

**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 UMEMAGA, Advisor, Economic Infrastructure Department, JICA from 3<sup>rd</sup> to 17<sup>th</sup> June, 2009.

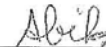
As a result of discussions, both sides have confirmed the main items described on the attached sheet.

Maputo, Mozambique  
11<sup>th</sup> June 2009



**Mr. Satoshi UMEMAGA**

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 19<sup>th</sup> 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 16<sup>th</sup> 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. 事業事前計画表(概略設計時)

1. 案件名
モザンビーク共和国中学校建設計画
2. 要請の背景(協力の必要性・位置付け)
<p>モザンビーク国政府は国家開発計画である「貧困削減行動計画 2006-2009 (PARPA II) /2006 年」において、教育分野を 6 つの最重要分野の 1 つに位置付け、「すべての人々への質の高い教育普及」を掲げている。教育文化省では 2006 年に「教育文化戦略 (PEEC) 2006-2010/2011」を策定し、初等教育 7 年間の完全普及と教育の質の向上と平等を教育政策の中心にするとともに、中等教育、技術・職業教育、特殊教育、識字・ノンフォーマル教育、教員教育、文化及び HIV/AIDS、ジェンダーなど横断的課題に取り組んでいる。また、2008 年に「中等教育戦略計画 (EESG) 2008-2015」案を策定し、2015 年までに前期中等教育 3 年間の総就学率を 70%とするアクセス拡大、施設の改善、カリキュラム改革、有資格教員の増加を進めており、教育の質の改善を図ることで教育効率の向上を目指すとしている。その結果、前期中等教育の就学状況は年々改善を見せ、生徒数は 2005 年の 357,830 人から 2008 年に 585,887 人と 1.64 倍に増加しているが、一方、中学校教育施設数は 252 校、3,092 教室 (2005 年) から 316 校、4,166 教室 (2008 年) の 1.18 倍の増加に止まり、施設、教室不足が深刻となっている。</p> <p>このため、教育文化省では全国で応急的に 3 部制授業の実施や、小学校施設の中学校への転用等で教室不足に対応しているが、3 部制を実施してもクラス当り生徒数は全国平均で 62 人と過密解消基準の 55 人を超えている状況にある。また、中等教育施設が無い地域、施設不足の地域では小学校を卒業しても進学できない待機者が多く滞留する結果となっている。2008 年の就学率は 39.4%となっているが、施設、教室不足のために就学目標 70%達成が困難な状況にある。</p> <p>今回、要請の地域は中学校がない、また中学校がないために小学校施設を使用して授業をしている地域であり、中学校建設整備の緊急性が高く、協力の必要性、妥当性は高い。本プロジェクトは、同国の最重要分野の 1 つである教育分野、中等教育のアクセス拡大を支援するものであり、「モ」国の国家政策と本案件とは整合性がある。また、我が国が同国援助の重点分野として、社会セクター、農業及び人的資源開発を重点分野として進める援助方針と整合性がある。</p>
3. プロジェクトの全体計画概要
<p>(1) プロジェクトの全体計画の目標 (裨益対象の範囲及び規模)</p> <p>マプト州及びガザ州の対象地域において教育施設環境が整備され、前期中等教育へのアクセスが拡大する。</p> <p>裨益対象の範囲及び規模： マプト州、ガザ州の対象地域の前期中等教育施設 4 校の就学児童 9,570 人及び教職員 286 人 (2014 年)</p> <p>(2) プロジェクト全体計画の成果</p> <p>① <u>前期中等教育施設 4 校の学校施設が整備される。</u></p> <p>② <u>上記施設において教育用の家具が整備される。</u></p> <p>(3) プロジェクト全体計画の主要活動</p> <p>① <u>前期中等教育施設 4 校の建設と家具の整備を行う。</u></p> <p>② 上記 4 校において運営・維持管理体制を整え、必要な教職員を配置する。</p> <p>③ 上記施設・家具を使用して学校を運営し、教育活動を実施する。</p> <p>(4) 投入 (インプット)</p> <p>ア. <u>日本側：コミュニティ開発支援無償資金協力 非公表</u></p> <p>イ. 相手国側</p> <ul style="list-style-type: none"> <li>・ 学校運営に必要な教職員 (教員 184 名、職員 102 名以上)</li> <li>・ 施設の運営・維持管理に係る経費 (年間約 26,378 千 Mt.)</li> </ul>

- ・必要な範囲の門扉の建設、植栽
- ・日本側協力に含まれない一般家具、什器、備品
- ・教育の実施に必要な教育機材、事務機器

(5) 実施体制

主管官庁及び実施機関：教育文化省 計画協力局

4. 無償資金協力案件の内容

(1) サイト

モザンビーク国マプト州、ガザ州の4校：コンゴロテ、コベ、マンジャカゼ、シサノ

(2) 概要

- ① 教育施設（58 教室、多目的教室、図書室、IT 教室、管理諸室、便所、運動場及び更衣室）の建設
- ② 家具（上記施設の生徒用、教員用家具及び事務管理諸室家具）の整備

(3) 相手国側負担事項

- ① 建設用地確保及び整備、②既存構造物の撤去、③アクセス道路整備、④電力引込
- ⑤給水井戸建設、⑥門・扉の建設及び植栽、⑦教育機材調達、⑧諸手続き手数料、⑨税金負担

(4) 概算事業費

非公表

(5) 工期

入札期間を含め約 26 ヶ月（予定）

(6) 貧困、ジェンダー、環境及び社会面の配慮

- ・男女別便所と更衣室を設け女子生徒の教育環境を整備した施設とする。
- ・地下水脈や周辺地域を汚染しないよう、敷地形状を考慮した汚水処理、排水設備を設ける。

5. 外部要因リスク

- ・大きな経済的変動や政情、治安の悪化が生じない。

6. 過去の類似案件からの教訓の活用

- ・特になし

7. プロジェクト全体計画の事後評価に係る提案

(1) プロジェクト全体計画の目標達成を示す成果指標

成果指標	現状（2009年）	計画（2014年）
ガザ州、マプト州対象地域*1の前期中等教育施設数	17校（242教室）	21校（300教室）
4校における就学可能生徒数	678人*2	9,570人

\*1 ガザ州マシアビレネ郡及びマンジャカゼ郡、マプト州マトラ市

\*2 建設敷地シサノの既存転用小学校（中等教育施設）に通学する生徒数

(2) その他の成果指標

なし

(3) 評価のタイミング

2014年以降（事業実施後3年目以降）

## 6. 入手資料リスト

### A. 教育計画関連資料

NO.	資料タイトル	発行年	発行者	オリジナル/ コピー
A1	Plano de Activades 2006, 2007, 2008,2009	2008	MEC	電子 データ
A2	Execução do Orçamento do Estado de Janeiro a Dezembro de 2007, 2008	2008	MEC	電子 データ
A3	Mozambique Procurement Code (Portugues) (English)	2005	MEC	電子 データ
A4	Relatório Financeiro e de Progereo do Fundo de Apoio ao Sector da Educação	2008	MEC	電子 データ
A5	Regulamento sobre o Pprocesso de Avaliação do Impacto Ambiental	1997	Publicação Oficial da República de Moçambique	電子 データ
A6	マトラ州行政区分地図		Maputo 州教育局	電子 データ
A7	マプト市 No.5 区スクールマップ		Maputo 市都市計画部	電子 データ

### B. 施設/施工/調達計画関連資料

NO.	資料タイトル	発行年	発行者	オリジナル/ コピー
B1	Macia 中学校入札図書	2007	MEC	電子 データ
B2	Salamanga 中学校入札図書	2008	MEC	電子 データ
B3	Lichinga 中学校入札図書	2008	MEC	電子 データ

### C. 家具関連資料

NO.	資料タイトル	発行年	発行者	オリジナル/ コピー
C1	Angoche Bidding Documents Procurement of Goods.	2008	CEE	電子 データ

MEC : 教育文化省

CEE : 教育文化省計画局建設ユニット

## 7. その他

### □計画対象地域の小学校及び卒業生徒数

	所在地	通学対象小学校	2008					
			生徒数合計			7cl 卒業生徒数		
			6+7	6cl	7cl	[g]		
ガザ州	シサノ 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		
		合計	2113	928	1185	718		
	マンジャカゼ 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		
		合計	3465	1702	1763	1263		
		マプト州	コベ マトラ市	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		
合計	3462			1642	1820	1291		
コンゴロテ マトラ市	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		
	合計		6990	3158	3832	2280		
	マプト市		マテンデネ	EPC 10 de Janeiro	1119	408	711	340
EPC Magoanine		1840		472	1368	840		
合計		2959		880	2079	1180		

## 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<sup>2</sup>, 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 where 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 14<sup>th</sup> of February 2009.

#### 3. Results obtained

##### 3.1. Nature of the crossed layers

The pit opened n° 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 n°2, 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 n°3, 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:**

- $q_r$  = ultimate bearing capacity (Terzaghi)
- $q_a$  = allowable bearing capacity (Terzaghi)
- $F=3$  (factor of safety)
- $\phi=27^\circ$  (friction angle)
- $C=0$  T/m<sup>2</sup> (cohesion)
- $\gamma=1.7$  T/m<sup>3</sup> (bulk density)
- $D=1.0$  meter (footing deep)



- B=1.0 meter (square or strip footing of length B )
- $N_c, N_q$  e  $N_y$  = bearing capacity factors

#### 4.1. Ultimate bearing capacity

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

$\phi$	$N_c$	$N_q$	$N_y$	$N_q/N_c$	$tg\phi$
27°	23,94	13,20	14,47	0,55	0,51

$$q_r = 0,23 \cdot 23,94 \cdot 1,55 + 1,7 \cdot 1,0 \cdot 13,20 \cdot 1,51 + 0,5 \cdot 1 \cdot 1,7 \cdot 14,47 \cdot 0,60$$

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

#### 4.2. Allowable bearing capacity

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

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

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

Once the soil nature is very loose to loose, the following steps can be observed, in order to improve the soil mechanical properties below 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.

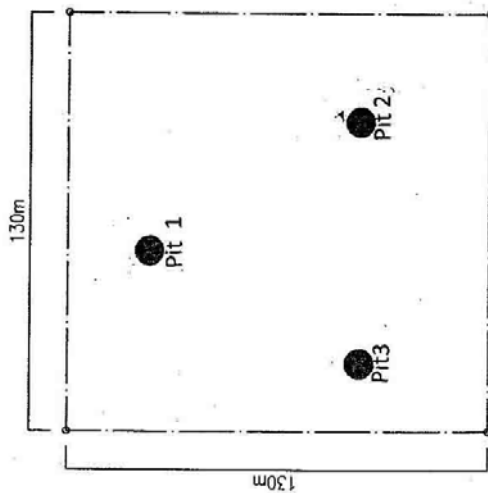
In this way the soil conditions will be improved, because the natural soil is very loose.

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

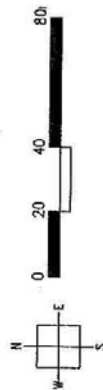
Maputo, 25<sup>th</sup> of March 2009

# CHISSANO

学校名： CHISSANO



将来建設用地  
敷地境界線  
敷地境界フェンス  
主出入口(人)  
出入口(車)



建物配置図  
BUILDING LAYOUT PLAN  
S=1/2,000  
モダンヒーヴン中学校建築設計面単体調査  
配置計画スライス 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<sup>2</sup>, 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 where 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 15<sup>th</sup> and 16<sup>th</sup> of February 2009.

### 3. Results obtained

#### 3.1. Nature of the crossed layers

The pit opened n° 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 n°2, 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 determined 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:**

- $q_r$  = ultimate bearing capacity (Terzaghi)
- $q_a$  = allowable bearing capacity (Terzaghi)
- $F = 3$  (factor of safety)

- $\phi = 28^\circ$  (friction angle)
- $C = 0 \text{ T/m}^2$  (cohesion)
- $\gamma = 1.7 \text{ T/m}^3$  (bulk density)
- $D = 1$  meter (footing deep)
- $B = 1.0$  meter (square or strip footing of length B)
- $N_c, N_q$  e  $N_y$  = bearing capacity factors

#### 4.1. Ultimate bearing capacity

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

$\phi$	$N_c$	$N_q$	$N_y$	$N_q/N_c$	$tg\phi$
$28^\circ$	25,80	14,72	16,72	0,57	0,531

$$q_r = 0 \times 25,80 \times 1,57 + 1,7 \times 1 \times 14,72 \times 1,53 + 0,5 \times 1 \times 1,7 \times 16,72 \times 0,60$$

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

#### 4.2. Allowable bearing capacity

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

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

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

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.

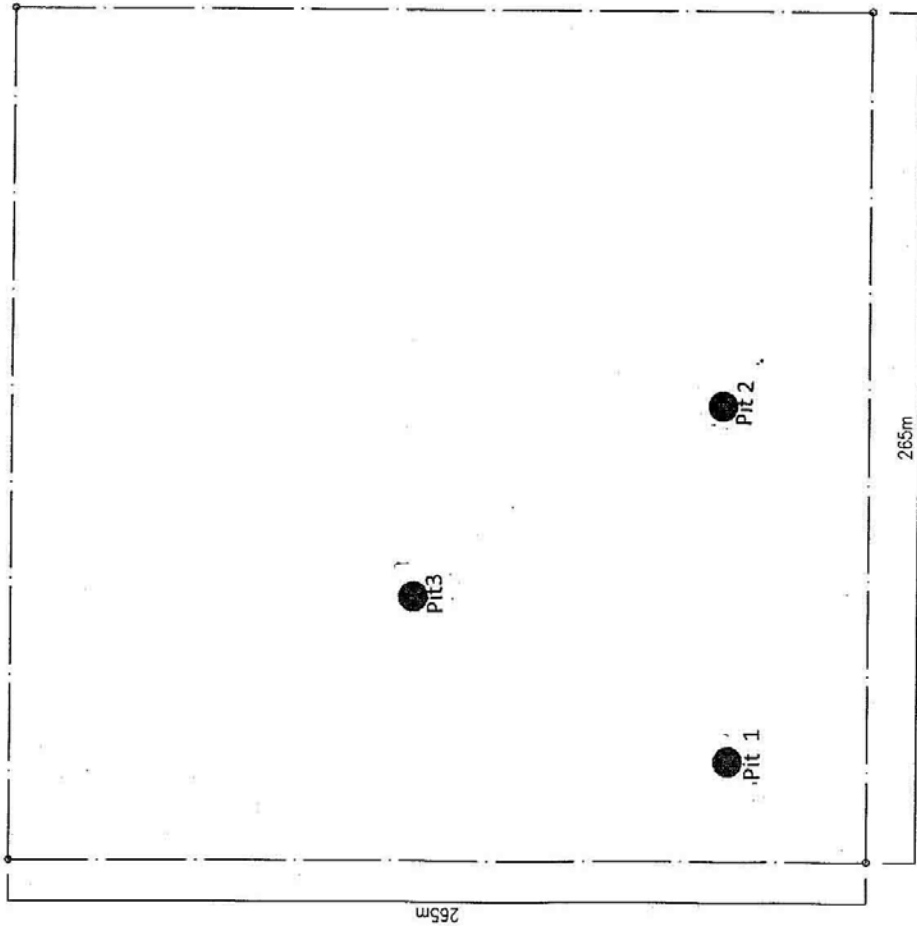
In this way the soil conditions will be improved, because the natural soil is loose.

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

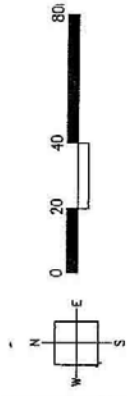
Maputo, 25<sup>th</sup> of February 2009

# MANJACAZ

学校名 : MANJACAZ



- ◯ 将来建設範囲
- 敷地境界線
- 敷地境界フェンス
- ▲ 主出入口(人)
- 出入口(車)



建築物配置図  
BUILDING LAYOUT PLAN  
S=1/2,000

モダンヒーロー中学校建設設計運籌管理調査  
配置計画スライド  
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 district, Maputo Province. It is an area of 10,800 m<sup>2</sup>, 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 planned 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 where 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 19<sup>th</sup> of February 2009.

### 3. Results obtained

#### 3.1. Nature of the crossed layers

The pit opened n° 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 n°2, 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 deep, 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 n°3, 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:**

- $q_r$  = ultimate bearing capacity (Terzaghi)
- $q_a$  = allowable bearing capacity (Terzaghi)
- $F = 3$  (factor of safety)
- $\phi = 29^\circ$  (friction angle)
- $C = 0 \text{ T/m}^2$  (cohesion)
- $\gamma = 1.7 \text{ T/m}^3$  (bulk density)



- D=1.0 meter (footing deep)
- B=1.0 meter (square or strip footing of length B)
- $N_c, N_q$  e  $N_y$  = bearing capacity factors

#### 4.1. Ultimate bearing capacity

- $q_a = CN_c fc + \gamma DN_q fq + 0,5B\gamma N_y f\gamma$
- $fc = 1 + N_q / N_c$
- $fq = 1 + tg\phi$
- $f\gamma = 0,60$

$\phi$	$N_c$	$N_q$	$N_y$	$N_q/N_c$	$tg\phi$
29°	27,86	16,44	19,34	0,59	0,55

$$q_r = 0 \times 27,86 \times 1,59 + 1,7 \times 1,0 \times 16,44 \times 1,55 + 0,5 \times 1,7 \times 19,34 \times 0,60$$

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

#### 4.2. Allowable bearing capacity

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

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

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

Once the soil nature is loose to medium dense, the following steps can be observed, in order to improve the soil mechanical properties below 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.

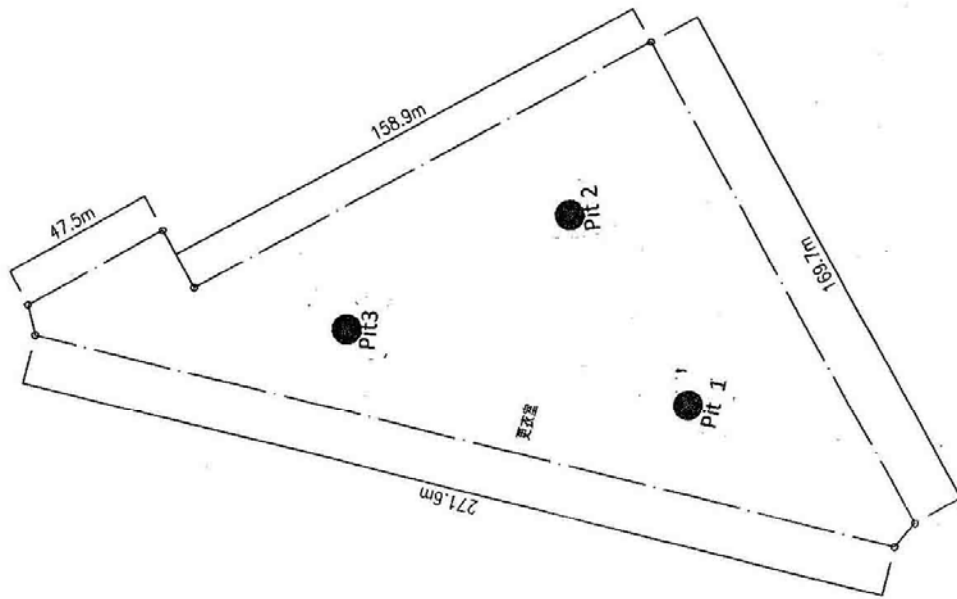
In this way the soil conditions will be improved, because the natural soil is loose to medium dense.

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

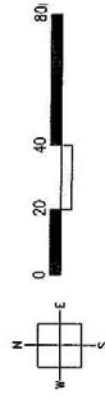
Maputo, 25<sup>th</sup> of February 2009

# COBE

学校名 : COBE



将来建設範囲  
敷地境界線  
敷地境界フェンス  
主出入口(人)  
出入口(車)



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  
配置計画スナップ  
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 district, Maputo Province. It is an area of 75,000 m<sup>2</sup>, 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 planned 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 where 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 18<sup>th</sup> 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:**

- $q_r$  = ultimate bearing capacity (Terzaghi)
- $q_a$  = allowable bearing capacity (Terzaghi)
- $F = 3$  (factor of safety)
- $\phi = 30^\circ$  (friction angle)
- $C = 0 \text{ T/m}^2$  (cohesion)
- $\gamma = 1.7 \text{ T/m}^3$  (bulk density)

- D=1.0 meter (footing deep)
- B=1.0 meter (square or strip footing of length B)
- $N_c, N_q$  e  $N_y$  = bearing capacity factors

#### 4.1. Ultimate bearing capacity

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

$\phi$	$N_c$	$N_q$	$N_y$	$N_q/N_c$	$tg\phi$
30°	30,14	18,40	22,40	0,61	0,58

$$q_r = 0 \times 30,14 \times 1,61 + 1,7 \times 1,0 \times 18,40 \times 1,58 + 0,5 \times 1 \times 1,7 \times 22,40 \times 0,60$$

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

#### 4.2. Allowable bearing capacity

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

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

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

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.

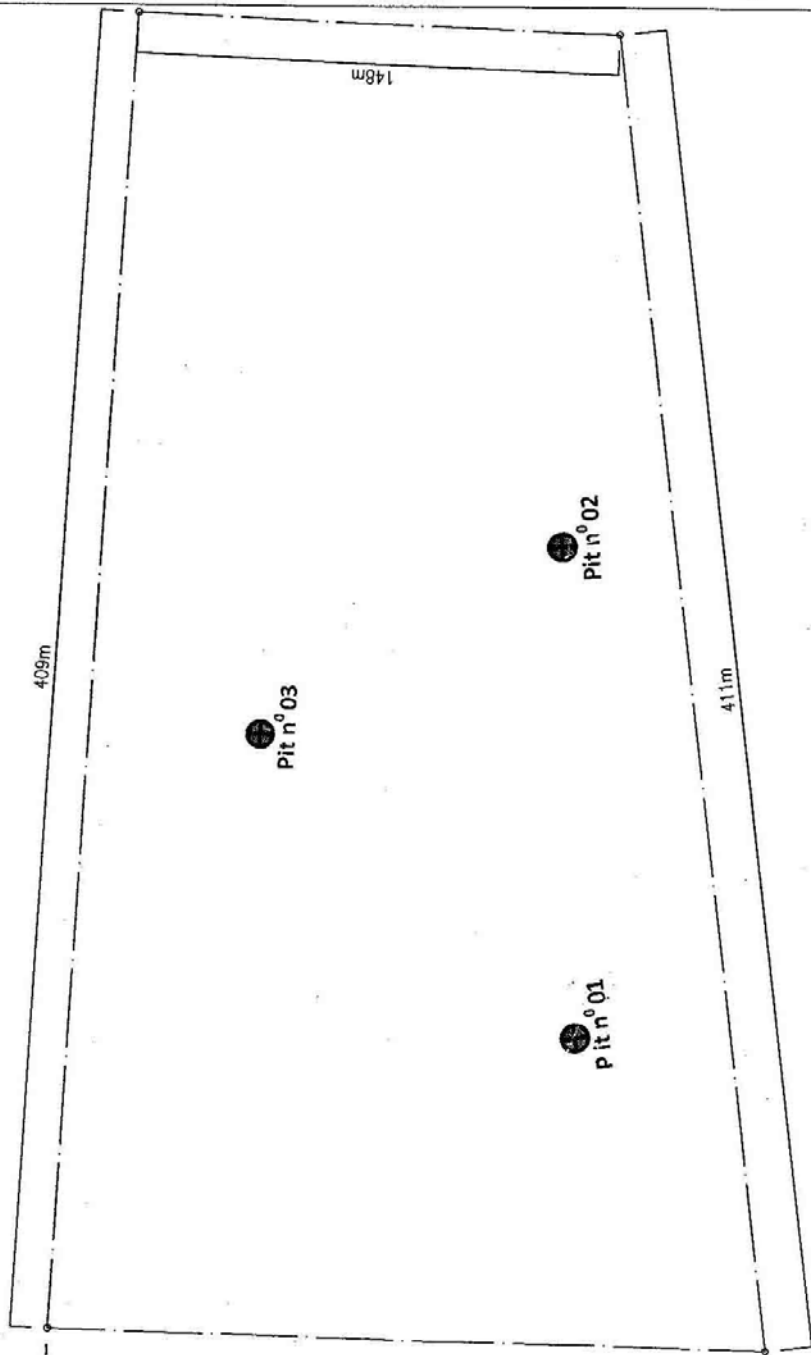
In this way the soil conditions will be improved, because the natural soil is loose.

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, 25<sup>th</sup> 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)



S=1/2,000

建築配置図

BUILDING LAYOUT PLAN

モザンビーク国中学校建設設計生産準備調査

配置計画スケッチ

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<sup>2</sup>, 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 where 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 19<sup>th</sup> 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)
- $\phi = 31^\circ$  (friction angle)
- $C = 0 \text{ T/m}^2$  (cohesion)
- $\gamma = 1.7 \text{ T/m}^3$  (bulk density)



- D=1.0 meter (footing deep)
- B=1.0 meter (square or strip footing of length B)
- $N_c, N_q$  e  $N_y$  = bearing capacity factors

#### 4.1. Ultimate bearing capacity

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

$\phi$	$N_c$	$N_q$	$N_y$	$N_q/N_c$	$tg\phi$
31°	32,67	20,63	25,99	0,63	0,60

$$q_r = 0 \times 32,67 \times 1,63 + 1,7 \times 1,0 \times 20,63 \times 1,60 + 0,5 \times 1 \times 1,7 \times 25,99 \times 0,60$$

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

#### 4.2. Allowable bearing capacity

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

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

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

Once the soil nature is loose to medium dense, the following steps can be observed, in order to improve the soil mechanical properties below 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.

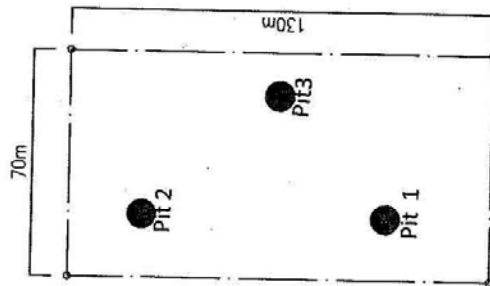
In this way the soil conditions will be improved, because the natural soil is loose to medium dense.

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, 25<sup>th</sup> of February 2009

# MATENDENE

学校名 : MATENDENE



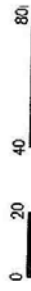
将来増設範囲

動地境界線

動地境界フェンス

主出入口(人)

出入口(車)



建物配置図

BUILDING LAYOUT PLAN

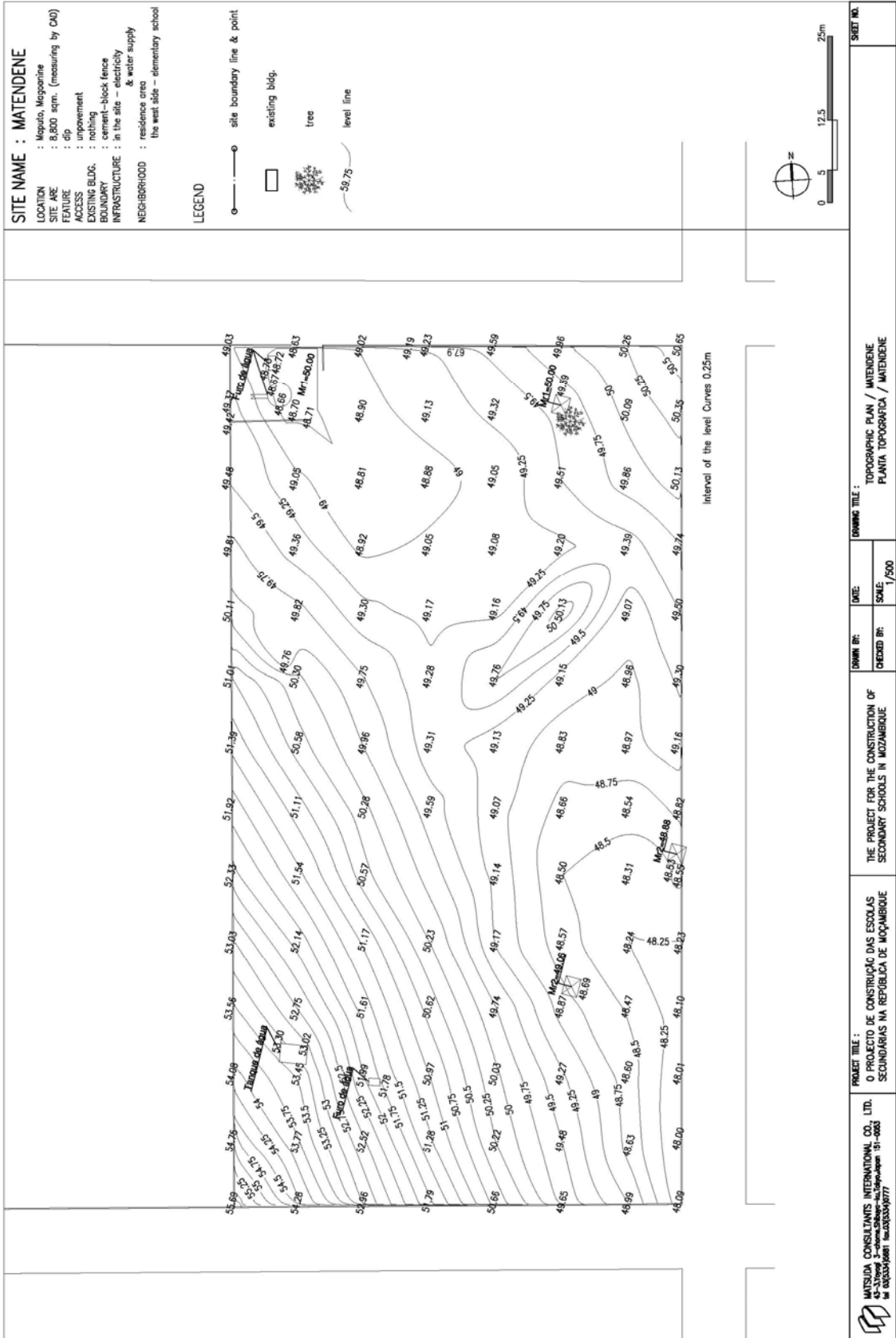
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モザンビーク国中学校建築設計・調査事務所

配置計画スナップ

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■ 現地再委託業務サイト測量図：マテンデネ



 MATSUDA CONSULTANTS INTERNATIONAL CO., LTD. 4-3-17 Tori 2-chome, Chiyoda-ku, Tokyo, Japan 100-0063 TEL: 03(3203)0811 FAX: 03(3203)0777	PROJECT TITLE : O. PROJECTO DE CONSTRUÇÃO DAS ESCOLAS SECUNDARIAS NA REPUBLICA DE MOÇAMBIQUE	DRAWING TITLE : TOPOGRAPHIC PLAN / MATENDENE PLANTA TOPOGRAFICA / MATENDENE	SHEET NO. _____
	DRAWN BY : _____	DATE : _____	CHECKED BY : _____