

محضر استلام موقع

مشروع: أعمال الجسر الترابي للخط الأول للقطار الكهربائي السريع قطاع
(برج العرب - العامين) في المسافة من الكم 371+000 إلى الكم 371+500
بطول 0.5 كم

تنفيذ: شركة إنشاء للمقاولات العامة .
إشراف : المنطقة الخامسة – منطقة غرب الدلتا
طبقاً للعقد رقم (2024/2023/814) بتاريخ 2023/12/04
إنه في يوم الاربعاء الموافق 2023/12/5 اجتمع كل من:-

- 1- السيد المهندس/محمد حسني فياض مدير عام مشروعات - الهيئة العامة للطرق والكباري
- 2- السيدة المهندس/مارجريت مجدي زاهر الهيئة العامة للطرق والكباري
- 3- السيد المهندس/ محمود شعبان أحمد مدير مشروع- شركة إنشاء للمقاولات العامة

وذلك للمرور على مسار العملية المذكورة عاليه لاستلام الموقع :-
وقد تبين أن الموقع خالياً من العوائق الظاهرية ويسمح بالبدء في التنفيذ وبناء عليه يعتبر
تاريخ 2023/12/5 هو تاريخ استلام الموقع وبدء الأعمال بالعملية
واقفل المحضر على ذلك ووقع الحضور

التوقيعات

رئيس الإدارة المركزية

منطقة غرب الدلتا

الاسكندرية - مرسى مطروح

عميد . مهندس /

"هاني محمد محمود طه"

3- مرسى مطروح

2-

1-

محضر معاينة مسافة

أنه في يوم السبت 2023/12/2 وبحضور كلا من :-

- 1- م/ مارجریت مجدي الهيئة العامة للطرق والكباري
- 2- م/ عبدالعزیز مصطفى سيكترم للاستشارات الهندسية (مكتب د. عماد نبیل)
- 3- م/ محمود شعبان احمد شركة إنشاء للمقاولات العامة

تم النزول والمعاينة وطبقا للتعليمات الواردة بالمقايضة بمسافات نقل التوريد للسن

(prepared subgrade & sub ballast)

من الكسارة حتى محور مسار الطريق وجد أنه :-

يتم النقل السن من الكسارة إلى محور مسار القطار السريع (الحمام - العلمين) لقطاع شركة إنشاء للمقاولات العامة من 371+000 الى 371+500 مسافة قدرها :-

(83 كم)

التوقيعات :-

3- م/ محمود شعبان

2- م/ عبدالعزیز مصطفى

1- م/ مارجریت مجدي



شركة إنشاء للمقاولات العامة
ابن محمد محمود رضوان وشركة
ب. ت. ٢٦٠٠٠ ١٩٠٠٠ ٢٥٥٢٢١

التوقيع / م/ مارجریت مجدي
2023
12/2
التوقيع / م/ عبدالعزیز مصطفى
التوقيع / م/ محمود شعبان

مشروع : القطار السريع (السخنة - العلمين - مطروح)
المقايضة التقديرية لجنود الاعمال تنفيذ شركة: إنشاء للمقاولات العامة (1)
القطاع من الكم 371+000 الي الكم 371+500 بطول 500 م

رقم البند	بيان الأعمال	الوحدة	الكمية	سعر الوحدة	الإجمالي
4-2	بالتر المكعب أعمال توريد وفرش طبقة أساس من الاحجار الصلبة المترجعة ناتج تكسير الكسارات والمطابقة للمواصفات والمقياس حجم التحديدات ما بين 31.5 سم الي 40 سم والا يزيد نسبة العار من منخل 200 عن 95 وفترج الورق بالاشتراطات الخاصة بالمشروع لا تقل نسبة تحمل كايكورتيا عن 88% ولا يقل معامل المرونة (E) من تعريه لوح التحميل عن 120 ميجاباسكال والا يزيد نسبة الفقد بجهاز لوس الجيوس عن 30% والا يزيد الانحساس عن 15% ويتم فردها على طبقتين باستخدام آلات التسوية الحديثة على ان لا يزيد سمك الطبقة بعد تمام الدمك عن 20 سم وريشها بالدمك الاصولية الوصول الي نسبة الرطوبة المطلوبة والدمك الجيد والهرسات للوصول الي المقياس كتلة جافة (لا تقل عن 100%) من الكثافة المصممة والفلة تشمل اجراء التجارب المصممة والحقلية ويتم تنفيذ طبقة لاسول الصنعة والرسومات التنفيذية المعتمدة والمند بجمع مشتتاته طبقا للمواصفات الفنية للمشروع وتقرير الاستشاري وتعليمات المهندس المشرف. - مسافة النقل لا تقل 20 كم . - يتم احساب علاوة 1.2 جنيه لكل 1 كم زائدا او نقصان . - السعر يشمل قبة اليوم المعجيرة طبقا لاولا المنطقة بهذا القطاع رقم (5) من الكم 325 الي الكم 392.5	م ³	2,975.16	298.00	886,597.08
	علاوة مسافة النقل 83 كم ($1.2 \times 63 = 75.6$)	م ³	2,975.16	75.60	224,921.94
	علاوة تحميل رسوم الكرتة والموازين طبقا للاتحة الشركة الوطنية	م ³	2,975.16	25.00	74,378.95
	الاجمالي				3,142,218

شركة إنشاء للمقاولات العامة
أ.م.م. محمد محمود رضوان وشركاه
ب.ض. : ٥١٩/٠٢٦/٠٠٤ س.ت : ٢٥٥٧٢٢

شركة إنشاء للمقاولات العامة
أ.م.م. محمد محمود رضوان وشركاه
ب.ض. : ٥١٩/٠٢٦/٠٠٤ س.ت : ٢٥٥٧٢٢



MATERIAL APPROVAL REQUEST

Inshaa

S5-B-IN

Contractor Company	INSHAA GENERAL OF CONSTRUCTION Company		Designer Company	(SPECTRUM) Engineering Consulting Office								
Issued by Contractor	Name Eng. Mahmoud shaban	Sign 	Date/Serial Number 30-03-2023 (M.A.R.) (f.1)	Time 1:30								
Received by GARB CONSULTANT	Eng. Mazen Essamy		MAR	<table border="1"> <tr> <td>371</td> <td>EW</td> <td>CS</td> <td>11</td> <td>MM</td> <td>YY</td> <td>HH</td> <td>MM</td> </tr> </table>	371	EW	CS	11	MM	YY	HH	MM
371	EW	CS	11	MM	YY	HH	MM					

CODE-1	51 to 521 Station Reference	D1 to S3 Depot Reference	Kp XXX Note For Kilometer point only Start Km is used
CODE-2		Work Activity	
CODE-3		Sub Element of Activity	

Description of Materials	Fill Layer Total Quantity (5000 m3) Upper Embankment		
Location to be Used	From Station (371+000) to Station (371+500)		
Sample only	Yes	Materials Type	Fill layers
Supplier Name		Data Sheet provided	Yes attached INSHAA GENERAL OF CONSTRUCTION Company contracting ASTM D (1557)
Reference in BoQ		Specification	EARTHWORK SPECIFICATIONS & TESTING REPORT (CG21-41.2) VERSION 2 BY CIVECON GROUP
Prequalification reference		Test Samples Results	
Reference Photos	No/Yes	Other	
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.		1- All tests are in accordance with project specifications. 2-Results report attached and acceptable with the project specifications. 3-Final approval is subject to above mentioned comments.	
			
← wait for chemical analysis Result Done 8-6-2023			

Organisation	Name	Sign	Date	APPROVAL STATUS
Contractor	Eng. Mahmoud shaban		31-03-2023	A AWC-R
QA/QC *	Eng. Mazen Essamy			A
GARB**	Eng. Mohammed Fayad			A
Employers Representative	Eng. Alaa Abd-Allatif		8-4-2023	Awc

* Designer
** Alignment/Bridges/Culvert only



COMIBASSAL International Controllers

Internal inspection and laboratories sector

Accredited by : Egypt General Authority for Petroleum under No. 34/29-11-2011
Accredited by : Egypt Accreditation council (EGAC) under No. 031706/1A

I- Introduction

General Consultant :	SYSTRA
Consultant :	SPECTRUM
Contractor :	شركة انشاء للمقاولات
Sample :	FERMA
Station :	St(371+000) to St(371+500)
Date of Test :	31/03/2023
QC :	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)	MDD	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



Kilo 23 Alexandria - Cairo Desert Road - Merghem

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WebSite : www.comibassal.com



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Tel: 002 033920176 - 002 033931482

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Email : internal-inspection@comibassal.com



COMIBASSAL International Controllers

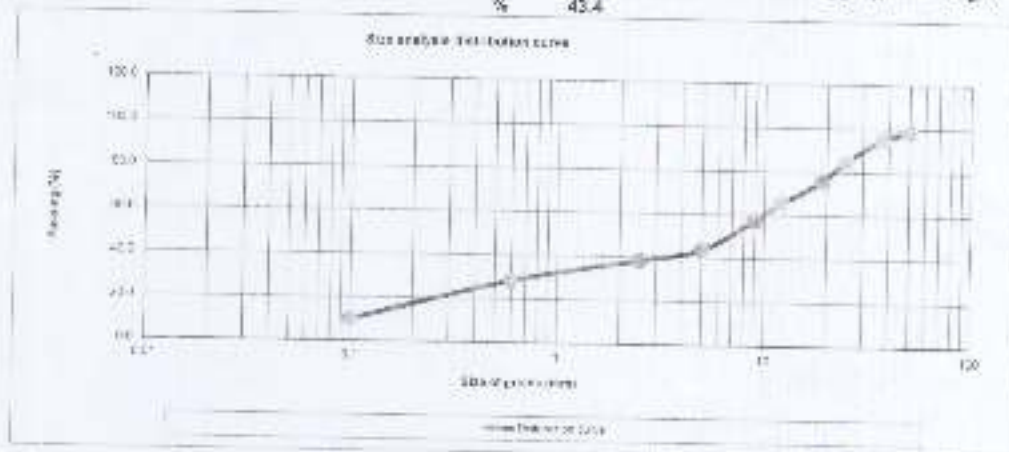
Internal inspection and laboratories sector

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Accredited by : Egypt Accreditation council (EGAC) under No. 031708/1A

PARTICLE SIZE DISTRIBUTION ANALYSIS ASTM C-136 / AASHTO T27

	WEIGHT RETAINED	CUMULATIVE WEIGHT RETAINED (gm)	CUMULATIVE PERCENTAGE RETAINED (%)	CUMULATIVE PERCENTAGE PASSING (%)	STANDARD SPECIFICATION LIMITS
2	158.00	158.00	1.58	98.4	
1.175	358.00	516.00	5.16	94.8	
1	965.00	1481.00	14.81	85.2	
3/4	957.00	2438.00	24.38	75.6	
1/2	1050.00	3488.00	34.88	65.1	
3/8	785.00	4273.00	42.73	57.3	
No. 4	1387.00	5660.00	56.60	43.4	
No. 10	60.00	60.00	12.00	38.2	
No. 40	174.00	174.00	34.80	28.3	
No. 200	387.00	387.00	77.40	9.8	

Total sample weight = 10000.00 pass No. 4 = 4340.0 Total fine aggregates weight = 5660.0
% 43.4



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



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Internal inspection and laboratories sector

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Accredited by : Egypt Accreditation council (EGAC) under No. 031706/LA

Modified Proctor Test Report ASTM - D 1557

Mould Number :- 1
Volume of mould = 2120 cm³
Weight of mould = 5657 g
G.S = 2.6 g/cm³

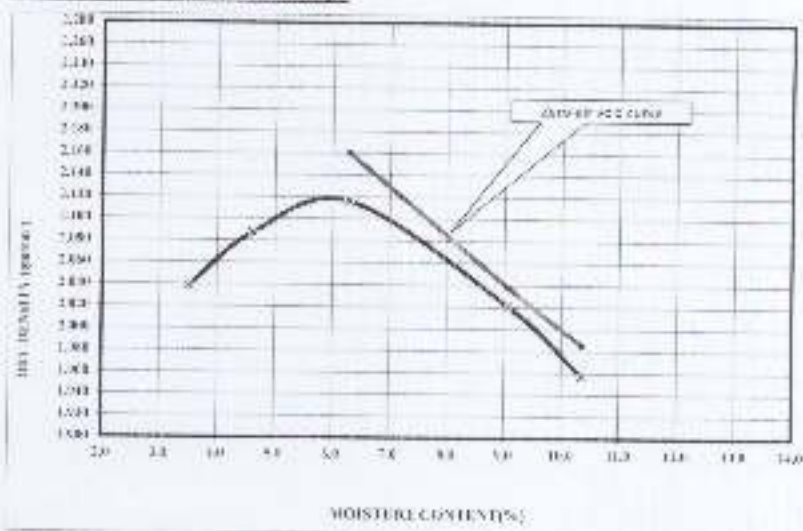
A- Density Calculations :-

	1	2	3	4	5
Weight of wet soil+mould (g)	10130	10285	10425	10330	10236
Weight of mould (g)	5657	5657	5657	5657	5657
Weight of wet soil (g)	4473	4628	4768	4673	4579
Volume of mould (cm ³)	2120	2120	2120	2120	2120
Wet density (g/cm ³)	2.110	2.183	2.249	2.204	2.160
Dry density (g/cm ³)	2.038	2.087	2.116	2.021	1.957
Zero-air Void curve			2.160	2.038	1.986

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)	244.3	242.5	240.0	236.2	234.9
Weight of container (g)	82.0	80.0	81.0	84.0	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 = 6.3 %





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Internal inspection and laboratories sector

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Accredited by : Egypt Accreditation council (EGAC) under No. 031706/1A

Report	:	541 - 1 - Center
Date	:	08/06/2023

CHEMICAL ANALYSIS

General Consultant	:	SYSTRA
Consultant	:	SPECTRUM
Contractor	:	شركة انشاء للمقاولات
Project	:	Electric express train
Sample	:	FERMA
Station	:	ST (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




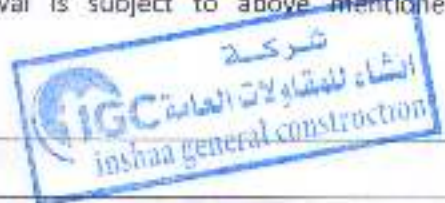
LAB DIRECTOR
CH/ Mostafa Asker
Per Amany Amin



MATERIAL APPROVAL REQUEST	Inshaa		الهيئة العامة للمشروعات والبنية التحتية EGPC	الهيئة العامة للمشروعات والبنية التحتية EGPC	الهيئة العامة للمشروعات والبنية التحتية EGPC

Contractor Company	INSHAA GENERAL OF CONSTRUCTION Company		Designer Company	(SPECTRUM) Engineering Consulting Office																
Issued by Contractor	Name Eng. Mohamed Hassan	Sign 	Date/Serial Number 07-04-2023 (M.A.R.) Rev (P.S.G.1)	Time 1:30																
Received by GARB CONSULTANT	Eng. Mazen Essamy		MAR	<table border="1"> <tr> <td>C1</td> <td>C2</td> <td>C3</td> <td>DD</td> <td>MM</td> <td>YY</td> <td>HH</td> <td>MM</td> </tr> <tr> <td>371</td> <td>EW</td> <td>CS</td> <td>08</td> <td>04</td> <td>23</td> <td>01</td> <td>30</td> </tr> </table>	C1	C2	C3	DD	MM	YY	HH	MM	371	EW	CS	08	04	23	01	30
C1	C2	C3	DD	MM	YY	HH	MM													
371	EW	CS	08	04	23	01	30													

CODE-1	S1 to S21 Station Reference	D1 to S3 Depot Reference	Kp XXX Note For Kilometer point only Start Km is used
CODE-2	Work Activity		
CODE-3	Sub Element of 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
Supplier Name		Data Sheet provided	Yes attached INSHAA GENERAL OF CONSTRUCTION Company contracting ASTM D (1557)
Reference in BoQ	(4-1)	Specification	EARTHWORK SPECIFICATIONS & TESTING REPORT (CG21-41.2) VERSION 2 BY CIVECON GROUP
Prequalification reference		Test Samples Results	
Reference Photos	No/Yes	Other	
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. 		1- All tests were carried-out by third Party lab (comibassal international) 2-Results report attached and acceptable with the project specifications. 3-Final approval is subject to above mentioned comments. 	

APPROVAL STATUS				
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/Bridges: Culverts only



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I- Introduction

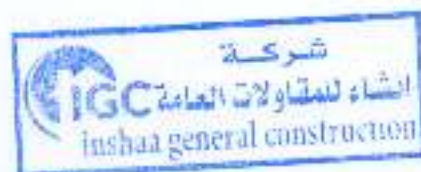
General Consultant :	SYSTRA
Consultant :	SPECTRUM
Contractor :	شركة انشاء للمقاولات
Sample :	Prepare Sub-Grade
Station :	St(371+000) to st(371+500)
Date of Test :	08/04/2023
QC :	883-3

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%
6- Los Angeles test	Abrasion ratio	27.2%

LAB DIRECTOR

Eng / Eman kandil



Geotechnical consultant

For. Dr. M.
Dr. Mohamed Mostafa Badry





COMIBASSAL International Controllers Internal inspection and laboratories sector

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APPENDIX





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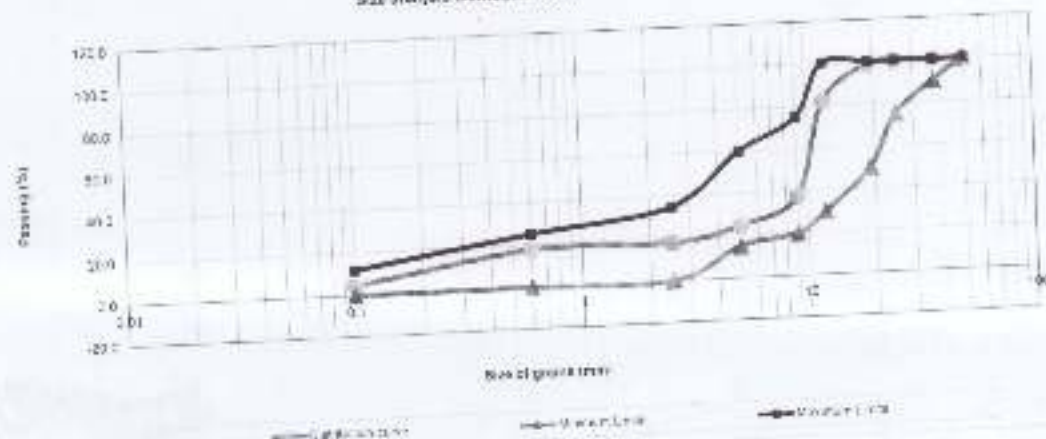
PARTICLE SIZE DISTRIBUTION ANALYSIS ASTM C-136 / AASHTO T27

	WEIGHT RETAINED	CUMULATIVE WEIGHT RETAINED (gm)	CUMULATIVE PERCENTAGE RETAINED (%)	CUMULATIVE PERCENTAGE PASSING (%)	STANDARD SPECIFICATION LIMITS	
	(gm)				100	100
5	0.00	0.00	0.00	100.0	60	100
4	0.00	0.00	0.00	100.0	75	100
3	0.00	0.00	0.00	100.0	80	100
1.5	150.00	150.00	1.54	98.5	20	75
3/4	4355.00	6083.00	62.45	37.5	15	50
3/8	1255.00	7338.00	75.34	24.7	5	35
No.10	138.00	138.00	27.60	17.9	0	12
No.200	405.00	405.00	81.00	4.7		

Total sample weight = 9740.00

pass No.30 = 3980.0 Total fine aggregates weight = 500 gm
% 40.9

Size analysis distribution curve



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



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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

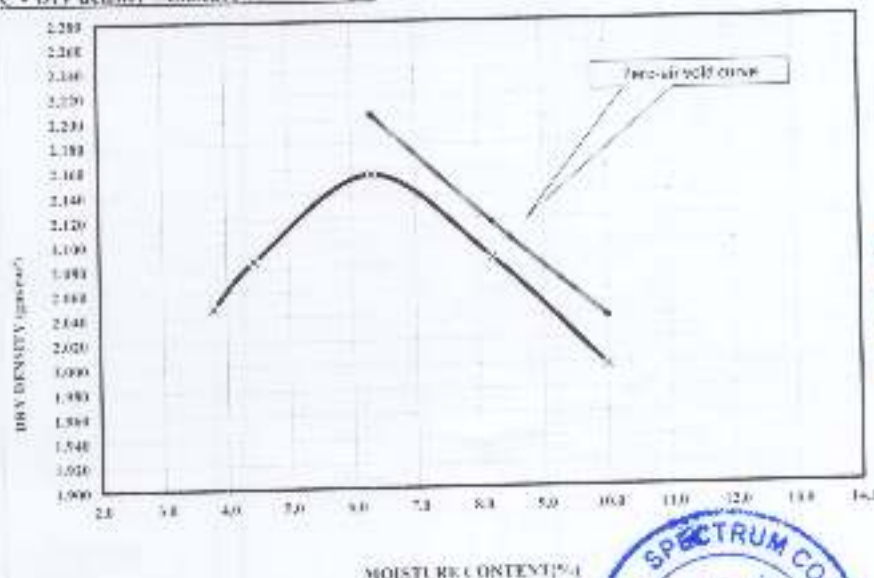
A- Density Calculations :-

	1	2	3	4	5
Weight of wet soil+mould (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 Void 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:-



M.D.D= 2.155 g/cm³
O.M.C= 6.30 %

شركة
IGC
إتشاء للمقاولات العامة
inshaa general construction





COMIBASSAL International Controllers

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Accredited by : Egypton Accreditation council (EGAC) under No. 031706/1A

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 spicific gravity = $B / (B-C)$	2.569
Bulk spicific gravity = $A / (B-C)$	2.538
Apparent spicific gravity = $A / (A-C)$	2.618
Asorbtion of water = $(B-A)/A*100$	1.2
Degradation of aggregate = $(2500-A)/ A*100$	0.2





COMIBASSAL International Controllers

Internal inspection and laboratories sector

Accredited by : Egyptian General Authority for Petroleum under No. 34/28-11-2011
Accredited by : Egyptian Accreditation council (EGAC) under No. 031706/1A

ABRASION AND IMPACT " LOS ANGELES " TEST

(For coarse aggregate)

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

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





COMIBASSAL International Controllers

Internal inspection and laboratories sector

Accredited by : Egyptian General Authority for Petroleum under No. 34/29-11-2011
Accredited by : Egyptian Accreditation council (EGAC) under No. 031706/1A

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

CHEMICAL ANALYSIS

General Consultant	:	SYSTRA
Consultant	:	SPECTRUM
Contractor	:	شركة انشاء للمقاولات
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

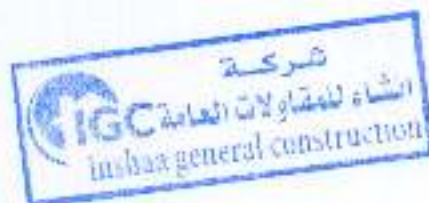
Humidity : 40%

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



LAB DIRECTOR
CH/ Mostafa Asker

Mostafa Asker

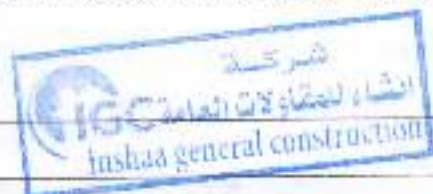


MATERIAL APPROVAL REQUEST	  	

Contractor Company	INSHAA GENERAL OF CONSTRUCTION Company		Designer Company	(SPECTRUM) Engineering Consulting Office																
Issued by Contractor	Name	Sign	Date/Serial Number	Time																
	Eng. Mahmoud shaban		28-04-2023 (M.A.R.) Rev (B.S.1)	1:30																
Received by GARD CONSULTANT	Eng. Mazen Essamy		MAR	<table border="1"> <tr> <td>6</td> <td>C2</td> <td>C3</td> <td>DD</td> <td>MM</td> <td>YY</td> <td>HH</td> <td>MM</td> </tr> <tr> <td>371</td> <td>ENV</td> <td>CS</td> <td>28</td> <td>04</td> <td>23</td> <td>01</td> <td>30</td> </tr> </table>	6	C2	C3	DD	MM	YY	HH	MM	371	ENV	CS	28	04	23	01	30
6	C2	C3	DD	MM	YY	HH	MM													
371	ENV	CS	28	04	23	01	30													

CODE - 1	S1 to S21 Station Reference	D1 to D3 Depot Reference	Kp XXX Note For Kilometer point only Start Km is used
CODE - 2	Work Activity		
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)
Reference in BoQ	(1, 2)	Specification	EARTHWORK SPECIFICATIONS & TESTING REPORT (CE21-41.2) VERSION 2 BY CIVECON GROUP
Prequalification reference		Test Samples Results	
Reference Photos	No/Yes	Other	
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.		1- All tests were carried out by third Party Lab (combassal international) 2- Results report attached and acceptable with the project specifications. 3- Final approval is subject to above mentioned comments.	



APPROVAL STATUS

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

* Designer

** Alignment/Bridges: Culvert only



COMIBASSAL International Controllers

Internal inspection and laboratories sector

Accredited by : Egypt General Authority for Petroleum under No. 34/29-11-2011
Accredited by : Egypt Accreditation council (EGAC) under No. 031708/1A

I- Introduction

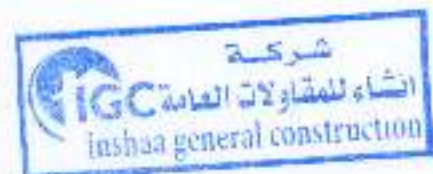
General Consultant :	SYSTRA
Consultant :	SPECTRUM
Contractor :	شركة إنشاء للمقاولات
Sample :	Sub-Ballast
Station :	St(371+0.00) to st(371+500)
Date of Test :	29/04/2023
QC :	1034-1

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
	Classification	A-1-a
2- Modified compaction (Proctor test)	MDD	2.184
	OMC	7.5%
3- Liquid limit, plastic limit and plasticity index	LL	Non plastic
	PL	Non plastic
	PI	Non plastic
4- California bearing ratio (CBR)	CBR ratio	95%
5- Specific gravity (SG), absorption and degradation	S S D	2.579
	Absorption	1.3%
	Degradation	0.2%
6- Los Angeles test	Abrasion ratio	30%

LAB DIRECTOR

Eng / Eman kandil

Eman



Geotechnical consultant

For: Dr. M.

Dr. Mohamed Mostafa Badry





COMIBASSAL International Controllers

Internal inspection and laboratories sector

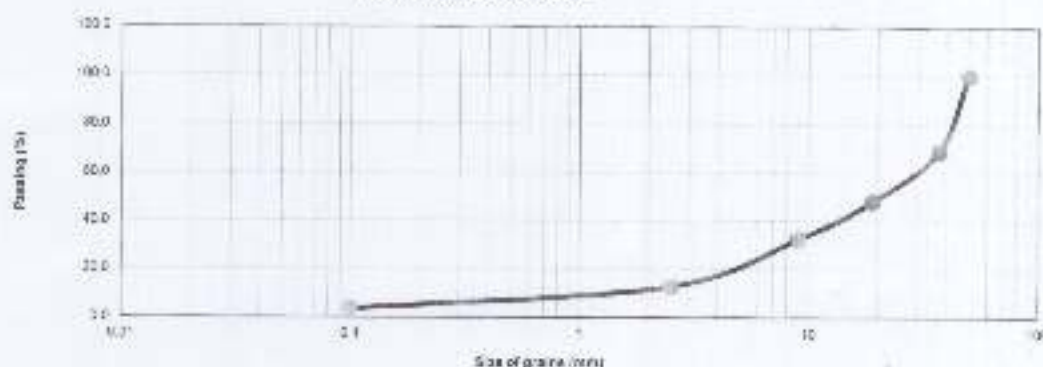
Accredited by : Egypt General Authority for Petroleum under No. 34/29-11-2011
Accredited by : Egypt Accreditation council (EGAC) under No. 031706/1A

PARTICLE SIZE DISTRIBUTION ANALYSIS ASTM C-136 / AASHTO T27

	WEIGHT RETAINED	CUMULATIVE WEIGHT RETAINED (gm)	CUMULATIVE PERCENTAGE RETAINED (%)	CUMULATIVE PERCENTAGE PASSING (%)	STANDARD SPECIFICATION LIMITS
	(gm)				
2	0.00	0.00	0.00	100.0	
11/2	3103.00	3103.00	31.03	69.0	
1	1851.00	4954.00	49.54	50.5	
3/4	235.00	5189.00	51.89	48.1	
1/2	855.00	6044.00	60.44	39.6	
3/8	714.00	6758.00	67.58	32.4	
No.4	1110.00	7868.00	78.68	21.3	
No.10	200.00	200.00	40.00	12.8	
No.200	418.00	418.00	83.60	3.5	

total sample weight= 10000.00 pass No.4= 2132.0 Total fine aggregates weight = 500 gm
pass% 21.3

See analysis distribution curve



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



Kilo 23 Alexandria - Cairo Desert Road - Merghem
Tel: 002 03 4704595 - 002 034701191
Email: civdept@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



COMIBASSAL International Controllers

Internal inspection and laboratories sector

Accredited by : Egypt General Authority for Petroleum under No. 34/29-11-2011
Accredited by : Egypt Accreditation council (EGAC) under No. 031706/1A

Modified Proctor Test Report

ASTM - D 1557

Mould Number :- 3
Volume of mould = 2199 cm³
Weight of mould = 7046 g
G.S = 2.7 g/cm³

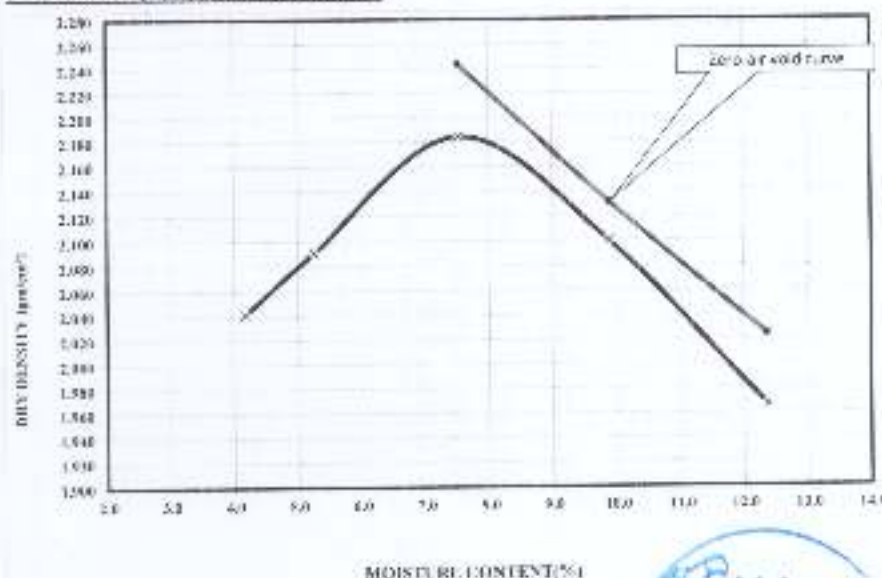
A- Density Calculations :-

	1	2	3	4	5
Weight of wet soil + mould (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

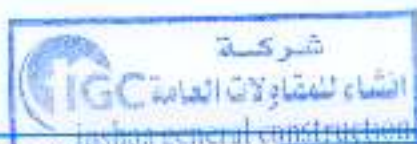
B- Moisture Calculations :-

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 %



Kilo 23 Alexandria - Cairo Desert Road - Mersha

Tel: 002 03 4704595 - 002 034701191

Email: civdept@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



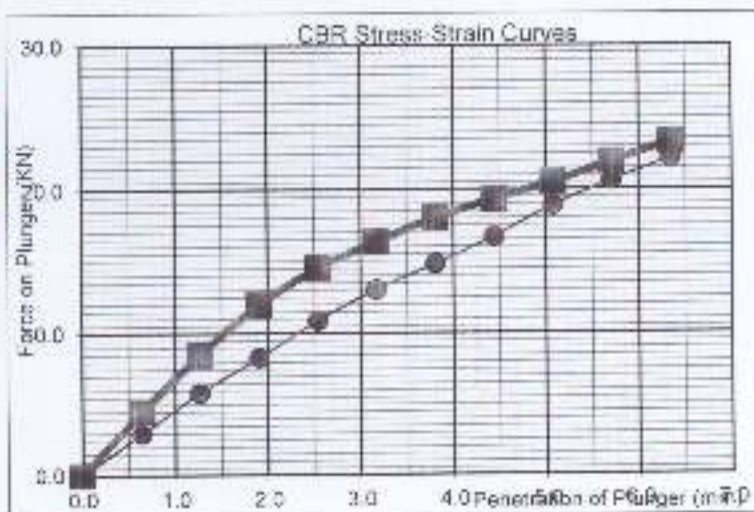
COMIBASSAL International Controllers

Internal inspection and laboratories sector

Accredited by : Egypt General Authority for Petroleum under No. 34/29-11-2011
Accredited by : Egypt Accreditation council (EGAC) under No. 031706/1A

Report Of CBR Test - ASTM - D 1883

NO OF BLOWS	56				Swell %		
MOULD NO	1				56		
WT OF MOULD+SOIL	12150			Start	0.00		
WT OF MOULD	7047			End	0.00		
WT OF SOIL	5103			Swell	0.00		
VOLUME OF MOULD	2190						
WET DENSITY	2.330						
	MC before soaking		Weight of Rammer		4.54Kg		
TIN NO	1			MDD	Kg/m ³	2.184	
WT OF WET SOIL+TIN	250.00			OMC	%	7.5	
WT OF DRY SOIL+TIN	240						
WT OF WATER	10.00						
WT OF TIN	52			PROVING RING			
WT OF DRY SOIL	148	2.120		D _w /KN			
MOISTURE CONTENT	5.8						
DRY DENSITY	2.183			Capacity (KN)	50		
Pen in mm	56		Bearing (KN)		CBR		
	56		56		standar	56	
0.30	0		FALSE		0.0		
0.54	302		3.0		4.5		
1.27	595		5.8		8.5		
1.91	850		8.3		12.0		
2.54	1110		10.9		14.5	82	
3.17	1330		13.0		16.3		
3.81	1510		14.8		18.0		
4.45	1700		16.7		19.3		
5.08	1925		18.8		20.5	95	
5.71	2100		20.6		21.9		
6.35	2260		22.2		23.3		





COMIBASSAL International Controllers Internal inspection and laboratories sector

Accredited by : Egypt General Authority for Petroleum under No. 34/29-11-2011
Accredited by : Egypt Accreditation council (EGAC) under No. D31706/1A

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





COMIBASSAL International Controllers

Internal inspection and laboratories sector

Accredited by : Egypton General Authority for Petroleum under No. 34/29-11-2011
Accredited by : Egypton Accreditation council (EGAC) under No. 031706/1A

ABRASION AND IMPACT " LOS ANGELES " TEST

(For coarse aggregate)

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

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





COMIBASSAL International Controllers

Internal inspection and laboratories sector

Accredited by : Egypt General Authority for Petroleum under No. 34/29-11-2011
Accredited by : Egypt Accreditation council (EGAC) under No. 031706/1A

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

CHEMICAL ANALYSIS

General Consultant	:	SYSTRA
Consultant	:	SPECTRUM
Contractor	:	شركة انشاء للمقاولات
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%	
ORGANIG MATTER	NEGATIVE	



LAB DIRECTOR
CH/ Mostafa Asker

Mostafa



**MATERIAL
INSPECTION
REQUEST**


Contractor Company	INSHAA GENERAL OF CONSTRUCTION Company		Designer Company	(SPECTRUM) Engineering Consulting Office								
Issued by Contractor	Name Eng. Mahmoud shaban	Sign 	Date/ Serial Number 09/04/2023 (P.L.T.1)	Time 01:00 PM								
Received by GARB CONSULTANT	Eng. Mazen Essamy		PLT	<table border="1"> <tr> <td>371</td> <td>1W</td> <td>CS</td> <td>10</td> <td>04</td> <td>2023</td> <td>2</td> <td>00</td> </tr> </table>	371	1W	CS	10	04	2023	2	00
371	1W	CS	10	04	2023	2	00					

CODE-1	S1 to S21 Station Reference	D1 to S3 Depot Reference	Kp XXX Note For Kilometer point only Start Km is used
CODE-2	Work Activity		
CODE-3	Sub Element of Activity		

Description of Materials	Prepared subgrade level 2				
Location to be Used	St. (371+350) To (373+500)				
MAR Approval No	M.A.R (P.S.G 1)	Date	08/04/2023		
Supplier Name					
Test Requirement	P.L.T (DIN 18134)	Specification	EARTHWORK SPECIFICATIONS & TESTING REPORT (CG21-41.2) VERSION 2 BY OVECON GROUP		
Reference Photos	Yes / No	Other	Ref UIR-P.S.G (2)		
Item	Description	Unit	Quantity	Arrival Date	Note
1	PLATE LOAD TEST	NUMBER	6	10/04/2023	
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 Approved


 1-Plate Load Test was carried- out by (F-just)
 2-Results report attached and acceptable with project specifications.
 3-Final approval is subject to above mentioned comments.

APPROVAL STATUS

Organisation	Name	Sign	Date	A-AWC-R
Contractor	Eng. Mahmoud shaban		10-04-2023	A
QA/QC *	Eng. Mazen Essamy			A
GARB**	Eng. Margret magdy			
Employers Representative	Eng. Alaa Abd-Allatif		10-4-2023	AWC

* Designer

** Alignment / Bridges: Culvert Only



Technical Report

Plate Loading Tests

KM 371+475, KM 371+450,
KM 371+425, KM 371+400,
KM 371+375, and KM 371+350

Project

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

Prepared for
Inshaa General Construction

Mobilka CC - Abu Youssef, Alexandria, Egypt

(April 10, 2023)

بمقتضى
أمر من
لواء مرقن / أسامة لستبر

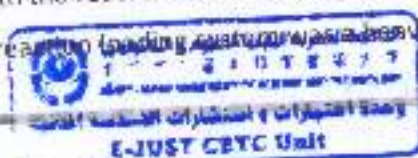
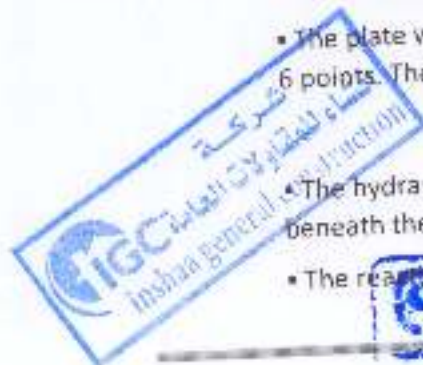


1. Introduction

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 Mamdouh) 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 $19 \pm 1^\circ\text{C}$.
- 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 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. 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)

Loading stage	Load (F)	Normal	Settlement
	kN	MN/m ²	mm
0	1.414	0.005	0.00
1	7.07	0.025	0.28
2	14.14	0.050	0.34
3	21.21	0.075	0.45
4	28.28	0.100	0.55
5	35.35	0.125	0.64
6	42.42	0.150	0.73
7	49.49	0.175	0.83
8	56.56	0.200	0.92
9	63.63	0.225	1.02
10	70.7	0.250	1.07
11	56.56	0.200	1.07
12	49.49	0.175	1.08
13	35.35	0.125	1.09
14	21.21	0.075	0.95
15	1.414	0.005	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)

Loading stage	Load (F) kN	Normal stress (s_0) MN/m ²	Settlement (S) mm
0	1.414	0.005	0.15
1	7.07	0.025	0.38
2	14.14	0.050	0.46
3	21.21	0.075	0.55
4	28.28	0.100	0.65
5	35.35	0.125	0.76
6	42.42	0.150	0.83
7	49.49	0.175	0.89
8	56.56	0.200	0.94
9	63.63	0.225	1.00

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	1st loading cycle	2nd loading cycle
($s_{0, \max}$) MN/m ²	0.25	0.25
s_0 (mm)	0.16	0.17
a_1 (mm/(MN/m ²))	3.96	5.96
a_2 (mm/(MN ² /m ⁴))	-1.03	-10.43
$E_v = 1.5 \cdot (a_1 + a_2 \cdot s_0 \cdot w_{\max})$	121.65	134.10
E_{v2}/E_{v1}	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)

Loading stage	Load (F)	Normal stress (s_v)	Settlement (S)
	kN	MN/m ²	mm
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:
(KM 371+350)

Parameters	1st loading cycle	2nd loading cycle
$[s_v]_{max}$ (MN/m ²)	0.25	0.25
a_2 (mm)	0.09	0.24
a_1 (mm/(MN/m ²))	3.11	5.31
a_2 (mm/(MN/m ²))	-0.55	-10.77
$E_v = 1.5 r / (a_1 + a_2 \cdot s_v, MN)$	151.18	171.72
E_{v2}/E_{v1}	1.14	

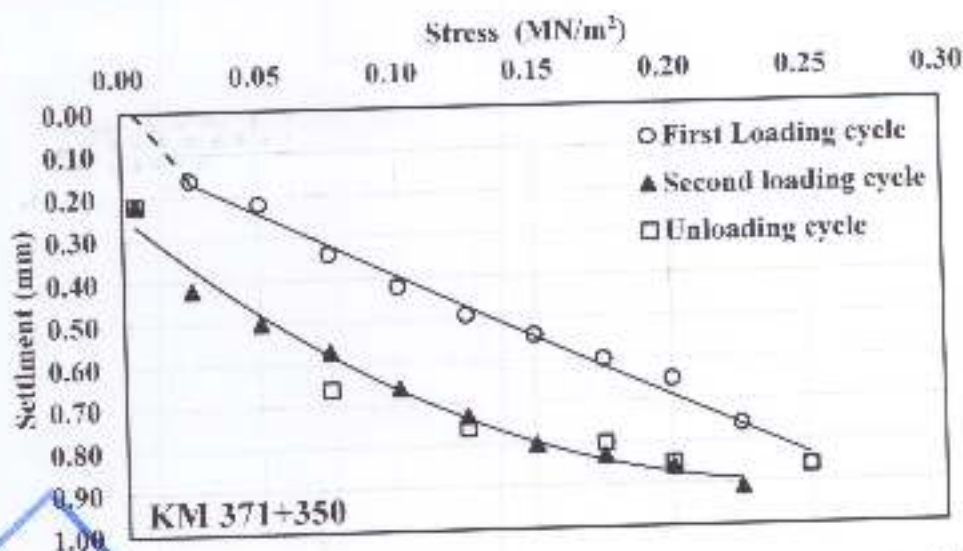


Figure 6: Load-settlement data: plate loading test performed at (KM 371+350)

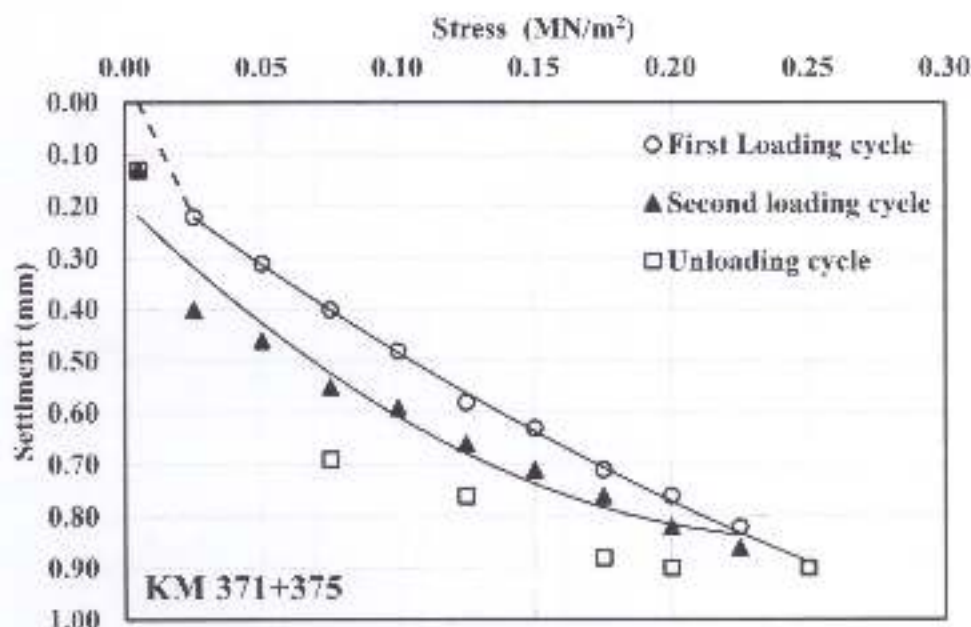


Figure 5: Load-settlement data: plate loading test performed at (KM 371+375)

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

Loading stage	Load (F) kN	Normal stress (s_0) 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	56.56	0.200	0.85
12	49.49	0.175	0.80
13	35.35	0.125	0.76
14	21.21	0.075	0.66
15	1.414	0.005	0.22



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)

Loading stage	Load (F)	Normal stress (s_0)	Settlement (S)
	kN	MN/m ²	mm
0	1.414	0.005	0.00
1	7.07	0.025	0.22
2	14.14	0.050	0.31
3	21.21	0.075	0.40
4	28.28	0.100	0.48
5	35.35	0.125	0.58
6	42.42	0.150	0.63
7	49.49	0.175	0.71
8	56.56	0.200	0.76
9	63.63	0.225	0.82
10	70.7	0.250	0.90
11	56.56	0.200	0.90
12	49.49	0.175	0.88
13	35.35	0.125	0.76
14	21.21	0.075	0.69
15	1.414	0.005	0.13

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)

Loading stage	Load (F)	Normal stress (s_0)	Settlement (S)
	kN	MN/m ²	mm
0	1.414	0.005	0.13
1	7.07	0.025	0.40
2	14.14	0.050	0.46
3	21.21	0.075	0.55
4	28.28	0.100	0.59
5	35.35	0.125	0.66
6	42.42	0.150	0.71
7	49.49	0.175	0.76
8	56.56	0.200	0.82
9	63.63	0.225	0.86

Table 15: Calculations of the resilient modulus of the tested soil according to DIN18134: (KM 371+375)

Parameters	1st loading cycle	2nd loading cycle
(s_{max}) MN/m ²	0.25	0.25
s_0 (mm)	0.12	0.19
a_1 (mm/(MN/m ²))	3.95	5.16
a_2 (mm/(MN ² /m ²))	-3.58	-10.27
$E_v = 1.5 / (a_1 - a_2 s_0)$	1.18	1.18
E_v / E_s		

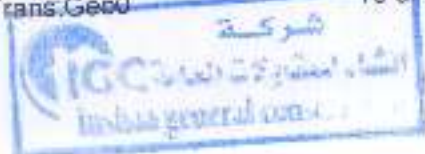




Table 11: Load-settlement data obtained at the second loading and unloading stages of the plate loading test performed at the location (KM 371+400)

Loading stage	Load (F)	Normal stress (s_0)	Settlement (S)
	kN	MN/m^2	mm
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: (KM 371+400)

Parameters	1st loading cycle	2nd loading cycle
$(s_{0, \max}) \text{ MN/m}^2$	0.25	0.25
$a_0 \text{ (mm)}$	0.16	0.29
$a_1 \text{ (mm/(MN/m}^2))$	2.65	4.14
$a_2 \text{ (mm/(MN}^2/\text{m}^2))$	1.76	-6.43
$E_v = 1.5 r / (a_1 + a_2 \cdot s_{0, \max})$	145.57	177.88
E_{v2}/E_{v1}	1.22	

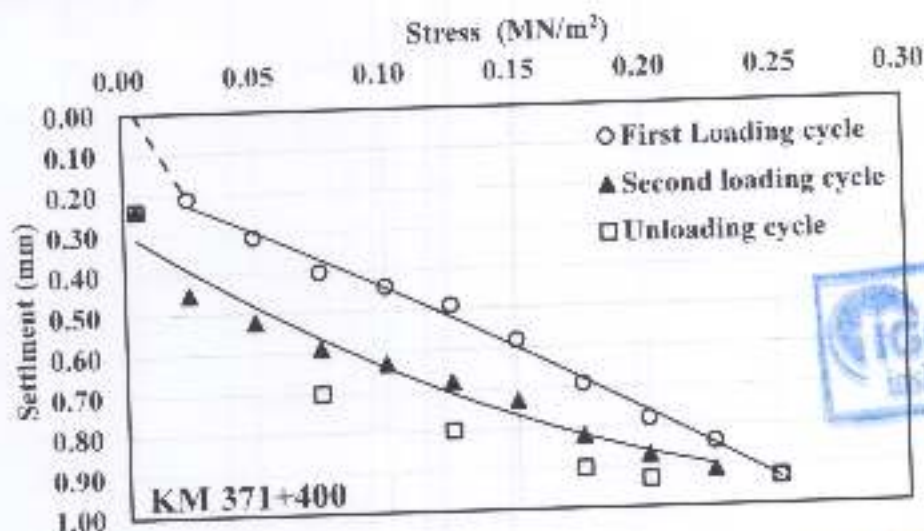


Figure 4: Load-settlement data: plate loading test performed at (KM 371+400)

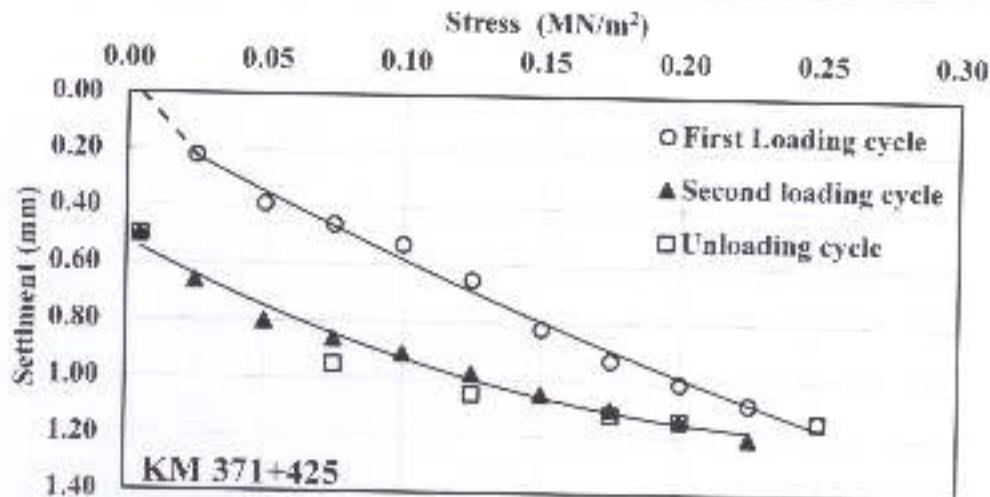


Figure 3: Load-settlement data: plate loading test performed at (KM 371+425)

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)

Loading stage	Load (F)	Normal stress (σ_0)	Settlement (S)
	kN	MN/m ²	mm
0	1.414	0.005	0.00
1	7.07	0.025	0.21
2	14.14	0.050	0.31
3	21.21	0.075	0.40
4	28.28	0.100	0.44
5	35.35	0.125	0.49
6	42.42	0.150	0.58
7	49.49	0.175	0.69
8	56.56	0.200	0.78
9	63.63	0.225	0.84
10	70.7	0.250	0.93
11	56.56	0.200	0.93
12	49.49	0.175	0.90
13	35.35	0.125	0.80
14	21.21	0.075	0.70
15	1.414	0.005	0.24





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)

Loading stage	Load (F) kN	Normal stress (s_0) MN/m ²	Settlement (S) mm
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	0.82
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	56.56	0.200	1.14
12	49.49	0.175	1.12
13	35.35	0.125	1.05
14	21.21	0.075	0.95
15	1.414	0.005	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)

Loading stage	Load (F) kN	Normal stress (s_0) MN/m ²	Settlement (S) mm
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
a_0 (mm)	0.10	0.52
a_1 (mm/(MN/m ²))	5.23	4.95
a_2 (mm/(MN ² /m ⁴))	-3.82	0.07
$Ev = 1.5 r / (a_1 + a_2 \cdot s_0, \max)$	105.31	167.89
Ev_2/Ev_1		1.59



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)

Loading stage	Load (F) kN	Normal stress (s_0) MN/m ²	Settlement (S) mm
0	1.414	0.005	0.47
1	7.07	0.025	0.73
2	14.14	0.050	0.83
3	21.21	0.075	0.89
4	28.28	0.100	0.95
5	35.35	0.125	1.05
6	42.42	0.150	1.10
7	49.49	0.175	1.20
8	56.56	0.200	1.24
9	63.63	0.225	1.29

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

Parameters	1st loading cycle	2nd loading cycle
$(s_{p,max})$ MN/m ²	0.25	0.25
a_0 (mm)	0.14	0.53
a_1 (mm/(MN/m ²))	3.81	5.50
a_2 (mm/(MN ² /m ⁴))	2.61	-9.65
$Ev = 1.5 r / (a_1 + a_2 \cdot s_{p,max})$	100.91	145.58
Ev_2/Ev_1	1.44	

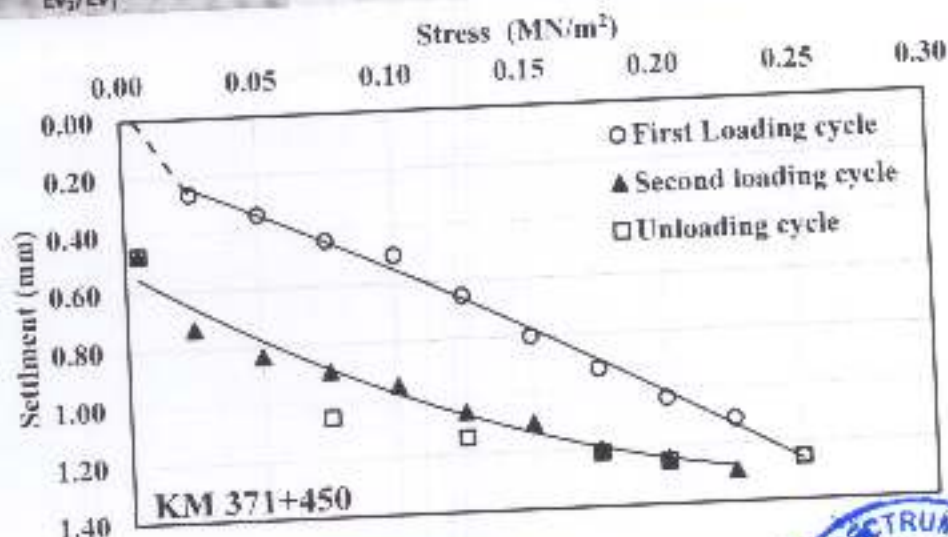
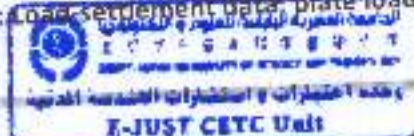


Figure 2: Load-settlement data, plate loading test performed at (KM 371+450)



E-JUST CETC Unit



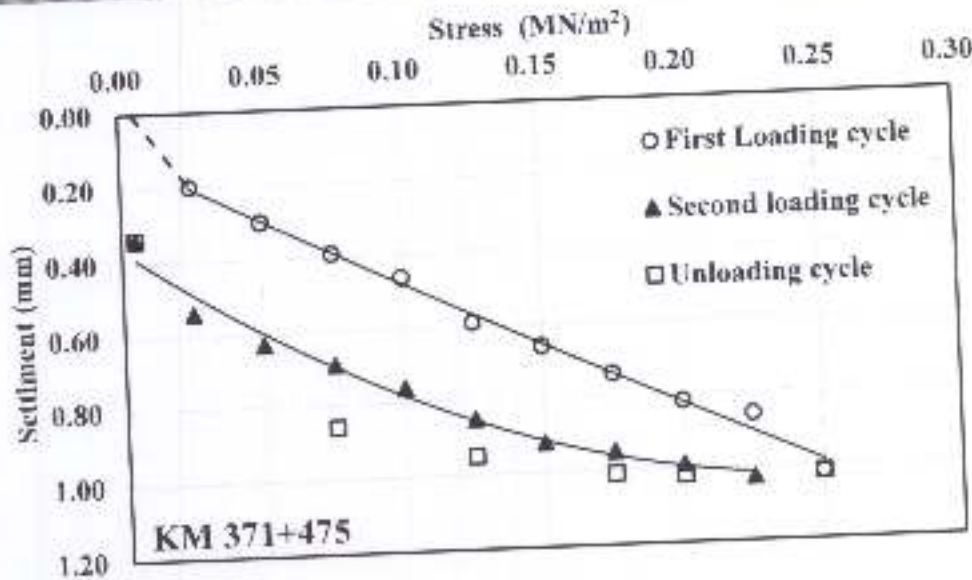


Figure 1: Load-settlement data: plate loading test performed at (KM 371+475)

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)

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





Table 2: Load-settlement data obtained at the second loading and unloading stages of the plate loading test performed at the location (KM 371+475)

Loading stage	Load (F)	Normal stress (s_p)	Settlement (S)
	kN	MN/m ²	mm
0	1.414	0.005	0.34
1	7.07	0.025	0.54
2	14.14	0.050	0.63
3	21.21	0.075	0.69
4	28.28	0.100	0.76
5	35.35	0.125	0.85
6	42.42	0.150	0.92
7	49.49	0.175	0.95
8	56.56	0.200	0.99
9	63.63	0.225	1.03

The load-settlement data obtained in all loading and unloading stages for the test performed at the first location (KM 371+475) 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+450) is provided in Tables 4-6 and Figure 2. The testing data corresponding to the third testing point (KM 371+425) is provided in Tables 7-9 and Figure 3. The testing data corresponding to the fourth testing point (KM 371+400) is provided in Tables 10-12 and Figure 4. The testing data corresponding to the fifth testing point (KM 371+375) is provided in Tables 13-15 and Figure 5. The testing data corresponding to the sixth testing point (KM 371+350) is provided in Tables 16-18 and Figure 6.

Table 3: Calculations of the resilient modulus of the tested soil according to DIN18134: (KM 371+475)

Parameters	1st loading cycle	2nd loading cycle
$(s_{p,max})$ MN/m ²	0.25	0.25
a_0 (mm)	0.11	0.37
a_1 (mm/(MN/m ²))	3.77	5.19
a_2 (mm/(MN ² /m ⁴))	-1.03	-10.18
$E_v = 1.5 r / (a_1 + a_2 \cdot s_{p,max})$	128.29	170.24
E_{v2}/E_{v1}	1.33	





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 2.0 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)

Loading stage	Load (F) kN	Normal MN/m ²	Settleme mm
0	1.414	0.005	0.00
1	7.07	0.025	0.20
2	14.14	0.050	0.30
3	21.21	0.075	0.39
4	28.28	0.100	0.46
5	35.35	0.125	0.59
6	42.42	0.150	0.66
7	49.49	0.175	0.74
8	56.56	0.200	0.82
9	63.63	0.225	0.86
10	70.7	0.250	1.02
11	56.56	0.200	1.02
12	49.49	0.175	1.01
13	35.35	0.125	0.95
14	21.21	0.075	0.86
15	1.414	0.005	0.34





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 6 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.

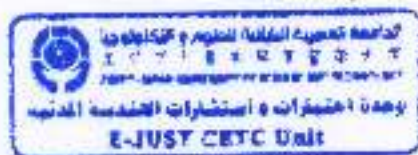
Location	E_{v1} MN/m ²	E_{v2} MN/m ²	E_{v2}/E_{v1} ratio
KM 371+475	128.29	170.24	1.33
KM 371+450	100.91	145.58	1.44
KM 371+425	105.31	167.69	1.59
KM 371+400	145.57	177.88	1.22
KM 371+375	147.31	173.53	1.18
KM 371+350	151.18	171.72	1.14

• 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 team	Mr.Mohamed Mamdouh
Project title:	Electric Express Train Project - Inshaa General Construction		Date:	10/4/2023
Diameter of loading plate	600		Time	9:02:00 AM 9:28:00 AM
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)	Dial Gauge 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	
Unloading Stage	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)	Dial Gauge Reading (mm)	
Reloading Stage	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	9.07	
	9	63.63	8.98	

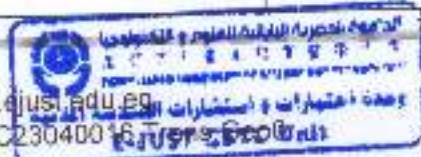




Location of test site:	KM 371+450		Field team	Mr.Mohamed Mamdouh
Project title:	Electric Express Train Project - Inshaa General Construction		Date:	10/4/2023
Diameter of loading plate	600		Time	9:35:00 AM
				10:03:00 AM
Lever ratio	1		Note: CAT 966F	
Type of Soil	Prepared Subgrade 2.0			
Bedding material	0			
Temperature	19°C			
Test regime	Loading Stage No.	Load (kN)	Dial Gauge Reading (mm)	
Loading Stage	0	1.414	10.00	
	1	7.07	9.74	
	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	
Unloading Stage	10	70.7	8.75	
	11	56.56	8.75	
	12	49.49	8.79	
	13	35.35	8.86	
	14	21.21	8.95	
Reloading Stage	15	1.414	9.53	
	0	1.414	9.53	
	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		

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Inshaa general construction

SPECTRUM
8.71





Location of test site:	KM 371+425		Field team	Mr.Mohamed Mamdouh
Project title:	Electric Express Train Project - Inshaa General Construction		Date:	10/4/2023
Diameter of loading plate	600		Time	10:10:00 AM 10:38:00 AM
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)	Dial Gauge Reading (mm)	
Loading Stage	0	1.414	10.00	
	1	7.07	9.78	
	2	14.14	9.61	
	3	21.21	9.54	
	4	28.28	9.47	
	5	35.35	9.35	
	6	42.42	9.18	
	7	49.49	9.07	
	8	56.56	8.99	
	9	63.63	8.92	
	10	70.7	8.86	
Unloading Stage	11	56.56	8.86	
	12	49.49	8.88	
	13	35.35	8.95	
	14	21.21	9.05	
	15	1.414	9.50	
Test regime	Loading Stage No.	Load (kN)	Dial Gauge Reading (mm)	
Reloading Stage	0	1.414	9.50	
	1	7.07	9.34	
	2	14.14	9.20	
	3	21.21	9.14	
	4	28.28	9.09	
	5	35.35	9.02	
	6	42.42	8.95	
	7	49.49	8.90	
	8	56.56	8.86	
	9	63.63	8.80	





Location of test site:	KM 371+400		Field team	Mr.Mohamed Mamdouh
Project title:	Electric Express Train Project - Inshaa General Construction		Date:	10/4/2023
Diameter of loading plate	600		Time	10:45:00 AM 11:13:00 AM
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)	Dial Gauge 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	
Unloading Stage	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)	Dial Gauge 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	
		63.63	9.09	

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inshaa general construction

10





Location of test site:	KM 371+375		Field team	Mr.Mohamed Mamdouh
Project title:	Electric Express Train Project - Inshaa General Construction		Date:	10/4/2023
Diameter of loading plate	600		Time	11:20:00 AM 11:48:00 AM
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)	Dial Gauge Reading (mm)	
Loading Stage	0	1.414	10.00	
	1	7.07	9.78	
	2	14.14	9.69	
	3	21.21	9.60	
	4	28.28	9.52	
	5	35.35	9.42	
	6	42.42	9.37	
	7	49.49	9.29	
	8	56.56	9.24	
	9	63.63	9.18	
	10	70.7	9.10	
Unloading Stage	11	56.56	9.10	
	12	49.49	9.12	
	13	35.35	9.24	
	14	21.21	9.31	
	15	1.414	9.87	
Test regime	Loading Stage No.	Load (kN)	Dial Gauge Reading (mm)	
Reloading Stage	0	1.414	9.87	
	1	7.07	9.60	
	2	14.14	9.54	
	3	21.21	9.45	
	4	28.28	9.41	
	5	35.35	9.34	
	6	42.42	9.29	
	7	49.49	9.24	
	8	56.56	9.18	
	9	63.63	9.14	





Location of test site:	KM 371+350		Field team	Mr.Mohamed Mamdouh
Project title:	Electric Express Train Project - Inshaa General Construction		Date:	10/4/2023
Diameter of loading plate	600		Time	11:55:00 AM 12:23:00 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)	Dial Gauge Reading (mm)	
Loading Stage	0	1.414	10.00	
	1	7.07	9.84	
	2	14.14	9.78	
	3	21.21	9.66	
	4	28.28	9.58	
	5	35.35	9.51	
	6	42.42	9.46	
	7	49.49	9.40	
	8	56.56	9.35	
	9	63.63	9.24	
	10	70.7	9.14	
Unloading Stage	11	56.56	9.15	
	12	49.49	9.20	
	13	35.35	9.24	
	14	21.21	9.34	
	15	1.414	9.78	
Test regime	Loading Stage No.	Load (kN)	Dial Gauge Reading (mm)	
Reloading Stage	0	1.414	9.78	
	1	7.07	9.58	
	2	14.14	9.50	
	3	21.21	9.43	
	4	28.28	9.34	
	5	35.35	9.27	
	6	42.42	9.20	
	7	49.49	9.17	
	8	56.56	9.14	
	9	63.63	9.09	

شركة
البناء للمقاولات العامة
Inshaa general construction

الهيئة العامة للغذاء والدواء
123456789





Location of test site:	KM 371+325		Field team	Mr. Mohamed Mamdouh
Project title:	Electric Express Train Project - Inshaa General Construction		Date:	11/4/2023
Diameter of loading plate	600		Time	9:02:00 AM 9:28:00 AM
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)	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	
	10	70.7	8.93	
Unloading Stage	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)	
Reloading 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	9.00	

شركة
إنشاء البنية التحتية العامة
Inshaa general construction

SPECT



MATERIAL INSPECTION REQUEST



Contractor Company	INSHAA GENERAL OF CONSTRUCTION		Designer Company	(SPECTRUM) Engineering Consulting Office
Issued by Contractor	Name	Sign	Date/ Serial Number	Time
	Eng. Mahmoud shaban		10/04/2023 (P.L.T. 2)	01:00 PM
Received by GARB CONSULTANT	Eng. Mazen Essamy		P.L.T	
			371	IW
			CS	11
			04	2023
			2	00

CODE-1	St to SK1	D1 to S3	Kp XXX Note
CODE-2	Station Reference	Depot Reference	For Kilometer point only Start Km is used
CODE-3		Work Activity	
		Sub Element of Activity	

Description of Materials	Prepared subgrade level 2		
Location to be Used	St. (371+100) To (373+350)		
MAR Approval No	M.A.R (P.S.G 1)	Date	08/04/2023
Supplier Name			
Test Requirement	P.L.T (DIN 18134)	Specification	EARTHWORK SPECIFICATIONS & TESTING REPORT (CG21-41.2) VERSION 2 BY DVECON GROUP
Reference Photos	Yes / No	Other	Ref UIR-P.S.G (3&4)
Item	Description	Unit	Quantity
1	PLATE LOAD TEST	NUMBER	10
2			
3			
4			

Comments by: Eng. Mazen Essamy (SPECTRUM)	Comments by: Eng. Alaa Abd-Allatif (ER)
1-The Plate Load Test Report P.L.T (DIN 18134) is Approved	1-Plate Load Test was carried-out by (E-just) 2-Results report attached and acceptable with project specifications. 3-Final approval is subject to above mentioned comments.



APPROVAL STATUS			
Organisation	Name	Sign	Date
Contractor	Eng. Mahmoud shaban		11-04-2023
QA/QC *	Eng. Mazen Essamy		
GARB **	Eng. Margret magdy		
Employers Representative	Eng. Alaa Abd-Allatif		11-4-2023

* Designer
** Alignment / Bridges / Culvert Only



Technical Report

Plate Loading Tests

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

Project

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

Prepared for
Inshaa General Construction

3 Mobilka CC - Abu Youssef, Alexandria, Egypt

(April 11, 2023)

امينة عامر الجامعة
لواء مهدي / أسامة فتحي





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 Mamdouh) 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 beneath the reaction loading system and secured against tilting.

The reaction loading system was a heavy multi-purpose Loader CAT 988.



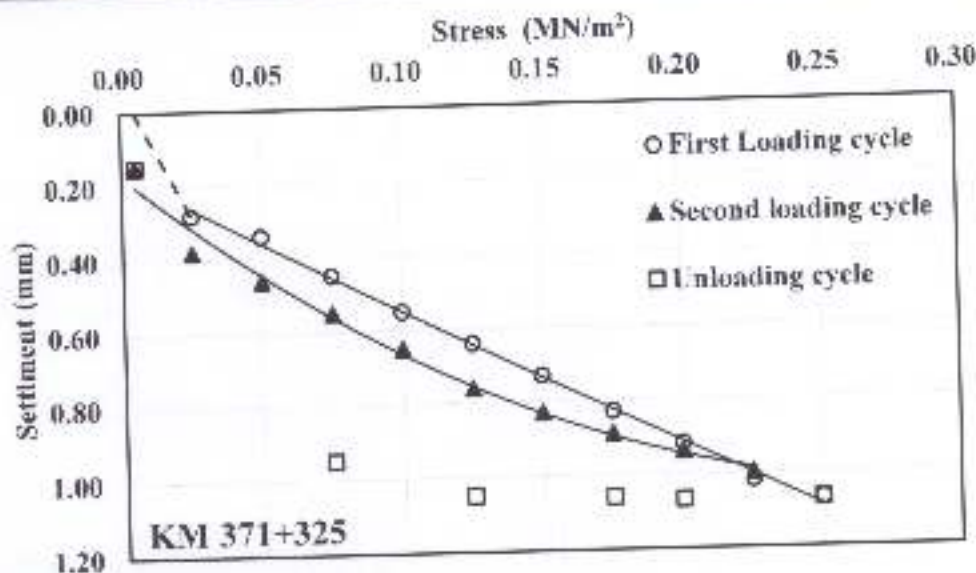


Figure 1: Load-settlement data: plate loading test performed at (KM 371+325)

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)

Loading stage	Load (F)	Normal stress (s_0)	Settlement (S)
	kN	MN/m ²	mm
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	56.56	0.200	1.02
12	49.49	0.175	1.02
13	35.35	0.125	0.98
14	21.21	0.075	0.88
15	1.414	0.005	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)

Loading stage	Load (F)	Normal stress (s_0)	Settlement (S)
	kN	MN/m ²	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	1st loading cycle	2nd loading cycle
($s_{0,max}$) MN/m ²	0.25	0.25
a_0 (mm)	0.12	0.31
a_1 (mm/(MN/m ²))	4.23	4.59
a_2 (mm/(MN ² /m ⁴))	-2.43	-6.68
$E_v = 1.5 F / (a_1 + a_2 \cdot s_{0,max})$	124.31	154.08
E_{v2}/E_{v1}	1.24	

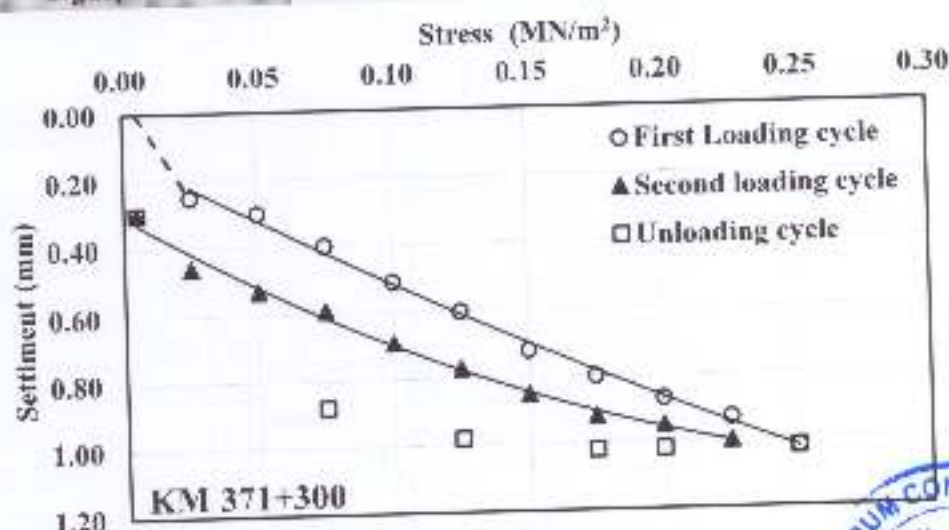


Figure 2: Load-settlement data: plate loading test performed at (KM 371+300)



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)

Loading stage	Load (F)	Normal stress (s_0)	Settlement (S)
	kN	MN/m ²	mm
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	56.56	0.200	1.16
12	49.49	0.175	1.16
13	35.35	0.125	1.10
14	21.21	0.075	0.99
15	1.414	0.005	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)

Loading stage	Load (F)	Normal stress (s_0)	Settlement (S)
	kN	MN/m ²	mm
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
(s_0 max) MN/m ²	0.25	0.25
a_0 (mm)	0.20	0.35
a_1 (mm/(MN/m ²))	3.51	6.00
a_2 (mm/(MN ² /m ⁴))	1.21	12.49
$Ev = 1.5 T / (a_1 + a_2 \times s_0 \text{ max})$	118.02	155.57
Ev_1 / Ev_2		1.32



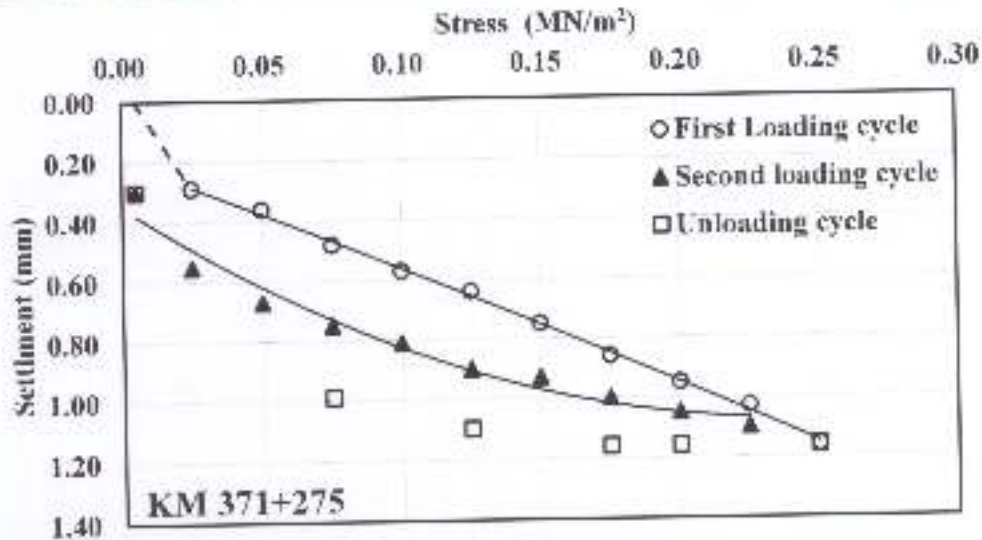


Figure 3: Load-settlement data: plate loading test performed at (KM 371+275)

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)

Loading stage	Load (F)	Normal stress (s_0)	Settlement (S)
	kN	MN/m ²	mm
0	1.414	0.005	0.00
1	7.07	0.025	0.31
2	14.14	0.050	0.38
3	21.21	0.075	0.45
4	28.28	0.100	0.53
5	35.35	0.125	0.61
6	42.42	0.150	0.72
7	49.49	0.175	0.80
8	56.56	0.200	0.86
9	63.63	0.225	0.95
10	70.7	0.250	1.05
11	56.56	0.200	1.05
12	49.49	0.175	1.04
13	35.35	0.125	0.95
14	21.21	0.075	0.86
15	1.414	0.005	0.26





Table 11: Load-settlement data obtained at the second loading and unloading stages of the plate loading test performed at the location (KM 371+250)

Loading stage	Load (F)	Normal stress (s_0)	Settlement (S)
	kN	MN/m ²	mm
0	1.414	0.005	0.26
1	7.07	0.025	0.48
2	14.14	0.050	0.54
3	21.21	0.075	0.65
4	28.28	0.100	0.74
5	35.35	0.125	0.83
6	42.42	0.150	0.86
7	49.49	0.175	0.93
8	56.56	0.200	1.00
9	63.63	0.225	1.05

Table 12: Calculations of the resilient modulus of the tested soil according to DIN18134: (KM 371+250)

Parameters	1st loading cycle	2nd loading cycle
$(s_{0, \max})$ MN/m ²	0.25	0.25
a_0 (mm)	0.23	0.29
a_1 (mm/(MN/m ²))	2.97	5.45
a_2 (mm/(MN ² /m ²))	1.21	-9.54
$Ev = 1.5 r / (a_1 + a_2 \cdot s_{0, \max})$	137.52	146.62
Ev_2/Ev_1	1.07	

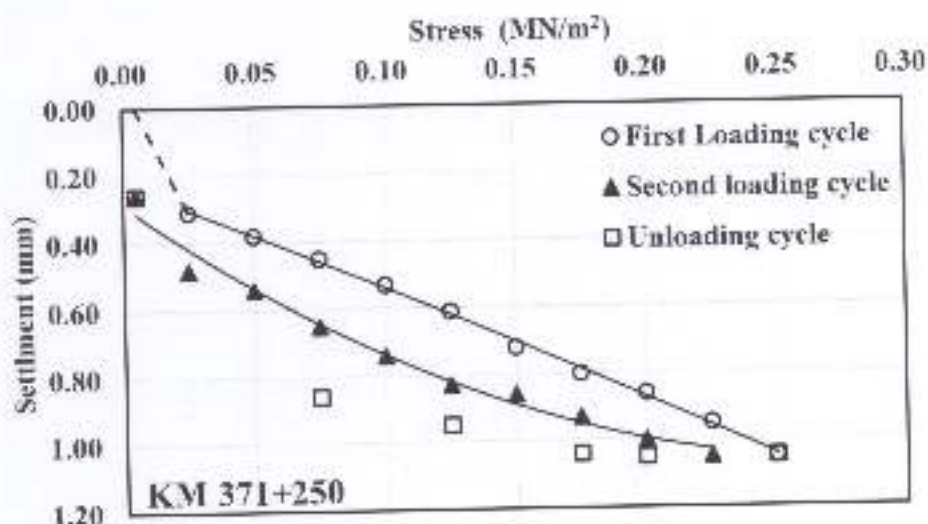


Figure 4: Load-settlement data from plate loading test performed at (KM 371+250)



Table 13: Load-settlement data obtained at the first loading and unloading stages of the plate loading test performed at the location (KM 371+225)

Loading stage	Load (F)	Normal stress (s_0)	Settlement (S)
	kN	MN/m ²	mm
0	1.414	0.005	0.00
1	7.07	0.025	0.20
2	14.14	0.050	0.29
3	21.21	0.075	0.40
4	28.28	0.100	0.49
5	35.35	0.125	0.58
6	42.42	0.150	0.64
7	49.49	0.175	0.71
8	56.56	0.200	0.80
9	63.63	0.225	0.88
10	70.7	0.250	0.99
11	56.56	0.200	0.99
12	49.49	0.175	0.97
13	35.35	0.125	0.87
14	21.21	0.075	0.74
15	1.414	0.005	0.19

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)

Loading stage	Load (F)	Normal stress (s_0)	Settlement (S)
	kN	MN/m ²	mm
0	1.414	0.005	0.19
1	7.07	0.025	0.38
2	14.14	0.050	0.45
3	21.21	0.075	0.53
4	28.28	0.100	0.61
5	35.35	0.125	0.69
6	42.42	0.150	0.79
7	49.49	0.175	0.85
8	56.56	0.200	0.90
9	63.63	0.225	0.96

Table 15: Calculations of the resilient modulus of the tested soil according to DIN18134: (KM 371+225)

Parameters	1st loading cycle	2nd loading cycle
($s_{0,max}$) MN/m ²	0.25	0.25
a_0 (mm)	0.12	0.21
a_1 (mm/(MN/m ²))	3.72	4.81
a_2 (mm/(MN ² /m ⁴))	-1.21	-6.69
$E_v = 1.5 \text{ r} / (a_1 + a_2 \cdot s_{0,max})$	131.76	143.42
E_{v2}/E_{v1}		1.09

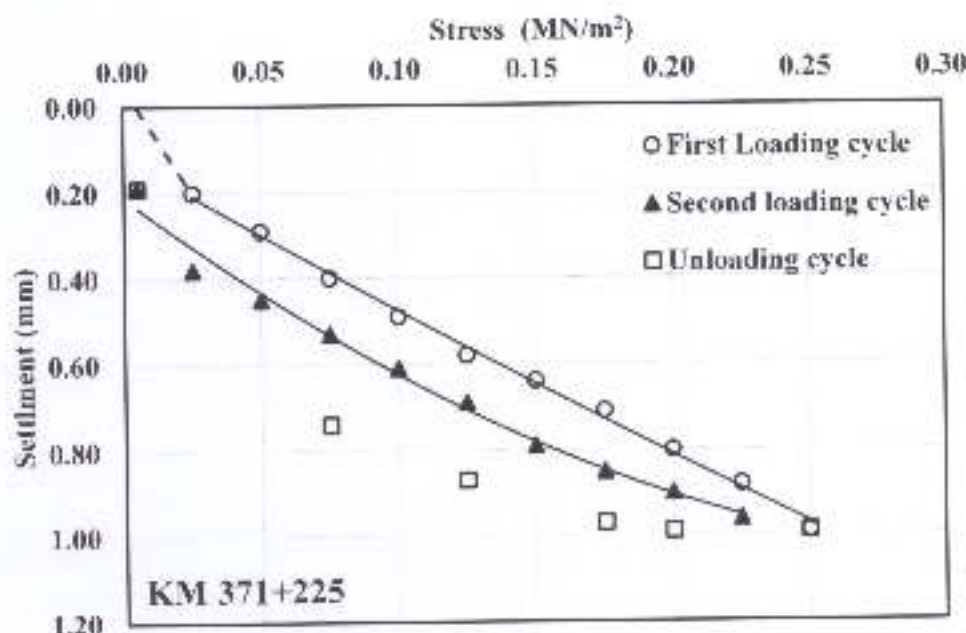


Figure 5: Load-settlement data: plate loading test performed at (KM 371+225)

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)

Loading stage	Load (F)	Normal stress (s_0)	Settlement (S)
	kN	MN/m ²	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	0.40
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	56.56	0.200	1.23
12	49.49	0.175	1.23
13	35.35	0.125	1.15
14	21.21	0.075	1.04
15	1.414	0.005	0.44

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)

Loading stage	Load (F)	Normal stress (s_0)	Settlement (S)
	kN	MN/m ²	mm
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: (KM 371+200)

Parameters	1st loading cycle	2nd loading cycle
$[s_0 \text{ max}] \text{ MN/m}^2$	0.25	0.25
$a_0 \text{ (mm)}$	0.11	0.46
$a_1 \text{ (mm/(MN/m}^2\text{))}$	4.39	4.47
$a_2 \text{ (mm/(MN}^2\text{/m}^4\text{))}$	0.67	-5.02
$E_v = 1.5 \cdot a_0 \cdot (a_1 + 5 \cdot a_2 \cdot s_0)$	98.71	139.89

1.42



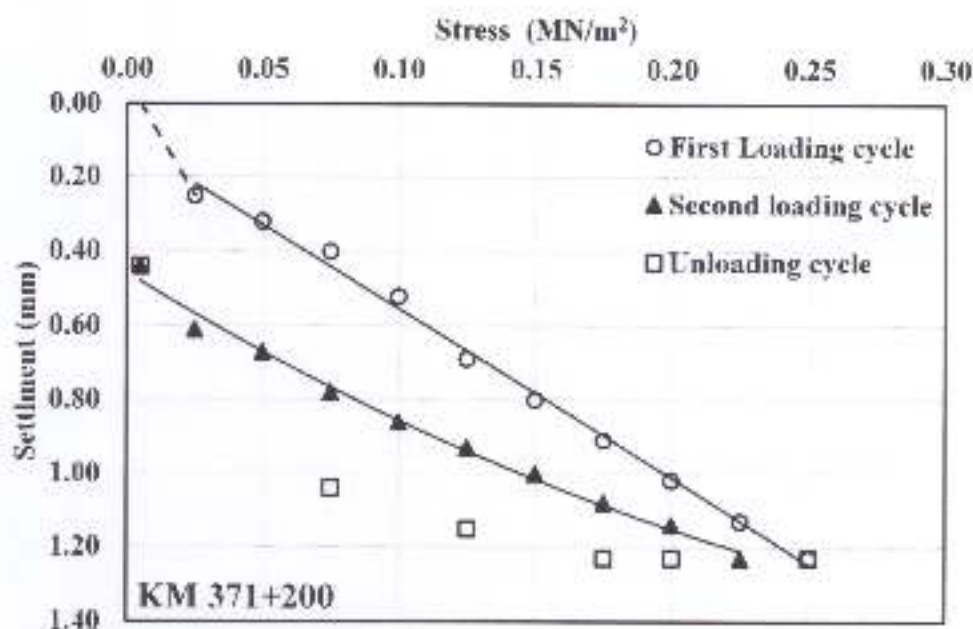


Figure 6: Load-settlement data: plate loading test performed at (KM 371+200)

Table 19: Load-settlement data obtained at the first loading and unloading stages of the plate loading test performed at the location (KM 371+175)

Loading stage	Load (F) kN	Normal stress (s_0) 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	0.35
3	21.21	0.075	0.46
4	28.28	0.100	0.56
5	35.35	0.125	0.68
6	42.42	0.150	0.77
7	49.49	0.175	0.93
8	56.56	0.200	1.03
9	63.63	0.225	1.13
10	70.7	0.250	1.30
11	56.56	0.200	1.30
12	49.49	0.175	1.28
13	35.35	0.125	1.27
14	21.21	0.075	1.25
15	1.414	0.005	1.21





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)

Loading stage	Load (F)	Normal stress (s_0)	Settlement (S)
	kN	MN/m ²	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: (KM 371+175)

Parameters	1st loading cycle	2nd loading cycle
($s_{0,max}$) MN/m ²	0.25	0.25
a_0 (mm)	0.16	0.49
a_1 (mm/(MN/m ²))	3.64	5.50
a_2 (mm/(MN ² /m ⁴))	3.40	-8.70
$Ev = 1.5 r / (a_1 + a_2 \cdot s_{0,max})$	100.21	135.45
Ev_2/Ev_1	1.35	

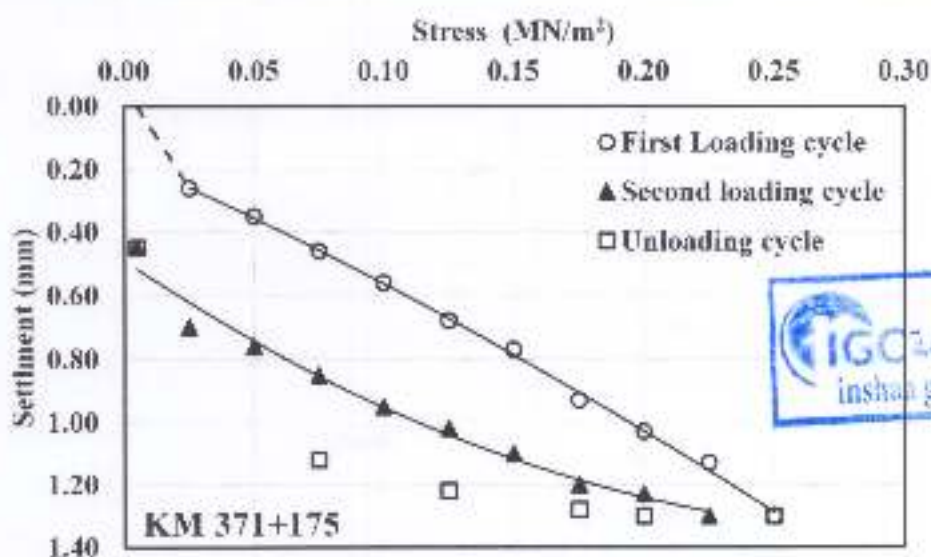


Figure 7: Load-settlement data: plate loading test performed at (KM 371+175)



Table 22: Load-settlement data obtained at the first loading and unloading stages of the plate loading test performed at the location (KM 371+150)

Loading stage	Load (F)	Normal stress (s_0)	Settlement (S)
	kN	MN/m ²	mm
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 23: Load-settlement data obtained at the second loading and unloading stages of the plate loading test performed at the location (KM 371+150)

Loading stage	Load (F)	Normal stress (s_0)	Settlement (S)
	kN	MN/m ²	mm
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 24: Calculations of the resilient modulus of the tested soil according to ASTM D1557 (KM 371+150)

Parameters	1st loading cycle	2nd loading cycle
(s_2, \max) MN/m ²	0.25	0.25
a_0 (mm)	0.15	0.67
a_1 (mm)/(MN/m ²)	5.23	6.40
a_2 (mm)/(MN ² /m ⁴)	0.12	-10.64
$EV = 1.5 \times [a_1 + a_2 \cdot (s_2, \max)]$	85.49	128.18
EV_1/EV_2	1.41	

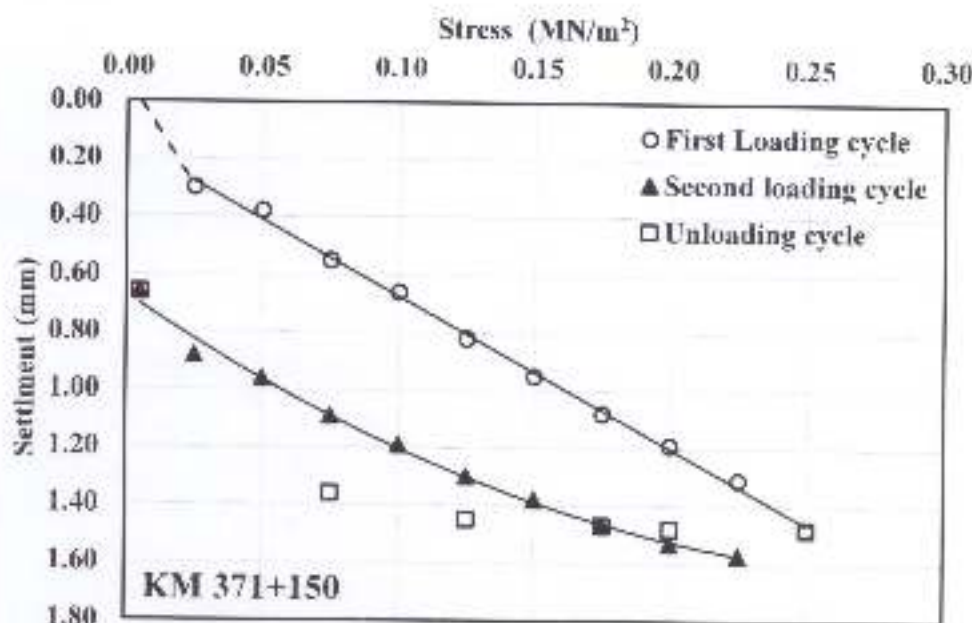


Figure 8: Load-settlement data: plate loading test performed at (KM 371+150)

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)	Normal stress (σ_0)	Settlement (S)
	kN	MN/m^2	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	1.15
11	56.56	0.200	1.19
12	49.49	0.175	1.18
13	35.35	0.125	1.12
14	21.21	0.075	1.01
15	1.414	0.005	0.40

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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)

Loading stage	Load (F)	Normal stress (s_p)	Settlement (S)
	kN	MN/m ²	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: (KM 371+125)

Parameters	1st loading cycle	2nd loading cycle
$\{s_{p,max}\}$ MN/m ²	0.25	0.25
a_1 (mm)	0.13	0.44
a_2 (mm/(MN/m ²))	4.18	5.10
a_3 (mm/(MN ² /m ⁴))	0.24	-7.50
$Ev = 1.5 r / (a_1 + a_2 \cdot s_{p,max})$	106.08	139.54
Ev_2/Ev_1	1.32	

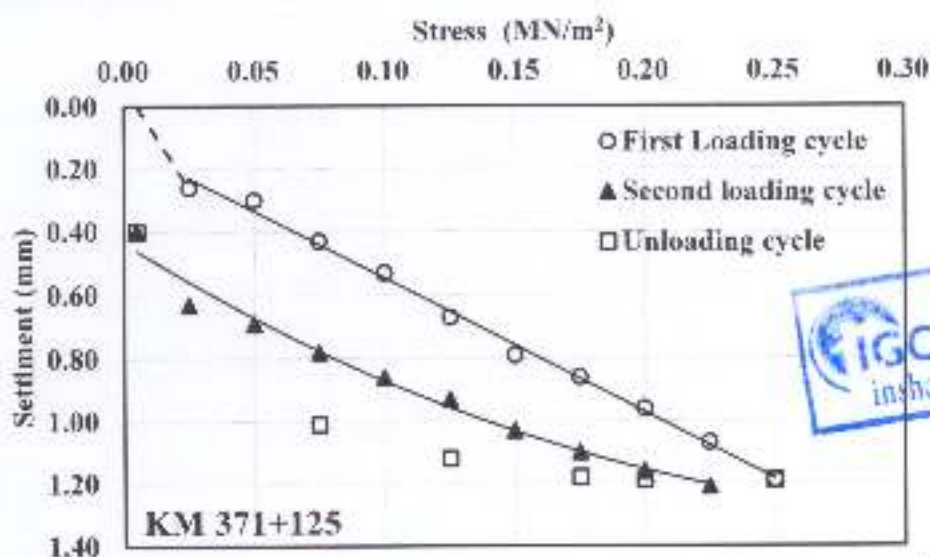


Figure 9: Load-settlement data: plate loading test performed at (KM 371+125)



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)

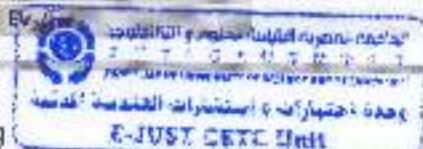
Loading stage	Load (F)	Normal stress (s_0)	Settlement (S)
	kN	MN/m ²	mm
0	1.414	0.005	0.00
1	7.07	0.025	0.35
2	14.14	0.050	0.41
3	21.21	0.075	0.50
4	28.28	0.100	0.60
5	35.35	0.125	0.76
6	42.42	0.150	0.90
7	49.49	0.175	1.00
8	56.56	0.200	1.13
9	63.63	0.225	1.22
10	70.7	0.250	1.37
11	56.56	0.200	1.37
12	49.49	0.175	1.36
13	35.35	0.125	1.21
14	21.21	0.075	1.07
15	1.414	0.005	0.34

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)

Loading stage	Load (F)	Normal stress (s_0)	Settlement (S)
	kN	MN/m ²	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
($s_{0,max}$) MN/m ²	0.25	0.25
a_0 (mm)	0.22	0.42
a_1 (mm/(MN/m ²))	3.84	7.02
a_2 (mm/(MN ² /m ²))	3.09	-12.86
$EV = 1.5 \pi / (a_1 + a_2 \cdot s_{0,max})$	97.57	118.34
	1.21	



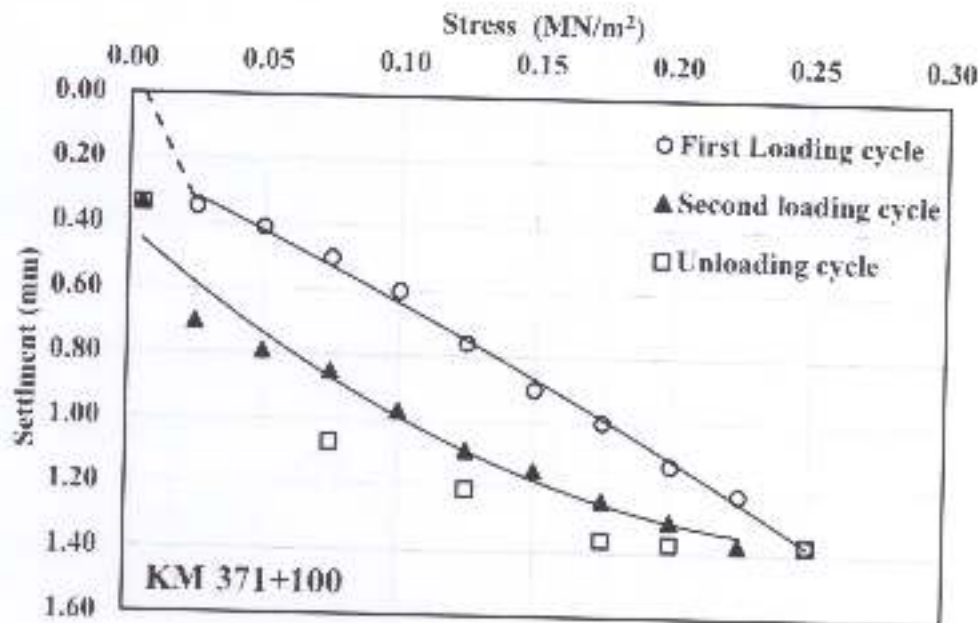


Figure 10: Load-settlement data: plate loading test performed at (KM 371+100)





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_{v2} MN/m ²	E_{v2}/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



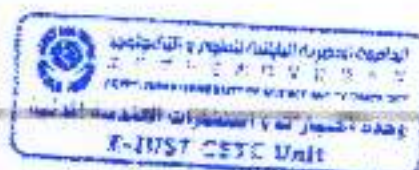
Lab Engineer

Mohamed A. Al-Najjar





Appendix A





Location of test site:	KM 371+300		Field team	Mr. Mohamed Mamdouh
Project title:	Electric Express Train Project - Inshaa General Construction		Date:	11/4/2023
Diameter of loading plate	600		Time	9:35:00 AM 10:03:00 AM
Lever ratio	1		Note: CAT 966F	
Type of Soil	Prepared Subgrade 2.0			
Bedding material	0			
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	
Unloading Stage	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	
Test regime	Loading Stage No.	Load (kN)	Dial Gauge Reading (mm)	
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	
		63.63	9.00	

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Location of test site:	KM 371+275		Field team	Mr.Mohamed Mamdouh
Project title:	Electric Express Train Project - Inshaa General Construction		Date:	11/4/2023
Diameter of loading plate	600		Time	10:10:00 AM 10:38:00 AM
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)	Dial Gauge Reading (mm)	
Loading Stage	0	1.414	10.00	
	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	
	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	8.89	

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Location of test site:	KM 371+250		Field team	Mr.Mohamed Mamdouh
Project title:	Electric Express Train Project - Inshaa General Construction		Date:	11/4/2023
Diameter of loading plate	600		Time	10:45:00 AM 11:12:00 AM
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)	Dial Gauge Reading (mm)	
Loading Stage	0	1.414	10.00	
	1	7.07	9.69	
	2	14.14	9.62	
	3	21.21	9.55	
	4	28.28	9.47	
	5	35.35	9.39	
	6	42.42	9.28	
	7	49.49	9.20	
	8	56.56	9.14	
	9	63.63	9.05	
	10	70.7	8.95	
Unloading Stage	11	56.56	8.95	
	12	49.49	8.96	
	13	35.35	9.05	
	14	21.21	9.14	
	15	1.414	9.74	
Test regime	Loading Stage No.	Load (kN)	Dial Gauge Reading (mm)	
Reloading Stage	0	1.414	9.74	
	1	7.07	9.52	
	2	14.14	9.46	
	3	21.21	9.35	
	4	28.28	9.26	
	5	35.35	9.17	
	6	42.42	9.14	
	7	49.49	9.07	
	8	56.56		
	9	63.63		

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Location of test site:	KM 371+225		Field team	Mr. Mohamed Mamdouh
Project title:	Electric Express Train Project - Inshaa General Construction		Date:	11/4/2023
Diameter of loading plate	600		Time	11:20:00 AM 11:48:00 AM
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)	Dial Gauge Reading (mm)	
Loading Stage	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	
Unloading Stage	11	56.56	9.01	
	12	49.49	9.03	
	13	35.35	9.13	
	14	21.21	9.26	
	15	1.414	9.81	
Test regime	Loading Stage No.	Load (kN)	Dial Gauge Reading (mm)	
Reloading Stage	0	1.414	9.81	
	1	7.07	9.62	
	2	14.14	9.55	
	3	21.21	9.47	
	4	28.28	9.39	
	5	35.35	9.31	
	6	42.42	9.21	
	7	49.49	9.15	
	8	56.56	9.10	
		63.63	9.04	

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Location of test site:	KM 371+200		Field team	Mr.Mohamed Mamouth
Project title:	Electric Express Train Project - Inshaa General Construction		Date:	11/4/2023
Diameter of loading plate	600		Time	11:55:00 AM 12:23:00 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)	Dial Gauge Reading (mm)	
Loading Stage	0	1.414	10.00	
	1	7.07	9.75	
	2	14.14	9.68	
	3	21.21	9.60	
	4	28.28	9.48	
	5	35.35	9.31	
	6	42.42	9.20	
	7	49.49	9.09	
	8	56.56	8.98	
	9	63.63	8.87	
	10	70.7	8.77	
Unloading Stage	11	56.56	8.77	
	12	49.49	8.77	
	13	35.35	8.85	
	14	21.21	8.96	
	15	1.414	9.56	
Test regime	Loading Stage No.	Load (kN)	Dial Gauge Reading (mm)	
Reloading Stage	0	1.414	9.56	
	1	7.07	9.39	
	2	14.14	9.33	
	3	21.21	9.22	
	4	28.28	9.14	
	5	35.35	9.07	
	6	42.42	9.00	
	7	49.49	8.92	
	8	56.56	8.80	
	9	63.63	8.70	

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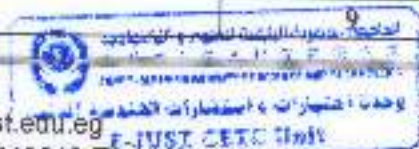




Location of test site:	KM 371+175		Field team	Mr. Mohamed Mamlouk
Project title:	Electric Express Train Project - Inshaa General Construction		Date:	11/4/2023
Diameter of loading plate	600		Time	12:30:00 PM 12:58:00 PM
Lever ratio	1		Note: CAT 966F	
Type of Soil	Prepared Subgrade 2.0			
Bedding material	—			
Temperature	19°C			
Test regime	Loading Stage No.	Load (kN)	Dial Gauge Reading (mm)	
Loading Stage	0	1.414	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	
Unloading Stage	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	
Test regime	Loading Stage No.	Load (kN)	Dial Gauge Reading (mm)	
Reloading Stage	0	1.414	9.55	
	1	7.07	9.30	
	2	14.14	9.24	
	3	21.21	9.15	
	4	28.28	9.05	
	5	35.35	8.98	
	6	42.42	8.90	
	7	49.49	8.80	
	8	56.56	8.70	
	9	63.63	8.60	

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Location of test site:	KM 371+150		Field team	Mr. Mohamed Mamlouh
Project title:	Electric Express Train Project - Inshaa General Construction		Date:	11/4/2023
Diameter of loading plate	600		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)	Dial 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	
Unloading Stage	11	56.56	8.52	
	12	49.49	8.53	
	13	35.35	8.55	
	14	21.21	8.64	
	15	1.414	9.34	
Test regime	Loading Stage No.	Load (kN)	Dial Gauge Reading (mm)	
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	8.40	

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Location of test site:	KM 371+125		Field team	Mr. Mohamed Mamdouh
Project title:	Electric Express Train Project - Inshaa General Construction		Date:	11/4/2023
Diameter of loading plate	600		Time	1:43:00 PM 2:10:00 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)	Dial Gauge 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	
Unloading Stage	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	
Test regime	Loading Stage No.	Load (kN)	Dial Gauge 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	8.81	

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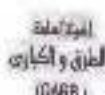




Location of test site:	KM 371+100		Field team	Mr. Mohamed Mamlouk
Project title:	Electric Express Train Project - Inshan General Construction		Date:	11/4/2023
Diameter of loading plate	600		Time	2:18:00 PM 2:48:00 PM
Lever ratio	1		Note: CAT 966F	
Type of Soil	Prepared Subgrade 2.0			
Bedding material	---			
Temperature	19°C			
Test regime	Loading Stage No.	Load (kN)	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	
Unloading Stage	11	56.56	8.63	
	12	49.49	8.64	
	13	35.35	8.79	
	14	21.21	8.93	
	15	1.414	9.66	
Test regime	Loading Stage No.	Load (kN)	Dial Gauge Reading (mm)	
Reloading Stage	0	1.414	9.66	
	1	7.07	9.30	
	2	14.14	9.21	
	3	21.21	9.15	
	4	28.28	9.03	
	5	35.35	8.91	
	6	42.42	8.85	
	7	49.49	8.76	
	8	56.56	8.70	
	9	63.63	8.63	



MATERIAL INSPECTION REQUEST



S5-B-1N

Contractor Company	INSHAA GENERAL OF CONSTRUCTION Company		Designer Company	(SPECTRUM) Engineering Consulting Office																
Issued by Contractor	Name Eng. Moahmed hassan elssyd	Sign 	Date/ Serial Number 10-05-2023 (P.L.T.A)	Time 01:00 PM																
Received by GARB CONSULTANT	Eng. Mazen Essamy		PLT	<table border="1"> <tr> <td>C1</td> <td>C2</td> <td>C3</td> <td>DD</td> <td>MM</td> <td>YY</td> <td>HH</td> <td>MM</td> </tr> <tr> <td>371</td> <td>EW</td> <td>CS</td> <td>11</td> <td>05</td> <td>2023</td> <td>3</td> <td>00</td> </tr> </table>	C1	C2	C3	DD	MM	YY	HH	MM	371	EW	CS	11	05	2023	3	00
C1	C2	C3	DD	MM	YY	HH	MM													
371	EW	CS	11	05	2023	3	00													

CODE-1	S1 to S21 Station Reference	D1 to S3 Depot Reference	Kp XXX Note For Kilometer point only Start Km is used
CODE-2	Work Activity		
CODE-3	Sub Element of Activity		

Description of Materials	Prepared sub grade level 2		
Location to be Used	St. (371+000) To (371+100)		
MAR Approval No	M.A.R. P.S.G 1	Date	08/04/2023
Supplier Name	ALFARDI		
Test Requirement	P.L.T (DIN 18134)	Specification	EARTHWORK SPECIFICATIONS & TESTING REPORT (CG21-41.2) VERSION 2 BY CIVECON GROUP
Reference Photos	Yes / No	Other	Rev UIR- P.S.G 6
Item	Description	Unit	Quantity
1	PLATE LOAD TEST	NUMBER	4
2			
3			
4			

Comments by: Eng. Mazen Essamy (SPECTRUM)

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



Comments by: Eng. Alaa Abd Allatif (ER)

1-Plate Load Test Was Carried-out By (E-just)
2-Results report attached and acceptable with project specifications.
3-Final approval is subject to above mentioned comments.



APPROVAL STATUS

Organisation	Name	Sign	Date	A-AWC-R
Contractor	Eng. Mohamed Hassan		11-05-2023	A
QA/QC *	Eng. Mazen Essamy			A
GARB**	Eng. Mohammed Fayad			
Employers Representative	Eng. Alaa Abd-Allatif		12-5-2023	Awc

* Designer

** Alignment / Bridges: Culvert Only



Technical Report

Plate Loading Tests

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

Prepared Subgrade 2

Project

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

Prepared for

Inshaa General Construction

3 Mobilka CC - Abu Youssef, Alexandria, Egypt



(May 11, 2023)

يعتمد
أمين عام الجامعة
لواء مهندس / أسامة شوقي



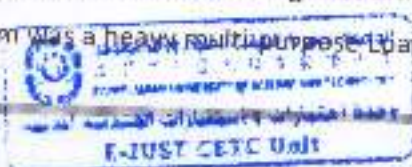
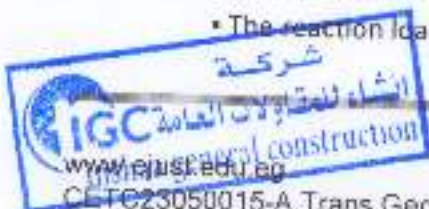


1. Introduction

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 4 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 (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 $24 \pm 1^\circ\text{C}$.
- 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) kN	Normal MN/m ²	Settlement mm
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	
14	21.21	0.075	
15	1.414	0.005	

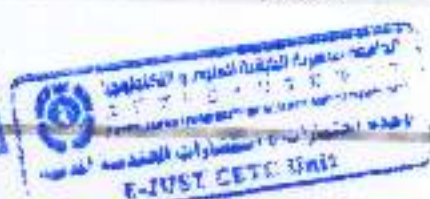


Table 2: Load-settlement data obtained at the second loading and unloading stages of the plate loading test performed at the location (KM 371+000 to 371+025)

Loading stage	Load (F) kN	Normal stress (σ_0) 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
$(s_{0,max})$ MN/m ²	0.25	0.25
s_0 (mm)	0.02	0.72
a_1 (mm/(MN/m ²))	5.22	4.19
a_2 (mm/(MN ² /m ⁴))	0.97	-5.42
$Ev = 1.5 \cdot (a_1 + a_2 \cdot s_{0,max})$	82.34	158.76
Ev_2/Ev_1	1.93	



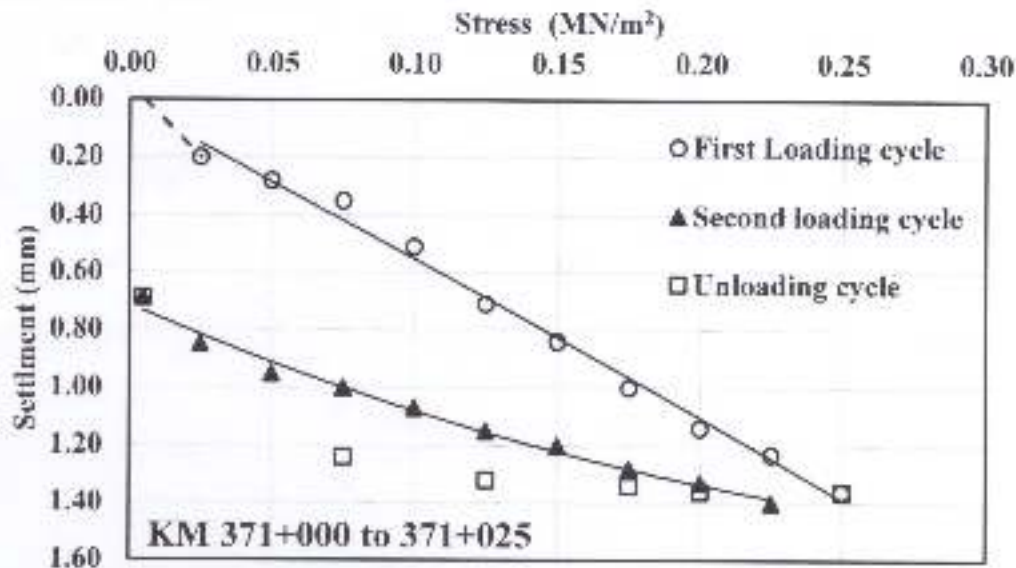


Figure 1: Load-settlement data: plate loading test performed at (KM 371+000 to 371+025)

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_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	0.40
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	56.56	0.200	1.08
12	49.49	0.175	1.07
13	35.35	0.125	1.04
14	21.21	0.075	0.98
15	1.414		0.34

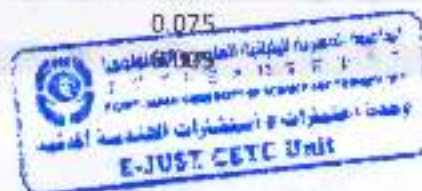




Table 5: Load-settlement data obtained at the second loading and unloading stages of the plate loading test performed at the location (KM 371+025 to 371+050)

Loading 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
($s_{0,max}$) 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 ² /m ⁴))	2.79	-11.55
$E_v = 1.5 \pi' (a_1 + a_2 \cdot s_{0,max})$	136.24	174.64
E_{v2}/E_{v1}	1.28	

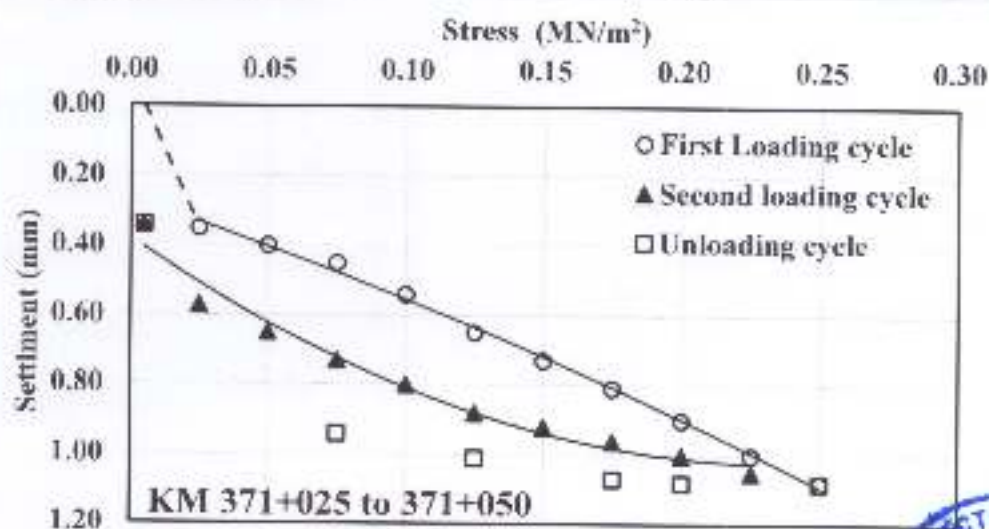


Figure 2: Load-settlement data: plate loading test performed at (KM 371+025 to 371+050)

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)

Loading 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	0.25
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	56.56	0.200	1.30
12	49.49	0.175	1.29
13	35.35	0.125	1.22
14	21.21	0.075	1.15
15	1.414	0.005	0.45

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)

Loading stage	Load (F) kN	Normal stress (σ_0) 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	1st loading cycle	2nd loading cycle
($\sigma_{0,max}$) MN/m ²	0.25	0.25
a_0 (mm)	0.12	0.25
a_1 (mm/(MN/m ²))	4.28	4.28
a_2 (mm/(MN ² /m ⁴))	2.00	2.00
$E_{vs} = 1.5 \sigma' (a_1 + a_2 \cdot \sigma_{0,max})$	93.86	145.26
E_{v2}/E_{v1}	1.55	



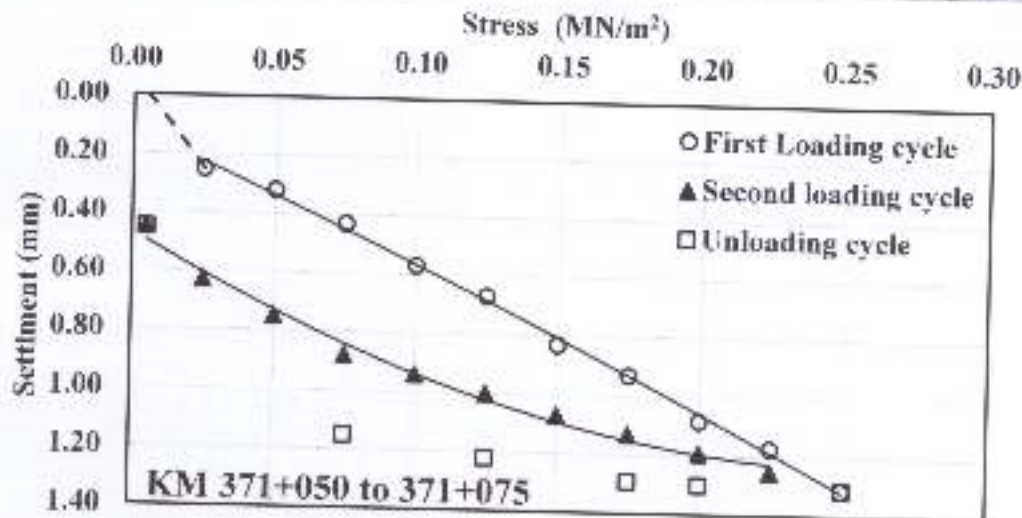


Figure 3: Load-settlement data: plate loading test performed at (KM 371+050 to 371+075)

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)

Loading 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	1.12
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)

Loading stage	Load (F)	Normal stress (σ_0)	Settlement (S)
	kN	MN/m ²	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	1st loading cycle	2nd loading cycle
($s_{0,max}$) MN/m ²	0.25	0.25
a_0 (mm)	0.20	0.33
a_1 (mm/(MN/m ²))	3.69	6.80
a_2 (mm/(MN ² /m ⁴))	0.12	13.26
$E_v = 1.5 r / (a_1 + a_2 \cdot s_{0,max})$	120.92	129.14
E_{v2}/E_{v1}	1.07	

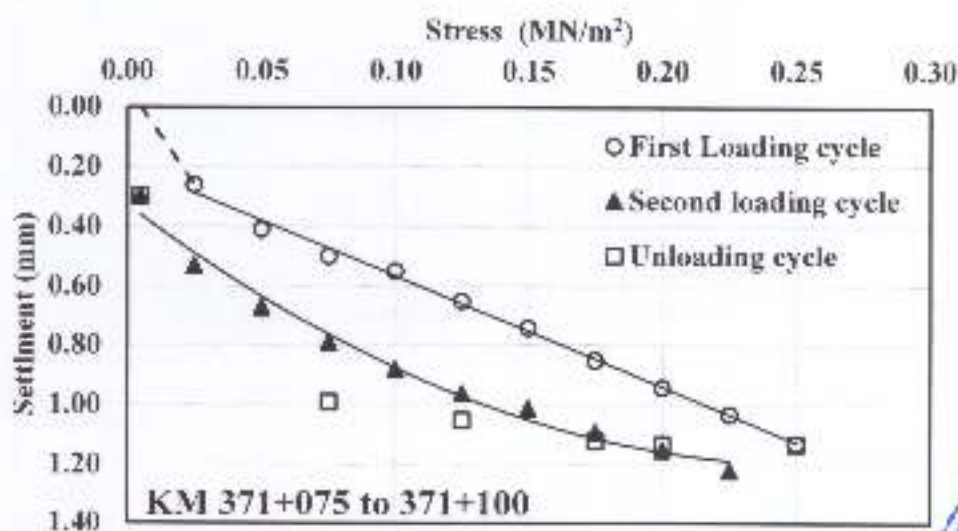


Figure 4: Load-settlement data: plate loading test performed at (KM 371+075 to 371+100)



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_{v1} MN/m ²	E_{v2} MN/m ²	E_{v2}/E_{v1} 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





Location of test site:	KM 371+000 to 371+025		Field team	Mr.Mohamed Mamdouh
Project title:	Electric Express Train Project - Inshaa General Construction		Date:	11/5/2023
Diameter of loading plate	600		Time	10:30:00 am 10:58:00 am
Lever ratio	1		Note: CAT 966F	
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	10.00	
	1	7.07	9.80	
	2	14.14	9.72	
	3	21.21	9.65	
	4	28.28	9.49	
	5	35.35	9.29	
	6	42.42	9.16	
	7	49.49	9.00	
	8	56.56	8.86	
	9	63.63	8.77	
	10	70.7	8.64	
Unloading Stage	11	56.56	8.64	
	12	49.49	8.66	
	13	35.35	8.68	
	14	21.21	8.76	
	15	1.414	9.31	
Test regime	Loading Stage No.	Load (kN)	Dial Gauge Reading (mm)	
Reloading Stage	0	1.414	9.31	
	1	7.07	9.15	
	2	14.14	9.05	
	3	21.21	9.00	
	4	28.28	8.98	
	5	35.35	8.88	
	6	42.42	8.80	
	7	49.49	8.72	
	8	56.56	8.68	
	9	63.63	8.60	

شركة
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Inshaa general construction

مختبر
ميكانيكا التربة
Geotechnical Engineering Lab
7-11 شارع
E-POST CODE 11411

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شركة
إشياء للمقاولات العامة
Inshaa general construction

SPECTRUM CONSULTING
SPECTRUM CONSULTING
مستشارات الهندسة المدنية



Location of test site:	KM 371+025 to 371+050		Field team	Mr.Mohamed Mamdouh
Project title:	Electric Express Train Project - Inshaa General Construction		Date:	11/5/2023
Diameter of loading plate	600		Time	11:05:00 am
				11:33:00 am
Lever ratio	1		Note: CAT 966F	
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	10.00	
	1	7.07	9.65	
	2	14.14	9.60	
	3	21.21	9.55	
	4	28.28	9.46	
	5	35.35	9.35	
	6	42.42	9.27	
	7	49.49	9.19	
	8	56.56	9.10	
	9	63.63	9.00	
	10	70.7	8.92	
Unloading Stage	11	56.56	8.92	
	12	49.49	8.93	
	13	35.35	8.99	
	14	21.21	9.06	
	15	1.414	9.66	
Test regime	Loading Stage No.	Load (kN)	Dial Gauge Reading (mm)	
Reloading Stage	0	1.414	9.66	
	1	7.07	9.43	
	2	14.14	9.35	
	3	21.21	9.27	
	4	28.28	9.20	
	5	35.35	9.12	
	6	42.42	9.08	
	7	49.49	9.04	
	8	56.56	9.00	
	9	63.63	8.95	

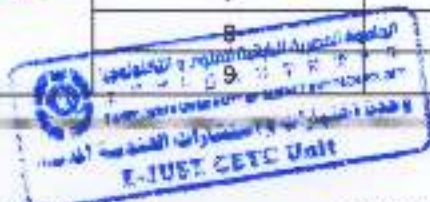
شركة
انشاء للمقاولات العامة
Inshaa general construction

المكتب الفني للمشروعات والدراسات
Inshaa Engineering & Studies

م.م. محمد ممدوح
Mohamed Mamdouh

م.م. محمد ممدوح
Mohamed Mamdouh

م.م. محمد ممدوح
Mohamed Mamdouh





Location of test site:	KM 371+050 to 371+075		Field team	Mr.Mohamed Mamdouh
Project title:	Electric Express Train Project - Inshaa General Construction		Date:	11/5/2023
Diameter of loading plate	600		Time	11:40:00 am 12:08:00 pm
Lever ratio	1		Note: CAT 966F	
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	10.00	
	1	7.07	9.75	
	2	14.14	9.68	
	3	21.21	9.57	
	4	28.28	9.43	
	5	35.35	9.33	
	6	42.42	9.17	
	7	49.49	9.07	
	8	56.56	8.92	
	9	63.63	8.83	
	10	70.7	8.69	
Unloading Stage	11	56.56	8.70	
	12	49.49	8.71	
	13	35.35	8.78	
	14	21.21	8.85	
	15	1.414	9.55	
Test regime	Loading Stage No.	Load (kN)	Dial Gauge Reading (mm)	
Reloading Stage	0	1.414	9.55	
	1	7.07	9.37	
	2	14.14	9.25	
	3	21.21	9.12	
	4	28.28	9.06	
	5	35.35	9.00	
	6	42.42	8.93	
	7	49.49	8.87	
	8	56.56	8.81	
	9	63.63	8.75	





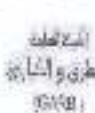
Location of test site:	KM 371+075 to 371+100		Field team	Mr.Mohamed Mamdouh
Project title:	Electric Express Train Project - Inshaa General Construction		Date:	11/5/2023
Diameter of loading plate	600		Time	12:15:00 pm 12:43:00 pm
Lever ratio	1		Note: CAT 966F	
Type of Soil	Prepared Subgrade 2			
Bedding material	---			
Temperature	24°C			
Test regime	Loading Stage No.	Load (kN)	Dial Gauge Reading (mm)	
Loading Stage	0	1.414	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	
Unloading Stage	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	
Reloading Stage	15	1.414	9.70	
	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	

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MATERIAL
INSPECTION
REQUEST

Contractor Company	INSHAA GENERAL OF CONSTRUCTION Company		Designer Company	(SPECTRUM) Engineering Consulting Office																
Issued by Contractor	Name Eng. Mahmoud shaban	Sign 	Date/ Serial Number 19/06/2023 (P.L.T.5)	Time 02:00 PM																
Received by GARB CONSULTANT	Eng. Mazen Essamy		PLT	<table border="1"> <tr> <th>VI</th> <th>Q</th> <th>CS</th> <th>DD</th> <th>MM</th> <th>YY</th> <th>HH</th> <th>MM</th> </tr> <tr> <td>371</td> <td>FW</td> <td>CS</td> <td>20</td> <td>06</td> <td>2023</td> <td>2</td> <td>00</td> </tr> </table>	VI	Q	CS	DD	MM	YY	HH	MM	371	FW	CS	20	06	2023	2	00
VI	Q	CS	DD	MM	YY	HH	MM													
371	FW	CS	20	06	2023	2	00													

CODE-1	S1 to S21 Station Reference	D1 to D3 Dapot Reference	Rp XXX Note For Kilometer point only Start Km is used
CODE-2	Work Activity		
CODE-3	Sub Element of Activity		

Description of Materials	Sub Ballast 2.		
Location to be Used	St. (371+000) To (371+100)		
MAR Approval No.	M.A.R. (B.S 1)	Date	29/04/2023
Supplier Name			
Test Requirement	P.L.T (DIN 18134)	Specification	EARTHWORK SPECIFICATIONS & TESTING REPORT (DG21-AL.2) VERSION 2 BY CIVECON GROUP
Reference Photos	Yes / No	Other	Rev UIR-S.B-(7)

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)
<p>1-The Plate Load Test Result P.L.T (DIN 18134) is Approved</p> 	<p>1-Plate Load Test was carried- out by (Cornibassal) 2-Results report attached and acceptable with project specifications. 3-Final approval is subject to above mentioned comments.</p> 

APPROVAL STATUS				
Organisation	Name	Sign	Date	A-AWC-R
Contractor	Eng. Mahmoud shaban		20-06-2023	A
QA/QC*	Eng. Mazen Essamy			A
GARB**	Eng. Margret magdy			
Employers Representative	Eng. Alaa Abd-Allatif		21-6-2023	Auc

* Designer

** Alignment / Bridges: Culvert Only



COMIBASSAL International Controllers

Internal inspection and laboratories sector

Accredited by : Egypton General Authority for Petroleum under No. 34/29-11-2011
Accredited by : Egypton Accreditation council (EGAC) under No. 031706/1A

Technical report

of Plate Loading Test (DIN 18134)

General	:	SYSTRA
Consultant	:	SPECTRUM
Contractor	:	شركة إنشاء للمقاولات 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





COMIBASSAL International Controllers

Internal inspection and laboratories sector

Accredited by : Egypt General Authority for Petroleum under No. 34/29-11-2011
Accredited by : Egypt Accreditation council (EGAC) under No. 031706/1A

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 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 increasement 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.



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COMIBASSAL International Controllers

Internal inspection and laboratories sector

Accredited by : Egypt General Authority for Petroleum under No. 34/29-11-2011
Accredited by : Egypt Accreditation council (EGAC) under No. 031706/1A

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

600

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

Loading stage no.	Load (P) kN	Normal stress (σ_c) MN/m ²	Settlement of loading plate S (mm)
0	1.414	0.005	0.00
1	7.07	0.025	0.07
2	14.14	0.050	0.14
3	21.21	0.075	0.21
4	28.28	0.100	0.26
5	35.35	0.125	0.32
6	42.42	0.150	0.38
7	49.49	0.175	0.44
8	56.56	0.200	0.50
9	63.63	0.225	0.55
10	70.7	0.250	0.60
11	56.56	0.200	0.59
12	49.49	0.175	0.58
13	35.35	0.125	0.47
14	21.21	0.075	0.35
15	1.414	0.005	0.17

Table 2: Measured values for second loading cycle

Loading stage no.	Load (P) kN	Normal stress (σ_0) MN/m ²	Settlement of loading plate S (mm)
15	1.414	0.005	0.17
16	7.07	0.025	0.25
17	14.14	0.050	0.29
18	21.21	0.075	0.35
19	28.28	0.100	0.41
20	35.35	0.125	0.46
21	42.42	0.150	0.52
22	49.49	0.175	0.58
23	56.56	0.200	0.63
24	63.63	0.225	0.65

Table 3: Compilation of results

Parameters	1st loading cycle	2nd loading cycle
(σ_{max}) MN/m ²	0.250	0.250
a_s (mm)	0.008	0.164
a_0 (mm/(MN/m ²))	2.680	2.747
a_1 (mm/(MN/m ²))	-1.152	-3.298
For 1.5 m (a, b, c, d, e, f)	188.12	207.13
Ev2/Ev1	1.39	



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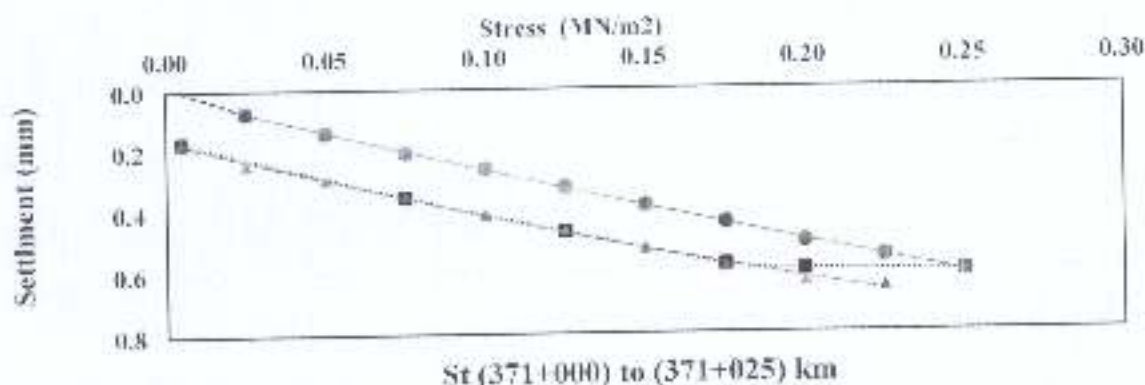


Fig. 1: Load-settlement curve, fitting curves according to Table 1 and Table 2 for the first and second loading cycles

- Measurement points from the first loading cycle
- Measurement points from the unloading cycle
- ▲ Measurement points from the second loading cycle
- S Settlement in mm
- σ_1 Normal stress MN/m²





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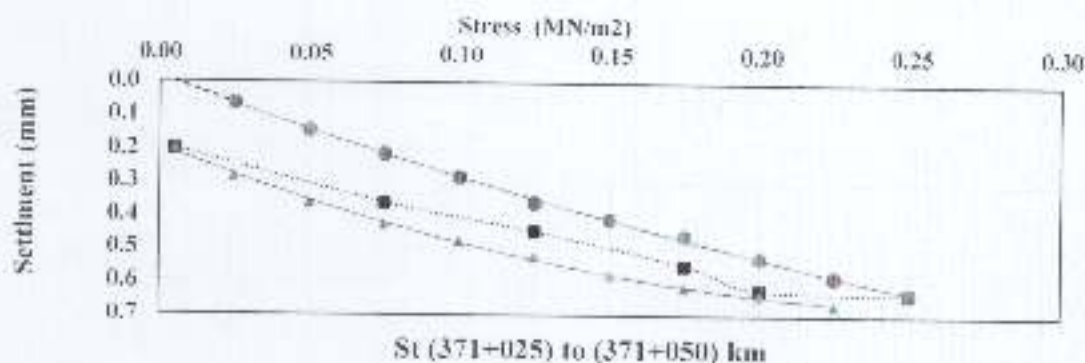


Fig. 2: Load-settlement curve, fitting curves according to Table 4 and Table 5 for the first and second loading cycles

- Measurement points from the first loading cycle
- Measurement points from the unloading cycle
- ▲ Measurement points from the second loading cycle
- S Settlement in mm
- σ_0 Normal stress MN/m²





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

600

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

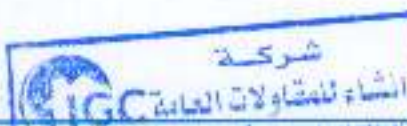
Loading stage no.	Load (F) kN	Normal stress (σ_x) MN/m ²	Settlement of loading plate S (mm)
0	1.414	0.005	0.00
1	7.07	0.025	0.09
2	14.14	0.050	0.14
3	21.21	0.075	0.19
4	28.28	0.100	0.20
5	35.35	0.125	0.26
6	42.42	0.150	0.32
7	49.49	0.175	0.39
8	56.56	0.200	0.45
9	63.63	0.225	0.52
10	70.7	0.250	0.55
11	56.56	0.200	0.62
12	49.49	0.175	0.55
13	35.35	0.125	0.44
14	21.21	0.075	0.32
15	1.414	0.005	0.16

Table 8: Measured values for second loading cycle

Loading stage no.	Load (F) kN	Normal stress (σ_x) MN/m ²	Settlement of loading plate S (mm)
15	1.414	0.005	0.16
16	7.07	0.025	0.20
17	14.14	0.050	0.25
18	21.21	0.075	0.31
19	28.28	0.100	0.36
20	35.35	0.125	0.42
21	42.42	0.150	0.47
22	49.49	0.175	0.52
23	56.56	0.200	0.57
24	63.63	0.225	0.62

Table 9: Compilation of results

Parameters	1st loading cycle	2nd loading cycle
$(\sigma_{1.00})$ MN/m ²	0.250	0.250
u_x (mm)	0.056	0.150
u_x (mm/(MN/m ²))	1.407	2.165
α_x (mm/(MN ² /m ⁴))	2.547	-0.288
$\sigma_{1.00}^2 (4 \times 10^{-6} \times u_x \times \alpha_x)$	230.21	215.00
$\sigma_{1.00}^2 (E \times 10^{-6})$	0.99	





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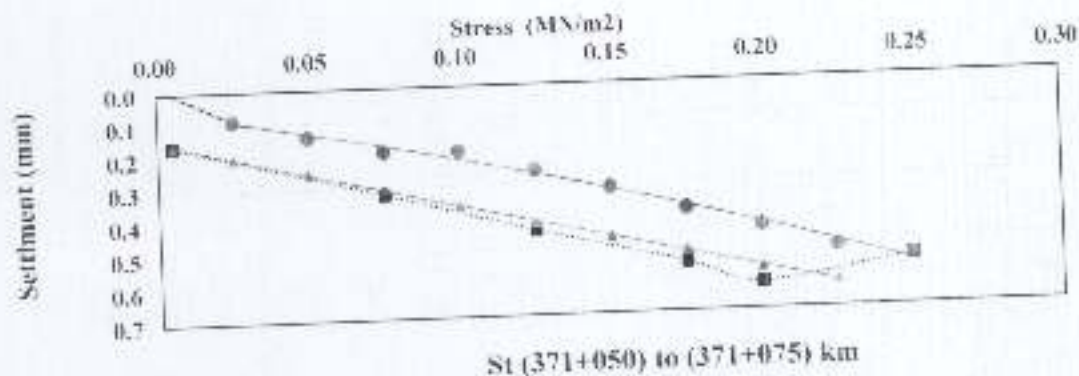


Fig. 3: Load-settlement curve, fitting curves according to Table 7 and Table 8 for the first and second loading cycles

- 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_z Normal stress MN/m^2





COMIBASSAL International Controllers

Internal inspection and laboratories sector

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

600

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

Loading stage no.	Load (F) kN	Normal stress (σ_y) MN/m ²	Settlement of loading plate S (mm)
0	1.414	0.025	0.00
1	7.07	0.025	0.07
2	14.14	0.050	0.15
3	21.21	0.075	0.21
4	28.28	0.100	0.28
5	35.35	0.125	0.34
6	42.42	0.150	0.40
7	49.49	0.175	0.45
8	56.56	0.200	0.50
9	63.63	0.225	0.54
10	70.7	0.250	0.58
11	56.56	0.200	0.57
12	49.49	0.175	0.50
13	35.35	0.125	0.43
14	21.21	0.075	0.30
15	1.414	0.005	0.20

Table 11: Measured values for second loading cycle

Loading stage no.	Load (F) kN	Normal stress (σ_y) MN/m ²	Settlement of loading plate S (mm)
16	1.414	0.005	0.20
16	7.07	0.025	0.28
17	14.14	0.050	0.32
18	21.21	0.075	0.38
19	28.28	0.100	0.43
20	35.35	0.125	0.48
21	42.42	0.150	0.52
22	49.49	0.175	0.57
23	56.56	0.200	0.59
24	63.63	0.225	0.63

Table 12: Compilation of results

Parameters	1st loading cycle	2nd loading cycle
$\sigma_{y,avg}$ (MN/m ²)	0.250	0.250
s_y (mm)	-0.003	0.196
a_1 (mm/(MN/m ²))	2.197	2.698
a_2 (mm/(MN/m ²))	-3.456	3.515
E_{avg} (MN/m ²)	192.44	247.34
	1.29	





COMIBASSAL International Controllers

Internal inspection and laboratories sector

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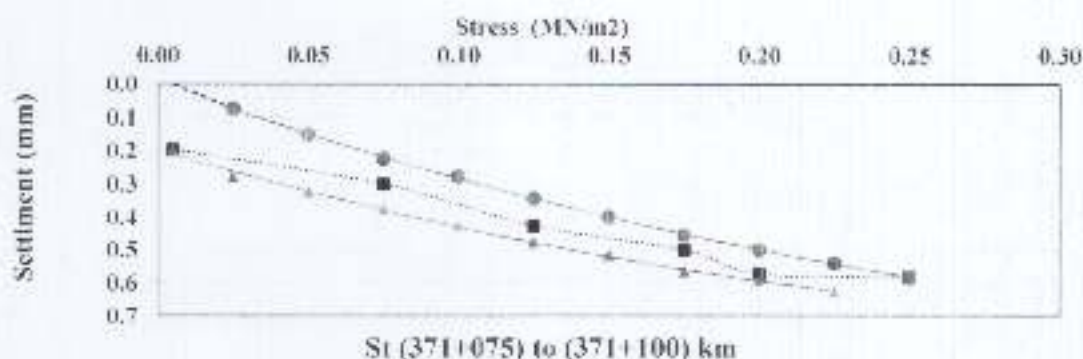
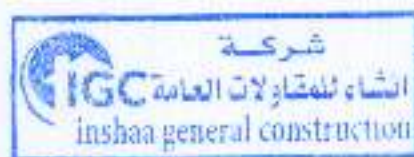
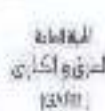


Fig. 4: Load-settlement curve, fitting curves according to Table 10 and Table 11 for the first and second loading cycles

- Measurement points from the first loading cycle
- Measurement points from the unloading cycle
- ▲ Measurement points from the second loading cycle
- S Settlement in mm
- σ_0 Normal stress MN/m²



MATERIAL INSPECTION REQUEST



Contractor Company	INSHAA GENERAL OF CONSTRUCTION Company		Designer Company	[SPECTRUM] Engineering Consulting Office			
Issued by Contractor	Name	Sign	Date/ Serial Number	Time			
	Eng. Mahmoud shaban		20/06/2023 (P.L.T.6)	02:00 PM			
Received by GARB CONSULTANT	Eng. Mazen Essamy		PLT	CI	CS	DO	MM
				371	FW	CS	21

CODE - 1	S1 to S21 Station Reference	D1 to S3 Depot Reference	Kp XXX Note For Kilometer point only Start Km is used
CODE - 2	Work Activity		
CODE - 3	Sub Element of Activity		

Description of Materials	Sub Ballast 2.		
Location to be Used	St. (371+100) To (371+275)		
MAR Approval No	M.A.R. (B.S.1)	Date	29/04/2023
Supplier Name			
Test Requirement	P.L.T (DIN 18134)	Specification	EARTHWORK SPECIFICATIONS & TESTING REPORT (OG21-41.2) VERSION 2 BY OVECON GROUP
Reference Photos	Yes / No	Other	Rev UIR-S.B-(8)&(9)
Item	Description	Unit	Quantity
1	PLATE LOAD TEST	NUMBER	7
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) Approved 	1-Plate Load Test was carried out by (Comibesse) 2-Results report attached and acceptable with project specifications. 3-Final approval is subject to above mentioned comments.

APPROVAL STATUS				
Organisation	Name	Sign	Date	A-AWC-R
Contractor	Eng. Mahmoud shaban		21-06-2023	A
QA/QC *	Eng. Mazen Essamy			A
GARB**	Eng. Margret magdy			
Employers Representative	Eng. Alaa Abd-Allatif		22-6-2023	Awc

* Designer

** Alignment / Bridges - Culvert Only



COMIBASSAL International Controllers

Internal inspection and laboratories sector

Accredited by : Egyptian General Authority for Petroleum under No. 34/29-11-2011
Accredited by : Egyptian Accreditation council (EGAC) under No. 031708/1A

Technical report

of Plate Loading Test (DIN 18134)

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





COMIBASSAL International Controllers

Internal inspection and laboratories sector

Accredited by : Egypt General Authority for Petroleum under No. 34/29-11-2011
Accredited by : Egypt Accreditation council (EGAC) under No. 031706/1A

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.

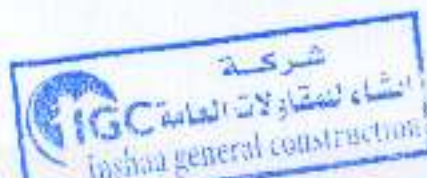
The test to be carried out on the native soil according to German specifications DIN 18134.

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 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 0.025 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.



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COMIBASSAL International Controllers

Internal inspection and laboratories sector

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Accredited by : Egypt Accreditation council (EGAC) under No. 031706/1A

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

600

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

Loading stage no.	Load (F) kN	Normal stress (σ_n) MN/m ²	Settlement of loading plate S (mm)
0	1.414	0.005	0.00
1	7.07	0.025	0.07
2	14.14	0.050	0.12
3	21.21	0.075	0.17
4	28.28	0.100	0.22
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	0.64
12	84.84	0.300	0.70
13	91.91	0.325	0.76
14	98.98	0.350	0.82
15	106.05	0.375	0.88

Table 2: Measured values for second loading cycle

Loading stage no.	Load (F) kN	Normal stress (σ_n) MN/m ²	Settlement of loading plate S (mm)
15	1.414	0.005	0.13
16	7.07	0.025	0.17
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	0.36
21	42.42	0.150	0.42
22	49.49	0.175	0.47
23	56.56	0.200	0.53
24	63.63	0.225	0.58

Table 3: Compilation of results

Parameters	1st loading cycle	2nd loading cycle
(σ_{lim}) MN/m ²	0.250	0.250
s_0 (mm)	0.016	0.121
a_1 (mm/(MN/m ²))	1.917	1.873
a_2 (mm/(MN ² /m ⁴))	1.415	0.873
$L_c = \frac{a_1^2}{4a_2}$	135.19	215.15



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COMIBASSAL International Controllers

Internal inspection and laboratories sector

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Accredited by : Egypt Accreditation council (EGAC) under No. 031708/1A

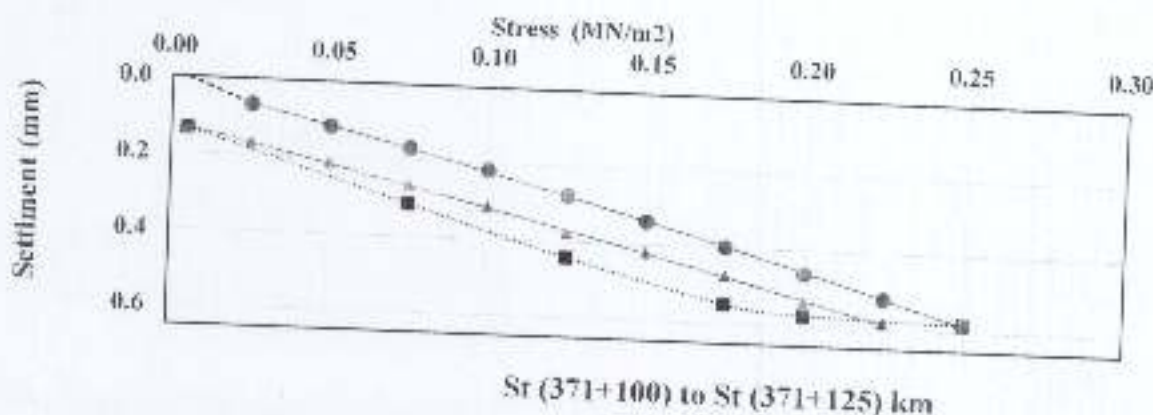


Fig. 1: Load-settlement curve, fitting curves according to Table 1 and Table 2 for the first and second loading cycles

- Measurement points from the first loading cycle
- Measurement points from the unloading cycle
- ▲ Measurement points from the second loading cycle
- S Settlement in mm
- σ_s Normal stress MN/m²





COMIBASSAL International Controllers

Internal inspection and laboratories sector

Accredited by : Egypt General Authority for Petroleum under No. 34/29-11-2011
Accredited by : Egypt Accreditation council (EGAC) under No. 031708/LA

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) kN	Normal stress (σ_n) MN/m ²	Settlement of loading plate S (mm)
0	1.414	0.005	0.00
1	7.07	0.025	0.07
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	0.32
7	49.49	0.175	0.38
8	56.56	0.200	0.44
9	63.63	0.225	0.50
10	70.7	0.250	0.57
11	56.56	0.200	0.55
12	49.49	0.175	0.54
13	35.35	0.125	0.42
14	21.21	0.075	0.33
15	1.414	0.005	0.11

Table 5: Measured values for second loading cycle

Loading stage no.	Load (F) kN	Normal stress (σ_n) MN/m ²	Settlement of loading plate S (mm)
15	1.414	0.005	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	0.41
22	49.49	0.175	0.46
23	56.56	0.200	0.51
24	63.63	0.225	0.57

Table 6: Compilation of results

Parameters	1st loading cycle	2nd loading cycle
(σ_{max}) MN/m ²	0.250	0.250
s_d (mm)	0.034	0.034
u_r (mm/(MN/m ²))	1.588	2.077
a_r (mm/(MN/m ²))	2.344	-0.211
$E_v = 1.5 \cdot E \cdot (1 + \mu_r) \cdot \sigma_{max} / (s_d - a_r)$	206.90	123.27
$(\sigma > 2 \cdot \sigma_{max})$	1.00	





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Internal inspection and laboratories sector

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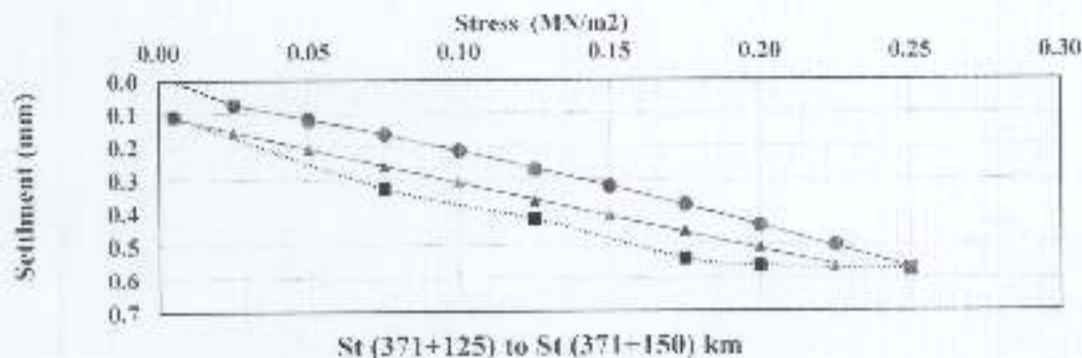


Fig. 2: Load-settlement curve, fitting curves according to Table 4 and Table 5 for the first and second loading cycles

- Measurement points from the first loading cycle
- Measurement points from the unloading cycle
- ▲ Measurement points from the second loading cycle
- S Settlement in mm
- σ_v Normal stress kN/m²





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

600

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

Loading stage no.	Load (F) kN	Normal stress (σ_n) MN/m ²	Settlement of loading plate S (mm)
0	1.414	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	86.56	0.260	0.68
12	49.49	0.175	0.58
13	35.35	0.125	0.45
14	21.21	0.075	0.32
15	1.414	0.005	0.10

Table 8: Measured values for second loading cycle

Loading stage no.	Load (F) kN	Normal stress (σ_n) MN/m ²	Settlement of loading plate S (mm)
15	1.414	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	0.29
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	0.53
24	63.63	0.225	0.58

Table 9: Compilation of results

Parameters	1st loading cycle	2nd loading cycle
(σ_{lim}) MN/m ²	0.250	0.250
a_p (mm)	4.00	0.889
a_1 (mm/(MN/m ²))	1.945	1.931
a_2 (mm/(MN/m ²))	1.960	1.713
Eqs 1.5 a_1 (σ_p & σ_{lim})	184.77	200.39
	1.09	





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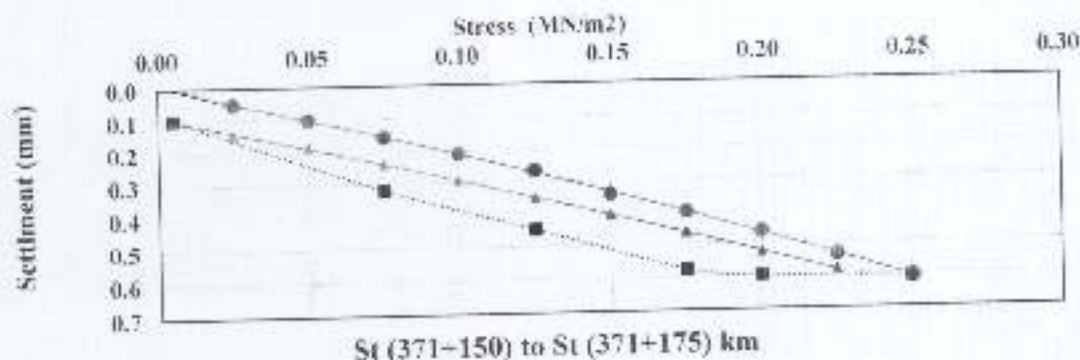


Fig. 3: Load-settlement curve, fitting curves according to Table 7 and Table 8 for the first and second loading cycles

- 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 MN/m²





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St (371+175) to St (371+200) km
600

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

Loading stage no.	Load (F) kN	Normal stress (σ) MN/m ²	Settlement of loading plate S (mm)
0	1.414	0.005	0.00
1	7.07	0.025	0.08
2	14.14	0.050	0.14
3	21.21	0.075	0.19
4	28.28	0.100	0.24
5	35.35	0.125	0.29
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	0.51
10	70.7	0.250	0.57
11	77.77	0.275	0.62
12	84.84	0.300	0.67
13	91.91	0.325	0.72
14	98.98	0.350	0.77
15	106.05	0.375	0.82

Table 11: Measured values for second loading cycle

Loading stage no.	Load (F) kN	Normal stress (σ) MN/m ²	Settlement of loading plate S (mm)
15	1.414	0.005	0.12
16	7.07	0.025	0.17
17	14.14	0.050	0.22
18	21.21	0.075	0.28
19	28.28	0.100	0.32
20	35.35	0.125	0.38
21	42.42	0.150	0.43
22	49.49	0.175	0.47
23	56.56	0.200	0.52
24	63.63	0.225	0.58

Table 12: Compilation of results

Parameters	1st loading cycle	2nd loading cycle
σ_{max} (MN/m ²)	0.380	0.380
s_g (mm)	0.042	0.100
a_1 (mm/(MN/m ²))	1.840	2.227
a_2 (mm/(MN/m ²))	1.192	0.711
$E = 1.5 \times 10^4$ (MN/m ²)	210.48	186.78
0.59		



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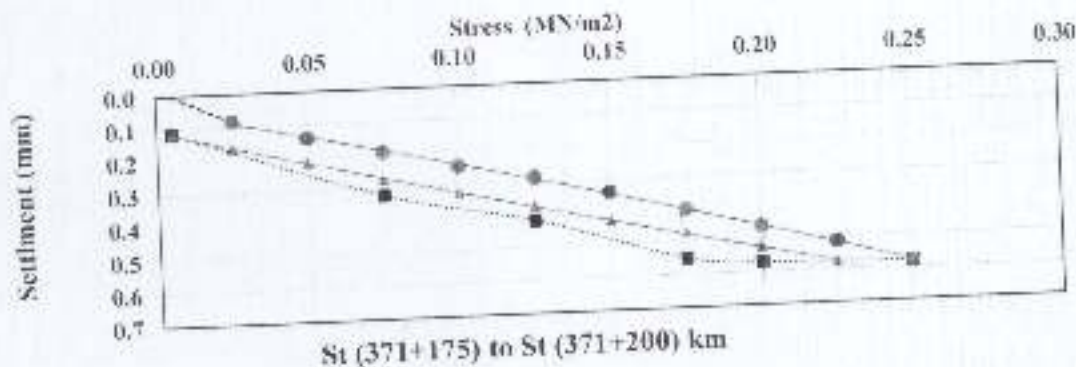


Fig. 4: Load-settlement curve, fitting curves according to Table 10 and Table 11 for the first and second loading cycles

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





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St (371+200) to St (371+225) km
600

Table 13: Measured values for first loading cycle and unloading cycle

Loading stage no.	Load (F) kN	Normal stress (σ_n) MN/m ²	Settlement of loading plate s (mm)
0	1.414	0.005	0.00
1	7.07	0.025	0.07
2	14.14	0.050	0.12
3	21.21	0.075	0.18
4	28.28	0.100	0.23
5	35.35	0.125	0.28
6	42.42	0.150	0.33
7	49.49	0.175	0.39
8	56.56	0.200	0.44
9	63.63	0.225	0.49
10	70.7	0.250	0.58
11	56.56	0.200	0.57
12	49.49	0.175	0.55
13	35.35	0.125	0.44
14	21.21	0.075	0.34
15	1.414	0.005	0.16

Table 14: Measured values for second loading cycle

Loading stage no.	Load (F) kN	Normal stress (σ_n) MN/m ²	Settlement of loading plate s (mm)
16	1.414	0.005	0.16
17	7.07	0.025	0.19
18	14.14	0.050	0.23
19	21.21	0.075	0.25
20	28.28	0.100	0.33
21	35.35	0.125	0.38
22	42.42	0.150	0.43
23	49.49	0.175	0.48
24	56.56	0.200	0.53
25	63.63	0.225	0.58

Table 15: Compilation of results

Parameters	1st loading cycle	2nd loading cycle
$(\sigma_{p,0.01})$ MN/m ²	0.250	0.250
s_1 (mm)	0.027	0.149
α (mm/(MN/m ²))	1.855	1.046
$\alpha_{\text{settlement}}$ (mm)	1.192	1.301
E_{soil} (MPa)	209.22	228.25
	1.05	



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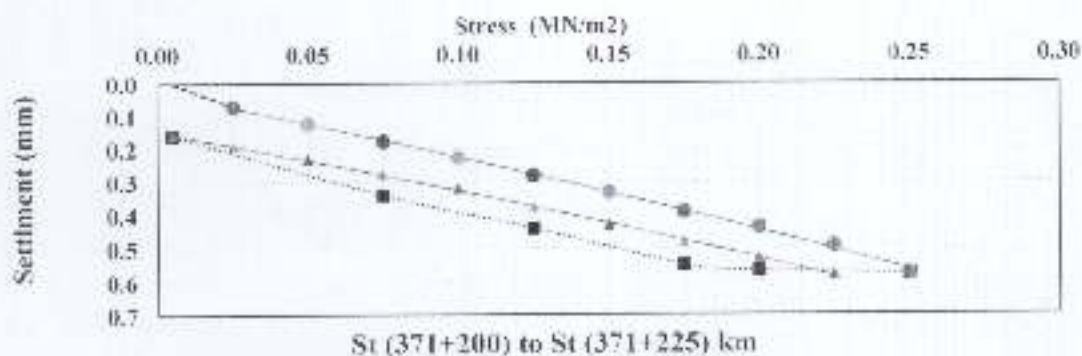


Fig. 5: Load-settlement curve, fitting curves according to Table 13 and Table 14 for the first and second loading cycles

- 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_s Normal stress MN/m²





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St (371+225) to St (371+250) km

600

Table 16: Measured values for first loading cycle and unloading cycle

Loading stage no.	Load (F) kN	Normal stress (σ_n) MN/m ²	Settlement of loading plate S (mm)
0	1.414	0.005	0.00
1	7.07	0.025	0.08
2	14.14	0.050	0.12
3	21.21	0.075	0.17
4	28.28	0.100	0.22
5	35.35	0.125	0.28
6	42.42	0.150	0.32
7	49.49	0.175	0.38
8	56.56	0.200	0.47
9	63.63	0.225	0.55
10	70.7	0.250	0.61
11	76.86	0.280	0.60
12	49.49	0.175	0.55
13	35.35	0.125	0.41
14	21.21	0.075	0.32
15	1.414	0.005	0.14

Table 17: Measured values for second loading cycle

Loading stage no.	Load (F) kN	Normal stress (σ_n) MN/m ²	Settlement of loading plate S (mm)
15	1.414	0.005	0.14
16	7.07	0.025	0.18
17	14.14	0.050	0.22
18	21.21	0.075	0.27
19	28.28	0.100	0.31
20	35.35	0.125	0.36
21	42.42	0.150	0.41
22	49.49	0.175	0.45
23	56.56	0.200	0.52
24	63.63	0.225	0.58

Table 18: Compilation of results

Parameters	1st loading cycle	2nd loading cycle
(σ_{max}) MN/m ²	0.250	0.250
s_n (mm)	0.044	0.135
a_1 (mm)/(MN/m ²)	1.355	1.575
a_2 (mm)/(MN/m ²)	1.779	1.784
$E_s = 1.5 \text{ (MN/m}^2)$	98.69	212.63
	1.14	





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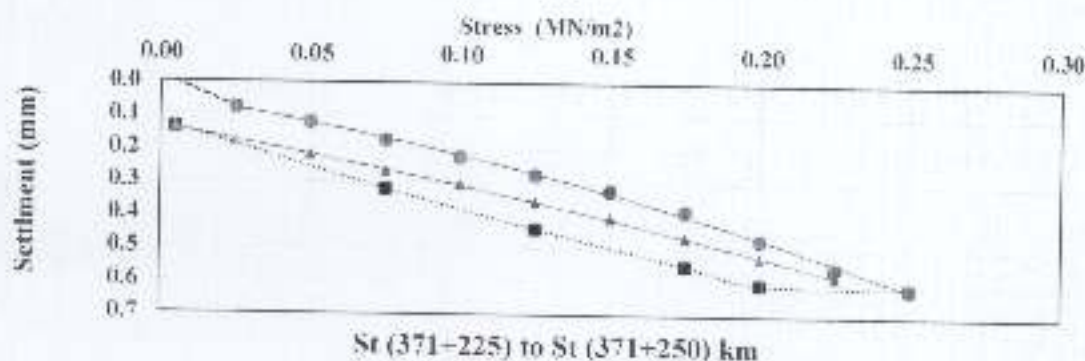


Fig. 6c Load-settlement curve, fitting curves according to Table 16 and Table 17 for the first and second loading cycles

- Measurement points from the first loading cycle
- Measurement points from the unloading cycle
- ▲ Measurement points from the second loading cycle
- δ Settlement in mm
- σ_z Normal stress MN/m²





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St (371+250) to St (371+275) km
600

Table 19: Measured values for first loading cycle and unloading cycle

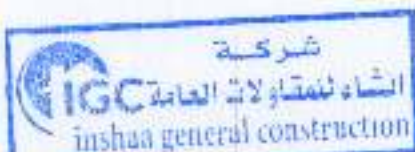
Loading stage no.	Load (F) kN	Normal stress (σ_0) MN/m ²	Settlement of loading plate S (mm)
0	1.414	0.005	0.00
1	7.07	0.025	0.09
2	14.14	0.050	0.15
3	21.21	0.075	0.20
4	28.28	0.100	0.26
5	35.35	0.125	0.32
6	42.42	0.150	0.38
7	49.49	0.175	0.43
8	56.56	0.200	0.48
9	63.63	0.225	0.54
10	70.7	0.250	0.51
11	56.56	0.200	0.50
12	49.49	0.175	0.55
13	35.35	0.125	0.45
14	21.21	0.075	0.34
15	1.414	0.005	0.14

Table 20: Measured values for second loading cycle

Loading stage no.	Load (F) kN	Normal stress (σ_0) MN/m ²	Settlement of loading plate S (mm)
15	1.414	0.005	0.14
16	7.07	0.025	0.18
17	14.14	0.050	0.22
18	21.21	0.075	0.27
19	28.28	0.100	0.31
20	35.35	0.125	0.37
21	42.42	0.150	0.42
22	49.49	0.175	0.47
23	56.56	0.200	0.54
24	63.63	0.225	0.60

Table 21: Compilation of results

Parameters	1st loading cycle	2nd loading cycle
$(\sigma_{f_{max}})$ MN/m ²	0.250	0.250
S_f (mm)	0.034	0.126
a (mm) (1/300)	2.218	1.608
k_1 (MN/m ³)	0.303	1.971
E_{soil} (MN/m ²)	196.41	214.55
	1.08	





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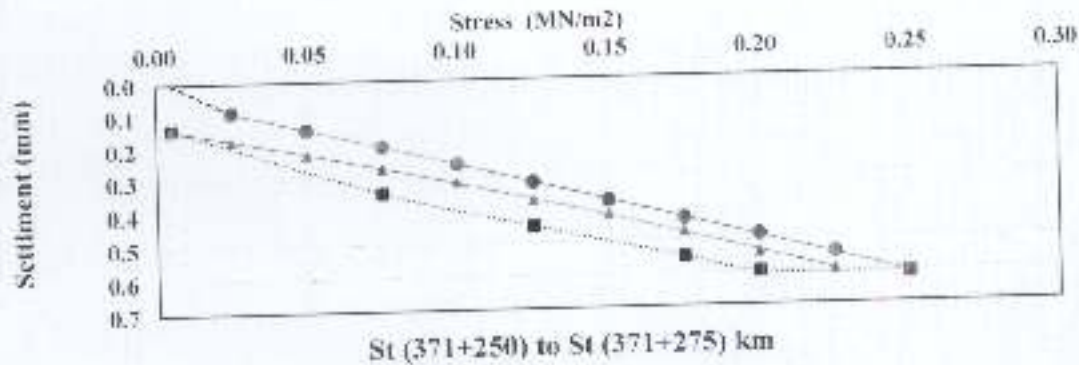


Fig. 7: Load-settlement curve, fitting curves according to Table 19 and Table 20 for the first and second loading cycles

- 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_s Normal stress MN/m²





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Internal inspection and laboratories sector

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Conclusions:

The present test results which obtained from the plate loading tests of the native soil on top of the sub-ballast layer of the electric express train project at location St (371+100) to St (371+275) km in accordance to the German standard , DIN 18134 are illustrated in table 22 .

Table 22 :Test results

Location	Ev1(MN/m ²)	Ev2(MN/m ²)	Ev2/Ev1 ratio
St (371+100) : St (371+125) km	198.19	215.15	1.09
St (371+125) : St (371+150) km	209.90	222.27	1.06
St (371+150) : St (371+175) km	184.77	200.99	1.09
St (371+175) : St (371+200) km	210.48	186.78	0.89
St (371+200) : St (371+225) km	209.22	228.29	1.09
St (371+225) : St (371+250) km	195.69	222.63	1.14
St (371+250) : St (371+275) km	196.41	214.53	1.09

Lab Director

Eng / Eman Kandil

Eman

Geotechnical Consultant

For Dr. M.
Dr / Mohamed Mostafa Badry



**MATERIAL
INSPECTION
REQUEST**


Contractor Company	INSHAA GENERAL OF CONSTRUCTION Company		Designer Company	[SPECTRUM] Engineering Consulting Office							
Issued by Contractor	Name	Sign	Date/ Serial Number	Time							
	Eng. Mahmoud shaban		21/06/2023 (P.L.T.7)	02:00 PM							
Received by GARB CONSULTANT	Eng. Mazen Essamy		PLT	C1	C2	C3	C4	MM	YY	HH	MM
				371	EW	C5	22	06	2023	2	00

CODE-1	S1 to S21 Station Reference	D1 to D3 Depot Reference	Rp XXX Note For Kilometer point only Start Km is used
CODE-2	Work Activity		
CODE-3	Sub Element of Activity		

Description of Materials	Sub Ballast 2.		
Location to be Used	St. (371+275) To (371+500)		
MAR Approval No	M.A.R. (B.S 1)	Date	29/04/2023
Supplier Name			
Test Requirement	P.L.T (DIN 18134)	Specification	FARHWORKE SPECIFICATIONS & TESTING REPORT (CG21-41,2) VERSION 2 BY CIVECON GROUP
Reference Photos	Yes / No	Other	Rev UIR-S.B-(6)&(9)&(10)

Item	Description	Unit	Quantity	Arrival Date	Note
1	PLATE LOAD TEST	NUMBER	9	22/06/2023	
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 Approved



1-Plate Load Test was carried-out by (Comibassa)

2-Results report attached and acceptable with project specifications.

3-Final approval is subject to above mentioned comments.


APPROVAL STATUS

Organisation	Name	Sign	Date	A-AWC-R
Contractor	Eng. Mahmoud shaban		22-06-2023	A
QA/QC *	Eng. Mazen Essamy			A
GARB **	Eng. Margret magdy			
Employers Representative	Eng. Alaa Abd-Allatif		23-6-2023	Awe

* Designer

** Alignment / Bridges/Culvert Only



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Internal inspection and laboratories sector

Accredited by : Egyptian General Authority for Petroleum under No. 94/29-11-2011
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Technical report

of Plate Loading Test (DIN 18134)

General	:	SYSTRA
Consultant	:	SPECTRUM
Contractor	:	شركة إنشاء للمقاولات العامة
Project	:	ELECTRIC EXPRESS TRAIN
Sample	:	Sub-Ballast (2)
Station	:	ST(371+275) TO ST(371+500)
Date of Test	:	22/6/2023
QC	:	1476





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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 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 0.025 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.





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St (371+275) to St (371+300) km

600

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

Loading stage no.	Load (T) kN	Normal stress (σ_k) MN/m ²	Settlement of loading plate S (mm)
0	1.414	0.005	0.00
1	7.07	0.025	0.08
2	14.14	0.050	0.14
3	21.21	0.075	0.19
4	28.28	0.100	0.25
5	35.35	0.125	0.31
6	42.42	0.150	0.37
7	49.49	0.175	0.42
8	56.56	0.200	0.48
9	63.63	0.225	0.53
10	70.7	0.250	0.59
11	56.56	0.200	0.58
12	49.49	0.175	0.56
13	35.35	0.125	0.43
14	21.21	0.075	0.30
15	1.414	0.005	0.12

Table 2: Measured values for second loading cycle

Loading stage no.	Load (T) kN	Normal stress (σ_0) MN/m ²	Settlement of loading plate S (mm)
15	1.414	0.005	0.12
16	7.07	0.025	0.16
17	14.14	0.050	0.20
18	21.21	0.075	0.25
19	28.28	0.100	0.30
20	35.35	0.125	0.35
21	42.42	0.150	0.40
22	49.49	0.175	0.46
23	56.56	0.200	0.52
24	63.63	0.225	0.54

Table 3: Compilation of results

Parameters	1st loading cycle	2nd loading cycle
(σ_{max}) MN/m ²	0.250	0.250
s_k (mm)	0.022	0.107
s_1 (mm) / (kN/m ²)	2.345	1.991
s_2 (mm) / (kN/m ²)	4.380	0.053
$E = 1.5 \times 10^4$ (kN/cm ²)	200.01	226.67
By (kN)	1.15	





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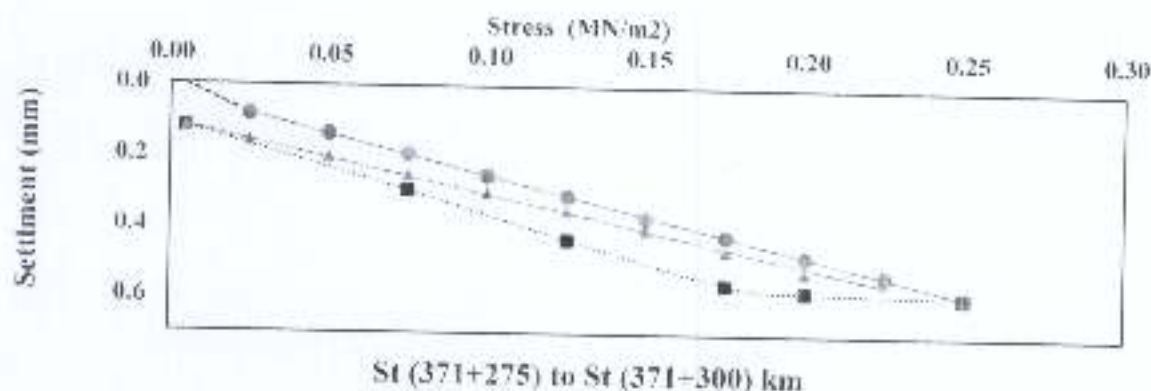


Fig. 1: Load-settlement curve, fitting curves according to Table 1 and Table 2 for the first and second loading cycles

- Measurement points from the first loading cycle
- Measurement points from the unloading cycle
- ▲ Measurement points from the second loading cycle
- S Settlement in mm
- σ_0 Normal stress MN/m²





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St (371+300) to St (371+325) km

600

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

Loading stage no.	Load (F) kN	Normal stress (σ_n) MN/m ²	Settlement of loading plate S (mm)
0	1.414	0.005	0.00
1	7.07	0.025	0.01
2	14.14	0.050	0.13
3	21.21	0.075	0.19
4	28.28	0.100	0.25
5	35.35	0.125	0.30
6	42.42	0.150	0.35
7	49.49	0.175	0.41
8	56.56	0.200	0.46
9	63.63	0.225	0.51
10	70.7	0.250	0.56
11	56.56	0.200	0.55
12	49.49	0.175	0.54
13	35.35	0.125	0.41
14	21.21	0.075	0.30
15	1.414	0.005	0.14

Table 5: Measured values for second loading cycle

Loading stage no.	Load (F) kN	Normal stress (σ_n) MN/m ²	Settlement of loading plate S (mm)
15	1.414	0.005	0.14
16	7.07	0.025	0.19
17	14.14	0.050	0.23
18	21.21	0.075	0.29
19	28.28	0.100	0.33
20	35.35	0.125	0.39
21	42.42	0.150	0.44
22	49.49	0.175	0.48
23	56.56	0.200	0.53
24	63.63	0.225	0.56

Table 6: Compilation of results

Parameters	1st loading cycle	2nd loading cycle
$(\sigma_{k,0.05})$ MN/m ²	0.250	0.250
a_1 (mm)	0.035	0.132
a_2 (mm/(MN/m ²))	2.234	2.781
a_3 (mm/(MN/m ²))	-0.303	-0.362
For 1.5 cm	209.82	235.58
E_s/E_v	1.12	





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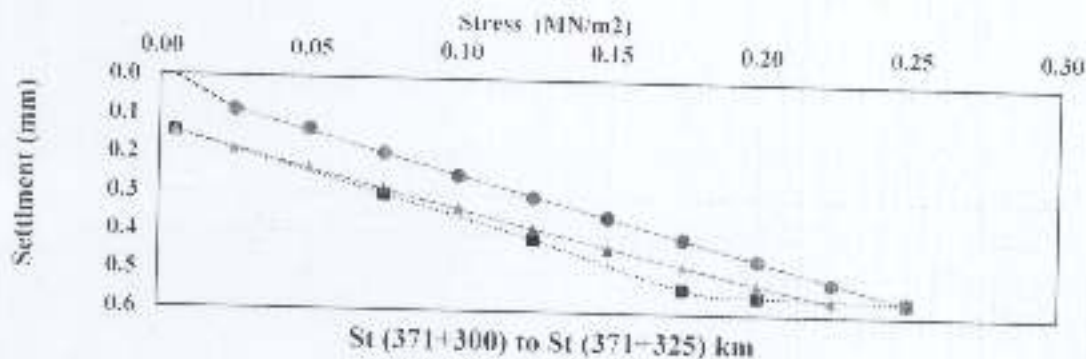


Fig. 2: Load-settlement curve, fitting curves according to Table 4 and Table 5 for the first and second loading cycles

- Measurement points from the first loading cycle
- Measurement points from the unloading cycle
- ▲ Measurement points from the second loading cycle
- S Settlement in mm
- σ_n Normal stress MN/m²





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St (371+325) to St (371+350) km

600

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

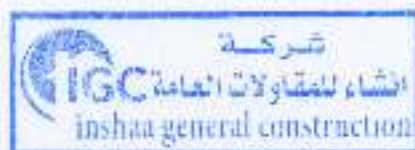
Loading stage no.	Load (F) kN	Normal stress (σ_x) MN/m ²	Settlement of loading plate S (mm)
0	1.414	0.005	0.00
1	7.07	0.025	0.09
2	14.14	0.050	0.14
3	21.21	0.075	0.19
4	28.28	0.100	0.25
5	35.35	0.125	0.31
6	42.42	0.150	0.37
7	49.49	0.175	0.42
8	56.56	0.200	0.48
9	63.63	0.225	0.54
10	70.7	0.250	0.60
11	56.56	0.200	0.59
12	49.49	0.175	0.57
13	35.35	0.125	0.50
14	21.21	0.075	0.33
15	1.414	0.005	0.16

Table 8: Measured values for second loading cycle

Loading stage no.	Load (F) kN	Normal stress (σ_x) MN/m ²	Settlement of loading plate S (mm)
15	1.414	0.005	0.16
16	7.07	0.025	0.21
17	14.14	0.050	0.26
18	21.21	0.075	0.31
19	28.28	0.100	0.36
20	35.35	0.125	0.41
21	42.42	0.150	0.46
22	49.49	0.175	0.51
23	56.56	0.200	0.56
24	63.63	0.225	0.60

Table 9: Compilation of results

Parameters	1st loading cycle	2nd loading cycle
σ_{max} (MN/m ²)	0.250	0.250
s_x (mm)	0.657	0.154
α_1 (mm/(MN/m ²))	2.075	2.142
α_2 (mm/(MN/m ²))	0.687	0.386
$E = 1.5 \times 10^6 / (\alpha_1 + \alpha_2)$	200.75	218.32
Ex2/E1	1.14	



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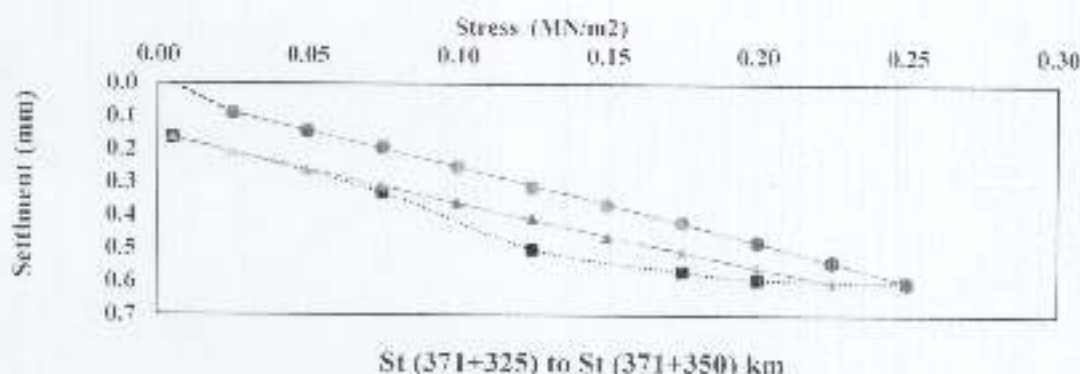


Fig. 3: Load-settlement curve, fitting curves according to Table 7 and Table 8 for the first and second loading cycles

- 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_x Normal stress MN/m²





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St (371+350) to St (371+375) km

600

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

Loading stage no.	Load (F) kN	Normal stress (σ) MN/m ²	Settlement of loading plate S (mm)
0	1.414	0.005	0.00
1	7.07	0.025	0.05
2	14.14	0.050	0.14
3	21.21	0.075	0.19
4	28.28	0.100	0.25
5	35.35	0.125	0.31
6	42.42	0.150	0.37
7	49.49	0.175	0.43
8	56.56	0.200	0.49
9	63.63	0.225	0.54
10	70.7	0.250	0.59
11	86.56	0.200	0.58
12	49.49	0.175	0.56
13	35.35	0.125	0.45
14	21.21	0.075	0.30
15	1.414	0.005	0.12

Table 11: Measured values for second loading cycle

Loading stage no.	Load (F) kN	Normal stress (σ) MN/m ²	Settlement of loading plate S (mm)
15	1.414	0.005	0.12
16	7.07	0.025	0.17
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	0.36
21	42.42	0.150	0.41
22	49.49	0.175	0.46
23	56.56	0.200	0.52
24	63.63	0.225	0.58

Table 12: Compilation of results

Parameters	1st loading cycle	2nd loading cycle
$(\sigma_{1, max})$ MN/m ²	0.250	0.250
s_p (mm)	0.004	0.112
α_1 (mm/(MN/m ²))	2.875	1.870
α_2 (mm/(MN/m ²))	0.569	0.002
$E_{1/2}$ (MN/m ²)	190.87	217.28
$E_{1/2} E_{2/2}$	1.14	





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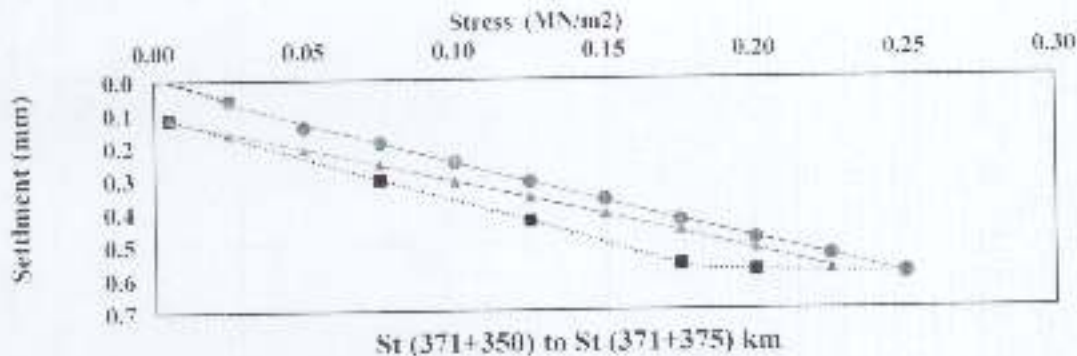


Fig. 4: Load-settlement curve, fitting curves according to Table 10 and Table 11 for the first and second loading cycles

- Measurement points from the first loading cycle
- Measurement points from the unloading cycle
- ▲ Measurement points from the second loading cycle
- S Settlement in mm
- σ_c Normal stress MN/m²





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St (371+375) to St (371+400) km

600

Table 13: Measured values for first loading cycle and unloading cycle

Loading stage no.	Load (F) kN	Normal stress (σ) MN/m ²	Settlement of loading plate S (mm)
0	1.414	0.005	0.00
1	7.07	0.025	0.13
2	14.14	0.050	0.12
3	21.21	0.075	0.17
4	28.28	0.100	0.23
5	35.35	0.125	0.27
6	42.42	0.150	0.33
7	49.49	0.175	0.39
8	56.56	0.200	0.44
9	63.63	0.225	0.50
10	70.7	0.250	0.58
11	56.56	0.200	0.57
12	49.49	0.175	0.55
13	35.35	0.125	0.44
14	21.21	0.075	0.34
15	1.414	0.005	0.13

Table 14: Measured values for second loading cycle

Loading stage no.	Load (F) kN	Normal stress (σ) MN/m ²	Settlement of loading plate S (mm)
15	1.414	0.005	0.13
16	7.07	0.025	0.17
17	14.14	0.050	0.22
18	21.21	0.075	0.36
19	28.28	0.100	0.30
20	35.35	0.125	0.36
21	42.42	0.150	0.41
22	49.49	0.175	0.46
23	56.56	0.200	0.51
24	63.63	0.225	0.55

Table 15: Compilation of results

Parameters	1st loading cycle	2nd loading cycle
(σ_{avg}) MN/m ²	0.250	0.250
s_1 (mm)	0.054	0.122
a_1 (mm/(MN/m ²))	0.987	1.790
a_2 (mm/(MN/m ²))	4.902	0.146
$E_{avg} = 1.5 \times 10^4$ (kg/cm ²)	225.24	250.58
E_{avg}/E_{11}		1.02



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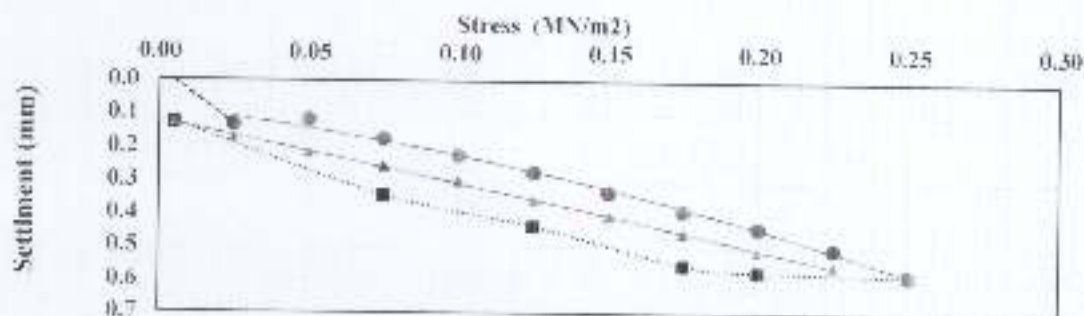
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St (371+375) to St (371+400) km

Fig. 5: Load-settlement curve, fitting curves according to Table 13 and Table 14 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_s Normal stress MN/m²





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St (371+400) to St (371+425) km

600

Table 16: Measured values for first loading cycle and unloading cycle

Loading stage no.	Load (F) kN	Normal stress (σ) MN/m ²	Settlement of loading plate S (mm)
0	1.414	0.005	0.00
1	7.07	0.025	0.09
2	14.14	0.050	0.14
3	21.21	0.075	0.20
4	28.28	0.100	0.26
5	35.35	0.125	0.31
6	42.42	0.150	0.36
7	49.49	0.175	0.41
8	56.56	0.200	0.46
9	63.63	0.225	0.53
10	70.7	0.250	0.59
11	56.56	0.200	0.58
12	49.49	0.175	0.56
13	35.35	0.125	0.44
14	21.21	0.075	0.32
15	1.414	0.005	0.14

Table 17: Measured values for second loading cycle

Loading stage no.	Load (F) kN	Normal stress (σ) MN/m ²	Settlement of loading plate S (mm)
16	1.414	0.005	0.14
16	7.07	0.025	0.18
17	14.14	0.050	0.23
18	21.21	0.075	0.27
19	28.28	0.100	0.32
20	35.35	0.125	0.36
21	42.42	0.150	0.41
22	49.49	0.175	0.46
23	56.56	0.200	0.52
24	63.63	0.225	0.58

Table 18: Compilation of results

Parameters	1st loading cycle	2nd loading cycle
$(\sigma_{1/2})$ MN/m ²	0.250	0.250
s_1 (mm)	0.035	0.33
σ_1 (mm) (MN/m ²)	2.085	1.720
s_2 (mm) (MN/m ²)	0.404	1.012
For 1.5 m ² loading plate	208.79	228.10
RS2/EV1	1.31	





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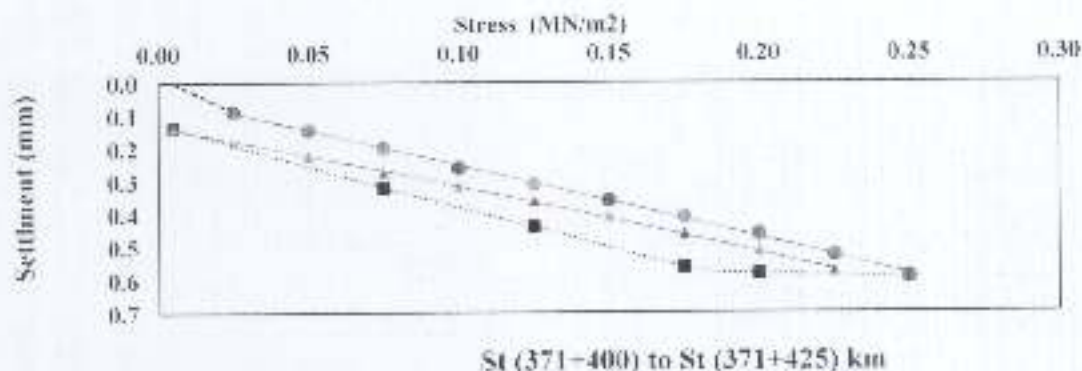


Fig. 6: Load-settlement curve, fitting curves according to Table 16 and Table 17 for the first and second loading cycles

- 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_c Nominal stress MN/m^2





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St (371+425) to St (371+450) km

600

Table 19: Measured values for first loading cycle and unloading cycle

Loading stage no.	Load (P) kN	Normal stress (σ_s) MN/m ²	Settlement of loading plate S (mm)
0	1.414	0.005	0.00
1	7.07	0.025	0.10
2	14.14	0.050	0.16
3	21.21	0.075	0.21
4	28.28	0.100	0.27
5	35.35	0.125	0.32
6	42.42	0.150	0.38
7	49.49	0.175	0.44
8	56.56	0.200	0.50
9	63.63	0.225	0.56
10	70.7	0.250	0.62
11	56.56	0.200	0.51
12	49.49	0.175	0.59
13	35.35	0.125	0.47
14	21.21	0.075	0.35
15	1.414	0.005	0.18

Table 20: Measured values for second loading cycle

Loading stage no.	Load (P) kN	Normal stress (σ) MN/m ²	Settlement of loading plate S (mm)
15	1.414	0.005	0.18
16	7.07	0.025	0.22
17	14.14	0.050	0.26
18	21.21	0.075	0.31
19	28.28	0.100	0.37
20	35.35	0.125	0.43
21	42.42	0.150	0.49
22	49.49	0.175	0.53
23	56.56	0.200	0.57
24	63.63	0.225	0.61

Table 21: Compilation of results

Parameters	1st loading cycle	2nd loading cycle
$(\sigma_{1.5\sigma})$ MN/m ²	0.250	0.250
a_g (mm)	0.45	0.161
a_1 (mm/(MN/m ²))	1.818	2.168
a_2 (mm/(MN/m ²))	0.562	0.562
$(a = 1.5 \sigma / (a_1 + a_2 \sigma))$	1.14	1.14
$B \geq 2Ea$		





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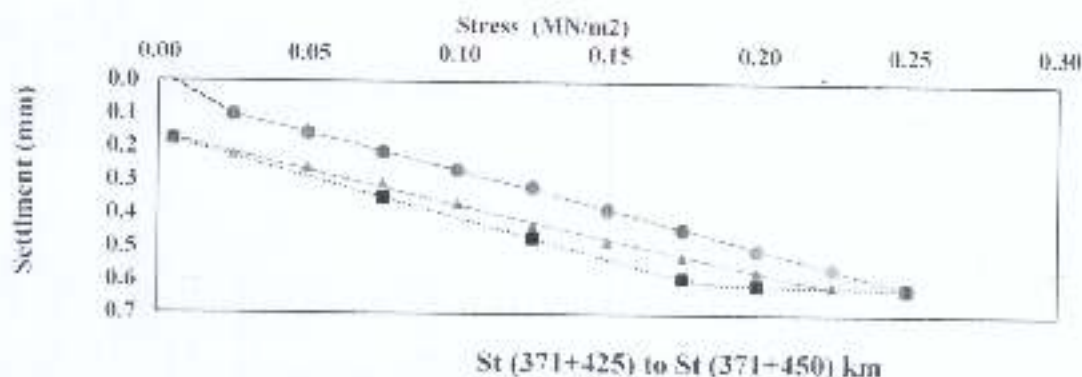


Fig. 7: Load-settlement curve, fitting curves according to Table 19 and Table 20 for the first and second loading cycles

- 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_f Normal stress MN/m²





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St (371+450) to St (371+475) km

600

Table 22: Measured values for first loading cycle and unloading cycle

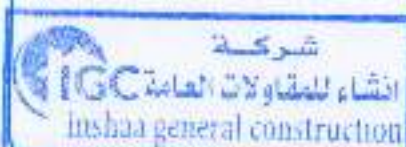
Loading stage no.	Load (F) kN	Normal stress (σ_v) MN/m ²	Settlement of loading plane S (mm)
0	1.414	0.005	0.00
1	7.07	0.025	0.08
2	14.14	0.050	0.13
3	21.21	0.075	0.19
4	28.28	0.100	0.24
5	35.35	0.125	0.29
6	42.42	0.150	0.35
7	49.49	0.175	0.41
8	56.56	0.200	0.47
9	63.63	0.225	0.53
10	70.7	0.250	0.59
11	56.56	0.200	0.58
12	49.49	0.175	0.56
13	35.35	0.125	0.48
14	21.21	0.075	0.35
15	1.414	0.005	0.12

Table 23: Measured values for second loading cycle

Loading stage no.	Load (F) kN	Normal stress (σ_v) MN/m ²	Settlement of loading plane S (mm)
15	1.414	0.005	0.12
16	7.07	0.025	0.16
17	14.14	0.050	0.20
18	21.21	0.075	0.25
19	28.28	0.100	0.31
20	35.35	0.125	0.35
21	42.42	0.150	0.41
22	49.49	0.175	0.45
23	56.56	0.200	0.50
24	63.63	0.225	0.54

Table 24: Compilation of results

Parameters	1st loading cycle	2nd loading cycle
(σ_{vmax}) MN/m ²	0.250	0.250
u_1 (mm)	0.028	0.113
α_1 (mm/(MN/m ²))	1.976	1.920
α_2 (mm/(MN/m ²))	1.132	1.510
$u = 1.5 \alpha_1 (\sigma_v - \sigma_{vmax})$	199.20	214.53
	1.08	



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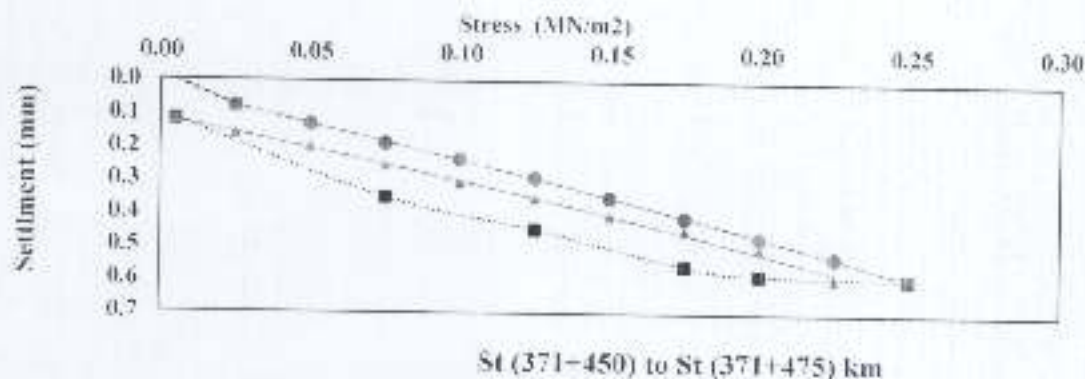


Fig. 8: Load-settlement curve, fitting curves according to Table 22 and Table 23 for the first and second loading cycles

- Measurement points from the first loading cycle
- Measurement points from the unloading cycle
- ▲ Measurement points from the second loading cycle
- ↓ Settlement in mm
- σ_0 Normal stress (MN/m²)





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St (371+475) to St (371+500) km

600

Table 25: Measured values for first loading cycle and unloading cycle

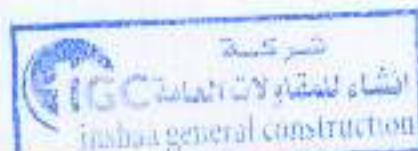
Loading stage no.	Load (F) kN	Normal stress (σ_n) MN/m ²	Settlement of loading plate S (mm)
0	1.414	0.005	0.00
1	7.07	0.025	0.07
2	14.14	0.050	0.12
3	21.21	0.075	0.17
4	28.28	0.100	0.22
5	35.35	0.125	0.28
6	42.42	0.150	0.34
7	49.49	0.175	0.39
8	56.56	0.200	0.46
9	63.63	0.225	0.52
10	70.7	0.250	0.58
11	56.56	0.200	0.55
12	49.49	0.175	0.48
13	35.35	0.125	0.40
14	21.21	0.075	0.25
15	1.414	0.005	0.10

Table 26: Measured values for second loading cycle

Loading stage no.	Load (F) kN	Normal stress (σ_n) MN/m ²	Settlement of loading plate S (mm)
16	1.414	0.005	0.10
16	7.07	0.025	0.14
17	14.14	0.050	0.19
18	21.21	0.075	0.25
19	28.28	0.100	0.29
20	35.35	0.125	0.34
21	42.42	0.150	0.39
22	49.49	0.175	0.45
23	56.56	0.200	0.51
24	63.63	0.225	0.57

Table 27: Compilation of results

Parameters	1st loading cycle	2nd loading cycle
(σ_{crack}) MN/m ²	0.250	0.250
s_1 (mm)	0.022	0.090
k_1 (mm/(MN/m ²))	1.911	1.935
s_2 (mm/(MN/m ²))	0.779	0.775
$E = 1.5 \times 10^4 \text{ MPa}$	199.48	210.38
Ex2Ex1	1.05	



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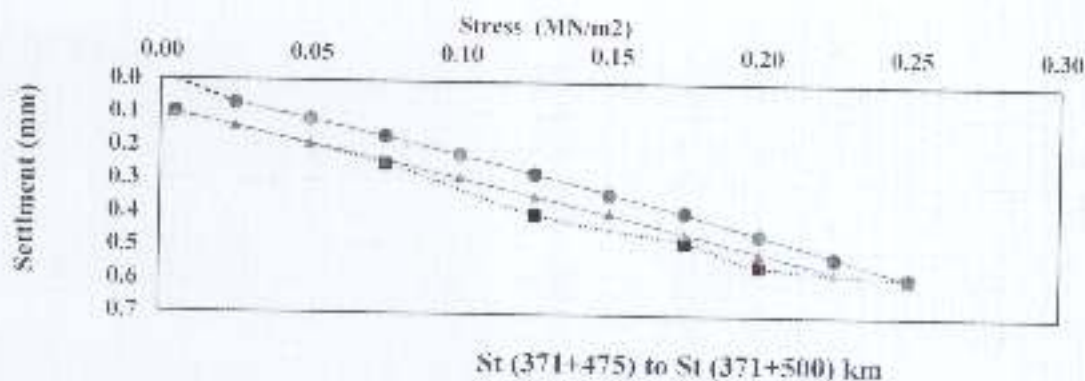
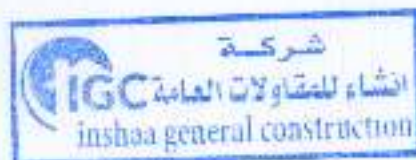


Fig. 8: Load-settlement curve, fitting curves according to Table 25 and Table 26 for the first and second loading cycles

- 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_s Normal stress MN/m²





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Conclusions:

The present test results which obtained from the plate loading tests of the native soil on the sub-ballast layer of the electric express train project at location from St (371+275) to St (371+500) km in accordance to the German standard , DIN 18134 are illustrated in table 28 .

Table 28 : Test results

Location	Ev1(MN/m ²)	Ev2(MN/m ²)	Ev2/Ev1 ratio
St (371+275) : St (371+300) km	200.01	226.67	1.13
St (371+300) : St (371+325) km	209.52	235.58	1.12
St (371+325) : St (371+350) km	200.75	228.32	1.14
St (371+350) : St (371+375) km	190.87	217.28	1.14
St (371+375) : St (371+400) km	225.29	230.58	1.02
St (371+400) : St (371+425) km	205.79	228.10	1.11
St (371+425) : St (371+450) km	195.70	222.54	1.14
St (371+450) : St (371+475) km	199.20	214.52	1.08
St (371+475) : St (371+500) km	199.48	210.98	1.06

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