5.5　参考資料

1. 施設整備の為の用地取得及び施設建設の許可レター（設備・運輸省大臣）

2. Baseline and Survey Assistance Services

- Socio-economic and biological environment baseline surveys
- Supervision of geotechnical and environmental surveys

3. Natural Conditions Survey Package-A (Amendment-1)

- Geotechnical conditions survey

4. Natural Conditions Survey Package-B (Ammendment-1)

- Bathymetric, sub-bottom profiling, topographic and metocean conditions survey)

5. Environmental Survey Package-C (Ammendment-2)

- Seabed sediment, noise, vibration, air, water quality and coral surveys
- Detailed water and coral surveys

6. 港湾施設設計資料

1. 施設整備の為の用地取得及び施設建設の許可レター（設備・運輸省大臣発行）

用地取得及び施設建設の許可について

設備・運輸省の大臣から施設整備のための用地取得及び施設建設の許可について、次のレターを受領した。

RÉPUBLIQUE DE DJIBOUTI
Unité - Egalité - Paix
جمهورية جيبوتي
الوحدة - المساواة - السلام

MINISTÈRE DE L'ÉQUIPEMENT
ET DES TRANSPORTS

Le Ministre

N°Réf :.....373...../ MET

Djibouti, le ...09 AOUT 2018

وزارة المعدات
والنقل

الوزير

الرقم:.....

جيبوتي في:.....

A

Monsieur le Représentant de la JICA

Monsieur le Représentant,

Dans le cadre de la coopération qui nous lie avec le Japon, une etude de faisabilité est en cours pour l'acquisition d'un deuxième ferry sous forme de don non remboursable.

Je tiens encore une fois à remercier au nom de mon ministère votre Organisation pour l'appui indefectible à notre développement.

Nous nous réjouissons aussi que dans le cadre de ce projet il nous est accordé la construction de nouvelles infrastructures à l'escale de Djibouti et de Tadjourah.

À cet effet, nous donnons notre accord pour la construction de ces ouvrages et tel que stipulé par la loi portant organisation du domaine privé de l'Etat; un arrêté d'attribution de ces parcelles sera soumis au conseil de ministre par mon ministère une fois les points de coordonnées matérialisés.

Vous remerciant de votre cooperation, Je vous prie de croire, Monsieur le Représentant, en l'assurance de ma respectueuse considération.

MOHAMED ABDOULKADER MOUSSA

Djibouti, Plateau de Serpent, AV. Idriss O. Guelleh,
Tél :(253) 21.35.79.13- FAX : (253) 21.35.59.75 – BP: 2501 Djibouti
الهاتف : ٢١ ٣٥٧٩١٣ (٢٥٣) - الفاكس : ٢١٣٥٥٩٧٥ (٢٥٣) - صندوق بريد: ٢٥٠١ جيبوتي

ジブチ共和国

設備・運輸省

大臣

設備・運輸省

リファレンス No. : 373 /MET

ジブチ、2018 年 8 月 9 日

JICA 代表者殿

JICA 代表者殿、

我々と日本を繋ぐ協力スキームにおいて、無償資金協力において 2 隻目のフェリー供与のためにフィージビリティ調査が進行中です。

我が省を代表し、貴機構の我が国の発展への変わらぬご支援に、改めて御礼申し上げます。

また、本プロジェクトにおいて、ジブチ及びタジュラの船着場に新しいインフラ施設が整備されることを喜ばしく思っております。

本件に関し、我々は、国家の私有地に関する編成に関する法律に規定されている通り、上記施設の建設を許可します。これらの土地の供与に関する条例（アレテ）は、調整事項の確認後に、我が省により閣議にかけられます。

貴機構の協力に感謝申し上げます。

MOHAMED ABDOULKADER MOUSSA

2. Baseline and Survey Assistance Services

- Socio-economic and biological environment baseline surveys
- Supervision of geotechnical and environmental surveys

INSUCO
Local understanding for sustainable solutions

Japan Port Consultants

ERM

January 2019

Baseline and Survey Assistance Services on Maritime Transport Capacity Enhancement in Tadjourah bay

-

Djibouti

Baseline andSurvey Assistance Services on Maritime Transport Capacity Enhancement in Tadjourah bay

- PART 1: Socio-economic and biological environment baseline
- PART 2: Supervision of Geotechnical and Environmental Survey

Final Version

January 2019

Team:

- Moussa Omar Youssouf, Marine biology expert
- Bori Abdoulkader Akadar, Socio-economic environment expert
- Alessandro Aubry, geotechnical expert
- Louise Pierre, project coordinator
- Caroline Amrom, project coordinator

Baseline and Survey Assistance Services on Maritime Transport Capacity Enhancement in Tadjourah bay

Client(s): Japan Port Consultants – ERM Japan

Consultants:

- Insuco Djibouti SARL, 13 rue de Paris, Djibouti

Authors:

- Moussa Omar Youssouf, Marine biology expert
- Bori Abdoulkader Akadar, Socio-economic environment expert
- Alessandro Aubry, geotechnical expert

Internal quality control:

- Caroline Amrom (Insuco)

January 2019

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INSUCO
Local understanding for sustainable solutions

ERM

September 2018

Reinforcement of Maritime Transport Capacity in the Gulf of Tadjourah - Socio-economic and biological environment baseline

-

Djibouti

PART 1: Socio-economic and biological environment baseline

Final Version

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- Moussa Omar Youssouf, Marine biology expert
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List of acronyms

AFESD	Arab Fund for Economic and Social Development
APZFD	Authorities Port and Free Zone of Djibouti
DCT	Doraleh Container Terminal
DMA	Directorate of Maritime Affairs des Affaires Maritimes
DISED	Directorate of statistics and demographic studies
DMP	Doraleh Multi-Purpose
EDAM4	Djiboutian survey amongst households
EEZ	Exclusive Economic Zone
IAPD	International Autonomous Port of Djibouti (PAID-Port Autonome International de Djibouti)
IFC	International Finance Corporation
JICA	Japanese International Cooperation Agency
NUDW	National Union of Djiboutian Women
MAEM-RH	Ministry of Agriculture, Animal Husbandry and Sea, in charge of Hydraulic ressources (Ministère de l'Agriculture, de l'Elevage et de la Mer, chargé des Ressources Hydrauliques)
MET	Minsitry of Equipment and transport (Ministère de l'Équipement et des Transports)
SCAPE	Accelerated growth and Employment promotion Strategy (Stratégie de Croissance Accélérée et de Promotion de l'Emploi)
SEE	Strategic Environmental Evaluation
SFD	Saudi Fund for Development
WB	World Bank

1. Introduction

1.1. General context

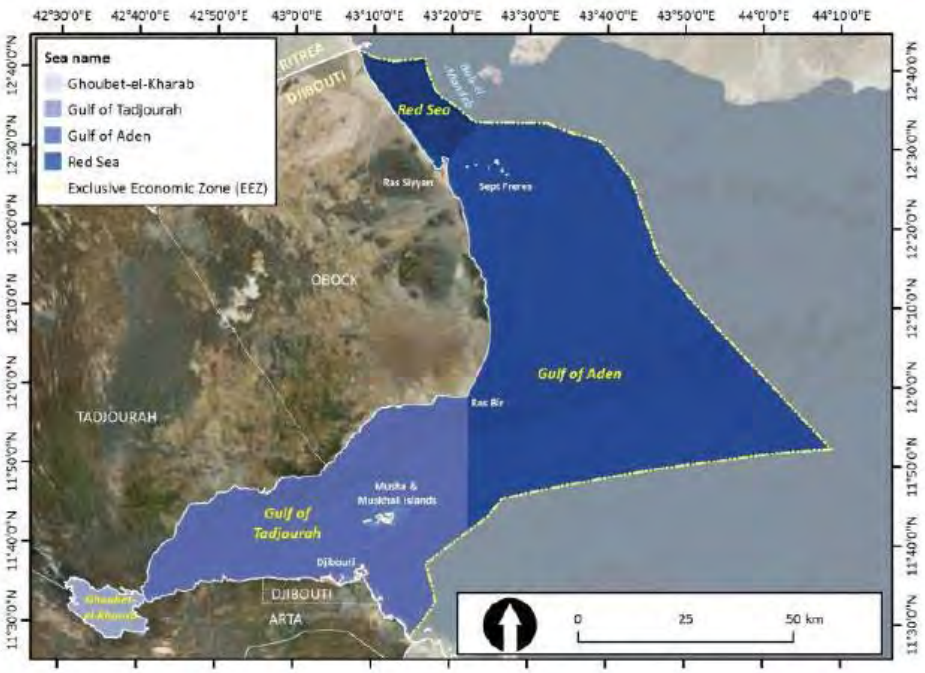
The Republic of Djibouti is a small country of 23 200km² located in the Horn of Africa. It is bordered by Erithrea in the north, Ethiopia in the west and south and Somalia in the southeast. The remainder of the border is formed by the Red Sea and the Gulf of Aden at the east. The country's coastline stretches 403 kilometers, with terrain consisting of plateau, plains and highlands. The Republic of Djibouti is strategically located at the crossroads of one of the busiest shipping routes in the world, linking Europe, the Far East, the Horn of Africa and the Persian Gulf.

Map 1 : Republic of Djibouti

The Republic of Djibouti oversees an Exclusive Economic Zone (EEZ) covering 7025 km2. The EEZ stretches from the Eritrean border in the north to the border with Somalia in the south. This EEZ can be subdivided into four marine zones1:

- The Red Sea coast, which extends from Ras Siyyan at the Bab al Mandeb to the border with Eritrea (314.01 km²),
- The Gulf of Aden, which extends from Ras Siyyan to Ras Obock and southwards (4433.33 km²),
- The Gulf of Tadjourah (2118.48 km²) and;
- Ghoubet al Karab (159.38 km²).

[1] IUCN 2017. Seascape Management Plan for the Gulf of Tadjourah and Ghoubet-el-Kharab in the Republic of Djibouti, IGAD/UICN-ESARO, Nairobi, Kenya.



Map 2 : Exclusive Economic Zone and the different seas (Klaus 2016)[2]

Located in the Horn of Africa, the Republic of Djibouti which has little arable land, knows a low rainfall (150 mm / year). This situation makes the country sensitive to external disturbances such as rising food prices. The Djiboutian economy is based on port services, because of its geostrategic position of choice and because of Ethiopian exports / imports.

For some time now, the Government has been trying to put its actions into new frameworks that address specifically the issues of growth and the fight against poverty in the medium or long term. In March 2014, for instance, an ambitious program was developped to reduce absolute poverty by more than one-third (1/3) and create more than 200,000 jobs by 2035. Covering the period 2015-2019, the Strategy for Accelerated Growth and Promotion of Employment (SCAPE) is the first operational version of a "Djibouti 2035 Vision" that will be implemented in five-year planning cycles.

In terms of transport, the strategy calls for strengthening the capacity of the port of Djibouti, which is expected to become the main and privileged port[3] of Ethiopia. As for the development of the domestic transport, it will allow a rebalancing of the national territory and thus a development / diversification of the economic activities in the regions of the interior.
Based on that information and in order to decongest shipping traffic to the northern regions and particularly Tadjourah, the Djiboutian government has requested support from the Japanese government for the acquisition of a new vessel and the rehabilitation of the port structures.

The shore of Djibouti counts several ports and marina, which capacity have been extended along the years. We distinguish notably:

- **The International Autonomous Port of Djibouti (IAPD)**, that started in 1888 with the creation of Djibouti-town by the French colonial administration. It progressively evolved out of landlocked Ethiopia's search for a maritime outlet and since 1998, the Port handled 100% of Ethiopia's maritime traffic[4], which moves to and from Addis Ababa by truck and rail. To accommodate this important business, the Port has made many additional dry yard areas available. The Port of

[2] Ibid
[3] Recent events of reconciliation between Ethiopia and Erythrea may change and have a great influence on this situation. https://www.bbc.co.uk/news/world-africa-44758327
[4] http://www.portdedjibouti.com

Djibouti is ideally located to serve the COMESA[5] market, linking 19 countries and 380 million peoples. However, the port of Djibouti suffered from congestion and new ports have been built in the 2000's in order to increase commercial activities;

- **The Doraleh Container Terminal (DCT) and Doraleh Multi-Purpose (DMP)**: recently built with Chinese support that will ultimately and normally replace the activities of the IAPD;
- **The port de pêche** which is on the left flank of the port considered in this study, where leisure boats are parked, and fishing activities and market are to be found.
- **The port of Djibouti:** targeted in this study.

Image 1 : Port of Djibouti (targeted by the project)

The shore of Tadjourah has recently been equipped with a large port that will be exclusively dedicated to potach transport. This large potash port (large brown surface on the left on Image 3) was established with the support of two financial partners: the Arab Fund for Economic and Social Development (AFESD) and the Saudi Fund for Development (FSD)[6].

Image 2 : Port of Tadjourah (targeted by the project)

[5] The common market for Eastern and Southern Africa (COMESA): is a free trade area with nineteen member states: Djibouti, Erithrea, Ethiopia, Egypt, Lybia, Sudan, Comoros, Madagascar, Mauritius, Seychelles, Burundi, Kenya, Malawi, Rwanda, Swaziland, Zambia, Zimbabwe and Democratic Republic of Congo.
[6] The inauguration ceremony of the Tadjourah port: http://www.presidence.dj/article.php?ID=434

1.2. Presentation of the project

The Government of Djibouti has initiated, in partnership with Japan, a project to strengthen the capacity of maritime transport in Tadjourah Bay. The objective of this project is to provide the Tadjourah region with a new ferry of greater capacity (200 to 250 pers.), adapted to the harsh conditions of the sea and able to navigate all year long. This new ferry will make shipping more regular, increase trade and move goods and services to the region. The project is part of a new economic perspective characterized by the opening of the new port of Tadjourah and the Tadjourah / Balho road linking the regional capital to the city of Mekeleh (Ethiopia).
However, despite its multiple benefits, the project is likely to have potentially negative impacts on the marine environment and society. In order to anticipate and mitigate these potential impacts and in a perspective of sustainable development associating the preservation of the environment, the economic and social development, the government of Djibouti has recommended the realization of an environmental and social impact assessment (ESIA hereinafter).
Therefore, the ERM-Japan (Environmental Resources Management) in charge of the project, called on the company INSUCO Sarl Djibouti for collecting physical, environmental and socio-economic data for the development of the baseline needed for the ESIA.

1.3. Objectives of the study

Mainly based on the analysis of the available documentation and the information collected from the users of the site, the study aims to give a general overview of the initial state of the socio-economic and the biological environment in the zones of influence that can be affected by the project.

More specifically, this study has different objectives:

- Describe and characterize the initial state of the socio-economic environment within and around the ports of Tadjourah and Djibouti;
- Identify the potential expectations of the communities surrounding the two ports and their associated economic activities;
- Realize a first assessment of the impact of the project on this socio-economic baseline situation;
- Describe and characterize the initial state of the biological environment in the Gulf of Tadjourah and around the docking ports located in Djibouti and Tadjourah;
- Identify the main habitat types and stands, their condition and vulnerability;
- Identify the types of works to be done that best meet the problem of preserving the natural environment in the zone of influence of the project, for the sustainability of the marine ecosystem of the Gulf of Tadjourah *(this is more detailed in the Coral survey and its chapter on impact assessment)*;
- Compile a range of theorical information concerning the physical environment.

These socio-economic and biological environment baselines will serve as reference for the Environmental and Social Impact Assessment study that will be then covered by the Directorate of Matitime Affairs.
As stated in the international safeguards and JICA standards, the communication and stakeholders' engagement aspects are key for the good social development of a project. The scoping phase as well as the baseline studies were occasion for the experts to present the project in detail to the stakeholders and to communicate thoroughly and in local languages about the ambitioned project and its development.

2. Methodology

2.1. Socio-economic environment

2.1.1. Content of the socio-economic baseline study

The main purpose of the social base is to produce an accurate and complete picture of the social and economic situation of the project areas and the people who live there. Basic data from the persons working directly on the port (dockers, street vendors, commercial actors, ferries, non-ferries, users of traditional boats ...) were collected at the port of Djibouti as well as at the port of Tadjourah. The collection of information covered the following themes:

- Profile and revenues (any type, with specific demand for the sales activities),
- Social security and work conditions,
- Women's presence,
- Housing;
- Knowledge of the project.

2.1.2. Technical tools

The overall socio-economic analysis was carried out through:

- the collection and exploitation of the available documentation on the intervention zone coming from different sources (administrative services, DISED, projects, etc.)
- On field observations and data collection.

The modal of data collection survey is given in Annex 4. Mapping tools were also used. Finally, the realization of this socio-economic analysis and the collection of data in the field was done in consultation and with the widest possible collaboration of the different stakeholders (population, local authorities, other stakeholders).

2.1.3. Survey preparation

The surveys were carefully prepared, including:

- The choice of sites,
- Survey materials (questionnaires),
- The necessary human resources (surveyor mobilized to assist the expert),
- The distribution of tasks within the team,
- Training program of the surveyor,
- The information and explanation campaign with regards to the target groups and their representatives,
- Technical means (pens, pencils, erasers, calculators, papers, etc.),
- Material means for transport (vehicles, per diem, etc).

2.1.4. Sources of information and different steps of work

The results documented in the studies are the results of:

- **A documentary review** that first served to better situate the field of study (physical, geographical, social, economic and cultural) and then served to develop tools for collecting information.
- **Individual and semi-collective interviews**, on the socio-economic situation of the populations, were made from questionnaires, in the framework of a participative approach facilitating open and interactive discussions.
    - **Individual interviews**: enabled us to obtain the perception of the populations on some key questions of the maritime transport activities. Structured around open questions that enable the respondents to express themselves more freely, they provide enough

information to make a pre-diagnosis that got discussed or validated during the semi-collective interviews.

- **The semi-collective interviews (focus-group):** Their objective was to validate the gender analysis of the socio-economic situation.

The individual interviews and focus groups took place from July 28th until August 2nd in Djibouti. In Tadjourah, they were led from August 4th until August 8th 2018 (See table below for details).
The preparation of the report presenting the summary of the information collected.

Table 1: Details of meetings with different stakeholders and potential affected persons in Djibouti

Methods	Target	Date	Place	Type of participants	Number of participants	Purpose/content of the meeting
DJIBOUTI						
Focus group	Dockers of the ferry	28/07/18	Djibouti port	Private sector	3	Work conditions, expectations, revenues, fear, work accidents, etc
Focus group	Dockers for the dhows	28/07/18	Fishing port	Private sector	7	Work conditions, expectations, revenues, fear, work accidents, etc
Focus group	Bus users	30/07/18	Bus station	Private sector	11	Conditions of transport, price, satisfaction of the proposed service
Focus group	Bus drivers	30/07/18	Bus station	Private sector	3	Price, revenues, spendings, constraints, expectations, fears
Individual interview	Small shop owner	29/07/18	Djibouti Port	Private sector	1	Choice of his location, products to be sold, price, expectations, fears
Focus group	Drivers of dhows	29/07/18	Fishing port	Private sector	2	Goods, price, expectations, revenues, type of spendings, competition, fear
Focus group	Drivers of speed boat	31/07/18	Fishing port	Private sector	2	Goods, price, expectations, type of spendings, competition, fear
Individual interview	Informal restauration	1/08/18	Fishing port	Private sector	1	Choice of its location, sold meals, price, revenues, spendings, expectations, fears
Individual interview	Chief mechanicien for the ferry	2/08/18	Djibouti port	Governmental authority	1	Safety and rescue equipment, price of the tickets, problems encountered, expectations, negative potentials impacts
Individual interview	Directeur de la DAM (Direction des Affaires Maritimes)	29/07/18	Building of the Maritime Affairs Directorate	Governmental authority	1	Responsibilities of the Directorate of Maritime Affairs , documentation, encountered problems, expectations, potential negative impacts

Table 2: Details of meetings with different stakeholders and potential affected persons in Tadjourah

Methods	Target	Date	Place	Type of participants	Number of participants	Purpose/content of the meeting
TADJOURAH						
Individual interview	Préfet of the region of Tadjourah	5/08/18	Building of the préfecture	Governmental authority	1	Assets of the region, management of the port of Tadjourah, documentation, encontered problems, expectations, potential negative impacts
Individual interview	Regional Council of Tadjourah	8/08/18	EDD's building	Local authority	1	Ongoing projects, encountered problems, expectations, potential negative impacts
Individual interview	Customary leader	12/07/18	Buildings of the prefecture	Traditionnal authority	1	Roles and responsabilities of traditional authority, expectations, potential negative impacts
Individual interview	President of the fishermen cooperative	4/08/18	Fising place of Tadjourah	Civil society	1	Location of the jetty, price, expectations, potential negative impacts
Focus group	Fishermen	4/08/18	Fising place of Tadjourah	Private sector	6	Fishing conditions, expectations, spendings, fears, accident, equipment
Focus group	Dockers	6/08/18	Port of Tadjourah	Private sector	5	Work conditions, expectatins, revenues, spendings, fears, work accidents, etc.
Individual interview	Dhows'owners	5/08/18	Port of Tadjourah	Private sector	2	Type of goods, location of the jetty, price, expectations, potential negative impacts
Individual interview	Commerçants grossistes	4/08/18	In their buildings	Private sector	2	Type of goods, encountered problems, price, expectations, potential negative impacts
Individual interview	Restauratation professionals	7/08/18	In their buildings	Private sector	1	Proposed services, encountered problems, price, expectations potential negative impacts
Individual interview	Hotel managers	7/08/18	In their buildings	Private sector	2	Proposed services, encountered problems, price, expectations potential negative impacts
Individual interview	Touristic center managers	6/08/18	In their buildings	Private sector	2	Proposed services, encountered problems, price, expectations potential negative impacts
Individual interview	Representative of the directorate of fishing	4/08/18	Fishing place of Tadjourah	Governmental authority	1	Roles, ongoing projects, texts in application, expectations, potential negative impacts

Focus group	Drivers of bajaj	5/08/18	Fishing place of Tadjourah	Private sector	3	Revenues, spendings, expectations, fear, accident, etc.
Individual interview	General Secretary of the women association for the protection of the environment	8/08/18	Hospital of Tadjourah	Civil society	1	Sector of intervention, creation date, objectives, roles of women in Tadjourah, expectations, potential negative impacts
Individual interview	Member of the association Mahoubani	6/08/18	Port of Tadjourah	Civil society	1	Sector of intervention, creation date, objectives, roles of youth in Tadjourah, expectations, potential negative impacts
Individual interview	Membre of the Association for the development of culture	6/08/18	Port of Tadjourah	Civil society	1	Sector of intervention, creation date, objectives, roles of youth in Tadjourah, expectations, potential negative impacts

2.1.5. Main expected results

The main expected results are:

- Level and structure of households' income (Identification of different income sources: fishing, trade, and others),
- Levels and structure of expenditures (food / nutrition, water, health, child rearing and others);
- Social characteristics (unemployment, health, education / training, social and disadvantaged groups, socio-cultural aspects),
- Access to energy, water supply situation,
- Situation of women (participation in the process of social organization and decision-making, own resources) structures / actors intervening in the area (Potential vulnerable persons),
- Suggestions for improving the quality of the ferry service,
- Proposals to make the management of the port of Tadjourah viable.

2.1.6. Study zone: Site 1: Djibouti port

The map below shows the distribution of study areas in the city of Djibouti, represented by dots of different colors. Thus, we will have 4 distinct areas that are: -

- **Zone 1: Port of Djibouti**

It is the port of Djibouti, point of departure / docking of the ferry. This area is closest to the project site and interactions / impacts on stakeholders will occur very frequently.

- **Zone 2: Bus station**

This is the bus station for Tadjourah. Zone 2 stakeholders will frequently be faced by the impacts of the project: the impacts will be less direct than for Zone 1, but still visible and economically important for the persons active in the transport activities.

- **Zone 3: Fishing port**

This is the fishing port, starting point / dock dhow. Interactions between these stakeholders and the project are limited in time and may be restricted to a defined phase of the project. The potential impacts of that port are quite reduced.

- **Zone 4: The Direction of Maritime Affairs (Buildings of the DMA)**

Interactions may occur incidentally or occasionally with stakeholders in this area. Physical impacts will be very limited or non-existant, but the DMA will be in charge of the follow-up of all the transport means (old and new ones).

Figure 1 : Different point of surveys

2.1.1. Study zone: Site 2: Tadjourah port

The entire Tadjourah region, even the most remote areas, is currently served by this port. It is the only port in the region. Our study will focus on diverse users (traders, tourism promoters, civil society, etc.) as explained in the following paragraphs.
The site of the new pier and the port infrastructure has been set in agreement with the competent authorities of the region. This site, which belongs to the state, is not inhabited. No relocation is therefore necessary. As general information, all the sites/lands present in the neighborhood (restaurant, hagar, etc.) are possessed by private owners who have official land titles.

Figure 2 : Infrastructures mapping in Tadjourah

2.2. Biological environment

2.2.1. Methodology

The methodology for this report is based on the following three-steps approach:

- Carry out a first framing of the study (meetings with regional and local authorities, site visits and delineation of the study area)
- Review the bibliography (study reports, publications, and documents) of the biological environment in Tadjourah Bay and at the project sites;
- Conduct interviews with individuals or user groups (local fishermen, divers, coast guards, etc.) and relevant department heads.

It is within this framework that:

- a scoping mission composed of the representative of the ERM Japan, INSUCO and the national consultant, visited Tadjourah on July 12, 2018. The mission met the stakeholders involved in the project (State, regional and traditional authorities, fishermen and civil society).
- A first reconnaissance of the site was done during this mission: the environmental consultant visited the project site in Tadjourah (Tadjourah Port Site 2, hereinafter), and exchanged with the users and the people concerned by the safeguarding of the marine environment.

- A prospecting study in Djibouti at site 1 (Djibouti Port Site 1 herinafter) and stakeholders including site users (local fishermen, boaters, coast guards) and public ministries (Ministry responsible of Environment, Ministry of Agriculture, Ministry of Equipment and Transport, the Study and Research Center of Djibouti, etc.)

For the description of the habitats we describe the types of habitats as well as the biological communities.

Several sources of information have been used to describe the project site and the biological communities that live there. The main sources of information are:

- Google Earth images that give an overview of the project site
- Benthic habitat mapping using satellite field verification imagery (Landsat 8 image data); to provide comprehensive coverage of the coastal environment of Djibouti (Seascape, 2016)[7].
- Interviews with fishermen, coast guards and divers at the Ports

2.2.2. Study zones of the project

Project locations include the berthing and mooring ports in Djibouti (Figure 3) and the berthing port in Tadjourah (Figure 4). These two sites respectively identified as Djibouti Port Site 1 and Tadjourah Port Site 2 correspond to the sites that will be directly impacted by the project. They will undergo transformations during the construction works (construction phase) and impacts related to the operations of berthing, mooring, loading and unloading of the goods as well as the boarding and the disembarkation of the passengers (operational phase).

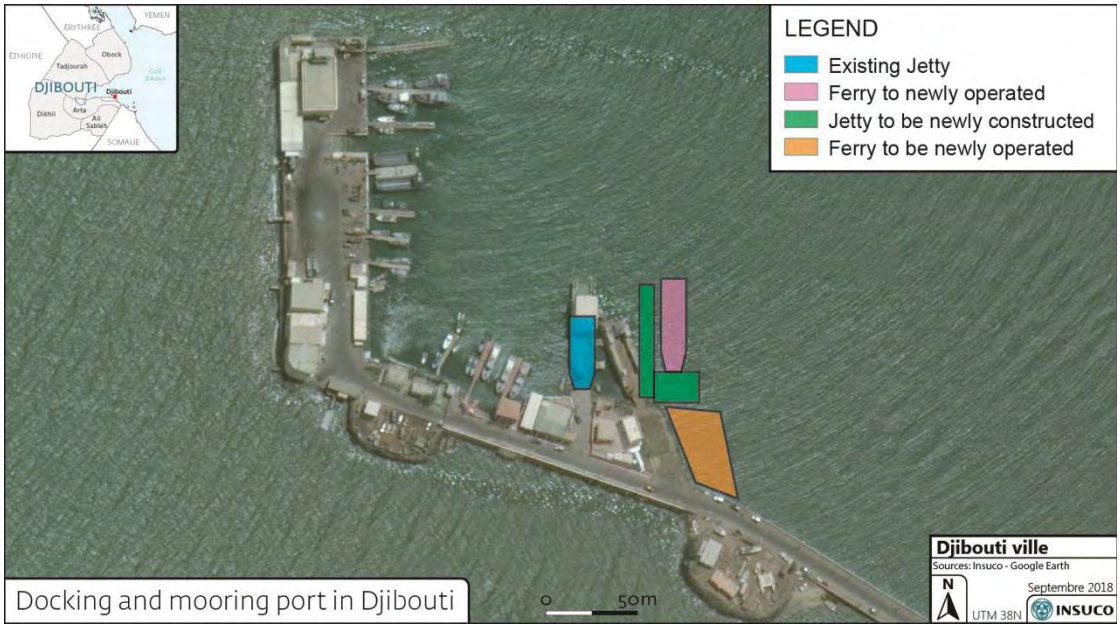


Figure 3 : Detail of the works and new infrastructures to be implemented in Djibouti port

[7] Habitats: An integrated hierarchical classification scheme was developed for the purposes of the SCP, which attempted to harmonise between marine and terrestrial classification schemes. The integrated classification scheme was used to prepare a new integrated base map for Djibouti using the freely available Landsat 8 satellite data to illustrate the distribution of both marine and terrestrial environments throughout the Djibouti EEZ. Gaps in the habitat datasets were infilled using best available data from Harris et al. (2014) in the marine environment and by digitization of other terrestrial habitat types. This process resulted in the creation of new data layers covering some of the critical coastal and shallow marine 'process' habitats (e.g. beaches, coral reefs, seagrass beds and mangroves).

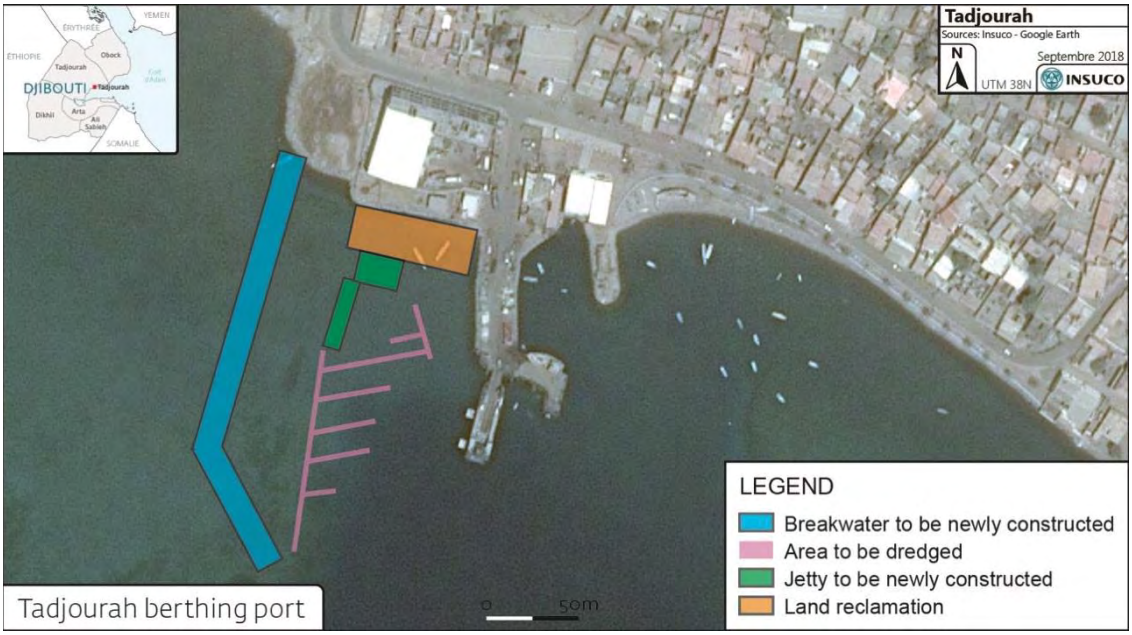


Figure 4 : Different works and infrastructures to be implemented in Tadjourah

Considering the physical and biological environment likely to be affected by the project, the study area was defined around both sites (Djibouti Port Site and Tadjourah Port Site 2) and including the maritime route for the trips: Djibouti-Tadjourah and Tadjourah-Djibouti.

Figure 5 : Project study area include the docking/ berthing sites in Djibouti and Tadjourah and the maritime route between the two ports.

2.3. Physical environment

The information presented in the report are the results of desk studies done by the geotechnical survey assistants/expert. The bibliography is displayed at the end of the report.

3. Project description

3.1. General characteristics of the project

The communication between Djibouti and Tadjourah or between Djibouti and Obock is currently insured by various means of public and commercial transport: by land, with local buses (Tadjourah : 173 km in three hours for a cost of 1500 FDJ- Obock: 238 km in four hours for 2000 FDJ) or with trucks and by sea with traditional commercial boats, called Dhows ("boutres"), by small speedboart, and by the existing ferry that was given by the Japanese cooperation in 2008.

Table 3 : Information about the transport by the road

	Distance	Duration	Price
Djibouti - Tadjourah	173 km	3 hours	1500 FDJ
Djibouti - Obock	238 km	4 hours	2000 FDJ

The existing ferry has a capacity of transporting 200 persons, cars and supplys which has proven to be limited in comparison to the needs of both towns: The road Djibouti -Tadjourah is done four times a week, whereas the connection Djibouti-Obock is only done twice a week. Various constraints have appeared along the years and the Djiboutian authorithy have sollicitated the Japanese cooperation to consider the replacement of the actual ferry and the improvement of the transport services offer.
Moreover, the current ferry is only operational from October until late June – between June and September; the local winds (Khamzin) make it dangerous to be on and therefore there is no ferry service during that period.

The new project being discussed is composed of:

- A new ferry to insure the route Djibouti-Tadjourah; this new ferry will be characterized with:
  - Greater capacity to welcome around 250 people,
  - Greater capacity for the transport of trucks and cars,
  - Two doors enabling a safer circulation on the boat as well as safer boarding and disembarkation,
  - The capacity to be functioning all year long: the ferry will be equipped with specific shaped-hull. This element will make the ferry safer while navigating during khamzin season.
- The old ferry will be used for the route Djibouti-Obock;
- Port Infrastructures:
  - pavement of the new backfill area,
  - construction of a waiting lounge including the sale and purchase of tickets,
  - infrastructure installation (water supply, sanitation, electricity),
  - implementation of a security system such as gates, fence walls, lighting.

The new ferry will be operating according to the schedule hereunder:

Table 4 : New schedule of transport of the two operating ferries

From Djibouti to	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Tadjourah	9:00 am	Off	9:00 am	9:00 am	9:00 am	9:00 am	9:00 am
Obock	9:00 am	9:00 am	Off	9:00 am	9:00 am	9:00 am	9:00 am

3.2. General planning

Between May and June 2017, JICA sent a study mission to Djibouti in order to collect various data and information about the current situation in order to apprehend in a global and experience-based way the development of the future collaboration around the project.
During its implementation, the project will be in three phases:

1. The study phase within which this report is being developed,
2. The construction and development phase of the new jetties and terminals at the docking and mooring ports of Djibouti and Tadjourah,
3. The operating phase during which the ferry will provide transportation between Djibouti and Tadjourah and the “old” ferry from Djibouti to Obock.

3.2.1. Study phase[8]

The study phase of the project covering a whole range of studies is scheduled to run from July 2018 to May 2019. During this period, several studies (including the socio-economic study, the environmental study, the study on the situation and forecast of the volume of traffic, etc.) will be launched. The study on environmental and social considerations will run from July to September 2018.

1. Implementation Policy of Survey Work in Djibouti: Survey Work in Phase 1:

- Background, circumstances and contents of project,
- Project implementation formation,
- Related laws and ordinances, etc,
- Ferry boat operation status,
- Port Facility status,
- Social and environmental conditions survey,
- Natural conditions including Khamsin winds,
- Others.

2. Implementation Policy of Survey Work in Djibouti Survey Work in Phase 2

JICA Study team will prepare and explain the Draft Final Report (DFR) to the Government of Djibouti and obtain their basic understanding.

3. Surveys of Normal Ferry Boat Operations and Natural Conditions during the Khamsin season

One of the important survey works in Phase 1 is to confirm the normal ferry boat operation status and conduct the natural conditions survey during both the Khamsin season and remaining part of the year.
1) JICA study team will survey the status of ferry boat operations, numbers of passengers and vehicles on the ferry boat of normal operation time.
2) JICA study team will survey natural conditions during the Khamsin season in order to design ferry boat and berthing facilities and secure safe ferry operations all year round.

4. Consideration of Design concept and principal dimensions of Ferry to be built

1) Appropriate hull bottom form for the new ferry is designed in consideration of its adequate seaworthiness in the Khamsin season.

The port’s facilities such as the berth for mooring, breakwaters to make the port calm are designed to be adapted to new ship operation. Thus, the environmental conditions will be examined in order to design the ship and the port facilities.
2) The new ferry is assumed to be operated between Djibouti and Tadjoura throughout a whole year, while the existing ferry is assumed to be operated between Djibouti to Obock except for the Khamsin season. The demand of transportation of passengers, vehicles and cargos will be estimated in order to confirm economic sustainability in the operation of both routes by two ferries.

[8] As indicated in the Inception report.

5. Study of Port Facilities and Onshore Ancillary Facilities

1) Necessity of construction/rehabilitation of port facilities will be studied by investigating present conditions of port facilities and ferry berthing in Djibouti port and Tadjourah port as well as required equipment and materials for berthing of the new ferry. Structural types of port facilities such as breakwater, mooring facilities, jetty, quay wall will be proposed on: the basis of the results of natural conditions surveys, including soil test, topographic survey, bathymetric survey, wave height survey, etc. Design will consider incoming routes for the ferry, as well.

2) Along with the design of new mooring facilities at Djibouti port and Tadjourah port, onshore ancillary equipment will be studied, such as a holding area for vehicles and mini buses to board, and a waiting room for passengers. Since there is heavy congestion around the existing mooring facilities, particulars of traffic line of passengers and vehicles will be studied and reflected on design.

3) Implementation scope of the project is divided into two (2) parts, i.e. the berthing facilities by the Japanese assistance and the facilities on land by Djibouti government.

6. Review of Port Management and Facility Maintenance System

The current port management and facility maintenance system, which is managed by the Maritimes Affaires, Ministry of Equipment and Transport, will be verified and reviewed. The cost which will be required for the new management and facility maintenance system for the new Project will be calculated and proposed as necessary.

7. Construction/Procurement Plan

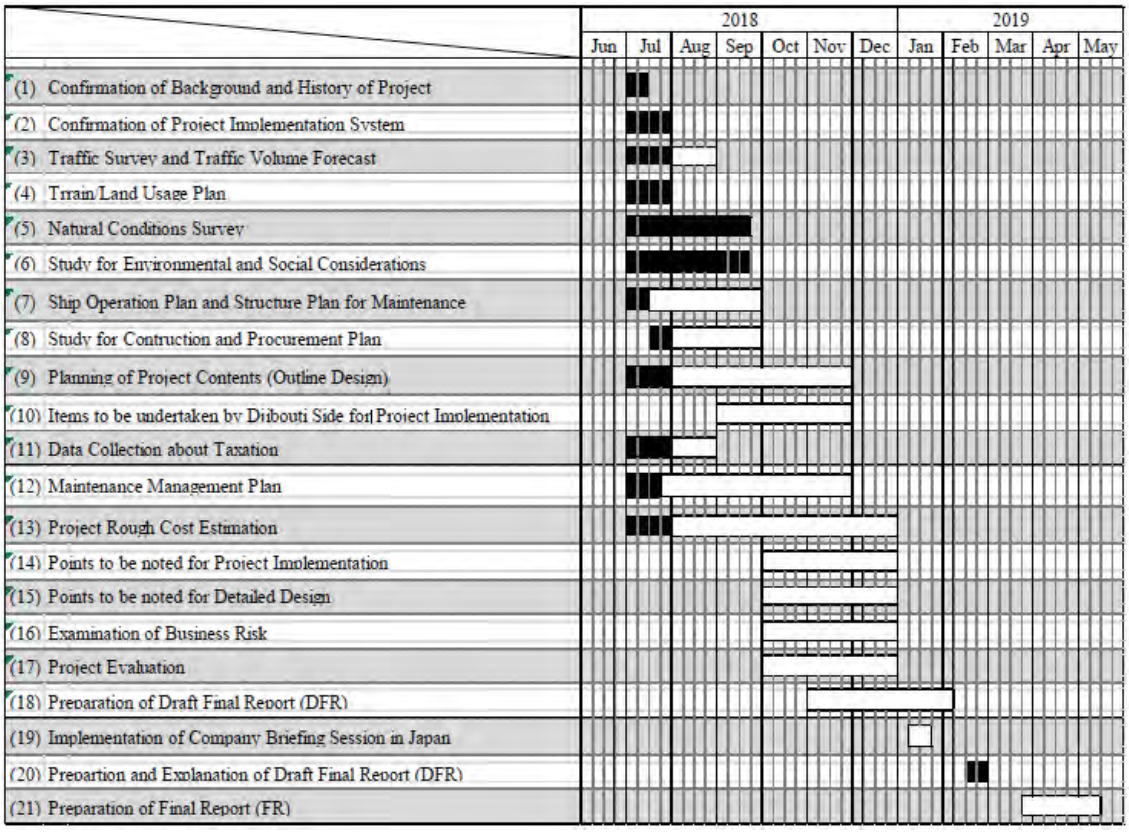
Although the construction market in Djibouti is small, construction conditions for the Project are different between Djibouti port and Tadjourah port that are parted by the Gulf of Tadjourah. Pertaining to the conditions of construction and procurement of materials and equipment, workable plans will be prepared taking into consideration several local specific conditions.

8. Study for Environmental and Social Considerations and Climate Change Mitigation Measures

1) In accordance with the JICA Guidelines for Environmental and Social Considerations, this project falls into the sector of Ports and Harbors and is classified as Category B. This is because this project is not considered as a large-scale project, does not have sensitive characteristics and is not located in sensitive areas. The study will be conducted with reference to the “JICA Guidelines of Report Preparation for Projects Classified as Category B of Environmental and Social Considerations”.

2) Prior to rehabilitation work of existing ports, stakeholders will be identified and coordinated properly, such as government authorities, neighboring residents, private companies and fishermen. The support for stakeholder meetings will be provided in this preparatory survey.

Table 5 : Previsionnal Planning of the study phase



3.2.2. Construction phase

During the construction phase, project activities will include the rehabilitation of Djibouti and Tadjourah berthing ports and the construction of port infrastructures in Djibouti port and Tadjourah port. Infrastructures include (see figure 3 & 4):

- New mooring infrastructure,
- Backfilling and dredging,
- Breakwater (only at Tadjourah),
- Coating of the new backfill area,
- Construction of a waiting lounge,
- Installation of water, sanitation and electricity supply units,
- Implementation of security systems.

3.2.3. Operation phase

- Transportation of passengers and goods,
- Mooring and maintenance work on the ferry.

3.3. Implementation zone of the project

The project will be carried out on two sites: Tadjourah and Djibouti. The basic layout of each of the port infrastructures will be defined considering the result of the "Report of the study for the collection and confirmation of information on the sea transport capacity of the Gulf of Tadjourah" in consultation with the concerned aujtorities and agencies in Djibouti.

Although the vessel to be provided by the Project is a new ferryboat, the implementation of the port infrastructure will be designed considering the docking conditions of the existing ferryboat.

For the construction of the infrastructures of the port of Djibouti, two options are still being examined[9] :

- Option 1: To use the docking infrastructures of the existing ferryboat and to build only the infrastructure for the new ferryboat,
- Option 2: To build the infrastructure for the new ferry boat and to rebuild the infrastructure of the existing ferryboat.

The implementation of infrastructure will be defined in consultation with the Djiboutian side. As the existing infrastructure is very tightly packed together, the final implementation will be designed considering the results of the studies and examinations on passengers and vehicles travel circuits in order to improve safety.

[9] According to the inception report.

4. Legal review

4.1. Environment

4.1.1. Institutions

- **Ministry of Housing, Town Planning and Environment Planning**

The Ministry is responsible for drafting and implementing policies related to the habitat, urban development, environment and spatial planning in order to promote a balanced and harmonious development of the territories. In addition, MHUE is tasked with drafting and implementing the urban and regional development policy. It is responsible for urban and regional planning between districts and between regions, including in terms of urban development, infrastructure and urban equipment, with the view to fight insecurity and social inequality.
The Ministry also develops legislative and regulatory instruments, monitors environmental standards in the areas of infrastructure, housing, equipment, transport and energy in partnership with the other relevant ministries. The ministry is responsible fro enforcing and overseeing environmental impact studies.

Spatial Planning, Town Planning and Housing Directorate
The Directorate is tasked with drafting, implementing and controlling, over the territory, the ministerial policies in relation to territory development and spatial planning, town planning, habitat as well as public and private constructions.
The functions of the Directorate are outline below:

- Design and implement public policies in relation to spatial planning,
- Assess needs, design and implement programs for all urban areas including habitat and urban planning, as well as public and private constructions,
- Draft regulations in relation with the Directorate's role.

The Directorate is comprised of three sub-directorates, namely:

- Spatial and Town Planning Sub-Directorate,
- Habitat and Architecture Sub-Directorate,
- Expertise and Control of Public and Private Constructions Sub-Directorate.

Environment and Sustainable Development Directorate[10]
The Directorate is tasked with drafting, implementing and controlling the ministerial policies in relation to the environment and sustainable development over the territory.
The functions of the Directorate are outline below:

- Strengthen the institutional and judicial framework in terms of environmental matters,
- Contribute to natural resources protection,
- Implement relevant instruments to monitor and control the state of the environment;
- Implement impact studies and provide opinions on development projects that may impact the environment,
- Prevent and mitigate all form of pollutions and nuisances that may adversely impact human health and the environment,
- Implement relevant controls and assist legal entities in terms of environmental matters;
- Along with other relevant Ministries, integrate the "environmental" dimension within development programs such as in education, training, research and information,
- Implement environmental projects,
- Promote cooperation with international non-governmental organisations, national associations and local communities in the environmental arena.

[10] Engagement with the relevant Ministries is done through the Director of the Environment and Sustainble Development, as the single point of contact, who will disseminate relevant information to other Ministries.

The Directorate is comprised of three sub-directorates, namely:

- Sustainable Development Sub-Directorate,
- Pollutions and Environmental Assessment Sub-Directorate,
- Great Green Wall Sub-Directorate.

- **Ministry of Agriculture, Water, Fishing, Livestock and Fishery Resources**

The Ministry is responsible for the implementation of sectoral policies in the areas of food security, rural development and water. It is also responsible for promoting and developing animal and plant production, improving plant cover, studying and exploiting water resources, as well as fish production. It is responsible for the preparation, coordination and implementation of the Government's food security policy and rural development policy. It is responsible for the preparation and implementation of the government's water policy in both urban and rural areas. In the field of sanitation, and jointly with the relevant ministries, the Ministry is responsible for coordinating and implementing the government's sanitation policy through the design and implementation of the master plan and sanitation infrastructure.

The Ministry comprises the following five Directorates:

1. Agriculture and Forest Directorate,
2. Farming and Veterinary Vervices Directorate,
3. Water Directorate,
4. Major Public Works Directorate,
5. Fishing Directorate.

4.1.2. Texts

The Republic of Djibouti has important legislation governing the protection and management of the environment. Most of this legislation is contained in

The Law No. 51 / AN / 09 / 6th L on the Environment Code of the Republic of Djibouti. Promulgated on 1 July 2009, the Environment Code lays down the basic rules and principles of the national policy in the field of environmental protection, to ensure sustainable development and compliance with multilateral agreements. The Code of the Environment is composed of 149 articles distributed in 9 chapters (themes).

Concerning Sea waters: The Environmental Code defines the sea waters under Djiboutian jurisdiction as the waters contained in the Exclusive Economic Zone. These waters constitute State property; their protection is the responsibility of the State and local authorities (Arts 16 and 17).
Articles 18 to 24 of the Code of the Environment regulate spills, flows, discharges, direct or indirect deposits of any nature likely to cause or increase the degradation of waters by modifying their physical, chemical, biological or bacteriological characteristics at the border of territorial waters.
With regard to waste, Article 75 specifies that for the purposes of this law, household, industrial, toxic, hazardous, biomedical and other wastes which may harm or cause damage to health are considered as waste human and the environment.

Concerning Activities on the coast: Articles 143 and 144 of the Environmental Code regulate activities on the coastline. Article 143 classifies the coastline as a geographical entity with a specific policy of planning, protection and enhancement. The realization of this policy of general interest implies a coordination of the actions of the State having for object:

- Implementation of a research and innovation effort on the particularities and resources of the coastline;
- Protection of biological and ecological balances, the fight against erosion, the preservation of sites and landscapes and heritage;

- Preservation and development of economic activities related to the proximity of water, such as fishing, marine culture, port activities, shipbuilding and ship repair and maritime transport;
- Maintenance or development, in the coastal zone, of agricultural or forestry activities, industry, crafts and tourism.

The environmental Code deals with several other issues related to the protection of the biological environment, in particular the conservation of ecosystems, fauna and flora (Art 40), marine protected areas (Art. environmental impact study (Articles 99 to 101), marine pollution (Article 23). These main themes are developed and supplemented by specific application laws.
The main laws of application are as follow:

The law on the protection of biodiversity: On 22 April 2004, the government of the Republic of Djibouti issued Decree No. 2004-0065 / PR / MHUEAT on the Protection of Biodiversity, in application of the Environmental Code and for the implementation of international conventions relating to the protection of biodiversity. Biodiversity (CITES, Convention on the Conservation of Biodiversity, Convention to Combat Desertification, Convention on Wetlands) ratified by Djibouti. This text supplements the three previous regulatory decrees, including Decree No. 85-103 / PR / AG of 28 October 1985 on the protection of wildlife and the seabed and the two decrees of 6 May 1999 establishing a National Steering Committee for Biodiversity and a National Steering Committee to fight against desertification.

Marine Protected Areas Act: Law No. 45 / AN / 04 / 5^{e} on the establishment of terrestrial and marine protected areas was adopted in 2004. In article 3 of this law, the islands of seven brothers, Musha, Maskali and Haramous Islands, were declared protected marine areas. Three new marine protected areas (Ghoubet Bay, Sagalou Kalaf and Raysali-White Sand) are being created in the Tadjourah region. *Article 4* states that fishing activities, in any form whatsoever, as well as diving are regulated and controlled in Marine Protected Areas by the MHUE. The collection of corals and shells and underwater hunting are prohibited.
Article 5 specifies that Protected Terrestrial and Marine Areas are not closed areas and are not prohibited from access. Traditional farming and fishing activities as well as ecotourism are allowed but regulated and controlled to preserve biodiversity. To this end, local communities must be closely involved in the management of Protected Areas and sensitized on the importance of preserving biodiversity *(Article 6).*
The exact boundaries of Marine Protected Areas and their management should be specified by regulation. The application text is pending adoption.

- Article 18: In accordance with the texts in force, the MHUE is in charge, in relation with the other relevant departments, of the protection of marine life and the application of all the international and regional conventions relating to the protection of the marine environment.
- Article 20: Marine protected species and marine reserves are subject to decrees of application.

We must also consider the:

Decree 2011-029 on impact studies: it stipulates that all activities likely to induce negative impacts on the environment must be the subject of a preliminary environmental impact study. The environmental impact study can be brief or detailed depending on the size and nature of the project. The decree provides that the environmental impact study is drafted in French and includes a non-technical summary. Activities of port infrastructures retauration are submitted to impact studies. (see figure 6)

Throughout all those studies, no national standard values have been defined so far, therefore for all that concerns metrics of the environment (Air and water quality, noise and vibration) the international standards have to be considered.

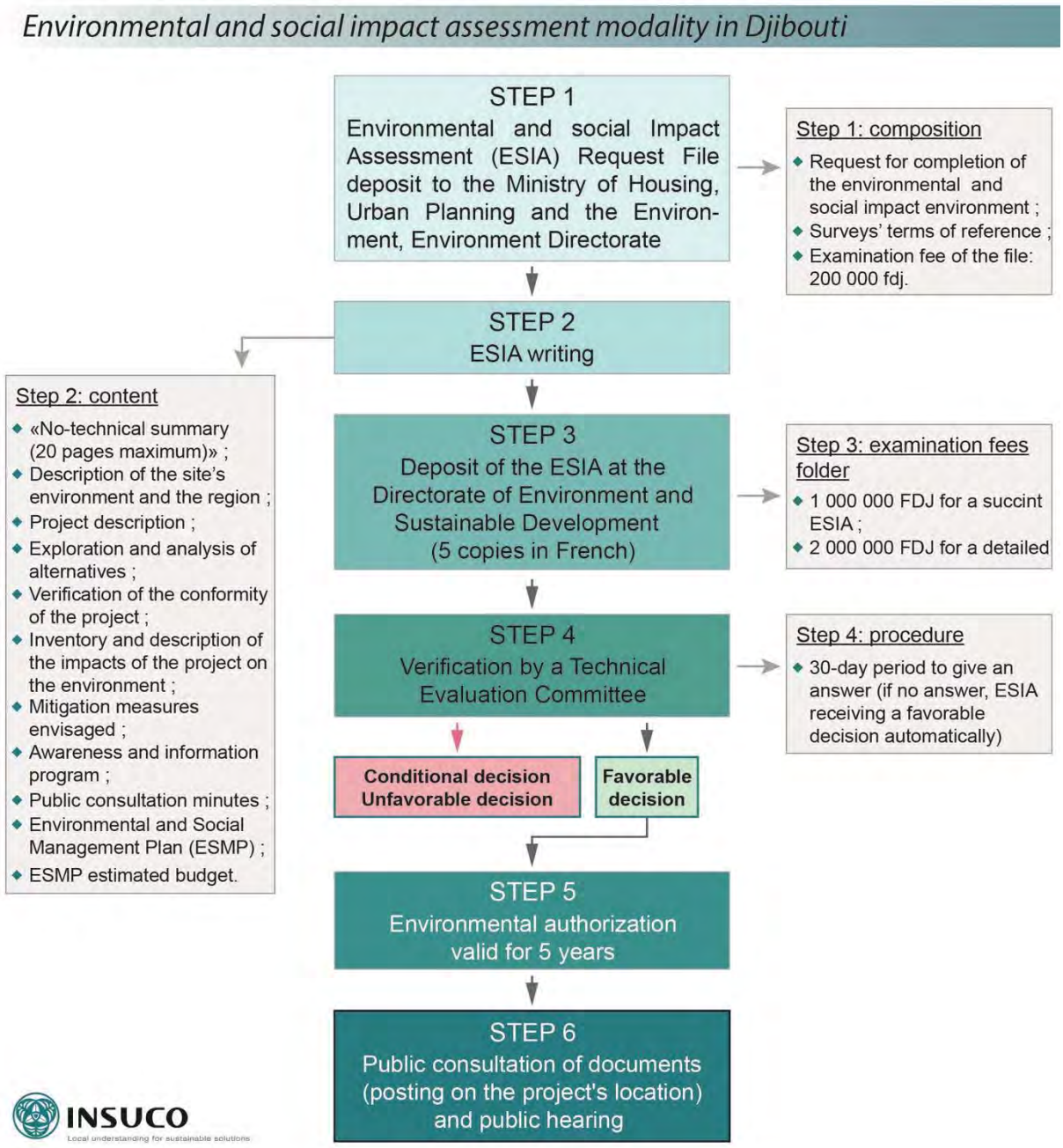


Figure 6: ESIA - Environment permit obtention in Djibouti

(Based on the Djiboutian Decree 2011-029 on impact studies)

4.2. Transport

4.2.1. Institutions

- **Ministry of Equipment and Transport**

The Ministry is responsible for the implementation and coordination of the road, rail, maritime and air transport policy as well as national meteorology. He is also responsible for the management, operation, maintenance and renovation of public facilities. In addition, the Ministry is responsible for designing and implementing government policies on road, port and airport infrastructure.
The following entities fall under the responsibility of the Ministry:

- The Djibouti-Ethiopian Railroad,
- the Djibouti Ports and Secondary Ports,
- the Djibouti International Airport,
- the Civil Aviation and the Road Agency are under the supervision of the Ministry.

4.2.1.1. Organisation

The Djibouti Ministry of Equipment and Transport is organized as follows. Are directly attached to the Minister:

- The cabinet,
- The secretary general,
- The general inspection,
- The coast guard,
- Some institutions and public enterprise such as the port.

As always, the Secretary General assists the Minister in carrying out his duties. Under the authority of the Minister, he assumes the role of the General Manager. In this ministry, are placed the under-secretary general four directions namely:

- Administrative and financial management;
- Transportation Directorate;
- Statistics, Prospective Studies and Legal Affairs Department;
- Maritime Affairs Directorate (DAM).

For this study, the Maritime Affairs Directorate is particularly in charge: the study teams have been in direct contact with them.

4.2.1.2. Missions of the Maritime Affairs directorate

The Directorate of Maritime Affairs deals with all matters relating to the organization and development of the Merchant Navy, Maritime Affairs and the Law of the Sea in national and international waters, the prevention and the verbalization of all offenses national and international legislation concerning marine pollution, maritime traffic and the protection of territorial waters and their shores. In the field of marine pollution, the missions of the Department of Maritime Affairs are carried out jointly with the Ministry of the Environment.

In order to insure its various missions, the directorate includes four services:

- the Human Resource Service;
- the Department of Hygiene and Protection of the People of the Sea;
- the boating and nautical monitoring service;
- the ferry management service.

In general, the Director has authority over all services; as such, the following services are also under his direction:

- administrative coordination of the hierarchical structures of the Directorate;
- monitoring and evaluation of the implementation of decisions, plans and projects;
- the competence and responsibility in the management of the credits placed at his disposal;
- studies, preparation and proposition to the Minister concerning issues relating to the orientation, implementation, evolution and development of the Department's policy in the various areas of its jurisdiction.

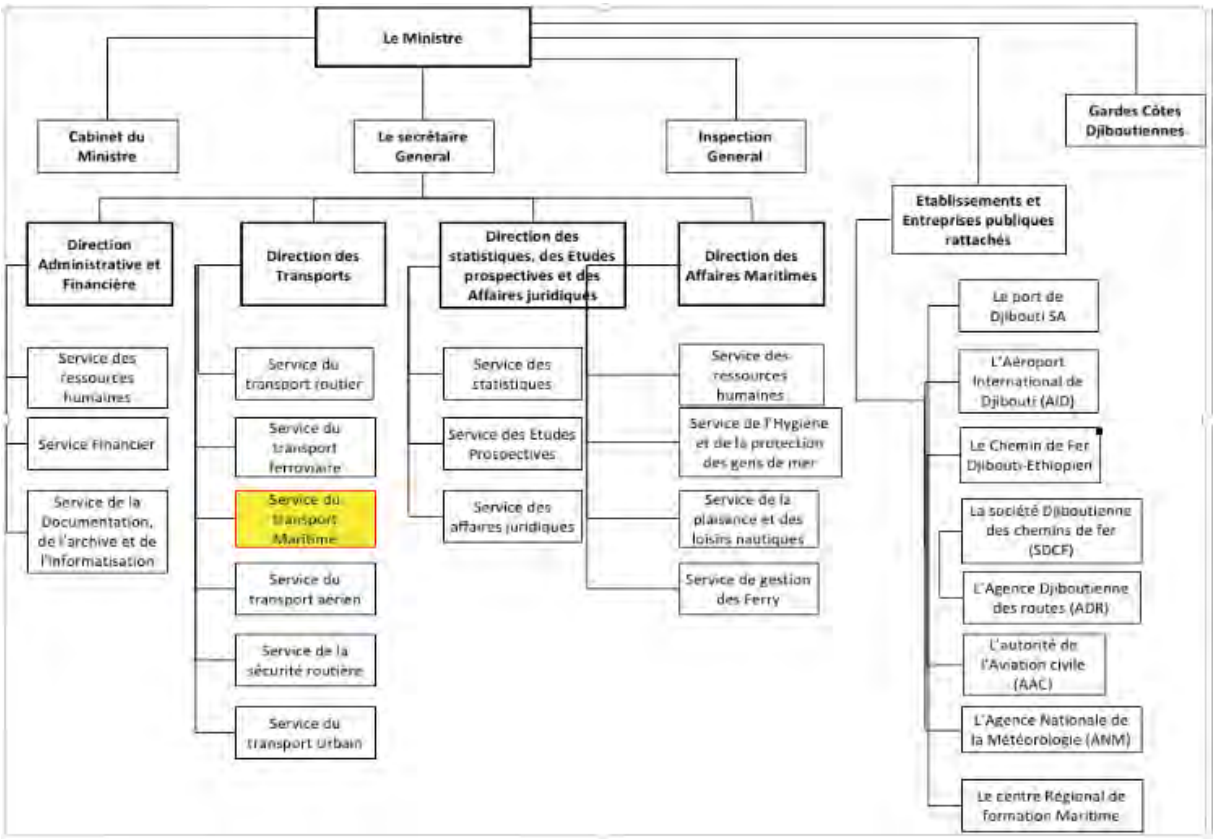


Figure 7: Organigram of the Minisitry of Equipment and Transport. We can observe that the Directorate of Maritime Affairs and the ferry management is disconnected from the Maritime Transport service.

4.2.2. Texts

Concerning the logistic transport plan:

- **Decree n ° 2007-0157 / PRE** on the general regulation of the International Autonomous Port of Djibouti, places this commercial port under the tutelage of the Ministry of transport.
- **Law No. 52 / AN / 99 / 4th** establishing the Fishing Port of Djibouti, sets the limit of this maritime zone and places it under the supervision of the Ministry of Agriculture, Livestock and Sea, in charge of Hydraulic Resources (MAEM-RH).
- **Decree n°2006-0184/PR/MET** details the conditions of Practice for the Urban and Long Distance Carrier Occupation of July 23, 2006. Those conditions only apply for non-public actors.

4.3. Land tenure, housing and Resettlement

4.3.1. Institutions

- **The Ministry of Housing, Urban Planning and Environment**

The ministry is responsible for the government's environmental policy, including the development of normative texts, the control of environmental standards in the areas of infrastructure, housing, equipment, transport, energy in partnership with the concerned ministries and the realization of the environmental impact studies. He is also in charge of

- the preparation and application of the housing, urban planning, environment and land-use policy by promoting the balanced and harmonious development of the territory;
- the preparation and implementation of the urban planning policy;
- balancing neighborhoods, particularly in terms of urban development, infrastructure and urban equipment in the context of the fight against precariousness and social inequalities;
- the preparation and implementation of the government's planning policy through the design of a regional development plan jointly with the relevant ministries as part of the economic development policy of the regions.
- the coordination of the policy concerning the opening up of the national territory; this is done jointly with the Ministry of Equipment and Transport,
- the development policy of the regions, together with the Ministry of the Economy and Finance, within the limits of its attributions.

4.3.2. Texts

The law n°171/AN/91 establishing and organizing the public domain. This law establishes the basic regime of the natural and artificial public domain of the State and the relative easements to which land and buildings of private property are subject. The minister in charge of the domain grants by decree the authorizations to occupy the public domain and to build there.

The law n°173/AN/91/2e organisation of the State's private domain. This law defines and organises the State's private urban and country domains and rules for the cession of State land.

The law n° 172 / AN / 91 / 2 e L Regulating compulsory purchase order for public use. This law regulates the expropriation for public utility, which is carried out by authority of justice and whose procedure comprises 4 phases: the declaration of public utility; the cessation order, the essential purpose of which is to determine the properties to be expropriated and to give interested persons the opportunity to assert their rights and produce their titles; the pronouncement of expropriation by authority of justice; fixing the expropriation indemnity by a clerk.

The law n° 177 / AN / 91 / 2e L organization of land ownership. This law establishes a land conservation service, which is responsible for guaranteeing property owners the roles they have in these buildings by registering all the buildings with the land books and publishing them. Registration is mandatory and final.

The law n° 178/AN/91/2nd L Property Law. This law regulates property law in Djibouti-town.
The arrêté n°2006-0515/PR/MHUEAT Obligation for the Ministerial Departments, the Public Establishments and the Project Units to resort to the assistance of the State Technical Services during the realization of works of urban development and construction and during building permit applications. This law Carries requirements for Ministerial Departments, Public Institutions and Project Units to seek the assistance of state technical services during implementation of urban development and construction and when requesting permission to build.

The Arrêté n°2007-0645/pr/MHUEAT amending and supplementing Order No. 73-1580 / SG / CG of 31 October 1973 on the organization of the procedure for examining and issuing the building permit.

This law establishes that no building can be built without an Ordinary Building Permit issued under the conditions indicated by this decree. These provisions apply to all constructions built with permanent materials on public land registered in the territory's land register. The building permit is required for work performed on existing constructions if the work would change their external appearance.

The Arrêté n°2010-0061/PR/MHUEAT on the reorganization of the investigation procedure and issuance of the Building Permit. This law regulates the procedure for the issuance of building permits.

4.4. Tourism

4.4.1. Institutions

- The Ministry delegated to the ministry of economics and finance, in charge of trade, sme, crafts, tourism and formalization

The Ministry is responsible for proposing and implementing government policy in the areas of internal and external trade, small and medium-sized enterprises, crafts, tourism and formalization. Among a wide range of responsibilities, the ministry is in charge of the preparation and implementation of the development of the touristic activities and to monitor its legal framework. Within that ministry, several directorates exist, and they are composed of departements, which each have their own mission.

The Department of Crafts and Tourism has the following missions:

- To implement the development strategy and update the legislative texts;
- To implement regulations in the field of crafts and tourism;
- To ensure the implementation of the National Crafts Development Strategy;
- To define guidelines for the development of service, traditional and artistic crafts;
- To guide investment in the craft sector and monitor projects;
- To study in collaboration with the support structures concerned, the means of development of the craft sector, the assistance and vocational training programs;
- To design actions and measures for the development and promotion of tourism;
- To participate in the development and implementation of general guidelines in the field of tourist leisure.

The Management includes in addition to the Executive Secretariat: (i) the Sub Directorate for the Promotion of Crafts and (ii) the Tourism Development Sub Department.

4.4.2. Texts

- **Law No. 55 / AN / 14 / 7th L** on the organization of the Ministry Delegate to the Ministry of Economy and Finance in charge of Trade, SMEs, Crafts, Tourism and Formalization.
- **Law No. 233 / AN / 82** defining the Tourism Development Program of the Republic of Djibouti (not accessible on line)
- **Law No. 79 / AN / 79** regulation of tourist traffic, employment in tourism enterprises. (not accessible on line)

Those texts may be of use because the development of the ferry will not only be beneficial to the inhabitants but also to the tourists who spend reduced time in Djibouti and would then be able to enjoy Tadjourah for one or two days.

4.5. Labor and work conditions

4.5.1. Institutions

- **The Ministry of Labour and Administrative Reform**

The Ministry is responsible for implementing the Government's policy in the areas of labor, employment, occupational integration, social relations, management of state agents and social protection. It prepares and implements the rules relating to working conditions, collective agreements and employee rights. The Ministry drafts and implements the rules on working conditions, collective agreements and rights of employees. It also drafts and implements the administrative reform.
The Ministry has authority over the Employment Observatory. A number of public institutions fall under the supervision of the Ministry, including: the National Agency for Employment, Training and Professional Insertion (ANEFIP), the National Institute of Public Administration (INAP), the National Social Security Fund (CNSS).

4.5.2. Texts

- **Law No. 133 / AN / 05 / 5th of 26 January 2006:** the Labor Code. The code regulates all activities involving the use of labour and imposes obligation on employees. This code sets the minimum age of access to the labor market at 16 (Art.5) and specifies that forced or compulsory labor is absolutely prohibited (Art.2).
- **Law No. 172 / AN / 17 / 7th** L amending the provisions of Law No. 28 / AN / 7th L amending Law No. 153 / AN / 12 / 6th L establishing the tariff applicable to work permits for foreign workers in the Republic of Djibouti.

4.6. Brief review of international convention signed by Djibouti

Djibouti is engaged in many international conventions, especially when it comes to work and environment: Djiboutian law observes the principle of the prominence of international legal instruments (ratified and published) on the internal laws. Among others, we would like to underline the following ones:

- The International Convention on Biological Diversity - CBD (ratified by Djibouti in 1994);
- The United Nations Framework Convention on Climate Change (1992);
- The Kyoto Protocol to the United Nations Framework Convention on Climate Change;
- Djibouti's Nationally Determined Planned Contribution (CPDN) following the Paris agreement, COP21 in 2015
- The African Convention on the Conservation of Nature and Natural Resources (known also as Algiers Convention), International Union for Conservation of Nature and Natural Resources (IUCN): which implies protection and conservation of biodiversity;
- RAMSAR Convention on Wetlands and Bird Species (ratified by Djibouti in 2003);

4.7. International standards and safeguards

4.7.1. IFC convention

The International Finance Corporation's (IFC) Performance Standards are internationally used benchmarks for identifying and managing environmental and social risks. They have been adopted by many organizations as an essential part of their environmental and social risk management. Clause 2 sets out the eight Performance Standards that define the criteria that a client must meet throughout the life of an investment (see Annex 1):

- Performance standard 1: Assessment and management of environmental and social risks and impacts
- Performance Standard 2: Workforce and Working Conditions
- Performance Standard 3: Rational Use of Resources and Pollution Prevention
- Performance standard 4: Health, safety and security of communities
- Performance Standard 5: Land Acquisition and Involuntary Resettlement
- Performance standard 6: Biodiversity conservation and sustainable management of living natural resources
- Performance Standard 7: Aboriginal Peoples
- Performance Standard 8: Cultural Heritage

4.7.2. JICA standards

In Djibouti, the production of an ESIA is compulsory for any projects however different indicators, or criteria (Air/water quality values for instance) are not determined by the law. In those cases, International standards must be called upon and used as reference. In the case of this project, it was therefore based on the JICA Directive, which respects IFC standards, while considering local conditions. The "Environmental and Social Considerations Studies" are intended to provide an overview of the situation in order to anticipate and assess the negative and foreseeable impacts of projects on the environment and the local community and the mitigation measures aimed at preventing them and minimize them. It must notably appreciate a possible forced relocation of residents and respect for human rights. In 2008, JICA sat up a committee composed of academics, members of non-governmental organizations (NGOs), the private sector and relevant ministries to revise these guidelines on environmental and social considerations.

4.7.3. Fundamental principles for socio-economic considerations

Even though project proponents are the ultimate responsible parties for the environmental and social considerations of the projects, JICA contributes through its support and study actions to avoid or minimize the impacts of development projects on the environment and local communities and to prevent the occurrence of unacceptable negative impacts. JICA therefore promotes sustainable development in developing countries. Through these guidelines, JICA has established specific conditions for environmental and social considerations, which project sponsors must adhere to. JICA supports their efforts to fulfill the requirements by preparing and implementing cooperative actions.

JICA then reviews the achievements of project proponents considering the above conditions and, based on the results, formulates appropriate decisions on environmental and social considerations. JICA attaches great importance to the following seven principles, detailed in Annex 2:

- Target a broad field of study of the risks of impacts,
- Apply environmental and social measures from the early stage to the follow-up phase,
- Report on its cooperative action,
- Promote the participation of partners,
- Dissemination of information,
- Strengthen the organizational capacity of JICA,
- Improve the speed of intervention.

4.7.4. Classification of the projects according to JICA

JICA ranks projects in four categories according to the extent of their potential environmental and social impact. To this end, it considers the outline of the project, its size, location, etc. This present project is classified as Category B.

A project is classified in category B if the negative impacts it may have on the environment and society are less harmful than those of category A (see Annex 3):

- These effects are limited to the project site,
- Few of these effects are irreversible;
- In most cases, mitigation measures are easier to implement.

5. Socio-economic environment baseline

5.1. General history

5.1.1. History of the routes leading to the North of the country

The port can be defined as an interface between the sea and the land. It is a meeting point for land and sea transport requests that are used to transport passengers and goods. In line with transportation development strategies, the Government has put in place projects to (i) develop marine traffic, (ii) ensure the distribution of goods between the capital Djibouti and the North; (iii) reduce regional disparity; (iv) reduce poverty in the North region.

5.1.1.1. From 1999 until 2001

In accordance with these development policies, the government of Djibouti received in 1981 a ferry provided by Germany to correct regional disparity and improve social conditions for northerners. This ferry carried out twice a week the transport of the population, vehicles and goods from Djibouti to Tadjourah and Obock. In 2001, this ship provided about 70 trips between Djibouti and Tadjourah, and about 90 round trips between Djibouti and Obock. During that same year, it transported between Djibouti and Obock: 21,000 passengers, 500 vehicles, 200 trucks, 500 animals and 1,000 tons of goods. The navigation of the ferry was unfortunately interrupted in July 2004 because of its obsolescence. Transport in the Gulf of Tadjourah was at that point very difficult for the users because they could only rely on private traditional boats, in small dhows and in irregular service. The shortage of these ships' capacity and activities and their rising costs then affected the economic activities of the northern region. Faced with this situation, in 2002, the Djiboutian government had requested non-refundable financial cooperation from Japan for the supply of two new ferry boats to replace the obsolete vessel. The study carried out for this purpose, at the time, showed, on the one hand, that the Port Authority International of Djibouti (PAID), responsible for the management of the ferry, was operated according to a concession contract owned by a foreign company and on the other hand that the repair of the port facilities of Djibouti, Obock and Tadjourah was necessary.
In view of these observations, the Government of Djibouti then attributed the operation and management of the ferry activity to the Maritime Affairs Directorate of the Ministry of Equipment and Transport. This attribution got confirmed by the adoption in August 2006 of a presidential decree which stipulated the obtaining of the budget and the necessary staff.

5.1.1.2. From 2009 until 2018

Data are severely lacking between 2002 and 2005. In November 2006, JICA dispatched a team to conduct a preliminary study for the "Tadjourah Gulf Shipping Capacity Building Plan" which resulted in the following conclusions:

- the presidential decree on a reorganization and strengthening of the staff of the Ministry of Equipment and Transport to strengthen its operating and maintenance capacity was effective;
- the field of rehabilitation of the three port facilities could be limited to the minimum small-scale rehabilitation required to ensure the safe movement of this vessel such as the reconstruction of the inclined way, and the installation of defenses of “the ducs d’Albe”;
- the Directorate of Maritime Affairs was responsible for maintenance;
- the results of the environmental impact assessment related to the refurbishment of the ports had confirmed that the project would not result in any new land acquisition or displacement, that there was no negative impact natural or social and that category C according to JICA's evaluation of the socio-environmental guidelines was adequate for it.

As all conditions were met, the Japanese cooperation provided a new ferry in 2009, the characteristics of which are summarized in the table below.

Table 6: Characteristics of the current ferry

Maximum number of passengers	**200**
Cruise speed	9 knots
Cars (4wheels-drive)	6
Animals (camels)	6
Cargo	12 tons
Toilets	4 men, 4 women

This ship served 4 times a week Tadjourah and twice a week Obock. However, the increase in the number of users and vehicles, the development of economic activities in the northern regions in general and more particularly in the Tadjourah region, made this ferry no longer suitable. It was therefore necessary to find a solution that could meet these new requirements).

5.2. General quantitive data of two sites

In this study, quantitative analyzes were based on DISED publications and more specifically on the World Bank (WB) funded report of EDAM4. Conducted in May 2017 and November / December 2017, the sample of this study includes 376 enumeration areas (251 in urban areas, 125 in rural areas). A total of 4,474 households were interviewed.

5.2.1. Demography of the two zones

Actualized demographic data are hard to find in Djibouti, the official statistic agency DISED has done its last complete inventory in 2014. Since 2014, they apply a formula in order to get estimates of Djibouti's population. On the DISED website, we find a total population of 1.024.194 in the whole country.
The percentage hereunder are official data from 2015

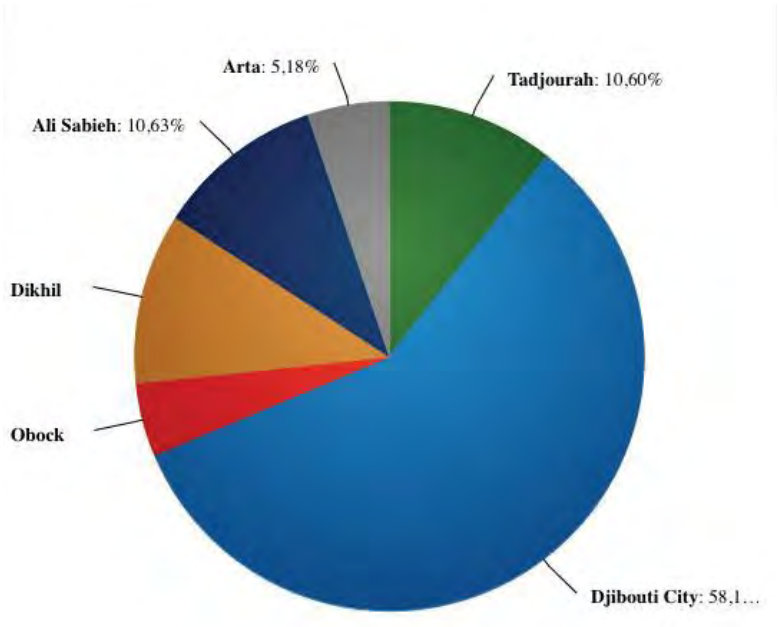


Figure 8: Population distribution in the different regions of Djibouti (58,10% in Djibouti city and 10,60 % in Tadjourah)- (Source: Data Catalog Djibouti)

The table of numbers we get from projections is the following:

Table 7: Demography in the different regions (Source: Statistical Reference, 2017)

Region	Total	Ordinary urban population	Rural sedentary population	Nomadic population	Particular population
Djibouti City	**576687**	**429251**	**0**	**0**	**147436**
Ali Sabieh	105491	27456	14531	44930	18574
Dikhil	107916	23473	27310	50413	6720
Tadjourah	**105195**	**14750**	**28490**	**58724**	**3231**
Obock	45929	12051	11866	19861	2151
Arta	51418	13398	13764	21566	2690
Total	**992636**	**520379**	**95961**	**195494**	**180802**

5.2.2. Population geographical distribution

The figure below shows the distribution of the population in rural and urban areas in the capital and in the five interior regions. There is an unequal population according to the regions. Thus, in Tadjourah more than ¾ of its population (77%) live in rural areas. This spatial distribution of the population will influence both monetary and non-monetary indicators.

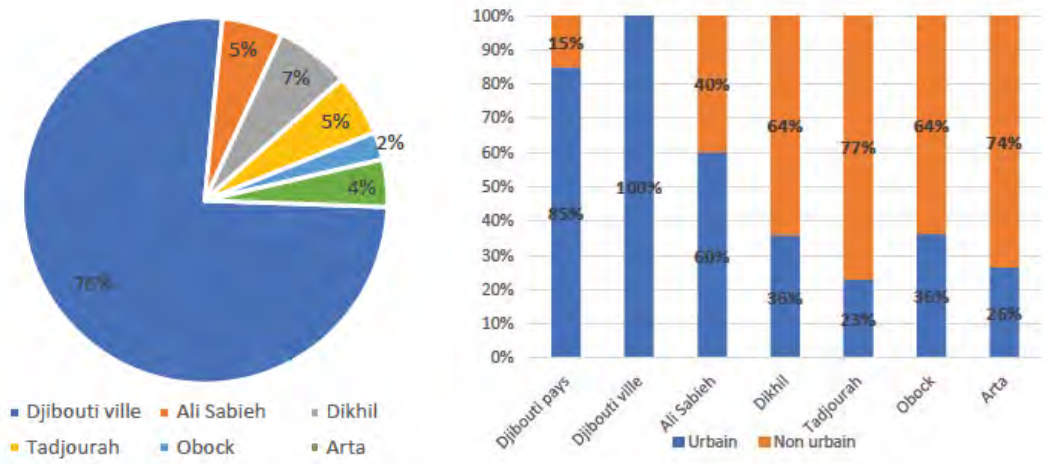


Figure 9 : Geographic distribution of population between regions and between urban and non-urban (Djibouti ville is Djibouti city)

5.2.3. Literacy rate

The figure below gives the literacy rate of the population in five regions of the interior. The Tadjourah region has the lowest literacy rate among the five regions. Thus, only 1/5 of the population is in school.

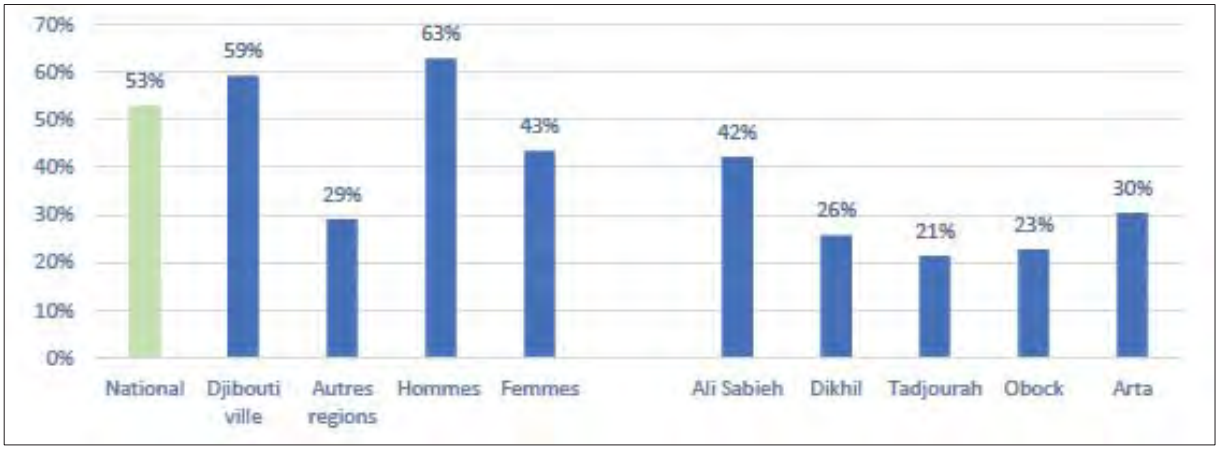


Figure 10 : Literacy rate in different region of Djibouti

5.2.4. Employment Rate

The unemployment rate in Djibouti city and in the interior regions is highlighted by the figure below. With 56%, Tadjourah is the region with the highest unemployment rate. This supposes that a tiny part of the population is working. The job market is not dynamic.

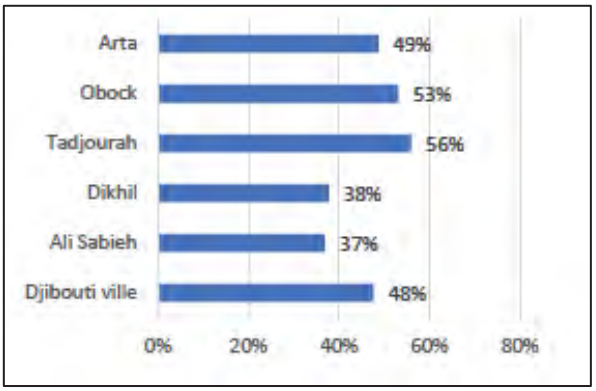


Figure 11: Employment rate in the different region of Djibouti and in Djibouti city

5.2.5. Access to electricity

Access to electricity is defined as the use of electricity as the main source of lighting. The following figure shows access to Djiboutian electricity service. With only 21.9%, Tadjourah is the region with the lowest access to electricity service after Obock. The prohibitive price of electricity is the main reason for such low results.

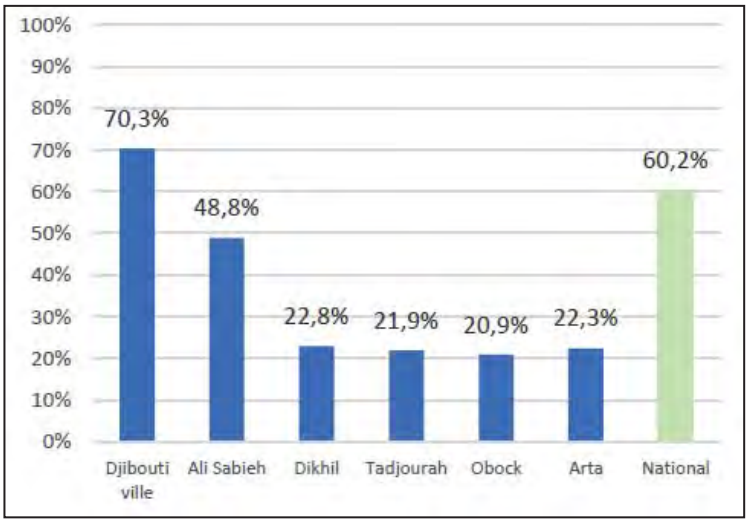


Figure 12 : Access to electricity in the country

5.2.6. Access to water

Access to water is defined as the availability of water in the household in the form of running water (ONEAD indoor connection). This covers different type of connections:

- Direct connection from a borehole,
- ONEAD outdoor connection, by pipe, public fountain and drilling (with a pump).
- With only 45.5%, Tadjourah is the region where households have less access to water. Thus, more than half of the population does not have access to water. This can be explained by a lack of infrastructure development as well as by a lack of sensitized persons concerning the need or benefits of sanitation.

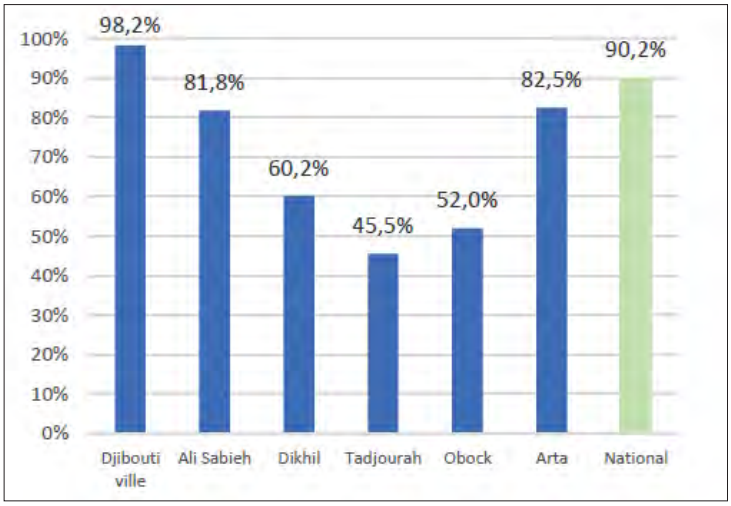


Figure 13 : Access to water in the country[11]

[11] Results of the 4th Djiboutian survey collecting data from households for social indicators (EDAM4), p8.

5.2.7. Poverty line

Djibouti has defined its own poverty line. To estimate the threshold of global poverty and the extreme poverty line, the Ravallion (1998) approach was used. This one is starting from a food poverty line to construct an extreme poverty line and a threshold of global poverty[12]. Regarding the estimation of the poverty line, the main parameters and results are presented in table below. Our source if the EDAM4 survey established by the DISED with the support of the World Bank. In that study they used the results of the 2017 EDAM4 survey and the reference consumption basket which guarantees 2115 kilocalories per day and per adult to do the calculus. With those references, the extreme poverty line of 2017 equals 111783 FDJ and the overall poverty line is estimated at 151391 FDJ. Both lines are expressed in annual term of adult equivalent.

Table 8 : Poverty line established with datas of 2017 (Source: EDAM4, 2018)

Parameters	
Reference consumption basket	2115 Kcal/day
Normalisation of households	Adult equivalent
Extreme Poverty line (FDj)	**111783**
Golbal poverty line (FDj)	**151391**

[12] EDAM4, 2018, Publication of the DISED with the support of the World Bank

5.3. Site1: Port of Djibouti

5.3.1. General characteristics of the city of Djibouti

Djibouti city is composed of six boroughs. The first five borough were established via the Arrêté n°82-1735/PR/INT of 2nd February1989 modifying the arreté n°118/SG/CG of 30 December 1967, modified, concerning the creation and organization of the district of Djibouti.The sixth one was added on in the Arreté n°2003-0278/PR/MID[13]. In this text, we can find the geographic and legal description of the 6 boroughs.

5.3.1.1. Governemental Authorities

5.3.1.1.1. Mayor

The city of Djibouti is governed by a mayor. The current mayor entered in position in March 2017. Mrs Fatouma Awaleh Osman was, before taking that mandate, the Director of the statistics, Prospective studies and Legal Affairs at the Ministry of Equipment and Transport. She is in position for a five-year long period. Once elected the mayor can choose two assistants that will have to chosen among the elected members of the counsel.

5.3.1.1.2. Townships

The administrative district of Djibouti is composed of three townships:

1. **Boulaos**

The township of Boulaos covers the territories of 1st, 2nd and 3rd boroughs. The council is composed of a deliberative assembly, a president and a vice-president. The municipal councilors are elected for five (5) years. The executive is composed of a President and the Vice President are elected by the Communal Assembly. Each deliberative assembly is composed of elected councilors comprising, specialized commissions, and an office of not more than four (4) persons including the president and the vice-president, the secretary and the quaestor of the communal council.

2. **Balbala**

The township covers the territories of 4th and 5th boroughs. The council is composed of a deliberative assembly, a president and a vice-president.

3. **Ras Dika**

The township covers the territory of the 6th borough. The council is composed of a deliberative assembly, a president and a vice-president. The communal councilors are elected for five (5) years. The President and the Vice President are elected by the Communal Council.

5.3.1.1.3. The counsel of Djibouti[14]

The Council of Djibouti is composed of members elected within the council of each townships by uninominal and secret ballot by the communal councilors at the rate of:

- 20 representatives for Boulaos commune;
- 10 representatives for Balbala commune;
- 5 representatives for Ras Dika commune.

[13] The Arreté n°2003-0278/PR/MID concerns the creation of a new boroughs and delimits the administrative district details. http://www.presidence.dj/texte.php?ID=2003-0278&ID2=2003-04-09&ID3=Arr%EAt%E9&ID4=7&ID5=2003-04-15&ID6=n

[14] Law n°122/AN/05/5èmeL portant sur le statut de la Ville de Djibouti,

It establishes its own rules of procedure and regulates by its deliberations the following matters of common interest:

- Development programs and projects of the city of Djibouti;
- The budgets and accounts of the communal councils and the Council of Djibouti;
- Environmental protection;
- The construction and maintenance of road and sanitation infrastructure whose management will be progressively transferred to the Council of Djibouti;
- Acceptance or refusal of gifts and legacies to the Council of Djibouti;
- The creation and management of the Council's services and the management of staff;
- Management of the public and private domain of the city of Djibouti;
- The construction and maintenance of equipment of common interest in the city of Djibouti;
- The institution of local taxes within the limits set by law;
- Cooperation and twinning with other communities;

5.3.2. Qualitative information

5.3.2.1. Ministry of Equipment & Transport: Directorate of Maritime Affairs

Information collected by the experts were completed with information shared by ERM experts present on the field in the begin of July. The technical staff of the ferry Mohamed Bourhan, who has a lot of experience in shipping, master the operation of the Japanese marine engine yanmar. That explains why they want the new ferry to be equipped with it. In addition, the dealer of this engine is based in Dubai, which implies that the delivery could be done quite rapidly.

For eight years (2010-2017), the crew of this ferry was composed of 12 people. A year ago, the International Autonomous Port of Djibouti (IAPD), stopped taking over the fuel costs which is now the responsibility of the DAM. To cope with this new expense, management has decided to reduce the number of its staff from 12 to 10 members.
The flight crew is composed of:

- the captain;
- the captain's assistant;
- the chief engineer;
- the assistant to the chief engineer;
- an electrician;
- the electrician assistant;
- 4 sailors.

On land, the staff is composed of:

- **5 staffs in Djibouti**: 2 staff members for the sale of tickets and 3 traffic controllers (vehicle tester, freight controller, accountant). The accountant will board on the boat to do the extra tariff collection;
- **2 staffs in Tadjourah**: One employee for ticket sales and another for security;
- **2 staffs in Obock:** One employee for ticket sales and another for security.

Security is provided by 4 Coast Guard agents, who receive a daily allowance equivalent to a meal.
When the ship is moored, the pilot warns the Coast Guards and the Navy on specific frequencies. If a fire occurs or a failure occurs, the crew has to manage the situation without warning the passengers in order to avoid panic movements. Since the commissioning of the current ship, the fire has been declared 5 times (3 times in Obock and 2 times in Tadjourah). To combat fire, appropriate measures were taken:

- Definition of an isolated place for the smoking area;
- A load of extinguisher has been bought;
- 3 staff members were trained in the use of those extinguisher.

In order to avoid any eventuality, the centerpieces are stored in a room on the ferry. In case of risk, stress or accident, only the captain may activate the hazard lights. For those purposes also, the vessel is equipped with:

- 6 floating rescue channels
- 350 vests for adults and children;
- 4 lifebuoys.

The current rate for a one-way ticket is:

- 700 FDJ for an adult;
- 400 FDJ for a child
- 400 FDJ for a student;

The definition of a specific rate for student and kid was legally established in 2012 but was only applied in 2018. It should be noted that people with disabilities are exempt and can therefore travel for free.

The payment of those rate is invested in:

- The special maintenance during its time in the port (Khamzin season);
- The regular maintenance (emptying, filter replacement, etc.);
- The salary of the staff. Indeed, only the captain and chief engineer would be paid by the state.

In general, this vessel carries food products, building materials, chemicals, etc. Some products are prohibited: for example, cement (except if it is in a well-wrapped vehicle), lubricants (petrol, diesel, etc.) that can catch fire as well as charcoal and grass.

The rates for the vehicles are as follows:

- 1500 FDJ for a motorcycle;
- 3000 FDJ for the bajaj;
- 5000 FDJ for a standard car;
- 6000 FDJ for a 4 * 4 car;
- 8000 FDJ for the bus and minibus;
- 10000 FDJ for the big bus;

Among the difficulties encountered with the population, one of them is the rush with which the passengers want to board, diminishing sometimes the safety feeling and making it difficult for the staff to respect safety procedures. Since the security presence has been reinforced at the port of Tadjourah and Obock, incidents due to those situations are minimal.

The management is well informed about the new project.
The management team hopes to improve the working conditions by setting up a warehouse for the storage of equipment and a waiting room for passengers. Moreover, it often happens that it is asked for a facility of payment or even an exemption especially during a death or a marriage. The setting up of a ticket for this case is desirable.

5.3.2.2. Private sector

5.3.2.2.1. Dockers of the ferry

The group's discussion with those stakeholders took place at the port of Djibouti within the wreckage of the old ferry provided by Germany. The only telephone contact provided by these people at the first

meeting did not work. The INSUCO team decided to wait on the spot. After a long wait, the meeting was conducted with three people only: those who were present on site, could not guarantee the arrival of other members.

Profile and revenues

The ferry dockers are men, whose age range varies from 35 to 50 years. However, one of them seemed to be over 60 years old. They mostly live in Arhiba, a popular neighborhood close to the port and are either married or divorced. The possibility of exercising this profession is based on good physical fitness: no academic knowledge is required. Ferry dockers work only on days when the ferry is in service and during the departure and arrival times of the vessel. 5 days a week and 3 hours a day.

Their job is to load the luggage / goods on the ferry. When they see a customer or a car park, they show up. Then begins the negotiation. Rates vary depending on the customer, volume or weight of luggage and goods. Thus, the loading of a carton their 100 FDJ and a bag of 50 kg 200 FDJ. Regarding the price of a lightweight luggage, it depends on the customer. The dockers carry all. However, since access to the ferry is regulated, some goods are not allowed. This is the case of cement or herbaceous.

The range of the daily gain of a dockworker is between 2500 and 3000 FDJ.

Table 9: Rates and calculated income for the dockers in Djibouti

	Rate
One-way ticket (adult)	700 FDJ
One-way ticket (student, child)	400 FDJ
A carton	100 FDJ
A bag of 50 kg	200 FDJ
Daily income	2500-3000 FDJ
Monthly income	20000 FDJ

However, one person claims to earn up to 20,000 FDJ. This is an exception. The difference observed is related to the volume of the goods but also to the physical capacity of a docker. For instance, this one person is clever and with a good sense of enterpreneurship, he has woven trust with customers. Those customers will then only come to him and give him an exclusivity on their goods.

None of them is saving or sparing any money. They have no other income than the one earned on the port. Based on an average daily gain of 2750 F FDJ, the monthly expense of a ferry docker is estimated at 66 000 FDJ. Half of this envelope (30000 FDJ) is allocated to food. The rest is shared between children's education (20 000 FDJ) health (7000 FDJ), housing (3000 FDJ) and various expenses (6000 FDJ) including inter-assistance.

Table 10 : Distribution of expenses - based on a daily revenue of 2750 FDJ

Expenses	Amount (FDJ)	Percentage
Food	30000	46%
Children education	20000	30 %
Health	7000	10 %
Housing	3000	5%
Various expenses (inter-assisance)	6000	9 %
TOTAL	66000	100%

Social security and workconditions

These workers are not immune to accidents during the exercise of their work and in order to face any potential accidents they have developed a system of interassistance which enable them to put money in common for the one in need.

For instance, one of them claimed that he slipped while trying to get on the ferry with heavy goods. Since then, he has a visible hematoma on his arm. The two others keep traces of wounds they got during the

transport of steel sheets they wanted to load on the ship in windy conditions. Preferring to sacrifice their lives, they risked a lot by carrying it. Moreover, more and more their colleagues refuse this work forcing them to accept it. Their work is not officially recognized nor organized, consequently they are not affiliated to social security. This led them to having to face those accidents and their related costs with their own ressources.

Currently, the dockers do not have any protective equipment. While working: they do not wear gloves, neither shoes nor helmets. They also miss work equipment like wheelbarrow or trolley. However, the ferry management has provided them with vests that enable them to distinguish themselves from other users. If these workers do not have a professional association recognized by the state, they have organized themselves in an informal group of ten (10) people. This organization/informal structure enable them to build some sort of solidarity and help network. It also helps them to settle the disputes they could have among themselves.

Women's presence

Regarding the presence of women in this structure, the respondents replied that no woman currently does this job. The reason is that according to these men, this is quite a painful work that is extremely physical. Besides it is considered as low quality/condition profession. They do not see how women who do not even want to bother with their own things, will lower themselves to the point of carrying the luggage of others.

They are, all the same, present at the port in the restoration. In the future, if working conditions improve (remuneration, access to care, etc.), mentalities may change, and women may work in this occupation.

Housing

Knowing the price of housing in the capital of Djiboutu, the amount (3000 FDj / monthly) advanced by the dockers may seem derisory. It is not so. Because they live in slums. Most of the time thay have settled on private land that is rent to them by the person in charge of guarding the house of someone else. These homes are built with recycled materials. The surface of those houses does not exceed 9m2 They do not have water connections or latrines. The defecation is done in the open air. In June 2014, at the 12th meeting of the Council of Ministers, the draft law extending the social security cover to dockers was adopted. Since then, the dockers of the International Autonomous Port of Djibouti (IAPD) have the same rights as other Djiboutian workers. As such, they benefit from the health care benefit. This is not the case for those dockers who do not benefit from an official contract with the port or the DAM.

Knowledge of the project

Finally, the dockers are aware of the project. Their level of information is still low. For them, this project is a real opportunity that will improve their living conditions. Indeed, they hope to be able to work in the construction site during the operation phase and then during the operational phase, as dockers. The competition does not scare them because, firmly implanted, they master the field well.

5.3.2.2.2. Bus drivers

Buses to Tadjourah are stationed on the Arta road in front of the Arhiba neighborhood, next to the headquarters of the National Union of Djiboutian Women (NUDW). These 15-seater public transport vehicles, which use diesel as fuel, have no program or schedule. Thus, the first that fills up, starts up. On the departure site, the drivers are busy filling the last places still vacant. They want to leave Djibouti before it gets hot. An early departure will give them time to return before nightfall to Tadjourah.

In Djibouti, the spot for the departure is well known but on the return each passenger is brought in front of his house.

Profile and revenues

The drivers are young Afars, from Tadjourah, who left school at a very young age. Equipped with a D permit (public transport) issued by the mining and road safety department of the Ministry of the Interior,

these drivers who master the route Djibouti-Tadjourah, make one return trip per day. The cost of transporting an adult is equivalent to the cost of a child, it is 1500 FDJ from Djibouti and 1000 FDJ from Tadjourah. During the trip, they load the goods on the luggage rack. The price of a 50 kg bag is 600 FDJ while the transport of a carton is free. In general, the driver is helped by two other people. This activity yields an average of 20000 FDJ a day. Since most drivers do not own the vehicle they drive, the amount they earn is used for routine expenses that include food, rent, education and health.

Table 11: Rate and calculated income for the bus drivers

	Rate
Transport Djibouti-Tadjourah	1500 FDJ
Transport Tadjourah-Djibouti	1000 FDJ
A carton	0 FDJ
A bag of 50 kg	600 FDJ
Daily income	20000 FDJ
Monthly income	20000 FDJ

Social security and work conditions
Not benefiting from a medical cover, they must payfor the medical expenses. For example, one of the drivers had to pay 150000 FDJ because a member of his family was ill. The difficulties encountered are numerous. The most enumerated are heating of engines and deflation of tires. If on the way the engine gets too hot, the drivers have no solution but to wait for it to cool down. It can take hours. Sometimes the passengers are being stuck in those transport waiting for the engine to cool down. In the second case, these drivers who often do not have spare tires have to wait for another road user (a bus or an individual) to help him out. Attendance is higher during the hot season because the ferry is out of service.

Knowledge on the project
The level of information of the bus drivers of the new ferry project is very low. Most of them learned the news during the exchanges with their users. They consider that during the construction phase, there will be little or no negative impact. On the other hand, once the ferry is operational, the high frequency of the ferry will represent a threat because bus attendance will decrease during the hot season if the ferry is available.

5.3.2.2.3. Smal business holders

When the INSUCO team moved into the field, the shop opposite the wharf, the starting and docking point of the ferry, was closed. Contacted by phone, the seller spoke only in hamhari (spoken language in Ethiopia). This is how the interview was conducted with the manager.

Profile and Revenues
Dini Habib Dini is a young man of 29, living in Einguella and fluent in French. He is part of a trading family and he is originally from Tadjourah. His family manages this strategic location since the 80s. For him, the price defies all competition because their products are diversified and cheaper than on board the ferry (they sell it at the same price as in town).

Social conditions and revenues
When the ferry runs, the shop is open from 8am to 5pm every day except on Monday when the ship does not circulate. Per day, they manage to sell about 6 cartons of bottled water and 8 cartons of soda. Being the owner of the place, Mr. Dini employs a person that he deploys to another commercial place during the months of July and August when the ship is out of service. It allows him to reduce the load of functioning costs. On average, he earns 13,000 FDJ a day. Of this amount 30% is saved. Its savings are used for education (10%) and food (5%). This also enables him to pay the employee (5%) as well as electricity (10%).

Social security and work conditions

Private sector employee, he has a bank account. As an employee, he has medical coverage.

Observation
Regarding the difficulties encountered and considering his close location to the ferry boarding and disembarkation, the owner of the shop says that the management of the flow of goods and passengers by the guards is not very effective. Indeed, they erect a metal barrier preventing anyone from accessing the ferry. When they lift it at the last minute, it turns into a small chaos and the passengers do not have time to buy anything anymore. He has already started to discuss with the officials of this entity in order to see how to best arrange that moment and to keep it fluid.

Knowledge on the project
Aware of the new ferry project, Mr Dini is waiting for his achievement as he sees it as a real opportunity. Indeed, currently the fact that the ferry is not operational during the two months of the summer is for him a huge shortfall. The increase in the number of passengers will lead to an increase in turnover. However, Dini fears that he will not be able keep the exclusivity that he currently enjoys due to the new arrangement of the port.

5.3.2.2.4. Dockers of the Dhows

There are three dhows serving the northern regions (Tadjourah and Obock. They dock and depart from the fishing port. Two of them connect Djibouti-Tadjourah while only one makes the trip Djibouti-Obock and vice-versa. The loading of the goods is carried out with available facilities: using two solid planks placed side by side in order for the dockers to load the boat: with 50 kg bags and with cartons.

Profile and revenues
Dock workers can neither read nor write. Their ages range from 20 to 42 years old. To practice this profession, no academic knowledge is necessary. A good physical condition is the only must-have as well ad knowing a person to join the group. There is no fixed schedule. They work when the goods arrive to be loaded or unloaded. The loading / unloading of a cardboard brings them 10 FDJ and a bag of 50 kg, 20 FDJ. On average, they earn 2,500 FDJ a day.

Table 12 : Rates and calculated income for the dhows dockers

	Rate
A carton	10 FDJ
A bag of 50 kg	20 FDJ
Daily income	2500 FDJ

Monthly expenses are broken down as follows:

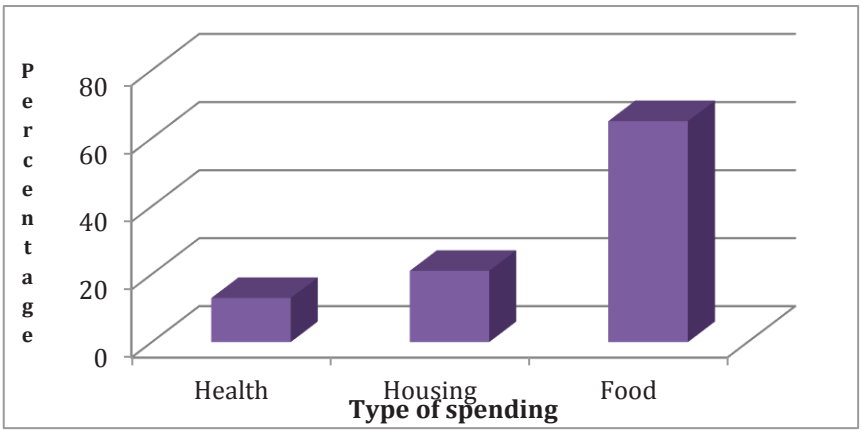


Figure 14 : Expenses of the Dhows dockers

We note that more than half of their expenses are spent on food. They do not realize savings. In Djibouti, they do not have close families and do not have a professional association either. They are vulnerable people.

Social Security and work conditions
These workers do not have any protective equipment. These men, who are mostly single, do not receive any medical coverage.

Women representation
No woman is present in their group of workers.

Knowledge of the project
Their information level of the new ferry project is low. They heard about the place of their work, namely at the fishing port but have no more information. For the moment, they are convinced that this project will not negatively impact their activities. Indeed, currently every dhow transports the goods of the owner / trader. The commissioning of a new ferry will not change this mode of operation. However, if there is a need for labor temporarily during or after the construction phase, it could be an opportunity for them and they could make themselves available.

5.3.2.2.5. Speedboat drivers (called Vedette)

The “Vedettes” are small fast boats from 4 to 5 m long, that take 1 hour to connect Tadjourah to Djibouti and vice versa; they dock at the fishing port.
Profile and revenues
Their pilots are men from the city of Tadjourah and have the A license issued by the Directorate of Maritime Affairs. Currently, two gasoline-powered motorboats serve the city of Tadjourah daily, one round trip. Indeed, they leave early the white city (around 6am) in the morning and leave Djibouti around 9am. The price is 1500 FDF per adult and 500 FDJ per child. Customers choose this means of transport because it is fast and cheaper. Only condition: do not suffer from seasickness.
Pilots of the vedetts earn 15000 FDJ a day. Family leaders, they try to save even if it is not always easy.

Table 13: Rates and calculated revenue of the Speedboats drivers

	Amount
One-way ticket -Adult	1500 FDJ
On-way ticket - Child	500 FDJ
Daily income	15000 FDJ

Social security and work conditions
They carry khat and light goods. Cigarettes, drugs and all contraband products from Yemen passing through Obock are prohibited. Because of the waves, pregnant women are also advised not to use this method.
The difficulty faced by the pilots of these boats is the bad weather that can surprise them at sea. In this case, the solution is to gain the edge as quickly as possible in order to shelter.

Knowledge of the project
These pilots are aware of the new ship project. They have heard both at the fishing port but also at Tadjourah. Their activities are not affected by the project. Indeed, their customers and passengers are different from those who use the ferry. Their time slots are also different.

5.3.2.2.6. Dhows drivers

The dhow is a traditional wooden boat used for the transportation of goods and passengers to Tadjourah and Obock. Its point of departure / docking is the fishing port. During the months of July and August, as

the ferry is out of service, Tadjourhian traders turn to this means of transport especially for their goods. Among the benefits provided by the dhow, it can be mentioned that the cost of transporting both goods and passengers is cheaper, unbeatable competition. However, the journey is long, uncomfortable.

Profile and revenues

Currently, the dhows only make one return trip per week. The total number of passengers is 30 people and the prices vary from 300 FDJ (children) to 500 FDJ (adults). The price of the goods is fixed according to the weight; light goods cost less than heavier goods. Indeed, the transport price of a carton is fixed at 100 FDJ while that of a bag of 50 kg is 150 FDJ. The dhows currently employ 5 people. Compared to the hot season, they earn more in the cool season, because sensitive khamsin crossing is more difficult in July and August. With a salary of 60 000 FDJ monthly, he can not save. Its spending last year is divided between education (10000 FDJ), housing (30000 FDJ) and food (20000 FDJ).

Table 14: Rates and calculated income for the dhow drivers

	Amount
One-way ticket -Adult	500 FDJ
On-way ticket - Child	300 FDJ
Monthly income	60000 FDJ

Social security and working conditions

Among the difficulties encountered, there is the speed and strength of summer wind (khamsin). They are then obliged to postpone or even cancel the trip and wait for the wind to drop down. This explains why dhows do not really have a fixed departure time. Pilots must be ready to leave at any time.

Knowledge of the project

The dhow pilots are aware of the project. However, their levels of knowledge remain low. As they primarily carry the goods of the owner who is also a large trader, and occasionally those of other users, their activities will not be impacted by the arrival of the ferry.

5.3.2.2.7. Restauration Area

At the port of Djibouti, close to the ferry dock, multiple informal restaurants are present. They are run by two women who are also the owners.

Profile and revenues

These women who live in Balbala have chosen these sites because they can do their business independently and peacefully. Open six days a week, these restaurants offer meals in the morning only. Those meals are composed of eggs and beans. The price for a meal cost is 100 FDJ. Among their customers, we find: staff of the Coast Guard, the Navy but also the guards, the shopkeeper and some customers of the ferry. During the cool season, they can sell up to 50 meals a day. During the hot season, due to the ferry being put out of water, the number of meals sold is smaller. These restaurants are not subject to tax. The owners pay only the service of an employee. The daily gain is 3000 FDJ. Their expenses are distributed as follows:

- one third is dedicated to health,
- a third is devoted to food;
- one sixth to education;
- one-sixth to housing.

Social security and work conditions

The Coast Guard and Navy elements, who benefit from the facility, pay at the end of the month. However, sometimes these elements do not want to pay their debts in which case they are forced to seize the respective command.

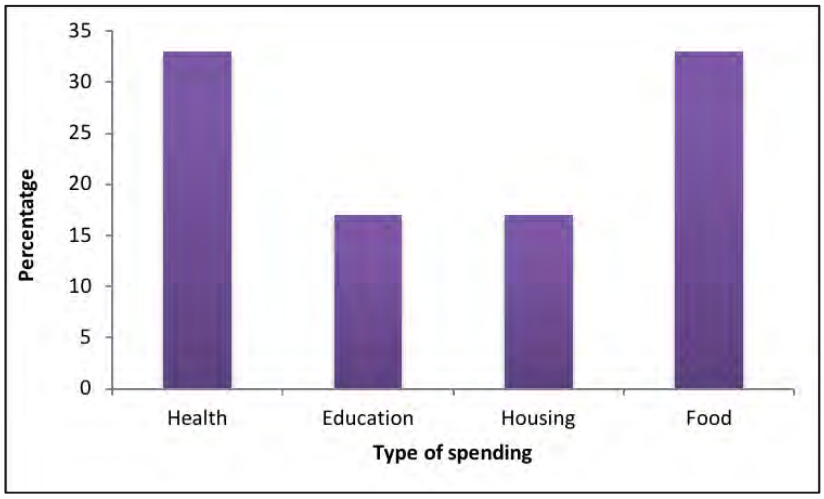


Figure 15 : Categories of expenses of Restauration owners

Knowledge of the project

These women have heard about the project, but their information level is still rudimentary. They see this project as an opportunity. During the construction phase, their restaurant will be open, and employees will be able to eat there. Subsequently, once the new ferry is operational, the passengers will keep on coming to their place. They do not fear competition because they are well established.

5.3.2.3. Civil society

5.3.2.3.1. Bus users

The interviews with the bus users took place at the bus's departure site while waiting for the transport to get filled up. Because no driver does not start until all seats are occupied. The waiting time can vary from ten minutes only to a few hours depending on the number of travelers, the popularity of the driver, the condition of the car, etc. Different categories of users with different interests have been approached. These are men working in Djibouti, women, young people (pupils, students), and people living in villages on the road like Sagalou or Kalaf.

- **Category 1: Men working in Djibouti**

These men are between the ages of 20 and 45, working in Djibouti and living in Tadjourah.
They travel once or twice a month to reunite with their families.

- **Categorie 2: Women**

They are women, aged between 26 and 45.
They travel to Tadjourah to visit their families.

- **Categories 3: Students**

This category is made up of young students (high school students, students).
In July, they could be found because they were going to spend their holidays in Tadjourah.

- **Categories 4: People living in the neighboring village**

The last category consists of people living in the villages located along the Djibouti-Tadjourah National Road 9. Village dwellers have low incomes.
They use this means of transport for the transportation of people and goods.

The interview of those users covered five different questions, namely:

i. Preferred means of transport

Regarding the first point, 91% prefer the ferry over the bus. The 9% who prefer to take the bus are Category 4 people. This convenient way is cheaper. Indeed, instead of renting a car to the port of Djibouti, then another from Tadjourah to their villages, they only have to load the bus and to unload on arrival. Depending on the location, they use camels or donkeys. For them, the bus remains the most efficient and useful means of transport.

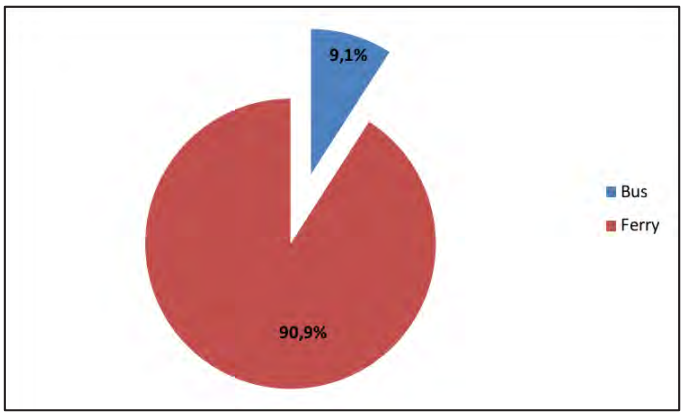


Figure 16: Favorite mean of transport

ii. Overall appreciation of the bus service

Considering the appreciation of the service offered by the bus, 91% find it bad. Indeed, the customers are "piled up like sardines" in those bus: they can not even move their feet. During all the trips, they remain seated and do not have time to take the air or to pray. They can not restore themselves. In addition, the privacy of women is not considered -they do not dare to ask for toilet stop- constraining them to wait for the arrival. Moreover, the noise that reigns throughout the journey because of the men who graze and talk loud, cause headaches. The remaining 9% who find the service good is in category 4. The reasons are explained above.

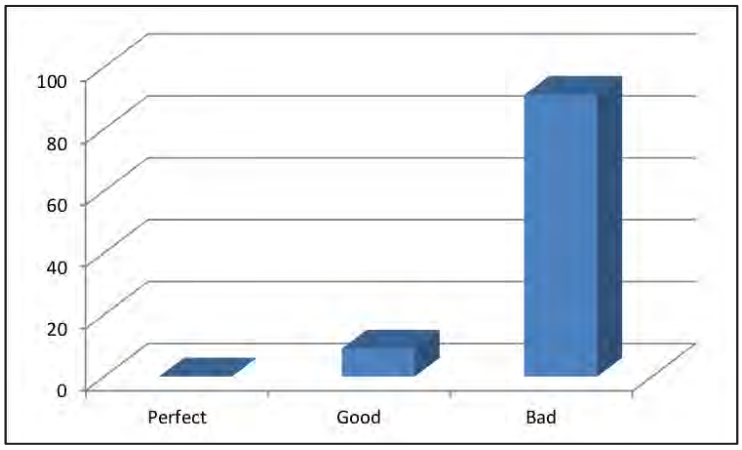


Figure 17 : Appreciation of the Bus (by the bus users)

iii. Bus service improvements

As for the improvement to be considered, half of the people intervewed think that it is necessary to improve the comfort; a little more than 20% mention the need for improvement of the security. With only 9% mentioning the access: the price is 1500 FDJ for both an adult and a child (double the ferry) and not everyone has the means. Finally, the noise is mentioned as the last potential improvement.

iv. Overall appreciation of the ferry service

Regarding the appreciation of the service offered by the ferry, 91% are satisfied because they find it good. This can be explained by those parameters :

- the ferry trip is faster, more comfortable.
- The direction of the ferry has set up a special rate for youth.

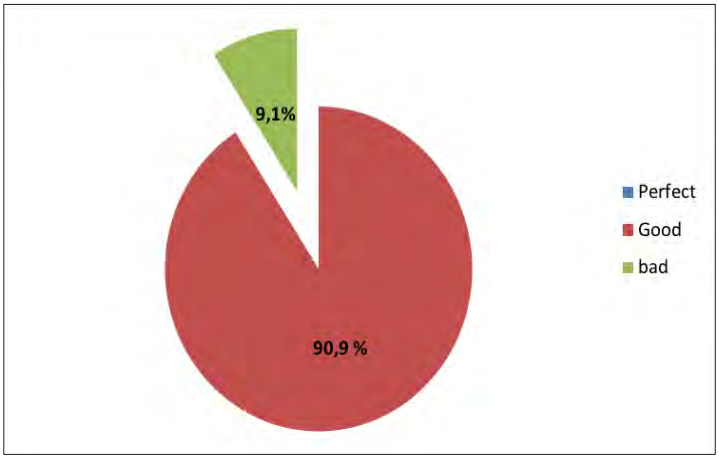


Figure 18 : Overall appreciation of the ferry's service

v. Ferry service improvements

The ferry does not pose a problem of safety or comfort. According to the bus users, who also use the ferry, it would be necessary:

- Put in place means to reduce the noise nuisance on the boat;
- Improve the communication about potential changes adisturbances (the trip may be cancelled on the day without any means for the customers to be informed about the cancellation).

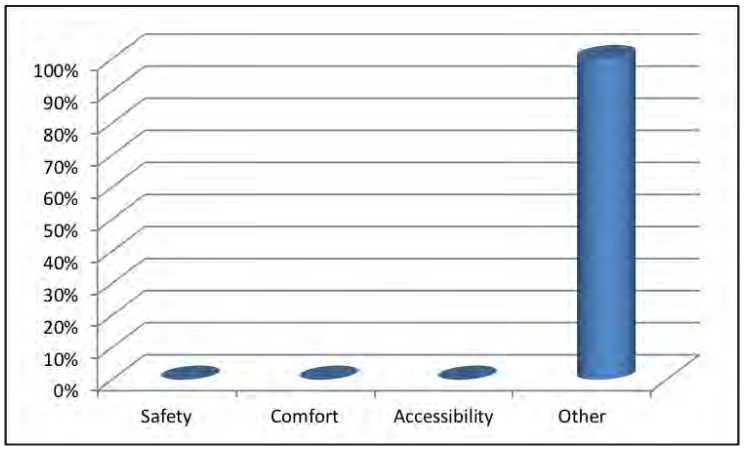


Figure 19 : Potential improvement of the ferrys's services

5.4. Site 2: Port of Tadjourah

5.4.1. General characteristics of the region

The Tadjourah region covers an area of 7,300 km2 and represents about 31% of the national territory (23,000 km2). Located north of the capital Djibouti city, in the Gulf of Tadjourah, the Tadjourah region shares its eastern borders with the Obock region, in the north-east with Eritrea, in the West with the region from Dikhil, to the South with the Arta region and finally to the north with Ethiopia. In terms of administrative and territorial organization, the region has since 2003, a prefecture (whose capital is the city of Tadjourah) and four sub-prefectures namely Randa, Lake Assal, Adailou and Dorra and a local authority. The region has a population estimated at more than 90,000 inhabitants with a density of about 10 inhabitants per km². The largest concentration of the population is in the city of Tadjourah and its periphery. Then the descrescendo order is: the population of the sub-prefecture of Dorra, of the sub-prefecture of Randa and Adaïlou and finally the population of the sub-prefecture of Lake Assal. The annual population growth rate in the Region is expected to correspond to the national rate of about 2.8%. The proportion of the under-25 population would be about 54%. According to the statistics, the population constitutes 12% of the national population, but if we look at the percentage of national population living outside the city of Djibouti, we reach the amount of 37%.

5.4.1.1. General characteristics of Tadjourah city

The city of Tadojurah, which gave its name to the region, is one of the oldest cities in the sub-region. The largest concentration of the population is in the city of Tadjourah and its suburbs, spread over 13 neighborhoods composing 4 geographical areas (see map):

- **North zone (Zone Nord)**: districts of Yomatara, Gablassan and Badoli - AF
- **South Zone (Zone Sud)** (center): Galaato, ShaharitoHarak, Palmeraie, Alwan City and Elamo neighborhoods,
- **East Zone (Zone Est):** Marsaki- Gawra district
- **West Zone (Zone Ouest):** neighborhoods of Fi'a and Agraf.

Located at the edge of the sea, the city of Tadjourah, nicknamed the "white city", is served by sea and land. **By sea, it is served by**:

- ferry since October 2009 (4 times a week) with a capacity of 150 passengers and ten cars.
- private dhows (three in number) which provide the Tadjourah-Djibouti maritime links, mainly used for the transport of goods.

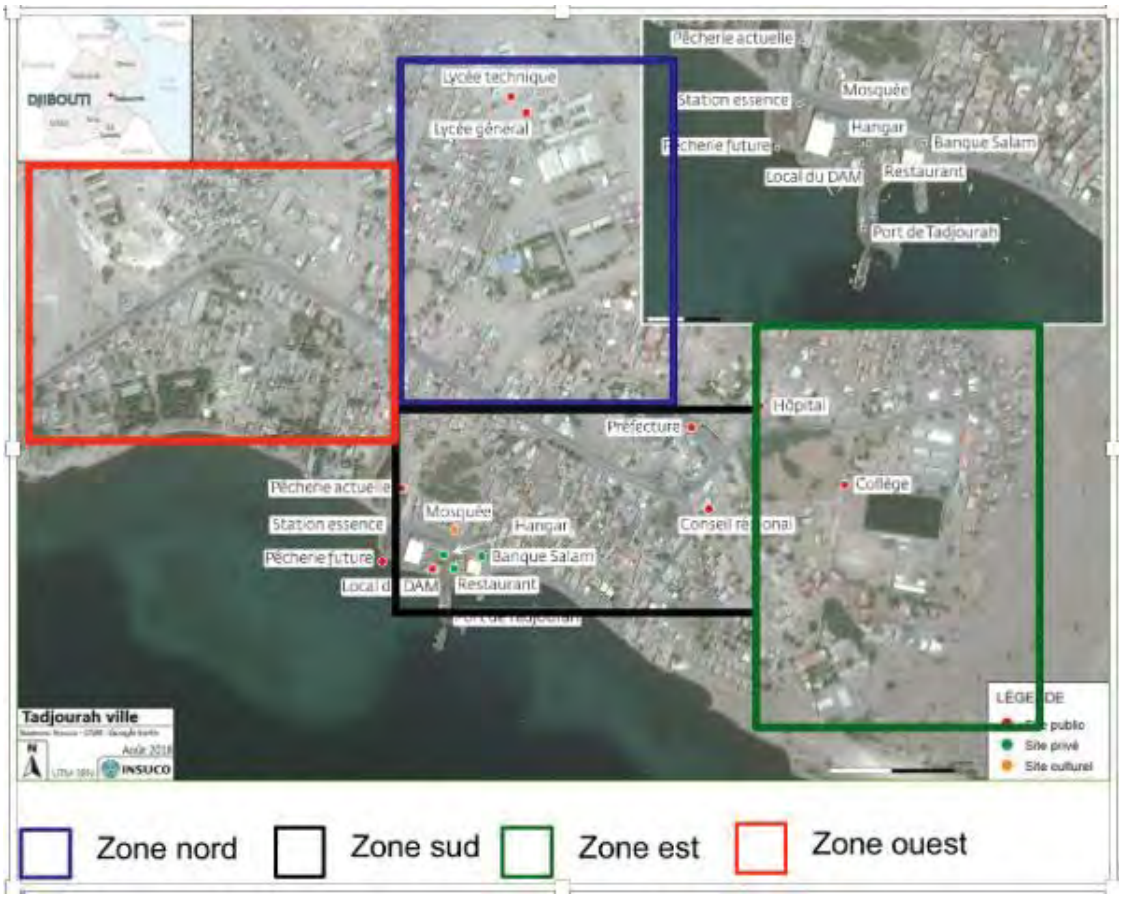
By land it is served by:

- Djibouti-Tadjourah asphalt road 178 km long
- The new road connecting Tadjourah-city to the city of Obock.
- The national road (RN 11) connects the chief town to Randa.
- The Tadjourah -Balho road, under construction, will link the Port of Tadjourah to Ethiopia.

In addition, this city has schools:

- Three primary schools;
- Middle School College (CEM);
- A general high school and a technical high school.

Finally, regarding health infrastructures, the region has a Hospital Medical Center (CMH) in the city of Tadjourah and 16 health posts located in the three chief towns of the sub-prefectures and villages, with significant litter capacity. CMH health facilities have 48 beds.



Map 3 : Different zones of Tadjourah

5.4.1.2. Governemental authorithies

5.4.1.2.1. Prefecture

The central power is represented in the region by the prefect who is appointed to the council of ministers. He is responsible for the security of persons and property and the issues of justice. He also ensures compliance of the acts of the Regional Council in relation with national laws and regulations. The current prefect, Mr. ABDOULMALIK MOHAMED BANOITA is a competent and respected young man. With the support of the State, he has engaged many infrastructure projects since his appointment in 2011.

5.4.1.2.2. Regional Council

In the area of administration, the Tadjourah region is administered like all regions of the country: An entity known as the "Regional Council" is elected for a five-year term by the inhabitants of the region. This council is composed of fourteen (14) members and is chaired by Mr. Omar Houssein[15].
This council was set up in the context of decentralization in February 2006 by His Excellency Mr. ISMAEL OMAR GUELLEH, President of the Republic and Head of Government. Its mission is to manage the region and coordinate the actions of civil society.

[15] Website of the Tadjourah region: http://www.region-tadjourah.dj/la-region/les-cabinets-du-president

5.4.1.2.1. Great projects of the region

Considering ports: The Tadjourah region will have two new ports: **one located on the Goubet, 95 km from the city of Tadjourah and the other in Tadjourah city itself**.

The Port du Goubet, called "Goubet Mineral Terminal" will be used to export the salt produced at Lake Assal in the Tadjourah region. Its cost is estimated at $ 63,998,908. It will consist of a linear platform with a length of 400 meters and will have a depth of more than 15 m. Ships with capacities of more than 60,000 to 80,000 metric tons (DWT) will be able to dock there. The implementation of the major industrial and commercial project on the Lac Assal and Goubet site should allow the construction, installation and operation of complete industrial units for the exploitation of salt, as well as all the installations annexes, such as a power plant, a seawater desalination plant, storage areas and a port.

The realization of this strategic project for the economic and social development of the region will allow the creation of about 200 jobs in the Lac Assal area with the objective of producing six million tons. It is also expected that in the long term, the project will enable the establishment of various salt-derived industries such as the manufacture of detergents, caustic acids and chlorine and provide the Tadjourah region with a modern and viable industrial fabric. while respecting the requirements of the preservation of the environment. When at the New Port of Tadjourah, it will be dedicated to the export of potash from Ethiopia, a landlocked country facing a huge demand for potash exports, to other countries. It responds to the ever-increasing demand for maritime activity around Djiboutian ports. Its creation is also part of the policy of deployment of maritime transport services which is one of the main axes in the country's development strategy. Its cost is estimated at $ 69,920,756 and will create between 170 and 200 jobs.

This new Port of Tadjourah will have a depth of 14 to 15 meters with a quay of 488 meters. It will accommodate vessels with capacities of more than 65,000 metric tons. He will be able to simultaneously accommodate two boats of 200 meters each.

Considering Roads: Tadjourah-Balhoou Road North Corridor
In the sector of road development, a new corridor is being built in the Tadjourah region. It is the 114 km long Tadjourah-Balho Corridor with a budget of $ 522,000,000. The road will connect the city of Tadjourah to the city of Mekele in Ethiopia via Balho on the Djiboutian border. The Tadjourah-Balho corridor will reduce road traffic at the Djibouti and Doraleh Ports.

This corridor thus responds to a concern to strengthen the country's road infrastructure capacities with a view to regional integration. Moreover, it is of major importance for the economy of the northern regions as well as for improving the conditions and way of life of northern populations.

Considering Railway activities:
Parallel to the construction of the New Port of Tadjourah and the Tadjourah-Balho road, the construction of a railway line connecting Tadjourah and the Ethiopian city of Mekele is planned. This element, which complements the regional integration infrastructure, also supports the new port of Tadjourah and the Tadjourah-Balho road.

5.4.2. Qualitative information

5.4.2.1. Governmental Authorithies

5.4.2.1.1. Préfecture

The port of Tadjourah, owned by the state is under the responsibility of the Authorities Port and Free Zone of Djibouti (APZFD). As the representative of the state on the spot, the prefect is responsible for the day-to-day management. Currently, goods belonging to local traders are often stored on the spot. This hinders the movement of goods and people when arriving / leaving the ferry. Aware of this situation, the prefec, native of the district, spares no effort to change attitudes. The day the ferry serves Tadjourah, elements of the gendarmerie and the police are mobilized. Therefore, there is no security problem.

Knowledge of the project
The prefect of the Tadjourah region thinks that this project will contribute enormously to the development of this region. This optimistic point of view can be explained by the fact that daily maritime connections with the capital will bring in a large flow of passengers and goods. Tourist and economic activities will increase. There will be job creation and therefore less unemployment. This is an opportunity.

Observation
The location of the new pier was discussed and approved by the prefecture. However, to minimize the phenomenon of dredging, **the Prefect proposes to add the length of the new plus to the depth**. The current rate should not suffer any increase on the grounds that it is a better service. Local companies and local work force should be favored when recruiting.

5.4.2.1.2. Regional Council

The president of the Tadjourah regional council, Mr. Omar Houssein, who has been in office for a year, considers **the port of Tadjourah a "cultural heritage" that must be preserved because "it is part of the Tadjourah history".**

Knowledge of the project
The regional council strongly supported the project because, with the increase of the population and the opening of port built by the Chinese, it has become necessary to develop the means of transport facilitating the transfer of goods and persons to the capital. The regional council has given an indefectible support to the project.

Observations
However, the time slots must be flexible and adapted to the customers. Thus, on Thursday the ship could leave Djibouti around 13:30 and on Saturday, make the return from 14h instead of 12h as it is now. This would give people who come to spend the weekend more time to enjoy the region t. According to him, the project does not have a negative impact on the human level. On the environmental side, it will be necessary to take into consideration the marine pollution which could affect the fauna and flora.

5.4.2.1.3. Traditional power

The current Sultan ascended to the throne on April 8, 1985. He is the 33rd sultan of the chieftaincy. He is from the Bourhanto clan. He is appointed for life. He is assisted by a Vizier and assisted by an assembly of wise men called "Miglis". The Sultan arbitrates the conflicts between the different tribes and territorial disputes between the various clans. It is the only recourse in case of blood crimes since it is the only one to empower to settle the crimes of blood. It thus still has an important traditional power. He is very respected by the population. The Djiboutian state also recognizes its rank of traditional authority.

Knowledge of the project
The traditional power is favorable to the project which it considers as an opportunity for the region that should lead to the creation of employment for the young people.

5.4.2.1.4. Directorate of Fishery from the Minisrty of Agriculture

The Ministry of Agriculture, Water, Fisheries, Livestock and Water Resources is represented in the Tadjourah region by a representative of the Directorate of Fisheries.

Knowledge of the project
The ferry project is a real opportunity. Indeed, thanks to this means of transport, not only the fishermen of the city of Tadjourah but also those of neighboring localities like Sagalou, Kalaf or Ripta will be able to transport their fish to Djibouti. Since there will be a lot of fish, the price will go down. Consumers will then be able to enjoy it. As for the Directorate of Fisheries, it will spare no effort to help the cooperative. However, the directorate would like to be associated with all the technical meetings.

Observations
For the new jetty to be usable by the ferry and the fishermen's cooperative, it would be necessary to:

- Perform a dredging of 1 to 1.5 m in the basin located in front of the future fishery because the soil is a loose soil without living coral reef;
- Solidify the rear part of the pier;
- Arrange anchor points for small fishing boats.

5.4.2.2. Private sector

5.4.2.2.1. Traders, small business holders

The survey was conducted with wholesalers. Retailers who purchase from these wholesalers and therefore do not use the ferry service have not intervened. In Tadjourah, wholesalers are subject to an annual license. Those stores are open every day.

Profile and revenues
They sell a great variety of products: general food, cosmetics, fabric, school supplies, cleaning products, etc. The bi-weekly electricity bill can rise up to 70,000 FDJ during the summer while the water bill, which is fortnightly, reaches 17,000 FDJ. During the hot season, these traders rent a trucker's service to transport these goods at least once a month. This transport, which they consider expensive, costs them 40000 FDJ per trip. Added to this is the difficulty of finding a serious driver. Indeed, because of the poor state of the road, finding a driver who accepts this work, is not easy. Repeated and sometimes fatal accidents make things more difficult.

Social security and work conditions
A large shopkeeper supplies the city of Tadjourah with vegetables and fruit. He brings back from the capital, according to demand, 8 to 10 bags, once or twice a week. The transport by the ferry costs him 150 FDJ per bag, that is 1200 to 1500 FDJ the trip. When transporting by bus, it must pay 500 FDJ per bag. He must therefore pay 4000 to 5000 FDJ per trip. Bus transportation costs him 3 times more than ferry transport. In addition, during transport by bus, the quality of vegetables and fruits are degraded. In fact, piled up along the way, the crops eventually get damaged and may not be sold on the market because of their aspects and spoiled quality.

Knowledge of the project
For all these reasons, these traders are eagerly waiting for the new ferry to come into service, especially during the hot season. They hope to satisfy their customers.

5.4.2.2.2. Dhows

Dhows continue to serve the northern regions (Tadjourah and Obock) from the capital. The two dhow owners are also well known traders beyond Tadjourah. The history of the white city is closely linked to history of dhows. In fact, the Tadjourians have always had commercial relations with the Arabian Peninsula and especially the city of Aden thanks to the dhow. Today, with the technological progress, this means of transport is neglected but continues to serve.

Profile and revenues

The dhows are constructed of either hardwood or plastic. Plastic ones, cheaper, easy to maintain, can be insured. But they are not suitable for the transport of heavy load especially in low tide. Wooden dhows, which are more difficult to maintain, can not be insured because the insurance does not accept them. However, even at low tide, they can withstand heavy loads. Because of the lack of dock maintenance, the dhows can not anchor properly either at the fishing port or the port of Tadjourah, especially at low tide.

In 2010, during the launching of the ferry Mohamed Bourhan, the price of freight transport of the ferry was aligned with that of the dhow which is 150 FDJ per bag of 50 kg. As a result, they lost all their customers. Currently, dhows carry the respective goods pf their owners- who are tarders- and occasionally other goods. While two return trips can be done per day during fresh season, only one trip can be done during the hot period. For transport, priority is given to the owner's goods. In the remaining space are loaded the other goods. The factors that explain the frequency of round trips are:

- The bad status of two ports;
- The low availability of work force;
- Bad weather conditions.

Knowledge of the project

These traders, native of Tadjourah, aware of the stakes, are in favor of the new ferry project that will allow the development of their regions. They just want to continue using their dhows. Their expectations are:

- Have a decent anchorage point;
- Build the new jetty or embankment for the dhows at the fishing port;
- A dredging of the port of Tadjourah.

5.4.2.2.3. Touristic center

The region of Tadjourah is famous for its touristic seaside (white sand, Rayssali, etc.) and mountainous (Day, Bankoualeh, etc.). Due to a lack of time, we focused our attention to only two actors of those touristic opportunities:

- Exchanges with the staff and managers of the seaside centers;
- Exchange with the local guides.
- We did not go to the mountainous places. The tourist centers are nestled along the Rayssali coast. Thanks to the word of mouth publicity, the site attracts more and more tourists. Those tourist groups ar mostly composed of French force stationed in Djibouti. It is the quality of the coral reef that make the place so attractive. On site, equipped tourists can indulge themselves with scuba diving or just snorkeling activities. Added to these activities, people can also enjoy troll fishing sessions or some fishing by night activities offered by the different hotels and tourist service providers. Once the tourists arrive to the port of Tadjourah, speedboats take them directly to their hotels to which they arrive by the beach.

One proposed option is for the tourist to board their car on the boat and to collect it at the ned of the weekend to drive back to Djibouyi. The accomodations site are open to the public from mid-September to mid-May and close during summer, because of the khamsin.

Profile and revenues

The profession of “tour guide” has developed in the last years in Tadjourah as well as within the whole country. The accompanying guides are young natives of Tadjourah, bilingual, always smiling, who travel the country from south to north, along with tourists to make them discover the counrty’s culture and treasures. These guides, which do not have a website, have forged a solid reputation, thanks to their powerful informal networks. The services offered include circuit à la carte, or choice throughout the Republic of Djibouti. The route is to travel by land from the south (Lake Abbe) to the north (Bankoualeh) and return to Djibouti by ferry.

Observation

Tourists prefer to take the ferry rather than driving all the way to Tadjourah through the road 9. Indeed, they find the ferry transport faster, more comfortable and safer. The acquisition of this vessel is seen as an opportunity that contributes to the development of tourism activities.

5.4.2.2.4. Bajaj

The bajaj, of Indian manufacture, is a vehicle with three motorized wheels.

Profile and revenues

The bajaj drivers are among the stakeholders of the ferry project. Initially, it was planned to carry out a focus group with them. In the field, it was found that this means of transport, much in demand, does never stop for the demand is so big[16]. Bajaj drivers are young men, aged 25 to 40 years old. To be able to exercise this profession, one must be physically fit, not to have a handicap of motor skills or of sight. They carry both passengers and their goods. On duty in the morning from 6am to 12pm, afternoons from 4pm to 8pm, every day, they serve both the city of Tadjourah, its surroundings, and even Obock.
In Tadjourah, the price of transporting people and bag of 50 kg is fixed at 100 FDJ while the transport to the localities is linked to the distance traveled. As for the transport of cardboard, it is not invoiced. The longer the distance, the higher the price: the transport up to Kallaf is 1600 FDJ, Sagalou 2500 FDJ, Randa 6000 FDJ and Obock 10,000 FDJ. The number of places available is 4. The goods that are not allowed are fuels, kerosene and khat.

Table 15 : Rates and calculated income for the Bajaj drivers

Income	Rate
A bag of 50kg	100 FDJ
Transport to Kallaf (9kms)	1600 FDJ j
Transport to Sagalou (12 kms)	2500 FDJ j
Transport to Randa (16 kms)	6000 FDJ
Transport to Obock (63 kms)	10000 FDJ
Daily income	6000 FDJ

They pay annually 30 000 FDJ for the insurance and 10 000 FDJ for the vignette. The average fuel consumption is 2000 FDJ. They earn 6000 FDJ a day.

Table 16 : Regular expenses of Bajaj drivers

Expenses	Rate
Annual insurance	30000 FDJ
Average daily fuel consumption	2000 FDj

[16] The team decided to conduct individual interviews, even on board the craft and in full service.

Social security and work conditions
Bajaj drivers do not benefit from any medical coverage. They work all year; indeed, during the cool season, with the return trips of the ferry, they have a lot of customers. During the hot season, the ferry is out of service, but they still get a lot of clients because of the very high temperatures, the persons have difficulties to do long walks from one place to another.

Knowledge of the project
Bajaj drivers are aware of the new ferry project. For them, this is an opportunity since this new ferry, being larger, will bring in more passengers and goods. This increase on the affluence of persons represent an opportunity for them that should to an increase of the demand for their services and therefore their incomes.
However, they fear that those good perspectives attract a significant number of bajajs and that this phenomenon could lead to a tax increase on car insurance.

General information
As soon as they arrived on the Djiboutian market, the Bajajs seduced the population, which found this means of transport very convenient, especially in Balbala commune and in the interior regions. Indeed, they cost less than a taxi. However, faced with the upsurge of often fatal accidents, the state of Djibouti has opted to increase the tax on insurance then for an import ban. Since then, the number of Bajajs has decreased considerably.

5.4.2.2.5. Hotels

In the city of Tadjourah, there are only two hotels: Corto maltese and the Golf.

Profile and revenues
These hotels, both counting around twenty rooms, charge their foreign customers 12,000 FDJ per night and Djiboutian customers 11,000 FDJ a night with breakfast included. The main customers are members of the French force stationed in Djibouti. However, there was a drastic decrease in attendance to those hotels during the last four years without a clear and understandable reason. Faced with this situation, a strategy to conquer other customers has been established. This includes the establishment of cooperation with major hotels in Djibouti, gain the trust of the National Office of Tourism of Djibouti (ONTD).
Within Tadjourah's economy, the hotels play a crucial role in local economy: including fishing (buying fish), breeding (buying young goats), handicrafts, etc.

Knowledge of the project
The program of the current ferry (serving Tadjourah 4 times / week) is a breath of fresh air for the local economy. Hotel owners use the ship for the transport of their goods at least twice a month. The new ferry project is an opportunity as attendance will increase.

Observations
However, it will be necessary to modify the schedules by shifting them, especially for the Saturday's schedule: the ferry, could leave Tadjourah from 3 pm instead of 12pm on Saturdays.

5.4.2.2.6. Dockers

The dockers were met at the port of Tadjourah while a dhow had just moored. It was difficult to meet them otherwise knowing neither their identities nor their addresses. However, when the traditional ship arrives, they are busy with their activities and are no longer available for an interview. After 2 hours of waiting and negotiations (because they are tired and do not want to talk), five of them were kind enough to answer our questions.

Profile and revenues
All dockers are of Ethiopian nationalities. Their age varies from 21 to 50 years old. The oldest among them express themselves clearly in Afar language unlike the new ones who have more difficulties. Composed only of men, recruited on the basis of trust, they work according to the boat activities, which they look for incessantly. There are no specific schedules or holidays or business days; A docker must be mobilisable at any time. Loading and unloading a bag yields 10 Fd. Their average daily gain is 1500 Fd. They do not spare money or build any savings.

Social security and work conditions
In this environment governed by trust, where competition rages, integrating a team is a guarantee of success (there are informal groups / structures). The slightest misstep however can cost you the job. They do not benefit from medical coverage therefore, if one of them has a severe disease that request an evacuation to the capital or to another hospital, they organize a collect of money. This form of solidarity is the one that binds dockworkers together. Especially since this business is quite risky.
For instance, it happens that the board serving as a bridge between the dhow and the stopover cracks and breaks under their weight, or that they stumble. These accidents, which frequency is certainly rare, are very present. Measures are taken to diminish those risks: either they bring the dhow closer to the edge, or they put a stronger board.

It is important to note, that at present, these men do not wear nor have any work equipment (adequate bridge for example) nor protective equipment (glove, mask, etc.). There is no docker association either. No Djiboutian native from the Tadjourah region or another region, does want to exercise this business as it is considered as a sub-business (low quality business).

Knowledge of the project
The dockers think that during the construction phase they could be recruited as workers, which could be a ggod opportunity for them. But they hope to be able to keep their job, onse the new ferry is operational. If the state were to value and frame the profession of dockers, they could, as Ethiopian, be disregarded for the job.

5.4.2.2.7. Restaurants

The restaurant, the shop and the juice area belong to a certain Garad Habib Dini, who inherited his father's business. The latter affirmed is in possession of a definitive land title issued by the competent authorities. The restaurant, open every day, offers a variety of dishes at affordable prices. There are many juices including those here local agricultural perimeters. The bottles of water and soda are very popular with travelers, sold at the same price as in the city so cheaper than by ferry.
Mr. Dini's guests include both ferry, dhow, celebrity and those who simply relax at the stopover. When the ferry is in service, the gain is greater. During the summer months the ship is stopped and a decrease in the recipe is recorded. In order to better serve his ferry customers, who are often in a hurry, this trader temporarily recruits more staff, increases safety and increases the volume of meals.

Knowledge of the project
His expectations on the new ferry are an increase of its activities and an improved transportation of goods. He fears however that the ship gets equipped with a restaurant which would have a heavy impact on its activity.

5.4.2.3. Civil society

5.4.2.3.1. Fishermen cooperative

The focus group of fishermen from Tadjourah, which gathers nine people, took place in front of the fishery.

Profile and revenues

Tadjourian fishermen are men whose age range from 18 until 50, living in the white city. This profession does not mobilze any academic knowledge but requires a good physical condition. Participants in this focus group stated that there is no time slot or working days per week in this work. They work every day morning or evening. For the fish sale activities, several parameters intervene including the type of fish, the market, the season, the climate, etc The fish are sold either by kilo or by slice. Often, customers want it per kilo. On average, one kilo of fish is worth 700 FDJ while in summer they sell the kilo at 1000 Fdj.

During the hot season, the sea is agitated because of the wind, the fish are then more expensive because they are rare. They sell their goods both on the Tadjourah market and on the Djibouti market. Most fishermen have a primary level of education. 80% of participants said they earned 3000 FDJ / day against 2000FDJ / day for the remaining 20%.

Social security and work conditions

They save nothing and have no other source of income. Fishermen do not benefit from medical coverage. They form a cooperative that currently has 61 members.

The only contribution, currently demanded, is the daily payment by the person who caught and brought fish of 300 FDJ for the cleaning activities the point of sale.

More than half of the cooperative membres have boats of category C (floating gear) according to the the Djiboutian fishing code and only some have boats of category B (boat less than 9 m).

For those activities, they do not have protective equipment like gloves or means of preservation (no cold room). The difficulties encountered are the presence of waves, the storm, the cold. In the Republic of Djibouti in general, fishing activity and practice remain pretty traditional. therefore, injuries to the hand during angling and cutting, the hook or from the attack by some species are common. The turtle, dolphins are examples of protected species: it is prohibited to fish them.

Women's presence

Within Tadjourah's community, there are still no women fishing. The reasons are, according to fishermen, multiple. First, culturally, no woman is engaged in this practice. Then, women consider this as a sub-business devaluing their ranks.

Knowledge of the project

The fishermen have heard about the project of a new ship: they have quite great expectations on that project:

- The presence on the ferry of a room dedicated to the cooperative that would include a cold room. This will enable them to feed the Djibouti capital with good quality fish;
- The supply of refrigerated vehicles, supplying fresh fish to Ethiopia via the Balho road;
- The supply of boats that will allow them to fish offshore;
- Training in oysters fishing techniques because the region is quite rich in oyster culture and natural breeding.

They also have fears that are:

- The restriction of their movements due to the presence of the larger vessel;
- The reduction of the space available for their boats in Tadjourah bay.

5.4.2.3.2. Women association

In order to organize the focus group with the women's associations, three of them were contacted. On the appointment day, because of a program in Djibouti, two of these associations missed the call.

Profile and revenues

The interview was then carried out with the responsibles of the association of the Women Engaged for the Protection of the Environment (AFEPE), created in 2010 and which gathers about ten active members. Originally, having seen the spread of garbage throughout the city, because of the lack of a competent state service, women have taken the initiative to remedy themselves. Then, they received state support that equipped them with a ben truck. Every family, except the poorest, must pay a monthly contribution of 300 FDJ. This is used to pay the salaries of the staff of 6 people (5 workers and 1 driver). The fuel is at the expense of the prefecture. The collected garbage is burned in shackles of 10 meters depth, outside the city. Their field of intervention is the administrative center of Tadjourah district. Neighboring localities are not included at this time. Through this association, tadjourian women started the process of emancipation. Indeed, it was hard to imagine 10 years ago, that women could be in charge of the collection of garbage. Today, they are present in many sectors (commerce, regional council, education, etc.) although much remains to be done.

Knowledge of the project

The women think that the current ferry is very convenient since the journey is short and comfortable. They deplore, however, the lack of space (women do not like climbing the stairs) and toilet downstairs. Latrines that smell bad, often clogged, usually lack water. One of the great advantages of this boat is that it reduces the pressure on the bus especially during festive periods or during the school holidays.

Observation

However, to be effective, you will need:

- Have one or two people trained in first aid;
- Proceed to the merchandise billing system. Because currently, during the transport of goods, no invoice is established and some of their merchandise loaded on the boat get lost.
- To look at the different options of actering on the boat with specific attention to traditional Tadjourian pancake vendors

5.4.2.3.3. Youth association

As part of this survey, three youth associations were met. These are the Mahoubani Association, the Association of Tadjourah Associations and the Association for the Development of Culture and Sport (ADCUS).

Profile and revenues

Founded in 2002, the Mahoubani association has its headquarter in Tadjourah in the Elamo district. Mouhoubani which wishes to acquire the status of NGO soon, will work both in the capital and in the remote localities. Its broad area of intervention includes education, health, environment, water, etc. With 100 paying members, it is headed by a steering committee, elected for two years.

The Association of Tadjourah associations aims to coordinate all the activities of different associations. The association for the development of culture and sport was, twenty years ago, the pioneer in the field of youth awareness for culture. Its members are scattered, the association is not active as in previous years in the field. The region is bursting with ideas, but the youth has encountered difficulty to get fully and strongly involved in those projects for many reasons.

Considering the frequentation of the ferry, during school breaks, or at the approach of festivities during the school year, the public-school attendees already exceed the number of places available on the boat. The possibility of a special ticket marked "pupil or student ticket" sold at a different rate must be looked at. The current practice is that each adult can be accompanied by two students. But in a period of

holidays, because there is a large number of passengers, this practice is difficult to apply. This sometimes leads to conflicts with the police.

Knowledge of the project

Youth associations, even though their level of information and knowledge on the project remains low, consider the project as an opportunity. Thus, during the construction phase, young people from Tadjourah will be able to work in the construction site. During the operational phase, they hope with the potential existence of a ticket student / young, it would be easier to reach Djibouti and to look for work there or develop their businesses.

6. Biological environment baseline

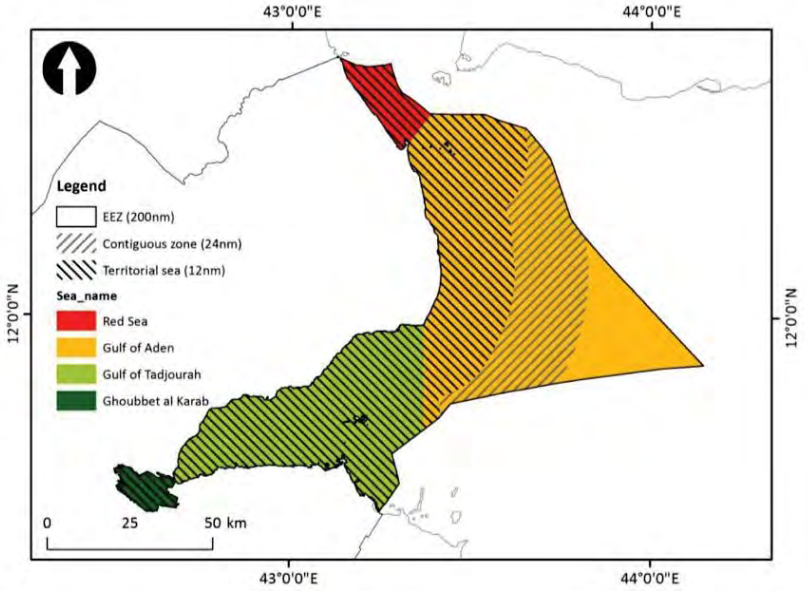
6.1. The marine and coastal environment of Djibouti

6.1.1. General Information on Djiboutian waters (EEZ)

The Republic of Djibouti is responsible for an Exclusive Economic Zone (EEZ) covering about 7025.19 km^2 (Seascape, 2016). This EEZ can be subdivided into four marine areas:

- The Red Sea coast, which runs from Bab al-Mandeb to Ras Siyyan (314.01 km²)
- The Gulf of Aden, which runs from Ras Siyyan to Obock and to the south (4433.33 km²)
- The Gulf of Tadjourah (2118.48 km²)
- The Ghoubbet-Al-Karab (159.38 km²)

These marine areas are distinguished by their own specific oceanographic conditions.



Map 4: Exclusive Economic Zone of Djibouti

The western Gulf of Aden and the southern Red Sea have been the subject of several oceanographic studies (Bower et *al*., 2002, 2005 and 2011). This whole area including the gulf of Tadjourah, is directly influenced by the monsoon of the Indian Ocean which regulates the exchanges between the Red Sea and the Gulf of Aden and the mixing of the water masses (Denguy, 1974; Donguy and Mayer, 1996).

During the southwestern monsoon (June - September), the outflow Red Sea water (RSOW) enters the Gulf of Aden (GOA) as a dense overflow through the shallow Bab Al Mandeb (BAM) Strait and continues to mix with the ambient waters as it spreads laterally (Figure 20, b) (Maillard and Soliman, 1986; Smeed, 1997; Murray and John, 1997, Bower 2005).

During the northeastern monsoon (October - May), the exchanges through the Bab Al Mandeb Strait are reduced in two layers. The surface layer containing the waters of the Gulf of Aden entering the Red Sea and the deep layer with cold waters emerging from the Red Sea (Figure 20, a.)

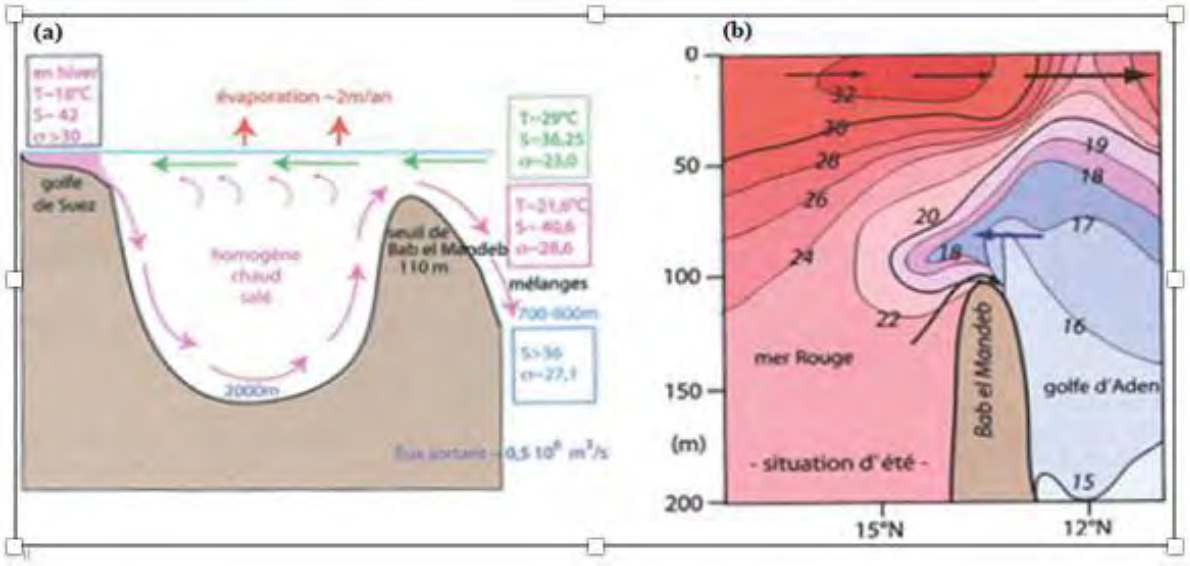


Figure 20 : Diagram showing the exchanges between the Red Sea and the Gulf of Aden: North-East monsoon period (a) South-West monsoon period (b) (source: Fieux, 2010)

The main characteristic of the EEZ of Djibouti is that it is located in the zone of crossing and mixing of the different masses of the Red Sea and the Gulf of Aden. This has important consequences for coastal marine ecosystems, habitats and the biological environment (Klaus et *al.*, 2016). In terms of biological diversity, we find species and endemism of two major biogeographical provinces: the Red Sea and the Indian Ocean (Obura, 1999).

6.1.2. The Gulf of Tajourah

6.1.2.1. Red Sea and Indian Ocean influences

Located at the extreme west of the Gulf of Aden, the Gulf of Tadjourah experiences both the Red Sea and the Indian Ocean influences (Moussa Omar et *al.*, 2015 and 2016). During the southwest monsoon, the superficial layer contains the water of the Red Sea. Under this layer, form the waters of the Gulf of Aden which contains the thermocline (Moussa Omar et *al.*, 2016). The rise of this thermocline towards the surface causes a bloom of primary productivity that attracts numerous migratory fish (Bouhlel, 1986). On the other hand, from October to May, the period during which north-east monsoons predominate, the cold waters from the Arabian Sea occupy the entire water column between the surface and 150 m of depth (Al Saafani 2006 and 2007). The thermocline becomes deeper and this causes the decrease in primary production and the departure of migratory fish (Bouhlel, 1986).

6.1.2.2. Bathymetric features

The marine environment of the gulf of Tadjourah is also characterized by the presence of several rifts: the Tadjourah rift and the Assal rift which is still active (Bonatti, 2011). The geomorphology of the seafront and the seabed is conditioned by geology and especially by the existence of oceanic and continental rifts. Thus, the Gulf of Tadjourah results from the Tadjourah rift which extends into the continent by the Bay of Ghoubet El Kharab and Lake Assal (Bosworth 2005; Daoud, 2008). This great rift creates deep furrows (Obock pit: 1100 m and Tadjourah pit: 850 m) (Bäcker et *al.*, 1973). On either side of this collapse ditch, the continental shelf has variable widths. It is restricted (0-100 m), almost nonexistent in the Gulf of Tadjourah and a little more developed from Djibouti to Loyada (South) and Ras Bir to Doumeira (North).

These structural discontinuities observed along the Djiboutian coast led Moel and Grateau (1967) to define three large sections or coastal strips:

1. **The coastal strip stretching from the border with Eritrea (Red Sea) to Ras Bir** (near the town of Obock), characterized by lower terrain and larger expanses of benches shallow sand.
2. **The interior of the Gulf of Tadjourah**, between Ras Bir and Khor Ambado, characterized by steep volcanic slopes interspersed with some coastal plains and sandy beaches.
3. **The southern coastal strip extending from Khor Ambado to the Somali border**, characterized by sandy plains extending to the sea and causing large areas of shallow sandbanks and lagoons.

These three coastal sections correspond to the three main types of coastal marine environment of Djibouti (CNE, 2000, Newman et *al*., 2015).

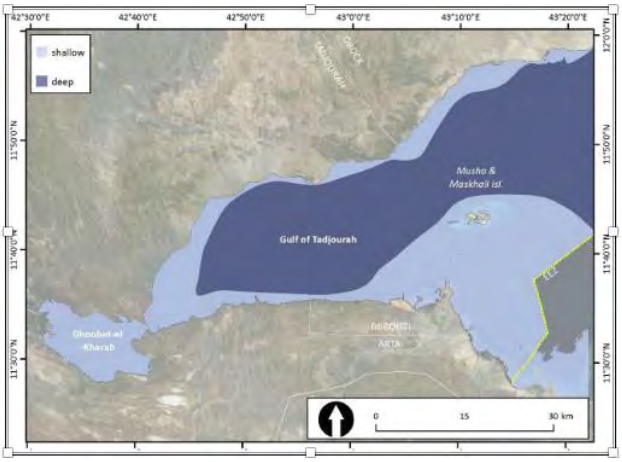


Figure 21 : Bathymetric map showing the deep zone of the Gulf of Tadjourah ((CNE, 2000, Newman et al., 2015).

6.1.2.3. The biological environment of the Gulf of Tadjourah

Along the northern and southern shores of the Gulf of Tadjourah, the National Monograph of Biodiversity (Republique de Djibouti, 2000a) identified three main coastal marine ecosystems:

- mangroves,
- coral reefs and
- phanerogamous seagrasses.

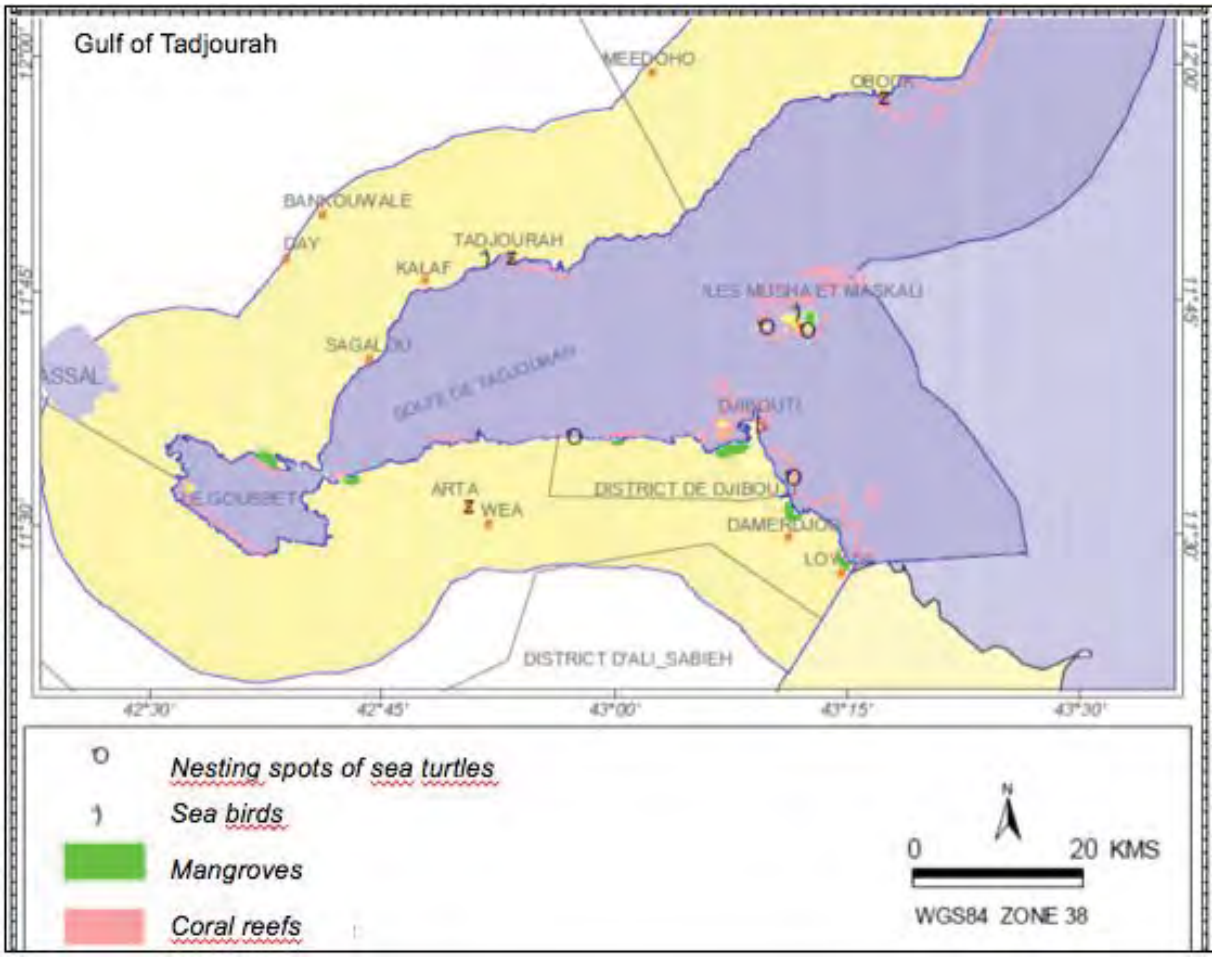
Coral reefs and mangroves are quite well studied while the phanerogam meadows which is restricted to certain areas, have been little studied. There are also other ecosystems such as beaches or rocky cliffs that have not been extensively studied (Klaus et *al*., 2016).

6.1.2.3.1. Mangroves

Mangroves are characterized by their ability to develop and adapt to salinity and to grow in the intertidal zone of the tropical shores. In our case in the intertidal zone of the tropical shores of the Red Sea and the Gulf of Aden. Djiboutian waters contain eight mangrove areas covering a total area of 700-800 ha (Republic of Djibouti, 2000a). These mangroves consist of two main species: *Avicennia marinna* and *Rhizophora mucronata*. Two other species *Cerips tagal* and *Bruguiera gymnorrhiza* have been identified but these have a restricted distribution and are found in low numbers.

Photography 1: Mangroves in the Gulf of Tadjourah

In the Gulf of Tadjourah, mangroves grow in the mouth of Ambouli Wadi between Doraleh and the "*Route de Venis*". This mangrove covers about 1 km². It is exclusively composed of *Avicennia marina* (Figure 4). To the west of the Arta coast and at the north of Ghoubbet Al Kharab, a few small mangrove relics have been also identified.



Map 5: Map showing turtle nesting area, coral reefs and mangroves distribution

These mangroves provide habitat for many species of invertebrates and fishes. Crabs are the dominant species of wildlife in this ecosystem (Prarev, 2014). The PERSGA study assessed the invertebrate fauna living in mangroves: they identified four species of mollusks, seven species of crabs and one species of barnacle (PERSGA, 1998). This study estimated at thirty the number of fish species using mangroves at a stage of their development. Many juvenile fish of commercial species live in the Djibouti-city mangroves, particularly the mullet (*Valamugil saheli*) which is highly appreciated by the Djiboutian population (Djama, 2000). The mangroves of Djibouti city extend to Doraleh along the shore and are a good fishing area for national fishermen. Shrimps, crabs and fish are constantly fished in mangroves and resold on local markets. Mangroves can be found at 1,4 km east of Djibouti.
Tadjourah has no mangrove area, except of a few mangrove trees identified in the north of Goubet bay, located at about 35 km from the site2, the port of Tadjourah.

6.1.2.3.2. Coral Reefs

Coral reefs are formed by the accumulation of biological organisms whose main architects are corals. In order to develop, corals need specific physical chemical and climatic conditions that they have encountered only in tropical waters (Spalding and Grenfell, 1997).
The Djiboutian waters contain 400 km² of coral reefs (Gouvernement de Djibouti, 2000a). In the Gulf of Tadjourah, these coral formations develop in ***three main reef areas*** (Seascape, 2016):

- The north and south coasts of the Gulf of Tadjourah;
- The coastal waters of Ghoubet;
- Offshore reefs located on Mucha and Maskali islands and around submerged banks.

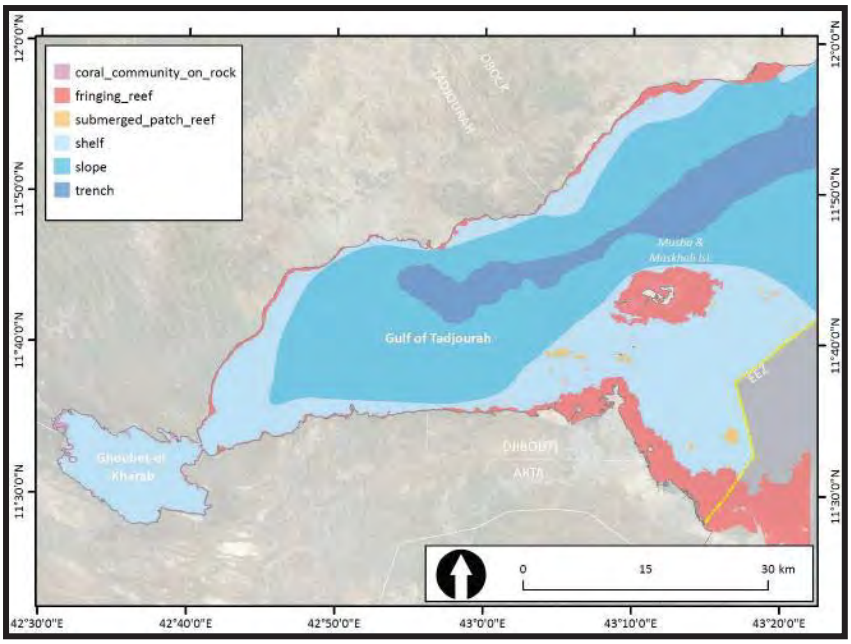


Figure 22 : Typology of coral reefs in the Gulf of Tadjourah (Source: Seacape, 2016)

On the north and south coast of the Gulf of Tadjourah, corals are well represented. In some places, they start a few meters from the beach (i.e Sable Blanc coral reef)). At the entrance to the Gulf of Tadjourah, north of Djibouti city, are the Mucha and Maskali islands, which are surrounded by important coral reefs. Within those three areas, we can distinguish three main types of coral reef:

- **Fringing reefs**: Majority of coral reefs are fringing (north and south coasts of the Gulf of Tadjourah, southeastern coast between Djibouti and Loyada, the islands Mucha and Maskali).
- **The rocky reefs** are found in the Ghoubet.
- **The submerged banks of reefs** which are in front of Ambouli (Ambouli bench) and between Mucha, Maskali and the city of Djibouti

6.1.2.3.3. Phanerogam herbaria

Little is known about the Djibouti phanerogam meadows. The limited information available on this habitat comes from descriptive work (PERGSA, 2002, Kemp and Benzoni, 2000, Ahmed et *al*., 2001). The meadows grow in shallow water covering mud banks between Djibouti City and the Somali border at Loyada on the south coast and between the town of Obock and Ras Bir on the north coast of the Gulf of Tadjourah. The study of (PERSGA / GEF, 2003b) identified two species of marine phanerogam: *Halodule sp and Thalassia sp*.

These phanerogamous seagrasses act as a privileged breeding and resting area for some species of fish and crustacea and are important feeding areas for green turtles *Chelonia mydas* and potentially for dugongs (*Dugong dugon*) (Gouvernement de Djibouti, 2000a), 2000). This ecosystem is threatened throughout the region by the wild development activities of urban centers, industry, tourism and fishing. Herbaria are destroyed by dredging and backfilling as well as trawling (PERSGA, 1998).

6.1.2.1. Biological communities

The confluence position between the Red Sea and the Indian Ocean gives Djiboutian waters a rich biodiversity, of global, regional and local importance. This biological diversity is reflected in the assembly of species and endemism of several biogeographically provinces including the Red Sea, the Gulf of Aden and the Arabian Sea. Despite its importance, marine biodiversity had long been unknown. It was only in the early 1990s, that the Republic of Djibouti initiated biodiversity inventories as part of a program funded by the Global Environment Facility (GEF). The results of these studies were synthesized in the National Monograph of Biodiversity. In the light of recent data, we will describe the main groups of marine life that may be present in the Gulf of Tadjourah.

6.1.2.1.1. Marine mammals

The marine mammals of Djibouti were studied by Robineau and Rose (1982, 1983 and 1984). These studies identified 12 marine mammals consisting of 11 cetaceans and *Dugon dugon*. Dolphins are the most widespread cetaceans in the Gulf of Tadjourah and in Ghoubbet Al Kharab Bay. Robineau and Rose (1983 and 1984) identified 7 species of dolphins: Humpback dolphins (*Sousa chinensis*), Long-tailed dolphin (*Stenella longirostris*), Spotted dolphin (*Stenella attenuata*), Risso's dolphin (*Grampus griseus*) (*Tursiops truncatus*), *Ziphius cavirostris*, *Physeter catodon*. In contrast, large cetaceans and dugons rarely frequent the waters of the Gulf of Tadjourah. The dugons frequented the southern coastal waters between Djibouti-Town and Loyada. Large cetaceans have been recorded during stranding on the coast. Three species have been identified: the sperm whale (*Physeter catodon*), the Cuvier's beaked whale (*Ziphius cavirostris*) and the Bryde's whale (*Balaenoptera edeni*).

6.1.2.1.2. The fish

The fish of Djibouti have been quite well studied. The first study (Rose, Tello and Gilbert, 1980) gives details of 185 species from all groups. Barrat and Mendley's (1988) identified 134 species of the reef fish from 30 genera. In the same year, Bouhlel (1988) produced an illustrated guide in which he described, 222 species of fish belonging to 59 families. The last and the most exhaustive study, focused on the main edible species (Khunzel, 1996). This study identified 192 fish species in Djiboutian waters. Other studies have also provided additional information on particular species or groups of reef fish. Hutchins (1986) described a new species of limefish, *Pervagor randalli*, while Dalpadado and Gjøsaeter (1987) report the results of a trawl fishery and describe four species of mesopelagic lantern fish. Dawson-Shepherd and Burkitt (1998) added grouper (*Seranidae* family) and snapper (*Lutjanidae*) species to the country's fish list, while Obura (1999) added several species of surgeon (*Acanthuridae*), apogon (Caesionidae) and parrot fish (*Scaridae*). The compilation of all these data and for all groups combined revealed the confirmed presence of 454 species of fish in Djiboutian waters. These species mostly belong to 77 families of bone fish and only 7 families of cartilaginous fish (*Chondrichtyens*). Among teleosts, there are 34 species of *Carangidae* (= jacks); 34 species of Labridae (wrasses); 32

species of Serranidae (grouper or old); 29 species of *Lutjanidae* (snappers); 26 species of *Pomacentridae* (damselflies or chromis); 14 species of *Acanthuridae* (surgeons); 14 species of *Chaetodontidae* (butterflyfish); 13 species of *Lethrinidae* (hunchbacks or emperors); 12 species of *Balistidae* (triggerfish); and 12 species of *Haemulidae* (= diagrams or grunts). Together, these 10 families account for half (49%) of Djibouti's fish species.

6.1.2.1.3. Reptiles

Four species of sea turtles are reported to be present within Djiboutian waters namely, the green turtle (*Chelonia mydas*), hawksbill turtle (*Eretmochelys imbricata*) and loggerhead turtle (*Caretta caretta*), and leatherback turtle (*Dermochelys coriacea*) (Al-Mansi et al., 2003, PERSGA/GEF 2004b).

All turtles are recognised as being threatened and listed on the IUCN Red List. These turtles are found throughout EEZ. They come to lay at specific sites (see map 5). The green turtle frequents preferentially the east coast between Djibouti city and Loyada

The green turtle *Chelonia mydas*, is listed as Endangered, the hawksbill turtle *Eretmochelys imbricata* is listed as Critically Endangered, while the loggerhead Caretta caretta and leatherback turtle *Dermochelys coriacea* are both listed as Vulnerable Only two species of marine turtle have been found to nest on Djiboutian beaches, namely green turtles and hawksbills turtles (Al-Mansi et al., 2003, PERSGA/GEF 2004b). There is no specific distribution data on turtles within the Djiboutian EEZ, but there is historical information available on turtle nesting beaches.

6.1.2.1.4. Marine invertebrates

Marine invertebrates are the least studied group and therefore the least well known. Within the Djiboutian EEZ, the main invertebrates are mollusks, crustaceans, cnidarians (corals) and polychaetes.

Echinoderms
No detailed studies have been conducted on this group of marine invertebrates. However, in different studies (Pichon, 1989, Obura, 1999), eight species of echinoderms have been identified in Djiboutian waters: three species of sea stars, three species of sea urchins and two species of holuthiridians. According to Obura (1999) echinoderms and other mobile invertebrates are not very abundant in the coral reefs of Djibouti, with the exception of sea urchins, especially the species *Diadema setosum, but also Echinothrix diadema*, which are abundant at Arta Plage and on the reef flat at Musha. The particular abundance of these species indicates the onset of degradation of the coral reef.

Crustaceans
Only 10 species of crustaceans have been identified in Djiboutian waters (Bouhlel, 1988, Gouvernement de Djibouti, 2000a): three species of lobster, the *cicada raquetta*, three species of crabs and three species of shrimps. The spiny lobster species potentially present in Djibouti are *Panulirus homarus*, *Panulirus versicolor Panuliru sornatus* and *Panulirus penicilatus*. In Djibouti, the colorful lobster (*Panulirus versicolor*) is the most exploited. This species occurs on the reefs of Musha and Maskali Islands, Khor Ambado, Haramous Islands and Obock (Bouhlel, 1989).
The three species of shrimp are *Penaeus semisulcatus*; *Panaeus indicus* and *Metapenaeus monoceros*. The species *Panaeus indicus* is the most important. It inhabits the shallow bottoms of Doraleh and the coast between Haramous Island and Loyada. Fishing
The species of crabs are: *Lupapelagica*, *Portunus convexus* (Red legged swimming crab) and *Lupapelagica*. The swimming crab is common to the Gulf of Tadjourah. It is found abundantly on the muddy seabed located in Heron and around the Haramous Islands (Bouhlel, 1988, p 377). The *Lupapelagica* species, known as blue swimming crab is uncommon in muddy waters. It is found in coral reefs in deep water (10 to 50 m).

Mollusks

No detailed inventory has been made of any of the groups of molluscs in Djibouti. However, in a very illustrated book, Coulombel (1994) presents physical descriptions and distribution maps for 176 species of gastropod mollusks and 40 bivalves of Djiboutian waters. To this can be added at least one species of chiton, three species of nudibranchs and four species of cephalopods (various sources), giving a total of 224 identified species (Gouvernement de Djibouti, 2000a). Coulombel (1994) also describes the distribution and abundance of marine mollusk genera in Djibouti. Strombus and Murex genera are common in seagrass beds along the coast between Djibouti City and Loyada. Around the peninsula of Djibouti city, bivalves are abundant on sandy beaches, while muddy areas contain olives and shins. In addition, porcelain is abundant on the reef flats. Cones and porcelains are also found on the reefs along the sandy beaches that follow the coast between Doraléh and Arta Plage. Porcelain is widespread in the quite isolated waters of Ghoubbet Al Kharâb and reaches a significant size in protected areas.

Corals[17]

The coral reefs of the northern shores of the Gulf of Tadjourah have been studied by Gravier (1911) and Obura (1999). The Obura study is the largest and by far the most comprehensive. During its investigations, Obura (1999) identified 167 coral species. Of the sites surveyed, 93 species of coral were observed on the sites of Arta Plage and Trois Plages, in the Gulf of Tadjourah. The dominant species are *Acropora hemprichi*, *Echinopora fruticulosa* and *Porites nodifera* (Obura 1999; Pilcher and Djama 2000).

In the Gulf of Tadjourah, a recent study on coral reefs was conducted by the CORDIO teams (CORDIO, 2015, 2016), and the Cousteau Foundation (Klaus and Newman, 2014); Klaus et *al.*, 2016), under the IGAD-IUCN project. This study listed 53 genera of corals. The most abundant coral groups are: Acroporidae and Pacilloporidae, Poritidae, Faviidae, Mussidae, Pectinidae, Agaricidae (PRAREV, 2016).

Table 17 : Synthesis of species of marine fauna and flora of Djibouti

Taxonomic group	Number of species	References
Marine Mammals	12	Robineau and Rose, 1982, 1983, and 1984
Fish	454	Rose, Tello and Gilbert (1980), Bouhlel (1988), Khunzel (1996) Barrat and Mandley (1988) Barker et al. (2002), PERSGA (2003) and Obura (1999), CORDIO (2015a)
Mollusks	224	Columbel, 1994
Crustaceae	10	Bouhlel, 1986
Echinoderms	8	Obura (1999)
Corals	167	Obura, 1999, CORDIO, 2014, PRAREV, 2014

[17] *This chapter can be completed with the coral survey performed by Dr. Omar Moussa with Insuco in January 2019*

6.2. Project sites description

6.2.1. Site1: Port of Djibouti

6.2.1.1. Overview of the site

The International Autonomous Port of Djibouti (PAID) and the northern part of the city of Djibouti are located on a madreporic shelf (Plateau du Héron). On both sides of this shelf, the coral reefs are clearly visible *(see Figure 23).*

Figure 23 : Overview of the peninsula of the city of Djibouti and the western coast which includes the DjibPort Site 1

The southwest of the peninsula of the Djibouti city contains Ambouli wadi which flows into the sea as a delta. The Site 1 DjiPort is located on the west coast of the city of Djibouti. It is surrounded on the north by PAID, on the south by the fishing port of call and on the east by the "Route de Venis" (*see figure 23 and figure 23)*.

6.2.1.2. State of the site

During our study, the site was littered with garbage, including many bottles of mineral water and plastic bags piled up in the wave swaying area. The site is devoid of vegetations. A few fishing boats seized from illegal fishermen are moored on the shallow area near the coast.

Figure 24 : Infrastructures around DjibPort Site 1: PAID, Naval Force, fishing port called "Escale de Djibouti", Coast guard and the two lagoons

Photography 2: Djibouti Port Site 1: moored fishing boats, rocky coast, sandy seabed (photo taken in august 2018 by Moussa Omar)

6.2.1.3. Description of the habitats

The Djibouti Port-Site 1- is located in a lagoon formed between the PAID in the north, the Route de Venis in the East and the south by the port of call "Escale de Djibouti" *(see Photography 2).*

Figure 25 : Map of different types of seabed in the coastal zone of the Gulf of Tadjourah (Seascape, 2016)

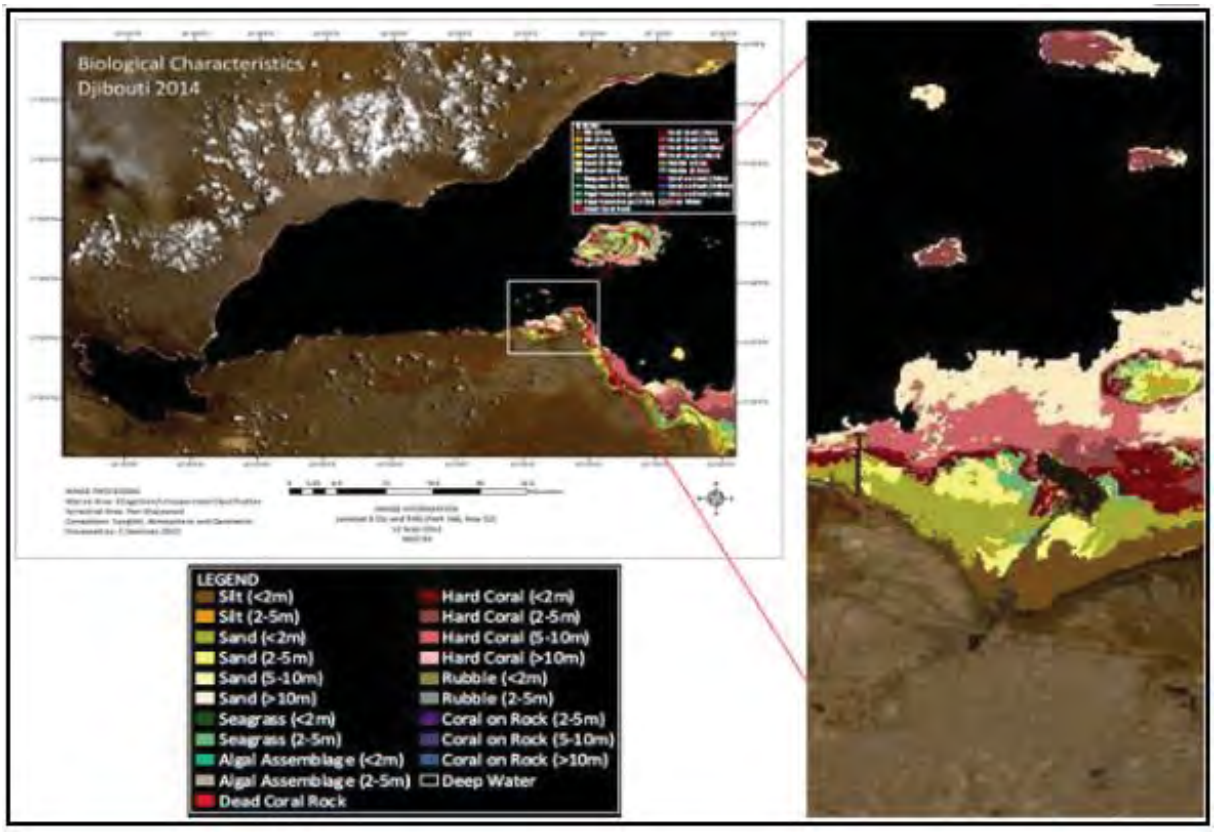


Figure 26 : Coastal habitats classification map (Seascape, 2016), focus on the DjibPort Site 1

Two types of substrates are observed on this site: (i) basalt blocks that form the bedrock at the wave breaking zone and (ii) the muddy sand. The granulometry of sand is mixed with gravel at the coast and finer in the submerged area.

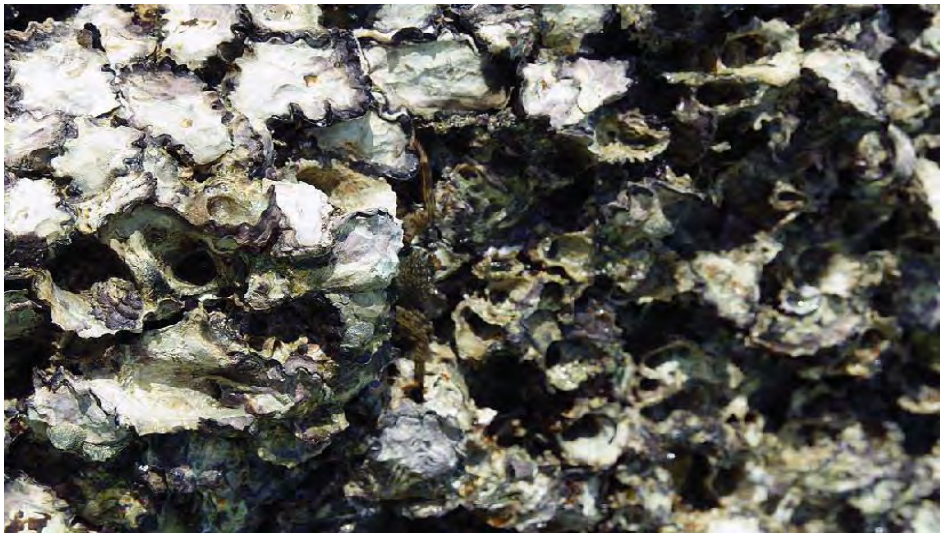
The habitat of this area has not been studied. The Systematic Conservation Planning and preparation of a Marine Spatial Plan for the Gulf of Tadjoura-Ghoubet-el-Kharab Seascape - Djibouti (Klaus, 2016) provides the first information on the types of habitats potentially present at this site. This mapping, which

integrates several data sources (topography, bathymetry, marine geomorphology, seabed structure, biodiversity, etc.), reveals that the seabed is mostly composed of muddy sand between 2 and 10 m deep. The maps of habitats also indicate the presence of hard corals (on rocks), phanerogam meadows, rubble and algae (Figure 26 and Figure 27). The information collected from Port Divers and coastguards confirm the information provided by the Seascape (2016) cartography. The hard corals would develop preferentially on the rocky edges in the western part of the lagoon (Houssein, pers Com)[18].

6.2.1.4. Biological communities

No studies have focused on the marine fauna of this site. In the absence of data, the consultant relied on information collected from local fishermen, coastguards and divers at the Port. This information has been supplemented with the Djibouti Fish Guide (Bouhlel, 1988) which describes the different species, the type of habitat frequented and the areas where the species is usually found (see photo 3 and 4).

Photography 3: Rocky coast and its biological communities (mollusks)



Photography 4: Oyster colony on rock (Saccostrea cucullata) (photo taken in august 2018 by Moussa Omar)

[18] Coastguard diver

The combination of this information allowed the establishment of a list of fish species and invertebrates potentially present on Djibouti Port Site 1 (Table 12).

6.2.2. Site 2: Port of Tadjourah

Figure 27 : An overview of the Tadjourah Port -Site -2 showing coral reef, sandy and gravely seabed

The Tadjourah Port Site 2 is located in Tadjourah at the berthing port of the new ferry. It is bounded on the east by the Tadjourah port of call and on the west by the breakwater route (Figure 26). To the south from the coast, it will spread outwards for a distance of 230 m.

6.2.2.1. Description of the physical environment

From the coast, there is a shallow area of fine sand that ends at a hundred meters by a slope. This area of fine sand is bordered on the west by a coral reef. The area between the reef and the beach is composed of sand and gravel (Figure 27).

6.2.2.2. Description of the habitats

At Tadjourah Port Site 2, three types of bottoms are clearly distinguishable. On figure 28 we can distinguish:

- coral reef (green),
- gravelly sands (purple) ,
- fine sands (gray).

These different types of seabed appear on the Seascape (2016) cartography (Klaus, 2016). The map shows the presence of sand in the intertidal zone and hard corals in the continental shelf area (Figure 27, in yellow and red).

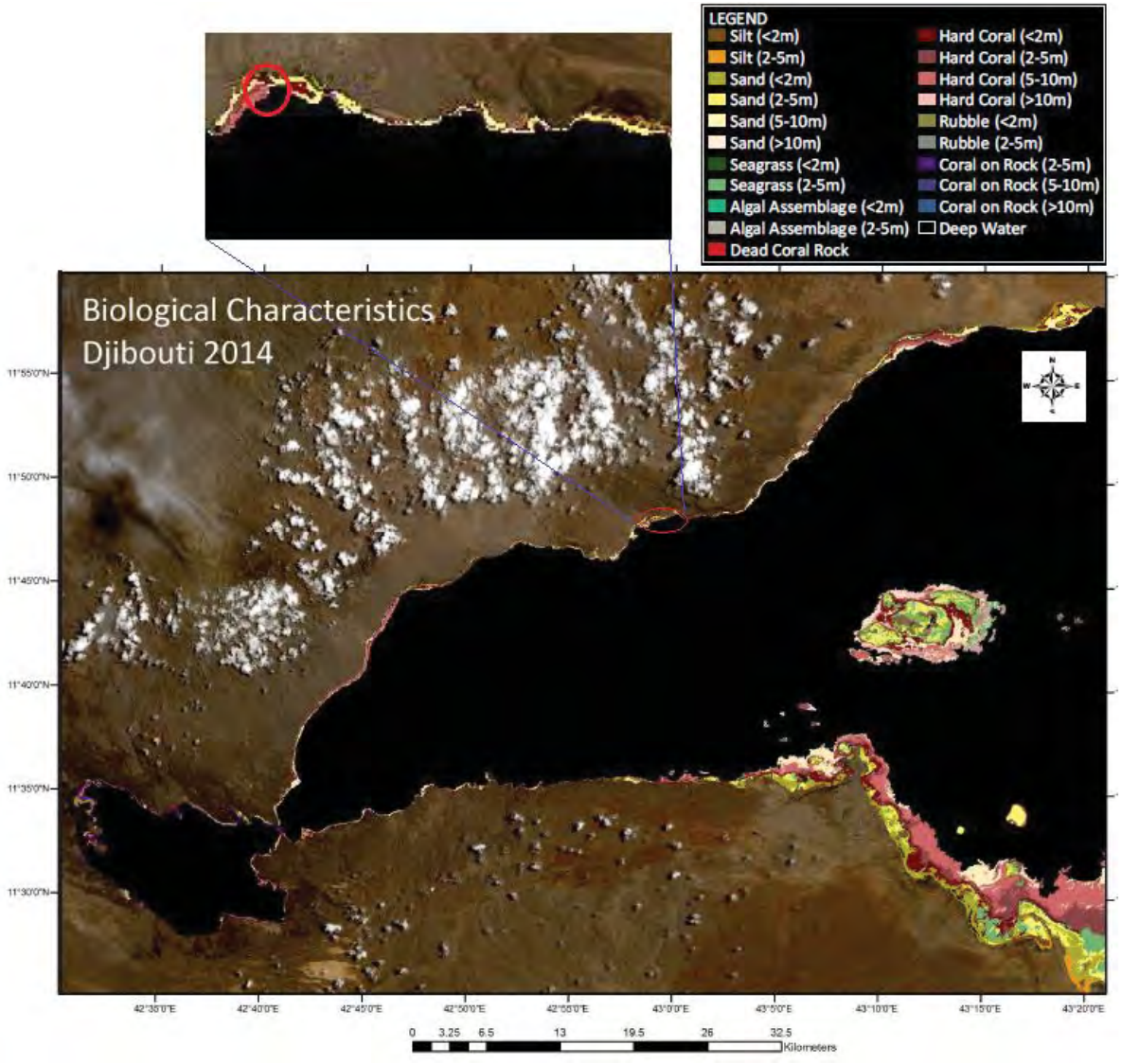


Figure 28 : Different types of sea bottoms on TadjPort Site 2: fine sand (gray), gravelly sand (viollet) and coral reef (green), (Seacape, 2016)

6.2.2.3. Biological communities

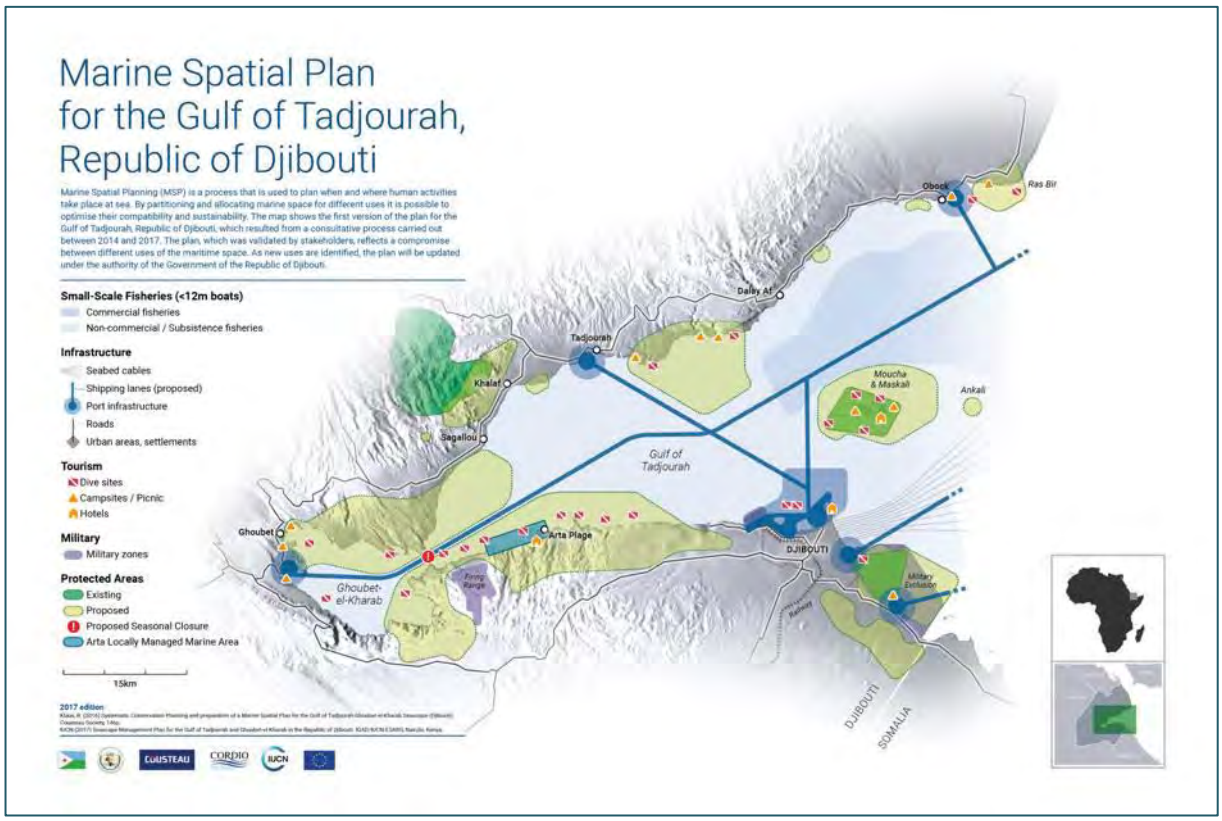
Like Djibouti Port -Site 1, the Tajourah Port -Site 2- is home to the characteristic species of sandy and gravelly seabed. It contains all species subservient to sandy, gravelly and rocky seabed (see Table 2).
Reef species
The coral reefs that line the shoreline of the town of Tadjourah are not studied. These reefs are different from the fringing reefs found along the northern shores of the Gulf of Tadjourah and have been the subject of several studies (Obura, 1999, CORDIO, 2014, Klaus, 2016).
All coral species identified by Obura (1999) and fish species identified by Barrat ans Mendley (1986) are potentially in the reefs bordering the Tadjourah Port -Site 2.

Table 18 : Species potentially present in both study zones

Fish	
Fustilaria petimba	Albula glossodonta
Acinaceous Gerres	Arius thalassinus
Gerres oyena	Tylosorus acus melanotus
Pomadacys argenteus	Bothus pantherinus
Pomadacys kaadan	Pseudorhombus arsius
Hemuramphis far	Drepane longimana
Kyphosus vaigiensis	Leiognathus lineolatus
Lisa vaigiensis	
Valamugil saheli	
Upeneus bensasi	
Abudefduf sexatilis	
Psttodes erumei	
Gastrophysus spadiceus	
Lagocefalus sceleratus	
Terapon jarbua	
Crustaceans	
Penaeus indicus	
Lupa pelazica	
Charypdis	
Mollusks	
Acanthopleura granulate	
Patellas sp.	
Monodonta sp.	
Saccostrea cucullata	

7. Physical environment in brief

The geotechnical data gathered in this scoping report are the result of desktop studies and is a compilation of knowledge and data produced for port development projects as well as for conservation biodiversity project. The new and specific data will be produced in the framework of the environmental and natural conditions surveys.



Map 6: Map of the Tadjourah's Gulf

7.1.1. Topography and geology

The Republic of Djibouti is located in a volcanic active region known as the Afar Triangle. Around thirty million years, the tectonic activity with the Arabian, African and Somalian plates three (Arabia, Africa and Somalia) has led to the opening of the Gulf of Tadjourah and the formation of a vast regional depression, called Afar depression. This Afar depression is the result of the movement of the Danakile plate, formed by the block north of the Gulf of Tadjourah. The last major sismic event resulted in the appearance of the Ardoukoba volcano, in 1978, in the Asal rift area. Ardoukoba results from a crack in the ground, caused by rifting between two diverging plates, fed by a hotspot and can be considered as one of the most recent volcanoes.[19]

Seismicity in the Republic of Djibouti is important: it is related to the activity of the Tadjourah Ridge. More episodically, there are significant earthquakes whose magnitudes average around 4 to 5, followed by many aftershocks (several tens, hundreds or thousands) during seismic crises. Historically, damages caused by seismicity are quite rare because of the limited magnitudes[20]. The dangers of seismicity, however, remain potential in the coastal zone, the areas near the Gulf of Tadjourah and Ghoubet being

[19] Ardoukoba, the seven-day Wonder in the Afar triangle: https://volcanohotspot.wordpress.com/2016/11/27/ardoucoba-the-seven-day-wonder-in-the-afar-triangle/

[20] Coast profile of the Republic of Djibouti, p22

the most vulnerable given the passage of the oceanic ridge of the Gulf of Aden in the Gulf of Tadjourah and Ghoubet until to the Asal rift.[21]

7.1.2. Geomorphology

The geological history, marked by volcanism and tectonics, still active today, explains the landscape and geomorphology in Djibouti. The landscape is characterized by a succession of steep mountains, plateaus and plains. In all the coastal zone, however it changes rapidly from one site to another. There are three main coastal plains: those of Djibouti, Tadjourah and Obock. They are the result of sediment thrusting by wadis and are associated with marine formations and wind deposits. The rest of the coast is marked by more plateaus and mountains. Much of the coast is characterized by steep cliffs, linked to fracking.
Between 3.4 and 1.5 Ma, the basalts and Gulf basalts characterize the expansion of the plates and the opening of the Gulf of Tadjourah[22]. Gulf basalts are located on either side of the Gulf of Tadjourah.

7.1.3. Meteorology

The Republic of Djibouti has an arid tropical climate characterized by high temperatures and evaporation throughout the year as well as low and irregular rainfall. The classification in arid tropical climate of Djibouti is based on monthly average data of temperatures, precipitations and evaporation.
Local and regional topography exert so much influence on the climate in different parts of the country that the average annual rainfall is much lower than other areas of similar latitude elsewhere on the African continent. The rainfall analysis defines 3 seasons in the country: summer (June, October), spring (March, May) and winter (November, February)[23]. Specific data for Tadjourah seem to be difficult to obtain.

	2006		2007		2008		2009		2010		2011	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
Janvier	22	29	18	30	20	30	20	30	23	29	20	30
Février	24	30	20	30	19	30	21	31	24	30	20	33
Mars	24	31	22	32	18	31	22	33	25	31	22	33
Avril	26	32	24	33	23	33	23	34	28	33	23	34
Mai	28	37	25	36	26	35	25	39	30	36	25	44
Juin	30	39	29	42	31	40	29	45	32	39	29	45
Juillet	32	43	25	43	32	42	31	47	33	41	31	46
Août	31	41	24	43	32	42	29	46	32	42	28	45
Septembre	30	39	28	40	30	37	28	44	31	37	27	44
Octobre	27	34	23	34	26	35	25	39	28	34	24	39
Novembre	24	32	22	32	24	31	22	34	25	32	23	37
Décembre	23	30	21	31	21	30	23	32	23	30	20	32
Moyenne annuelle	26,7	34,7	23,4	35,5	25,1	34,6	24,7	37,7	27,7	34,6	24,3	38,4

Figure 29: Temperatures (minimum and maximum in Djibouti city) in degree celsius. (Source: Statistic Document, 2012)

7.1.4. Hydrographic and hydrogeologic conditions

The hydro-climatic studies (BGR 1982) on the statistical characteristics of rainfall, have defined from west to east 5 climatic zones in which the distribution of rainfall differs slightly. The maximum annual monthly rainfall is observed in the mountains west of Tadjourah (Goda Massif).
The average annual rainfall in the country is about 150 mm. The country is particularly marked by the low rainfall, which results in the absence of permanent watercourses. On the other hand, catastrophic floods occur from time to time causing major human and material damage, as was the case particularly in 1989, 1994 and 2004. In two days, in 1994, the rains exceeded 60 mm in Djibouti and 100 mm at the

[21] Ibid, p22
[22] Ibid, p34
[23] Integrated Management program of the Coast zone of Djibouti, 2004, p7

PK50 station (kilometer point 50, starting from Djibouti). An analysis of the rainfall trends over the medium term made it possible to observe, in certain stations, trends in the decrease of rainfall.

7.1.5. Water quality[24]

In the Republic of Djibouti the sea is represented by the Ghoubet, connected to the Gulf of Tadjourah by a narrow pass, and by the Gulf of Tadjourah which opens on the Gulf of Aden to the East. The morphology of the underwater surface results from the recent geological history. In the Ghoubet, the depth of the sea exceeds 200 meters. In the Gulf of Tadjourah, the depth of the sea reaches 700 meters in front of Tadjourah and 1000 meters north of the Moucha Islands. In front of Obock, the Obock pit is over 1300 meters deep.
Two sea flats can be recognized east of the Obock plain between Obock and Doumeira, as well as east of Djibouti, in the area between Djibouti City and the Moucha-Maskali Islands. In these areas, the depths remain a few tens of meters. They are limited, offshore, by steep cliffs bordering the deepest depths. The salinity of seawater varies from 39.3 g / l in November to 125 m depth to 37.7 g / l in June on the surface. Surface temperatures fluctuate between 28 ° C and 30.5 ° C. The cool-season thermocline (March) in the Gulf of Tadjourah is about 60 meters deep and is characterized by a sharp drop in temperature from 26.5 ° C to 22.5 ° C.

[24] Ibid, p9

8. Stakeholders engagement

8.1. Category of stakeholders

Given the fact that the project is expected to collaborate with a multitude of different actors, there is a need to develop and implement a communication and stakeholder engagement plan to facilitate communication. Stakeholders are numerous and belong to different categories of actors.
They can also be classified into four categories according to their interests and influences in the implementation of the project, namely:

- **Organizations with the most interest and influence** in the implementation of the project: These are the institutions responsible for the project management, the public institutions in direct correlation with the sector impacted or correlated to the project, as well as national and international economic investors interested in the transport sector;
- **The entities with the most interest and the least influence** in the implementation of the project: They consist of the final beneficiaries of the impacts of the implementation of the project, such as households.
- **Entities with the least interest and influence:** They are usually management or decision-making bodies, public institutions and / or technical and financial partners that have no direct interest in the implementation of the project but whose experience or opinion can have a lasting impact on the project implementation process.
- **Entities with little interest and little influence:** they are usually consultative bodies, technical and financial partners, etc.

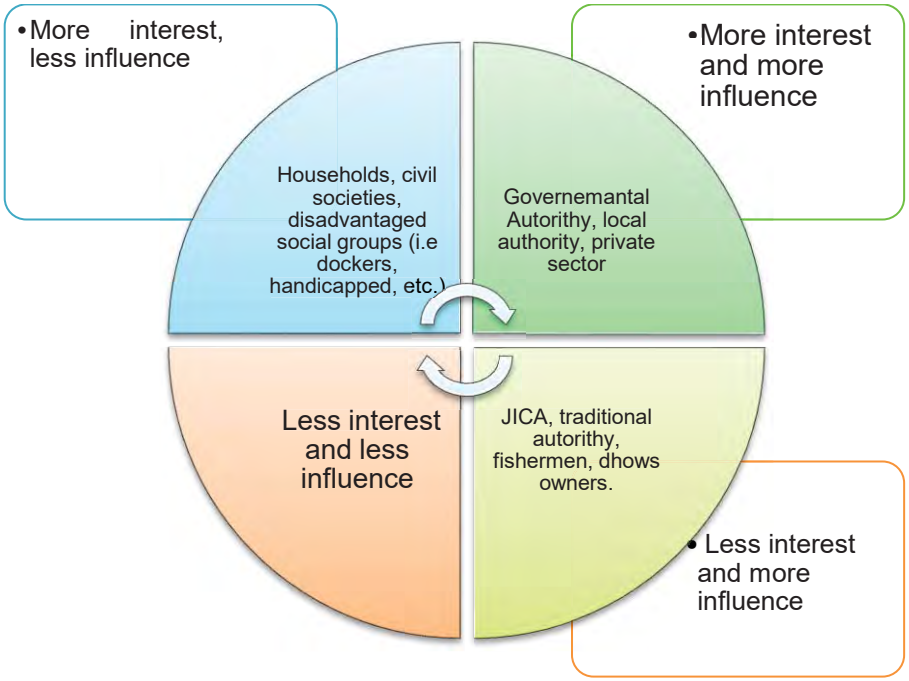


Figure 30 : Different stakeholders

8.2. Stakeholder mapping

In order to carry out a complete mapping of the project stakeholders, the list of all the institutions involved as well as people directly or indirectly affected by the project was carried out both in Djibouti and Tadjourah. The information collected during the survey conducted on these two sites is summarized in the tables below.
Two large stakeholder meeting have taken place in the begin of July (July 3rd in Tadjourah and and July 9th in Djibouti). Powerpoint presentation are available as support documents.

8.3. Site 1: Port of Djibouti

In Djibouti, eight (8) stakeholders, divided into 3 categories, were identified. Those are:

- Public authority;
- Private sector;
- Civil society.

Half of the stakeholders (50%) see the project as an opportunity while 38% of them think that this project has no influence on their activities and 12% see it as a threat. This table can be combined with the impact matrix establish at the scoping stage. It can be found in annex 6.

Table 19 : Impact of the project on Djiboutian stakeholders

N°	Category	Stakeholders	Responsibility / Activities	Opinion on the project	Expectations	Fear	How engaged/ how to engage?
1	Public authority	Directorate of Maritime Affairs	Organisation & development of maritime affairs	Opportunity	Improvement of maritime transport conditions between Djibouti and Tadjourah, wishes to remain the supervising minstry	-	Signed MOU, production of ESIA and other studies
2	Private Sector	Ferry Docker	Loading/Unloading goods	Opportunity	Increase of the income, improvement of working conditions	Accident on the workplace, injuries	Communication/ information
3	Private Sector	Dhows' docker	Loading/Unloading goods	Neutral	-	-	Communication / information
4	Private Sector	Informal restauration	Food sale	Opportunity	Increase of the number of clients, increse of incomes	Competition	Communication / information
5	Private Sector	Dhow	Transport of persons and goods	Neutral	-	-	Communication / information
6	Private Sector	Speed boat	Transport of persons and goods	Neutre	-	-	Communication / information
7	Private Sector	Bus	Transport of persons and goods	threat	-	Decrease in the number of passengers Decrease of the income	Communication / information, potential collaboration ?
8	Civil society	Bus users	Bus passenegers	Opportunity	Good and confomrtable transport means	Limited number of seats available	Communication / information

					available all year long	(Limited room)	

8.4. Site 2: Port of Tadjourah

In Tadjourah, fourteen (14) type of stakeholders, divided into five categories, were identified. Those are:

- Public authority;
- Local authority;
- Traditional authority;
- Private sector;
- Civil society.

A vast majority of stakeholders (93%) consider the project an opportunity. Only a minority, 7% believe that this project has no influence on their activities. It should be noted that in Tadjourah, no stakeholder considers the project a threat. This table can be combined with the impact matrix establish at the scoping stage. It can be found in annex 6.

Table 20 : Impact of the project on different stakeholders

N°	Category	Stakeholders	Role	Opinion on the project	Expectations	Fear	Engagement
1	Public Authority	Préfecture	State representative	Opportunity	Improvement of the conditions of maritime transport, job creation	Poor management of the port	Communication / information
2	Public Authority	Fishing Direction	Ministry of agricultre representative	Opportunity	Improvement of the storage and transport conditions of the fish between the cities	High price of the fish	Communication / information,
3	Public Authority	Regional counsel	Population representative	Opportunity	Improvement of the conditions of maritime transo-oirt job creation	Too much flexibility of the schedule	Communication / information
4	Traditional authority	Customary leaders	Representative of the traditional authorithies	Opportunity	Improvement of the conditions of maritime transport, job creation	-	Communication / information
5	Civil society	Fishermen cooperative	Representative of fishermen	Opportunity	Increase in the distribution and selling of fresh fich on both cities market	High price for the transport of fish with the ferry, poor access to the jetty	Communication / information

6	Private sector	Wholesalers	Food and goods providers for the city of Tadjourah	Opportunity	Increase of the flux of goods, better exchange with Djibouti	Increase of the price of transport of their goods	Communication / information
7	Private sector	Dockers	Loading and unloading of goods	Opportunity	Increase of goods transport, increase of the income	Competition for the jobs (locals>< ethiopian)	Communication / information
8	Private sector	Dhows	Transport of persons and goods	Neutral	-	-	Communication / information
9	Private sector	Bajaj	Transport of persons and light goods	Opportunity	Increase of users, customers; increase in salary	-	Communication / information
10	Private sector	Hotels	Room renting to tourists	Opportunity	Increase in frequency of transport and number of tourists, increase of the income	Not sufficient flexibility of the schedule	Communication / information
11	Private sector	Touristic centers	Visit of the northern region	Opportunity	Increase of visitors and tourists: increase of the income	Not sufficient flexibility of the schedule	Communication / information
12	Private sector	Restaurants	Vente des repas	Opportunity	Increase of visitors and tourists: increase of the income	-	Communication / information
13	Civil society	Women association	Supportive to the project	Opportunity	Improvement of the conditions of traveling on the boat, creation of small lucrative activities	-	Communication / information
14	Civil society	Youth Association	Supportive to the project	Opportunity	Creation of a specific rate for the youngsters	-	Communication / information

While many stakeholders see the project as an opportunity for the region, direct competitors (bus drivers) see it as a threat, as they operate in the same business sector namely passenger transport.
The PEPP is structured in two main actions:

- A communication plan primarily aiming at harmonizing the evel of information on the projects for all the stakeholders and local partners and then establishing more sustainable partnerships;
- A partnership engagement strategy.

The PEPP will evolve as the project progresses and adapt to changes in perception and commitment of the PPs. It will have to be regularly re-evaluated.

8.5. Specific exchanges

Some issues or concerns were raised during those meetings. Hereunder are presented the different answers that could be given by the expert during his days on the field:

Table 21: Specific exchanges with stakeholders in Djibouti

Participants	Opinions and concerns raised by participants	Responses from the the Consultants/DMA
DJIBOUTI		
Dockers of the ferry	Accident on the workplace, injuries	The expert collected the complaints while explaining that he can not make any commitment. He therefore recommended to discuss with the DMA for these questions.
Bus	Decrease in the number of passengers Decrease of the income	The consultant first shared with the drivers the observation collected through the exchanges done with the users who are not satisfied with the services offered. He recommended them to think of ways of improvement. Moreover, it should be noted that the ferry by its volume, its shape is not equal to a bus. Therefore, they can not compete. On the other hand, this does not mean the end of bus transport since there will always be customers for the bus: for instance, those living along the road. Finally, as the expert can not make commitments, it is recommended to discuss with the DMA for greater precision.

Table 22 : Specific exchanges with the stakeholders in Tadjourah

Participants	Opinions and concerns raised by participants	Responses from the the experts/DMA
TADJOURAH		
Préfecture	Poor management of the port	The consultant exchanged with the prefect on ways and means to improve the management of the port. Thus, a reinforcement of decentralized service of the DAM was evoked. But, as the expert could not make commitments, it was recommended to discuss with the officials of the DMA.
Hotels	Not sufficient flexibility of the schedule	The grievance was collected. As the expert can not make commitments, it was recommended to discuss with the DMA for further clarification.

8.6. Communication plan

8.6.1.1. Objective

The overall purpose of the communication is to promote the opportunities offered by the project to potential beneficiaries and ensure its ownership.
The communication mission in the context of the implementation aims specifically at:

- **Ensure the visibility** of the project by informing and raising awareness among its various internal and external stakeholders at the local and national levels;
- **Involve**, to a large extent, private sector enterprises, communities, local and national NGOs as well as state and decentralized government agencies in a collaboration;
- **Define the different stakeholder groups**, involve them in order to collect inputs for the design of the activities, take stock of the progress made, provide information on the next steps and validate their progress;
- **Sensitize stakeholders on JICA/SFI** standards and national environmental requirements.

8.6.1.2. Content and communication tools

The main communication tools that will be adopted by the project are presented in this section. It should be borne in mind that this is a set of instruments that could be supplemented or replaced by others depending on the progress of the project.

- **Communication through the media**

To ensure effective media coverage, the media must be regularly fed by the project. The radio bulletins will be written in local languages: afar and somalia. As the literacy rate is low in Tadjourah, it is recommended to opt for radio and television programs to get the message across. On the other hand, press releases will be developed and sent to journalists to maintain and show the dynamics of the project.

- **Promotional leaflet**

The leaflet presenting the project and disseminating the expected results is produced in the base period in French and is intended for all project stakeholders, including potential grant applicants, public authorities, etc.

- **Written materials for conducting meetings with stakeholders (study reports, mission reports, minutes, PP presentations, etc.)**

These are working papers that need to be disseminated to stakeholders to inform and assist in decision-making. For example, the Fisheries Branch has expressed the wish to be more involved. It would be interesting to take advantage to share the maximum of information with them.

8.7. Engagement strategy

In a second step, the project must carry out a more comprehensive stakeholder engagement strategy that will address the following issues:

Recruitment: give priority to young people in the region. Indeed, during the construction phase of the port infrastructure in Tadjourah, young people can be employed as simple workers or security guards. During the operational phase, the youth of Tadjourah can be incorporated into the coast guard to provide security at the port as on the new ferry. In addition, they can also integrate the strengthened decentralized service of the DMA, based in Tadjourah.

Strengthen the capacity of the DAM: The lack of efficiency of the service offered by the direction of the ferry is often pointed at. Thus, we can consider strengthening this service by setting up an office in the new hangar with a fixed number that can inform customers, make reservations especially for vehicles. This office, which will take up residence next to the boat dock, will issue tickets and regulate access to the ship. Thus, the passengers will board before the cars. Priority will be given to the elderly, persons with reduced mobility, pregnant women, patients, etc. Schedules should consider the concerns of users and stakeholders in the region. That is why it must be fixed after consultation. Any change of time or disruption will be reported a week before on television and radio.

Valuing the job of dock worker: Currently, dockworkers live in a precarious situation. They have no work equipment and do not have medical coverage. In collaboration with the DMA, the project can provide them with work equipment such as gloves, helmets, shoes, etc. The setting up of a medical cover as well as a lump sum monthly allowance could also be discussed with the managers of the DAM.

Management of Tadjourah Port: The new, larger capacity ferry will serve Tadjourah port daily. It will then be necessary to set up rigorous and methodological management. This involves setting up a detached unit of the DAM, active, which will regulate access to this point. Thus, any merchandise will be stored only for a fixed period, agreed during the consultation with the merchants. After this period, the merchant will be inflicted a fixed amount/fine which will increase with time. The car park will include places for cars and places for bajajs. Any vehicle or bajaj crossing this barrier must be sanctioned.

Fishing cooperative: the very dynamic fishermen's cooperative will be able to use the new ferry to transport fresh fish and sell them on the capital's market. For this, the new ship could include a room dedicated to their uses. The transport price must be set in agreement with the cooperative's managers. The new, larger ferry can spike fishermen who are about to anchor their small boats. An agreement will have to be found on the sustainable and long-term use of port infrastructures.

Bus Drivers: These are the only ones who consider this project a threat. This is because the new ferry is a direct and serious competitor. The survey showed that users are not satisfied with the service offered by buses whose prices are more expensive. In addition, most of these people are just employees. To think that the arrival of the ferry will definitively put an end to the existence of false buses since the latter can work in Djibouti city. These means of transport can also route passengers on the day the ferry is out of service. The project team can inform them of the progress of the project and seek to integrate them as far as possible.

Arrangements of the new ferry: The long-awaited new ferry could be equipped with a special room for medical evacuation. It would also be interesting if at least one staff member is trained in first aid. In addition, the new ferry could also include

- a room dedicated to the fishing cooperative
- a prayer area,
- a toilet for women in preference to padded rice
- Special ticket for special events (deaths and weddings)
- a billing system for the goods.

Port infrastructure: The site chosen for the construction of the new pier at Tadjourah port is suitable for everyone. In addition, to reassure the co-op, consideration should be given to the extension of the wharf and an arrangement of anchor points for small boats.

8.8. Grievance mechanism

Stakeholder's engagement is a two-way process. It is therefore important to plan a grievance mechanism that allows the stakeholders to express themselves and bring their viewpoints to the attention of the Project: requests, advices, reactions, grievances and complaints. The Project needs to be in measure to systematically take these views into account and treat them as appropriate.
The grievance mechanism is a compulsory component of an IFC or World bank financed project. It is not specifically mentioned in JICA standards therefore, the following elements are to be considered as piece of information.

The Grievance mechanism is the responsibility of the Project and it should be structured so as to be able to identify and manage the flux of communication and of grievances during all the cycles of the project. For this reason, a grievance committee could be established in order to ensure and follow the aspects of transparency and accessibility of the process. This committee may choose to have a

representative that will be designated by the project to act as liaison officer and to be responsible for managing the grievance system. The existence of a grievance committee composed of different voluntary stakeholders facilitates the access to the grievance mechanism for more vulnerable people. A grievance mechanism is a mean of direct communication and makes it possible to avoid lots of social risks.

Hereunder is a simplified scheme of a classif grievance mechanism. According to the projet, the client or the promotor of the project will be in charge of its implementation – if it is agreed to establish one.

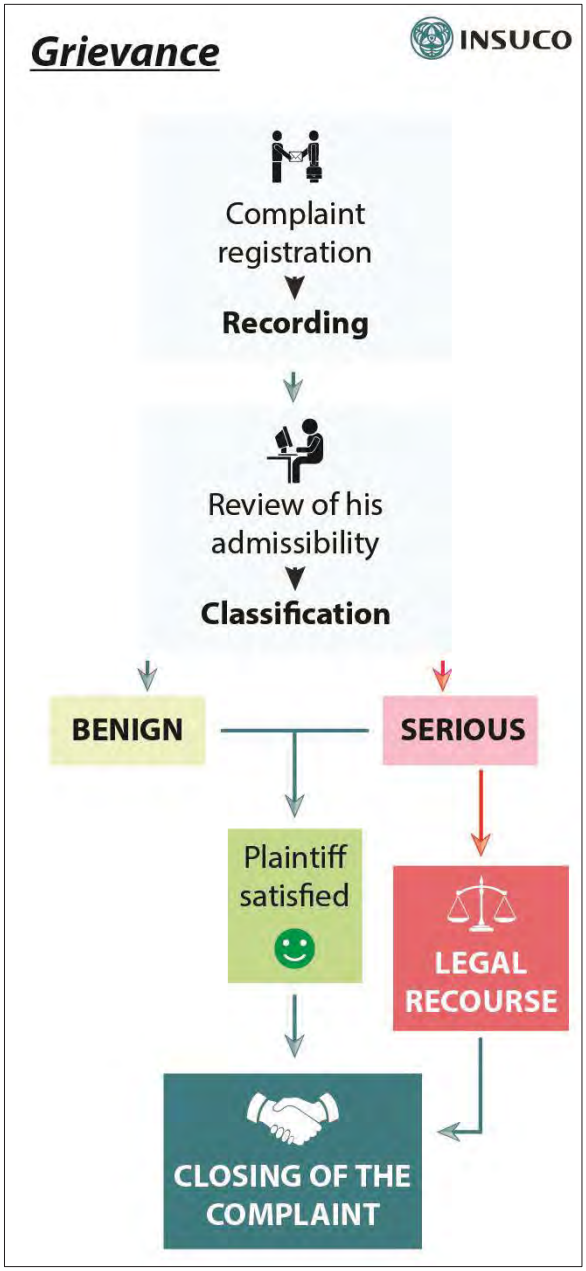


Figure 31: General Grievance Mechanism

9. Conclusions

9.1. Socio-economic environment

The socio-economic study of the ferry project took place both at the port of Djibouti and the port of Tadjourah. All stakeholders were consulted for their views. This consultation took place in a pleasant atmosphere. Most of the stakeholders see the project as an opportunity.
The engagement strategy should be considered as potential improvement perspective for the project and as basis for the impact assessment and social and environment management plan. The attention has been given to the increase of transport between Djibouti and Tadjourah. Extra information should be identified at the Obock level in order to get a complete understanding of the project impact. We can expect similar positive and optimistic expectations on the increase in frequency of transport between Obock and Djibouti.

9.2. Biological environment

This preliminary study focuses on the biological environment of the Gulf of Tadjoura and around the two sites (Djibouti Port Site 1 and Tadjourah Port Site 2) planned for the construction of the berths for the new ferry. The main conclusions that emerge are as follows:

Due to their confluent position between the Red Sea and the Indian Ocean, Djiboutian waters are characterized by significant biological diversity, resulting from a mixture of the two biogeographical zone. The Gulf of Tadjourah (2118.48 km²) and its extension the Ghoubbet-Al-Karab (159.38 km²) is subject to the direct oceanographic influences of the Indian Oceans and the Red Sea but also the effects of the continental climate of surrounding arid volcanic lands. The marine environment of the gulf of Tadjourah includes a narrow continental shelf and a deep pelagic zone along the east-west axis in the prolongation of the Tadjourah rift.

The deep pelagic zone is frequented by migratory species. The diversity and distribution of these species varies with the seasons. This area also contains species of national and international importance as well as threatened and endangered marine life, such as whale shark, turtles, dolphins, etc.

The coastal zone supports important habitats including mangroves and coral reefs that host a wealth of biodiversity. These two coastal marine ecosystems have a high ecological value as they provide habitat and breeding grounds for multitudes of fish and invertebrates. Coral reefs around Djibouti ports are vulnerable and need special protection.
The two project sites are characterized by the scarcity of data. Based on the Seascape (2016) mapping, the study identified several types of habitats. The biological communities living in these habitats are poorly known. A list of species subservient to the identified habitats and potentially present on the sites has been established.

In order to verify and deepen these first results, further study at two sites is necessary. This study should focus on the nature and composition of habitats, the existence or not of corals, the species of fish and invertebrates that live there and their conservation status.
An Environmental survey and a specific study on corals were led from September 2018 to January 2019. Those studies enable us to identify a range of potential impacts. Those are presented in the scoping matrix of impacts (Annex 5). A more in-depths environmental impact assessment can be found in the coral survey report.

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11. Annexes

11.1. Annex1: Performance standards of IFC

The international finance company, headquartered in Washington, is the institution of the World Bank Group in charge of operations with the private sector. IFC coordinates with other World Bank Group institutions but is legally and financially independent. Its 178 members form its social capital and collectively determine its policies.
IFC's mission is to promote sustainable private investments that will help reduce poverty and improve the lives of people in developing countries and countries in transition. IFC finances private investment in developing countries, mobilizes capital in international markets, helps clients improve the social and environmental sustainability of their operations, and provides advice and technical assistance to governments and businesses. IFC's Performance Standards cover eight areas:

1. **Risk and environmental and social risk assessment and management system**: Commercial clients of financial institutions / companies in which they invest are required to manage the environmental and social performance of their economic activities. This management must also lead to communication between the client / company, its staff and the local communities directly affected by the activity being pursued. To this end, it is necessary to design a good management system, adapted to the size and nature of operations, to promote strong environmental and social performance and improve financial performance.

2. **Workforce and working conditions**: The workforce is a valuable asset for any business, and good management of employee relations is a critical factor in the success of the workforce. By protecting the fundamental rights of workers, ensuring fair treatment and safe and healthy working conditions, the commercial clients of an FI / companies in which it invests can increase their efficiency and the productivity of their operations and also strengthen the commitment and retention of their employees.

3. **Pollution prevention and mitigation**: Increased economic activity and urbanization often generate increased levels of air, water and soil pollution, which can be a threat to the population. and the environment at the local, regional and global levels. The business clients of an FI / companies in which it invests are required to adopt pollution prevention and control technologies and practices (technically and financially feasible and cost-effective) as part of their activities.

4. **Community health, safety and security**: Economic activities can increase the risks and impacts to the community, whether as a result of accidents involving machinery and equipment, structural failures and spills of hazardous materials. impacts on communities' natural resources, their exposure to disease and the employment of security personnel. The business clients of an FI / the companies in which it invests have the responsibility to avoid or reduce the health and safety risks and impacts that their activities expose to communities.

5. **Land Acquisition and Involuntary Resettlement**: Land acquisition motivated by the activities of a FI / d business clients in which it invests may result in physical displacement (relocation or loss of shelter) and economic displacement (loss of assets or access to assets resulting in loss of source of income or livelihood) of individuals or communities. Resettlement is considered involuntary when the persons or communities concerned have no right to oppose the acquisition of their land and are displaced; this can lead to lasting consequences and impoverishment of the people and communities concerned, as well as environmental damage and social tensions. The commercial clients of an FI / companies in which it invests are required to avoid any physical or economic displacement or to minimize the impact of such travel on the individuals or communities concerned by taking appropriate measures such as 'fair compensation and improved livelihoods and living conditions.

6. **Conservation of biodiversity and sustainable management of natural resources**: The protection and conservation of biodiversity (including genes, species and ecosystems) and its ability to change and evolve is of crucial importance for sustainable development. Commercial clients of an FI / companies in which it invests are required to avoid or mitigate threats to biodiversity from their activities and to promote the use of renewable natural resources in their operations.

7. **Indigenous Peoples:** Indigenous peoples are defined as social groups with identities different from those of other groups within national societies and are often among the most marginalized and vulnerable segments of the population. Their economic, social and legal status may hinder their ability to defend their interests and rights over lands and natural and cultural resources. The business clients of an FI / companies in which it invests are required to ensure that their activities respect the natural resource-based identity, culture and livelihoods of Aboriginal people and to reduce their exposure to natural resources. poverty and diseases.

8. **Cultural Heritage**: Cultural heritage includes properties and sites of historical, cultural, artistic and religious archaeological value, unique natural features, cultural knowledge, innovations and practices of communities embodying traditional ways of life, including protection is provided for the benefit of present and future generations. Commercial clients of an FI / companies in which it invests are required to prevent their activities from having a significant negative impact on the cultural heritage.

11.2. Annex 2: Basic Principles of JICA Environmental and Social Considerations

- **Target a broad field of study of the risks of impacts**

The impact risks studied by JICA cover a wide range of environmental and social applications.

- **Apply environmental and social measures from an early stage to the follow-up phase**

JICA applies Strategic Environmental Assessment (SEA) during the implementation of the master plan studies and encourages project proponents to respect environmental and social considerations from an early stage to the monitoring phase.

- **Report on its cooperative action**

Accountability and transparency are two fundamental elements of the implementation of JICA cooperation projects.

- **Promote the participation of partners**

JICA ensures the effective participation of stakeholders in environmental and social decision-making processes to raise awareness of environmental and social factors and to build consensus among stakeholders. JICA responds to questions from stakeholders, who are held accountable for their public statements

- **Dissemination of information**

In collaboration with the project promoters, JICA is providing the population with information on environmental and social issues to report on the work in this area and to encourage the participation of different partners.

- S**trengthen the organizational capacity of JICA**

JICA strives to strengthen the overall organizational and operational capacity to ensure, in all circumstances, an appropriate and effective consideration of environmental factors.

- **Improve the speed of intervention**

JICA is working to implement the project as quickly as possible, considering environmental and social considerations.

11.3. Annex 3: Classification of projects by JICA

JICA ranks projects submitted in four categories according to the extent of their potential environmental and social impact. To this end, it considers the outline of the project, its size, location, etc.

- **Category A:** A project is classified as Category A if it is likely to have significant adverse effects on the environment and society. Projects with complex or unprecedented impacts that are difficult to assess, or multiple or irreversible are also classified as Category A. These impacts may affect a larger area than the sites or facilities being worked on. Category A includes, in principle, projects in sectors that are sensitive or characteristic in terms of environmental risks, or located in or near sensitive areas.
- **Category B:** a project is classified in category B if the negative impacts it may have on the environment and society are less harmful than those of category A. Generally, these effects are limited to the project site, few of these effects are irreversible; and in most cases mitigation measures are easier to implement.
- **Category C:** a project is classified in category C if the probability of negative impacts on the environment and society is minimal or zero.
- **FI category:** a project is classified as FI if it meets all of the following requirements: JICA project financing is provided by a financial intermediary or an executing agency; Sub-project selection and approval is provided mainly by this agency only subject to JICA's funding agreement, so that sub-projects can not be defined until the funding agreement is reached. JICA (or project evaluation); these sub-projects are likely to have a potential impact on the environment.

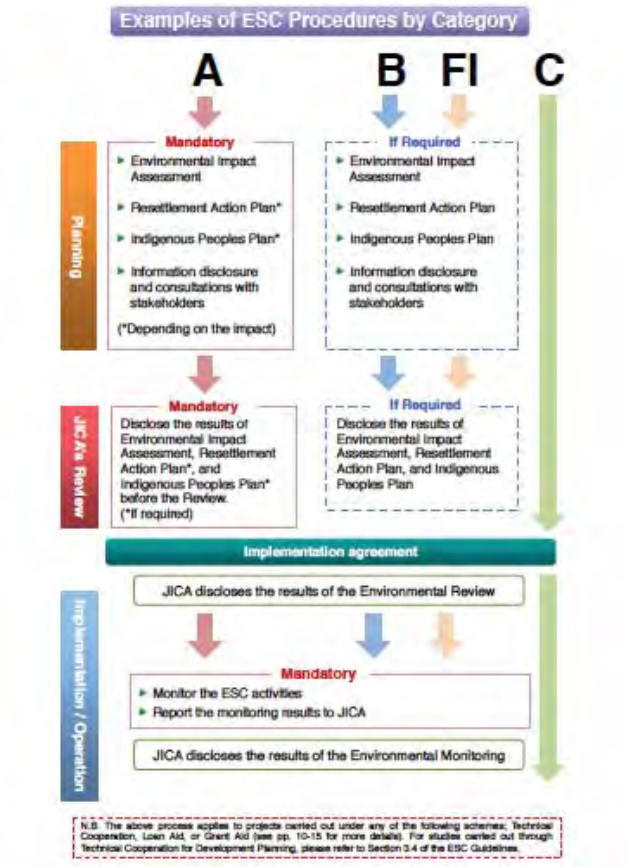

Figure 32 : Different categories of project according to JICA

11.4. Annex 4: Features of the new ferry

- **Design of the hull**

The hull of the ship should allow safe navigation in season Khamsin and it should be of the type adapted to the water depth of the port of Djibouti and the port of Tadjourah. The turning performance of the ship will be taken into consideration.

- **Navigation area and stability performance**

In the report of the "Survey for the Collection and Confirmation of Information on the Sea Transport Capacity of the Gulf of Tadjourah" conducted in 2017, as constraints and marine weather conditions it is mentioned that the (maximum) wind speed is 15.0 m / s and the swell height (maximum) 1.8 m. Therefore, the zone corresponds to the limited coastal zone according to the MTITT rules. The stability performance will be calculated based on this classification of the area.

- **Examination and confirmation of the weight on board and the boarding conditions**

The number of vehicles on board and the number of enlisted passengers requested by the Djibouti side will be examined and confirmed. The vessel shall be designed considering the speed of navigation and the improvement of the stability on the basis of the weight on board and the expected conditions of boarding.

- **Separation of passengers and vehicles**

The layout plan of the hull will be studied to ensure the safe loading and unloading of passengers and vehicles.

Basic plan (preliminary draft)

- **Improved stability performance**

The vessel will be a displacement type with a light alloy superstructure to lower the center of gravity position to provide better stability performance.

- **Propulsive efficiency**

The helix diameter will be as large as possible based on the result of the bathymetric study to increase the propulsive efficiency. The bow bulb in round shape will be installed at the front of the hull to allow the increase of the speed by the reduction of the hydrodynamic resistance.

- **Maneuvering performance**

The bow thruster will be installed to ensure good maneuvering performance, and the rudder will be adopted to improve rudder performance.

- **Examination of the car deck and the boarding / disembarking ramp**

Passenger transport circuits from the vehicle deck to the loading / unloading point will be traced and those of passengers and vehicles will be separated by means of sidewalks, handrails, etc. This information will be integrated into the terminal's basic plan to ensure consistency between them.

11.5. Annex 5: Survey template for the data collection

Points of discussion	Answers
1- General information on the interviewed person	
Gender	
Age	
Adress	
Etat civil	
2- General information on the job done	
Age range to do the job	
Physical conditions to have to correctly do the job	
Accademic knowledge	
3- Activities, Responsabilities	
Activities	
Work schedule de travail	
Type of work (temporay, daly, fixed terms,…)	
Rate for a private person	
Rate for a trader, rate for disembarkation of a package	
Rate for a trader, rate for the loading of a package	
For a trader, your rate for the disembarkation of a bag of 50 kgs	
For a trader, your rate for the disembarkation of a bag of 50 kgs	
Exemple of forbidden/unauthorized merchandise / non autorisé (tiles?)	
4- Schooling/Level of education	
Ability to read and/or write	
Which written, read and spoken langages ?	
Quality used to hold the job	
5- Revenues	
Daily income	
Sparing habits/amounts	
Rate and sparing frequency	
Sparing modality (social sparing system)	
Any other sources of income	
6- Spending	
Monthly spending	
Health expenses Dépense santé	
Education expenses	
Housing expenses	
Food expenses	
7- Health	
Beneficiary of the medical cover (indicate the percentage of the number of persons benefiting from social covers/services out of the total mount of persons present in the focus group)	
Health care	
8- Work accident	
Any professional accidents	
What kind of accident	
Frequency: often, regularly, never…	
What are your options in cas of an accident?	
9- Equipement	
Work equipment: trolley?	
Protection equipment: gloves, helmet, etc.	
10- Organisation	
Many persons do the job.	

Member or existence of any socio-professional organizations?	
11- Gender	
Women active in tha profession?	
If yes, how many?	
Of none, why?	
What do you think about that situation?	
How could we increase the number of women in that profession?	
12- Which knowledge of the Project?	
Have you headr about of the project?	
Source of Information	
Expectations	
Negative impacts	

11.6. Annex 6: First identification of potential impacts

11.6.1. Social impacts

This project is classified as a Category B project, according to the JICA guideline. This assumes that it has a limited negative socio-environmental impact. Indeed, the analysis of various parameters selected shows that:

- The project does not require the resettlement of local populations both at the port of Djibouti and the port of Tadjourah.
- That it does not have a negative impact on the lives of local people. Indeed, all stakeholders consider that the project is an opportunity that will allow the economic development of the region. Only bus drivers bound for Tadjourah, who were taking advantage of the ferry's pause during the hot season, consider it a threat.
- The cultural heritage is affected neither in the port of Djibouti nor the port of Tadjourah.
- The seascape may be affected. This explains why a pre-project environmental study has been launched.
- The indigenous population consists of dockworkers working on both sites. These people more vulnerable, often of Ethiopian origin, fear for their future, because of a revaluation of the profession that could generate the project;
- The working conditions in force in the country are respected. However, since the working conditions of these workers are difficult (they carry heavy loads without means of protection), for a better efficiency, the project could try to improve their working conditions.

11.6.2. Scoping matrix of impacts

Based on the different surveys social, environmental and geotechnical, the scoping matrix of impacts presented hereunder has been produced.
This scoping matrix will have to be reviewed and completed during the ESIA.

Table 23: Scoping matrix of impacts

	No.	Item	Phase		Expected Impacts
			Planning Construction	Operation	
Pollution control	1	Air Pollution	A-	B-	Emission of dust and gas from the mobilized engines will be high during the planning and construction phases. During the operation, the pollution of air will only be limited to the boat fumes produced by its functioning.
	2	Water Pollution	A-	A-	During the construction phase, we can expect an increase in the suspended solid concentration in the water column to which we can associate an impact on coral growth. The pollution of seawater is associated with the breakwater construction and the dredging and excavation activities. We can also identify that the construction of the breakwater will have a continuous impact on the circulation of water (as long as the breakwater remains).

	No.	Item	Phase		Expected Impacts
			Planning Construction	Operation	
	3	Soil Pollution	A-	B-	The construction phase will bring in the risks of release of oils, greases and effluents. This will concern the two sites as well as the roads connecting one and another. During the operation similar risks should be considered but would be limited to the functioning of the boat.
	4	Waste	A-	B-	All the construction waste will have to be specifically managed as well as the waste produced by the passengers of the boats during the operation phase. The increase of transport of persons will increase the production of waste on both sites and on the boat trajectory.
	5	Noise/Vibration	A-	B-	The phase of construction will increase the noise and vibration level. Once the construction phase is over, the level of impact will be less and only associated with the functioning od the boat. The increase of the boat's frequency will have an impact on the vibration level: the magnitude of that impact will have to be evaluated
	6	Ground subsidence	A-	D	The magnitude of the impact will depend on the work and construction procedures. Since the soils are mainly composed of sand; the dredging will most probably have an impact on the ground subsidence. The geotechnical survey should help to evaluate the risks
	7	Odor	B-	A-	The increase of circulation between the two ports will probably cause the increase of persons going through the port and therefore the increase of waste: the management of those waste will be key for managing the odor within the ports and their outskirts.
	8	Bottom sediment	A-	A-	The seabed will be deteriorated with the dredging and excavation activities as well as during the construction and operation phases. The dredging will also impact the volume of present bottom sediment (*it will important to manage well their transport and storage*). It is also a risk to have the pollutants produced during the construction and operation phase, falling down and mixing with the bottom sediments.

	No.	Item	Phase		Expected Impacts
			Planning Construction	Operation	
Natural Environment	9	Protected Areas/ Protected species	A-	B-	The coral survey led in Tadjourah has identified the presence of 14 coral species classified as Near Threatened (NT), 17 species as Least Concern (LC) et one species as Vulnerable (VU). The construction phase of the breakwater will cause the destruction of coral reefs. All the dredging and excavation phases will also have a negative impact on the corals reef present in the port.
	10	Ecosystem	A-	A-	The construction and the operation phase of the project will have an impact on the marine ecosystem located in Tadjourah (the sensitivity of the sites is lower in Djibouti than in Tadjourah). The ecosystem found in Tadjourah is characterized by a high population of corals that will be affected by the emissions of particles and sediments associated with the breakwater construction, the dredging and excavation needed for the land reclamation and further out in the sea. The breakwater construction in its current scenario will cause the destruction of coral reefs.
	11	Hydrology	A-	A-	The construction of the breakwater will change the circulation of water. This phenomenon that will be ongoing from the construction until the operation phase may have an impact on the marine ecosystem (corals, fish and other living organisms)
	12	Geological Features	C-	D	No specific impact on geological features can be identified at this stage. It is however important to notice that the land reclamation work will modify the coastal profile.
	13	Involuntary Resettlement	D	D	The project site is a harbor zone; therefore, it is not inhabited, and no economic actors will be affected by the changes of the project. Therefore, no resettlement and no economic compensation should be considered.
	14	Poverty	B+	A+	Construction phase: Potential employment of local work forces for the work during construction phase. Operation phase: Employment of local young persons for services jobs like maintenance, security or other needs. The transport to the capital city will also be facilitated by the ferry, therefore probably more persons will come to work in Djibouti.

	No.	Item	Phase		Expected Impacts
			Planning Construction	Operation	
	15	Indigenous/Minorities	D	B+	Construction phase: no impact expected. Operation phase: The impact can be positive if they keep an access to the dockers profession. Some foreigners (Ethiopian workers) who are currently on the site, fear to lose their work with the new ferry's development. The increase in fleet and frequency of the transport between the two cities is good for the development of Tadjourah.
	16	Economic activities, living and livelihood	B+	A+	Construction phase: Employment of local work forces, small informal businesses. Operation: phase: an operational ferry that crosses the golf every day is supposed to facilitate the exchanges with the capital city and to increase the economic activities on the two sides of the Gulf. A risk of negative impact may be expected for the bus drivers and dhows' pilots.
	17	Land Use and Utilization of local resources	B-	C-	Construction phase: no impact. Except if the consideration of corals potential depletion is to be considered here. Operation phase: the development of the fleet and transport in the Gulf is increasing the use of navigable waters and creating an extra pressure on fish and corals population.
	18	Water Use and Water Right	D	D	No specific impact of the project on the aspect of water use and water rights is expected.
	19	Existing social infrastructure and services	B-	A+	Construction phase: disturbances caused by the work on the port, especially in Djibouti (extra deck to be built) Operation phase: improvement of the current services. With improvement of the safety of the people working on the boats (thanks to the two doors system), improvement also of the possibilities of exiting the ferry.
	20	Social institutions such as social infrastructure and local decision-making institutions	D	D	No specific impacts on the governance aspect. The project has gathered different actors in Tadjourah that are enthusiastic. Possible construction of a place for the fishermen cooperative to establish its head office.
	21	Misdistribution of benefits & damages	D	D	The project affects a zone that is state property, the direct revenues and benefit will be managed by the state. The benefits of the other economic activities and sectors are difficult to evaluate at this point.

	No.	Item	Phase		Expected Impacts
			Planning Construction	Operation	
	22	Local conflicts of interest	D	D	The project is being developed by the state and financed by governmental money (based on foreign funds) and has gone through various steps of stakeholders' engagement that should prevail conflicts of interest.
	23	Heritage	D	D	The harbor site is managed by the government and along the years the two ports 'Djibouti and Tadjourah) have been totally dedicated to economic activities with no cultural heritage site being present on the site.
	24	Landscape	-	-	Construction phase: the works will have an impact on the port landscape, however the port is already a quite industrialized place, the impact will be quite low. Operation phase: The two sites are already fully devoted to ferry and maritime activities, the impact on the landscape will be quite reduced. The gulf od Tadjourah is constantly populated by commercial boats and large ferries, so the addition of one will not have a great impact neither.
	25	Gender	D	B+	Construction phase: No impact on the gender aspects Operation phase: specific attention may be given to installing toilets at both levels of the ferry because the women do not go on the first level of the ferry for the moment. A better consideration for both gender habits would be a good thing.
	26	Children's right	D	D	No impact related to children's rights
	27	Infectious Disease (HIV/AIDS, etc.)	D	D	No impact on contagious and sexually transmitted diseases: all the work force that will be mobilized for the construction will be local work force, meaning there won't be any special risk connected to the project.
	28	Occupational health hazards	B-	D	Construction phase: Important to respect Health and security standards in the construction zone Operation phase: Important to respect Health and security standards in the construction zone
Others	29	Accidents	B-	B-	Construction phase: Important to respect Health and security standards in the construction zone Operation phase: The new functioning of the ferry may cause more risk in the begin of its functioning, however this risk can be managed by a good equipment of the workers/dockers with a uniform (helmet, gloves) in order to reduce the level of accident

	No.	Item	Phase		Expected Impacts
			Planning Construction	Operation	
	30	Global warming	B-	B-	The increase of the fleet and of the frequency of the boats will have environmental impacts. In order to have a complete overview of the impact of the project the increase if fuel use and pollution production should be balanced with the decrease in bus transport that is caused by the project.

A+/-: Significant positive/negative impact is expected.

B+/-: Positive/negative impact is expected to some extent.

C+/-: Extent of positive/negative impact is unknown. (A further examination is needed, and the impact could be clarified as the study progresses)

D: No significant impact is expected.

11.7. Annex7: Photos of the project

Ferry dockers and Insuco Surveyors

Bus driver with Insuco surveyor

Equipment provided by the MAD

Chief mechanician showing the safety boat of the ferry

Life buoy on the ferry

Bajaj driver with insuco surveyor

Project team in Tadjourah

Insuco surveyor with the fishermen

Location of the future fishing storage building (indicated by wood sticks)

11.8. Annex 8: List of encountered stakeholders

#	Name	Organisation & Tasks/status
1	Ali-Merah Chehem	Maritime Affairs Director
2	Abdi Abdillahi Aden	Maritime Affairs Directorate
3	Mohamed Abdoulkader	Docker ferry
4	Ali Youssouf Mohamed	Docker ferry
5	Mohamed Balleh	Docker ferry
6	Ali Momin Ahmed	Dhow Docker
8	Ahmed Hadj Ali	Dhow Docker
9	Adlao Hassan Ibrahim	Dhow Docker
10	Ali Houssein Ibrahim	Dhow Docker
11	Idriss Abdou Ahmed	Dhow Docker
12	Aden Said Ahmed	Dhow Docker
13	Ahmed Mohamed Aden	Dhow Docker
14	Ali Ahmed Mohamed	Bus driver
15	Abdallah Ismael Mohamed	Bus driver
16	Saleh Mohamed Daoud	Bus driver
17	Mariam Bouh Diraneh	Restauration
18	Hamadou Youssouf Ali	Bus users
19	Abdallah Ahmed Gardo	Bus users
20	Nasro Mohamed Aramis	Bus users
21	Sadick Ali Daoud	Bus users
22	Saada Omar Mouktar	Bus users
23	Salim Gourra Ali	Bus users
24	Abdo Hamadou Abdo	Bus users
25	Fatouma Taklo Mohamed	Bus users
26	Momin Orbisso Ahmed	Bus users
27	Abdo Ali Aden	Bus users
28	Hamadou Mohamed Hamadou	Bus users
29	Ali Daoud Mohamed	Speedboat Pilot
30	Abdo Mohamed Adabo	Speedboat Pilot
31	Mohamed Salim	Dhow Pilot
32	Dini Abdoulkader	Dhow Pilot
33	Dini Habib Dini	Small shop manager
34	Abdoulmalick Mohamed Banoita	Préfet
35	Omar Houssein	Regional Council president
36	Houmed Barkhat	Representative of tradictinal power
37	Bourhanta Abdoulkader	President of the fishermen cooperative
38	Ibrahim Aboubaker	Trader/dhow owner
39	Ali Ambassa	Trader/dhow owner
40	Ahmed Saick	Trader
41	Abdo Said	Trader
42	Garad Habib	Restaurant
43	Moussa Alwi	Hotel Corto maltèse
44	Ani Mandino	Hotel Le golf
45	Hassan Hayssama	Rayssali touristic place
46	Kamil Dimbio	Guide
47	Mohamed Djilani Chehem	Fisherman
48	Mohamed Houssein Abdo	Fisherman
49	Ahmed Mohamed Habib	Fisherman

59	Haroun Mohamed Adoyta	Fisherman
51	Amin Houmed Daoud	Fisherman
52	Abdo Mohamed Ahmed	Fisherman
53	Mohamed Chehem	Fishing directorate
53	Iman Mohamed Iman	Ferry and dhow Docker
54	Abdo Ahmed Mohamed	Ferry and dhow Docker
55	Hassan Houssein Mohamed	Ferry and dhow Docker
56	Idriss Omar Mohamed	Ferry and dhow Docker
57	Ibrahim Ahmed Ibrahim	Ferry and dhow Docker
58	Aboubaker Mohamed Omar	Bajaj driver
59	Ali Hassan Houmed	Bajaj driver
60	Ali Mohamed Igahleh	Bajaj driver
61	Fatto Moussa	Women association for environment protection
62	Abdallah Youssouf	Association Mahoubani
63	Abdoulkader Bourhan	Association for culture and development

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Local understanding for sustainable solutions

ERM

January 2019

Reinforcement of Maritime Transport Capacity in the Gulf of Tadjourah – Supervision of Geotechnical and Environmental Survey

-

Djibouti

Supervision of Environmental and Geotechnical Survey

Preparatory study on marine transport capacity enhancement project in Tadjourah bay

Final report

January 2019

Team : Alessandro Aubry, Geotechnical expert

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1. Introduction

The Government of Djibouti, in partnership with Japan, is conducting a project to strengthen the capacity of maritime transport in Tadjourah Bay. The objective of this project is to provide the Tadjourah region with a new ferry with a greater capacity (200 to 250 pers.) and adapted to the harsh conditions of the sea in order to be able to navigate all year long. This new ferry will insure more regular transport from Djibouti to Tadjourah (every day of the week), increase trade and goods transportation between the two regions.

The project is part of a new economic perspective characterized by the opening of the new port of Tadjourah and the Tadjourah / Balho road linking the regional capital to the city of Mekeleh (Ethiopia).

The various studies needed have been dispatched between different actors, some studies will be covered by Djibouti state, for example the ESIA, some will be covered by the JICA directly and finally several technical studies are being managegd by Japan Port Consulting with the support of ERM Japan.
Concerning the work and new infrastructures building, the Japanese part intends to take care of the following harbor facilities:

- Infrastructures of mooring; `
- Remblayage and cover of the banks of the location intended for infrastructures on ground;
- Dredging of the channel of access to the portand the zone of the infrastructures of mooring;
- Buoy of the channel of access to the port.

The work ambitioned in the framework of the project is located in the port of Djibouti and in the port of Tadjourah, the figures 1 and 2, below, present the existing infrastructures as well as the new one to be built.

Figure 1: Existing and new infrastructures to be built in Djibouti Port

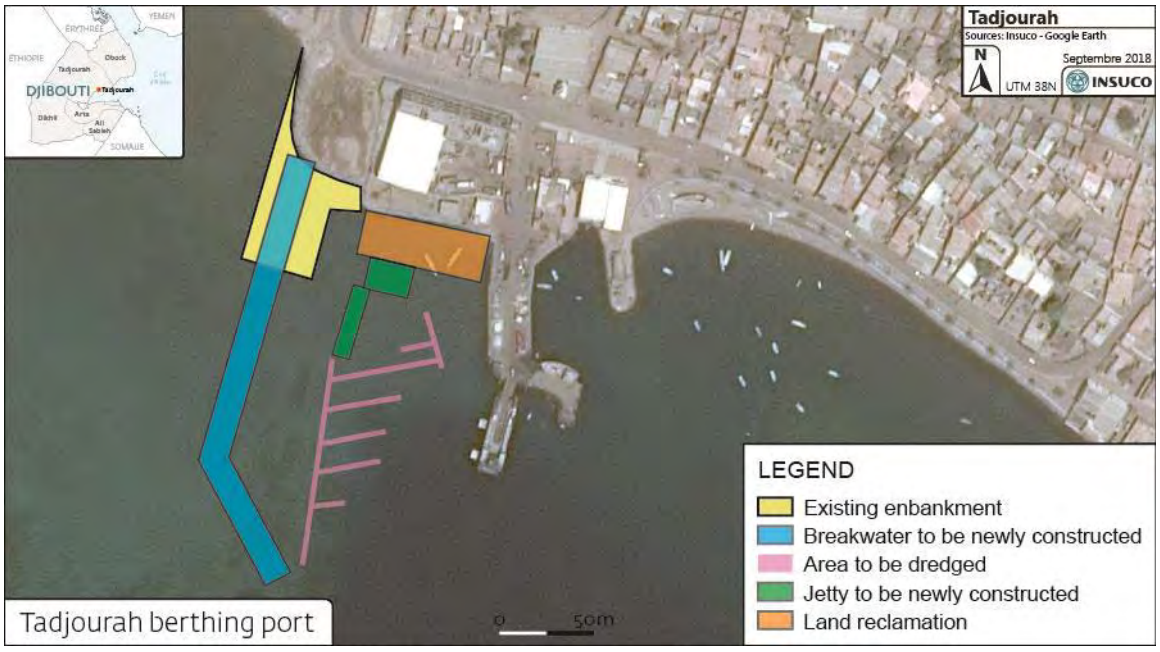


Figure 2: Existing and new infrastructures to be built in the port of Tadjourah

For the figure 2, it is important to notice that a supplementary reclaimed land already exists (shown in yellow in figure 2) and is changing the look of Tadjourah's port as presented with google earth representation.

In order to collect data on the physical environment survey present in both ports, an environmental survey, a geotechnical survey and a bathymetric survey, among others, were done between September and December 2018. The present report documents the good realization of the environmental and geotechnical survey.

2. Objectives and methodology

The mission had two objectives:

- Gathering of data and information on geotechnical aspects and previous geotechnical studies in the counrty
- Supervise and document the geotechnical survey and the environmental survey.

To serve the first objective, a range of documents were read and compiled in order to provide the documentation presented hereunder.

To serve the second objective -the supervision- the expert organized his time between:

- **Meeting with the national experts:** the expert had several meetings with notably the director of the national laboratory, Hydroterra and their staff;
- **Exchanges with JPC:** while M. Harada was present in Djibouti, several meetings and exchanges took place in order to identify and mobilize the proper equipment needed for the geotechnical survey;
- **Days on the field:**in order to monitor and supervise the proper realization of the collection of water and marine sediments for the environmental survey and of the drilling for the geotechnical survey, several days were spent in Djibouti' and Tadjourah's port.

3. Geotechnical survey supervision

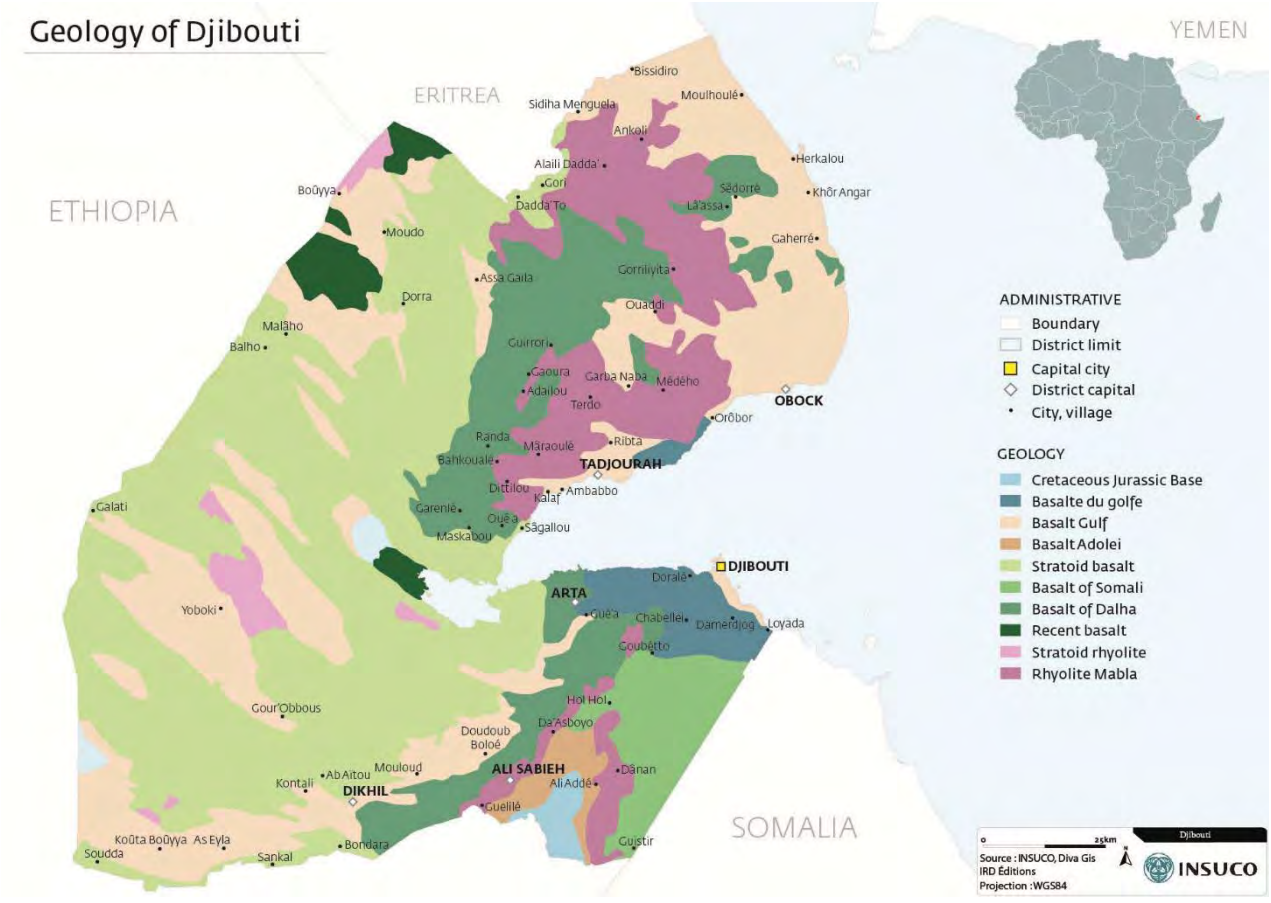
3.1. Survey' objective

The objective of the geotechnical survey, which is composed of polls, Standard Penetration Test (SPT) and laboratory tests is the evaluation of the constituent elements of the different layers of materials and their physical / mechanical characteristics. The geotechnical surveys were launched in the Port of Djibouti "La Marine" and in the Port of Tadjourah.

3.2. General geological data

3.2.1. The sedimentary formations of Djibouti-town

The description of the sedimentary formations presented here is based on the record of the geological map of Djibouti (Gasse, Fournier et al., 1983). The sedimentary formations of the study area are composed of fluvial sediments and marine deposits along the coastal plain of Djibouti. The sedimentary filling is composed of clays, silts, gravels, pebbles and conglomerates of the Upper Pleistocene resting on basalts. The wadi basins are formed by fluvial sediments from the Holocene to the present, which come from accumulations of basaltic blocks and pebbles interspersed with silts. Stratigraphic logging of the Djibouti plains has shown a hydraulic continuity between sedimentary and basaltic formations (Houmed Gaba 2009). The red soils of the Djibouti region come from the alteration of silty clay basalts. Results from X-ray diffractometer analyzes revealed the presence of quartz, calcite and gypsum (Gasse, Fournier et al., 1983).

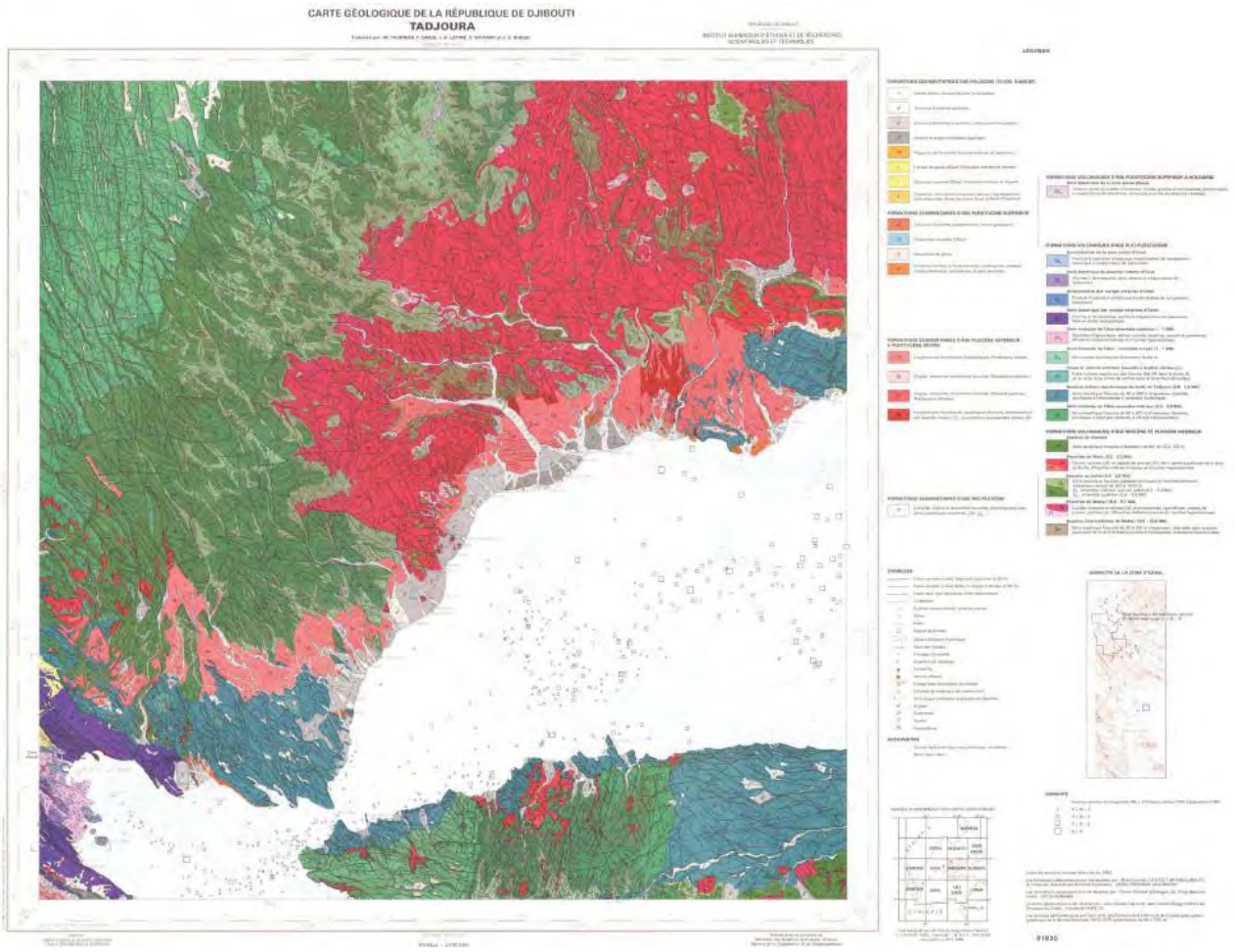


Map 1: Geological map of Djibouti

3.2.2. The sedimentary formations of Tadjourah

Sedimentation was largely dependent on climatic fluctuations. In Upper Pliocene and Lower Pleistocene, lake diatomites record wet phases already identified in East Africa. In the middle Pleistocene, an arid-dominated period, deposits are mainly conglomeratic. The 125 000 BP interglacial stage is represented by reef limestones. In Upper Pleistocene and Holocene, episodes of high lake level alternate with varying arid phases and reflect known climatic variations throughout Tropical Africa. The volumetric importance of Plio-Pleistocene deposits and the existence of Holocene marine beaches are, on the other hand, related to tectonic phenomena. Tectonics is also responsible for the spatial distribution of different stratigraphic units and the topography of their surface. The edges of the rift-zones of uprising-come in opposition to the axis of the rift -zone of collapse. Slump movements are recorded in the axial zone of the emerged Asa rift. Elsewhere, where only the margins of the rift are visible, uplift movements could be detected. This tendency to rise is not continuous from east to west. This tendancy becomes complex, mainly towards the east, by fracturing in multiple compartments delimited by E-O and N-S faults to NNO-SSE, and of different behavior. An asymmetry appears between the northern and southern borders of the Gulf.

In the south, the sediments are thin and not very extensive. The most developed outcrop, detrital formations are older than 2-1 MA. In the north, the bulk of the large conglomerate accumulation is of Lower and Middle Pleistocene age, which appears to be related to a contemporary uprising of the northern margin of the rift. Whereas the Middle and Upper Pleistocene reef limestones are faulted and raised to the north, no deformation has been observed in these formations to the south. An east-west gradient is observed in the age of the sediments and in the apparent average rates of vertical movements. At Plio-Pleistocene, coarse detrital sedimentation is poorly developed in the Obock and Djibouti sectors, which appear to be relatively stable. The thickness of the sediments (lacustrine and fluvial) and their topography suggest that the maximum amplitude of vertical movements at that time was in the region of Tadjoura. Ancient marine sediments (~ 300 000-250 000 BP years) are mainly exposed in the region of Obock. The 125,000 BP coral reefs form a continuous coastal strip to the east; the outcrops become scarce and then disappear towards west. This distribution is related to the uplift of the northern Gulf coast which affects the Obock and Tadjoura areas after 250000 BP years. Holocene tectonized sediments occur in the west, around the Ghoubbet (raised sea beaches) and in the emerged Asal rift (collapsed lake deposits).



Map 2 : Geological map of Tadjourah

3.3. Geotechnical study methodology

For this study, the investigation program initially planned was modified in order to consider the difficulties of access to the site. The initial program also provided, according to the specifications, to stop the survey after touching the bedrock and a rock continuity of 5 meters beyond the firstly planned foundation level. In order to carry out the planned drilling, a floating pontoon was used (instead of a more traditional pontoon. On this ponton the team placed the drilling rig and the drilling equipment. The pontoon was then moved to the defined GPS points. This pontoon was stabilized with six anchor points. The survey/drill work could only be done during the period of very low tide (with the pontoon just above the sea ground)

Photography 1: Floating pontoon

The survey and the scheduling of the works were carried out according to the punctual assessment of the local conditions of the tides, the winds and the marine currents for each day and each point of sounding. This specific attention to the tide was needed to ensure the stability of the pontoon and thus the feasibility of sounding work.

Another criterion was the very short time interval between the lowest and the high tide. This timing had to be watched because it could force the team to stop the work and recover the casing.

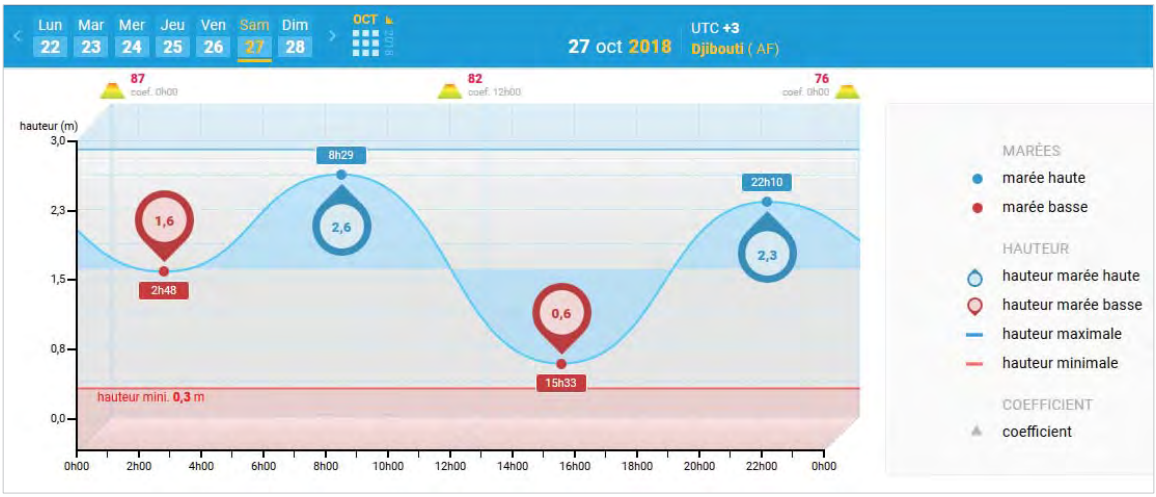


Figure 3 : Tide study (Djibouti tide site)

Source: Website documenting the tides of Djibouti[1]

Drilling was carried out by the method of rotation by means of a drill string provided at its base with a perforating tool which rotates in the borehole. A bentonite-based slurry injected into the system is used to cool the drill string, protect the casing and clean the borehole. Tungsten carbide crowns and diamond crowns are used depending on the formations encountered.

The standard penetration test (SPT) was performed with a sampler that has an outside diameter of 51 mm and does not have a liner inside. The sampler is driven into the ground with a 63.5 kg hammer. The sampler is placed 150 mm in the ground. The SPT will then measure the number of blows on the sampler needed to have the sampler progressing to a depth of 450 mm. The blows are done with a hammer of 63.5 kg falling in free fall of 760 mm.

The standard penetration tests were carried out using a hammer, providing the drill string with an effective energy of about 80% of the theoretical potential free fall energy.
This test, carried out in accordance with the French standard (NF P 94-116), makes it possible to provide information on the nature of the soil and to take samples of remodeled materials for carrying out physical tests in the laboratory.

[1]https://mareespeche.com/af/djibouti/djibouti

3.4. Locatilization of the points of measure

3.4.1. Djibouti site

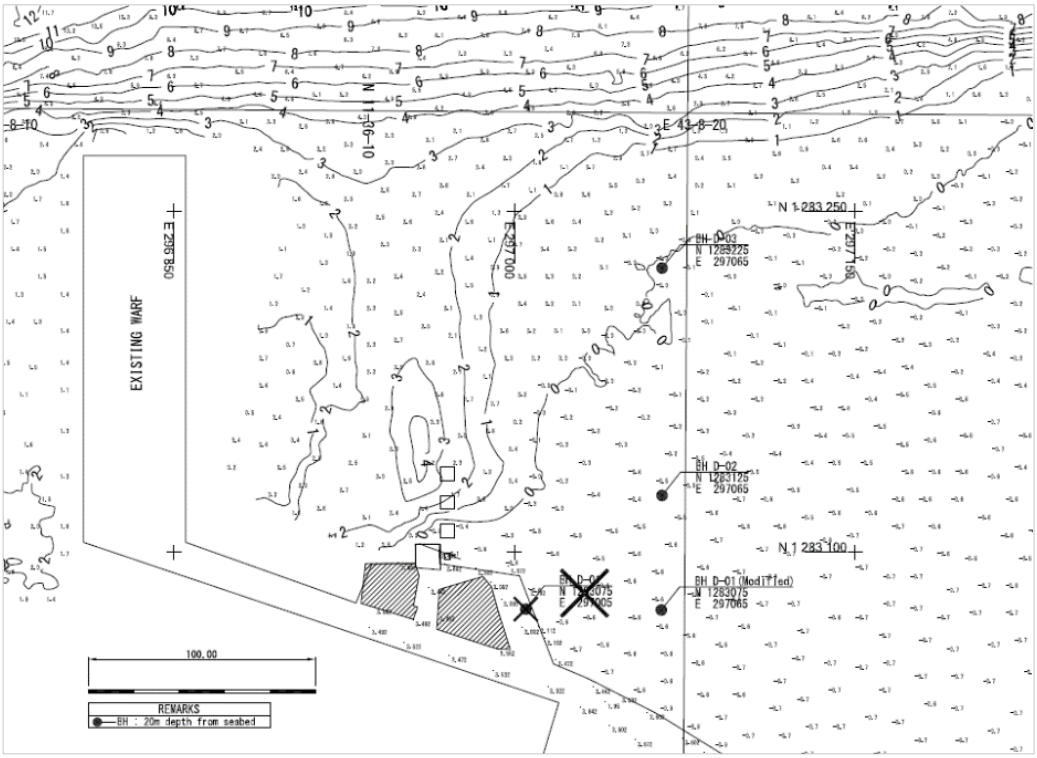
Map 3: Djibouti port

The points of measure were defined with the clients and in accordance with information collected through the bathymetric study.

Table 1 : Coordonates of the points of measure and depth of the drilling exercice

Points of surveys	East	North	Depth of the survey (m)
SC01 bis (BH D-02)	297065	1283125	36
SC02 (BH D-03)	297065	1283225	10
SC03 (BH-D01) Modified	297065	1283075	22

The points of drilling are represented on the map and figure here under.



Map 4: Coordonate indications for the drilling

Source: Japan Consulting Port

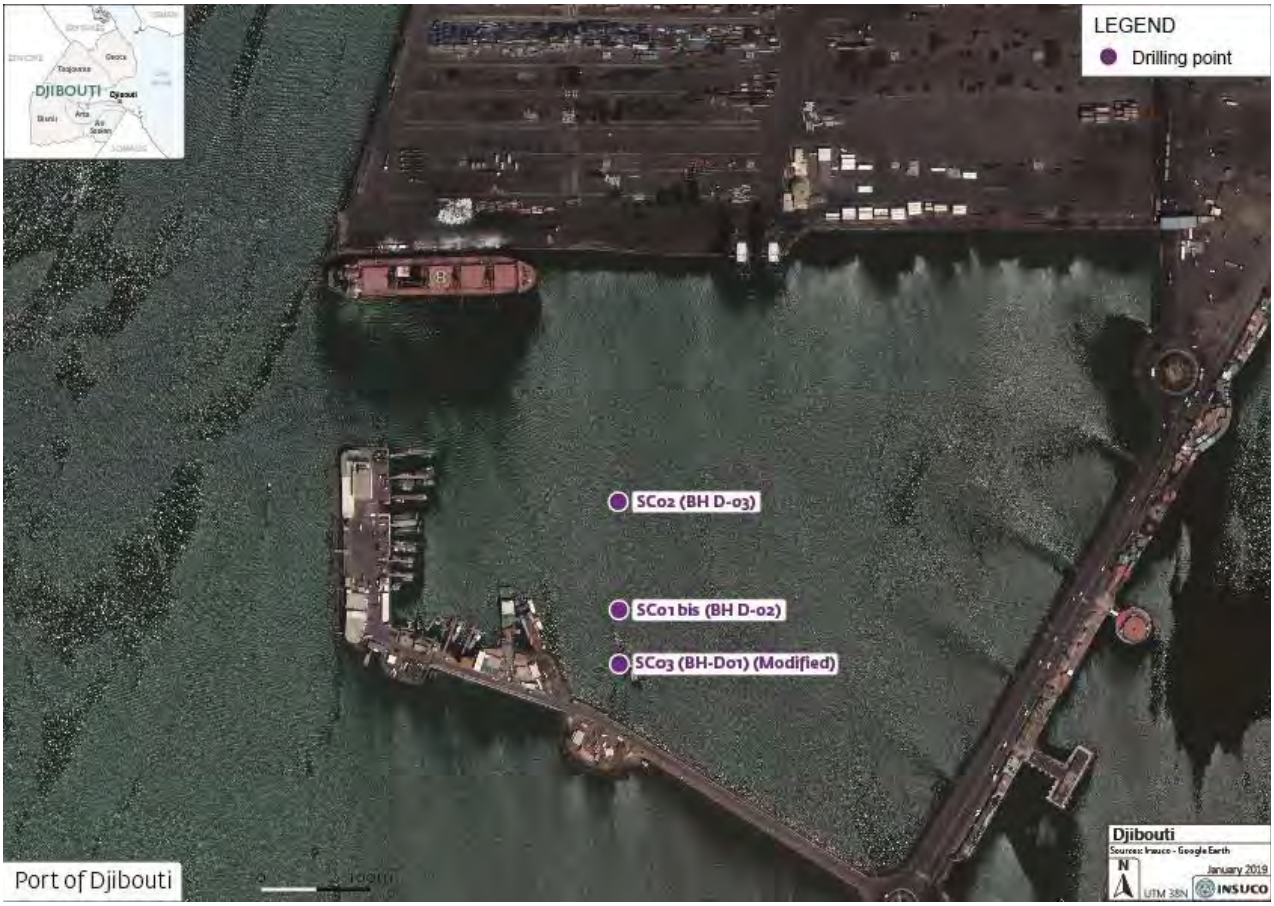


Figure 4: Localization of the points of drilling in the port of Djibouti

3.4.2. Tadjourah site

The points of measure were defined with the client.

Points of survey	East	North	Depth of survey (m)
BH-T-01	269050	1303570	14
BH-T-02	269070	1303520	22
BH-T-01 Mod correct	269102	1303549	10

Table 2: Coordonates of the points of drilling and depth of the drilling exercice

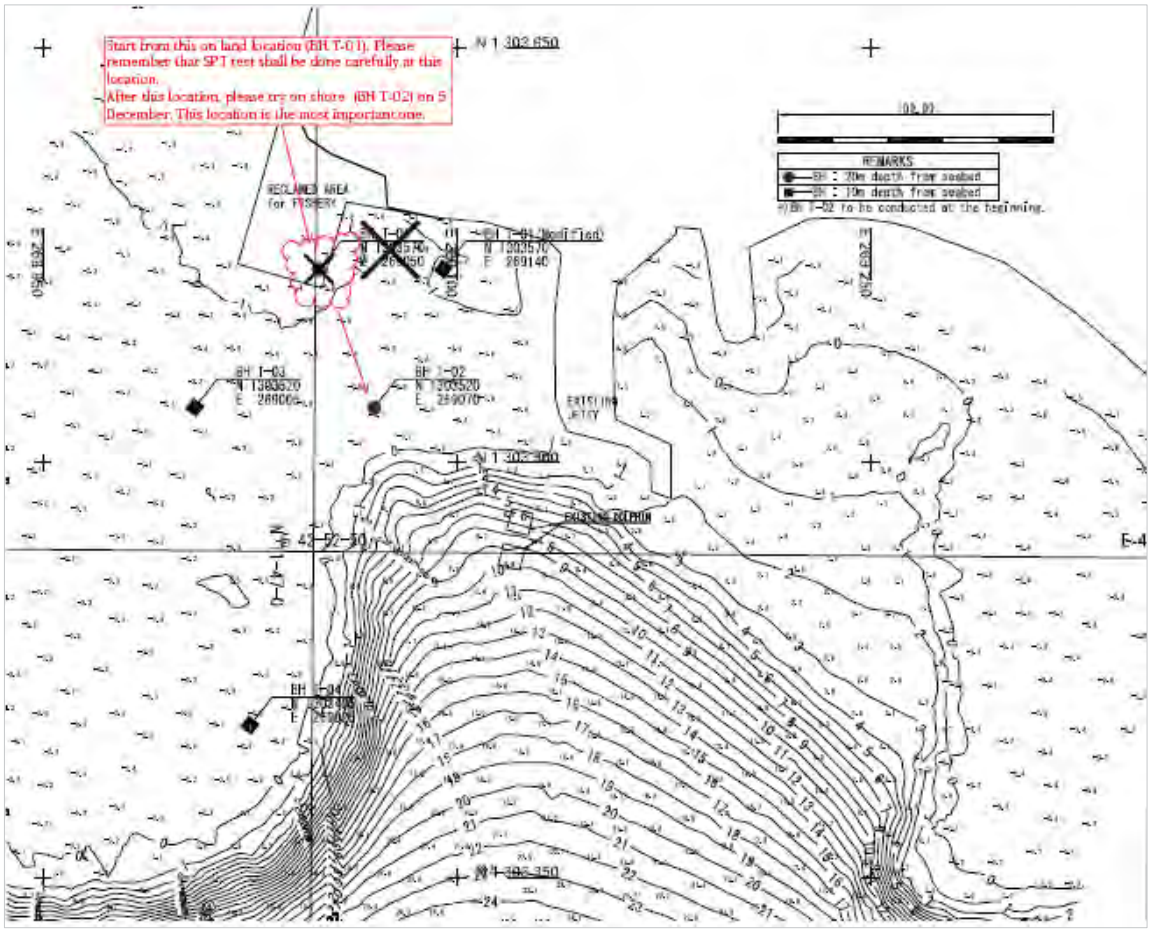


Figure 5: Bathymetry of the port of Tadjourah - Location of polls

Source: JPC

Figure 6 : Localization of the points of drilling in the port of Tadjourah

Because of the updated topography and the existence of an embankment (as drawn in figure 5 and 6)[2]; the point BH-T-01 was realized where shown on the map and after exchanges with JPC, the BH-T-01 mod was considered for the drilling.

3.5. Conclusions

Survey work in the two sites "La Marine" and Tadjourah "Port", despite the many implementation difficulties, have been completed. It should be noted that during the coring and sample recovery operations, the voids in some stratigraphic layers generated a high percentage of recovered materials. The sandy-silty sediments (corresponding to the sedimentary series of Djibouti and Tadjourah) saturated and in the presence of circulating water, emerged between the casing and the coring rods. As well as the SPT tests, in these cases, gave N coefficient (resistance to penetration) almost zero.

The technical report of the Central Laboratory will complete this supervision report.

Photography 2: Sandy-silty sediments

[2] The satellite images available for Tadjourah date back to 2016 when the enbakment was not existing yet.

3.6. Photographies

Photography 3: Charging of the sun pruner and equipment on the pontoon

Photography 4: Equipment:Cartier rod - spt

Photography 5: Starting phase of survey

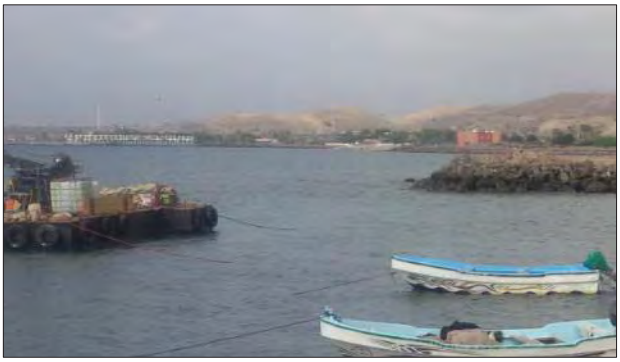
Photography 6: SPT test

Photography 7: SPT samples

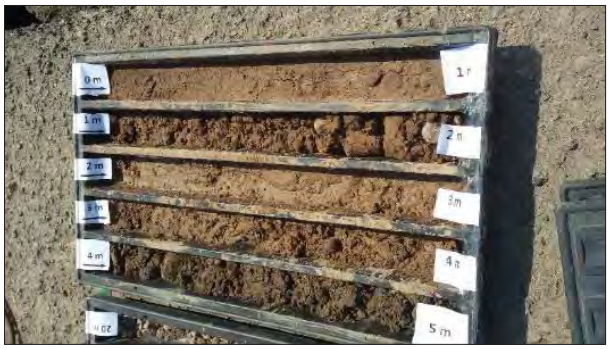
Photography 8: Night work due to low tide schedules

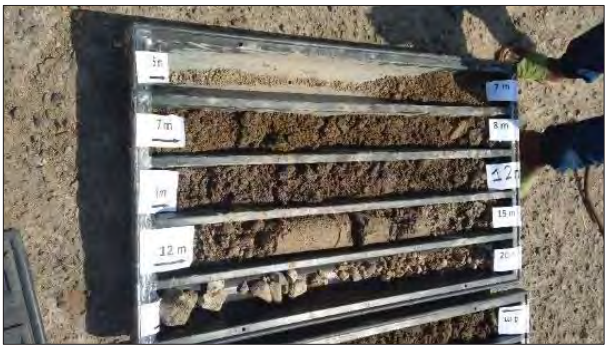
Photography 9: Recovery of samples

Photography 10: Recovery of samples



Photography 11: Waiting for the high tide for the displacement of the position of the pontoon in Tadjourah





Photography 12: Sampling on the filling in Tadjourah

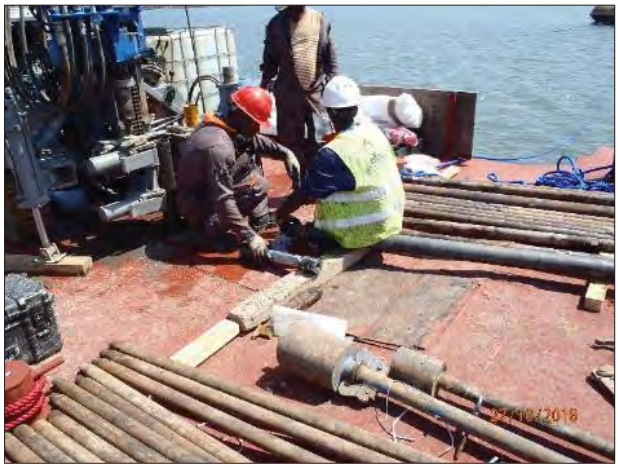
Photography 13: Sampling part on the point of BH-T-02

Photography 14: Execution of SPT

Photography 15: Restoration of carrotage with adjuvant in traffic waters

Photography 16: Sediments out of tubing during carrotage


Photography 17: Survey work




Photography 18 : Recovery of samples in the carrot


Photography 19: Arrangement and protection case for samples

4. Environmental Survey supervision

In order to collect data on the water quality and sediments compositions, studies were being led in both ports. Samples were collected and then sent to labs in Djibouti and France for various analysis.

4.1. Methodology

4.1.1. Planning

The schedules for the realization of the sampling were chosen according to climate condition and according to the best tide height

4.1.2. Material

With the support of the boat, we aligned with the GPS identified positions and the samples were collected. All the samples were:

- inserted and kept into temporary containers,
- identified with a specific number
- sealed individually.

In order to avoid any contamination or uncontrolled development of species, a low temperature freezing box was used. For the realization of the sampling of the superficial sediments, corresponding to the first centimeter, we have used PVC tubes and box corers. For the bottling, the material has always been the same. All the samples were sent to the Lab for the required analysis.

4.2. Port of Djibouti

For the test planned in the Port of Djibouti, we have chosen the tide at 1 pm (high tide). This choice can be explained by the relatively small depth of the port.

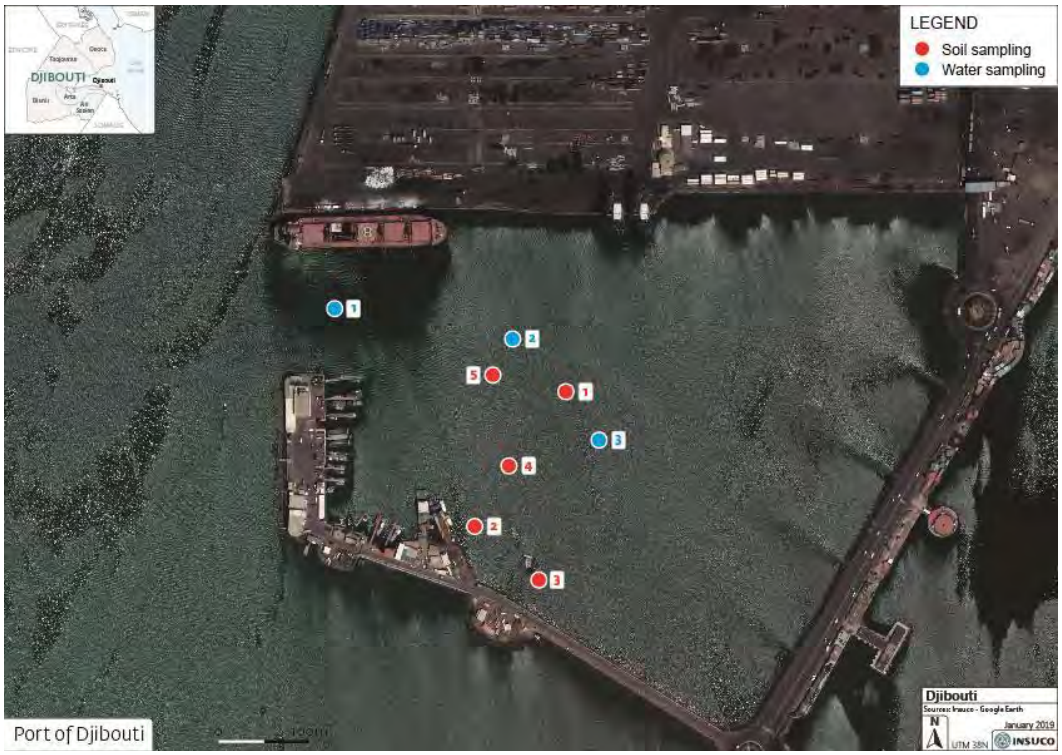


Figure 7: Points of sampling and measures in the Port of Djibouti

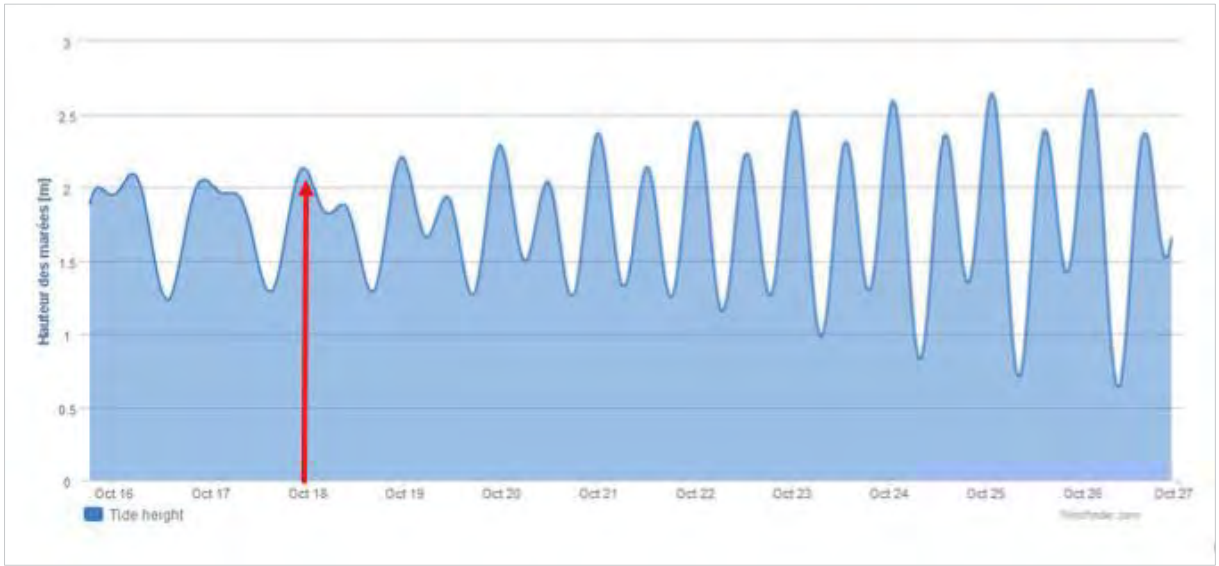


Figure 8: Tide height prospective per day

Source: https://mareespeche.com/af/djibouti/djibouti

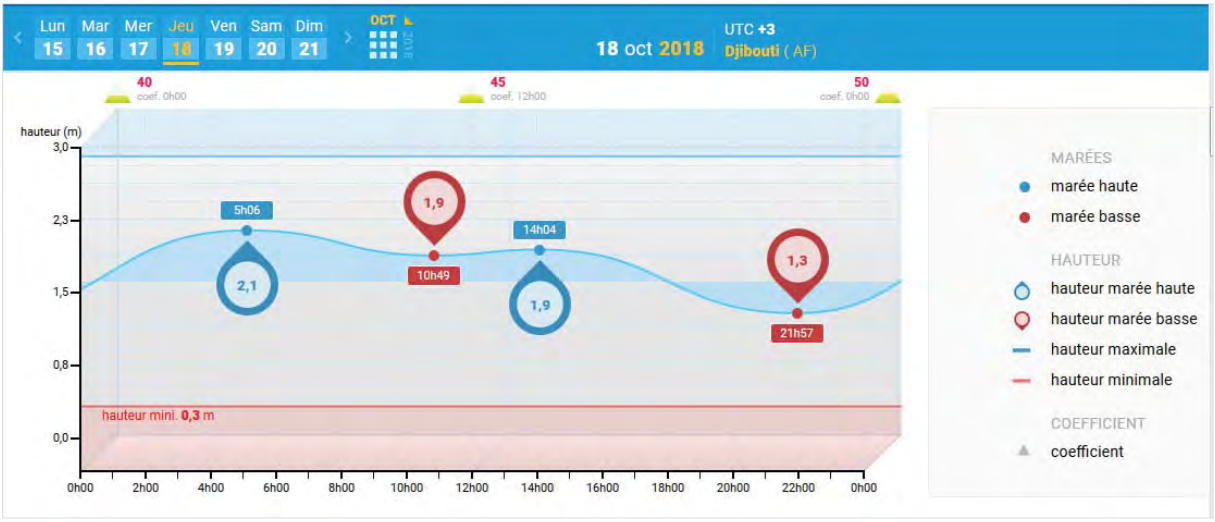
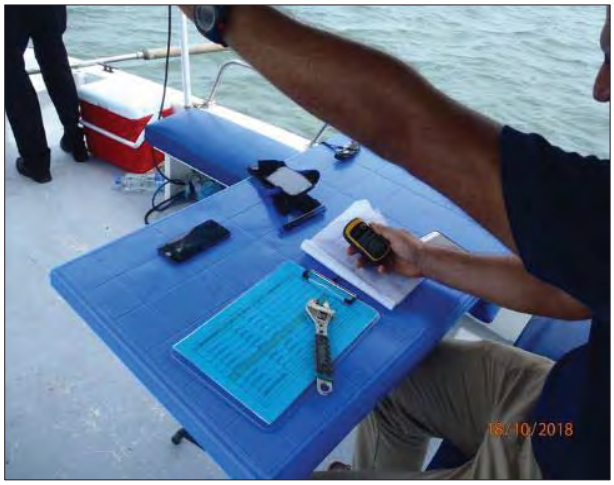


Figure 9: Depth of water according to the tidal range for the day of survey (18th October)

The sampling activities were led and done in accordance with the terms of reference and with the specifics procedures needed to insure good quality tests and results. The results presented in the environmental survey report will complete this information and document.

4.2.1. Photography

Photography 20: Water sampling in the port of Djibouti

Photography 21: Sediments sampling in Djibouti

Photography 22: Sedimentscollection in Djibouti

4.3. Port of Tadjourah

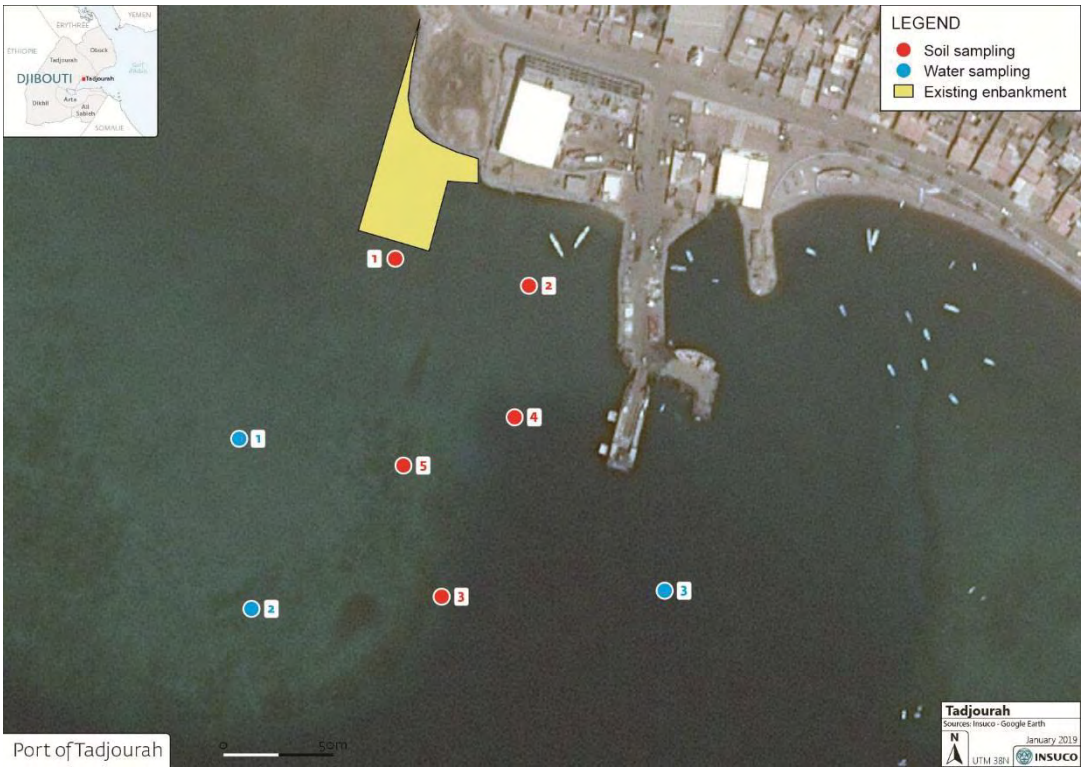


Figure 10: Points of sampling and measures in the Port of Djibouti

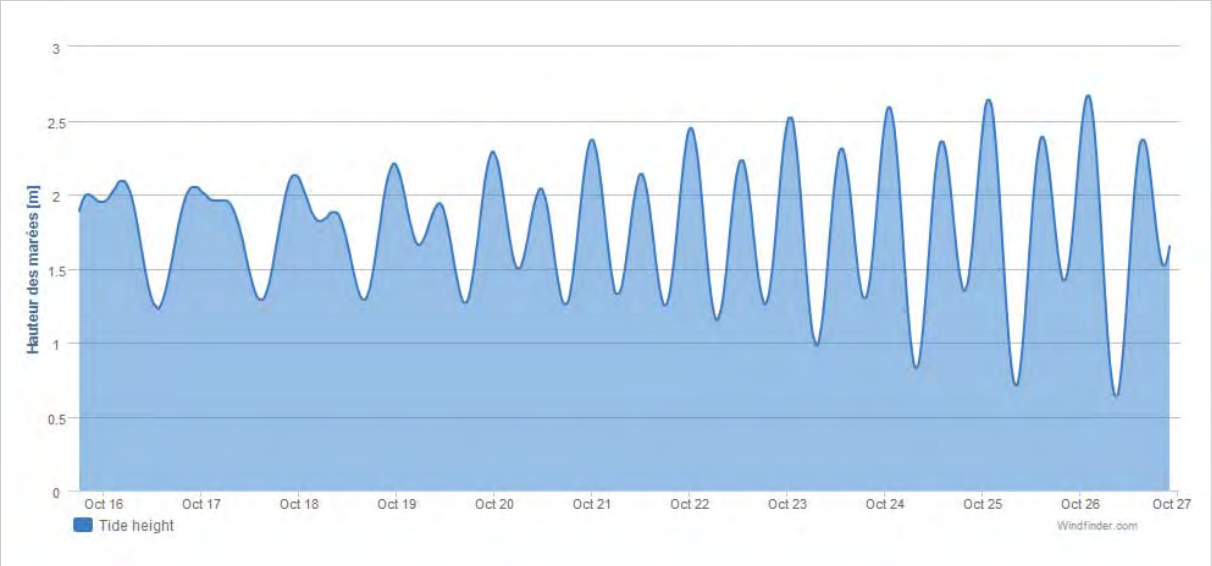


Figure 11: Tide hights prospective per day

Source: https://mareespeche.com/af/djibouti/djibouti

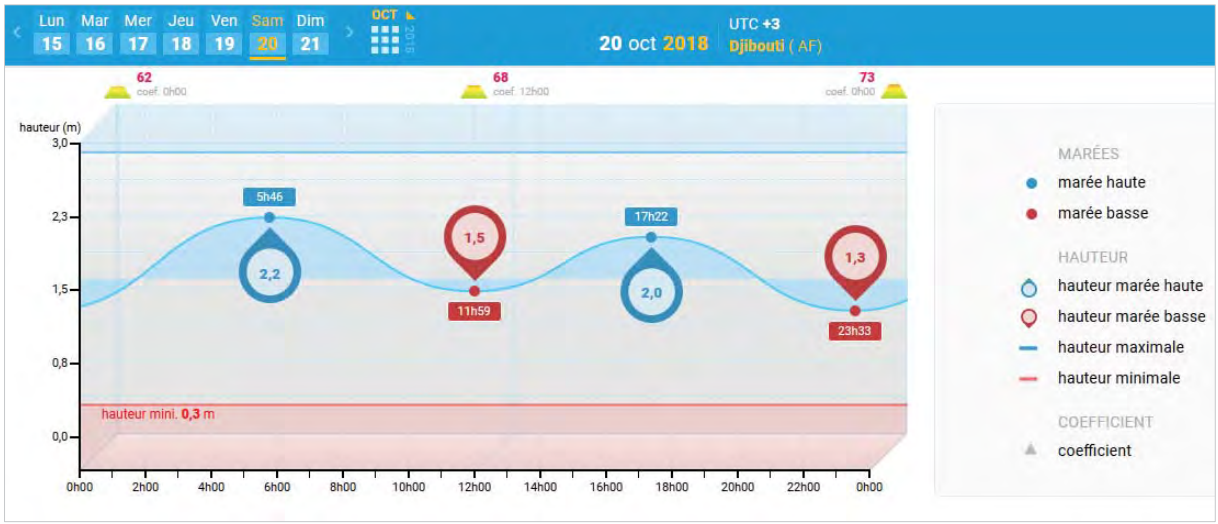


Figure 12: Depth of water according to the tidal range for the day of survey (20th October)

4.3.1. Photography

Photography 23: Water sampling in Tadjourah

Photography 24 : Sediments sampling in Tadjourah

Photography 25: Sediments sampling in Tadjourah



Photography 26: Under and above sea photographies

5. Bibliography

- **Geological map and informatoin of Djibouti:** https://www.researchgate.net/profile/M_Fournier2/publication/32988422_Notice_explicative_carte_geologique_de_la_Republique_de_Djibouti_a_1100_000_Djibouti/links/59bfb212a6fdcca8e56fae81/Notice-explicative-carte-geologique-de-la-Republique-de-Djibouti-a-1-100-000-Djibouti.pdf
- **Geological map and information of Tadjourah:** https://core.ac.uk/download/pdf/39872459.pdf

3. Natural Conditions Survey Package-A (Amendment-1)

- Geotechnical conditions survey

Hydroterra engineering SARL
Dupleix Barkat
BP 2073 Marabout
Tel: 77029325
www.hydroterra-engineering.com

GEOTECHNICAL FINAL REPORT

NATURAL CONDITIONS SURVEY PACKAGE-A

PREPARATORY SURVEY ON REINFORCEMENT OF MARITIME TRANSPORT AT GOLF OF TADJOURAH

SOIL IDENTIFICATION CAMPAIGN

SITE: PORT OF DJIBOUTI

PROJECT: BUILDING A DOCK

CLIENT: JAPAN CONSULTANT PORT

GEOTECHNICAL MISSION

PRELIMINARY STUDIES - GEOTECHNICAL

Included in this document:

1. A geotechnical report
2. Annex1 :Lithology of boreholes
3. Annex2 : Laboratory results
4. Annex3 : Survey crate pictures
5. Annex4 : Site pictures
6. Annex5 : Définitions des missions U.S.G., norme NF P 94-500

Table of content

I. PRESENTATION

1.1 Mission Definition

♦ Mission

At the request of la Société HYDROTERRA ENGINEERING, the CENTRAL BUILDING AND EQUIPMENT LABORATORY (LCBE) moved to the site of Djibouti to carry out a SERIE OF IDENTIFICATION OF SOIL. This mission should allow:

1. Determine the lithological nature of the formations crossed
2. To identify the geotechnical nature of the samples taken from the section
3. Provide the results of the laboratory tests performed on the samples taken.

.

1.2 Regulation used

The various tests performed (in situ and laboratory tests) comply with AFNOR standards

.

II. SOIL IDENTIFICATION

2.1 Identificationprogram:

For this study, the investigation program initially planned was modified to take into account the difficulties of access to the site. The initial program also planned, according to the specifications, to stop the depth of investigation if the bedrock is reached with a rock continuity of 6 meters beyond the planned foundation level

.

The table below gives a summary of the work performed:

Survey points	X	Y	Z seabed	Sieveanalysis	Atterberg Limits	Water content	Specificweight	Apparent weight
SC01 bis (BH D-02)	297065	1283125	-0,5	10	9	10	10	10
SC02 (BH D-03)	297065	1283225	0	4	4	4	4	4
SC03 (BH-D01 Modified)	297065	1283075	-0,6	5	5	5	5	5
Total :				**19**	**18**	**19**	**19**	**19**

In addition to the core drilling and manual sampling of soil samples, the following test has been realized on the site:

1. 1. SPT tests to determine the bearing capacity of crossed layers:

2. 2. laboratory tests to identify and characterize soils in place, including:

- 19Sieve analysis [NF P 94-056],
- 19Atterberg Limits [NF P 94-051],
- 19 Water content [NF P 94-050],
- 19Specific weight [NF P94-054],
- 19Apparent weight ,

The results of all the tests are presented in the appendices to this report.

2.2 Identification synthesis

♦ Surveying procedures

1. Boreholes drilling with Standard penetration test :

For these types of machines, drillings are carried out by the method of rotation by means of a drill string provided at its base with a perforating tool which rotates in the borehole. Bentonite-based slurry injected into the circuit allows the drill string to be cooled down, the wall to be shielded and the borehole to be cleaned. Tungsten carbide crowns, carbonites and diamond crowns are used depending on the formations encountered.Drilling was carried out by rotation and washing.

The Standard Penetration Test is carried out following a battering of a 450 mm penetration of the split sampler, using a hammer weighing 63.5 kg and falling in free fall from a height of 760 mm on the head of a drill string.

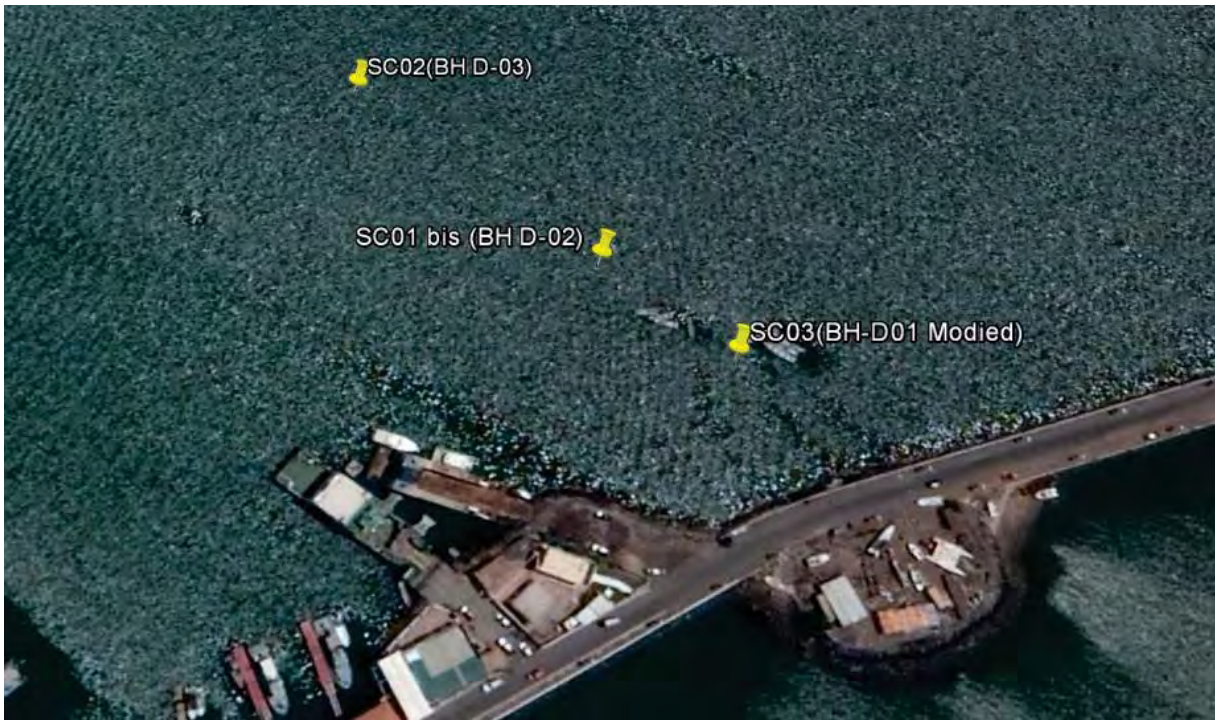
The split sampler used has an outside diameter of 51 mm and does not have a liner inside. The standard penetration tests were performed using an automatic hammer, providing effective energy to the rod train of about 80% of the theoretical potential free fall energy.

This test, carried out in accordance with the French Standard (NF P 94-116), makes it possible to provide information on the nature of the soil and to take samples of remodeled material for carrying out physical tests in the laboratory.

Survey points	X	Y	Z seabed	InvestigatedDepth (m)
SC01 bis(BH D-02)	297065	1283125	-0,5	36
SC02 (BH D-03)	297065	1283225	0	10
SC03 (BH-D01 Modified)	297065	1283075	-0,6	**22**

♦Site plan of Survey points:

The different survey points made are materialized on the ground plan below.



♦Synthesis of laboratory tests:

The results of the laboratory tests carried out on the soil samples taken from the holes are presented in appendices.

1. Standard Penetration Test Synthesis

Standard Penetration Test (SPT)				
Depth (m)	15 cm	15cm	15cm	SPT Value (N)
SC01 bis				
2	0	0	0	0
4	0	0	0	0
6	0	0	0	0
8	0	0	0	0
10	0	0	0	0
12	2	2	4	6
14	3	2	3	5
16	10	22	25	47
18	12	20	23	43
20	16	19	23	42
22	17	21	24	45
25	13	18	23	41

28	12	20	25	45
33	16	23	27	50
SC02				
5	1	2	2	4
7	2	3	2	5
10	2	2	4	6
SC03				
1,5	1	0	0	0
3	1	1	1	2
4,5	1	2	2	4
6	2	1	2	3
7,5	1	2	2	4
9	2	3	2	5
10,5	3	3	4	7
12	6	8	10	18
13,5	12	25	27	52
15	15	20	20	40
16,5	10	15	16	31
18	18	20	21	41
19,5	7	12	15	27
21	8	10	17	27

- Results obtained:

Table n° 03: Synthesis of the tests

Survey	Reference depth	Depth of sampling	Particle size analysis			Atterberg limits			Water Content	Specificweight	Apparent weight
			% Ø < 50 mm	% Ø < 2,5 mm	% Ø < 0,08 mm	WL (%)	WP (%)	IP (%)	(%)		(g/cm³)
SC01-Bis	0 à 11 m	0 à 6,60 m	100	94,6	66				29,26	2,68	1,13
		6,60 à 11 m	100	85,6	57,7	36,7	22,9	13,8	17,33	2,91	1,13
	11 à 12 m	11 à 12 m	100	74,1	44,8	Non Mesurable			20,36	2,52	1,27
	12 à 13 m	12 à 13 m	100	98,6	88	49,5	34,5	15	56,56	2,57	1,81
	13 à 15 m	13 à 15 m	100	97,4	79,6	43	28,6	14,4	24,45	2,55	1,94
	15 à 17 m	15 à 17 m	100	38	25,2	Non Mesurable			19,88	2,57	1,75
	17 à 19,5 m	17 à 19,5 m	100	91,5	88,1	70,8	29,3	41,5	55,84	2,71	1,78
	19,5 à 30 m	19,5 à 30 m	100	97,8	85,1	58	25	33	76,12	2,62	1,1
	30 à 36 m	30 à 33,60 m	100	81,1	65,1	61,7	28,6	33,1	27,09	2,51	1,71
		33,60 à 36 m	100	88,1	73,7	36,5	25,8	10,7	26,88	2,67	1,12
SC02	0 à 3 m	0 à 3 m	100	99,8	93,5	Non Mesurable			59,26	2,82	1,15
	3 à 5 m	3 à 5 m	100	99,5	91,4	Non Mesurable			63,8	2,66	1,12
	5 à 7 m	5 à 7 m	100	99,1	90,2	41,5	26,1	15,4	75,95	2,69	1,08
	7 à 10 m	7 à 10 m	100	99,4	88,1	38,5	34,5	4	68,96	2,65	1,1
SC03	0 à 13 m	0 à 13 m	100	98,2	85,5	41,5	26,8	14,7	44,6	2,7	1,83

	13 à 15 m	13 à 15 m	100	95,6	63,6	65	28,6	36,4	19,85	2,78	1,93
	15 à 19,5 m	15 à 19,5 m	100	53,1	41,5	36	20,8	15,2	16,9	2,71	1,74
	19,5 à 22 m	19,5 à 20,7 m	100	87,8	82	48,2	24,9	23,3	32,72	2,64	1,84
		20,7 à 22 m	100	99,6	98	42,1	23,2	18,9	30,29	2,59	1,37

III. CONCLUSIONS

The laboratory tests were carried out on the samples taken, the results obtained are inserted in the report and attached.

Done in Djibouti, the *07/01/2019*

LE DIRECTEUR DU LCBE

SOUBANEH SAID ISMAEL

ANNEX:

Annex 1 : Lithologycut of Boreholes

Annex 2 : Laboratory test results

Annex 3 : Survey cratespictures

Annex4:Site Project pictures

Annex 5: Diagraphy

Annex 6 : Percentage recovered

Annex 1: Lithologycut of Boreholes

SC01 bis
(BH D-02)

Ministère de l'Equipement et des Transports

LABORATOIRE CENTRAL

المختبر المركزي للبناء والتجهيز

BORING LOG

BOREHOLE SC01 BIS

Commenced date : 27/10/2018
Completed date : 30/10/2018
Site Localisation : Port of Djibouti
Boring equipement : SEDIDRILL drilling machine
Boring method : Rotary drilling with polymer
Boring diameter : 101 mm (from beginning to end)
Depth of the borehole : 36 m
Coordinates of the borehole : -

Depth (m)	LEGEND	DESCRIPTION	STANDARD PENETRATTION TEST					
			Depth (m)	Blows /15cm			Spt value (N)	SPT Chart N = N2 + N3
				N1	N2	N3		
0								
			2				0	
			4				0	
		Silt CLAY witch sand ans shells	6				0	
			8				0	
			10				0	
11								
12		SAND witch silty clay and shells	12	2	2	4	6	
13		Blocks of clays light grey						
15		Block of clay brown stiff	14	3	2	3	5	
17		Blocks of clays brown witch shells	16	10	22	25	47	
20		Clay witch sand cohesive brown with presence of calcareous sandstone	18	12	20	23	43	
			20	16	19	23	42	
			22	17	21	24	45	
		CLAY soils brown	25	13	18	23	41	
			28	12	20	25	45	
30								
		CLAY soils very stiff witch limestone	33	16	23	27	50	
36								

SC02

(BH D-03)

Ministère de l'Equipement et des Transports

LABORATOIRE CENTRAL
DU BATIMENT ET DE L'EQUIPEMENT

المختبر المركزي للبناء والتجهيز

BORING LOG

BOREHOLE SC02

Commenced date : 31/10/2018
Completed date : 31/10/2018

Site Localisation : Port of Djibouti

Boring equipement : SEDIDRILL drilling machine
Boring method : Rotary drilling with polymer
Boring diameter : 101 mm (from beginning to end)
Depth of the borehole : 10 m
Coordinates of the borehole : -

Depth (m)	LEGEND	DESCRIPTION	STANDARD PENETRATTION TEST					
			Depth (m)	Blows /15cm			Spt value (N)	SPT Chart N = N2 + N3
				N1	N2	N3		10 20 30 40 50 > 50
0								
1								
2			1,5					
3			3					
4								
5		Silt CLAY soils dark gray	5	1	2	2	4	
6								
7			7	2	3	2	5	
8								
9								
10			10	2	2	4	6	

Zone Industrielle Sud (Boulaos) – BP : 2016 – Tel . +(253) 21 35 34 77 – Fax +(253) 21 35 11 68

SC03

(BH-D01 Modified)

Ministère de l'Equipement et des Transports

LABORATOIRE CENTRAL

المختبر المركزي للبناء والتجهيز

BORING LOG

BOREHOLE SC03

Commenced date : 06/11/2018
Completed date : 07/11/2018
Site Localisation : Port of Djibouti
Boring equipement : SEDIDRILL drilling
Boring method : Rotary drilling with polymer
Boring diameter : 101 mm (from beginning to end)
Depth of the borehole : 22 m
Coordinates of the borehole : -

Depth (m)	LEGEND	DESCRIPTION	STANDARD PENETRATTION TEST					
			Depth (m)	Blows N1	Blows N2	Blows N3	SPT value	SPT Chart
0			0					
1								
2			1,5	1	0	0	0	
3			3	1	1	1	2	
4								
5	Muddy soils witch shells from friable to compact		4,5	1	2	2	4	
6			6	2	1	2	3	
7								
8			7,5	1	2	2	4	
9			9	2	3	2	5	
10								
11			10,5	3	3	4	7	
12			12	6	8	10	18	
13								
14	silt clay brown very stiff		13,5	12	25	27	52	
15			15	15	20	20	40	
16								
17	Limestone marl stiff		16,5	10	15	16	31	
18			18	18	20	21	41	
19								
20	Gray clay		19,5	7	12	15	27	
21			21	8	10	17	27	
22	Brown clay very stiff							

SPT Chart: 10 20 30 40 50 > 50

Annex2: Laboratory Test Results

SC01 bis - (BH D-02)

Sieve analysis

REPUBLIQUE DE DJIBOUTI
Unité – Egalité – Paix

Ministère de l'Equipement et des Transports

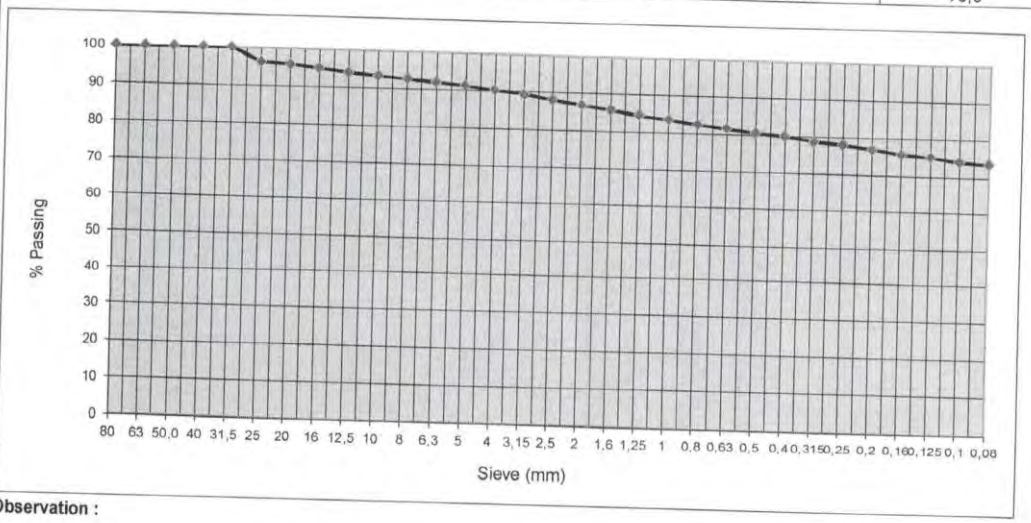
LABORATOIRE CENTRAL
DU BATIMENT ET DE L'EQUIPEMENT
المختبر المركزي للبناء والتجهيز

ANALYSE GRANULOMETRIQUE - NORME NF P 94-056

Dossier : 254-2018
Chantier : Construction d'un quai d'embarquement au Port de Djibouti
Client : Hydroterra Engineering SARL
Matériaux : Identification
Provenance : SC01-Bis (33,6 - 36,0 m)

Poinds Initial (grs): 2215,6

Tamis	Refus Partiel(gr)	Refus Cumules (gr)	Refus Cumules (%)	Passant (%)
80	0,0	0,0	0,0	100,0
63	0,0	0,0	0,0	100,0
0,0	0,0	0,0	0,0	100,0
40	0	0,0	0,0	100,0
31,5	0	0,0	0,0	100,0
25	79	79,0	3,6	96,4
20	11,5	90,5	4,1	95,9
16	20,9	111,4	5,0	95,0
12,5	21,4	132,8	6,0	94,0
10	15,4	148,2	6,7	93,3
8	11,7	159,9	7,2	92,8
6,3	19,0	178,9	8,1	91,9
5	15,2	194,1	8,8	91,2
4	22,6	216,7	9,8	90,2
3,15	19,1	235,8	10,6	89,4
2,5	28,6	264,4	11,9	88,1
2	24,9	289,3	13,1	86,9
1,6	25,8	315,1	14,2	85,8
1,25	25,2	340,3	15,4	84,6
1	19,9	360,2	16,3	83,7
0,8	26,4	386,6	17,4	82,6
0,63	21,1	407,7	18,4	81,6
0,5	21,3	429,0	19,4	80,6
0,4	16,6	445,6	20,1	79,9
0,315	26,8	472,4	21,3	78,7
0,25	13,5	485,9	21,9	78,1
0,2	21,8	507,7	22,9	77,1
0,16	23,4	531,1	24,0	76,0
0,125	16,1	547,2	24,7	75,3
0,1	26,0	573,2	25,9	74,1
0,08	10,2	583,4	26,3	73,7
FOND	2,5	585,9	26,4	73,6



Observation :

Le Directeur du LCBE,

Mr. Soubaneh Said Ismael

REPUBLIQUE DE DJIBOUTI
Unité – Egalité – Paix

Ministère de l'Equipement et des Transports

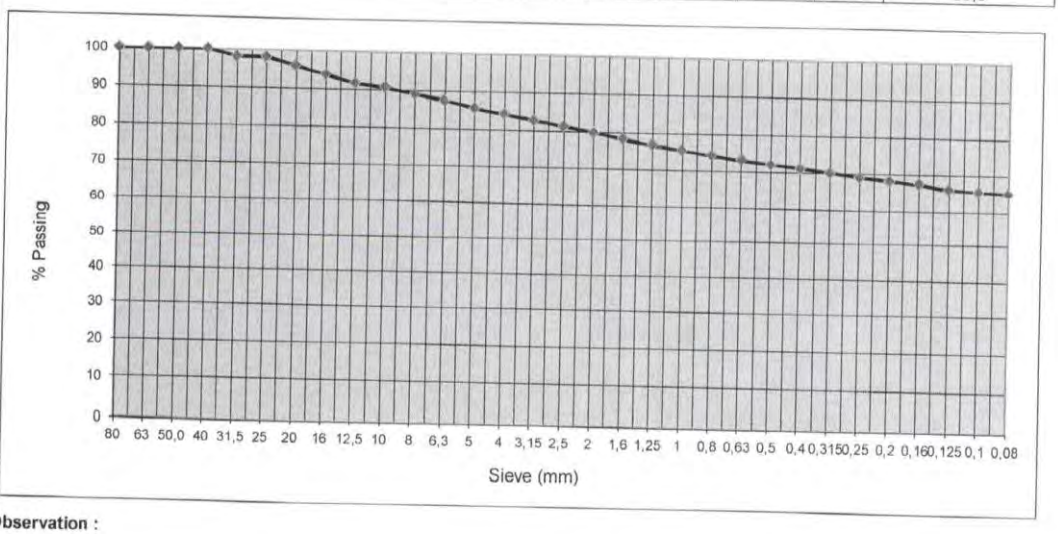
LABORATOIRE CENTRAL DU BATIMENT ET DE L'EQUIPEMENT
المختبر المركزي للبناء والتجهيز

ANALYSE GRANULOMETRIQUE - NORME NF P 94-056

Dossier : 254-2018
Chantier : Construction d'un quai d'embarquement au Port de Djibouti
Client : Hydroterra Engineering SARL
Matériaux : Identification
Provenance : SC01-Bis (30,0 - 33,6 m)

Poinds Initial (grs): 2160,6

Tamis	Refus Partiel(gr)	Refus Cumules (gr)	Refus Cumules (%)	Passant (%)
80	0,0	0,0	0,0	100,0
63	0,0	0,0	0,0	100,0
0,0	0,0	0,0	0,0	100,0
40	0	0,0	0,0	100,0
31,5	43,6	43,6	2,0	98,0
25	0	43,6	2,0	98,0
20	44,1	87,7	4,1	95,9
16	50,1	137,8	6,4	93,6
12,5	46	183,8	8,5	91,5
10	21,6	205,4	9,5	90,5
8	35,5	240,9	11,1	88,9
6,3	33,3	274,2	12,7	87,3
5	36,9	311,1	14,4	85,6
4	32,5	343,6	15,9	84,1
3,15	32,6	376,2	17,4	82,6
2,5	31,4	407,6	18,9	81,1
2	30,5	438,1	20,3	79,7
1,6	32,3	470,4	21,8	78,2
1,25	30,3	500,7	23,2	76,8
1	28,1	528,8	24,5	75,5
0,8	28,4	557,2	25,8	74,2
0,63	26,3	583,5	27,0	73,0
0,5	22,9	606,4	28,1	71,9
0,4	22	628,4	29,1	70,9
0,315	20,8	649,2	30,0	70,0
0,25	21	670,2	31,0	69,0
0,2	19,4	689,6	31,9	68,1
0,16	17	706,6	32,7	67,3
0,125	27,5	734,1	34,0	66,0
0,1	10,9	745,0	34,5	65,5
0,08	10	755,0	34,9	65,1
FOND	1,8	756,8	35,0	65,0



Observation :

Le Directeur du LCBE.

Mr. Soubaneh Said Ismael

REPUBLIQUE DE DJIBOUTI

Unité – Egalité – Paix

Ministère de l'Equipement et des Transports

LABORATOIRE CENTRAL
DU BATIMENT ET DE L'EQUIPEMENT

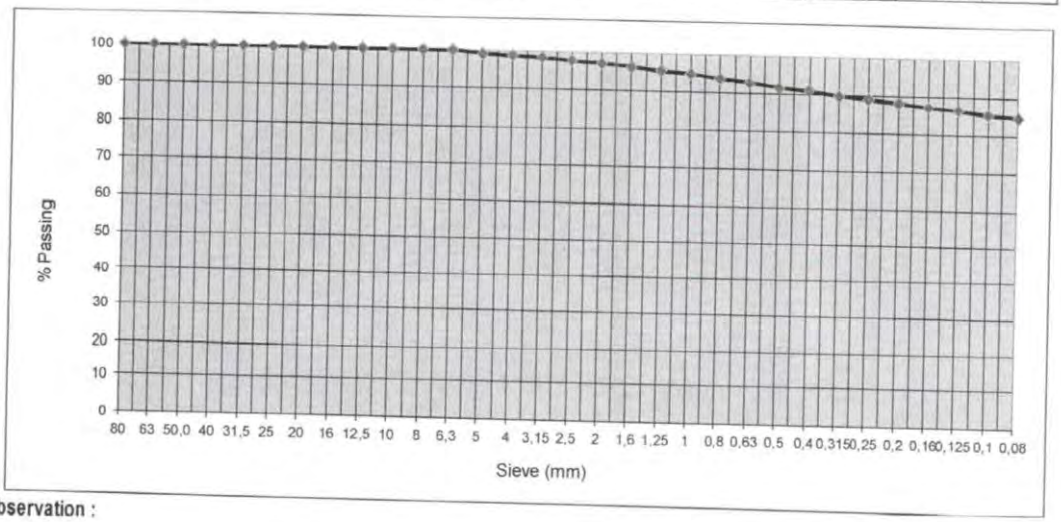
المختبر المركزي للبناء والتجهيز

ANALYSE GRANULOMETRIQUE - NORME NF P 94-056

Dossier : 254-2018
Chantier : Construction d'un quai d'embarquement au Port de Djibouti
Client : Hydroterra Engineering SARL
Matériaux : Identification
Provenance : SC01-Bis (19,5 - 30,0 m)

Poinds Initial (grs): 2293,5

Tamis	Refus Partiel(gr)	Refus Cumules (gr)	Refus Cumules (%)	Passant (%)
80	0,0	0,0	0,0	100,0
63	0,0	0,0	0,0	100,0
0,0	0,0	0,0	0,0	100,0
40	0,0	0,0	0,0	100,0
31,5	0,0	0,0	0,0	100,0
25	0,0	0,0	0,0	100,0
20	0,0	0,0	0,0	100,0
16	0,0	0,0	0,0	100,0
12,5	0,0	0,0	0,0	100,0
10	0,0	0,0	0,0	100,0
8	0,0	0,0	0,0	100,0
6,3	0,0	0,0	0,0	100,0
5	20	20,0	0,9	99,1
4	7,4	27,4	1,2	98,8
3,15	7,2	34,6	1,5	98,5
2,5	15,8	50,4	2,2	97,8
2	15,9	66,3	2,9	97,1
1,6	17,4	83,7	3,6	96,4
1,25	19,1	102,8	4,5	95,5
1	14,1	116,9	5,1	94,9
0,8	26,8	143,7	6,3	93,7
0,63	20,1	163,8	7,1	92,9
0,5	27,2	191,0	8,3	91,7
0,4	15,4	206,4	9,0	91,0
0,315	25,4	231,8	10,1	89,9
0,25	15,1	246,9	10,8	89,2
0,2	19,5	266,4	11,6	88,4
0,16	23,7	290,1	12,6	87,4
0,125	14,9	305,0	13,3	86,7
0,1	24,7	329,7	14,4	85,6
0,08	12,2	341,9	14,9	85,1
FOND	6,1	348,0	15,2	84,8



Observation :

Le Directeur du LCBE,

Mr. Soubaneh Said Ismael

REPUBLIQUE DE DJIBOUTI
Unité – Egalité – Paix

Ministère de l'Equipement et des Transports

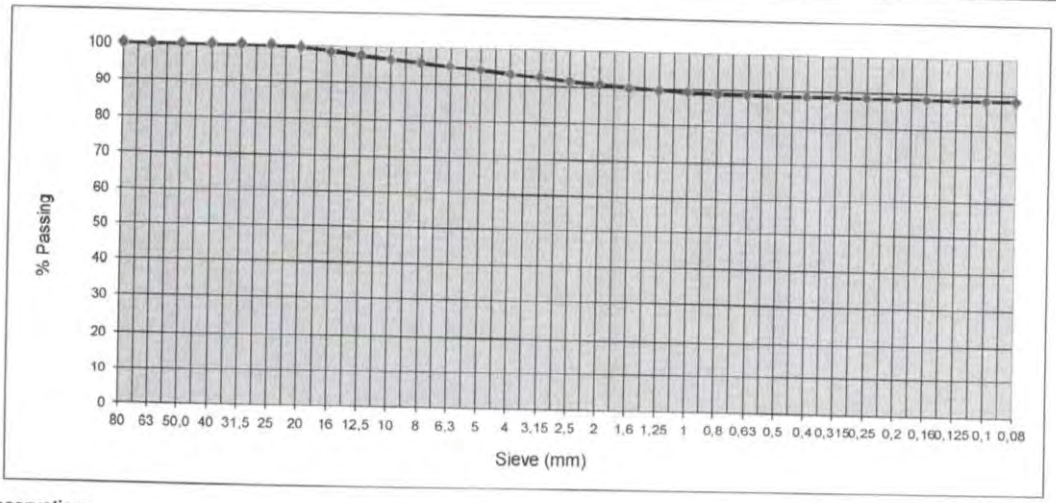
LABORATOIRE CENTRAL
DU BATIMENT ET DE L'EQUIPEMENT
المختبر المركزي للبناء والتجهيز

ANALYSE GRANULOMETRIQUE - NORME NF P 94-056

Dossier : 254-2018
Chantier : Construction d'un quai d'embarquement au Port de Djibouti
Client : Hydroterra Engineering SARL
Matériaux : Identification
Provenance : SC01-Bis (17,0 - 19,5 m)

Poinds Initial (grs): **2247,7**

Tamis	Refus Partiel(gr)	Refus Cumules (gr)	Refus Cumules (%)	Passant (%)
80	0,0	0,0	0,0	100,0
63	0,0	0,0	0,0	100,0
0,0	0,0	0,0	0,0	100,0
40	0,0	0,0	0,0	100,0
31,5	0,0	0,0	0,0	100,0
25	0,0	0,0	0,0	100,0
20	10,5	10,5	0,5	99,5
16	18,9	29,4	1,3	98,7
12,5	22,8	52,2	2,3	97,7
10	19,6	71,8	3,2	96,8
8	13,7	85,5	3,8	96,2
6,3	22,2	107,7	4,8	95,2
5	17,3	125,0	5,6	94,4
4	25,4	150,4	6,7	93,3
3,15	18	168,4	7,5	92,5
2,5	23	191,4	8,5	91,5
2	15	206,4	9,2	90,8
1,6	16,3	222,7	9,9	90,1
1,25	12	234,7	10,4	89,6
1	6,9	241,6	10,7	89,3
0,8	5,5	247,1	11,0	89,0
0,63	2,8	249,9	11,1	88,9
0,5	3,0	252,9	11,3	88,7
0,4	1,2	254,1	11,3	88,7
0,315	3,7	257,8	11,5	88,5
0,25	0,9	258,7	11,5	88,5
0,2	3,3	262,0	11,7	88,3
0,16	0,9	262,9	11,7	88,3
0,125	4,1	267,0	11,9	88,1
0,1	0,6	267,6	11,9	88,1
0,08	0,4	268,0	11,9	88,1
FOND	0,1	268,1	11,9	88,1



Observation :

Le Directeur du LCBE,

Mr. Soubaneh Said Ismael

REPUBLIQUE DE DJIBOUTI
Unité – Egalité – Paix

Ministère de l'Equipement et des Transports

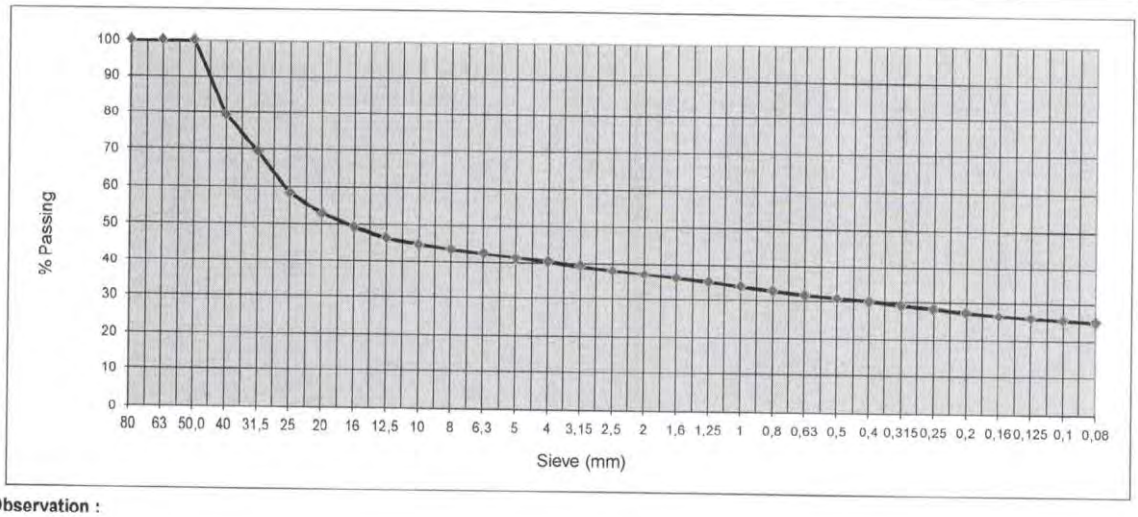
LABORATOIRE CENTRAL
DU BATIMENT ET DE L'EQUIPEMENT
المختبر المركزي للبناء والتجهيز

ANALYSE GRANULOMETRIQUE - NORME NF P 94-056

Dossier : 254-2018
Chantier : Construction d'un quai d'embarquement au Port de Djibouti
Client : Hydroterra Engineering SARL
Matériaux : Identification
Provenance : SC01-Bis (15,0 - 17,0 m)

Poinds Initial (grs): 1963,8

Tamis	Refus Partiel(gr)	Refus Cumules (gr)	Refus Cumules (%)	Passant (%)
80	0,0	0,0	0,0	100,0
63	0,0	0,0	0,0	100,0
50,0	0,0	0,0	0,0	100,0
40	406,5	406,5	20,7	79,3
31,5	195,7	602,2	30,7	69,3
25	218,8	821,0	41,8	58,2
20	104	925,0	47,1	52,9
16	70,1	995,1	50,7	49,3
12,5	51,6	1046,7	53,3	46,7
10	32,8	1079,5	55,0	45,0
8	25,4	1104,9	56,3	43,7
6,3	24,5	1129,4	57,5	42,5
5	25,1	1154,5	58,8	41,2
4	19,1	1173,6	59,8	40,2
3,15	20,2	1193,8	60,8	39,2
2,5	23,3	1217,1	62,0	38,0
2	22,8	1239,9	63,1	36,9
1,6	21,9	1261,8	64,3	35,7
1,25	21,1	1282,9	65,3	34,7
1	19,7	1302,6	66,3	33,7
0,8	21,2	1323,8	67,4	32,6
0,63	18,3	1342,1	68,3	31,7
0,5	15,8	1357,9	69,1	30,9
0,4	15,6	1373,5	69,9	30,1
0,315	16,6	1390,1	70,8	29,2
0,25	16	1406,1	71,6	28,4
0,2	15,8	1421,9	72,4	27,6
0,16	14,8	1436,7	73,2	26,8
0,125	13,5	1450,2	73,8	26,2
0,1	10,3	1460,5	74,4	25,6
0,08	8,4	1468,9	74,8	25,2
FOND	5,1	1474,0	75,1	24,9



Observation :

Le Directeur du LCBE,

Mr. Soubaneh Said Ismael

REPUBLIQUE DE DJIBOUTI

Unité – Egalité – Paix

Ministère de l'Equipement et des Transports

LABORATOIRE CENTRAL DU BATIMENT ET DE L'EQUIPEMENT

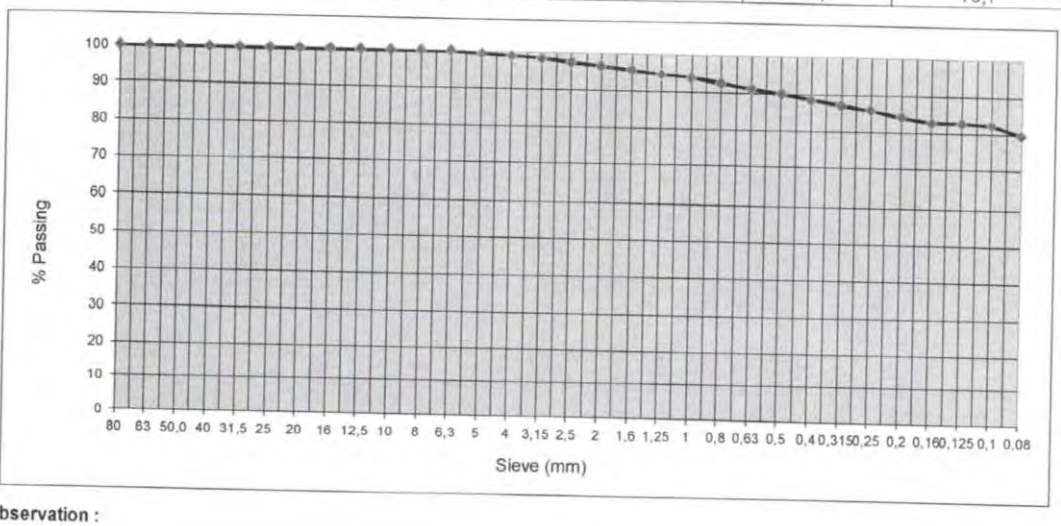
المختبر المركزي للبناء والتجهيز

ANALYSE GRANULOMETRIQUE - NORME NF P 94-056

Dossier : 254-2018
Chantier : Construction d'un quai d'embarquement au Port de Djibouti
Client : Hydroterra Engineering SARL
Matériaux : Identification
Provenance : SC01-Bis (13,0 - 15,0 m)

Poinds Initial (grs): 1399,6

Tamis	Refus Partiel(gr)	Refus Cumules (gr)	Refus Cumules (%)	Passant (%)
80	0,0	0,0	0,0	100,0
63	0,0	0,0	0,0	100,0
50,0	0,0	0,0	0,0	100,0
40	0,0	0,0	0,0	100,0
31,5	0,0	0,0	0,0	100,0
25	0,0	0,0	0,0	100,0
20	0,0	0,0	0,0	100,0
16	0,0	0,0	0,0	100,0
12,5	0,0	0,0	0,0	100,0
10	0,0	0,0	0,0	100,0
8	0,0	0,0	0,0	100,0
6,3	0,0	0,0	0,0	100,0
5	9,0	9,0	0,6	99,4
4	6,9	15,9	1,1	98,9
3,15	6,8	22,7	1,6	98,4
2,5	13,3	36,0	2,6	97,4
2	12,9	48,9	3,5	96,5
1,6	12,7	61,6	4,4	95,6
1,25	14,3	75,9	5,4	94,6
1	11,2	87,1	6,2	93,8
0,8	18,7	105,8	7,6	92,4
0,63	16,1	121,9	8,7	91,3
0,5	18,4	140,3	10,0	90,0
0,4	19,0	159,3	11,4	88,6
0,315	19,4	178,7	12,8	87,2
0,25	17,0	195,7	14,0	86,0
0,2	22,7	218,4	15,6	84,4
0,16	21,1	239,5	17,1	82,9
0,125	0,0	239,5	17,1	82,9
0,1	5,8	245,3	17,5	82,5
0,08	40,3	285,6	20,4	79,6
FOND	7,5	293,1	20,9	79,1



Observation :

Le Directeur du LCBE,

Mr. Soubaneh Said Ismael

REPUBLIQUE DE DJIBOUTI
Unité – Egalité – Paix

Ministère de l'Equipement et des Transports

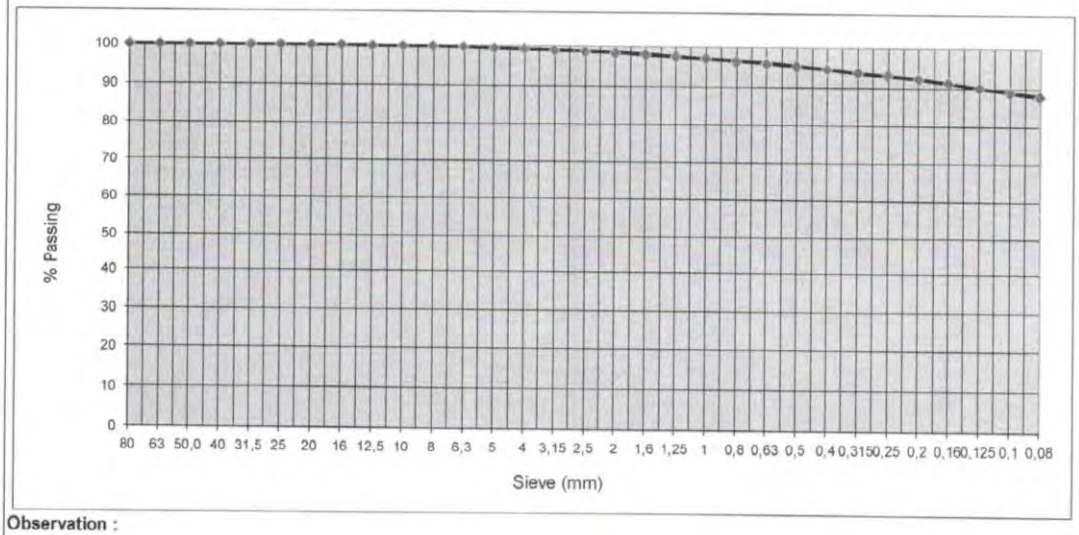
LABORATOIRE CENTRAL
المختبر المركزي للبناء والتجهيز

ANALYSE GRANULOMETRIQUE - NORME NF P 94-056

Dossier : 254-2018
Chantier : Construction d'un quai d'embarquement au Port de Djibouti
Client : Hydroterra Engineering SARL
Matériaux : Identification
Provenance : SC01-Bis (12,0 - 13,0 m)

Poinds Initial (grs): 1426,4

Tamis	Refus Partiel(gr)	Refus Cumules (gr)	Refus Cumules (%)	Passant (%)
80	0,0	0,0	0,0	100,0
63	0,0	0,0	0,0	100,0
0,0	0,0	0,0	0,0	100,0
40	0,0	0,0	0,0	100,0
31,5	0,0	0,0	0,0	100,0
25	0,0	0,0	0,0	100,0
20	0,0	0,0	0,0	100,0
16	0,0	0,0	0,0	100,0
12,5	3,6	3,6	0,3	99,7
10	0,0	3,6	0,3	99,7
8	0,0	3,6	0,3	99,7
6,3	2,4	6,0	0,4	99,6
5	4,0	10,0	0,7	99,3
4	2,1	12,1	0,8	99,2
3,15	4,4	16,5	1,2	98,8
2,5	3,6	20,1	1,4	98,6
2	4,2	24,3	1,7	98,3
1,6	5,5	29,8	2,1	97,9
1,25	6,0	35,8	2,5	97,5
1	5,8	41,6	2,9	97,1
0,8	8,7	50,3	3,5	96,5
0,63	7,2	57,5	4,0	96,0
0,5	9,6	67,1	4,7	95,3
0,4	7,6	74,7	5,2	94,8
0,315	14,0	88,7	6,2	93,8
0,25	9,1	97,8	6,9	93,1
0,2	12,2	110,0	7,7	92,3
0,16	14,4	124,4	8,7	91,3
0,125	19,1	143,5	10,1	89,9
0,1	15,3	158,8	11,1	88,9
0,08	12,4	171,2	12,0	88,0
FOND	0,2	171,4	12,0	88,0



Observation :

Le Directeur du LCBE,

Mr. Soubaneh Said Ismael

REPUBLIQUE DE DJIBOUTI
Unité – Egalité – Paix

Ministère de l'Equipement et des Transports

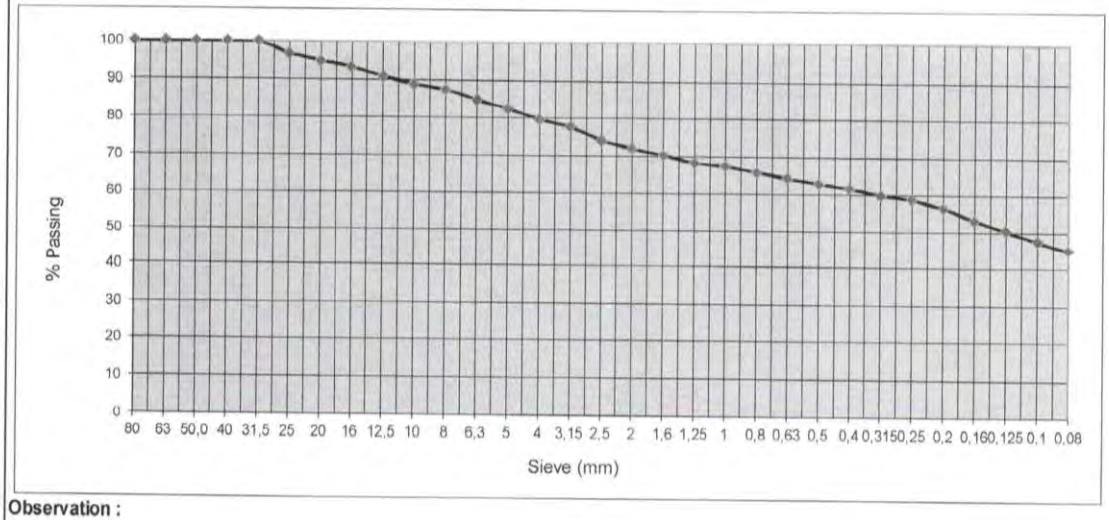
LABORATOIRE CENTRAL
المختبر المركزي للبناء والتجهيز

ANALYSE GRANULOMETRIQUE - NORME NF P 94-056

Dossier : 254-2018
Chantier : Construction d'un quai d'embarquement au Port de Djibouti
Client : Hydroterra Engineering SARL
Matériaux : Identification
Provenance : SC01-Bis (11,0 - 12,0 m)

Poinds Initial (grs): **1029,5**

Tamis	Refus Partiel(gr)	Refus Cumules (gr)	Refus Cumules (%)	Passant (%)
80	0,0	0,0	0,0	100,0
63	0,0	0,0	0,0	100,0
50,0	0,0	0,0	0,0	100,0
40	0,0	0,0	0,0	100,0
31,5	0,0	0,0	0,0	100,0
25	34,3	34,3	3,3	96,7
20	18,2	52,5	5,1	94,9
16	16,8	69,3	6,7	93,3
12,5	27,6	96,9	9,4	90,6
10	18,2	115,1	11,2	88,8
8	12,9	128,0	12,4	87,6
6,3	28,3	156,3	15,2	84,8
5	22,9	179,2	17,4	82,6
4	30,1	209,3	20,3	79,7
3,15	18,9	228,2	22,2	77,8
2,5	38,1	266,3	25,9	74,1
2	20,2	286,5	27,8	72,2
1,6	18,2	304,7	29,6	70,4
1,25	20,8	325,5	31,6	68,4
1	9,8	335,3	32,6	67,4
0,8	16,5	351,8	34,2	65,8
0,63	15,0	366,8	35,6	64,4
0,5	14,7	381,5	37,1	62,9
0,4	14,4	395,9	38,5	61,5
0,315	17,4	413,3	40,1	59,9
0,25	12,0	425,3	41,3	58,7
0,2	23,5	448,8	43,6	56,4
0,16	34,0	482,8	46,9	53,1
0,125	28,6	511,4	49,7	50,3
0,1	30,2	541,6	52,6	47,4
0,08	26,2	567,8	55,2	44,8
FOND	3,5	571,3	55,5	44,5



Observation :

Le Directeur du LCBE,

Mr. Soubaneh Said Ismael

REPUBLIQUE DE DJIBOUTI

Unité – Egalité – Paix

Ministère de l'Equipement et des Transports

LABORATOIRE CENTRAL DU BATIMENT ET DE L'EQUIPEMENT

المختبر المركزي للبناء والتجهيز

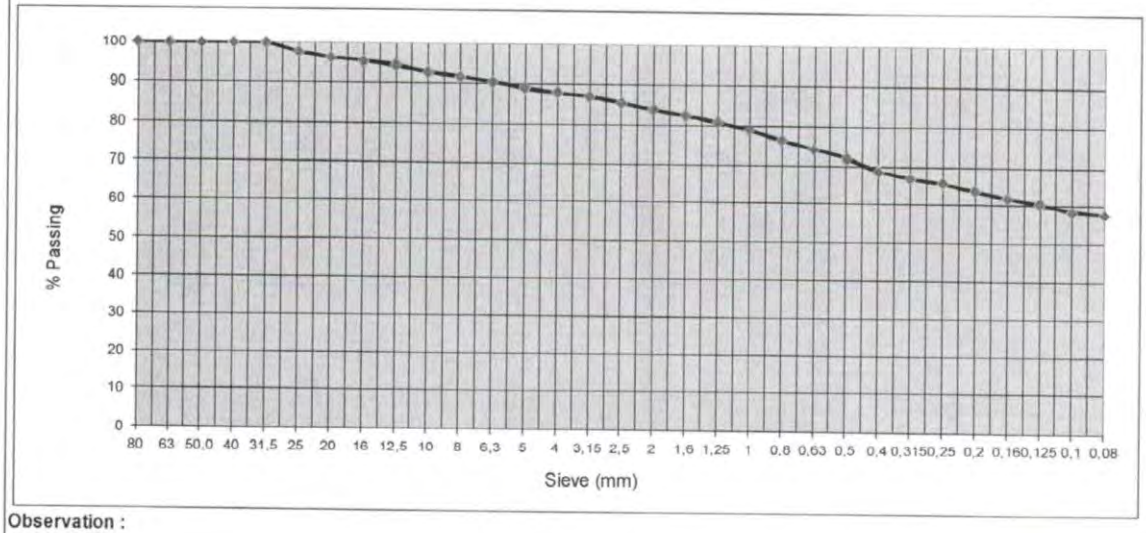
ANALYSE GRANULOMETRIQUE - NORME NF P 94-056

Dossier : 254-2018

Chantier : Construction d'un quai d'embarquement au Port de Djibouti
Client : Hydroterra Engineering SARL
Matériaux : Identification
Provenance : SC01-Bis (6,60- 11,0 m)

Poinds Initial (grs): **1455,9**

Tamis	Refus Partiel(gr)	Refus Cumules (gr)	Refus Cumules (%)	Passant (%)
80	0,0	0,0	0,0	100,0
63	0,0	0,0	0,0	100,0
50,0	0,0	0,0	0,0	100,0
40	0,0	0,0	0,0	100,0
31,5	0,0	0,0	0,0	100,0
25	37,1	37,1	2,5	97,5
20	22,4	59,5	4,1	95,9
16	11,3	70,8	4,9	95,1
12,5	12,6	83,4	5,7	94,3
10	22,8	106,2	7,3	92,7
8	16,9	123,1	8,5	91,5
6,3	17,8	140,9	9,7	90,3
5	19,0	159,9	11,0	89,0
4	15,6	175,5	12,1	87,9
3,15	12,6	188,1	12,9	87,1
2,5	21,5	209,6	14,4	85,6
2	24,4	234,0	16,1	83,9
1,6	22,8	256,8	17,6	82,4
1,25	22,3	279,1	19,2	80,8
1	27,3	306,4	21,0	79,0
0,8	37,9	344,3	23,6	76,4
0,63	33,6	377,9	26,0	74,0
0,5	34,1	412,0	28,3	71,7
0,4	42,6	454,6	31,2	68,8
0,315	27,8	482,4	33,1	66,9
0,25	19,1	501,5	34,4	65,6
0,2	28,6	530,1	36,4	63,6
0,16	27,4	557,5	38,3	61,7
0,125	19,7	577,2	39,6	60,4
0,1	29,0	606,2	41,6	58,4
0,08	10,0	616,2	42,3	57,7
FOND	0,5	616,7	42,4	57,6



Observation :

Le Directeur du LCBE,

Mr. Soubaneh Said Ismael

REPUBLIQUE DE DJIBOUTI
Unité – Egalité – Paix

Ministère de l'Equipement et des Transports

LABORATOIRE CENTRAL
المختبر المركزي للبناء والتجهيز

ANALYSE GRANULOMETRIQUE - NORME NF P 94-056

Dossier : 254-2018
Chantier : Construction d'un quai d'embarquement au Port de Djibouti
Client : Hydroterra Engineering SARL
Matériaux : Identification
Provenance : SC01-Bis (0,0 - 6,6 m)

Poinds Initial (grs): 1731,0

Tamis	Refus Partiel(gr)	Refus Cumules (gr)	Refus Cumules (%)	Passant (%)
80	0,0	0,0	0,0	100,0
63	0,0	0,0	0,0	100,0
50,0	0,0	0,0	0,0	100,0
40	0,0	0,0	0,0	100,0
31,5	0,0	0,0	0,0	100,0
25	0,0	0,0	0,0	100,0
20	0,0	0,0	0,0	100,0
16	0,0	0,0	0,0	100,0
12,5	8,0	8,0	0,5	99,5
10	3,9	11,9	0,7	99,3
8	9,6	21,5	1,2	98,8
6,3	13,6	35,1	2,0	98,0
5	13,1	48,2	2,8	97,2
4	11,7	59,9	3,5	96,5
3,15	15,8	75,7	4,4	95,6
2,5	17,6	93,3	5,4	94,6
2	20,6	113,9	6,6	93,4
1,6	25,7	139,6	8,1	91,9
1,25	30,2	169,8	9,8	90,2
1	31,4	201,2	11,6	88,4
0,8	40,7	241,9	14,0	86,0
0,63	46,3	288,2	16,6	83,4
0,5	44,1	332,3	19,2	80,8
0,4	34,7	367,0	21,2	78,8
0,315	39,3	406,3	23,5	76,5
0,25	31,4	437,7	25,3	74,7
0,2	34,7	472,4	27,3	72,7
0,16	29,2	501,6	29,0	71,0
0,125	32,7	534,3	30,9	69,1
0,1	25,4	559,7	32,3	67,7
0,08	28,2	587,9	34,0	66,0
FOND	3,8	591,7	34,2	65,8

Observation :

Le Directeur du LCBE,

Mr. Soubaneh Said Ismael

Atterberg Limits

REPUBLIQUE DE DJIBOUTI
Unité – Egalité – Paix

Ministère de l'Equipement et des Transports

LCBE
LABORATOIRE CENTRAL
DU BÂTIMENT ET DE L'EQUIPEMENT

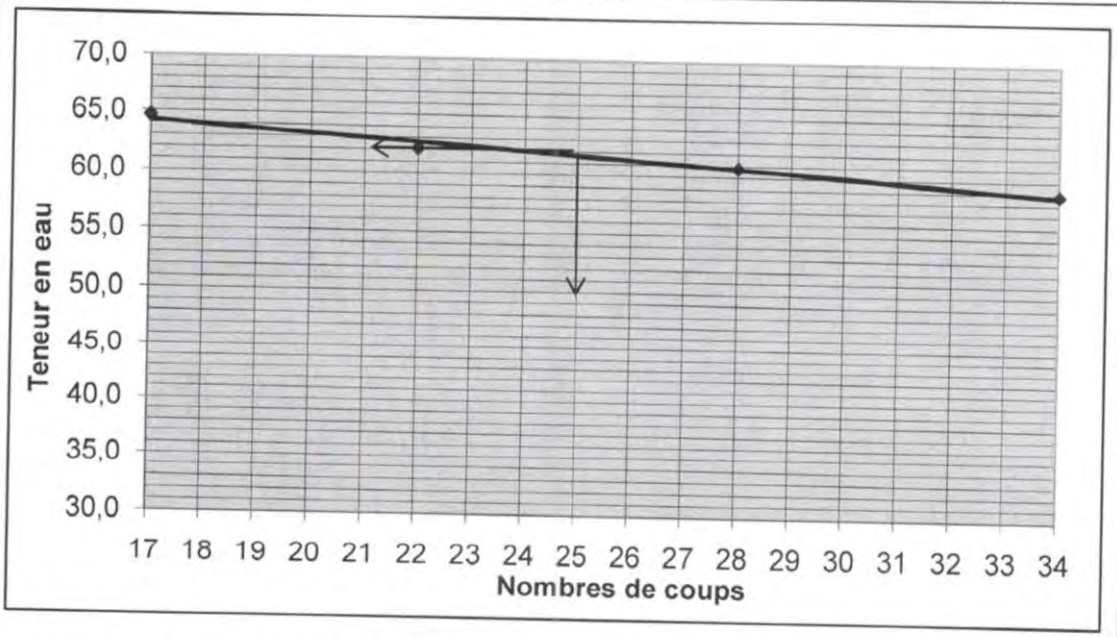
المختبر المركزي للبناء والتجهيز

ESSAI DE LIMITE D'ATTERBERG NORME NF P 94 - 051

Dossier : 254-2018
Chantier : Construction d'un quai d'embarquement au Port de Djibouti
Client : Hydroterra Engineering SARL
Matériaux : Identification
Provenance : SC01 bis (30,00-33,60m)

LL: 61,7 **LP: 28,6** **IP: 33,1**

LIMITE DE LIQUIDITE					LIMITE DE PLASTICITE	
NOMBRE DE COUPS	17	22	28	34	Test n°1	Test n°2
NUMERO DE LA TARE	1	2	3	4	A	B
POIDS TOTAL HUMIDE (g)	40,72	42,26	43,8	41,55	32,8	32,9
POIDS TOTAL SEC (g)	37,1	38,1	39	37,9	32,6	32,7
POIDS DE LA TARE (g)	31,5	31,4	31,1	31,7	31,9	32
POIDS D'EAU (g)	3,62	4,16	4,8	3,65	0,2	0,2
POIDS NET SEC (g)	5,6	6,7	7,9	6,2	0,7	0,7
TENEUR EN EAU (%)	64,6	62,1	60,8	58,9	28,6	28,6
TOTAL (%)	61,6				28,6	



Observation : **La limite de liquidité est de 61,7 et la limite de plasticité du sol de 28,6**

Le Directeur du LCBE,

Mr. Soubaneh Said Ismael

REPUBLIQUE DE DJIBOUTI

Unité – Egalité – Paix

Ministère de l'Equipement et des Transports

LCBE

LABORATOIRE CENTRAL

DU BÂTIMENT ET DE L'ÉQUIPEMENT

المختبر المركزي للبناء والتجهيز

ESSAI DE LIMITE D'ATTERBERG NORME NF P 94 - 051

Dossier : 254-2018

Chantier : Construction d'un quai

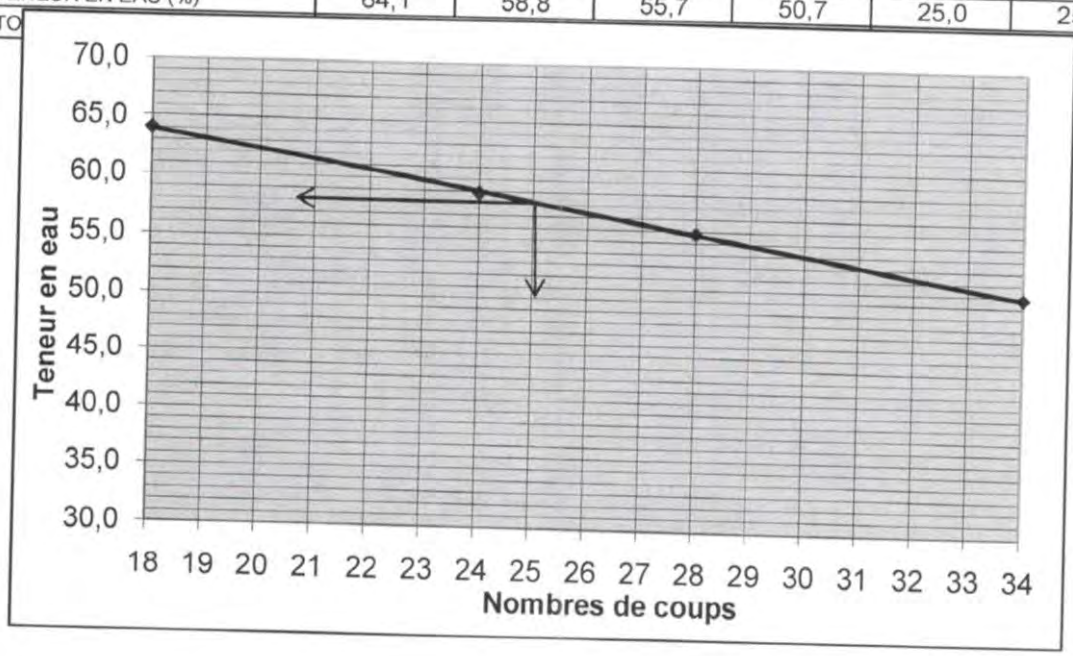
Client : Hydroterra Engineering SARL

Matériaux : Identification

Provenance : SC01 bis (19,50-30,00m)

LL: 58,0 **LP: 25,0** **IP: 33,0**

LIMITE DE LIQUIDITE					LIMITE DE PLASTICITE	
NOMBRE DE COUPS	18	24	28	34	Test n°1	Test n°2
NUMERO DE LA TARE	AA	BB	CC	DD	15	8
POIDS TOTAL HUMIDE (g)	75,8	76	75,6	76,5	32,3	32,5
POIDS TOTAL SEC (g)	71,7	72	71,7	72,9	32,1	32,3
POIDS DE LA TARE (g)	65,3	65,2	64,7	65,8	31,3	31,5
POIDS D'EAU (g)	4,1	4	3,9	3,6	0,2	0,2
POIDS NET SEC (g)	6,4	6,8	7	7,1	0,8	0,8
TENEUR EN EAU (%)	64,1	58,8	55,7	50,7	25,0	25,0



Observation : **La limite de liquidité est de 58,0 et la limite de plasticité du sol de 25,0**

Le Directeur du LCBE,

Mr. Soubaneh Said Ismael

REPUBLIQUE DE DJIBOUTI
Unité – Egalité – Paix

Ministère de l'Equipement et des Transports

LCBE
LABORATOIRE CENTRAL
DU BÂTIMENT ET DE L'EQUIPEMENT

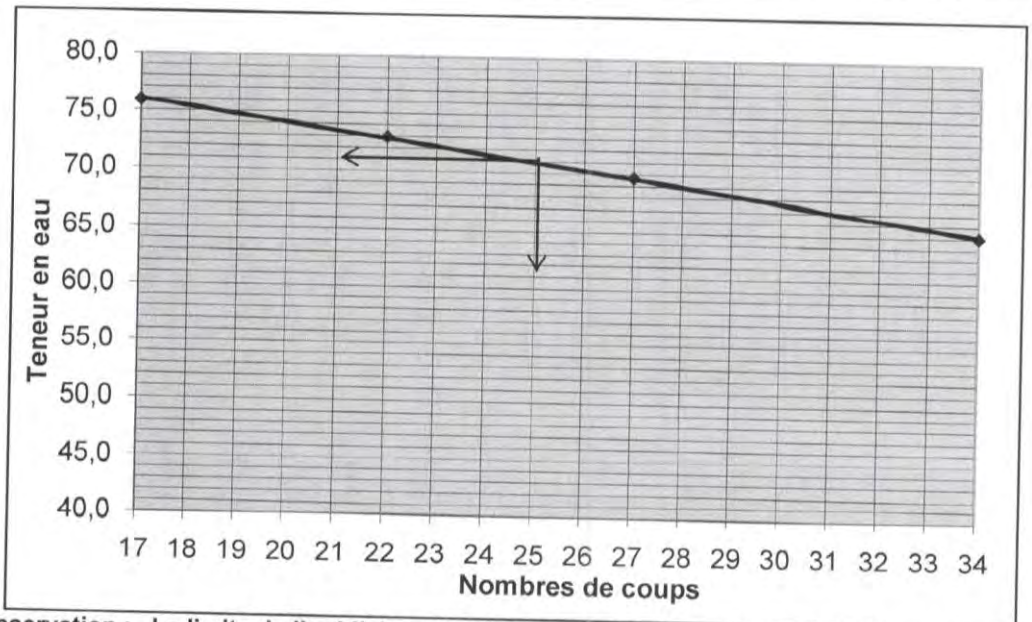
المختبر المركزي للبناء والتجهيز

ESSAI DE LIMITE D'ATTERBERG NORME NF P 94 - 051

Dossier : 254-2018
Chantier : Construction d'un quai d'embarquement au Port de Djibouti
Client : Hydroterra Engineering SARL
Matériaux : Identification
Provenance : SC01 bis (17,00-19,50m)

LL: 70,8 **LP: 29,3** **IP: 41,5**

LIMITE DE LIQUIDITE					LIMITE DE PLASTICITE	
NOMBRE DE COUPS	17	22	27	34	Test n°1	Test n°2
NUMERO DE LA TARE	A	D	3	6	15	8
POIDS TOTAL HUMIDE (g)	50,55	52,14	90,42	105,1	23,4	23,3
POIDS TOTAL SEC (g)	46,3	47,4	86,1	101,2	23,1	23,1
POIDS DE LA TARE (g)	40,7	40,9	79,9	95,2	22,1	22,4
POIDS D'EAU (g)	4,25	4,74	4,32	3,9	0,3	0,2
POIDS NET SEC (g)	5,6	6,5	6,2	6	1	0,7
TENEUR EN EAU (%)	75,9	72,9	69,7	65,0	30,0	28,6
TOTAL (%)	70,9				29,3	



Observation : La limite de liquidité est de 70,8 et la limite de plasticité du sol de 29,3

Le Directeur du LCBE,

Mr. Soubaneh Said Ismael

REPUBLIQUE DE DJIBOUTI
Unité – Egalité – Paix

Ministère de l'Equipement et des Transports

LCBE
LABORATOIRE CENTRAL
DU BÂTIMENT ET DE L'ÉQUIPEMENT

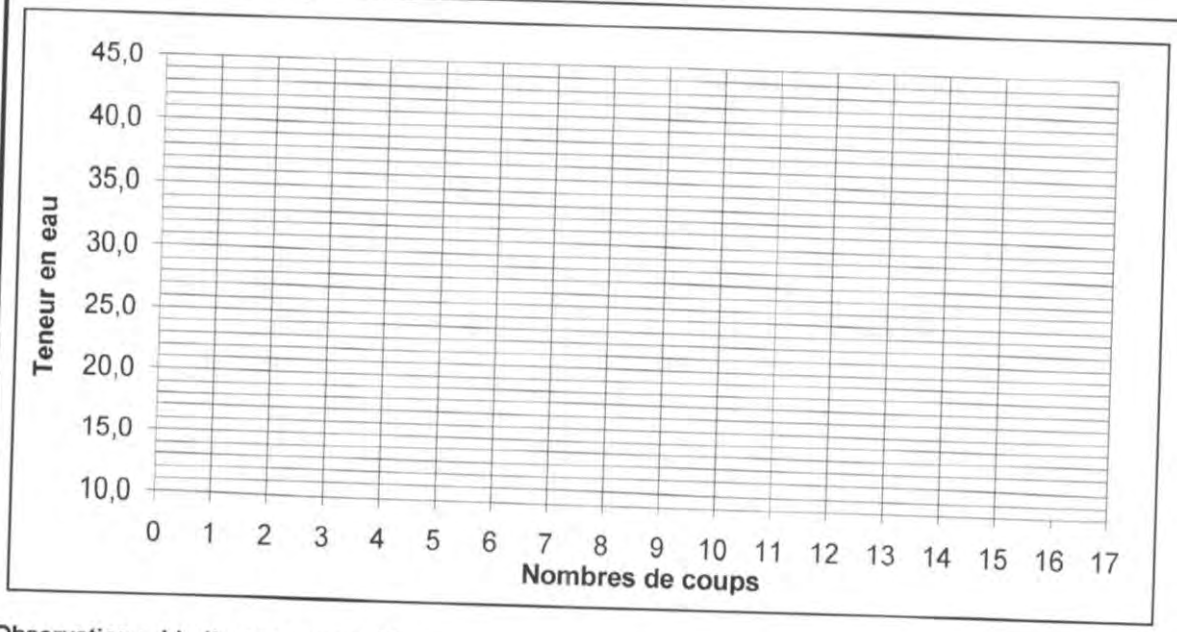
المختبر المركزي للبناء والتجهيز

ESSAI DE LIMITE D'ATTERBERG
NORME NF P 94 - 051

Dossier : 254-2018
Chantier : Construction d'un quai
Client : Hydroterra Engineering SARL
Matériaux : Identification
Provenance : SC01 bis 15,00-17,00m)

LL: **LP:** **IP: 0,0**

LIMITE DE LIQUIDITE		LIMITE DE PLASTICITE	
NOMBRE DE COUPS	Non Mesurable	Test n°1	Test n°2
NUMERO DE LA TARE			
POIDS TOTAL HUMIDE (g)			
POIDS TOTAL SEC (g)			
POIDS DE LA TARE (g)			
POIDS D'EAU (g)			
POIDS NET SEC (g)			
TENEUR EN EAU (%)			
TOTAL (%)			



Observation : Limite non mesurable

Le Directeur du LCBE,

Mr. Soubaneh Said Ismael

REPUBLIQUE DE DJIBOUTI

Unité – Egalité – Paix

Ministère de l'Equipement et des Transports

LCBE

LABORATOIRE CENTRAL

DU BÂTIMENT ET DE L'EQUIPEMENT

ESSAI DE LIMITE D'ATTERBERG NORME NF P 94 - 051

Dossier : 254-2018

Chantier : Construction d'un quai d'embarquement au Port de Djibouti

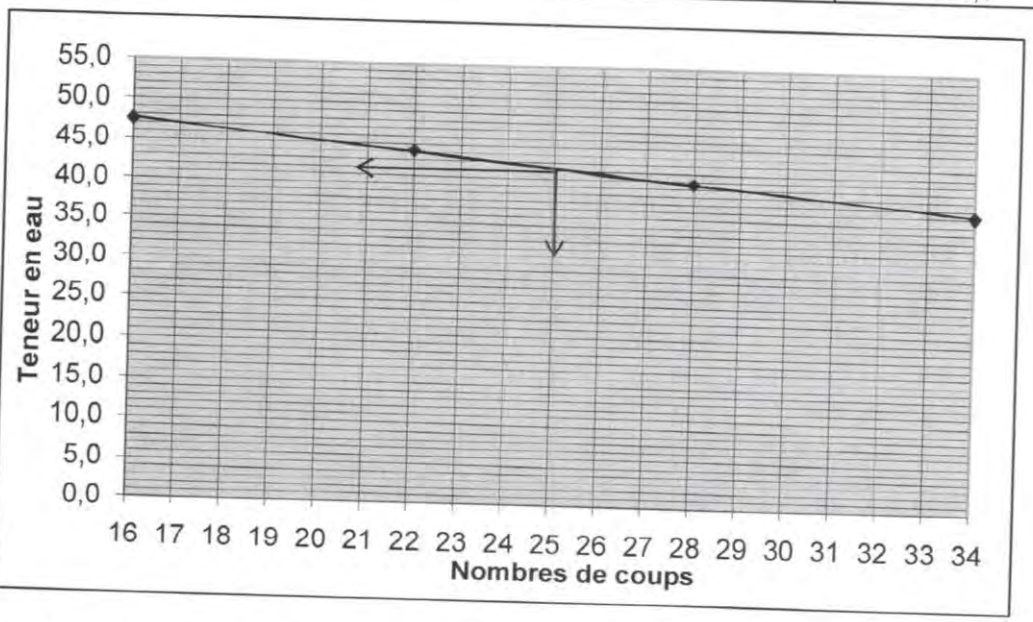
Client : Hydroterra Engineering SARL

Matériaux : Identification

Provenance : SC01 bis (13,00-15,00m)

LL: 43,0 **LP: 28,6** **IP: 14,4**

LIMITE DE LIQUIDITE					LIMITE DE PLASTICITE	
NOMBRE DE COUPS	16	22	28	34	Test n°1	Test n°2
NUMERO DE LA TARE	AA	BB	CC	DD	EE	19
POIDS TOTAL HUMIDE (g)	74	75,48	75,71	76,4	66,3	65,7
POIDS TOTAL SEC (g)	71,2	72,3	72,5	73,5	66	65,4
POIDS DE LA TARE (g)	65,3	65,1	64,6	65,7	65	64,3
POIDS D'EAU (g)	2,8	3,18	3,21	2,9	0,3	0,3
POIDS NET SEC (g)	5,9	7,2	7,9	7,8	1	1,1
TENEUR EN EAU (%)	47,5	44,2	40,6	37,2	30,0	27,3
TOTAL (%)	42,4				28,6	



Observation : La limite de liquidité est de 43 et la limite de plasticité du sol de 28.6

Le Directeur du LCBE,

Mr. Soubaneh Said Ismael

REPUBLIQUE DE DJIBOUTI

Unité – Egalité – Paix

Ministère de l'Equipement et des Transports

LCBE

LABORATOIRE CENTRAL

DU BÂTIMENT ET DE L'EQUIPEMENT

المختبر المركزي للبناء والتجهيز

ESSAI DE LIMITE D'ATTERBERG NORME NF P 94 - 051

Dossier : 254-2018

Chantier : Construction d'un quai d'embarquement au Port de Djibouti

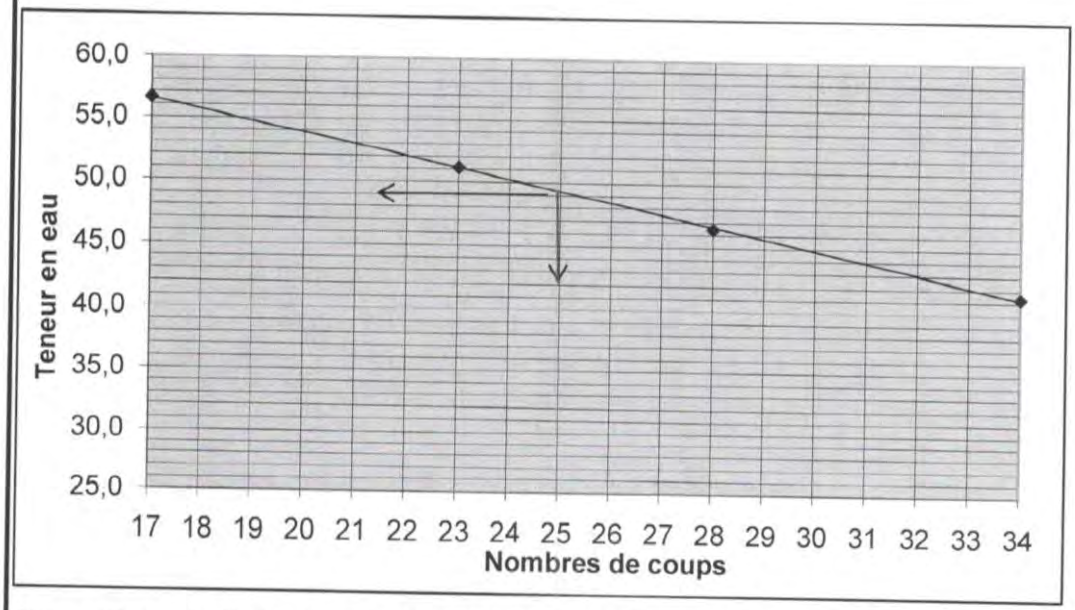
Client : Hydroterra Engineering SARL

Matériaux : Identification

Provenance : SC01 bis (12,00-13,00m)

LL: 49,5 **LP: 34,5** **IP: 15,0**

LIMITE DE LIQUIDITE					LIMITE DE PLASTICITE	
NOMBRE DE COUPS	17	23	28	34	Test n°1	Test n°2
NUMERO DE LA TARE	8	9	10	4	A	B
POIDS TOTAL HUMIDE (g)	41,82	40,92	42,63	42,1	33,6	33,1
POIDS TOTAL SEC (g)	38,2	37,7	39,1	39	33,1	32,7
POIDS DE LA TARE (g)	31,8	31,4	31,5	31,5	31,7	31,5
POIDS D'EAU (g)	3,62	3,22	3,53	3,1	0,5	0,4
POIDS NET SEC (g)	6,4	6,3	7,6	7,5	1,4	1,2
TENEUR EN EAU (%)	56,6	51,1	46,4	41,3	35,7	33,3
TOTAL (%)	48,9				34,5	



Observation : **La limite de liquidité est de 49,5 et la limite de plasticité du sol de 34,5**

Le Directeur du LCBE,

Mr. Soubaneh Said Ismael

REPUBLIQUE DE DJIBOUTI
Unité – Egalité – Paix

Ministère de l'Equipement et des Transports

LCBE
LABORATOIRE CENTRAL
DU BÂTIMENT ET DE L'EQUIPEMENT

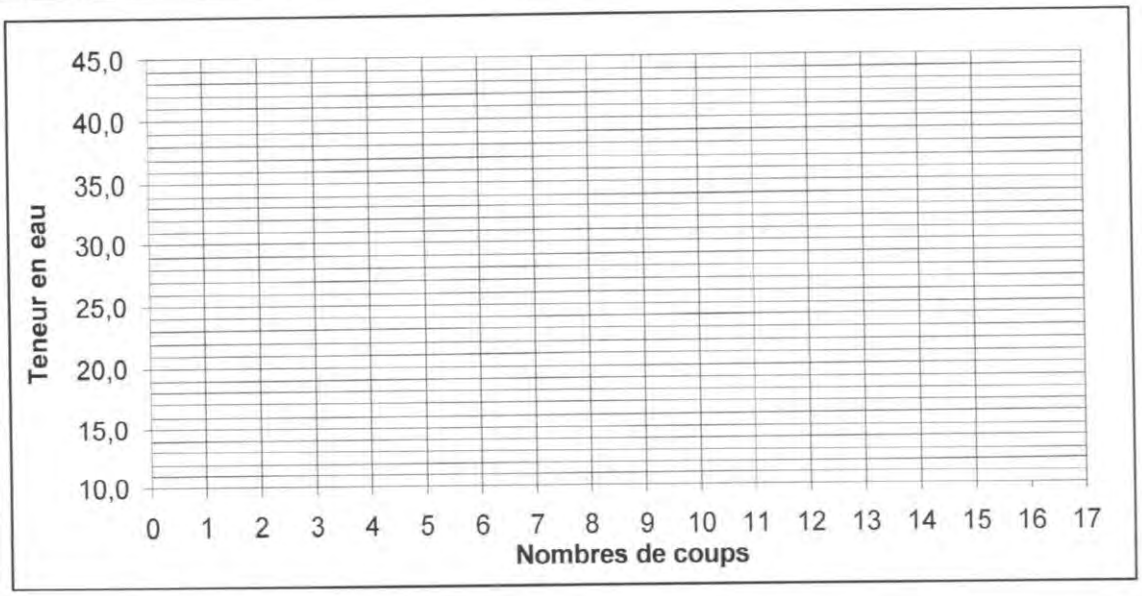
المختبر المركزي للبناء والتجهيز

ESSAI DE LIMITE D'ATTERBERG
NORME NF P 94 - 051

Dossier : 254-2018
Chantier : Construction d'un quai
Client : Hydroterra Engineering SARL
Matériaux : Identification
Provenance : SC01 bis (11,00-12,00m)

LL: **LP:** **IP: 0,0**

LIMITE DE LIQUIDITE	**LIMITE DE PLASTICITE**	
	Test n°1	**Test n°2**
NOMBRE DE COUPS	Non Mesurable	
NUMERO DE LA TARE		
POIDS TOTAL HUMIDE (g)		
POIDS TOTAL SEC (g)		
POIDS DE LA TARE (g)		
POIDS D'EAU (g)		
POIDS NET SEC (g)		
TENEUR EN EAU (%)		
TOTAL (%)		



Observation : Limite non mesurable

Le Directeur du LCBE,

Mr. Soubaneh Said Ismael

REPUBLIQUE DE DJIBOUTI

Unité – Egalité – Paix

Ministère de l'Equipement et des Transports

LCBE

LABORATOIRE CENTRAL
DU BÂTIMENT ET DE L'EQUIPEMENT

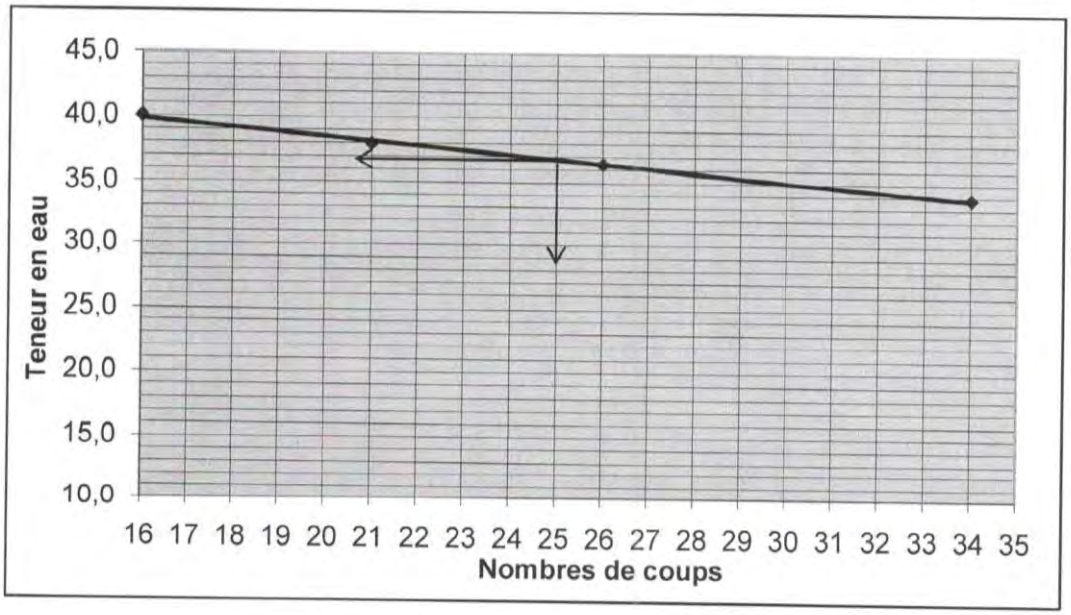
المختبر المركزي للبناء والتجهيز

ESSAI DE LIMITE D'ATTERBERG NORME NF P 94 - 051

Dossier : 254-2018
Chantier : Construction d'un quai d'embarquement au Port de Djibouti
Client : Hydroterra Engineering SARL
Matériaux : Identification
Provenance : SC01 bis (0,00-11,00m)

LL: 36,7 **LP: 22,9** **IP: 13,8**

LIMITE DE LIQUIDITE					LIMITE DE PLASTICITE	
NOMBRE DE COUPS	16	21	26	34	Test n°1	Test n°2
NUMERO DE LA TARE	1	2	3	4	A	B
POIDS TOTAL HUMIDE (g)	42,0	41,17	40,02	40,9	33,7	34,2
POIDS TOTAL SEC (g)	39,0	38,4	37,8	38,5	33,3	33,8
POIDS DE LA TARE (g)	31,5	31,1	31,7	31,4	31,6	32
POIDS D'EAU (g)	3,0	2,77	2,22	2,4	0,4	0,4
POIDS NET SEC (g)	7,5	7,3	6,1	7,1	1,7	1,8
TENEUR EN EAU (%)	40,0	37,9	36,4	33,8	23,5	22,2
TOTAL (%)	37,0				22,9	



Observation : **La limite de liquidité est de 36,7 et la limite de plasticité du sol de 22,9**

Le Directeur du LCBE,

Mr. Soubaneh Said Ismael

REPUBLIQUE DE DJIBOUTI
Unité – Egalité – Paix

Ministère de l'Equipement et des Transports

LCBE
LABORATOIRE CENTRAL
DU BÂTIMENT ET DE L'EQUIPEMENT

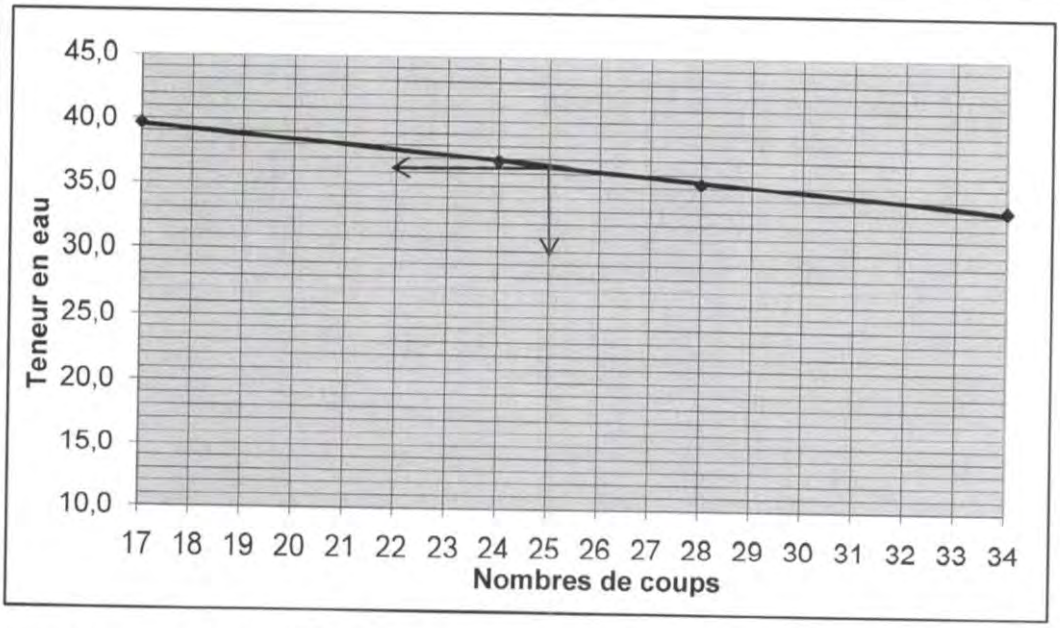
المختبر المركزي للبناء والتجهيز

ESSAI DE LIMITE D'ATTERBERG NORME NF P 94 - 051

Dossier : 254-2018
Chantier : Construction d'un quai d'embarquement au Port de Djibouti
Client : Hydroterra Engineering SARL
Matériaux : Identification
Provenance : SC01 bis (33,60-36,00m)

LL: 36,5 **LP: 25,8** **IP: 10,7**

LIMITE DE LIQUIDITE					LIMITE DE PLASTICITE	
NOMBRE DE COUPS	17	24	28	34	Test n°1	Test n°2
NUMERO DE LA TARE	1	2	3	4	A	B
POIDS TOTAL HUMIDE (g)	42,95	42,05	42,9	43,7	33,5	33,6
POIDS TOTAL SEC (g)	39,7	39,1	39,9	40,7	33,1	33,3
POIDS DE LA TARE (g)	31,5	31,1	31,4	31,7	31,7	32
POIDS D'EAU (g)	3,25	2,95	3	3	0,4	0,3
POIDS NET SEC (g)	8,2	8	8,5	9	1,4	1,3
TENEUR EN EAU (%)	39,6	36,9	35,3	33,3	28,6	23,1
TOTAL (%)	36,3				25,8	



Observation : La limite de liquidité est de 36,5 et la limite de plasticité du sol de 25,8

Le Directeur du LCBE,

Mr. Soubaneh Said Ismael

Water content

REPUBLIQUE DE DJIBOUTI
Unité – Egalité – Paix

Ministère de l'Equipement et des Transports

LCBE
LABORATOIRE CENTRAL
DU BATIMENT ET DE L'EQUIPEMENT

المختبر المركزي للبناء والتجهيز

ESSAI DE TENEUR EN EAU

Dossier : 254-2018
Chantier : Construction d'un quai d'embarquement au Port de Djibouti
Client : Hydroterra Engineering SARL
Matériaux : Identification
Provenance : SC01-BIS

PROFONDEUR	0 -6,6 m	6,6-11 m	11-12 m	12-13 m	13-15 m
NUMERO DE LA TARE	II	AC	H	X	B
POIDS TOTAL HUMIDE (g)	571	380,6	643,4	486,6	408,8
POIDS TOTAL SEC (g)	455,5	332,9	544,7	332,8	338,7
POIDS DE LA TARE (g)	60,7	57,7	59,9	60,9	52
POIDS D'EAU (g)	115,5	47,7	98,7	153,8	70,1
POIDS NET SEC (g)	394,8	275,2	484,8	271,9	286,70
TENEUR EN EAU (%)	29,26	17,33	20,36	56,56	24,45

PROFONDEUR	15-17m	17-19,5 m	19,5-30 m	30-33,6 m	33,6-36 m
NUMERO DE LA TARE	FF	7	4	E	G
POIDS TOTAL HUMIDE (g)	558,9	488,7	437	532,5	591,6
POIDS TOTAL SEC (g)	474,9	332,8	270	429,9	478,4
POIDS DE LA TARE (g)	52,3	53,6	50,6	51,1	57,2
POIDS D'EAU (g)	84	155,9	167	102,6	113,2
POIDS NET SEC (g)	422,6	279,2	219,4	378,8	421,2
TENEUR EN EAU (%)	19,88	55,84	76,12	27,09	26,88

Observations :

Le Directeur du L C B E

Soubaneh Said Ismael

Specific weight

REPUBLIQUE DE DJIBOUTI
Unité – Egalité – Paix

Ministère de l'Equipement et des Transports

LABORATOIRE CENTRAL
DU BATIMENT ET DE L'EQUIPEMENT
المختبر المركزي للبناء والتجهيز

FEUILLE D'ESSAIS

DENSITE SPECIFIQUE PAR PYCOMETRE

DOSSIER N° : 254-2018 **DATE D'EDITION:** 17/11/2018 **NORME :** NF P94-054

DOSSIER :

Demandeur : *Hydroterra Engineering SARL*
Chantier : *Construction d'un quai d'embarquement au Port de Djibouti*
Epreuve de : *Identification*
Partie de l'ouvrage : *Etude Géotechnique et Sondage*

REFERENCES DE L'ECHANTILLON :

Provenance : *SC01-Bis*
N° échantillon : 17-19.5 m et 19.5-30 m

RESULTATS :

description	détermination	
Profondeur : 17.0 m-19.5 m	1	2
Poids pycnomètre (W1) en g	241,3	241,3
Poids pycnomètre + échantillon (W2) en g	341,3	343,2
Poids pycnomètre + échantillon +eau (W3) en g	962,6	961,0
Poids pycnomètre +eau (W4) en g	898,2	898,2
Poids spécifique	2,81	2,61
Moyenne	2,71	

description	détermination	
Profondeur : 19.5 m-30.0 m	1	2
Poids pycnomètre (W1) en g	243,1	243,1
Poids pycnomètre + échantillon (W2) en g	343,0	341,6
Poids pycnomètre + échantillon +eau (W3) en g	960,0	959,4
Poids pycnomètre +eau (W4) en g	898,3	898,3
Poids spécifique	2,62	2,63
Moyenne	2,62	

OBSERVATIONS :

LE DIRECTEUR DU LCBE

SOUBANEH SAID ISMAEL

Zone Industrielle Sud (Boulaos) – BP : 2016 – Tel : +(253) 21 35 34 77 Fax : (253) 21 35 11 68

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Ministère de l'Equipement et des Transports

LCBE
LABORATOIRE CENTRAL
DU BATIMENT ET DE L'EQUIPEMENT

المختبر المركزي للبناء والتجهيز

FEUILLE D'ESSAIS

DENSITE SPECIFIQUE PAR PYCOMETRE

DOSSIER N° : 254-2018 **DATE D'EDITION:** 17/11/2018 **NORME :** NF P94-054

DOSSIER :

Demandeur : *Hydroterra Engineering SARL*
Chantier : *Construction d'un quai d'embarquement au Port de Djibouti*

Epreuve de : *Identification*
Partie de l'ouvrage : *Etude Géotechnique et Sondage*

REFERENCES DE L'ECHANTILLON :

Provenance : *SC01-Bis*
N° échantillon : 13-15 m et 15-17 m

RESULTATS :

description	détermination	
Profondeur : 13.0 m-15.0m	1	2
Poids pycnomètre (W1) en g	244	244
Poids pycnomètre + échantillon (W2) en g	344,0	343,9
Poids pycnomètre + échantillon +eau (W3) en g	958,7	959,1
Poids pycnomètre +eau (W4) en g	898,2	898,2
Poids spécifique	2,53	2,56
Moyenne	2,55	

description	détermination	
Profondeur : 15.0 m-17.0m	1	2
Poids pycnomètre (W1) en g	244	244
Poids pycnomètre + échantillon (W2) en g	341,6	343,4
Poids pycnomètre + échantillon +eau (W3) en g	958,7	957,9
Poids pycnomètre +eau (W4) en g	898,2	898,2
Poids spécifique	2,63	2,50
Moyenne	2,57	

OBSERVATIONS :

LE DIRECTEUR DU LCBE

SOUBANEH SAID ISMAEL

Zone Industrielle Sud (Boulaos) – BP : 2016 – Tel : +(253) 21 35 34 77 – Fax : +(253) 21 35 11 68

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DU BÂTIMENT ET DE L'ÉQUIPEMENT

المختبر المركزي للبناء والتجهيز

FEUILLE D'ESSAIS

DENSITE SPECIFIQUE PAR PYCOMETRE

DOSSIER N° :	**DATE D'EDITION:**	**NORME :**
254-2018	17/11/2018	NF P94-054

DOSSIER :

Demandeur : *Hydroterra Engineering SARL*
Chantier : *Construction d'un quai d'embarquement au Port de Djibouti*

Epreuve de : *Identification*
Partie de l'ouvrage : *Etude Géotechnique et Sondage*

REFERENCES DE L'ECHANTILLON :

Provenance : *SC01-Bis*
N° échantillon : 11-12 m et 12-13 m

RESULTATS :

description	détermination	
Profondeur : 11.0 m-12.0 m	1	2
Poids pycnomètre (W1) en g	244,2	244,2
Poids pycnomètre + échantillon (W2) en g	344,5	340,3
Poids pycnomètre + échantillon +eau (W3) en g	958,6	956,3
Poids pycnomètre +eau (W4) en g	898,2	898,2
Poids spécifique	2,51	2,53
Moyenne	2,52	

description	détermination	
Profondeur : 12.0 m-13.0 m	1	2
Poids pycnomètre (W1) en g	244,2	244,2
Poids pycnomètre + échantillon (W2) en g	340,9	344,0
Poids pycnomètre + échantillon +eau (W3) en g	959,3	957,3
Poids pycnomètre +eau (W4) en g	898,2	898,2
Poids spécifique	2,70	2,45
Moyenne	2,57	

OBSERVATIONS :

LE DIRECTEUR DU LCBE

SOUBANEH SAID ISMAEL

Zone Industrielle Sud (Boulaos) – BP : 2016 – Tel : +(253) 21 35 34 77 – Fax : +(253) 21 35 11 68

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LCBE
LABORATOIRE CENTRAL
DU BATIMENT ET DE L'EQUIPEMENT

المختبر المركزي للبناء والتجهيز

FEUILLE D'ESSAIS

DENSITE SPECIFIQUE PAR PYCOMETRE

DOSSIER N° :	DATE D'EDITION:	NORME :
254-2018	17/11/2018	NF P94-054

DOSSIER :

Demandeur : *Hydroterra Engineering SARL*
Chantier : *Construction d'un quai d'embarquement au Port de Djibouti*

Epreuve de : *Identification*
Partie de l'ouvrage : *Etude Géotechnique et Sondage*

REFERENCES DE L'ECHANTILLON :

Provenance : *SC01-Bis*

N° échantillon : 0.0-6.0 m et 6.6-11 m

RESULTATS :

description	détermination	
Profondeur : 0.0 m-6.6 m	1	2
Poids pycnomètre (W1) en g	243,1	243,1
Poids pycnomètre + échantillon (W2) en g	343,5	344,2
Poids pycnomètre + échantillon +eau (W3) en g	961,3	961,6
Poids pycnomètre +eau (W4) en g	898,3	898,3
Poids spécifique	2,68	2,67
Moyenne	2,68	

description	détermination	
Profondeur : 6.6 m -11.0 m	1	2
Poids pycnomètre (W1) en g	244,2	240,3
Poids pycnomètre + échantillon (W2) en g	343,8	340,5
Poids pycnomètre + échantillon +eau (W3) en g	966,6	960,6
Poids pycnomètre +eau (W4) en g	898,3	898,3
Poids spécifique	3,18	2,64
Moyenne	2,91	

OBSERVATIONS :

LE DIRECTEUR DU LCBE

SOUBANEH SAID ISMAEL

Zone Industrielle Sud (Boulaos) – BP : 2016 – Tel : +(253) 21 35 34 77 – Fax : +(253) 21 35 11 68

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DU BATIMENT ET DE L'EQUIPEMENT

المختبر المركزي للبناء والتجهيز

FEUILLE D'ESSAIS

DENSITE SPECIFIQUE PAR PYCOMETRE

DOSSIER N° : 254-2018 **DATE D'EDITION:** 17/11/2018 **NORME :** NF P94-054

DOSSIER :

Demandeur : *Hydroterra Engineering SARL*
Chantier : *Construction d'un quai d'embarquement au Port de Djibouti*

Epreuve de : *Identification*
Partie de l'ouvrage : *Etude Géotechnique et Sondage*

REFERENCES DE L'ECHANTILLON :

Provenance : *SC01-Bis*
N° échantillon : 30-33.6 m et 33.6-36m

RESULTATS :

description	détermination	
Profondeur : 30,0m-33,6m	1	2
Poids pycnomètre (W1) en g	244	244
Poids pycnomètre + échantillon (W2) en g	336,4	341,1
Poids pycnomètre + échantillon +eau (W3) en g	954,4	956
Poids pycnomètre +eau (W4) en g	898,2	898,2
Poids spécifique	2,55	2,47
Moyenne	2,51	

description	détermination	
Profondeur : 33,6m-36,00m	1	2
Poids pycnomètre (W1) en g	243,1	243,1
Poids pycnomètre + échantillon (W2) en g	341,4	341,1
Poids pycnomètre + échantillon +eau (W3) en g	960,0	959,4
Poids pycnomètre +eau (W4) en g	898,3	898,3
Poids spécifique	2,69	2,66
Moyenne	2,67	

OBSERVATIONS :

LE DIRECTEUR DU LCBE

SOUBANEH SAID ISMAEL

Zone Industrielle Sud (Boulaos) – BP : 2016 – Tel : +(253) 21 35 34 77 – Fax : +(253) 21 35 11 68

Apparent weight

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Ministère de l'Equipement et des Transports

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LABORATOIRE CENTRAL
DU BATIMENT ET DE L'EQUIPEMENT
المختبر المركزي للبناء والتجهيز

DENSITE APPARENTE GABARI

Dossier : 254-2018
Chantier : Construction d'un quai d'embarquement au Port de Djibouti
Client : Hydroterra Engineering SARL
Matériaux : Identification
Provenance : SC01-Bis

sonadage	SC01-Bis				
Profondeur (m)	0-6.60 m	6.6-11 m	11-12 m	19.5-30 m	33.60-36 m
Poids Total de Materiau (g)	3264	3263	3351	3247	3260
Poids de Gabari (g)	2569	2569	2569	2569	2569
Volume de Gabari (cm^3)	617	617	617	617	617
Densite Apparente (g/cm^3)	1,13	1,13	1,27	1,10	1,12

Observation :

Le Directeur du L C B E
Soubaneh Said Ismael

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LABORATOIRE CENTRAL
DU BATIMENT ET DE L'EQUIPEMENT
المختبر المركزي للبناء والتجهيز

DENSITE APPARENTE PAR PESEE HYDROSTATIQUE

Dossier : 254-2018
Chantier : Construction d'un quai d'embarquement au Port de Djibouti
Client : Hydroterra Engineering SARL
Matériaux : Identification
Provenance : SC01-Bis

Sondage	SC01-Bis				
Profondeur	12-13 m	13-15 m	15-17 m	17-19,5 m	30-33,6 m
Poids Humide avant paraffinage (g)	682	902	813,8	867,9	878,4
Poids après paraffinage (g)	705,2	932,1	860,9	896,8	908,7
Poids dans l'Eau (g)	305	438	349,5	380	365
Volume Total (cm^3)	400,2	494,1	511,4	516,8	543,7
Poids de paraffine (g)	23,2	30,1	47,1	28,9	30,3
Volume d'Echantillon (cm^3)	377	464	464,3	487,9	513,4
Volume de paraffine (cm^3)	25,78	33,4	52,3	32,11	33,67
Densité Apparente (g/cm^3)	1,81	1,94	1,75	1,78	1,71

Observation :

Le Directeur du L C B E
Soubaneh Said Ismael

SC02

(BH D-03)

Sieve analysis

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Ministère de l'Equipement et des Transports

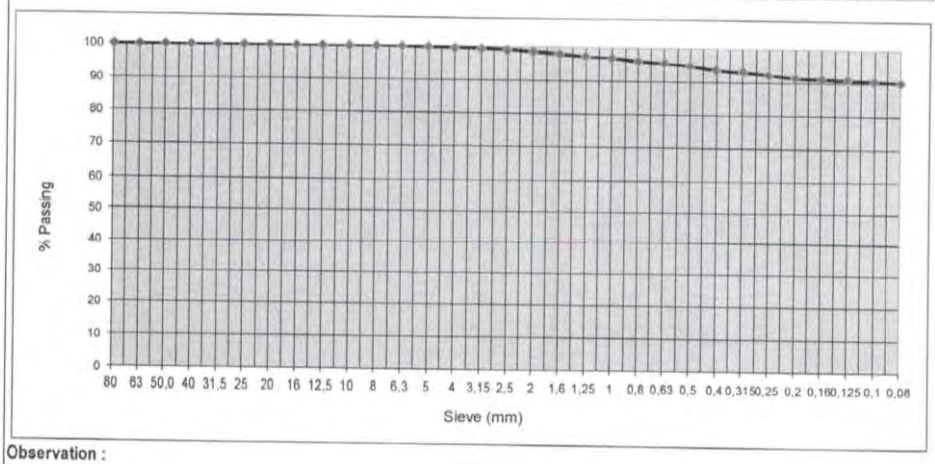
LABORATOIRE CENTRAL DU BATIMENT ET DE L'EQUIPEMENT
المختبر المركزي للبناء والتجهيز

ANALYSE GRANULOMETRIQUE - NORME NF P 94-056

Dossier : 254-2018
Chantier : Construction d'un quai d'embarquement au Port de Djibouti
Client : Hydroterra Engineering SARL
Matériaux : Identification
Provenance : SC02 (5,0- 7,0 m)

Poinds Initial (grs): **2287,7**

Tamis	Refus Partiel(gr)	Refus Cumules (gr)	Refus Cumules (%)	Passant (%)
80	0,0	0,0	0,0	100,0
63	0,0	0,0	0,0	100,0
50,0	0,0	0,0	0,0	100,0
40	0,0	0,0	0,0	100,0
31,5	0,0	0,0	0,0	100,0
25	0,0	0,0	0,0	100,0
20	0,0	0,0	0,0	100,0
16	0,0	0,0	0,0	100,0
12,5	0,0	0,0	0,0	100,0
10	0,0	0,0	0,0	100,0
8	0,0	0,0	0,0	100,0
6,3	0,0	0,0	0,0	100,0
5	4,8	4,8	0,2	99,8
4	3,4	8,2	0,4	99,6
3,15	3,6	11,8	0,5	99,5
2,5	8,1	19,9	0,9	99,1
2	10,5	30,4	1,3	98,7
1,6	11,9	42,3	1,8	98,2
1,25	13,8	56,1	2,5	97,5
1	9,1	65,2	2,9	97,1
0,8	19,2	84,4	3,7	96,3
0,63	13,3	97,7	4,3	95,7
0,5	16,4	114,1	5,0	95,0
0,4	30,3	144,4	6,3	93,7
0,315	9,2	153,6	6,7	93,3
0,25	18,3	171,9	7,5	92,5
0,2	22,1	194,0	8,5	91,5
0,16	6,3	200,3	8,8	91,2
0,125	5,3	205,6	9,0	91,0
0,1	9,0	214,6	9,4	90,6
0,08	10,4	225,0	9,8	90,2
FOND	2,4	227,4	9,9	90,1



Observation :

Le Directeur du LCBE,

Mr. Soubaneh Said Ismael

REPUBLIQUE DE DJIBOUTI
Unité – Egalité – Paix

Ministère de l'Equipement et des Transports

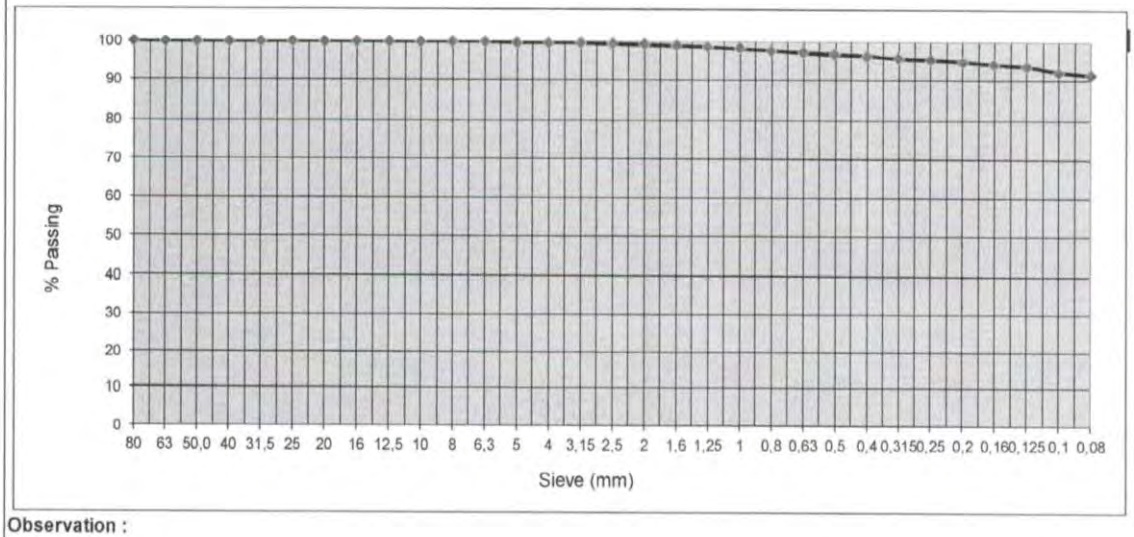
LABORATOIRE CENTRAL DU BATIMENT ET DE L'EQUIPEMENT
المختبر المركزي للبناء والتجهيز

ANALYSE GRANULOMETRIQUE - NORME NF P 94-056

Dossier : 254-2018
Chantier : Construction d'un quai d'embarquement au Port de Djibouti
Client : Hydroterra Engineering SARL
Matériaux : Identification
Provenance : SC02 (3,0- 5,0 m)

Poinds Initial (grs): **2459,9**

Tamis	Refus Partiel(gr)	Refus Cumules (gr)	Refus Cumules (%)	Passant (%)
80	0,0	0,0	0,0	100,0
63	0,0	0,0	0,0	100,0
50,0	0,0	0,0	0,0	100,0
40	0,0	0,0	0,0	100,0
31,5	0,0	0,0	0,0	100,0
25	0,0	0,0	0,0	100,0
20	0,0	0,0	0,0	100,0
16	0,0	0,0	0,0	100,0
12,5	0,0	0,0	0,0	100,0
10	0,0	0,0	0,0	100,0
8	0,0	0,0	0,0	100,0
6,3	0,0	0,0	0,0	100,0
5	4,3	4,3	0,2	99,8
4	1,1	5,4	0,2	99,8
3,15	1,7	7,1	0,3	99,7
2,5	4,3	11,4	0,5	99,5
2	5,3	16,7	0,7	99,3
1,6	6,9	23,6	1,0	99,0
1,25	9,7	33,3	1,4	98,6
1	8	41,3	1,7	98,3
0,8	13,9	55,2	2,2	97,8
0,63	11,5	66,7	2,7	97,3
0,5	11,2	77,9	3,2	96,8
0,4	11,6	89,5	3,6	96,4
0,315	14,4	103,9	4,2	95,8
0,25	9,4	113,3	4,6	95,4
0,2	12,6	125,9	5,1	94,9
0,16	16,7	142,6	5,8	94,2
0,125	14,2	156,8	6,4	93,6
0,1	35,3	192,1	7,8	92,2
0,08	20,0	212,1	8,6	91,4
FOND	4	216,1	8,8	91,2



Observation :

Le Directeur du LCBE,

Mr. Soubaneh Said Ismael

REPUBLIQUE DE DJIBOUTI
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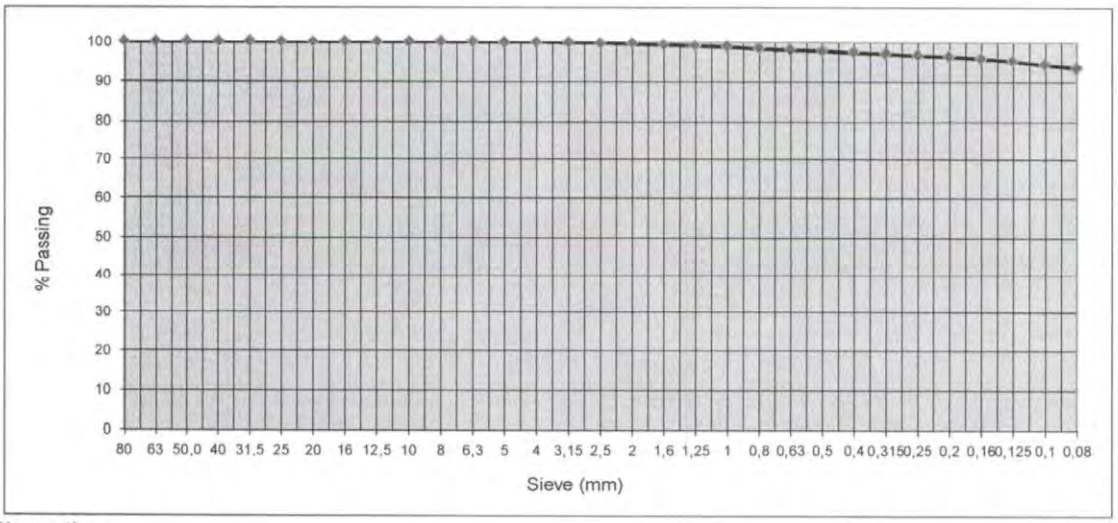
DU BATIMENT ET DE L'EQUIPEMENT
المختبر المركزي للبناء والتجهيز

ANALYSE GRANULOMETRIQUE - NORME NF P 94-056

Dossier : 254-2018
Chantier : Construction d'un quai d'embarquement au Port de Djibouti
Client : Hydroterra Engineering SARL
Matériaux : Identification
Provenance : SC02 (0,0- 3,0 m)

Poinds Initial (grs): **1917,8**

Tamis	Refus Partiel(gr)	Refus Cumules (gr)	Refus Cumules (%)	Passant (%)
80	0,0	0,0	0,0	100,0
63	0,0	0,0	0,0	100,0
0,0	0,0	0,0	0,0	100,0
40	0,0	0,0	0,0	100,0
31,5	0,0	0,0	0,0	100,0
25	0,0	0,0	0,0	100,0
20	0,0	0,0	0,0	100,0
16	0,0	0,0	0,0	100,0
12,5	0,0	0,0	0,0	100,0
10	0,0	0,0	0,0	100,0
8	0,0	0,0	0,0	100,0
6,3	0,0	0,0	0,0	100,0
5	0,4	0,4	0,0	100,0
4	0,3	0,7	0,0	100,0
3,15	1	1,7	0,1	99,9
2,5	1,9	3,6	0,2	99,8
2	2,8	6,4	0,3	99,7
1,6	6,4	12,8	0,7	99,3
1,25	4	16,8	0,9	99,1
1	6,0	22,8	1,2	98,8
0,8	6,8	29,6	1,5	98,5
0,63	7,0	36,6	1,9	98,1
0,5	6,5	43,1	2,2	97,8
0,4	6,1	49,2	2,6	97,4
0,315	6,9	56,1	2,9	97,1
0,25	5,9	62,0	3,2	96,8
0,2	6,7	68,7	3,6	96,4
0,16	8,8	77,5	4,0	96,0
0,125	15,1	92,6	4,8	95,2
0,1	16,8	109,4	5,7	94,3
0,08	15,8	125,2	6,5	93,5
FOND	0,4	125,6	6,5	93,5



Observation :

Le Directeur du LCBE,

Mr. Soubaneh Said Ismael

REPUBLIQUE DE DJIBOUTI
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Ministère de l'Equipement et des Transports

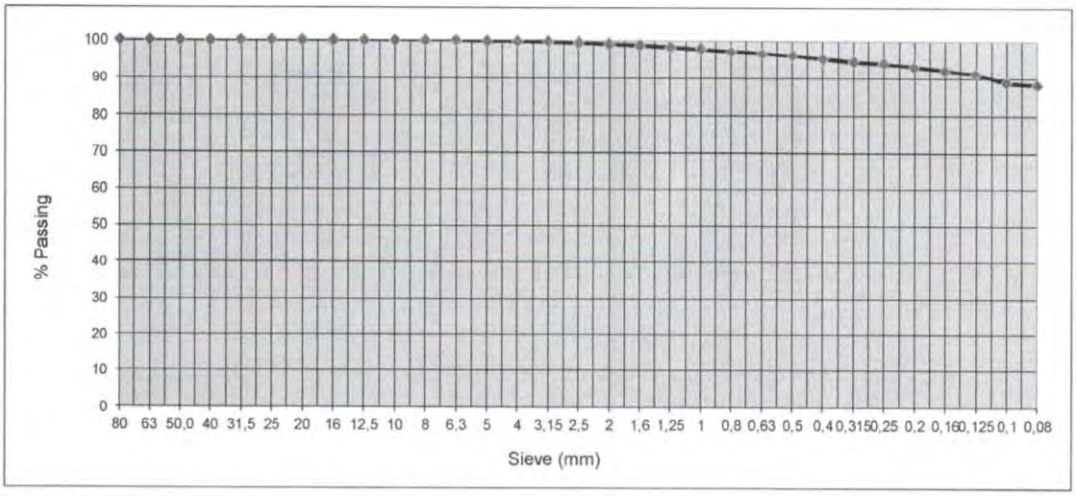
LABORATOIRE CENTRAL
DU BATIMENT ET DE L'EQUIPEMENT
المختبر المركزي للبناء والتجهيز

ANALYSE GRANULOMETRIQUE - NORME NF P 94-056

Dossier : 254-2018
Chantier : Construction d'un quai d'embarquement au Port de Djibouti
Client : Hydroterra Engineering SARL
Matériaux : Identification
Provenance : SC02 (7,0- 10,0 m)

Poinds Initial (grs): **2305,4**

Tamis	Refus Partiel(gr)	Refus Cumules (gr)	Refus Cumules (%)	Passant (%)
80	0,0	0,0	0,0	100,0
63	0,0	0,0	0,0	100,0
50,0	0,0	0,0	0,0	100,0
40	0,0	0,0	0,0	100,0
31,5	0,0	0,0	0,0	100,0
25	0,0	0,0	0,0	100,0
20	0,0	0,0	0,0	100,0
16	0,0	0,0	0,0	100,0
12,5	0,0	0,0	0,0	100,0
10	0,0	0,0	0,0	100,0
8	0,0	0,0	0,0	100,0
6,3	0,0	0,0	0,0	100,0
5	3,6	3,6	0,2	99,8
4	2,1	5,7	0,2	99,8
3,15	2,8	8,5	0,4	99,6
2,5	5,0	13,5	0,6	99,4
2	7,0	20,5	0,9	99,1
1,6	9,3	29,8	1,3	98,7
1,25	9,9	39,7	1,7	98,3
1	9,0	48,7	2,1	97,9
0,8	17,0	65,7	2,8	97,2
0,63	11,0	76,7	3,3	96,7
0,5	14,5	91,2	4,0	96,0
0,4	20,5	111,7	4,8	95,2
0,315	17,1	128,8	5,6	94,4
0,25	11,6	140,4	6,1	93,9
0,2	21,2	161,6	7,0	93,0
0,16	22,2	183,8	8,0	92,0
0,125	23,0	206,8	9,0	91,0
0,1	52,2	259,0	11,2	88,8
0,08	14,5	273,5	11,9	88,1
FOND	2,6	276,1	12,0	88,0



Observation :

Le Directeur du LCBE,

Mr. Soubaneh Said Ismael

Atterberg Limits

REPUBLIQUE DE DJIBOUTI

Unité – Egalité – Paix

Ministère de l'Equipement et des Transports

LCBE

LABORATOIRE CENTRAL

DU BÂTIMENT ET DE L'EQUIPEMENT

المختبر المركزي للبناء والتجهيز

ESSAI DE LIMITE D'ATTERBERG NORME NF P 94 - 051

Dossier : 254-2018

Chantier : Construction d'un quai d'embarquement au Port de Djibouti

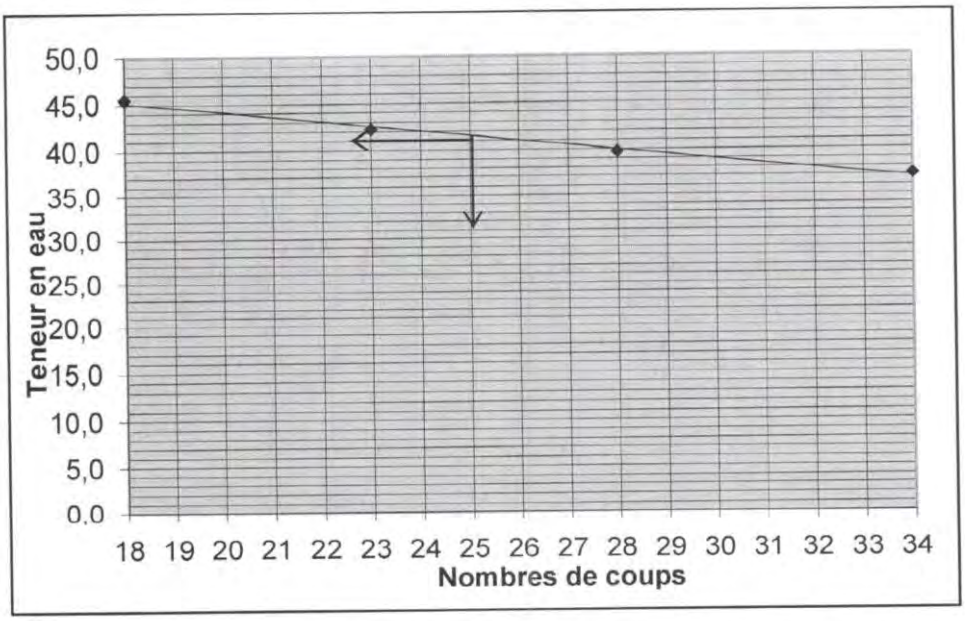
Client : Hydroterra Engineering

Matériaux : Identification

Provenance : SC02 (5,0- 7,0 m)

LL: 41,5 **LP: 26,1** **IP: 15,4**

LIMITE DE LIQUIDITE					LIMITE DE PLASTICITE	
NOMBRE DE COUPS	18	23	28	34	Test n°1	Test n°2
NUMERO DE LA TARE	1	2	3	4	A	B
POIDS TOTAL HUMIDE (g)	41,03	41,5	41,3	41,3	33,4	33,2
POIDS TOTAL SEC (g)	38,05	38,5	38,4	38,7	33,1	32,9
POIDS DE LA TARE (g)	31,5	31,4	31,1	31,7	32	31,7
POIDS D'EAU (g)	2,98	3	2,9	2,6	0,3	0,3
POIDS NET SEC (g)	6,55	7,1	7,3	7	1,1	1,2
TENEUR EN EAU (%)	45,5	42,3	39,7	37,1	27,3	25,0
TOTAL (%)	41,2				26,1	



Observation : La limite de liquidité est de 41,5 et la limite de plasticité du sol de 26,1

Le Directeur du LCBE,

Mr. Soubaneh Said Ismael

REPUBLIQUE DE DJIBOUTI

Unité – Egalité – Paix

Ministère de l'Equipement et des Transports

LCBE

LABORATOIRE CENTRAL

DU BÂTIMENT ET DE L'EQUIPEMENT

المختبر المركزي للبناء والتجهيز

ESSAI DE LIMITE D'ATTERBERG NORME NF P 94 - 051

Dossier : 254-2018

Chantier : Construction d'un quai d'embarquement au Port de Djibouti

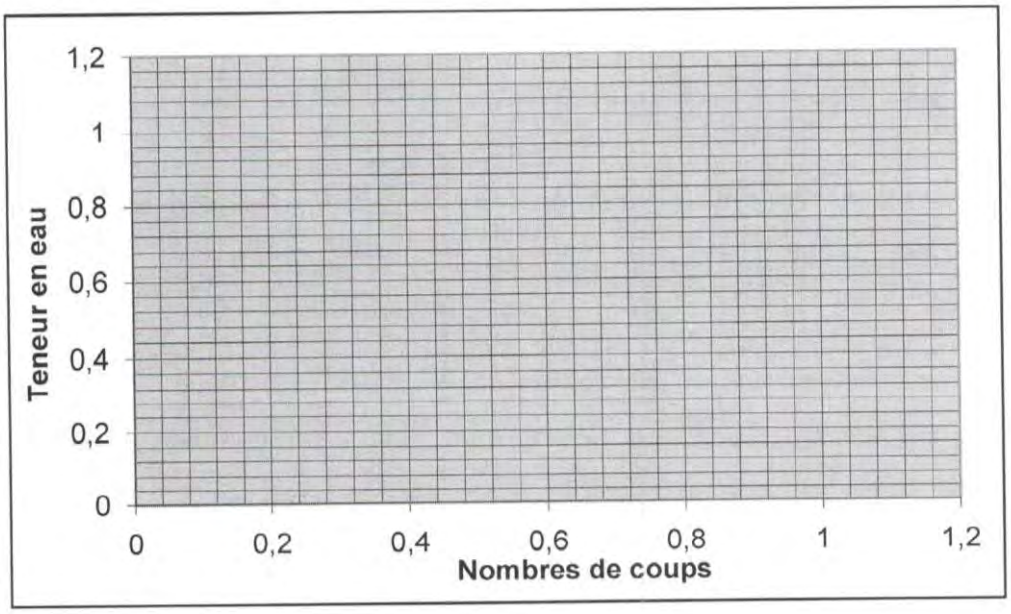
Client : Hydroterra Engineering

Matériaux : Identification

Provenance : SC02 (3,0- 5,0 m)

LL: **LP:** **IP:**

LIMITE DE LIQUIDITE		LIMITE DE PLASTICITE	
NOMBRE DE COUPS	Non mesurable	Test n°1	Test n°2
NUMERO DE LA TARE		Non mesurable	
POIDS TOTAL HUMIDE (g)			
POIDS TOTAL SEC (g)			
POIDS DE LA TARE (g)			
POIDS D'EAU (g)			
POIDS NET SEC (g)			
TENEUR EN EAU (%)			
TOTAL (%)			



Observation : La limite n'est pas mesurable

Le Directeur du LCBE,

Mr. Soubaneh Said Ismael

REPUBLIQUE DE DJIBOUTI
Unité – Egalité – Paix

Ministère de l'Equipement et des Transports

LCBE
LABORATOIRE CENTRAL
DU BÂTIMENT ET DE L'EQUIPEMENT

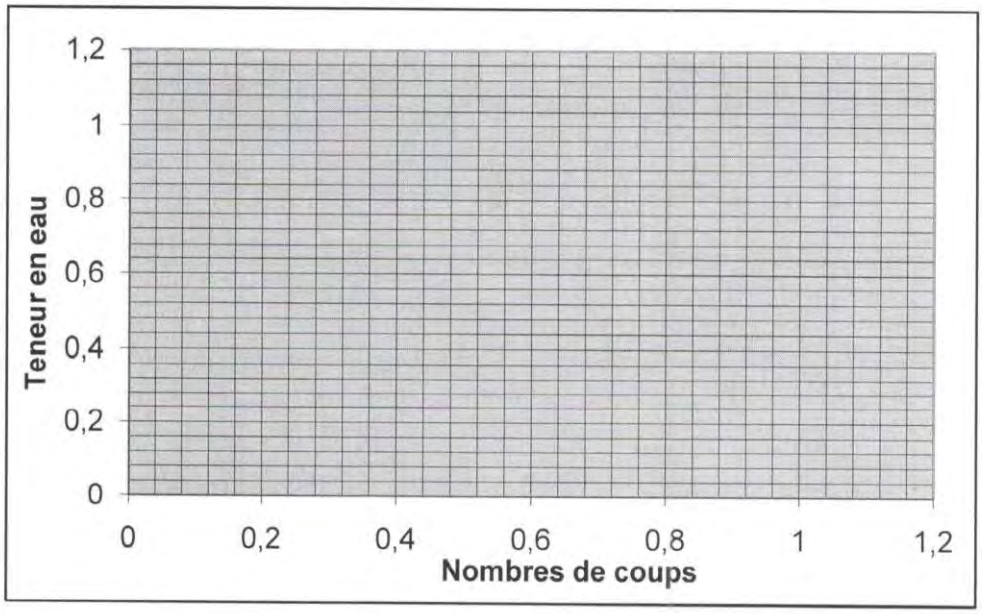
المختبر المركزي للبناء والتجهيز

ESSAI DE LIMITE D'ATTERBERG NORME NF P 94 - 051

Dossier : 254-2018
Chantier : Construction d'un quai d'embarquement au Port de Djibouti
Client : Hydroterra Engineering
Matériaux : Identification
Provenance : SC02 (0,0- 3,0 m)

LL: **LP:** **IP:**

LIMITE DE LIQUIDITE		LIMITE DE PLASTICITE	
NOMBRE DE COUPS	Non mesurable	Test n°1	Test n°2
NUMERO DE LA TARE		Non mesurable	
POIDS TOTAL HUMIDE (g)			
POIDS TOTAL SEC (g)			
POIDS DE LA TARE (g)			
POIDS D'EAU (g)			
POIDS NET SEC (g)			
TENEUR EN EAU (%)			
TOTAL (%)			



Observation : La limite n'est pas mesurable

Le Directeur du LCBE,

Mr. Soubaneh Said Ismael

REPUBLIQUE DE DJIBOUTI

Unité – Egalité – Paix

Ministère de l'Equipement et des Transports

LCBE

LABORATOIRE CENTRAL

DU BÂTIMENT ET DE L'EQUIPEMENT

المختبر المركزي للبناء والتجهيز

ESSAI DE LIMITE D'ATTERBERG NORME NF P 94 - 051

Dossier : 254-2018

Chantier : Construction d'un quai d'embarquement au Port de Djibouti

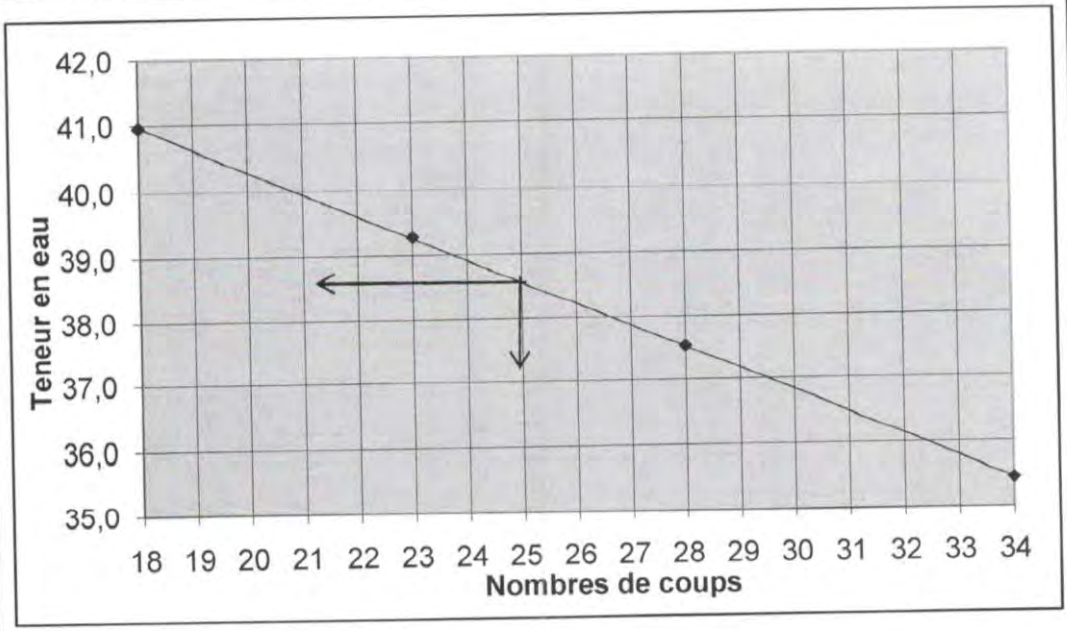
Client : Hydroterra Engineering

Matériaux : Identification

Provenance : SC02 (7,0- 10,0 m)

LL: 38,5 **LP: 34,5** **IP: 4,0**

LIMITE DE LIQUIDITE					LIMITE DE PLASTICITE	
NOMBRE DE COUPS	18	23	28	34	Test n°1	Test n°2
NUMERO DE LA TARE	1	2	3	4	A	B
POIDS TOTAL HUMIDE (g)	41,79	40,71	42,09	40,91	33,9	33,3
POIDS TOTAL SEC (g)	38,8	38	39,2	38,5	33,4	32,9
POIDS DE LA TARE (g)	31,5	31,1	31,5	31,7	32	31,7
POIDS D'EAU (g)	2,99	2,71	2,89	2,41	0,5	0,4
POIDS NET SEC (g)	7,3	6,9	7,7	6,8	1,4	1,2
TENEUR EN EAU (%)	41,0	39,3	37,5	35,4	35,7	33,3
TOTAL (%)	38,3				34,5	



Observation : **La limite de liquidité est de 38.5 et la limite de plasticité du sol de 34.5**

Le Directeur du LCBE,

Mr. Soubaneh Said Ismael

Water content

REPUBLIQUE DE DJIBOUTI
Unité – Egalité – Paix

Ministère de l'Equipement et des Transports

LCBE
LABORATOIRE CENTRAL
DU BATIMENT ET DE L'EQUIPEMENT

المختبر المركزي للبناء والتجهيز

ESSAI DE TENEUR EN EAU

Dossier : 254-2018
Chantier : Construction d'un quai d'embarquement au Port de Djibouti
Client : Hydroterra Engineering SARL
Matériaux : Identification
Provenance : SC02

PROFONDEUR	0 -3 m	3-5 m	5-7m	7-10 m
NUMERO DE LA TARE	S	K	P	R
POIDS TOTAL HUMIDE (g)	700,5	648,5	649	674,2
POIDS TOTAL SEC (g)	460,5	418,9	396	421,8
POIDS DE LA TARE (g)	55,5	59	62,9	55,8
POIDS D'EAU (g)	240	229,6	253	252,4
POIDS NET SEC (g)	405	359,9	333,1	366
TENEUR EN EAU (%)	59,26	63,80	75,95	68,96

Observations :

Le Directeur du L C B E

Soubaneh Said Ismael

Specific weight

REPUBLIQUE DE DJIBOUTI
Unité – Egalité – Paix

Ministère de l'Equipement et des Transports

LCBE
LABORATOIRE CENTRAL
DU BÂTIMENT ET DE L'EQUIPEMENT

المختبر المركزي للبناء والتجهيز

FEUILLE D'ESSAIS

DENSITE SPECIFIQUE PAR PYCOMETRE

DOSSIER N° :	DATE D'EDITION:	NORME :
254-2018	17/11/2018	NF P94-054

DOSSIER :

Demandeur : *Hydroterra Engineering SARL*
Chantier : *Construction d'un quai d'embarquement au Port de Djibouti*

Epreuve de : *Identification*
Partie de l'ouvrage : *Etude Géotechnique et Sondage*

REFERENCES DE L'ECHANTILLON :

Provenance : *SC02*

N° échantillon : 0.0-3.0 m et 3.0-5.0m

RESULTATS :

description	détermination	
Profondeur : 0m-3m	1	2
Poids pycnomètre (W1) en g	243,1	243,1
Poids pycnomètre + échantillon (W2) en g	341,4	341,5
Poids pycnomètre + échantillon +eau (W3) en g	962	961,5
Poids pycnomètre +eau (W4) en g	898,3	898,3
Poids spécifique	2,84	2,80
Moyenne	2,82	

description	détermination	
Profondeur : 3m-5m	1	2
Poids pycnomètre (W1) en g	243,1	243,1
Poids pycnomètre + échantillon (W2) en g	343,1	343,8
Poids pycnomètre + échantillon +eau (W3) en g	960,4	961,5
Poids pycnomètre +eau (W4) en g	898,3	898,3
Poids spécifique	2,64	2,69
Moyenne	2,66	

OBSERVATIONS :

LE DIRECTEUR DU LCBE

SOUBANEH SAID ISMAEL

Zone Industrielle Sud (Boulaos) – BP : 2016 – Tel : +(253) 21 35 34 77 – Fax : +(253) 21 35 11 68

REPUBLIQUE DE DJIBOUTI
Unité – Egalité – Paix

Ministère de l'Equipement et des Transports

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LABORATOIRE CENTRAL
DU BATIMENT ET DE L'EQUIPEMENT

المختبر المركزي للبناء والتجهيز

FEUILLE D'ESSAIS

DENSITE SPECIFIQUE PAR PYCOMETRE

DOSSIER N° :	**DATE D'EDITION:**	**NORME :**
254-2018	17/11/2018	NF P94-054

DOSSIER :

Demandeur : *Hydroterra Engineering SARL*
Chantier : *Construction d'un quai d'embarquement au Port de Djibouti*

Epreuve de : *Identification*
Partie de l'ouvrage : *Etude Géotechnique et Sondage*

REFERENCES DE L'ECHANTILLON :

Provenance : *SC02*
N° échantillon : 5.0-7.0 m et 7.0-10.0m

RESULTATS :

description	détermination	
Profondeur: 5m-7m	1	2
Poids pycnomètre (W1) en g	243,1	243,1
Poids pycnomètre + échantillon (W2) en g	344	341,4
Poids pycnomètre + échantillon +eau (W3) en g	961,1	960,7
Poids pycnomètre +eau (W4) en g	898,3	898,3
Poids spécifique	2,65	2,74
Moyenne	2,69	

description	détermination	
Profondeur: 7m-10m	1	2
Poids pycnomètre (W1) en g	243,1	243,1
Poids pycnomètre + échantillon (W2) en g	342,6	343,0
Poids pycnomètre + échantillon +eau (W3) en g	960,3	960,5
Poids pycnomètre +eau (W4) en g	898,3	898,3
Poids spécifique	2,65	2,65
Moyenne	2,65	

OBSERVATIONS :

LE DIRECTEUR DU LCBE

SOUBANEH SAID ISMAEL

Zone Industrielle Sud (Boulaos) – BP : 2016 – Tel : +(253) 21 35 34 77 – Fax : +(253) 21 35 11 68

Apparent weight

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Unité _ Egalité – Paix

Ministère de l'Equipement et des Transports

LCBE
LABORATOIRE CENTRAL
DU BATIMENT ET DE L'EQUIPEMENT

المختبر المركزي للبناء والتجهيز

DENSITE APPARENTE GABARI

Dossier : 254-2018
Chantier : Construction d'un quai d'embarquement au Port de Djibouti
Client : Hydroterra Engineering SARL
Matériaux : Identification
Provenance : SC02

sonadage	SC-02			
Profondeur (m)	0-3 m	3-5 m	5-7 m	7-10 m
Poids Total de Materiau (g)	3280,0	3263	3237	3247
Poids de Gabari (g)	2569	2569	2569	2569
Volume de Gabari (cm^3)	617	617	617	617
Densite Apparente (g/cm^3)	1,15	1,12	1,08	1,10

Observation :

Le Directeur du L C B E

Soubaneh Said Ismael

SC03
(BH-D01 Modified)

Sieve analysis

REPUBLIQUE DE DJIBOUTI

Unité – Egalité – Paix

Ministère de l'Equipement et des Transports

LABORATOIRE CENTRAL DU BATIMENT ET DE L'EQUIPEMENT

المختبر المركزي للبناء والتجهيز

ANALYSE GRANULOMETRIQUE - NORME NF P 94-056

Dossier : 254-2018

Chantier : Construction d'un quai d'embarquement au Port de Djibouti

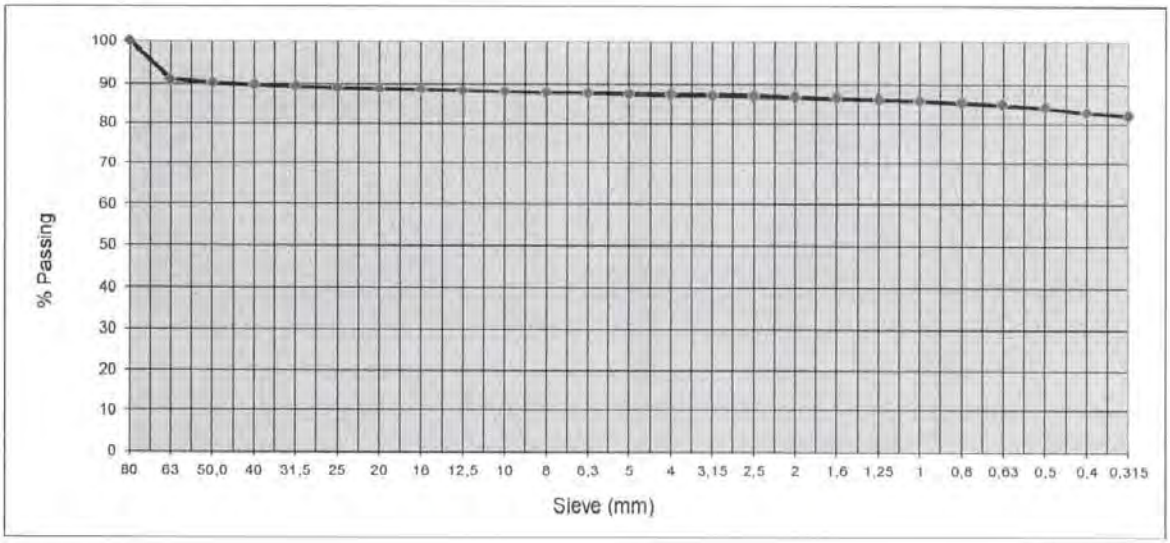
Client : Hydroterra Engineering SARL

Matériaux : Identification

Provenance : SC03 (19,5- 20,7m)

Poinds Initial (grs): **1221,8**

Tamis	Refus Partiel(gr)	Refus Cumules (gr)	Refus Cumules (%)	Passant (%)
80	0,0	0,0	0,0	100,0
63	109,7	109,7	9,0	91,0
12,5	11,8	121,5	9,9	90,1
10	6,2	127,7	10,5	89,5
8	5,0	132,7	10,9	89,1
6,3	3,8	136,5	11,2	88,8
5	2,7	139,2	11,4	88,6
4	3,9	143,1	11,7	88,3
3,15	2,7	145,8	11,9	88,1
2,5	3,1	148,9	12,2	87,8
2	2,4	151,3	12,4	87,6
1,6	2,2	153,5	12,6	87,4
1,25	1,8	155,3	12,7	87,3
1	1,6	156,9	12,8	87,2
0,8	1,9	158,8	13,0	87,0
0,63	2,3	161,1	13,2	86,8
0,5	2,9	164,0	13,4	86,6
0,4	2,8	166,8	13,7	86,3
0,315	4,1	170,9	14,0	86,0
0,25	3,7	174,6	14,3	85,7
0,2	4,9	179,5	14,7	85,3
0,16	6,8	186,3	15,2	84,8
0,125	8,5	194,8	15,9	84,1
0,1	16,2	211,0	17,3	82,7
0,08	9,5	220,5	18,0	82,0
FOND	0,0	220,5	18,0	82,0



Observation :

Le Directeur du LCBE,

Mr. Soubaneh Said Ismael

REPUBLIQUE DE DJIBOUTI
Unité – Egalité – Paix

Ministère de l'Equipement et des Transports

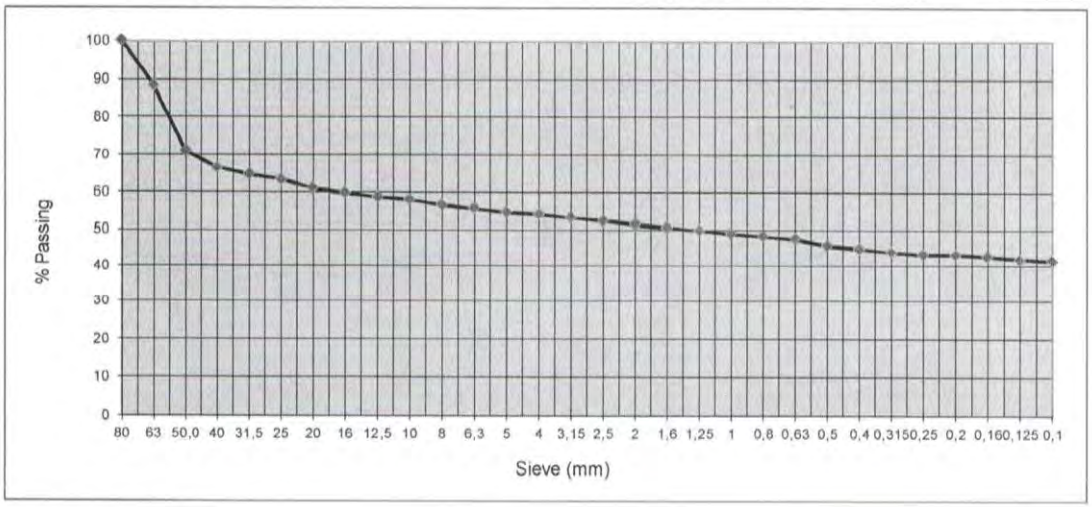
LABORATOIRE CENTRAL
DU BATIMENT ET DE L'EQUIPEMENT
المختبر المركزي للبناء والتجهيز

ANALYSE GRANULOMETRIQUE - NORME NF P 94-056

Dossier : 254-2018
Chantier : Construction d'un quai d'embarquement au Port de Djibouti
Client : Hydroterra Engineering SARL
Matériaux : Identification
Provenance : SC03 (15,0- 19,5m)

Poinds Initial (grs): **2038,5**

Tamis	Refus Partiel(gr)	Refus Cumules (gr)	Refus Cumules (%)	Passant (%)
80	0,0	0,0	0,0	100,0
63	239,6	239,6	11,8	88,2
50,0	354,5	594,1	29,1	70,9
31,5	89,5	683,6	33,5	66,5
25	37,5	721,1	35,4	64,6
20	27,4	748,5	36,7	63,3
16	46,8	795,3	39,0	61,0
12,5	25,7	821,0	40,3	59,7
10	21,9	842,9	41,3	58,7
8	14,8	857,7	42,1	57,9
6,3	30,3	888,0	43,6	56,4
5	17,6	905,6	44,4	55,6
4	20,4	926,0	45,4	54,6
3,15	12,1	938,1	46,0	54,0
2,5	18,2	956,3	46,9	53,1
2	17,3	973,6	47,8	52,2
1,6	19,2	992,8	48,7	51,3
1,25	17,5	1010,3	49,6	50,4
1	13,6	1023,9	50,2	49,8
0,8	18,4	1042,3	51,1	48,9
0,63	15,9	1058,2	51,9	48,1
0,5	14,7	1072,9	52,6	47,4
0,4	35,5	1108,4	54,4	45,6
0,315	17,1	1125,5	55,2	44,8
0,25	19,6	1145,1	56,2	43,8
0,2	14,2	1159,3	56,9	43,1
0,16	0,0	1159,3	56,9	43,1
0,125	8,8	1168,1	57,3	42,7
0,1	18,2	1186,3	58,2	41,8
0,08	6,9	1193,2	58,5	41,5
FOND	0,4	1193,6	58,6	41,4



Observation :

Le Directeur du LCBE,

Mr. Soubaneh Said Ismael

REPUBLIQUE DE DJIBOUTI

Unité – Egalité – Paix

Ministère de l'Equipement et des Transports

LABORATOIRE CENTRAL DU BATIMENT ET DE L'EQUIPEMENT

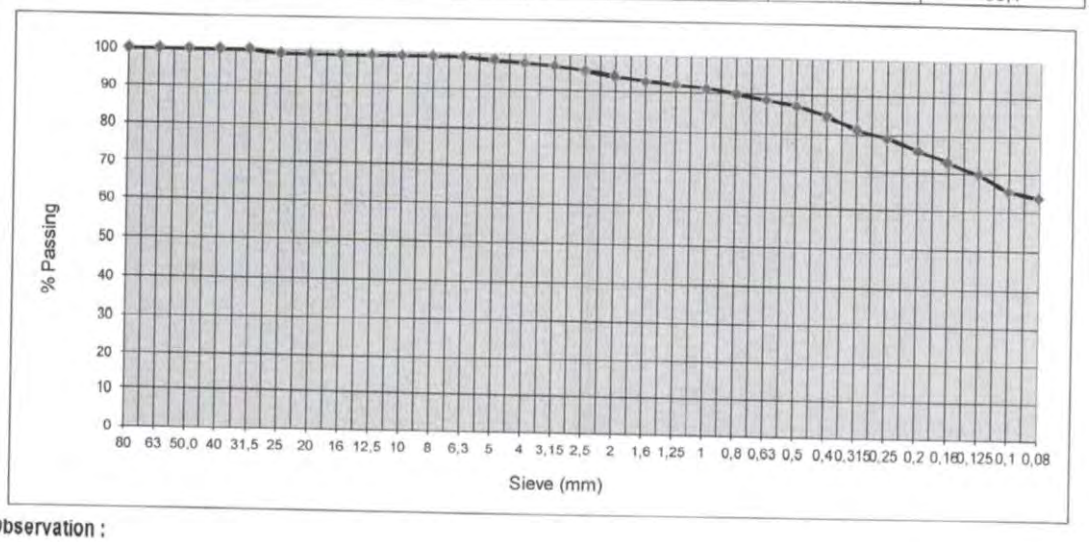
المختبر المركزي للبناء والتجهيز

ANALYSE GRANULOMETRIQUE - NORME NF P 94-056

Dossier : 254-2018
Chantier : Construction d'un quai d'embarquement au Port de Djibouti
Client : Hydroterra Engineering SARL
Matériaux : Identification
Provenance : SC03 (13,0- 15,0 m)

Poinds Initial (grs): **2003,2**

Tamis	Refus Partiel(gr)	Refus Cumules (gr)	Refus Cumules (%)	Passant (%)
80	0,0	0,0	0,0	100,0
63	0,0	0,0	0,0	100,0
50,0	0,0	0,0	0,0	100,0
40	0,0	0,0	0,0	100,0
31,5	0,0	0,0	0,0	100,0
25	20,9	20,9	1,0	99,0
20	0,0	20,9	1,0	99,0
16	0,0	20,9	1,0	99,0
12,5	0,0	20,9	1,0	99,0
10	0,0	20,9	1,0	99,0
8	0,0	20,9	1,0	99,0
6,3	0,0	20,9	1,0	99,0
5	14,9	35,8	1,8	98,2
4	14,0	49,8	2,5	97,5
3,15	14,2	64,0	3,2	96,8
2,5	24,5	88,5	4,4	95,6
2	23,5	112,0	5,6	94,4
1,6	24,0	136,0	6,8	93,2
1,25	17,6	153,6	7,7	92,3
1	18,3	171,9	8,6	91,4
0,8	29,1	201,0	10,0	90,0
0,63	28,8	229,8	11,5	88,5
0,5	32,2	262,0	13,1	86,9
0,4	50,2	312,2	15,6	84,4
0,315	59,1	371,3	18,5	81,5
0,25	48,9	420,2	21,0	79,0
0,2	61,0	481,2	24,0	76,0
0,16	61,3	542,5	27,1	72,9
0,125	61,9	604,4	30,2	69,8
0,1	87,7	692,1	34,5	65,5
0,08	37,6	729,7	36,4	63,6
FOND	3,4	733,1	36,6	63,4



Observation :

Le Directeur du LCBE,

Mr. Soubaneh Said Ismael

Unité – Egalité – Paix

Ministère de l'Equipement et des Transports

LABORATOIRE CENTRAL DU BATIMENT ET DE L'EQUIPEMENT

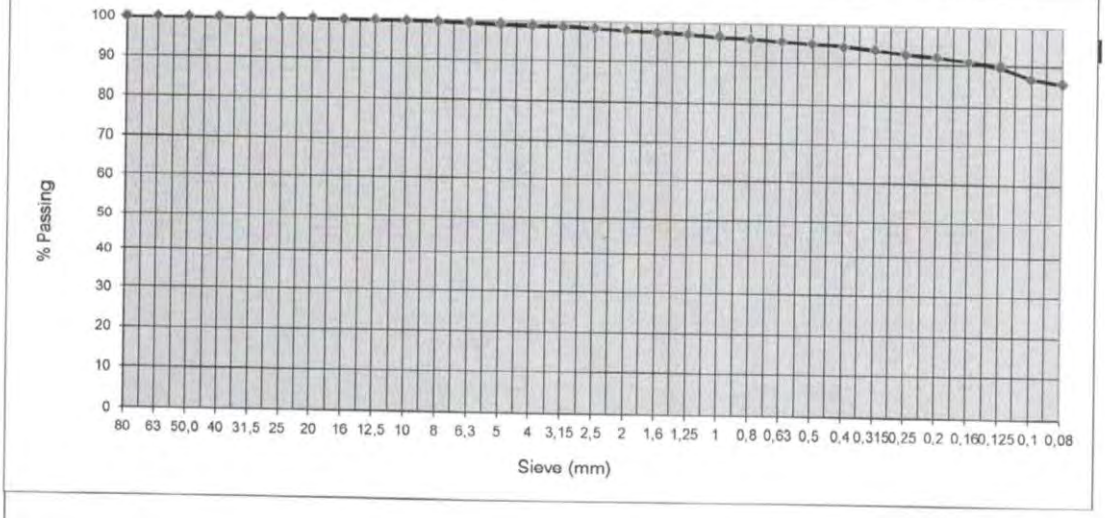
المختبر المركزي للبناء والتجهيز

ANALYSE GRANULOMETRIQUE - NORME NF P 94-056

Dossier : 254-2018
Chantier : Construction d'un quai d'embarquement au Port de Djibouti
Client : Hydroterra Engineering SARL
Matériaux : Identification
Provenance : SC03 (0,0- 13,0 m)

Poinds Initial (grs): 3447,2

Tamis	Refus Partiel(gr)	Refus Cumules (gr)	Refus Cumules (%)	Passant (%)
80	0,0	0,0	0,0	100,0
63	0,0	0,0	0,0	100,0
50,0	0,0	0,0	0,0	100,0
40	0,0	0,0	0,0	100,0
31,5	0,0	0,0	0,0	100,0
25	0,0	0,0	0,0	100,0
20	0,0	0,0	0,0	100,0
16	8,0	8,0	0,2	99,8
12,5	0,0	8,0	0,2	99,8
10	4,5	12,5	0,4	99,6
8	5,3	17,8	0,5	99,5
6,3	6,8	24,6	0,7	99,3
5	7,2	31,8	0,9	99,1
4	8,5	40,3	1,2	98,8
3,15	7,0	47,3	1,4	98,6
2,5	14	61,3	1,8	98,2
2	12,2	73,5	2,1	97,9
1,6	13,8	87,3	2,5	97,5
1,25	14,3	101,6	2,9	97,1
1	18,6	120,2	3,5	96,5
0,8	14,3	134,5	3,9	96,1
0,63	19,4	153,9	4,5	95,5
0,5	17,5	171,4	5,0	95,0
0,4	20,2	191,6	5,6	94,4
0,315	28,7	220,3	6,4	93,6
0,25	29,5	249,8	7,2	92,8
0,2	28,4	278,2	8,1	91,9
0,16	37,4	315,6	9,2	90,8
0,125	37,4	353,0	10,2	89,8
0,1	101,9	454,9	13,2	86,8
0,08	43,6	498,5	14,5	85,5
FOND	7,6	506,1	14,7	85,3



Observation :

Le Directeur du LCBE,

Mr. Soubaneh Said Ismael

REPUBLIQUE DE DJIBOUTI
Unité – Egalité – Paix

Ministère de l'Equipement et des Transports

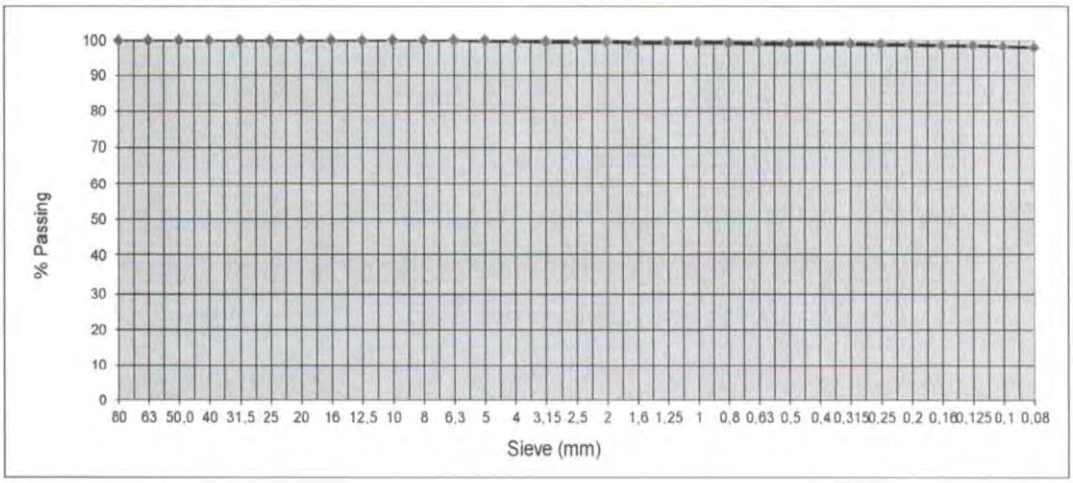
LABORATOIRE CENTRAL
DU BATIMENT ET DE L'EQUIPEMENT
المختبر المركزي للبناء والتجهيز

ANALYSE GRANULOMETRIQUE - NORME NF P 94-056

Dossier : 254-2018
Chantier : Construction d'un quai d'embarquement au Port de Djibouti
Client : Hydroterra Engineering SARL
Matériaux : Identification
Provenance : SC03 (20,7- 22,0 m)

Poinds Initial (grs): **1803,9**

Tamis	Refus Partiel(gr)	Refus Cumules (gr)	Refus Cumules (%)	Passant (%)
80	0,0	0,0	0,0	100,0
63	0,0	0,0	0,0	100,0
50,0	0,0	0,0	0,0	100,0
40	0,0	0,0	0,0	100,0
31,5	0,0	0,0	0,0	100,0
25	0,0	0,0	0,0	100,0
20	0,0	0,0	0,0	100,0
16	0,0	0,0	0,0	100,0
12,5	0,0	0,0	0,0	100,0
10	0,0	0,0	0,0	100,0
8	0,0	0,0	0,0	100,0
6,3	0,0	0,0	0,0	100,0
5	2,5	2,5	0,1	99,9
4	2,2	4,7	0,3	99,7
3,15	1,4	6,1	0,3	99,7
2,5	1,9	8,0	0,4	99,6
2	0,9	8,9	0,5	99,5
1,6	1,5	10,4	0,6	99,4
1,25	1,4	11,8	0,7	99,3
1	0,8	12,6	0,7	99,3
0,8	1,0	13,6	0,8	99,2
0,63	1,0	14,6	0,8	99,2
0,5	1,4	16,0	0,9	99,1
0,4	1,1	17,1	0,9	99,1
0,315	1,8	18,9	1,0	99,0
0,25	2,3	21,2	1,2	98,8
0,2	2,1	23,3	1,3	98,7
0,16	2,7	26,0	1,4	98,6
0,125	2,5	28,5	1,6	98,4
0,1	3,2	31,7	1,8	98,2
0,08	4,8	36,5	2,0	98,0
FOND	0,0	36,5	2,0	98,0



Observation :

Le Directeur du LCBE,

Mr. Soubaneh Said Ismael

Atterberg Limits

REPUBLIQUE DE DJIBOUTI

Unité – Egalité – Paix

Ministère de l'Equipement et des Transports

LCBE

LABORATOIRE CENTRAL

DU BÂTIMENT ET DE L'EQUIPEMENT

المختبر المركزي للبناء والتجهيز

ESSAI DE LIMITE D'ATTERBERG

Dossier : 254-2018

Chantier : Construction d'un quai d'embarquement au Port de Djibouti

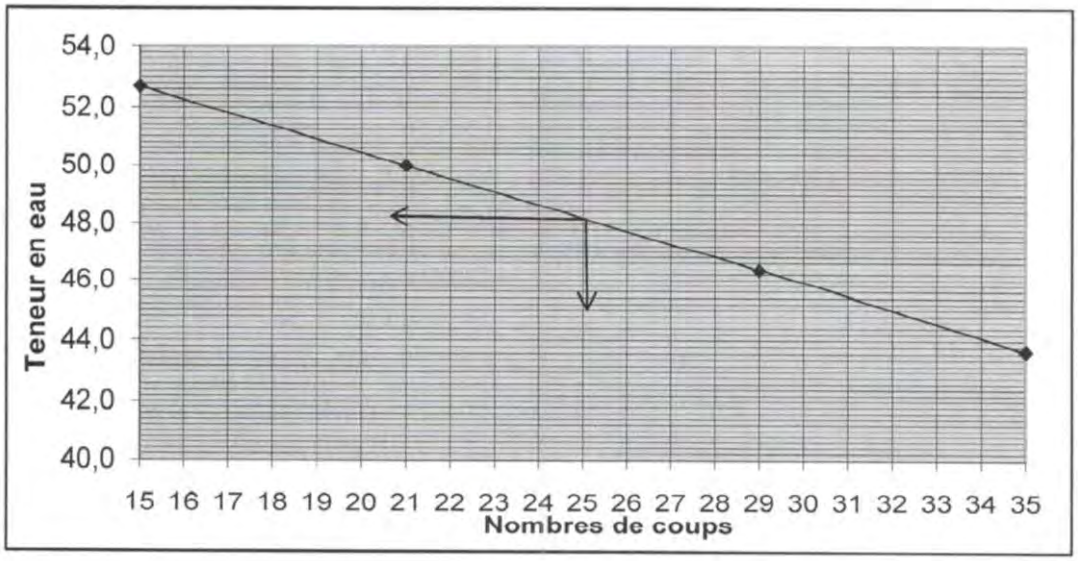
Client : Hydroterra Engineering SARL

Matériaux : Identification

Provenance : SC03 (19,5- 20,7 m)

LL: 48,2 **LP: 24,9** **IP: 23,3**

LIMITE DE LIQUIDITE					LIMITE DE PLASTICITE	
NOMBRE DE COUPS	15	21	29	35	Test n°1	Test n°2
NUMERO DE LA TARE	DD	AA	BB	CC	15	13
POIDS TOTAL HUMIDE (g)	77,1	78,9	77,2	74,9	67,4	67,7
POIDS TOTAL SEC (g)	73,2	74,4	73,4	71,8	67,1	67,3
POIDS DE LA TARE (g)	65,8	65,4	65,2	64,7	65,8	65,8
POIDS D'EAU (g)	3,9	4,5	3,8	3,1	0,3	0,4
POIDS NET SEC (g)	7,4	9	8,2	7,1	1,3	1,5
TENEUR EN EAU (%)	52,7	50,0	46,3	43,7	23,1	26,7
TOTAL (%)	48,2				24,9	



Observation : La limite de liquidité est de 48,2 et la limite de plasticité du sol de 24,9

Le Directeur du LCBE,

Mr. Soubaneh Said Ismael

REPUBLIQUE DE DJIBOUTI

Unité – Egalité – Paix

Ministère de l'Equipement et des Transports

LCBE

LABORATOIRE CENTRAL

DU BÂTIMENT ET DE L'EQUIPEMENT

المختبر المركزي للبناء والتجهيز

ESSAI DE LIMITE D'ATTERBERG
NORME NF P 94 - 051

Dossier : 254-2018

Chantier : Construction d'un quai d'embarquement au Port de Djibouti

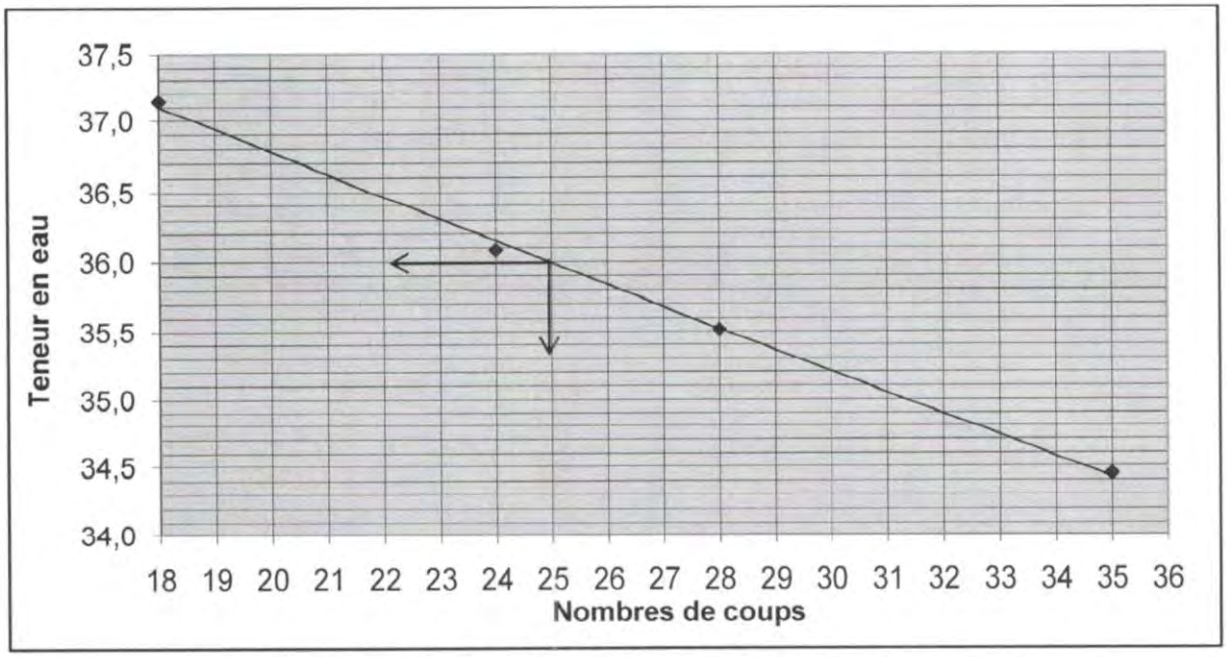
Client : Hydroterra Engineering

Matériaux : Identification

Provenance : SC03 (15,0- 19,5m)

LL: 36 **LP: 20,8** **IP: 15,2**

LIMITE DE LIQUIDITE					LIMITE DE PLASTICITE	
NOMBRE DE COUPS	18	24	28	35	Test n°1	Test n°2
NUMERO DE LA TARE	AA	CC	II	EE	DD	BB
POIDS TOTAL HUMIDE (g)	41,3	77,8	76,59	76,4	66,4	66,1
POIDS TOTAL SEC (g)	38,7	74,3	73,5	73,3	66,3	65,9
POIDS DE LA TARE (g)	31,7	64,6	64,8	64,3	65,7	65,1
POIDS D'EAU (g)	2,6	3,5	3,09	3,1	0,1	0,2
POIDS NET SEC (g)	7	9,7	8,7	9	0,6	0,8
TENEUR EN EAU (%)	37,1	36,1	35,5	34,4	16,7	25,0
TOTAL (%)	35,8				20,8	



Observation : La limite de liquidité est de 36,0 et la limite de plasticité du sol de 20,8

Le Directeur du LCBE,

Mr. Soubaneh Said Ismael

REPUBLIQUE DE DJIBOUTI

Unité – Egalité – Paix

Ministère de l'Equipement et des Transports

LCBE

LABORATOIRE CENTRAL
DU BÂTIMENT ET DE L'EQUIPEMENT

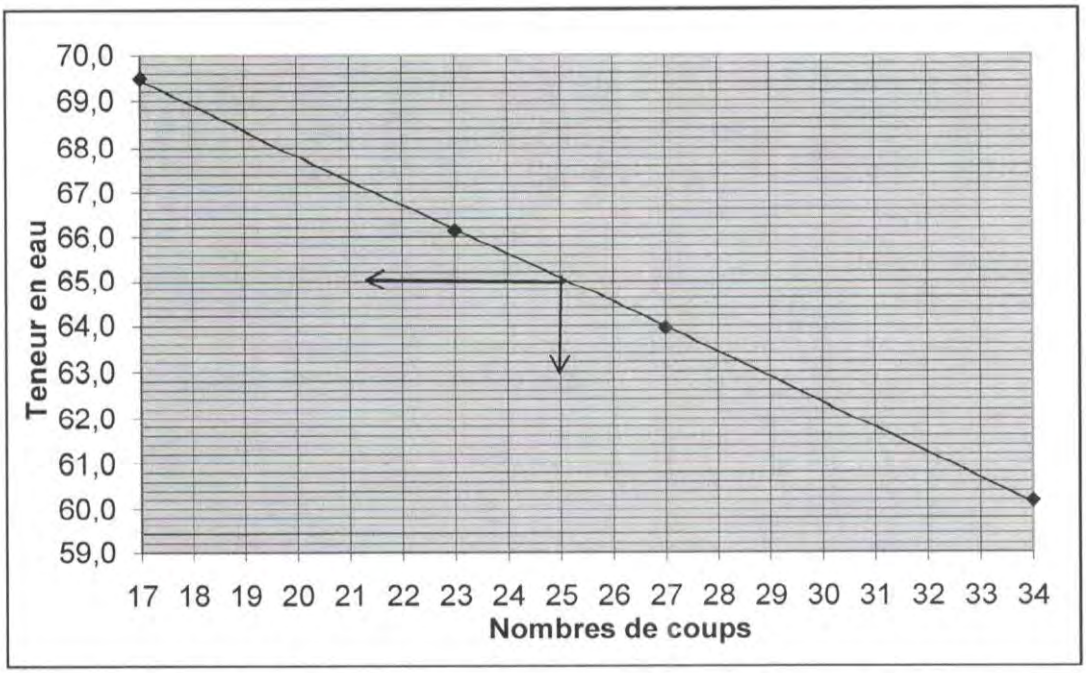
المختبر المركزي للبناء والتجهيز

ESSAI DE LIMITE D'ATTERBERG NORME NF P 94 - 051

Dossier : 254-2018
Chantier : Construction d'un quai d'embarquement au Port de Djibouti
Client : Hydroterra Engineering SARL
Matériaux : Identification
Provenance : SC03 (13,0- 15,0 m)

LL: 65,0 **LP: 28,6** **IP: 36,4**

LIMITE DE LIQUIDITE					LIMITE DE PLASTICITE	
NOMBRE DE COUPS	17	23	27	34	Test n°1	Test n°2
NUMERO DE LA TARE	4	9	10	12	12	A
POIDS TOTAL HUMIDE (g)	41,7	41,8	41,3	40,87	32,4	32,6
POIDS TOTAL SEC (g)	37,6	37,7	37,4	37,5	32,2	32,4
POIDS DE LA TARE (g)	31,7	31,5	31,3	31,9	31,5	31,7
POIDS D'EAU (g)	4,1	4,1	3,9	3,37	0,2	0,2
POIDS NET SEC (g)	5,9	6,2	6,1	5,6	0,7	0,7
TENEUR EN EAU (%)	69,5	66,1	63,9	60,2	28,6	28,6
TOTAL (%)	64,9				28,6	



Observation : La limite de liquidité est de 65,0 et la limite de plasticité du sol de 28,6

Le Directeur du LCBE,

Mr. Soubaneh Said Ismael

REPUBLIQUE DE DJIBOUTI

Unité – Egalité – Paix

Ministère de l'Equipement et des Transports

LCBE

LABORATOIRE CENTRAL

DU BÂTIMENT ET DE L'EQUIPEMENT

المختبر المركزي للبناء والتجهيز

ESSAI DE LIMITE D'ATTERBERG NORME NF P 94 - 051

Dossier : 254-2018

Chantier : Construction d'un quai d'embarquement au Port de Djibouti

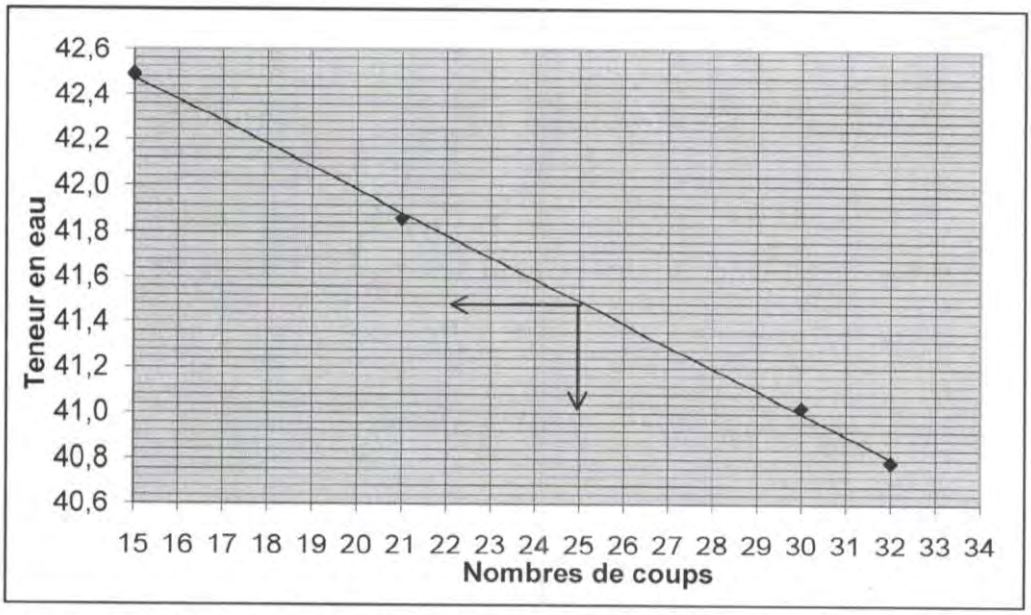
Client : Hydroterra Engineering

Matériaux : Identification

Provenance : SC03 (0,0- 13,0 m)

LL: 41,5 **LP: 26,8** **IP: 14,7**

LIMITE DE LIQUIDITE					LIMITE DE PLASTICITE	
NOMBRE DE COUPS	15	21	30	32	**Test n°1**	**Test n°2**
NUMERO DE LA TARE	4	1	B	3	2	8
POIDS TOTAL HUMIDE (g)	42,4	43,7	42,9	42,1	32,6	33,5
POIDS TOTAL SEC (g)	39,09	40,1	39,7	39	32,3	33,1
POIDS DE LA TARE (g)	31,3	31,5	31,9	31,4	31,1	31,7
POIDS D'EAU (g)	3,31	3,6	3,2	3,1	0,3	0,4
POIDS NET SEC (g)	7,79	8,6	7,8	7,6	1,2	1,4
TENEUR EN EAU (%)	42,5	41,9	41,0	40,8	25,0	28,6
TOTAL (%)	41,5				26,8	



Observation : La limite de liquidité est de 41,5 et la limite de plasticité du sol de 26,8.

Le Directeur du LCBE,

Mr. Soubaneh Said Ismael

REPUBLIQUE DE DJIBOUTI

Unité – Egalité – Paix

Ministère de l'Equipement et des Transports

LCBE

LABORATOIRE CENTRAL

DU BÂTIMENT ET DE L'EQUIPEMENT

المختبر المركزي للبناء والتجهيز

ESSAI DE LIMITE D'ATTERBERG

Dossier : 254-2018

Chantier : Construction d'un quai

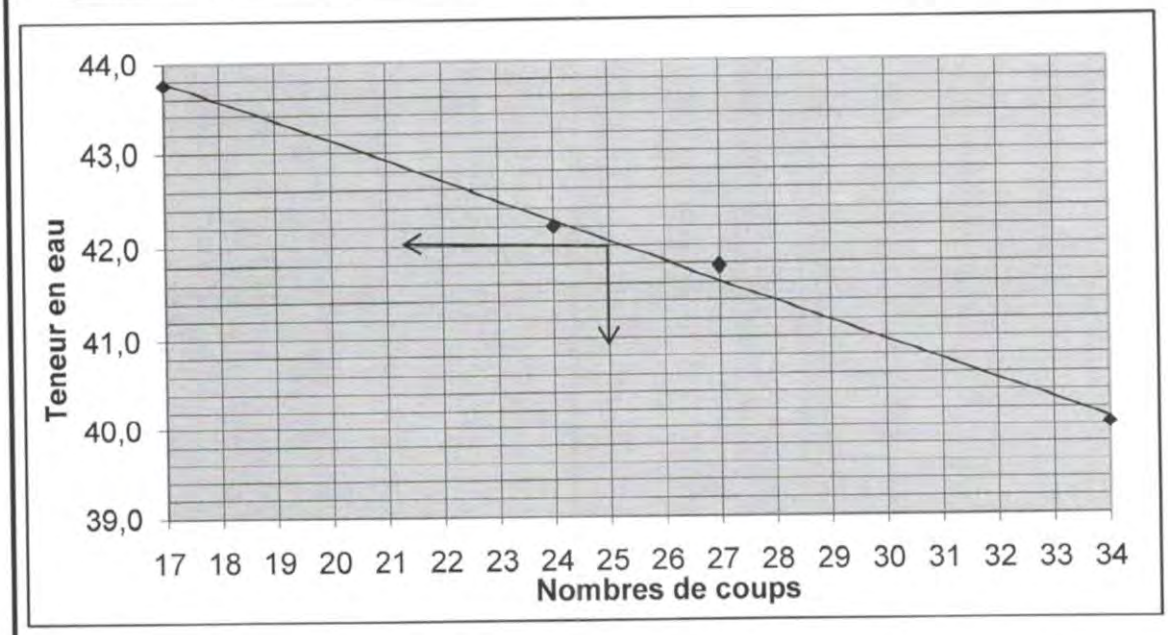
Client : Hydroterra Engineering SARL

Matériaux : Identification

Provenance : SC03 (20,7- 22,7 m)

LL: 42,1 **LP: 23,2** **IP: 18,9**

LIMITE DE LIQUIDITE					LIMITE DE PLASTICITE	
NOMBRE DE COUPS	17	24	27	34	Test n°1	Test n°2
NUMERO DE LA TARE	4	9	10	12	15	A
POIDS TOTAL HUMIDE (g)	40,9	42,42	43	41,41	33,5	33,4
POIDS TOTAL SEC (g)	38,1	39,09	39,7	38,6	33,1	33,1
POIDS DE LA TARE (g)	31,7	31,2	31,8	31,58	31,5	31,7
POIDS D'EAU (g)	2,8	3,33	3,3	2,81	0,4	0,3
POIDS NET SEC (g)	6,4	7,89	7,9	7,02	1,6	1,4
TENEUR EN EAU (%)	43,7	42,2	41,8	40,0	25,0	21,4
TOTAL (%)	41,9				23,2	



Observation : La limite de liquidité est de 42,1 et la limite de plasticité du sol de 23,2

Le Directeur du LCBE,

Mr. Soubaneh Said Ismael

Water content

REPUBLIQUE DE DJIBOUTI
Unité – Egalité – Paix

Ministère de l'Equipement et des Transports

LCBE
LABORATOIRE CENTRAL
DU BATIMENT ET DE L'EQUIPEMENT

المختبر المركزي للبناء والتجهيز

ESSAI DE TENEUR EN EAU

Dossier : 254-2018
Chantier : Construction d'un quai d'embarquement au Port de Djibouti
Client : Hydroterra Engineering SARL
Matériaux : Identification
Provenance : SC03

PROFONDEUR	0 -13 m	13-15 m	15-19,5 m	19,5-20,7 m	20,7-22 m
NUMERO DE LA TARE	1	KK	10	16	EE
POIDS TOTAL HUMIDE (g)	723	672,2	494,3	373,9	493,5
POIDS TOTAL SEC (g)	516	569,7	430	294	390,6
POIDS DE LA TARE (g)	51,9	53,4	49,5	49,8	50,9
POIDS D'EAU (g)	207	102,5	64,3	79,9	102,90
POIDS NET SEC (g)	464,1	516,3	380,5	244,2	339,7
TENEUR EN EAU (%)	44,60	19,85	16,90	32,72	30,29

Observations :

Le Directeur du L C B E

Soubaneh Said Ismael

Specific weight

REPUBLIQUE DE DJIBOUTI
Unité – Egalité – Paix

Ministère de l'Equipement et des Transports

LABORATOIRE CENTRAL
DU BATIMENT ET DE L'EQUIPEMENT

المختبر المركزي للبناء والتجهيز

FEUILLE D'ESSAIS

DENSITE SPECIFIQUE PAR PYCOMETRE

DOSSIER N° :	DATE D'EDITION:	NORME :
254-2018	17/11/2018	NF P94-054

DOSSIER :

Demandeur : *Hydroterra Engineering SARL*
Chantier : *Construction d'un quai d'embarquement au Port de Djibouti*

Epreuve de : *Identification*
Partie de l'ouvrage : *Etude Géotechnique et Sondage*

REFERENCES DE L'ECHANTILLON :

Provenance : *SC03*
N° échantillon : 15.0-19.5 m et 19.5 -20.7m

RESULTATS :

description	détermination	
Profondeur: 15m-19,5m	1	2
Poids pycnomètre (W1) en g	243,1	243,1
Poids pycnomètre + échantillon (W2) en g	340,3	344
Poids pycnomètre + échantillon +eau (W3) en g	959,3	962,2
Poids pycnomètre +eau (W4) en g	898,2	898,2
Poids spécifique	2,69	2,73
Moyenne	2,71	

description	détermination	
Profondeur : 19,5m-20,7m	1	2
Poids pycnomètre (W1) en g	243,1	243,1
Poids pycnomètre + échantillon (W2) en g	341,1	343,1
Poids pycnomètre + échantillon +eau (W3) en g	960,0	960,3
Poids pycnomètre +eau (W4) en g	899,2	898,2
Poids spécifique	2,63	2,64
Moyenne	2,64	

OBSERVATIONS :

LE DIRECTEUR DU LCBE

SOUBANEH SAID ISMAEL

Zone Industrielle Sud (Boulaos) – BP : 2016 – Tel : +(253) 21 35 34 77 – Fax : +(253) 21 35 11 68

REPUBLIQUE DE DJIBOUTI
Unité – Egalité – Paix

Ministère de l'Equipement et des Transports

LCBE
LABORATOIRE CENTRAL
DU BATIMENT ET DE L'EQUIPEMENT

المختبر المركزي للبناء والتجهيز

FEUILLE D'ESSAIS

DENSITE SPECIFIQUE PAR PYCOMETRE

DOSSIER N° :	**DATE D'EDITION:**	**NORME :**
254-2018	17/11/2018	NF P94-054

DOSSIER :

Demandeur : *Hydroterra Engineering SARL*
Chantier : *Construction d'un quai d'embarquement au Port de Djibouti*

Epreuve de : *Identification*
Partie de l'ouvrage : *Etude Géotechnique et Sondage*

REFERENCES DE L'ECHANTILLON :

Provenance : *SC03*

N° échantillon : 0.0-13.0 m et 13.0 -15.0m

RESULTATS :

description	détermination	
Profondeur : 0m-13m	1	2
Poids pycnomètre (W1) en g	243,1	243,1
Poids pycnomètre + échantillon (W2) en g	343,2	343,0
Poids pycnomètre + échantillon +eau (W3) en g	961,3	960,9
Poids pycnomètre +eau (W4) en g	898,2	898,2
Poids spécifique	2,71	2,69
Moyenne	2,70	

description	détermination	
Profondeur : 13m-15m	1	2
Poids pycnomètre (W1) en g	243,1	243,1
Poids pycnomètre + échantillon (W2) en g	341,3	341,4
Poids pycnomètre + échantillon +eau (W3) en g	960,6	961,6
Poids pycnomètre +eau (W4) en g	898,2	898,2
Poids spécifique	2,74	2,82
Moyenne	2,78	

OBSERVATIONS :

LE DIRECTEUR DU LCBE
SOUBANEH SAID ISMAEL

Zone Industrielle Sud (Boulaos) – BP : 2016 – Tel : +(253) 21 35 34 77 – Fax : +(253) 21 35 11 68

REPUBLIQUE DE DJIBOUTI
Unité – Egalité – Paix

Ministère de l'Equipement et des Transports

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LABORATOIRE CENTRAL
DU BATIMENT ET DE L'EQUIPEMENT

المختبر المركزي للبناء والتجهيز

FEUILLE D'ESSAIS

DENSITE SPECIFIQUE PAR PYCOMETRE

DOSSIER N° :	**DATE D'EDITION:**	**NORME :**
254-2018	17/11/2018	NF P94-054

DOSSIER :

Demandeur : *Hydroterra Engineering SARL*
Chantier : *Construction d'un quai d'embarquement au Port de Djibouti*

Epreuve de : *Identification*
Partie de l'ouvrage : *Etude Géotechnique et Sondage*

REFERENCES DE L'ECHANTILLON :

Provenance : *SC03*
N° échantillon : 20.7-22.0 m

RESULTATS :

description	détermination	
Profondeur : 20,7m-22m	1	2
Poids pycnomètre (W1) en g	243,1	243,1
Poids pycnomètre + échantillon (W2) en g	340,5	340,2
Poids pycnomètre + échantillon +eau (W3) en g	957,9	958
Poids pycnomètre +eau (W4) en g	898,2	898,2
Poids spécifique	2,58	2,60
Moyenne	2,59	

OBSERVATIONS :

LE DIRECTEUR DU LCBE
SOUBANEH SAID ISMAEL

Zone Industrielle Sud (Boulaos) – BP : 2016 – Tel : +(253) 21 35 34 77 – Fax : +(253) 21 35 11 68

Apparent weight

REPUBLIQUE DE DJIBOUTI
Unité – Egalité – Paix

Ministère de l'Equipement et des Transports

LCBE
LABORATOIRE CENTRAL
DU BATIMENT ET DE L'EQUIPEMENT
المختبر المركزي للبناء والتجهيز

DENSITE APPARENTE GABARI

Dossier : 254-2018
Chantier : Construction d'un quai d'embarquement au Port de Djibouti
Client : Hydroterra Engineering SARL
Matériaux : Identification
Provenance : SC03

sonadage	SC 03
Profondeur (m)	19.5 - 20,7 m
Poids Total de Materiau (g)	2595
Poids de Gabari (g)	2164
Volume de Gabari (cm^3)	314,1
Densite Apparente (g/cm^3)	1,37

Observation :

Le Directeur du L C B E

Soubaneh Said Ismael

REPUBLIQUE DE DJIBOUTI
Unité – Egalité – Paix

Ministère de l'Equipement et des Transports

LCBE
LABORATOIRE CENTRAL
DU BATIMENT ET DE L'EQUIPEMENT
المختبر المركزي للبناء والتجهيز

DENSITE APPARENTE PAR PESEE HYDROSTATIQUE

Dossier : 254-2018
Chantier : Construction d'un quai d'embarquement au Por de Djibouti
Client : Hydroterra Engineering SARL
Matériaux : Identification
Provenance : SC03

Sondage	SC03			
Profondeur	0-13 m	13-15 m	15-19,5 m	20,7-22 m
Poids Humide avant paraffinage (g)	592,7	1287,5	1082,2	798,8
Poids après paraffinage (g)	623,6	1304,2	1108	800
Poids dans l'Eau (g)	269	620	462	365
Volume Total (cm^3)	354,6	684,2	646	435
Poids de paraffine (g)	30,9	16,7	25,8	1,2
Volume d'Echantillon (cm^3)	323,7	667,5	620,2	433,8
Volume de paraffine (cm^3)	34,33	18,6	28,7	1,33
Densité Apparente (g/cm^3)	1,83	1,93	1,74	1,84

Observation :

Le Directeur du L C B E
Soubaneh Said Ismael

Annex4 : Survey crates pictures

SC01 bis
(BH D-02)

0 à 13.00 m

13 à 19.50 m

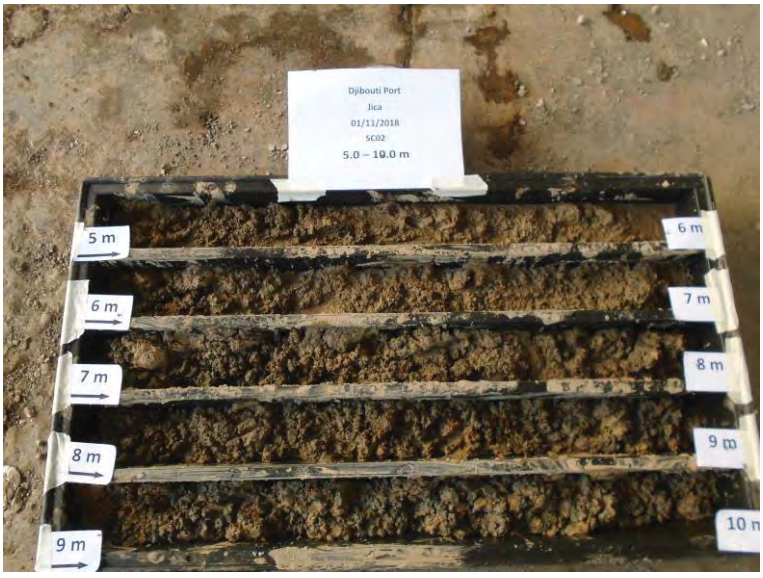
19.5 à 30 m

30 à 36 m

SC02

(BH D-03)

0.00 à 5.00 m



5.00 à 10.00 m

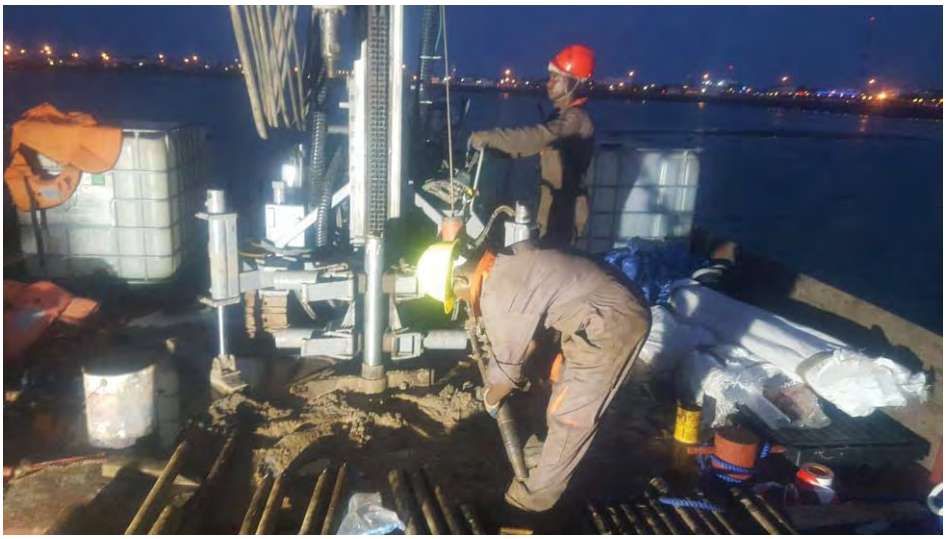
SC03
(BH-D01 Modified)

0.00 à m

à 19.50 m

19.50 à 22.00 m

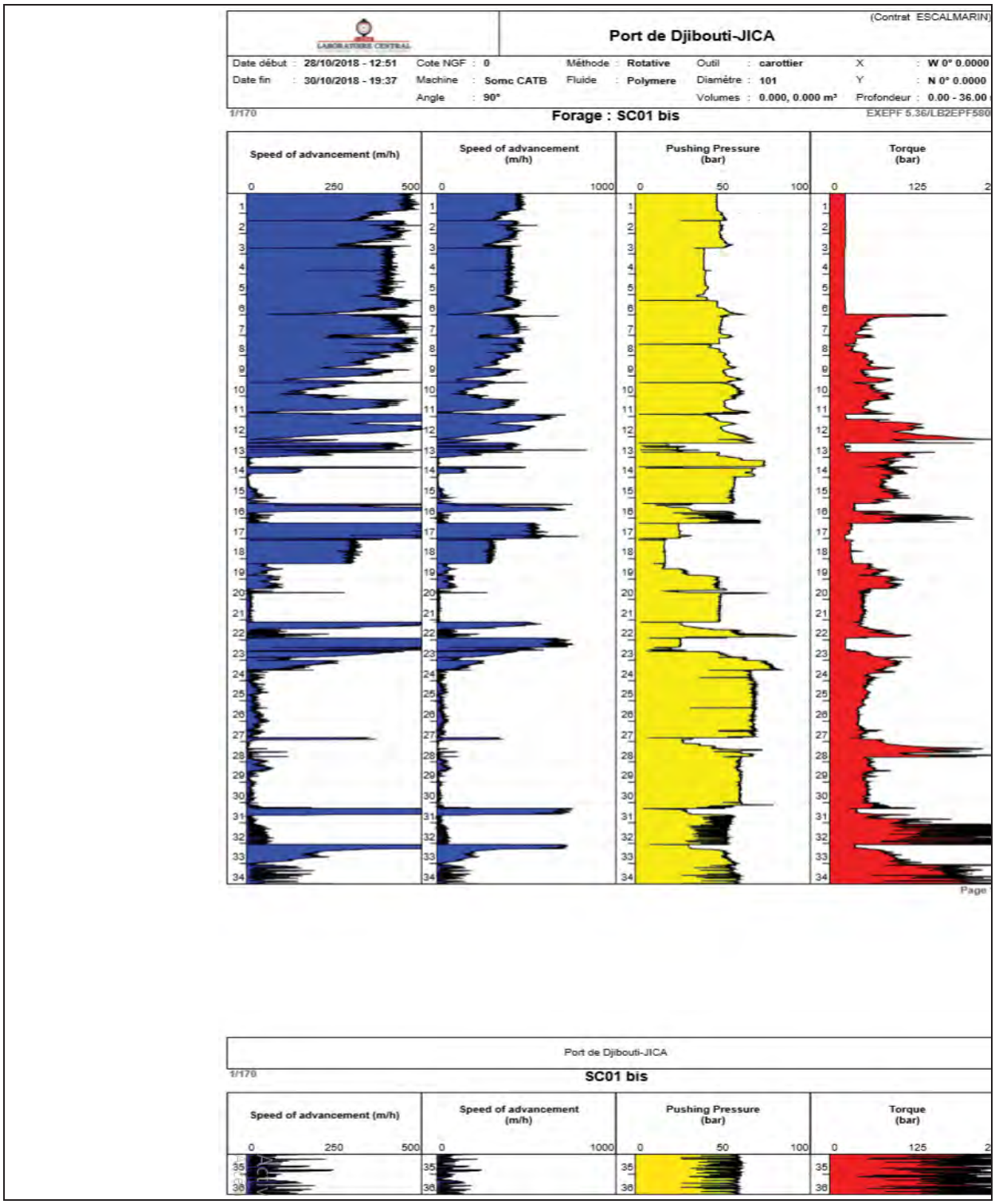
Annex 4 : Site projectpictures



Annex 5: Diagraphy

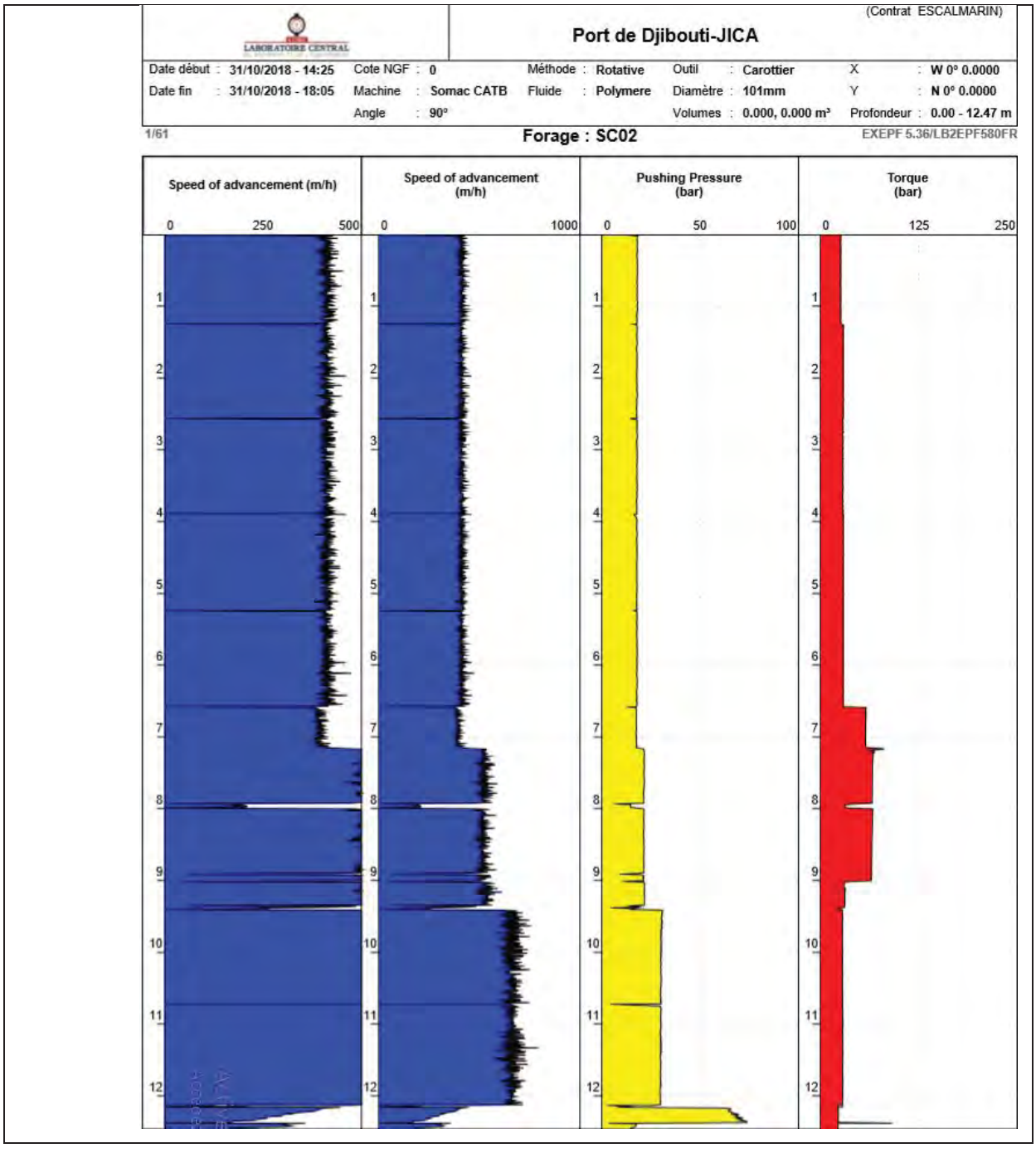
SC01 bis

(BH D-02)



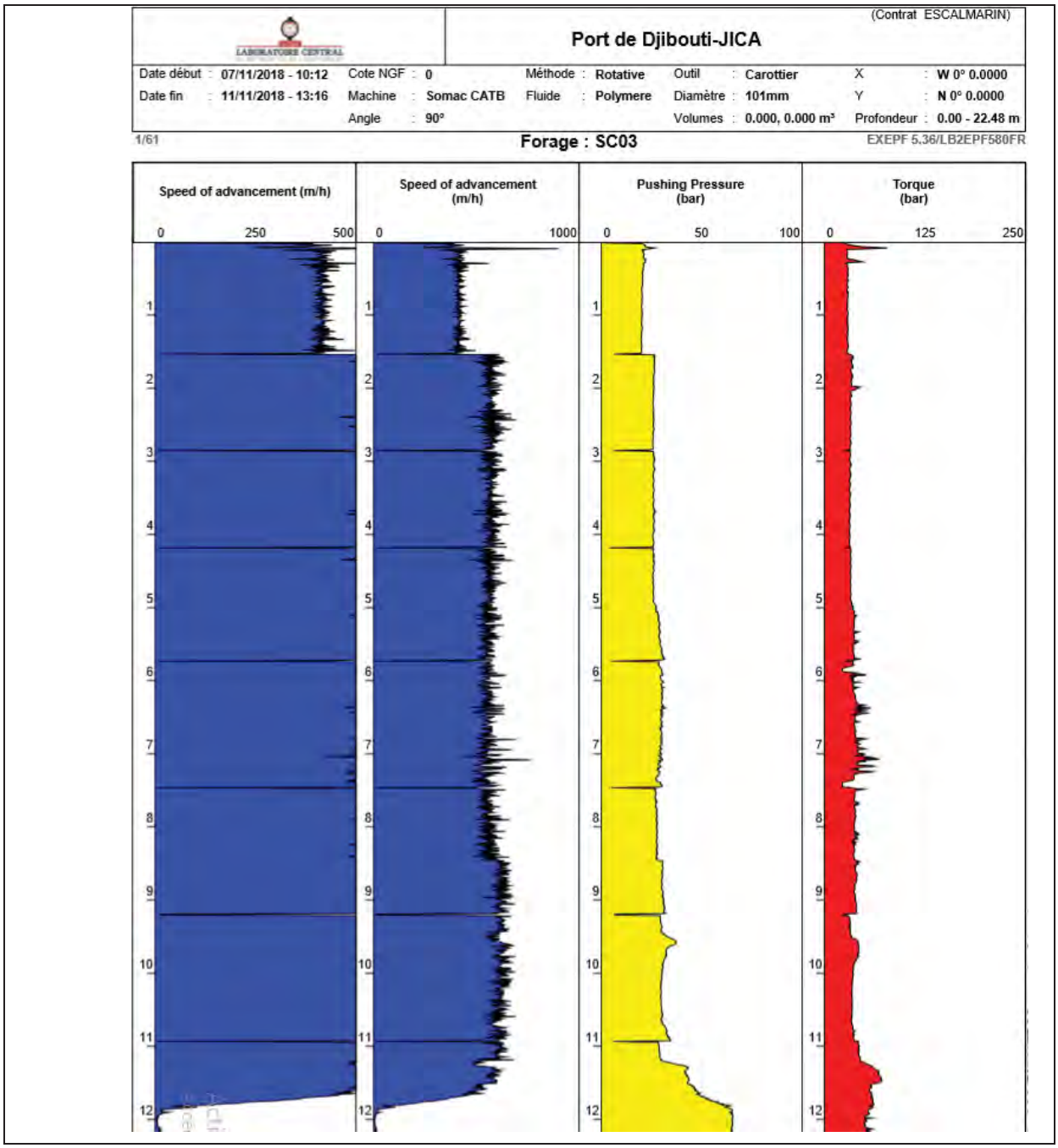
SC02

(BH D-03)


LABORATOIRE CENTRAL
(Contrat ESCALMARIN)
Port de Djibouti-JICA
Date début : 31/10/2018 - 14:25
Date fin : 31/10/2018 - 18:05
Cote NGF : 0
Machine : Somac CATB
Angle : 90°
Méthode : Rotative
Fluide : Polymere
Outil : Carottier
Diamètre : 101mm
Volumes : 0.000, 0.000 m³
X : W 0° 0.0000
Y : N 0° 0.0000
Profondeur : 0.00 - 12.47 m
1/61
Forage : SC02
EXEPF 5.36/LB2EPF580FR
Speed of advancement (m/h)
0
250
500
Speed of advancement (m/h)
0
1000
Pushing Pressure (bar)
0
50
100
Torque (bar)
0
125
250
1
2
3
4
5
6
7
8
9
10
11
12

SC03

(BH-D01 Modified)



Annex 6 : Percentage recovered

SC01 bis		
Depth of pass	length recovered (m)	Percentage recovered (%)
0,0-1,5	0,2	13,33
1,5-3,0	0,3	20
3,0-4,50	0,3	20
4,50-6,0	0,5	33,33
6,0-7,5	0,4	26,7
7,5-9,0	0,7	46,7
9,0-10,50	0,6	40
10,5-12,0	0,9	60
12,0-13,5	0,6	40
13,50-15,0	0,5	33,33
15,0-16,50	0,9	60
16,50-18,0	1	66,67
18,0-19,5	0,4	26,7
19,5-21,0	0,5	33,33
21,0-22,50	0,6	40
22,50-24,0	0,6	40
24,0-25,50	0,5	33,33
25,50-27,0	0,9	60
27,0-28,5	0,8	53,33
28,5-30,0	0,7	46,67
30,0-31,5	1,2	80
31,5-33,0	1,1	73,33
33,0-34,5	1,5	100
34,5-36,0	1,2	80

SC02		
Depth of pass	length recovered (m)	Percentage recovered (%)
0,0-1,5	1,4	93,33
1,5-3,0	1,5	100
3,0-4,50	1,3	86,67
4,50-6,0	1,5	100
6,0-7,5	1,5	100
7,5-9,0	1,4	93,33
9,0-10,0	1	66,67

SC03		
Depth of pass	length recovered (m)	Percentage recovered(%)
0,0-1,5	0,3	20
1,5-3,0	0,4	26,7
3,0-4,50	0,5	33,33
4,50-6,0	0,5	33,33
6,0-7,5	0,6	40
7,5-9,0	0,7	46,7
9,0-10,50	0,7	46,7
10,5-12,0	1,1	73,3
12,0-13,5	1,2	80
13,50-15,0	1	66,67
15,0-16,50	1,2	80
16,50-18,0	1	66,67
18,0-19,5	0,8	53,33
19,5-21,0	1	66,67
21,0-22,50	1	66,67

ANNEXE 5 : U.S.G. Mission definitions, standard NF P 94-500

GENERAL CONDITIONS OF GEOTECHNICAL MISSIONS

1. Frames of the mission

With reference to CLASSIFICATION OF TYPICAL GEOTECHNICAL MISSIONS (Standard NFP 94-500 of décember 2006), It is the responsibility of the project owner and his projet manager to ensure that all the geotechnical missions necessary for the design and execution of the work are undertaken with the appropriate means and entrusted to the men of the Art.

The sequence of geotechnical missions follows the succession of project development phases, each of these missions covering only a specific area of design or execution. In particular:

1. G1, G2, G3, G4 missions are realized in a successive order;
2. A mission entrusted to our company may contain only a part of the services described in the corresponding standard mission;
3. the geotechnical investigations engage our company only on the conformity of the executed works with those contractually ordered and the exactitude of the results which it provides;
4. A typical mission, G1 to G5, engages our company on its duty of advice only in the strict framework, on the one hand of the objectives explicitly defined in our technical proposal on the basis of which the order and its possible amendments have been established, on the other hand, the client's project described by the graphic documents or plans cited in the report;
5. A typical mission G1 or G5 excludes any commitment of our company on the quantities, costs and time of execution of the future geotechnical works;
6. A typical mission G2 engages our company as technical assistant to the prime contractor within the limits of the contract setting the scope of the mission and the part (s) of the work (s) concerned (s).

The responsibility of our company can not be engaged outside the framework of the geotechnical mission object of the report. In particular, any modification made to the project or its environment requires the updating of the geotechnical report as part of a new mission.

2. Recommandations

It is specified that the geotechnical study is based on recognition of the soil whose mesh does not make it possible to remove all the hazards always possible in natural environment. Indeed, heterogeneities, natural or man-made, discontinuities and performance hazards may arise given the relationship between the sampled or tested volume and the volume requested by the book, and even more so that these possible singularities can be limited in extension.

The new engineering elements highlighted during the execution, which may have an influence on the conclusions of the report, must be immediately reported to the geotechnician in charge of the supervision of the technical monitoring of execution (mission G4) so that he/she analyzes the consequences on the conditions of execution of the design of the technical work.

If a particular evolutionary character has been brought to light (especially slip, erosion, dissolution, upgradeable fill, peat), the application of the recommendations of the report requires validation at each successive stage of the design or execution. Such an evolutionary character can cause these recommendations to take a long time before they are implemented.

3. Mission report

The geotechnical report is the report of the geotechnical mission defined by the order under which it was established and whose references are recalled in mind. In the absence of specific contractual clauses, the delivery of the geotechnical report fixes the end of the mission. A geotechnical report and all its identified annexes constitute an inseparable whole. The two copies of reference are the two preserved original ones: one by the customer and the second by our company. In this context, any other interpretation that could be made of a communication or partial reproduction could not engage the responsibility of our company. In particular, even the partial use of these results and conclusions by another owner or by another constructor or for any other work than the entrusted mission, will not be able to engage the responsibility of our company and may result in prosecution.

CLASSIFICATION OF TYPES OF GEOTECHNICAL ENGINEERING MISSIONS

The sequence of engineering and engineering missions goes through the stages of elaboration and realization of any project to contribute to the control of the geological risks. Each mission relies on specific geotechnical investigations.
It is the responsibility of the project owner or his authorized representative to ensure the subsequent realization of all these missions by geotechnical engineer.

Stage 1 : Prior geotechnical study (G1)

These missions exclude all approaches to the quantities, deadlines and costs of execution of the engineering works which is part of a project engineering study mission (stage 2). They are normally the responsibility of the client.

Preliminary geotechnical site study (G11)

It is carried out at the stage of a preliminary study or sketch and allows a first identification of the geological risks of a site:

1. A documentary survey on the geotechnical framework of the site and the existence of surroundings is made with a visit of the site surroundings;

1. A specific geotechnical investigation program is defined and carried out, its technical follow-up is ensured, the results exploited;

2. A report with a preliminary geological model, some general principles of adaptation of the project to the site and a first identification of the risks is provided.

Geotechnical study of preliminary project (G12)

It is carried out at the pre-project stage and helps to reduce the consequences of the identified risks of geological hazards:

1. A specific geotechnical investigation program is defined and carried out, its technical follow-up is ensured, the results exploited;
2. to provide a report giving the technical and technical assumptions to be taken into account at the preliminary design stage, certain general construction principles (including earthworks, retaining walls, foundations, risks of deformation of the ground, general provisions with respect to groundwater and neighboring areas)..

This study will have to be completed during the project engineering study (step 2).

Stage 2 Project Geotechnical studies (G2)

It is carried out to define the project of engineering works and to reduce the consequences of significant geological risks that have been identified. It is normally the responsibility of the contracting authority and can be integrated into the general project management mission.

Project Phase

1. A specific geotechnical investigation program is defined and carried out, its technical follow-up is ensured, the results exploited;
2. To provide an updated summary of the site and the technical notes giving the proposed methods of execution for engineering structures (including grounding, support, groundwater layouts and neighboring layouts) and associated values, certain project level sizing calculation notes;

3. Provide an approach to the quantities / details / costs of performing these engineering works and an identification of the consequences of residual green risks.

Phase Assistance to Works Contrats

1. to draw up the documents necessary for the consultation of the companies for the execution of the engineering works (plans, technical instructions, price list and estimate framework, provisional planning);
2. Assist the client for the selection of companies and the technical analysis of offers.

Stage3: Execution of the Geotechnical Works (G3 and G4, separate and simultaneous)

Geotechnical Execution Study and Monitoring (G3)

It takes place in 2 interactive and inseparable phases, it allows to reduce the residual risks by the timely implementation of adaptation measures or optimization. It is normally assigned to the contractor.

Study phase

1. Define a specific engineering program, carry it out, ensure technical follow-up and exploit the results;

2. To study in detail the engineering structures, in particular validation of the technical hypotheses, definition and dimensioning (justifying computations), methods and conditions of execution (phasing, follow-up, controls, inspections in conjunction with the associated values, additional constructive provisions, if any), drawing up the geotechnical file of execution.

Follow-up Phase

1. To follow the program of inspection and execution of the geotechnical works, to trigger if necessary the constructive provisions pre-defined during the study phase;

2. To verify the geotechnical data by survey during excavations and by a program of complementary geotechnical investigations if necessary (to carry it out or to ensure the technical follow-up, to exploit the results);

3. Participate in the preparation of the end-of-works file and maintenance recommendations for geotechnical structures.

It makes it possible to verify the conformity with the objectives of the project, the study and the geotechnical follow-up of execution. It is normally the responsibility of the owner.

Supervision phase of the study of execution

1. Advice on the geotechnical execution study, on the adaptations or potential optimizations of the geotechnical works proposed by the contractor, on the monitoring program and the associated threshold values.

Supervision phase of the execution monitoring

1. Notice, by occasional interventions on the site, on the geotechnical context as observed by the contractor, on the observed behavior of the work and the neighbors concerned and on the adaptation or the optimization of the geotechnical work proposed by the contractor.

Geotechnical diagnosis (G5)

During the course of a project or during the life of a work, it may be necessary to proceed, in a strictly limited manner, to the study of one or more specific geotechnical elements, within the framework of a mission punctual.

1. Define, after documentary investigation, a specific program of geotechnical investigations, carry it out or ensure its technical follow-up, exploit the results;

2. To study one or more specific geotechnical elements (for example, or tenement, drawdown, geotechnical causes of a disorder) as part of this diagnosis, but without any involvement in other geotechnical elements.

Geotechnical project and / or execution, monitoring and supervision studies must be carried out subsequently, in accordance with the sequence of geotechnical engineering missions, if this diagnosis leads to the modification or completion of works

SOIL IDENTIFICATION CAMPAIGN

SITE: PORT OF TADJOURAH

PROJECT: BUILDING A DOCK

CLIENT: HYDROTERRA ENGINEERING SAR

GEOTECHNICAL FINAL REPORT

NATURAL CONDITIONS SURVEY PACKAGE-A

PREPARATORY SURVEY ON REINFORCEMENT OF MARITIME TRANSPORT AT GOLF OF TADJOURAH

SOIL IDENTIFICATION CAMPAIGN

SITE: PORT OF TADJOURAH

PROJECT: BUILDING A DOCK

CLIENT: JAPAN CONSULTANT PORT

JANVIER 2018

GEOTECHNICAL MISSION

PRELIMINARY STUDIES - GEOTECHNICAL

Included in this document:

1. A geotechnical report
2. Annex1 :Lithology of boreholes
3. Annex2 : Laboratory results
4. Annex3 : Survey crate pictures
5. Annex4 : Site pictures
6. Annex5 : Définitions des missions U.S.G., norme NF P 94-500

Table of content

I. PRESENTATION

1.1 Mission Definition

- Mission

At the request of Society HYDROTERRA ENGINEERING, the CENTRAL BUILDING AND EQUIPMENT LABORATORY (LCBE) moved to the site of TADJOURAH, to carry out a SERIE OF IDENTIFICATION OF SOIL of the ground. This mission should allow:

1. Determine the lithological nature of the formations crossed
2. To identify the geotechnical nature of the samples taken from the section
3. Provide the results of the laboratory tests performed on the samples taken.

.

1.2 Regulation used

The various tests performed (in situ and laboratory tests) comply with AFNOR standards

.

II. SOIL IDENTIFICATION

2.1 Identificationprogram:

For this study, the investigation program initially planned was modified to take into account the difficulties of access to the site. The initial program also planned, according to the specifications, to stop the depth of investigation if the bedrock is reached with a rock continuity of 6 meters beyond the planned foundation level

.

The table below gives a summary of the work performed:

Survey points	X	Y	Z seabed	Sieveanalysis	Atterberg Limits	Water content	Specificweight	Apparent weight
BH T01	269050	1303570	-3	1	1	1	1	1
BH T01 (modified)	269102	1303549	-0,6	3	3	3	3	3
BH T02	269070	1303520	-0,7	3	3	3	3	3
Total :				**7**	**7**	**7**	**7**	**7**

In addition to the core drilling and manual sampling of soil samples, the following test has been realized on the site:

1. 1. SPT tests to determine the bearing capacity of crossed layers:

2. 2. laboratory tests to identify and characterize soils in place, including:

- 7 Sieve analysis [NF P 94-056],
- 7 Atterberg Limits [NF P 94-051],
- 7Water content [NF P 94-050],
- 7 Specific weight [NF P94-054],
- 7 Apparent weight ,

The results of all the tests are presented in the appendices to this report.

2.2 Identification synthesis

♦ Surveying procedures

1. Boreholes drilling with Standard penetration test :

For these types of machines, drillings are carried out by the method of rotation by means of a drill string provided at its base with a perforating tool which rotates in the borehole. Bentonite-based slurry injected into the circuit allows the drill string to be cooled down, the wall to be shielded and the borehole to be cleaned. Tungsten carbide crowns, carbonites and diamond crowns are used depending on the formations encountered.Drilling was carried out by rotation and washing.

The Standard Penetration Test is carried out following a battering of a 450 mm penetration of the split sampler, using a hammer weighing 63.5 kg and falling in free fall from a height of 760 mm on the head of a drill string.

The split sampler used has an outside diameter of 51 mm and does not have a liner inside. The standard penetration tests were performed using an automatic hammer, providing effective energy to the rod train of about 80% of the theoretical potential free fall energy.

This test, carried out in accordance with the French Standard (NF P 94-116), makes it possible to provide information on the nature of the soil and to take samples of remodeled material for carrying out physical tests in the laboratory.

Survey points	X	Y	Z seabed	InvestigatedDepth (m)
BH T01	269050	1303570	-3	21
BH T01 (modified)	269102	1303549	-0,6	12
BH T02	269070	1303520	-0,7	23

♦Site plan of Survey points:

The different survey points made are materialized on the ground plan below.

♦Synthesis of laboratory tests:

The results of the laboratory tests carried out on the soil samples taken from the holes are presented in appendices.

1. Standard Penetration Test Synthesis

Standard Penetration Test (SPT)				
Depth (m)	15 cm	15cm	15cm	SPT Value (N)
BHT01				
1,5	10	17	20	37
3	9	15	21	36
4,5	1	0	1	1
6	5	5	5	10
7,5	2	3	2	5
9	9	9	7	16
10,5	12	18	19	37
12	8	14	18	32
13,5	18	20	27	47
15	20	35	41	76
16,5	18	30	24	54
18	28	1	32	33

19,5	24	19	23	42
21	18	25	27	52
BHT01 (modified)				
1,5	1	1	2	3
3	3	5	5	10
4,5	1	0	1	1
6	1	2	2	4
7,5	2	3	3	6
9	9	9	7	16
10,5	8	14	18	32
12	18	20	27	47
BHT02				
1,5	3	7	12	19
3	6	6	8	14
4,5	5	4	5	9
6	3	4	6	10
7,5	7	9	9	18
9	8	8	10	18
10,5	9	9	9	18
12	10	13	15	28
13,5	17	24	26	50
15	14	26	21	47
16,5	17	18	29	47
18	16	27	24	51
19,5	20	28	29	57
21	18	26	24	50
22,5	20	27	28	55

- Results obtained:

Table n° 03: Synthesis of the tests

Reference depth	Particle size analysis			Atterberg limits			Water Content	Specificweight	Apparent weight
	% Ø < 50 mm	% Ø < 2,5 mm	% Ø < 0,08 mm	WL (%)	WP (%)	IP (%)	(%)		(g/cm³)
0 à 10 m	100	91	18,3	Non Mesurable			7,84	2,68	1,33
0 à 4 m	100	62,3	32,7	38,1	14,3	23,8	19,73	2,69	1,37
4 à 8 m	100	84,7	28,4	Non Mesurable			18,43	2,53	1,26
8 à 15 m	100	81,5	81,5	Non Mesurable			15,2	2,72	1,31
0 à 10 m	100	99,8	23,9	Non Mesurable			27,46	2,64	1,31
10 à 13,5 m	100	98,7	34	Non Mesurable			25,48	2,75	1,28
13,5 à 23 m	100	92,9	50,3	Non Mesurable			24,8	2,73	1,31

III. CONCLUSIONS

The laboratory tests were carried out on the samples taken, the results obtained are inserted in the report and attached.

Done in Djibouti, the *07/01/2019*

LE DIRECTEUR DU LCBE

SOUBANEH SAID ISMAEL

ANNEX:

Annex1 :Lithologycut of Boreholes

Annex2 :Laboratory test results

Annex3 :Survey cratespictures

Annex4 :Site Project pictures

Annex 5 :Diagraphy

Annex 6 : Percentage recovered

Annex 1: Lithologycut of Boreholes

BH T01

Ministère de l'Equipement et des Transports

LABORATOIRE CENTRAL

المختبر المركزي للبناء والتجهيز

BORING LOG

BOREHOLE BHT01

Commenced date :
Completed date :
Site Localisation : Port of Tadjourah
Boring equipement : SEDIDRILL drilling
Boring method : Rotary drilling with polymer
Boring diameter : 101 mm (from beginning to end)
Depth of the borehole : 21 m
Coordinates of the borehole : -

Depth (m)	LEGEND	DESCRIPTION	STANDARD PENETRATTION TEST					
			Depth (m)	Blows N1	Blows N2	Blows N3	Spt value	SPT Chart
0			0					
1								
2	Backfilling		1,5	10	17	20	37	
3			3	9	15	21	36	
4								
5			4,5	1	0	1	1	
6	fine sandy soils		6	5	5	5	10	
7								
8			7,5	2	3	2	5	
9			9	9	9	7	16	
10								
11	Muddy soils witch presence of gravel		10,5	12	18	19	37	
12			12	8	14	18	32	
13								
14			13,5	18	20	27	47	
15			15	20	35	41	76	
16								
17			16,5	18	30	24	54	
18	fragments of natural stones		18	28	18	32	50	
19								
20			19,5	24	19	23	42	
21			21	18	25	27	52	

BH T01 (modified)

Ministère de l'Equipement et des Transports

LABORATOIRE CENTRAL

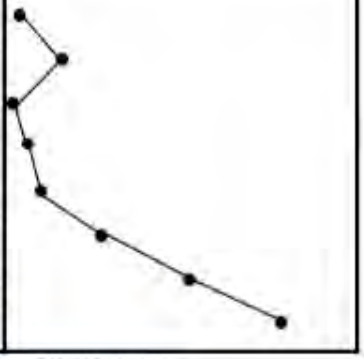
المختبر المركزي للبناء والتجهيز

BORING LOG

BOREHOLE BHT01 (Modified)

Commenced date :
Completed date :
Site Localisation : Port of Tadjourah
Boring equipement : SEDIDRILL drilling
Boring method : Rotary drilling with polymer
Boring diameter : 101 mm (from beginning to end)
Depth of the borehole : 12 m
Coordinates of the borehole : -

Depth (m)	LEGEND	DESCRIPTION	STANDARD PENETRATTION TEST					
			Depth (m)	Blows N1	Blows N2	Blows N3	Spt value	SPT Chart
0			0					
1								
2			1,5	3	1	2	3	
3			3	3	5	5	10	
4	SAND witch							
5	silty clay and		4,5	1	0	1	1	
6	shellst		6	1	2	2	4	
7								
8			7,5	2	3	3	6	
9			9	9	9	7	16	
10								
11	Sand witch		10,5	8	14	18	32	
12	presences of gravel		12	18	20	27	47	



BH T02

Ministère de l'Equipement et des Transports

LABORATOIRE CENTRAL

المختبر المركزي للبناء والتجهيز

BORING LOG

BOREHOLE BHT02

Commenced date :
Completed date :
Site Localisation : Port of Tadjourah
Boring equipement : SEDIDRILL drilling
Boring method : Rotary drilling with polymer
Boring diameter : 101 mm (from beginning to end)
Depth of the borehole : 23 m
Coordinates of the borehole : -

Depth (m)	LEGEND	DESCRIPTION	STANDARD PENETRATTION TEST					
			Depth (m)	Blows N1	N2	N3	Spt value	SPT Chart
0			0					
1								
2			1,5	3	7	12	19	
3	Muddy soils witch shells from friable to compact		3	6	6	8	14	
4								
5			4,5	5	4	5	9	
6			6	3	4	6	10	
7								
8			7,5	7	9	9	18	
9			9	9	8	8	16	
10								
11	Silt clay brown stiff		10,5	9	9	9	18	
12			12	10	13	15	28	
13								
14			13,5	17	24	26	50	
15			15	14	26	21	47	
16								
17			16,5	17	18	29	47	
18	Brown clay very stiff		18	16	27	24	51	
19								
20			19,5	20	28	29	57	
21			21	18	26	24	50	
22								
23			22,5	20	27	28	55	

SPT Chart: 10 20 30 40 50 > 50

Annex2: Laboratory Test Results

BH T01

Sieve analysis

REPUBLIQUE DE DJIBOUTI
Unité – Egalité – Paix

Ministère de l'Equipement et des Transports

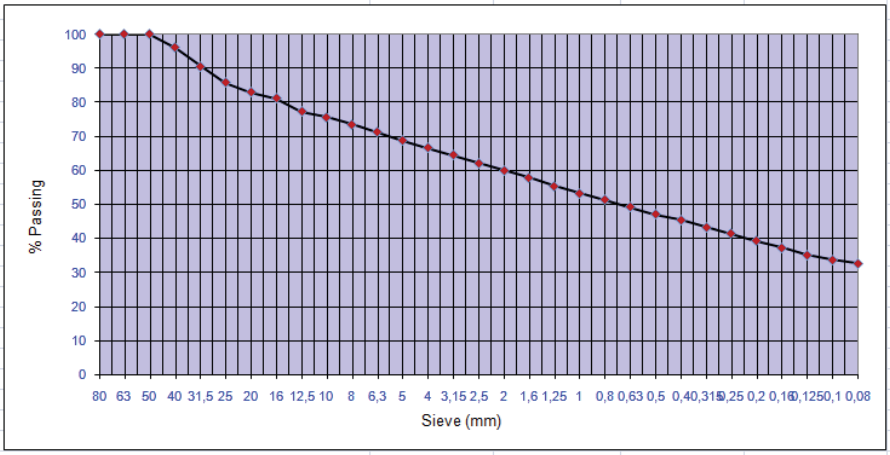
LABORATOIRE CENTRAL DU BATIMENT ET DE L'EQUIPEMENT
المختبر المركزي للبناء والتجهيز

ANALYSE GRANULOMETRIQUE - NORME NF P 94-056

Dossier : 254-2018
Chantier : Construction d'un quai d'embarquement au Port de Tadjourah
Client: Hydroterra Engineering SARL
Matériaux : Identification
Provenance : BH01 (0 - 10 m)

Poinds Initial (grs): **2330,5**

Tamis	Refus Partiel(gr)	Refus Cumules (gr)	Refus Cumules (%)	Passant (%)
80	0,0	0,0	0,0	100,0
63	0,0	0,0	0,0	100,0
0,0	0,0	0,0	0,0	100,0
40	0,0	0,0	0,0	100,0
31,5	0,0	0,0	0,0	100,0
25	0,0	0,0	0,0	100,0
20	34,8	34,8	1,5	98,5
16	41,0	75,8	3,3	96,7
12,5	21,2	97,0	4,2	95,8
10	40,8	137,8	5,9	94,1
8	13,2	151,0	6,5	93,5
6,3	21,3	172,3	7,4	92,6
5	13,5	185,8	8,0	92,0
4	8,0	193,8	8,3	91,7
3,15	7,1	200,9	8,6	91,4
2,5	9,5	210,4	9,0	91,0
2	7,9	218,3	9,4	90,6
1,6	14,0	232,3	10,0	90,0
1,25	15,2	247,5	10,6	89,4
1	15,8	263,3	11,3	88,7
0,8	28,8	292,1	12,5	87,5
0,63	27,4	319,5	13,7	86,3
0,5	45,1	364,6	15,6	84,4
0,4	47,9	412,5	17,7	82,3
0,315	106,3	518,8	22,3	77,7
0,25	179,7	698,5	30,0	70,0
0,2	562,7	1261,2	54,1	45,9
0,16	278,7	1539,9	66,1	33,9
0,125	206,4	1746,3	74,9	25,1
0,1	123,9	1870,2	80,2	19,8
0,08	22,6	1892,8	81,2	18,8
FOND	11,7	1904,5	81,7	18,3



Observation :

Le Directeur du LCBE,

Mr. Soubaneh Said Ismael

Atterberg Limits

REPUBLIQUE DE DJIBOUTI
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Ministère de l'Equipement et des Transports

LCBE
LABORATOIRE CENTRAL
DU BÂTIMENT ET DE L'EQUIPEMENT

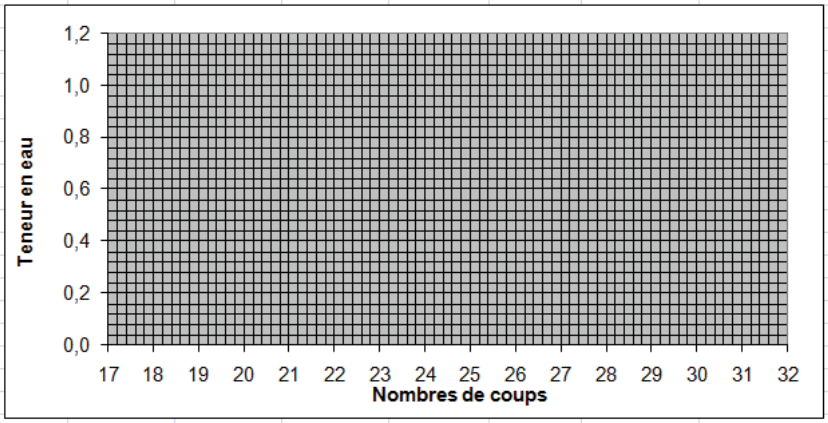
المختبر المركزي للبناء والتجهيز

ESSAI DE LIMITE D'ATTERBERG
NORME NF P 94 - 051

Dossier : 254-2018
Chantier : Construction d'un quai d'embarquement au Port de
Client : Hydroterra Engineering SARL
Matériaux : Identification
Provenance : BH01 (0 - 10m)

LL: **LP:** **IP:** **0,0**

LIMITE DE LIQUIDITE		LIMITE DE PLASTICITE	
NOMBRE DE COUPS	Non - Mesurable	Test n°1	Test n°2
NUMERO DE LA TARE		Non - Mesurable	
POIDS TOTAL HUMIDE (g)			
POIDS TOTAL SEC (g)			
POIDS DE LA TARE (g)			
POIDS D'EAU (g)			
POIDS NET SEC (g)			
TENEUR EN EAU (%)			
TOTAL (%)			



Observation :

Le Directeur du LCBE,

Mr. Soubaneh Said Ismael

Water content

REPUBLIQUE DE DJIBOUTI
Unité – Egalité – Paix

Ministère de l'Equipement et des Transports

LCBE
LABORATOIRE CENTRAL
DU BÂTIMENT ET DE L'EQUIPEMENT

المختبر المركزي للبناء والتجهيز

ESSAI DE TENEUR EN EAU

Dossier : 254-2018
Chantier : Construction d'un quai d'embarquement au Port de Tadjourah
Client: Hydroterra Engineering SARL
Matériaux : Identification
Provenance : BH01

PROFONDEUR	0-10m
NUMERO DE LA TARE	R
POIDS TOTAL HUMIDE (g)	616,5
POIDS TOTAL SEC (g)	575,7
POIDS DE LA TARE (g)	55,2
POIDS D'EAU (g)	40,8
POIDS NET SEC (g)	520,5
TENEUR EN EAU (%)	7,84

Observations :

Le Directeur du L C B E

Soubaneh Said Ismael

Specific weight

REPUBLIQUE DE DJIBOUTI
Unité – Egalité – Paix

Ministère de l'Equipement et des Transports

LABORATOIRE CENTRAL

المختبر المركزي للبناء والتجهيز

FEUILLE D'ESSAIS

DENSITE SPECIFIQUE PAR PYCOMETRE

DOSSIER N° :	**DATE D'EDITION:**	**NORME :**
254-2018	23/12/2018	NF P94-054

DOSSIER :

Demandeur : *Hydroterra Engineering SARL*
Chantier : *Construction d'un quai d'embarquement au Port de Tadjourah*

Epreuve de : *Identification*
Partie de l'ouvrage : *Etude Géotechnique et Sondage*

REFERENCES DE L'ECHANTILLON :

Provenance :

N° échantillon **:**BH01 (0.0-10.0m)

RESULTATS :

description	détermination	
Profondeur : 0.0-10.0m	1	2
Poids pycnomètre (W1) en g	243.1	243.1
Poids pycnomètre + échantillon (W2) en g	343.2	343.3
Poids pycnomètre + échantillon +eau (W3) en g	960.9	960.3
Poids pycnomètre +eau (W4) en g	897.7	897.7
Poids spécifique	2,71	2,66
Moyenne	2.68	

OBSERVATIONS :

LE DIRECTEUR DU LCBE

SOUBANEH SAID ISMAEL

Apparent weight

REPUBLIQUE DE DJIBOUTI
Unité _ Egalité – Paix

Ministère de l'Equipement et des Transports

LCBE
LABORATOIRE CENTRAL
DU BÂTIMENT ET DE L'EQUIPEMENT

المختبر المركزي للبناء والتجهيز

DENSITE APPARENTE GABARI

Dossier : 254-2018
Chantier : Construction d'un quai d'embarquement au Port de Tadjourah
Client: Hydroterra Engineering SARL
Matériaux : Identification
Provenance : BH01

sonadage	BH01
Profondeur (m)	0,00-10,0m
Poids Total de Materiau (g)	3403
Poids de Gabari (g)	2577,9
Volume de Gabari (cm^3)	617
Densite Apparente (g/cm^3)	1,33

Observation :

Le Directeur du L C B E

Soubaneh Said Ismael

BH T01 (modified)

Sieve analysis

REPUBLIQUE DE DJIBOUTI
Unité – Egalité – Paix

Ministère de l'Equipement et des Transports

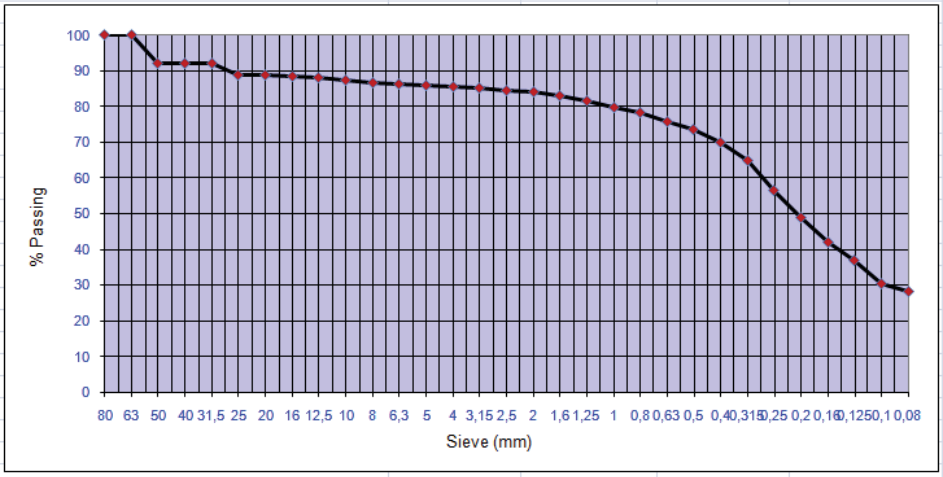
LABORATOIRE CENTRAL DU BATIMENT ET DE L'EQUIPEMENT
المختبر المركزي للبناء والتجهيز

ANALYSE GRANULOMETRIQUE - NORME NF P 94-056

Dossier : 254-2018
Chantier : Construction d'un quai d'embarquement au Port de Tadjourah
Client: Hydroterra Engineering SARL
Matériaux : Identification
Provenance : BH01' (4 - 8 m)

Poinds Initial (grs): **2133,2**

Tamis	Refus Partiel(gr)	Refus Cumules (gr)	Refus Cumules (%)	Passant (%)
80	0,0	0,0	0,0	100,0
63	0,0	0,0	0,0	100,0
50,0	169,5	169,5	7,9	92,1
40	0,0	169,5	7,9	92,1
31,5	0,0	169,5	7,9	92,1
25	63,5	233,0	10,9	89,1
20	0,0	233,0	10,9	89,1
16	12,6	245,6	11,5	88,5
12,5	9,6	255,2	12,0	88,0
10	15,2	270,4	12,7	87,3
8	11,8	282,2	13,2	86,8
6,3	7,2	289,4	13,6	86,4
5	12,5	301,9	14,2	85,8
4	7,0	308,9	14,5	85,5
3,15	8,6	317,5	14,9	85,1
2,5	8,5	326,0	15,3	84,7
2	13,3	339,3	15,9	84,1
1,6	22,0	361,3	16,9	83,1
1,25	26,7	388,0	18,2	81,8
1	39,2	427,2	20,0	80,0
0,8	36,5	463,7	21,7	78,3
0,63	50,0	513,7	24,1	75,9
0,5	45,8	559,5	26,2	73,8
0,4	76,6	636,1	29,8	70,2
0,315	114,6	750,7	35,2	64,8
0,25	176,8	927,5	43,5	56,5
0,2	162,3	1089,8	51,1	48,9
0,16	145,0	1234,8	57,9	42,1
0,125	110,2	1345,0	63,1	36,9
0,1	141,4	1486,4	69,7	30,3
0,08	40,8	1527,2	71,6	28,4
FOND	15,2	1542,4	72,3	27,7



Observation :

Le Directeur du LCBE,

Mr. Soubaneh Said Ismael

REPUBLIQUE DE DJIBOUTI
Unité – Egalité – Paix

Ministère de l'Equipement et des Transports

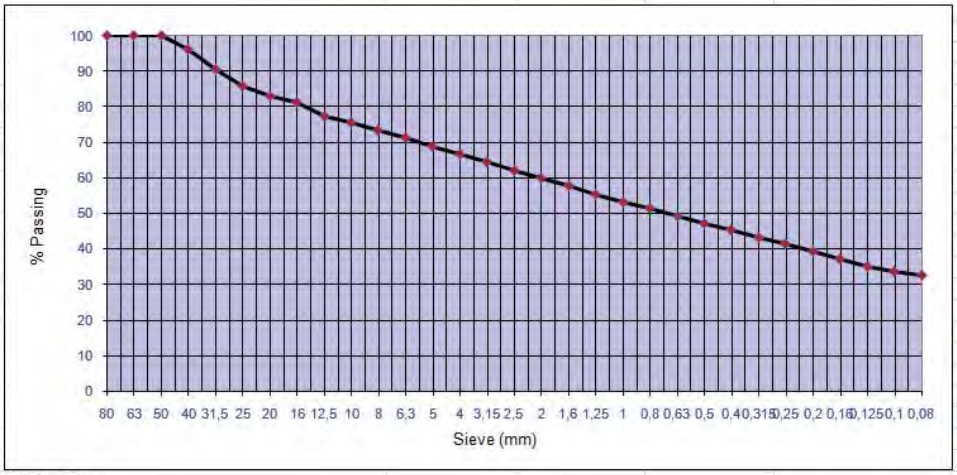
LABORATOIRE CENTRAL
DU BATIMENT ET DE L'EQUIPEMENT
المختبر المركزي للبناء والتجهيز

ANALYSE GRANULOMETRIQUE - NORME NF P 94-056

Dossier : 254-2018
Chantier : Construction d'un quai d'embarquement au Port de Tadjourah
Client: Hydroterra Engineering SARL
Matériaux : Identification
Provenance : BH01' (0 - 4 m)

Poinds Initial (grs): **3010,2**

Tamis	Refus Partiel(gr)	Refus Cumules (gr)	Refus Cumules (%)	Passant (%)
80	0,0	0,0	0,0	100,0
63	0,0	0,0	0,0	100,0
0,0	0,0	0,0	0,0	100,0
40	114,0	114,0	3,8	96,2
31,5	169,3	283,3	9,4	90,6
25	140,2	423,5	14,1	85,9
20	89,1	512,6	17,0	83,0
16	54,1	566,7	18,8	81,2
12,5	117,1	683,8	22,7	77,3
10	45,9	729,7	24,2	75,8
8	64,0	793,7	26,4	73,6
6,3	70,8	864,5	28,7	71,3
5	72,1	936,6	31,1	68,9
4	64,9	1001,5	33,3	66,7
3,15	66,8	1068,3	35,5	64,5
2,5	67,7	1136,0	37,7	62,3
2	63,1	1199,1	39,8	60,2
1,6	66,0	1265,1	42,0	58,0
1,25	73,2	1338,3	44,5	55,5
1	68,0	1406,3	46,7	53,3
0,8	56,4	1462,7	48,6	51,4
0,63	65,9	1528,6	50,8	49,2
0,5	60,0	1588,6	52,8	47,2
0,4	52,3	1640,9	54,5	45,5
0,315	62,5	1703,4	56,6	43,4
0,25	58,0	1761,4	58,5	41,5
0,2	65,3	1826,7	60,7	39,3
0,16	56,5	1883,2	62,6	37,4
0,125	65,6	1948,8	64,7	35,3
0,1	41,8	1990,6	66,1	33,9
0,08	34,2	2024,8	67,3	32,7
FOND	11,3	2036,1	67,6	32,4



Observation :

Le Directeur du LCBE,

Mr. Soubaneh Said Ismael

REPUBLIQUE DE DJIBOUTI

Unité – Egalité – Paix

Ministère de l'Equipement et des Transports

LABORATOIRE CENTRAL

المختبر المركزي للبناء والتجهيز

ANALYSE GRANULOMETRIQUE - NORME NF P 94-056

Dossier : 254-2018

Chantier : Construction d'un quai d'embarquement au Port de Tadjourah

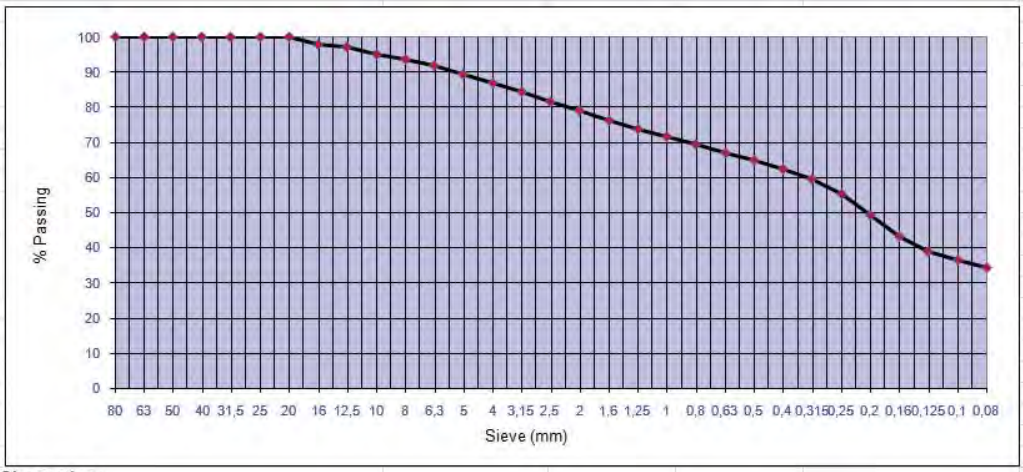
Client: Hydroterra Engineering SARL

Matériaux : Identification

Provenance : BH01' (8 - 15 m)

Poinds Initial (grs): **1962,9**

Tamis	Refus Partiel(gr)	Refus Cumules (gr)	Refus Cumules (%)	Passant (%)
80	0,0	0,0	0,0	100,0
63	0,0	0,0	0,0	100,0
50,0	0,0	0,0	0,0	100,0
40	0	0,0	0,0	100,0
31,5	0	0,0	0,0	100,0
25	0	0,0	0,0	100,0
20	0	0,0	0,0	100,0
16	36,3	36,3	1,8	98,2
12,5	19,8	56,1	2,9	97,1
10	36,8	92,9	4,7	95,3
8	27,6	120,5	6,1	93,9
6,3	39,8	160,3	8,2	91,8
5	46,6	206,9	10,5	89,5
4	49,9	256,8	13,1	86,9
3,15	45,2	302,0	15,4	84,6
2,5	60,5	362,5	18,5	81,5
2	47,7	410,2	20,9	79,1
1,6	54,5	464,7	23,7	76,3
1,25	47,7	512,4	26,1	73,9
1	42,6	555,0	28,3	71,7
0,8	44,8	599,8	30,6	69,4
0,63	45,3	645,1	32,9	67,1
0,5	42,5	687,6	35,0	65,0
0,4	46,5	734,1	37,4	62,6
0,315	60,4	794,5	40,5	59,5
0,25	80,9	875,4	44,6	55,4
0,2	120,5	995,9	50,7	49,3
0,16	114,8	1110,7	56,6	43,4
0,125	82,1	1192,8	60,8	39,2
0,1	53,8	1246,6	63,5	36,5
0,08	37,3	1283,9	65,4	34,6
FOND	5	1288,9	65,7	34,3



Observation :

Le Directeur du LCBE,

Mr. Soubaneh Said Ismael

REPUBLIQUE DE DJIBOUTI

Unité – Egalité – Paix

Ministère de l'Equipement et des Transports

LCBE
LABORATOIRE CENTRAL
DU BÂTIMENT ET DE L'EQUIPEMENT

المختبر المركزي للبناء والتجهيز

ESSAI DE LIMITE D'ATTERBERG
NORME NF P 94 - 051

Dossier : 254-2018

Chantier : Construction d'un quai d'embarquement au Port de Tadjourah

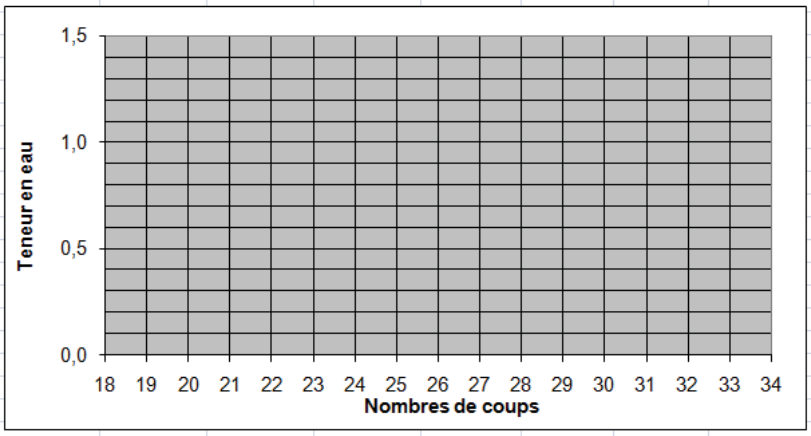
Client : Hydroterra Engineering SARL

Matériaux : Identification

Provenance : BH01' (4 - 8 m)

LL: **LP:** **IP:** **0,0**

LIMITE DE LIQUIDITE		LIMITE DE PLASTICITE	
NOMBRE DE COUPS	Non - Mesurable	Test n°1	Test n°2
NUMERO DE LA TARE		Non - Mesurable	
POIDS TOTAL HUMIDE (g)			
POIDS TOTAL SEC (g)			
POIDS DE LA TARE (g)			
POIDS D'EAU (g)			
POIDS NET SEC (g)			
TENEUR EN EAU (%)			
TOTAL (%)			



Observation :

Le Directeur du LCBE,

Mr. Soubaneh Said Ismael

REPUBLIQUE DE DJIBOUTI

Unité – Egalité – Paix

Ministère de l'Equipement et des Transports

LCBE

LABORATOIRE CENTRAL

DU BÂTIMENT ET DE L'EQUIPEMENT

المختبر المركزي للبناء والتجهيز

ESSAI DE LIMITE D'ATTERBERG
NORME NF P 94 - 051

Dossier : 254-2018

Chantier : Construction d'un quai d'embarquement au Port de

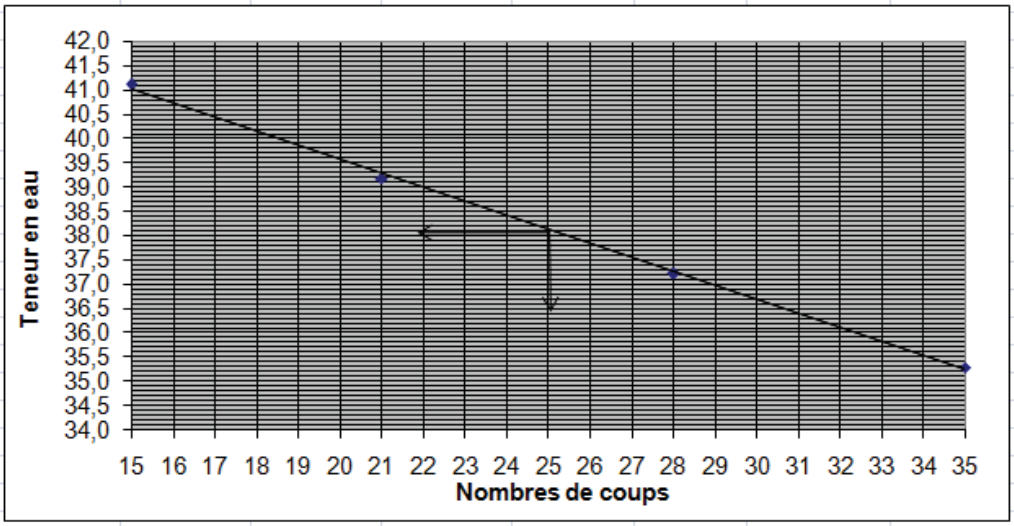
Client : Hydroterra Engineering SARL

Matériaux : Identification

Provenance : BH01' (0 - 4 m)

LL: 38,1 **LP: 14,3** **IP: 23,8**

LIMITE DE LIQUIDITE					LIMITE DE PLASTICITE	
NOMBRE DE COUPS	15	21	28	35	**Test n°1**	**Test n°2**
NUMERO DE LA TARE	1	2	11	12	A	B
POIDS TOTAL HUMIDE (g)	41,62	41,8	41,48	41,2	32,1	32,4
POIDS TOTAL SEC (g)	38,7	38,9	38,8	38,8	32	32,3
POIDS DE LA TARE (g)	31,6	31,5	31,6	32,0	31,3	31,6
POIDS D'EAU (g)	2,92	2,9	2,68	2,4	0,1	0,1
POIDS NET SEC (g)	7,1	7,4	7,2	6,8	0,7	0,7
TENEUR EN EAU (%)	41,1	39,2	37,2	35,3	14,3	14,3
TOTAL (%)	38,2				14,3	



Observation : La limites de liquidité est de 38,1et la limite de plasticité du sol de 14,3

Le Directeur du LCBE,

Mr. Soubaneh Said Ismae

REPUBLIQUE DE DJIBOUTI

Unité – Egalité – Paix

Ministère de l'Equipement et des Transports

LCBE

LABORATOIRE CENTRAL

DU BÂTIMENT ET DE L'ÉQUIPEMENT

المختبر المركزي للبناء والتجهيز

ESSAI DE LIMITE D'ATTERBERG
NORME NF P 94 - 051

Dossier : 254-2018

Chantier : Construction d'un quai d'embarquement au Port de

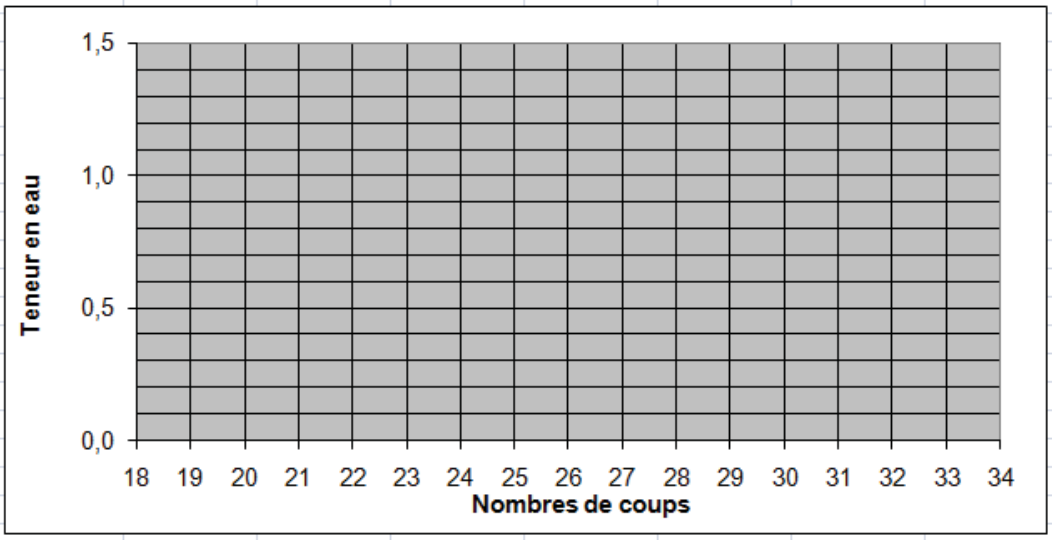
Client : Hydroterra Engineering SARL

Matériaux : Identification

Provenance : BH01' (8-15 m)

LL: **LP:** **IP:** **0,0**

LIMITE DE LIQUIDITE		LIMITE DE PLASTICITE	
NOMBRE DE COUPS	Non - Mesurable	Test n°1	Test n°2
NUMERO DE LA TARE		Non - Mesurable	
POIDS TOTAL HUMIDE (g)			
POIDS TOTAL SEC (g)			
POIDS DE LA TARE (g)			
POIDS D'EAU (g)			
POIDS NET SEC (g)			
TENEUR EN EAU (%)			
TOTAL (%)			



Observation :

Le Directeur du LCBE,

Mr. Soubaneh Said Ismael

Water content

REPUBLIQUE DE DJIBOUTI
Unité – Egalité – Paix

Ministère de l'Equipement et des Transports

LCBE
LABORATOIRE CENTRAL
DU BÂTIMENT ET DE L'EQUIPEMENT

المختبر المركزي للبناء والتجهيز

ESSAI DE TENEUR EN EAU
Norme NF P 94-050

Dossier : 254-2018
Chantier : Construction d'un quai d'embarquement au Port de Tadjourah
Client: Hydroterra Engineering SARL
Matériaux : Identification
Provenance : BH01'

PROFONDEUR	0-4m	4-8m	8-15m
NUMERO DE LA TARE	5	16	KK
POIDS TOTAL HUMIDE (g)	825,3	640,8	743
POIDS TOTAL SEC (g)	697,3	548,9	652
POIDS DE LA TARE (g)	51,8	50,3	53,2
POIDS D'EAU (g)	128	91,9	91
POIDS NET SEC (g)	645,5	498,6	598,8
TENEUR EN EAU (%)	19,83	18,43	15,20

Observations :

Le Directeur du L C B E

Soubaneh Said Ismael

REPUBLIQUE DE DJIBOUTI
Unité – Egalité – Paix

Ministère de l'Equipement et des Transports

LABORATOIRE CENTRAL

المختبر المركزي للبناء والتجهيز

FEUILLE D'ESSAIS

DENSITE SPECIFIQUE PAR PYCOMETRE

DOSSIER N° :	DATE D'EDITION:	NORME :
254-2018	23/12/2018	NF P94-054

DOSSIER :

Demandeur : *Hydroterra Engineering SARL*
Chantier : *Construction d'un quai d'embarquement au Port de Tadjourah*

Epreuve de : *Identification*
Partie de l'ouvrage : *Etude Géotechnique et Sondage*

REFERENCES DE L'ECHANTILLON :

Provenance :

N° échantillon :BH02 (10.0-13.50m)

RESULTATS :

description	détermination	
Profondeur : 10.0-13.50m	1	2
Poids pycnomètre (W1) en g	243.1	243.1
Poids pycnomètre + échantillon (W2) en g	344,3	344.2
Poids pycnomètre + échantillon +eau (W3) en g	962.0	962.1
Poids pycnomètre +eau (W4) en g	897.7	897.7
Poids spécifique	2,74	2,77
Moyenne	2.75	

OBSERVATIONS :

LE DIRECTEUR DU LCBE

SOUBANEH SAID ISMAEL

REPUBLIQUE DE DJIBOUTI
Unité – Egalité – Paix

Ministère de l'Equipement et des Transports

LABORATOIRE CENTRAL

المختبر المركزي للبناء والتجهيز

FEUILLE D'ESSAIS

DENSITE SPECIFIQUE PAR PYCOMETRE

DOSSIER N° :	**DATE D'EDITION:**	**NORME :**
254-2018	23/12/2018	NF P94-054

DOSSIER :

Demandeur : *Hydroterra Engineering SARL*
Chantier : *Construction d'un quai d'embarquement au Port de Tadjourah*

Epreuve de : *Identification*
Partie de l'ouvrage : *Etude Géotechnique et Sondage*

REFERENCES DE L'ECHANTILLON :

Provenance :

N° échantillon : BH02 (0.0-10.0m)

RESULTATS :

description	détermination	
Profondeur : 0.0-10.0m	1	2
Poids pycnomètre (W1) en g	241,1	241,1
Poids pycnomètre + échantillon (W2) en g	341,3	340.5
Poids pycnomètre + échantillon +eau (W3) en g	961,7	959.5
Poids pycnomètre +eau (W4) en g	898,6	898,6
Poids spécifique	2,70	2,58
Moyenne	2.64	

OBSERVATIONS :

LE DIRECTEUR DU LCBE

SOUBANEH SAID ISMAEL

REPUBLIQUE DE DJIBOUTI
Unité – Egalité – Paix

Ministère de l'Equipement et des Transports

LABORATOIRE CENTRAL

المختبر المركزي للبناء والتجهيز

FEUILLE D'ESSAIS

DENSITE SPECIFIQUE PAR PYCOMETRE

DOSSIER N° : 254-2018 **DATE D'EDITION:** 23/12/2018 **NORME :** NF P94-054

DOSSIER :

Demandeur : *Hydroterra Engineering SARL*
Chantier : *Construction d'un quai d'embarquement au Port de Tadjourah*

Epreuve de : *Identification*
Partie de l'ouvrage : *Etude Géotechnique et Sondage*

REFERENCES DE L'ECHANTILLON :

Provenance :
N° échantillon : BH02 (13.5-23.0m)

RESULTATS :

description	détermination	
Profondeur : 13.5-23.0m	1	2
Poids pycnomètre (W1) en g	243.1	243.1
Poids pycnomètre + échantillon (W2) en g	343.4	343.3
Poids pycnomètre + échantillon +eau (W3) en g	960.6	962.1
Poids pycnomètre +eau (W4) en g	897.7	897.7
Poids spécifique	2,68	2,79
Moyenne	2.73	

OBSERVATIONS :

LE DIRECTEUR DU LCBE

SOUBANEH SAID ISMAEL

Apparent weight

REPUBLIQUE DE DJIBOUTI
Unité – Egalité – Paix

Ministère de l'Equipement et des Transports

LCBE
LABORATOIRE CENTRAL
DU BATIMENT ET DE L'EQUIPEMENT

المختبر المركزي للبناء والتجهيز

DENSITE APPARENTE GABARI

Dossier : 254-2018
Chantier : Construction d'un quai d'embarquement au Port de Tadjourah
Client: Hydroterra Engineering SARL
Matériaux : Identification
Provenance : BH01'

sonadage	BH01'		
Profondeur (m)	0-4m	4-8m	8-15m
Poids Total de Matériau (g)	3423,5	3351,0	3382
Poids de Gabari (g)	2577,9	2571,5	2571,5
Volume de Gabari (cm^3)	617	617	617
Densite Apparente (g/cm^3)	1,37	1,26	1,31

Observation :

Le Directeur du L C B E

Soubaneh Said Ismael

BH T02

Sieve analysis

REPUBLIQUE DE DJIBOUTI
Unité – Egalité – Paix

Ministère de l'Equipement et des Transports

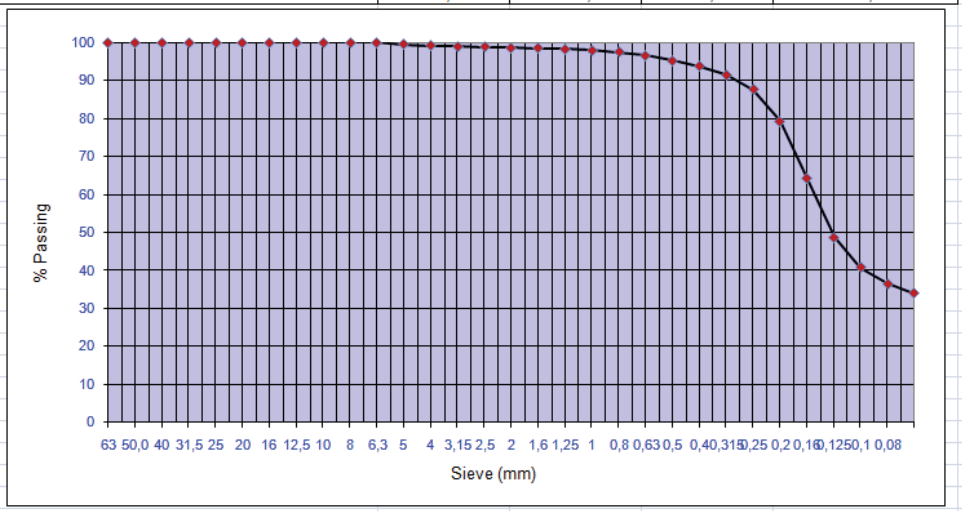
LABORATOIRE CENTRAL DU BÂTIMENT ET DE L'EQUIPEMENT
المختبر المركزي للبناء والتجهيز

ANALYSE GRANULOMETRIQUE - NORME NF P 94-056

Dossier : 254-2018
Chantier : Construction d'un quai d'embarquement au Port de Tadjourah
Client: Hydroterra Engineering SARL
Matériaux : Identification
Provenance : BH02 (10 -13,5 m)

Poinds Initial (grs): 1725,1

Tamis	Refus Partiel(gr)	Refus Cumules (gr)	Refus Cumules (%)	Passant (%)
80	0,0	0,0	0,0	100,0
63	0,0	0,0	0,0	100,0
50,0	0,0	0,0	0,0	100,0
40	0,0	0,0	0,0	100,0
31,5	0,0	0,0	0,0	100,0
25	0,0	0,0	0,0	100,0
20	0,0	0,0	0,0	100,0
16	0,0	0,0	0,0	100,0
12,5	0,0	0,0	0,0	100,0
10	0,0	0,0	0,0	100,0
8	0,0	0,0	0,0	100,0
6,3	9,2	9,2	0,5	99,5
5	3,8	13,0	0,8	99,2
4	4,0	17,0	1,0	99,0
3,15	2,5	19,5	1,1	98,9
2,5	2,5	22,0	1,3	98,7
2	3,0	25,0	1,4	98,6
1,6	4,4	29,4	1,7	98,3
1,25	5,8	35,2	2,0	98,0
1	9,5	44,7	2,6	97,4
0,8	14,6	59,3	3,4	96,6
0,63	21,6	80,9	4,7	95,3
0,5	27,0	107,9	6,3	93,7
0,4	38,7	146,6	8,5	91,5
0,315	67,0	213,6	12,4	87,6
0,25	142,2	355,8	20,6	79,4
0,2	263,3	619,1	35,9	64,1
0,16	264,4	883,5	51,2	48,8
0,125	137,8	1021,3	59,2	40,8
0,1	74,0	1095,3	63,5	36,5
0,08	43,0	1138,3	66,0	34,0
FOND	16,3	1154,6	66,9	33,1



Observation :

Le Directeur du LCBE,

Mr. Soubaneh Said Ismael

REPUBLIQUE DE DJIBOUTI
Unité – Egalité – Paix

Ministère de l'Equipement et des Transports

LABORATOIRE CENTRAL DU BATIMENT ET DE L'EQUIPEMENT
المختبر المركزي للبناء والتجهيز

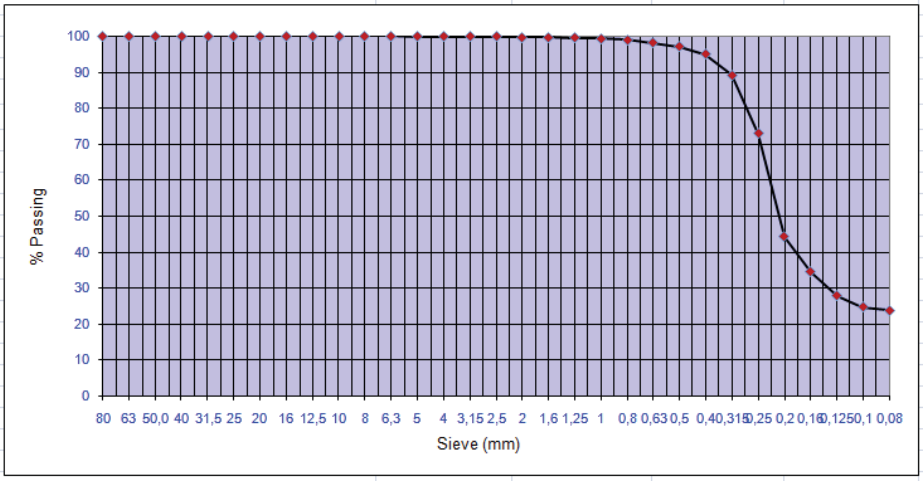
ANALYSE GRANULOMETRIQUE - NORME NF P 94-056

Dossier : 254-2018
Chantier : Construction d'un quai d'embarquement au Port de Tadjourah

Client: Hydroterra Engineering SARL
Matériaux : Identification
Provenance : BH02 (0 - 10 m)

Poinds Initial (grs): **2365,0**

Tamis	Refus Partiel(gr)	Refus Cumules (gr)	Refus Cumules (%)	Passant (%)
80	0,0	0,0	0,0	100,0
63	0,0	0,0	0,0	100,0
50,0	0,0	0,0	0,0	100,0
40	0,0	0,0	0,0	100,0
31,5	0,0	0,0	0,0	100,0
25	0,0	0,0	0,0	100,0
20	0,0	0,0	0,0	100,0
16	0,0	0,0	0,0	100,0
12,5	0,0	0,0	0,0	100,0
10	0,0	0,0	0,0	100,0
8	0,0	0,0	0,0	100,0
6,3	0,7	0,7	0,0	100,0
5	1,4	2,1	0,1	99,9
4	1,1	3,2	0,1	99,9
3,15	0,4	3,6	0,2	99,8
2,5	1,0	4,6	0,2	99,8
2	1,0	5,6	0,2	99,8
1,6	2,7	8,3	0,4	99,6
1,25	3,0	11,3	0,5	99,5
1	5,1	16,4	0,7	99,3
0,8	8,4	24,8	1,0	99,0
0,63	18,7	43,5	1,8	98,2
0,5	25,2	68,7	2,9	97,1
0,4	48,2	116,9	4,9	95,1
0,315	137,1	254,0	10,7	89,3
0,25	387,1	641,1	27,1	72,9
0,2	677,2	1318,3	55,7	44,3
0,16	229,5	1547,8	65,4	34,6
0,125	159,8	1707,6	72,2	27,8
0,1	73,1	1780,7	75,3	24,7
0,08	19,6	1800,3	76,1	23,9
FOND	5,5	1805,8	76,4	23,6



Observation :

Le Directeur du LCBE,

Mr. Soubaneh Said Ismael

REPUBLIQUE DE DJIBOUTI

Unité – Egalité – Paix

Ministère de l'Equipement et des Transports

LABORATOIRE CENTRAL
DU BATIMENT ET DE L'EQUIPEMENT

المختبر المركزي للبناء والتجهيز

ANALYSE GRANULOMETRIQUE - NORME NF P 94-056

Dossier : 254-2018

Chantier : Construction d'un quai d'embarquement au Port de Tadjourah

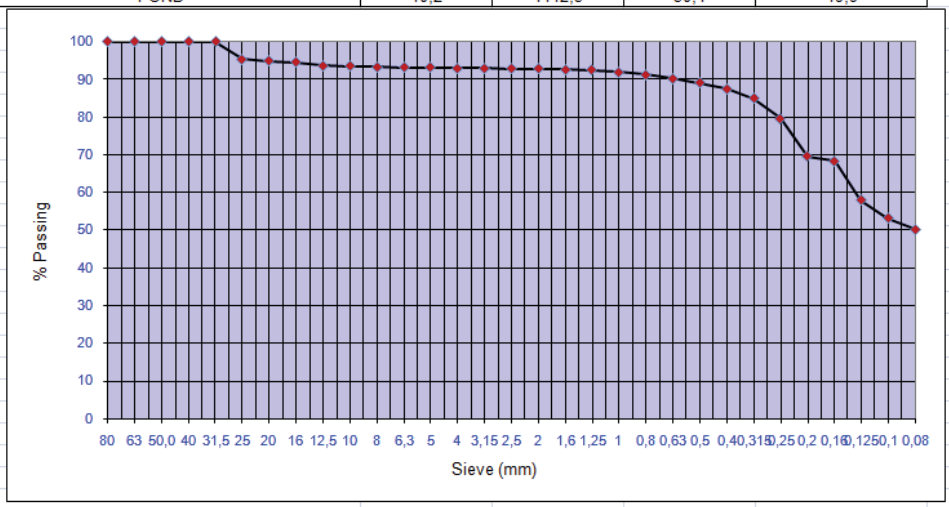
Client: Hydroterra Engineering SARL

Matériaux : Identification

Provenance : BH02 (13,5 - 23 m)

Poinds Initial (grs): **2278,2**

Tamis	Refus Partiel(gr)	Refus Cumules (gr)	Refus Cumules (%)	Passant (%)
80	0,0	0,0	0,0	100,0
63	0,0	0,0	0,0	100,0
50,0	0,0	0,0	0,0	100,0
40	0,0	0,0	0,0	100,0
31,5	0,0	0,0	0,0	100,0
25	107,3	107,3	4,7	95,3
20	10,6	117,9	5,2	94,8
16	7,9	125,8	5,5	94,5
12,5	16,8	142,6	6,3	93,7
10	7,4	150,0	6,6	93,4
8	1,8	151,8	6,7	93,3
6,3	2,8	154,6	6,8	93,2
5	2,6	157,2	6,9	93,1
4	1,8	159,0	7,0	93,0
3,15	1,8	160,8	7,1	92,9
2,5	1,4	162,2	7,1	92,9
2	2,3	164,5	7,2	92,8
1,6	3,6	168,1	7,4	92,6
1,25	4,5	172,6	7,6	92,4
1	11,6	184,2	8,1	91,9
0,8	13,8	198,0	8,7	91,3
0,63	25,8	223,8	9,8	90,2
0,5	26,1	249,9	11,0	89,0
0,4	35,3	285,2	12,5	87,5
0,315	59,9	345,1	15,1	84,9
0,25	118,2	463,3	20,3	79,7
0,2	232,0	695,3	30,5	69,5
0,16	25,5	720,8	31,6	68,4
0,125	238,2	959,0	42,1	57,9
0,1	109,8	1068,8	46,9	53,1
0,08	63,3	1132,1	49,7	50,3
FOND	10,2	1142,3	50,1	49,9



Observation :

Le Directeur du LCBE,

Mr. Soubaneh Said Ismael

Atterberg Limits

REPUBLIQUE DE DJIBOUTI
Unité – Egalité – Paix

Ministère de l'Equipement et des Transports

LCBE
LABORATOIRE CENTRAL
DU BÂTIMENT ET DE L'EQUIPEMENT

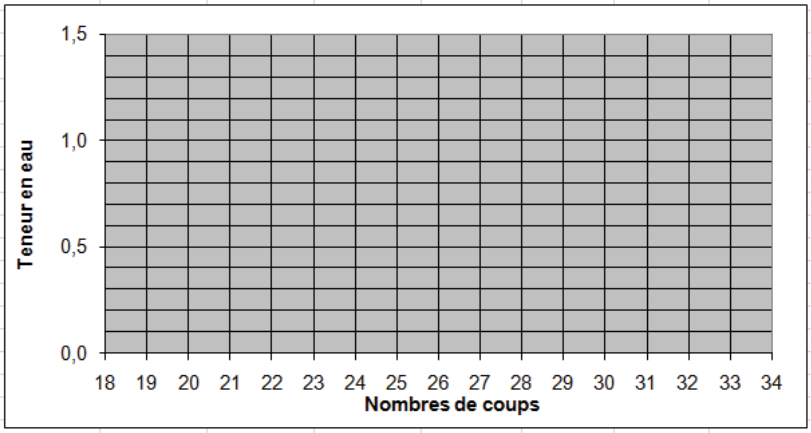
المختبر المركزي للبناء والتجهيز

ESSAI DE LIMITE D'ATTERBERG
NORME NF P 94 - 051

Dossier : 254-2018
Chantier : Construction d'un quai d'embarquement au Port de Tadjourah
Client : Hydroterra Engineering SARL
Matériaux : Identification
Provenance : BH02 (10 - 13,5 m)

LL: **LP:** **IP:** **0,0**

LIMITE DE LIQUIDITE		LIMITE DE PLASTICITE	
NOMBRE DE COUPS	Non - Mesurable	Test n°1	Test n°2
NUMERO DE LA TARE		Non - Mesurable	
POIDS TOTAL HUMIDE (g)			
POIDS TOTAL SEC (g)			
POIDS DE LA TARE (g)			
POIDS D'EAU (g)			
POIDS NET SEC (g)			
TENEUR EN EAU (%)			
TOTAL (%)			



Observation :

Le Directeur du LCBE,

Mr. Soubaneh Said Ismael

REPUBLIQUE DE DJIBOUTI

Unité – Egalité – Paix

Ministère de l'Equipement et des Transports

LCBE

LABORATOIRE CENTRAL

DU BÂTIMENT ET DE L'EQUIPEMENT

المختبر المركزي للبناء والتجهيز

ESSAI DE LIMITE D'ATTERBERG
NORME NF P 94 - 051

Dossier : 254-2018

Chantier : Construction d'un quai d'embarquement au Port de

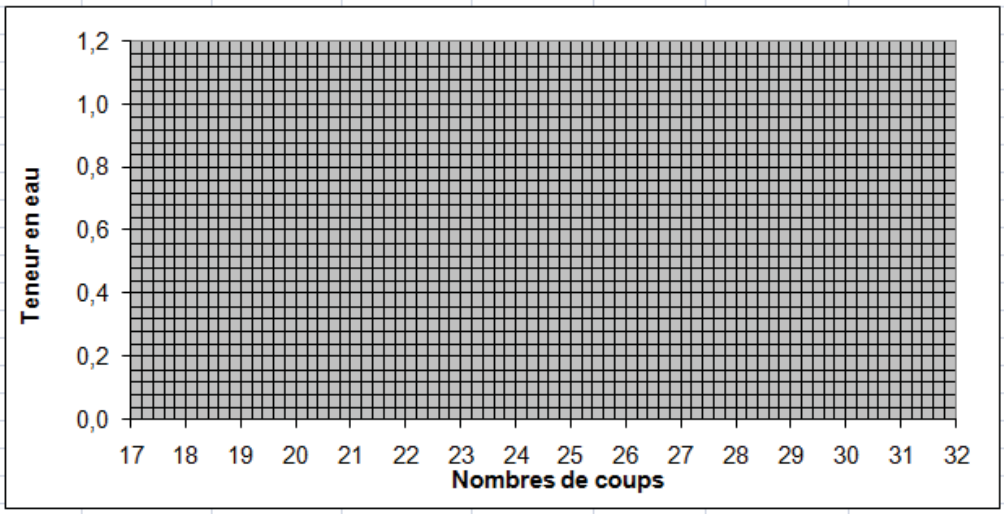
Client : Hydroterra Engineering SARL

Matériaux : Identification

Provenance : BH02(0 - 10 m)

LL: **LP:** **IP:** **0,0**

LIMITE DE LIQUIDITE			LIMITE DE PLASTICITE	
NOMBRE DE COUPS			Test n°1	Test n°2
NUMERO DE LA TARE				
POIDS TOTAL HUMIDE (g)				
POIDS TOTAL SEC (g)		Non - Mesurable	Non - Mesurable	
POIDS DE LA TARE (g)				
POIDS D'EAU (g)				
POIDS NET SEC (g)				
TENEUR EN EAU (%)				
TOTAL (%)				



Observation :

Le Directeur du LCBE,

Mr. Soubaneh Said Ismael

REPUBLIQUE DE DJIBOUTI

Unité – Egalité – Paix

Ministère de l'Equipement et des Transports

LCBE

LABORATOIRE CENTRAL

DU BÂTIMENT ET DE L'ÉQUIPEMENT

المختبر المركزي للبناء والتجهيز

ESSAI DE LIMITE D'ATTERBERG
NORME NF P 94 - 051

Dossier : 254-2018

Chantier : Construction d'un quai d'embarquement au Port de

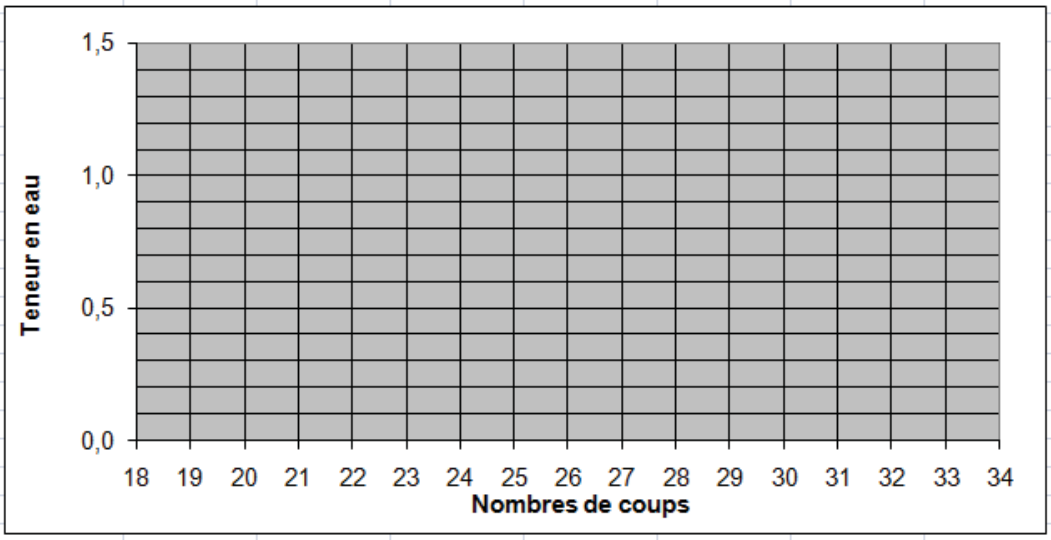
Client : Hydroterra Engineering SARL

Matériaux : Identification

Provenance : BH02 (13,5 - 23 m)

LL: **LP:** **IP:** **0,0**

LIMITE DE LIQUIDITE		LIMITE DE PLASTICITE	
NOMBRE DE COUPS	Non - Mesurable	Test n°1	Test n°2
NUMERO DE LA TARE		Non - Mesurable	
POIDS TOTAL HUMIDE (g)			
POIDS TOTAL SEC (g)			
POIDS DE LA TARE (g)			
POIDS D'EAU (g)			
POIDS NET SEC (g)			
TENEUR EN EAU (%)			
TOTAL (%)			



Observation :

Le Directeur du LCBE,

Mr. Soubaneh Said Ismael

Water content

REPUBLIQUE DE DJIBOUTI
Unité – Egalité – Paix

Ministère de l'Equipement et des Transports

LCBE
LABORATOIRE CENTRAL
DU BÂTIMENT ET DE L'ÉQUIPEMENT

المختبر المركزي للبناء والتجهيز

ESSAI DE TENEUR EN EAU

Dossier : 254-2018

Chantier : Construction d'un quai d'embarquement au Port de Tadjourah

Client: Hydroterra Engineering SARL

Matériaux : Identification

Provenance : BH02

PROFONDEUR	0-10m	10-13,5m	13,5-23m
NUMERO DE LA TARE	XX	W	SB
POIDS TOTAL HUMIDE (g)	671,5	788,2	745,7
POIDS TOTAL SEC (g)	539,9	641,4	609,2
POIDS DE LA TARE (g)	60,7	65,2	58,7
POIDS D'EAU (g)	131,6	146,8	136,5
POIDS NET SEC (g)	479,2	576,2	550,5
TENEUR EN EAU (%)	27,46	25,48	24,80

Observations :

Le Directeur du L C B E

Soubaneh Said Ismael

REPUBLIQUE DE DJIBOUTI
Unité – Egalité – Paix

Ministère de l'Equipement et des Transports

LABORATOIRE CENTRAL

المختبر المركزي للبناء والتجهيز

FEUILLE D'ESSAIS

DENSITE SPECIFIQUE PAR PYCOMETRE

DOSSIER N° :	DATE D'EDITION:	NORME :
254-2018	23/12/2018	NF P94-054

DOSSIER :

Demandeur : *Hydroterra Engineering SARL*
Chantier : *Construction d'un quai d'embarquement au Port de Tadjourah*

Epreuve de : *Identification*
Partie de l'ouvrage : *Etude Géotechnique et Sondage*

REFERENCES DE L'ECHANTILLON :

Provenance :

N° échantillon : BH02 (10.0-13.50m)

RESULTATS :

description	détermination	
Profondeur : 10.0-13.50m	1	2
Poids pycnomètre (W1) en g	243.1	243.1
Poids pycnomètre + échantillon (W2) en g	344,3	344.2
Poids pycnomètre + échantillon +eau (W3) en g	962.0	962.1
Poids pycnomètre +eau (W4) en g	897.7	897.7
Poids spécifique	2,74	2,77
Moyenne	2.75	

OBSERVATIONS :

LE DIRECTEUR DU LCBE

SOUBANEH SAID ISMAEL

REPUBLIQUE DE DJIBOUTI
Unité – Egalité – Paix

Ministère de l'Equipement et des Transports

LABORATOIRE CENTRAL

المختبر المركزي للبناء والتجهيز

FEUILLE D'ESSAIS

DENSITE SPECIFIQUE PAR PYCOMETRE

DOSSIER N° :	**DATE D'EDITION:**	**NORME :**
254-2018	23/12/2018	NF P94-054

DOSSIER :

Demandeur : *Hydroterra Engineering SARL*
Chantier : *Construction d'un quai d'embarquement au Port de Tadjourah*

Epreuve de : *Identification*
Partie de l'ouvrage : *Etude Géotechnique et Sondage*

REFERENCES DE L'ECHANTILLON :

Provenance :

N° échantillon : BH02 (0.0-10.0m)

RESULTATS :

description	détermination	
Profondeur : 0.0-10.0m	1	2
Poids pycnomètre (W1) en g	241,1	241,1
Poids pycnomètre + échantillon (W2) en g	341,3	340.5
Poids pycnomètre + échantillon +eau (W3) en g	961,7	959.5
Poids pycnomètre +eau (W4) en g	898,6	898,6
Poids spécifique	2,70	2,58
Moyenne	2.64	

OBSERVATIONS :

LE DIRECTEUR DU LCBE

SOUBANEH SAID ISMAEL

REPUBLIQUE DE DJIBOUTI
Unité – Egalité – Paix

Ministère de l'Equipement et des Transports

LABORATOIRE CENTRAL

المختبر المركزي للبناء والتجهيز

FEUILLE D'ESSAIS

DENSITE SPECIFIQUE PAR PYCOMETRE

DOSSIER N° : 254-2018 **DATE D'EDITION:** 23/12/2018 **NORME :** NF P94-054

DOSSIER :

Demandeur : *Hydroterra Engineering SARL*
Chantier : *Construction d'un quai d'embarquement au Port de Tadjourah*

Epreuve de : *Identification*
Partie de l'ouvrage : *Etude Géotechnique et Sondage*

REFERENCES DE L'ECHANTILLON :

Provenance :

N° échantillon : BH02 (13.5-23.0m)

RESULTATS :

description	détermination	
Profondeur : 13.5-23.0m	1	2
Poids pycnomètre (W1) en g	243.1	243.1
Poids pycnomètre + échantillon (W2) en g	343.4	343.3
Poids pycnomètre + échantillon +eau (W3) en g	960.6	962.1
Poids pycnomètre +eau (W4) en g	897.7	897.7
Poids spécifique	2,68	2,79
Moyenne	2.73	

OBSERVATIONS :

LE DIRECTEUR DU LCBE

SOUBANEH SAID ISMAEL

Apparent weight

REPUBLIQUE DE DJIBOUTI

Unité _ Egalité – Paix

Ministère de l'Equipement et des Transports

LCBE

LABORATOIRE CENTRAL

DU BÂTIMENT ET DE L'EQUIPEMENT

المختبر المركزي للبناء والتجهيز

DENSITE APPARENTE GABARI

Dossier : 254-2018

Chantier : Construction d'un quai d'embarquement au Port de Tadjourah

Client: Hydroterra Engineering SARL

Matériaux : Identification

Provenance : BH02

sonadage	BH02		
Profondeur (m)	0-10m	10-13,5m	13,5-23m
Poids Total de Materiau (g)	3 378,5	3370,5	3388,7
Poids de Gabari (g)	2571,5	2577,9	2577,9
Volume de Gabari (cm^3)	617	617	617
Densite Apparente (g/cm^3)	1,31	1,28	1,31

Le Directeur du L C B E

Observation :

Soubaneh Said Ismael

Annex4:Survey crates pictures

BH T01

0 à 10.00 m

BH T01 (modified)

0.00 à 5.00 m

5.00 à 22.00 m

BH T02

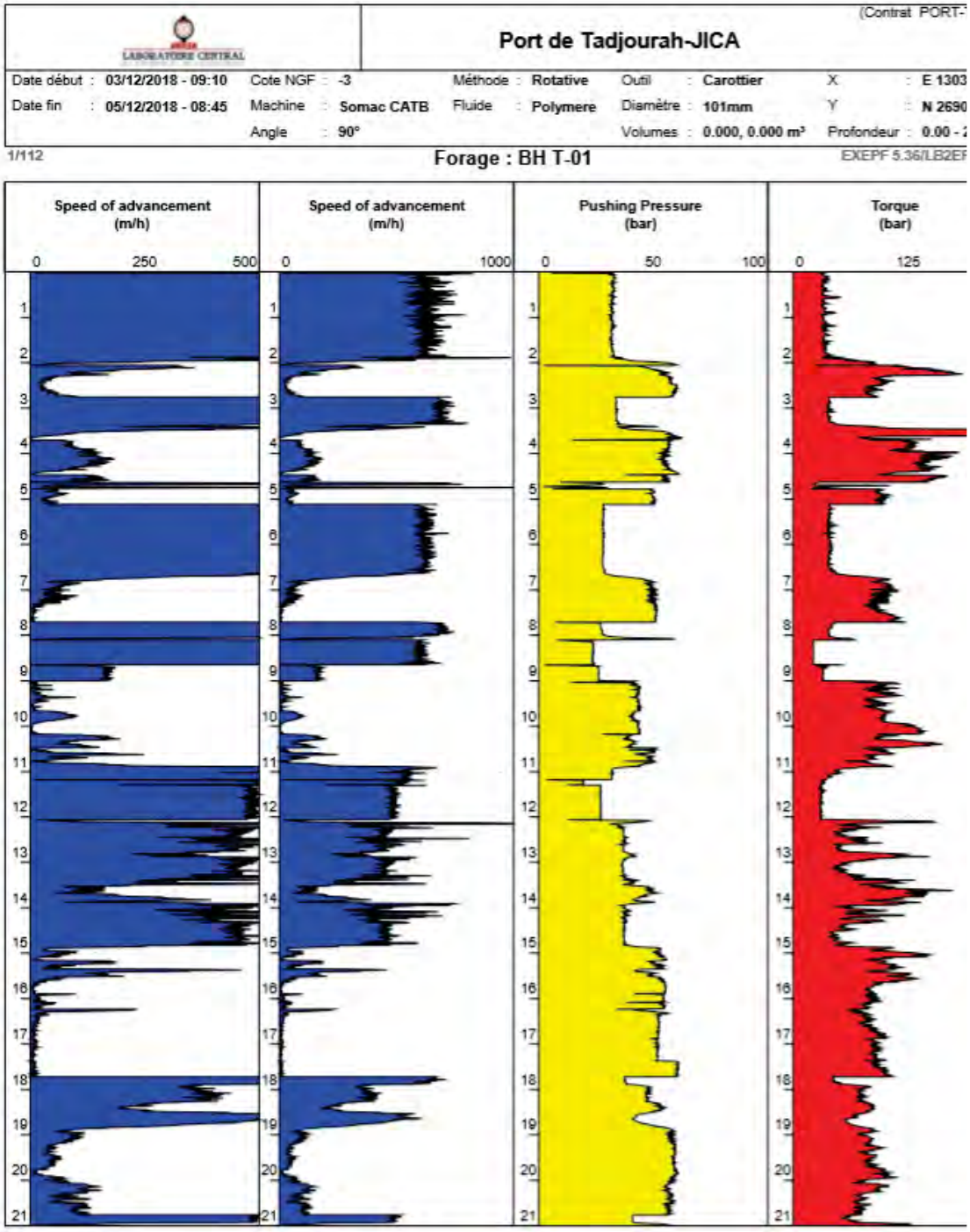
0.00 à 10.00 m

10.00 à 19.50 m

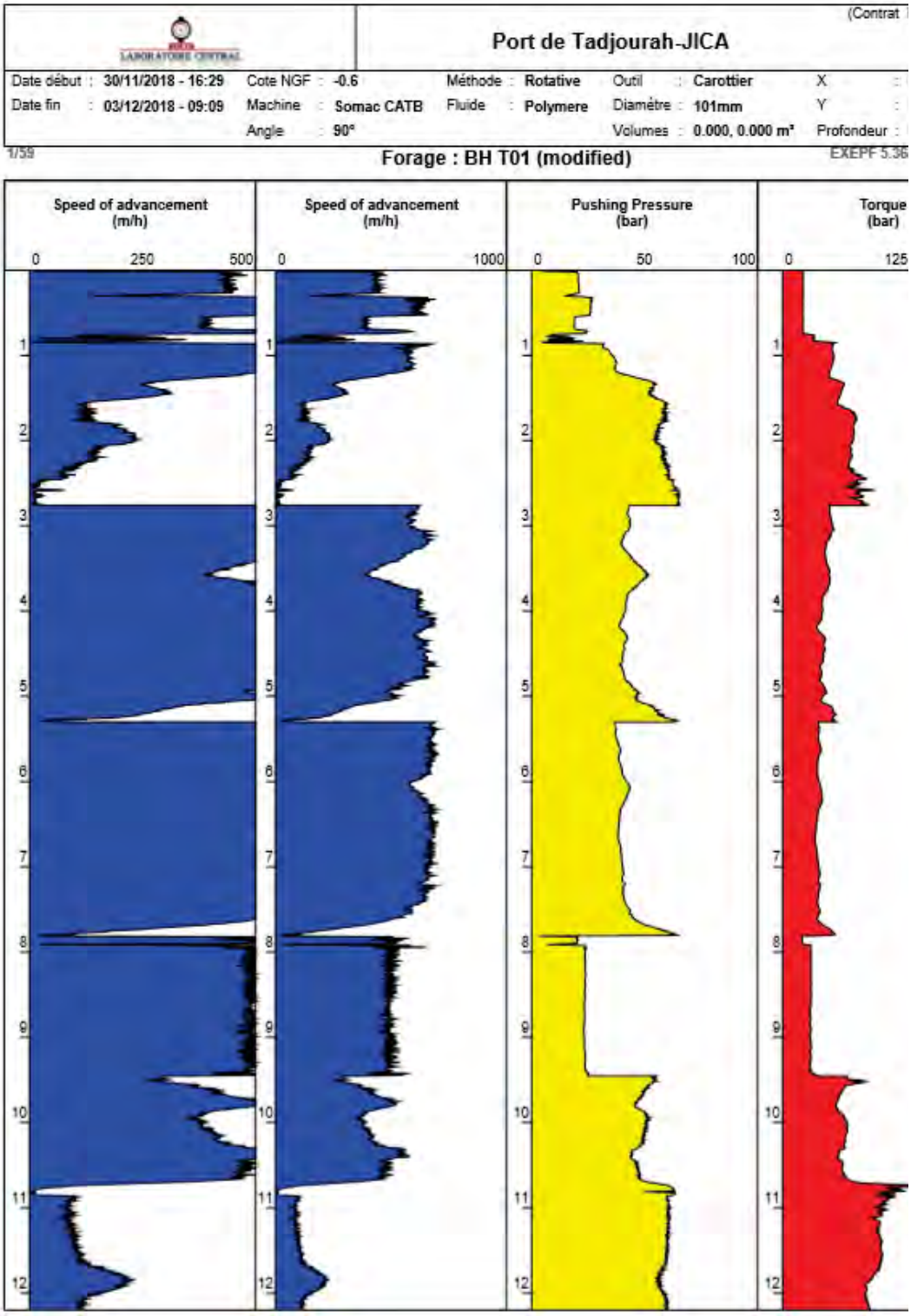
Annex 4 : Site projectpictures

Annex 5: Diagraphy

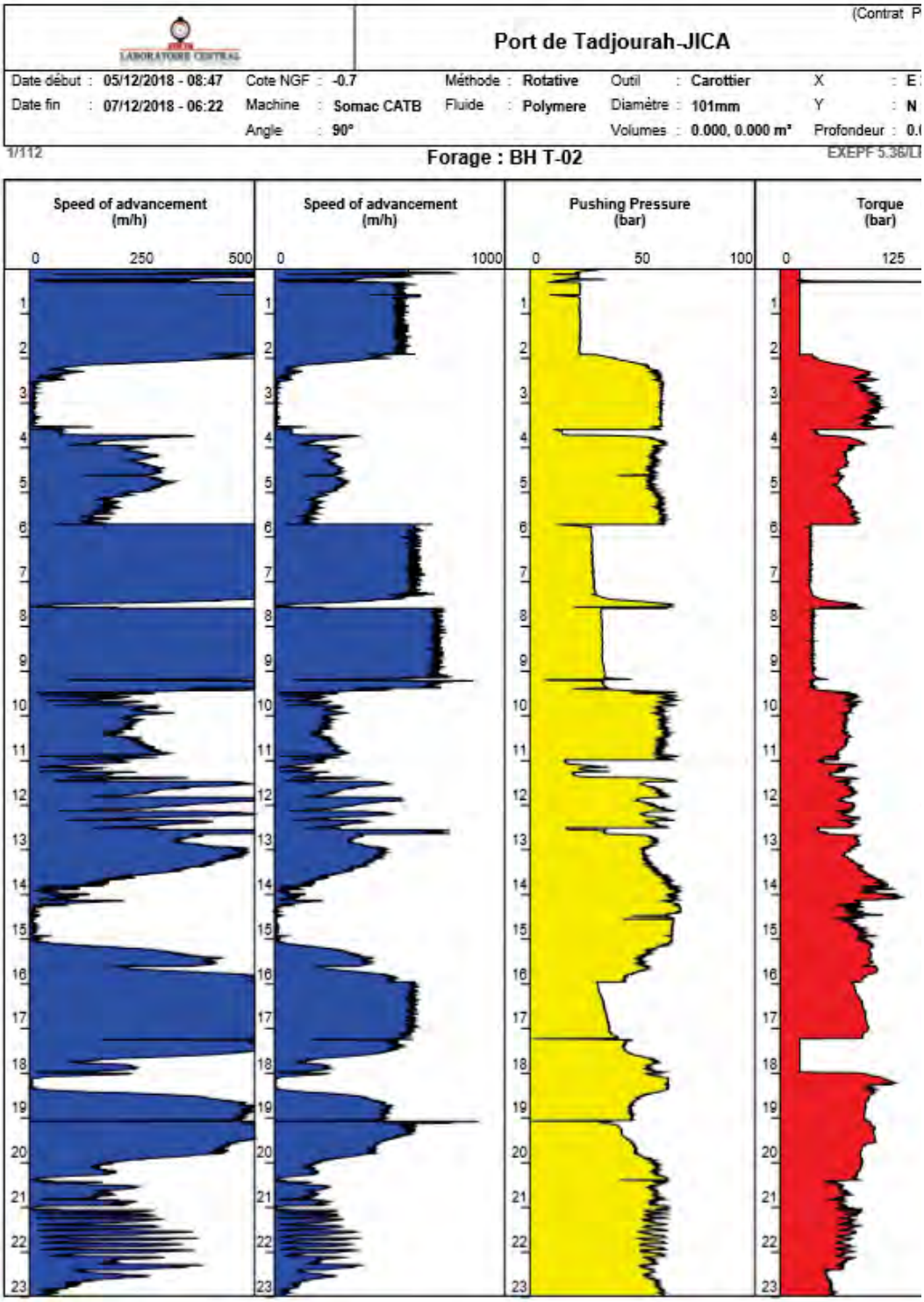
BH T01



BH T01 (modified)



BH T02


LABORATOIRE CENTRAL
Port de Tadjourah-JICA
(Contrat P
Date début : 05/12/2018 - 08:47
Date fin : 07/12/2018 - 06:22
Cote NGF : -0.7
Machine : Somac CATB
Angle : 90°
Méthode : Rotative
Fluide : Polymere
Outil : Carottier
Diamètre : 101mm
Volumes : 0.000, 0.000 m³
X : E
Y : N
Profondeur : 0.
1/112
Forage : BH T-02
EXEPF 5.36/L
Speed of advancement (m/h)
0
250
500
Speed of advancement (m/h)
0
1000
Pushing Pressure (bar)
0
50
100
Torque (bar)
0
125
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23

Annex 6 : Percentage recovered

BH T-01		
Depth of pass (m)	Lengthrecovered (m)	Percentage recovered (%)
0.0-1.5	1,3	86,6
1.5-3.0	1,5	100
3.0-4.5	0,5	33,3
4.5-6.0	0,4	26,7
6.0-7.5	0,3	20
7.5-9.0	0,5	33,3
9.0-10.5	1,1	73,3
10.5-12.0	1,1	73,3
12.0-13.5	1,2	80
13.50-15.0	0	0
15.0-16.5	0,2	13,3
16.5-18.0	0	0
18.0-19.50	0	0
19.50-21.0	0,5	33,3

BH T-01 (modified)		
Depth of pass (m)	Lengthrecovered (m)	Percentage recovered (%)
0.0-1.5	0,4	26,7
1.5-3.0	0,3	20
3.0-4.5	0,5	33,3
4.5-6.0	0,5	33,3
6.0-7.5	0,8	53,3
7.5-9.0	0,9	60
9.0-10.5	1,1	73,3
10.5-12.0	1	66,7

BH T-02		
Depth of pass (m)	Lengthrecovered (m)	Percentage recovered (%)
0.0-1.5	0,4	26,7
1.5-3.0	0,5	33,3
3.0-4.5	0,5	33,3
4.5-6.0	0,6	40
6.0-7.5	0,8	53,33
7.5-9.0	0,7	46,7
9.0-10.5	0,7	46,7
10.5-12.0	0,6	40
12.0-13.5	1,3	86,67

13.50-15.0	1,1	73,3
15.0-16.5	0,9	60
16.5-18.0	1	66,67
18.0-19.50	0,9	60
19.50-21.0	1	66,67
21.0-22.5	1,1	73,3

ANNEXE 5 : U.S.G. Mission definitions, standardNF P 94-500

GENERAL CONDITIONS OF GEOTECHNICAL MISSIONS

1. Frames of the mission

With reference to CLASSIFICATION OF TYPICAL GEOTECHNICAL MISSIONS (Standard NFP 94-500 of décember 2006), It is the responsibility of the project owner and his projet manager to ensure that all the geotechnical missions necessary for the design and execution of the work are undertaken with the appropriate means and entrusted to the men of the Art.

The sequence of geotechnical missions follows the succession of project development phases, each of these missions covering only a specific area of design or execution. In particular:

1. G1, G2, G3, G4 missions are realized ina successive order;
2. A mission entrusted to our company may contain only a part of the services described in the corresponding standard mission;
3. the geotechnical investigations engage our company only on the conformity of the executed works with those contractually ordered and the exactitude of the results which it provides;
4. A typical mission, G1 to G5, engages our company on its duty of advice only in the strict framework, on the one hand of the objectives explicitly defined in our technical proposal on the basis of which the order and its possible amendments have been established, on the other hand, the client's project described by the graphic documents or plans cited in the report;
5. A typical mission G1 or G5 excludes any commitment of our company on the quantities, costs and time of execution of the future geotechnical works;
6. A typical mission G2 engages our company as technical assistant to the prime contractor within the limits of the contract setting the scope of the mission and the part (s) of the work (s) concerned (s).

The responsibility of our company can not be engaged outside the framework of the geotechnical mission object of the report. In particular, any modification made to the project or its environment requires the updating of the geotechnical report as part of a new mission.

2. Recommandations

It is specified that the geotechnical study is based on recognition of the soil whose mesh does not make it possible to remove all the hazards always possible in natural environment. Indeed, heterogeneities, natural or man-made, discontinuities and performance hazards may arise given the relationship between the sampled or tested volume and the volume requested by the book, and even more so that these possible singularities can be limited in extension.

The new engineering elements highlighted during the execution, which may have an influence on the conclusions of the report, must be immediately reported to the geotechnician in charge of the supervision of the technical monitoring of execution (mission G4) so that he/she analyzes the consequences on the conditions of execution of the design of the technical work.

If a particular evolutionary character has been brought to light (especially slip, erosion, dissolution, upgradeable fill, peat), the application of the recommendations of the report requires validation at each successive stage of the design or execution. Such an evolutionary character can cause these recommendations to take a long time before they are implemented.

3. Mission report

The geotechnical report is the report of the geotechnical mission defined by the order under which it was established and whose references are recalled in mind. In the absence of specific contractual clauses, the delivery of the geotechnical report fixes the end of the mission. A geotechnical report and all its identified annexes constitute an inseparable whole. The two copies of reference are the two preserved original ones: one by the customer and the second by our company. In this context, any other interpretation that could be made of a communication or partial reproduction could not engage the responsibility of our company. In particular, even the partial use of these results and conclusions by another owner or by another constructor or for any other work than the entrusted mission, will not be able to engage the responsibility of our company and may result in prosecution.

CLASSIFICATION OF TYPES OF GEOTECHNICAL ENGINEERING MISSIONS

The sequence of engineering and engineering missions goes through the stages of elaboration and realization of any project to contribute to the control of the geological risks. Each mission relies on specific geotechnical investigations.

It is the responsibility of the project owner or his authorized representative to ensure the subsequent realization of all these missions by geotechnical engineer.

Stage1 : Prior geotechnical study (G1)

These missions exclude all approaches to the quantities, deadlines and costs of execution of the engineering works which is part of a project engineering study mission (stage 2). They are normally the responsibility of the client.

Preliminary geotechnical site study (G11)

It is carried out at the stage of a preliminary study or sketch and allows a first identification of the geological risks of a site:

1. A documentary survey on the geotechnical framework of the site and the existence of surroundings is made with a visit of the site surroundings;

1. A specific geotechnical investigation program is defined and carried out, its technical follow-up is ensured, the results exploited;

2. A report with a preliminary geological model, some general principles of adaptation of the project to the site and a first identification of the risks is provided.

Geotechnical study of preliminary project (G12)

It is carried out at the pre-project stage and helps to reduce the consequences of the identified risks of geological hazards:

1. A specific geotechnical investigation program is defined and carried out, its technical follow-up is ensured, the results exploited;
2. to provide a report giving the technical and technical assumptions to be taken into account at the preliminary design stage, certain general construction principles (including earthworks, retaining walls, foundations, risks of deformation of the ground, general provisions with respect to groundwater and neighboring areas)..

This study will have to be completed during the project engineering study (step 2).

Stage 2 Project Geotechnical studies (G2)

It is carried out to define the project of engineering works and to reduce the consequences of significant geological risks that have been identified. It is normally the responsibility of the contracting authority and can be integrated into the general project management mission.

ProjectPhase

1. A specific geotechnical investigation program is defined and carried out, its technical follow-up is ensured, the results exploited;
2. To provide an updated summary of the site and the technical notes giving the proposed methods of execution for engineering structures (including grounding, support, groundwater layouts and neighboring layouts) and associated values, certain project level sizing calculation notes;

3. Provide an approach to the quantities / details / costs of performing these engineering works and an identification of the consequences of residualgreen risks.

Phase Assistance toWorks Contrats

1. to draw up the documents necessary for the consultation of the companies for the execution of the engineering works (plans, technical instructions, price list and estimate framework, provisional planning);
2. Assist the client for the selection of companies and the technical analysis of offers.

Stage3: Execution of the Geotechnical Works (G3 and G4, separate and simultaneous)

Geotechnical Execution Study and Monitoring (G3)

It takes place in 2 interactive and inseparable phases, it allows to reduce the residual risks by the timely implementation of adaptation measures oroptimization. It is normally assigned to the contractor.

Study phase

1. Define a specific engineering program, carry it out, ensure technical follow-up and exploit the results;

2. To study in detail the engineering structures, in particular validation of the technical hypotheses, definition and dimensioning (justifying computations), methods and conditions of execution (phasing, follow-up, controls, inspections in conjunction with the associated values, additional constructive provisions, if any), drawing up the geotechnical file of execution.

Follow-up Phase

1. To follow the program of inspection and execution of the geotechnical works, to trigger if necessary the constructive provisions pre-defined during the study phase;

2. To verify the geotechnical data by survey during excavations and by a program of complementary geotechnical investigations if necessary (to carry it out or to ensure the technical follow-up, to exploit the results);

3. Participate in the preparation of the end-of-works file and maintenance recommendations for geotechnical structures.

It makes it possible to verify the conformity with the objectives of the project, the study and the geotechnical follow-up of execution. It is normally the responsibility of the owner.

Supervision phase of the study of execution

1. Advice on the geotechnical execution study, on the adaptations or potential optimizations of the geotechnical works proposed by the contractor, on the monitoring program and the associated threshold values.

Supervision phase of the execution monitoring

1. Notice, by occasional interventions on the site, on the geotechnical context as observed by the contractor, on the observed behavior of the work and the neighbors concerned and on the adaptation or the optimization of the geotechnical work proposed by the contractor.

Geotechnical diagnosis (G5)

During the course of a project or during the life of a work, it may be necessary to proceed, in a strictly limited manner, to the study of one or more specific geotechnical elements, within the framework of a mission punctual.

1. Define, after documentary investigation, a specific program of geotechnical investigations, carry it out or ensure its technical follow-up, exploit the results;

2. To study one or more specific geotechnical elements (for example, or tenement, drawdown, geotechnical causes of a disorder) as part of this diagnosis, but without any involvement in other geotechnical elements.

Geotechnical project and / or execution, monitoring and supervision studies must be carried out subsequently, in accordance with the sequence of geotechnical engineering missions, if this diagnosis leads to the modification or completion of works