4-2 Missão de Explanação do Desenho Esboço

Minutes of Discussion

on

The Preparatory Survey

(Explanation on Outline Design Draft Report)

on the Project for

Construction of Secondary Schools in Mozambique

In February 2009, the Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched a Preparatory Survey Team (hereinafter referred to as "the Team") on the Project for Construction of Secondary Schools (hereinafter referred to as "the Project") to Mozambique, and through discussions, site surveys and technical examination of the results in Japan, JICA prepared a draft report of the survey.

In order to explain and to consult the Mozambique side on the components of the Outline Design draft report, JICA sent the Team for draft report explanation, which was headed by Mr. Satoshi UMENAGA, Advisor, Economic Infrastructure Department, JICA from 3rd to 17th June, 2009.

As a result of discussions, both sides have confirmed the main items described on the attached sheet.

Maputo, Mozambique
11th June 2009

Mr. Satoshi UMENAGA

Leader of the Mission
Japan International Cooperation Agency

Ms. Maria Albertina da Conceição Bila

Permanent Secretary
Ministry of Education and Culture
Republic of Mozambique

Attachment

1. **Contents of the draft report**
   The Mozambique side agreed and accepted in principle the contents of the Outline Design draft report explained by the Team.

2. **Japan's Grant Aid Scheme**
   The Mozambique side understood the Japan's Grant Aid Scheme, and assured to take the necessary measures, as described in ANNEX-4 of the Minutes of Discussion signed by both sides on 19th February, 2009. Furthermore, both sides reconfirmed following issues noted in the above Minutes of Discussion to be taken by Mozambique side.

   (1) Water Supply
   (2) Electricity
   (3) Clearance, leveling and reclamation of the sites
   (4) Access Roads
   (5) Tax Exemption
   (6) Others

   Both sides also confirmed that the Project shall be implemented according with "The Procurement Guidelines of Japan's Grant Aid for Community Empowerment".

3. **Confidentiality of the Project**
   Both sides confirmed that all information related to the Project including design documents of facilities and furniture shall not be released to any outside parties before the signing of all the Contract(s) for the Project. Both sides agreed that the Project Cost Estimation should never be duplicated or released to any outside parties before the signing of all the Contract(s) for the Project.

4. **Schedule of the Survey**

(1) The Consultant members of the Team will proceed to undertake further studies in Mozambique until 16th June 2009.

(2) Based on the contents of the draft report and the discussion, the Team continues to prepare reference documents for tendering by December 2009 in Japan and Mozambique.

(3) JICA will complete the Outline Design final report in accordance with the result of discussions and forward it to the Mozambique side around November 2009.

5. **Other relevant issues**

(1) **Allocation of necessary budget and personnel**
The Mozambique side agreed to allocate necessary budget and personnel for the proper operation and maintenance of the facilities to be covered by the Project.

(2) **Evaluation Committee**
To evaluate the reference documents for tendering to be prepared by JICA, both sides agreed to set and facilitate a committee chaired by CEE/DIPLAC, Ministry of Education and Culture.

(3) **Pre screening for EIA**
The Mozambique side agreed to conduct pre screening of EIA (Environment Impact Assessment) on the Project and inform JICA Mozambique office of the result by the end of June, 2009.

5. Outros

□ Número de Escolas Primárias e Graduados da área alvo

	Local	EP da área escolar	2008			
			Total de alunos			7 cl Graduados
			6+7	6cl	7cl	[g]
Prov. Gaza	Chissano Dist. Bilene Macia	EP2 Chissano	546	222	324	197
		EPC Macia-Bairo 3	460	186	274	166
		EPC Macia-Bairo 1	468	195	273	165
		EPC Mazivila	282	140	142	86
		EP2 Messano	357	185	172	104
		Total	2113	928	1185	718
	Manjacaze Dist.Manjacaze Dingane	EP2 Grau de Manjacaze	652	289	363	210
		EP2 Grau de Chalala	450	222	228	174
		EPC Mussengue	174	85	89	67
		EPC Matsinhane	280	152	128	99
		EPC Macasselane(Manjacaze)	175	84	91	87
		EPC Mondlane-Mausse	248	129	119	101
		EPC Macave	336	170	166	138
		EPC Dingane	276	146	130	62
		EPC Maguiguane	297	137	160	110
		EPC Magoene	254	128	126	90
		EPC 25 Sept. Nguzene	323	160	163	125
		Total	3465	1702	1763	1263
Prov. Maputo	Ndobe, cidade Matola	EPC Km 15	1372	705	667	449
		EPC Matola Gare	595	269	326	180
		EPC Cobe	542	275	267	263
		EPC 8 de Marco	587	233	354	254
		EPC Muhalaze*3	366	160	206	145
		Total	3462	1642	1820	1291
	Nkongolote, cidade Matola	EPC Boquisso	357	164	193	116
		EPC Nkongolote A	1743	703	1040	416
		EPC Khongolote	1331	534	797	478
		EPC Samora. Machel	1091	561	530	351
		EPC Ndlavela	1931	865	1066	737
		EPC Benfica Nova	537	331	206	182
		Total	6990	3158	3832	2280
Cidade Maputo	Matendene	EPC 10 de Janeiro	1119	408	711	340
		EPC Magoanine	1840	472	1368	840
		Total	2959	880	2079	1180

□ Relatório do Estudo de Solos

TOPOGRAPHIC REPORT
CHISSANO

1. Introduction

Matsuda Consultants International CO.,LTD requested a geotechnical survey program aimed to evaluate soil characteristics, on a plot located in Chissano near to the escola secundaria de Chissano, in Gaza Province. It is an area of 16,900 m^2, envisaged for the construction of the Secondary School.

The area of study is practically plain, covered by sand, homogeneous in the surface.

This report describes the work done, presents the results obtained from the tests and makes a general interpretation of them in order to give indications about which foundation to adopt for the planed infrastructure.

2. The Survey Program

The program, as defined by the Matsuda Consultants International CO.,LTD coordinator, consisted, of digging 3 pits up to 1.5 meters deep, including collecting samples at the 0.80 meter deep and 1.5 meter deep for the laboratorial tests.

The points where the pits were opened were marked by the Matsuda Consultants International coordinator. For this purpose, a localization map of the pits indicating were the pits were opened was provided, as attached in annex 1.

2.1. Works undertaken

2.1.1 Digging of the pits

3 pits were opened up to 1.50 meter deep, aiming to evaluate macroscopically the layers crossed by the opened pits and collecting of disturbed and "undisturbed" samples for the laboratorial tests. The logs obtained from the pits opened are in annex 2.

No water was detected during the field works. The field work was done on the 14th of February 2009.

3. Results obtained

3.1. Nature of the crossed layers

The pit opened nº 1, detected a dark brown medium to fine sand from 0 to 0.30 meters due to the organic material, with some roots (topsoil). From 0.30 meters to 0.80 meters deep, it was found a dark brown medium to fine sand. From 0.80 meters to 1.50 meters deep, it was found a yellowish brown silty sand. Photographs to illustrate the process, from the opening of the pit to the collection of the samples, are presented in annex 4.

The pit opened nº2, detected a dark brown medium to fine sand from 0 to 0.40 meters due to the organic material, with some roots (topsoil). From 0.40 meters to 0.60 meters deeps, it was found a dark brown medium to fine sand. From 0.60 meters to 1.50 meters deep, it was found a yellowish brown medium to fine silty sand. Photographs to illustrate the process, from the opening of the pit to the collection of the samples, are presented in annex 4.

The pit opened nº3, detected a dark brown medium to fine sand from 0 to 0. 35 meters due to the organic material, with some roots (topsoil). From 0.35 meters to 0.85 meters deep, it was found a dark brown medium to fine silty

sand. From 0.85 meters to 1.50 meters deep, it was found a yellowish brown medium to fine silty sand. Photographs to illustrate the process, from the opening of the pit to the collection of the samples, are presented in annex 4.

In both opened pits the soils are landscape and deep homogeneous and composed by very loose to loose silty sand.

The logs obtained from all the pits opened are presented in annex 2.

In all the pits opened, were collected samples at the deep of 0.80 meter (disturbed samples) and of 1,50 meter ("undisturbed" samples), as illustrated in table nº 1, for the laboratorial tests.

During the pit digging, the soil did not offered any resistance, proving to be very loose to loose.

Table 1 – Collected samples

Pit nº	Depth (m)	Kind of samples
1	0,80	disturbed
1	1,50	"undisturbed"
2	0,80	disturbed
2	1,50	"undisturbed"
3	0,80	disturbed
3	1,50	"undisturbed"

3.2 Geotechnical characterization – Laboratorial tests

The samples from the pits opened helped to identify the main layers crossed. Concerning the samples collected in the pits opened (disturbed and"undisturbed"), the following tests were performed:

- Moisture content tests;
- Specific gravity tests;
- Particle size distribution;
- Consistency limit;
- Shear box tests.

The moisture content was determinated in situ (on site) by Speedy method as illustrated in the figure 9 in annex 4.

The results obtained from the laboratorial tests are attached in annex 3.

- The soils studied are sedimentary soils of the kind SP and SP-SM, according to the United Soil Classification System (USCS), are presented in table nº 2 in annex 3.

- **Bearing capacity**

Considering the shallow foundation (square or strip footing) there are:

According to Terzaghi there are:

- qr = ultimate bearing capacity (Terzaghi)
- qa = allowable bearing capacity (Terzaghi)
- F =3 (factor of safety)
- ϕ =27° (friction angle)
- C=0 T/m^2 (cohesion)
- γ=1.7 T/m^3 (bulk density)
- D=1.0 meter (footing deep)

- B=1.0 meter (square or strip footing of length B)
- Nc, Nq e Ny = bearing capacity factors

4.1. Ultimate bearing capacity

- $q_a = CN_c fc + \gamma DN_q fq + 0,5B\gamma N_\gamma f\gamma$
- $fc = 1 + N_q / N_c$
- $fq = 1 + tg\phi$
- fy=0.60

ϕ	Nc	Nq	Ny	Nq/Nc	$tg\phi$
27°	23,94	13,20	14,47	0,55	0,51

$$q_r = 0x23,94x1,55 + 1,7x1.0x13,20x1,51 + 0,5x1x1,7x14,47x0,60$$

$$q_r = 41\ \mathrm{T/m^2}$$

4.2. Allowable bearing capacity

$$q_a = \frac{q_r}{F}$$

$$q_a = \frac{41}{3}$$

$$q_a = 13,7\ \mathrm{T/m^2} \approx 1,37 Kg/cm^2$$

Once the soil nature is very loose to loose, the following steps can be observed, in order to improve the soil mechanical properties bellow the base of the foundation, with the following suggestions:

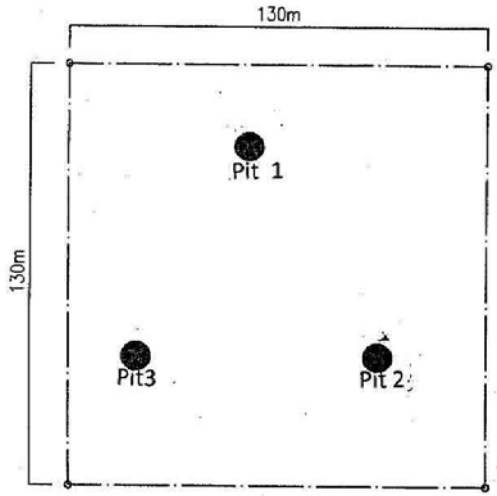
1. Dig the soils up to at least 2.00 meters deep;
2. Pour the foundation with water and leave it for 24 hours;
3. After that, replace with imported soil suitable for compaction, using granular material, and compacted up to 1.0 meter thickness (1,0 meter deep).
4. The square or strip footing will (lay) fixed at 1.0 meter, having thus, 1.0 meter of compacted with good soils under the foundation.
5. Recover with the imported soils or excavated soils.

In this way the soil conditions will be improved, because the natural soil is very loose.

Another better solution would be using soil-cement with a percentage of cement not less than 3%, combined with the silty sand.

Maputo, 25th of March 2009

CHISSANO



学校名 ： CHISSANO

将来増設範囲

敷地境界線

敷地境界フェンス

主出入口（人）

出入口（車）

N
W
E
S

0 20 40 80

建物配置図
BUILDING LAYOUT PLAN

S=1/2,000

モザンビーク国中学校建設計画準備調査
配置計画スタディ

A01

TOPOGRAPHIC REPORT

MANJAKAZE

1. Introduction

Matsuda Consultants International CO.,LTD requested a geotechnical survey program aimed to evaluate soil characteristics, on a plot located in Manjakase, in Gaza Province. It is an area of 70,225 m^2, envisaged for the construction of the Secondary School.

The area of study is practically plain, covered by sand, homogeneous in the surface and deep.

This report describes the work done, presents the results obtained from the tests and makes a general interpretation of them in order to give indications about which foundation to adopt for the planed infrastructure.

2. The Survey Program

The program, as defined by the Matsuda Consultants International CO.,LTD coordinator, consisted, of digging 3 pits up to 1.5 meters deep, including collecting samples at the 0.80 meter deep and 1.5 meter deep for the laboratorial tests.

The points where the pits were opened were marked by the Matsuda Consultants International coordinator. For this purpose, a localization map of the pits indicating were the pits were opened was provided, as attached in annex 1.

2.1. Works undertaken

2.1.1 Digging of the pits

3 pits were opened up to 1.50 meter deep, aiming to evaluate macroscopically the layers crossed by the opened pits and collecting of disturbed and "undisturbed" samples for the laboratorial tests. The logs obtained from the pits opened are in annex 2.

No water was detected during the field works. The field work was done on the 15th and 16th of February 2009.

3. Results obtained

3.1. Nature of the crossed layers

The pit opened nº 1, detected a blackish grey medium to coarse sand from 0 to 0.25 meters due to the organic material, with some roots (topsoil). From 0.25 meters to 0.80 meters deep, it was found a brownish grey medium to coarse sand. From 0.80 meter to 1.50 meter deep, it was found a yellowish grey medium to coarse silty sand. Photographs to illustrate the process, from the opening of the pits to the collection of the samples, are presented in annex 4.

The pit opened nº2, detected a blackish grey medium to coarse sand from 0 to 0.20 meters due to the organic material, with some roots (topsoil). From 0.20 meters to 0.50 meter deep, it was found a brownish grey medium to coarse sand. From 0.50 meter to 1.50 meter deep, it was found a yellowish grey medium to coarse silty sand. Photographs to illustrate the process, from the opening of the pits to the collection of the samples, are presented in annex 4.

The pit opened n°3, detected a blackish grey medium to coarse sand from 0 to 0.18 meters due to the organic material, with some roots (topsoil). From 0.18 meters to 0.80 meter deep, it was found a brownish grey medium to coarse silty sand. From 0.80 meter to 1.50 meter deep, it was found a yellowish grey medium to coarse silty sand. Photographs to illustrate the process, from the opening of the pits to the collection of the samples, are presented in annex 4.

In both opened pits the soils are landscape and deep homogeneous and composed by loose sand.

The logs obtained from all the pits opened are presented in annex 2.

In all the pits opened, were collected samples at the deep of 0.80 meter (disturbed samples) and of 1,50 meter ("undisturbed" samples), as illustrated in table n° 1, for the laboratorial tests.

During the pits digging, the soil did not offered any resistance, proving to be loose.

Table 1 – Collected samples

Pit n°	Depth (m)	Kind of samples
1	0,80	disturbed
1	1,50	"undisturbed"
2	0,80	disturbed
2	1,50	"undisturbed"
3	0,80	disturbed
3	1,50	"undisturbed"

3.2 Geotechnical characterization – Laboratorial tests

The samples from the pits opened helped to identify the main layers crossed. Concerning the samples collected in the pits opened (disturbed and"undisturbed"), the following tests were performed:

- Moisture content tests;
- Specific gravity tests;
- Particle size distribution;
- Consistency limit;
- Shear box tests.

The moisture content was determinated in situ (on the site) by Speedy method as illustrated in the figure 8 in annex 4.

The results obtained from the laboratorial tests are attached in annex 3.

The soil studied are sedimentary soils of the kind SP and SP-SM, according to the United Soil Classification System (USCS), are presented in table n° 2 in annex 3.

4. Bearing capacity

Considering the shallow foundation (square or strip footing) there are:

According to Terzaghi there are:

- qr = ultimate bearing capacity (Terzaghi)
- qa = allowable bearing capacity (Terzaghi)
- F =3 (factor of safety)

- ϕ =28° (friction angle)
- C=0 T/m^2 (cohesion)
- γ=1.7 T/m^3 (bulk density)
- D=1 meter (footing deep)
- B=1.0 meter (square or strip footing of length B)
- Nc, Nq e Ny = bearing capacity factors

4.1. Ultimate bearing capacity

- $q_a = CN_c fc + \gamma DN_q fq + 0,5B\gamma N_\gamma f\gamma$
- $fc = 1 + N_q / N_c$
- $fq = 1 + tg\phi$
- fy=0.60

ϕ	Nc	Nq	Ny	Nq/Nc	$tg\phi$
28°	25,80	14,72	16,72	0,57	0,531

$$q_r = 0x25,80x1,57 + 1,7x1x14,72x1,53 + 0,5x1x1,7x16,72x0,60$$

$$q_r = 46,8\ \mathrm{T/m^2}$$

4.2. Allowable bearing capacity

$$q_a = \frac{q_r}{F}$$

$$q_a = \frac{46,8}{3}$$

$$q_a = 15,6\ \mathrm{T/m^2} \approx 1,56 Kg/cm^2$$

Once the soil nature is loose, the following steps can be observed, in order to improve the soil mechanical properties bellow the base of the foundation, with the following suggestions:

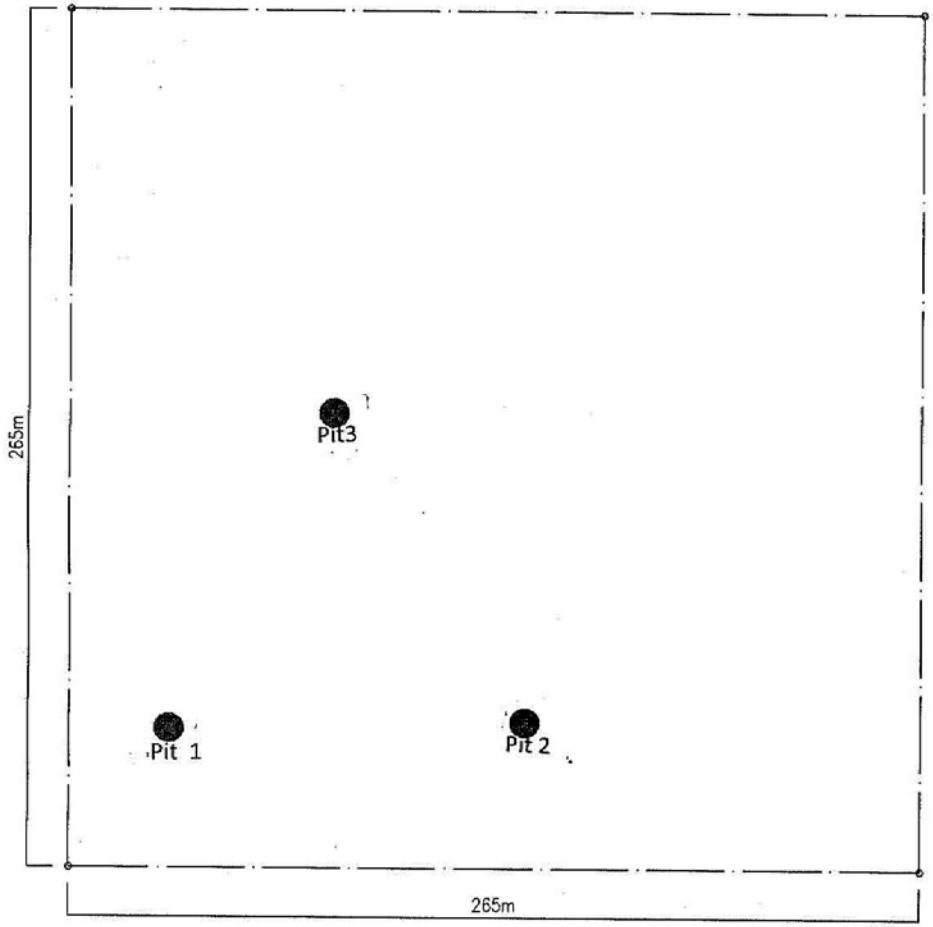
1. Dig the soils up to at least 2.0 meters deep;
2. Pour the foundation with water and leave it for 24 hours;
3. After that, replace with imported soil suitable for compaction, using granular material, and compacted up to 1.0 meter thickness (1,0 meter deep).
4. The square strip or footing will (lay) fixed at 1.0 meter, having thus, 1.0 meter of compacted with good soils under the foundation.
5. Recover with the imported soils or excavated soils.

In this way the soil conditions will be improved, because the natural soil is loose.

Another better solution would be using soil-cement with a percentage of cement not less than 3%, combined with the silty sand.

Maputo, 25th of February 2009

MANJACAZ



学校名 ： MANJACAZ

将来増設範囲

敷地境界線

敷地境界フェンス

主出入口（人）

出入口（車）

N
W
E
S

0 20 40 80

建物配置図
BUILDING LAYOUT PLAN

S=1/2,000

モザンビーク国中学校建設計画準備調査
配置計画スタディ

A02

TOPOGRAPHIC REPORT

COBE

1. Introduction

Matsuda Consultants International CO.,LTD requested a geotechnical survey program aimed to evaluate soil characteristics, on a plot located in Ncobe, Matola distrit, Maputo Province. It is an area of 10,800 m^2, envisaged for the construction of the Secondary School.

The area of study is practically plain, covered by sand, homogeneous in the surface.

This report describes the work done, presents the results obtained from the tests and makes a general interpretation of them in order to give indications about which foundation to adopt for the planed infrastructure.

2. The Survey Program

The program, as defined by the Matsuda Consultants International CO.,LTD coordinator, consisted, of digging 3 pits up to 1.5 meters deep, including collecting samples at the 0.80 meter deep and 1.5 meter deep for the laboratorial tests.

The points where the pits were opened were marked by the Matsuda Consultants International coordinator. For this purpose, a localization map of the pits indicating were the pits were opened was provided, as attached in annex 1.

2.1. Works undertaken

2.1.1 Digging of the pits

3 pits were opened up to 1.50 meter deep, aiming to evaluate macroscopically the layers crossed by the opened pits and collecting of disturbed and "undisturbed" samples for the laboratorial tests. The logs obtained from the pits opened are in annex 2.

No water was detected during the field works. The field work was done on the 19th of February 2009.

3. Results obtained

3.1. Nature of the crossed layers

The pit opened nº 1, detected a blackish grey fine sand from 0 to 0.30 meters due to the organic material, with some roots (topsoil). From 0.30 meters to 0.75 meters deep, it was found a yellowish brown fine sand. From 0.75 meters to 1.50 meters deep, it was found a yellow fine silty sand,with brownish nodules. Photographs to illustrate the process, from the opening of the pit to the collection of the samples, are presented in annex 4.

The pit opened nº2, detected a blackish grey fine sand from 0 to 0.28 meters due to the organic material, with some roots (topsoil). From 0.28 meters to 0.65 meters deeps, it was found a yellowish brown fine sand. From 0.65 meters to 1.50 meters deep, it was found a yellow fine silty sand with brownish nodules. Photographs to illustrate the process, from the opening of the pit to the collection of the samples, are presented in annex 4.

The pit opened nº3, detected a blackish grey fine sand from 0 to 0.40 meters due to the organic material, with some roots (topsoil). From 0.40 meters to 0.70 meters deep, it was found a yellowish brown fine sand. From 0.70 meters

to 1.50 meters deep, it was found a yellow fine silty sand with brownish nodules. Photographs to illustrate the process, from the opening of the pits to the collection of the samples, are presented in annex 4.

In both opened pits the soils are landscape and deep homogeneous and composed by loose to medium dense sand.

The logs obtained from all the pits opened are presented in annex 2.

In all the pits opened, were collected samples at the deep of 0.80 meter (disturbed samples) and of 1,50 meter ("undisturbed" samples), as illustrated in table n° 1, for the laboratorial tests.

During the pit digging, the soil did not offered any resistance, proving to be loose to medium dense.

Table 1 – Collected samples

Pit n°	Depth (m)	Kind of samples
1	0,80	disturbed
1	1,50	"undisturbed"
2	0,80	disturbed
2	1,50	"undisturbed"
3	0,80	disturbed
3	1,50	"undisturbed"

3.2 Geotechnical characterization – Laboratorial tests

The samples from the pits opened helped to identify the main layers crossed. Concerning the samples collected in the pits opened (disturbed and"undisturbed"), the following tests were performed:

- Moisture content tests;
- Specific gravity tests;
- Particle size distribution;
- Consistency limit;
- Shear box tests.

The moisture content was determinated in situ (on site) by Speedy method as illustrated in the figure 8 in annex 4.

The results obtained from the laboratorial tests are attached in annex 3.

- The soils studied are sedimentary soils of the kind SP-SM, according to the United Soil Classification System (USCS), are presented in table n° 2 in annex 3.

- **Bearing capacity**

Considering the shallow foundation (square or strip footing) there are:

According to Terzaghi there are:

- qr = ultimate bearing capacity (Terzaghi)
- qa = allowable bearing capacity (Terzaghi)
- F =3 (factor of safety)
- ϕ =29° (friction angle)
- C=0 T/m^2 (cohesion)
- γ=1.7 T/m^3 (bulk density)

- D=1.0 meter (footing deep)
- B=1.0 meter (square or strip footing of length B)
- Nc, Nq e Ny = bearing capacity factors

4.1. Ultimate bearing capacity

- $q_a = CN_c fc + \gamma DN_q fq + 0,5B\gamma N_\gamma f\gamma$
- $fc = 1 + N_q / N_c$
- $fq = 1 + tg\phi$
- fy=0.60

ϕ	Nc	Nq	Ny	Nq/Nc	$tg\phi$
29°	27,86	16,44	19,34	0,59	0,55

$$q_r = 0x27,86x1,59 + 1,7x1.0x186,44x1,55 + 0,5x1x1,7x19,34x0,60$$

$$q_r = 53,2\ \mathrm{T/m^2}$$

4.2. Allowable bearing capacity

$$q_a = \frac{q_r}{F}$$

$$q_a = \frac{53,2}{3}$$

$$q_a = 17,7\ \mathrm{T/m^2} \approx 1,77\ Kg/cm^2$$

Once the soil nature is loose to medium dense, the following steps can be observed, in order to improve the soil mechanical properties bellow the base of the foundation, with the following suggestions:

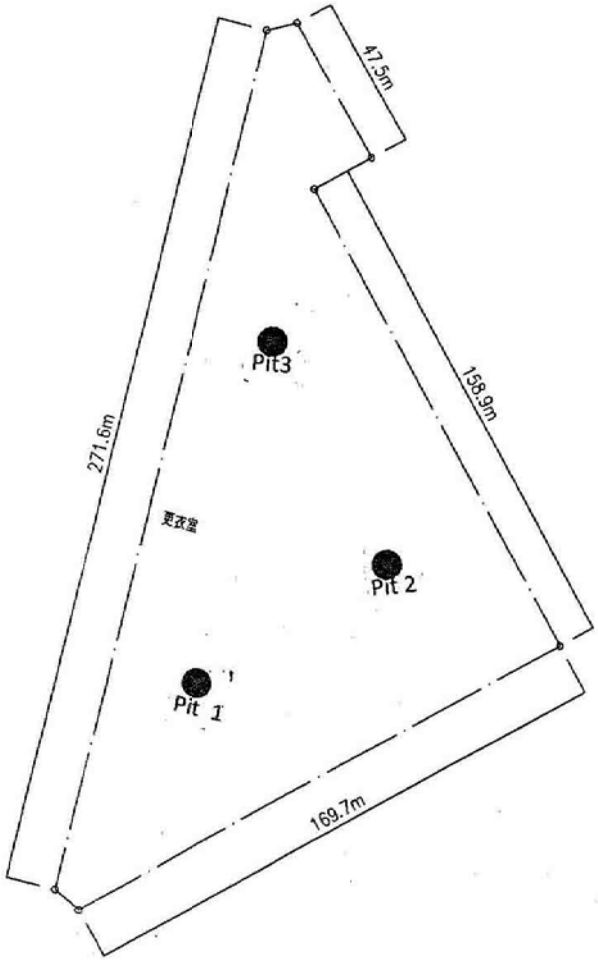
1. Dig the soils up to at least 2.00 meters deep;
2. Pour the foundation with water and leave it for 24 hours;
3. After that, replace with same soils (excavated soils), and compacted up to 1.0 meter thickness (1.0 meter deep).
4. The strip or square footing will (lay) fixed at 1.0 meter, having thus, 1.0 meter of compacted soils under the foundation with same (excavated soils).
5. Recover with the excavated soils.

In this way the soil conditions will be improved, because the natural soil is loose to medium dense.

Another better solution would be using soil-cement with a percentage of cement not less than 3%, combined with the same soils (excavated soils).

Maputo, 25th of February 2009

COBE



学校名 ： COBE

将来増設範囲

敷地境界線

敷地境界フェンス

主出入口（人）

出入口（車）

N
W
E
S

0 20 40 80

建物配置図
BUILDING LAYOUT PLAN

S=1/2,000

モザンビーク国中学校建設計画準備調査
配置計画スタディ

A03

TOPOGRAPHIC REPORT
KONGOLOTE

1. Introduction

Matsuda Consultants International CO.,LTD requested a geotechnical survey program aimed to evaluate soil characteristics, on a plot located in Kongolote near to the Mercado 7 de Março, in the Matola distrit, Maputo Province. It is an area of 75,000 m^2, envisaged for the construction of the Secondary School.

The area of study is practically plain, covered by sand, homogeneous in the surface.

This report describes the work done, presents the results obtained from the tests and makes a general interpretation of them in order to give indications about which foundation to adopt for the planed infrastructure.

2. The Survey Program

The program, as defined by the Matsuda Consultants International CO.,LTD coordinator, consisted, of digging 3 pits up to 1.5 meters deep, including collecting samples at the 0.80 meter deep and 1.5 meter deep for the laboratorial tests.

The points where the pits were opened were marked by the Matsuda Consultants International coordinator. For this purpose, a localization map of the pits indicating were the pits were opened was provided, as attached in annex 1.

2.1. Works undertaken

2.1.1 Digging of the pits

3 pits were opened up to 1.50 meter deep, aiming to evaluate macroscopically the layers crossed by the opened pits and collecting of disturbed and "undisturbed" samples for the laboratorial tests. The logs obtained from the pits opened are in annex 2.

No water was detected during the field works. The field work was done on the 18th of February 2009.

3. Results obtained

3.1. Nature of the crossed layers

The pit opened n° 1, detected a yellowish grey fine to medium sand from 0 to 0.40 meters due to the organic material, with some roots (topsoil). From 0.40 meters to 0.70 meters deep, it was found a yellowish grey fine to medium silty sand. From 0.70 meters to 1.50 meters deep, it was found a yellow fine to medium silty sand. Photographs to illustrate the process, from the opening of the pit to the collection of the samples, are presented in annex 4.

The pit opened n°2, detected a yellowish grey medium to fine sand from 0 to 0.25 meters due to the organic material, with some roots (topsoil). From 0.25 meters to 0.50 meters deeps, it was found a yellowish grey medium to fine sand. From 0.50 meters to 1.50 meters deep, it was found a yellow medium to fine silty sand. Photographs to illustrate the process, from the opening of the pit to the collection of the samples, are presented in annex 4.

The pit opened n°3, detected a yellowish grey medium to fine sand from 0 to 0. 20 meters due to the organic material, with some roots (topsoil). From 0.20 meters to 0.80 meters deep, it was found a yellowish grey medium to fine silty

sand. From 0.80 meters to 1.50 meters deep, it was found a yellow medium to fine silty sand. Photographs to illustrate the process, from the opening of the pits to the collection of the samples, are presented in annex 4.

In both opened pits the soils are landscape and deep homogeneous and composed by loose silty sand.

The logs obtained from all the pits opened are presented in annex 2.

In all the pits opened, were collected samples at the deep of 0.80 meter (disturbed samples) and of 1,50 meter ("undisturbed" samples), as illustrated in table n° 1, for the laboratorial tests.

During the pit digging, the soil did not offered any resistance, proving to be loose.

Table 1 – Collected samples

Pit n°	Depth (m)	Kind of samples
1	0,80	disturbed
1	1,50	"undisturbed"
2	0,80	disturbed
2	1,50	"undisturbed"
3	0,80	disturbed
3	1,50	"undisturbed"

3.2 Geotechnical characterization – Laboratorial tests

The samples from the pits opened helped to identify the main layers crossed. Concerning the samples collected in the pits opened (disturbed and"undisturbed"), the following tests were performed:

- Moisture content tests;
- Specific gravity tests;
- Particle size distribution;
- Consistency limit;
- Shear box tests.

The moisture content was determinated in situ (on site) by Speedy method as illustrated in the figure 8 in annex 4.

The results obtained from the laboratorial tests are attached in annex 3.

- The soils studied are sedimentary soils of the kind SP-SM, according to the United Soil Classification System (USCS), are presented in table n° 2 in annex 3.

- **Bearing capacity**

Considering the shallow foundation (square or strip footing) there are:

According to Terzaghi there are:

- qr = ultimate bearing capacity (Terzaghi)
- qa = allowable bearing capacity (Terzaghi)
- F =3 (factor of safety)
- ϕ =30° (friction angle)
- C=0 T/m^2 (cohesion)
- γ=1.7 T/m^3 (bulk density)

- D=1.0 meter (footing deep)
- B=1.0 meter (square or strip footing of length B)
- Nc, Nq e Ny = bearing capacity factors

4.1. Ultimate bearing capacity

- $q_a = CN_c fc + \gamma DN_q fq + 0,5B\gamma N_\gamma f\gamma$
- $fc = 1 + N_q / N_c$
- $fq = 1 + tg\phi$
- fy=0.60

ϕ	Nc	Nq	Ny	Nq/Nc	$tg\phi$
30°	30,14	18,40	22,40	0,61	0,58

$$q_r = 0x30,14x1,61 + 1,7x1.0x18,40x1,58 + 0,5x1x1,7x22,40x0,60$$

$$q_r = 60,8\ \mathrm{T/m^2}$$

4.2. Allowable bearing capacity

$$q_a = \frac{q_r}{F}$$

$$q_a = \frac{60,8}{3}$$

$$q_a = 20,3\ \mathrm{T/m^2} \approx 2,03\ Kg/cm^2$$

Once the soil nature is loose, the following steps can be observed, in order to improve the soil mechanical properties bellow the base of the foundation, with the following suggestions:

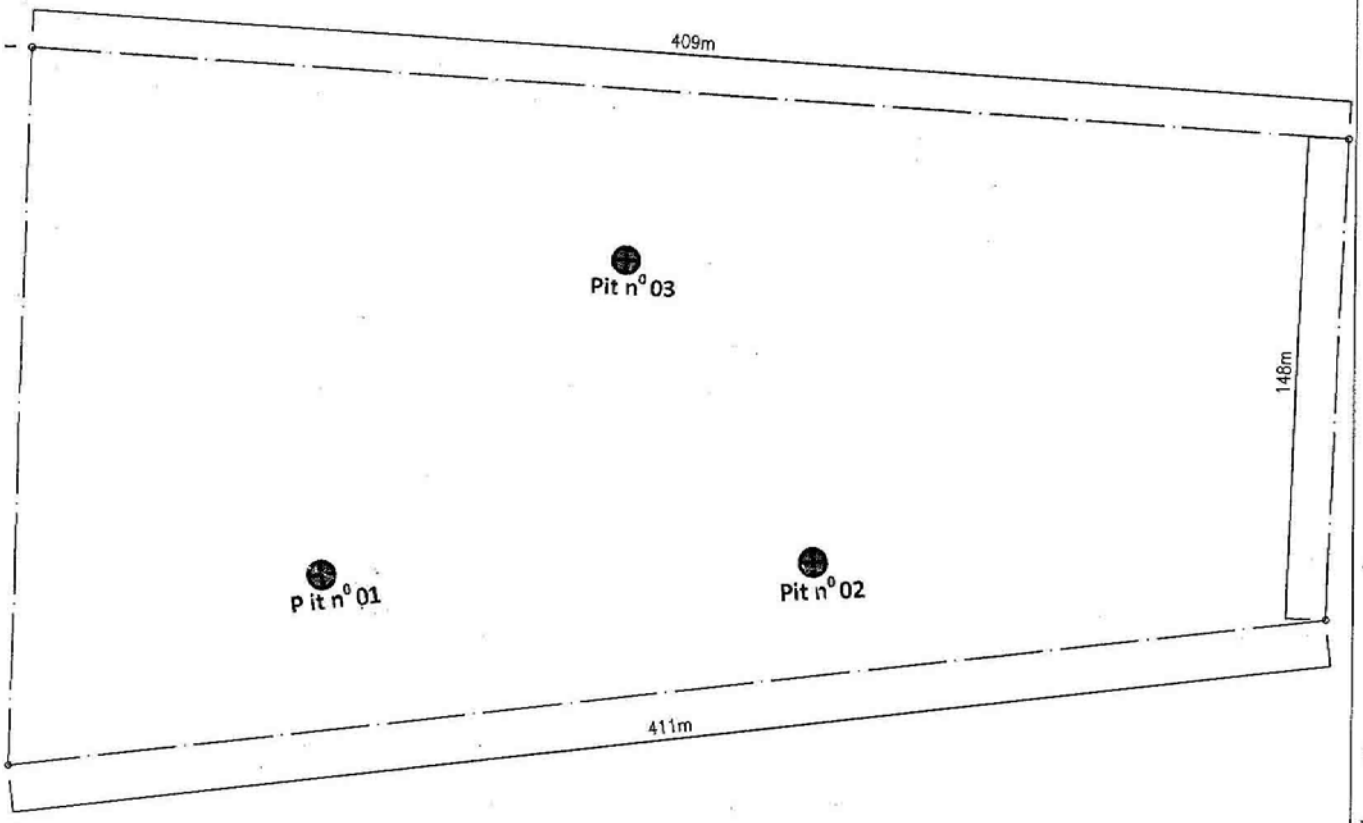
1. Dig the soils up to at least 2.00 meters deep;
2. Pour the foundation with water and leave it for 24 hours;
3. After that, replace with same soils (excavated soils), and compacted up to 1.0 meter thickness (1.0 meter deep).
4. The strip or square footing will (lay) fixed at 1.0 meter, having thus, 1.0 meter of compacted soils under the foundation with same (excavated soils).
5. Recover with the excavated soils.

In this way the soil conditions will be improved, because the natural soil is loose.

Another better solution would be using soil-cement with a percentage of cement not less than 3%, combined with the same soils (excavated soils).

Maputo, 25th of February 2009

KONGOLOTE



学校名 ： KONGOLOTE

将来増設範囲

敷地境界線

敷地境界フェンス

主出入口（人）

出入口（車）

N
W
E
S

0 20 40 80

建物配置図
BUILDING LAYOUT PLAN

S=1/2,000

モザンビーク国中学校建設計画準備調査
配置計画スタディ

A04

TOPOGRAPHIC REPORT

MATENDENE

1. Introduction

Matsuda Consultants International CO.,LTD requested a geotechnical survey program aimed to evaluate soil characteristics, on a plot located in Matendene near to the primary school, in the N° 5 distrit, Maputo City. It is an area of 9,100 m^2, envisaged for the construction of the Secondary School.

The area of study is practically plain, covered by sand, homogeneous in the surface.

This report describes the work done, presents the results obtained from the tests and makes a general interpretation of them in order to give indications about which foundation to adopt for the planed infrastructure.

2. The Survey Program

The program, as defined by the Matsuda Consultants International CO.,LTD coordinator, consisted, of digging 3 pits up to 1.5 meters deep, including collecting samples at the 0.80 meter deep and 1.5 meter deep for the laboratorial tests.

The points where the pits were opened were marked by the Matsuda Consultants International coordinator. For this purpose, a localization map of the pits indicating were the pits were opened was provided, as attached in annex 1.

2.1. Works undertaken

2.1.1 Digging of the pits

3 pits were opened up to 1.50 meter deep, aiming to evaluate macroscopically the layers crossed by the opened pits and collecting of disturbed and "undisturbed" samples for the laboratorial tests. The logs obtained from the pits opened are in annex 2.

No water was detected during the field works. The field work was done on the 19th of February 2009.

3. Results obtained

3.1. Nature of the crossed layers

The pit opened n° 1, detected a brownish grey medium to fine sand from 0 to 0.20 meters due to the organic material, with some roots (topsoil). From 0.20 meters to 0.50 meters deep, it was found a yellowish brown medium to fine sand. From 0.50 meters to 1.50 meters deep, it was found a yellow medium to fine silty sand. Photographs to illustrate the process, from the opening of the pits to the collection of the samples, are presented in annex 4.

The pit opened n°2, detected a brownish grey medium to fine sand from 0 to 0.16 meters due to the organic material, with some roots (topsoil). From 0.16 meters to 0.85 meters deeps, it was found a yellowish brown medium to fine silty sand. From 0.85 meters to 1.50 meters deep, it was found a yellow medium to fine sand. Photographs to illustrate the process, from the opening of the pits to the collection of the samples, are presented in annex 4.

The pit opened n°3, detected a brownish grey medium to fine sand from 0 to 0. 20 meters due to the organic material, with some roots (topsoil). From 0.20 meters to 0.70 meters deep, it was found a yellowish brown medium to fine

silty sand. From 0.70 meters to 1.50 meters deep, it was found a yellow medium to fine sand. Photographs to illustrate the process, from the opening of the pits to the collection of the samples, are presented in annex 4.

In both opened pits the soils are landscape and deep homogeneous and composed by loose to medium dense sand.

The logs obtained from all the pits opened are presented in annex 2.

In all the pits opened, were collected samples at the deep of 0.80 meter (disturbed samples) and of 1,50 meter ("undisturbed" samples), as illustrated in table n° 1, for the laboratorial tests.

During the pit digging, the soil did not offered any resistance, proving to be loose.

Table 1 – Collected samples

Pit n°	Depth (m)	Kind of samples
1	0,80	disturbed
1	1,50	"undisturbed"
2	0,80	disturbed
2	1,50	"undisturbed"
3	0,80	disturbed
3	1,50	"undisturbed"

3.2 Geotechnical characterization – Laboratorial tests

The samples from the pits opened helped to identify the main layers crossed. Concerning the samples collected in the pits opened (disturbed and"undisturbed"), the following tests were performed:

- Moisture content tests;
- Specific gravity tests;
- Particle size distribution;
- Consistency limit;
- Shear box tests.

The moisture content was determinated in situ (on site) by Speedy method as illustrated in the figure 8 in annex 4.

The results obtained from the laboratorial tests are attached in annex 3.

- The soils studied are sedimentary soils of the kind SP-SM, according to the United Soil Classification System (USCS), are presented in table n° 2 in annex 3.

- **Bearing capacity**

Considering the shallow foundation (square or strip footing) there are:

According to Terzaghi there are:

- qr = ultimate bearing capacity (Terzaghi)
- qa = allowable bearing capacity (Terzaghi)
- F =3 (factor of safety)
- ϕ =31° (friction angle)
- C=0 T/m^2 (cohesion)
- γ=1.7 T/m^3 (bulk density)

- D=1.0 meter (footing deep)
- B=1.0 meter (square or strip footing of length B)
- Nc, Nq e Ny = bearing capacity factors

4.1. Ultimate bearing capacity

- $q_a = CN_c fc + \gamma DN_q fq + 0,5B\gamma N_\gamma f\gamma$
- $fc = 1 + N_q / N_c$
- $fq = 1 + tg\phi$
- fy=0.60

ϕ	Nc	Nq	Ny	Nq/Nc	$tg\phi$
31°	32,67	20,63	25,99	0,63	0,60

$$q_r = 0x32,67x1,63 + 1,7x1.0x20,63x1,60 + 0,5x1x1,7x25,99x0,60$$

$$q_r = 69,4\ \mathrm{T/m^2}$$

4.2. Allowable bearing capacity

$$q_a = \frac{q_r}{F}$$

$$q_a = \frac{69,4}{3}$$

$$q_a = 23,1\ \mathrm{T/m^2} \approx 2,31\ Kg/cm^2$$

Once the soil nature is loose to medium dense, the following steps can be observed, in order to improve the soil mechanical properties bellow the base of the foundation, with the following suggestions:

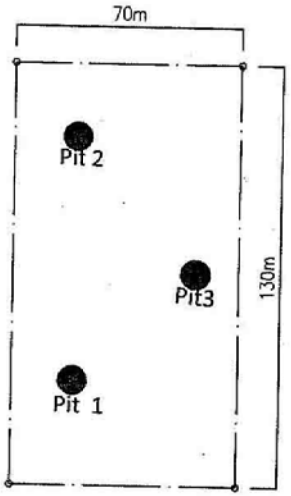
1. Dig the soils up to at least 2.00 meters deep;
2. Pour the foundation with water and leave it for 24 hours;
3. After that, replace with same soils (excavated soils), and compacted up to 1.0 meter thickness (1.0 meter deep).
4. The strip or square footing will (lay) fixed at 1.0 meter, having thus, 1.0 meter of compacted soils under the foundation with same (excavated soils).
5. Recover with the excavated soils.

In this way the soil conditions will be improved, because the natural soil is loose to medium dense.

Another better solution would be using soil-cement with a percentage of cement not less than 3%, combined with the same soils (excavated soils).

Maputo, 25th of February 2009

MATENDENE



学校名 ： MATENDENE

将来増設範囲
敷地境界線
敷地境界フェンス
主出入口（人）
出入口（車）

N
W
E
S
0 20 40 80

建物配置図
BUILDING LAYOUT PLAN
S=1/2,000

モザンビーク国中学校建設計画準備調査
配置計画スタディ
A05

□ Mapa Topográfico efectuados por empresa contractada: Matendene: