kPa
Side drains	No	Selected Machine Speed	0.048	mm/min	Rate of Strain	2.00	% per hr

FAILURE CRITERION

Max. deviator Stress	☐	Max. Stress ratio	☒		Axial Strain %		☐
Stage : 1	Applied Pressure (kPa) - Cell :	275	Back :	230	P.R. factor	3.1341	kN/mm

Date	Time	Strain Dial	Strain	Load P.R.No. 2	Pore Pressure	Dev. stress Corr.	Dev. stress q $\sigma_1 - \sigma_3$	Effective Stress Parameters: Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
02/01	08:40	0.00	0.00	0.044	230	0.000	0.0	45.0	45.0	45.0	0.0	45.0	1.00
	08:45	0.21	0.15	0.081	240	0.043	27.3	62.3	35.0	48.6	13.6	44.1	1.78
	08:50	0.51	0.35	0.095	246	0.101	37.5	66.5	29.0	47.7	18.7	41.5	2.29
	08:55	0.71	0.49	0.102	248	0.140	42.5	69.1	26.6	47.9	21.3	40.8	2.60
	09:00	0.92	0.64	0.108	250	0.183	46.8	71.7	24.9	48.3	23.4	40.5	2.88
	09:05	1.23	0.85	0.115	252	0.241	51.8	75.0	23.2	49.1	25.9	40.5	3.23
	09:10	1.43	0.99	0.120	253	0.280	55.4	77.9	22.5	50.2	27.7	41.0	3.46
	09:15	1.65	1.15	0.125	253	0.323	58.9	81.0	22.1	51.5	29.4	41.7	3.66
	09:20	1.92	1.33	0.131	253	0.372	63.1	84.7	21.6	53.1	31.5	42.6	3.92
	09:25	2.12	1.47	0.135	254	0.409	65.9	87.3	21.4	54.3	32.9	43.4	4.08
	09:30	2.35	1.63	0.139	254	0.452	68.6	90.0	21.4	55.7	34.3	44.3	4.21
	09:35	2.61	1.81	0.144	254	0.499	72.1	93.5	21.4	57.4	36.0	45.4	4.37
	09:40	2.86	1.99	0.148	254	0.546	74.8	96.3	21.5	58.9	37.4	46.4	4.48
	09:45	3.09	2.15	0.152	253	0.587	77.5	99.1	21.6	60.4	38.8	47.4	4.59
	09:50	3.33	2.31	0.156	253	0.628	80.3	102.3	22.0	62.1	40.1	48.8	4.65
	09:55	3.57	2.48	0.159	253	0.671	82.2	104.4	22.2	63.3	41.1	49.6	4.70
	10:00	3.83	2.66	0.164	252	0.716	85.6	108.2	22.6	65.4	42.8	51.1	4.79
	10:05	4.05	2.81	0.167	252	0.753	87.6	110.4	22.8	66.6	43.8	52.0	4.84
	10:10	4.33	3.00	0.172	252	0.799	91.0	114.3	23.3	68.8	45.5	53.6	4.91
	10:15	4.63	3.21	0.176	251	0.850	93.6	117.4	23.8	70.6	46.8	55.0	4.93
	10:20	4.85	3.37	0.179	251	0.889	95.6	119.7	24.1	71.9	47.8	56.0	4.97
	10:25	5.06	3.51	0.182	251	0.922	97.5	122.0	24.5	73.3	48.8	57.0	4.98
	10:30	**5.31**	**3.69**	**0.186**	**250**	**0.964**	**100.2**	**125.2**	**25.0**	**75.1**	**50.1**	**58.4**	**5.01**
	10:35	5.57	3.87	0.189	250	1.006	102.1	127.6	25.5	76.5	51.0	59.5	5.00
	10:40	5.78	4.02	0.192	249	1.041	104.0	130.0	26.0	78.0	52.0	60.7	5.00

Borehole No. : WCH-BH01 **Sample Depth m:- 9.00 - 10.00**

Sample No. : 9 **Specimen Depth m:- 9.80 - 10.00**

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.:** 059

Compiled by: W S Wat

Checked by: H W Chung

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Multi Stage		P.W.P,B.P		Effective Pressure 90	kPa
Side drains	No	Selected Machine Speed	0.045 mm/min	Rate of Strain 1.97	% per hr

FAILURE CRITERION

Max. deviator Stress ☐	Max. Stress ratio ☒	Axial Strain % ☐

Stage : 2	Applied Pressure (kPa) - Cell : 320	Back : 230	P.R. factor 3.1341 kN/mm

Date	Time	Strain Dial	Strain	Load P.R.No. 2	Pore Pressure	Dev. stress Corr.	Dev. stress q $\sigma_1 - \sigma_3$	Effective Stress Parameters: Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
										2	2	3	
		mm	%	mm	kPa	kPa		σ'_1	σ'_3				σ'_1/σ'_3
03/01	10:15	6.67	4.63	0.053	230	0.000	0.0	90.0	90.0	90.0	0.0	90.0	1.00
	10:20	6.80	4.72	0.139	249	1.198	60.6	131.6	71.0	101.3	30.3	91.2	1.85
	10:25	6.96	4.83	0.191	254	1.222	97.8	163.8	66.0	114.9	48.9	98.6	2.48
	10:30	7.13	4.95	0.231	256	1.248	126.3	190.2	63.9	127.0	63.1	106.0	2.98
	10:35	7.28	5.06	0.258	259	1.272	145.4	206.9	61.5	134.2	72.7	110.0	3.36
	10:40	7.51	5.21	0.278	261	1.305	159.5	218.4	58.9	138.6	79.7	112.1	3.71
	10:45	7.69	5.34	0.287	262	1.332	165.6	223.3	57.7	140.5	82.8	112.9	3.87
	10:50	7.92	5.50	0.295	263	1.366	171.0	227.7	56.7	142.2	85.5	113.7	4.02
	10:55	8.13	5.64	0.301	264	1.396	175.0	231.3	56.3	143.8	87.5	114.6	4.11
	11:00	8.33	5.78	0.306	264	1.425	178.3	234.3	56.0	145.1	89.1	115.4	4.18
	11:05	8.54	5.93	0.311	264	1.456	181.5	237.4	55.9	146.7	90.8	116.4	4.25
	11:10	8.75	6.07	0.316	264	1.485	184.7	240.6	55.9	148.3	92.4	117.5	4.30
	11:15	9.00	6.25	0.321	264	1.521	187.9	243.8	55.9	149.8	93.9	118.5	4.36
	11:20	9.18	6.37	0.325	264	1.545	190.4	246.5	56.1	151.3	95.2	119.6	4.39
	11:25	9.45	6.56	0.330	264	1.583	193.5	249.8	56.3	153.1	96.8	120.8	4.44
	11:30	9.71	6.74	0.334	263	1.619	195.9	252.6	56.7	154.7	98.0	122.0	4.46
	11:35	9.93	6.89	0.337	263	1.649	197.7	254.7	57.0	155.8	98.8	122.9	4.47
	11:40	10.11	7.02	0.340	263	1.674	199.5	256.8	57.3	157.0	99.7	123.8	4.48
	11:45	10.29	7.14	0.343	262	1.697	201.3	258.9	57.6	158.2	100.6	124.7	4.49
	11:50	10.51	7.29	0.346	262	1.726	203.0	260.9	57.9	159.4	101.5	125.6	4.51
	11:55	**10.75**	**7.46**	**0.350**	**262**	**1.758**	**205.4**	**263.8**	**58.4**	**161.1**	**102.7**	**126.9**	**4.52**
	12:00	10.99	7.63	0.353	261	1.790	207.1	266.0	58.9	162.5	103.6	127.9	4.52

Borehole No. : WCH-BH01 **Sample Depth m:-** 9.00 - 10.00

Sample No. : 9 **Specimen Depth m:-** 9.80 - 10.00

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.:** 059

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Form : GESR009.14 / Dec.13.04 / Issue 1 / Rev 1

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Multi Stage		P.W.P,B.P			Effective Pressure	135	kPa
Side drains	No	Selected Machine Speed	0.044	mm/min	Rate of Strain	1.99	% per hr

FAILURE CRITERION

Max. deviator Stress	☐	Max. Stress ratio	☒		Axial Strain %		☐
Stage : 3	Applied Pressure (kPa) - Cell :	365	Back :	230	P.R. factor	3.1341	kN/mm

Date	Time	Strain		Load	Pore Pressure	Dev. stress		Effective Stress Parameters					
		Dial		P.R.No. 2		Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
05/01	08:35	11.55	8.02	0.061	230	0.000	0.0	135.0	135.0	135.0	0.0	135.0	1.00
	08:40	11.70	8.13	0.173	249	1.883	76.7	192.5	115.8	154.1	38.3	141.4	1.66
	08:45	11.85	8.23	0.219	258	1.901	108.8	216.0	107.2	161.6	54.4	143.5	2.02
	08:50	12.04	8.36	0.265	264	1.925	140.8	241.7	100.9	171.3	70.4	147.8	2.40
	08:55	12.19	8.47	0.296	268	1.945	162.3	259.8	97.5	178.6	81.1	151.6	2.66
	09:00	12.37	8.59	0.328	271	1.967	184.4	278.8	94.4	186.6	92.2	155.9	2.95
	09:05	12.58	8.73	0.359	273	1.991	205.7	297.4	91.7	194.5	102.8	160.3	3.24
	09:10	12.76	8.86	0.381	275	2.015	220.7	310.3	89.6	199.9	110.3	163.2	3.46
	09:15	12.92	8.97	0.397	277	2.034	231.5	319.5	88.0	203.7	115.7	165.2	3.63
	09:20	13.18	9.15	0.416	279	2.065	244.2	330.5	86.3	208.4	122.1	167.7	3.83
	09:25	13.37	9.28	0.427	280	2.088	251.4	336.8	85.4	211.1	125.7	169.2	3.94
	09:30	13.60	9.44	0.437	280	2.116	257.9	342.6	84.7	213.6	128.9	170.7	4.04
	09:35	13.83	9.60	0.446	281	2.143	263.6	348.0	84.4	216.2	131.8	172.3	4.12
	09:40	14.03	9.74	0.453	281	2.167	268.0	352.3	84.3	218.3	134.0	173.6	4.18
	09:45	14.27	9.91	0.460	281	2.196	272.3	356.7	84.4	220.5	136.1	175.2	4.23
	09:50	14.48	10.05	0.465	280	2.219	275.2	359.8	84.6	222.2	137.6	176.3	4.25
	09:55	14.69	10.20	0.469	280	2.244	277.5	362.4	84.9	223.7	138.8	177.4	4.27
	10:00	14.89	10.34	0.473	280	2.267	279.8	365.0	85.2	225.1	139.9	178.5	4.28
	10:05	15.13	10.51	0.478	279	2.295	282.7	368.3	85.6	226.9	141.3	179.8	4.30
	10:10	15.32	10.64	0.481	279	2.316	284.3	370.3	86.0	228.1	142.1	180.8	4.31
	10:15	15.57	10.81	0.485	279	2.344	286.4	372.9	86.5	229.7	143.2	182.0	4.31
	10:20	15.81	10.98	0.488	278	2.372	287.9	374.9	87.0	230.9	143.9	183.0	4.31
	10:25	16.03	11.13	0.492	278	2.396	290.1	377.6	87.5	232.5	145.0	184.2	4.32
	10:30	**16.31**	**11.33**	**0.496**	**277**	**2.427**	**292.1**	**380.2**	**88.1**	**234.1**	**146.0**	**185.5**	**4.32**
	10:35	16.49	11.45	0.498	277	2.446	293.0	381.5	88.5	235.0	146.5	186.2	4.31
	10:40	16.71	11.60	0.500	276	2.470	293.8	382.8	89.0	235.9	146.9	186.9	4.30
	10:45	16.95	11.77	0.503	276	2.497	295.3	384.8	89.5	237.1	147.6	187.9	4.30
	10:50	17.18	11.93	0.506	275	2.522	296.7	386.7	90.0	238.4	148.4	188.9	4.30
	10:55	17.44	12.11	0.509	274	2.549	298.1	388.7	90.6	239.7	149.1	190.0	4.29
	11:00	17.60	12.22	0.511	274	2.566	299.0	390.0	91.0	240.5	149.5	190.7	4.29
	11:05	17.87	12.41	0.513	274	2.595	299.7	391.2	91.5	241.4	149.9	191.4	4.28
	11:10	18.11	12.58	0.516	273	2.621	301.1	393.2	92.1	242.6	150.5	192.5	4.27
	11:15	18.28	12.69	0.518	273	2.638	302.0	394.4	92.4	243.4	151.0	193.1	4.27
	11:20	18.54	12.88	0.521	272	2.666	303.3	396.3	93.0	244.7	151.7	194.1	4.26
	11:25	18.74	13.02	0.523	272	2.687	304.2	397.6	93.4	245.5	152.1	194.8	4.26
	11:30	19.00	13.19	0.525	271	2.713	304.8	398.8	94.0	246.4	152.4	195.6	4.24
	11:35	19.19	13.33	0.527	271	2.734	305.7	400.0	94.3	247.1	152.8	196.2	4.24
	11:40	19.41	13.48	0.529	270	2.756	306.4	401.2	94.8	248.0	153.2	196.9	4.23
	11:45	19.65	13.64	0.531	270	2.779	307.1	402.4	95.3	248.9	153.6	197.7	4.22

Borehole No. : WCH-BH01 — **Sample Depth m:- 9.00 - 10.00**

Sample No. : 9 — **Specimen Depth m:- 9.80 - 10.00**

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 — **Works Order No.: 059**

Compiled by: W S Wat

Checked by: H W Chung

Form : GESR009.14 / Dec.13.04 / Issue 1 / Rev 1

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TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2
Shearing Continuation

FAILURE CRITERION													
Max. deviator Stress ☐				Max. Stress ratio ☒			Axial Strain % ☐						
Stage :	3	Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
Date	Time	Dial		P.R.No. 2	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
05/01	11:50	19.89	13.81	0.533	269	2.804	307.8	403.5	95.7	249.6	153.9	198.3	4.22
	11:55	20.11	13.97	0.535	269	2.828	308.5	404.7	96.2	250.5	154.3	199.0	4.21
	12:00	20.33	14.11	0.537	268	2.848	309.3	405.9	96.6	251.3	154.7	199.7	4.20
	12:05	20.57	14.28	0.539	268	2.873	310.0	407.0	97.0	252.0	155.0	200.3	4.20
	12:10	20.79	14.44	0.541	268	2.896	310.7	408.1	97.4	252.7	155.3	201.0	4.19
	12:15	21.01	14.59	0.543	267	2.917	311.4	409.2	97.8	253.5	155.7	201.6	4.18
	12:20	21.25	14.75	0.545	267	2.940	312.1	410.4	98.3	254.3	156.0	202.3	4.17
	12:25	21.51	14.93	0.546	266	2.966	312.1	410.8	98.7	254.7	156.0	202.7	4.16
	12:30	21.72	15.08	0.547	266	2.988	312.1	411.2	99.1	255.2	156.1	203.1	4.15
	12:35	21.93	15.23	0.549	266	3.009	312.9	412.4	99.5	255.9	156.4	203.8	4.14
	12:40	22.15	15.38	0.550	265	3.030	312.9	412.7	99.8	256.3	156.5	204.1	4.14
	12:45	22.41	15.56	0.551	265	3.056	312.9	413.2	100.3	256.7	156.4	204.6	4.12
	12:50	22.61	15.70	0.552	264	3.075	313.0	413.8	100.8	257.3	156.5	205.1	4.10
	12:55	22.82	15.85	0.553	264	3.097	313.0	414.0	101.0	257.5	156.5	205.3	4.10
	13:00	23.03	15.99	0.554	264	3.116	313.1	414.4	101.3	257.9	156.6	205.7	4.09
	13:05	23.30	16.18	0.556	263	3.143	313.7	415.4	101.7	258.5	156.8	206.3	4.08
	13:10	23.47	16.30	0.557	263	3.160	313.8	415.8	102.0	258.9	156.9	206.6	4.08
	13:15	23.75	16.49	0.558	263	3.186	313.7	416.1	102.4	259.3	156.9	207.0	4.06
	13:20	23.94	16.62	0.559	262	3.205	313.8	416.5	102.7	259.6	156.9	207.3	4.06
	13:25	24.16	16.77	0.560	262	3.226	313.9	416.9	103.0	259.9	156.9	207.6	4.05
	13:30	24.44	16.97	0.562	262	3.253	314.4	417.8	103.4	260.6	157.2	208.2	4.04
	13:35	24.69	17.14	0.563	261	3.277	314.3	418.0	103.7	260.9	157.2	208.5	4.03
	13:40	24.86	17.26	0.564	261	3.294	314.5	418.4	103.9	261.1	157.2	208.7	4.03
	13:45	25.08	17.41	0.565	261	3.315	314.5	418.7	104.2	261.5	157.3	209.0	4.02
	13:50	25.27	17.54	0.566	261	3.333	314.6	419.1	104.5	261.8	157.3	209.4	4.01
	13:55	25.50	17.70	0.567	260	3.355	314.6	419.3	104.7	262.0	157.3	209.6	4.00
	14:00	25.80	17.92	0.569	260	3.386	315.0	420.0	105.0	262.5	157.5	210.0	4.00
	14:05	26.01	18.06	0.570	260	3.405	315.1	420.4	105.3	262.8	157.5	210.3	3.99
	14:10	26.23	18.22	0.570	260	3.428	314.4	419.9	105.5	262.7	157.2	210.3	3.98
	14:15	26.48	18.39	0.571	259	3.451	314.4	420.2	105.8	263.0	157.2	210.6	3.97
	14:20	26.72	18.56	0.572	259	3.475	314.3	420.3	106.0	263.1	157.1	210.8	3.97
	14:25	26.90	18.68	0.572	259	3.492	313.8	420.0	106.2	263.1	156.9	210.8	3.95
	14:30	27.16	18.86	0.573	259	3.517	313.7	420.2	106.5	263.3	156.8	211.1	3.95
	14:35	27.43	19.05	0.573	258	3.544	312.9	419.7	106.8	263.3	156.5	211.1	3.93
	14:40	27.70	19.24	0.574	258	3.570	312.8	419.8	107.0	263.4	156.4	211.3	3.92
	14:45	27.91	19.38	0.574	258	3.590	312.2	419.4	107.2	263.3	156.1	211.3	3.91
	14:50	28.03	19.47	0.575	258	3.603	312.5	419.8	107.3	263.5	156.2	211.5	3.91
	14:55	28.27	19.63	0.575	258	3.625	311.8	419.3	107.5	263.4	155.9	211.4	3.90
	15:00	28.60	19.86	0.577	257	3.658	312.1	420.0	107.9	263.9	156.0	211.9	3.89
	15:05	28.75	19.96	0.577	257	3.672	311.7	419.7	108.0	263.8	155.8	211.9	3.89
	15:10	28.95	20.10	0.578	257	3.692	311.7	419.8	108.1	264.0	155.9	212.0	3.88

Borehole No. : WCH-BH01 **Sample Depth m:- 9.00 - 10.00**

Sample No. : 9 **Specimen Depth m:- 9.80 - 10.00**

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.: 059**

Compiled by: W S Wat

Checked by: H W Chung

Form : GESR009.15 / Dec.13.04 / Issue 1 / Rev 1

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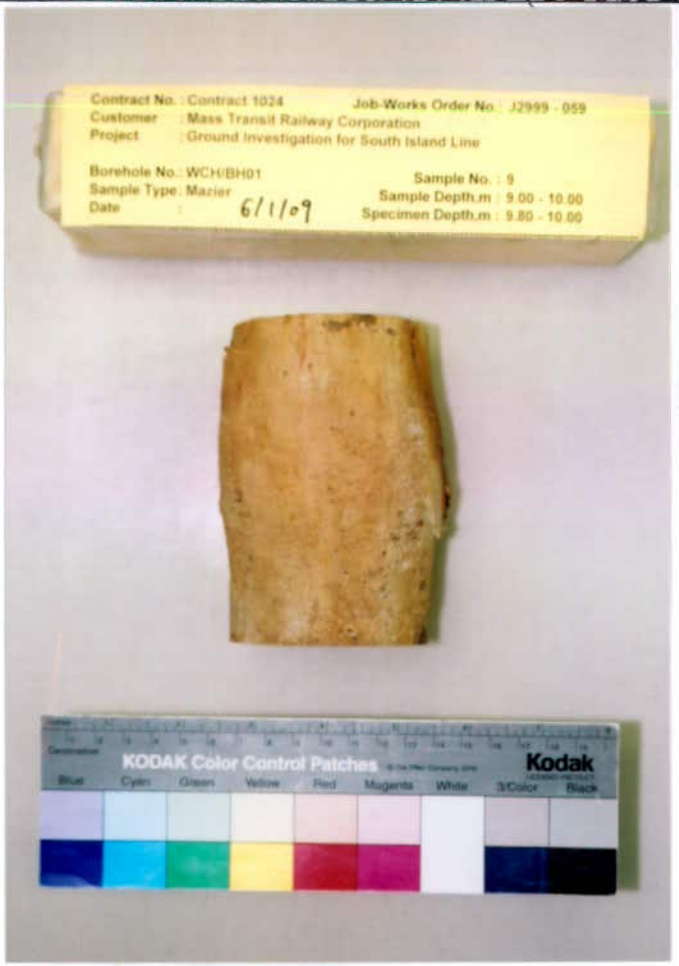
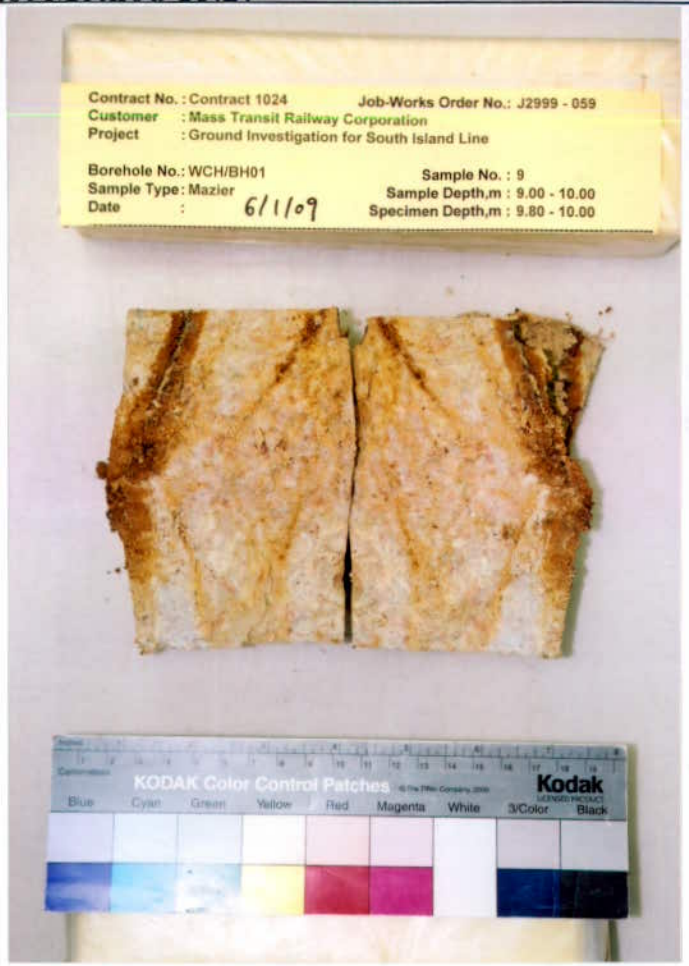
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT (GEOSPEC 3 : 2001 Test Method 15.2)





Description : Brown, silty, gravelly SAND

Sample Origin : CDM ‡ ‡ Information provided by customer

Borehole No. : WCH-BH01 Sample No. : 9 Sample Depth m:- 9.00 - 10.00 Specimen Depth m:- 9.80 - 10.00

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line

Contract No.: Contract 1024
Job No.: J2999
Works Order No.: 059

Compiled by W S Wat

Checked by H W Chung

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	WCH-BH01		
Sample		no	13		
Sample Type			Mazier		
Stage		no	1		
Sample Depth		m	11.00 - 12.00		
Specimen Depth		m	11.60 - 11.80		
INITIAL CONDITIONS					
Diameter	(D_o)	mm	73.9		
Height	(H_o)	mm	145.0		
Moisture Content	(W_o)	%	23		
Bulk density	(ρ_o)	Mg/m^3	1.90		
Dry density	(ρ_d)	Mg/m^3	1.54		
Particle density	(ρ_s)		2.65		
Voids Ratio	(e_o)		0.72		
Degree of Saturation	(S_r)	%	86.4		
DRAINAGE CONDITIONS			ONE END		
SATURATION					
Final Pore Pressure Coefficient B			0.96		
CONSOLIDATION					
Cell Pressure	(σ_3)	kPa	335		
Back Pressure	(u_b)	kPa	220		
Effective Pressure	(σ'_3)	kPa	115		
Coefficient of Consolidation (t100) (C_{vi})		m^2/Year	18899.22		
Coefficient of Volume Compressibility (m_{vi})		m^2/MN	0.25		
Coefficient of Permeability (k)		m/s	1.45E-06		
COMPRESSION TERMINATION CRITERION			MAXIMUM DEVIATOR STRESS		
COMPRESSION - INITIAL					
Moisture Content	(w)	%	25		
Pore Pressure at the End of Consolidation		kPa	220		
Effective Stress at the End of Consolidation		kPa	115		
Bulk density	(ρ_o)	Mg/m^3	1.99		
Dry density	(ρ_d)	Mg/m^3	1.58		
Voids Ratio	(e)		0.67		
Degree of Saturation	(S_r)	%	99.7		

Customer : **Mass Transit Railway Corporation**

Project : **Ground Investigation for South Island Line**

Report No. : J2999-059.11

Contract No.: Contract 1024

Job No.: **J2999** **Works Order No.: 059**

Technician : W S Wat

Checked By : Name : H W Chung Date : 17/12/2008

Approved By : Signatory : **Lau Wai Cheong** Date : 17/12/2008

Tested Date: 09/12/2008

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Form : GESR009.6 / Nov.10.06 / Issue 1 / Rev 1

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	WCH-BH01		
Sample		no	13		
Sample Type			Mazier		
Stage		no	1		
Sample Depth		m	11.00 - 12.00		
Specimen Depth		m	11.60 - 11.80		
COMPRESSION - FAILURE					
Cell Pressure		kPa	335		
Rate of Strain		mm/min	0.048		
CONDITIONS MAXIMUM DEVIATOR STRESS					
Major Effective Principal Stress (σ'_1)		kPa	575		
Corrected Deviator Stress ($\sigma'_1 - \sigma'_3$)		kPa	451		
Minor Effective Principal Stress (σ'_3)		kPa	124		
$s' = (\sigma'_1 + \sigma'_3)/2$		kPa	349		
$t = (\sigma_1 - \sigma_3)/2$		kPa	226		
Expanded Uncertainty of s' ^		kPa	-		
Expanded Uncertainty of t ^		kPa	-		
Pore pressure parameter A_f			-0.02		
Strain at Failure	(εf)	%	11.8		
COMPRESSION - FINAL					
Moisture Content	(W_f)	%	25		
Bulk density	(ρ_o)	Mg/m^3	1.99		
Dry density	(ρ_d)	Mg/m^3	1.58		
Voids Ratio	(e_f)		0.67		
Degree of Saturation	(S_f)	%	99.7		

Notes -
1. The method of specimen preparation was in accordance with GEOSPEC 3 : 2001 :- Test method 13.3 : test specimen from undisturbed soil samples.
2. Sample received date :29/09/2008
3. The determination of moisture content was in accordance with test method 5.1 of GEOSPEC 3 : 2001.
4. Particle density : 2.65 (Assumed)
5. Maximum and minimum temperature recorded over the period of testing 19.9 - 20.7 °C.
6. Unavoidable variations from specified procedure : none
7. Comment on observed or inferred sample disturbance : none
8. Percentage by mass of soil particles larger than 1/5 of the diameter of specimen (%) : Nil
9. The specimen was selected by the laboratory.
   Name : W S Wat Designation : Senior Laboratory Technician
10. Sampling History : As Received

* Delete as appropriate ^ Upon request

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.: 059**

Compiled by W S Wat
Checked by H W Chung

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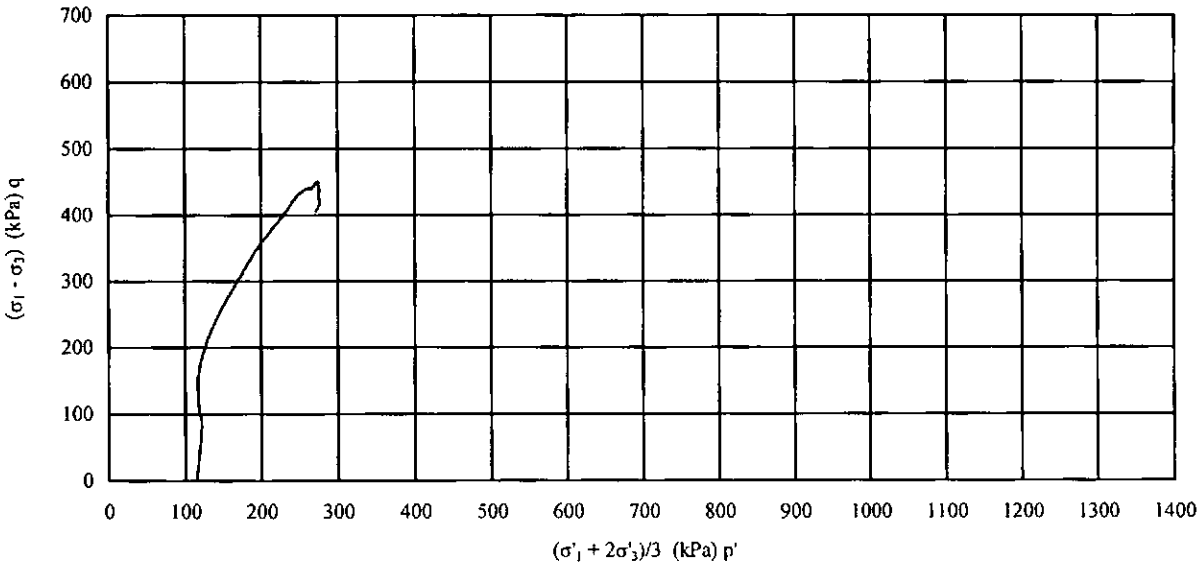
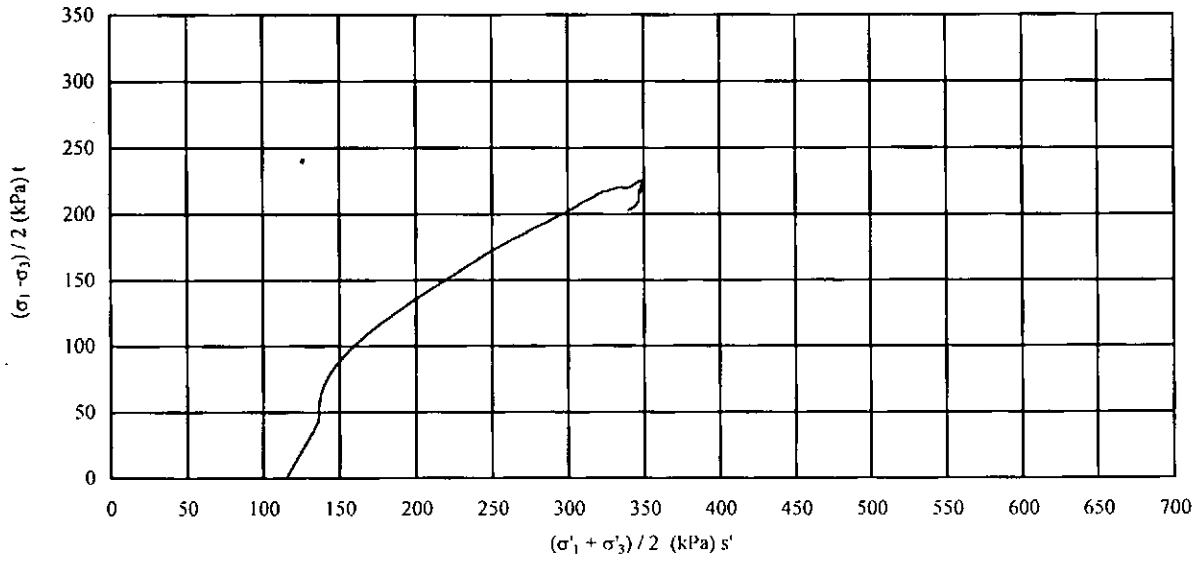
TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

STRESS PATH PARAMETERS FOR EFFECTIVE STRESS

p' - q PLOT



s' - t PLOT



Borehole No. :	**WCH-BH01**	**Sample Depth m:-**	**11.00 - 12.00**
Sample No. :	**13**	**Specimen Depth m:-**	**11.60 - 11.80**
Customer :	**Mass Transit Railway Corporation**		Compiled by W S Wat
Project :	**Ground Investigation for South Island Line**		
		Contract No.: Contract 1024	Checked by H W Chung
Job No.:	**J2999**	**Works Order No.: 059**	

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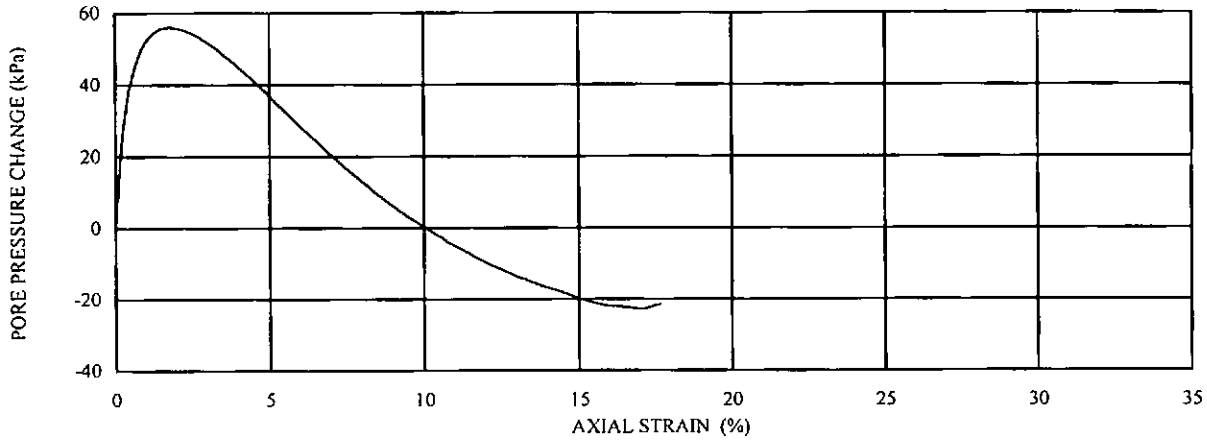
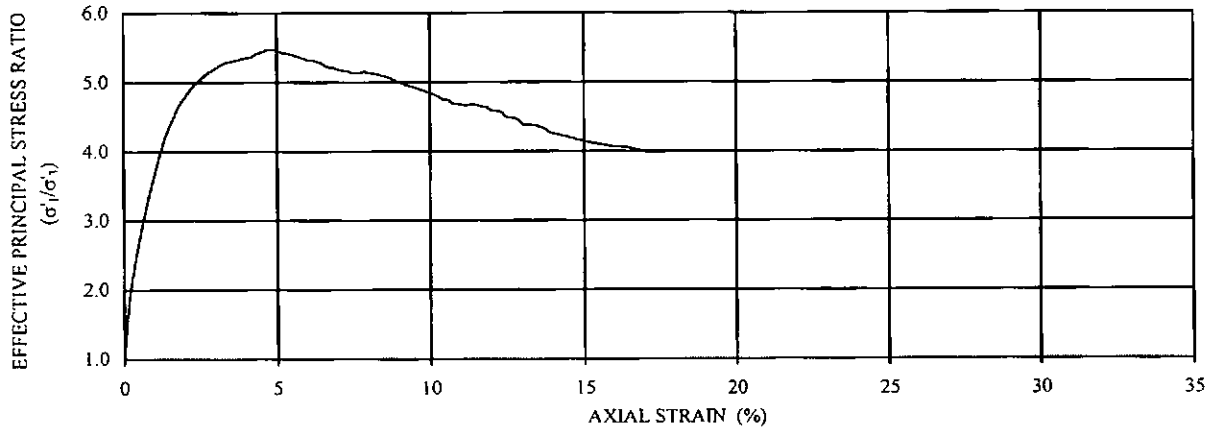
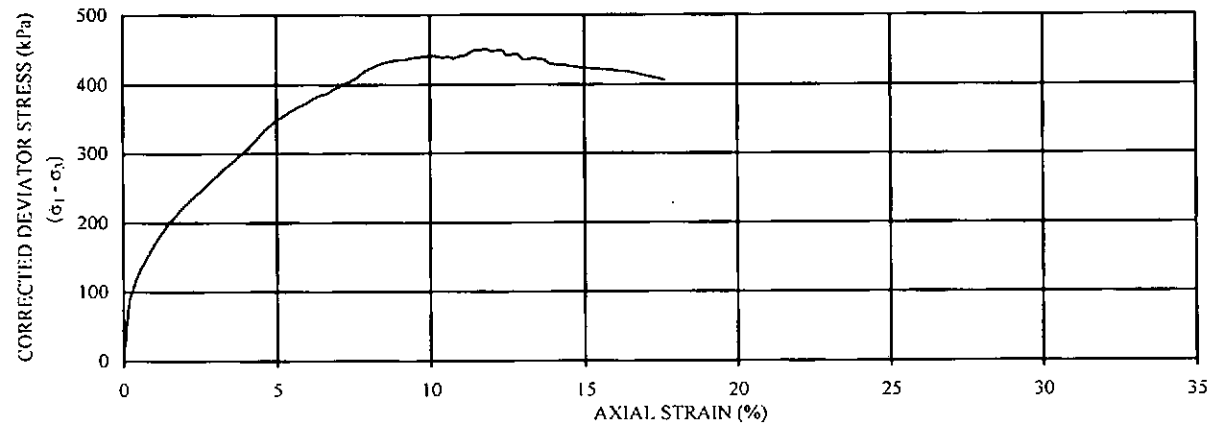
Form : GESR009.8 / Jun.02.03 / Issue 1 / Rev 0

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

COMPRESSION







Borehole No. : WCH-BH01		**Sample Depth m:-** 11.00 - 12.00
Sample No. : 13		**Specimen Depth m:-** 11.60 - 11.80
Customer : Mass Transit Railway Corporation		Compiled by W S Wat
Project : Ground Investigation for South Island Line		
	Contract No.: Contract 1024	Checked by H W Chung
Job No.: J2999	**Works Order No.:** 059	

Form : GESR009.9 / Jun.02.03 / Issue 1 / Rev 0

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TEST REPORT
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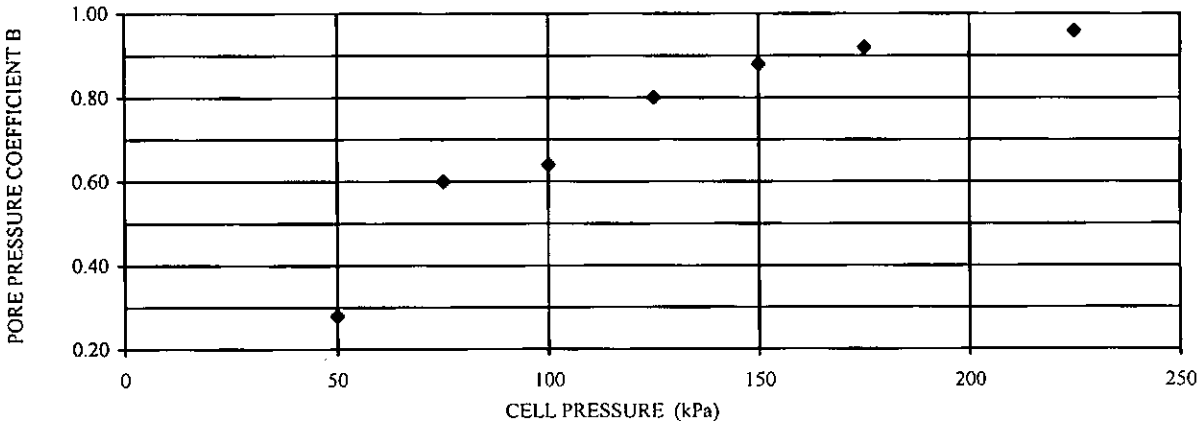
GEOSPEC 3 : 2001 Test Method 15.2

SATURATION



Date	Time	Cell Pressure kPa	Back Pressure kPa	Pore Pressure kPa	Cumulative Volume of Water cm^3	Pore Pressure Coefficient B
10/12/2008	14:06	0	0	-	0.0	
	14:14	25	-	9		-
	15:11	25	20	20	3.7	
	15:32	50	-	27		0.28
11/12/2008	10:40	50	45	45	17.3	
	10:51	75	-	60		0.60
	12:40	75	70	70	31.1	
	12:49	100	-	86		0.64
12/12/2008	09:10	100	95	95	31.2	
	09:17	125	-	115		0.80
	10:10	125	120	120	32.3	
	10:19	150	-	142		0.88
	11:10	150	145	145	33.9	
	11:20	175	-	168		0.92
	13:30	175	170	170	34.3	
	13:42	225	-	218		0.96
15/12/2008	13:05	225	220	220	34.5	

Borehole No. WCH-BH01 — **Sample Depth m:-** 11.00 - 12.00
Sample No. : 13 — **Specimen Depth m:-** 11.60 - 11.80
Customer : Mass Transit Railway Corporation — Compiled by W S Wat
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024 — Checked by H W Chung
Job No.: J2999 — **Works Order No.:** 059

Form : GESR009.11 / Jun.02.03 / Issue 1 / Rev 0

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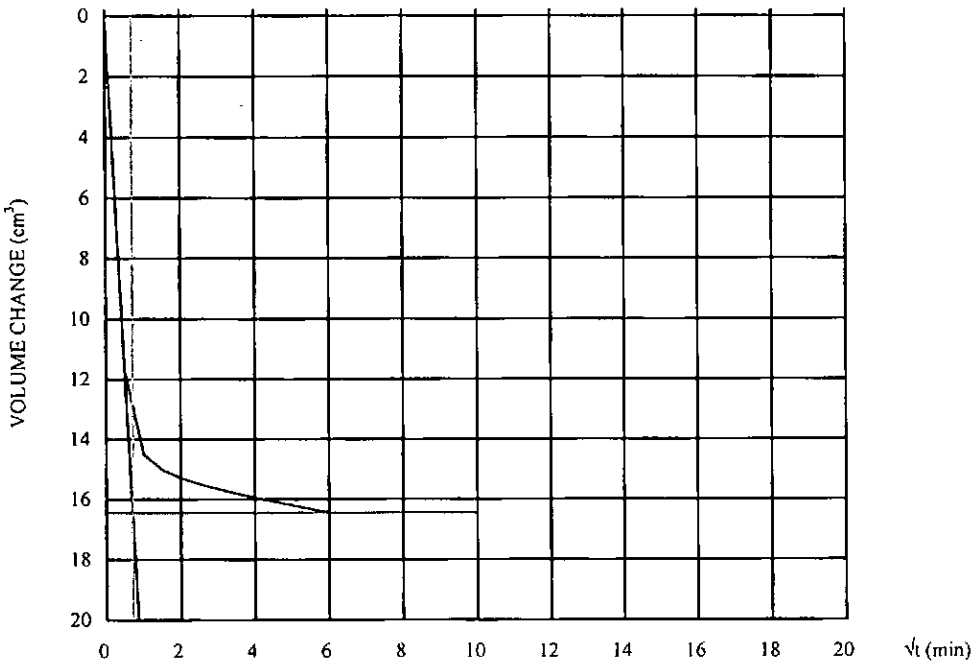
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

CONSOLIDATION (DRAINED PHASE) - Stage 1

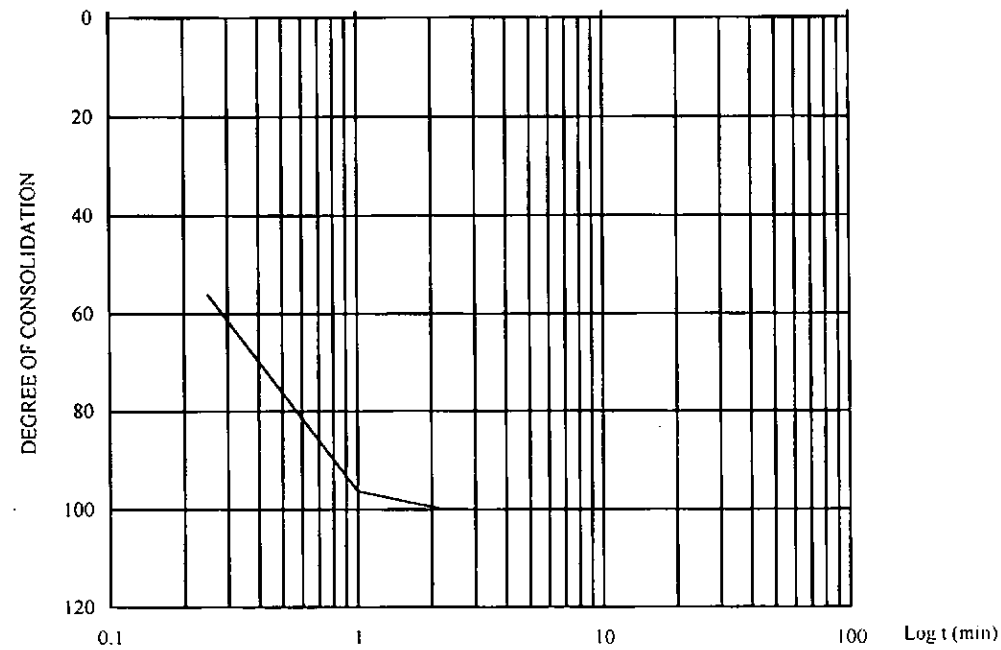


√t100 0.70 min

t100 0.492 min

tf 0.261 min

Calc. strain rate
38.600 mm/min



Borehole No. : WCH-BH01 — **Sample Depth m:-** 11.00 - 12.00

Sample No. : 13 — **Specimen Depth m:-** 11.60 - 11.80

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 — **Works Order No.:** 059

Complied by: W S Wat

Checked by: H W Chung

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TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Single Stage		P.W.P,B.P			Effective Pressure	115	kPa
Side drains	No	Selected Machine Speed	0.048	mm/min	Rate of Strain	2.00	% per hr

FAILURE CRITERION

Max. deviator Stress	☒	Max. Stress ratio	☐	Axial Strain %	☐

Stage : 1	Applied Pressure (kPa) - Cell :	335	Back :	220	P.R. factor	3.0328	kN/mm

Date	Time	Strain Dial	Strain	Load P.R.No. 25	Pore Pressure	Dev. stress Corr.	Dev. stress q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
16/12	08:35	0.00	0.00	0.064	220	0.000	0.0	115.0	115.0	115.0	0.0	115.0	1.00
	08:40	0.25	0.18	0.180	241	0.052	83.3	177.2	93.9	135.5	41.6	121.7	1.89
	08:45	0.43	0.30	0.209	251	0.087	103.9	188.3	84.4	136.4	52.0	119.0	2.23
	08:50	0.61	0.42	0.230	257	0.121	118.8	196.5	77.7	137.1	59.4	117.3	2.53
	08:55	0.82	0.57	0.251	263	0.163	133.6	205.7	72.1	138.9	66.8	116.6	2.85
	09:00	1.08	0.75	0.272	268	0.213	148.3	215.6	67.3	141.5	74.2	116.7	3.20
	09:05	1.31	0.91	0.290	271	0.258	160.8	225.0	64.2	144.6	80.4	117.8	3.51
	09:10	1.55	1.08	0.308	273	0.304	173.3	235.4	62.1	148.8	86.7	119.9	3.79
	09:15	1.77	1.23	0.323	274	0.345	183.7	244.4	60.7	152.5	91.8	121.9	4.03
	09:20	2.02	1.40	0.339	275	0.391	194.7	254.4	59.7	157.0	97.3	124.6	4.26
	09:25	2.22	1.54	0.350	276	0.428	202.2	261.5	59.3	160.4	101.1	126.7	4.41
	09:30	2.44	1.70	0.362	276	0.471	210.3	269.3	59.0	164.1	105.1	129.1	4.56
	09:35	2.62	1.82	0.371	276	0.502	216.3	275.3	59.0	167.2	108.2	131.1	4.67
	09:40	2.91	2.03	0.385	276	0.557	225.7	285.0	59.3	172.1	112.8	134.5	4.81
	09:45	3.19	2.22	0.398	275	0.605	234.4	294.1	59.7	176.9	117.2	137.8	4.93
	09:50	3.44	2.40	0.409	275	0.651	241.6	301.9	60.3	181.1	120.8	140.8	5.01
	09:55	3.69	2.57	0.419	274	0.694	248.1	309.1	61.0	185.1	124.1	143.7	5.07
	10:00	3.88	2.70	0.428	273	0.726	254.1	315.7	61.6	188.6	127.0	146.3	5.12
	10:05	4.25	2.95	0.444	272	0.788	264.5	327.6	63.1	195.4	132.3	151.3	5.19
	10:10	4.37	3.04	0.449	272	0.810	267.8	331.3	63.5	197.4	133.9	152.8	5.22
	10:15	4.66	3.24	0.462	270	0.858	276.2	340.9	64.7	202.8	138.1	156.8	5.27
	10:20	4.85	3.37	0.470	269	0.889	281.3	346.9	65.6	206.3	140.7	159.4	5.29
	10:25	5.06	3.52	0.479	268	0.925	287.1	353.8	66.7	210.3	143.6	162.4	5.30
	10:30	5.28	3.67	0.487	267	0.960	292.2	359.9	67.7	213.8	146.1	165.1	5.32
	10:35	5.50	3.83	0.497	266	0.997	298.6	367.4	68.8	218.1	149.3	168.3	5.34
	10:40	5.72	3.98	0.506	265	1.032	304.3	374.2	69.9	222.0	152.1	171.3	5.35
	10:45	5.95	4.14	0.516	264	1.069	310.7	381.9	71.2	226.5	155.3	174.8	5.36
	10:50	6.22	4.33	0.531	262	1.112	320.3	392.9	72.6	232.8	160.2	179.4	5.41
	10:55	6.47	4.51	0.544	261	1.152	328.6	402.7	74.1	238.4	164.3	183.6	5.43
	11:00	6.69	4.65	0.555	260	1.183	335.6	410.8	75.2	243.0	167.8	187.1	5.46
	11:05	6.96	4.85	0.567	258	1.227	343.1	419.9	76.8	248.4	171.6	191.2	5.47
	11:10	7.17	4.99	0.575	257	1.258	348.0	426.0	78.0	252.0	174.0	194.0	5.46
	11:15	7.46	5.19	0.584	255	1.301	353.4	433.2	79.8	256.5	176.7	197.6	5.43
	11:20	7.70	5.36	0.592	254	1.337	358.2	439.3	81.1	260.2	179.1	200.5	5.42
	11:25	7.94	5.53	0.600	253	1.373	362.9	445.4	82.5	264.0	181.5	203.5	5.40
	11:30	8.18	5.70	0.607	251	1.409	367.0	450.9	83.9	267.4	183.5	206.2	5.37
	11:35	8.42	5.86	0.613	250	1.442	370.4	455.6	85.2	270.4	185.2	208.7	5.35
	11:40	8.61	5.99	0.619	249	1.469	373.9	460.3	86.4	273.3	186.9	211.0	5.33
	11:45	8.86	6.17	0.628	247	1.506	379.2	467.0	87.8	277.4	189.6	214.2	5.32

Borehole No. : WCH-BH01 — **Sample Depth m:-** 11.00 - 12.00
Sample No. : 13 — **Specimen Depth m:-** 11.60 - 11.80

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 — **Works Order No.:** 059

Compiled by: W S Wat
Checked by: H W Chung

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2
Shearing Continuation

FAILURE CRITERION													
Max. deviator Stress ☒				Max. Stress ratio ☐				Axial Strain % ☐					
Stage : 1		Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
Date	Time	Dial		P.R.No. 25	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
16/12	11:50	9.12	6.35	0.635	246	1.542	383.2	472.4	89.2	280.8	191.6	216.9	5.30
	11:55	9.33	6.49	0.640	245	1.570	385.9	476.2	90.3	283.3	193.0	218.9	5.27
	12:00	9.52	6.63	0.642	244	1.598	386.7	478.1	91.4	284.7	193.3	220.3	5.23
	12:05	9.88	6.87	0.654	242	1.646	393.6	487.1	93.5	290.3	196.8	224.7	5.21
	12:10	10.09	7.02	0.659	240	1.675	396.3	491.0	94.7	292.9	198.2	226.8	5.19
	12:15	10.36	7.21	0.667	239	1.712	400.8	496.9	96.1	296.5	200.4	229.7	5.17
	12:20	10.58	7.37	0.673	238	1.742	404.1	501.4	97.3	299.4	202.1	232.0	5.15
	12:25	10.82	7.53	0.679	237	1.773	407.4	505.9	98.5	302.2	203.7	234.3	5.14
	12:30	11.06	7.69	0.687	235	1.803	411.9	511.6	99.7	305.7	206.0	237.0	5.13
	12:35	11.30	7.87	0.699	234	1.836	419.1	520.0	100.9	310.4	209.5	240.6	5.15
	12:40	11.54	8.03	0.705	233	1.866	422.3	524.4	102.1	313.2	211.1	242.9	5.14
	12:45	11.83	8.24	0.714	231	1.904	427.2	530.8	103.6	317.2	213.6	246.0	5.12
	12:50	12.09	8.41	0.720	230	1.935	430.3	535.2	104.9	320.1	215.2	248.3	5.10
	12:55	12.26	8.53	0.723	229	1.957	431.7	537.4	105.7	321.5	215.8	249.6	5.08
	13:00	12.42	8.64	0.726	229	1.977	433.1	539.5	106.4	323.0	216.6	250.8	5.07
	13:05	12.72	8.85	0.730	227	2.014	434.7	542.5	107.8	325.2	217.4	252.7	5.03
	13:10	13.00	9.05	0.733	226	2.049	435.7	544.8	109.1	326.9	217.8	254.3	4.99
	13:15	13.28	9.24	0.736	225	2.082	436.7	547.0	110.3	328.6	218.3	255.9	4.96
	13:20	13.53	9.41	0.740	224	2.112	438.4	549.7	111.3	330.5	219.2	257.4	4.94
	13:25	13.84	9.63	0.743	222	2.149	439.3	551.9	112.6	332.3	219.7	259.0	4.90
	13:30	13.99	9.74	0.745	222	2.168	440.0	553.2	113.2	333.2	220.0	259.9	4.89
	13:35	14.22	9.89	0.747	221	2.193	440.6	554.7	114.1	334.4	220.3	261.0	4.86
	13:40	14.46	10.07	0.749	220	2.224	441.0	556.0	115.0	335.5	220.5	262.0	4.83
	13:45	14.74	10.26	0.750	219	2.255	440.6	556.7	116.1	336.4	220.3	263.0	4.80
	13:50	14.98	10.42	0.748	218	2.282	438.5	555.5	117.0	336.3	219.3	263.2	4.75
	13:55	15.19	10.57	0.753	217	2.306	441.0	558.7	117.7	338.2	220.5	264.7	4.75
	14:00	15.45	10.75	0.750	216	2.336	438.1	557.0	118.9	338.0	219.1	264.9	4.68
	14:05	15.74	10.95	0.756	215	2.368	441.0	560.7	119.7	340.2	220.5	266.7	4.68
	14:10	15.99	11.13	0.759	214	2.397	442.0	562.7	120.7	341.7	221.0	268.0	4.66
	14:15	16.34	11.37	0.771	213	2.435	448.4	570.2	121.8	346.0	224.2	271.3	4.68
	14:20	16.45	11.45	0.773	213	2.448	449.2	571.3	122.1	346.7	224.6	271.8	4.68
	14:25	16.70	11.62	0.775	212	2.475	449.6	572.6	123.0	347.8	224.8	272.9	4.66
	14:30	**16.99**	**11.82**	**0.779**	**211**	**2.506**	**451.1**	**575.0**	**123.9**	**349.4**	**225.5**	**274.3**	**4.64**
	14:35	17.21	11.98	0.775	210	2.531	447.7	572.3	124.6	348.5	223.9	273.8	4.59
	14:40	17.45	12.14	0.779	210	2.555	449.4	574.7	125.3	350.0	224.7	275.1	4.59
	14:45	17.70	12.32	0.781	209	2.583	449.7	575.7	126.0	350.9	224.9	275.9	4.57
	14:50	17.93	12.48	0.771	208	2.607	442.6	569.2	126.6	347.9	221.3	274.1	4.50
	14:55	18.18	12.65	0.774	208	2.633	443.5	570.8	127.3	349.1	221.8	275.1	4.48
	15:00	18.46	12.85	0.775	207	2.663	443.1	571.1	128.0	349.6	221.6	275.7	4.46
	15:05	18.70	13.01	0.765	206	2.687	436.0	564.8	128.8	346.8	218.0	274.1	4.39
	15:10	18.92	13.17	0.768	206	2.711	437.1	566.3	129.2	347.7	218.5	274.9	4.38

Borehole No. : WCH-BH01 — **Sample Depth m:- 11.00 - 12.00**

Sample No. : 13 — **Specimen Depth m:- 11.60 - 11.80**

Customer : Mass Transit Railway Corporation — Compiled by W S Wat

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024 — Checked by H W Chung

Job No.: J2999 — **Works Order No.:** 059

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2
Shearing Continuation

FAILURE CRITERION

Max. deviator Stress ☒ | Max. Stress ratio ☐ | Axial Strain % ☐

Stage :	1	Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
Date	Time	Dial		P.R.No. 25	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
16/12	15:15	19.20	13.36	0.772	205	2.740	438.5	568.3	129.8	349.1	219.3	276.0	4.38
	15:20	19.46	13.54	0.772	205	2.766	437.6	568.0	130.4	349.2	218.8	276.3	4.36
	15:25	19.70	13.71	0.770	204	2.791	435.5	566.4	130.9	348.6	217.7	276.1	4.33
	15:30	19.93	13.87	0.763	204	2.815	430.3	561.8	131.5	346.7	215.2	274.9	4.27
	15:45	20.72	14.42	0.763	202	2.895	427.5	560.5	133.0	346.7	213.7	275.5	4.21
	16:00	21.48	14.95	0.762	200	2.971	424.1	558.7	134.6	346.7	212.1	276.0	4.15
	16:15	22.15	15.41	0.763	199	3.036	422.3	558.1	135.8	347.0	211.2	276.6	4.11
	16:30	22.94	15.96	0.764	198	3.114	420.1	557.0	136.9	346.9	210.0	276.9	4.07
	16:45	23.77	16.54	0.765	198	3.195	417.7	554.9	137.2	346.1	208.9	276.4	4.04
	17:00	24.48	17.03	0.760	197	3.264	412.2	550.0	137.8	343.9	206.1	275.2	3.99
	17:15	25.33	17.63	0.755	199	3.347	406.1	542.5	136.4	339.5	203.1	271.8	3.98

Borehole No. : WCH-BH01 **Sample Depth m:-** 11.00 - 12.00
Sample No. : 13 **Specimen Depth m:-** 11.60 - 11.80

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.:** 059

Compiled by: W S Wat
Checked by: H W Chung

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT (GEOSPEC 3 : 2001 Test Method 15.2)

Gammon

Description : Brown, silty, gravelly SAND **Sample Origin : CDM‡** ‡ Information provided by customer

Borehole No. :	**WCH-BH01**	**Sample No. : 13**	**Sample Depth m:-**	**11.00 - 12.00**
Specimen Depth m:-	**11.60 - 11.80**			

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line

Contract No. : Contract 1024
Job No. : J2999
Works Order No.: 059

Compiled by
W S Wat

Checked by
H W Chung

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	WCH-BH01	WCH-BH01	WCH-BH01
Sample		no	13	13	13
Sample Type			Mazier	Mazier	Mazier
Stage		no	1	2	3
Sample Depth		m	11.00 - 12.00	11.00 - 12.00	11.00 - 12.00
Specimen Depth		m	11.80 - 12.00	11.80 - 12.00	11.80 - 12.00
INITIAL CONDITIONS					
Diameter	(D_o)	mm	73.9	75.0	75.9
Height	(H_o)	mm	145.0	138.6	133.9
Moisture Content	(W_o)	%	23	25	24
Bulk density	(ρ_o)	Mg/m^3	1.94	2.00	2.02
Dry density	(ρ_d)	Mg/m^3	1.58	1.60	1.62
Particle density	(ρ_s)		2.65	2.65	2.65
Voids Ratio	(e_o)		0.68	0.65	0.63
Degree of Saturation	(S_r)	%	88.0	101.5	101.6
DRAINAGE CONDITIONS			ONE END		
SATURATION					
Final Pore Pressure Coefficient B			0.96		
CONSOLIDATION					
Cell Pressure	(σ_3)	kPa	275	330	385
Back Pressure	(u_b)	kPa	220	220	220
Effective Pressure	(σ'_3)	kPa	55	110	165
Coefficient of Consolidation (t100) (C_{vi})		$m^2/Year$	21716.06	21803.65	29671.97
Coefficient of Volume Compressibility (m_{vi})		m^2/MN	0.32	0.17	0.11
Coefficient of Permeability (k)		m/s	2.15E-06	1.16E-06	1.02E-06
COMPRESSION TERMINATION CRITERION			MAXIMUM STRESS RATIO		MAX ($\sigma'1 - \sigma'3$)
COMPRESSION - INITIAL					
Moisture Content	(w)	%	25	24	24
Pore Pressure at the End of Consolidation		kPa	220	220	220
Effective Stress at the End of Consolidation		kPa	55	110	165
Bulk density	(ρ_o)	Mg/m^3	2.00	2.02	2.03
Dry density	(ρ_d)	Mg/m^3	1.60	1.62	1.64
Voids Ratio	(e)		0.65	0.63	0.61
Degree of Saturation	(S_r)	%	101.5	101.6	101.6

Customer : **Mass Transit Railway Corporation**

Project : **Ground Investigation for South Island Line**

Report No. : J2999-059.11

Contract No.: Contract 1024

Job No.: **J2999** **Works Order No.: 059**

Technician : W S Wat Checked By : Name : H W Chung Approved By : Signatory : **Lau Wai Cheong**

Tested Date: 09/12/2008 Date : 17/12/2008 Date : 17/12/2008

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Form : GESR009.6 / Nov.10.06 / Issue 1 / Rev 1

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	WCH-BH01	WCH-BH01	WCH-BH01
Sample		no	13	13	13
Sample Type			Mazier	Mazier	Mazier
Stage		no	1	2	3
Sample Depth		m	11.00 - 12.00	11.00 - 12.00	11.00 - 12.00
Specimen Depth		m	11.80 - 12.00	11.80 - 12.00	11.80 - 12.00
COMPRESSION - FAILURE					
Cell Pressure		kPa	275	330	385
Rate of Strain		mm/min	0.048	0.046	0.044
CONDITIONS AT MAXIMUM STRESS RATIO					
Major Effective Principal Stress (σ'_1)		kPa	301	519	737
Corrected Deviator Stress ($\sigma'_1 - \sigma'_3$)		kPa	252	426	590
Minor Effective Principal Stress (σ'_3)		kPa	49	93	146
$s' = (\sigma'_1 + \sigma'_3)/2$		kPa	175	306	442
$t = (\sigma_1 - \sigma_3)/2$		kPa	126	213	295
Expanded Uncertainty of s' ^		kPa	-	-	-
Expanded Uncertainty of t ^		kPa	-	-	-
Pore pressure parameter A_f			0.02	0.04	0.03
Strain at Failure	(εf)	%	3.8	7.1	9.9
COMPRESSION - FINAL					
Moisture Content	(W_f)	%	25	24	24
Bulk density	(ρ_o)	Mg/m^3	2.00	2.02	2.03
Dry density	(ρ_d)	Mg/m^3	1.60	1.62	1.64
Voids Ratio	(e_f)		0.65	0.63	0.61
Degree of Saturation	(S_f)	%	101.5	101.6	101.6

Notes -
1. The method of specimen preparation was in accordance with GEOSPEC 3 : 2001 :- Test method 13.3 : test specimen from undisturbed soil samples.
2. Sample received date :29/09/2008
3. The determination of moisture content was in accordance with test method 5.1 of GEOSPEC 3 : 2001.
4. Particle density : 2.65 (Assumed)
5. Maximum and minimum temperature recorded over the period of testing 19.9 - 20.7 °C.
6. Unavoidable variations from specified procedure : none
7. Comment on observed or inferred sample disturbance : none
8. Percentage by mass of soil particles larger than 1/5 of the diameter of specimen (%) : Nil
9. The specimen was selected by the laboratory.
   Name : W S Wat Designation : Senior Laboratory Technician
10. Sampling History : As Received

* Delete as appropriate ^ Upon request

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.: 059**

Compiled by W S Wat
Checked by H W Chung

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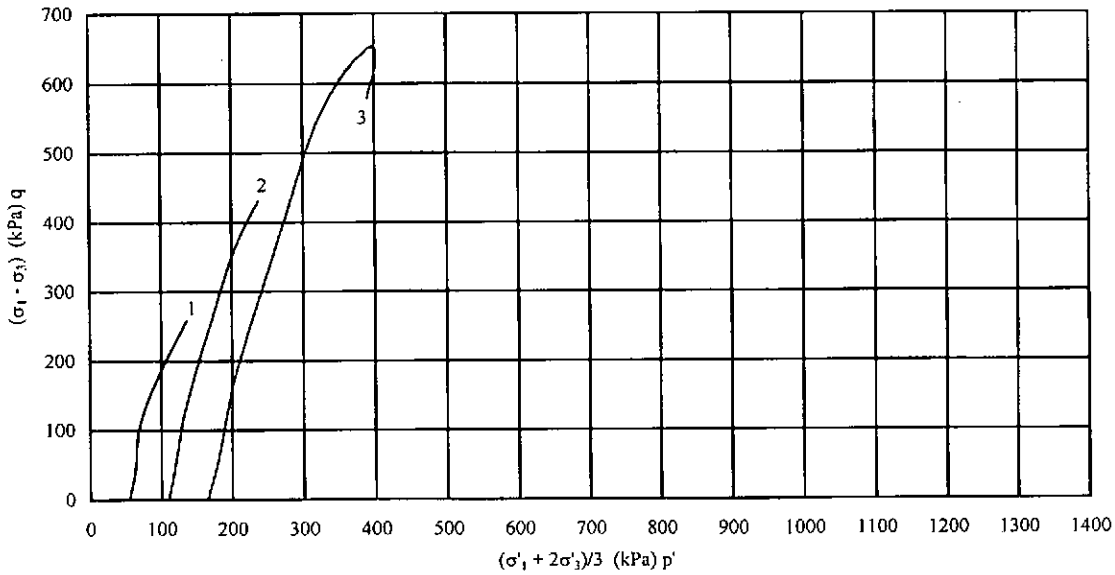
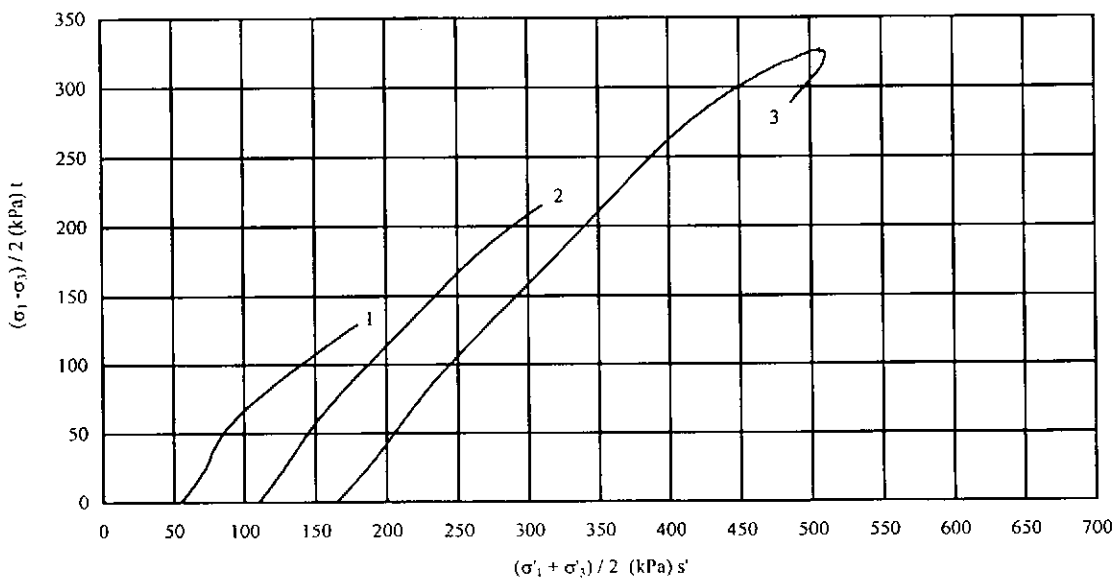
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

STRESS PATH PARAMETERS FOR EFFECTIVE STRESS

p' - q PLOT



s' - t PLOT



Borehole No. :	**WCH-BH01**	**Sample Depth m:-**	**11.00 - 12.00**
Sample No. :	**13**	**Specimen Depth m:-**	**11.80 - 12.00**
Customer :	**Mass Transit Railway Corporation**		Compiled by W S Wat
Project :	**Ground Investigation for South Island Line**		
		Contract No.: Contract 1024	Checked by H W Chung
Job No.:	**J2999**	**Works Order No.: 059**	

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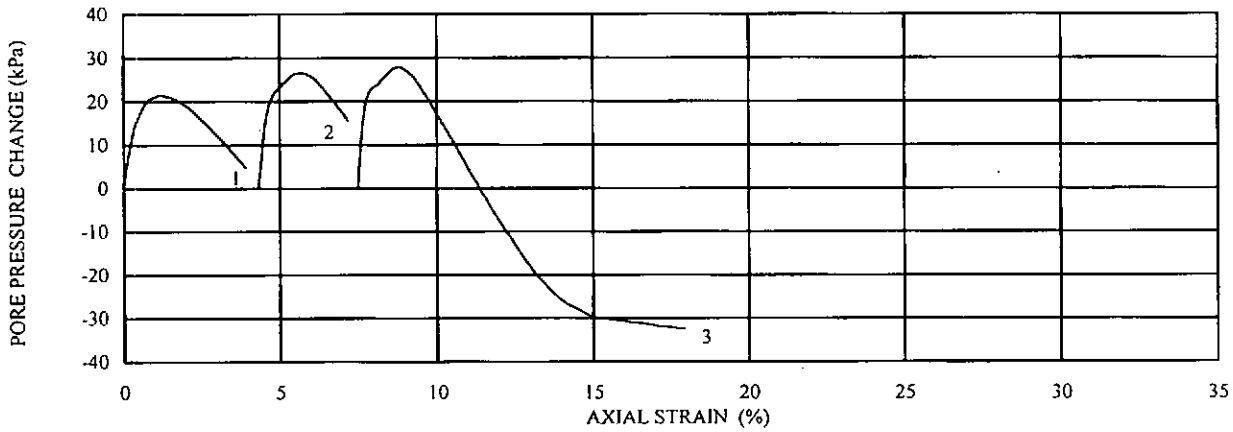
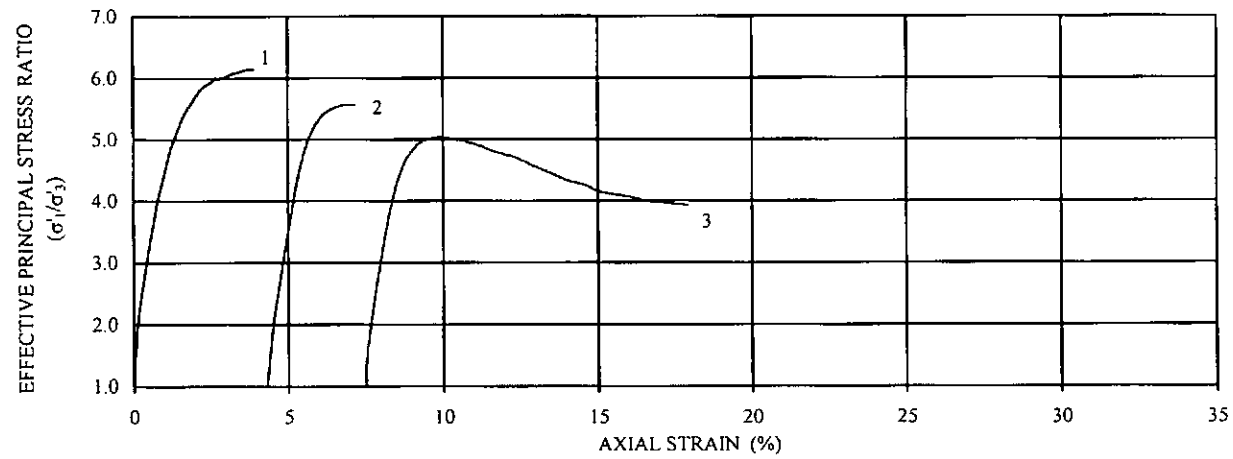
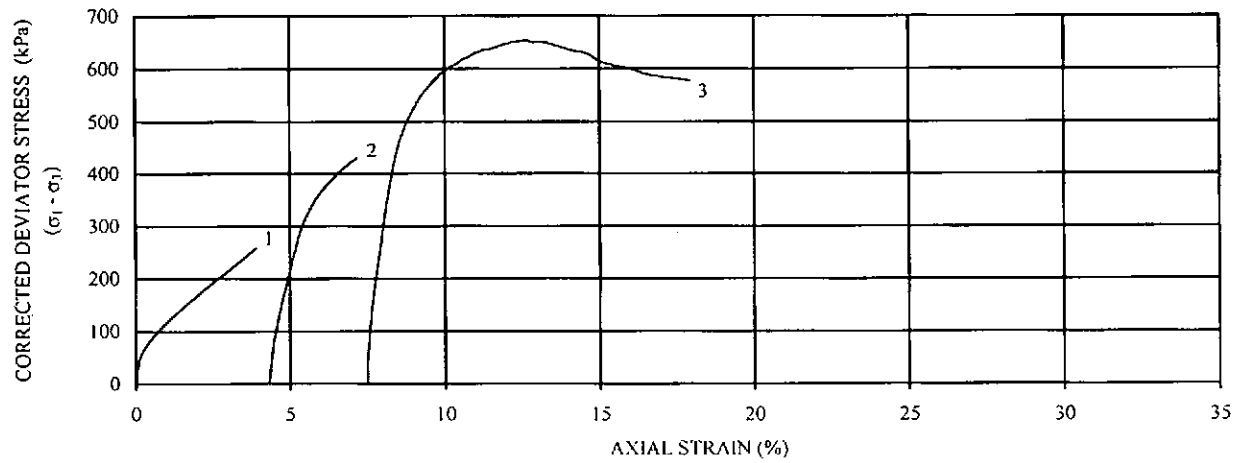
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

COMPRESSION







Borehole No. :	**WCH-BH01**	**Sample Depth m:-**	**11.00 - 12.00**
Sample No. :	**13**	**Specimen Depth m:-**	**11.80 - 12.00**
Customer :	**Mass Transit Railway Corporation**		Compiled by W S Wat
Project :	**Ground Investigation for South Island Line**		
		Contract No.: Contract 1024	Checked by H W Chung
Job No.:	**J2999**	**Works Order No.: 059**	

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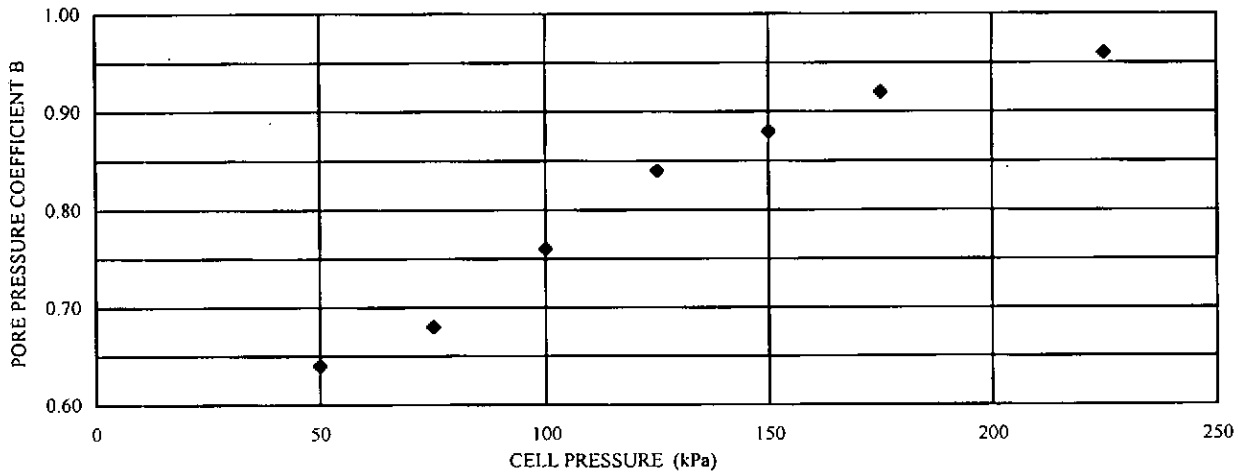
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

SATURATION



Date	Time	Cell Pressure kPa	Back Pressure kPa	Pore Pressure kPa	Cumulative Volume of Water cm^3	Pore Pressure Parameter B
10/12/2008	08:40	0	0	-	0.0	
	08:45	25	-	18		-
	09:35	25	20	20	3.6	
	09:44	50	-	36		0.64
	10:40	50	45	45	10.1	
	10:49	75	-	62		0.68
	11:44	75	70	70	15.6	
	11:52	100	-	89		0.76
11/12/2008	08:35	100	95	95	23.0	
	08:42	125	-	116		0.84
	09:13	125	120	120	25.0	
	09:25	150	-	142		0.88
	10:06	150	145	145	28.3	
	10:14	175	-	168		0.92
	10:55	175	170	170	30.1	
	11:06	225	-	218		0.96
12/12/2008	08:55	225	220	220	33.9	

Borehole No. : WCH-BH01 **Sample Depth m:-** 11.00 - 12.00
Sample No. : 13 **Specimen Depth m:-** 11.80 - 12.00

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.:** 059

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Checked by H W Chung

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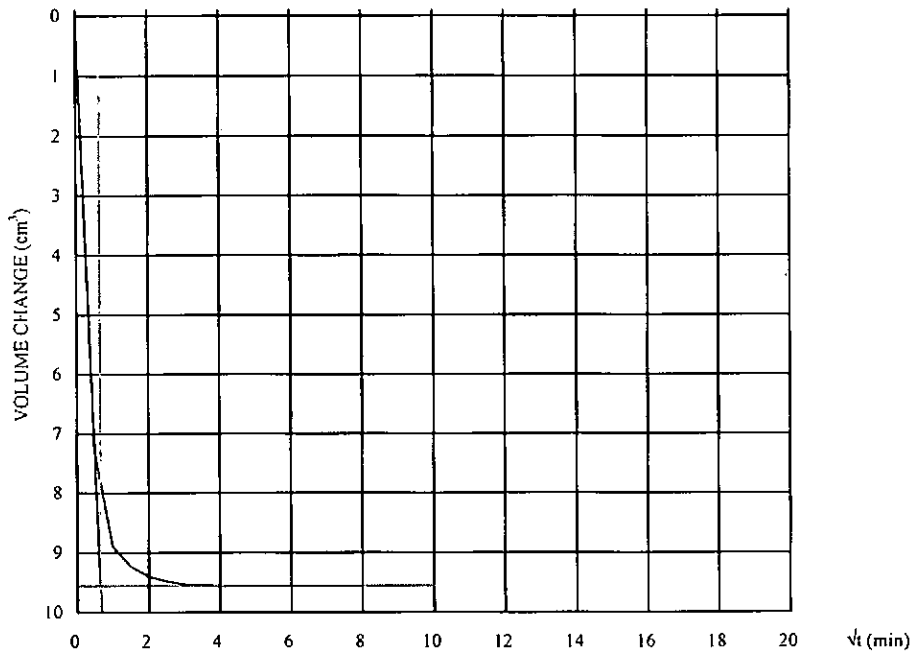
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

CONSOLIDATION (DRAINED PHASE) - Stage 1

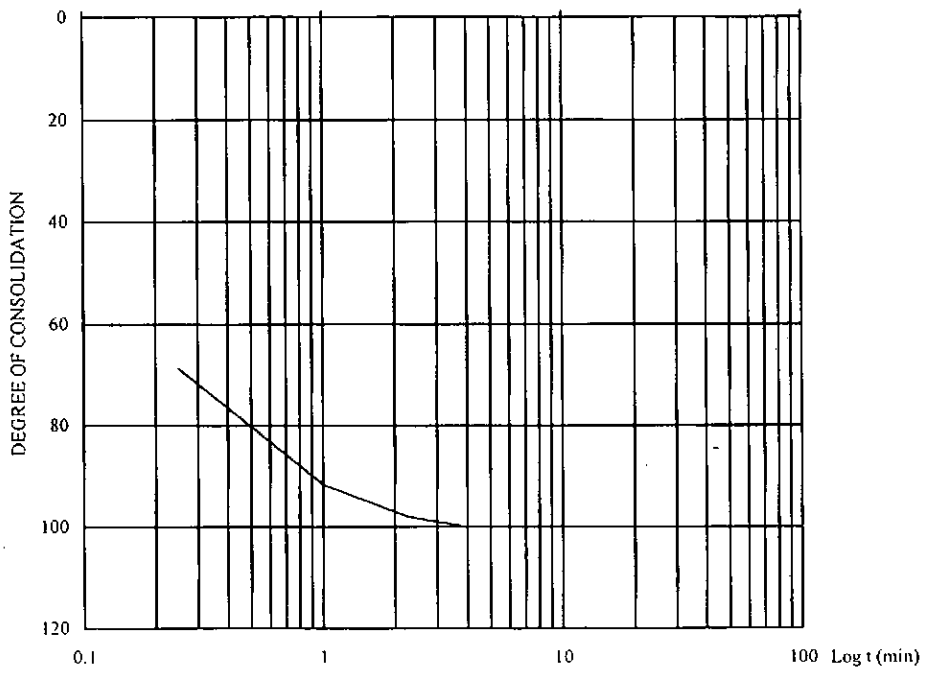


√t100 0.66 min

t100 0.43 min

tf 0.23 min

Calc. strain rate
44.306 mm/min



Borehole No. : WCH-BH01 **Sample Depth m:-** 11.00 - 12.00

Sample No. : 13 **Specimen Depth m:-** 11.80 - 12.00

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.:** 059

Complied by: W S Wat

Checked by: H W Chung

Form : GESR009.13 / Jun.02.03 / Issue 1 / Rev 0

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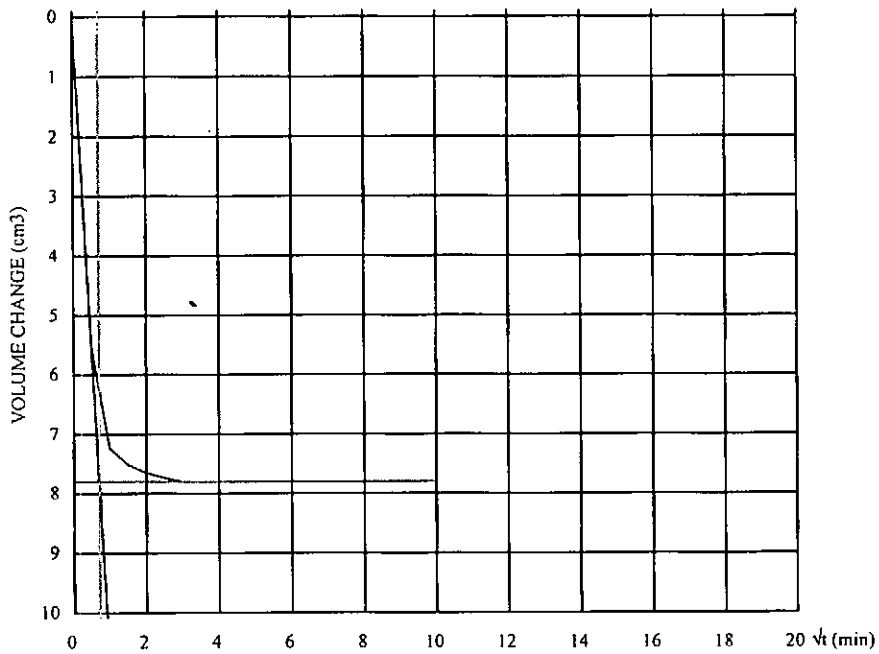
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

CONSOLIDATION (DRAINED PHASE) - Stage 2

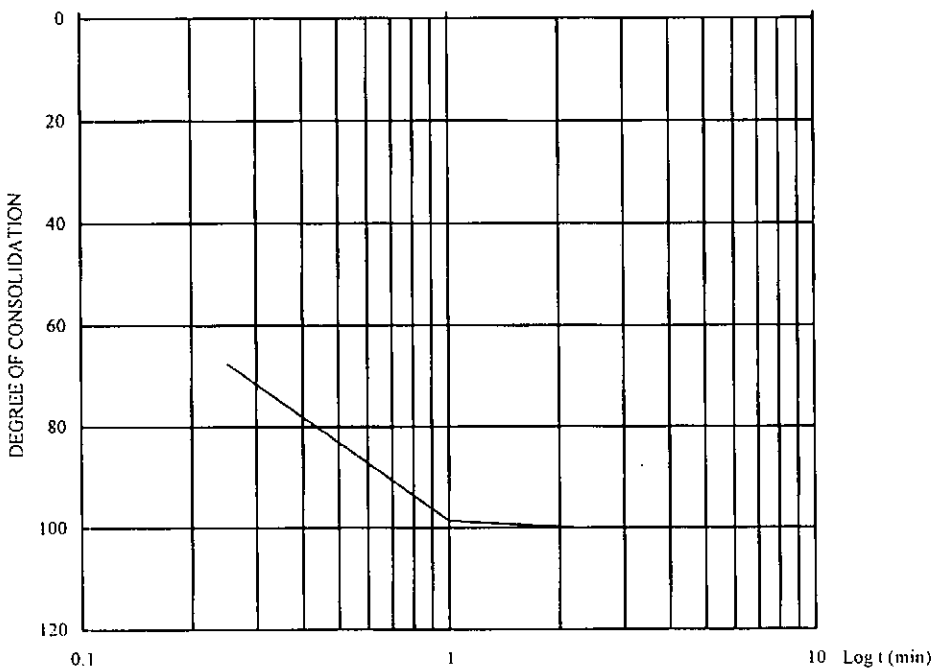


√t100 0.71 min

t100 0.50 min

tf 0.26 min

Calc. strain rate
36.628 mm/min



Borehole No. : WCH-BH01 **Sample Depth m:-** 11.00 - 12.00

Sample No. : 13 **Specimen Depth m:-** 11.80 - 12.00

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.:** 059

Complied by: W S Wat

Checked by: H W Chung

Form : GESR009.13 / Jun.02.03 / Issue 1 / Rev 0

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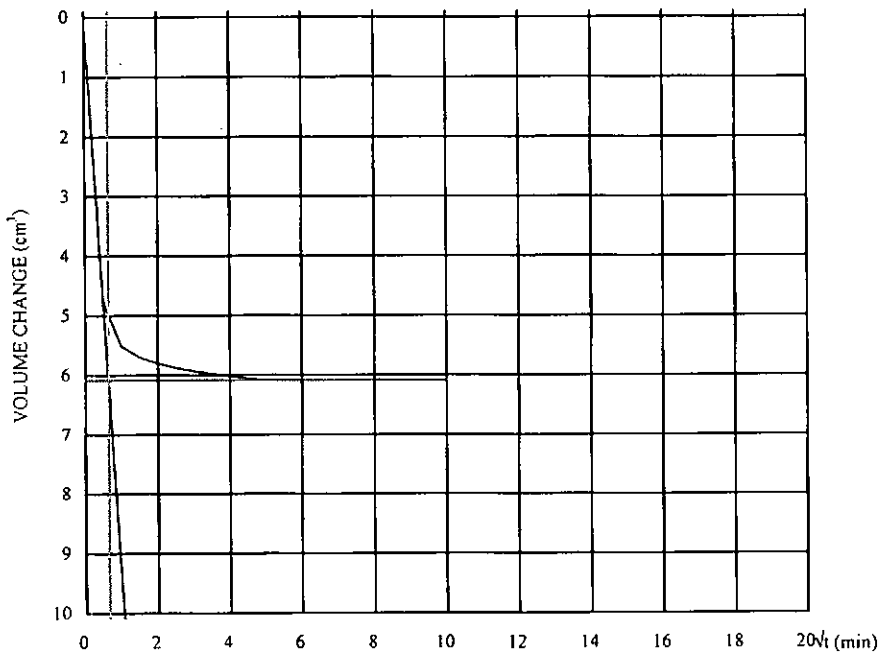
GEOSPEC 3 : 2001 Test Method 15.2

CONSOLIDATION (DRAINED PHASE) - Stage 3

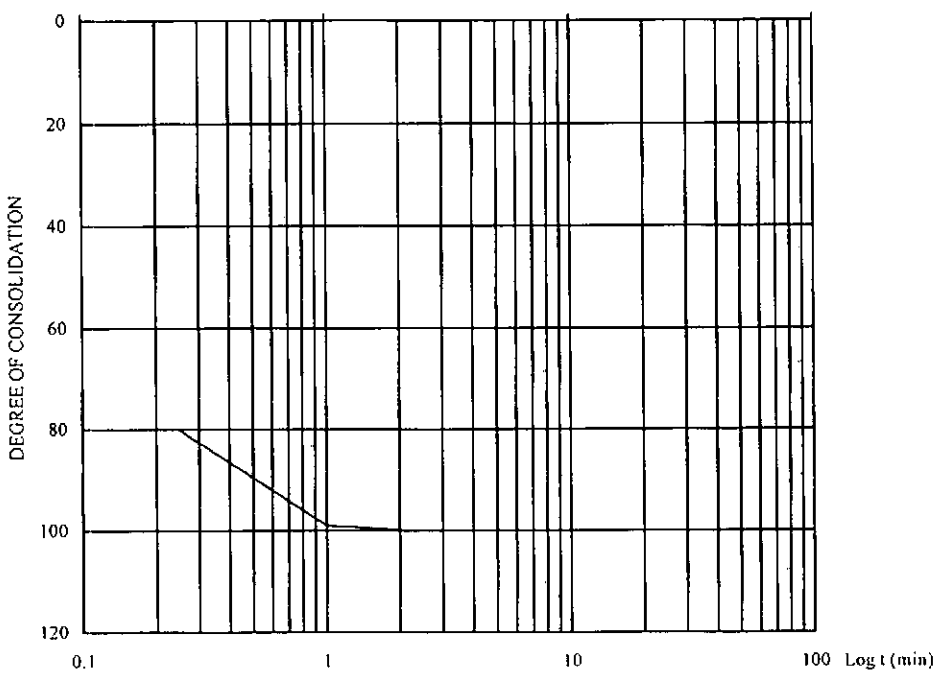


√t100 0.64 min

t100 0.41 min

tf 0.22 min

Calc. strain rate
43.030 mm/min



Borehole No. : WCH-BH01 **Sample Depth m:-** 11.00 - 12.00

Sample No. : 13 **Specimen Depth m:-** 11.80 - 12.00

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.:** 059

Complied by: W S Wat

Checked by: H W Chung

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TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Multi Stage		P.W.P,B.P		Effective Pressure 55	kPa
Side drains	No	Selected Machine Speed 0.048	mm/min	Rate of Strain 2.00	% per hr

FAILURE CRITERION

Max. deviator Stress	☐	Max. Stress ratio	☒	Axial Strain %	☐
Stage : 1	Applied Pressure (kPa) - Cell : 275	Back : 220		P.R. factor 3.1283	kN/mm

Date	Time	Strain Dial	Strain	Load P.R.No. 7	Pore Pressure	Dev. stress Corr.	Dev. stress q $\sigma_1 - \sigma_3$	Effective Stress σ'_1	Effective Stress σ'_3	s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa				2	2	3	σ'_1/σ'_3
12/12	10:25	0.00	0.00	0.045	220	0.000	0.0	55.0	55.0	55.0	0.0	55.0	1.00
	10:30	0.09	0.06	0.084	224	0.017	28.7	80.1	51.4	65.7	14.3	61.0	1.56
	10:35	0.25	0.17	0.119	228	0.049	54.3	100.9	46.6	73.8	27.2	64.7	2.17
	10:40	0.49	0.34	0.143	234	0.098	71.8	113.0	41.2	77.1	35.9	65.1	2.74
	10:45	0.69	0.48	0.159	236	0.138	83.4	122.0	38.6	80.3	41.7	66.4	3.16
	10:50	0.91	0.63	0.173	239	0.180	93.5	129.9	36.4	83.1	46.7	67.6	3.57
	10:55	1.14	0.79	0.188	240	0.225	104.2	139.0	34.8	86.9	52.1	69.5	3.99
	11:00	1.35	0.93	0.199	241	0.263	112.0	146.1	34.1	90.1	56.0	71.4	4.29
	11:05	1.56	1.08	0.211	241	0.304	120.6	154.3	33.7	94.0	60.3	73.9	4.58
	11:10	1.78	1.23	0.224	242	0.345	129.8	163.3	33.5	98.4	64.9	76.8	4.87
	11:15	2.06	1.43	0.238	241	0.399	139.6	173.4	33.8	103.6	69.8	80.3	5.13
	11:20	2.23	1.54	0.246	241	0.428	145.2	179.2	34.0	106.6	72.6	82.4	5.27
	11:25	2.45	1.70	0.258	240	0.470	153.7	188.3	34.6	111.4	76.8	85.8	5.44
	11:30	2.67	1.85	0.268	240	0.510	160.6	195.8	35.2	115.5	80.3	88.7	5.56
	11:35	2.91	2.02	0.280	239	0.554	168.9	204.9	36.0	120.5	84.5	92.3	5.69
	11:40	3.14	2.17	0.292	238	0.592	177.3	214.2	36.9	125.5	88.6	96.0	5.80
	11:45	3.37	2.33	0.303	237	0.633	184.9	222.8	37.9	130.3	92.4	99.5	5.88
	11:50	3.58	2.48	0.313	236	0.671	191.7	230.7	39.0	134.9	95.9	102.9	5.92
	11:55	3.80	2.63	0.324	235	0.708	199.3	239.3	40.0	139.6	99.6	106.4	5.98
	12:00	4.03	2.79	0.333	234	0.748	205.3	246.5	41.2	143.9	102.7	109.6	5.98
	12:05	4.27	2.96	0.345	232	0.790	213.5	256.1	42.6	149.4	106.8	113.8	6.01
	12:10	4.53	3.14	0.358	231	0.834	222.3	266.2	43.9	155.1	111.2	118.0	6.06
	12:15	4.73	3.28	0.367	230	0.867	228.4	273.4	45.0	159.2	114.2	121.1	6.08
	12:20	4.97	3.45	0.379	229	0.908	236.5	282.9	46.4	164.6	118.2	125.2	6.10
	12:25	5.21	3.61	0.391	227	0.946	244.5	292.2	47.7	170.0	122.3	129.2	6.13
	12:30	**5.43**	**3.77**	**0.402**	**226**	**0.983**	**251.9**	**300.9**	**49.0**	**175.0**	**126.0**	**133.0**	**6.14**
	12:35	5.64	3.91	0.412	225	1.016	258.6	308.9	50.3	179.6	129.3	136.5	6.14

Borehole No. :	**WCH-BH01**	**Sample Depth m:- 11.00 - 12.00**	
Sample No. :	**13**	**Specimen Depth m:- 11.80 - 12.00**	
Customer :	**Mass Transit Railway Corporation**		Compiled by
Project :	**Ground Investigation for South Island Line**		W S Wat
		Contract No.: Contract 1024	Checked by
Job No.:	**J2999**	**Works Order No.: 059**	H W Chung

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Form : GESR009.14 / Dec.13.04 / Issue 1 / Rev 1

TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Multi Stage		P.W.P,B.P			Effective Pressure	110	kPa
Side drains	No	Selected Machine Speed	0.046	mm/min	Rate of Strain	2.00	% per hr

FAILURE CRITERION

Max. deviator Stress	☐	Max. Stress ratio	☒		Axial Strain %		☐
Stage : 2	Applied Pressure (kPa) - Cell :	330	Back :	220	P.R. factor	3.1283	kN/mm

Date	Time	Strain		Load	Pore Pressure	Dev. stress		Effective Stress Parameters					
		Dial		P.R.No. 7		Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
12/12	13:20	6.23	4.32	0.053	220	0.000	0.0	110.0	110.0	110.0	0.0	110.0	1.00
	13:25	6.33	4.39	0.111	225	1.125	40.2	145.1	104.9	125.0	20.1	118.3	1.38
	13:30	6.45	4.47	0.163	231	1.143	77.2	175.8	98.6	137.2	38.6	124.3	1.78
	13:35	6.58	4.56	0.203	236	1.163	105.6	199.4	93.8	146.6	52.8	129.0	2.13
	13:40	6.77	4.69	0.252	240	1.192	140.2	230.4	90.2	160.3	70.1	136.9	2.55
	13:45	6.94	4.81	0.296	242	1.218	171.2	259.5	88.3	173.9	85.6	145.4	2.94
	13:50	7.15	4.96	0.345	243	1.251	205.7	292.7	87.0	189.8	102.8	155.6	3.36
	13:55	7.30	5.06	0.379	244	1.273	229.5	315.8	86.3	201.0	114.7	162.8	3.66
	14:00	7.48	5.19	0.420	245	1.301	258.1	343.5	85.4	214.5	129.1	171.4	4.02
	14:05	7.65	5.30	0.455	245	1.324	282.5	367.2	84.7	226.0	141.3	178.9	4.34
	14:10	7.82	5.42	0.485	246	1.350	303.3	387.2	83.9	235.5	151.6	185.0	4.61
	14:15	8.03	5.57	0.514	247	1.381	323.2	406.7	83.5	245.1	161.6	191.2	4.87
	14:20	8.23	5.71	0.537	247	1.411	338.9	422.3	83.4	252.8	169.4	196.4	5.06
	14:25	8.42	5.84	0.555	246	1.438	351.0	434.6	83.6	259.1	175.5	200.6	5.20
	14:30	8.64	5.99	0.574	246	1.469	363.7	447.9	84.2	266.1	181.9	205.4	5.32
	14:35	8.86	6.14	0.591	245	1.499	375.0	460.0	85.0	272.5	187.5	210.0	5.41
	14:40	9.06	6.28	0.605	244	1.528	384.2	470.4	86.2	278.3	192.1	214.3	5.46
	14:45	9.23	6.40	0.616	243	1.552	391.4	478.5	87.1	282.8	195.7	217.6	5.49
	14:50	9.48	6.57	0.632	241	1.586	401.7	490.3	88.6	289.5	200.9	222.5	5.53
	14:55	9.70	6.72	0.645	240	1.616	410.1	500.1	90.0	295.0	205.0	226.7	5.56
	15:00	9.90	6.86	0.656	239	1.643	417.1	508.5	91.4	299.9	208.5	230.4	5.56
	15:05	**10.18**	**7.06**	**0.670**	**237**	**1.682**	**425.9**	**519.1**	**93.2**	**306.1**	**212.9**	**235.2**	**5.57**
	15:10	10.35	7.17	0.678	236	1.703	430.9	525.4	94.5	309.9	215.4	238.1	5.56

Borehole No. : WCH-BH01 **Sample Depth m:- 11.00 - 12.00**

Sample No. : 13 **Specimen Depth m:- 11.80 - 12.00**

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.: 059**

Compiled by W S Wat

Checked by H W Chung

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Multi Stage		P.W.P,B.P		Effective Pressure 165	kPa
Side drains	No	Selected Machine Speed	0.044 mm/min	Rate of Strain 1.98	% per hr
FAILURE CRITERION					
Max. deviator Stress	☐	Max. Stress ratio	☒	Axial Strain %	☐
Stage : 3	Applied Pressure (kPa) - Cell :	385	Back : 220	P.R. factor 3.1283	kN/mm

Date	Time	Strain Dial	Strain %	Load P.R.No. 7	Pore Pressure	Dev. stress Corr.	Dev. stress q $\sigma_1 - \sigma_3$	Effective Stress σ'_1	Effective Stress σ'_3	s' $(\sigma'_1+\sigma'_3)$ 2	t $(\sigma_1-\sigma_3)$ 2	p' $(\sigma'_1+2\sigma'_3)$ 3	Stress Ratio σ'_1/σ'_3
		mm	%	mm	kPa	kPa							
15/12	08:35	10.80	7.49	0.081	220	0.000	0.0	165.0	165.0	165.0	0.0	165.0	1.00
	08:40	10.84	7.51	0.167	224	1.768	58.1	219.2	161.1	190.2	29.1	180.5	1.36
	08:45	10.97	7.61	0.261	233	1.787	123.5	275.3	151.8	213.5	61.7	193.0	1.81
	08:50	11.12	7.71	0.332	239	1.806	172.7	318.8	146.1	232.4	86.3	203.7	2.18
	08:55	11.27	7.81	0.396	241	1.825	216.9	360.5	143.6	252.0	108.4	215.9	2.51
	09:00	11.38	7.89	0.443	243	1.839	249.3	391.7	142.4	267.0	124.6	225.5	2.75
	09:05	11.53	7.99	0.504	243	1.858	291.3	433.0	141.7	287.3	145.6	238.8	3.06
	09:10	11.74	8.14	0.587	244	1.886	348.2	489.2	141.0	315.1	174.1	257.1	3.47
	09:15	11.88	8.23	0.634	245	1.902	380.3	520.5	140.2	330.4	190.2	267.0	3.71
	09:20	12.05	8.36	0.690	246	1.926	418.4	557.7	139.3	348.5	209.2	278.8	4.00
	09:25	12.22	8.47	0.732	247	1.945	446.8	585.2	138.4	361.8	223.4	287.3	4.23
	09:30	12.41	8.61	0.772	248	1.971	473.7	611.2	137.5	374.3	236.8	295.4	4.44
	09:35	12.59	8.73	0.801	248	1.992	493.0	630.2	137.2	383.7	246.5	301.5	4.59
	09:40	12.81	8.88	0.831	248	2.019	512.7	649.9	137.2	393.5	256.3	308.1	4.74
	09:45	13.22	9.16	0.877	246	2.068	542.5	681.2	138.7	410.0	271.3	319.5	4.91
	09:50	13.43	9.31	0.896	245	2.094	554.6	694.4	139.8	417.1	277.3	324.7	4.97
	09:55	13.53	9.38	0.904	244	2.106	559.6	700.2	140.6	420.4	279.8	327.1	4.98
	10:00	13.64	9.46	0.913	244	2.120	565.3	706.7	141.4	424.0	282.6	329.8	5.00
	10:05	13.83	9.59	0.927	242	2.142	573.9	716.8	142.9	429.9	287.0	334.2	5.02
	10:10	14.04	9.74	0.942	240	2.167	583.2	727.9	144.7	436.3	291.6	339.1	5.03
	10:15	**14.24**	**9.87**	**0.954**	**239**	**2.189**	**590.4**	**736.7**	**146.3**	**441.5**	**295.2**	**343.1**	**5.04**
	10:20	14.46	10.03	0.966	237	2.216	597.5	745.7	148.2	447.0	298.8	347.4	5.03
	10:25	14.69	10.18	0.977	235	2.241	603.9	754.0	150.1	452.0	301.9	351.4	5.02
	10:30	14.91	10.34	0.986	233	2.268	608.9	760.9	152.0	456.4	304.4	355.0	5.01
	10:35	15.11	10.48	0.995	231	2.291	614.0	767.8	153.8	460.8	307.0	358.5	4.99
	10:40	15.30	10.61	1.004	230	2.312	619.1	774.5	155.4	465.0	309.6	361.8	4.98
	10:45	15.59	10.81	1.013	227	2.345	623.7	781.7	158.0	469.9	311.9	365.9	4.95
	10:50	15.82	10.97	1.024	225	2.371	630.0	790.0	160.0	475.0	315.0	370.0	4.94
	10:55	16.01	11.10	1.028	223	2.391	631.7	793.5	161.8	477.7	315.9	372.4	4.90
	11:00	16.22	11.25	1.036	222	2.415	636.0	799.5	163.5	481.5	318.0	375.5	4.89
	11:05	16.46	11.41	1.040	219	2.441	637.4	803.2	165.8	484.5	318.7	378.3	4.84
	11:10	16.67	11.56	1.045	218	2.464	639.7	807.1	167.4	487.2	319.8	380.6	4.82
	11:15	16.90	11.71	1.051	216	2.488	642.5	811.9	169.4	490.7	321.3	383.6	4.79
	11:20	17.13	11.87	1.058	214	2.513	646.0	817.2	171.2	494.2	323.0	386.5	4.77
	11:25	17.35	12.03	1.063	212	2.538	648.1	821.2	173.1	497.2	324.1	389.1	4.74
	11:30	17.60	12.20	1.070	210	2.564	651.4	826.3	174.9	500.6	325.7	392.0	4.72
	11:35	17.82	12.36	1.073	208	2.588	652.2	828.8	176.6	502.7	326.1	394.0	4.69
	11:40	18.06	12.52	1.076	207	2.613	653.0	831.5	178.5	505.0	326.5	396.2	4.66
	11:45	18.28	12.67	1.078	205	2.636	653.1	833.2	180.1	506.7	326.6	397.8	4.63

Borehole No. : WCH-BH01 — **Sample Depth m:- 11.00 - 12.00**

Sample No. : 13 — **Specimen Depth m:- 11.80 - 12.00**

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 — **Works Order No.: 059**

Compiled by: W S Wat

Checked by: H W Chung

Form : GESR009.14 / Dec. 13.04 / Issue 1 / Rev 1

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TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2
Shearing Continuation

Gammon

HKAS HOKLAS 055

FAILURE CRITERION													
Max. deviator Stress ☐				Max. Stress ratio ☒			Axial Strain % ☐						
Stage : 3		Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
Date	Time	Dial		P.R.No. 7	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
15/12	11:50	18.50	12.83	1.075	203	2.660	650.0	831.8	181.8	506.8	325.0	398.5	4.58
	11:55	18.69	12.96	1.079	202	2.679	651.6	834.6	183.0	508.8	325.8	400.2	4.56
	12:00	18.90	13.10	1.079	201	2.700	650.5	834.9	184.4	509.6	325.2	401.2	4.53
	12:05	19.19	13.30	1.079	199	2.730	649.0	835.1	186.1	510.6	324.5	402.4	4.49
	12:10	19.38	13.44	1.077	198	2.751	646.6	833.7	187.1	510.4	323.3	402.6	4.46
	12:15	19.59	13.58	1.075	197	2.771	644.2	832.5	188.3	510.4	322.1	403.0	4.42
	12:20	20.30	14.07	1.067	194	2.843	635.3	826.6	191.3	508.9	317.6	403.1	4.32
	12:25	21.04	14.58	1.064	192	2.917	629.5	822.7	193.2	507.9	314.7	403.0	4.26
	12:30	21.62	14.99	1.046	190	2.976	614.9	809.5	194.6	502.0	307.4	399.6	4.16
	12:35	22.39	15.52	1.039	190	3.051	606.5	801.7	195.2	498.4	303.2	397.4	4.11
	12:40	23.12	16.03	1.035	189	3.123	600.3	795.9	195.6	495.7	300.1	395.7	4.07
	12:45	23.79	16.49	1.025	189	3.187	590.5	786.6	196.1	491.4	295.3	392.9	4.01
	12:50	24.48	16.97	1.022	188	3.254	585.2	781.8	196.6	489.2	292.6	391.7	3.98
	12:55	25.22	17.48	1.022	188	3.325	581.5	778.5	197.0	487.8	290.8	390.8	3.95
	13:00	25.86	17.93	1.021	188	3.388	577.7	775.1	197.4	486.2	288.8	390.0	3.93

Borehole No. : WCH-BH01 **Sample Depth m:- 11.00 - 12.00**

Sample No. : 13 **Specimen Depth m:- 11.80 - 12.00**

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.: 059**

Compiled by: W S Wat

Checked by: H W Chung

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Form : GESR009.15 / Dec.13.04 / Issue 1 / Rev 1

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT (GEOSPEC 3 : 2001 Test Method 15.2)

Description : Brown, silty, gravelly SAND

Sample Origin : CDM ‡ ‡ Information provided by customer

Borehole No. : WCH-BH01	Sample No. : 13	Sample Depth m:- 11.00 - 12.00	Specimen Depth m:- 11.80 - 12.00

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line

Contract No.: Contract 1024
Job No.: J2999
Works Order No.: 059

Compiled by: W S Wat
Checked by: H W Chung

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	WCH-BH02		
Sample		no	1		
Sample Type			Mazier		
Stage		no	1		
Sample Depth		m	4.00 - 5.00		
Specimen Depth		m	4.60 - 4.80		
INITIAL CONDITIONS					
Diameter	(D_o)	mm	73.9		
Height	(H_o)	mm	145.0		
Moisture Content	(W_o)	%	21		
Bulk density	(ρ_o)	Mg/m^3	1.95		
Dry density	(ρ_d)	Mg/m^3	1.62		
Particle density	(ρ_s)		2.64		
Voids Ratio	(e_o)		0.63		
Degree of Saturation	(S_r)	%	86.7		
DRAINAGE CONDITIONS			ONE END		
SATURATION					
Final Pore Pressure Coefficient B			0.98		
CONSOLIDATION					
Cell Pressure	(σ_3)	kPa	280		
Back Pressure	(u_b)	kPa	235		
Effective Pressure	(σ'_3)	kPa	45		
Coefficient of Consolidation (t100) (C_{vi})		m^2/Year	258.83		
Coefficient of Volume Compressibility (m_{vi})		m^2/MN	0.51		
Coefficient of Permeability (k)		m/s	4.08E-08		
COMPRESSION TERMINATION CRITERION			MAXIMUM DEVIATOR STRESS		
COMPRESSION - INITIAL					
Moisture Content	(w)	%	21		
Pore Pressure at the End of Consolidation		kPa	235		
Effective Stress at the End of Consolidation		kPa	45		
Bulk density	(ρ_o)	Mg/m^3	2.01		
Dry density	(ρ_d)	Mg/m^3	1.65		
Voids Ratio	(e)		0.60		
Degree of Saturation	(S_r)	%	94.9		

Customer : **Mass Transit Railway Corporation**

Project : **Ground Investigation for South Island Line**

Report No. : J2999-059.11

Contract No.: Contract 1024

Job No.: **J2999** **Works Order No.: 059**

Technician : W S Wat Checked By : Approved By :

Name : H W Chung Signatory : **Lau Wai Cheong**

Tested Date: 18/12/2008 Date : 09/01/2009 Date : 09/01/2009

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Form : GESR009.6 / Nov.10.06 / Issue 1 / Rev I

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	WCH-BH02		
Sample		no	1		
Sample Type			Mazier		
Stage		no	1		
Sample Depth		m	4.00 - 5.00		
Specimen Depth		m	4.60 - 4.80		
COMPRESSION - FAILURE					
Cell Pressure		kPa	280		
Rate of Strain		mm/min	0.048		
CONDITIONS MAXIMUM DEVIATOR STRESS					
Major Effective Principal Stress (σ'_1)		kPa	201		
Corrected Deviator Stress ($\sigma'_1 - \sigma'_3$)		kPa	156		
Minor Effective Principal Stress (σ'_3)		kPa	45		
$s' = (\sigma'_1 + \sigma'_3)/2$		kPa	123		
$t = (\sigma_1 - \sigma_3)/2$		kPa	78		
Expanded Uncertainty of s' ^		kPa	-		
Expanded Uncertainty of t ^		kPa	-		
Pore pressure parameter A_f			0.00		
Strain at Failure	(εf)	%	12.1		
COMPRESSION - FINAL					
Moisture Content	(W_f)	%	21		
Bulk density	(ρ_o)	Mg/m^3	2.01		
Dry density	(ρ_d)	Mg/m^3	1.65		
Voids Ratio	(e_f)		0.60		
Degree of Saturation	(S_f)	%	94.9		

Notes -
1. The method of specimen preparation was in accordance with GEOSPEC 3 : 2001 :- Test method 13.3 : test specimen from undisturbed soil samples.
2. Sample received date :29/09/2008
3. The determination of moisture content was in accordance with test method 5.1 of GEOSPEC 3 : 2001.
4. Particle density : 2.64 (Determined)
5. Maximum and minimum temperature recorded over the period of testing 19.9 - 20.7 °C.
6. Unavoidable variations from specified procedure : none
7. Comment on observed or inferred sample disturbance : none
8. Percentage by mass of soil particles larger than 1/5 of the diameter of specimen (%) : Nil
9. The specimen was selected by the laboratory.
   Name : W S Wat Designation : Senior Laboratory Technician
10. Sampling History : As Received

* Delete as appropriate ^ Upon request

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.: 059**

Compiled by W S Wat
Checked by H W Chung

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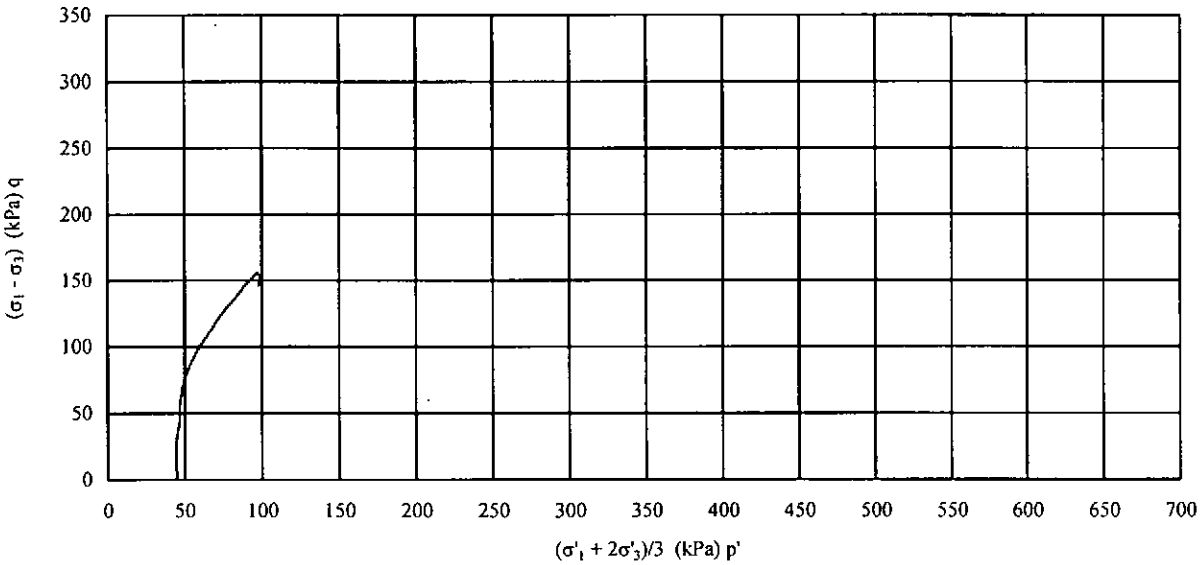
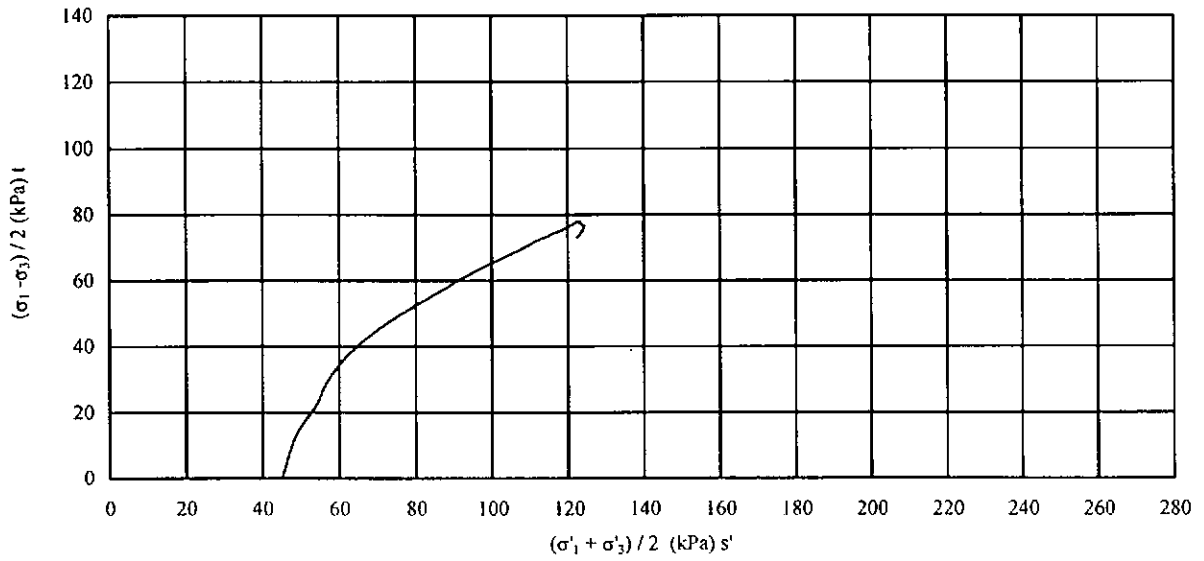
TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

STRESS PATH PARAMETERS FOR EFFECTIVE STRESS

p' - q PLOT



s' - t PLOT



Borehole No. : WCH-BH02 — **Sample Depth m:-** 4.00 - 5.00
Sample No. : 1 — **Specimen Depth m:-** 4.60 - 4.80

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 — **Works Order No.:** 059

Compiled by: W S Wat
Checked by: H W Chung

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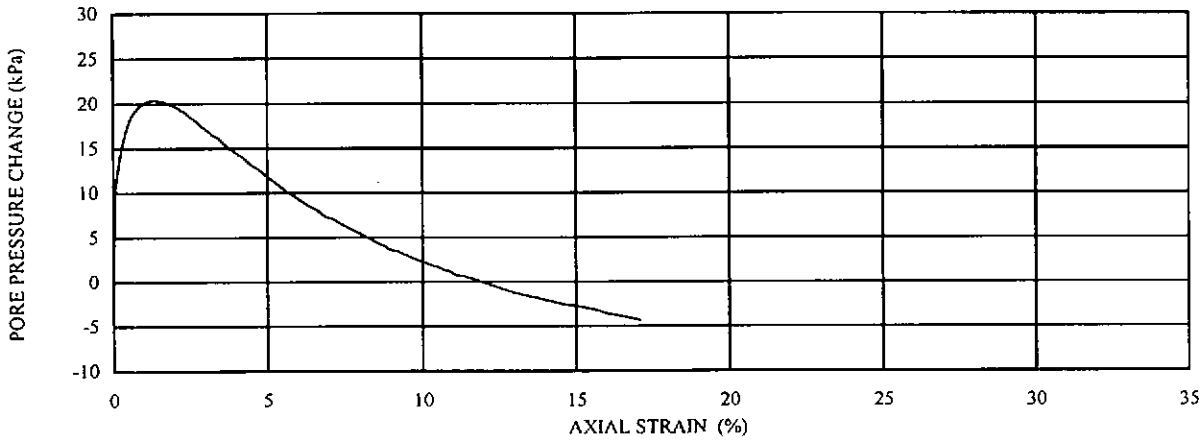
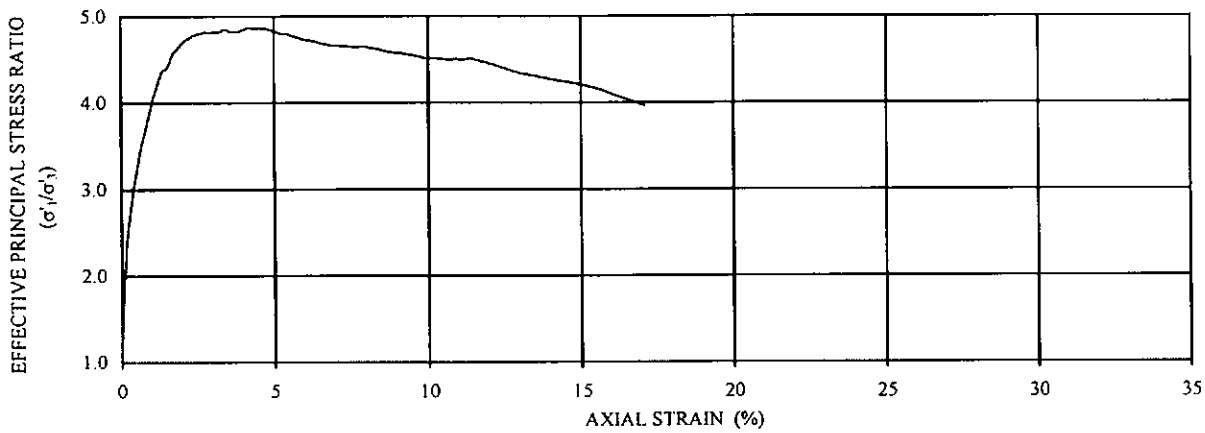
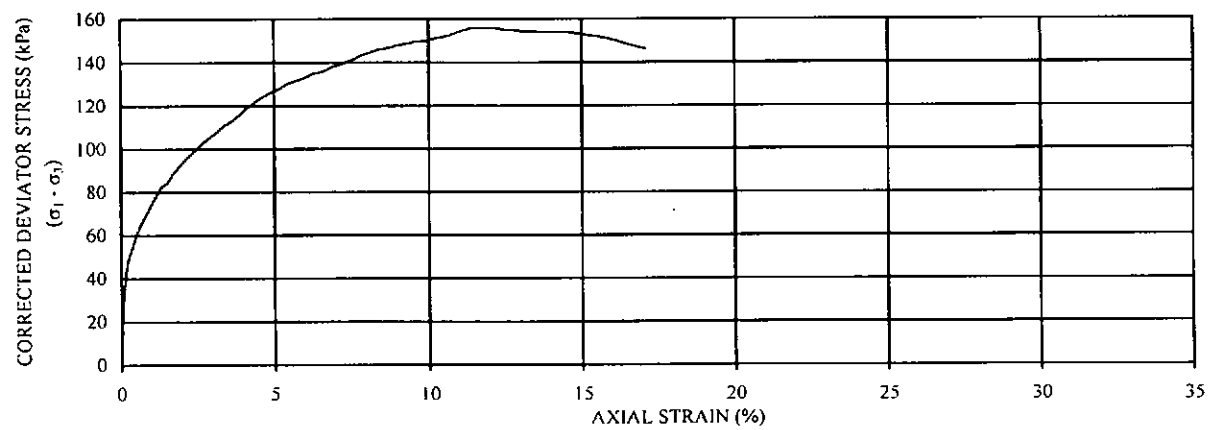
Form : GESR009.8 / Jun.02.03 / Issue 1 / Rev 0

TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

COMPRESSION







Borehole No. :	**WCH-BH02**	**Sample Depth m:-**	**4.00 - 5.00**
Sample No. :	**1**	**Specimen Depth m:-**	**4.60 - 4.80**
Customer :	**Mass Transit Railway Corporation**		Compiled by W S Wat
Project :	**Ground Investigation for South Island Line**		
		Contract No.: Contract 1024	Checked by H W Chung
Job No.:	**J2999**	**Works Order No.: 059**	

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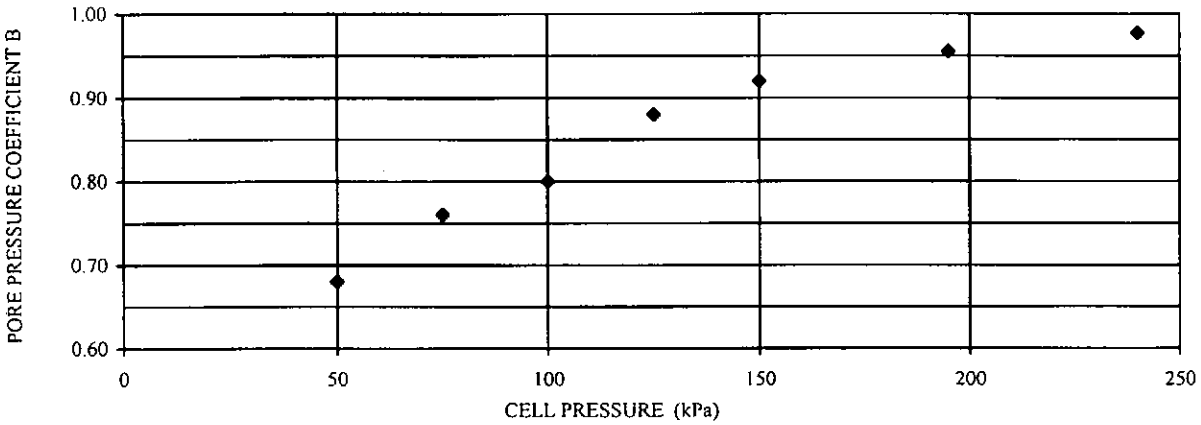
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

SATURATION



Date	Time	Cell Pressure kPa	Back Pressure kPa	Pore Pressure kPa	Cumulative Volume of Water cm^3	Pore Pressure Coefficient B
18/12/2008	15:56	0	0	-	0.0	
	16:07	25	-	21		-
19/12/2008	09:10	25	20	20	-0.6	
	09:18	50	-	37		0.68
	09:50	50	45	45	2.8	
	09:58	75	-	64		0.76
	10:20	75	70	70	6.6	
	10:28	100	-	90		0.80
	10:51	100	95	95	8.8	
	11:00	125	-	117		0.88
	13:14	125	120	120	11.5	
	13:20	150	-	143		0.92
	14:10	150	145	145	13.9	
	14:19	195	-	188		0.96
	15:10	195	190	190	15.7	
	15:18	240	-	234		0.98
22/12/2008	14:20	240	235	235	20.3	

Borehole No. WCH-BH02 **Sample Depth m:-** 4.00 - 5.00
Sample No. : 1 **Specimen Depth m:-** 4.60 - 4.80

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line

Compiled by: W S Wat
Checked by: H W Chung

Contract No.: Contract 1024
Job No.: J2999 **Works Order No.:** 059

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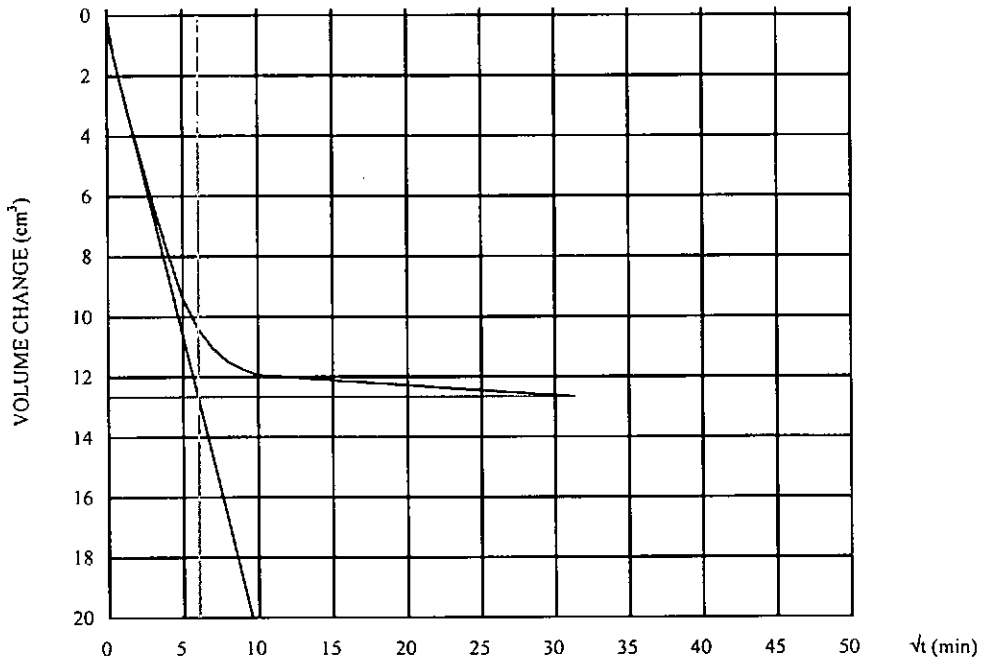
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

CONSOLIDATION (DRAINED PHASE) - Stage 1

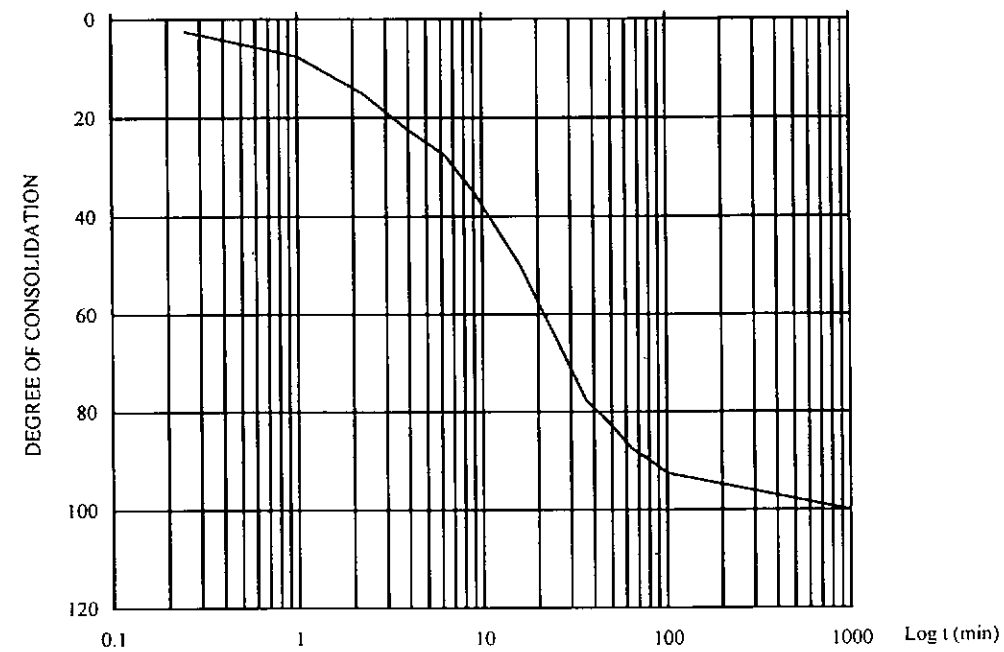


√t100 6.00 min

t100 35.984 min

tf 19.072 min

Calc. strain rate
0.528 mm/min



Borehole No. : WCH-BH02 **Sample Depth m:-** 4.00 - 5.00

Sample No. : 1 **Specimen Depth m:-** 4.60 - 4.80

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.:** 059

Complied by: W S Wat

Checked by: H W Chung

Form : GESR009.13 / Jun.02.03 / Issue 1 / Rev 0

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Single Stage			P.W.P,B.P					Effective Pressure	45				kPa
Side drains	No		Selected Machine Speed		0.048		mm/min	Rate of Strain	2.00				% per hr
FAILURE CRITERION													
Max. deviator Stress		☒	Max. Stress ratio		☐			Axial Strain %					☐
Stage :	1	Applied Pressure (kPa) - Cell :			280	Back :	235	P.R. factor			1.7305		kN/mm

Date	Time	Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
		Dial		P.R.No. 10	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
23/12	08:35	0.00	0.00	0.076	235	0.000	0.0	45.0	45.0	45.0	0.0	45.0	1.00
	08:40	0.09	0.06	0.140	244	0.017	26.1	61.8	35.7	48.8	13.1	44.4	1.73
	08:45	0.28	0.19	0.186	248	0.055	44.8	76.6	31.8	54.2	22.4	46.7	2.41
	08:50	0.48	0.34	0.207	251	0.098	53.3	82.4	29.1	55.7	26.6	46.9	2.83
	08:55	0.74	0.51	0.225	253	0.146	60.5	87.7	27.2	57.4	30.2	47.4	3.22
	09:00	0.96	0.67	0.238	254	0.191	65.6	91.7	26.1	58.9	32.8	48.0	3.51
	09:05	1.25	0.87	0.251	255	0.247	70.7	96.0	25.3	60.6	35.3	48.9	3.79
	09:10	1.47	1.02	0.262	255	0.288	75.0	99.9	24.9	62.4	37.5	49.9	4.01
	09:15	1.67	1.16	0.271	255	0.326	78.5	103.2	24.7	63.9	39.2	50.9	4.18
	09:20	1.92	1.34	0.282	255	0.375	82.7	107.3	24.6	66.0	41.4	52.2	4.36
	09:25	2.18	1.51	0.286	255	0.420	84.1	108.8	24.7	66.8	42.1	52.7	4.41
	09:30	2.43	1.69	0.297	255	0.468	88.4	113.2	24.8	69.0	44.2	54.3	4.56
	09:35	2.66	1.85	0.304	255	0.510	91.0	116.1	25.1	70.6	45.5	55.4	4.62
	09:40	2.97	2.06	0.313	255	0.564	94.3	119.7	25.4	72.6	47.2	56.8	4.71
	09:45	3.15	2.19	0.318	254	0.598	96.2	121.9	25.7	73.8	48.1	57.8	4.74
	09:50	3.43	2.38	0.325	254	0.646	98.7	124.8	26.1	75.5	49.4	59.0	4.78
	09:55	3.63	2.52	0.330	254	0.681	100.5	127.0	26.5	76.8	50.3	60.0	4.79
	10:00	3.90	2.71	0.337	253	0.729	103.1	130.1	27.0	78.5	51.5	61.4	4.82
	10:05	4.14	2.87	0.342	253	0.768	104.8	132.3	27.5	79.9	52.4	62.4	4.81
	10:10	4.41	3.06	0.348	252	0.814	107.0	135.0	28.0	81.5	53.5	63.7	4.82
	10:15	4.63	3.22	0.353	252	0.853	108.7	137.2	28.5	82.9	54.4	64.7	4.82
	10:20	4.86	3.38	0.359	251	0.891	110.9	139.7	28.8	84.2	55.4	65.8	4.85
	10:25	5.11	3.55	0.363	251	0.932	112.2	141.5	29.3	85.4	56.1	66.7	4.83
	10:30	5.35	3.72	0.368	250	0.972	114.0	143.8	29.8	86.8	57.0	67.8	4.82
	10:35	5.58	3.87	0.373	250	1.007	115.7	145.9	30.2	88.1	57.9	68.8	4.83
	10:40	5.88	4.08	0.381	249	1.055	118.5	149.2	30.7	90.0	59.3	70.2	4.86
	10:45	6.09	4.23	0.386	249	1.089	120.3	151.4	31.1	91.2	60.1	71.2	4.87
	10:50	6.32	4.39	0.391	248	1.125	122.0	153.6	31.6	92.6	61.0	72.3	4.86
	10:55	6.57	4.56	0.396	248	1.163	123.7	155.7	32.0	93.8	61.8	73.2	4.87
	11:00	6.82	4.74	0.400	248	1.203	125.0	157.4	32.4	94.9	62.5	74.1	4.86
	11:05	7.13	4.95	0.405	247	1.249	126.6	159.6	33.0	96.3	63.3	75.2	4.84
	11:10	7.33	5.09	0.408	247	1.280	127.5	160.9	33.4	97.2	63.8	75.9	4.82
	11:15	7.55	5.24	0.411	246	1.312	128.5	162.3	33.8	98.0	64.2	76.6	4.80
	11:20	7.81	5.43	0.416	246	1.352	130.1	164.4	34.3	99.3	65.0	77.7	4.79
	11:25	8.04	5.58	0.419	245	1.384	131.0	165.7	34.7	100.2	65.5	78.4	4.78
	11:30	8.27	5.75	0.422	245	1.419	131.9	167.0	35.1	101.0	65.9	79.1	4.76
	11:35	8.54	5.93	0.425	245	1.457	132.8	168.3	35.5	101.9	66.4	79.8	4.74
	11:40	8.77	6.09	0.428	244	1.490	133.6	169.5	35.9	102.7	66.8	80.4	4.72
	11:45	9.02	6.27	0.432	244	1.526	134.9	171.2	36.3	103.7	67.4	81.3	4.72

Borehole No. : WCH-BH02 — **Sample Depth m:- 4.00 - 5.00**

Sample No. : 1 — **Specimen Depth m:- 4.60 - 4.80**

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 — **Works Order No.:** 059

Compiled by: W S Wat

Checked by: H W Chung

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2
Shearing Continuation

FAILURE CRITERION

Max. deviator Stress ☒ | Max. Stress ratio ☐ | Axial Strain % ☐

Stage :	1	Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
Date	Time	Dial		P.R.No. 10	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
23/12	11:50	9.24	6.42	0.434	243	1.556	135.4	172.0	36.6	104.3	67.7	81.7	4.70
	11:55	9.49	6.59	0.436	243	1.590	135.9	172.8	36.9	104.8	67.9	82.2	4.68
	12:00	9.62	6.68	0.438	243	1.608	136.5	173.6	37.1	105.3	68.2	82.6	4.68
	12:05	9.92	6.89	0.443	242	1.649	138.0	175.7	37.7	106.7	69.0	83.7	4.66
	12:10	10.24	7.11	0.446	242	1.692	138.8	176.7	37.9	107.3	69.4	84.2	4.66
	12:15	10.51	7.30	0.450	242	1.729	140.0	178.3	38.3	108.3	70.0	85.0	4.66
	12:20	10.73	7.45	0.453	241	1.757	140.9	179.5	38.6	109.0	70.4	85.6	4.65
	12:25	10.96	7.62	0.456	241	1.789	141.7	180.6	38.9	109.8	70.9	86.1	4.64
	12:30	11.19	7.77	0.460	241	1.818	143.0	182.2	39.2	110.7	71.5	86.9	4.65
	12:35	11.49	7.98	0.464	241	1.857	144.1	183.6	39.5	111.6	72.1	87.5	4.65
	12:40	11.68	8.11	0.466	240	1.881	144.6	184.4	39.8	112.1	72.3	88.0	4.63
	12:45	11.99	8.33	0.470	240	1.921	145.7	185.9	40.2	113.1	72.9	88.8	4.63
	12:50	12.23	8.49	0.472	240	1.950	146.2	186.7	40.5	113.6	73.1	89.2	4.61
	12:55	12.45	8.65	0.474	239	1.978	146.7	187.5	40.8	114.1	73.3	89.7	4.59
	13:00	12.68	8.80	0.476	239	2.005	147.1	188.1	41.0	114.6	73.6	90.0	4.59
	13:05	12.94	8.99	0.479	239	2.039	147.9	189.3	41.4	115.3	73.9	90.7	4.57
	13:10	13.19	9.16	0.481	239	2.068	148.3	189.8	41.5	115.7	74.2	90.9	4.57
	13:15	13.52	9.39	0.484	238	2.108	149.0	190.9	41.9	116.4	74.5	91.6	4.56
	13:20	13.72	9.53	0.486	238	2.132	149.5	191.6	42.1	116.9	74.8	91.9	4.55
	13:25	13.99	9.72	0.488	238	2.165	149.9	192.3	42.4	117.3	74.9	92.4	4.54
	13:30	14.24	9.89	0.489	237	2.193	149.9	192.5	42.6	117.6	75.0	92.6	4.52
	13:35	14.49	10.06	0.492	237	2.222	150.7	193.5	42.8	118.2	75.4	93.0	4.52
	13:40	14.70	10.21	0.494	237	2.247	151.2	194.2	43.0	118.6	75.6	93.4	4.52
	13:45	14.94	10.37	0.496	237	2.273	151.6	194.8	43.2	119.0	75.8	93.7	4.51
	13:50	15.17	10.54	0.498	237	2.301	152.0	195.4	43.4	119.4	76.0	94.1	4.50
	13:55	15.42	10.71	0.501	236	2.329	152.8	196.5	43.7	120.1	76.4	94.6	4.50
	14:00	15.67	10.88	0.504	236	2.357	153.6	197.4	43.8	120.6	76.8	95.0	4.51
	14:05	15.96	11.08	0.508	236	2.389	154.6	198.8	44.2	121.5	77.3	95.7	4.50
	14:10	16.20	11.25	0.511	236	2.416	155.4	199.7	44.3	122.0	77.7	96.1	4.51
	14:15	16.40	11.39	0.513	236	2.438	155.9	200.3	44.4	122.3	77.9	96.4	4.51
	14:20	16.68	11.58	0.514	235	2.468	155.8	200.4	44.6	122.5	77.9	96.5	4.49
	14:25	16.94	11.77	0.515	235	2.498	155.8	200.6	44.8	122.7	77.9	96.7	4.48
	14:30	17.16	11.92	0.516	235	2.521	155.9	200.9	45.0	123.0	78.0	97.0	4.46
	14:35	**17.39**	**12.08**	**0.517**	**235**	**2.546**	**156.0**	**201.2**	**45.2**	**123.2**	**78.0**	**97.2**	**4.45**
	14:40	17.65	12.26	0.517	235	2.574	155.6	201.0	45.4	123.2	77.8	97.3	4.43
	14:45	17.89	12.43	0.517	234	2.600	155.3	200.9	45.6	123.2	77.6	97.4	4.41
	15:00	18.66	12.96	0.518	234	2.680	154.6	200.8	46.2	123.5	77.3	97.7	4.35
	15:15	19.39	13.47	0.520	233	2.756	154.3	200.9	46.6	123.8	77.2	98.0	4.31
	15:30	20.12	13.98	0.522	233	2.831	154.0	201.0	47.0	124.0	77.0	98.3	4.28
	15:45	21.00	14.58	0.525	233	2.918	153.9	201.4	47.5	124.4	76.9	98.8	4.24
	16:00	21.62	15.01	0.525	232	2.979	153.0	200.7	47.7	124.2	76.5	98.7	4.21

Borehole No. : WCH-BH02 — **Sample Depth m:-** 4.00 - 5.00

Sample No. : 1 — **Specimen Depth m:-** 4.60 - 4.80

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 — **Works Order No.:** 059

Compiled by: W S Wat

Checked by: H W Chung

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Form : GESR009.15 / Dec.13.04 / Issue 1 / Rev 1

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2
Shearing Continuation

FAILURE CRITERION

Max. deviator Stress ☒ | Max. Stress ratio ☐ | Axial Strain % ☐

Stage :	1	Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
Date	Time	Dial		P.R.No. 10	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
23/12	16:15	22.42	15.57	0.525	232	3.059	151.9	200.0	48.1	124.1	76.0	98.7	4.16
	16:30	23.16	16.08	0.523	231	3.131	150.2	198.8	48.6	123.7	75.1	98.7	4.09
	16:45	23.80	16.53	0.520	231	3.194	148.3	197.2	48.9	123.1	74.2	98.3	4.03
	17:00	24.61	17.09	0.517	231	3.272	146.2	195.5	49.3	122.4	73.1	98.0	3.97

Borehole No. : WCH-BH02 **Sample Depth m:-** 4.00 - 5.00
Sample No. : 1 **Specimen Depth m:-** 4.60 - 4.80

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.:** 059

Compiled by: W S Wat
Checked by: H W Chung

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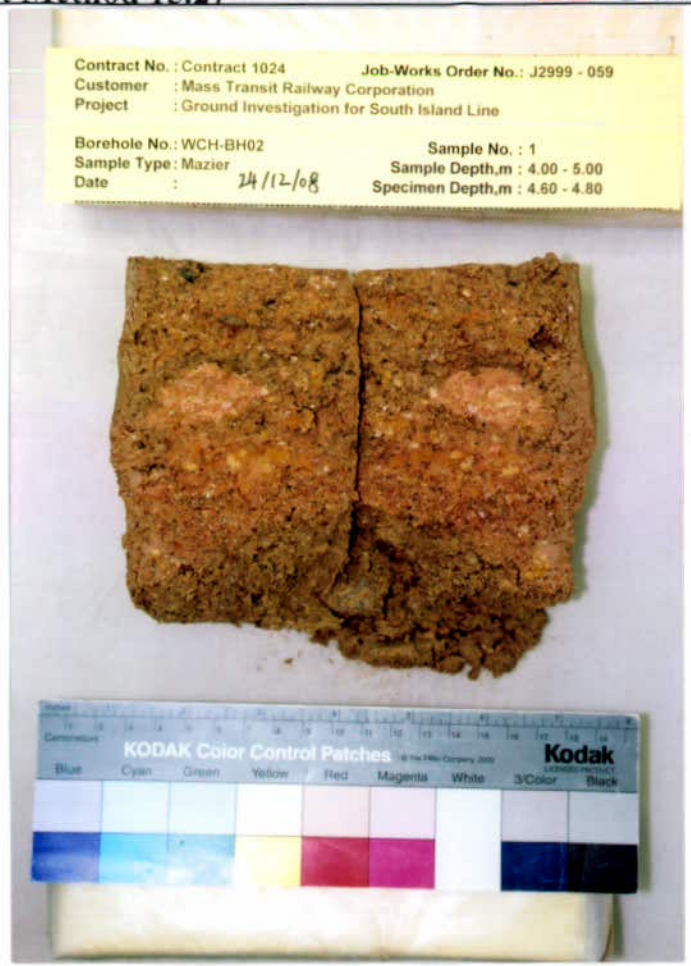
Form : GESR009.15 / Dec.13.04 / Issue 1 / Rev 1

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT (GEOSPEC 3 : 2001 Test Method 15.2)



Description : Dark brown, clayey, very silty, very sandy GRAVEL **Sample Origin : FILL‡** ‡ Information provided by customer

Borehole No. : WCH-BH02 **Sample No. :** 1 **Sample Depth m:-** 4.00 - 5.00 **Specimen Depth m:-** 4.60 - 4.80

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line

Contract No. : Contract 1024
Job No. : J2999
Works Order No.: 059

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	WCH-BH02	WCH-BH02	WCH-BH02
Sample		no	1	1	1
Sample Type			Mazier	Mazier	Mazier
Stage		no	1	2	3
Sample Depth		m	4.00 - 5.00	4.00 - 5.00	4.00 - 5.00
Specimen Depth		m	4.80 - 5.00	4.80 - 5.00	4.80 - 5.00
INITIAL CONDITIONS					
Diameter	(D_o)	mm	73.9	74.4	75.1
Height	(H_o)	mm	145.0	142.3	138.4
Moisture Content	(W_o)	%	19	22	22
Bulk density	(ρ_o)	Mg/m^3	1.94	2.00	2.01
Dry density	(ρ_d)	Mg/m^3	1.62	1.63	1.65
Particle density	(ρ_s)		2.64	2.64	2.64
Voids Ratio	(e_o)		0.62	0.62	0.60
Degree of Saturation	(S_r)	%	80.8	96.1	96.0
DRAINAGE CONDITIONS			ONE END		
SATURATION					
Final Pore Pressure Coefficient B			0.95		
CONSOLIDATION					
Cell Pressure	(σ_3)	kPa	235	255	275
Back Pressure	(u_b)	kPa	215	215	215
Effective Pressure	(σ'_3)	kPa	20	40	60
Coefficient of Consolidation (t100) (C_{vi})		$m^2/Year$	25298.85	13026.29	2884.90
Coefficient of Volume Compressibility (m_{vi})		m^2/MN	0.35	0.31	0.22
Coefficient of Permeability (k)		m/s	2.76E-06	1.24E-06	1.95E-07
COMPRESSION TERMINATION CRITERION			MAXIMUM STRESS RATIO		MAX ($\sigma'1 - \sigma'3$)
COMPRESSION - INITIAL					
Moisture Content	(w)	%	22	22	21
Pore Pressure at the End of Consolidation		kPa	215	215	220
Effective Stress at the End of Consolidation		kPa	20	40	55
Bulk density	(ρ_o)	Mg/m^3	2.00	2.01	2.02
Dry density	(ρ_d)	Mg/m^3	1.63	1.65	1.66
Voids Ratio	(e)		0.62	0.60	0.59
Degree of Saturation	(S_r)	%	96.1	96.0	95.9

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Report No. : J2999-059.11
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.:** 059

Technician : W S Wat Checked By : Approved By :

Name : H W Chung Signatory : Lau Wai Cheong

Tested Date: 18/12/2008 Date : 09/01/2009 Date : 09/01/2009

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	WCH-BH02	WCH-BH02	WCH-BH02
Sample		no	1	1	1
Sample Type			Mazier	Mazier	Mazier
Stage		no	1	2	3
Sample Depth		m	4.00 - 5.00	4.00 - 5.00	4.00 - 5.00
Specimen Depth		m	4.80 - 5.00	4.80 - 5.00	4.80 - 5.00
COMPRESSION - FAILURE					
Cell Pressure		kPa	235	255	275
Rate of Strain		mm/min	0.048	0.047	0.046
CONDITIONS AT MAXIMUM STRESS RATIO					
Major Effective Principal Stress (σ'_1)		kPa	76	141	246
Corrected Deviator Stress ($\sigma'_1 - \sigma'_3$)		kPa	62	110	192
Minor Effective Principal Stress (σ'_3)		kPa	14	31	54
$s' = (\sigma'_1 + \sigma'_3)/2$		kPa	45	86	150
$t = (\sigma_1 - \sigma_3)/2$		kPa	31	55	96
Expanded Uncertainty of s' ^		kPa	-	-	-
Expanded Uncertainty of t ^		kPa	-	-	-
Pore pressure parameter A_f			0.09	0.09	0.03
Strain at Failure	(εf)	%	1.5	4.2	9.1
COMPRESSION - FINAL					
Moisture Content	(W_f)	%	22	22	21
Bulk density	(ρ_o)	Mg/m^3	2.00	2.01	2.02
Dry density	(ρ_d)	Mg/m^3	1.63	1.65	1.66
Voids Ratio	(e_f)		0.62	0.60	0.59
Degree of Saturation	(S_f)	%	96.1	96.0	95.9

Notes -
1. The method of specimen preparation was in accordance with GEOSPEC 3 : 2001 :- Test method 13.3 : test specimen from undisturbed soil samples.
2. Sample received date :29/09/2008
3. The determination of moisture content was in accordance with test method 5.1 of GEOSPEC 3 : 2001.
4. Particle density : 2.64 (Determined)
5. Maximum and minimum temperature recorded over the period of testing 19.9 - 20.7 °C.
6. Unavoidable variations from specified procedure : none
7. Comment on observed or inferred sample disturbance : none
8. Percentage by mass of soil particles larger than 1/5 of the diameter of specimen (%) : Nil
9. The specimen was selected by the laboratory.
   Name : W S Wat Designation : Senior Laboratory Technician
10. Sampling History : As Received

* Delete as appropriate ^ Upon request

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.: 059**

Compiled by W S Wat
Checked by H W Chung

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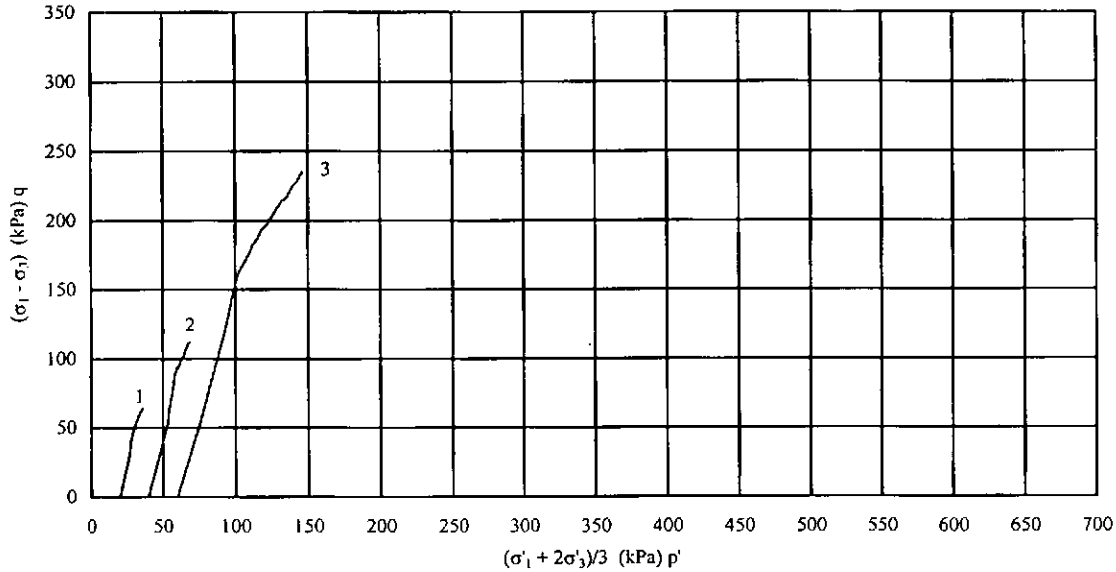
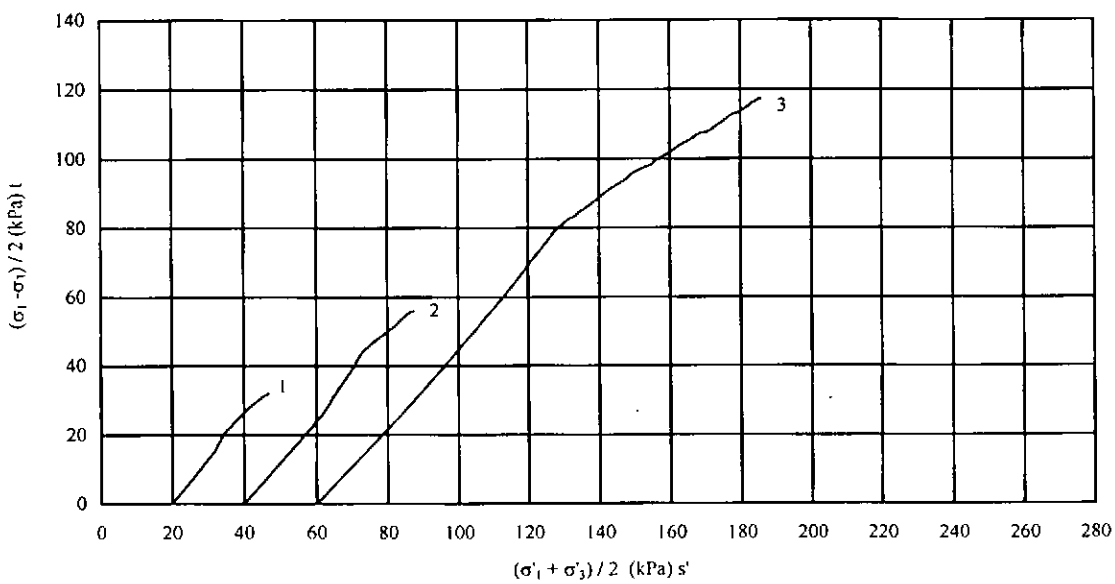
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

STRESS PATH PARAMETERS FOR EFFECTIVE STRESS

p' - q PLOT



s' - t PLOT



Borehole No. : WCH-BH02	**Sample Depth m:-** 4.00 - 5.00
Sample No. : 1	**Specimen Depth m:-** 4.80 - 5.00
Customer : Mass Transit Railway Corporation	Compiled by W S Wat
Project : Ground Investigation for South Island Line	
	Contract No.: Contract 1024
Job No.: J2999	**Works Order No.:** 059
	Checked by H W Chung

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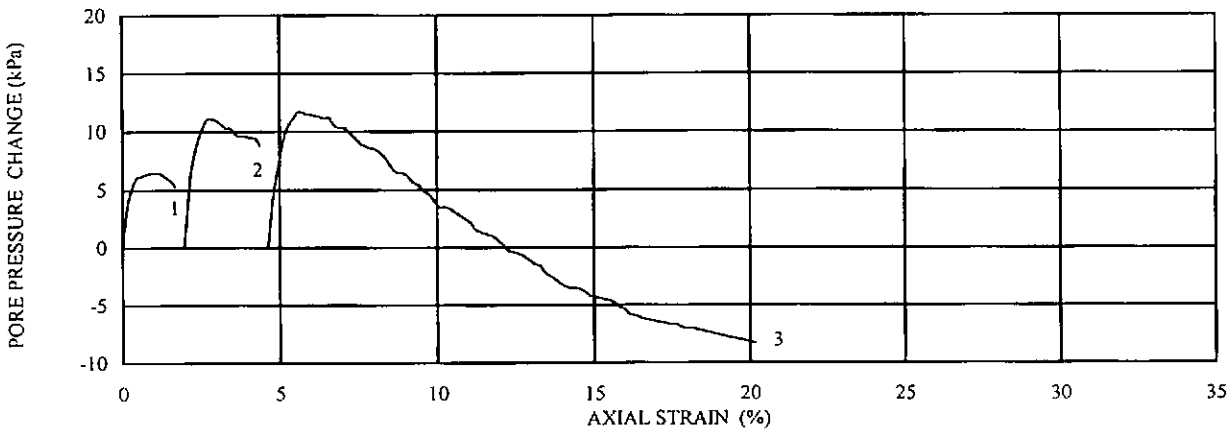
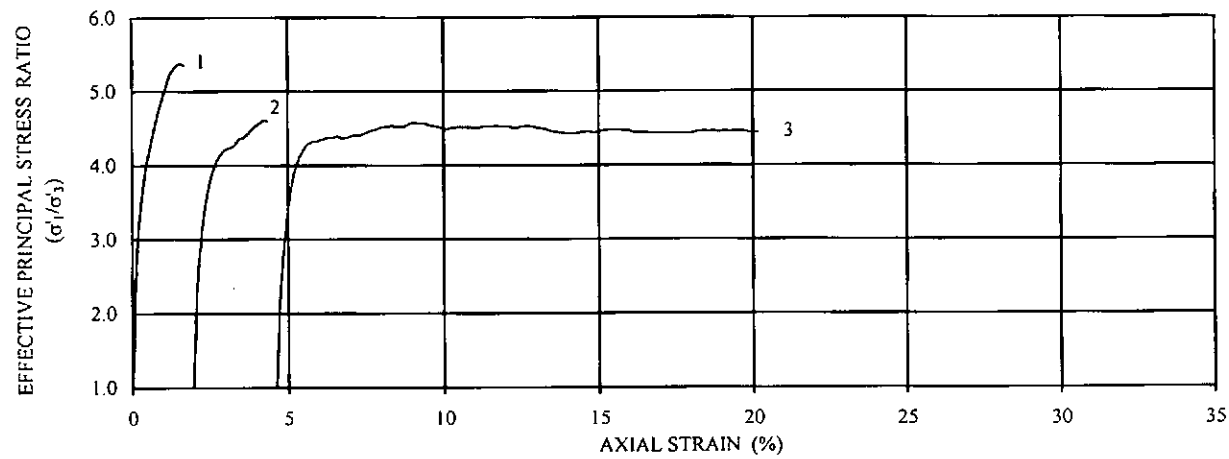
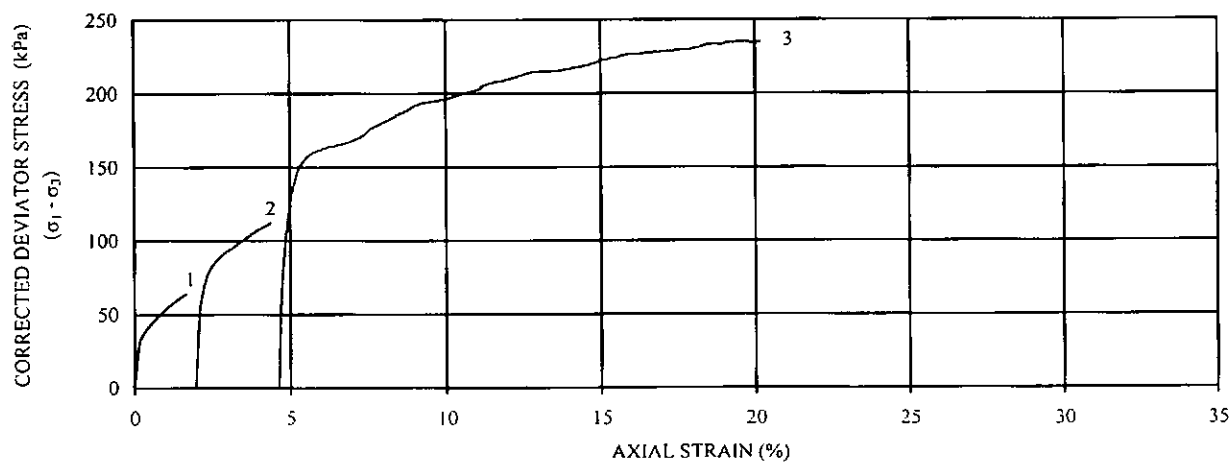
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

COMPRESSION







Borehole No. : WCH-BH02 — **Sample Depth m:-** 4.00 - 5.00
Sample No. : 1 — **Specimen Depth m:-** 4.80 - 5.00

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 — **Works Order No.:** 059

Compiled by W S Wat
Checked by H W Chung

Form : GESR009.9 / Jun.02.03 / Issue 1 / Rev 0

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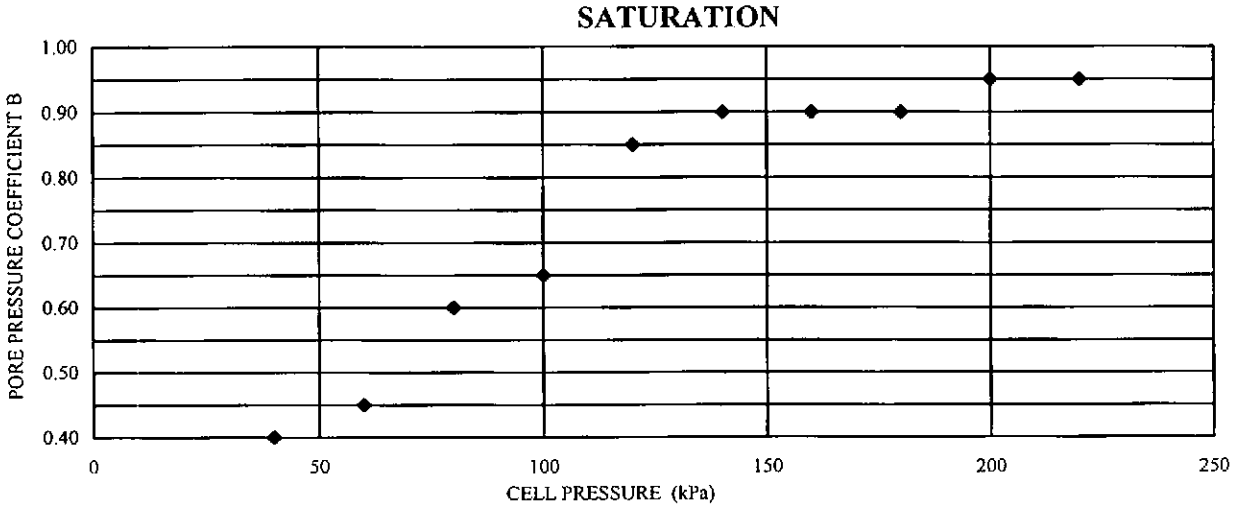
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2



Date	Time	Cell Pressure kPa	Back Pressure kPa	Pore Pressure kPa	Cumulative Volume of Water cm^3	Pore Pressure Parameter B
18/12/2008	16:36	0	0	-	0.0	
	16:45	20	-	16		-
19/12/2008	08:46	20	15	15	-1.0	
	08:55	40	-	23		0.40
	09:30	40	35	35	6.4	
	09:40	60	-	44		0.45
	10:00	60	55	55	12.0	
	10:09	80	-	67		0.60
	10:30	80	75	75	16.4	
	10:38	100	-	88		0.65
	13:08	100	95	95	20.7	
	13:14	120	-	112		0.85
	14:14	120	115	115	23.8	
	14:20	140	-	133		0.90
	14:47	140	135	135	26.4	
	14:55	160	-	153		0.90
	15:20	160	155	155	28.2	
	15:30	180	-	173		0.90
22/12/2008	08:45	180	175	175	34.6	
	08:57	200	-	194		0.95
	09:34	200	195	195	35.7	
	09:45	220	-	214		0.95
23/12/2008	08:35	220	215	215	36.7	

Borehole No. : WCH-BH02 **Sample Depth m:-** 4.00 - 5.00
Sample No. : 1 **Specimen Depth m:-** 4.80 - 5.00

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.:** 059

Compiled by: W S Wat
Checked by: H W Chung

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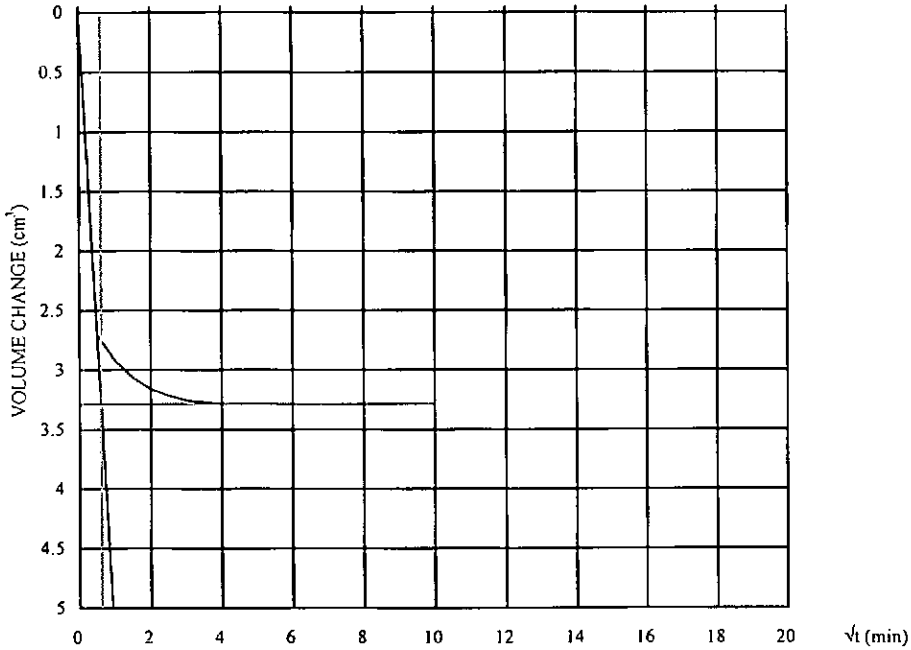
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

CONSOLIDATION (DRAINED PHASE) - Stage 1

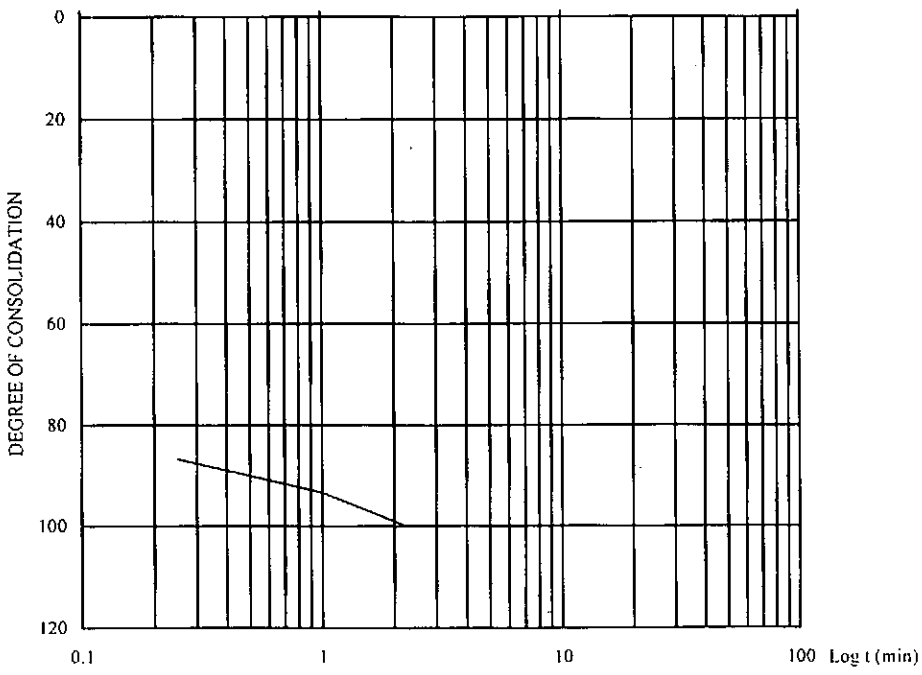


√t100 0.61 min

t100 0.37 min

tf 0.20 min

Calc. strain rate
51.651 mm/min



Borehole No. : WCH-BH02 **Sample Depth m:-** 4.00 - 5.00

Sample No. : 1 **Specimen Depth m:-** 4.80 - 5.00

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.:** 059

Complied by: W S Wat

Checked by: H W Chung

Form : GESR009.13 / Jun.02.03 / Issue 1 / Rev 0

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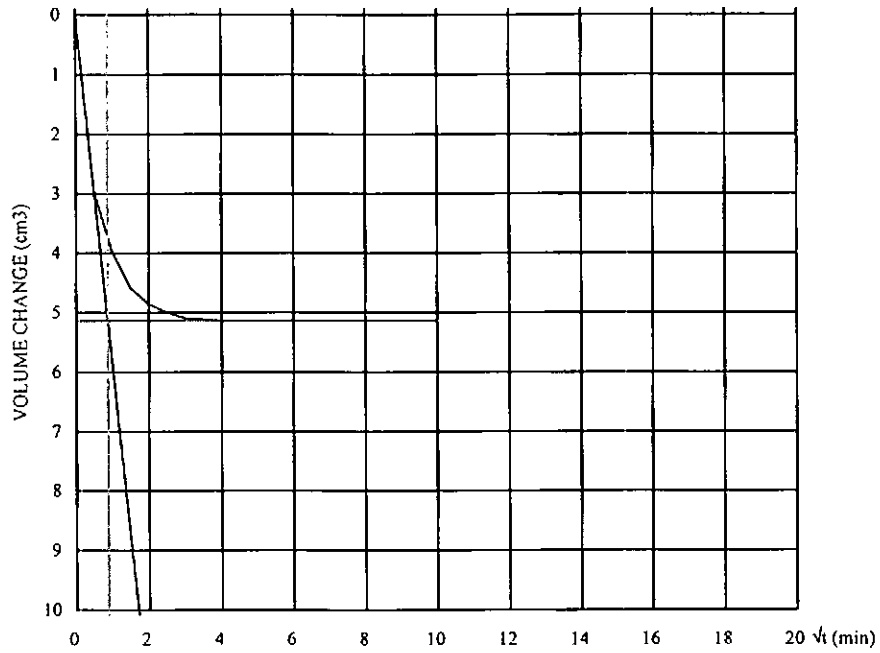
GEOSPEC 3 : 2001 Test Method 15.2

CONSOLIDATION (DRAINED PHASE) - Stage 2

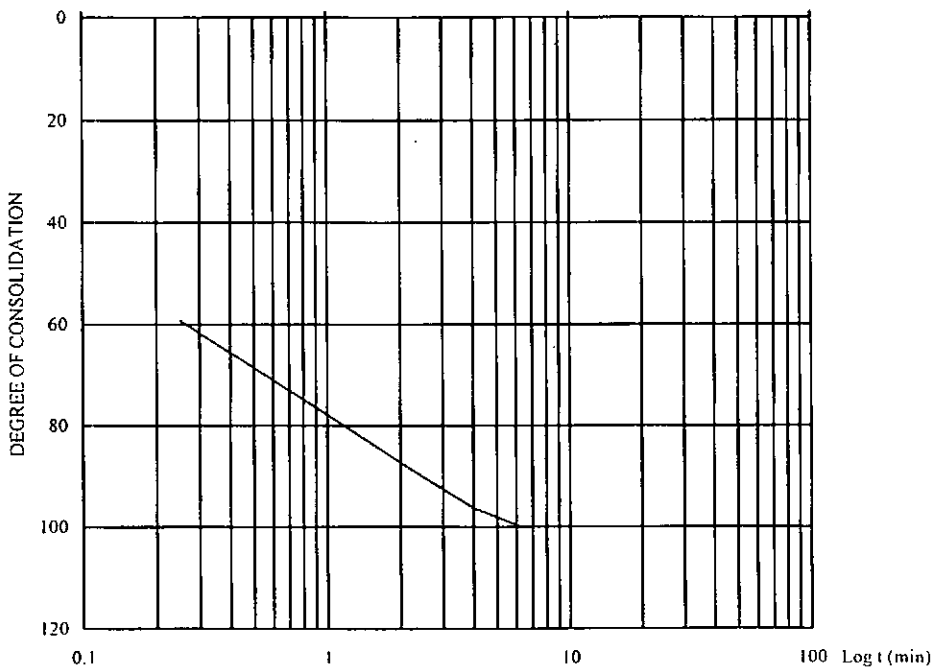


√t100 0.88 min

t100 0.77 min

tf 0.41 min

Calc. strain rate
24.474 mm/min



Borehole No. : WCH-BH02 **Sample Depth m:-** 4.00 - 5.00

Sample No. : 1 **Specimen Depth m:-** 4.80 - 5.00

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.:** 059

Complied by: W S Wat

Checked by: H W Chung

Form : GESR009.13 / Jun.02.03 / Issue 1 / Rev 0

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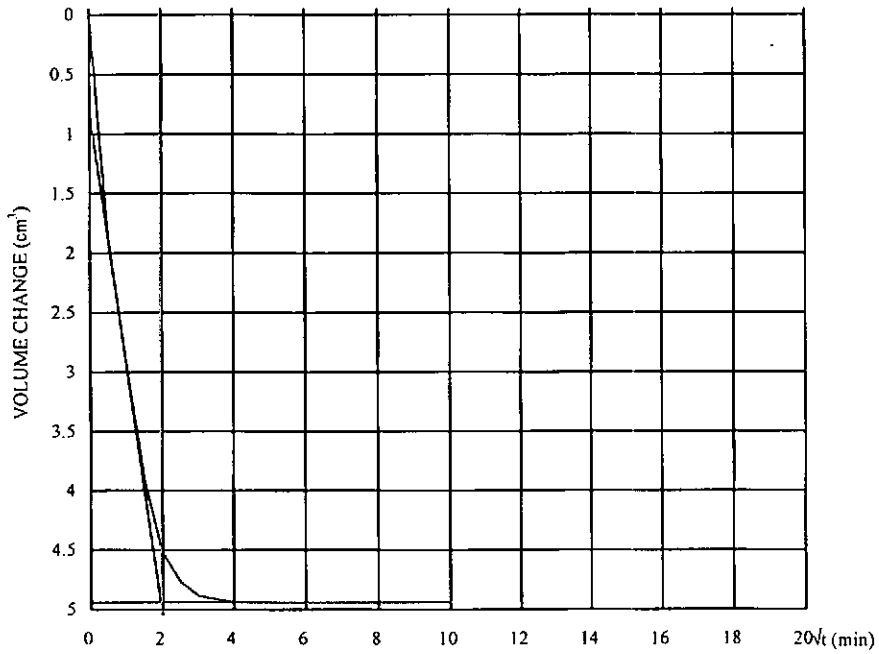
TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

CONSOLIDATION (DRAINED PHASE) - Stage 3

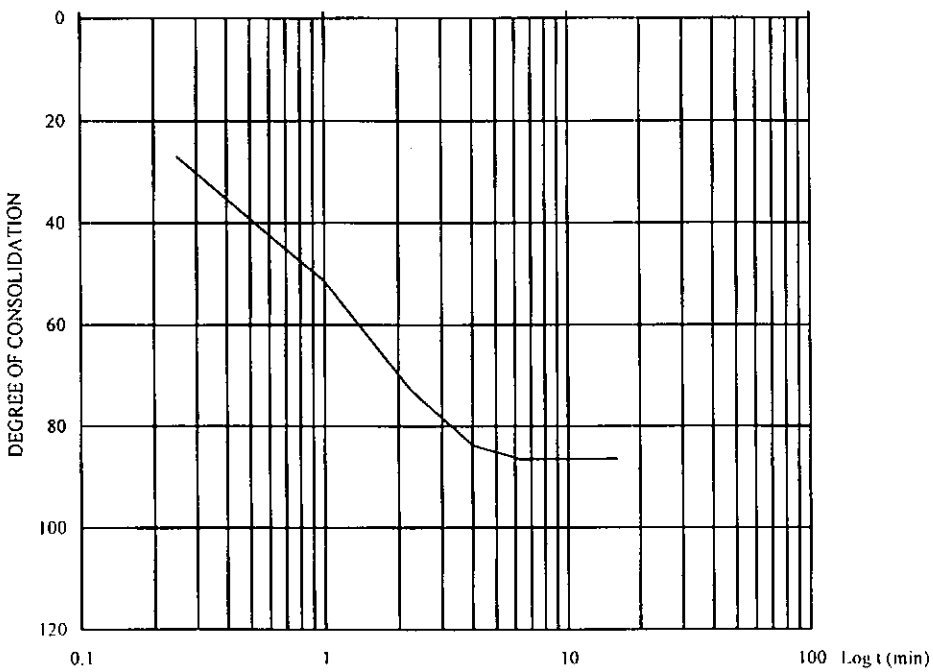


√t100 1.95 min

t100 3.80 min

tf 2.01 min

Calc. strain rate
4.797 mm/min



Borehole No. : WCH-BH02 **Sample Depth m:-** 4.00 - 5.00

Sample No. : 1 **Specimen Depth m:-** 4.80 - 5.00

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.:** 059

Complied by: W S Wat

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Multi Stage			P.W.P,B.P					Effective Pressure	20				kPa
Side drains	No		Selected Machine Speed		0.048		mm/min	Rate of Strain	1.99				% per hr
FAILURE CRITERION													
Max. deviator Stress		☐		Max. Stress ratio		☒		Axial Strain %		☐			
Stage :	1	Applied Pressure (kPa) - Cell :			235	Back :	215	P.R. factor		1.7511			kN/mm

Date	Time	Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
		Dial		P.R.No. 33	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
23/12	09:35	0.00	0.00	0.057	215	0.000	0.0	20.0	20.0	20.0	0.0	20.0	1.00
	09:40	0.21	0.14	0.129	218	0.041	29.4	46.1	16.7	31.4	14.7	26.5	2.76
	09:45	0.37	0.26	0.145	220	0.075	35.9	51.2	15.3	33.2	17.9	27.3	3.34
	09:50	0.63	0.44	0.159	221	0.126	41.5	55.5	14.0	34.7	20.7	27.8	3.96
	09:55	0.81	0.56	0.166	221	0.160	44.2	58.1	13.9	36.0	22.1	28.6	4.18
	10:00	1.06	0.73	0.176	221	0.208	48.2	61.9	13.7	37.8	24.1	29.8	4.52
	10:05	1.28	0.89	0.184	221	0.252	51.3	64.9	13.6	39.2	25.6	30.7	4.77
	10:10	1.53	1.06	0.192	221	0.299	54.4	68.0	13.6	40.8	27.2	31.7	5.00
	10:15	1.73	1.20	0.199	221	0.337	57.1	70.7	13.6	42.2	28.6	32.6	5.20
	10:20	1.95	1.35	0.206	221	0.378	59.8	73.7	13.9	43.8	29.9	33.8	5.30
	10:25	**2.20**	**1.52**	**0.212**	**221**	**0.423**	**62.1**	**76.3**	**14.2**	**45.2**	**31.0**	**34.9**	**5.37**
	10:30	2.44	1.68	0.217	220	0.465	63.9	78.6	14.7	46.7	32.0	36.0	5.35

Borehole No. :	**WCH-BH02**	**Sample Depth m:- 4.00 - 5.00**	
Sample No. :	**1**	**Specimen Depth m:- 4.80 - 5.00**	
Customer :	**Mass Transit Railway Corporation**		Compiled by
Project :	**Ground Investigation for South Island Line**		W S Wat
		Contract No.: Contract 1024	Checked by
Job No.:	**J2999**	**Works Order No.: 059**	H W Chung

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Technology Centre
21 Chun Wang Street, Tseung Kwan O Industrial Estate,
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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Gammon

Multi Stage		P.W.P,B.P		Effective Pressure 40	kPa
Side drains	No	Selected Machine Speed	0.047 mm/min	Rate of Strain 1.99	% per hr
FAILURE CRITERION					
Max. deviator Stress ☐		Max. Stress ratio ☒		Axial Strain % ☐	
Stage : 2	Applied Pressure (kPa) - Cell :	255	Back : 215	P.R. factor 1.7511	kN/mm

Date	Time	Strain Dial	Strain %	Load P.R.No. 33	Pore Pressure	Dev. stress Corr.	Dev. stress q $\sigma_1 - \sigma_3$	Effective Stress σ'_1	Effective Stress σ'_3	s' $(\sigma'_1+\sigma'_3)$ 2	t $(\sigma_1-\sigma_3)$ 2	p' $(\sigma'_1+2\sigma'_3)$ 3	Stress Ratio σ'_1/σ'_3
		mm	%	mm	kPa	kPa							
23/12	13:10	2.83	1.96	0.076	215	0.000	0.0	40.0	40.0	40.0	0.0	40.0	1.00
	13:15	3.03	2.09	0.200	219	0.572	49.6	85.6	36.0	60.8	24.8	52.5	2.38
	13:20	3.18	2.20	0.238	222	0.600	64.8	98.0	33.2	65.6	32.4	54.8	2.95
	13:25	3.42	2.36	0.269	224	0.641	77.2	108.4	31.2	69.8	38.6	56.9	3.47
	13:30	3.65	2.52	0.285	225	0.681	83.4	113.3	29.9	71.6	41.7	57.7	3.79
	13:35	3.88	2.68	0.296	226	0.721	87.7	116.7	29.0	72.8	43.8	58.2	4.02
	13:40	4.07	2.82	0.303	226	0.756	90.3	119.2	28.9	74.1	45.2	59.0	4.13
	13:45	4.30	2.97	0.310	226	0.793	93.0	122.0	29.0	75.5	46.5	60.0	4.21
	13:50	4.52	3.12	0.315	226	0.829	94.8	124.1	29.3	76.7	47.4	60.9	4.23
	13:55	4.75	3.28	0.321	225	0.868	97.0	126.7	29.7	78.2	48.5	62.0	4.27
	14:00	4.98	3.44	0.328	225	0.906	99.6	129.3	29.7	79.5	49.8	62.9	4.35
	14:05	5.24	3.62	0.336	225	0.948	102.5	132.8	30.3	81.6	51.3	64.5	4.38
	14:10	5.46	3.78	0.342	225	0.986	104.7	135.1	30.4	82.8	52.4	65.3	4.44
	14:15	5.64	3.90	0.347	225	1.014	106.5	136.9	30.4	83.7	53.3	65.9	4.50
	14:20	5.89	4.07	0.353	225	1.053	108.7	139.2	30.5	84.8	54.3	66.7	4.56
	14:25	**6.14**	**4.24**	**0.358**	**224**	**1.091**	**110.4**	**141.0**	**30.6**	**85.8**	**55.2**	**67.4**	**4.61**
	14:30	6.33	4.37	0.363	224	1.121	112.2	143.4	31.2	87.3	56.1	68.6	4.60

Borehole No. : WCH-BH02 **Sample Depth m:- 4.00 - 5.00**

Sample No. : 1 **Specimen Depth m:- 4.80 - 5.00**

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.:** 059

Compiled by: W S Wat

Checked by: H W Chung

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Form : GESR009.14 / Dec.13.04 / Issue 1 / Rev 1

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Multi Stage		P.W.P,B.P		Effective Pressure	60 kPa
Side drains	No	Selected Machine Speed	0.046 mm/min	Rate of Strain	2.00 % per hr
FAILURE CRITERION					
Max. deviator Stress	☐	Max. Stress ratio	☒	Axial Strain %	☐
Stage : 3	Applied Pressure (kPa) - Cell :	275	Back : 215	P.R. factor	1.7511 kN/mm

Date	Time	Strain Dial	Strain	Load P.R.No. 33	Pore Pressure	Dev. stress Corr.	Dev. stress q $\sigma_1 - \sigma_3$	Effective Stress σ'_1	Effective Stress σ'_3	s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio σ'_1/σ'_3
		mm	%	mm	kPa	kPa				2	2	3	
29/12	08:35	6.70	4.63	0.096	215	0.000	0.0	60.0	60.0	60.0	0.0	60.0	1.00
	08:40	6.82	4.71	0.239	217	1.197	55.5	113.1	57.6	85.4	27.8	76.1	1.96
	08:45	6.95	4.81	0.324	220	1.219	89.1	144.3	55.2	99.8	44.6	84.9	2.61
	08:50	7.10	4.91	0.378	221	1.240	110.4	164.0	53.6	108.8	55.2	90.4	3.06
	08:55	7.29	5.04	0.427	223	1.269	129.6	181.4	51.8	116.6	64.8	95.0	3.50
	09:00	7.47	5.16	0.456	225	1.295	140.8	191.1	50.3	120.7	70.4	97.2	3.80
	09:05	7.66	5.29	0.478	226	1.322	149.3	198.7	49.4	124.0	74.6	99.2	4.02
	09:10	7.89	5.45	0.492	226	1.356	154.5	203.3	48.8	126.1	77.3	100.3	4.17
	09:15	8.09	5.59	0.501	227	1.386	157.8	206.1	48.3	127.2	78.9	100.9	4.27
	09:20	8.32	5.75	0.508	227	1.419	160.2	208.6	48.4	128.5	80.1	101.8	4.31
	09:25	8.57	5.92	0.512	227	1.455	161.5	210.0	48.5	129.2	80.7	102.3	4.33
	09:30	8.80	6.08	0.516	226	1.488	162.7	211.3	48.6	130.0	81.4	102.8	4.35
	09:35	9.04	6.25	0.520	226	1.522	163.9	212.6	48.7	130.7	82.0	103.3	4.37
	09:40	9.28	6.41	0.522	226	1.554	164.4	213.2	48.8	131.0	82.2	103.6	4.37
	09:45	9.52	6.58	0.526	226	1.588	165.6	214.4	48.8	131.6	82.8	104.0	4.39
	09:50	9.77	6.75	0.529	226	1.622	166.5	216.0	49.5	132.7	83.2	105.0	4.36
	09:55	10.07	6.96	0.534	225	1.663	168.0	217.7	49.7	133.7	84.0	105.7	4.38
	10:00	10.26	7.09	0.538	225	1.688	169.3	219.0	49.7	134.3	84.6	106.1	4.41
	10:05	10.46	7.23	0.542	225	1.715	170.5	220.6	50.1	135.4	85.3	106.9	4.40
	10:10	10.71	7.40	0.548	225	1.748	172.5	223.0	50.5	136.7	86.2	108.0	4.42
	10:15	10.96	7.57	0.558	224	1.780	176.0	227.0	51.0	139.0	88.0	109.7	4.45
	10:20	11.16	7.71	0.563	224	1.806	177.6	228.8	51.2	140.0	88.8	110.4	4.47
	10:25	11.37	7.86	0.568	224	1.834	179.2	230.6	51.4	141.0	89.6	111.1	4.49
	10:30	11.63	8.04	0.574	224	1.868	181.1	232.6	51.5	142.1	90.6	111.9	4.52
	10:35	11.85	8.19	0.579	223	1.895	182.7	234.5	51.8	143.1	91.3	112.7	4.53
	10:40	12.07	8.34	0.584	223	1.923	184.3	236.5	52.2	144.3	92.1	113.6	4.53
	10:45	12.27	8.48	0.590	222	1.948	186.2	239.0	52.8	145.9	93.1	114.9	4.53
	10:50	12.48	8.63	0.594	222	1.975	187.4	240.7	53.3	147.0	93.7	115.8	4.52
	10:55	12.70	8.78	0.599	222	2.001	189.0	242.5	53.5	148.0	94.5	116.5	4.53
	11:00	12.93	8.94	0.606	221	2.030	191.3	244.9	53.6	149.2	95.6	117.4	4.57
	11:05	**13.16**	**9.09**	**0.610**	**221**	**2.056**	**192.4**	**246.3**	**53.9**	**150.1**	**96.2**	**118.0**	**4.57**
	11:10	13.40	9.26	0.615	221	2.086	193.9	248.3	54.4	151.4	97.0	119.0	4.57
	11:15	13.63	9.42	0.617	220	2.113	194.3	248.9	54.6	151.8	97.2	119.4	4.56
	11:20	13.86	9.58	0.619	220	2.141	194.7	249.8	55.1	152.5	97.4	120.0	4.53
	11:25	14.12	9.76	0.622	220	2.171	195.4	250.8	55.4	153.1	97.7	120.5	4.53
	11:30	14.35	9.92	0.625	219	2.198	196.2	252.2	56.0	154.1	98.1	121.4	4.50
	11:35	14.59	10.08	0.628	219	2.225	196.9	253.4	56.5	154.9	98.4	122.1	4.48
	11:40	14.81	10.24	0.632	219	2.252	198.0	254.5	56.5	155.5	99.0	122.5	4.50
	11:45	15.01	10.38	0.635	218	2.275	198.8	255.4	56.6	156.0	99.4	122.9	4.51

Borehole No. : WCH-BH02 — **Sample Depth m:- 4.00 - 5.00**

Sample No. : 1 — **Specimen Depth m:- 4.80 - 5.00**

Customer : Mass Transit Railway Corporation — Compiled by: W S Wat

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024 — Checked by: H W Chung

Job No.: J2999 — **Works Order No.:** 059

Form : GESR009.14 / Dec.13.04 / Issue 1 / Rev I

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2
Shearing Continuation

FAILURE CRITERION													
Max. deviator Stress ☐				Max. Stress ratio ☒				Axial Strain % ☐					
Stage : 3		Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
Date	Time	Dial		P.R.No. 33	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
29/12	11:50	15.26	10.55	0.639	218	2.303	199.9	256.8	56.9	156.8	99.9	123.5	4.51
	11:55	15.50	10.71	0.643	218	2.329	201.0	258.2	57.2	157.7	100.5	124.2	4.51
	12:00	15.76	10.89	0.647	218	2.358	202.0	259.5	57.5	158.5	101.0	124.8	4.51
	12:05	16.03	11.08	0.651	217	2.389	203.0	260.9	57.9	159.4	101.5	125.6	4.51
	12:10	16.20	11.19	0.658	217	2.406	205.3	263.7	58.4	161.1	102.7	126.8	4.52
	12:15	16.41	11.34	0.662	216	2.430	206.5	265.1	58.6	161.8	103.2	127.4	4.52
	12:20	16.67	11.52	0.666	216	2.459	207.5	266.3	58.8	162.5	103.7	128.0	4.53
	12:25	16.90	11.68	0.669	216	2.484	208.2	267.1	58.9	163.0	104.1	128.3	4.53
	12:30	17.12	11.83	0.671	216	2.507	208.5	267.6	59.1	163.4	104.3	128.6	4.53
	12:35	17.34	11.99	0.675	216	2.532	209.6	269.1	59.5	164.3	104.8	129.4	4.52
	12:40	17.57	12.14	0.678	215	2.555	210.3	270.1	59.8	164.9	105.1	129.9	4.52
	12:45	17.78	12.28	0.682	215	2.577	211.4	271.7	60.3	166.0	105.7	130.8	4.51
	12:50	18.04	12.46	0.686	215	2.604	212.4	272.8	60.4	166.6	106.2	131.2	4.52
	12:55	18.30	12.64	0.691	214	2.632	213.7	274.3	60.6	167.5	106.9	131.8	4.53
	13:00	18.43	12.74	0.693	214	2.647	214.2	274.9	60.7	167.8	107.1	132.1	4.53
	13:05	18.75	12.95	0.696	214	2.678	214.7	275.8	61.1	168.5	107.4	132.7	4.51
	13:10	19.03	13.15	0.698	214	2.708	214.9	276.4	61.5	169.0	107.5	133.1	4.49
	13:15	19.22	13.29	0.699	213	2.729	214.9	276.5	61.6	169.1	107.5	133.2	4.49
	13:20	19.46	13.45	0.701	213	2.753	215.2	277.4	62.2	169.8	107.6	133.9	4.46
	13:25	19.71	13.62	0.703	213	2.778	215.5	278.0	62.5	170.2	107.7	134.3	4.45
	13:30	19.96	13.79	0.706	212	2.803	216.1	278.9	62.8	170.8	108.0	134.8	4.44
	13:35	20.15	13.93	0.708	212	2.823	216.4	279.5	63.1	171.3	108.2	135.2	4.43
	13:40	20.42	14.11	0.712	212	2.850	217.4	280.8	63.4	172.1	108.7	135.9	4.43
	13:45	20.65	14.27	0.715	212	2.873	218.0	281.5	63.5	172.5	109.0	136.2	4.43
	13:50	20.89	14.43	0.718	212	2.896	218.6	282.1	63.5	172.8	109.3	136.4	4.44
	13:55	21.14	14.61	0.722	211	2.922	219.6	283.3	63.7	173.5	109.8	136.9	4.45
	14:00	21.37	14.77	0.726	211	2.945	220.6	284.6	64.0	174.3	110.3	137.5	4.45
	14:05	21.50	14.86	0.728	211	2.958	221.0	285.2	64.2	174.7	110.5	137.9	4.44
	14:10	21.76	15.04	0.734	211	2.983	222.7	287.0	64.3	175.6	111.3	138.5	4.46
	14:15	22.01	15.21	0.737	211	3.008	223.2	287.6	64.4	176.0	111.6	138.8	4.47
	14:20	22.19	15.33	0.740	211	3.025	223.9	288.4	64.5	176.5	112.0	139.1	4.47
	14:25	22.42	15.49	0.742	210	3.047	224.2	288.8	64.6	176.7	112.1	139.3	4.47
	14:30	22.65	15.65	0.747	210	3.070	225.5	290.3	64.8	177.6	112.8	140.0	4.48
	14:35	22.87	15.80	0.750	210	3.091	226.1	291.3	65.2	178.3	113.1	140.6	4.47
	14:40	23.13	15.99	0.753	210	3.118	226.6	292.0	65.4	178.7	113.3	140.9	4.47
	14:45	23.32	16.12	0.754	209	3.136	226.6	292.4	65.8	179.1	113.3	141.3	4.44
	14:50	23.61	16.32	0.756	209	3.164	226.7	292.6	65.9	179.3	113.4	141.5	4.44
	14:55	23.86	16.49	0.759	209	3.188	227.3	293.4	66.1	179.7	113.6	141.9	4.44
	15:00	24.03	16.61	0.761	209	3.205	227.6	293.8	66.2	180.0	113.8	142.1	4.44
	15:05	24.30	16.79	0.763	209	3.230	227.8	294.1	66.3	180.2	113.9	142.2	4.44
	15:10	24.50	16.93	0.765	209	3.250	228.1	294.5	66.4	180.4	114.0	142.4	4.43

Borehole No. : WCH-BH02 — **Sample Depth m:-** 4.00 - 5.00

Sample No. : 1 — **Specimen Depth m:-** 4.80 - 5.00

Customer : Mass Transit Railway Corporation — Compiled by W S Wat

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024 — Checked by H W Chung

Job No.: J2999 — **Works Order No.:** 059

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TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2
Shearing Continuation

FAILURE CRITERION

Max. deviator Stress ☐ Max. Stress ratio ☒ Axial Strain % ☐

Stage :	3	Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
Date	Time	Dial		P.R.No. 33	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
29/12	15:15	24.75	17.11	0.768	209	3.275	228.6	295.1	66.5	180.8	114.3	142.7	4.44
	15:20	25.03	17.30	0.770	208	3.301	228.7	295.3	66.6	181.0	114.4	142.8	4.43
	15:25	25.23	17.44	0.772	208	3.321	229.0	295.7	66.7	181.2	114.5	143.0	4.43
	15:30	25.49	17.62	0.775	208	3.346	229.5	296.2	66.7	181.4	114.7	143.2	4.44
	15:35	25.71	17.76	0.777	208	3.365	229.8	296.7	66.9	181.8	114.9	143.5	4.43
	15:40	25.92	17.91	0.779	208	3.386	230.0	297.0	67.0	182.0	115.0	143.7	4.43
	15:45	26.14	18.07	0.783	208	3.409	230.9	297.9	67.0	182.4	115.4	144.0	4.45
	15:50	26.41	18.25	0.787	208	3.434	231.7	298.8	67.1	183.0	115.9	144.3	4.45
	15:55	26.67	18.43	0.792	208	3.459	232.9	300.1	67.2	183.6	116.4	144.8	4.47
	16:00	26.84	18.55	0.793	208	3.476	232.8	300.1	67.3	183.7	116.4	144.9	4.46
	16:05	27.09	18.72	0.797	208	3.499	233.7	301.1	67.4	184.2	116.8	145.3	4.47
	16:10	27.30	18.86	0.796	208	3.519	232.9	300.4	67.5	183.9	116.4	145.1	4.45
	16:15	27.54	19.03	0.801	207	3.543	234.1	301.7	67.6	184.6	117.0	145.6	4.46
	16:20	27.73	19.17	0.803	207	3.563	234.3	302.0	67.7	184.9	117.2	145.8	4.46
	16:25	27.96	19.32	0.805	207	3.584	234.5	302.3	67.8	185.1	117.3	146.0	4.46
	16:30	28.20	19.49	0.808	207	3.608	235.0	302.9	67.9	185.4	117.5	146.2	4.46
	16:35	28.48	19.68	0.810	207	3.634	235.1	303.1	68.0	185.5	117.5	146.4	4.46
	16:40	28.76	19.87	0.810	207	3.661	234.5	302.6	68.1	185.3	117.2	146.3	4.44
	16:45	28.90	19.97	0.811	207	3.676	234.5	302.7	68.2	185.5	117.3	146.4	4.44
	16:50	29.20	20.18	0.814	207	3.705	234.9	303.2	68.3	185.7	117.4	146.6	4.44

Borehole No. : WCH-BH02 **Sample Depth m:-** 4.00 - 5.00

Sample No. : 1 **Specimen Depth m:-** 4.80 - 5.00

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.:** 059

Compiled by: W S Wat

Checked by: H W Chung

Form : GESR009.15 / Dec.13.04 / Issue 1 / Rev 1

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT (GEOSPEC 3 : 2001 Test Method 15.2)

Description : Dark brown, clayey, very silty, very sandy GRAVEL

Sample Origin : FILL ‡ ‡ Information provided by customer

Borehole No. : WCH-BH02	Sample No. : 1	Sample Depth m:- 4.00 - 5.00	Specimen Depth m:- 4.80 - 5.00

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line

Contract No.: Contract 1024
Job No.: J2999
Works Order No.: 059

Compiled by
W S Wat

Checked by
H W Chung

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	WCH-BH02		
Sample		no	5		
Sample Type			Mazier		
Stage		no	1		
Sample Depth		m	6.50 - 7.50		
Specimen Depth		m	7.10 - 7.30		
INITIAL CONDITIONS					
Diameter	(D_o)	mm	74.0		
Height	(H_o)	mm	145.0		
Moisture Content	(W_o)	%	26		
Bulk density	(ρ_o)	Mg/m^3	1.97		
Dry density	(ρ_d)	Mg/m^3	1.56		
Particle density	(ρ_s)		2.62		
Voids Ratio	(e_o)		0.68		
Degree of Saturation	(S_r)	%	101.4		
DRAINAGE CONDITIONS			ONE END		
SATURATION					
Final Pore Pressure Coefficient B			1.00		
CONSOLIDATION					
Cell Pressure	(σ_3)	kPa	290		
Back Pressure	(u_b)	kPa	220		
Effective Pressure	(σ'_3)	kPa	70		
Coefficient of Consolidation (t100) (C_{vi})		m^2/Year	21.82		
Coefficient of Volume Compressibility (m_{vi})		m^2/MN	0.57		
Coefficient of Permeability (k)		m/s	3.85E-09		
COMPRESSION TERMINATION CRITERION			MAXIMUM DEVIATOR STRESS		
COMPRESSION - INITIAL					
Moisture Content	(w)	%	24		
Pore Pressure at the End of Consolidation		kPa	220		
Effective Stress at the End of Consolidation		kPa	70		
Bulk density	(ρ_o)	Mg/m^3	2.00		
Dry density	(ρ_d)	Mg/m^3	1.62		
Voids Ratio	(e)		0.62		
Degree of Saturation	(S_r)	%	99.7		

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Report No. : J2999-059.11
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.:** 059

Technician : W S Wat Checked By : Name : H W Chung Approved By : Signatory : **Lau Wai Cheong**
Tested Date: 05/12/2008 Date : 18/12/2008 Date : 18/12/2008

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Form : GESR009.6 / Nov.10.06 / Issue 1 / Rev 1

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	WCH-BH02		
Sample		no	5		
Sample Type			Mazier		
Stage		no	1		
Sample Depth		m	6.50 - 7.50		
Specimen Depth		m	7.10 - 7.30		
COMPRESSION - FAILURE					
Cell Pressure		kPa	290		
Rate of Strain		mm/min	0.044		
CONDITIONS MAXIMUM DEVIATOR STRESS					
Major Effective Principal Stress (σ'_1)		kPa	228		
Corrected Deviator Stress ($\sigma'_1 - \sigma'_3$)		kPa	175		
Minor Effective Principal Stress (σ'_3)		kPa	54		
$s' = (\sigma'_1 + \sigma'_3)/2$		kPa	141		
$t = (\sigma_1 - \sigma_3)/2$		kPa	87		
Expanded Uncertainty of s' ^		kPa	-		
Expanded Uncertainty of t ^		kPa	-		
Pore pressure parameter A_f			0.09		
Strain at Failure	(εf)	%	12.1		
COMPRESSION - FINAL					
Moisture Content	(W_f)	%	24		
Bulk density	(ρ_o)	Mg/m^3	2.00		
Dry density	(ρ_d)	Mg/m^3	1.62		
Voids Ratio	(e_f)		0.62		
Degree of Saturation	(S_f)	%	99.7		

Notes -
1. The method of specimen preparation was in accordance with GEOSPEC 3 : 2001 :- Test method 13.3 : test specimen from undisturbed soil samples.
2. Sample received date :29/09/2008
3. The determination of moisture content was in accordance with test method 5.1 of GEOSPEC 3 : 2001.
4. Particle density : 2.62 (Determined)
5. Maximum and minimum temperature recorded over the period of testing 19.9 - 20.7 °C.
6. Unavoidable variations from specified procedure : none
7. Comment on observed or inferred sample disturbance : none
8. Percentage by mass of soil particles larger than 1/5 of the diameter of specimen (%) : Nil
9. The specimen was selected by the laboratory.
   Name : W S Wat Designation : Senior Laboratory Technician
10. Sampling History : As Received

* Delete as appropriate ^ Upon request

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.: 059**

Compiled by W S Wat
Checked by H W Chung

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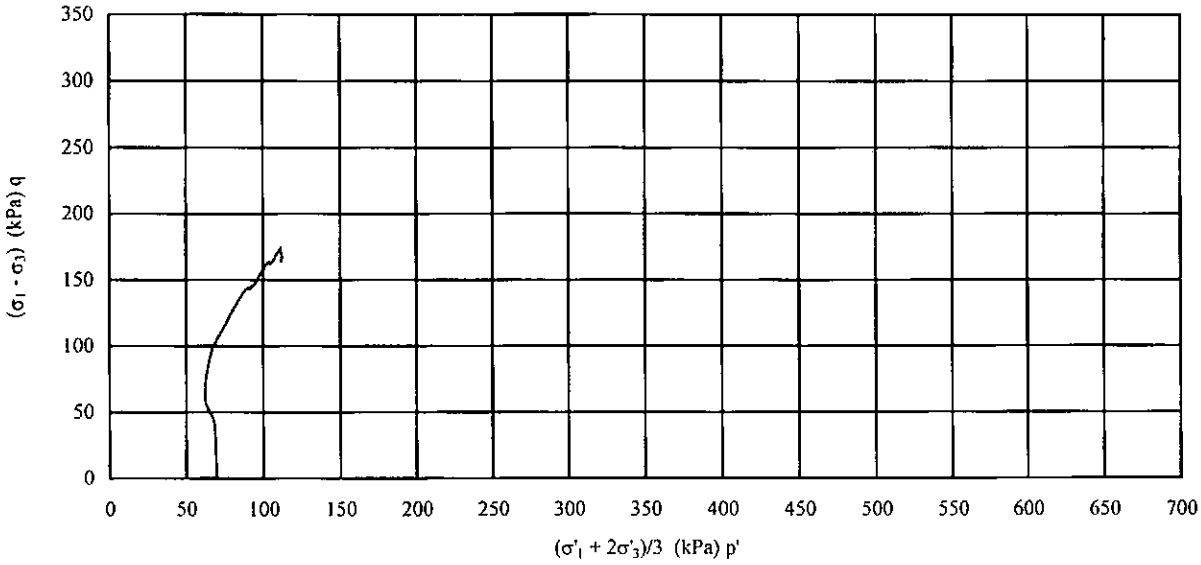
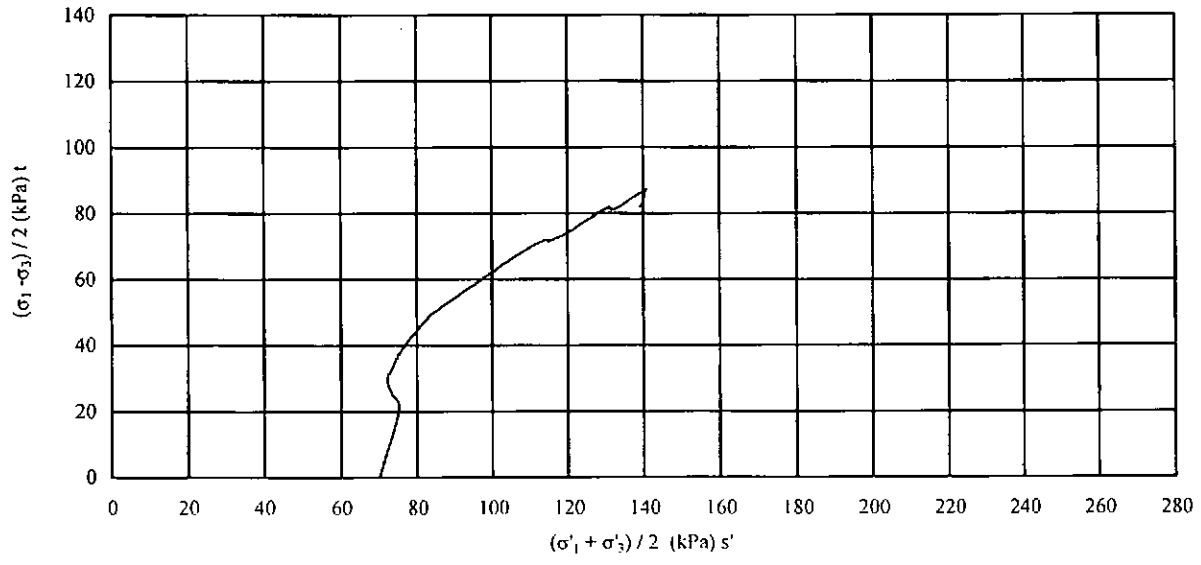
TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

STRESS PATH PARAMETERS FOR EFFECTIVE STRESS

p' - q PLOT



s' - t PLOT



Borehole No. : WCH-BH02 **Sample Depth m:-** 6.50 - 7.50
Sample No. : 5 **Specimen Depth m:-** 7.10 - 7.30

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.:** 059

Compiled by: W S Wat
Checked by: H W Chung

Form : GESR009.8 / Jun.02.03 / Issue 1 / Rev 0

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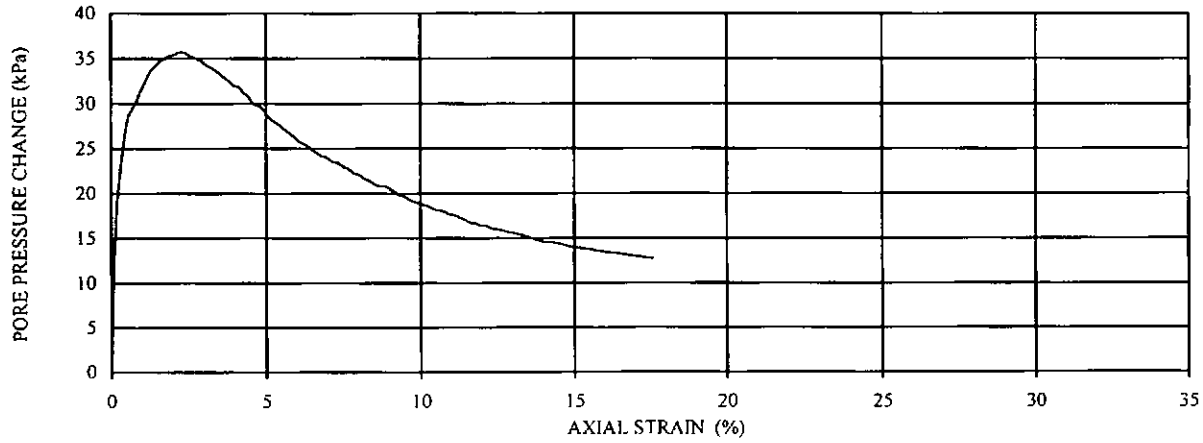
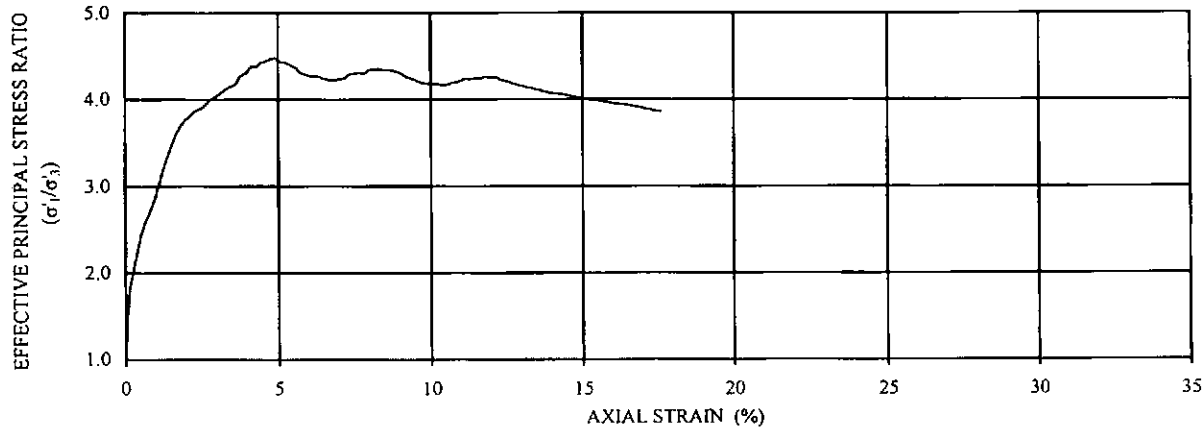
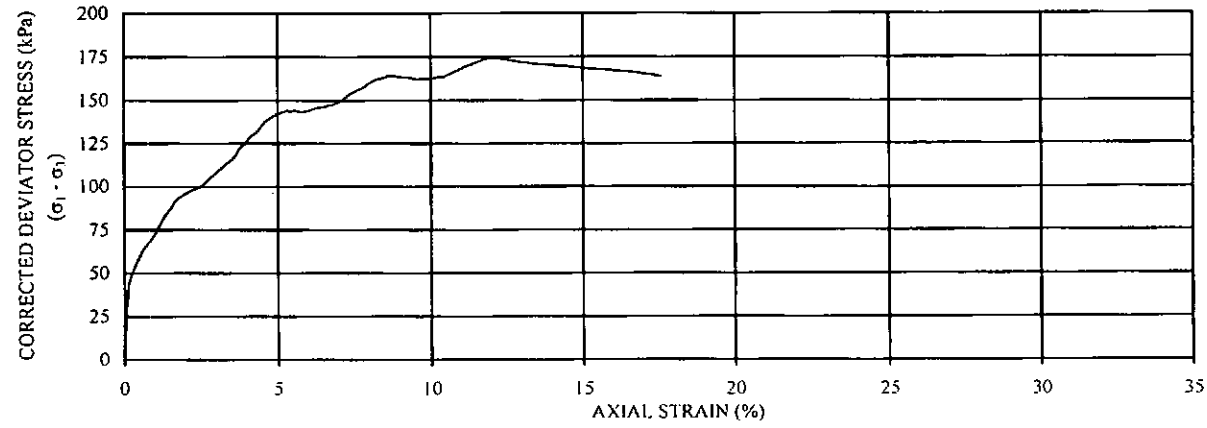
TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

COMPRESSION







Borehole No. : WCH-BH02 **Sample Depth m:-** 6.50 - 7.50
Sample No. : 5 **Specimen Depth m:-** 7.10 - 7.30

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.:** 059

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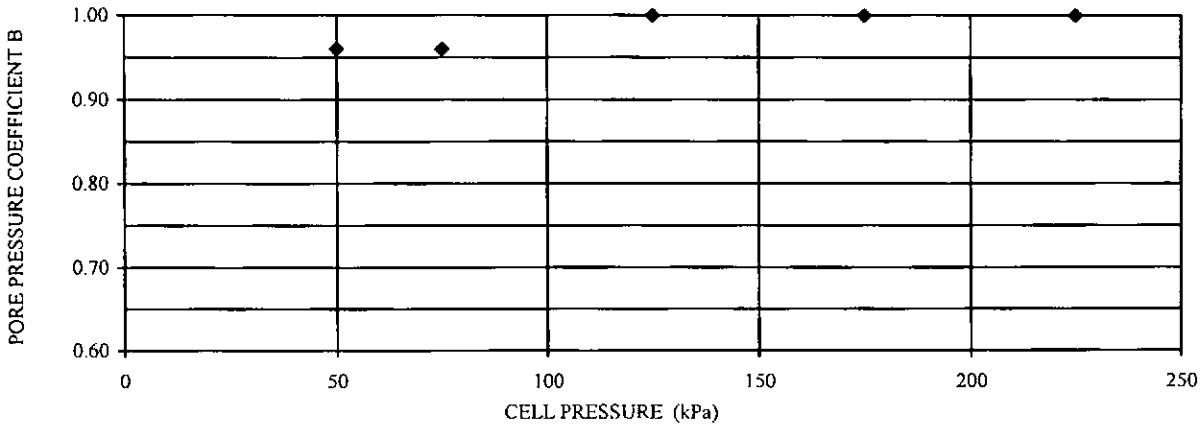
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

SATURATION



Date	Time	Cell Pressure kPa	Back Pressure kPa	Pore Pressure kPa	Cumulative Volume of Water cm^3	Pore Pressure Coefficient B
05/12/2008	15:40	0	0	-	0.0	
	15:48	25	-	25		-
06/12/2008	09:10	25	20	20	-15.0	
	09:19	50	-	44		0.96
	09:55	50	45	45	-7.4	
	10:03	75	-	69		0.96
	14:14	75	70	70	-5.2	
	14:22	125	-	120		1.00
	16:16	125	120	120	-5.0	
	16:23	175	-	170		1.00
	17:05	175	170	170	-4.8	
	17:12	225	-	220		1.00
08/12/2008	08:39	225	220	220	-4.1	

Borehole No. WCH-BH02 **Sample Depth m:-** 6.50 - 7.50
Sample No. : 5 **Specimen Depth m:-** 7.10 - 7.30
Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.:** 059

Compiled by: W S Wat
Checked by: H W Chung

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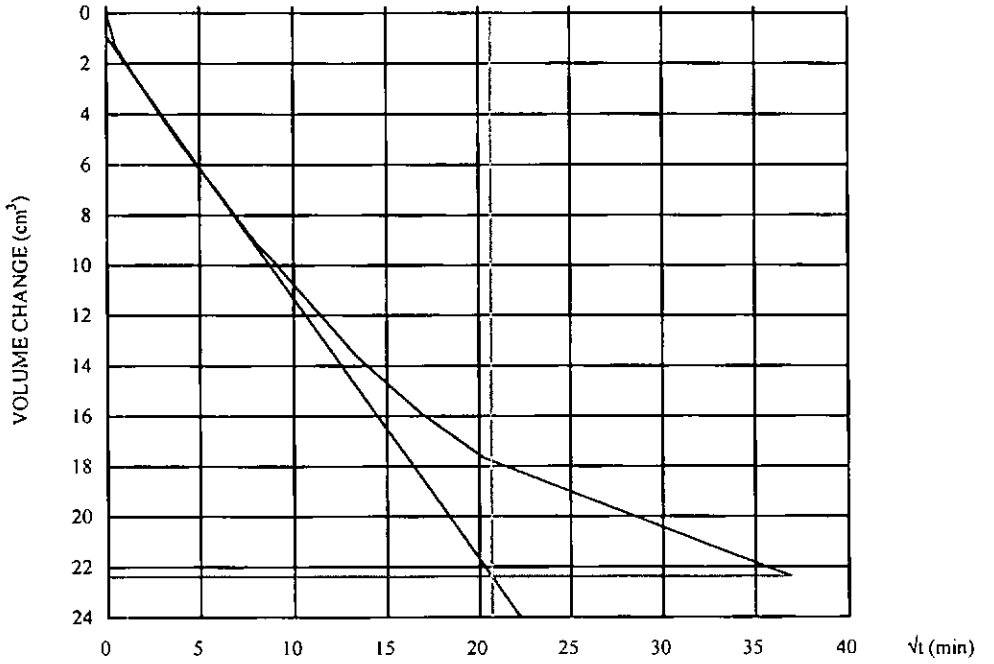
Form : GESR009.11 / Jun.02.03 / Issue 1 / Rev 0

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

CONSOLIDATION (DRAINED PHASE) - Stage 1

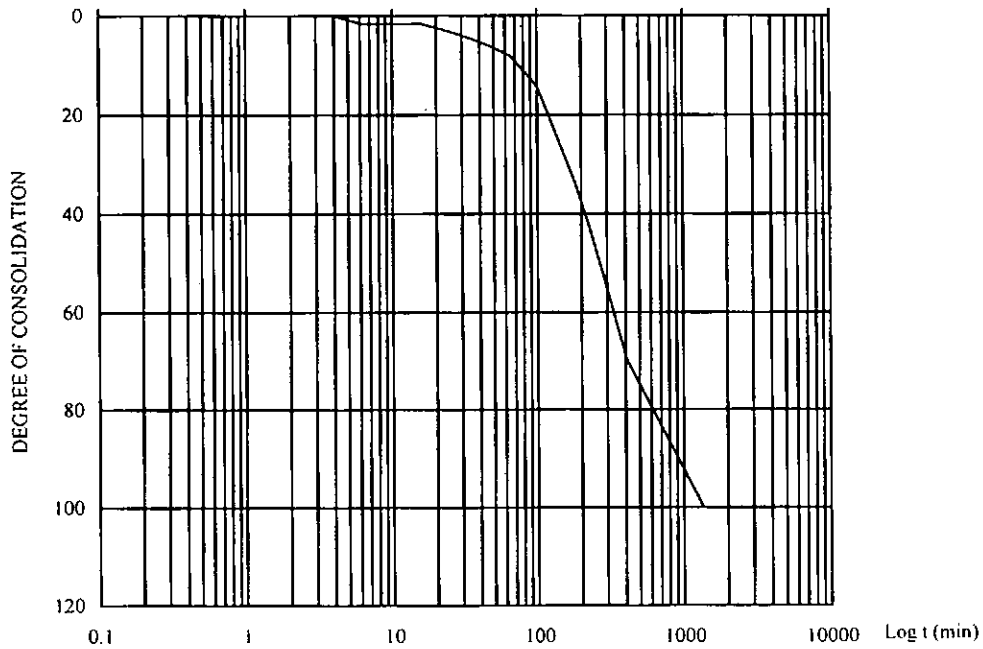


√t100 20.66 min

t100 426.843 min

tf 226.227 min

Calc. strain rate
0.044 mm/min



Borehole No. : WCH-BH02 **Sample Depth m:-** 6.50 - 7.50

Sample No. : 5 **Specimen Depth m:-** 7.10 - 7.30

Customer :	**Mass Transit Railway Corporation**	Complied by W S Wat
Project :	**Ground Investigation for South Island Line**	
	Contract No.: Contract 1024	Checked by H W Chung
Job No.:	**J2999** **Works Order No.: 059**	

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TEST REPORT
DETERMINATION OF
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UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Single Stage			P.W.P,B.P				Effective Pressure		70			kPa
Side drains	No	Selected Machine Speed		0.044	mm/min	Rate of Strain		1.84				% per hr
FAILURE CRITERION												
Max. deviator Stress		☒	Max. Stress ratio		☐	Axial Strain %						☐
Stage : 1	Applied Pressure (kPa) - Cell :			290	Back : 220	P.R. factor		1.6995				kN/mm

Date	Time	Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
		Dial		P.R.No. 40	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
09/12	08:35	0.00	0.00	0.079	220	0.000	0.0	70.0	70.0	70.0	0.0	70.0	1.00
	08:40	0.19	0.13	0.182	236	0.038	41.6	96.0	54.4	75.2	20.8	68.3	1.76
	08:45	0.39	0.27	0.204	242	0.078	50.4	98.7	48.3	73.5	25.2	65.1	2.04
	08:50	0.59	0.41	0.219	246	0.118	56.3	100.5	44.2	72.4	28.2	63.0	2.27
	08:55	0.78	0.55	0.232	248	0.157	61.4	103.0	41.6	72.3	30.7	62.1	2.48
	09:00	0.93	0.65	0.240	249	0.185	64.5	105.3	40.8	73.1	32.3	62.3	2.58
	09:05	1.13	0.79	0.248	250	0.224	67.6	107.6	40.0	73.8	33.8	62.5	2.69
	09:10	1.33	0.93	0.256	251	0.263	70.7	109.5	38.8	74.2	35.4	62.4	2.82
	09:15	1.57	1.10	0.270	252	0.309	76.1	113.7	37.6	75.7	38.1	63.0	3.02
	09:20	1.82	1.27	0.284	254	0.355	81.6	118.1	36.5	77.3	40.8	63.7	3.23
	09:25	2.08	1.45	0.296	254	0.404	86.1	121.9	35.8	78.9	43.1	64.5	3.41
	09:30	2.28	1.59	0.305	255	0.441	89.6	124.9	35.3	80.1	44.8	65.2	3.54
	09:35	2.47	1.73	0.313	255	0.478	92.6	127.6	35.0	81.3	46.3	65.9	3.65
	09:40	2.73	1.91	0.320	255	0.525	95.1	129.8	34.7	82.3	47.6	66.4	3.74
	09:45	2.95	2.06	0.324	255	0.564	96.5	131.1	34.6	82.9	48.3	66.8	3.79
	09:50	3.20	2.23	0.328	256	0.607	97.9	132.2	34.3	83.3	49.0	66.9	3.85
	09:55	3.46	2.42	0.332	256	0.655	99.3	133.7	34.4	84.0	49.6	67.5	3.89
	10:00	3.71	2.59	0.339	255	0.698	101.8	136.6	34.8	85.7	50.9	68.7	3.93
	10:05	3.97	2.77	0.347	255	0.742	104.7	139.7	35.0	87.4	52.4	69.9	3.99
	10:10	4.20	2.93	0.353	255	0.782	106.8	142.1	35.3	88.7	53.4	70.9	4.03
	10:15	4.44	3.10	0.361	254	0.823	109.8	145.6	35.8	90.7	54.9	72.4	4.07
	10:20	4.64	3.24	0.367	254	0.857	111.9	147.9	36.0	92.0	56.0	73.3	4.11
	10:25	4.86	3.40	0.374	254	0.895	114.4	150.8	36.4	93.6	57.2	74.5	4.14
	10:30	5.18	3.62	0.383	253	0.947	117.6	154.6	37.0	95.8	58.8	76.2	4.18
	10:35	5.40	3.77	0.395	253	0.982	122.1	159.5	37.4	98.4	61.0	78.1	4.26
	10:40	5.67	3.96	0.405	252	1.026	125.7	163.7	38.0	100.8	62.8	79.9	4.31
	10:45	5.93	4.14	0.415	252	1.067	129.3	167.5	38.2	102.8	64.6	81.3	4.38
	10:50	6.14	4.29	0.420	251	1.101	131.0	169.8	38.8	104.3	65.5	82.5	4.38
	10:55	6.34	4.43	0.429	251	1.133	134.2	173.4	39.2	106.3	67.1	83.9	4.42
	11:00	6.60	4.61	0.439	250	1.173	137.8	177.8	40.0	108.9	68.9	85.9	4.44
	11:05	6.86	4.79	0.445	250	1.213	139.8	180.1	40.3	110.2	69.9	86.9	4.47
	11:10	7.05	4.92	0.450	249	1.241	141.5	182.2	40.7	111.5	70.8	87.9	4.48
	11:15	7.31	5.10	0.454	249	1.280	142.7	184.2	41.5	112.9	71.4	89.1	4.44
	11:20	7.54	5.27	0.458	248	1.316	144.0	186.0	42.0	114.0	72.0	90.0	4.43
	11:25	7.77	5.42	0.458	248	1.348	143.7	186.0	42.3	114.2	71.9	90.2	4.40
	11:30	7.99	5.58	0.460	247	1.382	144.2	187.0	42.8	114.9	72.1	90.9	4.37
	11:35	8.22	5.74	0.458	247	1.415	143.2	186.4	43.2	114.8	71.6	90.9	4.31
	11:40	8.47	5.92	0.460	246	1.453	143.6	187.3	43.7	115.5	71.8	91.6	4.29
	11:45	8.71	6.08	0.463	246	1.486	144.5	188.7	44.2	116.4	72.2	92.4	4.27

Borehole No. : WCH-BH02 **Sample Depth m:- 6.50 - 7.50**

Sample No. : 5 **Specimen Depth m:- 7.10 - 7.30**

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.: 059**

Compiled by W S Wat

Checked by H W Chung

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Technology Centre
21 Chun Wang Street, Tseung Kwan O Industrial Estate,
Tseung Kwan O, N.T. Tel :26991980, Fax : 26917547

TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2
Shearing Continuation

FAILURE CRITERION

Max. deviator Stress ☒ | Max. Stress ratio ☐ | Axial Strain % ☐

Stage :	I	Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
Date	Time	Dial		P.R.No. 40	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
09/12	11:50	8.94	6.25	0.467	246	1.520	145.7	190.2	44.5	117.3	72.8	93.1	4.27
	11:55	9.23	6.45	0.469	245	1.560	146.1	191.1	45.0	118.0	73.0	93.7	4.25
	12:00	9.36	6.53	0.470	245	1.576	146.3	191.5	45.2	118.4	73.2	94.0	4.24
	12:05	9.76	6.81	0.475	244	1.632	147.7	193.5	45.8	119.7	73.9	95.0	4.23
	12:10	9.99	6.98	0.479	244	1.665	148.9	194.9	46.0	120.5	74.5	95.6	4.24
	12:15	10.25	7.16	0.485	244	1.700	150.8	197.3	46.5	121.9	75.4	96.8	4.24
	12:20	10.51	7.34	0.493	243	1.734	153.5	200.1	46.6	123.4	76.8	97.8	4.29
	12:25	10.73	7.50	0.498	243	1.764	155.1	202.1	47.0	124.5	77.5	98.7	4.30
	12:30	10.96	7.65	0.502	243	1.793	156.3	203.5	47.2	125.3	78.1	99.3	4.31
	12:35	11.18	7.81	0.506	242	1.823	157.5	205.2	47.7	126.4	78.7	100.2	4.30
	12:40	11.44	7.99	0.514	242	1.856	160.1	208.0	47.9	128.0	80.1	101.3	4.34
	12:45	11.69	8.16	0.519	242	1.887	161.6	209.9	48.3	129.1	80.8	102.2	4.35
	12:50	11.91	8.32	0.522	242	1.916	162.4	210.9	48.5	129.7	81.2	102.6	4.35
	12:55	12.15	8.48	0.525	241	1.945	163.2	212.1	48.9	130.5	81.6	103.3	4.34
	13:00	12.34	8.61	0.528	241	1.968	164.1	213.2	49.1	131.1	82.0	103.8	4.34
	13:05	12.65	8.83	0.528	241	2.008	163.6	212.8	49.2	131.0	81.8	103.7	4.33
	13:10	12.92	9.02	0.529	241	2.041	163.6	213.1	49.5	131.3	81.8	104.0	4.31
	13:15	13.14	9.18	0.528	240	2.069	163.0	212.9	49.9	131.4	81.5	104.2	4.27
	13:20	13.36	9.33	0.529	240	2.095	163.0	213.2	50.2	131.7	81.5	104.5	4.25
	13:25	13.63	9.51	0.528	240	2.126	162.3	212.7	50.4	131.5	81.1	104.5	4.22
	13:30	13.89	9.70	0.529	239	2.158	162.3	213.1	50.8	131.9	81.1	104.9	4.19
	13:35	14.13	9.87	0.530	239	2.187	162.3	213.3	51.0	132.2	81.2	105.1	4.18
	13:40	14.38	10.04	0.532	239	2.216	162.7	213.9	51.2	132.5	81.3	105.4	4.18
	13:45	14.64	10.22	0.535	239	2.246	163.4	214.8	51.4	133.1	81.7	105.9	4.18
	13:50	14.88	10.39	0.536	238	2.274	163.4	215.1	51.7	133.4	81.7	106.2	4.16
	13:55	15.14	10.57	0.541	238	2.303	164.9	216.8	51.9	134.3	82.4	106.9	4.18
	14:00	15.38	10.74	0.546	238	2.331	166.4	218.4	52.0	135.2	83.2	107.5	4.20
	14:05	15.64	10.92	0.551	238	2.360	167.8	220.1	52.3	136.2	83.9	108.2	4.21
	14:10	15.89	11.10	0.557	238	2.389	169.6	222.0	52.4	137.2	84.8	108.9	4.24
	14:15	16.14	11.27	0.560	237	2.416	170.3	223.0	52.7	137.8	85.1	109.5	4.23
	14:20	16.38	11.44	0.565	237	2.443	171.7	224.6	52.9	138.8	85.9	110.1	4.25
	14:25	16.65	11.62	0.569	237	2.471	172.8	226.1	53.3	139.7	86.4	110.9	4.24
	14:30	16.85	11.76	0.573	237	2.493	173.9	227.2	53.3	140.3	87.0	111.3	4.26
	14:35	17.08	11.93	0.575	236	2.519	174.3	227.9	53.6	140.7	87.1	111.7	4.25
	14:40	**17.35**	**12.11**	**0.577**	**236**	**2.547**	**174.6**	**228.2**	**53.6**	**140.9**	**87.3**	**111.8**	**4.26**
	14:45	17.62	12.30	0.576	236	2.576	173.8	227.7	53.9	140.8	86.9	111.8	4.22
	14:50	17.85	12.47	0.576	236	2.602	173.5	227.5	54.0	140.7	86.7	111.8	4.21
	14:55	18.09	12.63	0.575	236	2.627	172.7	226.8	54.1	140.5	86.4	111.7	4.19
	15:00	18.32	12.79	0.575	236	2.651	172.4	226.7	54.3	140.5	86.2	111.8	4.17
	15:15	19.08	13.32	0.575	235	2.730	171.3	226.0	54.7	140.3	85.6	111.8	4.13
	15:30	19.84	13.86	0.576	235	2.809	170.5	225.8	55.3	140.5	85.2	112.1	4.08

Borehole No. : WCH-BH02 — **Sample Depth m:-** 6.50 - 7.50

Sample No. : 5 — **Specimen Depth m:-** 7.10 - 7.30

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 — **Works Order No.:** 059

Compiled by: W S Wat

Checked by: H W Chung

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Form : GESR009.15 / Dec.13.04 / Issue 1 / Rev 1

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2
Shearing Continuation

FAILURE CRITERION

Max. deviator Stress ☒ Max. Stress ratio ☐ Axial Strain % ☐

Stage :	1	Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
Date	Time	Dial		P.R.No. 40	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
09/12	15:45	20.57	14.37	0.577	235	2.883	169.7	225.2	55.5	140.3	84.8	112.1	4.06
	16:00	21.35	14.91	0.578	234	2.961	168.9	224.9	56.0	140.4	84.4	112.3	4.02
	16:15	22.12	15.44	0.579	234	3.036	168.1	224.3	56.2	140.2	84.0	112.2	3.99
	16:30	22.82	15.93	0.580	234	3.105	167.3	223.8	56.5	140.2	83.7	112.3	3.96
	16:45	23.55	16.45	0.581	233	3.178	166.6	223.3	56.7	140.0	83.3	112.2	3.94
	17:00	24.30	16.97	0.581	233	3.251	165.4	222.4	57.0	139.7	82.7	112.1	3.90
	17:15	25.18	17.58	0.580	233	3.336	163.8	221.1	57.3	139.2	81.9	111.9	3.86

Borehole No. : WCH-BH02 **Sample Depth m:-** 6.50 - 7.50
Sample No. : 5 **Specimen Depth m:-** 7.10 - 7.30
Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.:** 059

Compiled by: W S Wat
Checked by: H W Chung

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Form : GESR009.15 / Dec.13.04 / Issue 1 / Rev 1

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT (GEOSPEC 3 : 2001 Test Method 15.2)

Description : Dark grey, slightly gravelly, slightly sandy SILT/CLAY **Sample Origin :** ALL‡ ‡ Information provided by customer

Borehole No. : WCH-BH02 **Sample No. :** 5 **Sample Depth m:-** 6.50 - 7.50 **Specimen Depth m:-** 7.10 - 7.30

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line

Contract No. : Contract 1024
Job No. : J2999
Works Order No.: 059

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	WCH-BH02	WCH-BH02	WCH-BH02
Sample		no	5	5	5
Sample Type			Mazier	Mazier	Mazier
Stage		no	1	2	3
Sample Depth		m	6.50 - 7.50	6.50 - 7.50	6.50 - 7.50
Specimen Depth		m	7.30 - 7.50	7.30 - 7.50	7.30 - 7.50
INITIAL CONDITIONS					
Diameter	(D_o)	mm	74.0	74.4	75.0
Height	(H_o)	mm	145.0	141.1	137.1
Moisture Content	(W_o)	%	24	23	22
Bulk density	(ρ_o)	Mg/m^3	2.00	2.02	2.03
Dry density	(ρ_d)	Mg/m^3	1.61	1.64	1.66
Particle density	(ρ_s)		2.62	2.62	2.62
Voids Ratio	(e_o)		0.63	0.60	0.58
Degree of Saturation	(S_r)	%	99.9	101.5	101.5
DRAINAGE CONDITIONS			ONE END		
SATURATION					
Final Pore Pressure Coefficient B			1.00		
CONSOLIDATION					
Cell Pressure	(σ_3)	kPa	240	275	305
Back Pressure	(u_b)	kPa	210	210	210
Effective Pressure	(σ'_3)	kPa	30	65	95
Coefficient of Consolidation (t100) (C_{vi})		$m^2/Year$	20.71	52.03	103.45
Coefficient of Volume Compressibility (m_{vi})		m^2/MN	0.66	0.23	0.12
Coefficient of Permeability (k)		m/s	4.21E-09	3.76E-09	3.89E-09
COMPRESSION TERMINATION CRITERION			MAXIMUM STRESS RATIO		MAX ($\sigma'1 - \sigma'3$)
COMPRESSION - INITIAL					
Moisture Content	(w)	%	23	22	22
Pore Pressure at the End of Consolidation		kPa	210	210	210
Effective Stress at the End of Consolidation		kPa	30	65	95
Bulk density	(ρ_o)	Mg/m^3	2.02	2.03	2.04
Dry density	(ρ_d)	Mg/m^3	1.64	1.66	1.67
Voids Ratio	(e)		0.60	0.58	0.57
Degree of Saturation	(S_r)	%	101.5	101.5	101.6

Customer : **Mass Transit Railway Corporation**
Project : **Ground Investigation for South Island Line**
Report No. : J2999-059.11
Contract No.: Contract 1024
Job No.: **J2999** **Works Order No.: 059**

Technician : W S Wat Checked By : Name : H W Chung Date : 18/12/2008 Approved By : Signatory : **Lau Wai Cheong** Date : 18/12/2008

Tested Date: 05/12/2008

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Form : GESR0009.6 / Nov.10.06 / Issue 1 / Rev 1

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	WCH-BH02	WCH-BH02	WCH-BH02
Sample		no	5	5	5
Sample Type			Mazier	Mazier	Mazier
Stage		no	1	2	3
Sample Depth		m	6.50 - 7.50	6.50 - 7.50	6.50 - 7.50
Specimen Depth		m	7.30 - 7.50	7.30 - 7.50	7.30 - 7.50
COMPRESSION - FAILURE					
Cell Pressure		kPa	240	275	305
Rate of Strain		mm/min	0.048	0.046	0
CONDITIONS AT MAXIMUM STRESS RATIO					
Major Effective Principal Stress (σ'_1)		kPa	85	188	336
Corrected Deviator Stress ($\sigma'_1 - \sigma'_3$)		kPa	69	143	250
Minor Effective Principal Stress (σ'_3)		kPa	16	45	86
$s' = (\sigma'_1 + \sigma'_3)/2$		kPa	51	116	211
$t = (\sigma_1 - \sigma_3)/2$		kPa	34	72	125
Expanded Uncertainty of s' ^		kPa	-	-	-
Expanded Uncertainty of t ^		kPa	-	-	-
Pore pressure parameter A_f			0.20	0.14	0.04
Strain at Failure	(εf)	%	2.0	4.6	8.2
COMPRESSION - FINAL					
Moisture Content	(W_f)	%	23	22	22
Bulk density	(ρ_o)	Mg/m^3	2.02	2.03	2.04
Dry density	(ρ_d)	Mg/m^3	1.64	1.66	1.67
Voids Ratio	(e_f)		0.60	0.58	0.57
Degree of Saturation	(S_f)	%	101.5	101.5	101.6

Notes -
1. The method of specimen preparation was in accordance with GEOSPEC 3 : 2001 :- Test method 13.3 : test specimen from undisturbed soil samples.
2. Sample received date :29/09/2008
3. The determination of moisture content was in accordance with test method 5.1 of GEOSPEC 3 : 2001.
4. Particle density : 2.62 (Determined)
5. Maximum and minimum temperature recorded over the period of testing 19.9 - 20.7 °C.
6. Unavoidable variations from specified procedure : none
7. Comment on observed or inferred sample disturbance : none
8. Percentage by mass of soil particles larger than 1/5 of the diameter of specimen (%) : Nil
9. The specimen was selected by the laboratory.
   Name : W S Wat Designation : Senior Laboratory Technician
10. Sampling History : As Received

* Delete as appropriate ^ Upon request

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.: 059**

Compiled by W S Wat
Checked by H W Chung

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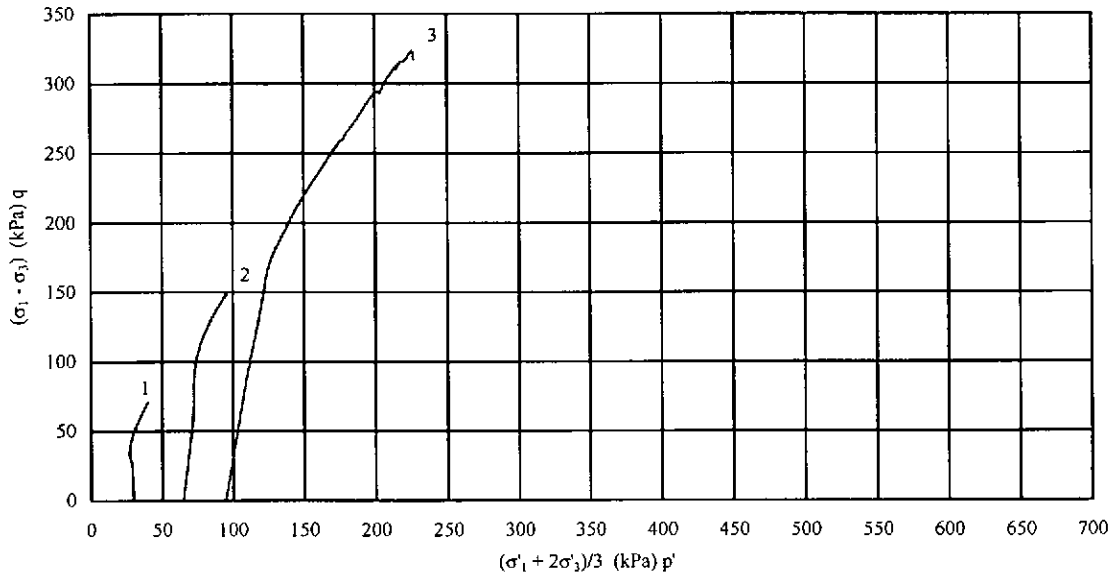
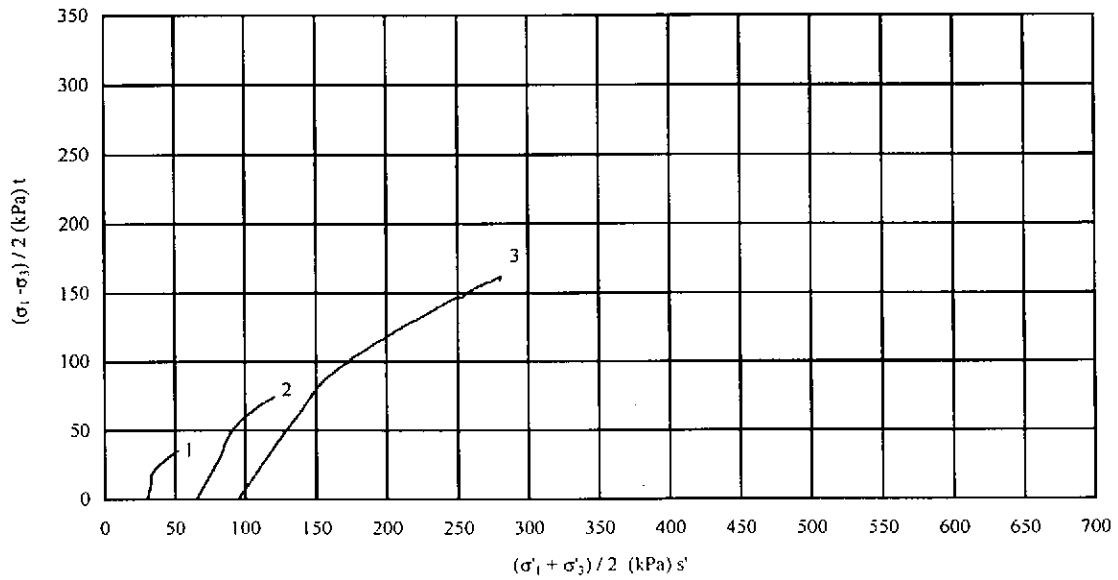
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

STRESS PATH PARAMETERS FOR EFFECTIVE STRESS

p' - q PLOT



s' - t PLOT



Borehole No. : WCH-BH02 **Sample Depth m:-** 6.50 - 7.50

Sample No. : 5 **Specimen Depth m:-** 7.30 - 7.50

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.:** 059

Compiled by: W S Wat

Checked by: H W Chung

Form : GES\R009.8 / Jun.02.03 / Issue 1 / Rev 0

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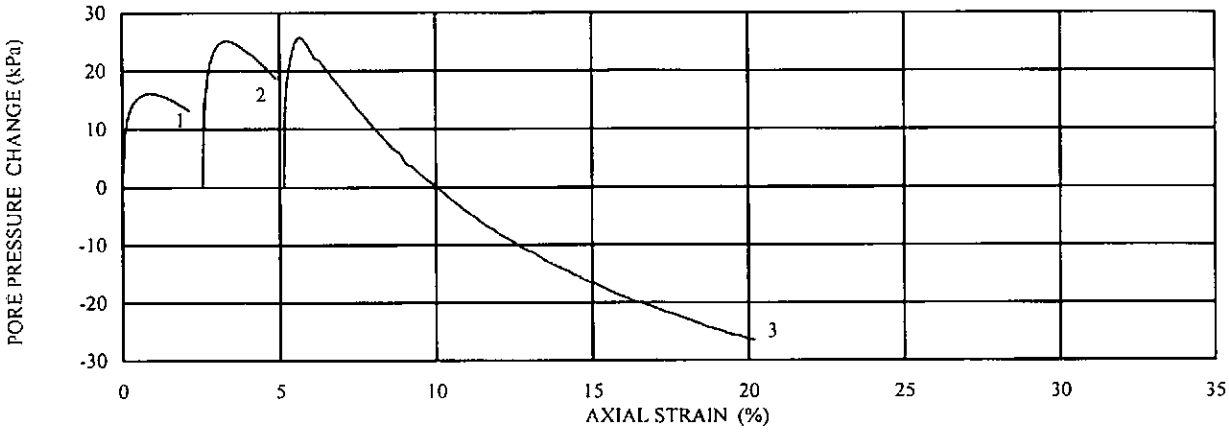
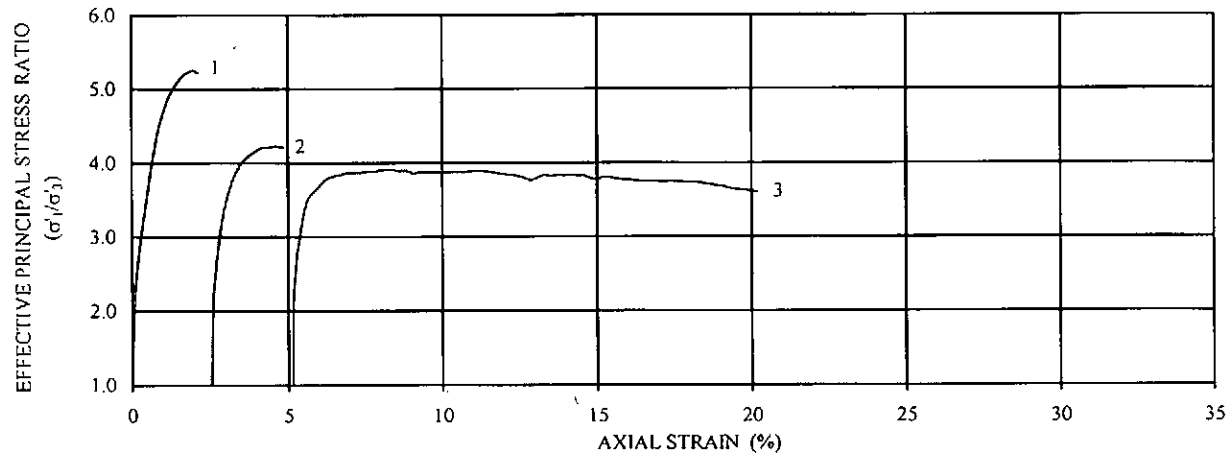
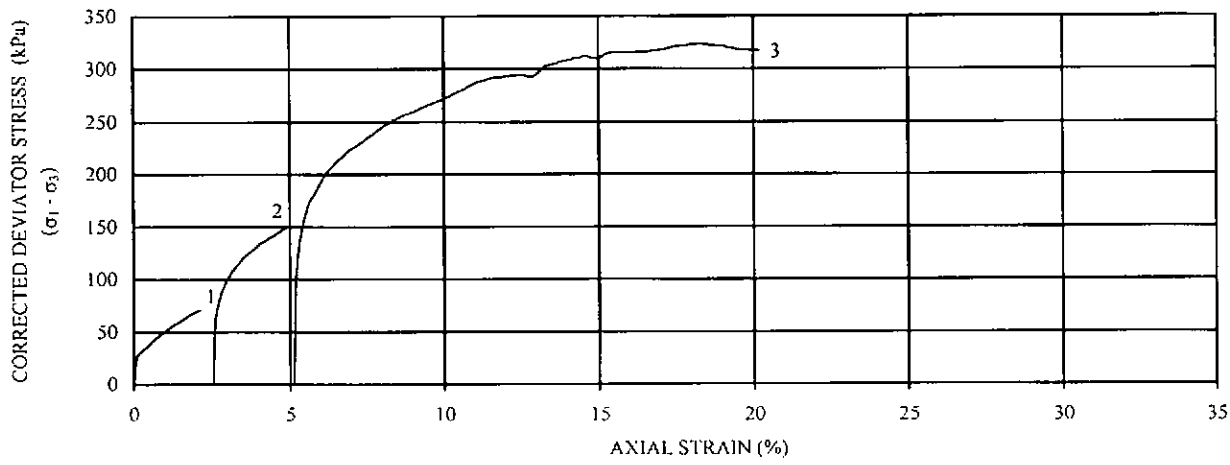
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

COMPRESSION







Borehole No. :	**WCH-BH02**	**Sample Depth m:-**	**6.50 - 7.50**
Sample No. :	**5**	**Specimen Depth m:-**	**7.30 - 7.50**
Customer :	**Mass Transit Railway Corporation**		Compiled by W S Wat
Project :	**Ground Investigation for South Island Line**		
		Contract No.: Contract 1024	Checked by H W Chung
Job No.:	**J2999**	**Works Order No.: 059**	

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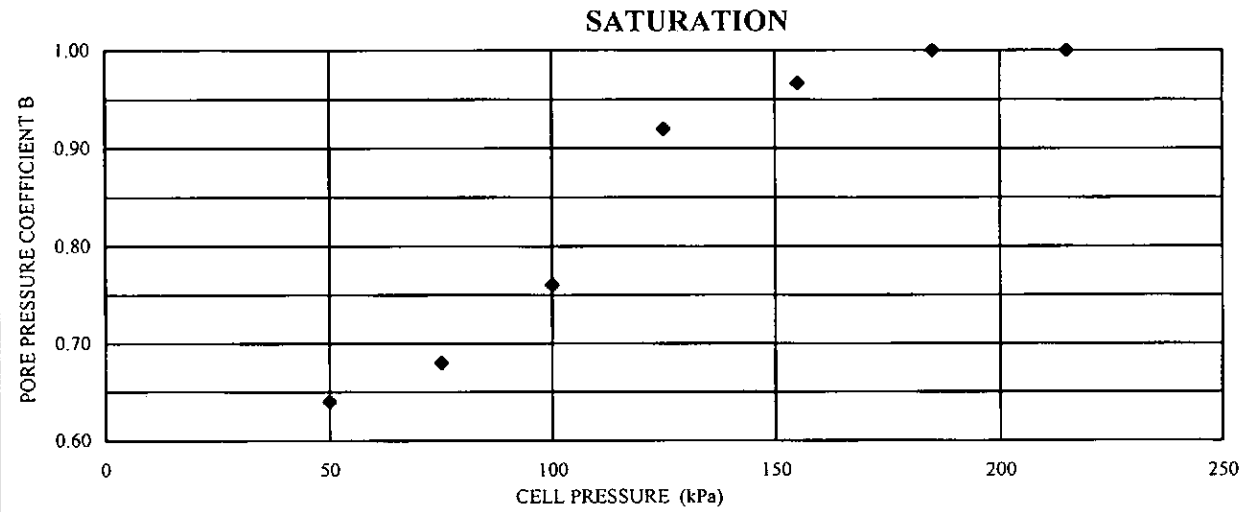
GEOSPEC 3 : 2001 Test Method 15.2



Date	Time	Cell Pressure kPa	Back Pressure kPa	Pore Pressure kPa	Cumulative Volume of Water cm^3	Pore Pressure Parameter B
05/12/2008	14:09	0	0	-	0.0	
	14:17	25	-	25		-
	14:59	25	20	20	-7.6	
	15:07	50	-	36		0.64
	16:44	50	45	45	-0.4	
	16:50	75	-	62		0.68
07/12/2008	10:10	75	70	70	0.4	
	10:18	100	-	89		0.76
	10:52	100	95	95	1.3	
	11:00	125	-	118		0.92
	12:42	125	120	120	2.1	
	12:50	155	-	149		0.97
	13:43	155	150	150	2.6	
	13:55	185	-	180		1.00
	15:36	185	180	180	2.9	
	15:45	215	-	210		1.00
08/12/2008	08:41	215	210	210	3.5	

Borehole No. : WCH-BH02 **Sample Depth m:-** 6.50 - 7.50
Sample No. : 5 **Specimen Depth m:-** 7.30 - 7.50
Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.:** 059

Compiled by W S Wat
Checked by H W Chung

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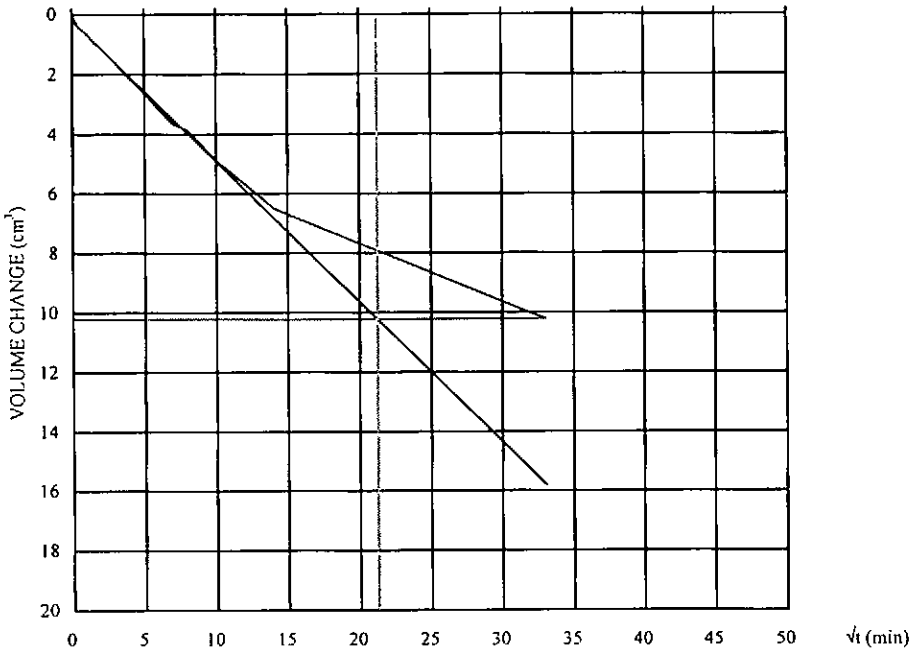
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

CONSOLIDATION (DRAINED PHASE) - Stage 1

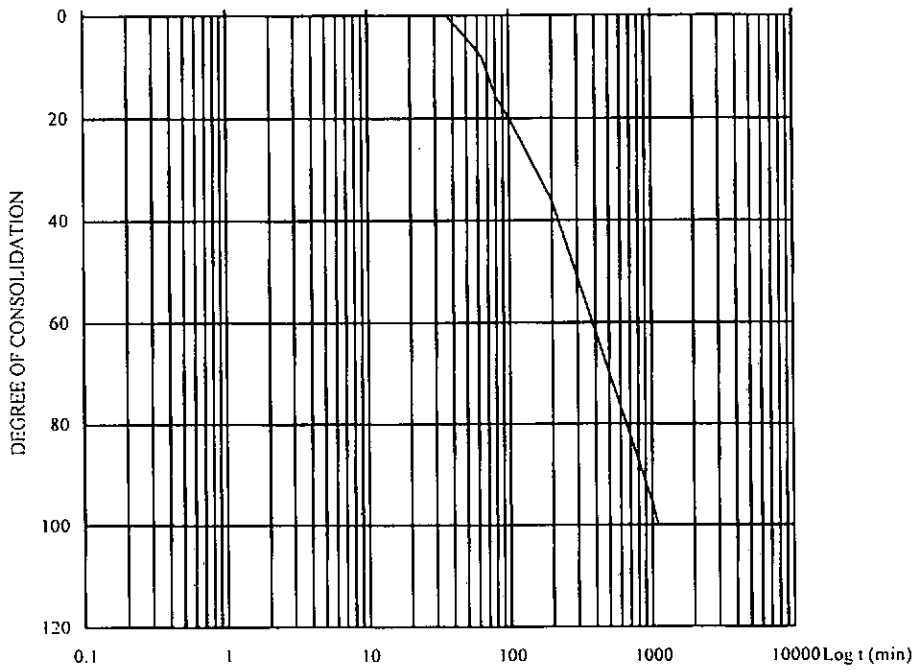


√t100 21.26 min

t100 451.86 min

tf 239.49 min

Calc. strain rate
0.060 mm/min



Borehole No. : WCH-BH02 **Sample Depth m:-** 6.50 - 7.50

Sample No. : 5 **Specimen Depth m:-** 7.30 - 7.50

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.:** 059

Complied by: W S Wat

Checked by: H W Chung

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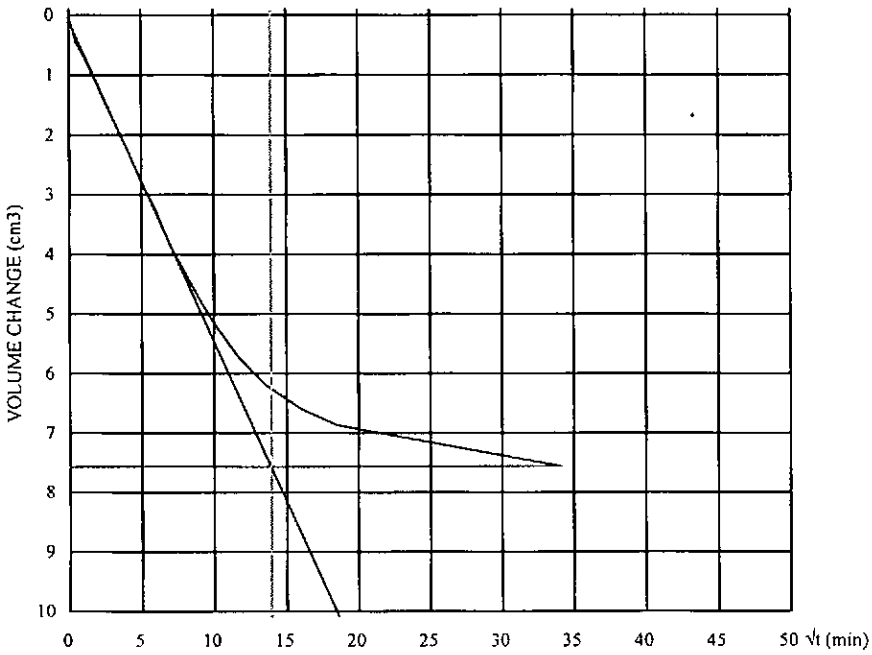
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

CONSOLIDATION (DRAINED PHASE) - Stage 2

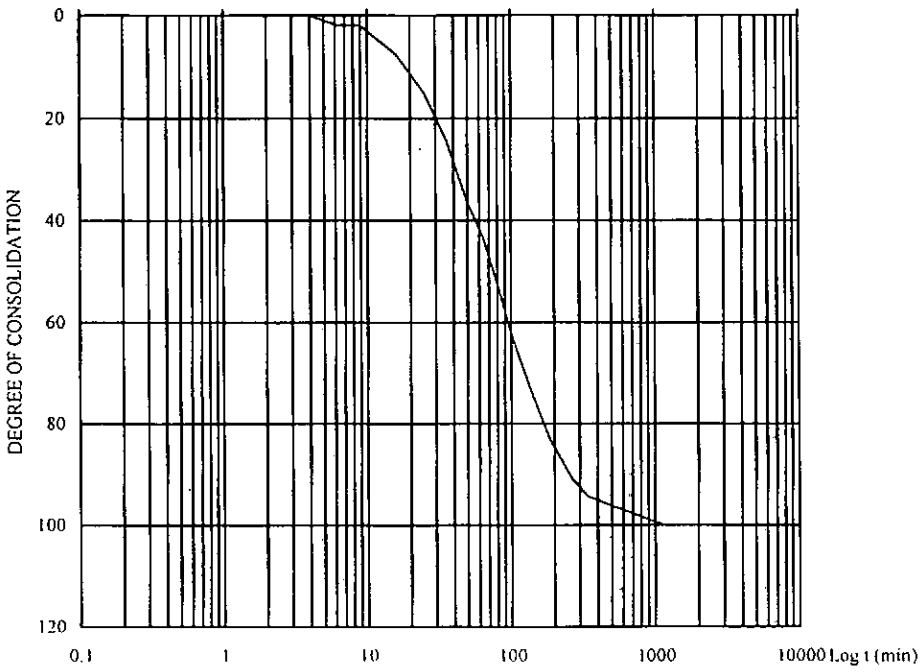


√t100 13.93 min

t100 194.14 min

tf 102.90 min

Calc. strain rate
0.137 mm/min



Borehole No. : WCH-BH02 **Sample Depth m:-** 6.50 - 7.50

Sample No. : 5 **Specimen Depth m:-** 7.30 - 7.50

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.:** 059

Complied by: W S Wat

Checked by: H W Chung

Form : GESR009.13 / Jun.02.03 / Issue 1 / Rev 0

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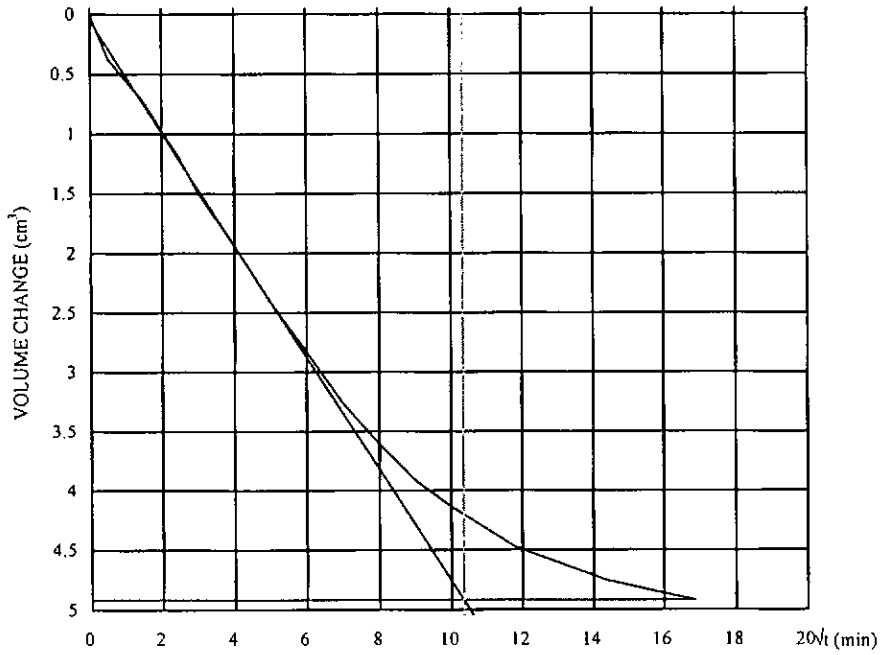
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

CONSOLIDATION (DRAINED PHASE) - Stage 3

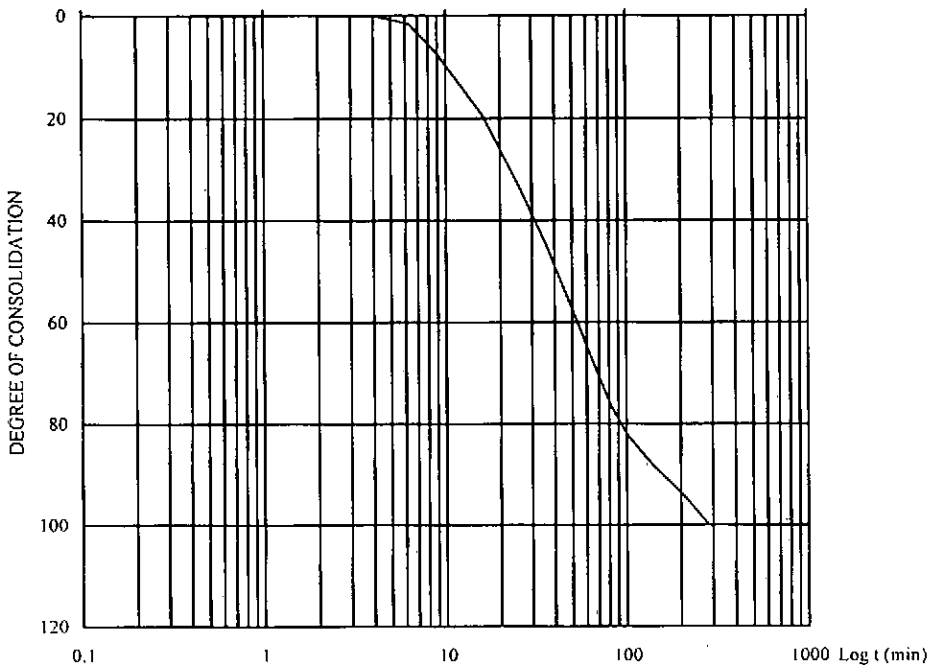


√t100 10.34 min

t100 106.85 min

tf 56.63 min

Calc. strain rate
0.169 mm/min



Borehole No. : WCH-BH02 **Sample Depth m:-** 6.50 - 7.50

Sample No. : 5 **Specimen Depth m:-** 7.30 - 7.50

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.:** 059

Complied by: W S Wat

Checked by: H W Chung

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TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Gammon

Multi Stage		P.W.P,B.P		Effective Pressure 30	kPa
Side drains	No	Selected Machine Speed	0.048 mm/min	Rate of Strain 2.00	% per hr
FAILURE CRITERION				3	
Max. deviator Stress ☐		Max. Stress ratio ☒		Axial Strain % ☐	
Stage : 1	Applied Pressure (kPa) - Cell : 240		Back : 210	P.R. factor 1.7426	kN/mm

Date	Time	Strain Dial	Strain	Load P.R.No. 12	Pore Pressure	Dev. stress Corr.	Dev. stress q $\sigma_1 - \sigma_3$	Effective Stress Parameters: Effective Stress σ'_1	Effective Stress σ'_3	s' $(\sigma'_1+\sigma'_3)/2$	t $(\sigma_1-\sigma_3)/2$	p' $(\sigma'_1+2\sigma'_3)/3$	Stress Ratio σ'_1/σ'_3
		mm	%	mm	kPa	kPa							
09/12	10:30	0.00	0.00	0.071	210	0.000	0.0	30.0	30.0	30.0	0.0	30.0	1.00
	10:35	0.14	0.10	0.134	220	0.029	25.8	46.1	20.3	33.2	12.9	28.9	2.27
	10:40	0.39	0.27	0.149	223	0.078	31.8	48.4	16.6	32.5	15.9	27.2	2.92
	10:45	0.61	0.43	0.160	225	0.123	36.2	51.3	15.1	33.2	18.1	27.2	3.40
	10:50	0.82	0.57	0.170	226	0.163	40.2	54.6	14.4	34.5	20.1	27.8	3.79
	10:55	1.01	0.70	0.179	226	0.199	43.8	57.8	14.0	35.9	21.9	28.6	4.13
	11:00	1.25	0.86	0.189	226	0.244	47.7	61.5	13.8	37.7	23.9	29.7	4.46
	11:05	1.51	1.04	0.199	226	0.293	51.6	65.5	13.9	39.7	25.8	31.1	4.71
	11:10	1.70	1.18	0.207	226	0.331	54.8	68.9	14.1	41.5	27.4	32.4	4.88
	11:15	1.94	1.35	0.215	226	0.377	57.9	72.3	14.4	43.3	28.9	33.7	5.02
	11:20	2.19	1.52	0.223	225	0.423	60.9	75.7	14.8	45.3	30.5	35.1	5.12
	11:25	2.40	1.66	0.230	225	0.460	63.6	78.8	15.2	47.0	31.8	36.4	5.19
	11:30	2.60	1.80	0.237	224	0.496	66.3	82.0	15.7	48.9	33.2	37.8	5.22
	11:35	**2.84**	**1.97**	**0.244**	**224**	**0.541**	**69.0**	**85.2**	**16.2**	**50.7**	**34.5**	**39.2**	**5.26**
	11:40	3.07	2.13	0.250	223	0.582	71.2	88.1	16.9	52.5	35.6	40.6	5.21

Borehole No. :	**WCH-BH02**	**Sample Depth m:- 6.50 - 7.50**	
Sample No. :	**5**	**Specimen Depth m:- 7.30 - 7.50**	
Customer :	**Mass Transit Railway Corporation**		Compiled by W S Wat
Project :	**Ground Investigation for South Island Line**	**Contract No.: Contract 1024**	Checked by H W Chung
Job No.:	**J2999**	**Works Order No.: 059**	

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TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Multi Stage		P.W.P,B.P			Effective Pressure	65	kPa
Side drains	No	Selected Machine Speed	0.046	mm/min	Rate of Strain	1.96	% per hr

FAILURE CRITERION

Max. deviator Stress	☐	Max. Stress ratio	☒		Axial Strain %		☐
Stage : 2	Applied Pressure (kPa) - Cell :	275	Back :	210	P.R. factor	1.7426	kN/mm

Date	Time	Strain Dial	Strain	Load P.R.No. 12	Pore Pressure	Dev. stress Corr.	Dev. stress q $\sigma_1 - \sigma_3$	Effective Stress σ'_1	Effective Stress σ'_3	s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio σ'_1/σ'_3
		mm	%	mm	kPa	kPa				2	2	3	
10/12	08:50	3.66	2.54	0.088	210	0.000	0.0	65.0	65.0	65.0	0.0	65.0	1.00
	08:55	3.76	2.61	0.237	223	0.703	59.5	111.5	52.0	81.8	29.8	71.8	2.14
	09:00	3.96	2.75	0.293	230	0.738	82.0	127.0	45.0	86.0	41.0	72.3	2.82
	09:05	4.17	2.89	0.322	233	0.772	93.5	135.5	42.0	88.8	46.8	73.2	3.23
	09:10	4.35	3.02	0.342	234	0.804	101.4	142.1	40.7	91.4	50.7	74.5	3.49
	09:15	4.62	3.21	0.364	235	0.850	110.0	149.9	39.9	94.9	55.0	76.6	3.76
	09:20	4.85	3.36	0.378	235	0.886	115.4	155.2	39.8	97.5	57.7	78.3	3.90
	09:25	5.08	3.52	0.392	235	0.924	120.8	160.9	40.1	100.5	60.4	80.4	4.01
	09:30	5.26	3.65	0.401	235	0.954	124.2	164.7	40.5	102.6	62.1	81.9	4.07
	09:35	5.46	3.79	0.410	234	0.987	127.6	168.6	41.0	104.8	63.8	83.5	4.11
	09:40	5.69	3.95	0.421	233	1.024	131.7	173.4	41.7	107.6	65.9	85.6	4.16
	09:45	5.92	4.11	0.430	233	1.061	135.0	177.2	42.2	109.7	67.5	87.2	4.20
	09:50	6.15	4.27	0.438	232	1.097	138.0	181.0	43.0	112.0	69.0	89.0	4.21
	09:55	6.40	4.44	0.447	231	1.136	141.2	185.1	43.9	114.5	70.6	91.0	4.22
	10:00	**6.57**	**4.56**	**0.453**	**231**	**1.162**	**143.4**	**187.9**	**44.5**	**116.2**	**71.7**	**92.3**	**4.22**
	10:05	6.79	4.71	0.461	230	1.196	146.3	191.7	45.4	118.6	73.2	94.2	4.22
	10:10	7.02	4.87	0.468	229	1.231	148.8	195.1	46.3	120.7	74.4	95.9	4.21

Borehole No. :	**WCH-BH02**	**Sample Depth m:- 6.50 - 7.50**	
Sample No. :	**5**	**Specimen Depth m:- 7.30 - 7.50**	
Customer :	**Mass Transit Railway Corporation**		Compiled by W S Wat
Project :	**Ground Investigation for South Island Line**	**Contract No.: Contract 1024**	Checked by H W Chung
Job No.:	**J2999**	**Works Order No.: 059**	

Form : GESR009.14 / Dec. 13.04 / Issue 1 / Rev 1

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TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Gammon

Multi Stage			P.W.P,B.P				Effective Pressure	95				kPa
Side drains	No	Selected Machine Speed				mm/min	Rate of Strain	0.00				% per hr
FAILURE CRITERION												
Max. deviator Stress		☐	Max. Stress ratio			☒	Axial Strain %					☐
Stage :	3	Applied Pressure (kPa) - Cell :		305	Back :	210	P.R. factor	1.7426				kN/mm

Date	Time	Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
		Dial		P.R.No. 12	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
11/12	08:40	7.40	5.13	0.141	210	0.000	0.0	95.0	95.0	95.0	0.0	95.0	1.00
	08:45	7.45	5.17	0.357	224	1.296	84.4	165.6	81.2	123.4	42.2	109.3	2.04
	08:50	7.60	5.27	0.464	230	1.317	126.7	202.2	75.5	138.9	63.4	117.7	2.68
	08:55	7.80	5.41	0.523	233	1.347	149.8	221.6	71.8	146.7	74.9	121.7	3.09
	09:00	7.95	5.51	0.555	235	1.368	162.3	232.3	70.0	151.2	81.2	124.1	3.32
	09:05	8.14	5.65	0.586	236	1.397	174.3	243.5	69.2	156.3	87.1	127.3	3.52
	09:10	8.35	5.79	0.603	235	1.427	180.7	250.5	69.8	160.1	90.3	130.0	3.59
	09:15	8.58	5.95	0.625	234	1.460	189.0	260.1	71.1	165.6	94.5	134.1	3.66
	09:20	8.83	6.12	0.651	232	1.494	198.8	271.6	72.8	172.2	99.4	139.1	3.73
	09:25	9.04	6.27	0.666	232	1.525	204.4	277.6	73.2	175.4	102.2	141.3	3.79
	09:30	9.40	6.52	0.687	230	1.575	212.0	287.0	75.0	181.0	106.0	145.7	3.83
	09:35	9.59	6.65	0.696	229	1.601	215.2	291.0	75.8	183.4	107.6	147.5	3.84
	09:40	9.72	6.74	0.703	229	1.619	217.7	294.2	76.5	185.3	108.8	149.1	3.85
	09:45	9.97	6.92	0.717	227	1.654	222.7	300.3	77.6	188.9	111.3	151.8	3.87
	09:50	10.16	7.05	0.724	227	1.679	225.1	303.6	78.5	191.0	112.5	153.5	3.87
	09:55	10.43	7.23	0.735	225	1.714	228.8	308.5	79.7	194.1	114.4	156.0	3.87
	10:00	10.56	7.33	0.740	225	1.733	230.5	310.8	80.3	195.6	115.3	157.1	3.87
	10:05	10.79	7.48	0.751	224	1.762	234.4	315.8	81.4	198.6	117.2	159.5	3.88
	10:10	11.03	7.65	0.761	223	1.794	237.8	320.2	82.4	201.3	118.9	161.7	3.89
	10:15	11.26	7.81	0.771	222	1.824	241.2	324.6	83.4	204.0	120.6	163.8	3.89
	10:20	11.48	7.96	0.781	221	1.851	244.6	329.0	84.4	206.7	122.3	165.9	3.90
	10:25	11.69	8.11	0.790	220	1.879	247.6	332.9	85.3	209.1	123.8	167.8	3.90
	10:30	**11.87**	**8.24**	**0.797**	**219**	**1.903**	**250.0**	**336.0**	**86.0**	**211.0**	**125.0**	**169.3**	**3.91**
	10:35	12.09	8.39	0.804	218	1.930	252.2	339.1	86.9	213.0	126.1	171.0	3.90
	10:40	12.39	8.59	0.813	217	1.966	255.0	343.1	88.1	215.6	127.5	173.1	3.89
	10:45	12.57	8.72	0.819	216	1.989	257.0	345.7	88.7	217.2	128.5	174.4	3.90
	10:50	12.79	8.87	0.824	216	2.016	258.4	347.7	89.3	218.5	129.2	175.4	3.89
	10:55	13.05	9.05	0.830	214	2.047	260.2	351.1	90.9	221.0	130.1	177.6	3.86
	11:00	13.30	9.23	0.838	214	2.079	262.7	354.1	91.4	222.7	131.3	179.0	3.87
	11:05	13.52	9.38	0.845	213	2.105	264.8	356.9	92.1	224.5	132.4	180.4	3.88
	11:10	13.75	9.54	0.851	212	2.132	266.6	359.5	92.9	226.2	133.3	181.8	3.87
	11:15	14.00	9.71	0.858	211	2.161	268.7	362.4	93.7	228.1	134.4	183.3	3.87
	11:20	14.26	9.89	0.865	211	2.192	270.8	365.2	94.4	229.8	135.4	184.7	3.87
	11:25	14.52	10.07	0.873	210	2.222	273.2	368.4	95.2	231.8	136.6	186.3	3.87
	11:30	14.68	10.18	0.877	209	2.240	274.3	370.0	95.7	232.9	137.2	187.1	3.87
	11:35	14.92	10.35	0.887	209	2.268	277.6	374.1	96.5	235.3	138.8	189.0	3.88
	11:40	15.18	10.53	0.894	208	2.298	279.6	376.9	97.3	237.1	139.8	190.5	3.87
	11:45	15.37	10.66	0.900	207	2.319	281.4	379.3	97.9	238.6	140.7	191.7	3.87
	11:50	15.60	10.82	0.909	206	2.345	284.2	382.8	98.6	240.7	142.1	193.3	3.88

Borehole No. :	WCH-BH02	Sample Depth m:- 6.50 - 7.50	
Sample No. :	5	Specimen Depth m:- 7.30 - 7.50	
Customer :	Mass Transit Railway Corporation		Compiled by
Project :	Ground Investigation for South Island Line		W S Wat
		Contract No.: Contract 1024	Checked by
Job No.:	J2999	Works Order No.: 059	H W Chung

Form : GESR009.14 / Dec.13.04 / Issue 1 / Rev 1

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TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2
Shearing Continuation

Gammon

HKAS HOKLAS 055

FAILURE CRITERION

Max. deviator Stress ☐ | Max. Stress ratio ☒ | Axial Strain % ☐

Stage :	3	Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
Date	Time	Dial		P.R.No. 12	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
11/12	11:55	15.84	10.99	0.917	206	2.373	286.6	385.8	99.2	242.5	143.3	194.7	3.89
	12:00	16.04	11.12	0.922	205	2.393	288.0	387.7	99.7	243.7	144.0	195.7	3.89
	12:05	16.30	11.31	0.928	205	2.424	289.6	390.0	100.4	245.2	144.8	196.9	3.88
	12:10	16.55	11.48	0.934	204	2.450	291.3	392.4	101.1	246.7	145.6	198.2	3.88
	12:15	16.77	11.63	0.938	203	2.474	292.2	393.9	101.7	247.8	146.1	199.1	3.87
	12:20	17.03	11.81	0.940	203	2.502	292.3	394.6	102.3	248.5	146.2	199.7	3.86
	12:25	17.28	11.99	0.944	202	2.530	293.2	396.2	103.0	249.6	146.6	200.7	3.85
	12:30	17.50	12.14	0.947	202	2.553	293.7	397.2	103.5	250.4	146.9	201.4	3.84
	12:35	17.73	12.30	0.949	201	2.578	293.9	397.8	103.9	250.9	147.0	201.9	3.83
	12:40	17.97	12.47	0.952	201	2.604	294.4	398.9	104.5	251.7	147.2	202.6	3.82
	12:45	18.18	12.61	0.952	200	2.625	293.9	398.9	105.0	252.0	147.0	203.0	3.80
	12:50	18.46	12.80	0.951	199	2.654	292.9	398.5	105.6	252.0	146.4	203.2	3.77
	12:55	18.65	12.94	0.956	199	2.675	294.2	400.2	106.0	253.1	147.1	204.1	3.78
	13:00	18.85	13.08	0.967	199	2.696	297.7	404.0	106.3	255.2	148.9	205.5	3.80
	13:05	19.12	13.26	0.982	198	2.723	302.5	409.4	106.9	258.2	151.3	207.7	3.83
	13:10	19.37	13.44	0.988	198	2.749	304.0	411.5	107.5	259.5	152.0	208.8	3.83
	13:15	19.65	13.63	0.993	197	2.777	305.1	413.2	108.1	260.7	152.6	209.8	3.82
	13:20	19.89	13.79	1.001	197	2.801	307.4	415.9	108.5	262.2	153.7	211.0	3.83
	13:25	20.04	13.90	1.003	196	2.817	307.7	416.5	108.8	262.7	153.9	211.4	3.83
	13:30	20.27	14.06	1.008	196	2.840	308.9	418.1	109.2	263.7	154.5	212.2	3.83
	13:35	20.57	14.27	1.015	195	2.871	310.6	420.3	109.7	265.0	155.3	213.2	3.83
	13:40	20.73	14.38	1.016	195	2.886	310.6	420.7	110.1	265.4	155.3	213.6	3.82
	13:45	20.97	14.54	1.023	195	2.909	312.5	422.9	110.4	266.6	156.2	214.6	3.83
	13:50	21.21	14.71	1.021	194	2.934	311.1	422.1	111.0	266.5	155.5	214.7	3.80
	13:55	21.46	14.88	1.020	194	2.958	310.1	421.5	111.4	266.4	155.0	214.8	3.78
	14:00	21.69	15.05	1.024	193	2.982	310.9	422.5	111.6	267.0	155.4	215.2	3.79
	14:05	21.90	15.19	1.033	193	3.002	313.5	425.5	112.0	268.8	156.8	216.5	3.80
	14:10	22.12	15.34	1.040	193	3.024	315.4	427.8	112.4	270.1	157.7	217.5	3.81
	14:15	22.40	15.54	1.043	192	3.052	315.7	428.7	113.0	270.9	157.9	218.2	3.79
	14:20	22.65	15.71	1.045	192	3.076	315.8	429.2	113.4	271.3	157.9	218.7	3.78
	14:25	22.90	15.88	1.046	191	3.100	315.4	429.2	113.8	271.5	157.7	218.9	3.77
	14:30	23.13	16.04	1.048	191	3.122	315.5	429.6	114.1	271.9	157.8	219.3	3.77
	14:35	23.46	16.27	1.052	190	3.155	316.0	430.6	114.6	272.6	158.0	219.9	3.76
	14:40	23.60	16.37	1.054	190	3.169	316.3	431.1	114.8	272.9	158.1	220.2	3.76
	14:45	23.83	16.53	1.056	190	3.191	316.4	431.4	115.0	273.2	158.2	220.5	3.75
	14:50	24.07	16.69	1.060	190	3.214	317.1	432.4	115.3	273.9	158.6	221.0	3.75
	14:55	24.27	16.84	1.063	189	3.234	317.6	433.2	115.6	274.4	158.8	221.5	3.75
	15:00	24.55	17.03	1.067	189	3.261	318.2	434.2	116.0	275.1	159.1	222.1	3.74
	15:05	24.77	17.18	1.072	189	3.282	319.3	435.6	116.3	276.0	159.7	222.7	3.75
	15:10	24.97	17.32	1.077	188	3.301	320.5	437.1	116.6	276.9	160.3	223.4	3.75
	15:15	25.21	17.49	1.081	188	3.325	321.2	438.0	116.8	277.4	160.6	223.9	3.75

Borehole No. : WCH-BH02 — **Sample Depth m:-** 6.50 - 7.50

Sample No. : 5 — **Specimen Depth m:-** 7.30 - 7.50

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 — **Works Order No.:** 059

Compiled by: W S Wat

Checked by: H W Chung

Form : GESR009.15 / Dec. 13.04 / Issue 1 / Rev 1

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TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2
Shearing Continuation

Gammon

HKAS HOKLAS 033

FAILURE CRITERION

Max. deviator Stress ☐ | Max. Stress ratio ☒ | Axial Strain % ☐

Stage :	3	Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
Date	Time	Dial		P.R.No. 12	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
11/12	15:20	25.51	17.69	1.085	188	3.353	321.7	438.9	117.2	278.1	160.9	224.4	3.75
	15:25	25.69	17.82	1.088	188	3.371	322.3	439.8	117.5	278.6	161.1	224.9	3.74
	15:30	25.92	17.98	1.092	187	3.393	323.0	440.8	117.8	279.3	161.5	225.5	3.74
	15:35	26.15	18.14	1.095	187	3.416	323.4	441.5	118.1	279.8	161.7	225.9	3.74
	15:40	26.38	18.30	1.097	187	3.438	323.4	441.8	118.4	280.1	161.7	226.2	3.73
	15:45	26.66	18.49	1.098	186	3.464	322.9	441.7	118.8	280.3	161.5	226.4	3.72
	15:50	26.86	18.63	1.099	186	3.484	322.7	441.8	119.1	280.4	161.3	226.7	3.71
	15:55	27.11	18.80	1.100	186	3.508	322.3	441.7	119.4	280.6	161.2	226.8	3.70
	16:00	27.37	18.99	1.101	185	3.534	321.9	441.6	119.7	280.6	160.9	227.0	3.69
	16:05	27.64	19.18	1.099	185	3.561	320.4	440.4	120.0	280.2	160.2	226.8	3.67
	16:10	27.92	19.36	1.098	185	3.586	319.3	439.7	120.4	280.0	159.6	226.8	3.65
	16:15	28.13	19.51	1.098	184	3.608	318.7	439.3	120.6	279.9	159.3	226.8	3.64
	16:20	28.35	19.67	1.099	184	3.630	318.4	439.1	120.7	279.9	159.2	226.8	3.64
	16:25	28.65	19.87	1.100	184	3.658	317.9	439.0	121.1	280.0	158.9	227.1	3.62
	16:30	28.91	20.05	1.101	184	3.684	317.5	438.8	121.3	280.0	158.7	227.1	3.62
	16:35	29.11	20.19	1.103	184	3.704	317.5	439.0	121.5	280.3	158.8	227.3	3.61

Borehole No. : WCH-BH02 **Sample Depth m:- 6.50 - 7.50**

Sample No. : 5 **Specimen Depth m:- 7.30 - 7.50**

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.: 059**

Compiled by: W S Wat

Checked by: H W Chung

Form : GESR009.15 / Dec.13.04 / Issue 1 / Rev 1

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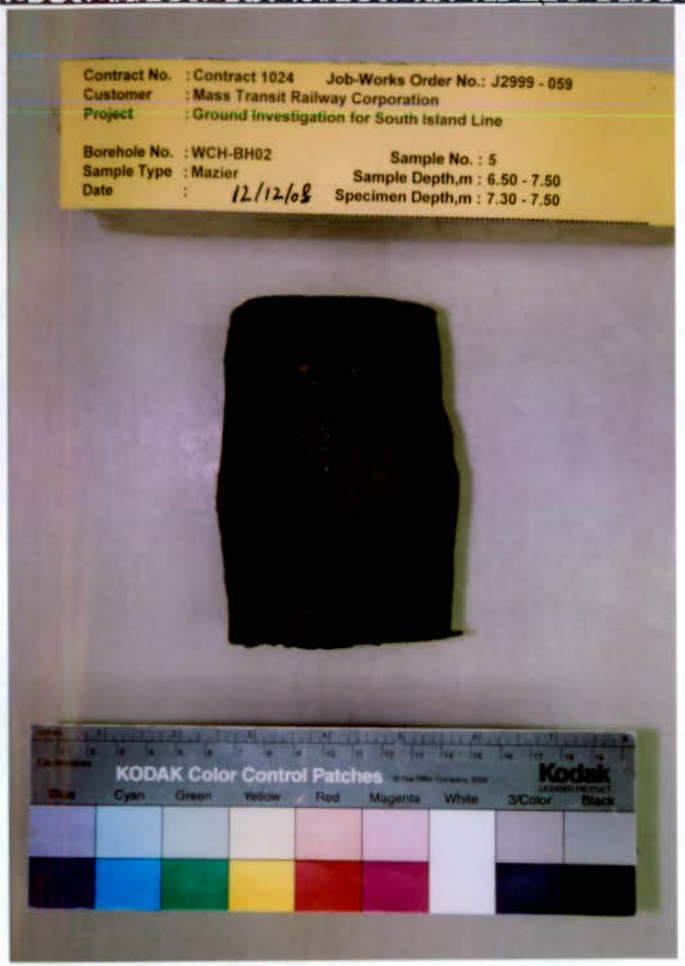
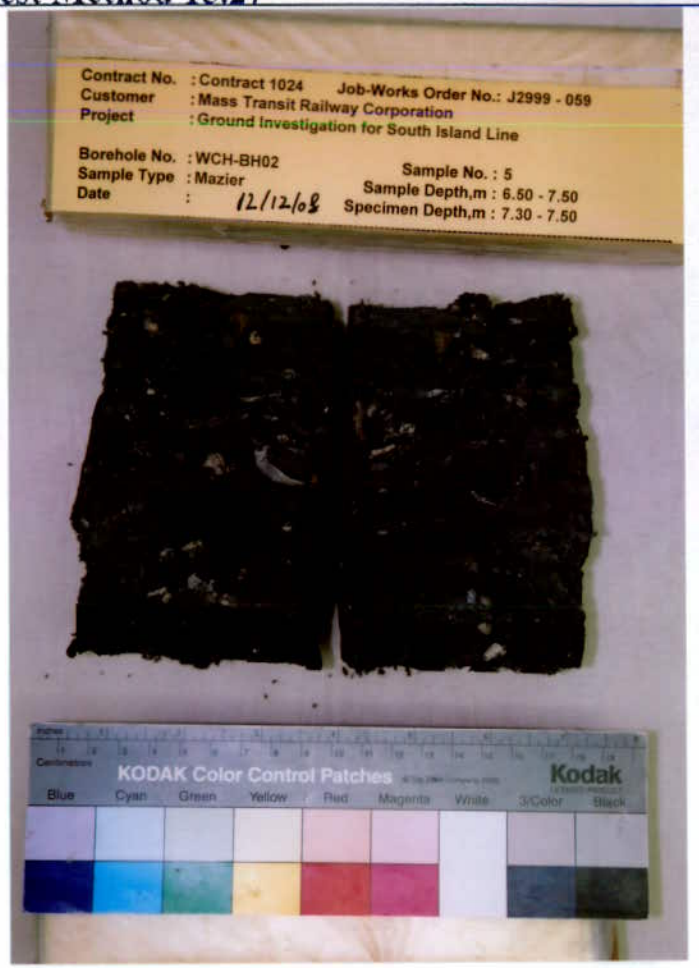
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT (GEOSPEC 3 : 2001 Test Method 15.2)





Description : Dark grey, slightly gravelly, slightly sandy SILT/CLAY

Sample Origin : ALL ‡ ‡ Information provided by customer

Borehole No. : WCH-BH02	**Sample No. :** 5	**Sample Depth m:-** 6.50 - 7.50	**Specimen Depth m:-** 7.30 - 7.50

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line

Contract No.: Contract 1024
Job No.: J2999
Works Order No.: 059

Compiled by: W S Wat
Checked by: H W Chung

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DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	WCH-BH03		
Sample		no	1		
Sample Type			Mazier		
Stage		no	1		
Sample Depth		m	4.00 - 5.00		
Specimen Depth		m	4.60 - 4.80		
INITIAL CONDITIONS					
Diameter	(D_o)	mm	73.8		
Height	(H_o)	mm	145.0		
Moisture Content	(W_o)	%	30		
Bulk density	(ρ_o)	Mg/m^3	1.85		
Dry density	(ρ_d)	Mg/m^3	1.42		
Particle density	(ρ_s)		2.65		
Voids Ratio	(e_o)		0.86		
Degree of Saturation	(S_r)	%	91.5		
DRAINAGE CONDITIONS			ONE END		
SATURATION					
Final Pore Pressure Coefficient B			1.00		
CONSOLIDATION					
Cell Pressure	(σ_3)	kPa	275		
Back Pressure	(u_b)	kPa	230		
Effective Pressure	(σ'_3)	kPa	45		
Coefficient of Consolidation (t100) (C_{vi})		m^2/Year	1253.60		
Coefficient of Volume Compressibility (m_{vi})		m^2/MN	0.33		
Coefficient of Permeability (k)		m/s	1.30E-07		
COMPRESSION TERMINATION CRITERION			MAXIMUM DEVIATOR STRESS		
COMPRESSION - INITIAL					
Moisture Content	(w)	%	30		
Pore Pressure at the End of Consolidation		kPa	230		
Effective Stress at the End of Consolidation		kPa	45		
Bulk density	(ρ_o)	Mg/m^3	1.88		
Dry density	(ρ_d)	Mg/m^3	1.44		
Voids Ratio	(e)		0.84		
Degree of Saturation	(S_r)	%	95.4		

Customer : **Mass Transit Railway Corporation**

Project : **Ground Investigation for South Island Line**

Report No. : J2999-059.11

Contract No.: Contract 1024

Job No.: **J2999** **Works Order No.: 059**

Technician : W S Wat

Checked By : Name : H W Chung Date : 18/12/2008

Approved By : Signatory : **Lau Wai Cheong** Date : 18/12/2008

Tested Date: 25/11/2008

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	WCH-BH03		
Sample		no	1		
Sample Type			Mazier		
Stage		no	1		
Sample Depth		m	4.00 - 5.00		
Specimen Depth		m	4.60 - 4.80		
COMPRESSION - FAILURE					
Cell Pressure		kPa	275		
Rate of Strain		mm/min	0.048		
CONDITIONS MAXIMUM DEVIATOR STRESS					
Major Effective Principal Stress (σ'_1)		kPa	251		
Corrected Deviator Stress ($\sigma'_1 - \sigma'_3$)		kPa	213		
Minor Effective Principal Stress (σ'_3)		kPa	38		
$s' = (\sigma'_1 + \sigma'_3)/2$		kPa	144		
$t = (\sigma_1 - \sigma_3)/2$		kPa	106		
Expanded Uncertainty of s' ^		kPa	-		
Expanded Uncertainty of t ^		kPa	-		
Pore pressure parameter A_f			0.03		
Strain at Failure	(εf)	%	11.0		
COMPRESSION - FINAL					
Moisture Content	(W_f)	%	30		
Bulk density	(ρ_o)	Mg/m^3	1.88		
Dry density	(ρ_d)	Mg/m^3	1.44		
Voids Ratio	(e_f)		0.84		
Degree of Saturation	(S_f)	%	95.4		

Notes -
1. The method of specimen preparation was in accordance with GEOSPEC 3 : 2001 :- Test method 13.3 : test specimen from undisturbed soil samples.
2. Sample received date :29/09/2008
3. The determination of moisture content was in accordance with test method 5.1 of GEOSPEC 3 : 2001.
4. Particle density : 2.65 (Assumed)
5. Maximum and minimum temperature recorded over the period of testing 19.9 - 20.7 °C.
6. Unavoidable variations from specified procedure : none
7. Comment on observed or inferred sample disturbance : none
8. Percentage by mass of soil particles larger than 1/5 of the diameter of specimen (%) : Nil
9. The specimen was selected by the laboratory.
   Name : W S Wat Designation : Senior Laboratory Technician
10. Sampling History : As Received

* Delete as appropriate ^ Upon request

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.: 059**

Compiled by W S Wat
Checked by

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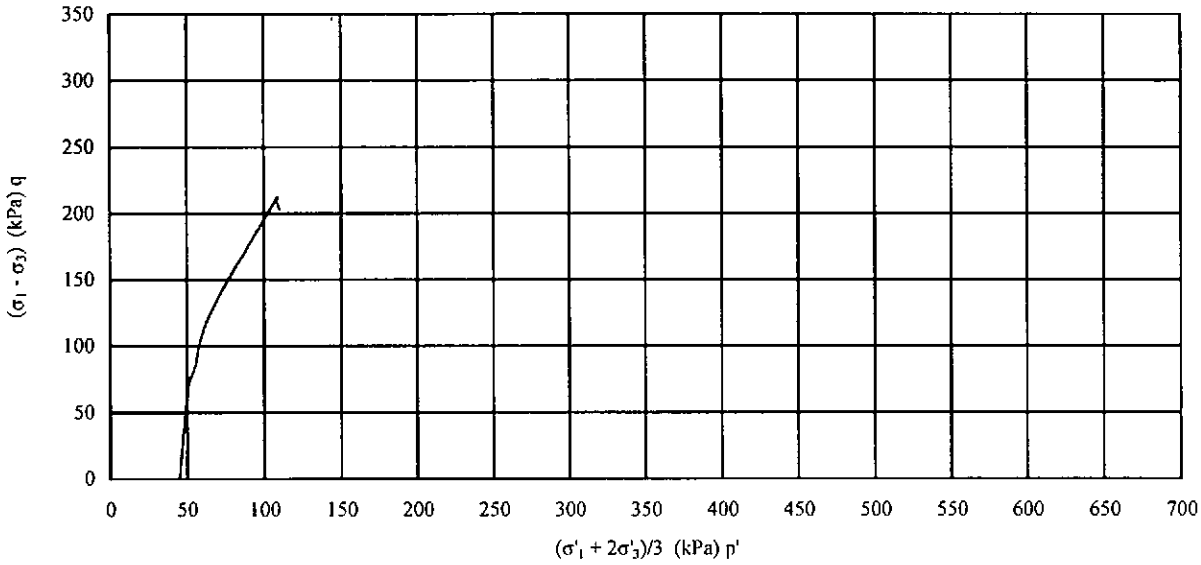
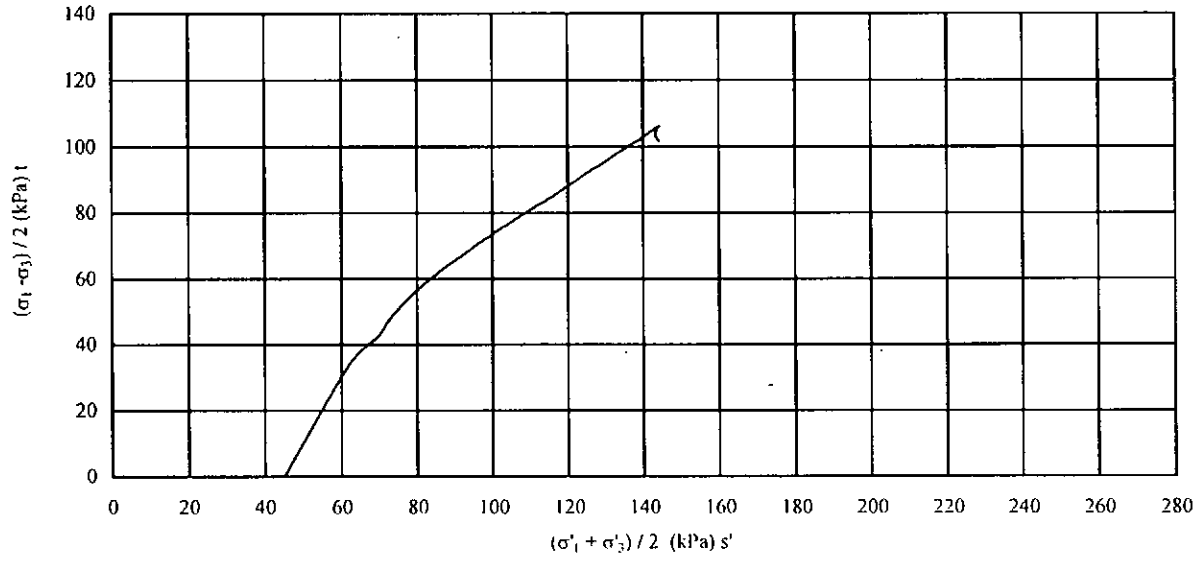
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

STRESS PATH PARAMETERS FOR EFFECTIVE STRESS

p' - q PLOT



s' - t PLOT



Borehole No. : WCH-BH03	**Sample Depth m:-** 4.00 - 5.00
Sample No. : 1	**Specimen Depth m:-** 4.60 - 4.80
Customer : Mass Transit Railway Corporation	Compiled by: W S Wat
Project : Ground Investigation for South Island Line	
Contract No.: Contract 1024	Checked by:
Job No.: J2999	**Works Order No.:** 059

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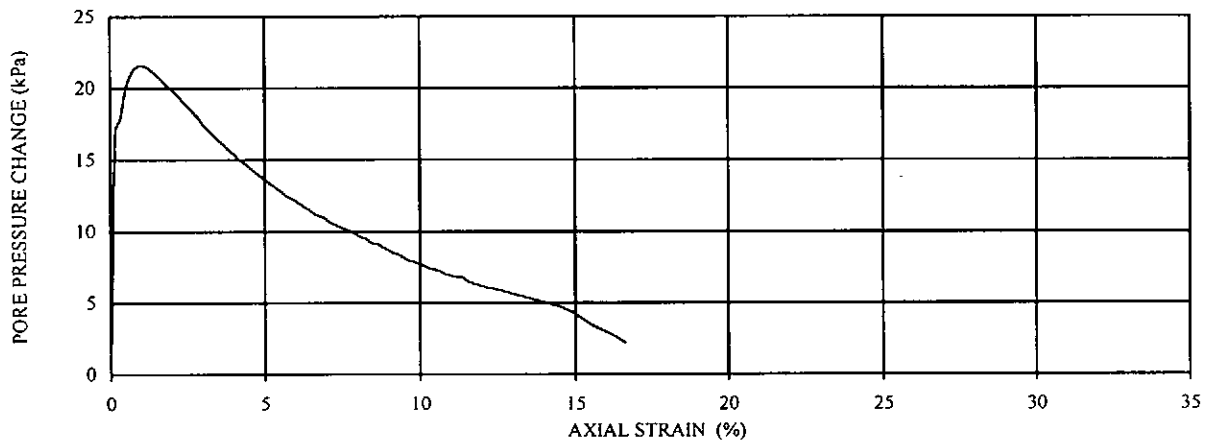
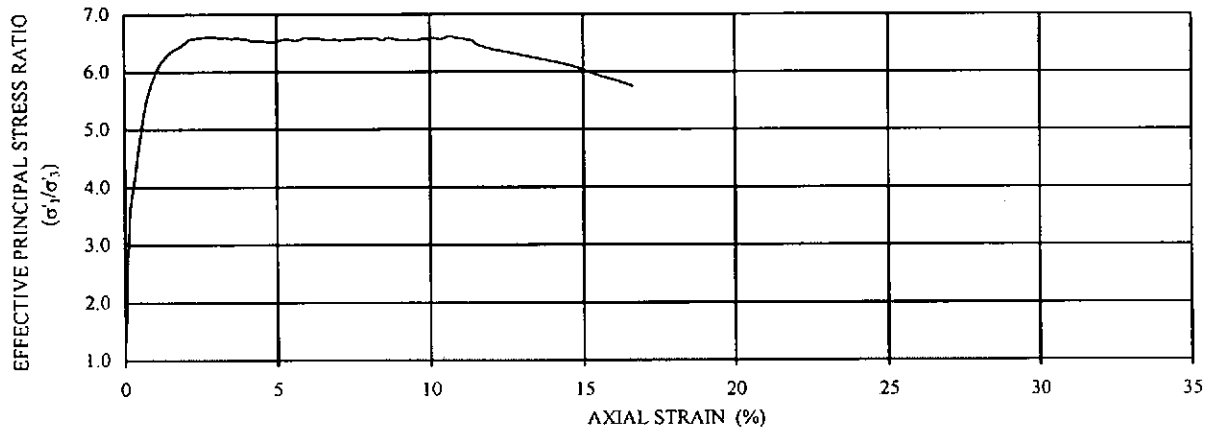
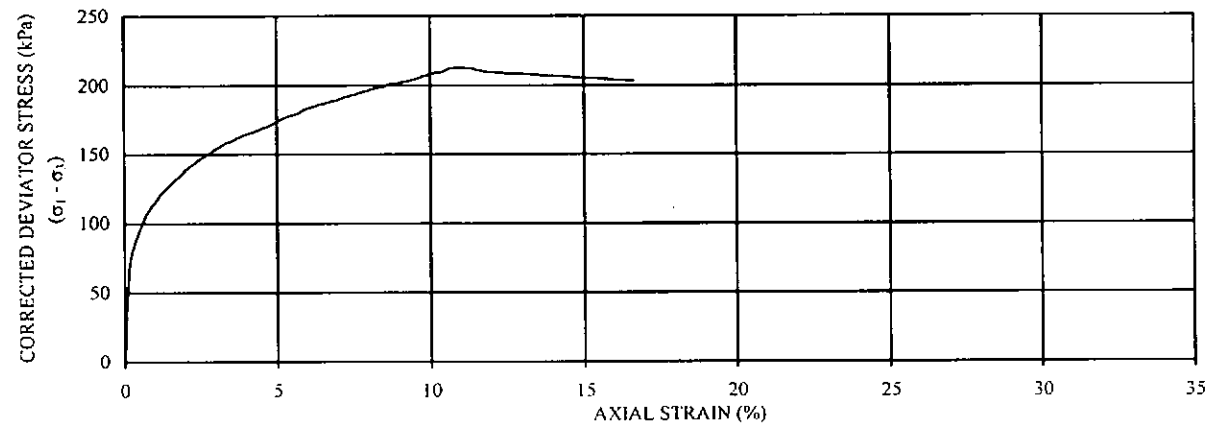
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

COMPRESSION







Borehole No. : WCH-BH03 **Sample Depth m:-** 4.00 - 5.00
Sample No. : 1 **Specimen Depth m:-** 4.60 - 4.80

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.:** 059

Compiled by: W S Wat
Checked by:

Form : GESR009.9 / Jun.02 03 / Issue 1 / Rev 0

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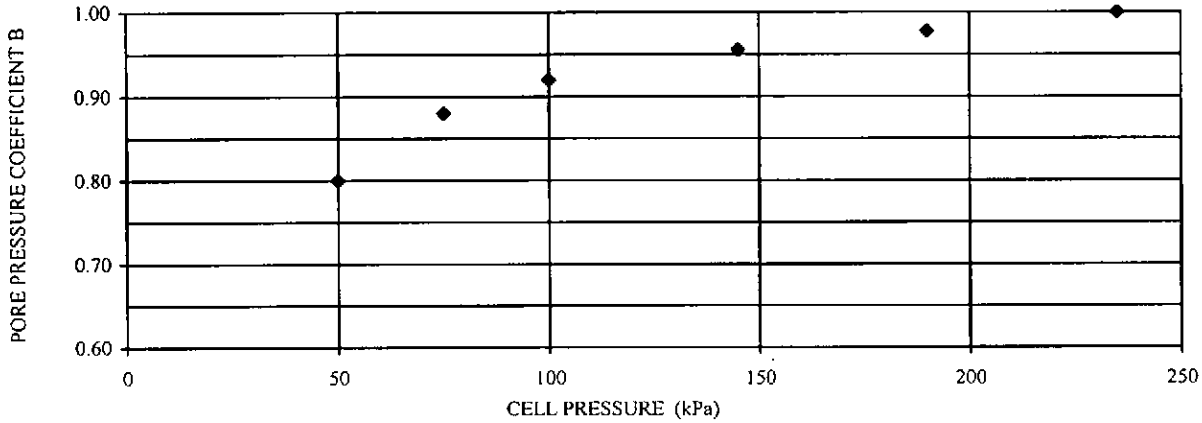
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

SATURATION



Date	Time	Cell Pressure kPa	Back Pressure kPa	Pore Pressure kPa	Cumulative Volume of Water cm^3	Pore Pressure Coefficient B
26/11/2008	08:32	0	0	-	0.0	
	08:39	25	-	20		-
	08:57	25	20	20	0.0	
	09:03	50	-	40		0.80
	09:23	50	45	45	2.2	
	09:30	75	-	67		0.88
	09:47	75	70	70	3.3	
	09:54	100	-	93		0.92
	10:20	100	95	95	6.6	
	10:28	145	-	138		0.96
	11:10	145	140	140	8.4	
	11:20	190	-	184		0.98
	14:10	190	185	185	10.1	
	14:18	235	-	230		1.00
27/11/2008	08:35	235	230	230	11.5	

Borehole No. WCH-BH03 **Sample Depth m:-** 4.00 - 5.00
Sample No. : 1 **Specimen Depth m:-** 4.60 - 4.80

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.:** 059

Compiled by: W S Wat
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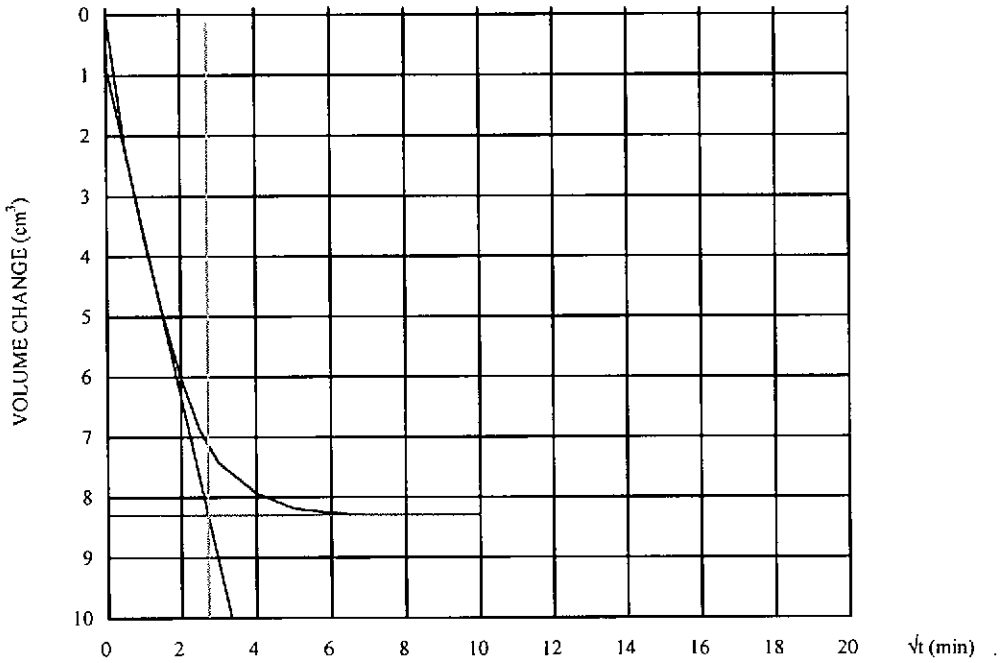
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

CONSOLIDATION (DRAINED PHASE) - Stage 1

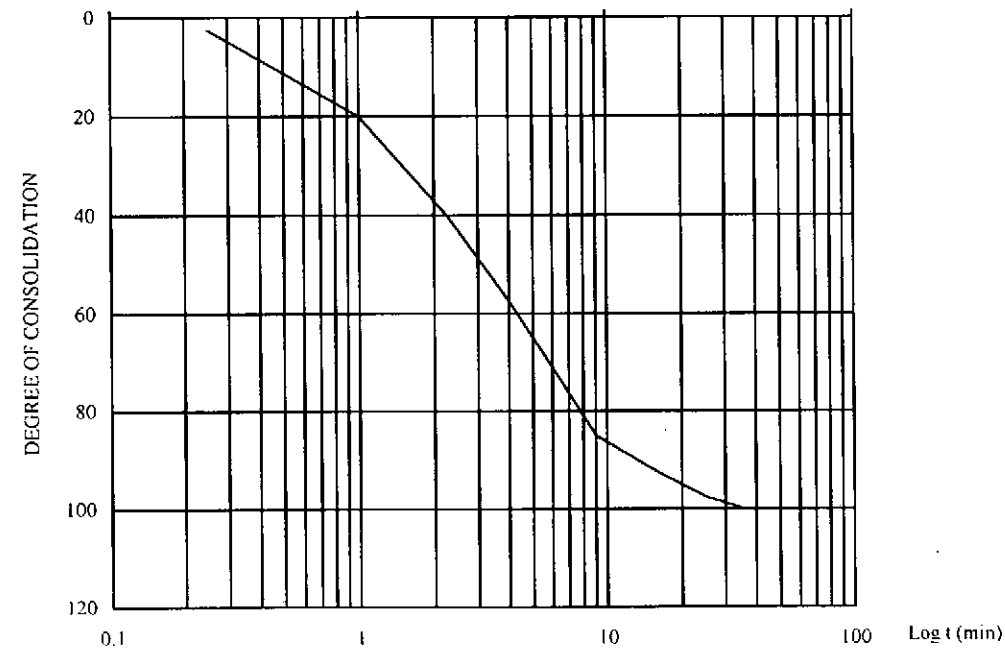


√t100 2.72 min

t100 7.405 min

tf 3.925 min

Calc. strain rate
2.574 mm/min



Borehole No. : WCH-BH03 **Sample Depth m:-** 4.00 - 5.00
Sample No. : 1 **Specimen Depth m:-** 4.60 - 4.80

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.:** 059

Complied by: W S Wat
Checked by:

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TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Single Stage		P.W.P,B.P			Effective Pressure	45	kPa
Side drains	No	Selected Machine Speed	0.048	mm/min	Rate of Strain	2.00	% per hr

FAILURE CRITERION

Max. deviator Stress	☒	Max. Stress ratio	☐		Axial Strain %		☐
Stage : 1	Applied Pressure (kPa) - Cell :	275	Back :	230	P.R. factor	3.1069	kN/mm

Date	Time	Strain Dial	Strain	Load P.R.No. 24	Pore Pressure	Dev. stress Corr.	Dev. stress q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
28/11	08:35	0.00	0.00	0.031	230	0.000	0.0	45.0	45.0	45.0	0.0	45.0	1.00
	08:40	0.24	0.16	0.124	247	0.046	68.0	96.1	28.1	62.1	34.0	50.8	3.42
	08:45	0.46	0.32	0.147	248	0.092	84.6	111.8	27.2	69.5	42.3	55.4	4.11
	08:50	0.71	0.49	0.161	250	0.141	94.6	119.8	25.2	72.5	47.3	56.7	4.75
	08:55	0.94	0.65	0.173	251	0.186	103.1	127.2	24.1	75.7	51.6	58.5	5.28
	09:00	1.17	0.81	0.182	251	0.230	109.5	133.1	23.6	78.3	54.7	60.1	5.64
	09:05	1.40	0.97	0.189	252	0.275	114.3	137.7	23.4	80.6	57.2	61.5	5.89
	09:10	1.69	1.17	0.198	252	0.329	120.6	144.1	23.5	83.8	60.3	63.7	6.13
	09:15	1.90	1.32	0.203	251	0.370	124.0	147.7	23.7	85.7	62.0	65.0	6.23
	09:20	2.11	1.46	0.208	251	0.408	127.3	151.3	24.0	87.7	63.7	66.4	6.31
	09:25	2.36	1.63	0.213	251	0.453	130.7	155.0	24.3	89.6	65.3	67.9	6.38
	09:30	2.60	1.80	0.218	250	0.497	134.0	158.7	24.7	91.7	67.0	69.4	6.43
	09:35	2.88	1.99	0.224	250	0.547	138.0	163.1	25.1	94.1	69.0	71.1	6.50
	09:40	3.10	2.15	0.229	250	0.588	141.3	166.7	25.4	96.1	70.7	72.5	6.56
	09:45	3.33	2.31	0.233	249	0.629	143.9	169.7	25.8	97.8	72.0	73.8	6.58
	09:50	3.57	2.47	0.237	249	0.670	146.5	172.7	26.2	99.4	73.2	75.0	6.59
	09:55	3.85	2.66	0.241	248	0.717	149.0	175.6	26.6	101.1	74.5	76.3	6.60
	10:00	4.08	2.83	0.245	248	0.759	151.6	178.6	27.0	102.8	75.8	77.5	6.61
	10:05	4.33	3.00	0.249	248	0.801	154.1	181.6	27.5	104.5	77.0	78.9	6.60
	10:10	4.57	3.17	0.252	247	0.842	155.9	183.8	27.9	105.9	78.0	79.9	6.59
	10:15	4.84	3.35	0.256	247	0.885	158.4	186.7	28.3	107.5	79.2	81.1	6.60
	10:20	5.05	3.50	0.258	246	0.921	159.5	188.1	28.6	108.4	79.8	81.8	6.58
	10:25	5.35	3.70	0.262	246	0.968	162.0	191.0	29.0	110.0	81.0	83.0	6.58
	10:30	5.61	3.89	0.265	246	1.013	163.7	193.1	29.4	111.3	81.9	84.0	6.57
	10:35	5.80	4.02	0.267	245	1.043	164.9	194.5	29.6	112.0	82.4	84.6	6.57
	10:40	6.05	4.19	0.269	245	1.081	165.9	195.9	30.0	113.0	83.0	85.3	6.53
	10:45	6.34	4.39	0.272	245	1.127	167.6	197.9	30.3	114.1	83.8	86.2	6.53
	10:50	6.58	4.56	0.275	244	1.165	169.4	200.0	30.6	115.3	84.7	87.1	6.54
	10:55	6.82	4.73	0.277	244	1.203	170.5	201.4	30.9	116.1	85.2	87.7	6.52
	11:00	7.08	4.91	0.280	244	1.242	172.2	203.4	31.2	117.3	86.1	88.6	6.52
	11:05	7.34	5.08	0.284	244	1.279	174.6	206.1	31.5	118.8	87.3	89.7	6.54
	11:10	7.55	5.23	0.287	243	1.311	176.4	208.1	31.7	119.9	88.2	90.5	6.56
	11:15	7.79	5.40	0.290	243	1.348	178.1	210.1	32.0	121.1	89.1	91.4	6.57
	11:20	8.06	5.59	0.292	243	1.388	179.1	211.4	32.3	121.9	89.6	92.0	6.55
	11:25	8.24	5.71	0.294	243	1.413	180.2	212.7	32.5	122.6	90.1	92.6	6.55
	11:30	8.49	5.88	0.298	242	1.448	182.6	215.3	32.7	124.0	91.3	93.6	6.58
	11:35	8.81	6.10	0.301	242	1.494	184.2	217.2	33.0	125.1	92.1	94.4	6.58
	11:40	9.01	6.24	0.303	242	1.522	185.3	218.5	33.2	125.8	92.6	95.0	6.58
	11:45	9.22	6.39	0.305	242	1.552	186.3	219.7	33.4	126.6	93.2	95.5	6.58

Borehole No. : WCH-BH03 — **Sample Depth m:- 4.00 - 5.00**

Sample No. : 1 — **Specimen Depth m:- 4.60 - 4.80**

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 — **Works Order No.: 059**

Compiled by W S Wat

Checked by

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Form : GESR009.14 / Dec. 13.04 / Issue 1 / Rev 1

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2
Shearing Continuation

FAILURE CRITERION

Max. deviator Stress ☒ | Max. Stress ratio ☐ | Axial Strain % ☐

Stage : 1		Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
Date	Time	Dial		P.R.No. 24	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
28/11	11:50	9.48	6.57	0.307	241	1.588	187.3	221.0	33.7	127.3	93.6	96.1	6.56
	11:55	9.70	6.72	0.309	241	1.618	188.3	222.2	33.9	128.1	94.2	96.7	6.56
	12:00	9.96	6.90	0.311	241	1.654	189.3	223.3	34.0	128.6	94.6	97.1	6.57
	12:05	10.19	7.06	0.313	241	1.685	190.3	224.6	34.3	129.4	95.1	97.7	6.55
	12:10	10.45	7.24	0.316	241	1.720	191.9	226.4	34.5	130.5	96.0	98.5	6.56
	12:15	10.72	7.42	0.318	240	1.754	192.9	227.6	34.7	131.1	96.4	99.0	6.56
	12:20	10.93	7.57	0.320	240	1.782	193.9	228.7	34.8	131.7	96.9	99.4	6.57
	12:25	11.23	7.78	0.323	240	1.822	195.4	230.4	35.0	132.7	97.7	100.1	6.58
	12:30	11.49	7.96	0.325	240	1.855	196.4	231.6	35.2	133.4	98.2	100.7	6.58
	12:35	11.70	8.11	0.327	240	1.883	197.4	232.8	35.4	134.1	98.7	101.2	6.57
	12:40	11.93	8.26	0.329	240	1.911	198.3	233.8	35.5	134.7	99.2	101.6	6.59
	12:45	12.18	8.44	0.330	239	1.943	198.6	234.4	35.8	135.1	99.3	102.0	6.55
	12:50	12.48	8.65	0.334	239	1.981	200.8	236.7	35.9	136.3	100.4	102.8	6.59
	12:55	12.67	8.78	0.335	239	2.004	201.1	237.2	36.1	136.7	100.6	103.1	6.57
	13:00	12.85	8.90	0.336	239	2.025	201.5	237.7	36.2	136.9	100.7	103.4	6.57
	13:05	13.16	9.12	0.338	239	2.064	202.3	238.8	36.5	137.7	101.2	103.9	6.54
	13:10	13.41	9.29	0.340	238	2.094	203.2	239.8	36.6	138.2	101.6	104.3	6.55
	13:15	13.75	9.53	0.343	238	2.135	204.6	241.5	36.9	139.2	102.3	105.1	6.55
	13:20	13.90	9.63	0.345	238	2.152	205.7	242.7	37.0	139.8	102.8	105.6	6.56
	13:25	14.11	9.77	0.347	238	2.176	206.7	243.8	37.1	140.4	103.3	106.0	6.57
	13:30	14.46	10.02	0.350	238	2.218	208.0	245.3	37.3	141.3	104.0	106.6	6.58
	13:35	14.62	10.13	0.352	238	2.237	209.1	246.5	37.4	141.9	104.5	107.1	6.59
	13:40	14.90	10.32	0.353	237	2.268	209.2	246.8	37.6	142.2	104.6	107.3	6.56
	13:45	15.20	10.53	0.357	237	2.303	211.3	249.0	37.7	143.4	105.7	108.1	6.61
	13:50	15.41	10.67	0.359	237	2.326	212.3	250.1	37.8	143.9	106.1	108.6	6.62
	13:55	15.61	10.82	0.360	237	2.350	212.6	250.6	38.0	144.3	106.3	108.9	6.59
	14:00	**15.87**	**11.00**	**0.361**	**237**	**2.379**	**212.8**	**250.9**	**38.1**	**144.5**	**106.4**	**109.0**	**6.58**
	14:05	16.11	11.16	0.361	237	2.405	212.3	250.5	38.2	144.4	106.2	109.0	6.56
	14:10	16.38	11.35	0.361	237	2.435	211.8	250.0	38.2	144.1	105.9	108.8	6.55
	14:15	16.64	11.53	0.360	237	2.464	210.7	249.2	38.5	143.9	105.4	108.7	6.47
	14:30	17.45	12.09	0.360	236	2.551	209.3	248.2	38.9	143.5	104.6	108.7	6.38
	14:45	18.08	12.53	0.361	236	2.619	208.8	247.9	39.1	143.5	104.4	108.7	6.34
	15:00	18.78	13.01	0.362	236	2.691	208.2	247.6	39.4	143.5	104.1	108.8	6.28
	15:15	19.54	13.53	0.363	235	2.768	207.5	247.2	39.7	143.4	103.7	108.9	6.23
	15:30	20.26	14.04	0.364	235	2.843	206.8	246.8	40.0	143.4	103.4	108.9	6.17
	15:45	21.00	14.55	0.365	235	2.917	206.1	246.4	40.3	143.4	103.1	109.0	6.12
	16:00	21.76	15.08	0.366	234	2.993	205.4	246.3	40.9	143.6	102.7	109.4	6.02
	16:15	22.49	15.58	0.367	233	3.064	204.7	246.3	41.6	143.9	102.3	109.8	5.92
	16:30	23.21	16.08	0.368	233	3.135	204.0	246.1	42.1	144.1	102.0	110.1	5.85
	16:45	24.02	16.64	0.369	232	3.213	203.2	246.0	42.8	144.4	101.6	110.5	5.75

Borehole No. : WCH-BH03 — **Sample Depth m:-** 4.00 - 5.00
Sample No. : 1 — **Specimen Depth m:-** 4.60 - 4.80

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 — **Works Order No.:** 059

Compiled by: W S Wat
Checked by:

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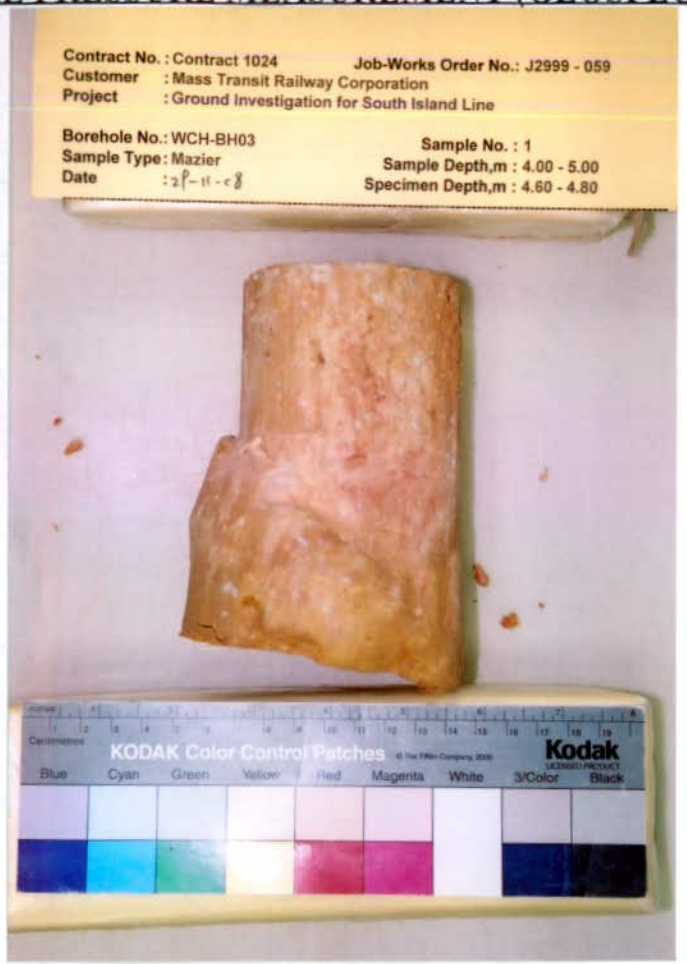
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT (GEOSPEC 3 : 2001 Test Method 15.2)



Description : Greyish brown, gravelly, silty SAND

Sample Origin : CDT‡

‡ Information provided by customer

Borehole No. :	WCH-BH03	Sample No. : 1	Sample Depth m:- 4.00 - 5.00	Specimen Depth m:- 4.60 - 4.80

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line

Contract No. : Contract 1024
Job No. : J2999
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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	WCH-BH03	WCH-BH03	WCH-BH03
Sample		no	1	1	1
Sample Type			Mazier	Mazier	Mazier
Stage		no	1	2	3
Sample Depth		m	4.00 - 5.00	4.00 - 5.00	4.00 - 5.00
Specimen Depth		m	4.80 - 5.00	4.80 - 5.00	4.80 - 5.00
INITIAL CONDITIONS					
Diameter	(D_o)	mm	73.8	74.1	74.8
Height	(H_o)	mm	145.0	143.0	139.3
Moisture Content	(W_o)	%	30	31	31
Bulk density	(ρ_o)	Mg/m^3	1.87	1.90	1.90
Dry density	(ρ_d)	Mg/m^3	1.44	1.44	1.46
Particle density	(ρ_s)		2.65	2.65	2.65
Voids Ratio	(e_o)		0.84	0.83	0.82
Degree of Saturation	(S_r)	%	95.2	99.5	99.4
DRAINAGE CONDITIONS			ONE END		
SATURATION					
Final Pore Pressure Coefficient B			0.95		
CONSOLIDATION					
Cell Pressure	(σ_3)	kPa	235	255	275
Back Pressure	(u_b)	kPa	215	215	215
Effective Pressure	(σ'_3)	kPa	20	40	60
Coefficient of Consolidation (t100) (C_{vi})		$m^2/Year$	80.07	39.88	14.40
Coefficient of Volume Compressibility (m_{vi})		m^2/MN	0.35	0.31	0.20
Coefficient of Permeability (k)		m/s	8.63E-09	3.88E-09	8.72E-10
COMPRESSION TERMINATION CRITERION			MAXIMUM STRESS RATIO		MAX ($\sigma'1 - \sigma'3$)
COMPRESSION - INITIAL					
Moisture Content	(w)	%	31	31	30
Pore Pressure at the End of Consolidation		kPa	215	215	215
Effective Stress at the End of Consolidation		kPa	20	40	60
Bulk density	(ρ_o)	Mg/m^3	1.90	1.90	1.91
Dry density	(ρ_d)	Mg/m^3	1.44	1.46	1.46
Voids Ratio	(e)		0.83	0.82	0.81
Degree of Saturation	(S_r)	%	99.5	99.4	99.4

Customer : **Mass Transit Railway Corporation**
Project : **Ground Investigation for South Island Line**
Report No. : J2999-059.11
Contract No.: Contract 1024
Job No.: **J2999** **Works Order No.: 059**

Technician : W S Wat Checked By : Name : H W Chung Approved By : Signatory : **Lau Wai Cheong**

Tested Date: 25/11/2008 Date : 18/12/2008 Date : 18/12/2008

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Form : GESR009.6 / Nov.10.06 / Issue 1 / Rev 1

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	WCH-BH03	WCH-BH03	WCH-BH03
Sample		no	1	1	1
Sample Type			Mazier	Mazier	Mazier
Stage		no	1	2	3
Sample Depth		m	4.00 - 5.00	4.00 - 5.00	4.00 - 5.00
Specimen Depth		m	4.80 - 5.00	4.80 - 5.00	4.80 - 5.00
COMPRESSION - FAILURE					
Cell Pressure		kPa	235	255	275
Rate of Strain		mm/min	0.048	0.047	0.046
CONDITIONS AT MAXIMUM STRESS RATIO					
Major Effective Principal Stress (σ'_1)		kPa	63	120	159
Corrected Deviator Stress ($\sigma'_1 - \sigma'_3$)		kPa	52	90	116
Minor Effective Principal Stress (σ'_3)		kPa	11	30	44
$s' = (\sigma'_1 + \sigma'_3)/2$		kPa	37	75	101
$t = (\sigma_1 - \sigma_3)/2$		kPa	26	45	58
Expanded Uncertainty of s' ^		kPa	-	-	-
Expanded Uncertainty of t ^		kPa	-	-	-
Pore pressure parameter A_f			0.18	0.11	0.14
Strain at Failure	(εf)	%	1.0	3.6	6.3
COMPRESSION - FINAL					
Moisture Content	(W_f)	%	31	31	30
Bulk density	(ρ_o)	Mg/m^3	1.90	1.90	1.91
Dry density	(ρ_d)	Mg/m^3	1.44	1.46	1.46
Voids Ratio	(e_f)		0.83	0.82	0.81
Degree of Saturation	(S_f)	%	99.5	99.4	99.4

Notes -
1. The method of specimen preparation was in accordance with GEOSPEC 3 : 2001 :- Test method 13.3 : test specimen from undisturbed soil samples.
2. Sample received date :29/09/2008
3. The determination of moisture content was in accordance with test method 5.1 of GEOSPEC 3 : 2001.
4. Particle density : 2.65 (Assumed)
5. Maximum and minimum temperature recorded over the period of testing 19.9 - 20.7 °C.
6. Unavoidable variations from specified procedure : none
7. Comment on observed or inferred sample disturbance : none
8. Percentage by mass of soil particles larger than 1/5 of the diameter of specimen (%) : Nil
9. The specimen was selected by the laboratory.
   Name : W S Wat Designation : Senior Laboratory Technician
10. Sampling History : As Received

* Delete as appropriate ^ Upon request

Customer : **Mass Transit Railway Corporation**
Project : **Ground Investigation for South Island Line**
Contract No.: Contract 1024
Job No.: **J2999** **Works Order No.: 059**

Compiled by W S Wat
Checked by H W Chung

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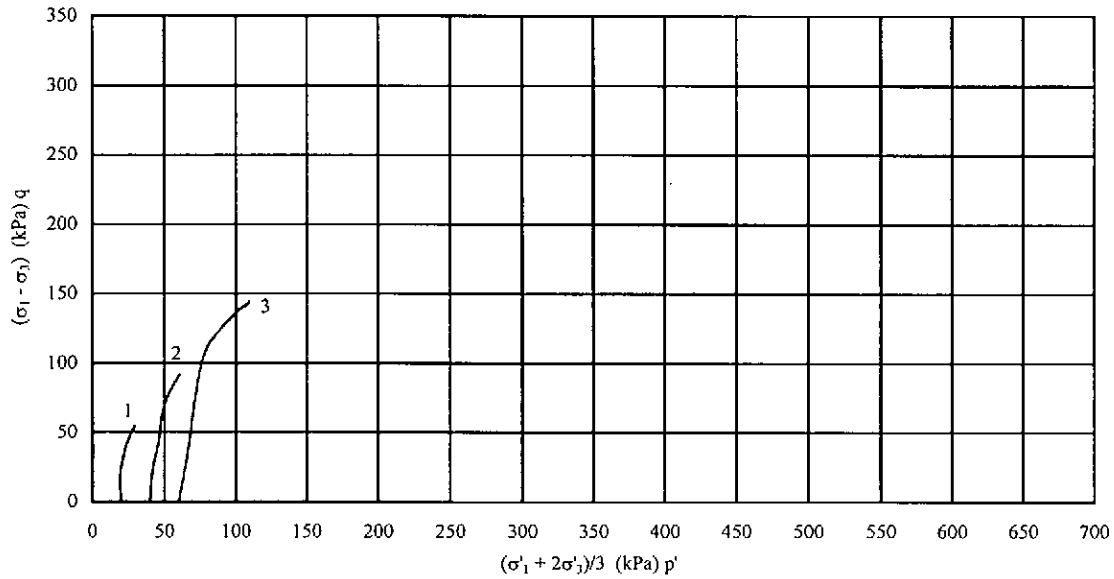
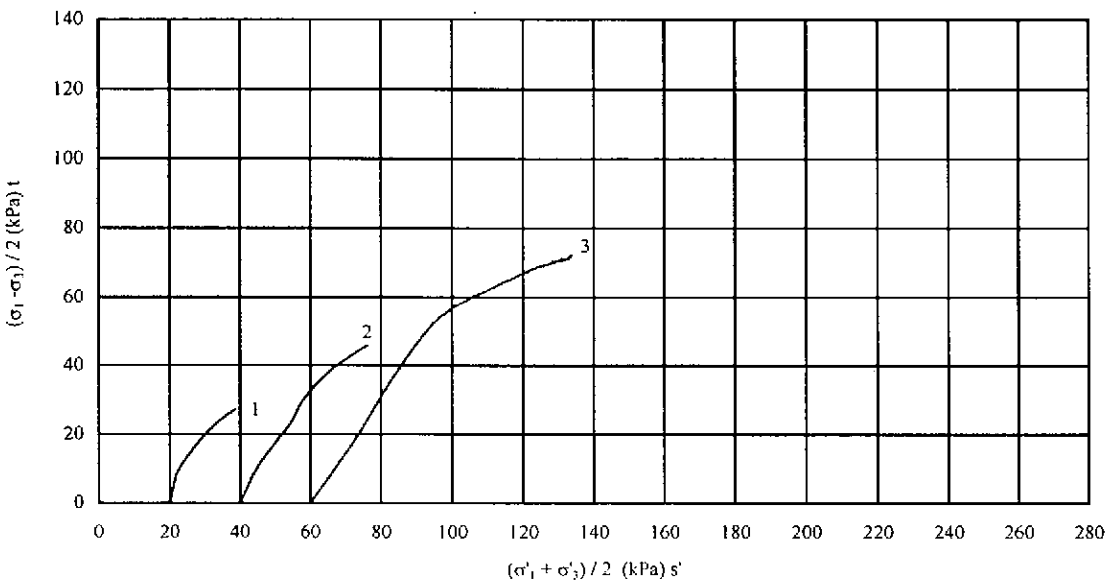
TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

STRESS PATH PARAMETERS FOR EFFECTIVE STRESS

p' - q PLOT



s' - t PLOT



Borehole No. :	**WCH-BH03**	**Sample Depth m:-**	**4.00 - 5.00**
Sample No. :	**1**	**Specimen Depth m:-**	**4.80 - 5.00**
Customer :	**Mass Transit Railway Corporation**		Compiled by W S Wat
Project :	**Ground Investigation for South Island Line**		
		Contract No.:	**Contract 1024**
Job No.:	**J2999**	**Works Order No.:**	**059**
			Checked by H W Chung

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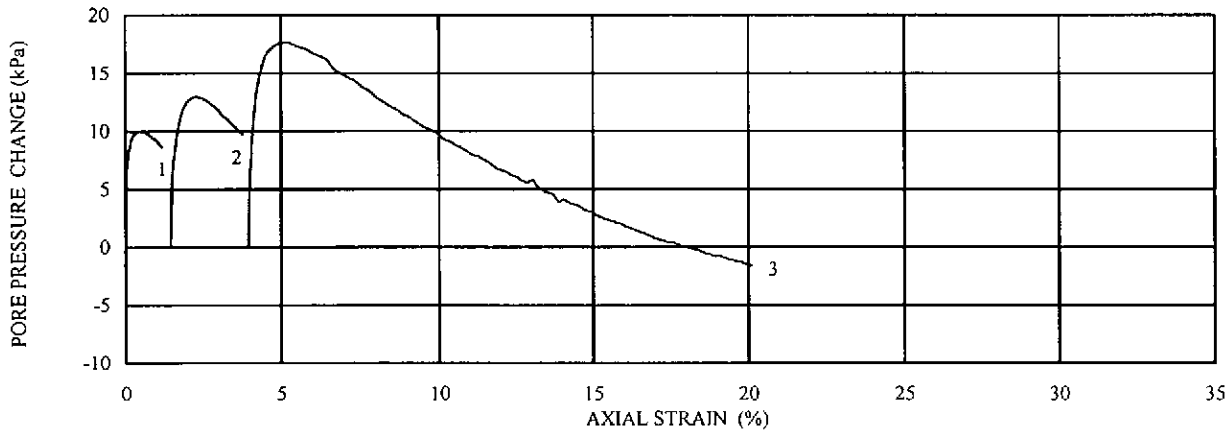
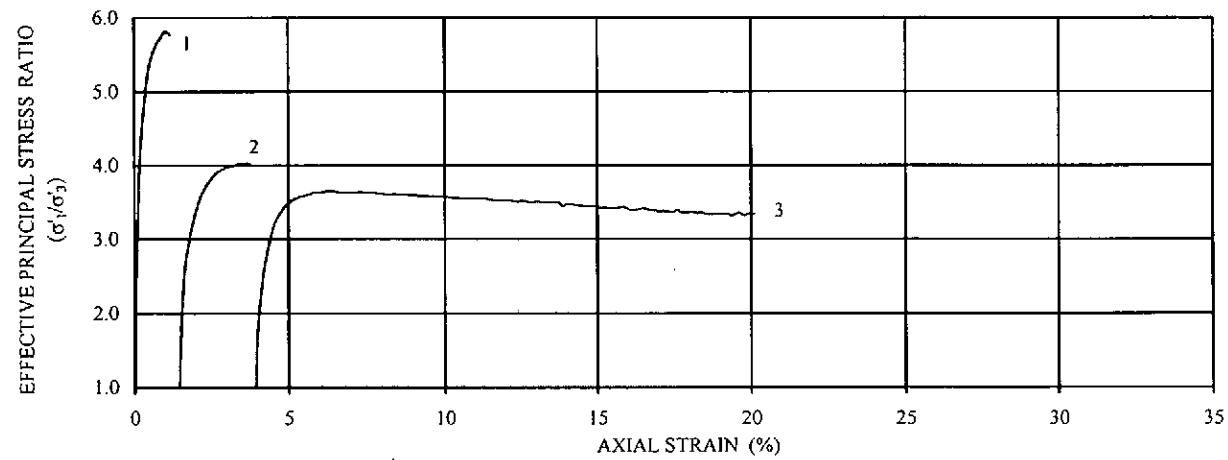
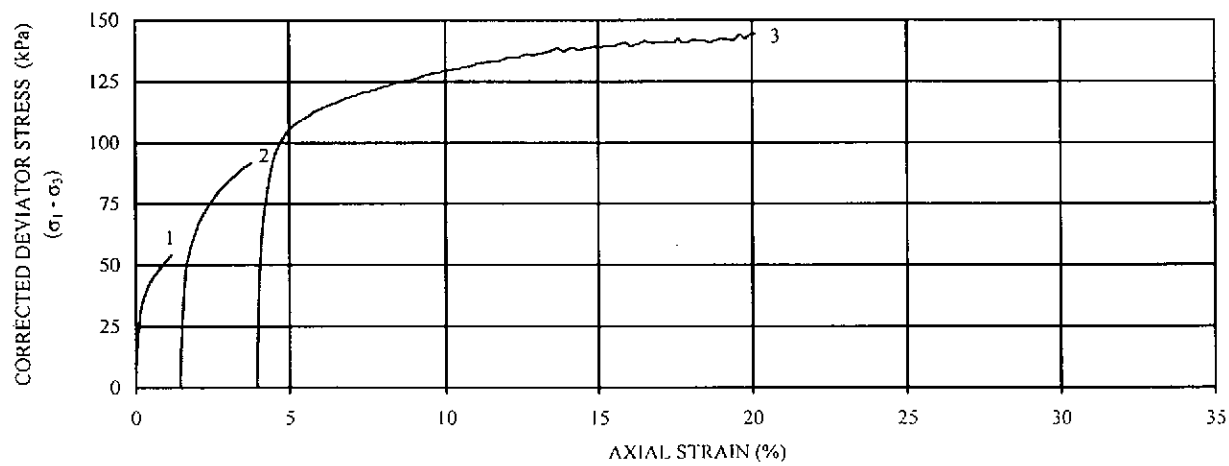
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

COMPRESSION







Borehole No. : WCH-BH03 **Sample Depth m:-** 4.00 - 5.00
Sample No. : 1 **Specimen Depth m:-** 4.80 - 5.00

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.:** 059

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Checked by H W Chung

Form : GESR009.9 / Jun.02.03 / Issue 1 / Rev 0

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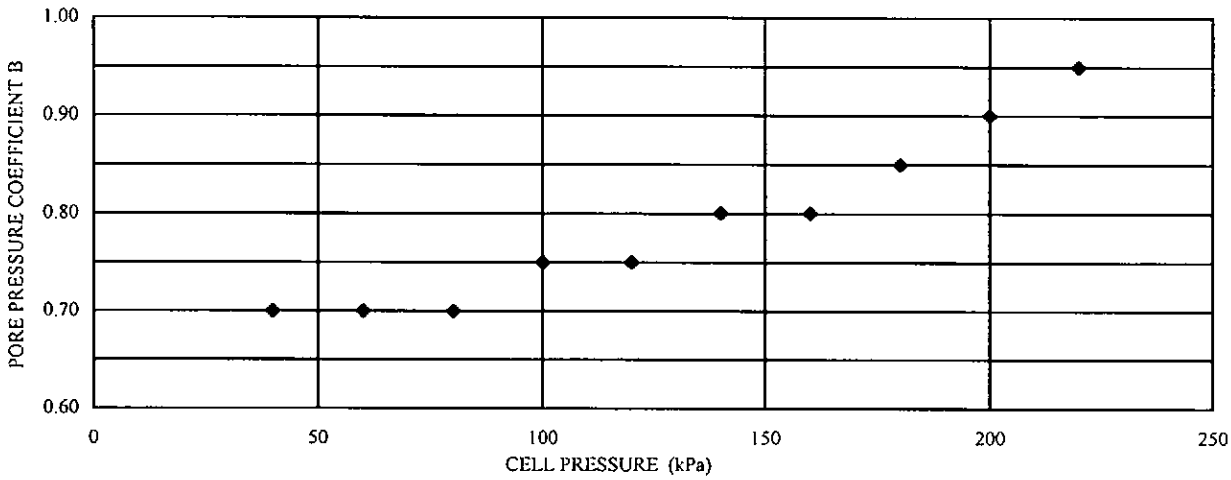
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

SATURATION



Date	Time	Cell Pressure kPa	Back Pressure kPa	Pore Pressure kPa	Cumulative Volume of Water cm^3	Pore Pressure Parameter B
26/11/2008	08:30	0	0	-	0.0	
	08:35	20	-	15		-
	08:50	20	15	15	-0.5	
	08:57	40	-	29		0.70
	09:12	40	35	35	0.7	
	09:18	60	-	49		0.70
	09:32	60	55	55	2.0	
	09:38	80	-	69		0.70
	09:56	80	75	75	4.4	
	10:02	100	-	90		0.75
	10:20	100	95	95	5.6	
	10:26	120	-	110		0.75
	10:49	120	115	115	7.3	
	10:57	140	-	131		0.80
	11:20	140	135	135	8.4	
	11:30	160	-	151		0.80
	11:51	160	155	155	9.2	
	11:59	180	-	172		0.85
	13:16	180	175	175	10.0	
	13:24	200	-	193		0.90
	14:05	200	195	195	10.5	
	14:14	220	-	214		0.95
27/11/2008	08:36	220	215	215	12.2	

Borehole No. : WCH-BH03 **Sample Depth m:-** 4.00 - 5.00
Sample No. : 1 **Specimen Depth m:-** 4.80 - 5.00

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.:** 059

Compiled by W S Wat
Checked by H W Chung

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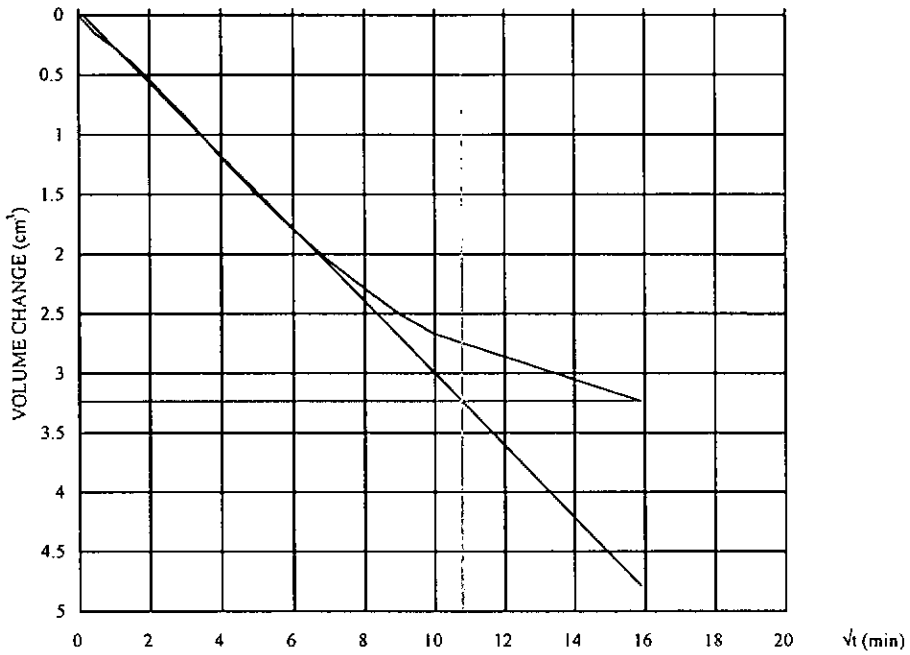
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

CONSOLIDATION (DRAINED PHASE) - Stage 1

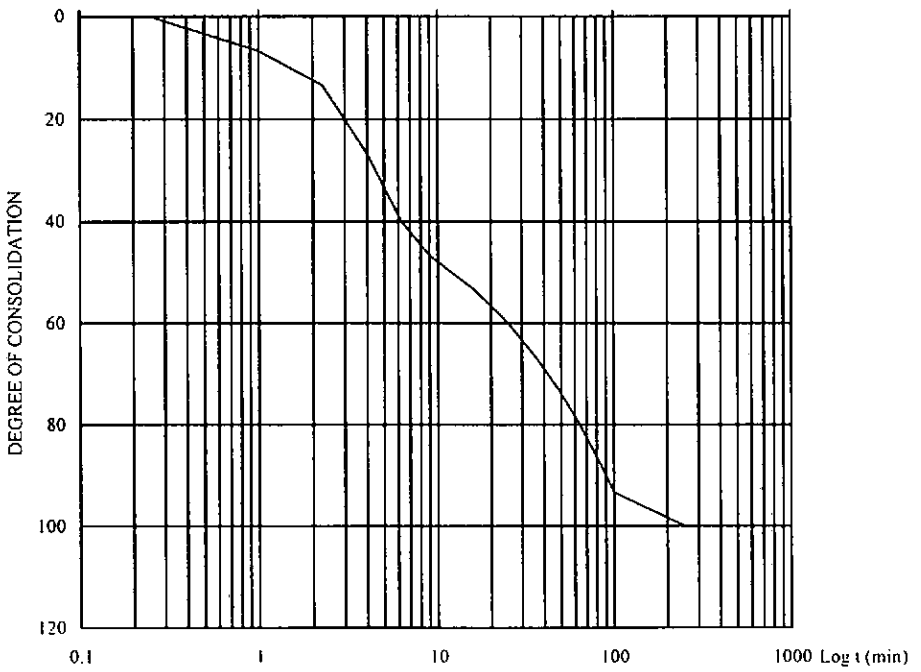


√t100 10.77 min

t100 116.01 min

tf 61.48 min

Calc. strain rate
0.165 mm/min



Borehole No. : WCH-BH03 **Sample Depth m:-** 4.00 - 5.00

Sample No. : 1 **Specimen Depth m:-** 4.80 - 5.00

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.:** 059

Complied by: W S Wat

Checked by: H W Chung

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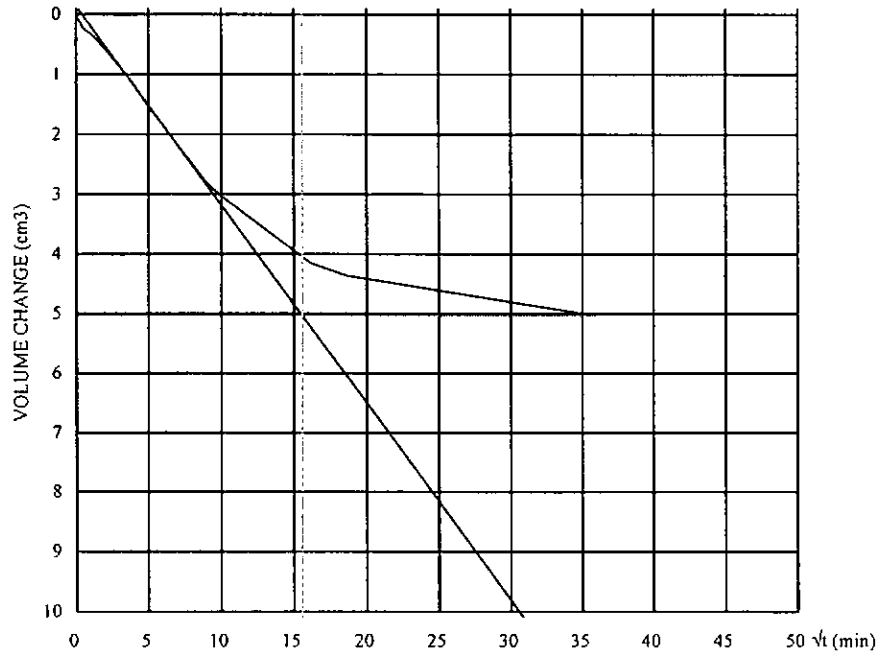
Form : GESR009.13 / Jun.02.03 / Issue 1 / Rev 0

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

CONSOLIDATION (DRAINED PHASE) - Stage 2

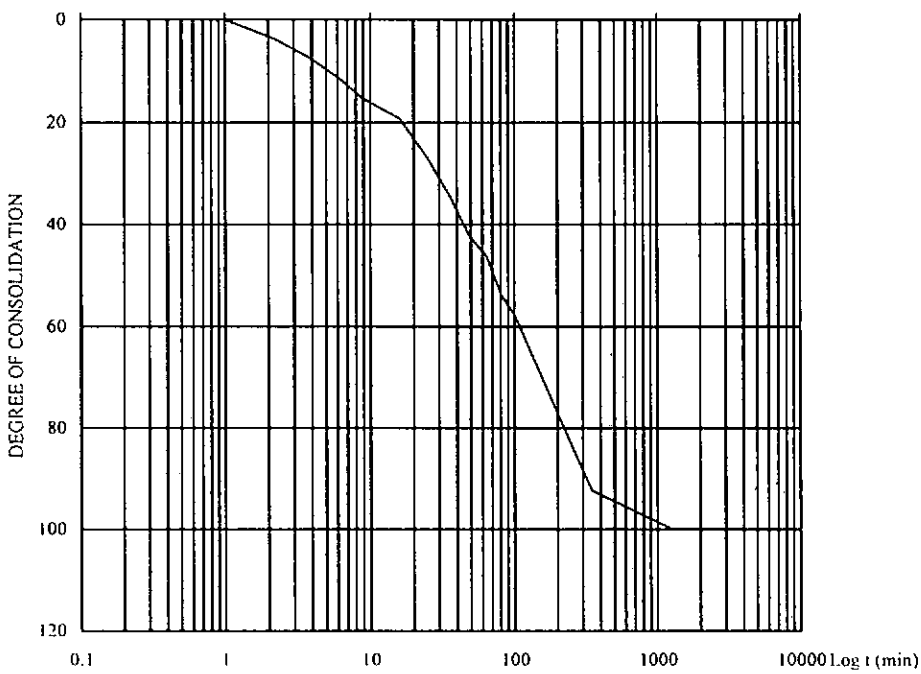


√t100 15.59 min

t100 243.15 min

tf 128.87 min

Calc. strain rate
0.077 mm/min



Borehole No. :	**WCH-BH03**	**Sample Depth m:-**	**4.00 - 5.00**
Sample No. :	**1**	**Specimen Depth m:-**	**4.80 - 5.00**
Customer :	**Mass Transit Railway Corporation**		Complied by
Project :	**Ground Investigation for South Island Line**		W S Wat
		Contract No.: Contract 1024	Checked by
Job No.:	**J2999**	**Works Order No.: 059**	H W Chung

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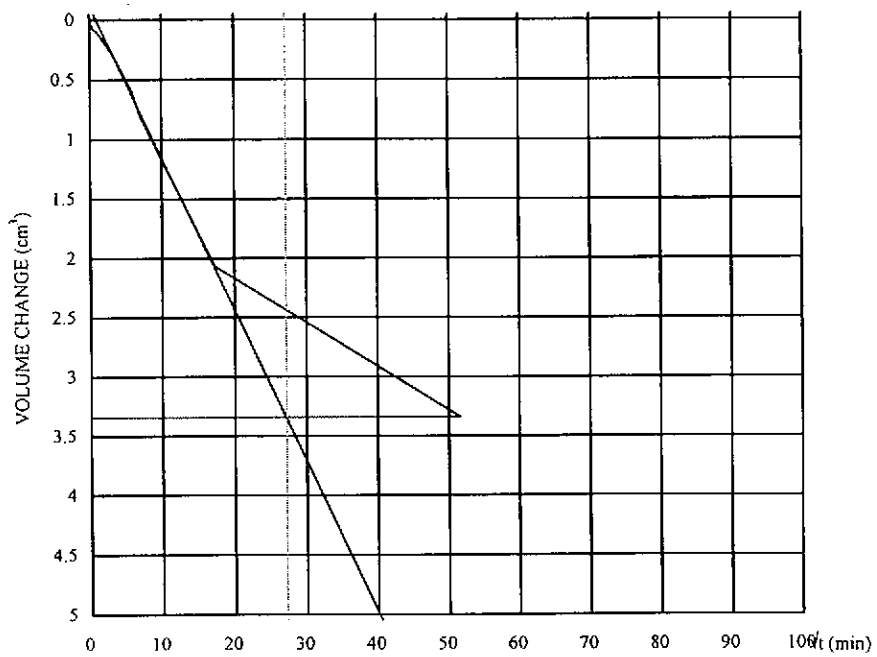
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

CONSOLIDATION (DRAINED PHASE) - Stage 3

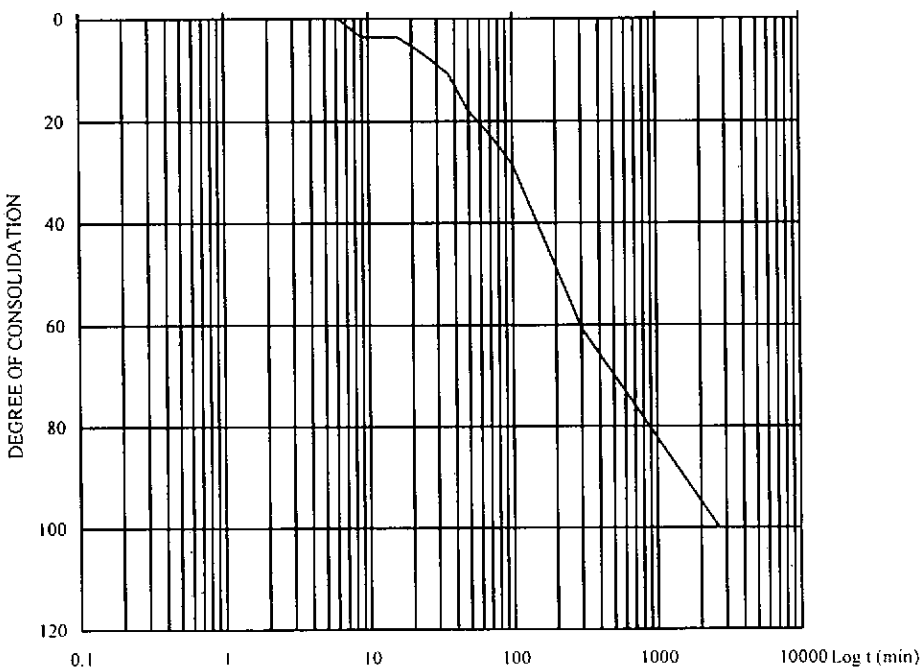


√t100 27.16 min

t100 737.45 min

tf 390.85 min

Calc. strain rate
0.053 mm/min



Borehole No. : WCH-BH03 **Sample Depth m:-** 4.00 - 5.00

Sample No. : 1 **Specimen Depth m:-** 4.80 - 5.00

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.:** 059

Complied by: W S Wat

Checked by: H W Chung

Form : GESR009.13 / Jun.02.03 / Issue 1 / Rev 0

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TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Multi Stage		P.W.P,B.P				Effective Pressure	20				kPa
Side drains	No	Selected Machine Speed		0.048	mm/min	Rate of Strain	1.99				% per hr
FAILURE CRITERION											
Max. deviator Stress	☐	Max. Stress ratio	☒			Axial Strain %	☐				
Stage : 1		Applied Pressure (kPa) - Cell :		235	Back : 215	P.R. factor	1.7999				kN/mm

Date	Time	Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
		Dial		P.R.No. 13	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio σ'_1/σ'_3
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	
28/11	08:45	0.00	0.00	0.045	215	0.000	0.0	20.0	20.0	20.0	0.0	20.0	1.00
	08:50	0.08	0.05	0.088	222	0.015	18.1	31.2	13.1	22.2	9.1	19.1	2.38
	08:55	0.28	0.19	0.123	224	0.055	32.8	43.5	10.7	27.1	16.4	21.6	4.07
	09:00	0.51	0.35	0.139	225	0.101	39.5	49.6	10.1	29.8	19.7	23.3	4.91
	09:05	0.73	0.50	0.149	225	0.144	43.6	53.6	10.0	31.8	21.8	24.5	5.36
	09:10	1.03	0.71	0.158	225	0.203	47.2	57.4	10.2	33.8	23.6	25.9	5.63
	09:15	1.25	0.86	0.164	225	0.244	49.6	60.1	10.5	35.3	24.8	27.0	5.72
	09:20	**1.46**	**1.01**	**0.170**	**224**	**0.286**	**52.0**	**62.8**	**10.8**	**36.8**	**26.0**	**28.1**	**5.81**
	09:25	1.71	1.18	0.176	224	0.332	54.4	65.8	11.4	38.6	27.2	29.5	5.77

Borehole No. :	**WCH-BH03**	**Sample Depth m:- 4.00 - 5.00**	
Sample No. :	**1**	**Specimen Depth m:- 4.80 - 5.00**	
Customer :	**Mass Transit Railway Corporation**		Compiled by W S Wat
Project :	**Ground Investigation for South Island Line**	**Contract No.: Contract 1024**	Checked by H W Chung
Job No.:	**J2999**	**Works Order No.: 059**	

Form : GESR009.14 / Dec.13.04 / Issue 1 / Rev 1

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TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Multi Stage		P.W.P,B.P		Effective Pressure 40	kPa
Side drains	No	Selected Machine Speed	0.047 mm/min	Rate of Strain 1.98	% per hr
FAILURE CRITERION					
Max. deviator Stress	☐	Max. Stress ratio	☒	Axial Strain %	☐
Stage : 2	Applied Pressure (kPa) - Cell :	255	Back : 215	P.R. factor 1.7999	kN/mm

Date	Time	Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
		Dial		P.R.No. 13	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
29/11	08:55	2.10	1.45	0.064	215	0.000	0.0	40.0	40.0	40.0	0.0	40.0	1.00
	09:00	2.17	1.50	0.117	221	0.418	21.8	56.2	34.4	45.3	10.9	41.7	1.63
	09:05	2.34	1.62	0.177	224	0.450	46.9	78.0	31.1	54.6	23.5	46.7	2.51
	09:10	2.56	1.77	0.199	226	0.490	56.0	84.8	28.8	56.8	28.0	47.5	2.94
	09:15	2.82	1.95	0.217	227	0.537	63.4	91.0	27.6	59.3	31.7	48.7	3.30
	09:20	3.05	2.10	0.229	228	0.576	68.2	95.4	27.2	61.3	34.1	49.9	3.51
	09:25	3.28	2.26	0.238	228	0.617	71.8	98.8	27.0	62.9	35.9	50.9	3.66
	09:30	3.53	2.44	0.247	228	0.662	75.4	102.5	27.1	64.8	37.7	52.2	3.78
	09:35	3.76	2.60	0.254	228	0.703	78.1	105.4	27.3	66.4	39.1	53.3	3.86
	09:40	3.99	2.75	0.260	227	0.740	80.4	108.0	27.6	67.8	40.2	54.4	3.91
	09:45	4.28	2.96	0.267	227	0.792	83.1	111.2	28.1	69.7	41.6	55.8	3.96
	09:50	4.47	3.09	0.272	227	0.823	85.0	113.5	28.5	71.0	42.5	56.8	3.98
	09:55	4.71	3.26	0.276	226	0.864	86.5	115.4	28.9	72.1	43.2	57.7	3.99
	10:00	4.97	3.43	0.282	226	0.905	88.8	118.2	29.4	73.8	44.4	59.0	4.02
	10:05	**5.20**	**3.59**	**0.286**	**225**	**0.943**	**90.2**	**120.0**	**29.8**	**74.9**	**45.1**	**59.9**	**4.03**
	10:10	5.46	3.77	0.290	225	0.985	91.6	121.9	30.3	76.1	45.8	60.8	4.02

Borehole No. :	**WCH-BH03**	**Sample Depth m:- 4.00 - 5.00**	
Sample No. :	**1**	**Specimen Depth m:- 4.80 - 5.00**	
Customer :	**Mass Transit Railway Corporation**		Compiled by W S Wat
Project :	**Ground Investigation for South Island Line**	**Contract No.: Contract 1024**	Checked by H W Chung
Job No.:	**J2999**	**Works Order No.: 059**	

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Form : GESR009.14 / Dec.13.04 / Issue 1 / Rev i

TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Gammon

Multi Stage		P.W.P,B.P		Effective Pressure	60 kPa
Side drains	No	Selected Machine Speed	0.046 mm/min	Rate of Strain	1.99 % per hr
FAILURE CRITERION					
Max. deviator Stress	☐	Max. Stress ratio	☒	Axial Strain %	☐
Stage : 3	Applied Pressure (kPa) - Cell :	275	Back : 215	P.R. factor	1.7999 kN/mm

Date	Time	Strain Dial	Strain	Load P.R.No. 13	Pore Pressure	Dev. stress Corr.	Dev. stress q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
01/12	08:55	5.71	3.95	0.088	215	0.000	0.0	60.0	60.0	60.0	0.0	60.0	1.00
	09:00	5.79	4.00	0.178	221	1.039	36.0	90.3	54.3	72.3	18.0	66.3	1.66
	09:05	5.99	4.14	0.249	227	1.071	65.0	113.4	48.4	80.9	32.5	70.1	2.34
	09:10	6.22	4.30	0.287	230	1.107	80.5	126.0	45.5	85.7	40.2	72.3	2.77
	09:15	6.47	4.47	0.314	231	1.145	91.3	135.1	43.8	89.5	45.7	74.2	3.09
	09:20	6.65	4.60	0.328	232	1.174	96.9	140.0	43.1	91.5	48.4	75.4	3.25
	09:25	6.98	4.82	0.342	232	1.223	102.3	144.9	42.6	93.8	51.2	76.7	3.40
	09:30	7.16	4.95	0.348	233	1.252	104.6	147.0	42.4	94.7	52.3	77.3	3.47
	09:35	7.39	5.11	0.354	233	1.286	106.8	149.2	42.4	95.8	53.4	78.0	3.52
	09:40	7.61	5.26	0.358	233	1.319	108.2	150.6	42.4	96.5	54.1	78.5	3.55
	09:45	7.91	5.46	0.363	232	1.361	110.0	152.6	42.6	97.6	55.0	79.3	3.58
	09:50	8.19	5.66	0.367	232	1.403	111.3	154.1	42.8	98.5	55.7	79.9	3.60
	09:55	8.40	5.80	0.371	232	1.433	112.7	155.6	42.9	99.3	56.4	80.5	3.63
	10:00	8.64	5.97	0.374	232	1.468	113.7	156.9	43.2	100.1	56.9	81.1	3.63
	10:05	8.88	6.13	0.377	232	1.501	114.7	158.1	43.4	100.7	57.3	81.6	3.64
	10:10	**9.12**	**6.30**	**0.380**	**231**	**1.535**	**115.6**	**159.2**	**43.6**	**101.4**	**57.8**	**82.1**	**3.65**
	10:15	9.35	6.46	0.382	231	1.567	116.2	160.1	43.9	102.0	58.1	82.6	3.65
	10:20	9.68	6.68	0.386	230	1.611	117.5	162.1	44.6	103.3	58.7	83.8	3.63
	10:25	9.95	6.87	0.389	230	1.649	118.4	163.4	45.0	104.2	59.2	84.5	3.63
	10:30	10.16	7.02	0.391	230	1.678	119.0	164.2	45.2	104.7	59.5	84.9	3.63
	10:35	10.36	7.16	0.393	230	1.705	119.6	165.0	45.4	105.2	59.8	85.3	3.63
	10:40	10.58	7.31	0.396	229	1.734	120.5	166.1	45.6	105.9	60.3	85.8	3.64
	10:45	10.91	7.53	0.398	229	1.776	121.0	167.1	46.1	106.6	60.5	86.4	3.62
	10:50	11.07	7.65	0.400	229	1.799	121.6	167.9	46.3	107.1	60.8	86.8	3.63
	10:55	11.33	7.83	0.402	228	1.832	122.1	168.7	46.6	107.7	61.1	87.3	3.62
	11:00	11.61	8.02	0.405	228	1.868	123.0	170.1	47.1	108.6	61.5	88.1	3.61
	11:05	11.78	8.14	0.406	228	1.890	123.2	170.5	47.3	108.9	61.6	88.4	3.61
	11:10	12.11	8.37	0.410	227	1.932	124.4	172.1	47.7	109.9	62.2	89.2	3.61
	11:15	12.37	8.55	0.412	227	1.964	124.9	172.9	48.0	110.5	62.5	89.6	3.60
	11:20	12.60	8.71	0.414	227	1.993	125.5	173.7	48.2	110.9	62.7	90.0	3.60
	11:25	12.78	8.83	0.415	227	2.014	125.7	174.2	48.5	111.3	62.8	90.4	3.59
	11:30	13.05	9.02	0.417	226	2.048	126.2	174.9	48.7	111.8	63.1	90.8	3.59
	11:35	13.27	9.17	0.419	226	2.074	126.7	175.7	49.0	112.3	63.3	91.2	3.59
	11:40	13.54	9.35	0.422	226	2.105	127.6	176.9	49.3	113.1	63.8	91.8	3.59
	11:45	13.77	9.51	0.424	225	2.133	128.1	177.7	49.6	113.6	64.0	92.3	3.58
	11:50	14.04	9.70	0.426	225	2.165	128.5	178.3	49.8	114.1	64.3	92.6	3.58
	11:55	14.24	9.84	0.427	225	2.189	128.7	178.7	50.0	114.4	64.4	92.9	3.57
	12:00	14.46	9.99	0.430	225	2.214	129.6	179.9	50.3	115.1	64.8	93.5	3.58
	12:05	14.74	10.18	0.431	224	2.246	129.7	180.4	50.7	115.5	64.8	93.9	3.56

Borehole No. :	**WCH-BH03**	**Sample Depth m:- 4.00 - 5.00**	
Sample No. :	**1**	**Specimen Depth m:- 4.80 - 5.00**	
Customer :	**Mass Transit Railway Corporation**		Compiled by W S Wat
Project :	**Ground Investigation for South Island Line**	**Contract No.: Contract 1024**	Checked by H W Chung
Job No.:	**J2999**	**Works Order No.: 059**	

Form : GESR009.14 / Dec.13.04 / Issue 1 / Rev 1

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2
Shearing Continuation

FAILURE CRITERION														
Max. deviator Stress ☐				Max. Stress ratio ☒				Axial Strain % ☐						
Stage : 3		Strain		Load	Pore	Dev. stress		Effective Stress Parameters						
Date	Time	Dial		P.R.No. 13	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio	
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3	
01/12	12:10	15.02	10.38	0.433	224	2.279	130.1	181.0	50.9	116.0	65.1	94.3	3.56	
	12:15	15.24	10.53	0.435	224	2.304	130.7	181.9	51.2	116.5	65.3	94.8	3.55	
	12:20	15.48	10.69	0.437	224	2.330	131.2	182.6	51.4	117.0	65.6	95.1	3.55	
	12:25	15.75	10.88	0.439	223	2.361	131.6	183.3	51.7	117.5	65.8	95.6	3.55	
	12:30	16.00	11.06	0.442	223	2.390	132.5	184.5	52.0	118.2	66.2	96.2	3.55	
	12:35	16.25	11.22	0.443	223	2.416	132.6	184.7	52.1	118.4	66.3	96.3	3.54	
	12:40	16.52	11.41	0.445	223	2.446	133.0	185.4	52.4	118.9	66.5	96.7	3.54	
	12:45	16.79	11.60	0.446	222	2.476	133.1	185.8	52.7	119.2	66.5	97.1	3.52	
	12:50	17.02	11.76	0.448	222	2.501	133.6	186.6	53.0	119.8	66.8	97.5	3.52	
	12:55	17.26	11.93	0.451	222	2.528	134.4	187.7	53.3	120.5	67.2	98.1	3.52	
	13:00	17.49	12.08	0.453	222	2.551	134.9	188.3	53.4	120.8	67.4	98.4	3.53	
	13:05	17.86	12.34	0.454	221	2.591	134.8	188.6	53.8	121.2	67.4	98.7	3.51	
	13:10	18.05	12.47	0.457	221	2.611	135.7	189.6	53.9	121.8	67.9	99.1	3.52	
	13:15	18.28	12.63	0.459	221	2.635	136.2	190.4	54.2	122.3	68.1	99.6	3.51	
	13:20	18.56	12.82	0.459	221	2.664	135.9	190.3	54.4	122.3	67.9	99.7	3.50	
	13:25	18.83	13.01	0.461	221	2.693	136.3	190.5	54.2	122.3	68.1	99.6	3.51	
	13:30	19.06	13.17	0.463	220	2.716	136.7	191.5	54.8	123.2	68.4	100.4	3.50	
	13:35	19.29	13.33	0.465	220	2.740	137.2	192.2	55.0	123.6	68.6	100.7	3.49	
	13:40	19.50	13.48	0.467	220	2.763	137.7	193.0	55.3	124.1	68.8	101.2	3.49	
	13:45	19.77	13.66	0.470	220	2.789	138.5	193.9	55.4	124.6	69.2	101.6	3.50	
	13:50	20.05	13.85	0.468	219	2.817	137.4	193.5	56.1	124.8	68.7	101.9	3.45	
	13:55	20.26	14.00	0.471	219	2.839	138.2	194.1	55.9	125.0	69.1	102.0	3.47	
	14:00	20.51	14.17	0.473	219	2.864	138.7	194.8	56.1	125.4	69.3	102.3	3.47	
	14:05	20.76	14.35	0.472	219	2.890	138.0	194.3	56.3	125.3	69.0	102.3	3.45	
	14:10	21.00	14.51	0.474	219	2.913	138.4	194.8	56.4	125.6	69.2	102.5	3.45	
	14:15	21.29	14.71	0.476	218	2.942	138.8	195.6	56.8	126.2	69.4	103.1	3.44	
	14:20	21.52	14.87	0.478	218	2.965	139.2	196.1	56.9	126.5	69.6	103.3	3.45	
	14:25	21.82	15.08	0.478	218	2.995	138.9	196.1	57.2	126.6	69.4	103.5	3.43	
	14:30	22.06	15.24	0.481	218	3.018	139.6	197.0	57.4	127.2	69.8	103.9	3.43	
	14:35	22.21	15.34	0.481	218	3.032	139.5	197.0	57.5	127.2	69.7	104.0	3.43	
	14:40	22.49	15.54	0.482	217	3.060	139.5	197.2	57.7	127.4	69.7	104.2	3.42	
	14:45	22.69	15.67	0.485	217	3.079	140.3	198.1	57.8	127.9	70.1	104.6	3.43	
	14:50	23.03	15.92	0.488	217	3.114	140.9	198.9	58.0	128.5	70.5	105.0	3.43	
	14:55	23.19	16.02	0.485	217	3.128	139.7	197.9	58.2	128.0	69.8	104.8	3.40	
	15:00	23.41	16.17	0.486	217	3.149	139.7	198.0	58.3	128.2	69.9	104.9	3.40	
	15:05	23.65	16.34	0.489	217	3.173	140.5	199.0	58.5	128.8	70.3	105.3	3.40	
	15:10	23.92	16.53	0.493	216	3.200	141.6	200.3	58.7	129.5	70.8	105.9	3.41	
	15:15	24.23	16.74	0.492	216	3.229	140.8	199.7	58.9	129.3	70.4	105.8	3.39	
	15:20	24.47	16.91	0.493	216	3.253	140.9	200.0	59.1	129.5	70.4	106.1	3.38	
	15:25	24.70	17.06	0.494	216	3.274	140.9	200.2	59.3	129.8	70.5	106.3	3.38	
	15:30	24.94	17.23	0.496	216	3.298	141.3	200.7	59.4	130.1	70.7	106.5	3.38	

Borehole No. : WCH-BH03 — **Sample Depth m:-** 4.00 - 5.00

Sample No. : 1 — **Specimen Depth m:-** 4.80 - 5.00

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 — **Works Order No.:** 059

Compiled by: W S Wat

Checked by: H W Chung

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TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2
Shearing Continuation

Gammon

FAILURE CRITERION

Max. deviator Stress ☐ | Max. Stress ratio ☒ | Axial Strain % ☐

Stage :	3	Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
Date	Time	Dial		P.R.No. 13	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
01/12	15:35	25.26	17.46	0.496	215	3.330	140.9	200.5	59.6	130.1	70.5	106.6	3.36
	15:40	25.48	17.60	0.502	215	3.349	142.8	202.4	59.6	131.0	71.4	107.2	3.40
	15:45	25.64	17.72	0.498	215	3.366	141.1	200.9	59.8	130.4	70.6	106.8	3.36
	15:50	25.91	17.90	0.499	215	3.391	141.1	201.0	59.9	130.5	70.6	106.9	3.36
	15:55	26.21	18.11	0.503	215	3.421	142.1	202.2	60.1	131.2	71.1	107.5	3.36
	16:00	26.42	18.25	0.502	215	3.440	141.5	201.7	60.2	131.0	70.8	107.4	3.35
	16:05	26.68	18.43	0.504	215	3.465	141.9	202.2	60.3	131.2	70.9	107.6	3.35
	16:10	26.91	18.60	0.503	215	3.489	141.2	201.7	60.5	131.1	70.6	107.6	3.33
	16:15	27.14	18.76	0.505	214	3.512	141.6	202.2	60.6	131.4	70.8	107.8	3.34
	16:20	27.42	18.95	0.508	214	3.538	142.3	203.1	60.8	131.9	71.1	108.2	3.34
	16:25	27.65	19.10	0.509	214	3.559	142.3	203.1	60.8	132.0	71.2	108.2	3.34
	16:30	27.94	19.30	0.509	214	3.588	141.9	202.9	61.0	132.0	71.0	108.3	3.33
	16:35	28.12	19.43	0.510	214	3.606	142.0	203.1	61.1	132.1	71.0	108.4	3.32
	16:40	28.37	19.60	0.517	214	3.630	144.1	205.3	61.2	133.2	72.0	109.2	3.35
	16:45	28.61	19.77	0.513	214	3.654	142.4	203.7	61.3	132.5	71.2	108.8	3.32
	16:50	28.86	19.94	0.519	214	3.678	144.1	205.6	61.5	133.6	72.1	109.5	3.34
	16:55	29.11	20.12	0.521	213	3.704	144.4	206.0	61.6	133.8	72.2	109.7	3.34

Borehole No. : WCH-BH03 — **Sample Depth m:- 4.00 - 5.00**

Sample No. : 1 — **Specimen Depth m:- 4.80 - 5.00**

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 — **Works Order No.:** 059

Compiled by: W S Wat

Checked by: H W Chung

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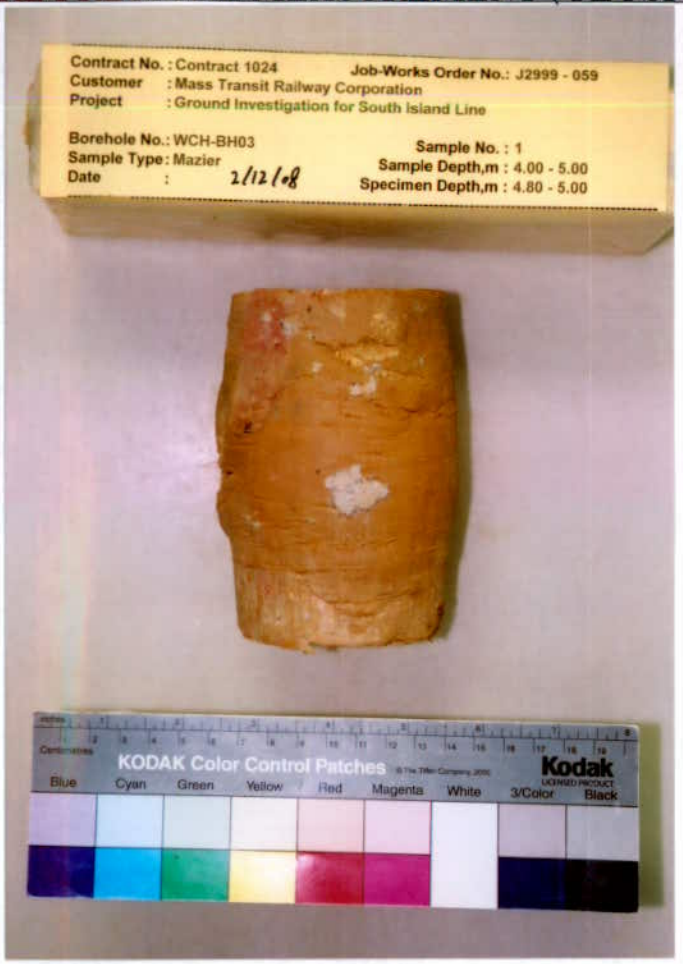
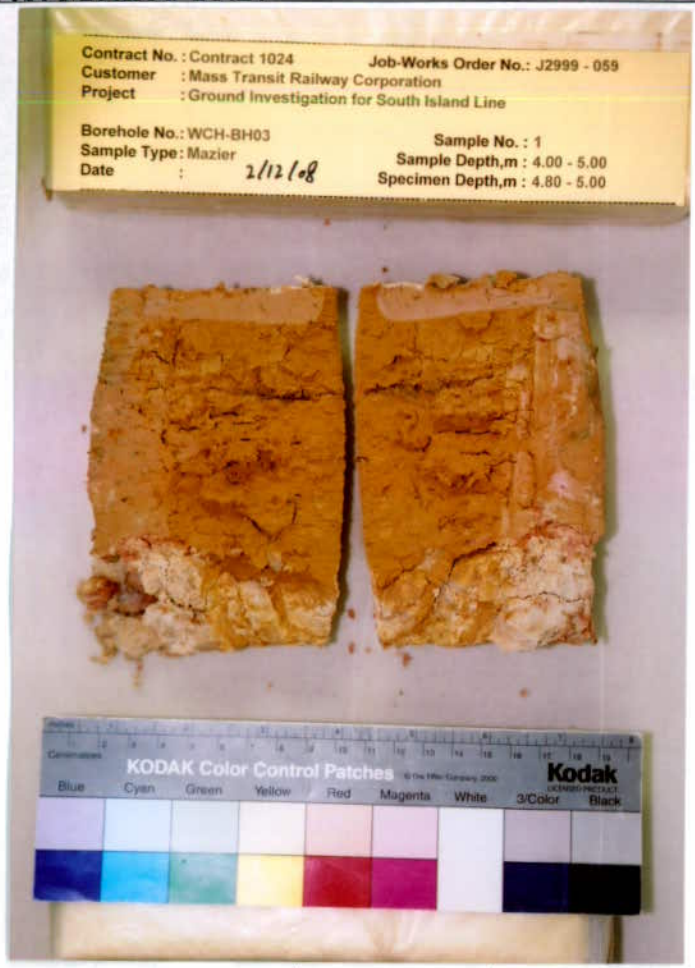
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT (GEOSPEC 3 : 2001 Test Method 15.2)





Description : Greyish brown, gravelly, silty SAND

Sample Origin : CDT ‡ ‡ Information provided by customer

Borehole No. : WCH-BH03	**Sample No. :** 1	**Sample Depth m:-** 4.00 - 5.00	**Specimen Depth m:-** 4.80 - 5.00

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line

Contract No.: Contract 1024
Job No.: J2999
Works Order No.: 059

Compiled by: W S Wat
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GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	WCH-BH03		
Sample		no	4		
Sample Type			Mazier		
Stage		no	1		
Sample Depth		m	6.00 - 6.90		
Specimen Depth		m	6.50 - 6.70		
INITIAL CONDITIONS					
Diameter	(D_o)	mm	73.7		
Height	(H_o)	mm	145.0		
Moisture Content	(W_o)	%	33		
Bulk density	(ρ_o)	Mg/m^3	1.91		
Dry density	(ρ_d)	Mg/m^3	1.44		
Particle density	(ρ_s)		2.65		
Voids Ratio	(e_o)		0.85		
Degree of Saturation	(S_r)	%	102.8		
DRAINAGE CONDITIONS			ONE END		
SATURATION					
Final Pore Pressure Coefficient B			0.98		
CONSOLIDATION					
Cell Pressure	(σ_3)	kPa	285		
Back Pressure	(u_b)	kPa	220		
Effective Pressure	(σ'_3)	kPa	65		
Coefficient of Consolidation (t100) (C_{vi})		$m^2/Year$	44.14		
Coefficient of Volume Compressibility (m_{vi})		m^2/MN	0.45		
Coefficient of Permeability (k)		m/s	6.16E-09		
COMPRESSION TERMINATION CRITERION			MAXIMUM DEVIATOR STRESS		
COMPRESSION - INITIAL					
Moisture Content	(w)	%	31		
Pore Pressure at the End of Consolidation		kPa	220		
Effective Stress at the End of Consolidation		kPa	65		
Bulk density	(ρ_o)	Mg/m^3	1.93		
Dry density	(ρ_d)	Mg/m^3	1.48		
Voids Ratio	(e)		0.80		
Degree of Saturation	(S_r)	%	103.2		

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Report No. : J2999-059.11
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.:** 059

Technician : W S Wat Checked By : Name : H W Chung Approved By : Signatory : Lau Wai Cheong

Tested Date: 09/12/2008 Date : 19/12/2008 Date : 19/12/2008

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Form : GESR009.6 / Nov.10.06 / Issue 1 / Rev 1

TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	WCH-BH03		
Sample		no	4		
Sample Type			Mazier		
Stage		no	1		
Sample Depth		m	6.00 - 6.90		
Specimen Depth		m	6.50 - 6.70		
COMPRESSION - FAILURE					
Cell Pressure		kPa	285		
Rate of Strain		mm/min	0.048		
CONDITIONS MAXIMUM DEVIATOR STRESS					
Major Effective Principal Stress (σ'_1)		kPa	332		
Corrected Deviator Stress ($\sigma'_1 - \sigma'_3$)		kPa	234		
Minor Effective Principal Stress (σ'_3)		kPa	97		
$s' = (\sigma'_1 + \sigma'_3)/2$		kPa	214		
$t = (\sigma_1 - \sigma_3)/2$		kPa	117		
Expanded Uncertainty of s' ^		kPa	-		
Expanded Uncertainty of t ^		kPa	-		
Pore pressure parameter A_f			-0.14		
Strain at Failure	(εf)	%	20.1		
COMPRESSION - FINAL					
Moisture Content	(W_f)	%	31		
Bulk density	(ρ_o)	Mg/m^3	1.93		
Dry density	(ρ_d)	Mg/m^3	1.48		
Voids Ratio	(e_f)		0.80		
Degree of Saturation	(S_f)	%	103.2		

Notes -
1. The method of specimen preparation was in accordance with GEOSPEC 3 : 2001 :- Test method 13.3 : test specimen from undisturbed soil samples.
2. Sample received date :29/09/2008
3. The determination of moisture content was in accordance with test method 5.1 of GEOSPEC 3 : 2001.
4. Particle density : 2.65 (Assumed)
5. Maximum and minimum temperature recorded over the period of testing 19.9 - 20.7 °C.
6. Unavoidable variations from specified procedure : none
7. Comment on observed or inferred sample disturbance : none
8. Percentage by mass of soil particles larger than 1/5 of the diameter of specimen (%) : Nil
9. The specimen was selected by the laboratory.
   Name : W S Wat Designation : Senior Laboratory Technician
10. Sampling History : As Received

* Delete as appropriate ^ Upon request

Customer : **Mass Transit Railway Corporation**
Project : **Ground Investigation for South Island Line**
Contract No.: Contract 1024
Job No.: **J2999** **Works Order No.: 059**

Compiled by W S Wat
Checked by H W Chung

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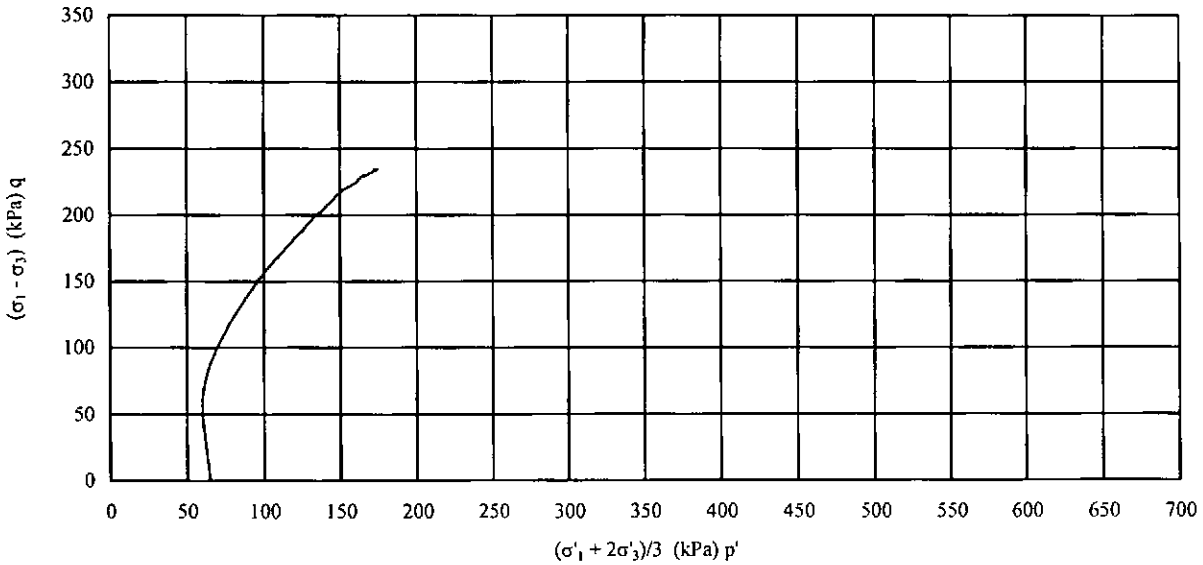
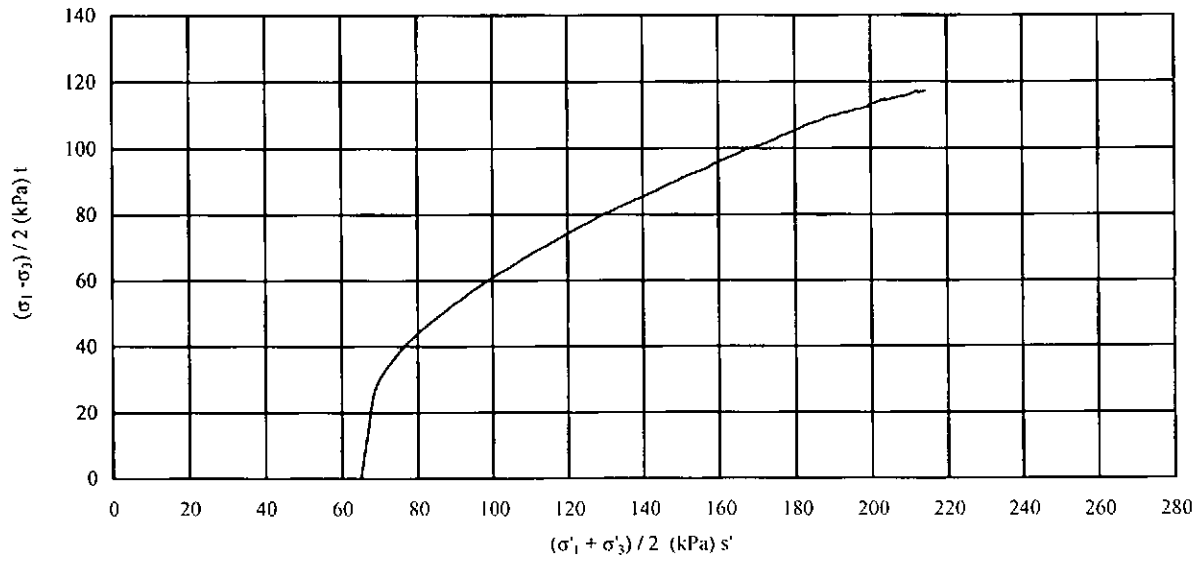
TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

STRESS PATH PARAMETERS FOR EFFECTIVE STRESS

p' - q PLOT



s' - t PLOT



Borehole No. :	**WCH-BH03**	**Sample Depth m:-**	**6.00 - 6.90**
Sample No. :	**4**	**Specimen Depth m:-**	**6.50 - 6.70**
Customer :	**Mass Transit Railway Corporation**		Compiled by W S Wat
Project :	**Ground Investigation for South Island Line**		
		Contract No.: Contract 1024	Checked by H W Chung
Job No.:	**J2999**	**Works Order No.: 059**	

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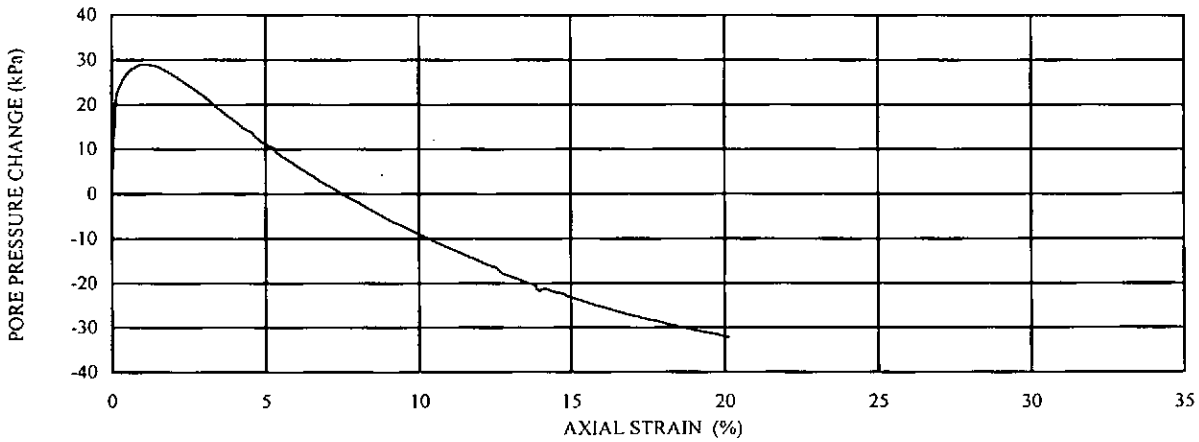
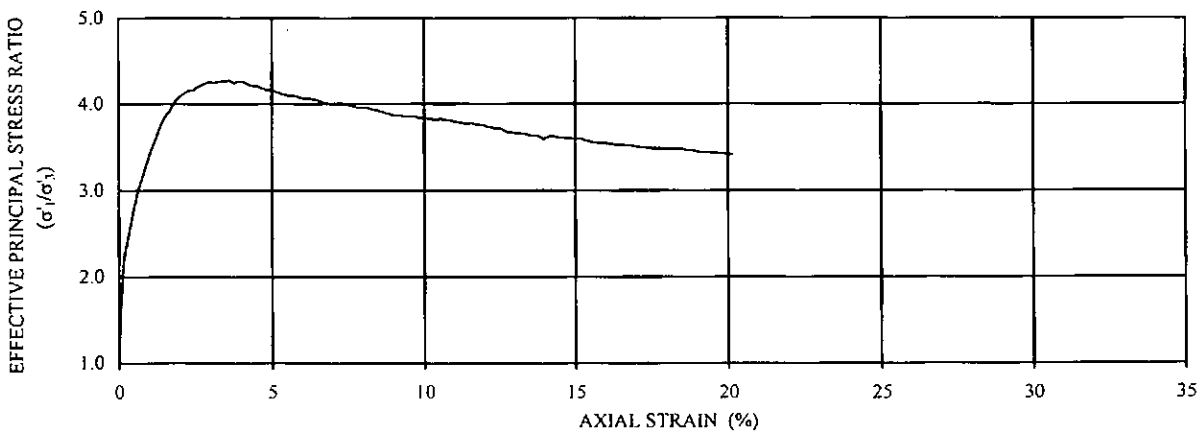
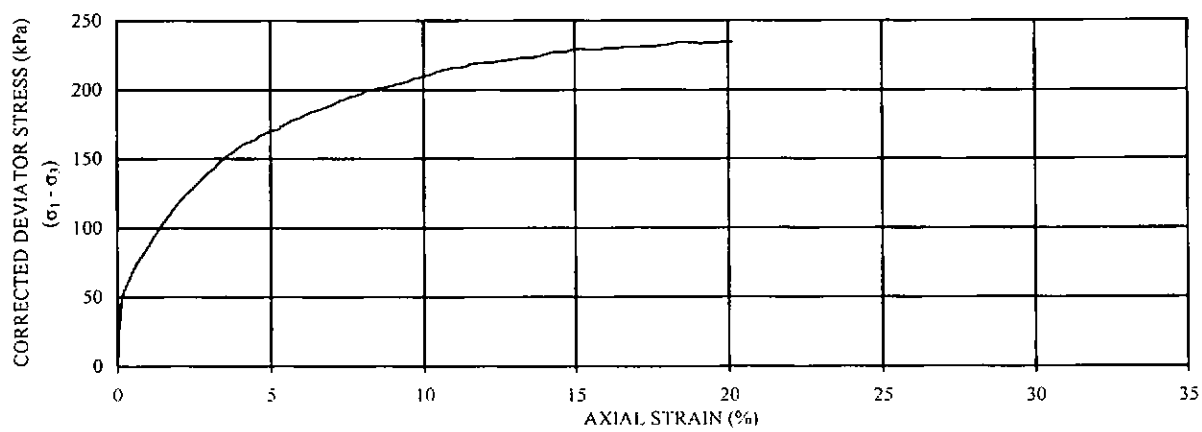
TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

COMPRESSION







Borehole No. : WCH-BH03 — **Sample Depth m:-** 6.00 - 6.90
Sample No. : 4 — **Specimen Depth m:-** 6.50 - 6.70

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 — **Works Order No.:** 059

Compiled by: W S Wat
Checked by: H W Chung

Form : GESR009.9 / Jun.02.03 / Issue 1 / Rev 0

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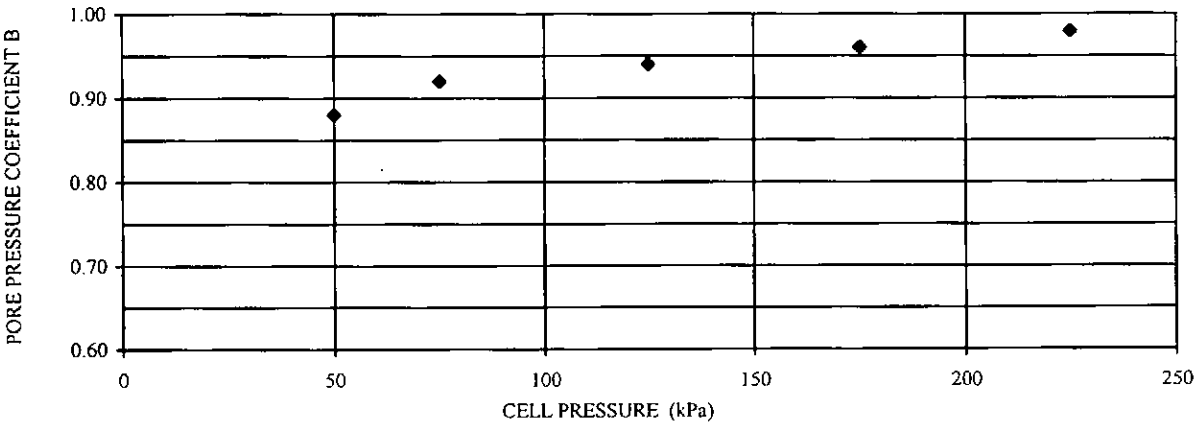
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

SATURATION



Date	Time	Cell Pressure kPa	Back Pressure kPa	Pore Pressure kPa	Cumulative Volume of Water cm^3	Pore Pressure Coefficient B
12/12/2008	08:59	0	0	-	0.0	
	09:11	25	-	24		-
	10:17	25	20	20	-2.5	
	10:30	50	-	42		0.88
	11:13	50	45	45	-1.6	
	11:20	75	-	68		0.92
	12:23	75	70	70	-1.4	
	12:35	125	-	117		0.94
	13:40	125	120	120	-0.8	
	13:50	175	-	168		0.96
	14:40	175	170	170	0.1	
	14:49	225	-	219		0.98
15/12/2008	09:40	225	220	220	0.5	

Borehole No. WCH-BH03 **Sample Depth m:-** 6.00 - 6.90
Sample No. : 4 **Specimen Depth m:-** 6.50 - 6.70

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.:** 059

Compiled by: W S Wat
Checked by: H W Chung

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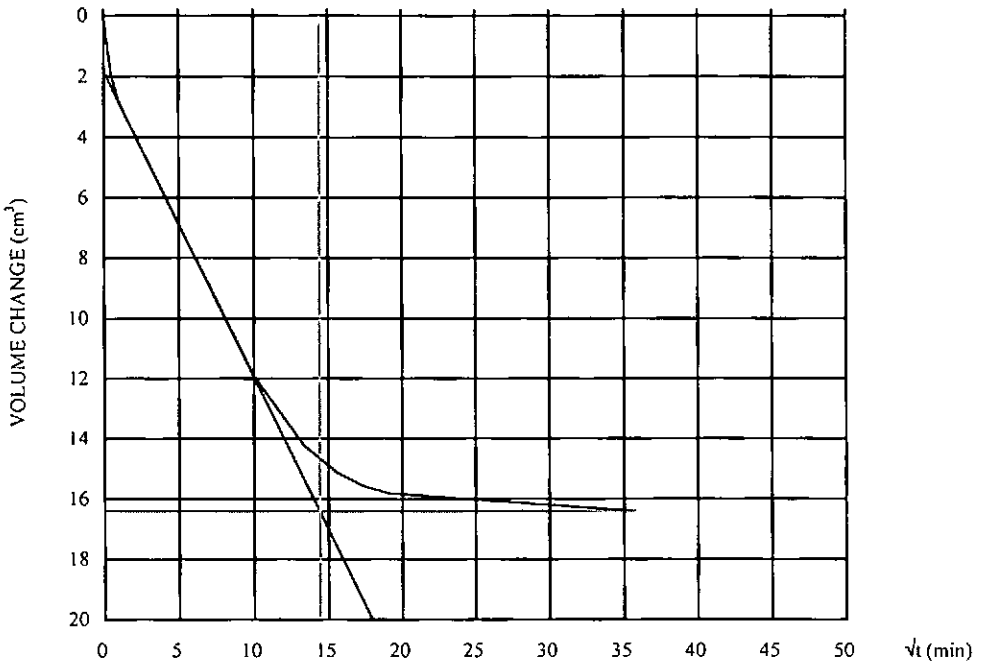
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

CONSOLIDATION (DRAINED PHASE) - Stage 1

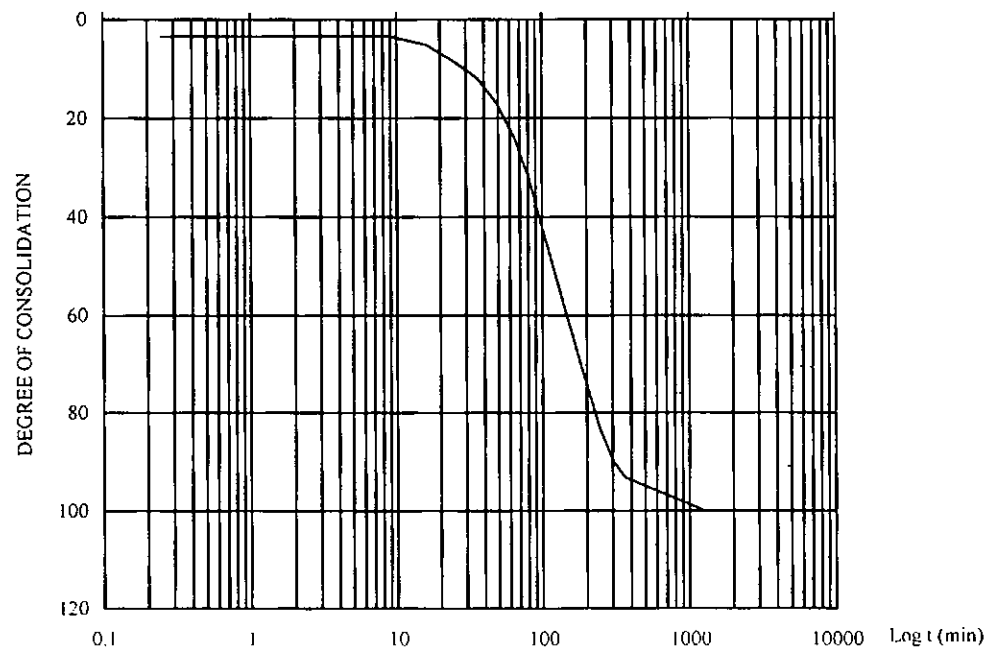


√t100 14.41 min

t100 207.786 min

tf 110.127 min

Calc. strain rate
0.091 mm/min



Borehole No. : WCH-BH03 **Sample Depth m:-** 6.00 - 6.90

Sample No. : 4 **Specimen Depth m:-** 6.50 - 6.70

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.:** 059

Complied by: W S Wat

Checked by: H W Chung

Form : GESR009.13 / Jun.02.03 / Issue 1 / Rev 0

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Single Stage			P.W.P.B.P				Effective Pressure	65				kPa
Side drains	No	Selected Machine Speed	0.048	mm/min	Rate of Strain	2.00	% per hr					
FAILURE CRITERION												
Max. deviator Stress	☒	Max. Stress ratio	☐	Axial Strain %	☐							
Stage : 1	Applied Pressure (kPa) - Cell :	285	Back :	220	P.R. factor	3.1069	kN/mm					

Date	Time	Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
		Dial		P.R.No. 24	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
16/12	08:40	0.00	0.00	0.053	220	0.000	0.0	65.0	65.0	65.0	0.0	65.0	1.00
	08:45	0.20	0.14	0.118	241	0.041	48.1	92.2	44.1	68.2	24.1	60.1	2.09
	08:50	0.39	0.27	0.130	244	0.078	56.9	97.8	40.9	69.3	28.4	59.9	2.39
	08:55	0.62	0.43	0.141	246	0.124	64.9	103.7	38.8	71.2	32.4	60.4	2.67
	09:00	0.89	0.62	0.153	248	0.178	73.5	110.8	37.3	74.1	36.8	61.8	2.97
	09:05	1.15	0.80	0.161	249	0.228	79.3	115.8	36.5	76.1	39.6	62.9	3.17
	09:10	1.39	0.97	0.169	249	0.275	84.9	121.0	36.1	78.6	42.5	64.4	3.35
	09:15	1.62	1.13	0.177	249	0.319	90.6	126.6	36.0	81.3	45.3	66.2	3.52
	09:20	1.86	1.29	0.185	249	0.363	96.3	132.5	36.2	84.3	48.1	68.3	3.66
	09:25	2.06	1.43	0.192	249	0.400	101.2	137.6	36.4	87.0	50.6	70.1	3.78
	09:30	2.28	1.59	0.199	248	0.443	106.1	142.9	36.8	89.9	53.1	72.2	3.88
	09:35	2.45	1.70	0.203	248	0.472	108.9	146.1	37.2	91.7	54.5	73.5	3.93
	09:40	2.69	1.87	0.211	247	0.517	114.5	152.3	37.8	95.1	57.3	76.0	4.03
	09:45	2.92	2.03	0.217	247	0.558	118.6	157.0	38.4	97.7	59.3	77.9	4.09
	09:50	3.28	2.28	0.226	245	0.623	124.8	164.4	39.6	102.0	62.4	81.2	4.15
	09:55	3.54	2.46	0.231	245	0.668	128.1	168.6	40.5	104.6	64.1	83.2	4.16
	10:00	3.74	2.60	0.236	244	0.703	131.5	172.6	41.1	106.9	65.8	84.9	4.20
	10:05	4.12	2.87	0.245	243	0.771	137.6	180.0	42.4	111.2	68.8	88.3	4.24
	10:10	4.26	2.96	0.248	242	0.793	139.6	182.5	42.9	112.7	69.8	89.4	4.25
	10:15	4.54	3.16	0.253	241	0.841	142.8	186.8	44.0	115.4	71.4	91.6	4.25
	10:20	4.75	3.30	0.258	240	0.875	146.2	191.0	44.8	117.9	73.1	93.5	4.26
	10:25	4.96	3.45	0.263	239	0.911	149.5	195.3	45.8	120.6	74.8	95.6	4.26
	10:30	5.22	3.63	0.268	238	0.954	152.8	199.5	46.7	123.1	76.4	97.6	4.27
	10:35	5.44	3.78	0.271	237	0.989	154.6	202.2	47.6	124.9	77.3	99.1	4.25
	10:40	5.67	3.95	0.276	237	1.028	157.9	206.3	48.4	127.3	78.9	101.0	4.26
	10:45	5.92	4.12	0.280	236	1.068	160.4	209.7	49.3	129.5	80.2	102.8	4.25
	10:50	6.19	4.31	0.283	235	1.111	162.2	212.6	50.4	131.5	81.1	104.5	4.22
	10:55	6.55	4.56	0.287	234	1.167	164.5	215.8	51.3	133.6	82.3	106.1	4.21
	11:00	6.66	4.64	0.290	233	1.185	166.5	218.6	52.1	135.3	83.2	107.6	4.20
	11:05	6.94	4.83	0.293	232	1.227	168.2	221.3	53.1	137.2	84.1	109.2	4.17
	11:10	7.15	4.97	0.296	231	1.258	170.1	223.9	53.8	138.8	85.0	110.5	4.16
	11:15	7.58	5.27	0.299	230	1.322	171.6	226.4	54.8	140.6	85.8	112.0	4.13
	11:20	7.68	5.34	0.302	229	1.337	173.5	229.1	55.6	142.4	86.8	113.4	4.12
	11:25	7.91	5.50	0.305	229	1.372	175.3	231.8	56.5	144.1	87.6	114.9	4.10
	11:30	8.17	5.69	0.309	228	1.412	177.7	235.0	57.3	146.2	88.9	116.5	4.10
	11:35	8.40	5.85	0.311	227	1.445	178.8	236.7	57.9	147.3	89.4	117.5	4.09
	11:40	8.60	5.98	0.313	226	1.472	179.9	238.5	58.6	148.5	89.9	118.6	4.07
	11:45	8.86	6.16	0.317	226	1.509	182.3	241.7	59.4	150.5	91.1	120.2	4.07
	11:50	9.12	6.34	0.320	225	1.545	184.0	244.2	60.2	152.2	92.0	121.5	4.06

Borehole No. : WCH-BH03 — **Sample Depth m:- 6.00 - 6.90**

Sample No. : 4 — **Specimen Depth m:- 6.50 - 6.70**

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 — **Works Order No.: 059**

Compiled by: W S Wat

Checked by: H W Chung

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2
Shearing Continuation

FAILURE CRITERION

Max. deviator Stress ☒ | Max. Stress ratio ☐ | Axial Strain % ☐

Stage :	1	Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
Date	Time	Dial		P.R.No. 24	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
16/12	11:55	9.33	6.49	0.322	224	1.575	185.0	245.8	60.8	153.3	92.5	122.5	4.04
	12:00	9.53	6.64	0.324	224	1.605	186.1	247.6	61.5	154.6	93.1	123.5	4.03
	12:05	9.93	6.91	0.328	222	1.659	188.3	251.0	62.7	156.8	94.1	125.5	4.00
	12:10	10.14	7.06	0.331	222	1.688	190.0	253.2	63.2	158.2	95.0	126.5	4.01
	12:15	10.42	7.25	0.335	221	1.725	192.3	256.3	64.0	160.2	96.2	128.1	4.00
	12:20	10.66	7.42	0.337	220	1.757	193.3	258.0	64.7	161.4	96.7	129.1	3.99
	12:25	10.91	7.59	0.340	220	1.790	195.0	260.4	65.4	162.9	97.5	130.4	3.98
	12:30	11.15	7.76	0.342	219	1.822	195.9	262.0	66.1	164.1	98.0	131.4	3.96
	12:35	11.47	7.98	0.345	218	1.863	197.5	264.2	66.7	165.4	98.7	132.5	3.96
	12:40	11.64	8.10	0.348	218	1.885	199.2	266.5	67.3	166.9	99.6	133.7	3.96
	12:45	11.92	8.30	0.350	217	1.921	200.1	268.2	68.1	168.2	100.1	134.8	3.94
	12:50	12.17	8.47	0.352	216	1.952	201.1	269.8	68.7	169.2	100.5	135.7	3.93
	12:55	12.34	8.59	0.353	216	1.974	201.5	270.7	69.2	169.9	100.7	136.4	3.91
	13:00	12.50	8.70	0.354	215	1.994	201.9	271.5	69.6	170.5	100.9	136.9	3.90
	13:05	12.79	8.90	0.356	215	2.029	202.7	273.1	70.4	171.8	101.4	138.0	3.88
	13:10	13.08	9.10	0.359	214	2.065	204.3	275.4	71.1	173.2	102.1	139.2	3.87
	13:15	13.35	9.29	0.361	213	2.098	205.2	276.9	71.7	174.3	102.6	140.1	3.86
	13:20	13.60	9.46	0.363	213	2.127	206.1	278.3	72.2	175.2	103.0	140.9	3.85
	13:25	13.92	9.69	0.367	212	2.167	208.2	281.2	73.0	177.1	104.1	142.4	3.85
	13:30	14.07	9.79	0.368	212	2.184	208.6	282.0	73.4	177.7	104.3	142.9	3.84
	13:35	14.29	9.95	0.370	211	2.211	209.6	283.5	73.9	178.7	104.8	143.8	3.84
	13:40	14.55	10.13	0.372	211	2.241	210.5	284.9	74.4	179.6	105.2	144.6	3.83
	13:45	14.84	10.33	0.375	210	2.274	211.9	287.0	75.1	181.1	106.0	145.7	3.82
	13:50	15.08	10.50	0.378	209	2.302	213.5	289.1	75.6	182.4	106.8	146.8	3.82
	13:55	15.30	10.65	0.380	209	2.327	214.4	290.4	76.0	183.2	107.2	147.5	3.82
	14:00	15.57	10.84	0.382	208	2.358	215.3	291.9	76.6	184.2	107.6	148.4	3.81
	14:05	15.86	11.03	0.384	208	2.389	216.1	293.3	77.2	185.2	108.0	149.2	3.80
	14:10	16.10	11.21	0.385	207	2.418	216.3	294.0	77.7	185.8	108.1	149.8	3.78
	14:15	16.46	11.46	0.388	207	2.457	217.6	296.1	78.5	187.3	108.8	151.0	3.77
	14:20	16.56	11.53	0.390	206	2.468	218.7	297.4	78.7	188.1	109.4	151.6	3.78
	14:25	16.81	11.70	0.391	206	2.495	218.9	298.1	79.2	188.7	109.5	152.2	3.76
	14:30	17.09	11.89	0.393	205	2.525	219.7	299.4	79.7	189.6	109.9	152.9	3.76
	14:35	17.31	12.04	0.394	205	2.548	220.0	300.2	80.2	190.2	110.0	153.5	3.74
	14:40	17.53	12.20	0.395	204	2.573	220.2	300.9	80.7	190.8	110.1	154.1	3.73
	14:45	17.77	12.37	0.396	204	2.599	220.4	301.5	81.1	191.3	110.2	154.6	3.72
	14:50	18.02	12.54	0.398	204	2.625	221.2	302.7	81.5	192.1	110.6	155.2	3.71
	14:55	18.26	12.71	0.399	202	2.651	221.4	304.1	82.7	193.4	110.7	156.5	3.68
	15:00	18.55	12.91	0.401	202	2.681	222.2	305.4	83.2	194.3	111.1	157.3	3.67
	15:05	18.76	13.05	0.402	201	2.702	222.4	306.0	83.6	194.8	111.2	157.7	3.66
	15:10	18.98	13.21	0.404	201	2.726	223.3	307.3	84.0	195.6	111.6	158.4	3.66
	15:15	19.27	13.41	0.405	201	2.756	223.4	307.9	84.5	196.2	111.7	159.0	3.64

Borehole No. : WCH-BH03 — **Sample Depth m:-** 6.00 - 6.90

Sample No. : 4 — **Specimen Depth m:-** 6.50 - 6.70

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 — **Works Order No.:** 059

Compiled by: W S Wat

Checked by: H W Chung

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GEOSPEC 3 : 2001 Test Method 15.2
Shearing Continuation

FAILURE CRITERION

Max. deviator Stress ☒ | Max. Stress ratio ☐ | Axial Strain % ☐

Stage :	1	Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
Date	Time	Dial		P.R.No. 24	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
16/12	15:20	19.55	13.61	0.406	200	2.786	223.5	308.5	85.0	196.7	111.7	159.5	3.63
	15:25	19.83	13.80	0.408	200	2.814	224.2	309.6	85.4	197.5	112.1	160.1	3.63
	15:30	20.02	13.93	0.410	198	2.833	225.1	311.8	86.7	199.3	112.6	161.7	3.60
	15:35	20.32	14.14	0.413	199	2.863	226.4	312.6	86.2	199.4	113.2	161.7	3.63
	15:40	20.54	14.29	0.415	198	2.885	227.3	313.9	86.6	200.2	113.6	162.4	3.62
	15:45	20.82	14.49	0.416	198	2.914	227.4	314.4	87.0	200.7	113.7	162.8	3.61
	15:50	21.15	14.72	0.417	198	2.947	227.4	314.7	87.3	201.0	113.7	163.1	3.60
	15:55	21.28	14.81	0.419	197	2.960	228.4	316.1	87.7	201.9	114.2	163.8	3.60
	16:00	21.57	15.01	0.421	197	2.989	229.0	317.2	88.2	202.7	114.5	164.5	3.60
	16:05	21.82	15.19	0.423	196	3.015	229.8	318.4	88.6	203.5	114.9	165.2	3.59
	16:10	22.02	15.32	0.423	196	3.033	229.4	318.3	88.9	203.6	114.7	165.4	3.58
	16:15	22.22	15.46	0.423	196	3.053	229.0	318.2	89.2	203.7	114.5	165.5	3.57
	16:20	22.47	15.64	0.424	195	3.079	229.1	318.7	89.6	204.2	114.6	166.0	3.56
	16:25	22.72	15.81	0.425	195	3.103	229.2	319.2	90.0	204.6	114.6	166.4	3.55
	16:30	22.98	15.99	0.427	195	3.128	230.0	320.3	90.3	205.3	115.0	167.0	3.55
	16:35	23.31	16.22	0.428	194	3.161	229.9	320.6	90.7	205.7	115.0	167.3	3.53
	16:40	23.56	16.40	0.429	194	3.186	230.0	321.1	91.1	206.1	115.0	167.8	3.52
	16:45	23.79	16.56	0.431	194	3.208	230.8	322.2	91.4	206.8	115.4	168.3	3.52
	16:50	24.02	16.72	0.432	193	3.231	230.9	322.6	91.7	207.2	115.5	168.7	3.52
	16:55	24.22	16.85	0.433	193	3.249	231.1	323.1	92.0	207.6	115.6	169.0	3.51
	17:00	24.50	17.05	0.434	193	3.277	231.2	323.5	92.3	207.9	115.6	169.4	3.50
	17:05	24.71	17.20	0.435	192	3.298	231.4	324.0	92.6	208.3	115.7	169.7	3.50
	17:10	24.98	17.39	0.436	192	3.325	231.4	324.3	92.9	208.6	115.7	170.0	3.49
	17:15	25.25	17.57	0.437	192	3.350	231.5	324.7	93.2	208.9	115.7	170.4	3.48
	17:20	25.56	17.79	0.439	192	3.381	232.0	325.5	93.5	209.5	116.0	170.8	3.48
	17:25	25.77	17.93	0.440	191	3.400	232.2	326.0	93.8	209.9	116.1	171.2	3.48
	17:30	26.00	18.10	0.442	191	3.424	232.9	327.0	94.1	210.6	116.5	171.7	3.48
	17:35	26.27	18.28	0.444	191	3.449	233.6	328.0	94.4	211.2	116.8	172.3	3.47
	17:40	26.47	18.42	0.446	190	3.469	234.4	329.0	94.6	211.8	117.2	172.7	3.48
	17:45	26.75	18.61	0.447	190	3.495	234.4	329.3	94.9	212.1	117.2	173.0	3.47
	17:50	26.97	18.77	0.447	190	3.518	233.9	329.0	95.1	212.1	117.0	173.1	3.46
	17:55	27.21	18.94	0.448	190	3.542	234.0	329.4	95.4	212.4	117.0	173.4	3.45
	18:00	27.48	19.12	0.448	189	3.567	233.4	329.1	95.7	212.4	116.7	173.5	3.44
	18:05	27.68	19.26	0.450	189	3.587	234.2	330.1	95.9	213.0	117.1	174.0	3.44
	18:10	28.03	19.50	0.451	189	3.621	234.1	330.3	96.2	213.2	117.0	174.2	3.43
	18:15	28.28	19.68	0.452	189	3.646	234.1	330.5	96.4	213.4	117.0	174.4	3.43
	18:20	28.42	19.78	0.453	188	3.660	234.4	331.0	96.6	213.8	117.2	174.7	3.43
	18:25	28.71	19.98	0.454	188	3.689	234.4	331.3	96.9	214.1	117.2	175.0	3.42
	18:30	**28.94**	**20.14**	**0.455**	**188**	**3.712**	**234.4**	**331.5**	**97.1**	**214.3**	**117.2**	**175.2**	**3.41**

Borehole No. : WCH-BH03 — **Sample Depth m:-** 6.00 - 6.90
Sample No. : 4 — **Specimen Depth m:-** 6.50 - 6.70

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 — **Works Order No.:** 059

Compiled by: W S Wat
Checked by: H W Chung

Form : GESR009.15 / Dec.19.04 / Issue 1 / Rev 1

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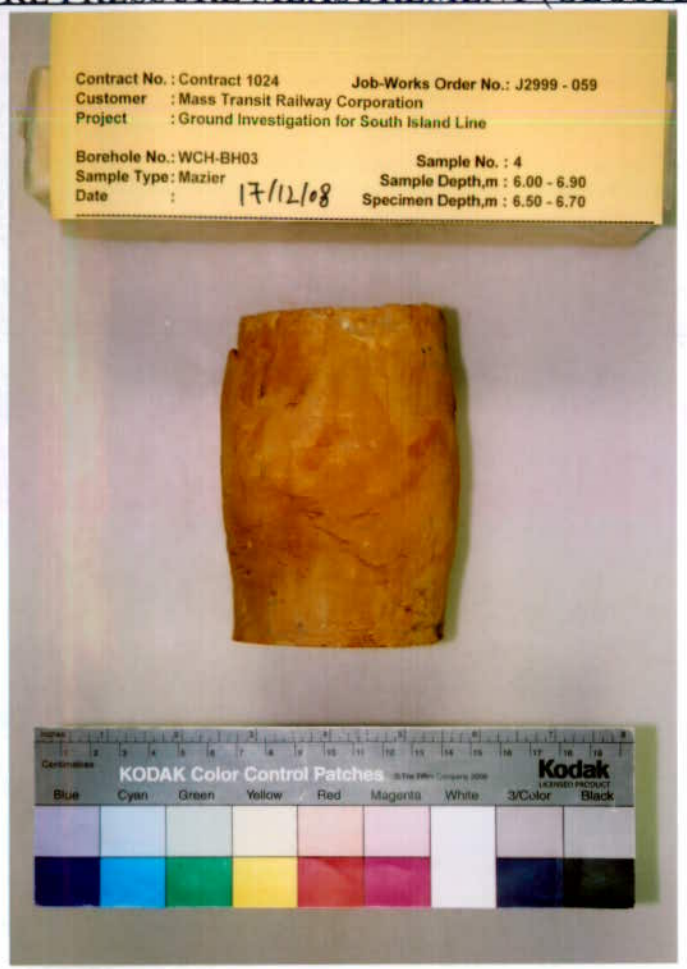
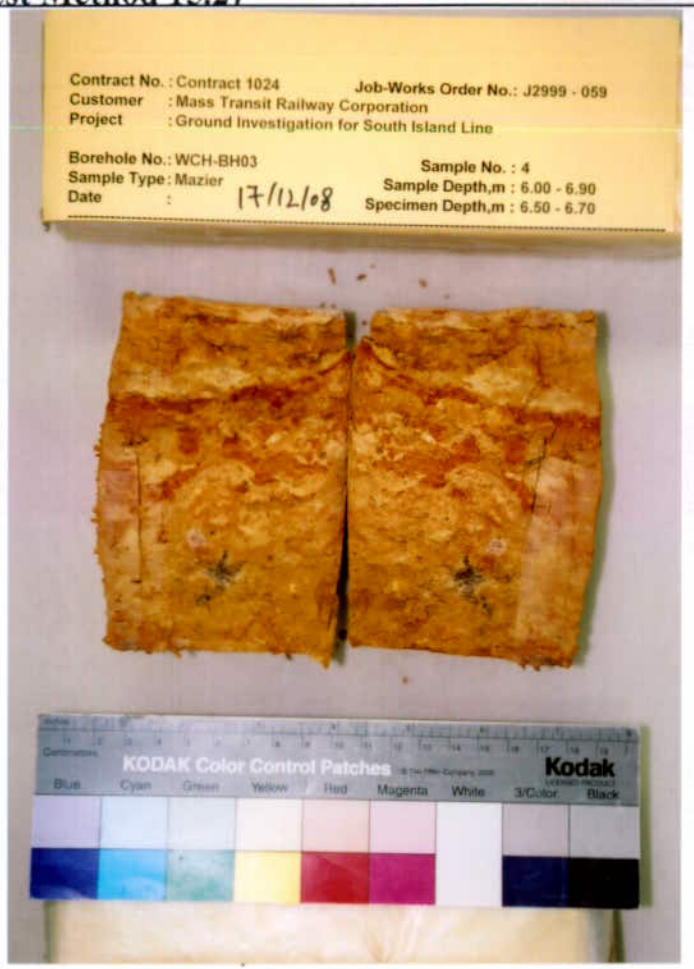
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT (GEOSPEC 3 : 2001 Test Method 15.2)





Description : Brown, gravelly, silty SAND **Sample Origin : HDT‡** ‡ Information provided by customer

Borehole No. : WCH-BH03 **Sample No. :** 4 **Sample Depth m:-** 6.00 - 6.90 **Specimen Depth m:-** 6.50 - 6.70

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line

Contract No. : Contract 1024
Job No. : J2999
Works Order No.: 059

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DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	WCH-BH03	WCH-BH03	WCH-BH03
Sample		no	4	4	4
Sample Type			Mazier	Mazier	Mazier
Stage		no	1	2	3
Sample Depth		m	6.00 - 6.90	6.00 - 6.90	6.00 - 6.90
Specimen Depth		m	6.70 - 6.90	6.70 - 6.90	6.70 - 6.90
INITIAL CONDITIONS					
Diameter	(D_o)	mm	73.7	74.3	74.9
Height	(H_o)	mm	145.0	140.3	135.8
Moisture Content	(W_o)	%	34	34	33
Bulk density	(ρ_o)	Mg/m^3	1.78	1.82	1.83
Dry density	(ρ_d)	Mg/m^3	1.33	1.35	1.37
Particle density	(ρ_s)		2.65	2.65	2.65
Voids Ratio	(e_o)		0.99	0.96	0.93
Degree of Saturation	(S_r)	%	89.7	95.0	94.8
DRAINAGE CONDITIONS			ONE END		
SATURATION					
Final Pore Pressure Coefficient B			1.00		
CONSOLIDATION					
Cell Pressure	(σ_3)	kPa	250	280	310
Back Pressure	(u_b)	kPa	220	220	220
Effective Pressure	(σ'_3)	kPa	30	60	90
Coefficient of Consolidation (t100) (C_{vi})		$m^2/Year$	170.78	242.89	440.62
Coefficient of Volume Compressibility (m_{vi})		m^2/MN	0.71	0.34	0.20
Coefficient of Permeability (k)		m/s	3.75E-08	2.54E-08	2.68E-08
COMPRESSION TERMINATION CRITERION			MAXIMUM STRESS RATIO		MAX ($\sigma'1 - \sigma'3$)
COMPRESSION - INITIAL					
Moisture Content	(w)	%	34	33	32
Pore Pressure at the End of Consolidation		kPa	220	220	220
Effective Stress at the End of Consolidation		kPa	30	60	90
Bulk density	(ρ_o)	Mg/m^3	1.82	1.83	1.84
Dry density	(ρ_d)	Mg/m^3	1.35	1.37	1.39
Voids Ratio	(e)		0.96	0.93	0.90
Degree of Saturation	(S_r)	%	95.0	94.8	94.7

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Report No. : J2999-059.11
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.:** 059

Technician : W S Wat Checked By : Approved By :
Name : H W Chung Signatory : **Lau Wai Cheong**
Tested Date: 09/12/2008 Date : 19/12/2008 Date : 19/12/2008

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	WCH-BH03	WCH-BH03	WCH-BH03
Sample		no	4	4	4
Sample Type			Mazier	Mazier	Mazier
Stage		no	1	2	3
Sample Depth		m	6.00 - 6.90	6.00 - 6.90	6.00 - 6.90
Specimen Depth		m	6.70 - 6.90	6.70 - 6.90	6.70 - 6.90
COMPRESSION - FAILURE					
Cell Pressure		kPa	250	280	310
Rate of Strain		mm/min	0.048	0.046	0.045
CONDITIONS AT MAXIMUM STRESS RATIO					
Major Effective Principal Stress (σ'_1)		kPa	95	161	224
Corrected Deviator Stress ($\sigma'_1 - \sigma'_3$)		kPa	78	125	169
Minor Effective Principal Stress (σ'_3)		kPa	18	36	55
$s' = (\sigma'_1 + \sigma'_3)/2$		kPa	56	99	140
$t = (\sigma_1 - \sigma_3)/2$		kPa	39	62	84
Expanded Uncertainty of s' ^		kPa	-	-	-
Expanded Uncertainty of t ^		kPa	-	-	-
Pore pressure parameter A_f			0.16	0.19	0.21
Strain at Failure	(εf)	%	2.5	5.6	8.8
COMPRESSION - FINAL					
Moisture Content	(W_f)	%	34	33	32
Bulk density	(ρ_o)	Mg/m^3	1.82	1.83	1.84
Dry density	(ρ_d)	Mg/m^3	1.35	1.37	1.39
Voids Ratio	(e_f)		0.96	0.93	0.90
Degree of Saturation	(S_f)	%	95.0	94.8	94.7

Notes -
1. The method of specimen preparation was in accordance with GEOSPEC 3 : 2001 :- Test method 13.3 : test specimen from undisturbed soil samples.
2. Sample received date :29/09/2008
3. The determination of moisture content was in accordance with test method 5.1 of GEOSPEC 3 : 2001.
4. Particle density : 2.65 (Assumed)
5. Maximum and minimum temperature recorded over the period of testing 19.9 - 20.7 °C.
6. Unavoidable variations from specified procedure : none
7. Comment on observed or inferred sample disturbance : none
8. Percentage by mass of soil particles larger than 1/5 of the diameter of specimen (%) : Nil
9. The specimen was selected by the laboratory.
   Name : W S Wat Designation : Senior Laboratory Technician
10. Sampling History : As Received

* Delete as appropriate ^ Upon request

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.: 059**

Compiled by W S Wat
Checked by H W Chung

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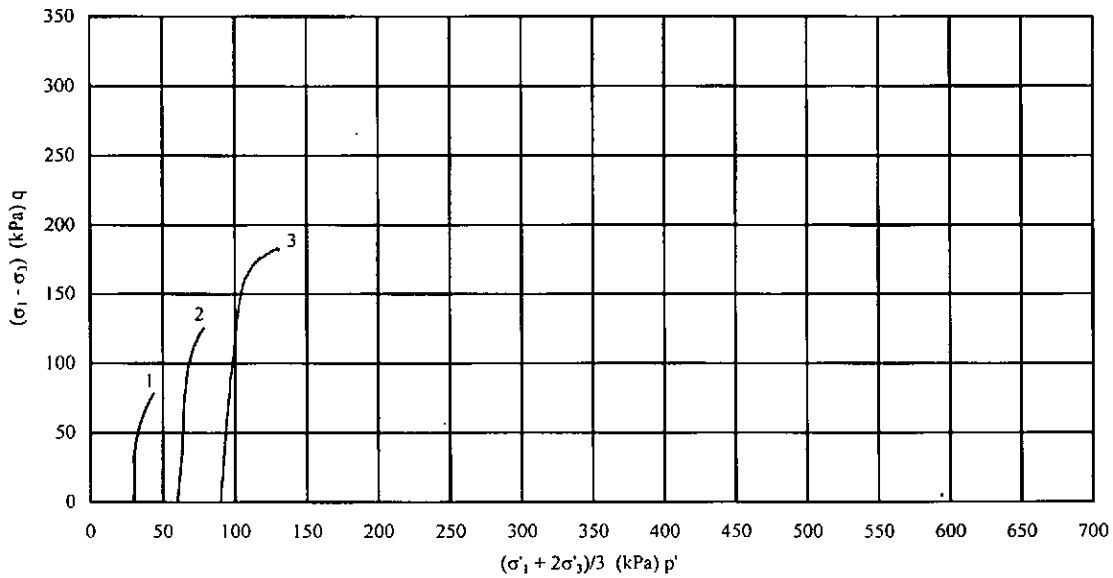
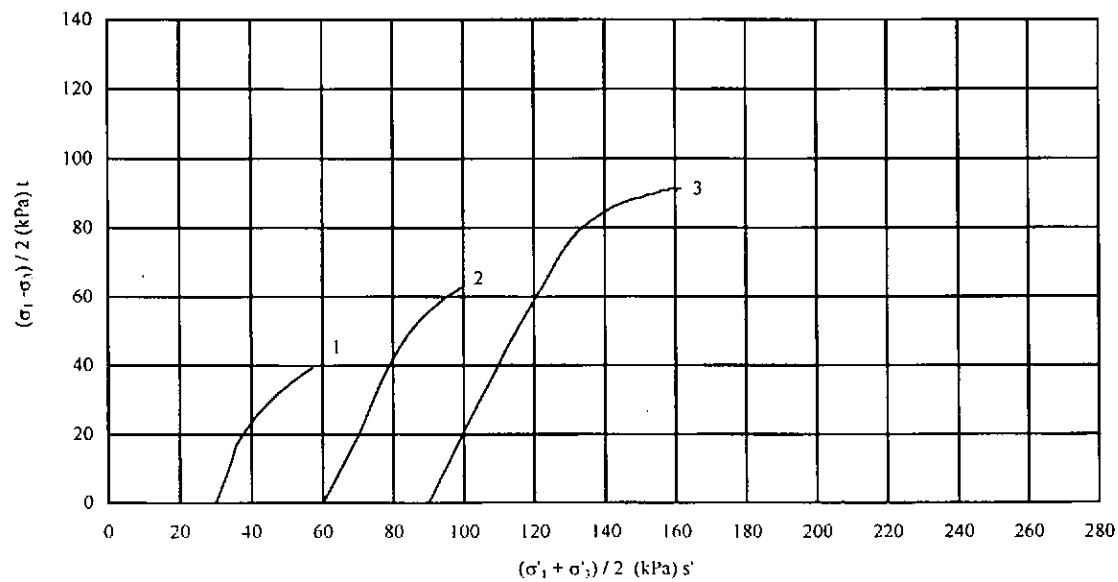
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

STRESS PATH PARAMETERS FOR EFFECTIVE STRESS

p' - q PLOT



s' - t PLOT



Borehole No. : WCH-BH03 **Sample Depth m:-** 6.00 - 6.90

Sample No. : 4 **Specimen Depth m:-** 6.70 - 6.90

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.:** 059

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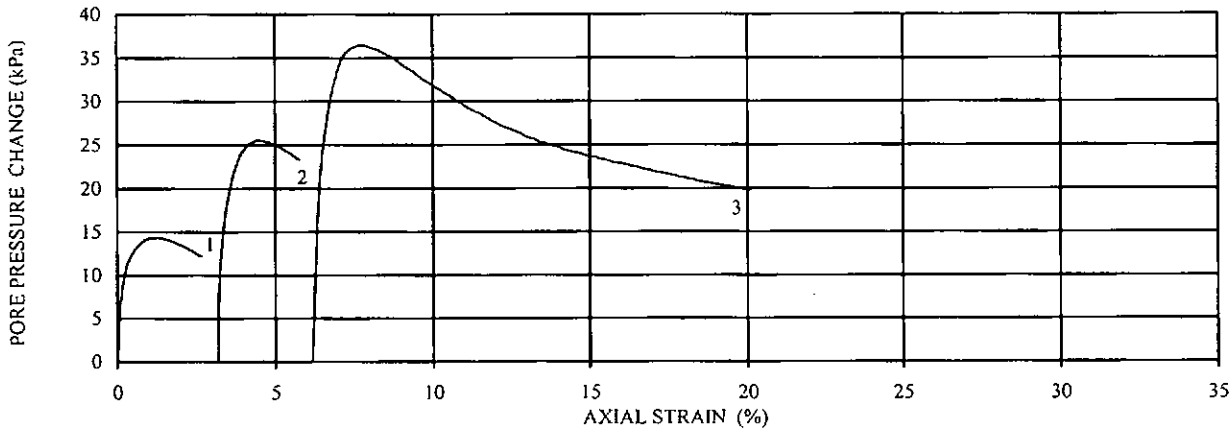
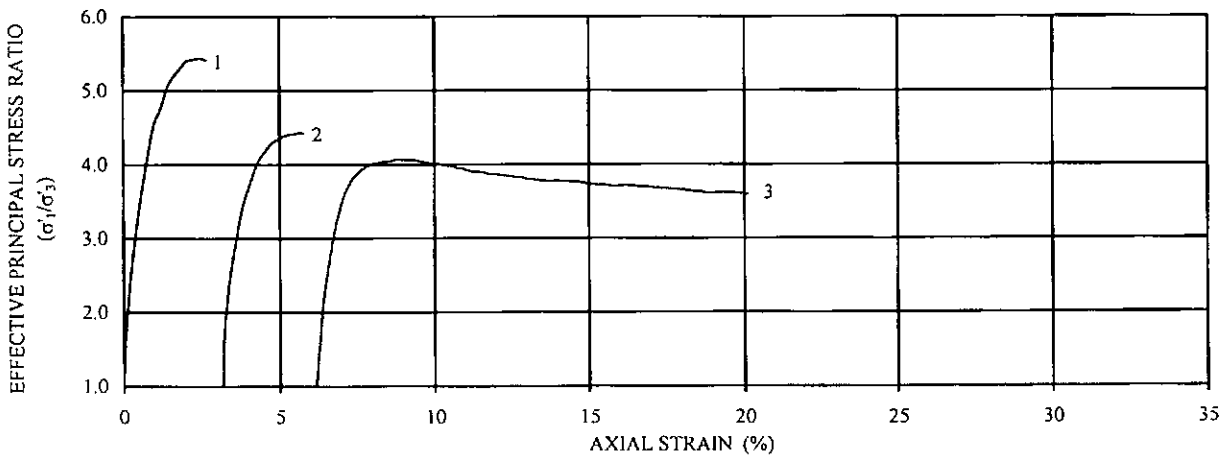
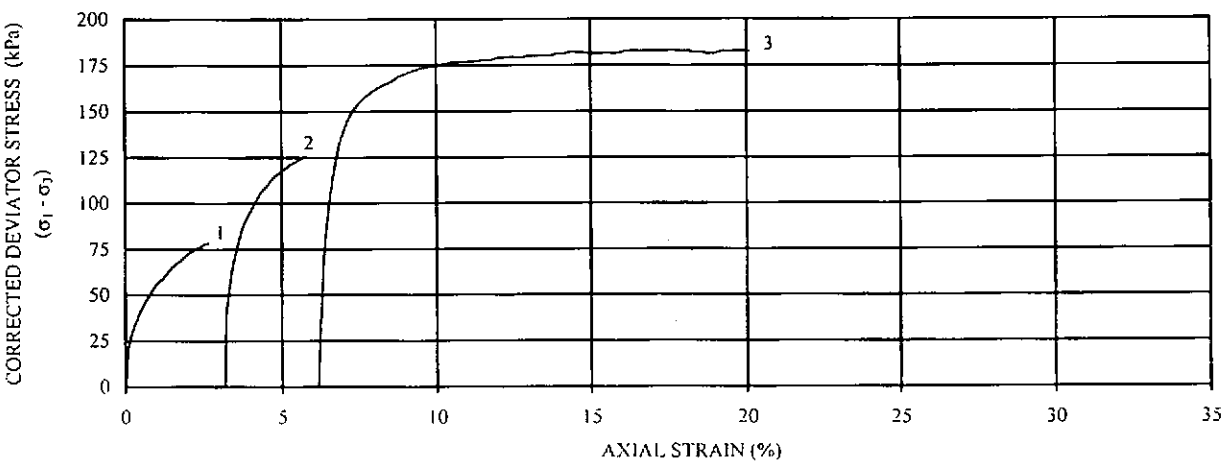
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

COMPRESSION







Borehole No. : WCH-BH03	**Sample Depth m:-** 6.00 - 6.90
Sample No. : 4	**Specimen Depth m:-** 6.70 - 6.90
Customer : Mass Transit Railway Corporation	Compiled by W S Wat
Project : Ground Investigation for South Island Line	
Contract No.: Contract 1024	Checked by H W Chung
Job No.: J2999	**Works Order No.:** 059

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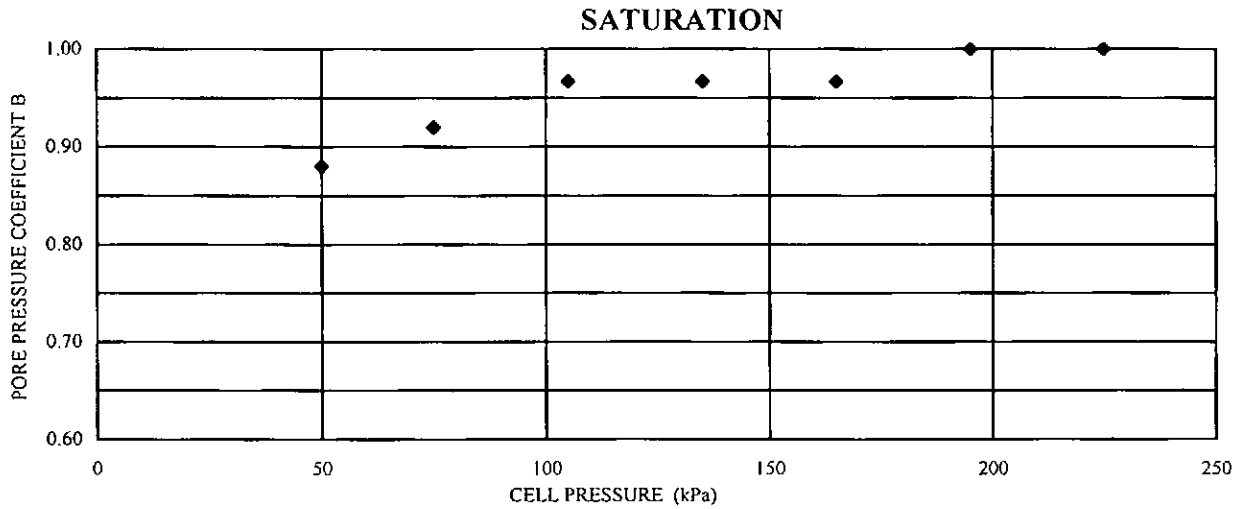
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2



Date	Time	Cell Pressure kPa	Back Pressure kPa	Pore Pressure kPa	Cumulative Volume of Water cm^3	Pore Pressure Parameter B
10/12/2008	15:06	0	0	-	0.0	
	15:16	25	-	23		-
11/12/2008	08:36	25	20	20	-0.4	
	08:45	50	-	42		0.88
	09:07	50	45	45	0.0	
	09:13	75	-	68		0.92
	09:32	75	70	70	0.2	
	09:40	105	-	99		0.97
	10:07	105	100	100	1.2	
	10:15	135	-	129		0.97
	11:06	135	130	130	2.1	
	11:14	165	-	159		0.97
	12:08	165	160	160	2.8	
	12:20	195	-	190		1.00
	13:26	195	190	190	11.9	
	13:40	225	-	220		1.00
12/12/2008	08:35	225	220	220	16.7	

Borehole No. : WCH-BH03 **Sample Depth m:-** 6.00 - 6.90
Sample No. : 4 **Specimen Depth m:-** 6.70 - 6.90
Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.:** 059

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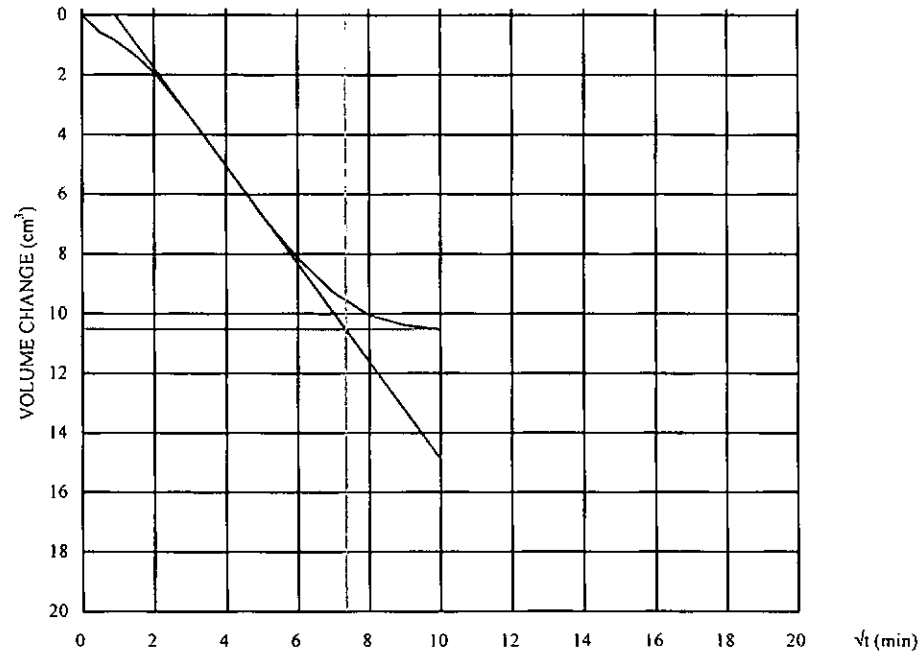
TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

CONSOLIDATION (DRAINED PHASE) - Stage 1

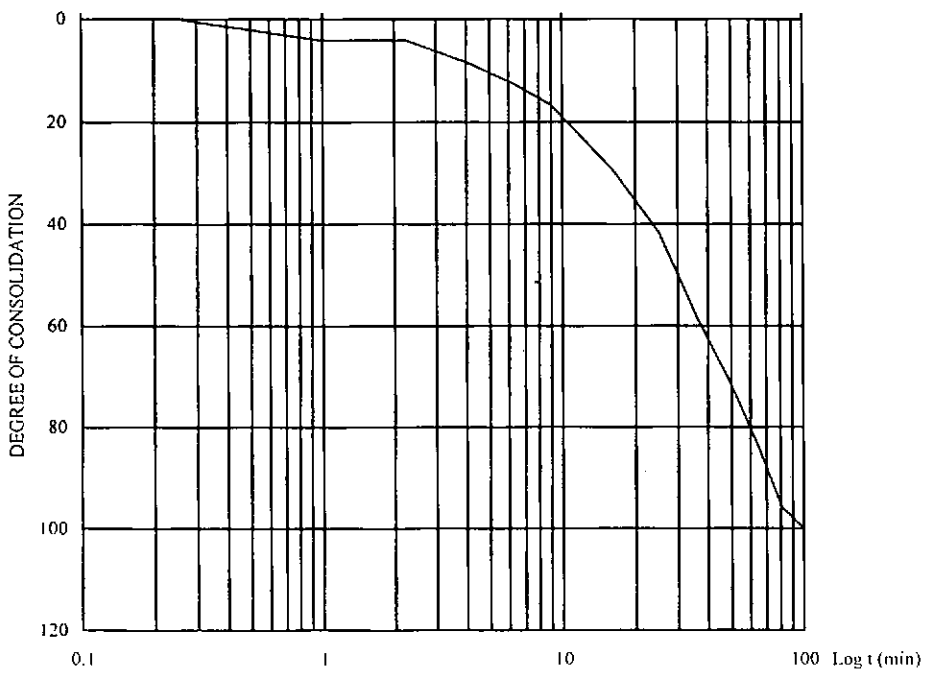


√t100 7.34 min

t100 53.89 min

tf 28.56 min

Calc. strain rate
0.353 mm/min



Borehole No. : WCH-BH03 **Sample Depth m:-** 6.00 - 6.90

Sample No. : 4 **Specimen Depth m:-** 6.70 - 6.90

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.:** 059

Complied by: W S Wat

Checked by: H W Chung

Form : GESR009.13 / Jun.02.03 / Issue 1 / Rev 0

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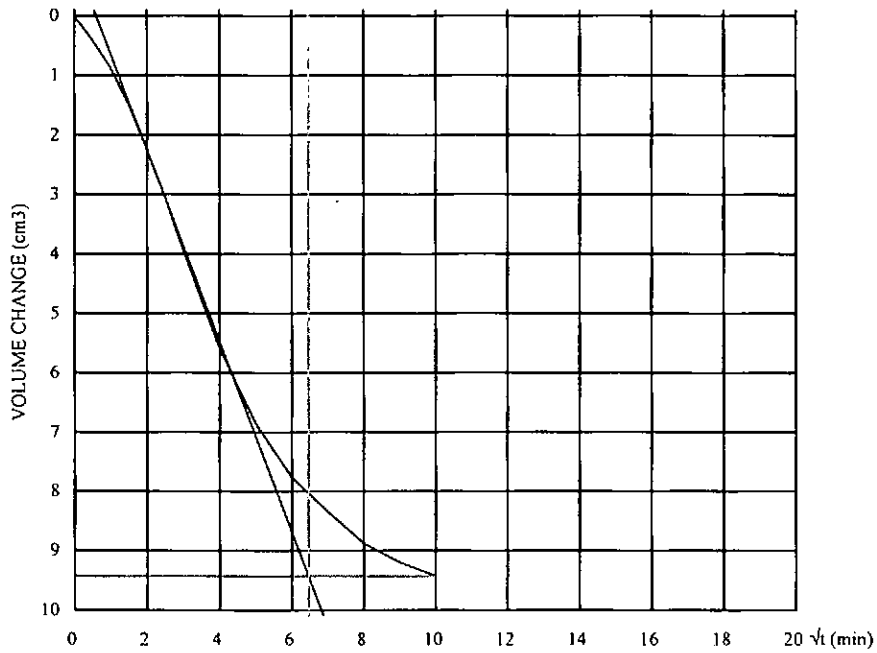
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

CONSOLIDATION (DRAINED PHASE) - Stage 2

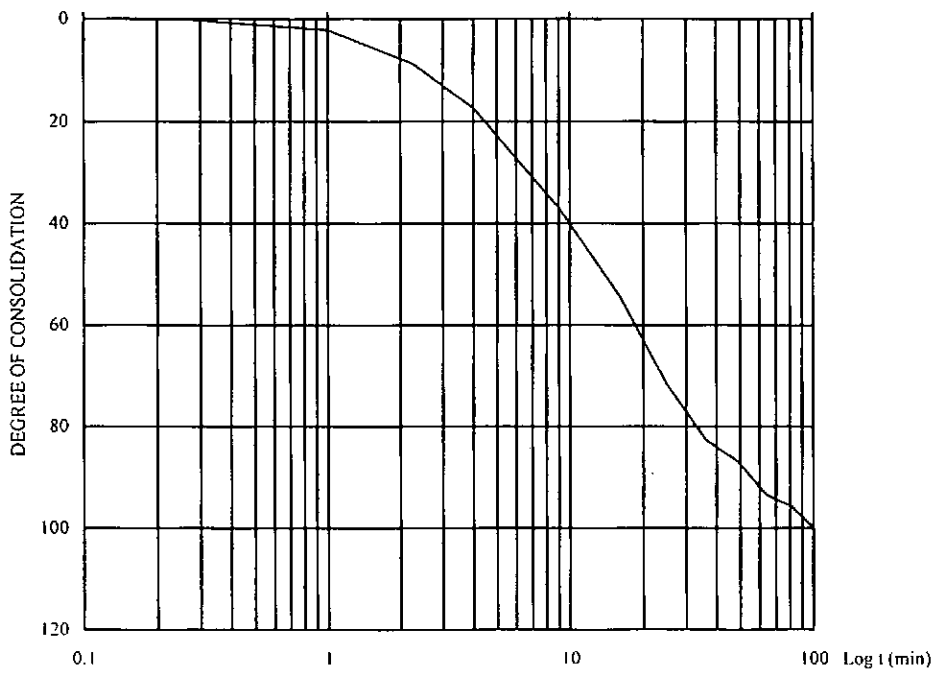


√t100 6.46 min

t100 41.76 min

tf 22.14 min

Calc. strain rate
0.441 mm/min



Borehole No. : WCH-BH03 Sample Depth m:- 6.00 - 6.90

Sample No. : 4 Specimen Depth m:- 6.70 - 6.90

Customer : Mass Transit Railway Corporation		Complied by
Project : Ground Investigation for South Island Line		W S Wat
	Contract No.: Contract 1024	Checked by
Job No.: J2999	Works Order No.: 059	H W Chung

Form : GESR009.13 / Jun.02.03 / Issue 1 / Rev 0

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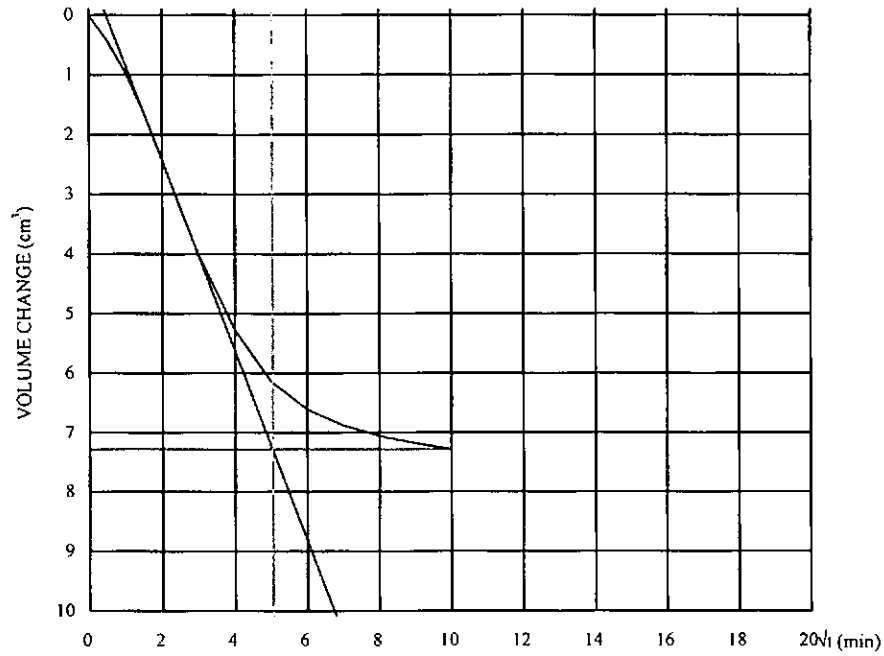
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

CONSOLIDATION (DRAINED PHASE) - Stage 3

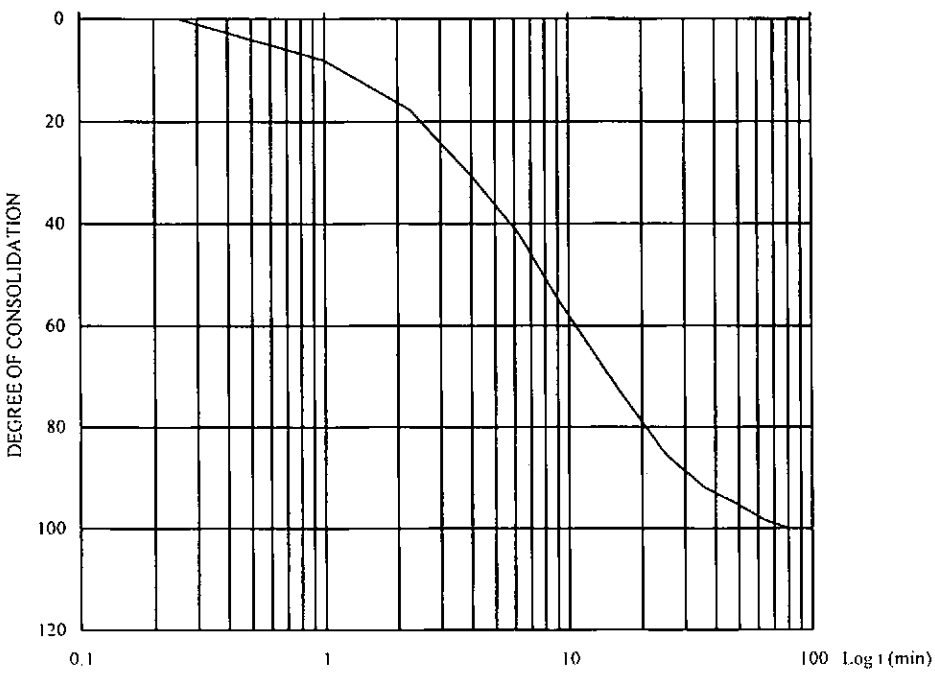


√t100 5.04 min

t100 25.42 min

tf 13.47 min

Calc. strain rate
0.703 mm/min



Borehole No. : WCH-BH03 **Sample Depth m:-** 6.00 - 6.90

Sample No. : 4 **Specimen Depth m:-** 6.70 - 6.90

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.:** 059

Complied by: W S Wat

Checked by: H W Chung

Form : GESR009.13 / Jun.02.03 / Issue 1 / Rev 0

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Multi Stage		P.W.P,B.P			Effective Pressure	30	kPa
Side drains	No	Selected Machine Speed	0.048	mm/min	Rate of Strain	2.00	% per hr

FAILURE CRITERION

Max. deviator Stress	☐	Max. Stress ratio	☒		Axial Strain %		☐
Stage : 1	Applied Pressure (kPa) - Cell :	250	Back :	220	P.R. factor	1.7257	kN/mm

Date	Time	Strain Dial	Strain	Load P.R.No. 35	Pore Pressure	Dev. stress Corr.	Dev. stress q $\sigma_1 - \sigma_3$	Effective Stress σ'_1	Effective Stress σ'_3	s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio σ'_1/σ'_3
		mm	%	mm	kPa	kPa				2	2	3	
12/12	10:30	0.00	0.00	0.072	220	0.000	0.0	30.0	30.0	30.0	0.0	30.0	1.00
	10:35	0.15	0.11	0.126	227	0.032	22.1	45.1	23.0	34.0	11.0	30.4	1.96
	10:40	0.41	0.28	0.151	231	0.081	32.2	51.5	19.3	35.4	16.1	30.0	2.67
	10:45	0.60	0.41	0.166	232	0.118	38.2	56.2	18.0	37.1	19.1	30.7	3.12
	10:50	0.82	0.57	0.180	233	0.164	43.8	60.8	17.0	38.9	21.9	31.6	3.58
	10:55	1.06	0.74	0.193	234	0.211	49.0	65.3	16.3	40.8	24.5	32.6	4.00
	11:00	1.27	0.88	0.203	234	0.250	52.9	68.8	15.9	42.4	26.5	33.5	4.33
	11:05	1.48	1.03	0.212	234	0.292	56.4	72.1	15.7	43.9	28.2	34.5	4.59
	11:10	1.72	1.19	0.218	234	0.335	58.7	74.4	15.7	45.1	29.4	35.3	4.74
	11:15	2.01	1.39	0.229	234	0.390	63.0	78.7	15.7	47.2	31.5	36.7	5.01
	11:20	2.19	1.52	0.235	234	0.424	65.3	81.1	15.8	48.4	32.6	37.6	5.13
	11:25	2.43	1.68	0.241	234	0.467	67.6	83.6	16.0	49.8	33.8	38.5	5.22
	11:30	2.65	1.84	0.247	234	0.509	69.8	86.0	16.2	51.1	34.9	39.5	5.31
	11:35	2.90	2.01	0.254	234	0.553	72.5	89.0	16.5	52.7	36.2	40.7	5.39
	11:40	3.14	2.18	0.259	233	0.597	74.3	91.1	16.8	53.9	37.1	41.6	5.42
	11:45	3.38	2.35	0.263	233	0.640	75.7	92.8	17.1	55.0	37.9	42.3	5.43
	11:50	**3.62**	**2.51**	**0.268**	**233**	**0.681**	**77.5**	**95.0**	**17.5**	**56.3**	**38.8**	**43.3**	**5.43**
	11:55	3.85	2.67	0.271	232	0.721	78.6	96.4	17.8	57.1	39.3	44.0	5.41

Borehole No. :	**WCH-BH03**	**Sample Depth m:- 6.00 - 6.90**	
Sample No. :	**4**	**Specimen Depth m:- 6.70 - 6.90**	
Customer :	**Mass Transit Railway Corporation**		Compiled by W S Wat
Project :	**Ground Investigation for South Island Line**		
		Contract No.: Contract 1024	Checked by H W Chung
Job No.:	**J2999**	**Works Order No.: 059**	

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TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Gammon

HKAS HOKLAS 055

Multi Stage			P.W.P,B.P					Effective Pressure	60				kPa
Side drains	No		Selected Machine Speed		0.046		mm/min	Rate of Strain	1.98				% per hr
FAILURE CRITERION													
Max. deviator Stress			☐	Max. Stress ratio			☒	Axial Strain %					☐
Stage :	2	Applied Pressure (kPa) - Cell :			280	Back :	220	P.R. factor		1.7257			kN/mm

Date	Time	Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
		Dial		P.R.No. 35	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
15/12	08:35	4.58	3.18	0.109	220	0.000	0.0	60.0	60.0	60.0	0.0	60.0	1.00
	08:40	4.66	3.23	0.204	229	0.858	37.4	88.3	50.9	69.6	18.7	63.4	1.73
	08:45	4.88	3.39	0.263	236	0.897	61.0	105.1	44.1	74.6	30.5	64.4	2.38
	08:50	5.08	3.53	0.292	239	0.930	72.5	113.3	40.8	77.0	36.2	65.0	2.78
	08:55	5.30	3.67	0.316	242	0.963	82.0	120.5	38.5	79.5	41.0	65.8	3.13
	09:00	5.46	3.79	0.331	243	0.991	87.8	125.0	37.2	81.1	43.9	66.5	3.36
	09:05	5.67	3.93	0.345	244	1.024	93.3	129.3	36.0	82.6	46.6	67.1	3.59
	09:10	5.96	4.13	0.361	245	1.070	99.4	134.5	35.1	84.8	49.7	68.2	3.83
	09:15	6.14	4.26	0.372	245	1.099	103.6	138.3	34.7	86.5	51.8	69.2	3.99
	09:20	6.35	4.41	0.381	246	1.133	107.0	141.5	34.5	88.0	53.5	70.2	4.10
	09:25	6.55	4.54	0.388	246	1.163	109.6	144.1	34.5	89.3	54.8	71.0	4.18
	09:30	6.77	4.70	0.397	245	1.198	112.9	147.5	34.6	91.1	56.5	72.2	4.26
	09:35	6.96	4.83	0.403	245	1.227	115.1	149.8	34.7	92.3	57.6	73.1	4.32
	09:40	7.19	4.99	0.409	245	1.262	117.3	152.3	35.0	93.6	58.6	74.1	4.35
	09:45	7.39	5.13	0.414	245	1.292	119.0	154.2	35.2	94.7	59.5	74.9	4.38
	09:50	7.63	5.29	0.420	244	1.327	121.2	156.8	35.6	96.2	60.6	76.0	4.40
	09:55	7.86	5.45	0.424	244	1.361	122.5	158.4	35.9	97.1	61.2	76.7	4.41
	10:00	**8.13**	**5.64**	**0.430**	**244**	**1.401**	**124.6**	**161.0**	**36.4**	**98.7**	**62.3**	**77.9**	**4.42**
	10:05	8.31	5.77	0.433	243	1.428	125.5	162.2	36.7	99.5	62.8	78.5	4.42

Borehole No. :	**WCH-BH03**	**Sample Depth m:- 6.00 - 6.90**	
Sample No. :	**4**	**Specimen Depth m:- 6.70 - 6.90**	
Customer :	**Mass Transit Railway Corporation**		Compiled by
Project :	**Ground Investigation for South Island Line**		W S Wat
		Contract No.: Contract 1024	Checked by
Job No.:	**J2999**	**Works Order No.: 059**	H W Chung

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Form : GESR009.14 / Dec 13.04 / Issue 1 / Rev 1

TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Gammon

Multi Stage			P.W.P,B.P					Effective Pressure	90				kPa
Side drains	No		Selected Machine Speed		0.045		mm/min	Rate of Strain	2.00				% per hr
FAILURE CRITERION													
Max. deviator Stress		☐	Max. Stress ratio			☒		Axial Strain %					☐
Stage :	3	Applied Pressure (kPa) - Cell :		310	Back :	220		P.R. factor	1.7257				kN/mm

Date	Time	Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
		Dial		P.R.No. 35	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
16/12	08:35	8.87	6.15	0.136	220	0.000	0.0	90.0	90.0	90.0	0.0	90.0	1.00
	08:40	9.06	6.29	0.270	233	1.535	51.3	128.0	76.7	102.4	25.7	93.8	1.67
	08:45	9.19	6.37	0.333	239	1.551	76.1	146.9	70.8	108.8	38.0	96.2	2.07
	08:50	9.33	6.47	0.374	243	1.571	92.1	158.7	66.6	112.7	46.1	97.3	2.38
	08:55	9.50	6.59	0.414	247	1.595	107.7	170.9	63.2	117.1	53.9	99.1	2.70
	09:00	9.72	6.74	0.454	250	1.625	123.2	183.1	59.9	121.5	61.6	101.0	3.06
	09:05	9.93	6.89	0.482	253	1.655	134.0	191.5	57.5	124.5	67.0	102.2	3.33
	09:10	10.14	7.04	0.502	254	1.684	141.5	197.3	55.8	126.6	70.8	103.0	3.54
	09:15	10.35	7.18	0.517	255	1.711	147.2	201.9	54.7	128.3	73.6	103.8	3.69
	09:20	10.58	7.34	0.529	256	1.742	151.6	205.7	54.1	129.9	75.8	104.6	3.80
	09:25	10.77	7.47	0.536	256	1.767	154.0	207.8	53.8	130.8	77.0	105.1	3.86
	09:30	10.98	7.62	0.544	256	1.795	156.9	210.5	53.6	132.0	78.4	105.9	3.93
	09:35	11.13	7.72	0.548	256	1.814	158.2	211.8	53.6	132.7	79.1	106.3	3.95
	09:40	11.36	7.88	0.554	256	1.844	160.3	213.9	53.6	133.7	80.1	107.0	3.99
	09:45	11.58	8.03	0.559	256	1.872	161.9	215.7	53.8	134.7	80.9	107.8	4.01
	09:50	11.92	8.27	0.566	256	1.916	164.1	218.2	54.1	136.2	82.1	108.8	4.03
	09:55	12.14	8.42	0.570	256	1.943	165.4	219.8	54.4	137.1	82.7	109.5	4.04
	10:00	12.32	8.55	0.573	255	1.967	166.3	220.9	54.6	137.7	83.1	110.0	4.05
	10:05	**12.65**	**8.78**	**0.581**	**255**	**2.008**	**168.9**	**224.0**	**55.1**	**139.5**	**84.4**	**111.4**	**4.06**
	10:10	12.77	8.86	0.583	255	2.022	169.5	224.8	55.3	140.0	84.7	111.8	4.06
	10:15	13.04	9.04	0.587	254	2.054	170.6	226.4	55.8	141.1	85.3	112.7	4.06
	10:20	13.22	9.17	0.590	254	2.077	171.5	227.6	56.1	141.9	85.8	113.3	4.06
	10:25	13.43	9.32	0.593	254	2.103	172.4	228.8	56.4	142.6	86.2	113.9	4.06
	10:30	13.64	9.47	0.596	253	2.129	173.2	230.0	56.8	143.4	86.6	114.5	4.05
	10:35	13.84	9.61	0.598	253	2.153	173.7	230.9	57.2	144.0	86.8	115.1	4.04
	10:40	14.06	9.76	0.600	252	2.179	174.1	231.7	57.6	144.6	87.0	115.6	4.02
	10:45	14.28	9.91	0.602	252	2.204	174.5	232.4	57.9	145.2	87.3	116.1	4.01
	10:50	14.54	10.09	0.605	252	2.234	175.3	233.6	58.3	145.9	87.6	116.7	4.01
	10:55	14.79	10.26	0.607	251	2.263	175.7	234.4	58.7	146.5	87.8	117.3	3.99
	11:00	14.99	10.40	0.609	251	2.286	176.1	235.1	59.0	147.1	88.1	117.7	3.99
	11:05	15.27	10.59	0.611	251	2.317	176.5	235.9	59.4	147.6	88.2	118.2	3.97
	11:10	15.46	10.73	0.612	250	2.340	176.6	236.4	59.8	148.1	88.3	118.7	3.95
	11:15	15.74	10.92	0.614	250	2.371	176.9	237.1	60.2	148.6	88.4	119.2	3.94
	11:20	15.96	11.08	0.615	249	2.397	176.9	237.5	60.6	149.1	88.5	119.6	3.92
	11:25	16.19	11.23	0.616	249	2.421	177.0	237.9	60.9	149.4	88.5	119.9	3.91
	11:30	16.42	11.39	0.618	249	2.446	177.3	238.5	61.2	149.9	88.7	120.3	3.90
	11:35	16.64	11.54	0.620	249	2.470	177.8	239.2	61.4	150.3	88.9	120.7	3.90
	11:40	16.82	11.67	0.621	248	2.490	177.9	239.6	61.7	150.6	88.9	121.0	3.88
	11:45	17.07	11.84	0.623	248	2.517	178.2	240.3	62.1	151.2	89.1	121.5	3.87

Borehole No. :	**WCH-BH03**	**Sample Depth m:- 6.00 - 6.90**	
Sample No. :	4	**Specimen Depth m:- 6.70 - 6.90**	
Customer :	**Mass Transit Railway Corporation**		Compiled by
Project :	**Ground Investigation for South Island Line**		W S Wat
		Contract No.: Contract 1024	Checked by
Job No.:	**J2999**	**Works Order No.: 059**	H W Chung

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TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2
Shearing Continuation

Gammon

HKLAS 059

FAILURE CRITERION

Max. deviator Stress ☐ | Max. Stress ratio ☒ | Axial Strain % ☐

Stage :	3	Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
Date	Time	Dial		P.R.No. 35	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
16/12	11:50	17.30	12.00	0.626	248	2.542	179.0	241.4	62.4	151.9	89.5	122.1	3.87
	11:55	17.49	12.14	0.627	247	2.564	179.1	241.8	62.7	152.2	89.5	122.4	3.86
	12:00	17.67	12.26	0.628	247	2.582	179.1	242.0	62.9	152.5	89.6	122.6	3.85
	12:05	18.02	12.50	0.630	247	2.619	179.3	242.5	63.2	152.9	89.7	123.0	3.84
	12:10	18.20	12.63	0.630	247	2.639	179.1	242.5	63.4	152.9	89.5	123.1	3.82
	12:15	18.45	12.80	0.632	246	2.665	179.4	243.0	63.6	153.3	89.7	123.4	3.82
	12:20	18.67	12.95	0.634	246	2.687	179.8	243.8	64.0	153.9	89.9	123.9	3.81
	12:25	18.90	13.11	0.635	246	2.711	179.8	244.0	64.2	154.1	89.9	124.1	3.80
	12:30	19.13	13.27	0.636	246	2.735	179.8	244.2	64.4	154.3	89.9	124.3	3.79
	12:35	19.36	13.43	0.638	245	2.759	180.2	244.9	64.7	154.8	90.1	124.8	3.78
	12:40	19.59	13.59	0.639	245	2.783	180.2	245.0	64.8	154.9	90.1	124.9	3.78
	12:45	19.86	13.78	0.641	245	2.811	180.5	245.5	65.0	155.2	90.2	125.2	3.78
	12:50	20.10	13.94	0.644	245	2.834	181.2	246.4	65.2	155.8	90.6	125.6	3.78
	12:55	20.26	14.06	0.645	245	2.852	181.3	246.6	65.3	156.0	90.7	125.7	3.78
	13:00	20.41	14.16	0.646	245	2.866	181.4	246.9	65.5	156.2	90.7	126.0	3.77
	13:05	20.69	14.35	0.649	244	2.894	182.1	247.8	65.7	156.7	91.0	126.4	3.77
	13:10	20.95	14.53	0.650	244	2.920	182.0	247.9	65.9	156.9	91.0	126.6	3.76
	13:15	21.20	14.71	0.651	244	2.946	182.0	248.0	66.0	157.0	91.0	126.7	3.76
	13:20	21.43	14.87	0.651	244	2.969	181.6	247.8	66.2	157.0	90.8	126.7	3.74
	13:25	21.73	15.07	0.652	244	2.998	181.5	247.9	66.4	157.1	90.7	126.9	3.73
	13:30	21.87	15.17	0.652	244	3.012	181.3	247.7	66.4	157.0	90.6	126.8	3.73
	13:35	22.07	15.31	0.653	243	3.032	181.3	247.9	66.6	157.2	90.6	127.0	3.72
	13:40	22.30	15.47	0.655	243	3.055	181.6	248.3	66.7	157.5	90.8	127.2	3.72
	13:45	22.55	15.65	0.656	243	3.080	181.6	248.5	66.9	157.7	90.8	127.4	3.71
	13:50	22.76	15.79	0.656	243	3.100	181.2	248.2	67.0	157.6	90.6	127.4	3.70
	13:55	22.96	15.93	0.659	243	3.120	182.0	249.1	67.1	158.1	91.0	127.8	3.71
	14:00	23.20	16.10	0.662	243	3.144	182.6	249.8	67.2	158.5	91.3	128.1	3.72
	14:05	23.46	16.28	0.664	243	3.169	182.9	250.3	67.4	158.9	91.5	128.4	3.71
	14:10	23.69	16.43	0.665	243	3.190	182.9	250.4	67.5	159.0	91.5	128.5	3.71
	14:15	24.03	16.67	0.666	242	3.224	182.7	250.4	67.7	159.0	91.3	128.6	3.70
	14:20	24.13	16.74	0.667	242	3.234	182.9	250.7	67.8	159.2	91.4	128.8	3.70
	14:25	24.36	16.90	0.668	242	3.256	182.8	250.7	67.9	159.3	91.4	128.8	3.69
	14:30	24.62	17.08	0.669	242	3.281	182.8	250.9	68.1	159.5	91.4	129.0	3.68
	14:35	24.82	17.22	0.670	242	3.301	182.8	251.0	68.2	159.6	91.4	129.1	3.68
	14:40	25.04	17.37	0.671	242	3.322	182.8	251.1	68.3	159.7	91.4	129.2	3.68
	14:45	25.27	17.53	0.673	242	3.344	183.1	251.5	68.4	159.9	91.5	129.4	3.68
	14:50	25.49	17.68	0.674	242	3.365	183.1	251.6	68.5	160.0	91.5	129.5	3.67
	14:55	25.71	17.84	0.674	241	3.388	182.7	251.4	68.7	160.1	91.4	129.6	3.66
	15:00	25.98	18.03	0.675	241	3.414	182.6	251.4	68.8	160.1	91.3	129.7	3.65
	15:05	26.17	18.16	0.676	241	3.432	182.6	251.5	68.9	160.2	91.3	129.8	3.65
	15:10	26.38	18.30	0.676	241	3.452	182.3	251.3	69.0	160.1	91.1	129.8	3.64

Borehole No. : WCH-BH03 — **Sample Depth m:- 6.00 - 6.90**

Sample No. : 4 — **Specimen Depth m:- 6.70 - 6.90**

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 — **Works Order No.:** 059

Compiled by: W S Wat

Checked by: H W Chung

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21 Chun Wang Street, Tseung Kwan O Industrial Estate,
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TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2
Shearing Continuation

FAILURE CRITERION

Max. deviator Stress ☐ | Max. Stress ratio ☒ | Axial Strain % ☐

Stage : 3		Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
Date	Time	Dial		P.R.No. 35	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
16/12	15:15	26.64	18.48	0.676	241	3.477	181.8	251.0	69.2	160.1	90.9	129.8	3.63
	15:20	26.86	18.64	0.677	241	3.500	181.8	251.1	69.3	160.2	90.9	129.9	3.62
	15:25	27.13	18.82	0.677	241	3.525	181.4	250.8	69.4	160.1	90.7	129.9	3.61
	15:30	27.31	18.95	0.678	241	3.543	181.4	250.9	69.5	160.2	90.7	130.0	3.61
	15:35	27.58	19.13	0.682	240	3.569	182.3	251.9	69.6	160.8	91.2	130.4	3.62
	15:40	27.77	19.27	0.684	240	3.588	182.7	252.4	69.7	161.0	91.3	130.6	3.62
	15:45	28.03	19.45	0.685	240	3.614	182.6	252.4	69.8	161.1	91.3	130.7	3.62
	15:50	28.24	19.59	0.687	240	3.634	182.9	252.8	69.9	161.3	91.4	130.9	3.62
	15:55	28.45	19.74	0.688	240	3.655	182.9	252.9	70.0	161.4	91.4	131.0	3.61
	16:00	28.73	19.93	0.689	240	3.682	182.7	252.8	70.1	161.5	91.4	131.0	3.61
	16:05	28.97	20.10	0.689	240	3.706	182.3	252.5	70.2	161.4	91.2	131.0	3.60

Borehole No. : WCH-BH03 — **Sample Depth m:-** 6.00 - 6.90

Sample No. : 4 — **Specimen Depth m:-** 6.70 - 6.90

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 — **Works Order No.:** 059

Compiled by: W S Wat

Checked by: H W Chung

Form : GESR009.15 / Dec.13.04 / Issue 1 / Rev 1

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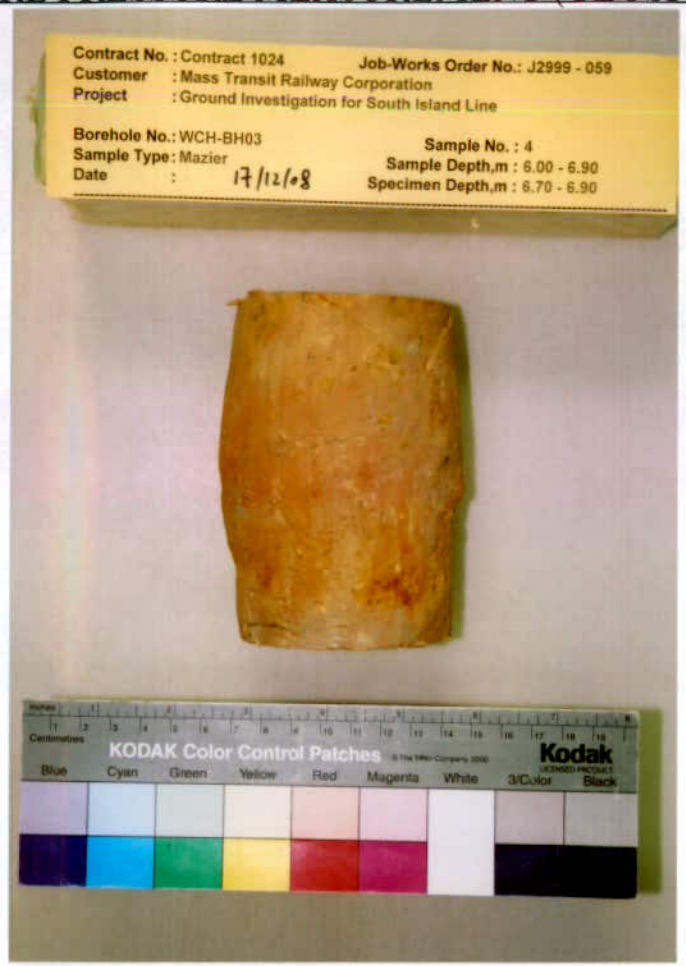
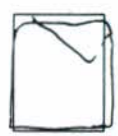
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT (GEOSPEC 3 : 2001 Test Method 15.2)





Description : Brown, gravelly, silty SAND

Sample Origin : HDT ‡ ‡ Information provided by customer

Borehole No. : WCH-BH03 **Sample No. :** 4 **Sample Depth m:-** 6.00 - 6.90 **Specimen Depth m:-** 6.70 - 6.90

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line

Contract No.: Contract 1024
Job No.: J2999
Works Order No.: 059

Compiled by: W S Wat
Checked by: H W Chung

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	WCH-BH09		
Sample		no	1		
Sample Type			Mazier		
Stage		no	1		
Sample Depth		m	3.00 - 4.00		
Specimen Depth		m	3.60 - 3.80		
INITIAL CONDITIONS					
Diameter	(D_o)	mm	74.0		
Height	(H_o)	mm	145.0		
Moisture Content	(W_o)	%	22		
Bulk density	(ρ_o)	Mg/m^3	1.99		
Dry density	(ρ_d)	Mg/m^3	1.63		
Particle density	(ρ_s)		2.65		
Voids Ratio	(e_o)		0.62		
Degree of Saturation	(S_r)	%	93.4		
DRAINAGE CONDITIONS			ONE END		
SATURATION					
Final Pore Pressure Coefficient B			1.00		
CONSOLIDATION					
Cell Pressure	(σ_3)	kPa	255		
Back Pressure	(u_b)	kPa	225		
Effective Pressure	(σ'_3)	kPa	30		
Coefficient of Consolidation (t100) (C_{vi})		m^2/Year	394.26		
Coefficient of Volume Compressibility (m_{vi})		m^2/MN	0.44		
Coefficient of Permeability (k)		m/s	5.37E-08		
COMPRESSION TERMINATION CRITERION			MAXIMUM DEVIATOR STRESS		
COMPRESSION - INITIAL					
Moisture Content	(w)	%	22		
Pore Pressure at the End of Consolidation		kPa	225		
Effective Stress at the End of Consolidation		kPa	30		
Bulk density	(ρ_o)	Mg/m^3	2.01		
Dry density	(ρ_d)	Mg/m^3	1.65		
Voids Ratio	(e)		0.61		
Degree of Saturation	(S_r)	%	96.4		

Customer : **Mass Transit Railway Corporation**

Project : **Ground Investigation for South Island Line**

Report No. : J2999-059.11

Contract No.: Contract 1024

Job No.: **J2999** **Works Order No.: 059**

Technician : W S Wat Checked By : Approved By :

Name : H W Chung Signatory : **Lau Wai Cheong**

Tested Date: 10/12/2008 Date : 19/12/2008 Date : 19/12/2008

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Form : GESR009.6 / Nov.10.06 / Issue 1 / Rev I

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	WCH-BH09		
Sample		no	1		
Sample Type			Mazier		
Stage		no	1		
Sample Depth		m	3.00 - 4.00		
Specimen Depth		m	3.60 - 3.80		
COMPRESSION - FAILURE					
Cell Pressure		kPa	255		
Rate of Strain		mm/min	0.048		
CONDITIONS MAXIMUM DEVIATOR STRESS					
Major Effective Principal Stress (σ'_1)		kPa	322		
Corrected Deviator Stress (σ'_1 - σ'_3)		kPa	244		
Minor Effective Principal Stress (σ'_3)		kPa	78		
$s' = (\sigma'_1 + \sigma'_3)/2$		kPa	200		
$t = (\sigma_1 - \sigma_3)/2$		kPa	122		
Expanded Uncertainty of s' ^		kPa	-		
Expanded Uncertainty of t ^		kPa	-		
Pore pressure parameter A_f			-0.20		
Strain at Failure	(εf)	%	20.1		
COMPRESSION - FINAL					
Moisture Content	(W_f)	%	22		
Bulk density	(ρ_o)	Mg/m^3	2.01		
Dry density	(ρ_d)	Mg/m^3	1.65		
Voids Ratio	(e_f)		0.61		
Degree of Saturation	(S_f)	%	96.4		

Notes -
1. The method of specimen preparation was in accordance with GEOSPEC 3 : 2001 :- Test method 13.3 : test specimen from undisturbed soil samples.
2. Sample received date :29/09/2008
3. The determination of moisture content was in accordance with test method 5.1 of GEOSPEC 3 : 2001.
4. Particle density : 2.65 (Assumed)
5. Maximum and minimum temperature recorded over the period of testing 19.9 - 20.7 °C.
6. Unavoidable variations from specified procedure : none
7. Comment on observed or inferred sample disturbance : none
8. Percentage by mass of soil particles larger than 1/5 of the diameter of specimen (%) : Nil
9. The specimen was selected by the laboratory.
   Name : W S Wat Designation : Senior Laboratory Technician
10. Sampling History : As Received

* Delete as appropriate ^ Upon request

Customer : **Mass Transit Railway Corporation**
Project : **Ground Investigation for South Island Line**
Contract No.: Contract 1024
Job No.: **J2999** **Works Order No.: 059**

Compiled by W S Wat
Checked by

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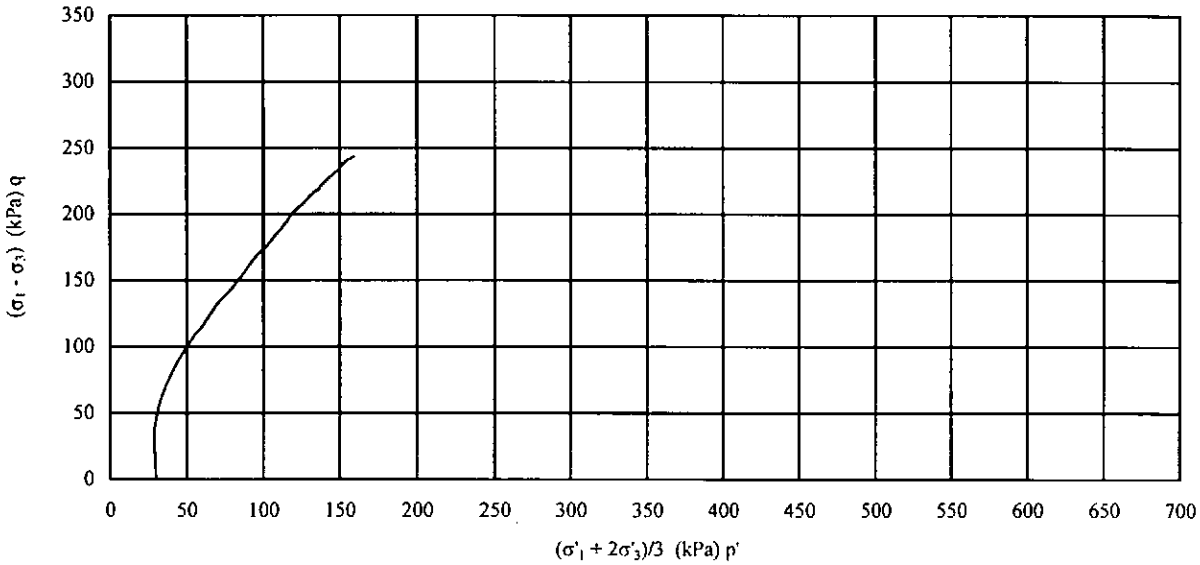
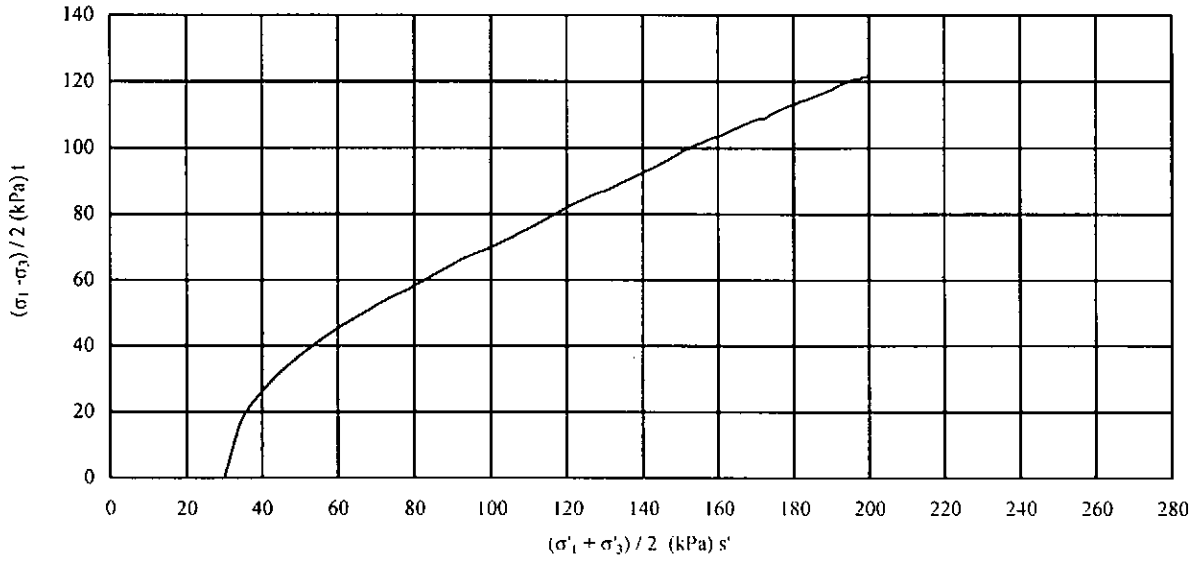
TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

STRESS PATH PARAMETERS FOR EFFECTIVE STRESS

p' - q PLOT



s' - t PLOT



Borehole No. : WCH-BH09	**Sample Depth m:-** 3.00 - 4.00
Sample No. : 1	**Specimen Depth m:-** 3.60 - 3.80
Customer : Mass Transit Railway Corporation	Compiled by W S Wat
Project : Ground Investigation for South Island Line	
	Contract No.: Contract 1024 — Checked by
Job No.: J2999	**Works Order No.:** 059

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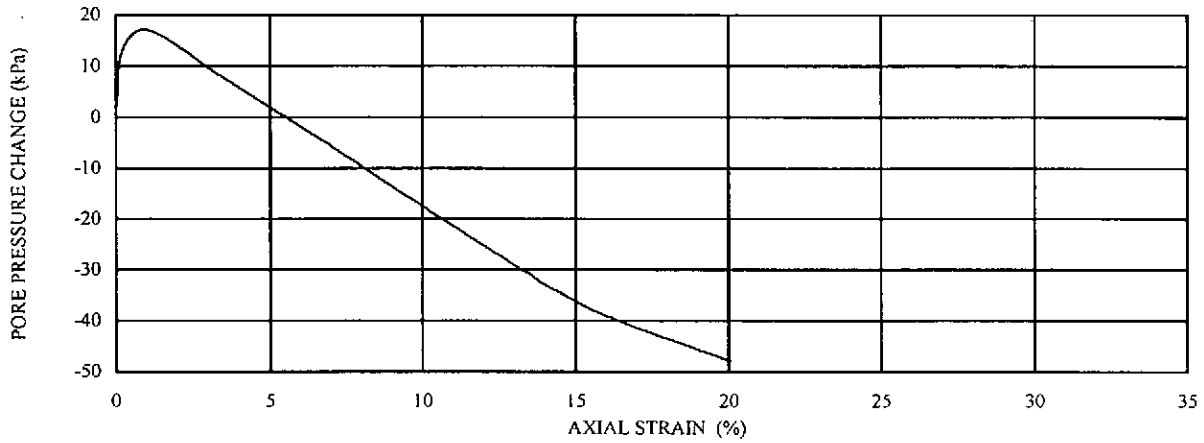
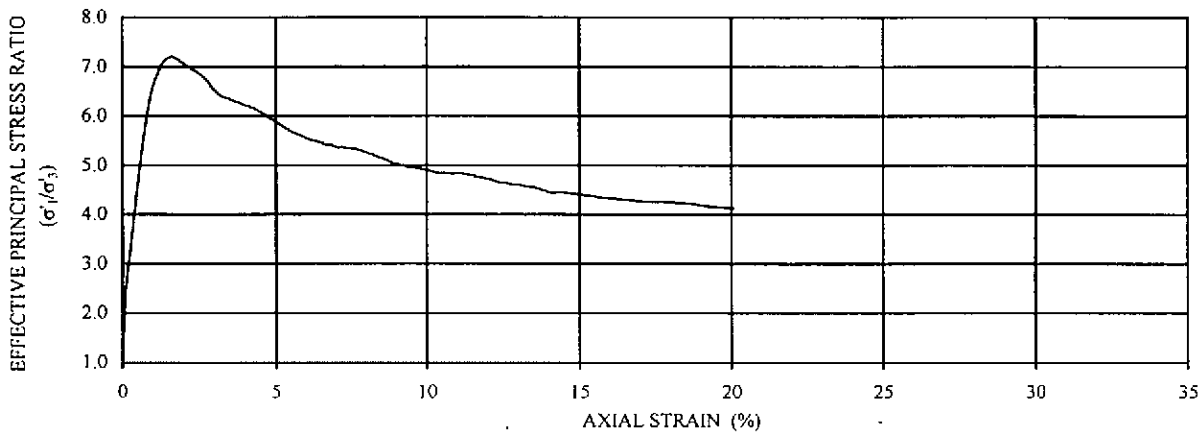
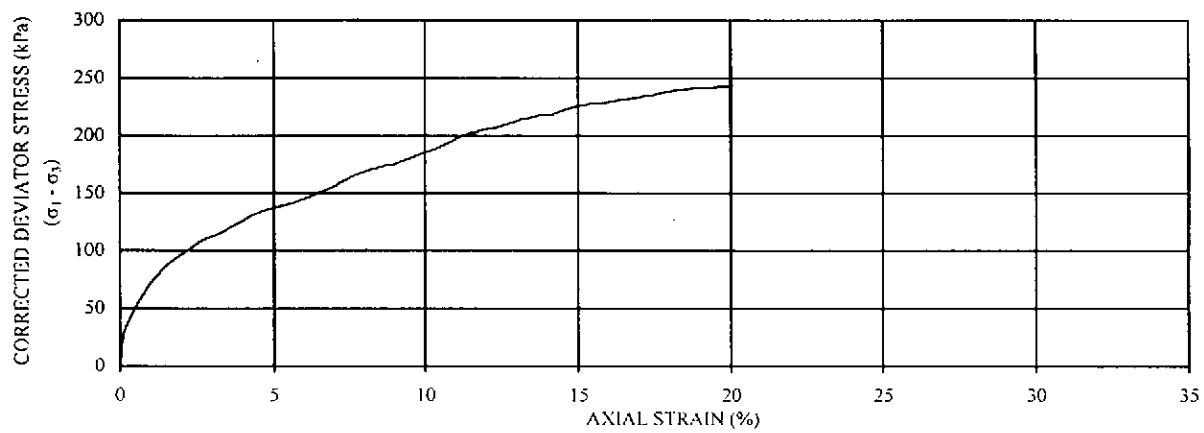
TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

COMPRESSION







Borehole No. : WCH-BH09 **Sample Depth m:-** 3.00 - 4.00
Sample No. : 1 **Specimen Depth m:-** 3.60 - 3.80

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.:** 059

Compiled by: W S Wat
Checked by:

Form : GESR009.9 / Jun.02.03 / Issue 1 / Rev 0

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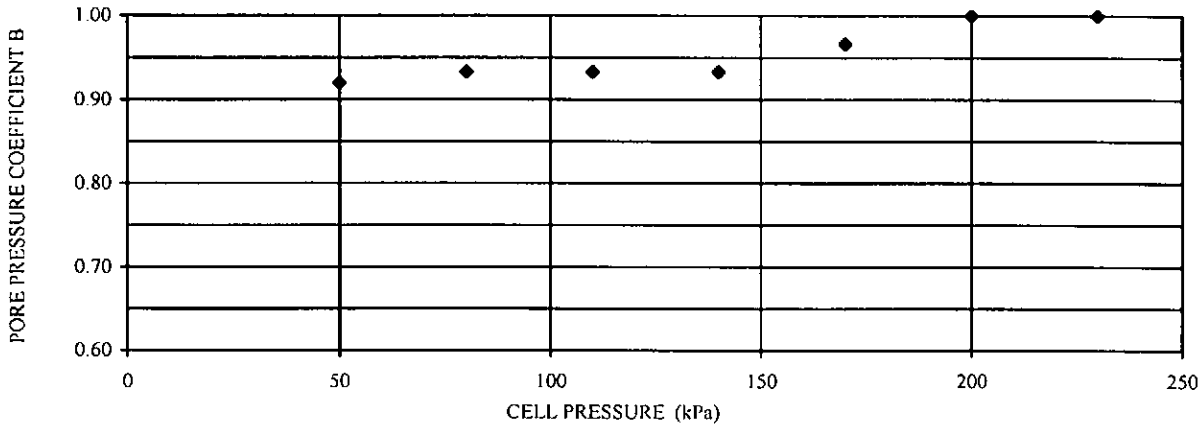
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

SATURATION



Date	Time	Cell Pressure kPa	Back Pressure kPa	Pore Pressure kPa	Cumulative Volume of Water cm^3	Pore Pressure Coefficient B
11/12/2008	10:12	0	0	-	0.0	
	10:18	25	-	20		-
	10:51	25	20	20	-0.4	
	10:59	50	-	43		0.92
	11:36	50	45	45	-0.1	
	11:42	80	-	73		0.93
	13:10	80	75	75	1.1	
	13:18	110	-	103		0.93
	14:34	110	105	105	2.8	
	14:45	140	-	133		0.93
12/12/2008	08:40	140	135	135	4.1	
	08:50	170	-	164		0.97
	09:43	170	165	165	5.3	
	09:52	200	-	195		1.00
	10:40	200	195	195	5.6	
	10:49	230	-	225		1.00
15/12/2008	09:16	230	225	225	7.3	

Borehole No. WCH-BH09 — **Sample Depth m:-** 3.00 - 4.00
Sample No. : 1 — **Specimen Depth m:-** 3.60 - 3.80

Customer : Mass Transit Railway Corporation — Compiled by W S Wat
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024 — Checked by
Job No.: J2999 — **Works Order No.:** 059

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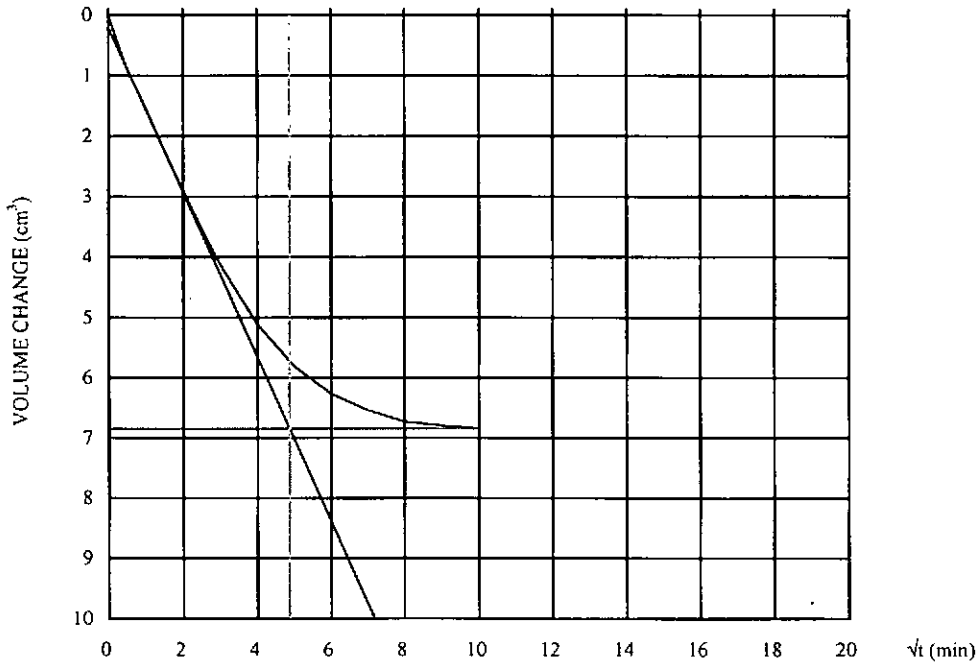
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

CONSOLIDATION (DRAINED PHASE) - Stage 1

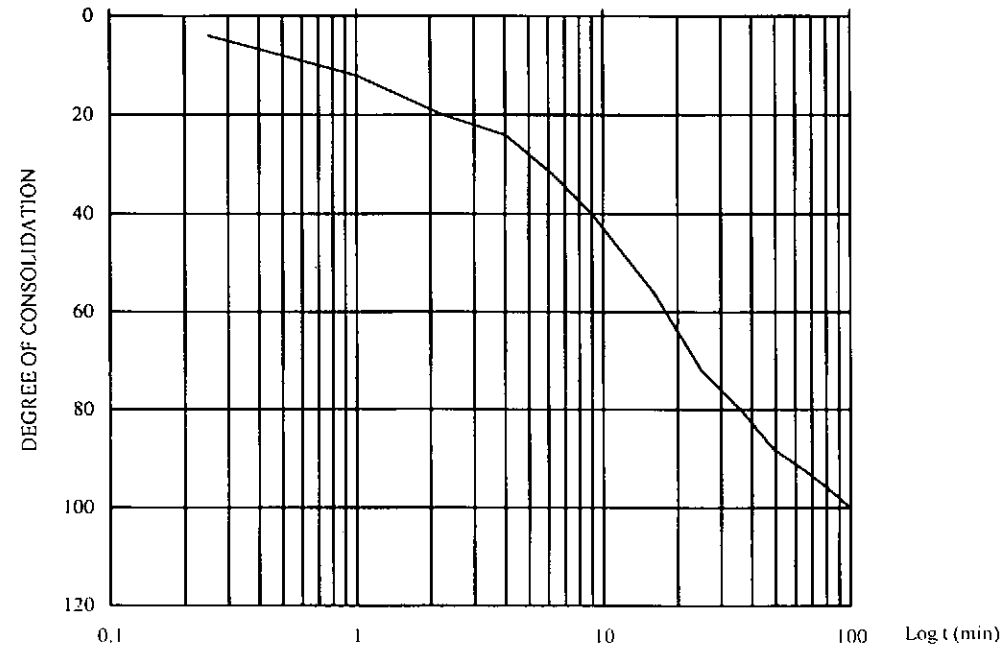


√t100 4.87 min

t100 23.762 min

tf 12.594 min

Calc. strain rate
0.803 mm/min



Borehole No. : WCH-BH09 **Sample Depth m:-** 3.00 - 4.00

Sample No. : 1 **Specimen Depth m:-** 3.60 - 3.80

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.:** 059

Complied by: W S Wat

Checked by:

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DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Single Stage			P.W.P,B.P				Effective Pressure	30				kPa
Side drains	No	Selected Machine Speed	0.048	mm/min	Rate of Strain	1.99	% per hr					
FAILURE CRITERION												
Max. deviator Stress	☒	Max. Stress ratio	☐	Axial Strain %	☐							
Stage : 1	Applied Pressure (kPa) - Cell :	255	Back :	225	P.R. factor	1.7511	kN/mm					

Date	Time	Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
		Dial		P.R.No. 33	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
16/12	08:50	0.00	0.00	0.068	225	0.000	0.0	30.0	30.0	30.0	0.0	30.0	1.00
	08:55	0.15	0.11	0.136	236	0.032	27.8	47.3	19.5	33.4	13.9	28.8	2.43
	09:00	0.41	0.28	0.163	239	0.081	38.8	54.8	16.0	35.4	19.4	28.9	3.42
	09:05	0.68	0.47	0.189	241	0.135	49.3	63.5	14.2	38.8	24.6	30.6	4.47
	09:10	0.90	0.62	0.207	242	0.177	56.5	69.9	13.4	41.7	28.3	32.2	5.22
	09:15	1.12	0.78	0.224	242	0.222	63.3	76.2	12.9	44.6	31.7	34.0	5.91
	09:20	1.36	0.94	0.241	242	0.266	70.1	82.9	12.8	47.8	35.0	36.2	6.47
	09:25	1.56	1.08	0.253	242	0.304	74.8	87.8	13.0	50.4	37.4	37.9	6.75
	09:30	1.79	1.24	0.265	242	0.348	79.5	92.8	13.3	53.0	39.7	39.8	6.98
	09:35	1.96	1.35	0.274	241	0.377	83.0	96.6	13.6	55.1	41.5	41.3	7.10
	09:40	2.20	1.52	0.285	241	0.423	87.3	101.4	14.1	57.7	43.6	43.2	7.19
	09:45	2.43	1.68	0.295	240	0.465	91.1	105.8	14.7	60.3	45.6	45.1	7.20
	09:50	2.80	1.94	0.307	239	0.533	95.6	111.3	15.7	63.5	47.8	47.6	7.09
	09:55	3.03	2.10	0.315	239	0.574	98.7	115.1	16.4	65.7	49.3	49.3	7.02
	10:00	3.22	2.23	0.321	238	0.607	100.9	117.8	16.9	67.4	50.5	50.5	6.97
	10:05	3.60	2.49	0.335	237	0.673	106.2	124.3	18.1	71.2	53.1	53.5	6.87
	10:10	3.74	2.59	0.339	237	0.698	107.6	126.1	18.5	72.3	53.8	54.4	6.82
	10:15	4.04	2.79	0.347	236	0.748	110.6	130.0	19.4	74.7	55.3	56.3	6.70
	10:20	4.24	2.93	0.351	235	0.782	112.0	132.1	20.1	76.1	56.0	57.4	6.57
	10:25	4.50	3.12	0.356	234	0.828	113.7	134.5	20.8	77.6	56.8	58.7	6.47
	10:30	4.74	3.28	0.362	234	0.867	115.8	137.3	21.5	79.4	57.9	60.1	6.39
	10:35	4.93	3.41	0.367	233	0.898	117.6	139.5	21.9	80.7	58.8	61.1	6.37
	10:40	5.17	3.58	0.374	232	0.938	120.1	142.7	22.6	82.7	60.1	62.6	6.32
	10:45	5.41	3.74	0.381	232	0.976	122.7	145.9	23.2	84.5	61.3	64.1	6.29
	10:50	5.69	3.94	0.389	231	1.022	125.5	149.5	24.0	86.8	62.8	65.8	6.23
	10:55	5.96	4.12	0.397	230	1.063	128.4	153.1	24.7	88.9	64.2	67.5	6.20
	11:00	6.17	4.27	0.403	230	1.097	130.5	155.8	25.3	90.6	65.3	68.8	6.16
	11:05	6.46	4.47	0.409	229	1.142	132.5	158.5	26.0	92.3	66.3	70.2	6.10
	11:10	6.67	4.61	0.414	228	1.173	134.3	160.9	26.6	93.7	67.1	71.4	6.05
	11:15	6.97	4.82	0.419	228	1.220	135.9	163.3	27.4	95.3	67.9	72.7	5.96
	11:20	7.20	4.99	0.423	227	1.257	137.2	165.2	28.0	96.6	68.6	73.7	5.90
	11:25	7.45	5.15	0.426	226	1.291	138.1	166.7	28.6	97.6	69.0	74.6	5.83
	11:30	7.71	5.33	0.430	226	1.330	139.3	168.6	29.3	99.0	69.7	75.7	5.75
	11:35	7.92	5.48	0.433	225	1.362	140.2	170.0	29.8	99.9	70.1	76.5	5.71
	11:40	8.11	5.61	0.436	225	1.389	141.2	171.5	30.3	100.9	70.6	77.4	5.66
	11:45	8.37	5.79	0.442	224	1.427	143.2	174.2	31.0	102.6	71.6	78.7	5.62
	11:50	8.62	5.97	0.447	223	1.464	144.8	176.5	31.7	104.1	72.4	80.0	5.57
	11:55	8.84	6.12	0.451	223	1.494	146.1	178.4	32.3	105.3	73.0	81.0	5.52
	12:00	9.04	6.25	0.456	222	1.521	147.7	180.5	32.8	106.7	73.9	82.0	5.50

Borehole No. : WCH-BH09 — **Sample Depth m:- 3.00 - 4.00**

Sample No. : 1 — **Specimen Depth m:- 3.60 - 3.80**

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 — **Works Order No.: 059**

Compiled by: W S Wat

Checked by:

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TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2
Shearing Continuation

FAILURE CRITERION

Max. deviator Stress ☒ | Max. Stress ratio ☐ | Axial Strain % ☐

Stage :	1	Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
Date	Time	Dial		P.R.No. 33	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
16/12	12:05	9.44	6.53	0.465	221	1.577	150.7	184.5	33.8	109.2	75.4	84.0	5.46
	12:10	9.64	6.67	0.469	221	1.605	152.0	186.4	34.4	110.4	76.0	85.1	5.42
	12:15	9.92	6.87	0.476	220	1.644	154.3	189.3	35.0	112.1	77.1	86.4	5.41
	12:20	10.17	7.04	0.482	219	1.677	156.3	192.1	35.8	113.9	78.1	87.9	5.36
	12:25	10.41	7.20	0.490	219	1.708	159.0	195.4	36.4	115.9	79.5	89.4	5.37
	12:30	10.65	7.37	0.497	218	1.741	161.3	198.4	37.1	117.8	80.7	90.9	5.35
	12:35	10.91	7.55	0.505	217	1.775	164.0	201.8	37.8	119.8	82.0	92.5	5.34
	12:40	11.16	7.72	0.511	217	1.807	166.0	204.4	38.4	121.4	83.0	93.7	5.32
	12:45	11.45	7.92	0.517	216	1.844	167.8	207.0	39.2	123.1	83.9	95.1	5.28
	12:50	11.69	8.09	0.522	215	1.875	169.4	209.3	39.9	124.6	84.7	96.4	5.24
	12:55	11.87	8.22	0.526	215	1.899	170.6	211.0	40.4	125.7	85.3	97.3	5.22
	13:00	12.03	8.33	0.528	214	1.919	171.1	212.0	40.9	126.5	85.6	97.9	5.18
	13:05	12.33	8.54	0.534	213	1.957	173.0	214.7	41.7	128.2	86.5	99.4	5.15
	13:10	12.61	8.73	0.538	213	1.991	174.1	216.6	42.5	129.5	87.0	100.5	5.10
	13:15	12.87	8.91	0.540	212	2.023	174.4	217.6	43.2	130.4	87.2	101.3	5.04
	13:20	13.11	9.08	0.546	211	2.053	176.3	220.2	43.9	132.1	88.2	102.7	5.02
	13:25	13.43	9.30	0.553	210	2.091	178.4	223.2	44.8	134.0	89.2	104.3	4.98
	13:30	13.59	9.41	0.556	210	2.110	179.3	224.5	45.2	134.9	89.7	105.0	4.97
	13:35	13.80	9.55	0.561	209	2.134	180.9	226.6	45.7	136.1	90.4	106.0	4.96
	13:40	14.06	9.73	0.567	209	2.165	182.7	229.0	46.3	137.7	91.3	107.2	4.95
	13:45	14.35	9.94	0.574	208	2.200	184.8	232.0	47.2	139.6	92.4	108.8	4.92
	13:50	14.59	10.10	0.579	207	2.227	186.3	234.1	47.8	141.0	93.2	109.9	4.90
	13:55	14.80	10.24	0.583	207	2.250	187.4	235.9	48.5	142.2	93.7	111.0	4.86
	14:00	15.09	10.44	0.590	206	2.283	189.6	238.8	49.2	144.0	94.8	112.4	4.85
	14:05	15.36	10.63	0.598	205	2.314	192.1	242.0	49.9	145.9	96.0	113.9	4.85
	14:10	15.60	10.80	0.604	204	2.342	193.9	244.5	50.6	147.5	96.9	115.2	4.83
	14:15	15.98	11.06	0.617	204	2.384	198.0	249.5	51.5	150.5	99.0	117.5	4.84
	14:20	16.07	11.13	0.620	203	2.395	198.9	250.7	51.8	151.3	99.5	118.1	4.84
	14:25	16.33	11.30	0.625	203	2.422	200.3	252.8	52.5	152.7	100.2	119.3	4.82
	14:30	16.62	11.50	0.632	202	2.454	202.4	255.7	53.3	154.5	101.2	120.8	4.80
	14:35	16.83	11.65	0.634	201	2.477	202.7	256.6	53.9	155.3	101.4	121.5	4.76
	14:40	17.08	11.82	0.641	200	2.504	204.8	259.4	54.6	157.0	102.4	122.9	4.75
	14:45	17.32	11.99	0.644	200	2.530	205.5	260.7	55.2	158.0	102.8	123.7	4.72
	14:50	17.56	12.16	0.648	199	2.556	206.5	262.3	55.8	159.1	103.3	124.6	4.70
	14:55	17.79	12.32	0.650	199	2.581	206.8	263.3	56.5	159.9	103.4	125.4	4.66
	15:00	18.08	12.52	0.656	198	2.611	208.5	265.7	57.2	161.4	104.2	126.7	4.64
	15:05	18.27	12.65	0.660	197	2.631	209.6	267.3	57.7	162.5	104.8	127.6	4.63
	15:10	18.50	12.80	0.665	197	2.654	211.0	269.3	58.3	163.8	105.5	128.6	4.62
	15:15	18.79	13.01	0.671	196	2.685	212.6	271.7	59.1	165.4	106.3	130.0	4.60
	15:20	19.03	13.17	0.677	195	2.709	214.3	274.1	59.8	167.0	107.2	131.2	4.58
	15:25	19.35	13.39	0.681	195	2.742	215.1	275.6	60.5	168.1	107.6	132.2	4.56

Borehole No. : WCH-BH09 — **Sample Depth m:- 3.00 - 4.00**

Sample No. : 1 — **Specimen Depth m:- 3.60 - 3.80**

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 — **Works Order No.: 059**

Compiled by: W S Wat

Checked by:

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2
Shearing Continuation

FAILURE CRITERION

Max. deviator Stress ☒ | Max. Stress ratio ☐ | Axial Strain % ☐

Stage :	1	Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
Date	Time	Dial		P.R.No. 33	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
16/12	15:30	19.55	13.53	0.686	194	2.762	216.5	277.4	60.9	169.2	108.3	133.1	4.56
	15:35	19.80	13.71	0.690	193	2.789	217.5	279.3	61.8	170.5	108.7	134.3	4.52
	15:40	20.06	13.88	0.693	192	2.814	218.1	280.7	62.6	171.6	109.0	135.3	4.48
	15:45	20.34	14.08	0.693	192	2.843	217.5	280.7	63.2	172.0	108.8	135.7	4.44
	15:50	20.56	14.23	0.700	191	2.865	219.6	283.3	63.7	173.5	109.8	136.9	4.45
	15:55	20.80	14.40	0.706	191	2.889	221.2	285.4	64.2	174.8	110.6	137.9	4.45
	16:00	21.10	14.60	0.713	190	2.918	223.1	288.0	64.9	176.5	111.6	139.3	4.44
	16:05	21.36	14.78	0.718	190	2.944	224.4	289.9	65.5	177.7	112.2	140.3	4.43
	16:10	21.55	14.92	0.722	189	2.964	225.4	291.3	65.9	178.6	112.7	141.0	4.42
	16:15	21.76	15.06	0.725	189	2.984	226.0	292.4	66.4	179.4	113.0	141.7	4.40
	16:20	22.02	15.24	0.729	188	3.010	226.9	293.9	67.0	180.5	113.5	142.6	4.39
	16:25	22.28	15.42	0.734	188	3.035	228.1	295.6	67.5	181.6	114.1	143.5	4.38
	16:30	22.52	15.59	0.736	187	3.059	228.3	296.3	68.0	182.2	114.2	144.1	4.36
	16:35	22.85	15.82	0.739	186	3.092	228.7	297.3	68.6	183.0	114.4	144.8	4.33
	16:40	23.11	15.99	0.743	186	3.115	229.6	298.7	69.1	183.9	114.8	145.6	4.32
	16:45	23.34	16.16	0.747	186	3.139	230.5	299.9	69.4	184.6	115.2	146.2	4.32
	16:50	23.57	16.31	0.750	185	3.160	231.1	300.9	69.8	185.3	115.5	146.8	4.31
	16:55	23.76	16.45	0.753	185	3.180	231.7	301.8	70.1	185.9	115.8	147.3	4.31
	17:00	24.00	16.61	0.756	185	3.202	232.2	302.7	70.5	186.6	116.1	147.9	4.29
	17:05	24.24	16.78	0.759	184	3.226	232.8	303.7	70.9	187.3	116.4	148.5	4.28
	17:10	24.53	16.98	0.763	184	3.254	233.5	304.9	71.4	188.2	116.8	149.2	4.27
	17:15	24.80	17.17	0.768	183	3.280	234.7	306.5	71.8	189.1	117.3	150.0	4.27
	17:20	25.05	17.34	0.771	183	3.304	235.2	307.3	72.1	189.7	117.6	150.5	4.26
	17:25	25.32	17.53	0.775	183	3.331	236.0	308.5	72.5	190.5	118.0	151.2	4.25
	17:30	25.55	17.69	0.781	182	3.353	237.5	310.4	72.9	191.6	118.7	152.1	4.26
	17:35	25.79	17.85	0.784	182	3.375	238.0	311.2	73.2	192.2	119.0	152.5	4.25
	17:40	25.98	17.99	0.788	182	3.395	238.9	312.4	73.5	193.0	119.5	153.1	4.25
	17:45	26.32	18.22	0.792	181	3.427	239.6	313.6	74.0	193.8	119.8	153.9	4.24
	17:50	26.56	18.38	0.795	181	3.449	240.0	314.3	74.3	194.3	120.0	154.3	4.23
	17:55	26.81	18.56	0.799	180	3.474	240.8	315.5	74.7	195.1	120.4	155.0	4.22
	18:00	27.08	18.74	0.802	180	3.499	241.3	316.4	75.1	195.7	120.6	155.5	4.21
	18:05	27.27	18.88	0.804	180	3.519	241.5	316.9	75.4	196.2	120.8	155.9	4.20
	18:10	27.63	19.12	0.806	179	3.553	241.4	317.4	76.0	196.7	120.7	156.5	4.18
	18:15	27.88	19.30	0.808	179	3.578	241.5	317.8	76.3	197.1	120.8	156.8	4.17
	18:20	28.01	19.39	0.810	179	3.591	241.9	318.4	76.5	197.4	120.9	157.1	4.16
	18:25	28.27	19.57	0.814	178	3.616	242.6	319.4	76.8	198.1	121.3	157.7	4.16
	18:30	28.50	19.73	0.816	178	3.639	242.8	320.0	77.2	198.6	121.4	158.1	4.14
	18:35	28.76	19.91	0.819	177	3.664	243.2	320.8	77.6	199.2	121.6	158.7	4.13
	18:40	**28.98**	**20.06**	**0.822**	**177**	**3.685**	**243.7**	**321.6**	**77.9**	**199.7**	**121.8**	**159.1**	**4.13**

Borehole No. : WCH-BH09 — **Sample Depth m:- 3.00 - 4.00**

Sample No. : 1 — **Specimen Depth m:- 3.60 - 3.80**

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 — **Works Order No.: 059**

Compiled by: W S Wat

Checked by:

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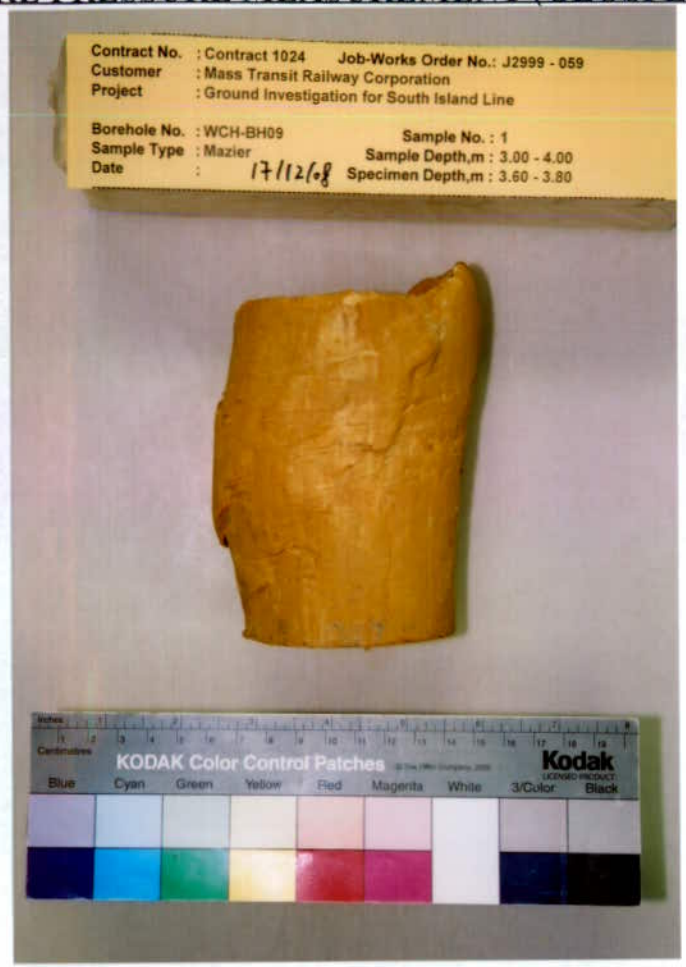
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT (GEOSPEC 3 : 2001 Test Method 15.2)



Description : Orangish brown, slightly gravelly, slightly sandy SILT/CLAY **Sample Origin :** COL‡ ‡ Information provided by customer

Borehole No. : WCH-BH09 **Sample No. :** 1 **Sample Depth m:-** 3.00 - 4.00 **Specimen Depth m:-** 3.60 - 3.80

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line

Contract No. : Contract 1024
Job No. : J2999
Works Order No.: 059

Compiled by: W S Wat
Checked by: H W Chung

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	WCH-BH09		
Sample		no	1		
Sample Type			Mazier		
Stage		no	1		
Sample Depth		m	3.00 - 4.00		
Specimen Depth		m	3.80 - 4.00		
INITIAL CONDITIONS					
Diameter	(D_o)	mm	74.0		
Height	(H_o)	mm	145.0		
Moisture Content	(W_o)	%	23		
Bulk density	(ρ_o)	Mg/m^3	1.97		
Dry density	(ρ_d)	Mg/m^3	1.60		
Particle density	(ρ_s)		2.65		
Voids Ratio	(e_o)		0.66		
Degree of Saturation	(S_r)	%	93.3		
DRAINAGE CONDITIONS			ONE END		
SATURATION					
Final Pore Pressure Coefficient B			1.00		
CONSOLIDATION					
Cell Pressure	(σ_3)	kPa	245		
Back Pressure	(u_b)	kPa	205		
Effective Pressure	(σ'_3)	kPa	40		
Coefficient of Consolidation (t100)	(C_{vi})	$m^2/Year$	292.77		
Coefficient of Volume Compressibility	(m_{vi})	m^2/MN	0.44		
Coefficient of Permeability (k)		m/s	4.03E-08		
COMPRESSION TERMINATION CRITERION			MAXIMUM DEVIATOR STRESS		
COMPRESSION - INITIAL					
Moisture Content	(w)	%	23		
Pore Pressure at the End of Consolidation		kPa	205		
Effective Stress at the End of Consolidation		kPa	40		
Bulk density	(ρ_o)	Mg/m^3	1.99		
Dry density	(ρ_d)	Mg/m^3	1.62		
Voids Ratio	(e)		0.63		
Degree of Saturation	(S_r)	%	94.6		

Customer : **Mass Transit Railway Corporation**

Project : **Ground Investigation for South Island Line**

Report No. : J2999-059.11

Contract No.: Contract 1024

Job No.: **J2999** **Works Order No.: 059**

Technician : W S Wat Checked By : Approved By :

Name : H W Chung Signatory : **Lau Wai Cheong**

Tested Date: 10/12/2008 Date : 19/12/2008 Date : 19/12/2008

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Form : GESR009.6 / Nov.10.06 / Issue 1 / Rev 1

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	WCH-BH09		
Sample		no	1		
Sample Type			Mazier		
Stage		no	1		
Sample Depth		m	3.00 - 4.00		
Specimen Depth		m	3.80 - 4.00		
COMPRESSION - FAILURE					
Cell Pressure		kPa	245		
Rate of Strain		mm/min	0.048		
CONDITIONS MAXIMUM DEVIATOR STRESS					
Major Effective Principal Stress (σ'_1)		kPa	266		
Corrected Deviator Stress (σ'_1 - σ'_3)		kPa	207		
Minor Effective Principal Stress (σ'_3)		kPa	59		
$s' = (\sigma'_1 + \sigma'_3)/2$		kPa	162		
$t = (\sigma_1 - \sigma_3)/2$		kPa	103		
Expanded Uncertainty of s' ^		kPa	-		
Expanded Uncertainty of t ^		kPa	-		
Pore pressure parameter A_f			-0.09		
Strain at Failure	(εf)	%	8.2		
COMPRESSION - FINAL					
Moisture Content	(W_f)	%	23		
Bulk density	(ρ_o)	Mg/m^3	1.99		
Dry density	(ρ_d)	Mg/m^3	1.62		
Voids Ratio	(e_f)		0.63		
Degree of Saturation	(S_f)	%	94.6		

Notes -
1. The method of specimen preparation was in accordance with GEOSPEC 3 : 2001 :- Test method 13.3 : test specimen from undisturbed soil samples.
2. Sample received date :29/09/2008
3. The determination of moisture content was in accordance with test method 5.1 of GEOSPEC 3 : 2001.
4. Particle density : 2.65 (Assumed)
5. Maximum and minimum temperature recorded over the period of testing 19.9 - 20.7 °C.
6. Unavoidable variations from specified procedure : none
7. Comment on observed or inferred sample disturbance : none
8. Percentage by mass of soil particles larger than 1/5 of the diameter of specimen (%) : Nil
9. The specimen was selected by the laboratory.
   Name : W S Wat Designation : Senior Laboratory Technician
10. Sampling History : As Received

* Delete as appropriate ^ Upon request

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.: 059**

Compiled by: W S Wat
Checked by:

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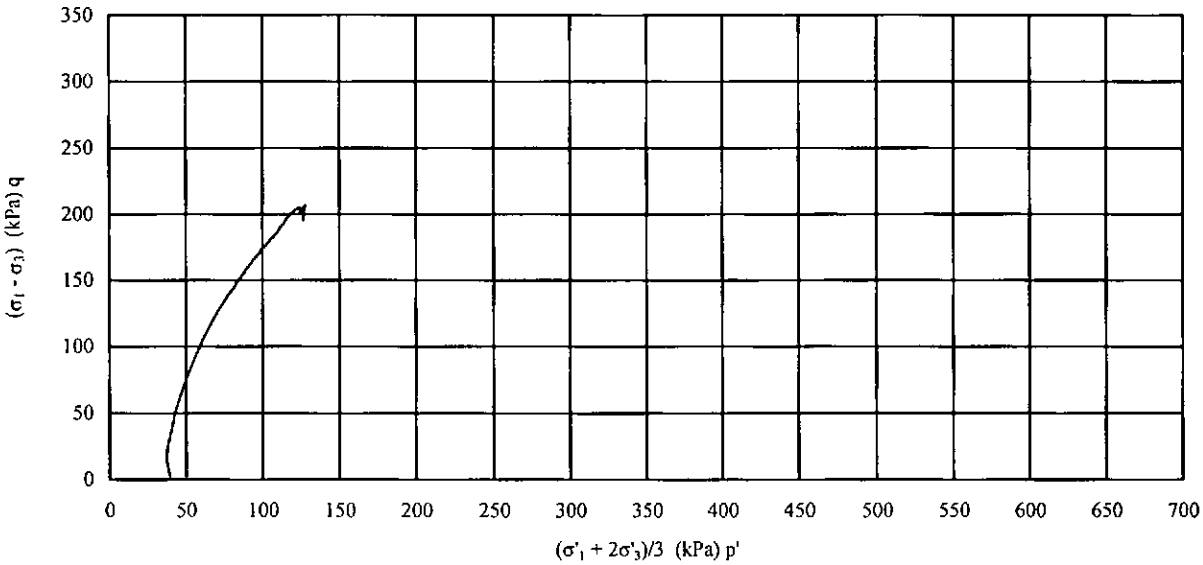
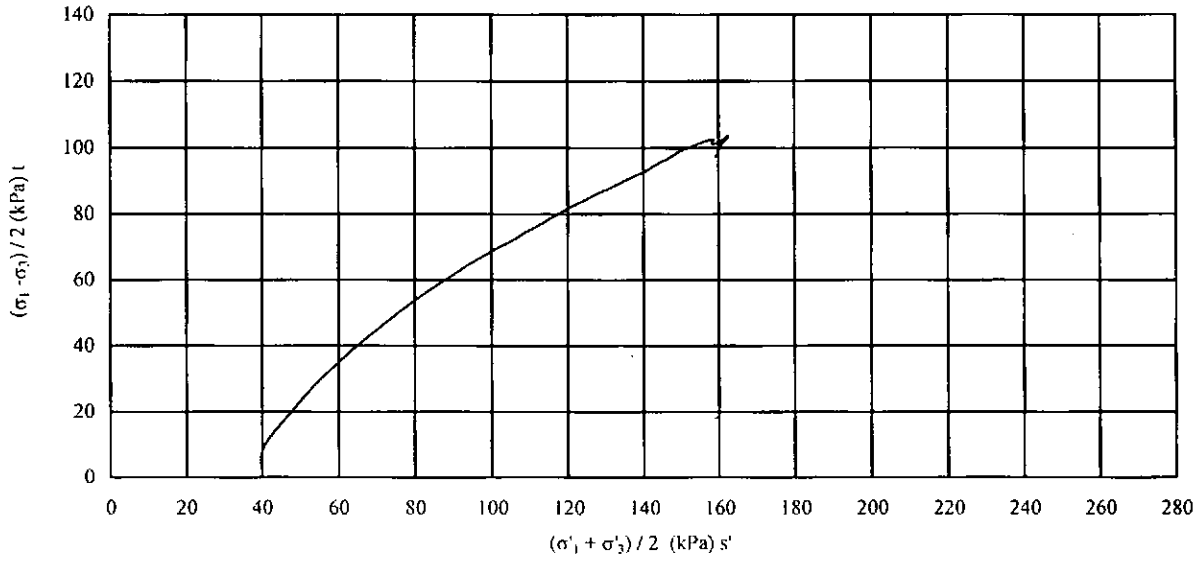
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

STRESS PATH PARAMETERS FOR EFFECTIVE STRESS

p' - q PLOT



s' - t PLOT



Borehole No. : WCH-BH09	**Sample Depth m:-** 3.00 - 4.00
Sample No. : 1	**Specimen Depth m:-** 3.80 - 4.00
Customer : Mass Transit Railway Corporation	Compiled by W S Wat
Project : Ground Investigation for South Island Line	
Contract No.: Contract 1024	Checked by
Job No.: J2999	**Works Order No.:** 059

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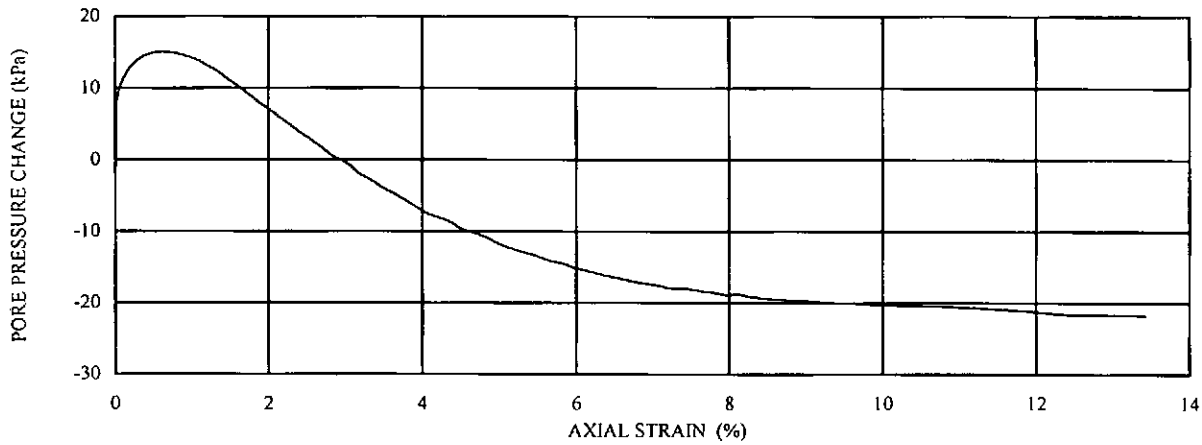
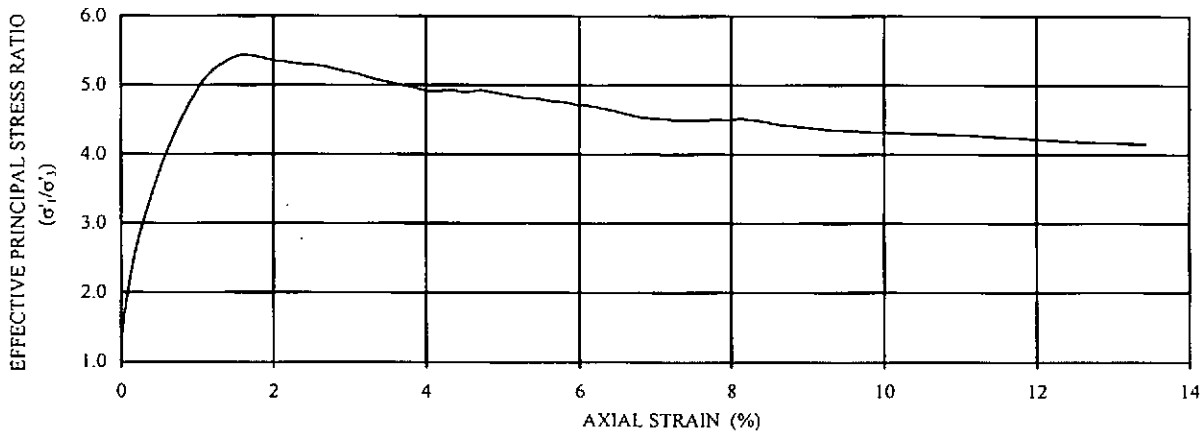
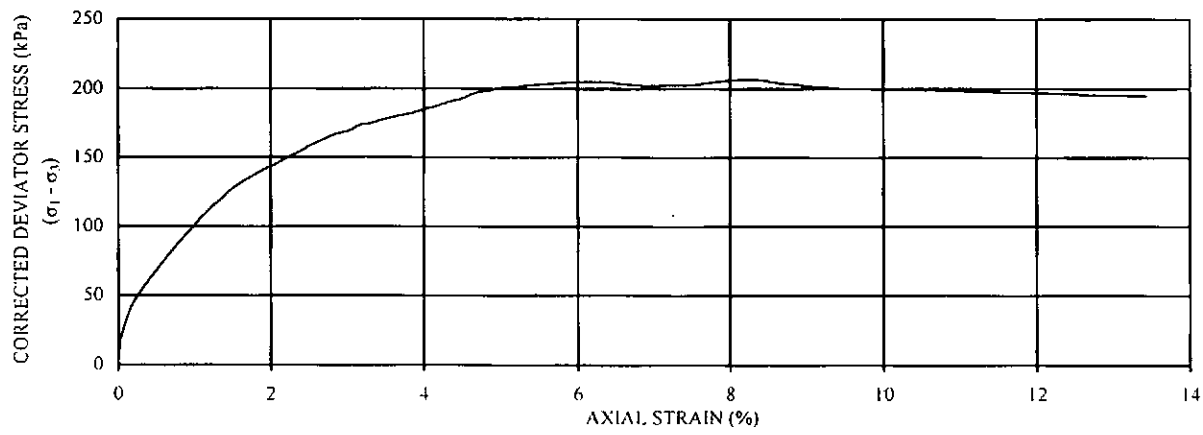
Form : GESR009.8 / Jun.02.03 / Issue 1 / Rev 0

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

COMPRESSION







Borehole No. :	**WCH-BH09**	**Sample Depth m:-**	**3.00 - 4.00**
Sample No. :	**1**	**Specimen Depth m:-**	**3.80 - 4.00**
Customer :	**Mass Transit Railway Corporation**		Compiled by W S Wat
Project :	**Ground Investigation for South Island Line**		
		Contract No.: Contract 1024	Checked by
Job No.:	**J2999**	**Works Order No.: 059**	

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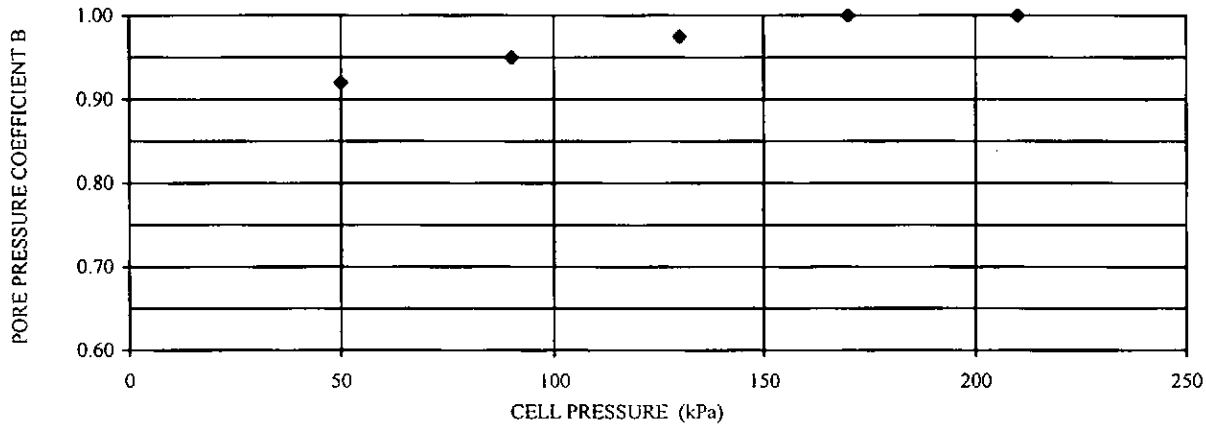
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

SATURATION



Date	Time	Cell Pressure kPa	Back Pressure kPa	Pore Pressure kPa	Cumulative Volume of Water cm^3	Pore Pressure Coefficient B
11/12/2008	10:46	0	0	-	0.0	
	10:53	25	-	22		-
	11:31	25	20	20	-0.8	
	11:40	50	-	43		0.92
	13:13	50	45	45	-0.5	
	13:20	90	-	83		0.95
12/12/2008	08:43	90	85	85	0.1	
	08:50	130	-	124		0.98
	09:34	130	125	125	0.6	
	09:45	170	-	165		1.00
	10:24	170	165	165	0.8	
	10:34	210	-	205		1.00
15/12/2008	09:36	210	205	205	3.7	

Borehole No. WCH-BH09 **Sample Depth m:-** 3.00 - 4.00
Sample No. : 1 **Specimen Depth m:-** 3.80 - 4.00
Customer : Mass Transit Railway Corporation — Compiled by: W S Wat
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024 — Checked by:
Job No.: J2999 **Works Order No.:** 059

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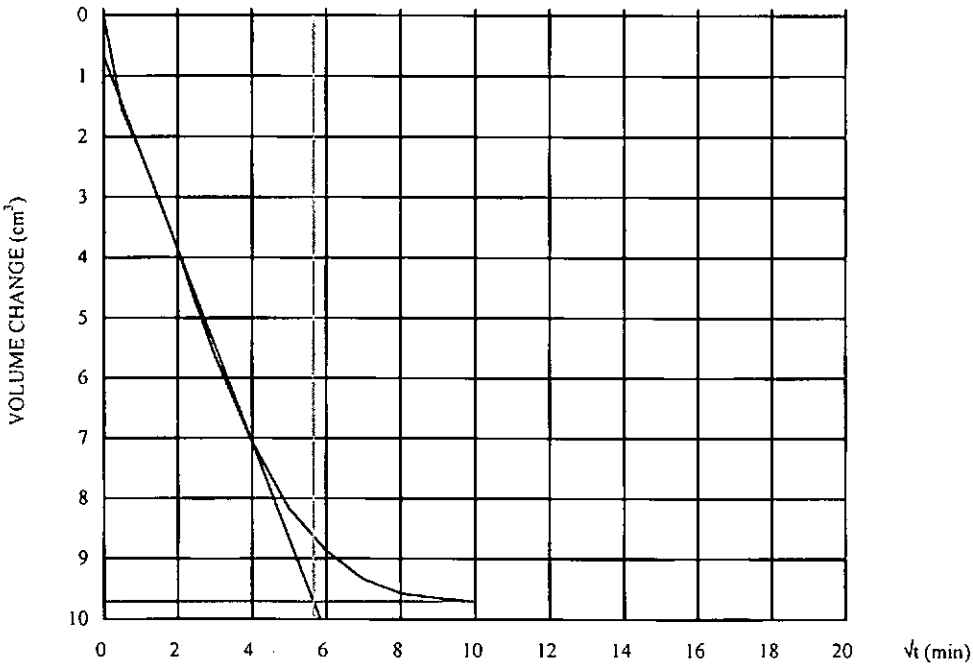
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

CONSOLIDATION (DRAINED PHASE) - Stage 1

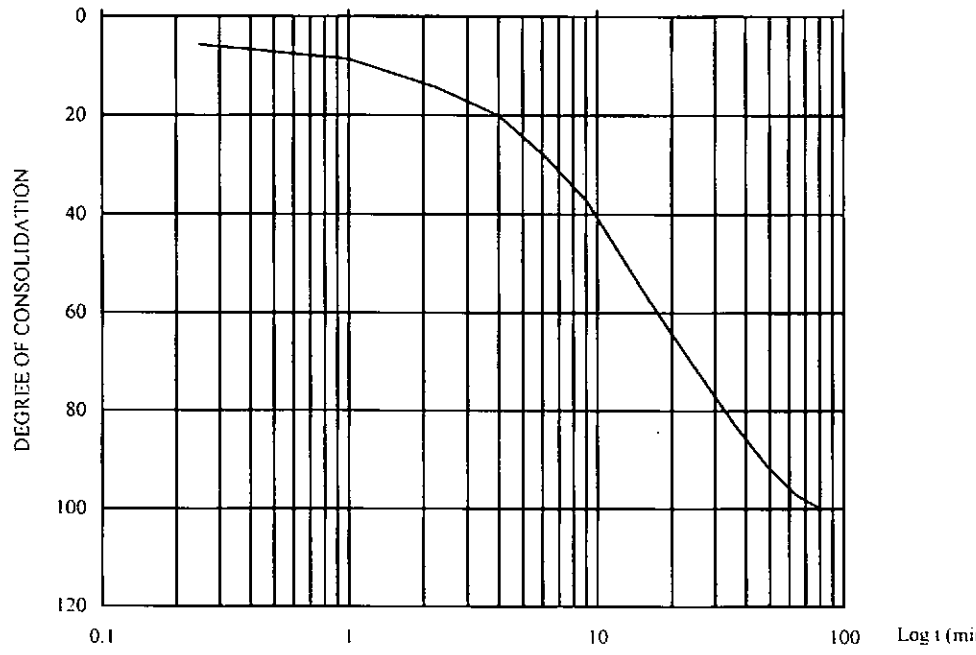


√t100 5.66 min

t100 32.071 min

tf 16.998 min

Calc. strain rate
0.594 mm/min



Borehole No. : WCH-BH09 **Sample Depth m:-** 3.00 - 4.00

Sample No. : 1 **Specimen Depth m:-** 3.80 - 4.00

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.:** 059

Complied by: W S Wat

Checked by:

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Single Stage		P.W.P,B.P		Effective Pressure	40 kPa
Side drains	No	Selected Machine Speed	0.048 mm/min	Rate of Strain	2.00 % per hr

FAILURE CRITERION

Max. deviator Stress	☒	Max. Stress ratio	☐	Axial Strain %	☐
Stage : 1	Applied Pressure (kPa) - Cell :	245	Back : 205	P.R. factor	1.7305 kN/mm

Date	Time	Strain Dial	Strain	Load P.R.No. 10	Pore Pressure	Dev. stress Corr.	Dev. stress q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
16/12	08:45	0.00	0.00	0.068	205	0.000	0.0	40.0	40.0	40.0	0.0	40.0	1.00
	08:50	0.04	0.03	0.113	214	0.009	18.3	49.6	31.3	40.4	9.1	37.4	1.58
	08:55	0.23	0.16	0.168	217	0.046	40.5	68.2	27.7	48.0	20.3	41.2	2.46
	09:00	0.47	0.32	0.204	219	0.092	55.0	80.8	25.8	53.3	27.5	44.1	3.13
	09:05	0.73	0.50	0.238	220	0.143	68.6	93.6	25.0	59.3	34.3	47.9	3.74
	09:10	0.94	0.65	0.264	220	0.185	78.9	103.8	24.9	64.4	39.5	51.2	4.17
	09:15	1.15	0.80	0.289	220	0.227	88.8	113.9	25.1	69.5	44.4	54.7	4.54
	09:20	1.38	0.96	0.314	219	0.271	98.7	124.3	25.6	74.9	49.3	58.5	4.85
	09:25	1.56	1.08	0.333	219	0.304	106.2	132.3	26.1	79.2	53.1	61.5	5.07
	09:30	1.77	1.23	0.354	218	0.345	114.4	141.4	27.0	84.2	57.2	65.1	5.24
	09:35	1.92	1.33	0.366	217	0.372	119.1	146.7	27.6	87.1	59.5	67.3	5.31
	09:40	2.13	1.48	0.386	216	0.412	126.8	155.6	28.8	92.2	63.4	71.1	5.40
	09:45	2.34	1.62	0.400	215	0.449	132.2	162.0	29.8	95.9	66.1	73.9	5.44
	09:50	2.69	1.87	0.421	213	0.514	140.2	172.1	31.9	102.0	70.1	78.6	5.39
	09:55	2.93	2.03	0.431	212	0.556	143.9	177.0	33.1	105.0	71.9	81.1	5.35
	10:00	3.12	2.16	0.442	211	0.589	148.0	182.1	34.1	108.1	74.0	83.4	5.34
	10:05	3.48	2.41	0.461	209	0.652	155.1	191.2	36.1	113.7	77.6	87.8	5.30
	10:10	3.61	2.50	0.469	208	0.675	158.1	194.9	36.8	115.9	79.1	89.5	5.30
	10:15	3.89	2.70	0.483	207	0.725	163.3	201.6	38.3	119.9	81.6	92.7	5.26
	10:20	4.09	2.83	0.492	206	0.757	166.6	206.0	39.4	122.7	83.3	94.9	5.23
	10:25	4.38	3.04	0.501	204	0.808	169.7	210.3	40.6	125.5	84.9	97.2	5.18
	10:30	4.56	3.16	0.511	203	0.837	173.4	215.2	41.8	128.5	86.7	99.6	5.15
	10:35	4.78	3.31	0.515	202	0.873	174.7	217.4	42.7	130.0	87.3	100.9	5.09
	10:40	5.01	3.47	0.523	201	0.911	177.5	221.3	43.8	132.5	88.7	103.0	5.05
	10:45	5.25	3.64	0.530	200	0.951	179.9	224.7	44.8	134.7	89.9	104.8	5.01
	10:50	5.53	3.84	0.538	199	0.998	182.6	228.6	46.0	137.3	91.3	106.9	4.97
	10:55	5.80	4.02	0.546	198	1.039	185.3	232.6	47.3	139.9	92.6	109.1	4.92
	11:00	6.01	4.17	0.553	197	1.074	187.7	235.6	47.9	141.7	93.8	110.5	4.92
	11:05	6.29	4.36	0.563	196	1.117	191.2	239.9	48.7	144.3	95.6	112.4	4.93
	11:10	6.48	4.50	0.569	195	1.148	193.2	242.8	49.6	146.2	96.6	114.0	4.89
	11:15	6.76	4.69	0.581	195	1.190	197.4	247.7	50.3	149.0	98.7	116.1	4.92
	11:20	6.99	4.84	0.585	194	1.223	198.6	249.5	50.9	150.2	99.3	117.1	4.90
	11:25	7.21	5.00	0.591	193	1.258	200.5	252.3	51.8	152.1	100.3	118.6	4.87
	11:30	7.47	5.18	0.594	193	1.297	201.3	253.8	52.5	153.1	100.6	119.6	4.83
	11:35	7.69	5.33	0.597	192	1.329	202.1	255.1	53.0	154.0	101.0	120.4	4.81
	11:40	7.89	5.47	0.600	192	1.359	202.9	256.3	53.4	154.8	101.4	121.0	4.80
	11:45	8.15	5.65	0.603	191	1.396	203.6	257.7	54.1	155.9	101.8	122.0	4.76
	11:50	8.40	5.83	0.606	191	1.434	204.3	258.8	54.5	156.7	102.2	122.6	4.75
	11:55	8.61	5.97	0.608	190	1.463	204.8	259.9	55.1	157.5	102.4	123.4	4.72

Borehole No. :	**WCH-BH09**	**Sample Depth m:- 3.00 - 4.00**	
Sample No. :	**1**	**Specimen Depth m:- 3.80 - 4.00**	
Customer :	**Mass Transit Railway Corporation**		Compiled by W S Wat
Project :	**Ground Investigation for South Island Line**		
		Contract No.: Contract 1024	Checked by
Job No.:	**J2999**	**Works Order No.: 059**	

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Form : GESR009.14 / Dec.13.04 / Issue 1 / Rev

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2
Shearing Continuation

FAILURE CRITERION

Max. deviator Stress ☒ | Max. Stress ratio ☐ | Axial Strain % ☐

Stage :	1	Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
Date	Time	Dial		P.R.No. 10	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
16/12	12:00	8.82	6.11	0.610	190	1.491	205.2	260.6	55.4	158.0	102.6	123.8	4.70
	12:05	9.22	6.39	0.611	189	1.548	204.9	261.1	56.2	158.6	102.4	124.5	4.65
	12:10	9.43	6.54	0.609	189	1.578	203.8	260.3	56.5	158.4	101.9	124.4	4.61
	12:15	9.73	6.74	0.607	188	1.617	202.5	259.5	57.0	158.3	101.3	124.5	4.55
	12:20	9.97	6.92	0.607	188	1.653	202.1	259.4	57.3	158.4	101.1	124.7	4.53
	12:25	10.23	7.10	0.609	187	1.688	202.4	260.0	57.6	158.8	101.2	125.1	4.51
	12:30	10.49	7.27	0.610	187	1.720	202.4	260.4	58.0	159.2	101.2	125.5	4.49
	12:35	10.74	7.45	0.612	187	1.755	202.7	260.7	58.0	159.4	101.4	125.6	4.50
	12:40	10.99	7.62	0.615	187	1.787	203.5	261.8	58.3	160.0	101.7	126.1	4.49
	12:45	11.27	7.81	0.621	186	1.822	205.2	263.8	58.6	161.2	102.6	127.0	4.50
	12:50	11.50	7.98	0.624	186	1.854	206.0	264.9	58.9	161.9	103.0	127.6	4.50
	12:55	11.67	8.09	0.626	186	1.874	206.4	265.1	58.7	161.9	103.2	127.5	4.52
	13:00	**11.82**	**8.20**	**0.628**	**186**	**1.894**	**206.9**	**265.9**	**59.0**	**162.5**	**103.5**	**128.0**	**4.51**
	13:05	12.12	8.40	0.628	186	1.930	206.4	265.7	59.3	162.5	103.2	128.1	4.48
	13:10	12.40	8.60	0.624	186	1.966	204.4	263.9	59.5	161.7	102.2	127.6	4.44
	13:15	12.67	8.79	0.622	185	2.000	203.2	262.8	59.6	161.2	101.6	127.3	4.41
	13:30	13.40	9.29	0.619	185	2.088	200.9	260.8	59.9	160.4	100.5	126.9	4.35
	13:45	14.17	9.82	0.620	185	2.178	200.0	260.2	60.2	160.2	100.0	126.9	4.32
	14:00	14.93	10.35	0.622	185	2.266	199.4	259.8	60.4	160.1	99.7	126.9	4.30
	14:15	15.85	10.99	0.624	184	2.371	198.6	259.2	60.6	159.9	99.3	126.8	4.28
	14:30	16.45	11.41	0.625	184	2.437	198.0	258.8	60.8	159.8	99.0	126.8	4.26
	14:45	17.12	11.87	0.626	184	2.509	197.2	258.3	61.1	159.7	98.6	126.8	4.23
	15:00	17.90	12.41	0.628	183	2.593	196.6	258.2	61.6	159.9	98.3	127.1	4.19
	15:15	18.61	12.91	0.628	183	2.668	195.4	257.0	61.6	159.3	97.7	126.7	4.17
	15:30	19.37	13.43	0.630	183	2.745	194.8	256.6	61.8	159.2	97.4	126.7	4.15

Borehole No. : WCH-BH09 — **Sample Depth m:-** 3.00 - 4.00

Sample No. : 1 — **Specimen Depth m:-** 3.80 - 4.00

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 — **Works Order No.:** 059

Compiled by: W S Wat

Checked by:

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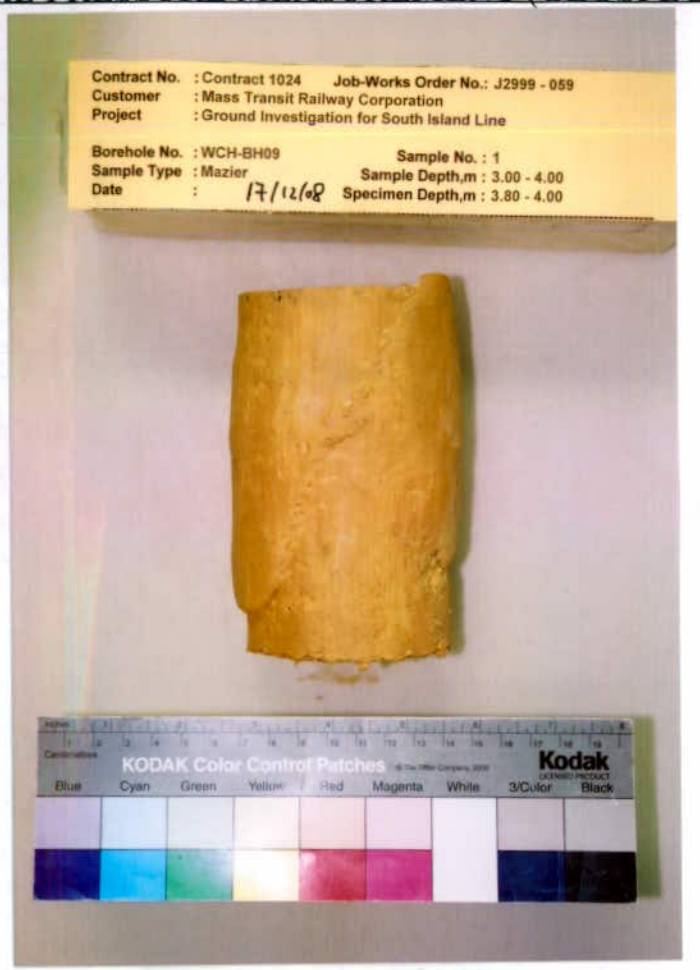
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT (GEOSPEC 3 : 2001 Test Method 15.2)



Description : Orangish brown, slightly gravelly, slightly sandy SILT/CLAY **Sample Origin :** COL‡ ‡ Information provided by customer

Borehole No. : WCH-BH09 **Sample No. :** 1 **Sample Depth m:-** 3.00 - 4.00 **Specimen Depth m:-** 3.80 - 4.00

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line

Contract No. : Contract 1024
Job No. : J2999
Works Order No.: 059

Compiled by W S Wat
Checked by H W Chung

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GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	WCH-BH09		
Sample		no	5		
Sample Type			Mazier		
Stage		no	1		
Sample Depth		m	5.00 - 6.00		
Specimen Depth		m	5.60 - 5.80		
INITIAL CONDITIONS					
Diameter	(D_o)	mm	74.0		
Height	(H_o)	mm	145.0		
Moisture Content	(W_o)	%	26		
Bulk density	(ρ_o)	Mg/m^3	1.95		
Dry density	(ρ_d)	Mg/m^3	1.54		
Particle density	(ρ_s)		2.65		
Voids Ratio	(e_o)		0.72		
Degree of Saturation	(S_r)	%	97.1		
DRAINAGE CONDITIONS			ONE END		
SATURATION					
Final Pore Pressure Coefficient B			0.98		
CONSOLIDATION					
Cell Pressure	(σ_3)	kPa	300		
Back Pressure	(u_b)	kPa	245		
Effective Pressure	(σ'_3)	kPa	55		
Coefficient of Consolidation (t100)	(C_{vi})	m^2/Year	113.84		
Coefficient of Volume Compressibility	(m_{vi})	m^2/MN	0.43		
Coefficient of Permeability (k)		m/s	1.52E-08		
COMPRESSION TERMINATION CRITERION			MAXIMUM DEVIATOR STRESS		
COMPRESSION - INITIAL					
Moisture Content	(w)	%	26		
Pore Pressure at the End of Consolidation		kPa	245		
Effective Stress at the End of Consolidation		kPa	55		
Bulk density	(ρ_o)	Mg/m^3	1.98		
Dry density	(ρ_d)	Mg/m^3	1.57		
Voids Ratio	(e)		0.69		
Degree of Saturation	(S_r)	%	101.2		

Customer : **Mass Transit Railway Corporation**

Project : **Ground Investigation for South Island Line**

Report No. : J2999-059.11

Contract No.: Contract 1024

Job No.: **J2999** **Works Order No.: 059**

Technician : W S Wat Checked By : Approved By :

Name : H W Chung Signatory : **Lau Wai Cheong**

Tested Date: 03/12/2008 Date : 16/12/2008 Date : 16/12/2008

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	WCH-BH09		
Sample		no	5		
Sample Type			Mazier		
Stage		no	1		
Sample Depth		m	5.00 - 6.00		
Specimen Depth		m	5.60 - 5.80		
COMPRESSION - FAILURE					
Cell Pressure		kPa	300		
Rate of Strain		mm/min	0.035		
CONDITIONS MAXIMUM DEVIATOR STRESS					
Major Effective Principal Stress (σ'_1)		kPa	392		
Corrected Deviator Stress ($\sigma'_1 - \sigma'_3$)		kPa	283		
Minor Effective Principal Stress (σ'_3)		kPa	110		
$s' = (\sigma'_1 + \sigma'_3)/2$		kPa	251		
$t = (\sigma_1 - \sigma_3)/2$		kPa	141		
Expanded Uncertainty of s' ^		kPa	-		
Expanded Uncertainty of t ^		kPa	-		
Pore pressure parameter A_f			-0.19		
Strain at Failure	(εf)	%	20.1		
COMPRESSION - FINAL					
Moisture Content	(W_f)	%	26		
Bulk density	(ρ_o)	Mg/m^3	1.98		
Dry density	(ρ_d)	Mg/m^3	1.57		
Voids Ratio	(e_f)		0.69		
Degree of Saturation	(S_f)	%	101.2		

Notes -
1. The method of specimen preparation was in accordance with GEOSPEC 3 : 2001 :- Test method 13.3 : test specimen from undisturbed soil samples.
2. Sample received date :29/09/2008
3. The determination of moisture content was in accordance with test method 5.1 of GEOSPEC 3 : 2001.
4. Particle density : 2.65 (Assumed)
5. Maximum and minimum temperature recorded over the period of testing 19.9 - 20.7 °C.
6. Unavoidable variations from specified procedure : none
7. Comment on observed or inferred sample disturbance : none
8. Percentage by mass of soil particles larger than 1/5 of the diameter of specimen (%) : Nil
9. The specimen was selected by the laboratory.
   Name : W S Wat Designation : Senior Laboratory Technician
10. Sampling History : As Received

* Delete as appropriate ^ Upon request

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.: 059**

Compiled by W S Wat
Checked by H W Chung

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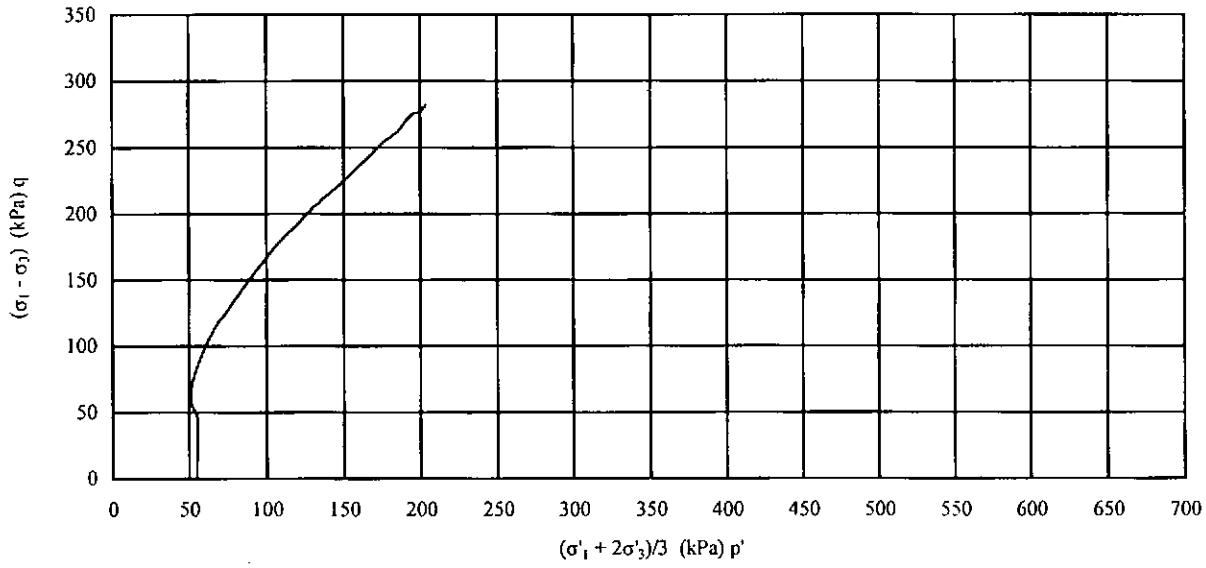
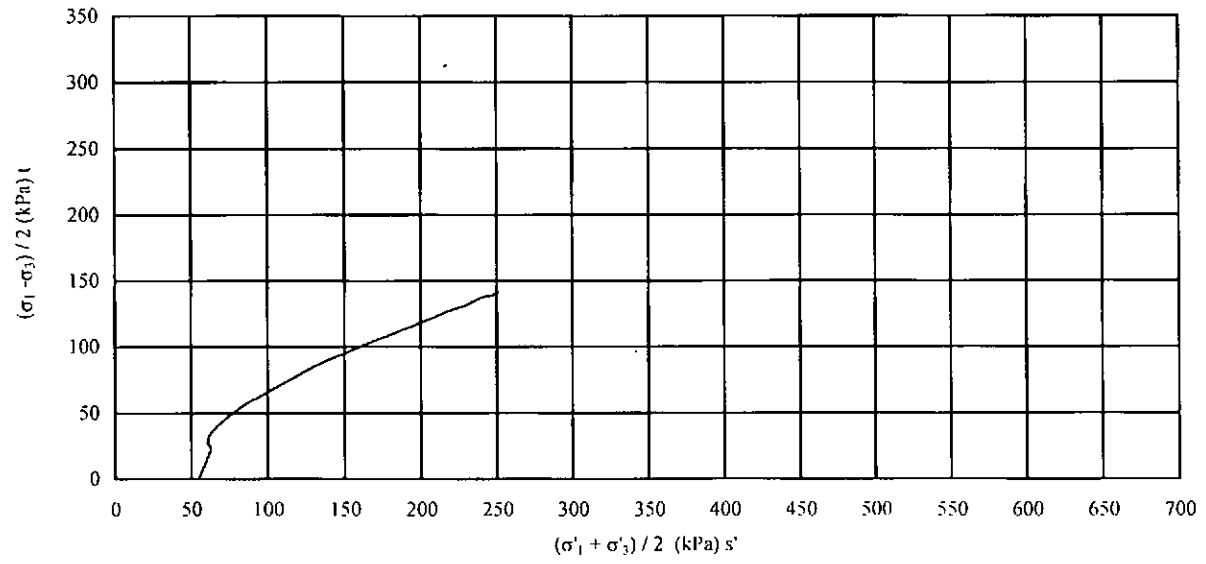
GEOSPEC 3 : 2001 Test Method 15.2

STRESS PATH PARAMETERS FOR EFFECTIVE STRESS

p' - q PLOT



s' - t PLOT



Borehole No. :	**WCH-BH09**	**Sample Depth m:-**	**5.00 - 6.00**
Sample No. :	**5**	**Specimen Depth m:-**	**5.60 - 5.80**
Customer :	**Mass Transit Railway Corporation**		Compiled by W S Wat
Project :	**Ground Investigation for South Island Line**		
		Contract No.: Contract 1024	Checked by H W Chung
Job No.:	**J2999**	**Works Order No.: 059**	

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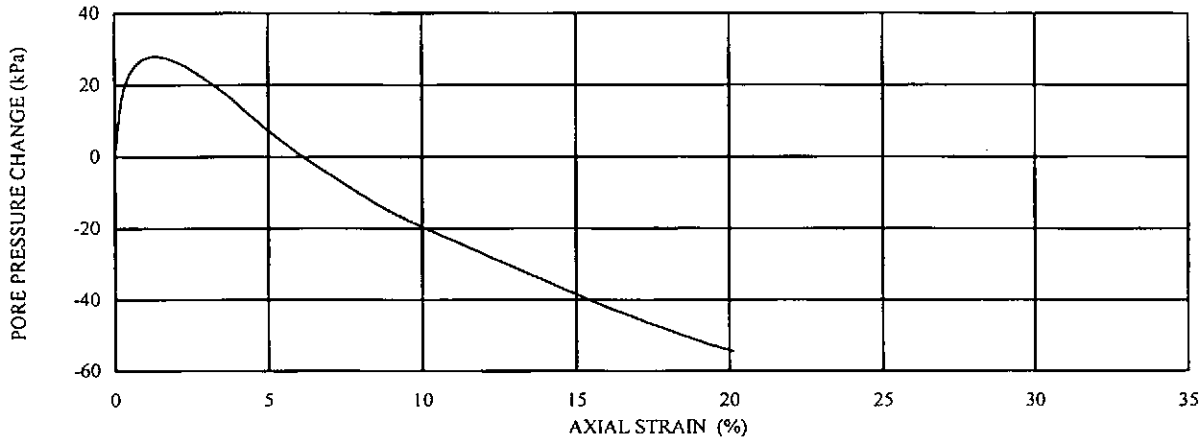
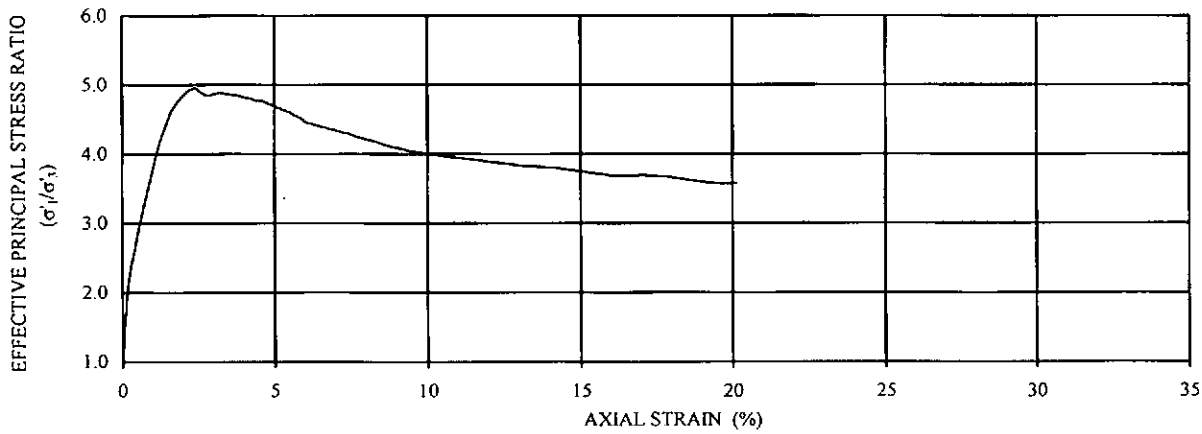
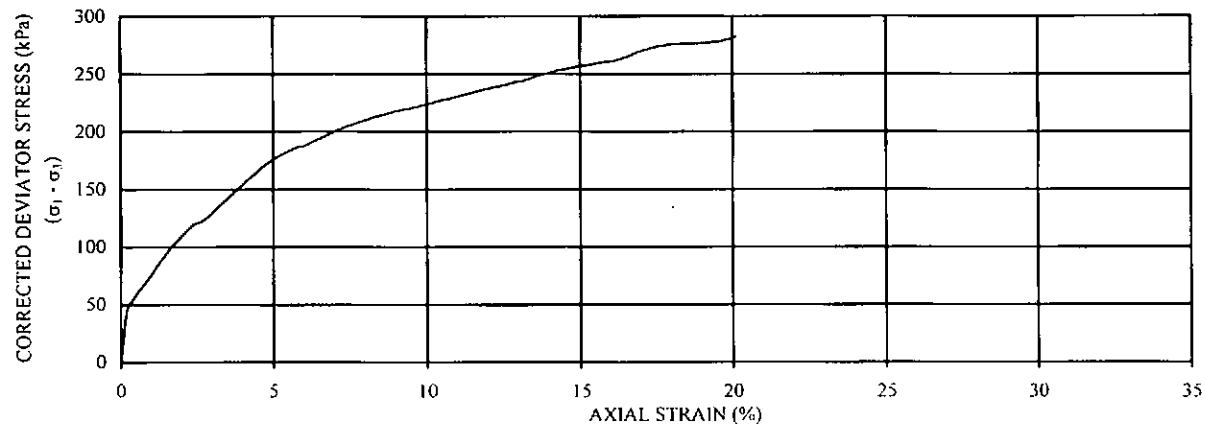
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

COMPRESSION







Borehole No. :	**WCH-BH09**	**Sample Depth m:-**	**5.00 - 6.00**
Sample No. :	**5**	**Specimen Depth m:-**	**5.60 - 5.80**
Customer :	**Mass Transit Railway Corporation**		Compiled by W S Wat
Project :	**Ground Investigation for South Island Line**		
		Contract No.: Contract 1024	Checked by H W Chung
Job No.:	**J2999**	**Works Order No.: 059**	

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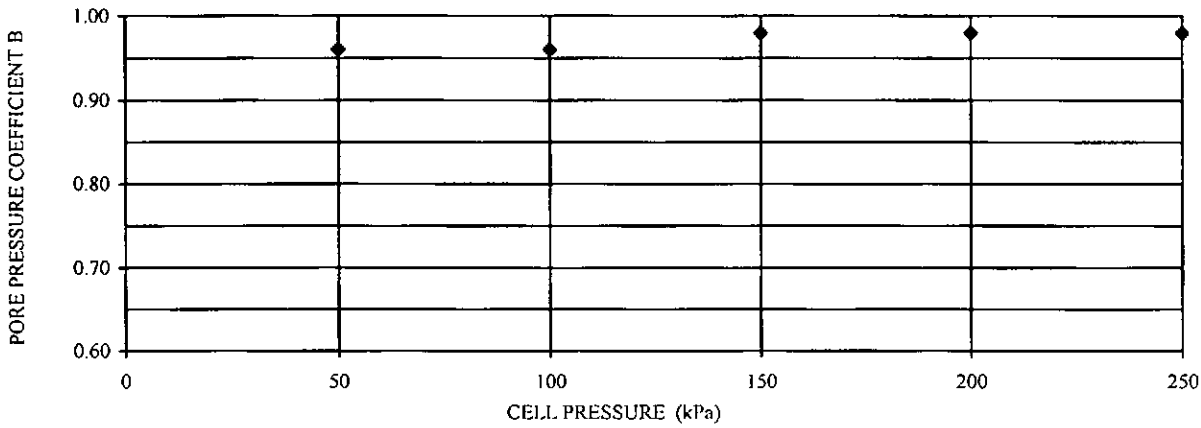
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

SATURATION



Date	Time	Cell Pressure kPa	Back Pressure kPa	Pore Pressure kPa	Cumulative Volume of Water cm^3	Pore Pressure Coefficient B
04/12/2008	09:09	0	0	-	0.0	
	09:17	25	-	24		-
	09:41	25	20	20	-3.2	
	09:59	50	-	44		0.96
	10:07	50	45	45	-3.1	
	10:27	100	-	93		0.96
	10:35	100	95	95	-2.9	
	10:57	150	-	144		0.98
	11:00	150	145	145	-2.7	
	11:26	200	-	194		0.98
	11:33	200	195	195	-2.4	
	11:37	250	-	244		0.98
05/12/2008	08:30	250	245	245	10.5	

Borehole No. WCH-BH09 — **Sample Depth m:-** 5.00 - 6.00
Sample No. : 5 — **Specimen Depth m:-** 5.60 - 5.80
Customer : Mass Transit Railway Corporation — Compiled by W S Wat
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024 — Checked by H W Chung
Job No.: J2999 — **Works Order No.:** 059

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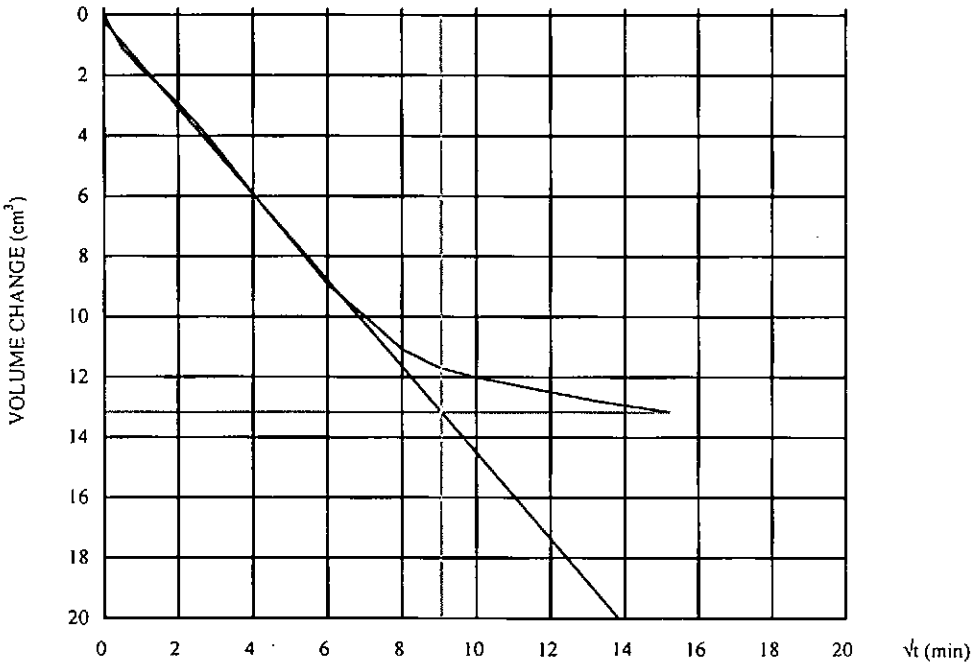
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

CONSOLIDATION (DRAINED PHASE) - Stage 1

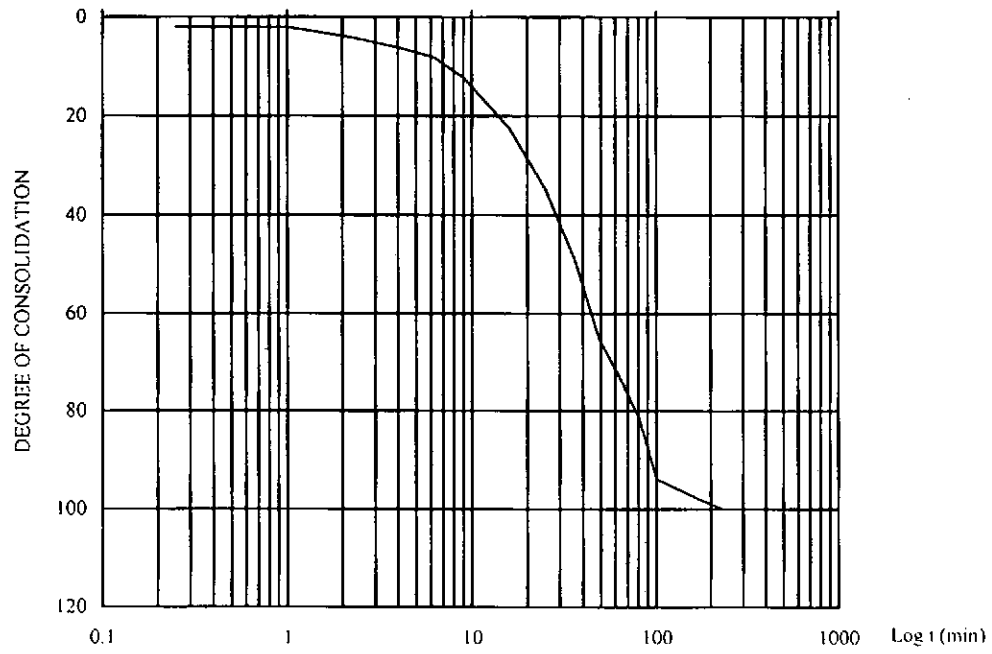


√t100 9.06 min

t100 81.993 min

tf 43.457 min

Calc. strain rate
0.232 mm/min



Borehole No. : WCH-BH09 **Sample Depth m:-** 5.00 - 6.00

Sample No. : 5 **Specimen Depth m:-** 5.60 - 5.80

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.:** 059

Complied by: W S Wat

Checked by: H W Chung

Form : GESR009.13 / Jun.02.03 / Issue 1 / Rev 0

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GEOSPEC 3 : 2001 Test Method 15.2

Single Stage		P.W.P,B.P			Effective Pressure	55	kPa
Side drains	No	Selected Machine Speed	0.035	mm/min	Rate of Strain	1.46	% per hr

FAILURE CRITERION

Max. deviator Stress	☒	Max. Stress ratio	☐		Axial Strain %		☐
Stage : 1	Applied Pressure (kPa) - Cell :	300	Back :	245	P.R. factor	1.7305	kN/mm

Date	Time	Strain Dial	Strain	Load P.R.No. 10	Pore Pressure	Dev. stress Corr.	Dev. stress q $\sigma_1 - \sigma_3$	Effective Stress σ'_1	Effective Stress σ'_3	s' $(\sigma'_1+\sigma'_3)$ 2	t $(\sigma_1-\sigma_3)$ 2	p' $(\sigma'_1+2\sigma'_3)$ 3	Stress Ratio σ'_1/σ'_3
		mm	%	mm	kPa	kPa							
05/12	15:00	0.00	0.00	0.075	245	0.000	0.0	55.0	55.0	55.0	0.0	55.0	1.00
	15:11	0.29	0.20	0.186	260	0.058	45.2	85.5	40.3	62.9	22.6	55.4	2.12
	15:20	0.58	0.40	0.209	266	0.115	54.4	88.3	33.9	61.1	27.2	52.0	2.60
	15:29	0.87	0.60	0.228	270	0.171	61.9	92.4	30.5	61.5	31.0	51.1	3.03
	15:38	1.16	0.81	0.246	272	0.230	69.0	97.5	28.5	63.0	34.5	51.5	3.42
	15:47	1.45	1.01	0.265	273	0.285	76.5	104.0	27.5	65.8	38.3	53.0	3.78
	15:56	1.74	1.21	0.286	273	0.339	84.8	111.9	27.1	69.5	42.4	55.4	4.13
	16:05	2.03	1.41	0.303	273	0.393	91.4	118.5	27.1	72.8	45.7	57.6	4.37
	16:14	2.32	1.61	0.321	273	0.446	98.4	125.7	27.3	76.5	49.2	60.1	4.60
	16:23	2.61	1.81	0.337	272	0.499	104.5	132.4	27.9	80.2	52.3	62.7	4.75
	16:32	2.90	2.01	0.351	271	0.551	109.9	138.5	28.6	83.5	54.9	65.2	4.84
	16:42	3.19	2.22	0.366	271	0.605	115.6	145.0	29.4	87.2	57.8	67.9	4.93
	16:51	3.48	2.42	0.378	270	0.655	120.1	150.5	30.4	90.4	60.0	70.4	4.95
	16:59	3.77	2.62	0.383	269	0.706	121.8	153.2	31.4	92.3	60.9	72.0	4.88
	17:07	4.06	2.82	0.393	267	0.755	125.4	158.0	32.6	95.3	62.7	74.4	4.85
	17:16	4.35	3.02	0.406	266	0.804	130.3	164.0	33.7	98.8	65.1	77.1	4.87
	17:25	4.64	3.22	0.420	265	0.852	135.5	170.4	34.9	102.6	67.7	80.1	4.88
	17:33	4.93	3.42	0.433	264	0.900	140.3	176.6	36.3	106.4	70.1	83.1	4.86
	17:42	5.22	3.63	0.446	262	0.950	145.1	182.7	37.6	110.1	72.5	86.0	4.86
	17:51	5.51	3.83	0.459	261	0.996	149.8	188.8	39.0	113.9	74.9	88.9	4.84
	17:59	5.80	4.03	0.472	260	1.043	154.5	195.0	40.5	117.8	77.3	92.0	4.82
	18:08	6.09	4.23	0.486	258	1.088	159.6	201.6	42.0	121.8	79.8	95.2	4.80
	18:17	6.38	4.43	0.498	257	1.133	163.9	207.4	43.5	125.5	82.0	98.1	4.77
	18:26	6.67	4.63	0.512	255	1.178	169.0	213.9	44.9	129.4	84.5	101.2	4.76
	18:35	6.96	4.83	0.523	254	1.222	172.9	219.3	46.4	132.8	86.4	104.0	4.73
	18:44	7.25	5.03	0.533	252	1.265	176.3	224.1	47.8	136.0	88.2	106.6	4.69
	18:53	7.54	5.24	0.542	251	1.311	179.4	228.6	49.2	138.9	89.7	109.0	4.65
	19:02	7.83	5.44	0.551	250	1.353	182.5	233.0	50.5	141.7	91.2	111.3	4.61
	19:11	8.12	5.64	0.558	248	1.395	184.7	236.5	51.8	144.2	92.4	113.4	4.57
	19:20	8.41	5.84	0.565	247	1.437	187.0	240.1	53.1	146.6	93.5	115.4	4.52
	19:28	8.70	6.04	0.568	246	1.478	187.7	242.0	54.3	148.1	93.8	116.9	4.46
	19:36	8.99	6.24	0.577	245	1.519	190.7	246.2	55.5	150.8	95.3	119.1	4.44
	19:45	9.28	6.44	0.585	243	1.559	193.3	250.0	56.7	153.3	96.6	121.1	4.41
	19:53	9.57	6.65	0.593	242	1.601	195.9	253.8	57.9	155.8	97.9	123.2	4.38
	20:02	9.86	6.85	0.600	241	1.640	198.1	257.1	59.0	158.0	99.0	125.0	4.36
	20:10	10.15	7.05	0.608	240	1.679	200.6	260.7	60.1	160.4	100.3	127.0	4.34
	20:19	10.44	7.25	0.615	239	1.718	202.8	264.1	61.3	162.7	101.4	128.9	4.31
	20:27	10.73	7.45	0.622	238	1.756	205.0	267.3	62.3	164.8	102.5	130.6	4.29
	20:36	11.02	7.65	0.628	237	1.794	206.7	270.2	63.5	166.9	103.4	132.4	4.26

Borehole No. :	**WCH-BH09**	**Sample Depth m:- 5.00 - 6.00**	
Sample No. :	**5**	**Specimen Depth m:- 5.60 - 5.80**	
Customer :	**Mass Transit Railway Corporation**		Compiled by W S Wat
Project :	**Ground Investigation for South Island Line**		
		Contract No.: Contract 1024	Checked by H W Chung
Job No.:	**J2999**	**Works Order No.: 059**	

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2
Shearing Continuation

FAILURE CRITERION

Max. deviator Stress ☒ Max. Stress ratio ☐ Axial Strain % ☐

Stage :	1	Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
Date	Time	Dial		P.R.No. 10	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
05/12	20:45	11.31	7.85	0.635	235	1.831	208.9	273.5	64.6	169.0	104.4	134.2	4.23
	20:54	11.60	8.06	0.641	234	1.870	210.6	276.3	65.7	171.0	105.3	135.9	4.21
	21:02	11.89	8.26	0.647	233	1.906	212.4	279.1	66.7	172.9	106.2	137.5	4.18
	21:11	12.18	8.46	0.652	232	1.943	213.7	281.5	67.8	174.7	106.9	139.0	4.15
	21:20	12.47	8.66	0.657	231	1.978	215.1	283.9	68.8	176.3	107.5	140.5	4.13
	21:29	12.76	8.86	0.662	230	2.014	216.4	286.2	69.8	178.0	108.2	141.9	4.10
	21:38	13.05	9.06	0.668	229	2.049	218.2	288.9	70.7	179.8	109.1	143.4	4.09
	21:47	13.34	9.26	0.672	228	2.084	219.1	290.7	71.6	181.2	109.6	144.6	4.06
	21:55	13.63	9.47	0.677	228	2.120	220.4	292.9	72.5	182.7	110.2	146.0	4.04
	22:03	13.92	9.67	0.682	227	2.154	221.8	295.1	73.3	184.2	110.9	147.2	4.03
	22:12	14.21	9.87	0.688	226	2.188	223.4	297.5	74.1	185.8	111.7	148.6	4.02
	22:20	14.50	10.07	0.693	225	2.222	224.7	299.7	75.0	187.4	112.4	149.9	4.00
	22:29	14.79	10.27	0.698	224	2.255	226.0	301.7	75.7	188.7	113.0	151.0	3.99
	22:37	15.08	10.47	0.704	224	2.288	227.7	304.2	76.5	190.3	113.8	152.4	3.98
	22:46	15.37	10.67	0.708	223	2.321	228.6	305.9	77.3	191.6	114.3	153.5	3.96
	22:54	15.66	10.88	0.714	222	2.355	230.2	308.2	78.0	193.1	115.1	154.7	3.95
	23:03	15.95	11.08	0.719	221	2.387	231.5	310.2	78.7	194.4	115.7	155.9	3.94
	23:11	16.24	11.28	0.724	221	2.419	232.7	312.2	79.5	195.9	116.4	157.1	3.93
	23:20	16.53	11.48	0.730	220	2.450	234.3	314.5	80.2	197.4	117.2	158.3	3.92
	23:29	16.82	11.68	0.736	219	2.482	235.9	316.9	81.0	199.0	118.0	159.6	3.91
	23:38	17.11	11.88	0.741	218	2.513	237.1	318.9	81.8	200.4	118.6	160.8	3.90
	23:47	17.40	12.08	0.746	217	2.544	238.3	320.9	82.6	201.8	119.2	162.0	3.89
	23:56	17.69	12.29	0.751	217	2.576	239.6	323.0	83.4	203.2	119.8	163.3	3.87
06/12	00:05	17.98	12.49	0.756	216	2.607	240.8	324.9	84.1	204.5	120.4	164.4	3.86
	00:13	18.27	12.69	0.761	215	2.637	241.9	326.8	84.9	205.9	121.0	165.5	3.85
	00:22	18.56	12.89	0.767	214	2.667	243.5	329.2	85.7	207.4	121.7	166.9	3.84
	00:30	18.85	13.09	0.771	214	2.697	244.3	330.7	86.4	208.6	122.2	167.8	3.83
	00:38	19.14	13.29	0.777	213	2.727	245.8	332.9	87.1	210.0	122.9	169.0	3.82
	00:47	19.43	13.49	0.784	212	2.757	247.7	335.6	87.9	211.7	123.8	170.5	3.82
	00:55	19.72	13.70	0.791	211	2.787	249.5	338.1	88.6	213.4	124.8	171.8	3.82
	01:04	20.01	13.90	0.796	211	2.817	250.7	340.1	89.4	214.7	125.3	173.0	3.80
	01:12	20.30	14.10	0.802	210	2.846	252.2	342.3	90.1	216.2	126.1	174.2	3.80
	01:21	20.59	14.30	0.808	209	2.875	253.6	344.5	90.9	217.7	126.8	175.4	3.79
	01:29	20.88	14.50	0.812	208	2.904	254.4	346.0	91.6	218.8	127.2	176.4	3.78
	01:38	21.17	14.70	0.817	208	2.932	255.5	347.9	92.4	220.2	127.8	177.6	3.77
	01:47	21.46	14.90	0.822	207	2.961	256.6	349.7	93.1	221.4	128.3	178.6	3.76
	01:55	21.75	15.10	0.826	206	2.990	257.4	351.2	93.8	222.5	128.7	179.6	3.74
	02:04	22.04	15.31	0.830	205	3.019	258.1	352.7	94.6	223.6	129.0	180.6	3.73
	02:13	22.33	15.51	0.835	205	3.048	259.2	354.6	95.4	225.0	129.6	181.8	3.72
	02:22	22.62	15.71	0.840	204	3.076	260.2	356.3	96.1	226.2	130.1	182.8	3.71
	02:31	22.91	15.91	0.844	203	3.104	261.0	357.8	96.8	227.3	130.5	183.8	3.70

Borehole No. : WCH-BH09 **Sample Depth m:- 5.00 - 6.00**

Sample No. : 5 **Specimen Depth m:- 5.60 - 5.80**

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.:** 059

Compiled by: W S Wat

Checked by: H W Chung

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2
Shearing Continuation

FAILURE CRITERION

Max. deviator Stress ☒ | Max. Stress ratio ☐ | Axial Strain % ☐

Stage :	1	Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
Date	Time	Dial		P.R.No. 10	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
06/12	02:39	23.20	16.11	0.847	203	3.132	261.3	358.7	97.4	228.1	130.7	184.5	3.68
	02:48	23.49	16.31	0.854	202	3.160	263.1	361.1	98.0	229.5	131.5	185.7	3.68
	02:56	23.78	16.51	0.861	201	3.188	264.8	363.5	98.7	231.1	132.4	187.0	3.68
	03:05	24.07	16.72	0.869	201	3.218	266.8	366.2	99.4	232.8	133.4	188.3	3.68
	03:13	24.36	16.92	0.878	200	3.246	269.2	369.3	100.1	234.7	134.6	189.8	3.69
	03:22	24.65	17.12	0.885	199	3.274	270.9	371.6	100.7	236.1	135.4	191.0	3.69
	03:30	24.94	17.32	0.891	199	3.301	272.2	373.6	101.4	237.5	136.1	192.1	3.68
	03:39	25.23	17.52	0.897	198	3.329	273.5	375.5	102.0	238.8	136.8	193.2	3.68
	03:47	25.52	17.72	0.902	197	3.357	274.5	377.1	102.6	239.8	137.2	194.1	3.68
	03:56	25.81	17.92	0.907	197	3.385	275.5	378.8	103.3	241.0	137.7	195.1	3.67
	04:05	26.10	18.13	0.910	196	3.414	275.8	379.7	103.9	241.8	137.9	195.8	3.65
	04:13	26.39	18.33	0.913	196	3.442	276.0	380.5	104.5	242.5	138.0	196.5	3.64
	04:22	26.68	18.53	0.915	195	3.470	276.0	381.1	105.1	243.1	138.0	197.1	3.63
	04:31	26.97	18.73	0.918	194	3.498	276.3	382.0	105.7	243.8	138.1	197.8	3.61
	04:39	27.26	18.93	0.921	194	3.526	276.5	382.8	106.3	244.6	138.3	198.5	3.60
	04:48	27.55	19.13	0.924	193	3.554	276.8	383.7	106.9	245.3	138.4	199.2	3.59
	04:57	27.84	19.33	0.928	193	3.582	277.4	384.9	107.5	246.2	138.7	200.0	3.58
	05:05	28.13	19.54	0.932	192	3.612	278.0	386.0	108.0	247.0	139.0	200.7	3.57
	05:14	28.42	19.74	0.938	192	3.640	279.2	387.7	108.5	248.1	139.6	201.6	3.57
	05:22	28.71	19.94	0.945	191	3.668	280.8	389.8	109.0	249.4	140.4	202.6	3.58
	05:31	**29.00**	**20.14**	**0.953**	**191**	**3.697**	**282.6**	**392.1**	**109.5**	**250.8**	**141.3**	**203.7**	**3.58**

Borehole No. : WCII-BH09 — **Sample Depth m:-** 5.00 - 6.00
Sample No. : 5 — **Specimen Depth m:-** 5.60 - 5.80

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 — **Works Order No.:** 059

Compiled by: W S Wat
Checked by: H W Chung

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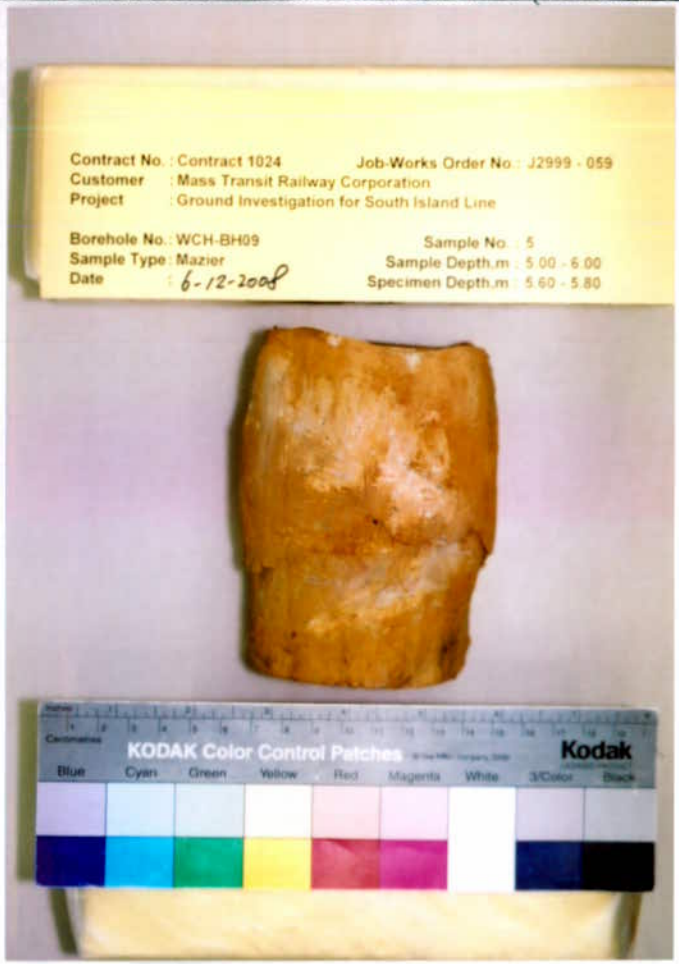
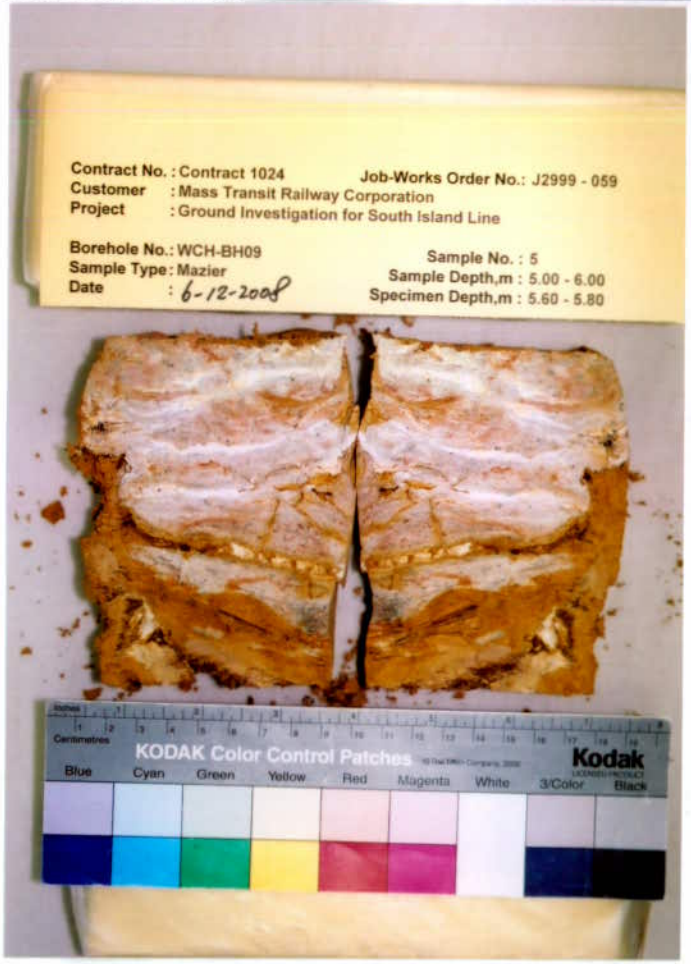
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT (GEOSPEC 3 : 2001 Test Method 15.2)





Description : Brown, gravelly, very silty SAND **Sample Origin :** CDT‡ ‡ Information provided by customer

Borehole No. : WCH-BH09 **Sample No. :** 5 **Sample Depth m:-** 5.00 - 6.00 **Specimen Depth m:-** 5.60 - 5.80

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line

Contract No. : Contract 1024
Job No. : J2999
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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	WCH-BH09	WCH-BH09	WCH-BH09
Sample		no	5	5	5
Sample Type			Mazier	Mazier	Mazier
Stage		no	1	2	3
Sample Depth		m	5.00 - 6.00	5.00 - 6.00	5.00 - 6.00
Specimen Depth		m	5.80 - 6.00	5.80 - 6.00	5.80 - 6.00
INITIAL CONDITIONS					
Diameter	(D_o)	mm	74.0	74.7	75.2
Height	(H_o)	mm	145.0	140.4	137.5
Moisture Content	(W_o)	%	26	26	25
Bulk density	(ρ_o)	Mg/m^3	1.97	2.00	2.00
Dry density	(ρ_d)	Mg/m^3	1.57	1.59	1.60
Particle density	(ρ_s)		2.65	2.65	2.65
Voids Ratio	(e_o)		0.69	0.67	0.66
Degree of Saturation	(S_r)	%	98.6	101.8	101.8
DRAINAGE CONDITIONS			ONE END		
SATURATION					
Final Pore Pressure Coefficient B			1.00		
CONSOLIDATION					
Cell Pressure	(σ_3)	kPa	245	270	295
Back Pressure	(u_b)	kPa	220	220	220
Effective Pressure	(σ'_3)	kPa	25	50	75
Coefficient of Consolidation (t100) (C_{vi})		$m^2/Year$	445.30	604.50	734.97
Coefficient of Volume Compressibility (m_{vi})		m^2/MN	0.62	0.22	0.14
Coefficient of Permeability (k)		m/s	8.51E-08	4.16E-08	3.13E-08
COMPRESSION TERMINATION CRITERION			MAXIMUM STRESS RATIO		MAX ($\sigma'1 - \sigma'3$)
COMPRESSION - INITIAL					
Moisture Content	(w)	%	26	25	25
Pore Pressure at the End of Consolidation		kPa	220	220	220
Effective Stress at the End of Consolidation		kPa	25	50	75
Bulk density	(ρ_o)	Mg/m^3	2.00	2.00	2.01
Dry density	(ρ_d)	Mg/m^3	1.59	1.60	1.61
Voids Ratio	(e)		0.67	0.66	0.65
Degree of Saturation	(S_r)	%	101.8	101.8	101.8

Customer : **Mass Transit Railway Corporation**
Project : **Ground Investigation for South Island Line**
Report No. : J2999-059.11
Contract No.: Contract 1024
Job No.: **J2999** **Works Order No.: 059**

Technician : W S Wat Checked By : Approved By :
Name : H W Chung Signatory : **Lau Wai Cheong**
Tested Date: 03/12/2008 Date : 19/12/2008 Date : 19/12/2008

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	WCH-BH09	WCH-BH09	WCH-BH09
Sample		no	5	5	5
Sample Type			Mazier	Mazier	Mazier
Stage		no	1	2	3
Sample Depth		m	5.00 - 6.00	5.00 - 6.00	5.00 - 6.00
Specimen Depth		m	5.80 - 6.00	5.80 - 6.00	5.80 - 6.00
COMPRESSION - FAILURE					
Cell Pressure		kPa	245	270	295
Rate of Strain		mm/min	0.048	0.046	0.045
CONDITIONS AT MAXIMUM STRESS RATIO					
Major Effective Principal Stress (σ'_1)		kPa	162	238	342
Corrected Deviator Stress ($\sigma'_1 - \sigma'_3$)		kPa	130	194	267
Minor Effective Principal Stress (σ'_3)		kPa	32	44	75
$s' = (\sigma'_1 + \sigma'_3)/2$		kPa	97	141	209
$t = (\sigma_1 - \sigma_3)/2$		kPa	65	97	133
Expanded Uncertainty of s' ^		kPa	-	-	-
Expanded Uncertainty of t ^		kPa	-	-	-
Pore pressure parameter A_f			-0.06	0.03	0.00
Strain at Failure	(εf)	%	2.6	4.6	6.8
COMPRESSION - FINAL					
Moisture Content	(W_f)	%	26	25	25
Bulk density	(ρ_o)	Mg/m^3	2.00	2.00	2.01
Dry density	(ρ_d)	Mg/m^3	1.59	1.60	1.61
Voids Ratio	(e_f)		0.67	0.66	0.65
Degree of Saturation	(S_f)	%	101.8	101.8	101.8

Notes -
1. The method of specimen preparation was in accordance with GEOSPEC 3 : 2001 :- Test method 13.3 : test specimen from undisturbed soil samples.
2. Sample received date :29/09/2008
3. The determination of moisture content was in accordance with test method 5.1 of GEOSPEC 3 : 2001.
4. Particle density : 2.65 (Assumed)
5. Maximum and minimum temperature recorded over the period of testing 19.9 - 20.7 °C.
6. Unavoidable variations from specified procedure : none
7. Comment on observed or inferred sample disturbance : none
8. Percentage by mass of soil particles larger than 1/5 of the diameter of specimen (%) : Nil
9. The specimen was selected by the laboratory.
   Name : W S Wat Designation : Senior Laboratory Technician
10. Sampling History : As Received

* Delete as appropriate ^ Upon request

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Job No.: J2999
Contract No.: Contract 1024
Works Order No.: 059

Compiled by W S Wat
Checked by H W Chung

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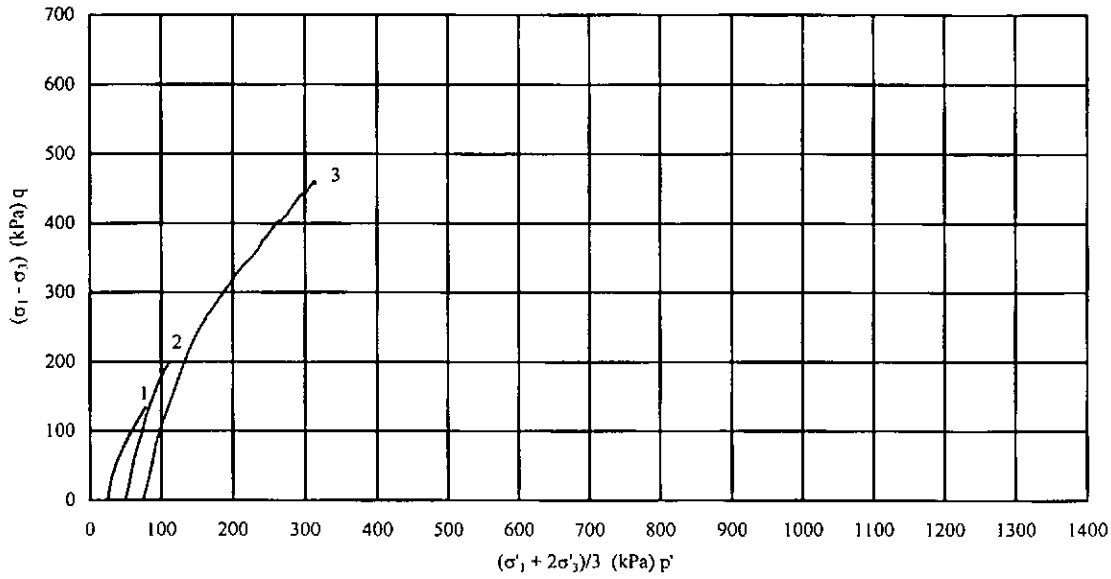
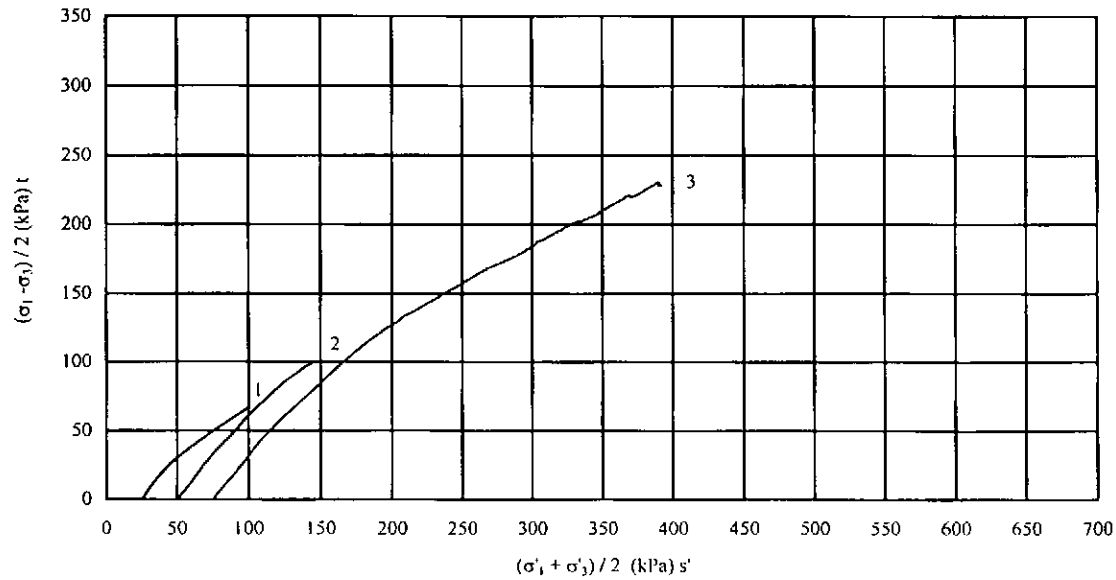
GEOSPEC 3 : 2001 Test Method 15.2

STRESS PATH PARAMETERS FOR EFFECTIVE STRESS

p' - q PLOT



s' - t PLOT



Borehole No. :	**WCH-BH09**	**Sample Depth m:-**	**5.00 - 6.00**
Sample No. :	**5**	**Specimen Depth m:-**	**5.80 - 6.00**
Customer :	**Mass Transit Railway Corporation**		Compiled by W S Wat
Project :	**Ground Investigation for South Island Line**		
		Contract No.: Contract 1024	Checked by H W Chung
Job No.:	**J2999**	**Works Order No.: 059**	

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Form : GESR009.8 / Jun.02.03 / Issue 1 / Rev 0

TEST REPORT
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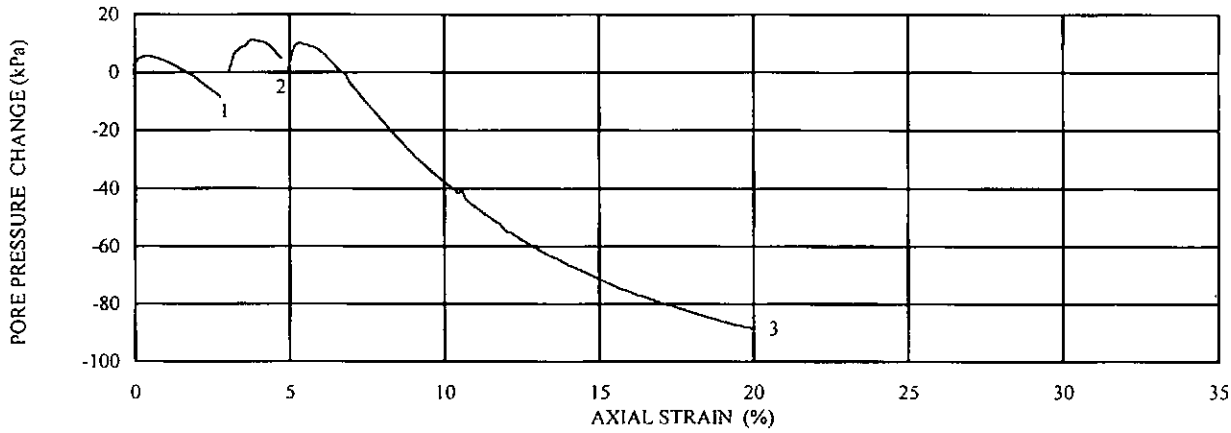
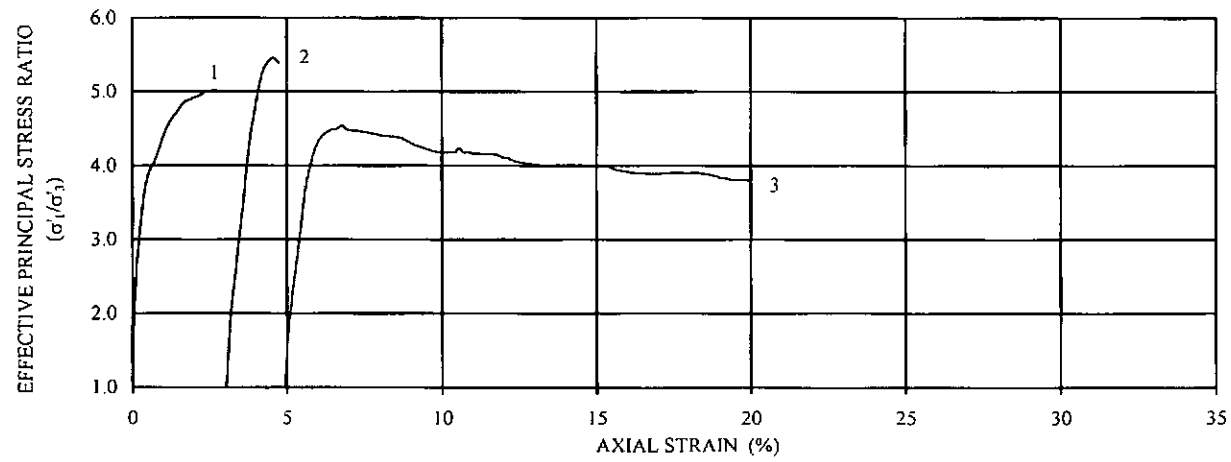
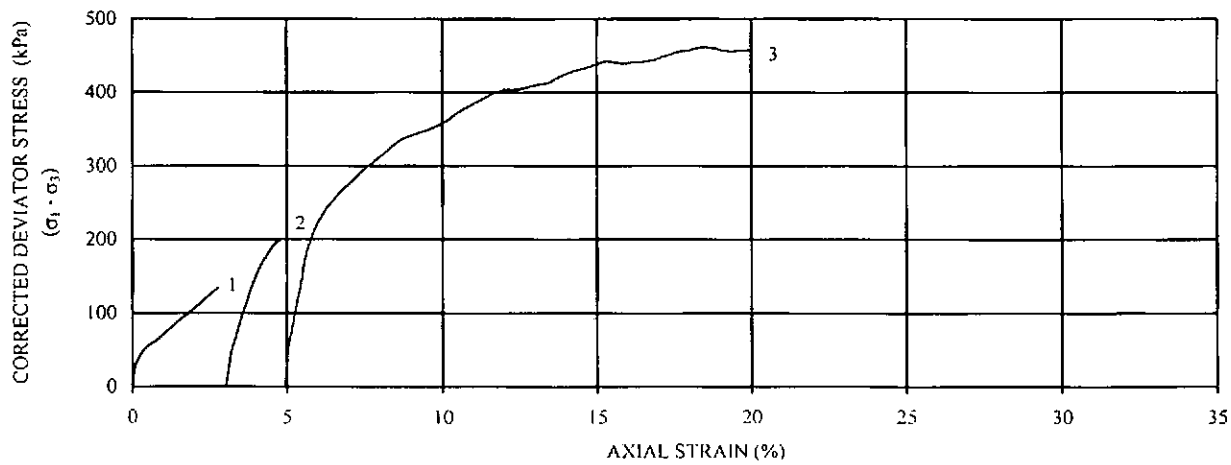
GEOSPEC 3 : 2001 Test Method 15.2

COMPRESSION







Borehole No. : WCH-BH09		**Sample Depth m:-** 5.00 - 6.00
Sample No. : 5		**Specimen Depth m:-** 5.80 - 6.00
Customer : Mass Transit Railway Corporation		Compiled by W S Wat
Project : Ground Investigation for South Island Line		
	Contract No.: Contract 1024	Checked by H W Chung
Job No.: J2999	**Works Order No.:** 059	

Form : GESR009.9 / Jun.02.03 / Issue 1 / Rev 0

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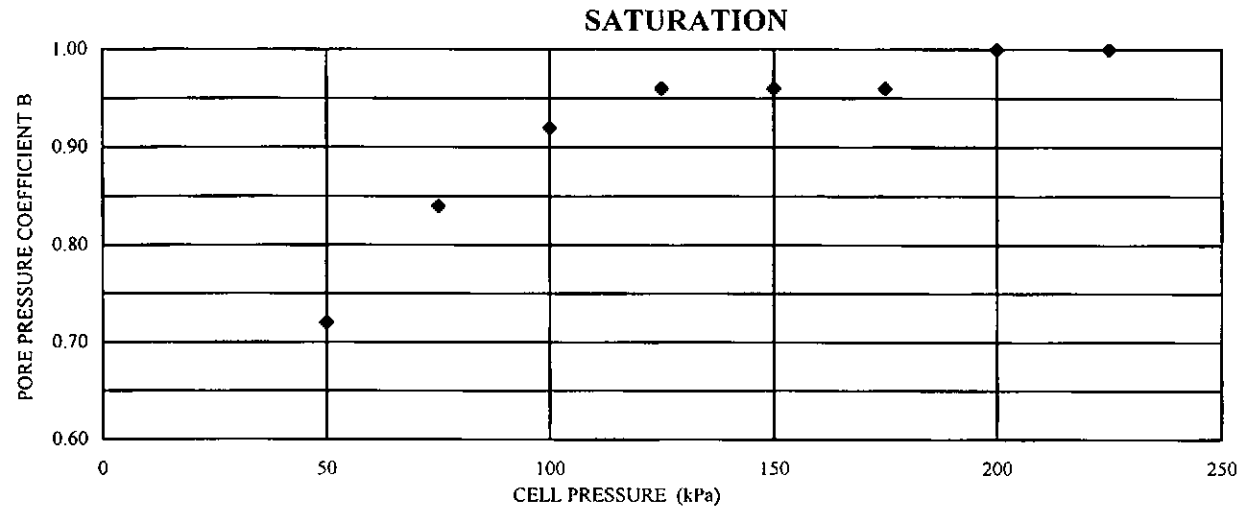
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2



Date	Time	Cell Pressure kPa	Back Pressure kPa	Pore Pressure kPa	Cumulative Volume of Water cm^3	Pore Pressure Parameter B
04/12/2008	08:33	0	0	-	0.0	
	08:45	25	-	24		-
	09:15	25	20	20	-4.0	
	09:20	50	-	38		0.72
	10:05	50	45	45	-2.1	
	10:13	75	-	66		0.84
	10:27	75	70	70	-2.1	
	10:31	100	-	93		0.92
	10:43	100	95	95	-1.8	
	10:50	125	-	119		0.96
	11:06	125	120	120	-1.4	
	11:11	150	-	144		0.96
	11:53	150	145	145	-0.6	
	12:00	175	-	169		0.96
	14:04	175	170	170	0.9	
	14:14	200	-	195		1.00
	14:34	200	195	195	3.0	
	14:46	225	-	220		1.00
05/12/2008	14:40	225	220	220	8.1	

Borehole No. : WCH-BH09 — **Sample Depth m:-** 5.00 - 6.00
Sample No. : 5 — **Specimen Depth m:-** 5.80 - 6.00
Customer : Mass Transit Railway Corporation — Compiled by W S Wat
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024 — Checked by H W Chung
Job No.: J2999 — **Works Order No.:** 059

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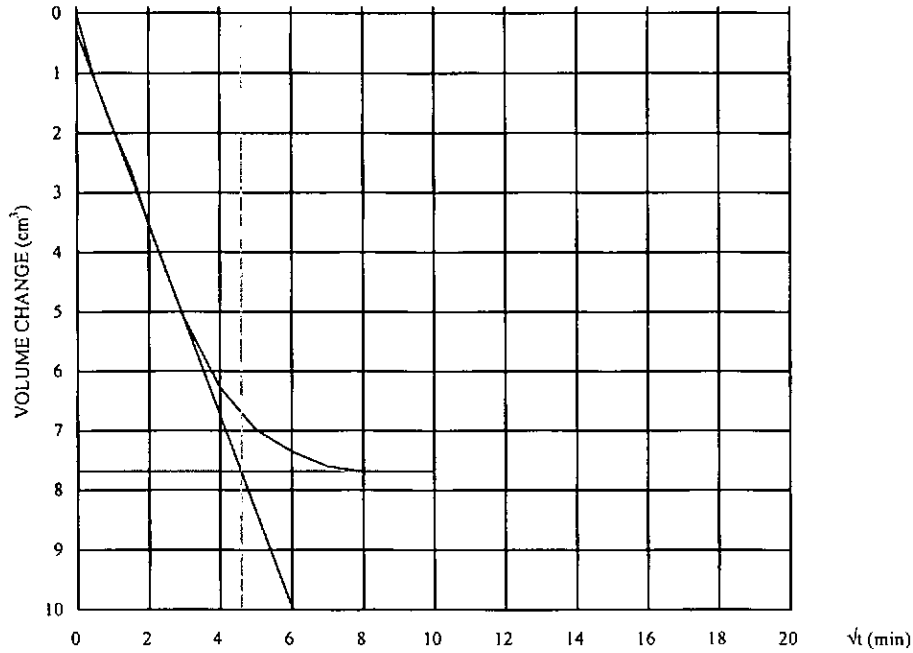
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

CONSOLIDATION (DRAINED PHASE) - Stage 1

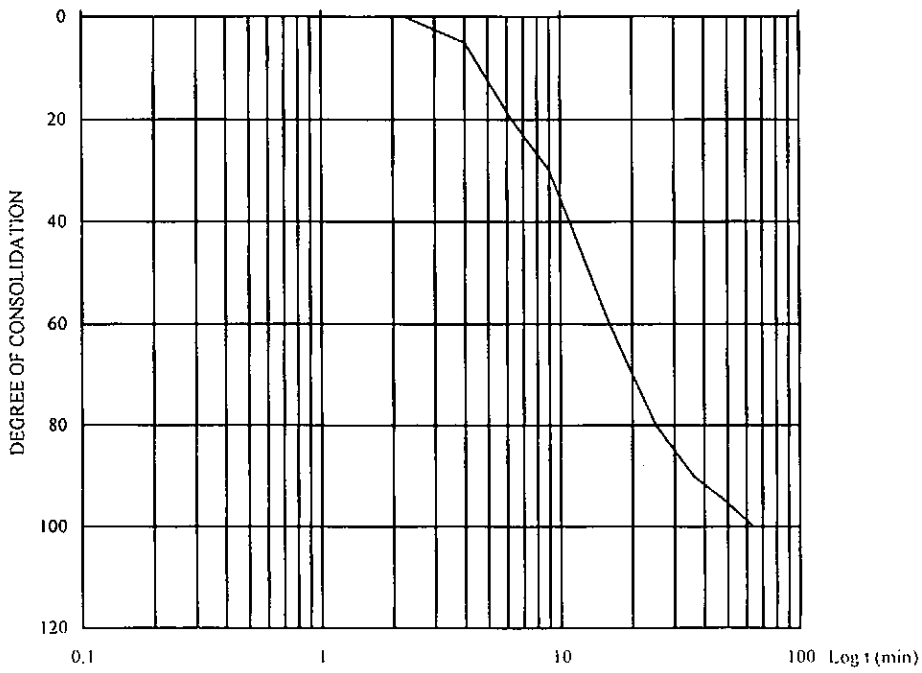


√t100 4.59 min

t100 21.03 min

tf 11.15 min

Calc. strain rate
0.907 mm/min



Borehole No. : WCH-BH09 **Sample Depth m:-** 5.00 - 6.00

Sample No. : 5 **Specimen Depth m:-** 5.80 - 6.00

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.:** 059

Complied by: W S Wat

Checked by: H W Chung

Form : GESR009.13 / Jun.02.03 / Issue 1 / Rev 0

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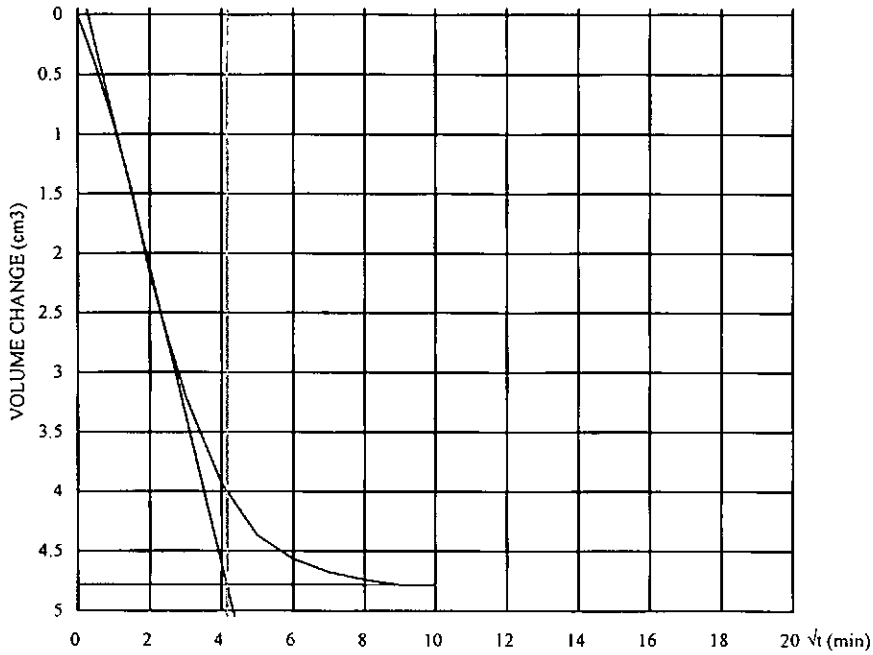
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

CONSOLIDATION (DRAINED PHASE) - Stage 2

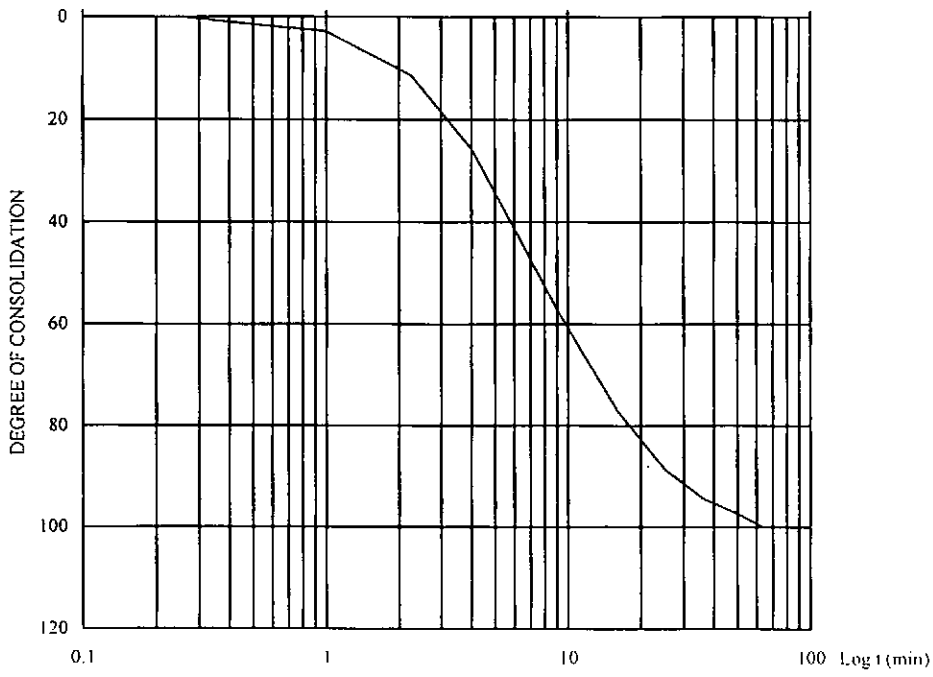


√t100 4.15 min

t100 17.22 min

tf 9.13 min

Calc. strain rate
1.074 mm/min



Borehole No. : WCH-BH09 **Sample Depth m:-** 5.00 - 6.00

Sample No. : 5 **Specimen Depth m:-** 5.80 - 6.00

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.:** 059

Complied by: W S Wat

Checked by: H W Chung

Form : GESR009.13 / Jun.02.03 / Issue 1 / Rev 0

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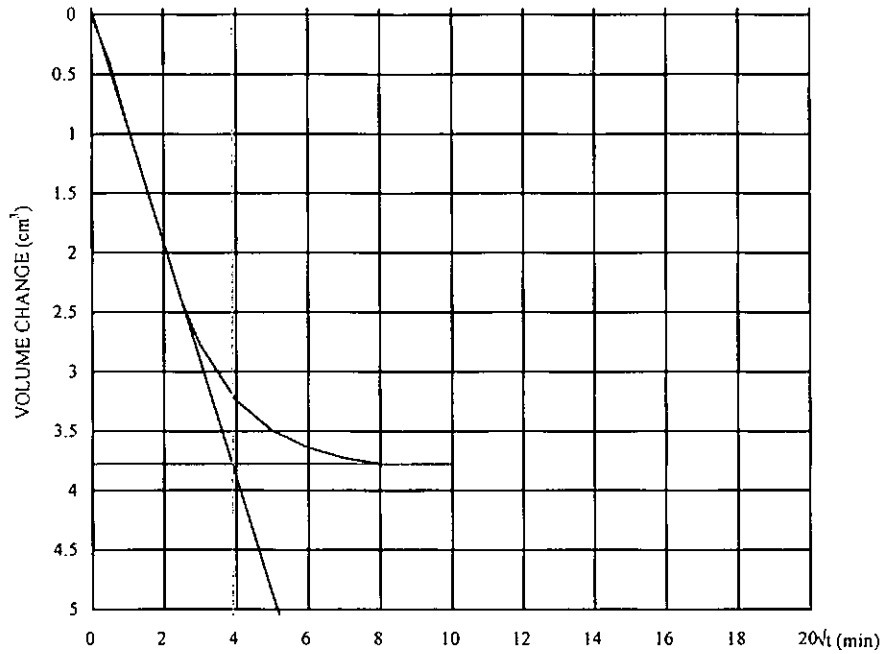
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

CONSOLIDATION (DRAINED PHASE) - Stage 3

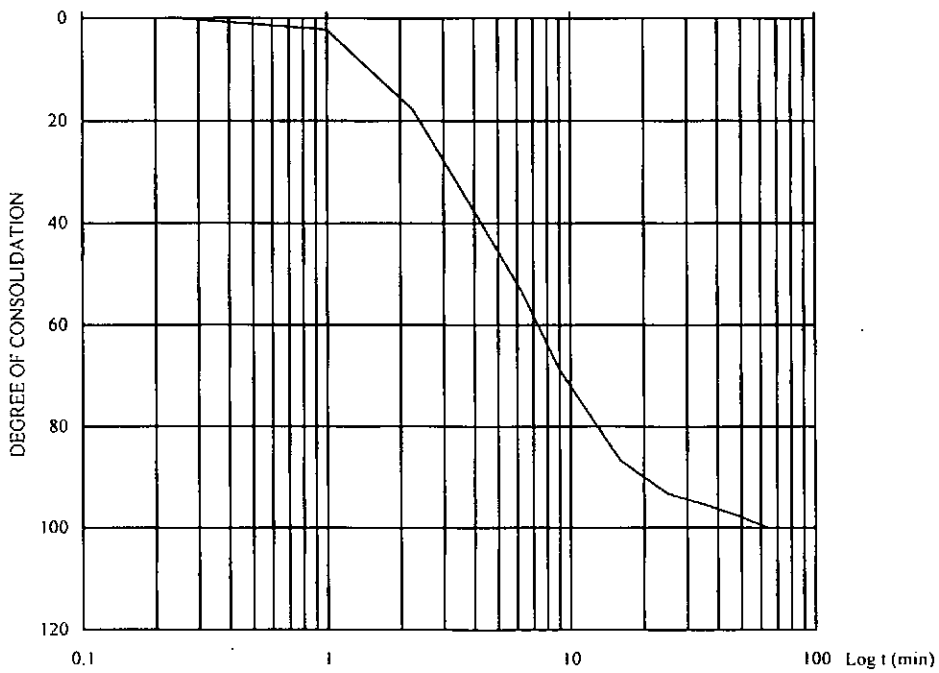


√t100 3.89 min

t100 15.15 min

tf 8.03 min

Calc. strain rate
1.197 mm/min



Borehole No. : WCH-BH09 **Sample Depth m:-** 5.00 - 6.00

Sample No. : 5 **Specimen Depth m:-** 5.80 - 6.00

Customer :	**Mass Transit Railway Corporation**	Complied by
Project :	**Ground Investigation for South Island Line**	W S Wat
	Contract No.: Contract 1024	Checked by
Job No.:	**J2999** **Works Order No.: 059**	H W Chung

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TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Multi Stage			P.W.P,B.P					Effective Pressure	25				kPa
Side drains	No	Selected Machine Speed	0.048	mm/min	Rate of Strain	1.99	% per hr						
FAILURE CRITERION													
Max. deviator Stress	☐	Max. Stress ratio	☒		Axial Strain %	☐							
Stage :	I	Applied Pressure (kPa) - Cell :	245	Back :	220	P.R. factor	1.7305	kN/mm					

Date	Time	Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
		Dial		P.R.No. 10	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
08/12	09:40	0.00	0.00	0.055	220	0.000	0.0	25.0	25.0	25.0	0.0	25.0	1.00
	09:45	0.08	0.06	0.111	224	0.017	22.7	44.0	21.3	32.7	11.4	28.9	2.07
	09:50	0.25	0.17	0.142	225	0.049	35.2	55.1	19.9	37.5	17.6	31.6	2.77
	09:55	0.47	0.33	0.173	226	0.095	47.6	67.0	19.4	43.2	23.8	35.3	3.46
	10:00	0.64	0.44	0.187	226	0.126	53.2	72.5	19.3	45.9	26.6	37.0	3.76
	10:05	0.81	0.56	0.197	226	0.160	57.2	76.7	19.5	48.1	28.6	38.6	3.93
	10:10	1.06	0.73	0.208	225	0.208	61.4	81.4	20.0	50.7	30.7	40.5	4.07
	10:15	1.29	0.90	0.223	224	0.255	67.3	87.9	20.6	54.3	33.7	43.0	4.27
	10:20	1.53	1.06	0.238	224	0.299	73.2	94.4	21.2	57.8	36.6	45.6	4.45
	10:25	1.79	1.24	0.256	223	0.348	80.2	102.4	22.2	62.3	40.1	48.9	4.61
	10:30	2.01	1.39	0.269	222	0.388	85.3	108.4	23.1	65.7	42.6	51.5	4.69
	10:35	2.23	1.54	0.284	221	0.428	91.1	115.2	24.1	69.6	45.5	54.5	4.78
	10:40	2.44	1.69	0.297	220	0.468	96.1	121.0	24.9	73.0	48.1	56.9	4.86
	10:45	2.68	1.86	0.311	219	0.512	101.5	127.6	26.1	76.8	50.7	59.9	4.89
	10:50	2.93	2.03	0.327	218	0.556	107.6	135.0	27.4	81.2	53.8	63.3	4.93
	10:55	3.17	2.19	0.342	216	0.597	113.3	142.0	28.7	85.4	56.7	66.5	4.95
	11:00	3.41	2.36	0.360	215	0.640	120.2	150.3	30.1	90.2	60.1	70.2	4.99
	11:05	3.62	2.51	0.374	214	0.678	125.6	157.0	31.4	94.2	62.8	73.3	5.00
	11:10	**3.80**	**2.63**	**0.385**	**213**	**0.708**	**129.7**	**162.0**	**32.3**	**97.2**	**64.9**	**75.5**	**5.02**
	11:15	4.00	2.77	0.397	212	0.743	134.2	167.7	33.5	100.6	67.1	78.2	5.01

Borehole No. :	**WCH-BH09**	**Sample Depth m:- 5.00 - 6.00**	
Sample No. :	**5**	**Specimen Depth m:- 5.80 - 6.00**	
Customer :	**Mass Transit Railway Corporation**		Compiled by
Project :	**Ground Investigation for South Island Line**		W S Wat
		Contract No.: Contract 1024	Checked by
Job No.:	**J2999**	**Works Order No.: 059**	H W Chung

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Form : GESR009.14 / Dec.13.04 / Issue 1 / Rev I

TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Gammon

HKAS HOKLAS 055

Multi Stage		P.W.P,B.P				Effective Pressure	50		kPa
Side drains	No	Selected Machine Speed	0.046	mm/min		Rate of Strain	1.97		% per hr
FAILURE CRITERION									
Max. deviator Stress	☐	Max. Stress ratio	☒			Axial Strain %	☐		
Stage : 2	Applied Pressure (kPa) - Cell :	270	Back :	220		P.R. factor	1.7305		kN/mm

Date	Time	Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
		Dial		P.R.No. 10	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
09/12	08:40	4.36	3.02	0.073	220	0.000	0.0	50.0	50.0	50.0	0.0	50.0	1.00
	08:45	4.44	3.08	0.121	222	0.819	18.2	66.5	48.3	57.4	9.1	54.4	1.38
	08:50	4.61	3.19	0.193	226	0.845	46.7	90.7	44.0	67.3	23.3	59.6	2.06
	08:55	4.80	3.32	0.239	228	0.876	64.8	107.0	42.2	74.6	32.4	63.8	2.54
	09:00	5.05	3.49	0.300	229	0.917	88.7	129.8	41.1	85.5	44.4	70.7	3.16
	09:05	5.19	3.59	0.335	229	0.940	102.4	143.0	40.6	91.8	51.2	74.7	3.52
	09:10	5.34	3.70	0.369	231	0.966	115.7	154.8	39.1	96.9	57.8	77.7	3.96
	09:15	5.52	3.82	0.411	231	0.994	132.0	170.8	38.8	104.8	66.0	82.8	4.40
	09:20	5.71	3.96	0.450	231	1.027	147.1	186.2	39.1	112.7	73.6	88.1	4.76
	09:25	5.90	4.09	0.481	231	1.056	159.0	198.3	39.3	118.8	79.5	92.3	5.05
	09:30	6.09	4.22	0.509	230	1.086	169.8	209.5	39.7	124.6	84.9	96.3	5.28
	09:35	6.26	4.34	0.530	229	1.113	177.7	218.4	40.7	129.6	88.9	99.9	5.37
	09:40	6.48	4.49	0.556	228	1.147	187.6	229.8	42.2	136.0	93.8	104.7	5.45
	09:45	**6.65**	**4.61**	**0.573**	**226**	**1.173**	**194.0**	**237.6**	**43.6**	**140.6**	**97.0**	**108.3**	**5.45**
	09:50	6.85	4.75	0.585	225	1.204	198.3	243.6	45.3	144.5	99.2	111.4	5.38

Borehole No. :	**WCH-BH09**	**Sample Depth m:- 5.00 - 6.00**	
Sample No. :	**5**	**Specimen Depth m:- 5.80 - 6.00**	
Customer :	**Mass Transit Railway Corporation**		Compiled by
Project :	**Ground Investigation for South Island Line**		W S Wat
		Contract No.: Contract 1024	Checked by
Job No.:	**J2999**	**Works Order No.: 059**	H W Chung

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Multi Stage		P.W.P,B.P			Effective Pressure	75	kPa
Side drains	No	Selected Machine Speed	0.045	mm/min	Rate of Strain	1.97	% per hr
FAILURE CRITERION							
Max. deviator Stress	☐	Max. Stress ratio	☒		Axial Strain %		☐
Stage : 3	Applied Pressure (kPa) - Cell :	295	Back :	220	P.R. factor	1.7305	kN/mm

Date	Time	Strain		Load	Pore Pressure	Dev. stress		Effective Stress Parameters					
		Dial		P.R.No. 10		Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
10/12	08:35	7.14	4.94	0.095	220	0.000	0.0	75.0	75.0	75.0	0.0	75.0	1.00
	08:40	7.29	5.05	0.231	225	1.270	51.9	121.8	69.9	95.8	25.9	87.2	1.74
	08:45	7.49	5.19	0.313	229	1.300	83.8	149.5	65.7	107.6	41.9	93.6	2.28
	08:50	7.66	5.30	0.374	230	1.324	107.4	172.3	64.9	118.6	53.7	100.7	2.66
	08:55	7.81	5.41	0.431	230	1.347	129.5	194.4	64.9	129.6	64.7	108.1	3.00
	09:00	7.95	5.51	0.494	230	1.368	153.8	219.1	65.3	142.2	76.9	116.6	3.36
	09:05	8.10	5.61	0.552	229	1.389	176.2	241.9	65.7	153.8	88.1	124.4	3.68
	09:10	8.26	5.72	0.595	229	1.412	192.6	258.6	66.0	162.3	96.3	130.2	3.92
	09:15	8.50	5.89	0.647	228	1.447	212.4	279.1	66.7	172.9	106.2	137.5	4.18
	09:20	8.71	6.03	0.681	227	1.476	225.2	292.9	67.7	180.3	112.6	142.8	4.33
	09:25	8.92	6.18	0.710	226	1.507	236.0	305.2	69.2	187.2	118.0	147.9	4.41
	09:30	9.11	6.31	0.732	224	1.533	244.1	314.8	70.7	192.8	122.1	152.1	4.45
	09:35	9.32	6.46	0.753	223	1.563	251.8	324.1	72.3	198.2	125.9	156.2	4.48
	09:40	9.55	6.62	0.774	221	1.595	259.4	333.7	74.3	204.0	129.7	160.8	4.49
	09:45	**9.80**	**6.79**	**0.795**	**220**	**1.629**	**267.0**	**342.4**	**75.4**	**208.9**	**133.5**	**164.4**	**4.54**
	09:50	10.04	6.95	0.812	217	1.660	273.0	351.4	78.4	214.9	136.5	169.4	4.48
	09:55	10.44	7.23	0.845	213	1.714	284.7	366.7	82.0	224.4	142.4	176.9	4.47
	10:00	10.63	7.36	0.861	211	1.739	290.4	374.3	83.9	229.1	145.2	180.7	4.46
	10:05	10.84	7.50	0.876	209	1.765	295.6	381.2	85.6	233.4	147.8	184.1	4.45
	10:10	11.07	7.67	0.893	207	1.797	301.5	389.1	87.6	238.4	150.8	188.1	4.44
	10:15	11.27	7.81	0.907	206	1.824	306.3	395.6	89.3	242.5	153.2	191.4	4.43
	10:20	11.53	7.98	0.925	203	1.855	312.5	404.1	91.6	247.9	156.3	195.8	4.41
	10:25	11.64	8.06	0.932	203	1.870	314.9	407.2	92.3	249.8	157.5	197.3	4.41
	10:30	11.75	8.14	0.940	202	1.885	317.7	411.2	93.5	252.3	158.8	199.4	4.40
	10:35	11.96	8.28	0.955	200	1.910	322.8	417.9	95.1	256.5	161.4	202.7	4.39
	10:40	12.08	8.37	0.965	199	1.926	326.2	422.4	96.2	259.3	163.1	204.9	4.39
	10:45	12.31	8.53	0.981	197	1.955	331.7	429.7	98.0	263.8	165.8	208.6	4.38
	10:50	12.53	8.68	0.995	195	1.982	336.4	436.2	99.8	268.0	168.2	211.9	4.37
	10:55	12.73	8.81	1.003	194	2.005	338.8	440.2	101.4	270.8	169.4	214.3	4.34
	11:00	12.97	8.98	1.011	192	2.035	341.2	444.4	103.2	273.8	170.6	216.9	4.31
	11:05	13.15	9.11	1.017	190	2.058	342.9	447.5	104.6	276.1	171.5	218.9	4.28
	11:10	13.43	9.30	1.028	189	2.091	346.2	452.6	106.4	279.5	173.1	221.8	4.25
	11:15	13.67	9.47	1.036	187	2.120	348.6	456.5	107.9	282.2	174.3	224.1	4.23
	11:20	13.85	9.59	1.043	186	2.141	350.7	459.9	109.2	284.5	175.3	226.1	4.21
	11:25	14.11	9.78	1.054	184	2.173	354.0	464.9	110.9	287.9	177.0	228.9	4.19
	11:30	14.33	9.93	1.064	183	2.198	357.1	469.4	112.3	290.8	178.5	231.3	4.18
	11:35	14.59	10.11	1.076	181	2.228	360.8	474.5	113.7	294.1	180.4	234.0	4.17
	11:40	14.81	10.26	1.091	180	2.253	365.7	480.6	114.9	297.7	182.8	236.8	4.18
	11:45	15.07	10.44	1.109	178	2.283	371.6	488.2	116.6	302.4	185.8	240.5	4.19

Borehole No. :	**WCH-BH09**	**Sample Depth m:- 5.00 - 6.00**	
Sample No. :	**5**	**Specimen Depth m:- 5.80 - 6.00**	
Customer :	**Mass Transit Railway Corporation**		Compiled by
Project :	**Ground Investigation for South Island Line**		W S Wat
		Contract No.: Contract 1024	Checked by
Job No.:	**J2999**	**Works Order No.: 059**	H W Chung

Form : GESR009.14 / Dec.13.04 / Issue 1 / Rev 1

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TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2
Shearing Continuation

Gammon

HOKLAS 059

FAILURE CRITERION

Max. deviator Stress ☐ | Max. Stress ratio ☒ | Axial Strain % ☐

Stage :	3	Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
Date	Time	Dial		P.R.No. 10	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	σ'_1/σ'_3
10/12	11:50	15.24	10.55	1.119	179	2.301	374.7	490.4	115.7	303.1	187.4	240.6	4.24
	11:55	15.43	10.69	1.129	176	2.324	377.8	496.6	118.8	307.7	188.9	244.7	4.18
	12:00	15.68	10.86	1.142	175	2.352	381.8	502.1	120.3	311.2	190.9	247.6	4.17
	12:05	15.96	11.06	1.156	173	2.384	386.1	508.0	121.9	314.9	193.0	250.6	4.17
	12:10	16.11	11.16	1.163	172	2.400	388.2	510.8	122.6	316.7	194.1	252.0	4.17
	12:15	16.38	11.35	1.176	171	2.430	392.1	516.3	124.2	320.2	196.0	254.9	4.16
	12:20	16.61	11.50	1.188	170	2.454	395.7	521.0	125.3	323.2	197.9	257.2	4.16
	12:25	16.77	11.62	1.196	169	2.473	398.1	524.4	126.3	325.4	199.1	259.0	4.15
	12:30	17.04	11.80	1.207	167	2.501	401.2	528.8	127.6	328.2	200.6	261.3	4.14
	12:35	17.28	11.97	1.216	165	2.527	403.7	533.5	129.8	331.6	201.8	264.4	4.11
	12:40	17.51	12.13	1.218	165	2.552	403.7	533.9	130.2	332.0	201.8	264.8	4.10
	12:45	17.70	12.26	1.220	164	2.572	403.8	535.0	131.2	333.1	201.9	265.8	4.08
	12:50	18.01	12.48	1.226	162	2.605	404.9	537.6	132.7	335.1	202.4	267.7	4.05
	12:55	18.16	12.58	1.229	162	2.620	405.5	538.8	133.3	336.0	202.7	268.5	4.04
	13:00	18.31	12.68	1.234	161	2.636	406.8	540.8	134.0	337.4	203.4	269.6	4.04
	13:05	18.56	12.85	1.241	160	2.661	408.4	543.4	135.0	339.2	204.2	271.1	4.03
	13:10	18.83	13.04	1.249	159	2.690	410.4	546.5	136.1	341.3	205.2	272.9	4.02
	13:15	19.12	13.24	1.256	158	2.720	411.9	549.3	137.4	343.4	206.0	274.7	4.00
	13:20	19.41	13.44	1.263	157	2.749	413.4	551.9	138.5	345.2	206.7	276.3	3.99
	13:25	19.57	13.55	1.273	156	2.765	416.4	555.3	138.9	347.1	208.2	277.7	4.00
	13:30	19.81	13.72	1.286	155	2.790	420.2	560.0	139.8	349.9	210.1	279.9	4.01
	13:35	20.00	13.85	1.294	154	2.809	422.4	563.0	140.6	351.8	211.2	281.4	4.00
	13:40	20.25	14.02	1.306	153	2.834	425.8	567.4	141.6	354.5	212.9	283.5	4.01
	13:45	20.47	14.18	1.314	153	2.857	427.8	570.1	142.3	356.2	213.9	284.9	4.01
	13:50	20.69	14.33	1.322	152	2.879	429.8	572.9	143.1	358.0	214.9	286.4	4.00
	13:55	20.86	14.45	1.328	151	2.897	431.3	575.0	143.7	359.4	215.7	287.5	4.00
	14:00	21.11	14.62	1.336	151	2.921	433.2	577.7	144.5	361.1	216.6	288.9	4.00
	14:05	21.32	14.77	1.344	150	2.943	435.3	580.5	145.2	362.8	217.6	290.3	4.00
	14:10	21.50	14.89	1.352	149	2.960	437.4	583.3	145.9	364.6	218.7	291.7	4.00
	14:15	21.85	15.13	1.365	148	2.994	440.7	587.7	147.0	367.3	220.3	293.9	4.00
	14:20	22.01	15.25	1.371	148	3.011	442.2	589.7	147.5	368.6	221.1	294.9	4.00
	14:25	22.16	15.35	1.373	147	3.025	442.3	590.4	148.1	369.3	221.2	295.5	3.99
	14:30	22.37	15.49	1.373	146	3.045	441.5	590.2	148.7	369.5	220.8	295.9	3.97
	14:35	22.65	15.69	1.372	145	3.073	440.1	589.9	149.8	369.9	220.1	296.5	3.94
	14:40	22.86	15.84	1.374	145	3.094	440.0	590.2	150.2	370.2	220.0	296.9	3.93
	14:45	23.13	16.02	1.377	144	3.120	440.1	591.0	150.9	370.9	220.0	297.6	3.92
	14:50	23.35	16.17	1.382	143	3.141	441.0	592.6	151.6	372.1	220.5	298.6	3.91
	14:55	23.57	16.32	1.385	143	3.162	441.2	593.4	152.2	372.8	220.6	299.3	3.90
	15:00	23.85	16.52	1.392	142	3.190	442.5	595.2	152.7	374.0	221.3	300.2	3.90
	15:05	24.06	16.66	1.395	142	3.209	442.8	596.1	153.3	374.7	221.4	300.9	3.89
	15:10	24.32	16.84	1.403	141	3.234	444.5	598.5	154.0	376.3	222.3	302.2	3.89

Borehole No. : WCH-BH09 — **Sample Depth m:-** 5.00 - 6.00

Sample No. : 5 — **Specimen Depth m:-** 5.80 - 6.00

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 — **Works Order No.:** 059

Compiled by: W S Wat

Checked by: H W Chung

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2
Shearing Continuation

FAILURE CRITERION

Max. deviator Stress ☐ | Max. Stress ratio ☒ | Axial Strain % ☐

Stage : 3		Strain		Load	Pore	Dev. stress		Effective Stress Parameters					
Date	Time	Dial		P.R.No. 10	Pressure	Corr.	q $\sigma_1 - \sigma_3$	Effective Stress		s' $(\sigma'_1+\sigma'_3)$	t $(\sigma_1-\sigma_3)$	p' $(\sigma'_1+2\sigma'_3)$	Stress Ratio σ'_1/σ'_3
		mm	%	mm	kPa	kPa		σ'_1	σ'_3	2	2	3	
10/12	15:15	24.58	17.03	1.414	140	3.261	447.3	601.9	154.6	378.2	223.6	303.7	3.89
	15:20	24.78	17.16	1.422	140	3.279	449.2	604.3	155.1	379.7	224.6	304.8	3.90
	15:25	25.00	17.32	1.430	139	3.301	451.1	606.7	155.6	381.1	225.5	306.0	3.90
	15:30	25.29	17.52	1.442	139	3.329	454.0	610.2	156.2	383.2	227.0	307.5	3.91
	15:35	25.43	17.61	1.447	138	3.342	455.2	611.8	156.6	384.2	227.6	308.3	3.91
	15:40	25.65	17.76	1.452	138	3.363	456.0	613.1	157.1	385.1	228.0	309.1	3.90
	15:45	25.91	17.95	1.456	137	3.389	456.3	613.9	157.6	385.8	228.2	309.7	3.90
	15:50	26.08	18.06	1.464	137	3.404	458.4	616.5	158.1	387.3	229.2	310.9	3.90
	15:55	26.37	18.26	1.474	136	3.432	460.5	619.2	158.7	389.0	230.3	312.2	3.90
	16:00	26.57	18.40	1.478	136	3.452	461.1	620.3	159.2	389.7	230.5	312.9	3.90
	16:05	26.74	18.52	1.481	135	3.469	461.4	621.0	159.6	390.3	230.7	313.4	3.89
	16:10	27.03	18.72	1.482	135	3.497	460.6	620.8	160.2	390.5	230.3	313.7	3.87
	16:15	27.30	18.90	1.482	134	3.522	459.5	620.3	160.8	390.5	229.7	314.0	3.86
	16:20	27.48	19.03	1.478	134	3.540	457.4	618.7	161.3	390.0	228.7	313.8	3.84
	16:25	27.73	19.20	1.479	133	3.564	456.7	618.3	161.6	390.0	228.4	313.8	3.83
	16:30	27.95	19.36	1.478	133	3.586	455.5	617.6	162.1	389.9	227.8	313.9	3.81
	16:35	28.16	19.50	1.484	133	3.606	456.7	619.1	162.4	390.7	228.3	314.6	3.81
	16:40	28.40	19.67	1.486	132	3.630	456.4	619.2	162.8	391.0	228.2	314.9	3.80
	16:45	28.69	19.87	1.492	132	3.658	457.1	620.4	163.3	391.9	228.6	315.7	3.80
	16:50	28.93	20.03	1.495	131	3.681	457.2	620.9	163.7	392.3	228.6	316.1	3.79

Borehole No. : WCH-BH09 **Sample Depth m:-** 5.00 - 6.00

Sample No. : 5 **Specimen Depth m:-** 5.80 - 6.00

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.:** 059

Compiled by: W S Wat

Checked by: H W Chung

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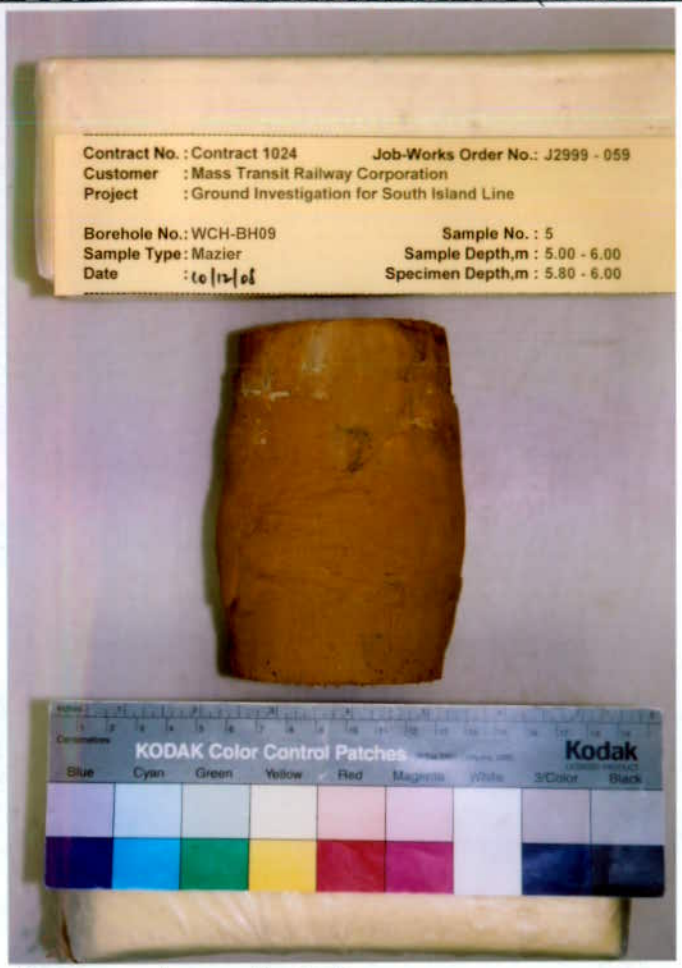
Form : GESR009.15 / Dec.13.04 / Issue 1 / Rev 1

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT (GEOSPEC 3 : 2001 Test Method 15.2)



Description : Brown, gravelly, very silty SAND

Sample Origin : CDT ‡ ‡ Information provided by customer

Borehole No. : WCH-BH09	Sample No. : 5	Sample Depth m:- 5.00 - 6.00	Specimen Depth m:- 5.80 - 6.00

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line

Contract No.: Contract 1024
Job No.: J2999
Works Order No.: 059

Compiled by: W S Wat
Checked by: H W Chung

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TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole			no	WCH-BH09	
Sample			no	9	
Sample Type				Mazier	
Stage			no	1	
Sample Depth			m	7.00 - 8.00	
Specimen Depth			m	7.60 - 7.80	
INITIAL CONDITIONS					
Diameter	(D_o)		mm	74.2	
Height	(H_o)		mm	145.0	
Moisture Content	(W_o)		%	24	
Bulk density	(ρ_o)		Mg/m^3	1.97	
Dry density	(ρ_d)		Mg/m^3	1.59	
Particle density	(ρ_s)			2.65	
Voids Ratio	(e_o)			0.67	
Degree of Saturation	(S_r)		%	95.7	
DRAINAGE CONDITIONS				ONE END	
SATURATION					
Final Pore Pressure Coefficient B				1.00	
CONSOLIDATION					
Cell Pressure	(σ_3)		kPa	320	
Back Pressure	(u_b)		kPa	245	
Effective Pressure	(σ'_3)		kPa	75	
Coefficient of Consolidation (t100) (C_{vi})			m^2/Year	1095.49	
Coefficient of Volume Compressibility (m_{vi})			m^2/MN	0.29	
Coefficient of Permeability (k)			m/s	9.96E-08	
COMPRESSION TERMINATION CRITERION				MAXIMUM DEVIATOR STRESS	
COMPRESSION - INITIAL					
Moisture Content	(w)		%	23	
Pore Pressure at the End of Consolidation			kPa	245	
Effective Stress at the End of Consolidation			kPa	75	
Bulk density	(ρ_o)		Mg/m^3	1.99	
Dry density	(ρ_d)		Mg/m^3	1.62	
Voids Ratio	(e)			0.64	
Degree of Saturation	(S_r)		%	94.9	

Customer : **Mass Transit Railway Corporation**

Project : **Ground Investigation for South Island Line**

Report No. : J2999-059.11

Contract No.: Contract 1024

Job No.: **J2999** **Works Order No.: 059**

Technician : W S Wat

Checked By : Name : H W Chung Date : 19/12/2008

Approved By : Signatory : **Lau Wai Cheong** Date : 19/12/2008

Tested Date: 03/12/2008

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Form : GESR009.6 / Nov.10.06 / Issue 1 / Rev 1

TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

Borehole		no	WCH-BH09		
Sample		no	9		
Sample Type			Mazier		
Stage		no	1		
Sample Depth		m	7.00 - 8.00		
Specimen Depth		m	7.60 - 7.80		
COMPRESSION - FAILURE					
Cell Pressure		kPa	320		
Rate of Strain		mm/min	0.048		
CONDITIONS MAXIMUM DEVIATOR STRESS					
Major Effective Principal Stress (σ'_1)		kPa	726		
Corrected Deviator Stress ($\sigma'_1 - \sigma'_3$)		kPa	514		
Minor Effective Principal Stress (σ'_3)		kPa	212		
$s' = (\sigma'_1 + \sigma'_3)/2$		kPa	469		
$t = (\sigma_1 - \sigma_3)/2$		kPa	257		
Expanded Uncertainty of s' ^		kPa	-		
Expanded Uncertainty of t ^		kPa	-		
Pore pressure parameter A_f			-0.27		
Strain at Failure	(εf)	%	18.7		
COMPRESSION - FINAL					
Moisture Content	(W_f)	%	23		
Bulk density	(ρ_o)	Mg/m^3	1.99		
Dry density	(ρ_d)	Mg/m^3	1.62		
Voids Ratio	(e_f)		0.64		
Degree of Saturation	(S_f)	%	94.9		

Notes -
1. The method of specimen preparation was in accordance with GEOSPEC 3 : 2001 :- Test method 13.3 : test specimen from undisturbed soil samples.
2. Sample received date :29/09/2008
3. The determination of moisture content was in accordance with test method 5.1 of GEOSPEC 3 : 2001.
4. Particle density : 2.65 (Assumed)
5. Maximum and minimum temperature recorded over the period of testing 19.9 - 20.7 °C.
6. Unavoidable variations from specified procedure : none
7. Comment on observed or inferred sample disturbance : none
8. Percentage by mass of soil particles larger than 1/5 of the diameter of specimen (%) : Nil
9. The specimen was selected by the laboratory.
   Name : W S Wat Designation : Senior Laboratory Technician
10. Sampling History : As Received

* Delete as appropriate ^ Upon request

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.: 059**

Compiled by W S Wat
Checked by H W Chung

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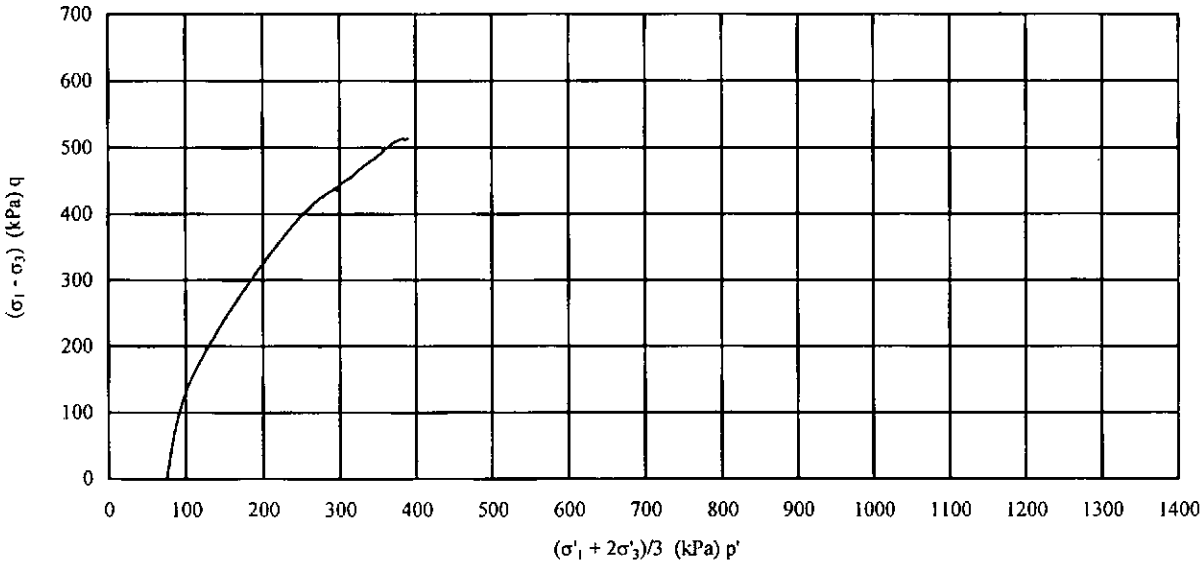
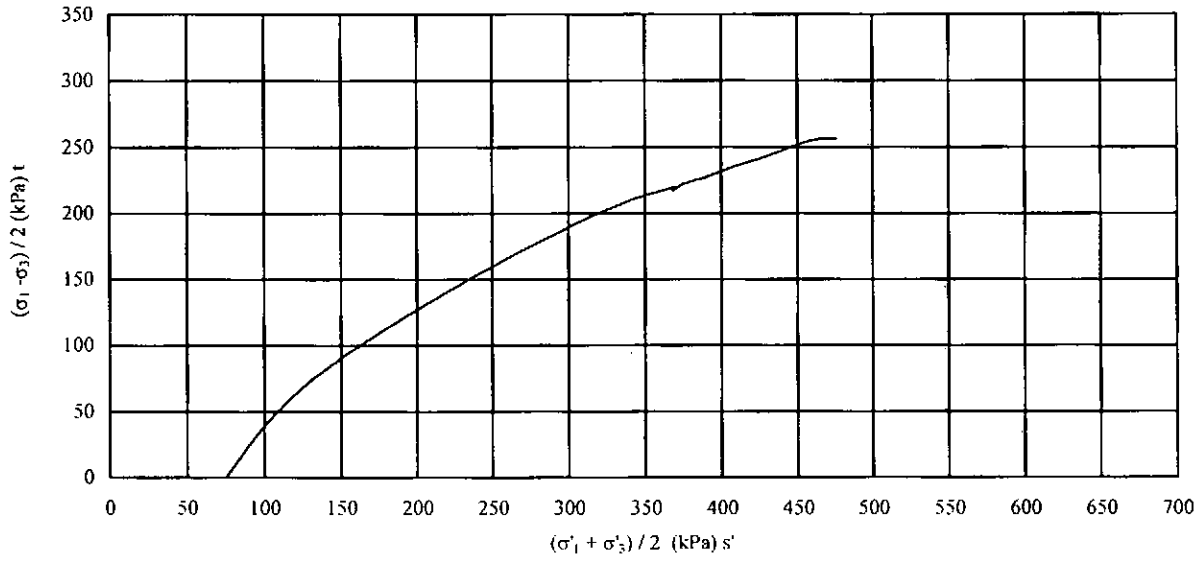
TEST REPORT
DETERMINATION OF THE ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

STRESS PATH PARAMETERS FOR EFFECTIVE STRESS

p' - q PLOT



s' - t PLOT



Borehole No. : WCH-BH09 — **Sample Depth m:-** 7.00 - 8.00
Sample No. : 9 — **Specimen Depth m:-** 7.60 - 7.80

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 — **Works Order No.:** 059

Compiled by: W S Wat
Checked by: H W Chung

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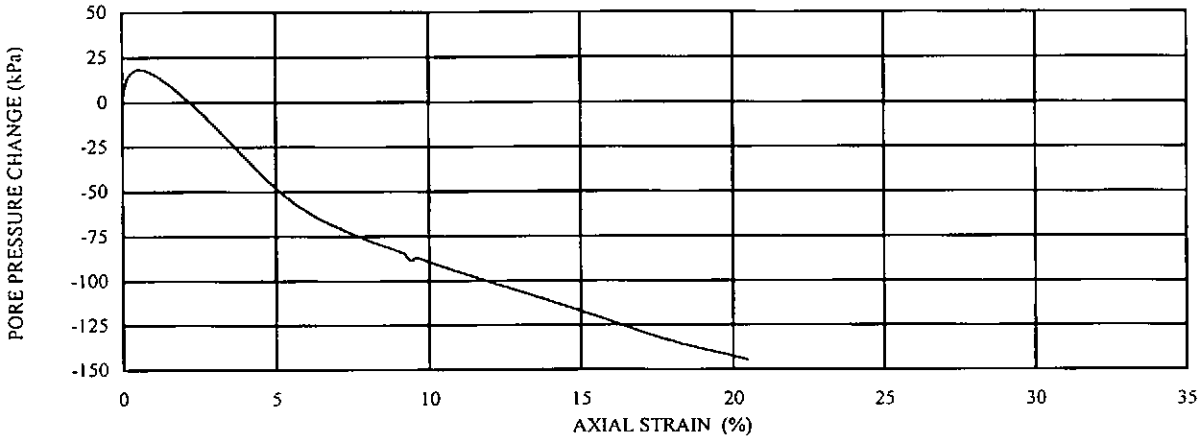
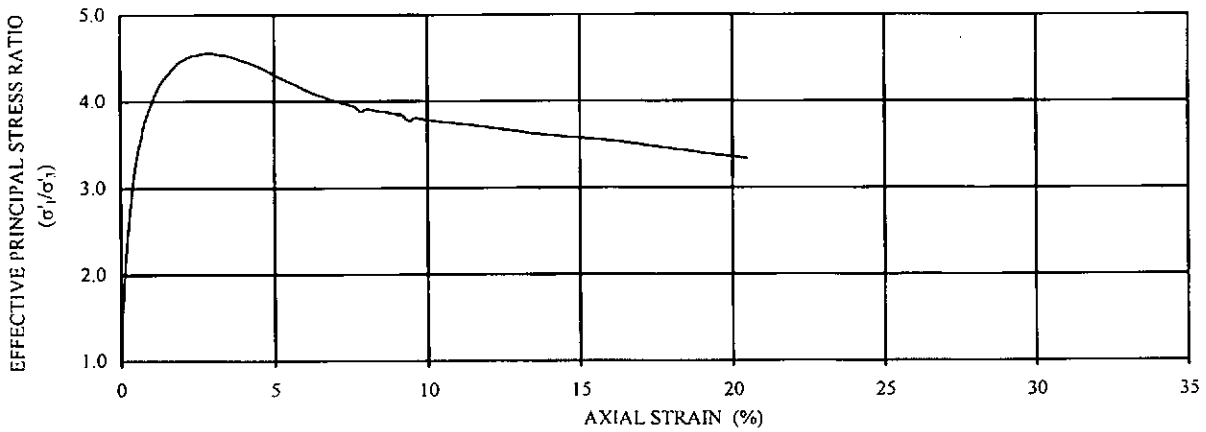
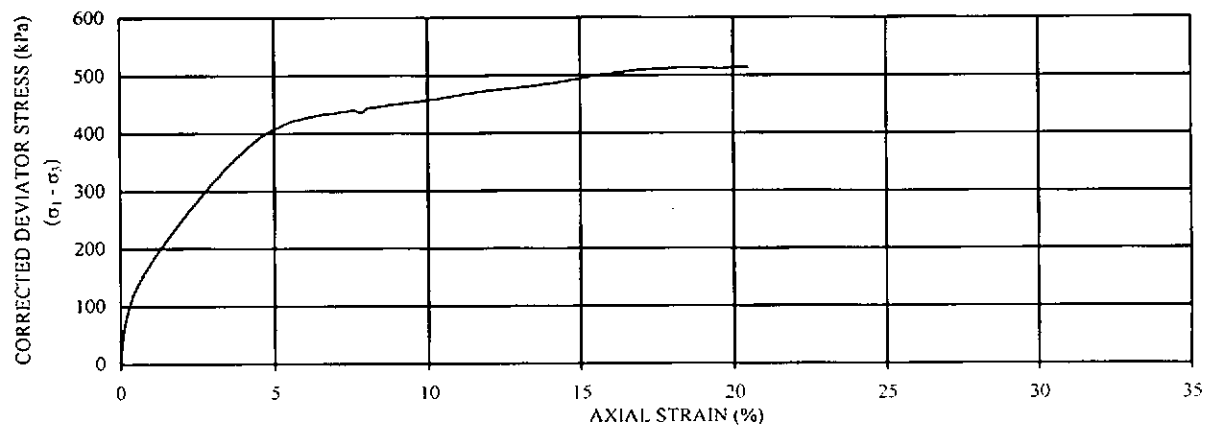
Form : GESR009.8 / Jun.02.03 / Issue 1 / Rev 0

TEST REPORT
DETERMINATION OF
THE ISOTROPICALLY CONSOLIDATED
UNDRAINED TRIAXIAL COMPRESSION TEST
WITH PORE PRESSURE MEASUREMENT
GEOSPEC 3 : 2001 Test Method 15.2

COMPRESSION







Borehole No. :	**WCH-BH09**	**Sample Depth m:-**	**7.00 - 8.00**
Sample No. :	**9**	**Specimen Depth m:-**	**7.60 - 7.80**
Customer :	**Mass Transit Railway Corporation**		Compiled by W S Wat
Project :	**Ground Investigation for South Island Line**		
		Contract No.:	**Contract 1024**
Job No.:	**J2999**	**Works Order No.:**	**059**
			Checked by H W Chung

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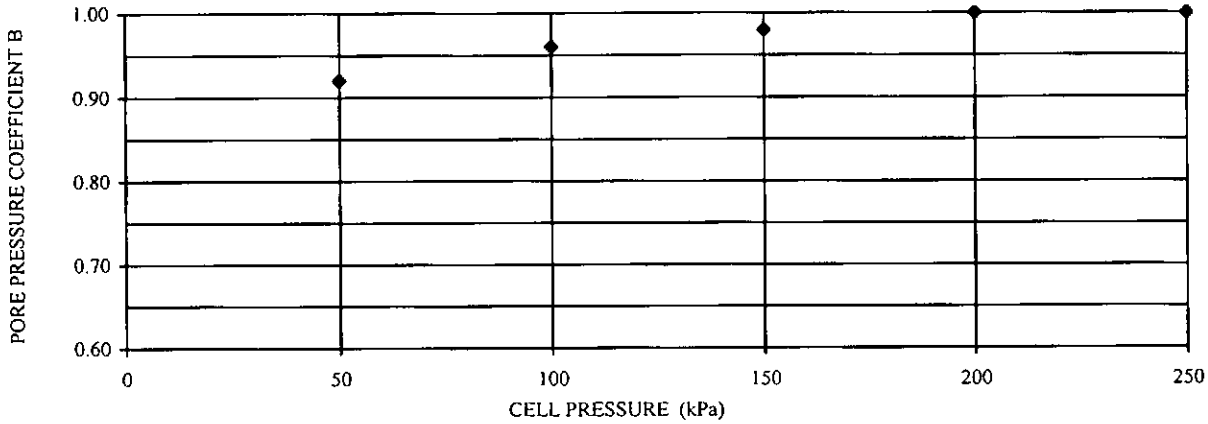
GEOSPEC 3 : 2001 Test Method 15.2

SATURATION



Date	Time	Cell Pressure kPa	Back Pressure kPa	Pore Pressure kPa	Cumulative Volume of Water cm^3	Pore Pressure Coefficient B
04/12/2008	08:34	0	0	-	0.0	
	08:43	25	-	24		-
	09:00	25	20	20	-4.5	
	09:10	50	-	43		0.92
	09:29	50	45	45	-4.1	
	09:37	100	-	93		0.96
	09:59	100	95	95	-4.0	
	10:05	150	-	144		0.98
	11:30	150	145	145	-3.7	
	11:41	200	-	195		1.00
	14:10	200	195	195	-3.5	
	14:18	250	-	245		1.00
05/12/2008	13:30	250	245	245	-1.3	

Borehole No. WCH-BH09 **Sample Depth m:-** 7.00 - 8.00
Sample No. : 9 **Specimen Depth m:-** 7.60 - 7.80

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.:** 059

Compiled by: W S Wat
Checked by: H W Chung

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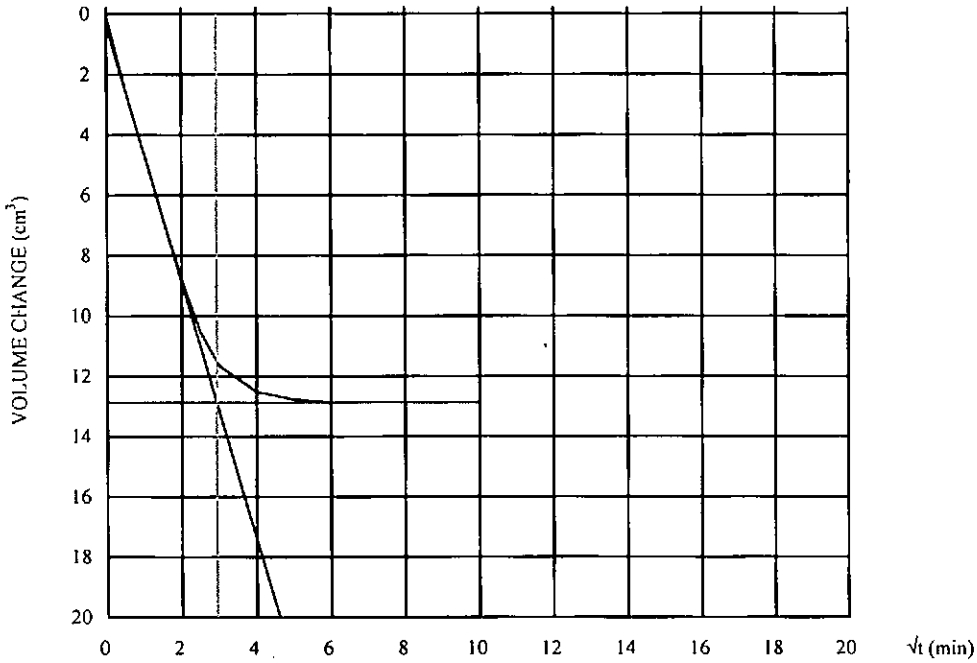
GEOSPEC 3 : 2001 Test Method 15.2

CONSOLIDATION (DRAINED PHASE) - Stage 1

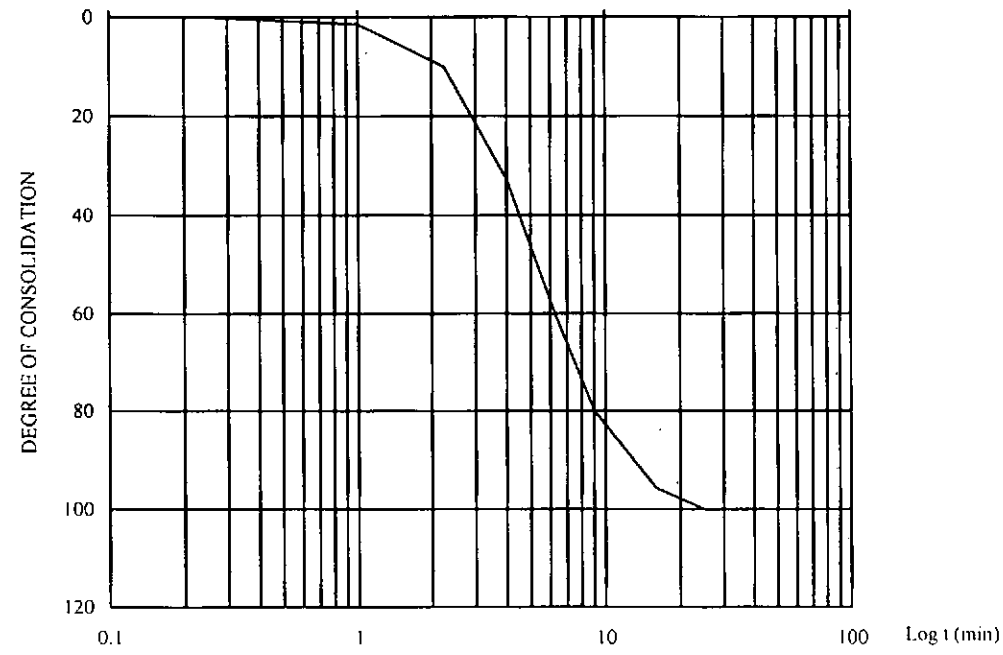


√t100 2.94 min

t100 8.619 min

tf 4.568 min

Calc. strain rate
2.206 mm/min



Borehole No. : WCH-BH09 **Sample Depth m:-** 7.00 - 8.00
Sample No. : 9 **Specimen Depth m:-** 7.60 - 7.80

Customer : Mass Transit Railway Corporation
Project : Ground Investigation for South Island Line
Contract No.: Contract 1024
Job No.: J2999 **Works Order No.:** 059

Complied by: W S Wat
Checked by: H W Chung

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GEOSPEC 3 : 2001 Test Method 15.2

Single Stage		P.W.P,B.P			Effective Pressure	75	kPa
Side drains	No	Selected Machine Speed	0.048	mm/min	Rate of Strain	2.00	% per hr

FAILURE CRITERION

Max. deviator Stress	☒	Max. Stress ratio	☐		Axial Strain %		☐
Stage : 1	Applied Pressure (kPa) - Cell :	320	Back :	245	P.R. factor	3.1659	kN/mm

Date	Time	Strain Dial	Strain	Load P.R.No. 37	Pore Pressure	Dev. stress Corr.	Dev. stress q $\sigma_1 - \sigma_3$	Effective Stress σ'_1	Effective Stress σ'_3	s' $(\sigma'_1+\sigma'_3)/2$	t $(\sigma_1-\sigma_3)/2$	p' $(\sigma'_1+2\sigma'_3)/3$	Stress Ratio σ'_1/σ'_3
		mm	%	mm	kPa	kPa							
08/12	08:40	0.00	0.00	0.049	245	0.000	0.0	75.0	75.0	75.0	0.0	75.0	1.00
	08:45	0.21	0.15	0.141	258	0.043	68.2	130.6	62.4	96.5	34.1	85.1	2.09
	08:50	0.54	0.38	0.201	262	0.109	112.4	170.0	57.6	113.8	56.2	95.1	2.95
	08:55	0.78	0.54	0.230	263	0.154	133.6	190.3	56.7	123.5	66.8	101.2	3.36
	09:00	0.96	0.67	0.247	263	0.190	145.9	202.7	56.8	129.7	72.9	105.4	3.57
	09:05	1.13	0.78	0.263	263	0.221	157.5	214.9	57.4	136.1	78.7	109.9	3.74
	09:10	1.37	0.95	0.282	261	0.268	171.1	229.8	58.7	144.3	85.6	115.7	3.92
	09:15	1.65	1.14	0.304	259	0.320	186.9	247.5	60.6	154.1	93.5	122.9	4.08
	09:20	1.92	1.33	0.324	257	0.371	201.2	263.8	62.6	163.2	100.6	129.7	4.21
	09:25	2.16	1.50	0.341	255	0.416	213.2	278.0	64.8	171.4	106.6	135.9	4.29
	09:30	2.44	1.69	0.361	253	0.466	227.3	294.7	67.4	181.1	113.7	143.2	4.37
	09:35	2.74	1.90	0.383	250	0.521	242.8	313.2	70.4	191.8	121.4	151.3	4.45
	09:40	3.04	2.11	0.403	246	0.575	256.8	330.4	73.6	202.0	128.4	159.2	4.49
	09:45	3.34	2.32	0.423	243	0.629	270.7	347.5	76.8	212.2	135.4	167.0	4.52
	09:50	3.56	2.47	0.437	241	0.666	280.4	359.7	79.3	219.5	140.2	172.8	4.54
	09:55	3.87	2.69	0.457	237	0.721	294.2	377.0	82.8	229.9	147.1	180.9	4.55
	10:00	4.09	2.84	0.472	235	0.758	304.5	390.0	85.5	237.7	152.2	187.0	4.56
	10:05	4.33	3.01	0.487	232	0.799	314.7	403.1	88.4	245.8	157.4	193.3	4.56
	10:10	4.62	3.21	0.503	228	0.848	325.5	417.4	91.9	254.7	162.8	200.4	4.54
	10:15	4.89	3.39	0.520	225	0.891	337.1	432.3	95.2	263.7	168.5	207.6	4.54
	10:20	5.16	3.59	0.535	221	0.938	347.1	445.7	98.6	272.1	173.5	214.3	4.52
	10:25	5.47	3.80	0.552	217	0.987	358.4	461.0	102.6	281.8	179.2	222.1	4.49
	10:30	5.69	3.95	0.563	215	1.021	365.7	471.0	105.3	288.1	182.8	227.2	4.47
	10:35	5.96	4.14	0.577	211	1.065	374.9	483.5	108.6	296.0	187.4	233.6	4.45
	10:40	6.20	4.31	0.589	209	1.103	382.7	494.2	111.5	302.9	191.4	239.1	4.43
	10:45	6.47	4.49	0.601	205	1.144	390.4	505.1	114.7	309.9	195.2	244.8	4.40
	10:50	6.76	4.69	0.613	202	1.188	398.1	516.1	118.0	317.0	199.0	250.7	4.37
	10:55	7.02	4.87	0.622	199	1.227	403.6	524.6	121.0	322.8	201.8	255.5	4.34
	11:00	7.35	5.11	0.632	195	1.279	409.6	534.2	124.6	329.4	204.8	261.1	4.29
	11:05	7.63	5.30	0.641	193	1.320	415.1	542.5	127.4	334.9	207.5	265.8	4.26
	11:10	7.88	5.47	0.647	190	1.356	418.5	548.1	129.6	338.9	209.3	269.1	4.23
	11:15	8.13	5.64	0.653	188	1.392	421.9	553.8	131.9	342.9	211.0	272.5	4.20
	11:20	8.45	5.87	0.658	186	1.439	424.4	558.8	134.4	346.6	212.2	275.9	4.16
	11:25	8.73	6.06	0.663	184	1.478	426.9	563.4	136.5	350.0	213.5	278.8	4.13
	11:30	9.03	6.27	0.668	181	1.521	429.4	568.0	138.6	353.3	214.7	281.7	4.10
	11:35	9.30	6.46	0.672	180	1.559	431.3	571.7	140.4	356.0	215.6	284.2	4.07
	11:40	9.61	6.67	0.676	178	1.601	433.0	575.2	142.2	358.7	216.5	286.5	4.05
	11:45	9.88	6.86	0.679	176	1.638	434.2	578.0	143.8	360.9	217.1	288.5	4.02
	11:50	10.18	7.07	0.683	175	1.679	435.9	581.1	145.2	363.2	218.0	290.5	4.00

Borehole No. : WCH-BH09 **Sample Depth m:- 7.00 - 8.00**

Sample No. : 9 **Specimen Depth m:- 7.60 - 7.80**

Customer : Mass Transit Railway Corporation

Project : Ground Investigation for South Island Line

Contract No.: Contract 1024

Job No.: J2999 **Works Order No.: 059**

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