



Contractor Company	INSHAA GENERAL OF CONSTRUCTION	
	Company Name	INSHAA GENERAL OF CONSTRUCTION
Issued by Contractor	Eng. Mahmoud shaban	Sign
	Received by GARB	Eng. Mazen Essamy
Date/Serial Number	30-03-2023 (M.A.R.)	Time
Designing Office	(SPECTRUM) Engineering Consulting Office	

CODE-1	52 to 521	Station Reference
CODE-2	D1 to 53	Daport Reference
CODE-3		Work Activity
Sub Element of Activity		
For Kilometer point only Start Km is used		

Description of Materials	Fill Layer Total Quantity (5000 m3) Upper Embankment
	Location to be Used
Sample only	Yes
Supplier Name	
Reference in BoQ	
Prequalification reference	
Reference Photos	No/Yes

Comments by: Eng. Mazen Essamy (SPECTRUM)	Other
	Test Samples Results
Specification	Yes attached INSHAA GENERAL OF CONSTRUCTION company
	contracting ASTM D (1557)
Data Sheet provided	Yes attached INSHAA GENERAL OF CONSTRUCTION company
	contracting ASTM D (1557)
Materials Type	Fill layers

Comments by: Eng. Alaa Abd-Allatif (EA)



1- Quality Test Results: Third party Lab is approved
2- This Sample Representative (5000 m3) only

2- Results report attached and accepted with the project specifications.
3- Final approval is subject to above mentioned comments

Wait for chemical analysis Result
Done 8-4-2023

Organisation	Name	Eng. Mahmoud shaban
QA/QC	Eng. Mazen Essamy	
GARB	Eng. Mohammed Fayad	
Employers Representative	Eng. Alaa Abd-Allatif	
Designer	Eng. Alaa Abd-Allatif	
Approval STATUS		
Date	31-03-2023	Sign
	A-AWC-R	

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Internal inspection and laboratories sector

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I- Introduction

General Consultant :
Contractor
Sample
Station
Date of Test
QC

SYTRA
SPECTRUM
GY 350
FERMA
St(371+500) to St(371+500)
31/03/2023
1359

II- Sample description:

Gravel and sand

III- Required tests and Results

Required Tests		Results	
1- Grain size analysis and classification	Grain size analysis	As showed in appendix	
	Classification	A-1-a	
2- Modified compaction (Proctor test)	MD	2.116	
	OMC	6.3%	
3- Liquid limit, plastic limit and plasticity index	LL	Non plastic	
	PL	Non plastic	
	PI	Non plastic	
4- California bearing ratio (CBR)		CBR ratio	
		42%	

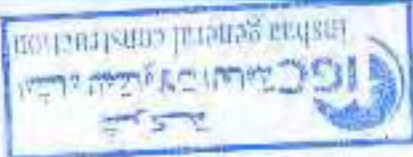
IV- Notes

- 1- Samples were brought by : Client
- 2- Samples are responsible from the Person who brought it.
- 3- The results are applying only for the present report.

LAB DIRECTOR
Eng / Eman Kandil



Geotechnical consultant
Dr. Mohamed Mostafa Badry



49 El Horria Ave. Alex. Egypt
Tel: 002 033920176 - 002 033931482
Fax :002 033900476
Email : internal-inspection@comibassal.com

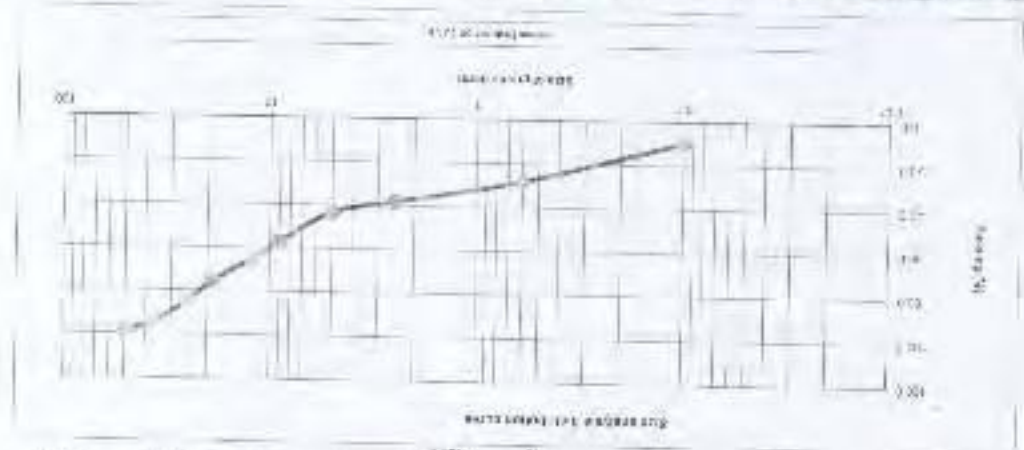
Kilo 23 Alexandria - Cairo Desert Road - Merghem
Tel: 002 03 4704595 - 002 03470119
Email : civedeg@comibassal.com
WebSite : www.comibassal.com



**PARTICLE SIZE DISTRIBUTION
 ANALYSIS
 ASTM C-136 / AASHTO T27**

WEIGHT	CUMULATIVE	PERCENTAGE	RETAINED (%)	PERCENTAGE	RETAINED (%)	STANDARD
RETAINED	WEIGHT	PERCENTAGE	PERCENTAGE	PERCENTAGE	PERCENTAGE	SPECIFICATION
100	RETAINED (gms)	RETAINED (%)	RETAINED (%)	RETAINED (%)	RETAINED (%)	LIMITS

1	158.00	1.58	1.58	98.4		
1.175	138.30	8.16	9.74	94.8		
1	565.00	11.81	21.55	85.3		
3.4	957.00	24.18	45.73	75.6		
12	1059.00	54.88	100.61	65.1		
30	1387.00	127.10	227.71	57.5		
60	1587.00	366.00	593.71	47.4		
75	160.00	60.00	653.71	38.2		
150	174.00	12.00	665.71	28.5		
300	385.00	137.00	802.71	9.8		
Total sample weight = 10000.00						
PASS No. 47 43.4						
4248.0 Total fine aggregates weight = 500 gm						



Soil classification: A-1-a (Non Plastic)



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Modified Proctor Test Report ASTM - D 1557

Mould Number =
Volume of mould =
Weight of mould =
G.S =
2130 cm³
5657 g
2.6 g/cm³

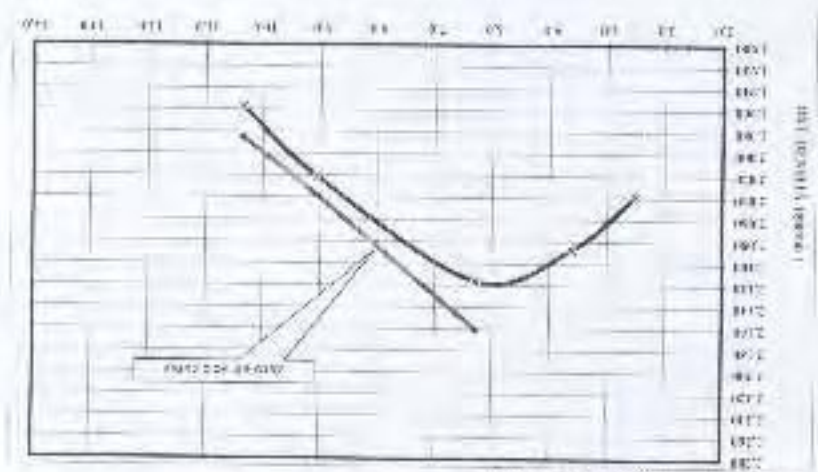
A- Density Calculations:-

Weight of wet soil-mould (g)	10130	10285	10330	10236
Weight of wet soil (g)	5657	5657	5657	5657
Volume of mould (cm ³)	2120	2120	2120	2120
Wet density (g/cm ³)	2.110	2.183	2.249	2.160
Dry density (g/cm ³)	2.038	2.097	2.116	2.021
Zero-air % old curve			2.160	2.038
				1.986

B- Moisture Calculations:-

Weight of wet soil-container (g)	250.0	250.0	250.0	250.0
Weight of dry soil-container (g)	244.3	242.5	240.0	234.8
Weight of container (g)	82.0	80.0	81.0	88.0
Moisture content (%)	3.5	4.6	6.3	9.1
				10.4

C- Dry density-Moisture relationship:-



M.D.D = 2.116 g/cm³
O.M.C = 4.6 %



49 El Horria Ave, Alex, Egypt
Tel: 002 033920176 - 002 033931482
Fax: 002 033900476
Email: internal-inspection@comibassal.com

Kilo 23 Alexandria - Cairo-Desert Road - Merghem
Tel: 002 03 4704595 - 002 034701191
Email: ctydes@comibassal.com
WebSite: www.comibassal.com



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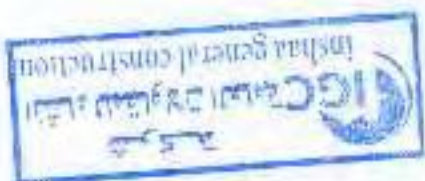
Report	:	S41 - 1 - Center
Date	:	08/06/2023

CHEMICAL ANALYSIS

General Consultant	:	SYSTRA
Consultant	:	SPECTRUM
Contractor	:	مصر للطاقة الكهربائية
Project	:	Electric express train
Sample	:	FERMA
Station	:	SE (371 +0.00) : (371 - 500)
Date of Test	:	31-3-2023
Temperature	:	25 °C
Humidity	:	40%

ANALYSIS	RESULTS	TEST METHOD
ORGANIC MATTER	NEGATIVE	ASTM D 2974

LAB DIRECTOR
CH/ Mostafa Asker
Dr Amany Amin



49 El Horria Ave. Alex, Egypt
Tel: 002 033920176 - 002 033931482
Fax: 002 033900476
Email: internal-inspection@comibassal.com

Kilo 23 Alexandria - Cairo Desert Road - Merghem
Tel: 002 03 4704595 - 002 034701191
Email: c/idepi@comibassal.com
Website: www.comibassal.com

S5-B-IN

MATERIAL
APPROVAL
REQUEST

INSHAA

INSHAA
GENERAL OF CONSTRUCTION

INSHAA

INSHAA GENERAL OF CONSTRUCTION



Contractor Company	INSHAA GENERAL OF CONSTRUCTION	Designer Company	(SPECTRUM) Engineering Consulting Office	Date/Serial Number	Time	Issued by	Eng. Mohamed Hassan	Sign	MAR	371	EW	CS	08	04	23	10	Received by	GARB	CONSULTANT	Eng. Mazen Essamy	MAR	371	EW	CS	08	04	23	10

CODE-1	51 to 521	01 to 53	Kp XXX Note
CODE-2	Station Reference	Report Reference	For Kilometer point only Start Km is used
CODE-3	Sub Element of Activity	Work Activity	

Description of Materials	Prepared Subgrade Total Quantity (5000 m3)	Location to be Used	From Station (371+000) to Station (371+500)	Sample only	Yes	Materials Type	Prepared Subgrade	Yes attached INSHAA GENERAL OF CONSTRUCTION Company Contracting ASTM D (1557)	EARTH WORK SPECIFICATIONS & TESTING REPORT (CE21-41) VERSION 3 BY CIVECON GROUP	Reference in Boq	471	Prequalification reference		Reference Photos	No/Yes	Other	Test Samples Results	Comments by: Eng. Mazen Essamy (SPECTRUM)	Comments by: Eng. Alaa Abd-Allatif (ER)
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1- Quality test Result By Third Party Lab is Approved.
2- This Sample Representative of 5000 m3 only.
3- All tests were carried-out by third Party Lab (combassa International)
2- Results report attached and acceptable with the project specifications.
3- Final approval is subject to above mentioned comments.



Organisation	Name	Sign	Date	A-AWC-R
Contractor	Eng. Mohamed Hassan		08-04-2023	A
QA/QC *	Eng. Mazen Essamy			A
GARB **	Eng. Mohammed Fayad			
Employers Representative	Eng. Alaa Abd-Allatif		12-4-2023	AWC

* Designer
** Alignment/Design: Colven only

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I- Introduction

General Consultant : SYSTRA
Consultant : SPECTRUM
Contractor : شركة البترول
Sample : Prepare Sub-Grade
Station : St(371+000) to st(371+500)
Date of Test : 08/04/2023
QC : 883-3

II- Sample description:

Crushed stone and sand

III- Required tests

- 1- Grain size analysis and classification
- 2- Modified compaction (Proctor test)
- 3- Liquid limit, plastic limit and plasticity index
- 4- California bearing ratio (CBR)
- 5- Specific gravity (SG)
- 6- Los Angeles test

IV- Results

1- Grain size analysis and classification	Grain size analysis	As showed in appendix
	Classification	A-1-A
2- Modified compaction(Proctor test)	MDD	2.155
	OMC	6.30%
3- Liquid limit, plastic limit and plasticity index	LL	Non plastic
	PL	Non plastic
	PI	Non plastic
4- California bearing ratio (CB		CBR ratio
		92%
5- Specific gravity (SG), absorption and degradation	S S D	2.569
	Absorption	1.2%
	Degradation	0.2%
	Abrasion ratio	27.2%
6- Los Angeles test		

LAB DIRECTOR
Eng / Eman Kandil



Geotechnical consultant
Dr. Mohamed Mostafa Badry



49 El Horria Ave. Alex, Egypt
Tel: 002 033920176 - 002 033931482
Fax :002 033900476
Email : internal-inspection@comibassal.com

Kilo 23 Alexandria - Cairo Desert Road - Meighem
Tel: 002 03 4704595 - 002 034701191
Email : cndept@comibassal.com
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APPENDIX



49 El Horria Ave. Alex, Egypt
Tel: 002 033920176 - 002 033931482
Fax: 002 033900476
Email: internal-inspection@combassal.com
Website: www.combassal.com

Kilo 23 Alexandria - Cairo Desert Road - Merghem
Tel: 002 03 4794595 - 002 034701191
Email: civedep@combassal.com
Website: www.combassal.com

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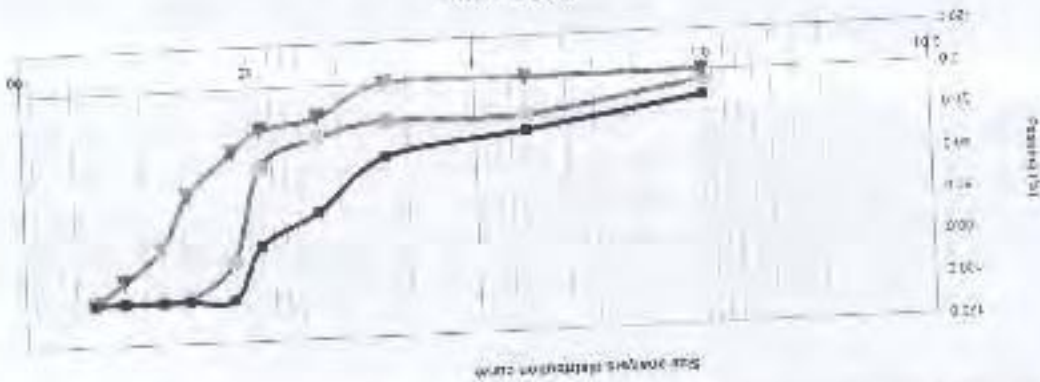


PARTICLE SIZE DISTRIBUTION ANALYSIS

ASTM C-136 / AASHTO T27

STANDARD SPECIFICATION	CUMULATIVE PERCENTAGE	PERCENTAGE	PASSING (%)	RETAINED (%)	WEIGHT
					RETAINED (gm)
					(gm)
5	0.00	0.00	100.0	0.00	0.00
4	0.00	0.00	100.0	0.00	0.00
3	0.00	0.00	100.0	0.00	0.00
1.5	150.00	1.53	98.5	1.53	150.00
3/4	435.00	62.45	37.5	62.45	435.00
3/8	1255.00	75.34	24.7	75.34	1255.00
No.10	138.00	27.60	17.9	27.60	138.00
No.200	405.00	81.90	4.7	81.90	405.00

Total sample weight = 9740.00 pass No.3/8 = 3880.0 Total fine aggregates weight = 500 gm



Soil classification: A-1-a (Non Plastic)



49 El Horria Ave. Alex. Egypt
Tel: 002 033920176 - 002 033931482
Fax: 002 033900476
Email: internal-inspection@comibassal.com

K/no 23 Alexandria - Cairo Desert Road - Mergem
Tel: 002 93 4204595 - 002 034701191
Email: cti@dept@comibassal.com
www.comibassal.com

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Modified Proctor Test Report ASTM - D 1557

Mould Number : 1
Volume of mould = 2190 cm³
Weight of mould = 7047 g
G.S = 2.56 g/cm³

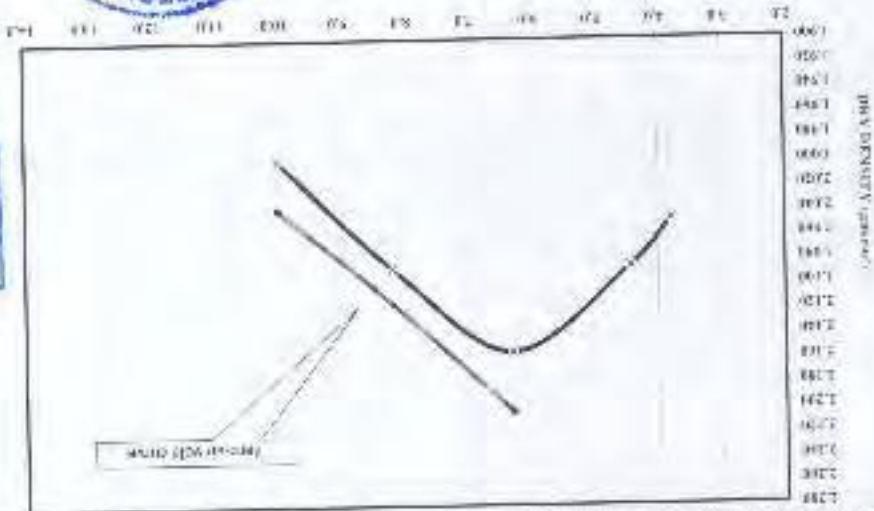
A- Density Calculations :-

Weight of wet soil (g)	11700	11818	12065	11993	11860
Weight of mould (g)	7047	7047	7047	7047	7047
Weight of wet soil (g)	4653	4771	5018	4946	4813
Volume of mould (cm ³)	2190	2190	2190	2190	2190
Wet density (g/cm ³)	2.125	2.179	2.291	2.258	2.198
Dry density (g/cm ³)	2.047	2.086	2.155	2.087	1.998
Zero-air Voids curve			2.204	2.116	2.038

B. Moisture Calculations :-

Weight of wet soil-container (g)	250.0	250.0	250.0	250.0	250.0
Weight of dry soil-container (g)	244.0	243.0	240.2	237.5	235.0
Weight of container (g)	85.5	85.5	85.0	85.0	85.0
moisture content (%)	3.8	4.4	6.3	8.2	10.0

C. Dry density-Moisture relationship:-



MOISTURE CONTENT (%)

M.D.D = 2.155 g/cm³
O.M.C = 8.30 %



Kilo 23 Alexandria - Cairo Desert Road - Mersha
Tel: 002 03 420495 - 002 03470119
Email: info@combassal.com
Website: www.combassal.com

49 El Horria Ave, Alex, Egypt
Tel: 002 033920176 - 002 033931482
Fax: 002 033900476
Email: internal-inspection@combassal.com

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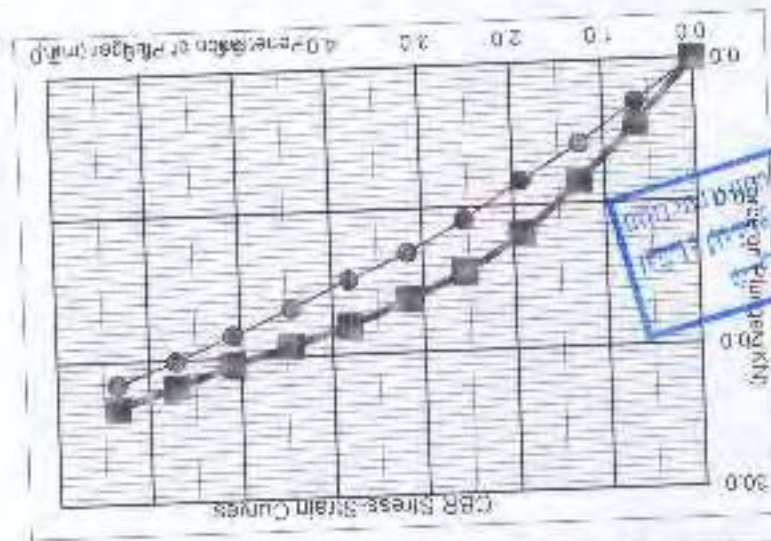
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Report of CBR Test - ASTM - D 1883

NO OF BLOWS		56	56	56
MOULD NO		1	1	1
WT OF MOULD + SOIL		12120	1047	5073
WT OF MOULD		7047	5073	2140
WT OF SOIL		5073	2140	2140
VOLUME OF MOULD		2140	2140	2140
WET DENSITY		2.146	2.146	2.146
MC before soaking		4.54kg	4.54kg	4.54kg
TIN NO		1	1	1
WT OF WET SOIL + TIN		250.00	250.00	250.00
WT OF DRY SOIL + TIN		240	240	240
WT OF WATER		10.00	10.00	10.00
WT OF TIN		92	92	92
WT OF DRY SOIL		148	148	148
MOISTURE CONTENT		6.8	6.8	6.8
DRY DENSITY		2.73	2.73	2.73
CBR		56	56	56
Swell %		56	56	56
Swell		0.00	0.00	0.00
Eng		0.00	0.00	0.00
Swt		0.00	0.00	0.00
MDD		2.171	2.171	2.171
OMC		6.3	6.3	6.3
PROVING RING		50	50	50
Capacity (kN)		50	50	50
Heating (kN)		56	56	56
CBR		56	56	56
Per m		56	56	56
0.00		0	0	0
0.64		502	502	502
1.27		595	595	595
1.91		850	850	850
2.54		1110	1110	1110
3.17		1330	1330	1330
3.81		1510	1510	1510
4.45		1700	1700	1700
5.08		1880	1880	1880
5.71		2050	2050	2050
6.35		2210	2210	2210



49 El Horria Ave, Alex, Egypt
Tel: 002 033920176 - 002 033931482
Fax: 002 033900476
Email: internal-inspection@comibassal.com



Kilo 23 Alexandria - Cairo Desert Road - Mersha
Tel: 002 03 4704595 - 002 03470179
Email: chidepi@comibassal.com
Website: www.comibassal.com



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Absorption & Specific Gravity for Aggregate

AASHTO T85 - ASTM C127

Weight of sample	2500
Weight of saturated - dry surface sample (B)	2525
Weight of saturated sample in water (C)	1542
Weight of dry sample after heating (A)	2495

Results:-

Saturation surface dry specific gravity = $B / (B - C)$	2.569
Bulk specific gravity = $A / (B - C)$	2.538
Apparent specific gravity = $A / (A - C)$	2.618
Absorption of water = $(B - A) / A \times 100$	1.2
Degradation of aggregate = $(2500 - A) / A \times 100$	0.2



Kilo 23 Alexandria - Cairo Desert Road - Marghem
Tel: 002 03 474595 - 002 03470191
Email: (info@comibassal.com)
Website: www.comibassal.com

49 El Horria Ave. Alex, Egypt
Tel: 002 033920176 - 002 033931482
Fax: 002 033900476
Email: internal-inspection@comibassal.com

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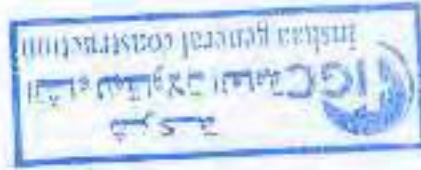


ABRASION AND IMPACT " LOS ANGELES " TEST

(For coarse aggregate)

ASTM- C 131-96 / AASHTO-T-96

Speed	Trial Grading			
Rotate at 30 to 33 Rpm For 500 Revolution	A			
Initial Weight (W1) gms	5000			
Weight of tested sample (W2) gms	3640			
% abrasion By Weight Passing from Sieve No.12	27.2%			



Kilo 23 Alexandria - Cairo Desert Road - Merghem

Tel: 002 03 4704595 - 402 034701191

Email: cnydepl@comibassal.com

Website: www.comibassal.com

49 El Horria Ave. Alex, Egypt
Tel: 002 033920176 - 002 033931482

Fax: 002 033900476

Email: Internal-Inspection@comibassal.com



COMBASSAL International Controllers

Internal inspection and laboratories sector

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Report	:	379 - 6 - Center
Date	:	12/04/2023

CHEMICAL ANALYSIS

General Consultant : SYSTRA
Consultant : SYSTRA
Contractor : SYSTRA
Project : Electric express train
Sample : Prepared Sub Grade
Station : ST (373 +0.00) : (374 +0.00)
Date of Test : 8-4-2023
Temperature : 20 °C
Humidity : 40%

ANALYSIS	RESULTS	TEST METHOD
CHLORIDE	0.0014%	ASTM D 2974
SULPHATE	0.0080%	
ORGANIC MATTER	NEGATIVE	

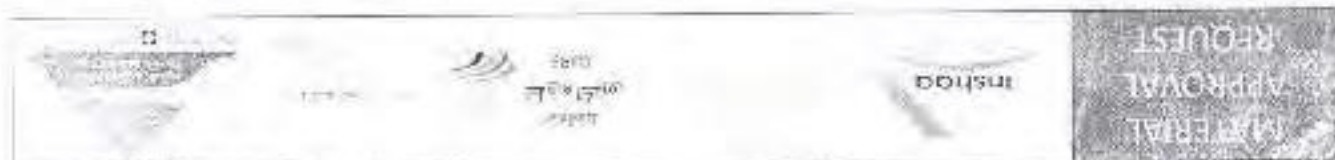


LAB DIRECTOR
CH/ Mostafa Asker



Kilo 23 Alexandria - Cairo Desert Road - Merghem
Tel: 002 03 4784595 - 002 034707191
Email: cidepi@combassal.com
Website: www.combassal.com

49 El Horria Ave. Alex, Egypt
Tel: 002 033920176 - 002 033931482
Fax: 002 033900476
Email: Internal-inspection@combassal.com



Contractor Company	INSHAA GENERAL OF CONSTRUCTION		Designer Company	(SPECTRUM) Engineering Consulting Office	
	Name			Date/Serial Number	
Issued by	Eng. Mahmoud shaban	Sign	28-04-2023 (M.A.R.) Rev (B.5.1)		Time
Received by	Eng. Mazen Essamy	Sign	321 EHV C2 C3 DD YY III W/M		
CONSULTANT		GARO			

CODE-1	51 to 521	D1 to 53	Kp XXX Note
CODE-2	Station Reference	Daport Reference	For Kilometer point only Start Km is used
CODE-3	Sub Element of Activity		

Description of Materials	Sub-Ballast Total Quantity (5000 m3)		Location to be Used		From Station (371+000) to Station (371+500)	
	Sample only	Yes	Materials Type	Prepared Subgrade		
Supplier Name	Data Sheet provided			Yes attached INSHAA GENERAL OF CONSTRUCTION Company Contracting ASTM D (1557) CARTRIDGE SPECIFICATIONS & TESTING REPORT (CG21-412) VERSION 2 BY CIVECON GROUP		
Reference in BoQ	Specification			Test Samples Results		
Prequalification reference				Other		
Reference Photos	No/Yes					

Comments by: Eng. Mazen Essamy (SPECTRUM)	Comments by: Eng. Alaa Abd-Allatif (ER)
1- Quality test Result By Third Party Lab is Approved 2- This Sample Representative (5000 m3) only. 3- Final approval is subject to above mentioned project specifications. 4- Results report attached and acceptable with the (com based international) 5- All tests were carried out by third party lab.	1- All tests were carried out by third party lab. 2- Results report attached and acceptable with the project specifications. 3- Final approval is subject to above mentioned comments.

Organisation	Name	Sign	Date	A-AWC-R
Contractor	Eng. Mohamed Hassan	Sign	29-04-2023	A
QA/QC *	Eng. Mazen Essamy	Sign		A
GARB **	Eng. Mohammed Fayad	Sign		
Employers Representative	Eng. Alaa Abd-Allatif	Sign	6-5-2023	AWC



COMIBASSAL International Controllers

Internal inspection and laboratories sector

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Accredited by : Egyptian Accreditation Council (EGAC) under No. 031708/1A

I- Introduction

General Consultant : SYSTRA
Consultant : SPECTRUM
Contractor : شركة اس جي
Sub-Ballast : St(371+0.00) to st(371+500)
Station :
Date of Test : 29/04/2023
QC : 1034-1

II- Sample description:

Crushed stone and sand

III- Required tests

- 1- Grain size analysis and classification
- 2- Modified compaction (Proctor test)
- 3- Liquid limit, plastic limit and plasticity index
- 4- California bearing ratio (CBR)
- 5- Specific gravity (SG)
- 6- Los Angeles test

IV- Results

1- Grain size analysis and classification		Grain size analysis	As showed in appendix
2- Modified compaction (Proctor test)		MD	2.184
3- Liquid limit, plastic limit and plasticity index		OMC	7.5%
		LL	Non plastic
		PL	Non plastic
		PI	Non plastic
4- California bearing ratio (CBR)		CBR ratio	95%
5- Specific gravity (SG), absorption and degradation		SS D	2.579
		Absorption	1.3%
		Degradation	0.2%
6- Los Angeles test		Abrasion ratio	30%

LAB DIRECTOR
Eng / Eman Kandil
Kilo 23 Alexandria - Cairo Desert Road - Mergham



Geotechnical consultant
For: Dr. M.
Dr. Mohamed Mostafa Badry



49 El Horria Ave. Alex, Egypt
Tel: 002 033920176 - 002 033931482
Fax: 002 033900476
Email: Internal-Inspection@comibassal.com

Kilo 23 Alexandria - Cairo Desert Road - Mergham
Tel: 002 03 4704555 - 002 034701191
Email: cndrpt@comibassal.com
Website: www.comibassal.com

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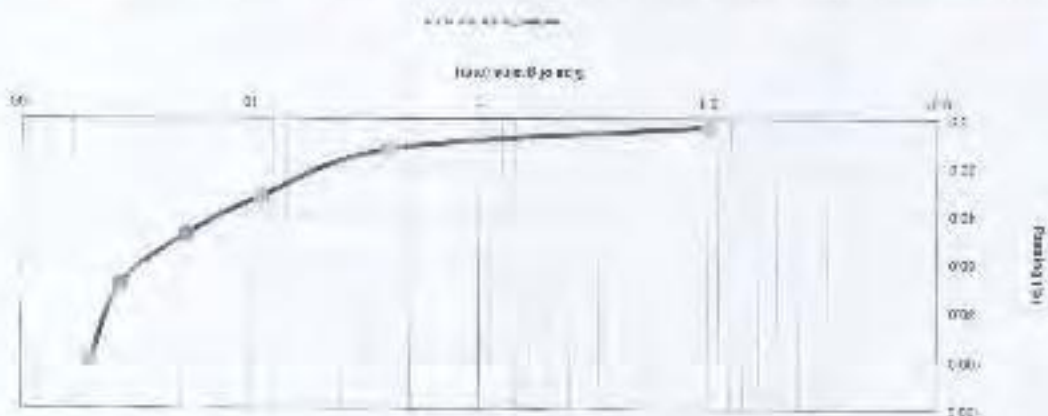
PARTICLE SIZE DISTRIBUTION ANALYSIS

ASTM C-136 / AASHTO T27

WEIGHT	RETAINED	WEIGHT	PERCENTAGE	RETAINED (gm)	RETAINED (%)	PASSING (%)	STANDARD
2	0.00	0.00	0.00	0.00	0.00	100.0	
1-2	3103.00	3103.00	31.03	3103.00	31.03	69.0	
1	1851.00	4954.00	49.54	4954.00	49.54	50.5	
3/4	235.00	5189.00	51.89	5189.00	51.89	48.1	
1/2	853.00	6044.00	60.44	6044.00	60.44	39.6	
3/8	714.00	6758.00	67.58	6758.00	67.58	32.4	
No.4	1110.00	7868.00	78.68	7868.00	78.68	21.3	
No.10	200.00	200.00	40.00	40.00	40.00	12.8	
No.200	418.00	418.00	83.60	83.60	83.60	3.5	

total sample weight= 10000.00 pass No.4= 2132.0 Total fine aggregates weight = 500 gm

See analysis distribution curve



Soil classification: A - 1 - a - sample is non plastic



49 El Horria Ave, Alex, Egypt
Tel: 002 033920176 - 002 033931482
Fax: 002 033900476
Email: internal-inspection@comibassal.com

Unit 23 Alexandria - Cairo Desert Road - Mersham
Tel: 001 03 4704595 - 002 034701191
Email: chidept@comibassal.com
Website: www.comibassal.com

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Modified Proctor Test Report

Mould Number :
Volume of mould =
Weight of mould =
G.S =

Mould Number :
Volume of mould =
Weight of mould =
G.S =

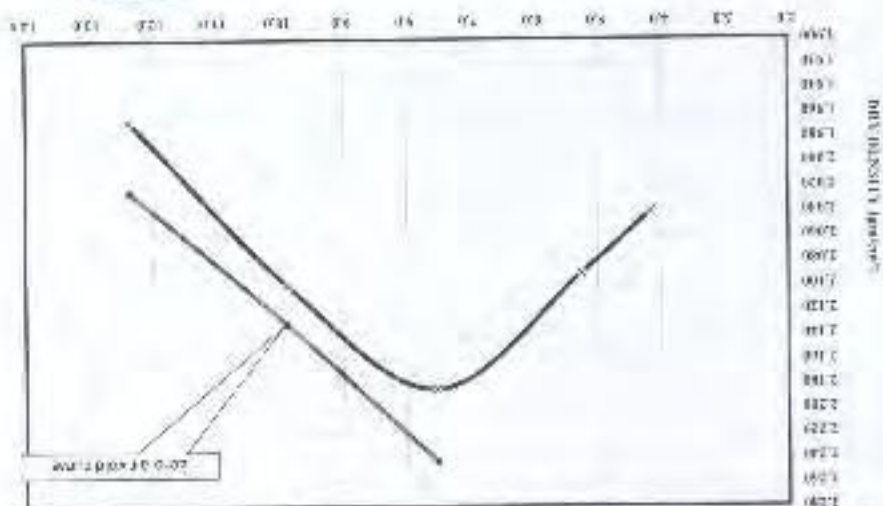
A - Density Calculations :-

Weight of wet soil (g)	11721	11886	12211	12120	11905
Weight of mould (g)	7046	7046	7046	7046	7046
Weight of wet soil (g)	4675	4840	5165	5074	4859
Volume of mould (cm ³)	2199	2199	2199	2199	2199
Wet density (g/cm ³)	2.126	2.201	2.349	2.307	2.210
Dry density (g/cm ³)	2.041	2.091	2.184	2.100	1.967
Zero-air Void curve			2.244	2.131	2.024

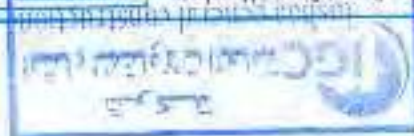
B - Moisture Calculations :-

Weight of wet soil (g)	100.0	100.0	100.0	100.0	100.0
Weight of dry soil (g)	96.0	95.0	93.0	91.0	89.0
moisture content %	4.2	5.3	7.5	9.9	12.4

C - Dry Density-Moisture relationship :-



M.D.D = 2.184 g/cm³
O.M.C = 7.5 %



49 El Horria Ave. Alex, Egypt
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Fax: 002 033900476
Email: internal-inspection@comibassal.com

Kilo 23 Alexandria - Cairo Desert Road - Mersin
Tel: 002 03 4704595 - 002 034701191
Email: cti@comibassal.com
Website: www.comibassal.com



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Absorption & Specific Gravity for Aggregate

AASHTO T85 - ASTM C127

Weight of sample	2500
Weight of saturated - dry surface sample (B)	2527
Weight of saturated sample in water (C)	1547
Weight of dry sample after heating (A)	2494

Results:-

Saturation surface dry specific gravity = $B / (B - C)$	2.579
Bulk specific gravity = $A / (B - C)$	2.545
Apparent specific gravity = $A / (A - C)$	2.634
Absorption of water = $(B - A) / A \times 100$	1.3
Degradation of aggregate = $(2500 - A) / A \times 100$	0.2



Kilo 23 Alexandria - Cairo Desert Road - Mergham
 Tel: 002 03 4704555 - 002 034701191
 Email: info@comibassal.com
 Website: www.comibassal.com



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 Tel: 002 033920176 - 002 033931482
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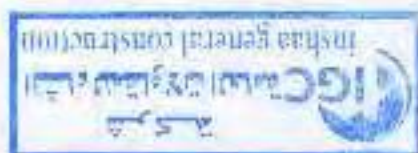


ABRASION AND IMPACT " LOS ANGELES " TEST

(For coarse aggregate)

ASTM- C 131-96 / AASHTO-T-96

Speed	Trial Grading	Initial Weight (W1) gms	Weight of tested sample (W2) gms	% abrasion By Weight	Passing from Sieve No.12
Rotate at 30 to 33 Rpm For 500 Revolution	A	5000	3500	30.0%	



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Report :	442 - 1 - Center
Date :	06/05/2023

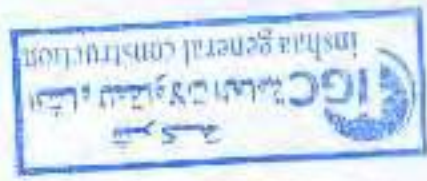
CHEMICAL ANALYSIS

General Consultant	SYSTRA
Consultant	SPECTRUM
Contractor	لجنة المتابعة
Project	Electric express train
Sample	Sub Ballast
Station	ST (371 + 0.00) : (371 - 500)
Date of Test	29-4-2023
Temperature :	21 °C
Humidity :	55%

ANALYSIS	RESULTS	TEST METHOD
CHLORIDE	0.0053%	ASTM D 2974
SULPHATE	0.0190%	
ORGANIC MATTER	NEGATIVE	



LAB DIRECTOR
CH/ Mostafa Asker
Moustafa



Technical Report

Plate Loading Tests

KM 371+450, KM 371+400,
 KM 371+425, KM 371+350
 and KM 371+375,

Project Electric Express Train (Sokhna - New capital - 6th of October city - New Elamein city)

Prepared for
 Inshaa General Construction

Mobilika CC - Abu Youssef, Alexandria, Egypt



1. Introduction

The Civil Engineering Testing & Consulting Unit (CETCU) of the Egypt-Japan University of Science and Technology (EJUST) was retained by Inshaa General Construction to conduct 6 plate loading tests on the Prepared Subgrade 2.0 of the Electric Express Train project at 6 locations (KM 371+475, KM 371+450, KM 371+425, KM 371+400, KM 371+375, and KM 371+350) in accordance with the German Standard DIN18134. The mandate was communicated by Eng. Mahmoud Shaban of Inshaa General Construction. Field team members (Mr. Mohamed Marmoud) from the working CETCU team visited the project site on April 10, 2023 and performed the required tests. This report summarizes the plate loading test procedure according to DIN18134, the test results and their interpretations, and the CETCU pertaining recommendations.

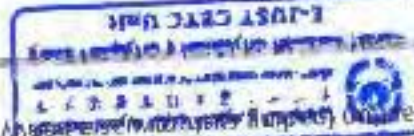
2. Test Set Up and Instrumentation

- The German standard DIN18134 was applied to define the test setup including the loading system, test conditions, and procedure for the plate loading tests.
- The tests were carried out to determine the Strain Moduli (E_{v1} and E_{v2}) and their ratio (E_{v2}/E_{v1}) from a stress – deformation relationship of two consecutive loading from Loading-Unloading-Loading regime.

- The loading plate has a diameter of 600 mm and a thickness of 25 mm and it is provided with equally spaced stiffeners. The upper plate face is parallel to the bottom face of the plate to allow a 300 mm plate to be placed on the 600-mm plate top.

- The loading system consisted of a hydraulic pump connected to a hydraulic jack of 700 bar capacity, which can apply and release the load increments.
- The dial gauge used to measure the plate settlement has a resolution of 0.01 mm and the lever ratio was equal to 1.

- The temperature at the time of the test was 19± 1°C.
- The plate was carried out on a Prepared Subgrade 2.0 (according to the company) at 6 points. The test surface area was levelled, and the plate was bedded on this surface.
- The hydraulic jack was placed on the middle of, and normal to, the loading plate beneath the reaction loading system and secured against tilting.
- The reaction loading system was a multi-purpose Loader CAT 966F.



3. Test Procedure and Results

The plate load test was conducted in accordance with the DIN18134. Loading, unloading, and reloading regimes were considered to estimate the resilient modulus of the tested soil. Prior to the test, the force transducer and dial gauge were reset to zero, and then a load corresponding to a stress of 0.01 MN/m² was applied. The load was increased in the first loading cycle until a normal stress of 0.25 MN/m² was reached, and the loading increment was 0.025 MN/m². The load was gradually released in four stages. Following unloading, a second loading cycle was performed, but the load was only increased to the penultimate stage of the first cycle. 10 plate loading tests on the Prepared Subgrade 2.0 of the Electric Express Train project were conducted at 10 locations (KM 371+325, KM 371+300, KM 371+275, KM 371+250, KM 371+225, KM 371+200, KM 371+175, KM 371+150, KM 371+125, and KM 371+100) and the data collected at the 10 test points is included in Appendix A.

Table 1 presents the load-settlement data obtained at the first loading and unloading stages of the plate loading test performed at the location (KM 371+325), while Table 2 shows the data obtained at the second loading stage.

Table 1: Load-settlement data obtained at the first loading and unloading stages of the plate loading test performed at the location (KM 371+325)

Load stage (F)	Normal	Settlement
0	1.414	0.00
1	7.07	0.28
2	14.14	0.34
3	21.21	0.45
4	28.28	0.55
5	35.35	0.64
6	42.42	0.73
7	49.49	0.83
8	56.56	0.92
9	63.63	1.02
10	70.7	1.07
11	56.56	1.07
12	49.49	1.08
13	35.35	1.08
14	21.21	0.95
15	1.414	0.15

Table 2: Load-settlement data obtained at the second loading and unloading stages of the plate loading test performed at the location (KM 371+325)

Settlement (S) mm	Normal stress (σ ₀) MN/m ²	Load (P) kN
0.15	0.005	1.414
0.38	0.025	7.07
0.46	0.050	14.14
0.55	0.075	21.21
0.65	0.100	28.28
0.76	0.125	35.35
0.83	0.150	42.42
0.89	0.175	49.49
0.94	0.200	56.56
1.00	0.225	63.63

The load-settlement data obtained in all loading and unloading stages for the test performed at the first location (KM 371+325) are shown in Figure 1. Table 3 shows the calculations of the resilient modulus of the tested soil according to DIN18134. The testing data corresponding to the second testing point (KM 371+300) is provided in Tables 4, 6 and Figure 2. The testing data corresponding to the third testing point (KM 371+275) is provided in Tables 7-9 and Figure 3. The testing data corresponding to the fourth testing point (KM 371+250) is provided in Tables 10-12 and Figure 4. The testing data corresponding to the fifth testing point (KM 371+225) is provided in Tables 13-15 and Figure 5.

Table 3: Calculations of the resilient modulus of the tested soil according to DIN18134: (KM 371+325)

Parameters	Test loading cycle	2nd loading cycle
(σ ₀ max) MN/m ²	0.25	0.25
σ ₀ (mm)	0.36	0.36
σ ₁ (mm/(MN/m ²))	3.96	3.96
σ ₂ (mm/(MN/m ²))	-1.03	-1.03
E _{ve} 1.5 f / (σ ₁ σ ₂ σ ₀ mod)	121.65	121.65
E _{ve} /E _v	1.10	1.10

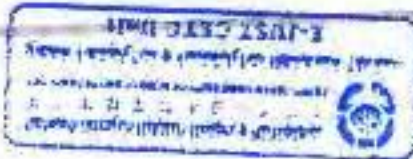


Table 17: Load-settlement data obtained at the second loading and unloading stages of the plate loading test performed at the location (KM 371+350)

Load stage	Load (F)	Normal stress (s)	Settlement (s)
0	1.414	0.005	0.22
1	7.07	0.025	0.42
2	14.14	0.050	0.50
3	21.21	0.075	0.57
4	28.28	0.100	0.66
5	35.35	0.125	0.73
6	42.42	0.150	0.80
7	49.49	0.175	0.83
8	56.56	0.200	0.86
9	63.63	0.225	0.91

Table 18: Calculations of the resilient modulus of the tested soil according to DIN18134:

Parameters	1st loading cycle	2nd loading cycle
$[s_p]_{max}$ mm/m	0.25	0.25
a_1 (mm/(MN/m ²))	3.11	5.31
a_2 (mm/(MN/m ²))	-0.55	-10.77
a_3 (mm/(MN/m ²))	151.18	171.72
$E_v = 1.57 / (a_1 + a_2 + a_3)$		
E_v/E_v		1.14

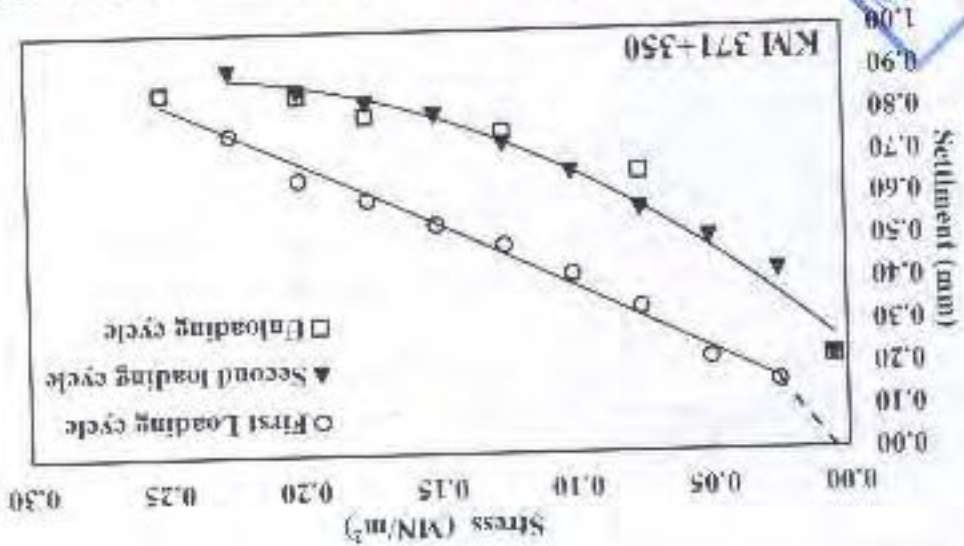


Figure 6: Load-settlement data: plate loading test performed at (KM 371+350)

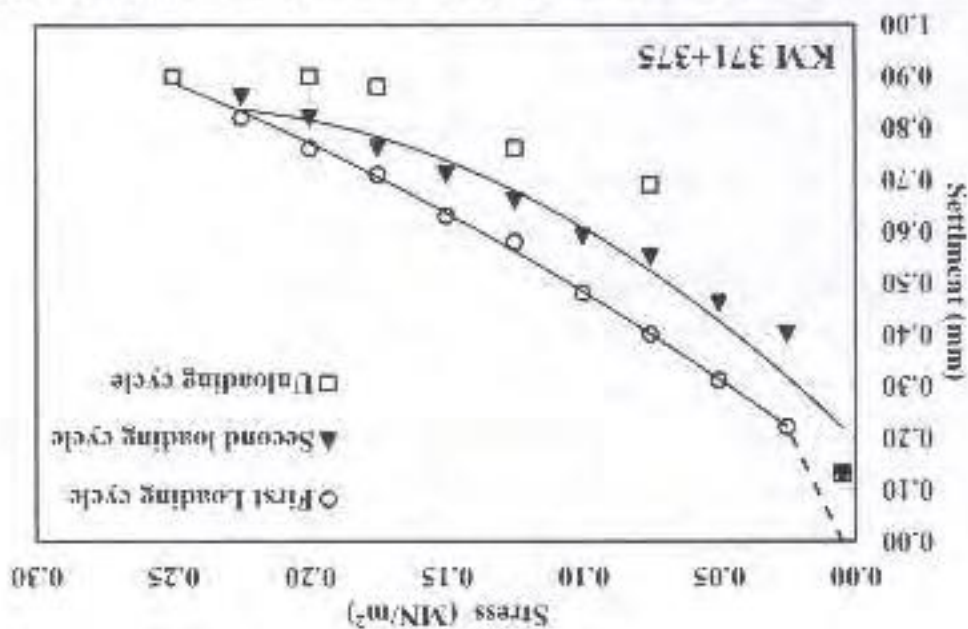
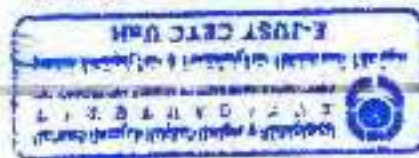


Figure 5: Load-settlement data: plate loading test performed at (KM 371+375)

Table 16: Load-settlement data obtained at the first loading and unloading stages of the

Loading stage	Load (F) kN	Normal stress (s _j) MN/m ²	Settlement (s) mm
0	1.414	0.005	0.00
1	7.07	0.025	0.16
2	14.14	0.050	0.22
3	21.21	0.075	0.34
4	28.28	0.100	0.42
5	35.35	0.125	0.49
6	42.42	0.150	0.54
7	49.49	0.175	0.60
8	56.56	0.200	0.65
9	63.63	0.225	0.76
10	70.7	0.250	0.86
11	77.77	0.275	0.85
12	84.84	0.300	0.80
13	91.91	0.325	0.76
14	98.98	0.350	0.66
15	106.05	0.375	0.22



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Table 13: Load-settlement data obtained at the first loading and unloading stages of the plate loading test performed at the location (KM 371+375)

Settlement (s)	mm	Normal stress (sq)	kN/m ²	Load (F)	kN
0.00	0.00	0.005	1.414	1	1.414
0.22	0.31	0.025	7.07	2	14.14
0.40	0.40	0.050	14.14	3	21.21
0.48	0.48	0.075	21.21	4	28.28
0.58	0.58	0.100	28.28	5	35.35
0.63	0.63	0.125	35.35	6	42.42
0.71	0.71	0.150	42.42	7	49.49
0.76	0.76	0.175	49.49	8	56.56
0.82	0.82	0.200	56.56	9	63.63
0.90	0.90	0.225	63.63	10	70.7
0.90	0.90	0.250	70.7	11	77.77
0.90	0.90	0.275	77.77	12	84.84
0.99	0.99	0.300	84.84	13	91.91
0.69	0.69	0.325	91.91	14	98.98
0.13	0.13	0.350	98.98	15	106.06

Table 14: Load-settlement data obtained at the second loading and unloading stages of the plate loading test performed at the location (KM 371+375)

Settlement (s)	mm	Normal stress (sq)	kN/m ²	Load (F)	kN
0.13	0.13	0.005	1.414	1	1.414
0.40	0.40	0.025	7.07	2	14.14
0.46	0.46	0.050	14.14	3	21.21
0.55	0.55	0.075	21.21	4	28.28
0.59	0.59	0.100	28.28	5	35.35
0.66	0.66	0.125	35.35	6	42.42
0.71	0.71	0.150	42.42	7	49.49
0.76	0.76	0.175	49.49	8	56.56
0.82	0.82	0.200	56.56	9	63.63

Table 15: Calculations of the resilient modulus of the tested soil according to DIN18134:

Parameters	(s, max) MN/m ²	a ₁ (mm)	a ₂ (mm/(MN ² /m ²))	B ₁ (mm ² /MN)	B ₂ (mm ² /MN)	Ev/E ₁
1st loading cycle	0.25	0.12	3.95	3.58	3.58	1.18
2nd loading cycle	0.25	0.19	5.16	10.27	10.27	1.18

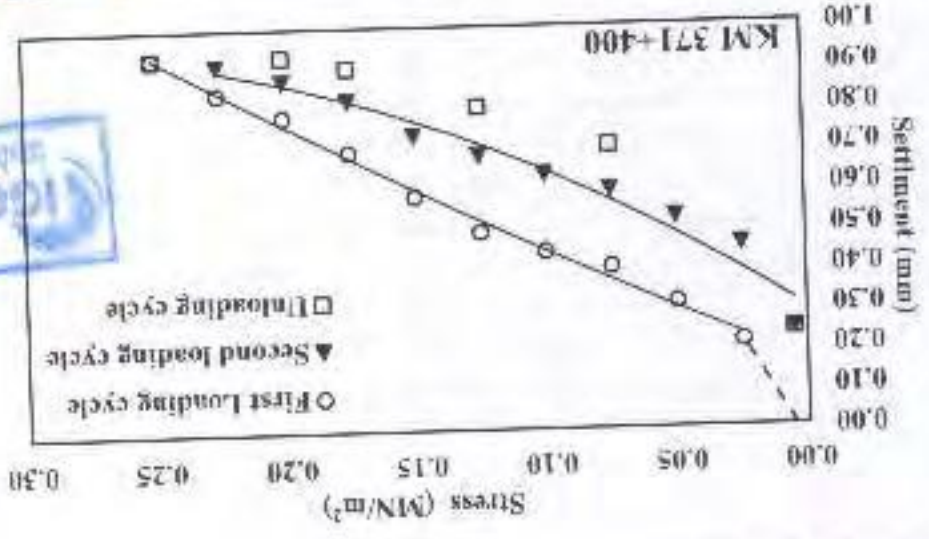


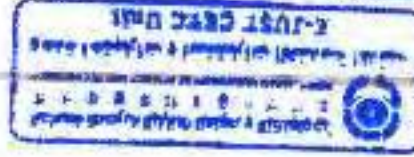
Table 11: Load-settlement data obtained at the second loading and unloading stages of the plate loading test performed at the location (KM 371+400)

Load stage	Load (F)	Normal stress (σ_0)	Settlement (S)
0	1.414	0.005	0.24
1	7.07	0.025	0.45
2	14.14	0.050	0.57
3	21.21	0.075	0.59
4	28.28	0.100	0.63
5	35.35	0.125	0.68
6	42.42	0.150	0.73
7	49.49	0.175	0.82
8	56.56	0.200	0.87
9	63.63	0.225	0.91

Table 12: Calculations of the resilient modulus of the tested soil according to DIN18134:

Parameters	1st loading cycle	2nd loading cycle
$(\sigma_{u,max})$ MN/m ²	0.25	0.25
σ_0 (mm)	0.16	4.14
σ_1 (mm)/(MN/m ²)	2.65	-6.43
σ_2 (mm)/(MN/m ²)	1.76	177.88
$E_{ur} = 1.5 \cdot r / (\sigma_1 + \sigma_2 - \sigma_0, \text{mm})$	145.57	1.22





Load (F) kN	Normal stress (σ ₀) MN/m ²	Settlement (s) mm
0	0.005	0.00
1	0.025	0.21
2	0.050	0.31
3	0.075	0.40
4	0.100	0.44
5	0.125	0.49
6	0.150	0.58
7	0.175	0.69
8	0.200	0.78
9	0.225	0.84
10	0.250	0.93
11	0.200	0.93
12	0.175	0.90
13	0.125	0.80
14	0.075	0.70
15	0.005	0.24

Table 10: Load-settlement data obtained at the first loading and unloading stages of the plate loading test performed at the location (KM 371+400)

Figure 3: Load-settlement data: plate loading test performed at (KM 371+425)

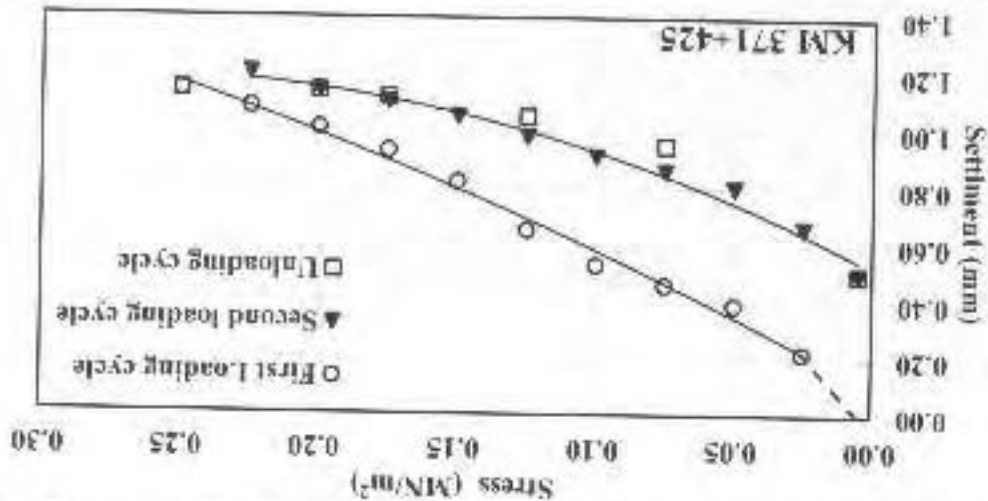


Table 7: Load-settlement data obtained at the first loading and unloading stages of the plate loading test performed at the location (KM 371+425)

Load stage	Load (F)	Normal stress (σ_0)	Settlement (S)
0	1.414	0.005	0.00
1	7.07	0.025	0.22
2	14.14	0.050	0.39
3	21.21	0.075	0.46
4	28.28	0.100	0.53
5	35.35	0.125	0.65
6	42.42	0.150	0.87
7	49.49	0.175	0.93
8	56.56	0.200	1.01
9	63.63	0.225	1.08
10	70.7	0.250	1.14
11	77.77	0.275	1.14
12	84.84	0.300	1.12
13	91.91	0.325	1.05
14	98.98	0.350	0.95
15	106.05	0.375	0.50

Table 8: Load-settlement data obtained at the second loading and unloading stages of the plate loading test performed at the location (KM 371+425)

Load stage	Load (F)	Normal stress (σ_0)	Settlement (S)
0	1.414	0.005	0.50
1	7.07	0.025	0.66
2	14.14	0.050	0.80
3	21.21	0.075	0.86
4	28.28	0.100	0.91
5	35.35	0.125	0.98
6	42.42	0.150	1.05
7	49.49	0.175	1.10
8	56.56	0.200	1.14
9	63.63	0.225	1.20

Table 9: Calculations of the resilient modulus of the tested soil according to DIN18134: (KM 371+425)

Parameters	1st loading cycle	2nd loading cycle
$(s_0)_{max}$ MN/m ²	0.25	0.25
s_0 (mm)	0.10	0.52
a_1 (mm)/(MN/m ²)	5.23	1.95
a_2 (mm)/(MN/m ²)	-3.82	167.69
$E_v = E_s \cdot v / (a_1 + a_2 \cdot s_0)$	105.31	
E_v/E_v		

Table 5: Load-settlement data obtained at the second loading and unloading stages of the plate loading test performed at the location (KM 371+450)

Settlement (s)	mm	Normal stress (s ₀)	kN/m ²	Load (F)	kN
0.47	0.73	0.025	0.005	1.414	0
0.83	0.89	0.050	0.050	7.07	1
0.89	0.89	0.075	0.075	14.14	2
0.95	0.95	0.100	0.100	21.21	3
1.05	1.05	0.125	0.125	28.28	4
1.10	1.10	0.150	0.150	35.35	5
1.20	1.20	0.175	0.175	42.42	6
1.24	1.24	0.200	0.200	49.49	7
1.29	1.29	0.225	0.225	56.56	8
				63.63	9

Table 6: Calculations of the resilient modulus of the tested soil according to DIN18134: (KM 371+450)

Parameters		1st loading cycle		2nd loading cycle	
(s ₀ max)	kN/m ²	0.25	0.14	0.53	5.50
a ₀ (mm)		3.81	2.61	-9.65	145.58
a ₁ (mm/(kN/m ²))		100.91			
a ₂ (mm/(kN/m ²))					
E _v =1.5 r / (a ₁ +a ₂ 50 mm)					
E _v /E _{v1}					

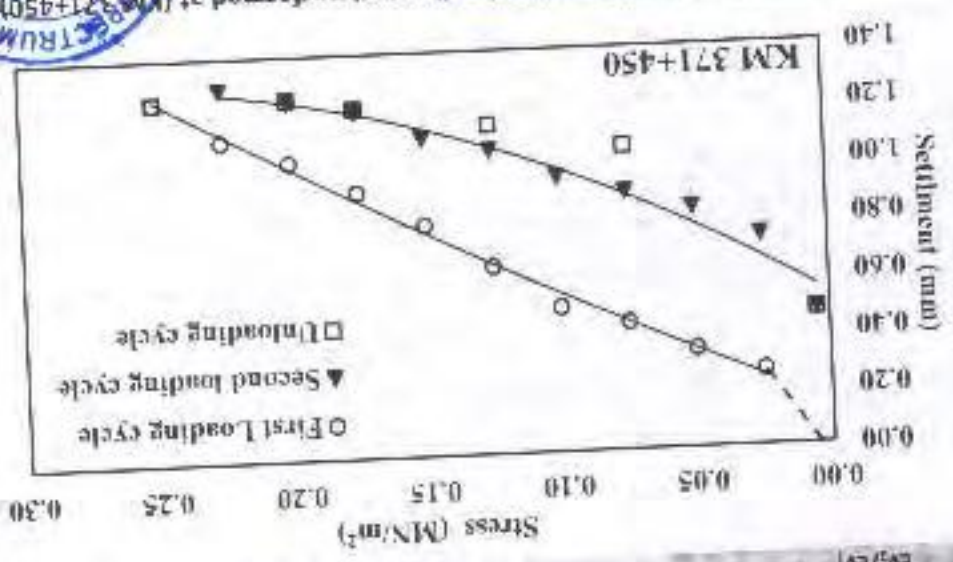
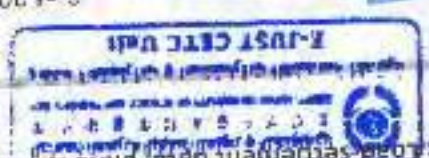


Figure 2: Load-settlement data plate loading test performed at (KM 371+450)



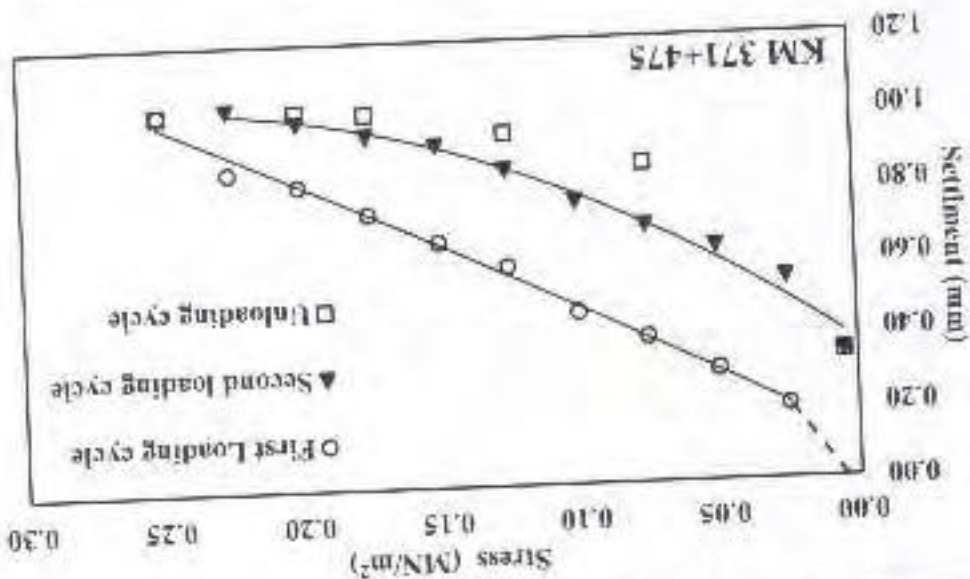


Figure 1: Load-settlement data: plate loading test performed at (KM 371+475)

Table 4: Load-settlement data obtained at the first loading and unloading stages of the plate loading test performed at the location (KM 371+450)

Settlement (mm)	Normal stress (sq)	Load (F)	Load stage
0.00	0.005	1.414	0
0.26	0.025	7.07	1
0.34	0.050	14.14	2
0.44	0.075	21.21	3
0.50	0.100	28.28	4
0.65	0.125	35.35	5
0.80	0.150	42.42	6
0.92	0.175	49.49	7
1.03	0.200	56.56	8
1.11	0.225	63.63	9
1.25	0.250	70.7	10
1.25	0.200	56.56	11
1.21	0.175	49.49	12
1.14	0.125	35.35	13
1.05	0.075	21.21	14
0.47	0.005	1.414	15



3. Test Procedure and Results

The plate load test was conducted in accordance with the DIN18134. Loading, unloading, and reloading regimes were considered to estimate the resilient modulus of the tested soil. Prior to the test, the force transducer and dial gauge were reset to zero, and then a load corresponding to a stress of 0.01 MN/m² was applied. The load was increased in the first loading cycle until a normal stress of 0.25 MN/m² was reached, and the loading increment was 0.025 MN/m². The load was gradually released in four stages. Following unloading, a second loading cycle was performed, but the load was only increased to the penultimate stage of the first cycle. 6 plate loading tests on the Prepared Subgrade 2.D of the Electric Express Train project were conducted at 6 locations (KM 371+475, KM 371+450, KM 371+425, KM 371+400, KM 371+375, and KM 371+350) and the data collected at the 6 test points is included in Appendix A.

Table 1 presents the load-settlement data obtained at the first loading and unloading stages of the plate loading test performed at the location (KM 371+475), while Table 2 shows the data obtained at the second loading stage.

Table 1: Load-settlement data obtained at the first loading and unloading stages of the plate loading test performed at the location (KM 371+475)

Settlement mm	Normal MN/m ²	Load (F) kN
0.00	0.005	1.414
0.20	0.025	7.07
0.30	0.050	14.14
0.39	0.075	21.21
0.46	0.100	28.28
0.59	0.125	35.35
0.66	0.150	42.42
0.74	0.175	49.49
0.82	0.200	56.56
0.86	0.225	63.63
1.02	0.250	70.7
1.02	0.200	56.56
1.01	0.175	49.49
0.95	0.125	35.35
0.86	0.075	21.21
0.34	0.005	1.414



4. Closure

Test results presented herein report the load-settlement data obtained from 6 plate loading tests conducted on the Prepared Subgrade 2.0 of the Electric Express train project at 5 locations (KM 371+475, KM 371+450, KM 371+425, KM 371+400, KM 371+375, and KM 371+350) in accordance with German Standard, DIN18134.

Location	E_1 MN/m ²	E_2 MN/m ²	E_2/E_1 ratio
KM 371+475	128.29	170.24	1.33
KM 371+450	100.91	145.58	1.44
KM 371+425	105.31	167.69	1.59
KM 371+400	145.57	177.88	1.22
KM 371+375	147.31	173.53	1.18
KM 371+350	151.18	171.72	1.14

* Note: Before interpreting these test results for future applications, the Prepared Subgrade 2.0 in-situ variability between the testing locations should be considered.

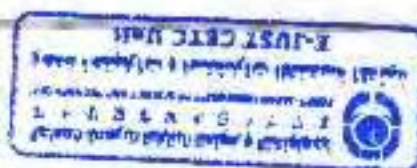
Technical committee

Dr. Mahmoud Ahmed

Prof. Dr. Mohamed F. M. Fahmy



Lab Engineer
 Mohamed A. Al-Najjar



Appendix A

Location of test site:	KM 371+475		Field	Mr. Mohamed Mamdouh
Project title:	Electric Express Train Project - Inshaa General Construction		Date:	10/4/2023
Diameter of loading plate	600	1	Note:	CAT 966F
Type of Soil	Prepared Subgrade 2.0		Temperature	19°C
Bedding material	---			
Test regime	Loading Stage No.	Load (kN)	Dial (Range Reading (mm))	
Loading Stage	0	1.414	10.00	
	1	7.07	9.80	
	2	14.14	9.70	
	3	21.21	9.61	
	4	28.28	9.54	
	5	35.35	9.41	
	6	42.42	9.34	
	7	49.49	9.26	
	8	56.56	9.18	
	9	63.63	9.14	
	10	70.7	8.98	
	11	56.56	8.98	
	12	49.49	8.99	
	13	35.35	9.05	
	14	21.21	9.14	
	15	1.414	9.66	
Unloading Stage	Loading Stage No.		Load (kN)	
	Dial (Range Reading (mm))		Test regime	
	0	1.414	9.66	
	1	7.07	9.46	
	2	14.14	9.37	
	3	21.21	9.31	
	4	28.28	9.24	
	5	35.35	9.15	
	6	42.42	9.08	
	7	49.49	9.05	
	8	56.56	9.05	
	9	63.63	9.05	
	10	70.7	8.98	
	11	56.56	8.98	
	12	49.49	8.99	
	13	35.35	9.05	
14	21.21	9.14		
15	1.414	9.66		
Test regime	Loading Stage No.		Load (kN)	
Reloading Stage	Dial (Range Reading (mm))		Test regime	

Inshaa General Construction
 25-10-2023
 25-10-2023

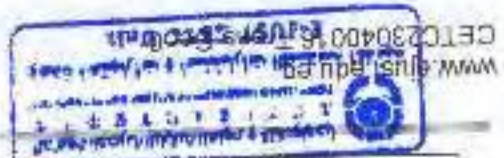
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 Mobile: +201555631725



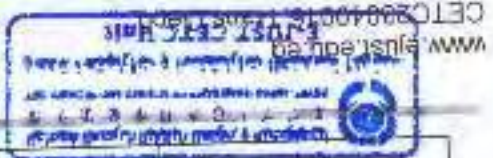
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Location of test site:	KM 371+450		Field	Mr. Mohamed	Team	10/4/2023	Date:	9:35:00 AM	Time	10:03:00 AM	Note:		CAT 966F		Dial Gauge Reading (mm)		Loading Stage No. Load (kN)		Dial Gauge Reading (mm)		Test regime		Reloading Stage	
Project title:	Electric Express Train Project - Inshaa		General Construction																					
Diameter of loading plate	600																							
Lever ratio	1																							
Type of Soil	Prepared Subgrade 2.0																							
Bedding material	0																							
Temperature	19°C																							
Test regime	Loading Stage No. Load (kN)																							
Loading Stage	0		1.414		10.00																			
Loading Stage	1		7.07		9.74																			
	2		14.14		9.66																			
	3		21.21		9.56																			
	4		28.28		9.50																			
	5		35.35		9.35																			
	6		42.42		9.20																			
	7		49.49		9.08																			
	8		56.56		8.97																			
	9		63.63		8.89																			
	10		70.7		8.75																			
Unloading Stage	11		56.56		8.75																			
	12		49.49		8.79																			
	13		35.35		8.86																			
	14		21.21		8.95																			
	15		1.414		9.53																			
Test regime	Loading Stage No. Load (kN)																							
Reloading Stage	0		1.414		9.53																			
Reloading Stage	1		7.07		9.27																			
	2		14.14		9.17																			
	3		21.21		9.11																			
	4		28.28		9.05																			
	5		35.35		8.95																			
	6		42.42		8.90																			
	7		49.49		8.80																			
	8		56.56		8.76																			
	9		63.63		8.71																			

Location of test site:	KM 371+425	
Project title:	Electric Express Train Project - Inshaa	
Diameter of loading plate	600	Field
		Mr. Mohamed
Date:	10/4/2023	Test
		10:38:00 AM
Lever ratio	1	Note:
Type of Soil	Prepared Subgrade 2.0	CAT 966F
Bedding material	19°C	
Temperature	19°C	Dial Gauge Reading (mm)
Test regime	Load (kN)	
Loading Stage	Loading Stage No.	Dial Gauge Reading (mm)
Loading Stage	0	1.414
	1	7.07
	2	14.14
	3	21.21
	4	28.28
	5	35.35
	6	42.42
	7	49.49
	8	56.56
	9	63.63
	10	70.7
	11	77.77
	12	84.84
	13	91.91
	14	98.98
Unloading Stage	15	1.414
	14	7.07
	13	14.14
	12	21.21
	11	28.28
	10	35.35
	9	42.42
	8	49.49
	7	56.56
	6	63.63
	5	70.7
	4	77.77
	3	84.84
	2	91.91
	1	98.98
Reloading Stage	0	1.414
	1	7.07
	2	14.14
	3	21.21
	4	28.28
	5	35.35
	6	42.42
	7	49.49
	8	56.56
	9	63.63
	10	70.7
	11	77.77
	12	84.84
	13	91.91
	14	98.98



Location of test site:	KM 371+400		Field	Mr. Mohamed Mladoun	
Project title:	Electric Express Train Project - Irbid General Construction		Date:	10/4/2023	
Diameter of loading plate	600	Time	10:45:00 AM	Note: CAT 966F	
Lever ratio	1				
Type of Soil	Prepared Subgrade 2.0				
Bedding material	---				
Temperature	19°C				
Test regime	Loading Stage No.	Load (KN)	Final Change Reading (mm)		
Loading Stage	0	1.414	10.00		
	1	7.07	9.79		
	2	14.14	9.69		
	3	21.21	9.60		
	4	28.28	9.56		
	5	35.35	9.51		
	6	42.42	9.42		
	7	49.49	9.31		
	8	56.56	9.22		
	9	63.63	9.16		
	10	70.7	9.07		
	11	56.56	9.07		
	12	49.49	9.10		
	13	35.35	9.20		
	14	21.21	9.30		
	15	1.414	9.76		
Test regime	Loading Stage No.	Load (KN)	Final Change Reading (mm)		
Reloading Stage	0	1.414	9.76		
	1	7.07	9.55		
	2	14.14	9.48		
	3	21.21	9.41		
	4	28.28	9.37		
	5	35.35	9.32		
	6	42.42	9.27		
	7	49.49	9.18		
	8	56.56	9.13		
	9	63.63	9.09		
	المشروع العام للبناء General Construction				

Location of test site:	KM 371+375	Field	Mr.Mohamed Mamdouh	Field
Project title:	Electric Express Train Project - Inshaa (General Construction)	Date:	10/4/2023	Date:
Diameter of loading plate	600	Time	11:20:00 AM 11:48:00 AM	Time
Lever ratio	1	Note:	CAT 966F	Note:
Type of Soil	Prepared Subgrade 2.0	Redding material	---	Redding material
Temperature	19°C	Test regime	---	Test regime
Loading Stage	0	Load (kN)	1.414	Load (kN)
Unloading Stage	1	Load (kN)	7.07	Load (kN)
Unloading Stage	2	Load (kN)	14.14	Load (kN)
Unloading Stage	3	Load (kN)	21.21	Load (kN)
Unloading Stage	4	Load (kN)	28.28	Load (kN)
Unloading Stage	5	Load (kN)	35.35	Load (kN)
Unloading Stage	6	Load (kN)	42.42	Load (kN)
Unloading Stage	7	Load (kN)	49.49	Load (kN)
Unloading Stage	8	Load (kN)	56.56	Load (kN)
Unloading Stage	9	Load (kN)	63.63	Load (kN)
Unloading Stage	10	Load (kN)	70.7	Load (kN)
Unloading Stage	11	Load (kN)	77.77	Load (kN)
Unloading Stage	12	Load (kN)	84.84	Load (kN)
Unloading Stage	13	Load (kN)	91.91	Load (kN)
Unloading Stage	14	Load (kN)	98.98	Load (kN)
Unloading Stage	15	Load (kN)	106.06	Load (kN)
Reloading Stage	0	Load (kN)	1.414	Load (kN)
Reloading Stage	1	Load (kN)	7.07	Load (kN)
Reloading Stage	2	Load (kN)	14.14	Load (kN)
Reloading Stage	3	Load (kN)	21.21	Load (kN)
Reloading Stage	4	Load (kN)	28.28	Load (kN)
Reloading Stage	5	Load (kN)	35.35	Load (kN)
Reloading Stage	6	Load (kN)	42.42	Load (kN)
Reloading Stage	7	Load (kN)	49.49	Load (kN)
Reloading Stage	8	Load (kN)	56.56	Load (kN)
Reloading Stage	9	Load (kN)	63.63	Load (kN)
Reloading Stage	10	Load (kN)	70.7	Load (kN)
Reloading Stage	11	Load (kN)	77.77	Load (kN)
Reloading Stage	12	Load (kN)	84.84	Load (kN)
Reloading Stage	13	Load (kN)	91.91	Load (kN)
Reloading Stage	14	Load (kN)	98.98	Load (kN)
Reloading Stage	15	Load (kN)	106.06	Load (kN)

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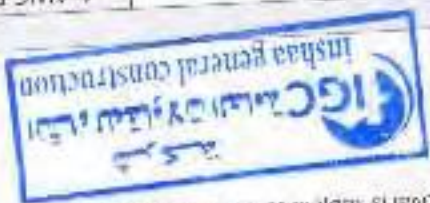
Location of test site:	KM 371+350		Field	Mr. Mohamed Mamdouh	Project title:	Electric Express Train Project - Inshaa General Construction		Diameter of loading plate		Lever ratio	Type of Soil	Bedding material	Temperature	Test regime	Loading Stage	15 General Construction	15 1500
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Location of test site:	KM 371+325		Field team	Mr. Mohamed Aloudouh	
Project title:	Electric Express Train Project - Irbid		Date:	11/4/2023	
Diameter of loading plate	600		Time	9:02:00 AM	
Lever ratio	1			9:28:00 AM	
Type of Soil	Prepared Subgrade 2.0		Note:		
Bedding material	---		CAT 966F		
Temperature	19°C				
Test regime	Loading Stage No.	Load (kN)	Dial Gauge Reading (mm)		
Loading Stage	0	1.414	10.00		
	1	7.07	9.72		
	2	14.14	9.66		
	3	21.21	9.55		
	4	28.28	9.45		
	5	35.35	9.36		
	6	42.42	9.27		
	7	49.49	9.17		
	8	56.56	9.08		
	9	63.63	8.98		
Unloading Stage	10	70.7	8.93		
	11	56.56	8.93		
	12	49.49	8.94		
	13	35.35	8.95		
	14	21.21	9.05		
	15	1.414	9.85		
	Test regime	Loading Stage No.	Load (kN)	Dial Gauge Reading (mm)	
	Retesting Stage	0	1.414	9.85	
	1	7.07	9.62		
	2	14.14	9.54		
3	21.21	9.45			
4	28.28	9.35			
5	35.35	9.24			
6	42.42	9.17			
7	49.49	9.11			
8	56.56	9.06			
9	63.63	8.99			

Contractor Company	INSHAA GENERAL OF CONSTRUCTION	Designer Company	(SPECTRUM) Engineering Consulting Office	Time	01:00 PM	Issued by	Eng. Mahmoud shaban	Contractor	Eng. Mahmoud shaban	Received by	Eng. Mazen Essamy	CONSULTANT
	Company Name		Eng. Mahmoud shaban		Sign				Date/Serial Number		10/04/2023 (P.L.T. 2)	

CODE 1	ST to ST1	Station Reference	Dipoint Reference	D1 to S3	Work Activity	Sub Element of Activity	Km XXX Note For Kilometer point only Start Km is used
	CODE 2						

Description of Materials	Prepared subgrade level 2	Location to be Used	ST (371+100) To (373+350)	M.A.R (P.S.G 1)	Supplier Name	Test Requirement	P.L.T (DIM 38134)	Specification	EARTHWORK SPECIFICATIONS & TESTING REPORT (03-21-11-2) VERSION 2 BY DESIGN GROUP	Reference Photos	Yes / No	Other	Ref UIR P.S.G (384)
	Item		Description				Unit		Quantity		Arrival Date	Note	

Comments by: Eng. Mazen Essamy (SPECTRUM)	Comments by: Eng. Alaa Abd-Allatif (ER)	1 Plate Load Test was carried out by (Ejout) 2-Results report attached and acceptable with project specifications. 3-Final approval is subject to above mentioned comments.		

Organisation	Name	Eng. Mahmoud shaban	Contractor	QA/QC	Eng. Mazen Essamy	GARB	Eng. Margaret magdy	Employers Representative	Eng. Alaa Abd-Allatif
Sign									
Date	11-04-2023								
A-AWC-R	A								

Technical Report

Plate Loading Tests

KM 371+250, KM 371+275, KM 371+300, KM 371+325, KM 371+225, KM 371+200, KM 371+175, KM 371+150, KM 371+125, and KM 371+100

Project Electric Express Train (Sokhna - New capital - 6th of October city - New Elamein city)

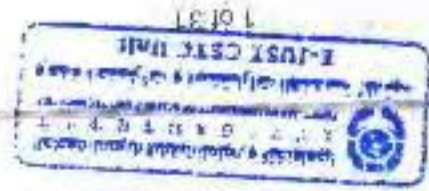
Prepared for
Inshaa General Construction

3 Mobilika CC - Abu Youssef, Alexandria, Egypt

(April 11, 2023)



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إدارة المشروع / إدارة الموقع

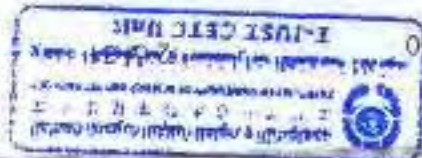


1. Introduction

The Civil Engineering Testing & Consulting Unit (CETCU) of the Egypt-Japan University of Science and Technology (EJUST) was retained by Inshaa General Construction to conduct 10 plate loading tests on the Prepared Subgrade 2.0 of the Electric Express Train project at 10 locations (KM 371+325, KM 371+300, KM 371+275, KM 371+250, KM 371+225, KM 371+200, KM 371+175, KM 371+150, KM 371+125, and KM 371+100) in accordance with the German Standard DIN18134. The mandate was communicated by Eng. Mahmoud Shaban of Inshaa General Construction. Field team members (Mr. Mohamed Marmoud) from the working CETCU team visited the project site on April 11, 2023 and performed the required tests. This report summarizes the plate loading test procedure according to DIN18134, the test results and their interpretations, and the CETCU pertaining recommendations.

2. Test Set Up and Instrumentation

- The German standard DIN18134 was applied to define the test setup including the loading system, test conditions, and procedure for the plate loading tests.
- The tests were carried out to determine the Strain Moduli (Ev1 and Ev2) and their ratio (Ev2/Ev1) from a stress – deformation relationship of two consecutive loading from Loading- Unloading-Loading regime.
- The loading plate has a diameter of 600 mm and a thickness of 25 mm and it is provided with equally spaced stiffeners. The upper plate face is parallel to the bottom face of the plate to allow a 300-mm plate to be placed on the 600-mm plate top.
- The loading system consisted of a hydraulic pump connected to a hydraulic jack of 700 bar capacity, which can apply and release the load increments.
- The dial gauge used to measure the plate settlement has a resolution of 0.01 mm and the lever ratio was equal to 1.
- The temperature at the time of the test was $19 \pm 1^\circ\text{C}$.
- The plate was carried out on a Prepared Subgrade 2.0 (according to the company) at 10 points. The test surface area was levelled, and the plate was bedded on this surface.
- The hydraulic jack was placed on the middle of, and normal to, the loading plate bearing the reaction on loading system and secured against tilting.
- The reaction loading system was a heavy multi-purpose Loader CAT 988B.



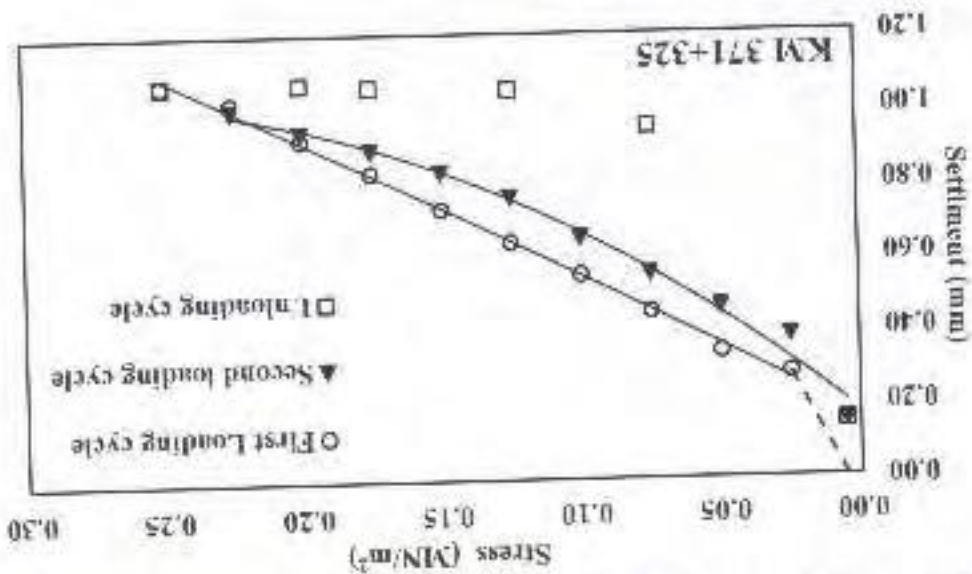


Figure 1: Load-settlement data: plate loading test performed at (KM 371+325)

Table 4: Load-settlement data obtained at the first loading and unloading stages of the plate loading test performed at the location (KM 371+300)

Load (t)	Load (kN)	Normal stress (s)	Settlement (s)
0	1.414	0.005	0.00
1	7.07	0.025	0.25
2	14.14	0.050	0.30
3	21.21	0.075	0.40
4	28.28	0.100	0.51
5	35.35	0.125	0.60
6	42.42	0.150	0.72
7	49.49	0.175	0.80
8	56.56	0.200	0.87
9	63.63	0.225	0.93
10	70.7	0.250	1.02
11	77.77	0.275	1.02
12	84.84	0.300	1.02
13	91.91	0.325	0.98
14	98.98	0.350	0.88
15	106.05	0.375	0.30

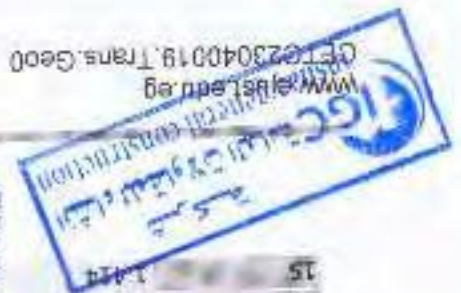


Table 5: Load-settlement data obtained at the second loading and unloading stages of the plate loading test performed at the location (KM 371+300)

Load stage	Load (F) kN	Normal stress (σ_0) MN/m ²	Settlement (S) mm
0	1.414	0.005	0.30
1	7.07	0.025	0.46
2	14.14	0.050	0.53
3	21.21	0.075	0.59
4	28.28	0.100	0.69
5	35.35	0.125	0.77
6	42.42	0.150	0.85
7	49.49	0.175	0.92
8	56.56	0.200	0.95
9	63.63	0.225	1.00

Table 6: Calculations of the resilient modulus of the tested soil according to DIN18134: (KM 371+300)

Parameters	(σ_{0max}) MN/m ²	a_0 (mm)	a_1 (mm/(MN/m ²))	a_2 (mm/(MN ² /m ²))	$E_v = 1.5 / (a_1 + a_2 \cdot \sigma_{0max})$	E_v/E_v
1st loading cycle	0.25	0.12	4.23	-2.43	124.31	1.24
2nd loading cycle	0.25	0.31	4.59	-6.68	154.08	

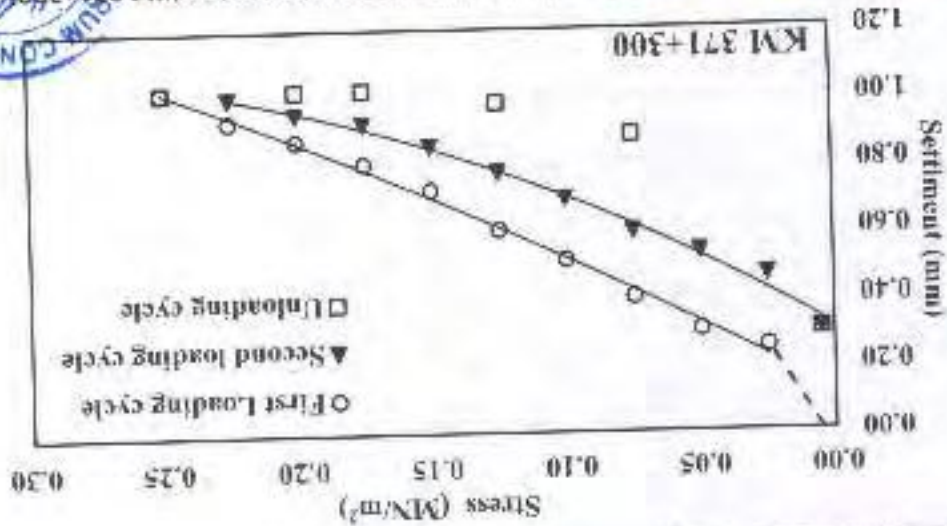


Figure 2: Load-settlement data: plate loading test performed at (KM 371+300)

Table 7: Load-settlement data obtained at the first loading and unloading stages of the plate loading test performed at the location (KM 371+275)

Load stage	Load (F)	Normal stress (σ ₀)	Settlement (s)
0	1.414	0.005	0.00
1	7.07	0.025	0.29
2	14.14	0.050	0.36
3	21.21	0.075	0.48
4	28.28	0.100	0.57
5	35.35	0.125	0.64
6	42.42	0.150	0.75
7	49.49	0.175	0.86
8	56.56	0.200	0.95
9	63.63	0.225	1.03
10	70.7	0.250	1.16
11	77.77	0.275	1.16
12	84.84	0.300	1.16
13	91.91	0.325	1.10
14	98.98	0.350	0.99
15	106.05	0.375	0.30

Table 8: Load-settlement data obtained at the second loading and unloading stages of the plate loading test performed at the location (KM 371+275)

Load stage	Load (F)	Normal stress (σ ₀)	Settlement (s)
0	1.414	0.005	0.30
1	7.07	0.025	0.55
2	14.14	0.050	0.67
3	21.21	0.075	0.75
4	28.28	0.100	0.81
5	35.35	0.125	0.90
6	42.42	0.150	0.93
7	49.49	0.175	1.00
8	56.56	0.200	1.05
9	63.63	0.225	1.10

Table 9: Calculations of the resilient modulus of the tested soil according to DIN18134: (KM 371+275)

Parameters	1st loading cycle	2nd loading cycle
(σ ₀) _{max} MN/m ²	0.25	0.25
a ₀ (mm)	0.20	0.35
b ₁ (mm/(MN/m ²))	3.51	6.00
a ₂ (mm/(MN ² /m ²))	1.21	12.49
E _{vr} = 1.5 τ / (ε ₁ + ε ₂ S _v / m _v)	118.02	155.7
E _{vr} / E _{vr1}		



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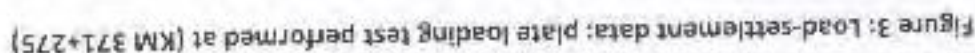


Table 10: Load-settlement data obtained at the first loading and unloading stages of the plate loading test performed at the location (KM 371+250)

Settlement (s)	mm	Normal stress (s _o)	kN/m ²	Load (F)	kN	Loading stage
0.00	0.00	0.005	1.414	0	0	
0.31	0.38	0.025	7.07	1	1	
0.45	0.45	0.050	14.14	2	2	
0.53	0.53	0.075	21.21	3	3	
0.61	0.61	0.100	28.28	4	4	
0.72	0.72	0.125	35.35	5	5	
0.80	0.80	0.150	42.42	6	6	
0.86	0.86	0.175	49.49	7	7	
0.95	0.95	0.200	56.56	8	8	
1.04	1.04	0.225	63.63	9	9	
1.05	1.05	0.250	70.7	10	10	
0.86	1.05	0.200	56.56	11	11	
0.95	1.04	0.175	49.49	12	12	
0.26	0.95	0.125	35.35	13	13	
	0.86	0.075	21.21	14	14	
	0.26	0.005	1.414	15	15	



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Table 13: Load-settlement data obtained at the first loading and unloading stages of the

Settlement (S)	Normal stress [σ_0]	Load (P)	Normal stress [σ_0]	Settlement (S)
0.00	0.005	1.414	0.005	0.19
0.20	0.025	7.07	0.025	0.74
0.29	0.050	14.14	0.050	0.87
0.40	0.075	21.21	0.075	0.97
0.49	0.100	28.28	0.100	0.99
0.58	0.125	35.35	0.125	0.99
0.64	0.150	42.42	0.150	0.88
0.71	0.175	49.49	0.175	0.80
0.80	0.200	56.56	0.200	0.88
0.88	0.225	63.63	0.225	0.80
0.97	0.250	70.7	0.250	0.74
0.99	0.275	77.77	0.275	0.64
1.00	0.300	84.84	0.300	0.58
1.1	0.350	99.49	0.350	0.49
1.2	0.400	114.14	0.400	0.40
1.3	0.450	128.28	0.450	0.29
1.4	0.500	141.42	0.500	0.20
1.5	0.550	154.56	0.550	0.00

Table 14: Load-settlement data obtained at the second loading and unloading stages of the plate loading test performed at the location (KM 371+225)

Settlement (s)	Normal stress (sq)	Load (F)	Normal stress (sq)	Settlement (s)
0.19	0.005	1.414	0.005	0.19
0.38	0.025	7.07	0.025	0.38
0.45	0.050	14.14	0.050	0.45
0.53	0.075	21.21	0.075	0.53
0.61	0.100	28.28	0.100	0.61
0.69	0.125	35.35	0.125	0.69
0.79	0.150	42.42	0.150	0.79
0.85	0.175	49.49	0.175	0.85
0.90	0.200	56.56	0.200	0.90
0.96	0.225	63.63	0.225	0.96

Table 15: Calculations of the resilient modulus of the tested soil according to DIN18134:

Parameters	
$(s_{0,max})$ MN/m ²	0.25
s_0 (mm)	0.12
s_1 (mm/(MN/σ ₁ ²))	3.72
s_2 (mm/(MN ² /m ²))	-1.21
E_V/E_V	131.76
E_V/E_V	1.09



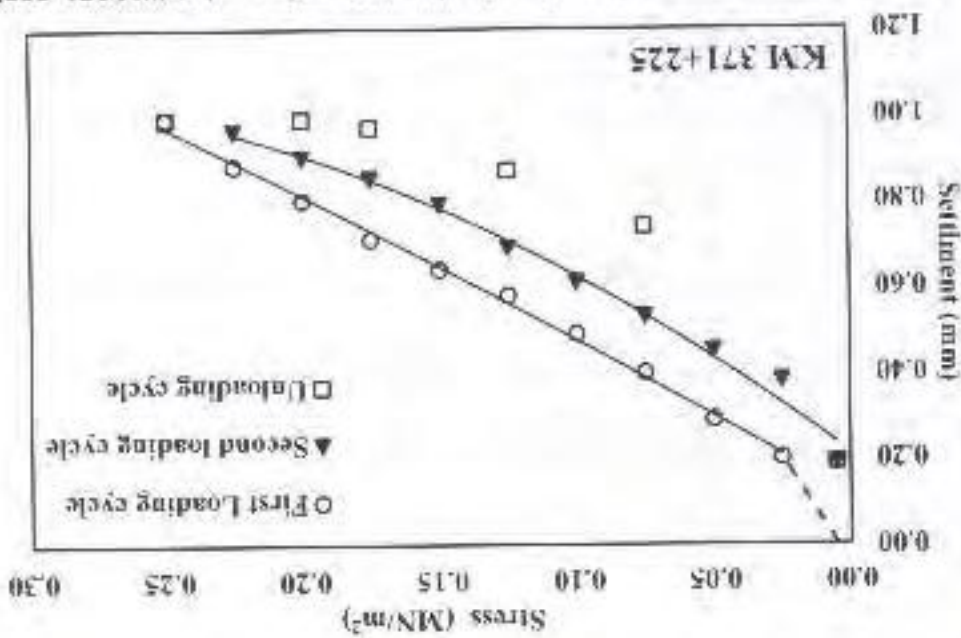


Figure 5: Load-settlement data: plate loading test performed at (KM 371+225)

The testing data corresponding to the sixth testing point (KM 371+200) is provided in Tables 16-18 and Figure 6. The testing data corresponding to the seventh testing point (KM 371+175) is provided in Tables 19-21 and Figure 7. The testing data corresponding to the eighth testing point (KM 371+150) is provided in Tables 22-24 and Figure 8. The testing data corresponding to the ninth testing point (KM 371+125) is provided in Tables 25-27 and Figure 9. The testing data corresponding to the tenth testing point (KM 371+100) is provided in Tables 28-30 and Figure 10.

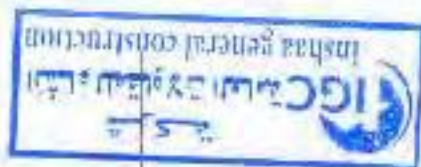


Table 16: Load-settlement data obtained at the first loading and unloading stages of the plate loading test performed at the location (KM 371+200)

Load stage	Load (F)	Normal stress (σ_v)	Settlement (S)
0	1.414	0.005	0.00
1	7.07	0.025	0.25
2	14.14	0.050	0.37
3	21.21	0.075	0.40
4	28.28	0.100	0.52
5	35.35	0.125	0.69
6	42.42	0.150	0.80
7	49.49	0.175	0.91
8	56.56	0.200	1.02
9	63.63	0.225	1.13
10	70.7	0.250	1.23
11	77.77	0.275	1.33
12	84.84	0.300	1.43
13	91.91	0.325	1.53
14	98.98	0.350	1.63
15	106.05	0.375	1.73

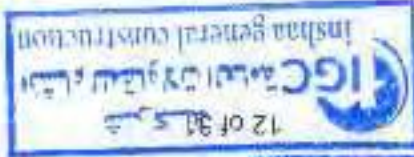
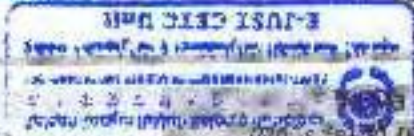
Table 17: Load-settlement data obtained at the second loading and unloading stages of the plate loading test performed at the location (KM 371+200)

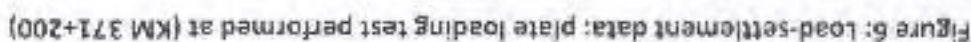
Load stage	Load (F)	Normal stress (σ_v)	Settlement (S)
0	1.414	0.005	0.44
1	7.07	0.025	0.61
2	14.14	0.050	0.67
3	21.21	0.075	0.78
4	28.28	0.100	0.86
5	35.35	0.125	0.93
6	42.42	0.150	1.00
7	49.49	0.175	1.08
8	56.56	0.200	1.14
9	63.63	0.225	1.23

Table 18: Calculations of the resilient modulus of the tested soil according to DIN18134:

Parameters	1st loading cycle	2nd loading cycle
$[s_{max}]$ MN/m ²	0.25	0.25
a_0 (mm)	0.11	0.46
a_1 (mm/(MN/m ²))	4.39	4.47
a_2 (mm/(MN/m ²))	0.67	-5.02
$E_{vr} = 1.5 \cdot a_2$ (MN/m ²)	98.71	139.89
E_{vr} (MPa)	98.71	139.89

1.42





Settlement (S) mm	Normal stress (s ₀) kN/m ²	Load (F) kN	Loading stage
0.00	0.005	1.414	0
0.26	0.025	7.07	1
0.35	0.050	14.14	2
0.46	0.075	21.21	3
0.56	0.100	28.28	4
0.68	0.125	35.35	5
0.77	0.150	42.42	6
0.93	0.175	49.49	7
1.03	0.200	56.56	8
1.13	0.225	63.63	9
1.30	0.250	70.7	10
1.30	0.200	56.56	11
1.28	0.175	49.49	12
1.27	0.125	35.35	13
	0.075	21.21	14
	0.005	1.414	15



Table 20: Load-settlement data obtained at the second loading and unloading stages of the plate loading test performed at the location (KM 371+175)

Load stage	Load (kN)	Normal stress (σ_n) MN/m ²	Settlement (S) mm
0	1.414	0.005	0.45
1	7.07	0.025	0.70
2	14.14	0.050	0.76
3	21.21	0.075	0.85
4	28.28	0.100	0.95
5	35.35	0.125	1.02
6	42.42	0.150	1.10
7	49.49	0.175	1.20
8	56.56	0.200	1.23
9	63.63	0.225	1.30

Table 21: Calculations of the resilient modulus of the tested soil according to DIN18134:

Parameters		
$(\sigma_{p,max})$ MN/m ²	0.25	
a_1 (mm/(MN/m ²))	0.16	
a_2 (mm)	0.49	
a_3 (mm/(MN/m ²))	3.64	
a_4 (mm/(MN/m ²))	3.40	
$E_v = 1.5 \cdot f / (a_1 + a_2 \cdot \sigma_{p,max})$	100.21	
E_{v2}/E_{v1}	1.35	
1st loading cycle		
2nd loading cycle		

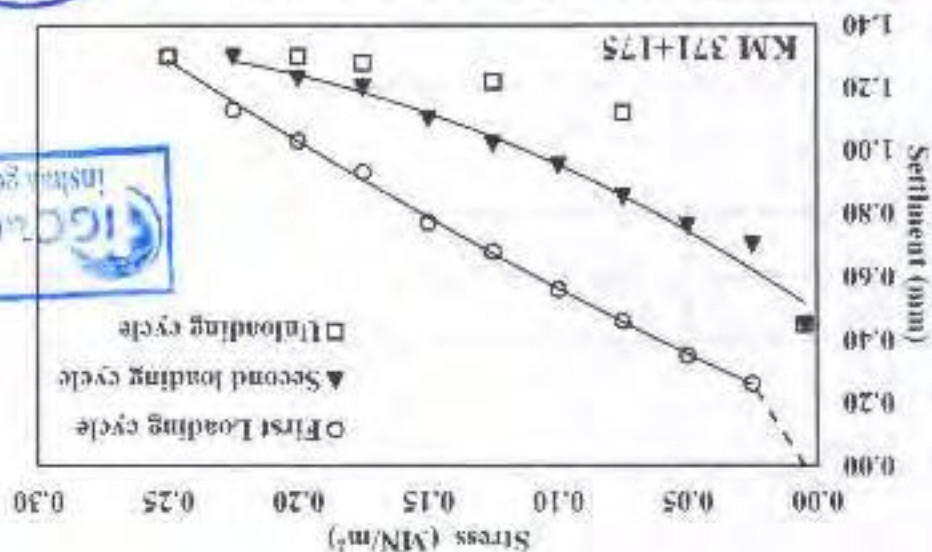


Figure 7: Load-settlement data: plate loading test performed at (KM 371+175)

Table Z2: Load-settlement data obtained at the first loading and unloading stages of the plate loading test performed at the location (KM 371+150)

Load stage	Load (F)	Normal stress (s_v)	Settlement (S)
0	1.414	0.005	0.00
1	7.07	0.025	0.30
2	14.14	0.050	0.38
3	21.21	0.075	0.55
4	28.28	0.100	0.66
5	35.35	0.125	0.82
6	42.42	0.150	0.95
7	49.49	0.175	1.08
8	56.56	0.200	1.19
9	63.63	0.225	1.31
10	70.7	0.250	1.48
11	56.56	0.200	1.48
12	49.49	0.175	1.47
13	35.35	0.125	1.45
14	21.21	0.075	1.36
15	1.414	0.005	0.66

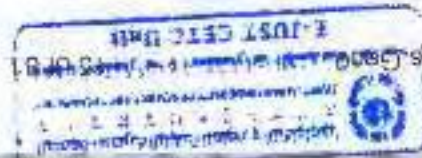
Table Z3: Load-settlement data obtained at the second loading and unloading stages of the plate loading test performed at the location (KM 371+150)

Load stage	Load (F)	Normal stress (s_v)	Settlement (S)
0	1.414	0.005	0.66
1	7.07	0.025	0.88
2	14.14	0.050	0.96
3	21.21	0.075	1.09
4	28.28	0.100	1.19
5	35.35	0.125	1.30
6	42.42	0.150	1.38
7	49.49	0.175	1.47
8	56.56	0.200	1.53
9	63.63	0.225	1.57

Table Z4: Calculations of the resilient modulus of the tested soil according to ASTM D1557

Parameters	1st loading cycle	2nd loading cycle
f_s (max) MN/m ²	0.25	0.25
a_0 (mm)	0.15	0.15
a_1 (mm/(MN/m ²))	5.23	5.23
a_2 (mm/(MN ² /m ⁴))	0.12	0.12
$E_v = 1.5 \times 10^4 \times (a_1 + a_2 \times f_s)$ (kPa)	85.49	85.49
E_v / E_v		

1.41



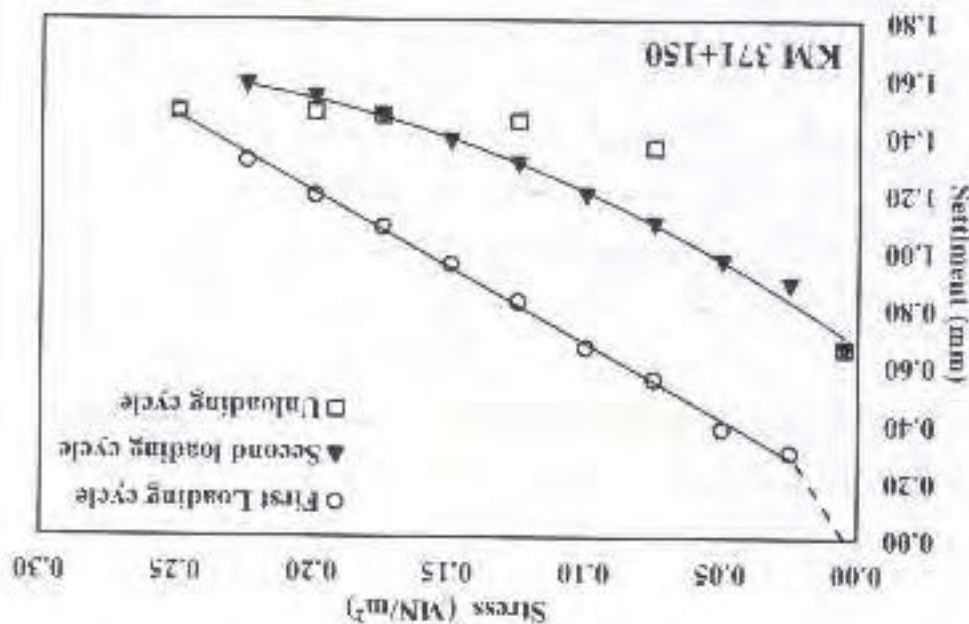


Figure 8: Load-settlement data: plate loading test performed at (KM 371+150)

Table 25: Load-settlement data obtained at the first loading and unloading stages of the plate loading test performed at the location (KM 371+125)

Loading stage	Load (F) kN	Normal stress (σ) MN/m ²	Settlement (S) mm
0	1.414	0.005	0.00
1	7.07	0.025	0.26
2	14.14	0.050	0.30
3	21.21	0.075	0.43
4	28.28	0.100	0.53
5	35.35	0.125	0.67
6	42.42	0.150	0.79
7	49.49	0.175	0.86
8	56.56	0.200	0.96
9	63.63	0.225	1.07
10	70.7	0.250	1.19
11	56.56	0.200	1.18
12	49.49	0.175	1.12
13	35.35	0.125	1.01
14	21.21	0.075	0.40
15	1.414	0.005	0.40

Table 26: Load-settlement data obtained at the second loading and unloading stages of the plate loading test performed at the location (KM 371+125)

Load stage	Load (F) kN	Normal stress (s _n) MN/m ²	Settlement (s) mm
0	1.414	0.005	0.40
1	7.07	0.025	0.63
2	14.14	0.050	0.69
3	21.21	0.075	0.78
4	28.28	0.100	0.86
5	35.35	0.125	0.93
6	42.42	0.150	1.03
7	49.49	0.175	1.10
8	56.56	0.200	1.16
9	63.63	0.225	1.21

Table 27: Calculations of the resilient modulus of the tested soil according to DIN18134:

Parameters	1st loading cycle	2nd loading cycle
(s _n ,max) MN/m ²	0.25	0.25
a ₂ (mm)	0.13	0.44
a ₁ (mm/(MN/m ²))	4.18	5.10
a ₂ (mm/(MN/m ²))	0.24	-7.50
Ev=1.5 r / (a ₁ +a ₂ s _n ,max)	106.08	139.54
Ev/Ev ₁	1.32	

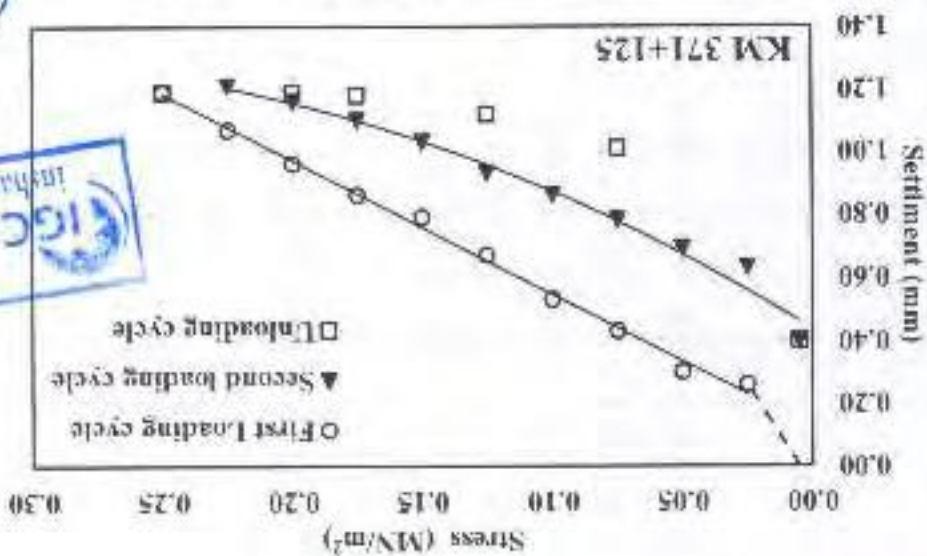


Figure 9: Load-settlement data: plate loading test performed at (KM 371+125)

Table 28: Load-settlement data obtained at the first loading and unloading stages of the plate loading test performed at the location (KM 371+100)

Load stage	Load (F) kN	Normal stress (σ_0) MN/m ²	Settlement (S) mm
0	1.414	0.005	0.00
1	7.07	0.025	0.35
2	14.14	0.050	0.41
3	21.21	0.075	0.50
4	28.28	0.100	0.60
5	35.35	0.125	0.76
6	42.42	0.150	0.90
7	49.49	0.175	1.00
8	56.56	0.200	1.13
9	63.63	0.225	1.22
10	70.7	0.250	1.37
11	77.77	0.275	1.37
12	84.84	0.300	1.37
13	91.91	0.325	1.36
14	98.98	0.350	1.21
15	106.05	0.375	1.07

Table 29: Load-settlement data obtained at the second loading and unloading stages of the plate loading test performed at the location (KM 371+100)

Load stage	Load (F) kN	Normal stress (σ_0) MN/m ²	Settlement (S) mm
0	1.414	0.005	0.34
1	7.07	0.025	0.70
2	14.14	0.050	0.79
3	21.21	0.075	0.85
4	28.28	0.100	0.97
5	35.35	0.125	1.09
6	42.42	0.150	1.15
7	49.49	0.175	1.24
8	56.56	0.200	1.30
9	63.63	0.225	1.37

Table 30: Calculations of the resilient modulus of the tested soil according to DIN 53134 (KM 371+100)

Parameters	1st loading cycle	2nd loading cycle
$\sigma_{v,max}$ MN/m ²	0.25	0.25
σ_v (MN/m ²)	0.22	0.42
σ_v (mm/(MN/m ²))	3.84	7.02
σ_v (mm/(MN/m ²))	3.09	-12.86
$E_v = 1.5 \sigma_v / (\sigma_v - \sigma_{v,max})$	97.57	118.34



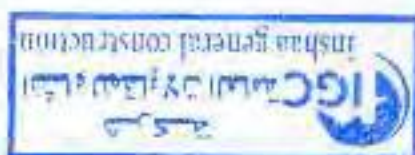
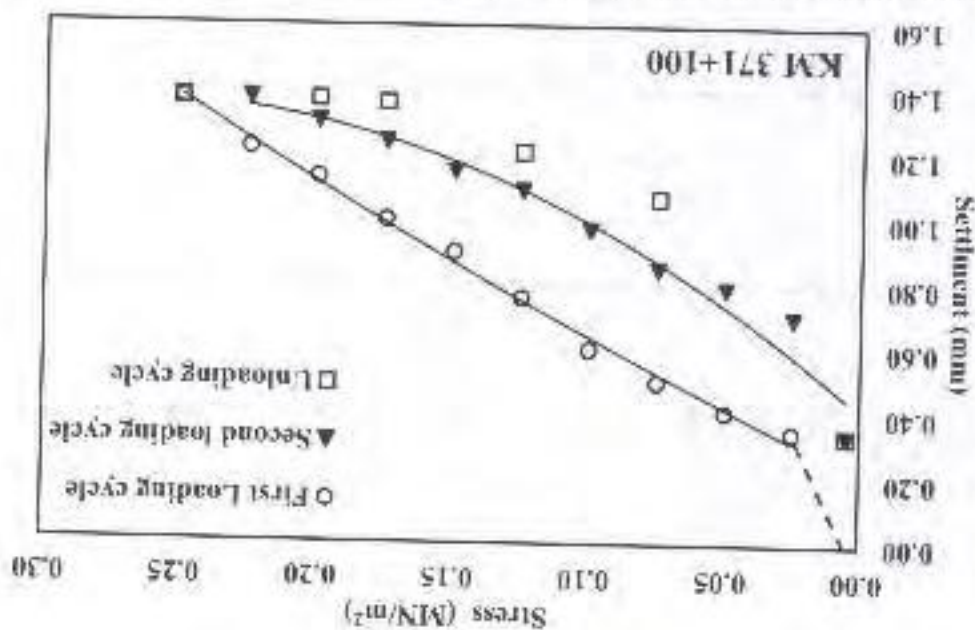


Figure 10: Load-settlement data: plate loading test performed at (KM 371+100)



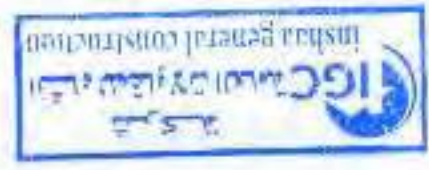
4. Closure

Test results presented herein report the load-settlement data obtained from 10 plate loading tests conducted on the Prepared Subgrade 2.0 of the Electric Express train project at 10 locations (KM 371+325, KM 371+300, KM 371+275, KM 371+250, KM 371+225, KM 371+200, KM 371+175, KM 371+150, KM 371+125, and KM 371+100) in accordance with German Standard, DIN18134.

Location	E_{v1} MN/m ²	E_v MN/m ²	E_v/E_{v1} ratio
KM 371+325	121.65	134.10	1.10
KM 371+300	124.31	154.08	1.24
KM 371+275	118.02	155.57	1.32
KM 371+250	137.52	146.62	1.07
KM 371+225	131.76	143.45	1.09
KM 371+200	98.71	139.89	1.42
KM 371+175	100.21	135.45	1.35
KM 371+150	85.49	120.18	1.41
KM 371+125	106.08	139.54	1.32
KM 371+100	97.57	118.34	1.21

• Note: Before interpreting these test results for future applications, the Prepared Subgrade 2.0 in-situ variability between the testing locations should be considered.

Technical committee
 Dr. Mahmoud Ahmed



Lab Engineer
 Mohamed A. Al-Najjar

Appendix A



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CINTECH@ejust.edu.eg
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Location of test site:	KM 371+300		Field	Mr. Mohamed Moudouh
Project title:	Electric Express Train Project - Jushua (General) Construction		Date:	11/4/2023
Diameter of loading plate	600		Time	9:35:00 AM
Lever ratio	1			10:03:00 AM
Type of Soil	Prepared Subgrade 2.0		Note: CAT 966F	
Bedding material	II			
Temperature	19°C			
Test regime	Loading Stage No.	Load (kN)	Dial Gauge Reading (mm)	
Loading Stage	0	1.414	10.00	
	1	7.07	9.75	
	2	14.14	9.70	
	3	21.21	9.60	
	4	28.28	9.49	
	5	35.35	9.40	
	6	42.42	9.28	
	7	49.49	9.20	
	8	56.56	9.13	
	9	63.63	9.07	
	10	70.7	8.98	
	11	56.56	8.98	
	12	49.49	8.98	
	13	35.35	9.02	
	14	21.21	9.12	
	15	1.414	9.70	
Unloading Stage	15	1.414	9.70	
	14	21.21		
	13	35.35		
	12	49.49		
	11	56.56		
	10	70.7		
	9	63.63		
	8	56.56		
	7	49.49		
	6	42.42		
	5	35.35		
	4	28.28		
	3	21.21		
	2	14.14		
	1	7.07		
	0	1.414		
Reloading Stage	0	1.414	9.70	
	1	7.07	9.54	
	2	14.14	9.47	
	3	21.21	9.41	
	4	28.28	9.31	
	5	35.35	9.23	
	6	42.42	9.15	
	7	49.49	9.08	
	8	56.56	9.05	
	9	63.63	9.00	

Location of test site:	KM 371+275	Field	Mr. Mohamed Moudoub
Project title:	Electric Express Train Project - Ishaq	Date:	11/4/2023
Diameter of loading plate	600	Time	10:10:00 AM 10:38:00 AM
Lever ratio	1	Note: CAT 966P	
Type of Soil	Prepared Subgrade 2.0		
Bedding material	—		
Temperature	19°C		
Test regime	Loading Stage No. Load (kN)	Dial Gauge Reading (mm)	
Loading Stage	0	1.414	10.00
Loading Stage	1	7.07	9.71
	2	14.14	9.64
	3	21.21	9.52
	4	28.28	9.43
	5	35.35	9.36
	6	42.42	9.25
	7	49.49	9.14
	8	56.56	9.05
	9	63.63	8.97
	10	70.7	8.84
Unloading Stage	11	56.56	8.84
	12	49.49	8.84
	13	35.35	8.90
	14	21.21	9.01
	15	1.414	9.70
Test regime	Loading Stage No. Load (kN)	Dial Gauge Reading (mm)	
Reloading Stage	0	1.414	9.70
Reloading Stage	1	7.07	9.45
	2	14.14	9.33
	3	21.21	9.25
	4	28.28	9.19
	5	35.35	9.10
	6	42.42	9.07
	7	49.49	9.00
	8	56.56	8.95
	9	63.63	8.95



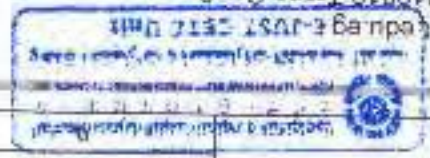
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Location of test site: KM 371+225
Field Mr. Mohamed Moudouh
Team
Project title: Electric Express Train Project - Jushaa
 (General Construction)
Diameter of loading plate 600
Lever ratio 1
Type of Soil Prepared Subgrade 2.0
Bedding material CAT 956R
Temperature 19°C
Test regime

Loading Stage	Loading Stage No.	Load (kN)	Dial Gauge Reading (mm)	Time	
				11:20:00 AM	11:48:00 AM
0	1.414	10.00			
1	7.07	9.80			
2	14.14	9.71			
3	21.21	9.60			
4	28.28	9.51			
5	35.35	9.42			
6	42.42	9.36			
7	49.49	9.29			
8	56.56	9.20			
9	63.63	9.12			
10	70.7	9.01			
11	77.7	9.01			
12	84.8	9.03			
13	91.9	9.13			
14	99.0	9.26			
15	106.1	9.81			

Unloading Stage		Loading Stage	
Test regime		Test regime	
Loading Stage No.		Loading Stage No.	
Load (kN)		Load (kN)	
Dial Gauge Reading (mm)		Dial Gauge Reading (mm)	
0	1.414	0	1.414
1	7.07	1	7.07
2	14.14	2	14.14
3	21.21	3	21.21
4	28.28	4	28.28
5	35.35	5	35.35
6	42.42	6	42.42
7	49.49	7	49.49
8	56.56	8	56.56
9	63.63	9	63.63
10	70.7	10	70.7
11	77.7	11	77.7
12	84.8	12	84.8
13	91.9	13	91.9
14	99.0	14	99.0
15	106.1	15	106.1

Refueling Stage		Refueling Stage	
Test regime		Test regime	
Loading Stage No.		Loading Stage No.	
Load (kN)		Load (kN)	
Dial Gauge Reading (mm)		Dial Gauge Reading (mm)	
0	1.414	0	1.414
1	7.07	1	7.07
2	14.14	2	14.14
3	21.21	3	21.21
4	28.28	4	28.28
5	35.35	5	35.35
6	42.42	6	42.42
7	49.49	7	49.49
8	56.56	8	56.56
9	63.63	9	63.63



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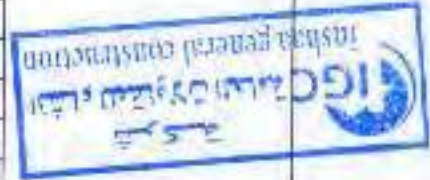
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Mobile: 0201555631725



Location of test site:	KM 371+175		Field	Site (Municipal Station)
Project title:	Electric Express Train Project - Inshaa General Construction		Date:	11/4/2023
Diameter of loading plate	600		Time	12:30:00 PM
Lever ratio	1			12:58:00 PM
Type of Soil	Prepared Subgrade 2.0		Notes:	CAT 966B
Bedding material	—			
Temperature	19°C			
Test regime	Loading Stage No.	Load (kN)		
Loading Stage	0	1.414	Dial Gauge Reading (mm)	10.00
	1	7.07		9.74
	2	14.14		9.65
	3	21.21		9.54
	4	28.28		9.44
	5	35.35		9.32
	6	42.42		9.23
	7	49.49		9.07
	8	56.56		8.97
	9	63.63		8.87
	10	70.7		8.70
	11	56.56		8.70
	12	49.49		8.72
	13	35.35		8.78
	14	21.21		8.88
	15	1.414		9.55
Unloading Stage	Loading Stage No.	Load (kN)	Dial Gauge Reading (mm)	9.55
				8.88
				8.78
				8.72
				8.70
				8.70
				8.70
				8.70
				8.70
				8.70
				8.70
				8.70
				8.70
				8.70
				8.70
				8.70
Reloading Stage	Loading Stage No.	Load (kN)	Dial Gauge Reading (mm)	9.55
				8.88
				8.78
				8.72
				8.70
				8.70
				8.70
				8.70
				8.70
				8.70
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				8.70
				8.70
				8.70
				8.70
				8.70

Location of test site:	KM 371+150		Field	Mr. Mohamed Alhandouh
Project title:	Electric Express Train Project - Irbid		Date:	11/4/2023
Diameter of loading plate	600	1	Time	1:07:00 PM
				1:35:00 PM
Lever ratio	1		Note: CAT 966F	
Type of Soil	Prepared Subgrade 2.0			
Bedding material	—			
Temperature	19°C			
Test regime	Loading Stage No.	Load (kN)	Dist Gauge Reading (mm)	
Loading Stage	0	1.414	10.00	
	1	7.07	9.70	
	2	14.14	9.62	
	3	21.21	9.45	
	4	28.28	9.34	
	5	35.35	9.18	
	6	42.42	9.05	
	7	49.49	8.92	
	8	56.56	8.81	
	9	63.63	8.69	
	10	70.7	8.52	
	11	77.7	8.32	
	12	84.8	8.13	
	13	91.9	7.95	
	14	99.0	7.78	
	15	106.1	7.62	
Unloading Stage	15	1.414	9.34	
	14	21.21	8.64	
	13	35.35	8.55	
	12	49.49	8.53	
	11	56.56	8.52	
	10	70.7	8.52	
	9	63.63	8.52	
	8	56.56	8.52	
	7	49.49	8.52	
	6	42.42	8.52	
	5	35.35	8.52	
	4	28.28	8.52	
	3	21.21	8.52	
	2	14.14	8.52	
	1	7.07	8.52	
	0	1.414	8.52	
Reloading Stage	0	1.414	9.34	
	1	7.07	9.12	
	2	14.14	9.04	
	3	21.21	8.91	
	4	28.28	8.81	
	5	35.35	8.70	
	6	42.42	8.62	
	7	49.49	8.53	
	8	56.56	8.47	
	9	63.63	8.41	



Location of test site:	KM 371+125		Field	Mr. Mohamed Moudouh	
Project title:	Electric Express Train Project - Inshaa		Date:	11/4/2023	
Diameter of loading plate	600	Time	1:43:00 PM	2:10:00 PM	
Lever ratio					1
Type of Soil					Prepared Subgrade 2.0
Bedding material					---
Temperature					19°C
Test regime	Loading Stage No.	Load (kN)	Dia (Range Reading) (mm)		
Loading Stage	0	1.414	10.00		
	1	7.07	9.74		
	2	14.14	9.70		
	3	21.21	9.57		
	4	28.28	9.47		
	5	35.35	9.33		
	6	42.42	9.21		
	7	49.49	9.14		
	8	56.56	9.04		
	9	63.63	8.93		
	10	70.7	8.81		
	11	56.56	8.81		
	12	49.49	8.82		
	13	35.35	8.88		
	14	21.21	8.99		
	15	1.414	9.60		
Unloading Stage	0	1.414	9.60		
	1	7.07	9.37		
	2	14.14	9.31		
	3	21.21	9.22		
	4	28.28	9.14		
	5	35.35	9.07		
	6	42.42	8.97		
	7	49.49	8.90		
	8	56.56	8.84		
	9	63.63			
	Reloading Stage	Loading Stage No.	Load (kN)	Dia (Range Reading) (mm)	
	Reloading Stage	0	1.414	9.60	
		1	7.07	9.37	
		2	14.14	9.31	
		3	21.21	9.22	
		4	28.28	9.14	
5		35.35	9.07		
6		42.42	8.97		
7		49.49	8.90		
8		56.56	8.84		
9		63.63			



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Location of test site:	KM 371+100		Field	Mr. Mohamed Moudoun
Project title:	Electric Express Train Project - Inshan General Construction		Date:	11/4/2023
Diameter of loading plate	600		Time	2:18:00 PM
Lever ratio	1			2:48:00 PM
Type of Soil	Prepared Subgrade 2.0		Note:	CAT 966F
Bedding material	—			
Temperature	19°C			
Test regime	Loading Stage No. Load (kN)			
Test regime	Loading Stage No. Load (kN)		Dial Gauge Reading (mm)	
Loading Stage	0	1.414	10.00	
	1	7.07	9.65	
	2	14.14	9.59	
	3	21.21	9.50	
	4	28.28	9.40	
	5	35.35	9.24	
	6	42.42	9.10	
	7	49.49	9.00	
	8	56.56	8.87	
	9	63.63	8.78	
	10	70.7	8.63	
	11	77.7	8.63	
	12	84.8	8.64	
	13	91.9	8.79	
	14	99.0	8.93	
	15	106.1	9.66	
Unloading Stage	15	1.414		
	14	21.21		
	13	35.35		
	12	49.49		
	11	63.63		
	10	77.7		
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	8	105.9		
	7	120.0		
	6	134.1		
	5	148.2		
	4	162.3		
	3	176.4		
	2	190.5		
	1	204.6		
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Reloading Stage	0	1.414		
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Test regime	15	1.414		
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	14	99.0		
	15	106.1		
Test regime	15	1.414		
	14	21.21</		

S5-B-IN

**MATERIAL
INSPECTION
REQUEST**



Contractor INSHAA GENERAL OF CONSTRUCTION	Company	Name	Sign	Issued by Contractor	Received by GARB	Consultant	371	FW	CS	11	05	2023	3	00
Designer Company	(SPECTRUM) Engineering Consulting Office	Date/Serial Number	10-05-2023 (P.L.T.A)	Time	01:00 PM									

CODE-1	51 to 521	Section Reference	D1 to 53	Depot Reference	Kp XXX Now
CODE-2		Work Activity			For Kilometer point only Start Km is used
CODE-3		Sub Element of Activity			

Description of Materials	Prepared sub grade level 2		Location to be Used	Sr. (371+000) To (371+100)		M.A.R.P.S.G-1	Supplier Name	ALFARDI		Test Requirement	P.L.T (DIN 18134)		Specification	Rev UIR-P.S.G-6
	Reference Photos	Yes / No		Other										
Item	Description	Unit	Quantity	Arrival Date	Note	1	PLATE LOAD TEST	4	11/05/2023		2			

Comments by: Eng. Mazen Essamy (SPECTRUM)	Comments by: Eng. Alaa Abd-Allah (ER)
---	---------------------------------------

Approved:

1-The Plate Load Test Result (P.L.T. DIN 18134) is

2-Results report attached and acceptable with project specifications.

3-Final approval is subject to above mentioned comments.

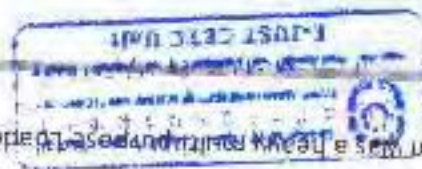
Organisation	Name	Sign	Date	A-AWC.B
Contractor	Eng. Mohamed Hassan	11/05/2023	11-05-2023	A
QA/QC	Eng. Mazen Essamy			
GARB	Eng. Mohamed Fayed			
Employers Representative	Eng. Alaa Abd-Allah	12-5-2023	12-5-2023	A.W.C

1. Introduction

The Civil Engineering Testing & Consulting Unit (CETCU) of the Egypt-Japan University of Science and Technology (EJUST) was retained by Inshaa General Construction to conduct plate loading tests on the Prepared Subgrade 2 of the Electric Express Train project at 4 locations (KM 371+000 to 371+025, KM 371+025 to 371+050, KM 371+050 to 371+075, and KM 371+075 to 371+100) in accordance with the German Standard DIN18134. The mandate was communicated by Eng. Mahmoud Shaban of Inshaa General Construction. Field team members (Mr. Mohamed Mamdouh) from the working CETCU team visited the project site on May 11, 2023 and performed the required tests. This report summarizes the plate loading test procedure according to DIN18134, the test results and their interpretations, and the CETCU pertaining recommendations.

2. Test Set Up and Instrumentation

- The German standard DIN18134 was applied to define the test setup including the loading system, test conditions, and procedure for the plate loading tests.
- The tests were carried out to determine the Strain Moduli (Ev1 and Ev2) and their ratio (Ev2/Ev1) from a stress – deformation relationship of two consecutive loading from Loading-Unloading-Loading regime.
- The loading plate has a diameter of 600 mm and a thickness of 25 mm and it is provided with equally spaced stiffeners. The upper plate face is parallel to the bottom face of the plate to allow a 300-mm plate to be placed on the 600-mm plate top.
- The loading system consisted of a hydraulic pump connected to a hydraulic jack of 700 bar capacity, which can apply and release the load increments.
- The dial gauge used to measure the plate settlement has a resolution of 0.01 mm and the lever ratio was equal to 1.
- The temperature at the time of the test was 24± 1°C
- The plate was carried out on a Prepared Subgrade 2 (according to the company) at 4 points (KM 371+000 to 371+025, KM 371+025 to 371+050, KM 371+050 to 371+075, and KM 371+075 to 371+100). The test surface area was levelled, and the plate was bedded on this surface.
- The hydraulic jack was placed on the middle of, and normal to, the loading plate beneath the reaction loading system and secured against tilting.
- The reaction loading system was a heavy multi-purpose loader CAT 966F.



3. Test Procedure and Results

The plate load test was conducted in accordance with the DIN18134. Loading, unloading, and reloading regimes were considered to estimate the resilient modulus of the tested soil. Prior to the test, the force transducer and dial gauge were reset to zero, and then a load corresponding to a stress of 0.01 MN/m² was applied. The load was increased in the first loading cycle until a normal stress of 0.25 MN/m² was reached, and the loading increment was 0.025 MN/m². The load was gradually released in four stages. Following unloading, a second loading cycle was performed, but the load was only increased to the penultimate stage of the first cycle. 4 plate loading tests on the Prepared Subgrade 2 of the Electric Express Train project were conducted at 4 locations (KM 371+000 to 371+025, KM 371+025 to 371+050, KM 371+050 to 371+075, and KM 371+075 to 371+100) and the data collected at the 4 test points is included in Appendix A.

Table 1 presents the load settlement data obtained at the first loading and unloading stages of the plate loading test performed at the location (KM 371+000 to 371+025), while Table 2 shows the data obtained at the second loading stage.

Table 1: Load-settlement data obtained at the first loading and unloading stages of the plate loading test performed at the location (KM 371+000 to 371+025)

Loading stage	Load (F)	Normal	Settlement
0	1.414	0.005	0.00
1	7.07	0.025	0.20
2	14.14	0.050	0.28
3	21.21	0.075	0.35
4	28.28	0.100	0.51
5	35.35	0.125	0.71
6	42.42	0.150	0.84
7	49.49	0.175	1.00
8	56.56	0.200	1.14
9	63.63	0.225	1.23
10	70.7	0.250	1.36
11	56.56	0.200	1.36
12	49.49	0.175	1.34
13	35.35	0.125	1.36
14	21.21	0.075	1.34
15	1.414	0.005	1.34

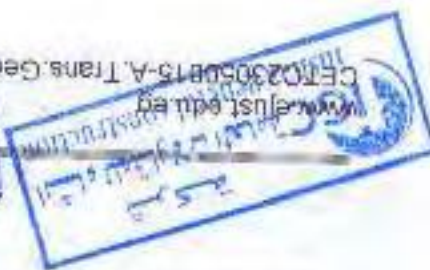
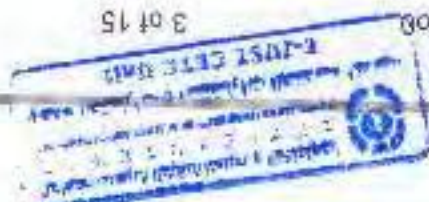


Table 2: Load-settlement data obtained at the second loading and unloading stages of the plate loading test performed at the location (KM 371+000 to 371+025)

Load stage	Load (F) kN	Normal stress (σ_n) MN/m ²	Settlement (S) mm
0	1.414	0.005	0.69
1	7.07	0.025	0.85
2	14.14	0.050	0.95
3	21.21	0.075	1.00
4	28.28	0.100	1.07
5	35.35	0.125	1.15
6	42.42	0.150	1.20
7	49.49	0.175	1.28
8	56.56	0.200	1.33
9	63.63	0.225	1.40

The load-settlement data obtained in all loading and unloading stages for the test performed at the first location (KM 371+000 to 371+025) are shown in Figure 1. Table 3 shows the calculations of the resilient modulus of the tested soil according to DIN18134. The testing data corresponding to the second testing point (KM 371+025 to 371+050) is provided in Tables 4-6 and Figure 2. The testing data corresponding to the third testing point (KM 371+050 to 371+075) is provided in Tables 7-9 and Figure 3. The testing data corresponding to the fourth testing point (KM 371+075 to 371+100) is provided in Tables 10-12 and Figure 4.

Table 3: Calculations of the resilient modulus of the tested soil according to DIN18134: (KM 371+000 to 371+025)

Parameters	1st loading cycle	2nd loading cycle
$(\sigma_{0,max})$ MN/m ²	0.25	0.25
a_0 (mm)	0.02	0.72
a_1 (mm/(MN/m ²))	5.22	4.19
a_2 (mm/(MN ² /m ²))	0.97	-5.42
$EV = 1.5 \sqrt{a_1 + a_2 \cdot \sigma_{0,max}}$	82.34	158.76
EV_2/EV_1	1.93	



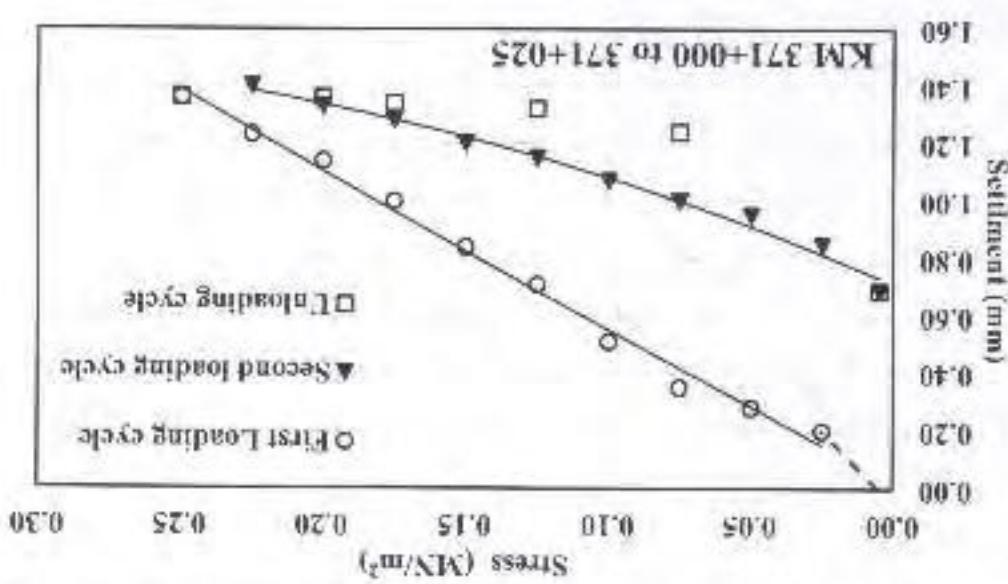


Figure 1: Load-settlement data: plate loading test performed at (KM 371+000 to 371+025)

Table 4: Load-settlement data obtained at the first loading and unloading stages of the plate loading test performed at the location (KM 371+025 to 371+050)

Loading stage	Load (F) KN	Normal stress (σ) MN/m²	Settlement (S) mm
D	1.414	0.005	0.00
1	7.07	0.025	0.35
2	14.14	0.050	0.40
3	21.21	0.075	0.45
4	28.28	0.100	0.54
5	35.35	0.125	0.65
6	42.42	0.150	0.73
7	49.49	0.175	0.81
8	56.56	0.200	0.90
9	63.63	0.225	1.00
10	70.7	0.250	1.08
11	77.77	0.275	1.08
12	84.84	0.300	1.07
13	91.91	0.325	1.07
14	98.98	0.350	0.98
15	106.05	0.375	0.88

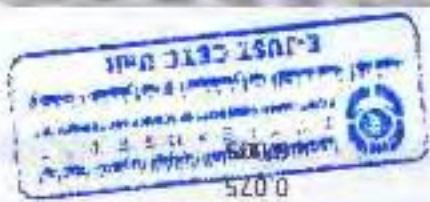


Table 5: Load-settlement data obtained at the second loading and unloading stages of the plate loading test performed at the location (KM 371+025 to 371+050)

Load stage	Load (F) kN	Normal stress (σ_0) MN/m ²	Settlement (s) mm
0	1.414	0.005	0.34
1	7.07	0.025	0.57
2	14.14	0.050	0.65
3	21.21	0.075	0.73
4	28.28	0.100	0.80
5	35.35	0.125	0.88
6	42.42	0.150	0.92
7	49.49	0.175	0.96
8	56.56	0.200	1.00
9	63.63	0.225	1.05

Table 6: Calculations of the resilient modulus of the tested soil according to DIN18134: (KM 371+025 to 371+050)

Parameters		1st loading cycle		2nd loading cycle	
$(\sigma_{a,max})$ MN/m ²		0.25		0.25	
a_0 (mm)		0.27		0.38	
a_1 (mm/(MN/m ²))		2.61		5.46	
a_2 (mm/(MN/m ²))		2.79		-11.55	
$E_v = 1.5 \cdot a_1^2 \cdot (a_2 + a_2 \cdot \sigma_{a,max})$		136.24		174.64	
E_v/E_v					1.28

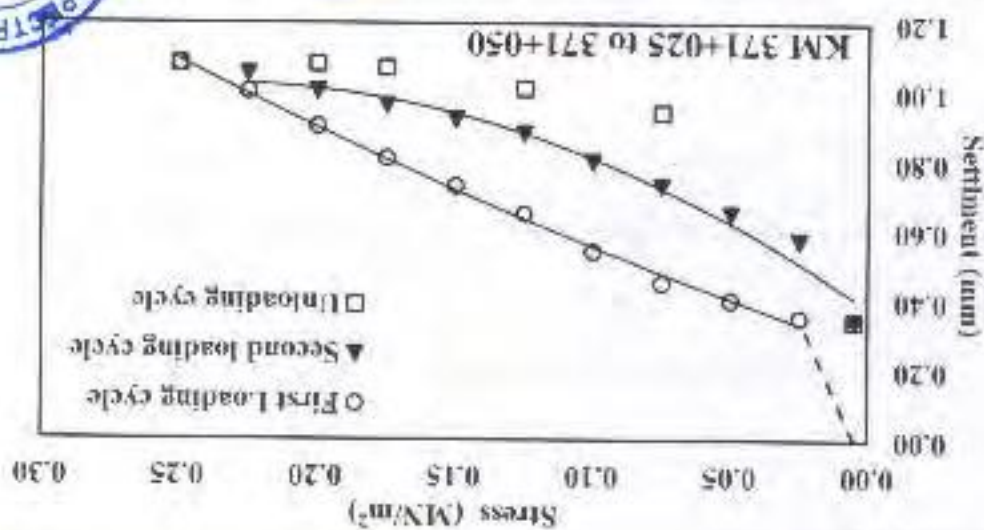


Figure 2: Load-settlement data: plate loading test performed at (KM 371+025 to 371+050)

Table 7: Load-settlement data obtained at the first loading and unloading stages of the plate loading test performed at the location (KM 371+050 to 371+075)

Load stage	Load (F) KN	Normal stress (σ_n) MN/m ²	Settlement (S) mm
0	1.414	0.005	0.00
1	7.07	0.025	0.25
2	14.14	0.050	0.32
3	21.21	0.075	0.43
4	28.28	0.100	0.57
5	35.35	0.125	0.67
6	42.42	0.150	0.83
7	49.49	0.175	0.93
8	56.56	0.200	1.08
9	63.63	0.225	1.17
10	70.7	0.250	1.31
11	77.77	0.275	1.45
12	84.84	0.300	1.60
13	91.91	0.325	1.75
14	98.98	0.350	1.90
15	106.05	0.375	2.05

Table 8: Load-settlement data obtained at the second loading and unloading stages of the plate loading test performed at the location (KM 371+050 to 371+075)

Load stage	Load (F) KN	Normal stress (σ_n) MN/m ²	Settlement (S) mm
0	1.414	0.005	0.45
1	7.07	0.025	0.63
2	14.14	0.050	0.75
3	21.21	0.075	0.88
4	28.28	0.100	0.94
5	35.35	0.125	1.00
6	42.42	0.150	1.07
7	49.49	0.175	1.13
8	56.56	0.200	1.19
9	63.63	0.225	1.25

Table 9: Calculations of the resilient modulus of the tested soil according to DIN18134: (KM 371+050 to 371+075)

Parameters	($\sigma_{n,max}$) MN/m ²	a_0 (mm)	a_1 (mm/(MN/m ²))	a_2 (mm/(MN/m ²))	$E_{ve} = 1.5 \cdot r / (a_1 + a_2 \cdot \sigma_{n,max})$	E_{ve}/E_v
1st loading cycle	0.25	0.12	4.38	2.00	93.86	1.55
2nd loading cycle	0.25	0.12	4.38	2.00	93.86	1.55



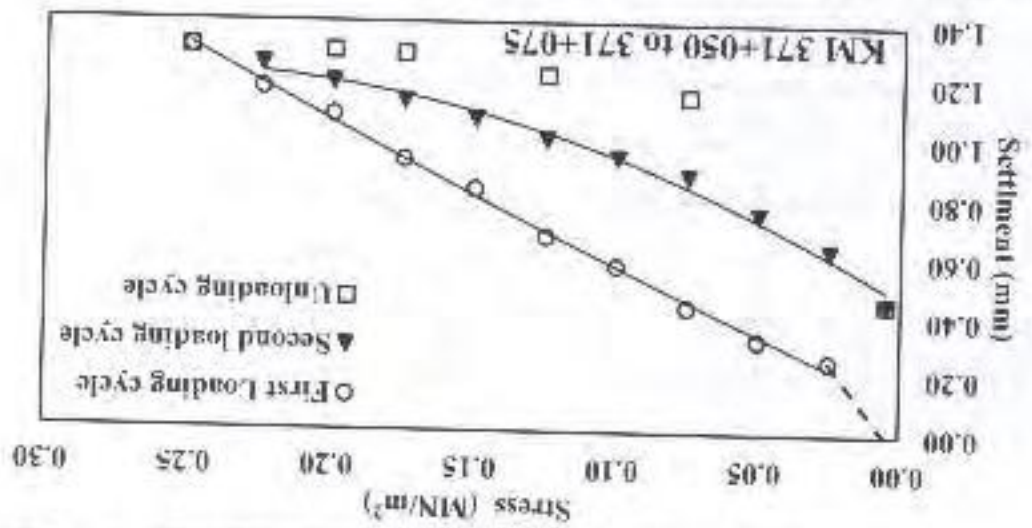


Figure 3: Load-settlement data: plate loading test performed at (KM 371+050 to 371+075)

Table 10: Load-settlement data obtained at the first loading and unloading stages of the plate loading test performed at the location (KM 371+075 to 371+100)

Load stage	Load (F) kN	Normal stress (σ _n) MN/m ²	Settlement (S) mm
0	1.414	0.005	0.00
1	7.07	0.025	0.26
2	14.14	0.050	0.41
3	21.21	0.075	0.50
4	28.28	0.100	0.55
5	35.35	0.125	0.65
6	42.42	0.150	0.74
7	49.49	0.175	0.85
8	56.56	0.200	0.94
9	63.63	0.225	1.03
10	70.7	0.250	1.13
11	56.56	0.200	1.13
12	49.49	0.175	1.13
13	35.35	0.125	1.05
14	21.21	0.075	0.99
15	1.414	0.005	0.30

Table 11: Load-settlement data obtained at the second loading and unloading stages of the plate loading test performed at the location (KM 371+075 to 371+100)

Load stage	Load (F) kN	Normal stress (σ_0) MN/m ²	Settlement (S) mm
0	1.414	0.005	0.30
1	7.07	0.025	0.53
2	14.14	0.050	0.67
3	21.21	0.075	0.79
4	28.28	0.100	0.88
5	35.35	0.125	0.96
6	42.42	0.150	1.01
7	49.49	0.175	1.09
8	56.56	0.200	1.15
9	63.63	0.225	1.22

Table 12: Calculations of the resilient modulus of the tested soil according to DIN18134: (KM 371+075 to 371+100)

Parameters			
$(s_0, \max)$ MN/m ²	0.25		
s_0 (mm)	0.20		
a_1 (mm/(MN/m ²))	3.69		
a_2 (mm/(MN/m ²))	0.12		
$EV = 1.5 \cdot r \cdot (a_1 + a_2 \cdot s_0, \max)$	120.92		
EV_2/EV_1			1.07
1st loading cycle			
2nd loading cycle			129.14

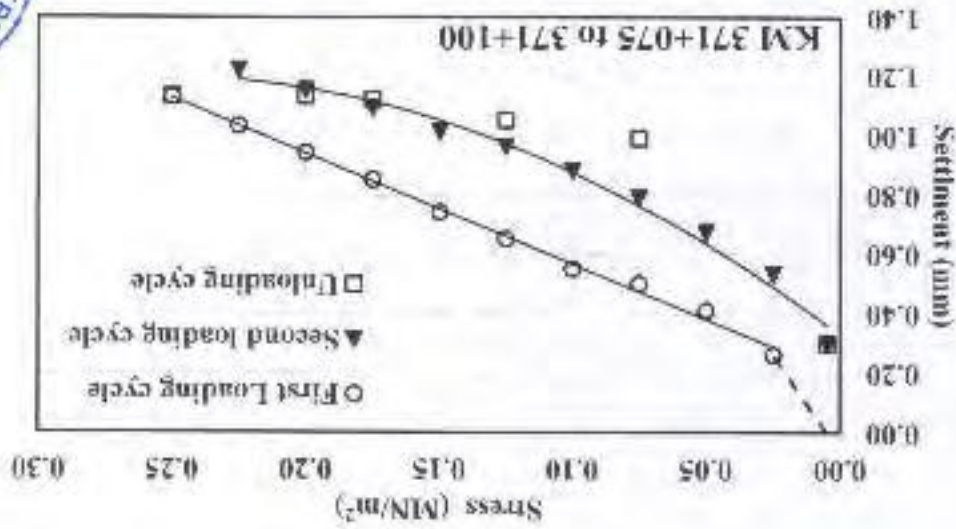


Figure 4: Load-settlement data: plate loading test performed at KM 371+075 to 371+100

4. Closure

Test results presented herein report the load settlement data obtained from 4 plate loading tests conducted on the Prepared Subgrade 2 of the Electric Express train project at 4 locations (KM 371+000 to 371+025, KM 371+025 to 371+050, KM 371+050 to 371+075, and KM 371+075 to 371+100) in accordance with German Standard, DIN18134.

Location	E_1 MN/m ²	E_2 MN/m ²	E_2/E_1 ratio
KM 371+000 to 371+025	82.34	158.76	1.93
KM 371+025 to 371+050	136.24	174.64	1.28
KM 371+050 to 371+075	93.86	145.26	1.55
KM 371+075 to 371+100	120.92	129.14	1.07

• Note: Before interpreting these test results for future applications, the Prepared Subgrade 2 in situ variability between the testing locations should be considered.

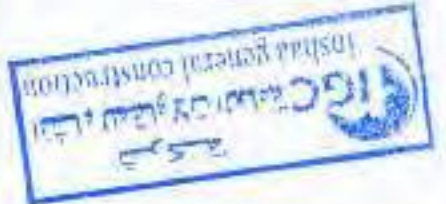
Technical committee

Dr. Mahmoud Ahmed

Prof. Dr. Mohamed F. M. Fahmy

Lab Engineer

Mohamed A. Al-Najjar





Appendix A

ՀԱՅԱՍՏԱՆԻ ՀԱՆՐԱՊԵՏՈՒԹՅԱՆ
ՄԱՐԴԱԿԱՆ ԳԻՏՈՒԹՅԱՆ ԱԿԱԴԵՄԻԱ
ՀԱՅԱՍՏԱՆԻ ՀԱՆՐԱՊԵՏՈՒԹՅԱՆ
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Location of test site:	KM 371+025 to 371+050		Field team	Mr. Mohamed Mamdouh	Project title:	Electric Express Train Project - Inshaa General Construction		Diameter of loading plate		600	Time		11:05:00 am 11:33:00 am	Lever ratio	1	Type of Soil	Prepared Subgrade 2	Bedding material	—	Temperature	24°C	Test regime			Loading Stage No.		Load (kN)	Dial Gauge Reading (mm)	Loading Stage	Unloading Stage															Test regime		Loading Stage No.	Load (kN)	Dial Gauge Reading (mm)	Reloading Stage	Unloading Stage															Test regime		Loading Stage No.	Load (kN)	Dial Gauge Reading (mm)	Reloading Stage	Unloading Stage															Test regime		Loading Stage No.	Load (kN)	Dial Gauge Reading (mm)	Reloading Stage	Unloading Stage															Test regime		Loading Stage No.	Load (kN)	Dial Gauge Reading (mm)	Reloading Stage	Unloading Stage															Test regime		Loading Stage No.	Load (kN)	Dial Gauge Reading (mm)	Reloading Stage	Unloading Stage															Test regime		Loading Stage No.	Load (kN)	Dial Gauge Reading (mm)	Reloading Stage	Unloading Stage															Test regime		Loading Stage No.	Load (kN)	Dial Gauge Reading (mm)	Reloading Stage	Unloading Stage															Test regime		Loading Stage No.	Load (kN)	Dial Gauge Reading (mm)	Reloading Stage	Unloading Stage															Test regime		Loading Stage No.	Load (kN)	Dial Gauge Reading (mm)	Reloading Stage	Unloading Stage															Test regime		Loading Stage No.	Load (kN)	Dial Gauge Reading (mm)	Reloading Stage	Unloading Stage															Test regime		Loading Stage No.	Load (kN)	Dial Gauge Reading (mm)	Reloading Stage	Unloading Stage															Test regime		Loading Stage No.	Load (kN)	Dial Gauge Reading (mm)	Reloading Stage	Unloading Stage															Test regime		Loading Stage No.	Load (kN)	Dial Gauge Reading (mm)	Reloading Stage	Unloading Stage															Test regime		Loading Stage No.	Load (kN)	Dial Gauge Reading (mm)	Reloading Stage	Unloading Stage															Test regime		Loading Stage No.	Load (kN)	Dial Gauge Reading (mm)	Reloading Stage	Unloading Stage															Test regime		Loading Stage No.	Load (kN)	Dial Gauge Reading (mm)	Reloading Stage	Unloading Stage															Test regime		Loading Stage No.	Load (kN)	Dial Gauge Reading (mm)	Reloading Stage	Unloading Stage															Test regime		Loading Stage No.	Load (kN)	Dial Gauge Reading (mm)	Reloading Stage	Unloading Stage															Test regime		Loading Stage No.	Load (kN)	Dial Gauge Reading (mm)	Reloading Stage	Unloading Stage															Test regime		Loading Stage No.	Load (kN)	Dial Gauge Reading (mm)	Reloading Stage	Unloading Stage															Test regime		Loading Stage No.	Load (kN)	Dial Gauge Reading (mm)	Reloading Stage	Unloading Stage															Test regime		Loading Stage No.	Load (kN)	Dial Gauge Reading (mm)	Reloading Stage	Unloading Stage															Test regime		Loading Stage No.	Load (kN)	Dial Gauge Reading (mm)	Reloading Stage	Unloading Stage															Test regime		Loading Stage No.	Load 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(kN)	Dial Gauge Reading (mm)	Reloading Stage	Unloading Stage															Test regime		Loading Stage No.	Load (kN)	Dial Gauge Reading (mm)	Reloading Stage	Unloading Stage															Test regime		Loading Stage No.	Load (kN)	Dial Gauge Reading (mm)	Reloading Stage	Unloading Stage															Test regime		Loading Stage No.	Load (kN)	Dial Gauge Reading (mm)	Reloading Stage	Unloading Stage															Test regime		Loading Stage No.	Load (kN)	Dial Gauge Reading (mm)	Reloading Stage	Unloading Stage															Test regime		Loading Stage No.	Load (kN)	Dial Gauge Reading (mm)	Reloading Stage	Unloading Stage															Test regime		Loading Stage No.	Load (kN)	Dial Gauge Reading (mm)	Reloading Stage	Unloading Stage															Test regime		Loading Stage No.	Load (kN)	Dial Gauge Reading (mm)	Reloading Stage	Unloading Stage															Test regime		Loading Stage No.	Load (kN)	Dial Gauge Reading (mm)	Reloading Stage	Unloading Stage															Test regime		Loading Stage No.	Load (kN)	Dial Gauge Reading (mm)	Reloading Stage	Unloading Stage															Test regime		Loading Stage No.	Load (kN)	Dial Gauge Reading (mm)	Reloading Stage	Unloading Stage															Test regime		Loading Stage No.	Load (kN)	Dial Gauge Reading (mm)	Reloading Stage	Unloading Stage															Test regime		Loading Stage No.	Load (kN)	Dial Gauge Reading (mm)	Reloading Stage	Unloading Stage															Test regime		Loading Stage No.	Load (kN)	Dial Gauge Reading (mm)	Reloading Stage	Unloading Stage															Test regime		Loading Stage No.	Load (kN)	Dial Gauge Reading (mm)	Reloading Stage	Unloading Stage															Test regime		Loading Stage No.	Load (kN)	Dial Gauge Reading (mm)	Reloading Stage	Unloading Stage															Test regime		Loading Stage No.	Load (kN)	Dial Gauge Reading (mm)	Reloading Stage	Unloading Stage															Test regime		Loading Stage No.	Load (kN)	Dial Gauge Reading (mm)	Reloading Stage	Unloading Stage															Test regime		Loading Stage No.	Load (kN)	Dial Gauge Reading (mm)	Reloading Stage
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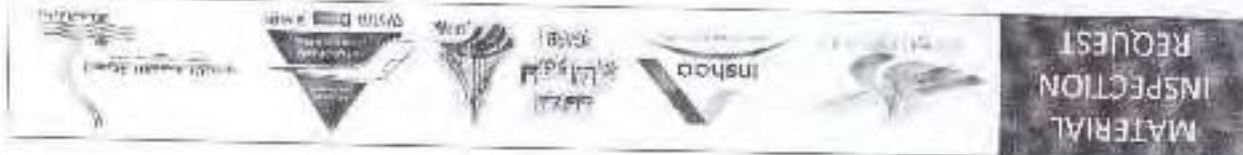


Location of test site:	KM 371+050 to 371+075		Field	Mr. Mohamed Mamdouh	Team	Project title:		Electric Express Train Project - Inshas General Construction		Diameter of loading plate		600	Time	11:40:00 am 12:08:00 pm	Note:		CAT 966F		Lever ratio		1	Type of Soil	Prepared Subgrade 2	Bedding material	—	Temperature	24°C	Test regime		Loading Stage No.	Load (kN)	Dial Gauge Reading (mm)							
Loading Stage		0	1.414	7.07	9.75	9.68	9.57	9.43	9.33	9.17	9.07	8.92	8.83	8.69	8.70	8.71	8.78	8.85	9.55	Unloading Stage		1	1.414	7.07	9.75	9.68	9.57	9.43	9.33	9.17	9.07	8.92	8.83	8.69	8.70	8.71	8.78	8.85	9.55
Loading Stage		2	14.14	21.21	28.28	35.35	42.42	49.49	56.56	63.63	70.7	77.77	84.84	91.91	99.0	106.06	113.13	120.2	127.27	Unloading Stage		3	14.14	21.21	28.28	35.35	42.42	49.49	56.56	63.63	70.7	77.77	84.84	91.91	99.0	106.06	113.13	120.2	127.27
Loading Stage		4	28.28	42.42	56.56	70.7	84.84	99.0	113.13	127.27	141.4	155.56	169.7	183.84	197.91	212.0	226.13	240.2	254.27	Unloading Stage		5	28.28	42.42	56.56	70.7	84.84	99.0	113.13	127.27	141.4	155.56	169.7	183.84	197.91	212.0	226.13	240.2	254.27
Loading Stage		6	42.42	63.63	84.84	106.06	127.27	148.48	169.69	190.9	212.13	233.33	254.54	275.75	296.96	318.17	339.38	360.59	381.79	Unloading Stage		7	42.42	63.63	84.84	106.06	127.27	148.48	169.69	190.9	212.13	233.33	254.54	275.75	296.96	318.17	339.38	360.59	381.79
Loading Stage		8	63.63	95.45	127.27	159.09	190.91	222.73	254.54	286.36	318.18	349.99	381.81	413.63	445.45	477.27	509.09	540.91	572.73	Unloading Stage		9	63.63	95.45	127.27	159.09	190.91	222.73	254.54	286.36	318.18	349.99	381.81	413.63	445.45	477.27	509.09	540.91	572.73
Loading Stage		10	84.84	127.27	169.69	212.13	254.54	296.96	339.38	381.79	424.21	466.63	509.05	551.47	593.89	636.31	678.73	721.15	763.57	Unloading Stage		11	84.84	127.27	169.69	212.13	254.54	296.96	339.38	381.79	424.21	466.63	509.05	551.47	593.89	636.31	678.73	721.15	763.57
Loading Stage		12	106.06	159.09	212.13	265.16	318.18	371.2	424.24	477.26	530.28	583.3	636.32	689.34	742.36	795.38	848.4	901.42	954.44	Unloading Stage		13	106.06	159.09	212.13	265.16	318.18	371.2	424.24	477.26	530.28	583.3	636.32	689.34	742.36	795.38	848.4	901.42	954.44
Loading Stage		14	127.27	190.91	254.54	318.18	381.79	445.4	509.05	572.67	636.28	699.89	763.5	827.11	890.73	954.34	1017.96	1081.58	1145.19	Unloading Stage		15	127.27	190.91	254.54	318.18	381.79	445.4	509.05	572.67	636.28	699.89	763.5	827.11	890.73	954.34	1017.96	1081.58	1145.19
Loading Stage		16	148.48	222.73	296.96	371.2	445.4	519.6	593.8	668.0	742.2	816.4	890.6	964.8	1039.0	1113.2	1187.4	1261.6	1335.8	Unloading Stage		17	148.48	222.73	296.96	371.2	445.4	519.6	593.8	668.0	742.2	816.4	890.6	964.8	1039.0	1113.2	1187.4	1261.6	1335.8
Loading Stage		18	169.69	254.54	339.38	424.21	509.05	593.89	678.73	763.57	848.41	933.25	1018.09	1102.93	1187.77	1272.61	1357.45	1442.29	1527.13	Unloading Stage		19	169.69	254.54	339.38	424.21	509.05	593.89	678.73	763.57	848.41	933.25	1018.09	1102.93	1187.77	1272.61	1357.45	1442.29	1527.13
Loading Stage		20	190.91	296.96	390.8	484.73	578.66	672.59	766.52	860.45	954.38	1048.31	1142.24	1236.17	1330.1	1424.03	1517.96	1611.89	1705.82	Unloading Stage		21	190.91	296.96	390.8	484.73	578.66	672.59	766.52	860.45	954.38	1048.31	1142.24	1236.17	1330.1	1424.03	1517.96	1611.89	1705.82
Loading Stage		22	212.13	339.38	445.4	551.47	657.5	763.57	869.6	975.69	1081.72	1187.75	1293.78	1399.81	1505.84	1611.87	1717.9	1823.93	1929.96	Unloading Stage		23	212.13	339.38	445.4	551.47	657.5	763.57	869.6	975.69	1081.72	1187.75	1293.78	1399.81	1505.84	1611.87	1717.9	1823.93	1929.96
Loading Stage		24	233.33	381.79	509.05	636.32	763.57	890.82	1018.07	1145.32	1272.57	1399.82	1527.07	1654.32	1781.57	1908.82	2036.07	2163.32	2290.57	Unloading Stage		25	233.33	381.79	509.05	636.32	763.57	890.82	1018.07	1145.32	1272.57	1399.82	1527.07	1654.32	1781.57	1908.82	2036.07	2163.32	2290.57
Loading Stage		26	254.54	424.21	565.78	707.01	848.74	990.47	1132.2	1273.93	1415.66	1557.39	1699.12	1840.85	1982.58	2124.31	2266.04	2407.77	2549.5	Unloading Stage		27	254.54	424.21	565.78	707.01	848.74	990.47	1132.2	1273.93	1415.66	1557.39	1699.12	1840.85	1982.58	2124.31	2266.04	2407.77	2549.5
Loading Stage		28	275.75	466.63	618.84	770.57	922.3	1074.03	1225.76	1377.49	1529.22	1680.95	1832.68	1984.41	2136.14	2287.87	2439.6	2591.33	2743.06	Unloading Stage		29	275.75	466.63	618.84	770.57	922.3	1074.03	1225.76	1377.49	1529.22	1680.95	1832.68	1984.41	2136.14	2287.87	2439.6	2591.33	2743.06
Loading Stage		30	296.96	509.05	672.73	836.46	1000.19	1163.92	1327.65	1491.38	1655.11	1818.84	1982.57	2146.3	2310.03	2473.76	2637.49	2801.22	2964.95	Unloading Stage		31	296.96	509.05	672.73	836.46	1000.19	1163.92	1327.65	1491.38	1655.11	1818.84	1982.57	2146.3	2310.03	2473.76	2637.49	2801.22	2964.95
Loading Stage		32	318.18	551.47	726.64	900.37	1074.1	1247.83	1421.56	1595.29	1769.02	1942.75	2116.48	2290.21	2463.94	2637.67	2811.4	2985.13	3158.86	Unloading Stage		33	318.18	551.47	726.64	900.37	1074.1	1247.83	1421.56	1595.29	1769.02	1942.75	2116.48	2290.21	2463.94	2637.67	2811.4	2985.13	3158.86
Loading Stage		34	339.38	593.89	788.96	972.69	1156.42	1340.15	1523.88	1707.61	1891.34	2075.07	2258.8	2442.53	2626.26	2809.99	2993.72	3177.45	3361.18	Unloading Stage		35	339.38	593.89	788.96	972.69	1156.42	1340.15	1523.88	1707.61	1891.34	2075.07	2258.8	2442.53	2626.26	2809.99	2993.72	3177.45	3361.18
Loading Stage		36	360.59	636.32	841.28	1035.01	1228.74	1422.47	1616.2	1809.93	2003.66	2197.39	2391.12	2584.85	2778.58	2972.31	3166.04	3359.77	3553.5	Unloading Stage		37	360.59	636.32	841.28	1035.01	1228.74	1422.47	1616.2	1809.93	2003.66	2197.39	2391.12	2584.85	2778.58	2972.31	3166.04	3359.77	3553.5
Loading Stage		38	381.79	678.73	893.6	1097.33	1300.06	1502.79	1705.52	1908.25	2110.98	2313.71	2516.44	2719.17	2921.9	3124.63	3327.36	3530.09	3732.82	Unloading Stage		39	381.79	678.73	893.6	1097.33	1300.06	1502.79	1705.52	1908.25	2110.98	2313.71	2516.44	2719.17	2921.9	3124.63	3327.36	3530.09	3732.82
Loading Stage		40	403.01	726.64	948.96	1161.29	1375.02	1588.75	1802.48	2016.21	2229.94	2443.67	2657.4	2871.13	3084.86	3298.59	3512.32	3726.05	3939.78	Unloading Stage		41	403.01	726.64	948.96	1161.29	1375.02	1588.75	1802.48	2016.21	2229.94	2443.67	2657.4	2871.13	3084.86	3298.59	3512.32	3726.05	3939.78
Loading Stage		42	424.21	769.01	1001.28	1225.01	1448.74	1672.47	1896.2	2119.93	2343.66	2567.39	2791.12	3014.85	3238.58	3462.31	3686.04	3909.77	4133.5	Unloading Stage		43	424.21	769.01	1001.28	1225.01	1448.74	1672.47	1896.2	2119.93	2343.66	2567.39	2791.12	3014.85	3238.58	3462.31	3686.04	3909.77	4133.5
Loading Stage		44	445.4	811.43	1053.6	1287.33	1511.06	1734.79	1958.52	2182.25	2405.98	2629.71	2853.44	3077.17	3300.9	3524.63	3748.36	3972.09	4195.82	Unloading Stage		45	445.4	811.43	1053.6	1287.33	1511.06	1734.79	1958.52	2182.25	2405.98	2629.71	2853.44	3077.17	3300.9	3524.63	3748.36	3972.09	4195.82
Loading Stage		46	466.63	853.85	1105.92	1340.05	1573.78	1807.51	2041.24	2274.97	2508.7	2742.43	2976.16	3209.89	3443.62	3677.35	3911.08	4144.81	4378.54	Unloading Stage		47	466.63	853.85	1105.92	1340.05	1573.78	1807.51	2041.24	2274.97	2508.7	2742.43	2976.16	3209.89	3443.62	3677.35	3911.08	4144.81	4378.54
Loading Stage		48	487.85	896.27	1158.24	1392.37	1626.1	1859.83	2093.56	2327.29	2561.02	2794.75	3028.48	3262.21	3495.94	3729.67	3963.4	4197.13	4430.86	Unloading Stage		49	487.85	896.27	1158.24	1392.37	1626.1	1859.83	2093.56	2327.29	2561.02	2794.75	3028.48	3262.21	3495.94	3729.67	3963.4	4197.13	4430.86
Loading Stage		50	509.05	938.69	1210.56	1444.69	1678.42	1912.15	2145.88	2379.61	2613.34	2847.07	3080.8	3314.53	3548.26	3781.99	4015.72	4249.45	4483.18	Unloading Stage		51	509.05	938.69	1210.56	1444.69	1678.42	1912.15	2145.88	2379.61	2613.34	2847.07	3080.8	3314.53	3548.26	3781.99	4015.72	4249.45	4483.18
Loading Stage		52	530.27	981.11	1262.88	1497.01	1730.74	1964.47	2198.2	2431.93	2665.66	2899.39	3133.12	3366.85	3600.58	3834.31	4068.04	4301.77	4535.5	Unloading Stage		53	530.27	981.11	1262.88	1497.01	1730.74	1964.47	2198.2	2431.93	2665.66	2899.39	3133.12	3366.85	3600.58	3834.31	4068.04	4301.77	4535.5
Loading Stage		54	551.47	1023.53	1315.2	1549.33	1783.06	2016.79	2250.52	2484.25	2717.98	2951.71	3185.44	3419.17	3652.9	3886.63	4120.36	4354.09	4587.82	Unloading Stage		55	551.47	1023.53	1315.2	1549.33	1783.06	2											

Location of test site:	KM 371+075 to 371+100		Field team	Mr. Mohamed Mamdouh
Project title:	Electric Express Train Project - Inshaa General Construction		Date:	11/5/2023
Diameter of loading plate	600	1	Note:	CAT 966F
Lever ratio				
Type of Soil				
Bedding material				
Temperature	24°C			
Test regime	Loading Stage No.	Load (kN)	Dial Gauge Reading (mm)	
Loading Stage	0	1.414	10.00	
	1	7.07	9.74	
	2	14.14	9.59	
	3	21.21	9.50	
	4	28.28	9.45	
	5	35.35	9.35	
	6	42.42	9.26	
	7	49.49	9.15	
	8	56.56	9.06	
	9	63.63	8.97	
	10	70.7	8.87	
	11	56.56	8.87	
	12	49.49	8.88	
	13	35.35	8.95	
	14	21.21	9.01	
	15	1.414	9.70	
Unloading Stage	15	1.414	9.70	
	14	21.21	9.01	
	13	35.35	8.95	
	12	49.49	8.88	
	11	56.56	8.87	
	10	70.7	8.87	
	9	63.63	8.97	
	8	56.56	9.06	
	7	49.49	9.15	
	6	42.42	9.26	
	5	35.35	9.35	
	4	28.28	9.45	
	3	21.21	9.50	
	2	14.14	9.59	
	1	7.07	9.74	
	0	1.414	10.00	
Reloading Stage	0	1.414	9.70	
	1	7.07	9.47	
	2	14.14	9.33	
	3	21.21	9.21	
	4	28.28	9.12	
	5	35.35	9.04	
	6	42.42	8.99	
	7	49.49	8.91	
	8	56.56	8.85	
	9	63.63	8.78	



SS-B-IN



Contractor Company	INSHA GENERAL OF CONSTRUCTION		Designer Company	(SPECTRUM) Engineering Consulting Office	
	Name			Date/Serial Number	
Issued by	Eng. Mahmoud shaban	Sign	Time		02:00 PM
Received by	Eng. Mazen Essamy	Sign	Date		19/06/2023
CONSULTANT	GARB		PLT		371
371		FW	CS	2D	06 2023
2		00			

CODE 1	At to S21	DI to S3	For Kilometer print only. Station is used
CODE 2	Station Reference	Work Activity	Sub Element of Activity
CODE 3			

Item	Description	Unit	Quantity	Arrival Date	Note
1	PLATE LOAD TEST	NUMBER	4	20/06/2023	
2					
3					
4					

Comments by: Eng. Mazen Essamy (SPECTRUM)		Comments by: Eng. Alaa Abd-Allatif (ER)	
1- The Plate Load Test Result P.L.T (DIN 18134) is		1- Plate Load Test was carried out by (Consultant)	
2- Results report attached and acceptable with project specifications.		2- Final approval is subject to above mentioned comments.	
APPROVAL STATUS			

Organization	Name	Sign	Date	A-AWC-R
Contractor	Eng. Mahmoud shaban		20-06-2023	A
QA/QC	Eng. Mazen Essamy			
GARB**	Eng. Margaret magdy			
Employers Representative	Eng. Alaa Abd-Allatif			



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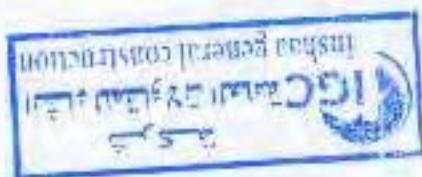
Internal inspection and laboratories sector

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Technical report

of Plate Loading Test (DIN 18134)

General	:	SYSTRA
Consultant	:	SPECTRUM
Contractor	:	شركة المقاولات العامة
Project	:	ELECTRIC EXPRESS TRAIN
Sample	:	Sub-Ballast (2)
Station	:	ST(371+000) TO ST(371+100)
Date of Test	:	20/6/2023
QC	:	1453



Kilo 23 Alexandria - Cairo Desert Road - Merghem
Tel: 002 43 4704595 - 002 034701191
Email : cndept@comibassal.com
Website : www.comibassal.com

49 El Horria Ave. Alex, Egypt
Tel: 002 033920176 - 002 033931482
Fax :002 033900476
Email : internal-inspection@comibassal.com



Introduction:

The plate load test is designed to determine the vertical deformation and strength characteristics of soil by assessing the force and amount of penetration with time when a rigid plate is made to penetrate the soil.

The test to be carried out on the native soil according to German specifications DIN 18134.

Test methods :

- 1- The German standard DIN 18134 was applied to define the apparatus used, the loading system, test conditions, and procedure for plate load test.
- 2- Loading plates with a diameter of 600 mm have a thickness of 25mm and are provided with equally spaced stiffeners with even upper faces parallel to the plate bottom face to allow 300 mm plate to be placed on top of it.
- 3- The loading system consisted of a hydraulic pump connected to a hydraulic jack of 700 bar capacity, which is capable of applying and releasing the load stages.
- 4- The dial gauge used to measure the plate settlement has a resolution of 0.01mm and the lever ratio was equal to 1.
- 5- The temperature at the time of the test was 25°.
- 6- The plate was carried out on a native soil (sand-gravel). The test surface area was level and the plate was bedded on this surface.
- 7- The hydraulic jack was placed on the middle of, and at normal to, the loading plate beneath the reaction loading system and secured against tilting.
- 8- The reaction loading system was a heavy multi-purpose excavator (more than 20 ton).

Description of experiment:

- 1- Loading, unloading and reloading regims were applied according to DIN 18134 for the plate load test to estimate the resilient modulus
- 2- Prior to the test, the force transducer and dial gauge were set to zero, after which a load was applied corresponding to a stress of 0.01 MN/m².
- 3- In the first loading cycle, the load was increased until a normal stress of 0.25 MN/m² was reached, and the loading increment was 0.25 MN/m². The load was released in four stages.
- 4- Following unloading, a further second loading cycle was carried out, in which, the load was increased only to the penultimate stage of the first cycle.



COMIBASSAL International Construction
 49 El Horria Ave, Alex, Egypt
 Tel: 002 033920176 - 002 033931482
 Fax: 002 033900476
 Email: internal-inspection@comibassal.com
 Website: www.comibassal.com



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St (371+000) to (371+025) km

600

Table 1: Measured values for first loading cycle and unloading cycle

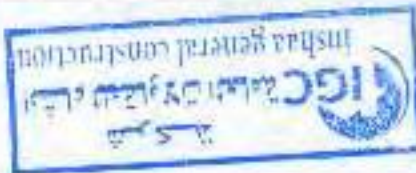
Loading stage no.	Load (t) KN	Normal stress (σ) MPa	Settlement of loading plate S (mm)
0	1.414	0.005	0.00
1	7.07	0.015	0.07
2	14.14	0.060	0.14
3	21.21	0.075	0.21
4	28.28	0.100	0.26
5	35.35	0.115	0.31
6	42.42	0.130	0.38
7	49.49	0.175	0.44
8	56.56	0.200	0.50
9	63.63	0.215	0.55
10	70.7	0.250	0.60
11	56.56	0.200	0.58
12	49.49	0.175	0.55
13	35.35	0.125	0.47
14	21.21	0.075	0.35
15	14.14	0.005	0.17

Table 2: Measured values for second loading cycle

Loading stage no.	Load (t) KN	Normal stress (σ) MPa	Settlement of loading plate S (mm)
16	1.414	0.005	0.17
17	14.14	0.060	0.29
18	21.21	0.075	0.35
19	28.28	0.100	0.41
20	35.35	0.115	0.46
21	42.42	0.130	0.52
22	49.49	0.175	0.58
23	56.56	0.200	0.63
24	63.63	0.215	0.67

Table 3: Completion of results

Parameters	2nd loading cycle	1st loading cycle
$(\sigma_{max}) MPa/mm^2$	0.250	0.250
$\sigma_1 (mm)$	0.008	0.008
$\sigma_2 (mm)$	2.680	2.747
$\sigma_3 (mm)$	1.153	1.298
$\sigma_4 (mm)$	1.088	1.298
$\sigma_5 (mm)$	1.088	1.298
$\sigma_6 (mm)$	1.088	1.298
$\sigma_7 (mm)$	1.088	1.298
$\sigma_8 (mm)$	1.088	1.298
$\sigma_9 (mm)$	1.088	1.298
$\sigma_{10} (mm)$	1.088	1.298
$\sigma_{11} (mm)$	1.088	1.298
$\sigma_{12} (mm)$	1.088	1.298
$\sigma_{13} (mm)$	1.088	1.298
$\sigma_{14} (mm)$	1.088	1.298
$\sigma_{15} (mm)$	1.088	1.298
$\sigma_{16} (mm)$	1.088	1.298
$\sigma_{17} (mm)$	1.088	1.298
$\sigma_{18} (mm)$	1.088	1.298
$\sigma_{19} (mm)$	1.088	1.298
$\sigma_{20} (mm)$	1.088	1.298
$\sigma_{21} (mm)$	1.088	1.298
$\sigma_{22} (mm)$	1.088	1.298
$\sigma_{23} (mm)$	1.088	1.298
$\sigma_{24} (mm)$	1.088	1.298



49 El Horria Ave, Alex, Egypt
Tel: 002 033920176 - 002 033931482
Fax: 002 033900476
Email: internal-inspection@comibassal.com

Kilo 23 Alexandria - Cairo Desert Road
Tel: 002 03 4704595 - 002 034701181
Email: chdepi@comibassal.com
Website: www.comibassal.com

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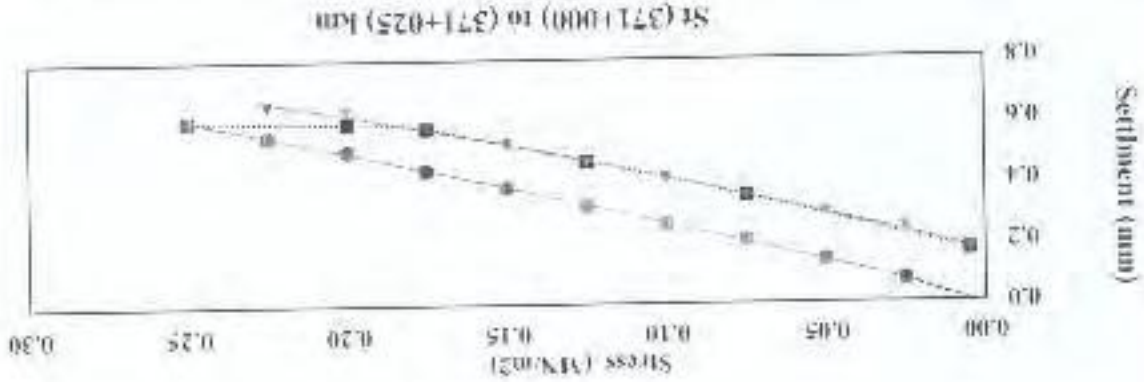
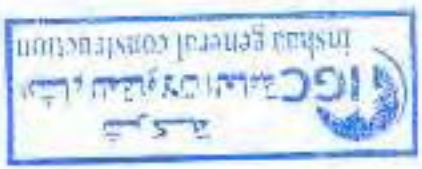


Fig. 1: Load-settlement curve, fitting curves according to Table 1 and Table 2 for the first and second loading cycles

■ Measurement points from the first loading cycle
▲ Measurement points from the second loading cycle
S Settlement in mm
 σ_v Normal stress MN/m^2



49 El Horria Ave. Alex. Egypt
Tel: 002 033920176 - 002 033931482
Fax: 002 033900476
Email: internal-inspection@comibassal.com

Kilo 23 Alexandria - Cairo Desert Road - Merghem
Tel: 002 03 4704595 - 002 034701191
Email: ctwdep@comibassal.com
Website: www.comibassal.com

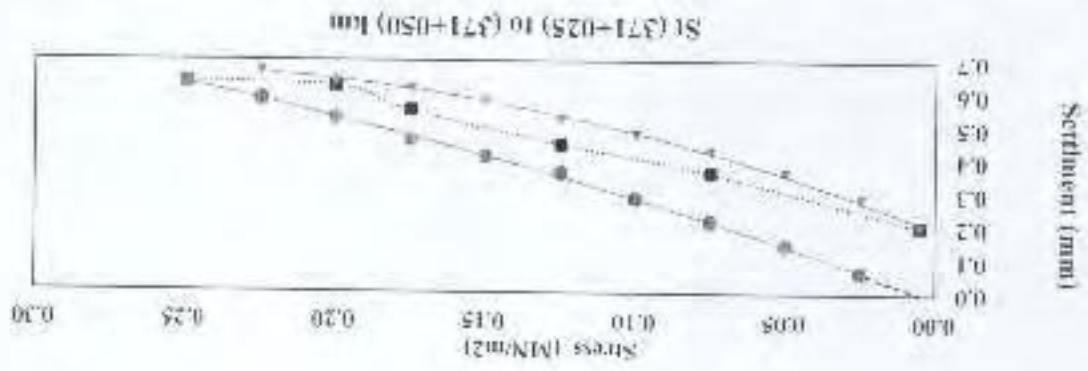


Fig. 2: Load-settlement curve: fitting curves according to Table 4 and Table 5 for the first and second loading cycles

• Measurement points from the first loading cycle
 ■ Measurement points from the unloading cycle
 ▲ Measurement points from the second loading cycle
 S Settlement in mm
 σ_v Normal stress kN/m^2





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St (371+050) to (371+075) km
600

Table 2 : Measured values for first loading cycle and unloading cycle

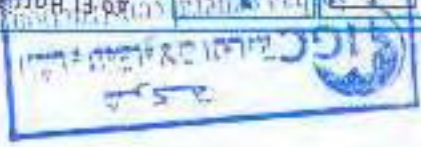
Loading stage no.	Load (T)	Normal stress (kg/MTs.m ²)	Seamount of loading plate (mm)
0	1.111	0.015	0.00
1	7.07	0.025	0.07
2	11.11	0.100	0.14
3	15.15	0.075	0.19
4	20.20	0.100	0.20
5	25.25	0.125	0.26
6	30.30	0.150	0.33
7	35.35	0.175	0.39
8	40.40	0.175	0.39
9	45.45	0.200	0.45
10	50.50	0.225	0.53
11	55.55	0.250	0.55
12	60.60	0.250	0.62
13	65.65	0.275	0.68
14	70.70	0.300	0.72
15	75.75	0.325	0.76

Table 3 : Measured values for second loading cycle

Loading stage no.	Load (T)	Normal stress (kg/MTs.m ²)	Seamount of loading plate (mm)
16	80.80	0.350	0.82
17	85.85	0.375	0.87
18	90.90	0.400	0.93
19	95.95	0.425	0.96
20	101.00	0.450	1.00
21	106.05	0.475	1.04
22	111.10	0.500	1.07
23	116.15	0.525	1.10
24	121.20	0.550	1.16
25	126.25	0.575	1.20
26	131.30	0.600	1.25
27	136.35	0.625	1.28
28	141.40	0.650	1.30
29	146.45	0.675	1.35
30	151.50	0.700	1.40
31	156.55	0.725	1.43
32	161.60	0.750	1.47
33	166.65	0.775	1.52
34	171.70	0.800	1.57
35	176.75	0.825	1.62

Table 9 : Completion of results

Parameter	for loading cycle	for unloading cycle
(σ_{max}) MPa/mm ²	0.750	0.250
d (mm)	0.056	0.150
n (mm/MTs.m ²)	1.507	2.165
σ_y (mm/MTs.m ²)	2.517	4.288
σ_{y1} (mm/MTs.m ²)	2.517	215.00



Kilo 23 Alexandria - Cairo Desert Road - Wierhem
Tel: 002 03 4704595 - 012 034701191
Email: cwi@comibassal.com
Website: www.comibassal.com



49 El Horra Ave. Alex, Egypt
Tel: 002 033920176 - 002 033931482
Fax: 002 033900476
Email: internal-inspection@comibassal.com

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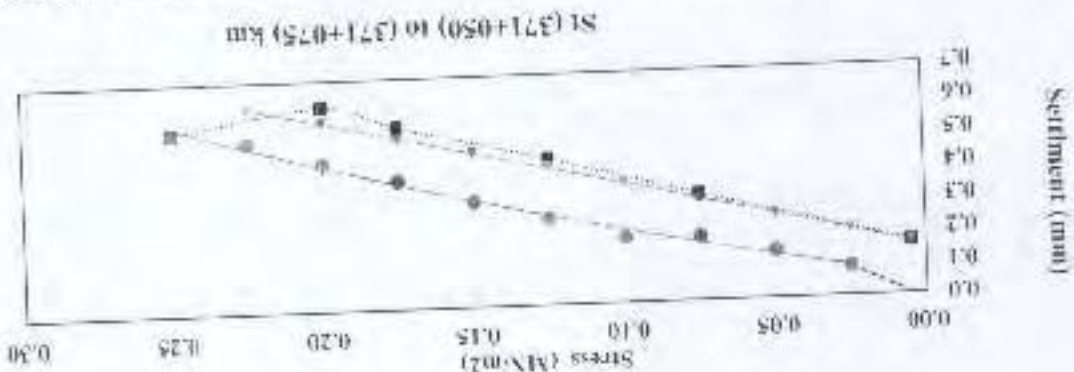
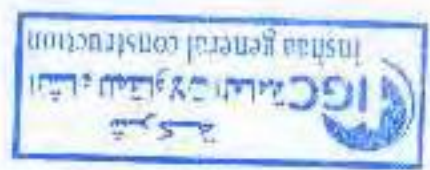


Fig. 3: Load-settlement curve, fitting curves according to Table 7 and Table 8 for the first and second loading cycles

● Measurement points from the first loading cycle
■ Measurement points from the unloading cycle
▲ Measurement points from the second loading cycle
○ Settlement in mm
□ Normal stress kN/m²



49 El Horria Ave. Alex, Egypt
Tel: 002 033920176 - 002 033931482
Fax: 002 033900476
Email: Internal-inspection@comibassal.com

Kilo 23 Alexandria - Cairo Desert Road - Merghem
Tel: 002 03 4704595 - 002 034701191
Email: cdivdept@comibassal.com
Website: www.comibassal.com

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51 (371+075) to (371+100) km

600

Table 10: Measured values for First loading cycle and unloading cycle

1 loading stage no.	Load (T)	Normal stress (kg/ Mm ²)	Settlement of loading plate (mm)
0	1.114	0.025	0.00
1	7.07	0.028	0.07
2	14.14	0.050	0.15
3	21.21	0.075	0.28
4	28.28	0.100	0.40
5	35.35	0.125	0.54
6	42.42	0.150	0.68
7	49.49	0.175	0.80
8	56.56	0.200	0.94
9	63.63	0.225	1.07
10	70.7	0.250	1.20
11	77.77	0.275	1.34
12	84.84	0.300	1.48
13	91.91	0.325	1.62
14	98.98	0.350	1.76
15	106.05	0.375	1.90
16	113.12	0.400	2.04
17	120.19	0.425	2.18
18	127.26	0.450	2.32
19	134.33	0.475	2.46
20	141.40	0.500	2.60
21	148.47	0.525	2.74
22	155.54	0.550	2.88
23	162.61	0.575	3.02
24	169.68	0.600	3.16
25	176.75	0.625	3.30
26	183.82	0.650	3.44
27	190.89	0.675	3.58
28	197.96	0.700	3.72
29	205.03	0.725	3.86
30	212.10	0.750	4.00
31	219.17	0.775	4.14
32	226.24	0.800	4.28
33	233.31	0.825	4.42
34	240.38	0.850	4.56
35	247.45	0.875	4.70
36	254.52	0.900	4.84
37	261.59	0.925	4.98
38	268.66	0.950	5.12
39	275.73	0.975	5.26
40	282.80	1.000	5.40
41	289.87	1.025	5.54
42	296.94	1.050	5.68
43	304.01	1.075	5.82
44	311.08	1.100	5.96
45	318.15	1.125	6.10
46	325.22	1.150	6.24
47	332.29	1.175	6.38
48	339.36	1.200	6.52
49	346.43	1.225	6.66
50	353.50	1.250	6.80
51	360.57	1.275	6.94
52	367.64	1.300	7.08
53	374.71	1.325	7.22
54	381.78	1.350	7.36
55	388.85	1.375	7.50
56	395.92	1.400	7.64
57	402.99	1.425	7.78
58	410.06	1.450	7.92
59	417.13	1.475	8.06
60	424.20	1.500	8.20

Table 11: Measured values for second loading cycle

1 loading stage no.	Load (T)	Normal stress (kg/ Mm ²)	Settlement of loading plate (mm)
1	1.114	0.025	0.00
2	7.07	0.028	0.07
3	14.14	0.050	0.15
4	21.21	0.075	0.28
5	28.28	0.100	0.40
6	35.35	0.125	0.54
7	42.42	0.150	0.68
8	49.49	0.175	0.80
9	56.56	0.200	0.94
10	63.63	0.225	1.07
11	70.7	0.250	1.20
12	77.77	0.275	1.34
13	84.84	0.300	1.48
14	91.91	0.325	1.62
15	98.98	0.350	1.76
16	106.05	0.375	1.90
17	113.12	0.400	2.04
18	120.19	0.425	2.18
19	127.26	0.450	2.32
20	134.33	0.475	2.46
21	141.40	0.500	2.60
22	148.47	0.525	2.74
23	155.54	0.550	2.88
24	162.61	0.575	3.02
25	169.68	0.600	3.16
26	176.75	0.625	3.30
27	183.82	0.650	3.44
28	190.89	0.675	3.58
29	197.96	0.700	3.72
30	205.03	0.725	3.86
31	212.10	0.750	4.00
32	219.17	0.775	4.14
33	226.24	0.800	4.28
34	233.31	0.825	4.42
35	240.38	0.850	4.56
36	247.45	0.875	4.70
37	254.52	0.900	4.84
38	261.59	0.925	4.98
39	268.66	0.950	5.12
40	275.73	0.975	5.26
41	282.80	1.000	5.40
42	289.87	1.025	5.54
43	296.94	1.050	5.68
44	304.01	1.075	5.82
45	311.08	1.100	5.96
46	318.15	1.125	6.10
47	325.22	1.150	6.24
48	332.29	1.175	6.38
49	339.36	1.200	6.52
50	346.43	1.225	6.66
51	353.50	1.250	6.80
52	360.57	1.275	6.94
53	367.64	1.300	7.08
54	374.71	1.325	7.22
55	381.78	1.350	7.36
56	388.85	1.375	7.50
57	395.92	1.400	7.64
58	402.99	1.425	7.78
59	410.06	1.450	7.92
60	417.13	1.475	8.06
61	424.20	1.500	8.20

Table 12: Completion of results

Parameters	1st loading cycle	2nd loading cycle
Load (T)	424.20	424.20
Normal stress (kg/ Mm ²)	1.500	1.500
Settlement of loading plate (mm)	8.20	8.20
Load (T)	424.20	424.20
Normal stress (kg/ Mm ²)	1.500	1.500
Settlement of loading plate (mm)	8.20	8.20

Parameters	1st loading cycle	2nd loading cycle
Load (T)	424.20	424.20
Normal stress (kg/ Mm ²)	1.500	1.500
Settlement of loading plate (mm)	8.20	8.20
Load (T)	424.20	424.20
Normal stress (kg/ Mm ²)	1.500	1.500
Settlement of loading plate (mm)	8.20	8.20



Kilo 23 Alexandria - Lake Desert Road - Merghem
Tel: 002 43 4304555 - 002 034701191
Email: cmi@comibassal.com
Website: www.comibassal.com



49 El Horria Ave. Alex, Egypt
Tel: 002 033920176 - 002 033931482
Fax: 002 033900476
Email: internal-inspection@comibassal.com



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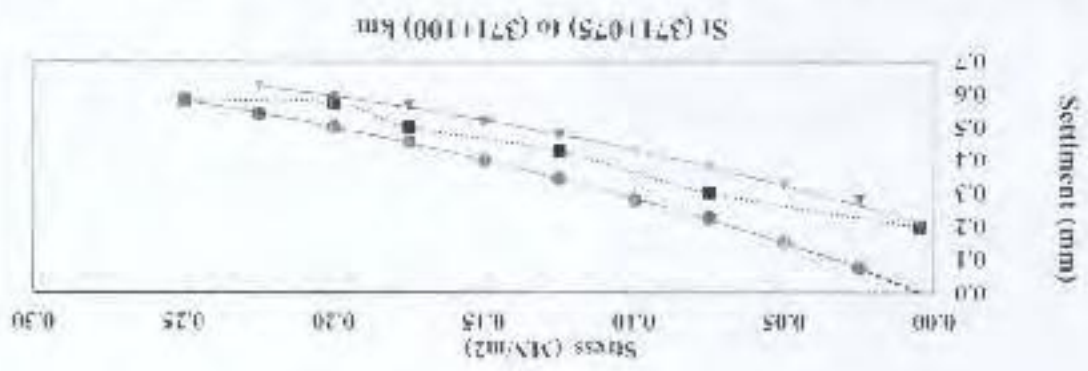


Fig. 4: Load-settlement curve, fitting curves according to Table 10 and Table 11 for the first and second loading cycles

● Measurement points from the first loading cycle
▲ Measurement points from the second loading cycle
S Settlement in mm
q₀ Normal stress kN/m²



SS-B-IN



Contractor		INSHAA GENERAL OF CONSTRUCTION		Designer Company		[Spectrum] Engineering Consulting Office	
Company		Company		Date/Serial Number		Time	
Issued by		Eng. Mahmoud shaban		20/06/2023		02:00 PM	
Contractor		Eng. Mahmoud shaban		20/06/2023		02:00 PM	
Received by		Eng. Mazen Essamy		20/06/2023		02:00 PM	
CONSULTANT		371		21		06 2023	

CODE 1	51 to 521	53 to 53	54 to 54	55 to 55
Station Reference	Report Reference	Work Activity	Sub Element of Activity	Code - 1

Description of Materials	Sub Ballast 2.	Location to be Used	St. (371+100) To (371+275)	MAA Approval No	MAA.8 (B.5.1)	Date	29/04/2023
Supplier Name							
Test Requirement	P.L.T (DIN 18134)	Specification	REPORT (G22-41.2) VERSION 2 BY OVERSEAS GROUP	Reference Photos	Yes / No	Other	Rev (U.R.S.B-(a)(g))
Item Description	PLATE LOAD TEST	Unit	NUMBER	Quantity	Arrival Date	Note	
	1			7	21/06/2023		
	2						
	3						
	4						

Comments by: Eng. Mazen Essamy (SPECTRUM)		Comments by: Eng. Alaa Abd-Allatif (ER)	
1-Plate Load Test was carried out by (Consultant) 2-Test report attached and acceptable with project specifications 3-Final approval is subject to above mentioned comments		APPROVAL STATUS Signature: [Signature] Date: 21-06-2023 Signature: [Signature] Date: 21-06-2023	

Organisation	Name	Sign	Date	Signature	Date
Contractor	Eng. Mahmoud shaban	[Signature]	21-06-2023	[Signature]	21-06-2023
QA/QC	Eng. Mazen Essamy	[Signature]		[Signature]	
GARR	Eng. Margaret magdy				
Employers Representative	Eng. Alaa Abd-Allatif	[Signature]	21-06-2023	[Signature]	21-06-2023



Technical report

of Plate Loading Test (DIN 18134)

General	:	SYSTRA
Consultant	:	SPECTRUM
Contractor	:	سكس (سكس) للهندسة والبناء
Project	:	ELECTRIC EXPRESS TRAIN
Sample	:	Sub-Ballast (2)
Station	:	ST(371+100) TO ST(371+275)
Date of Test	:	21/6/2023
QC	:	1459



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Introduction:

The Plate Load test is designed to determine the vertical deformation and strength characteristics of soil by assessing the force and amount of penetration with time when a rigid plate is made to penetrate the soil. The test to be carried out on the native soil according to German specifications DIN 18134.

Test methods :

- 1- The German standard DIN 18134 was applied to define the apparatus used, the loading system, test conditions, and procedure for plate load test.
- 2- Loading plates with a diameter of 600 mm have a thickness of 25mm and are provided with equally spaced stiffeners with even upper faces parallel to the plate bottom face to allow 300 mm plate to be placed on top of it.
- 3- The loading system consisted of a hydraulic pump connected to a hydraulic jack of 700 bar capacity, which is capable of applying and releasing the load stages.
- 4- The dial gauge used to measure the plate settlement has a resolution of 0.01mm and the lever ratio was equal to 1.
- 5- The temperature at the time of the test was 25.
- 6- The plate was carried out on a native soil (sand-gravel). The test surface area was levelled and the plate was bedded on this surface.
- 7- The hydraulic jack was placed on the middle of, and at normal to, the loading plate beneath the reaction loading system and secured against lifting.
- 8- The reaction loading system was a heavy multi-purpose excavator (more than 20 ton).

Description of experiment:

- 1- Loading, unloading and reloading regims were applied according to DIN 18134 for the plate load test to estimate the resilient modulus.
- 2- Prior to the test, the force transducer and dial gauge were set to zero, after which a load was applied corresponding to a stress of 0.01 MN/m².
- 3- In the first loading cycle, the load was increased until a normal stress of 0.25 MN/m² was reached, and the loading increment was 0.025 MN/m². The load was released in four stages.
- 4- Following unloading, a further second loading cycle was carried out, in which, the load was increased only to the penultimate stage of the first cycle.



Kilo 23 Alexandria - Cairo Desert Road - Merghem
Tel: 002 03 4704995 - 002 03470119
Email: cvid@comibassal.com
Website: www.comibassal.com

49 El Horria Ave. Alex, Egypt
Tel: 002 033920176 - 002 033931482
Fax: 002 033900476
Email: internal-inspection@comibassal.com



St (371+100) to St (371+125) km
600

Table 1: Measured values for first loading cycle and unloading cycle

Loading stage no.	Load (t)	Normal stress (kg/m ²)	Settlement of loading plate (mm)
0	1.414	0.005	0.00
1	7.07	0.075	0.07
2	14.14	0.050	0.17
3	21.21	0.075	0.17
4	28.28	0.100	0.27
5	35.35	0.125	0.28
6	42.42	0.150	0.34
7	49.49	0.175	0.40
8	56.56	0.200	0.46
9	63.63	0.225	0.52
10	70.7	0.250	0.58
11	77.77	0.275	0.65
12	84.84	0.300	0.67
13	91.91	0.325	0.68
14	98.98	0.350	0.71
15	106.05	0.375	0.75

Table 2: Measured values for second loading cycle

Loading stage no.	Load (t)	Normal stress (kg/m ²)	Settlement of loading plate (mm)
16	1.414	0.005	0.13
17	7.07	0.075	0.17
18	14.14	0.050	0.21
19	21.21	0.075	0.26
20	28.28	0.100	0.31
21	35.35	0.125	0.36
22	42.42	0.150	0.42
23	49.49	0.175	0.47
24	56.56	0.200	0.51
25	63.63	0.225	0.58

Table 3: Completion of results

Parameters	1st loading cycle	2nd loading cycle
$(m_{avg}) \text{ MN/m}^2$	0.290	0.290
$a_0 \text{ (mm)}$	0.016	0.011
$R_1 \text{ (mm/(MN/m}^2\text{))}$	0.917	1.975
$R_2 \text{ (mm/(MN/m}^2\text{))}$	1.415	0.871
$L_c \text{ (mm/(MN/m}^2\text{))}$	105.19	215.15
	1.09	



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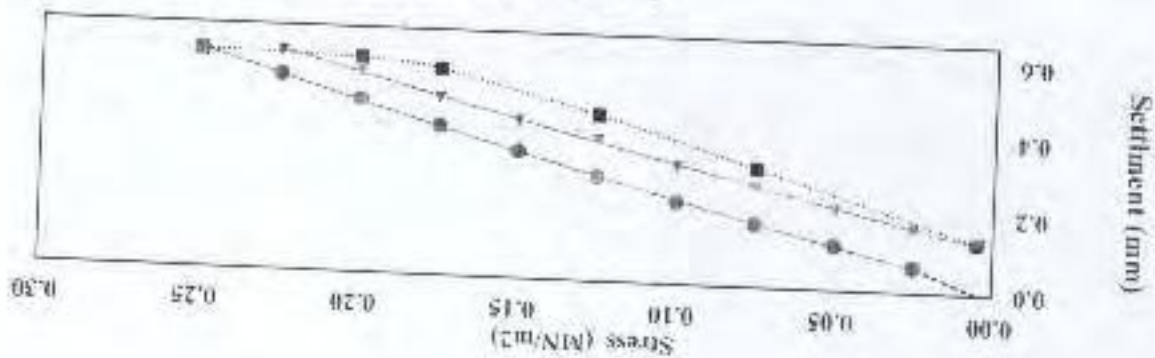
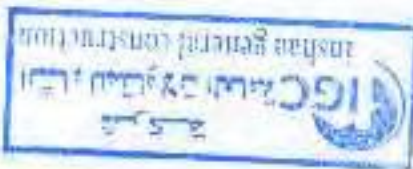


Fig. 1: Load-settlement curve, fitting curves according to Table 1 and Table 2 for the first and second loading cycles

● Measurement points from the first loading cycle
■ Measurement points from the second loading cycle
○ Settlement in mm
□ Normal stress MN/m²



49 El Horria Ave. Alex, Egypt
Tel: 002 033920176 - 002 033931482
Fax: 002 033900476
Email : info@comibassal.com

Kilo 23 Alexandria - Cairo Desert Road - Werghem
Tel: 002 03 4704595 - 012 034701191
Email : info@comibassal.com
Website : www.comibassal.com



St (371+125) to St (371+150) km

600

Table 4: Measured values for first loading cycle and unloading cycle

Loading stage no.	Load (F)	Normal stress (σ), (MPa)	Settlement of loading plate (s, mm)
0	1.11	0.005	0.00
1	1.07	0.025	0.02
2	14.14	0.050	0.12
3	21.21	0.075	0.16
4	28.28	0.100	0.21
5	35.35	0.125	0.27
6	42.42	0.150	0.33
7	49.49	0.175	0.38
8	56.56	0.200	0.44
9	63.63	0.225	0.48
10	70.7	0.250	0.50
11	77.77	0.275	0.57
12	84.84	0.300	0.56
13	91.91	0.325	0.54
14	98.98	0.350	0.43
15	1.04	0.005	0.11

Table 5: Measured values for second loading cycle

Loading stage no.	Load (F)	Normal stress (σ), (MPa)	Settlement of loading plate (s, mm)
15	1.44	0.006	0.11
16	7.07	0.025	0.16
17	14.14	0.050	0.21
18	21.21	0.075	0.26
19	28.28	0.100	0.31
20	35.35	0.125	0.37
21	42.42	0.150	0.43
22	49.49	0.175	0.48
23	56.56	0.200	0.51
24	63.63	0.225	0.57

Table 6: Comparison of results

Parameters	1st loading cycle	2nd loading cycle
(σ_{avg}) (MPa/m ²)	0.250	0.250
σ (mm)	0.034	0.034
μ (mm) (MPa/m ²)	1.566	1.577
λ (mm) (MPa/m ²)	2.344	0.211
E (MPa) (MPa/m ²)	208.93	207.27





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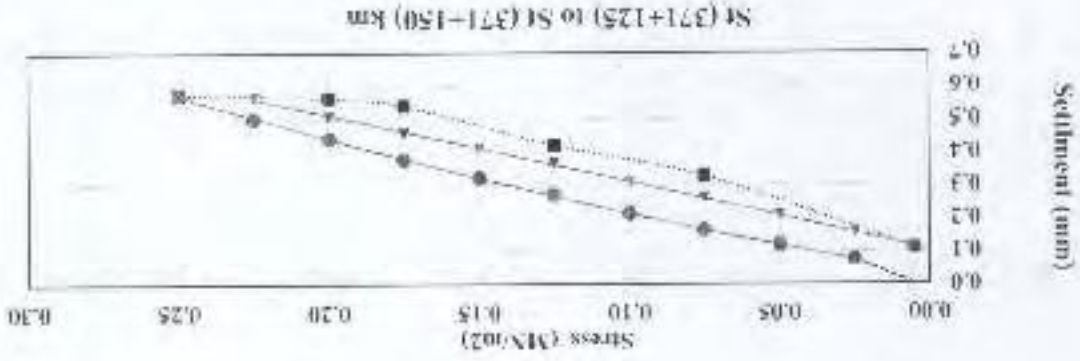


Fig. 2: Load-settlement curve, fitting curves according to Table 4 and Table 5 for the first and second loading cycles

● Measurement points from the first loading cycle
■ Measurement points from the unloading cycle
▲ Measurement points from the second loading cycle
5 Settlement in mm
 σ_v Normal stress kN/m²





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51 (371+150) to 51 (371+175) km

500

Table 7: Measured values for first loading cycle and unloading cycle

Loading stage no.	Load (F) kN	Normal stress (σ) MPa	Settlement of loading plate (mm)
0	1.114	0.005	0.00
1	7.07	0.025	0.05
2	14.14	0.050	0.10
3	21.21	0.075	0.16
4	28.28	0.100	0.21
5	35.35	0.125	0.27
6	42.42	0.150	0.34
7	49.49	0.175	0.40
8	56.56	0.200	0.46
9	63.63	0.225	0.54
10	70.7	0.250	0.61
11	77.7	0.275	0.68
12	84.84	0.300	0.76
13	91.91	0.325	0.84
14	98.98	0.350	0.92
15	106.05	0.375	1.00

Table 8: Measured values for second loading cycle

Loading stage no.	Load (F) kN	Normal stress (σ) MPa	Settlement of loading plate (mm)
15	1.114	0.005	0.10
16	7.07	0.025	0.14
17	14.14	0.050	0.15
18	21.21	0.075	0.24
19	28.28	0.100	0.28
20	35.35	0.125	0.35
21	42.42	0.150	0.41
22	49.49	0.175	0.46
23	56.56	0.200	0.55
24	63.63	0.225	0.58

Table 9: Completion of results

Parameters	Test loading cycle	2nd loading cycle
Load (F) kN	0.250	0.250
Normal stress (σ) MPa	0.001	0.001
Settlement (mm)	0.001	0.001
Load (F) kN	1.947	1.947
Normal stress (σ) MPa	0.001	0.001
Settlement (mm)	0.001	0.001
Load (F) kN	184.71	184.71
Normal stress (σ) MPa	0.001	0.001
Settlement (mm)	0.001	0.001



Kilo 33 Alexandria - Cairo Desert Road - Mersha
Tel: 03305 4704595 - 002 03470179
Email: cdivdep@combassal.com
Website: www.combassal.com

49 El Horria Ave, Alex, Egypt
Tel: 002 033920176 - 002 033931482
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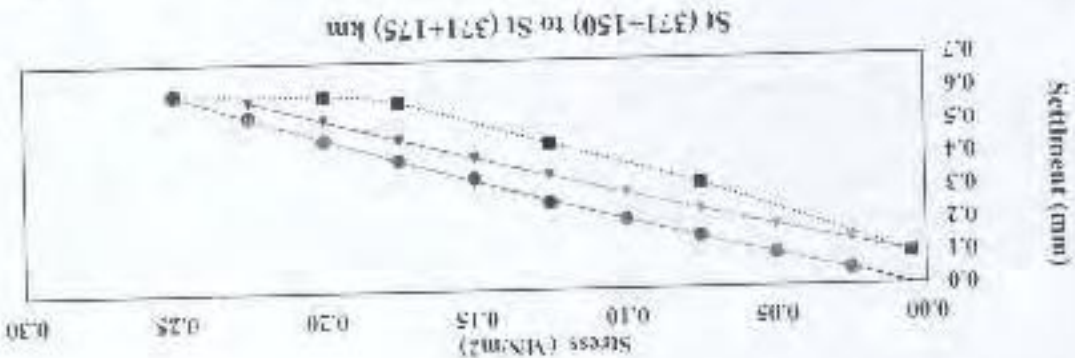


Fig. 3: Load-settlement curve, fitting curves according to Table 7 and Table 8 for the first and second loading cycles

■ Measurement points from the first loading cycle
 ▲ Measurement points from the unloading cycle
 △ Measurement points from the second loading cycle
 S Settlement in mm
 σ_1 Normal stress (kN/m²)



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St (371+175) to St (371+200) km

600

Table 10: Measured values for first loading cycle and reading cycle

Table 10. Measured values for first loading cycle and unloading cycle			
Settlement of loading plate (mm)	Load (t)	Nonlinear stress (kN / MN)	Unloading stage on:
			Settlement (mm)
0.00	1.414	0.005	0
0.08	1.07	0.025	1
0.14	1.411	0.050	2
0.19	2.121	0.075	3
0.24	1.828	0.100	4
0.29	0.125	0.125	5
0.34	0.150	0.150	6
0.40	0.172	0.172	7
0.46	0.200	0.200	8
0.51	0.224	0.224	9
0.57	0.250	0.250	10
0.62	0.275	0.275	11
0.67	0.300	0.300	12
0.72	0.325	0.325	13
0.77	0.350	0.350	14
0.82	0.375	0.375	15
0.87	0.400	0.400	16
0.92	0.425	0.425	17
0.97	0.450	0.450	18
1.02	0.475	0.475	19