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）

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（PARPAⅡ）/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。

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、1 教室あたり生徒数は 128 人、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。

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。

3. プロジェクトの全体計画概要

(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）

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。

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）

(2) プロジェクト全体計画の成果

①前期中等教育施設 4 校の学校施設が整備される。

②上記施設において教育用の家具が整備される。

(3) プロジェクト全体計画の主要活動

① 前期中等教育施設 4 校の建設と家具の整備を行う。
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。
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。

(4) 投入（インプット）

ア. 日本側：コミュニティ開発支援無償資金協力 10.41 億円

イ. 相手国側

・学校運営に必要な教職員（教員 184 名、職員 102 名以上）

・施設の運営・維持管理に係る経費（年間約 26,378 千 Mt.）
・必要な範囲の門塀の建設、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・塀の建設及び植栽、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

概算事業費 10.95 億円　（無償資金協力 10.41 億円、モザンビーク国側負担分 0.54 億円）

(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 Progreeo do Fundo de Apoio ao Sector da Educação	2008	MEC	電子データ
A5	Regulamento sobre o Precesso de Avaliação do Impacto Ambiental	1997	Publicação Official 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			7 cl 卒業生数
			6+7	6cl	7cl	[g]
ガザ州	シサノ	EP2 Chissano	546	222	324	197
	Dist. Bilene	EPC Macia-Bairo 3	460	186	274	166
	Macia	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	EP2 Grau de Manjacaze	652	289	363	210
	Dist.Manjacaze	EP2 Grau de Chalala	450	222	228	174
	Dingane	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	EPC Km 15	1372	705	667	449
	マトラ市	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	EPC Boquisso	357	164	193	116
	マトラ市	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

□土質試験報告書

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 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:

- 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:

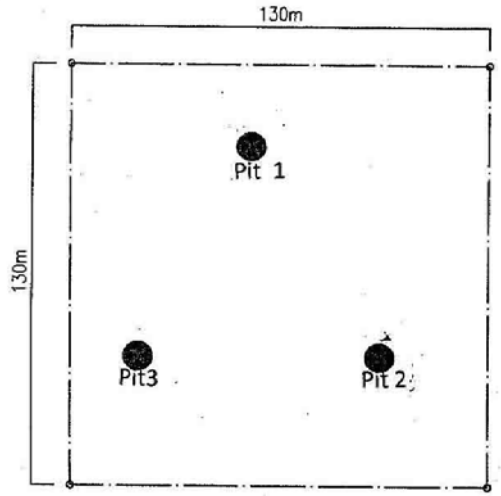
1. Dig the soils up to at least 2.00 meters deep;
2. Pour the foundation with water and leave it for 24 hours;
3. After that, replace with imported soil suitable for compaction, using granular material, and compacted up to 1.0 meter thickness (1,0 meter deep).
4. The square or strip footing will (lay)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

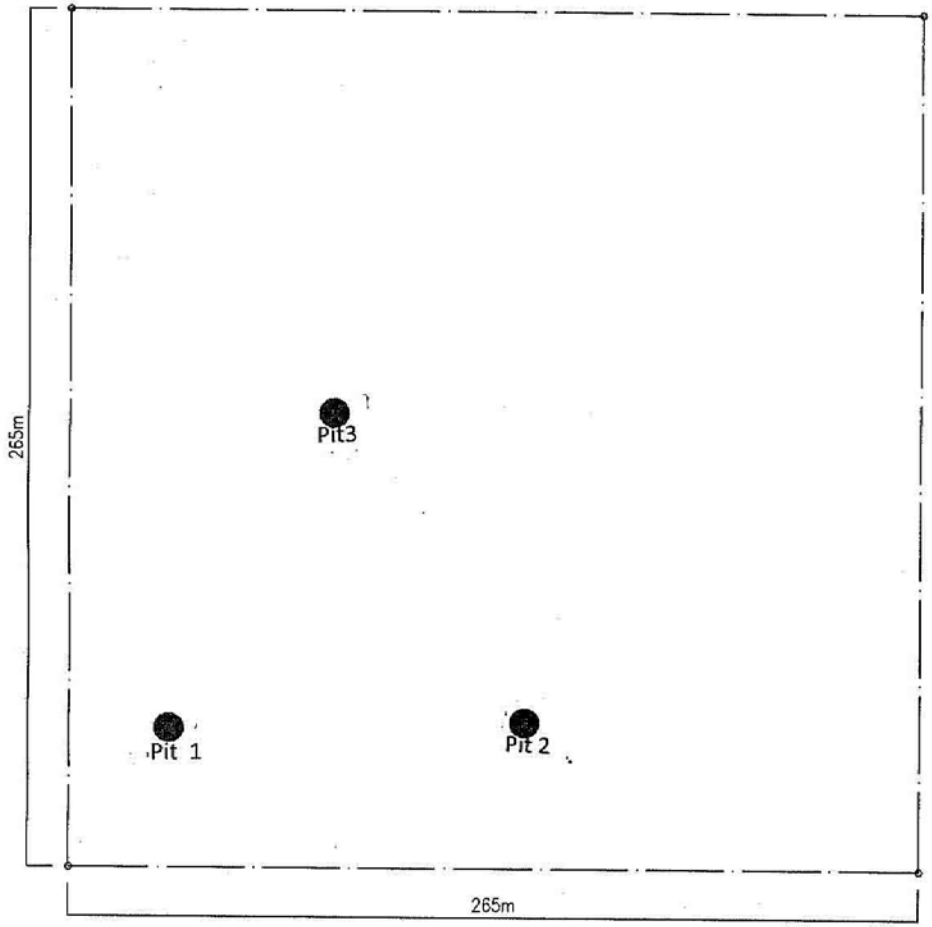
1. Dig the soils up to at least 2.0 meters deep;
2. Pour the foundation with water and leave it for 24 hours;
3. After that, replace with imported soil suitable for compaction, using granular material, and compacted up to 1.0 meter thickness (1,0 meter deep).
4. The square strip or footing will (lay)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

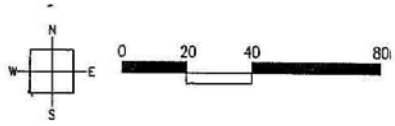
将来増設範囲

敷地境界線

敷地境界フェンス

主出入口（人）

出入口（車）



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 nº 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 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 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 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 =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:

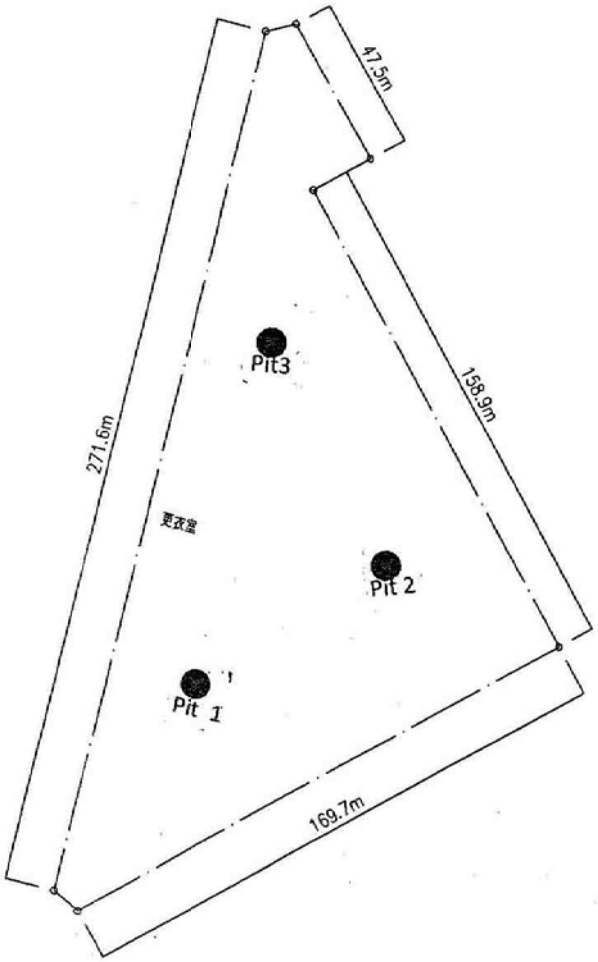
1. Dig the soils up to at least 2.00 meters deep;
2. Pour the foundation with water and leave it for 24 hours;
3. After that, replace with same soils (excavated soils), and compacted up to 1.0 meter thickness (1.0 meter deep).
4. The strip or square footing will (lay) fixed at 1.0 meter, having thus, 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 nº 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 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 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 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 =30º (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:

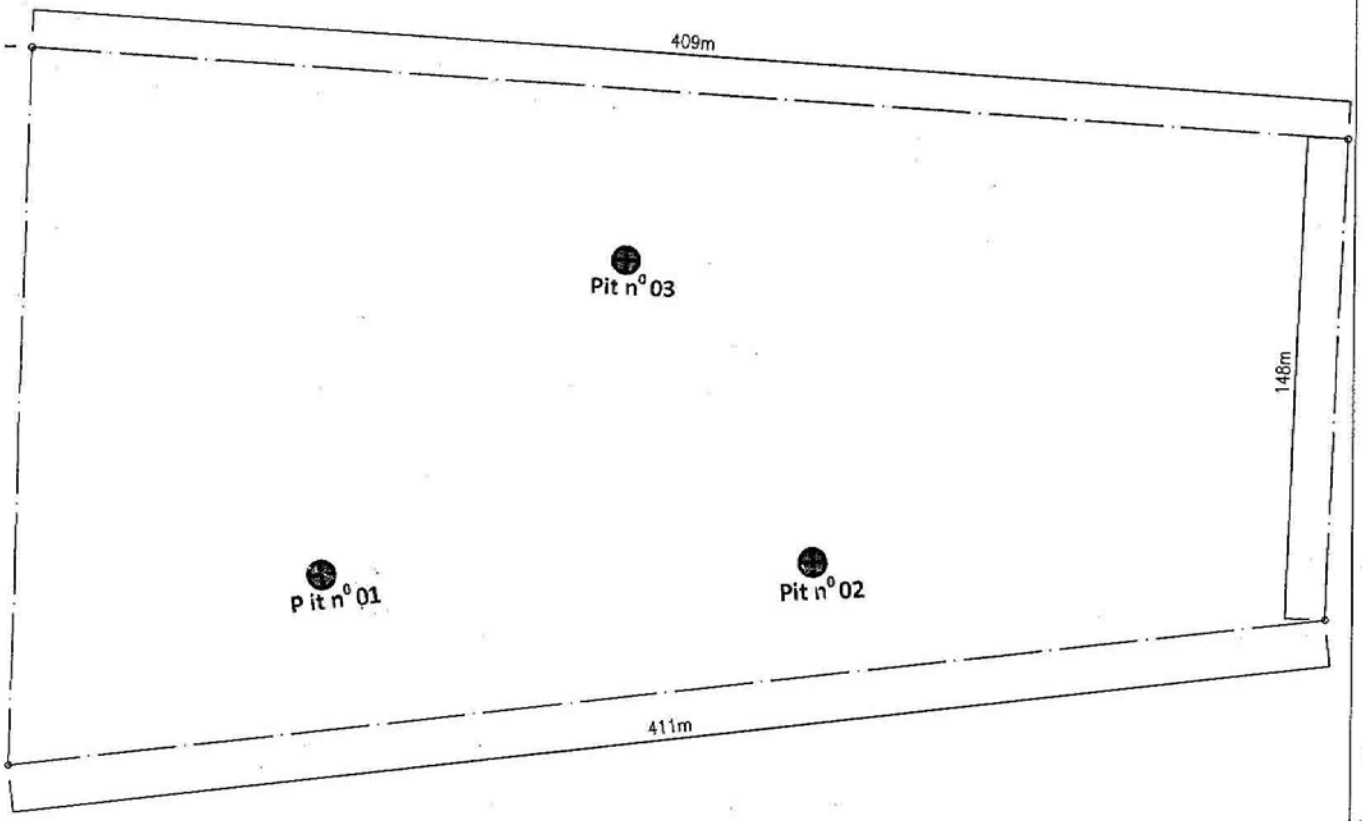
1. Dig the soils up to at least 2.00 meters deep;
2. Pour the foundation with water and leave it for 24 hours;
3. After that, replace with same soils (excavated soils), and compacted up to 1.0 meter thickness (1.0 meter deep).
4. The strip or square footing will (lay) fixed at 1.0 meter, having thus, 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 nº 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 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 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 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 =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:

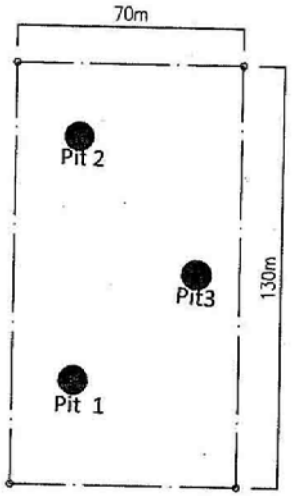
1. Dig the soils up to at least 2.00 meters deep;
2. Pour the foundation with water and leave it for 24 hours;
3. After that, replace with same soils (excavated soils), and compacted up to 1.0 meter thickness (1.0 meter deep).
4. The strip or square footing will (lay) fixed at 1.0 meter, having thus,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

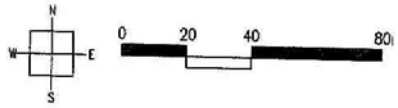
将来増設範囲

敷地境界線

敷地境界フェンス

主出入口（人）

出入口（車）



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

■現地再委託業務サイト測量図：マテンデネ