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COSMEZZ S.a.r.l.
GEOTECHNICAL LABORATORY

IMPROVEMENT OF POWER SUPPLY IN THE REPUBLIC OF DJIBOUTI

Project

YEC YACHIYO ENGINEERING CO., LTD - JAPAN

Client

FINAL GEOTECHNICAL INVESTIGATIONS REPORT

Dossier

12.14.2014

Date

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Version 2

_____ Version

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G E O T E C H N I C A L L A B O R A T O R Y

December 14, 2014

Mr. Takayasu Kase
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Tokyo, JAPAN
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Subject: G E C T E C H N I C A L I N V E S T I G A T I O N S R E P O R T, I M P R O V E M E N T O F P O W E R
 S U P P L Y I N T H E R E P U B L I C O F L J I B O U T I - P K 1 2 S U B S T A T I O N A N D
 T R A N S M I S S I O N L I N E R O U T E T O N A G A D .

Dear Mr. Kase:

COSMEZZ Sarl is pleased to submit our geotechnical engineering report for this project. This report includes tables, figures, and appendices with relevant data collected for this study. This study was performed in accordance with the scope of work defined in our proposal dated October 26, 2013 and our Agreement dated November 3, 2013 defines the scope of services for this project. Our revised proposal dated April 21, 2014 redefines the scope of services for this project and our agreement dated November 24, 2014.

We appreciate the opportunity to be of service for this project. Please call us if you have any questions regarding this report.

Sincerely,
COSMEZZ Sarl

THEOBARD NSHIMYUMUREMYI
Geotechnical Laboratory Chief



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GEO TECHNICAL ENGINEERING REPORT

Project: **IMPROVEMENT OF POWER SUPPLY IN THE REPUBLIC OF DJIBOUTI**

Location: **PK 12 SUBSTATION AND TRANSMISSION LINE ROUTE TO NAGAD.**

1. EXECUTIVE SUMMARY

This report presents the results of subsurface exploration, laboratory testing, and geotechnical engineering analysis for the proposed PK-12 Substation, Overhead Transmission Line Route between PK-12 and NAGAD. We are providing this executive summary solely for purposes of overview. Any party that relies on this report must read the full report. This executive summary omits several details, any one of which could be very important to the proper application of the report.

- The subsurface conditions for the proposed PK-12 Substation, Overhead Transmission Line between PK-12 and NAGAD, Djibouti were explored via four boreholes to a maximum depth of 5.36 meters and 4 Test Pits (TPs) to a maximum depth of 4.20 meters.
 - **PK-12 Substation:** On the top ground level of the new proposed substation there was a layer of 10 cm to 15 cm of crushed gravels placed during the previous construction works of the PK-12 interconnexion. The soils encountered in the borings and Test Pits were composed predominantly of medium plasticity, moist silts sands (SM) and clayey sands (SC) with gravels, cobbles, boulders to a depth up to 1.10 m (FILL MATERIAL) deposited on a fractured basalt rock (Bed rock), very hard to excavate.
 - **Overhead Transmission Line route:** The soils encountered in the borings and test pits for the overhead transmission line route were composed predominantly of low to high plasticity clay, sandy elastic SILT (MH), clayey sand (SC) and silts Sand (SM) with gravels, cobbles, boulders to a depth variable from 0.0 m up to 4.0 meters. Bed rock (basalt) was encountered to a maximum depth of 4.0 meters.
- The proposed new substation at PK-12 and other loaded structures may be supported by isolated footings bearing on basalt rocks or existing compacted fill. A design allowable bearing pressure of 144 kPa (3000 psf) is recommended for isolated footings constructed on existing compacted fill or basalt rock. This recommended allowable bearing pressure may be increased by a factor of 1.33 to size foundations for transient loads (blast and seismic) as discussed herein. Undercutting of unsuitable materials to reach suitable bearing strata should be expected in some areas during construction. Estimated total settlements of spread footings designed as recommended above are not expected to exceed about 25 mm (1 in) and differential settlements are not expected to exceed half the total settlement.



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- Floor slabs on-grade may be earth supported on suitable natural soils or compacted fill. Undercut floor slab subgrades should be backfilled with compacted fill or crushed stone. We recommend a modulus of subgrade reaction, k-value, of **65 kPa/mm** for floor slabs constructed on suitable natural soils or new compacted fill. A minimum 100 mm (4 in) thick washed gravel or crushed stone layer should be placed below floor slabs.
- Compacted fill and backfill in building areas should consist of soil classifying as SC, SM, SP, SW, GC, GM, GP, or GW, or combinations thereof per ASTM D-2487. The fines portion of compacted fill and backfill soils should have a liquid limit less than 40 and a plasticity index less than 15. Excavated portions of the on-site soils may generally meet these criteria but careful screening will be necessary in Nagad transmission line areas where the existing soils have a liquid limit more than 40 and a plasticity index more than 15. These will be performed in order to separate unsuitable soils from suitable soils. Compacted fill and backfill should be compacted in lifts not exceeding 20 cm (8 in) in loose thickness. Fill should be compacted to at least 95 percent of the maximum dry density per ASTM D1557 (Modified Proctor).
- Earthwork and foundation construction should be observed by a geotechnical engineer or other qualified individual to verify that the work is performed in accordance with the recommendations contained within this report.

2. SCOPE OF SERVICES

Our proposal dated October 26, 2013 and our Agreement dated November 3, 2013 defines the scope of services for this project. Our revised proposal dated April 21, 2014 redefines the scope of services for this project. The scope of services for this geotechnical report includes the following:

1. Field test and sampling logs.
2. Soil laboratory test results.
3. Calculation of the allowable bearing capacity.
4. Recommendation of foundation system.
5. Evaluation of estimated subsurface conditions below the proposed improvements based on the results of the subsurface exploration and other available subsurface data. Included is a description of the subsurface exploration procedures and special site preparation requirements.
6. A project site description; plan drawing indicating boring, test pit, and Standard penetration test (SPT) locations relative to planned improvements.
7. Recommendations for site preparation and construction of earthwork including an assessment of excavated on-site soils for use as fill in building areas.
8. Comments regarding geotechnical construction considerations for use in development of the design and construction plans and specifications.



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3. DESCRIPTION OF SITE AND PROPOSED CONSTRUCTION

3.1. Site Description

The project consists of the construction of the Substation at PK 12, Overhead Transmission Line between PK-12 and NAGAD in the Republic of Djibouti.

3.2. PK-12 Substation

The new PK-12 Substation is located to the north side of existing building at PK 12 Djibouti-Ethiopia power interconnexion; road service to the west and north side and opened gravel yard to the east side.

The PK 12 Substation site generally slopes gently downward to the east from approximate **EL 93.88 m** at the southwest corner to approximate **EL 92.35 m** at the northeast corner. A drainage channel bisects the site from southwest to northeast. A drainage channel has also been constructed along the western and northern limits of the new PK 12 Substation area as a part of the previous project. The site covered by crushed gravel, and poor draining areas are present to the eastern.

3.3. Overhead Transmission Line

The site for the overhead Transmission line is a desert boundary between PK 12 and NAGAD areas bounded by the National Road No.1 (RN1) to the north, existing PK 12 plants to the west, the Chebelley boundary to the south, and the National Road No.5 (RN5) and Nagad plants to the east. Existing site grades are erratic but generally decrease from west to east at the western limit of the National Road No.5, and back down at the southern limit of Chebelley boundary where the river (OUED) is passing. Existing site grades also generally flat in the middle near PK 12 Plants (industries).

A Site Vicinity Map is included as Figure 1.



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3.4. Proposed construction

3.5. PK12 Substation

We understand that the new PK 12 Substation will consists of earthwork and the construction of new building, structures, utilities, site drainage and other site preparations.

The new PK 12 Substation will be located in the northwestern portion of the site.

3.6. Overhead Transmission Line

The overhead Transmission Line will provide a new Djibouti-Ethiopie power extension to the existing infrastructures and will extend to the east of PK 12 Substation and end at the Nagad area. The planned overhead transmission line will consists of construction of reinforced poles foundations, steel poles, electrical works, and other site preparations.

3.7. Regional Geology

Based on our review of available data and our experience in the area, Djibouti is located at the convergence of the Gulf of Aden and the Red Sea. The region reportedly consists of silt sandy-clays medium to high plasticity underlain of basalt rocks and basalt rocks (boulders) in surface of existing site between PK 12 substation and Nagad site. The new PK 12 substation site is covered by crushed gravel and soil profile composed of silt sandy-clay mixture with basaltic boulders. There was no observed or reported evidence of surface faulting or ground rupture associated with seismic activities in the project area. However, extensive damage including ground fissures have been reported in the town of Djibouti and it's port from past earthquake events Recent seismic activities in Djibouti have had epicenters near the Ethiopian border and in the submerged area of the Gulf of Tadjoura. A maximum intensity of VII has been reported for several events in the Djibouti. The natural terrain is essentially plane with low slop going to the eastern south. There is no erosion channels observed at the time of soil exploration.

An active volcano associated with continental rifting is present approximately 100 km west of Djibouti. The volcano reportedly last erupted in 1978 covering an area approximately 3 square km with about 12x10⁶ cubic m of lava.

A Geologic Map is included as Figure 2.



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4. SUBSURFACE EXPLORATION PROGRAMM

We performed and observed a subsurface exploration and field testing program performed by COSMEZZ sarl, we were contracted by the YEC – YACHIYO ENGINEERING CO.,LTD of JAPAN.

Our subsurface exploration was performed to identify the soil conditions underlying the site and to evaluate the geotechnical properties of the materials encountered. This program included test borings, test pits, and Standard Penetration Tests (SPT).

Exploration methods used are discussed in subsequent sections. The appendices to this report contain the results of the exploration.

4.1. Previous explorations by others

We understand that a geotechnical investigation was performed for the previous construction of the PK 12 Djibouti-Ethiopie interconnexion substation but not engineering report was present during our preparation of this geotechnical exploration report. Two (2) others geotechnical engineering reports were prepared by us for the adjacent projects of JABAN'AS – Construction of a power plant and World Food Programme Humanitarian Logistics Base at PK 20.

4.2. Subsurface Exploration and Field Testing

In order to supplement the existing subsurface information within the project sites, test borings, Test pits and SPT tests were performed by COSMEZZ GEOTECHNICAL LABORATORY, under observations of the Client representative (YEC-EDD).

4.3. Test Borings

Cosmezz drilled four (4) test borings under client's observation between December 7, 2013 and April 26, 2014. The Standard Penetration Test (SPT) was conducted at selected depths in the borings. Two (2) test borings within the new PK 12 Substation area and two (2) to the overhead transmission line area.

Appendix A includes specific observations, remarks, and logs for the borings, classification criteria, drilling methods, and sampling protocols. Figure A1, included at the end of this report, indicates the test boring locations.



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4.4. Test Pits

Cosmezz excavated two (2) test pits within the new PK 12 Substation area and two (2) test pits within the overhead transmission line area under YEC-EDD's observation on December 31, 2013 and between May 11, 2014. Appendix A includes specific observations, remarks, and logs for the test pit classification criteria, excavation methods, sampling protocols. Figure A1, included at the end of this report, indicates the test pit locations.

5. LABORATORY TESTING

Our laboratory located in Djibouti, Rue de Venise – Salines Ouest, conducted testing on selected samples obtained during our subsurface exploration.

The testing aided in the classification of materials encountered in our subsurface exploration and provided data for use in the development of recommendations for design of foundations and earthwork. The results of the laboratory testing are presented in Appendix B. The testing is also summarized in the following sections.

Please note that the soil laboratory testing was assigned by us and all testing was performed by us. We can rely on the soil laboratory test results provided by us to develop the recommendations included herein.

5.1. Soils Testing

5.2. Index Testing

Natural moisture content, Atterberg Limit, and gradation tests on bag samples, bulk samples, and undisturbed samples were performed to provide soil classifications and to provide parameters for use with published correlations with soil properties.

5.3. Compaction and CBR Testing

COSMEZZ laboratory conducted three (3) Modified Proctor Compaction and CBR tests of soil samples representing Strata between 0.15 m and 2.30 meters depth.



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6. SITE GEOLOGY AND SUBSURFACE CONDITIONS

6.1. Generalized Subsurface Stratigraphy

We characterized the following generalized subsurface stratigraphy based on the exploration and laboratory test data developed from our recent subsurface explorations.

Stratum F (Fill): Below the ground surface or ground cover to depths of up to 0.7 m within the PK 12 substation site, encountered in borings BH-1 and BH-2. Light brown; SILTY SAND (SM) with gravel, very hard; natural moisture contents of 7.4 to 9.1 percent; a liquid limit of 39.4 to 41.6; a plasticity Index of 12 to 14; SPT N-values of more than 50 blows per 30 cm.

Stratum A1 (Fine Grained Alluvium): Below the ground surface or fill and interlayered with Stratum A2 to depths up to 2.75 m. Encountered in borings BH-3, BH-4 and in test pits TP-3 and TP-4. Reddish brown, light brown; sandy LEAN CLAY (CL) with varying amounts of sand, gravel, dry to very stiff; natural moisture contents of 6.8 to 15 percent; a liquid limit of 37.5; a plasticity Index of 9.7; SPT N-values of 27 to 50+ blows per 30 cm.

Stratum A2 (Coarse Grained Alluvium): Below the ground surface or fill interlayered with Stratum A1 to depths up to 4.0 m. Observed in borings BH-3, BH-4 and test pit TP-4. Light brown, sandy GRAVEL (GW), clayey SAND (SC) with varying amounts of sand, gravel, cobbles, very dense; natural moisture contents of 5.9 percent; a liquid limit of 41.4; a plasticity index of 16.5; SPT N-values of more 50 blows per 30 cm.

Stratum B (Basalt Rock): Below the ground surface, Stratum A1, or Stratum A2 to depths up to 5.36 m, the maximum depth explored. This stratum was observed in all borings and Test pits, BASALT ROCK (RK) with cobbles, boulders, gravel, moderately hard rock, little fractured, very hard to excavate; RQD of 27 to 65 %.

Significant amounts of topsoil were not observed in the borings or test pits performed, but may be present in other locations at the site.

COSMEZZ laboratory conducted eleven (3) modified Proctor Compaction tests and eleven (3) CBR tests on bulk samples representing Strata A1 and A2 obtained within the sites for the PK 12 substation and overhead transmission Line. The CBR testing was reportedly performed in accordance with ASTM D1883. The soil samples were compacted to varying densities per modified Proctor (ASTM D1557); soaked for four (4) days with a default surcharge of 4.5 kg (10 lb); and penetrated under surcharge with readings taken at intervals per the ASTM D1883. The 4.5 kg (10 lb) default surcharge was used at the time of testing. A summary of the compaction and CBR testing is presented in Table 1 at the end of this report. Swell values measured during CBR testing of the soils of Strata A1 and A2 were between 0.21



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and 4.28 percent under an approximate 2.4 kPa (50 psf) surcharge. The higher surcharge pressures and additional confinement will likely result in even lower swell values than those measured during CBR testing. Thus, we do not believe that the planned improvements will be impacted by swell potential of the existing site soils.

6.2. Site Geology

The predominant soils are silt sandy-clays medium to high plasticity and basalt rocks in surface of the existing site. During the geotechnical investigation at site, PK 12 Substation site was covered by crushed gravel. The overhead transmission line sites are composed of silt sandy-clay mixed with basaltic boulders. The dense or hard sand, silt, and gravel soils of Stratum A1 and A2 are believed to be ALLUVIUM. Basalt bedrock was encountered in the borings but at various depths.

There was no observed or reported evidence of surface faulting or ground rupture associated with seismic activities in the project area. However, extensive damage including ground fissures have been reported in the town of Djibouti and it's port from past earthquake events Recent seismic activities in Djibouti have had epicenters near the Ethiopian border and in the submerged area of the Gulf of Tadjoura. A maximum intensity of VII has been reported for several events in the Djibouti. The natural terrain is essentially plane with low slop going to the east side.

6.3. Groundwater

Groundwater was not observed during or after drilling in recent borings and test pits and the previous borings and test pits performed by us.

6.4. Seismic site Classification

Based on available information, the seismic hazard at the site is considered to be moderate (equivalent UBC Seismic Zone designation of 3).

We evaluated the Seismic Site Class and Seismic Site Coefficients for this project according to the International Building Code (IBC) Section 1613 and our experience in the area. Commonly, we use SPT N-values and/or shear strength data collected during the geotechnical subsurface exploration extrapolated to a depth of 30 m (100 ft) to evaluate the seismic site class as allowed by the International Building Code (IBC). Performing seismic site class evaluation this way results in a Seismic Site Class C per Section 1613 of the IBC.



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Seismic site parameters determined from Unified Facilities Criteria manual UFC 3-310-01/04 and the 2006 International Building Code appear to be appropriate for the project based on the results of this exploration and past seismic design in the same area. Seismic Structural design should be done using a Peak Ground Acceleration of 0.15g.

7. RECOMMENDATIONS

7.1. General

Based on the subsurface data obtained from the site and our engineering analysis of the subsurface conditions and project information, the following recommendations are provided for the basis of design.

7.2. Foundation recommendations

We based our geotechnical engineering analysis on the information collected during our subsurface exploration and the results of the soil laboratory testing, as well as the existing subsurface data presented on previous site project, project development plans, site plans, and structural loading information provided to us. We recommend square isolated footings of (1.0m x 1.0m) for support of the proposed PK 12 Substation building and other minor structures associated with this project. Based on Laboratory test results of the soils samples from boreholes and test pits, the CBR values of the encountered soils can be estimated in the range of about 5 to 18. No test was performed on the encountered basalt rock stratum. But a penetration speed equal to 7 cm/minute for simple core barrel was observed at basaltic rock with an RQD (Rock Quality Designation) = 65% at borehole BH-1 located at proposed new PK 12 Substation. Other geotechnical design parameters are in previous sections and the following sections or laboratory test results summary attached on this report.

The following sections of the report provide our detailed recommendations.

7.3. Isolated footings

We consider isolated footings suitable for support of the proposed PK 12 substation building and other lightly loaded structures.

Footings should be founded on suitable natural soils or basalt bed rock. Footings supported on suitable natural soils or compacted fill may be designed considering a net allowable soil bearing pressure of 145 kPa (3,000 psf).

We anticipate suitable natural soils will be encountered at shallow depths (less than 1.5 m) below the finished floor grade of the building. However, some of the near surface natural soils were observed to be loose in their natural state. Additionally, high plasticity soils may be encountered at footing subgrade at Nagad overhead transmission line site. Loose or soft soils and high plasticity soils are unsuitable for



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direct support of footings. If encountered, the high plasticity soils should be entirely removed from beneath footings. Unsuitable loose or soft soils and high plasticity soils should be undercut in their entirety or a minimum depth of 1 m below foundation bearing elevation, whichever is less. Undercut subgrades should be backfilled with compacted fill or crushed stone in accordance the applicable specifications.

Finished site grades should be set to permit positive drainage of surface water away from the building. Actual foundation subgrades and undercutting should be observed in the field by a qualified geotechnical engineer or other qualified individual.

7.4. Floor Slab recommendations

The proposed floor slabs should be supported on suitable natural soils or compacted fill. A modulus of subgrade reaction, k , of 65 kPa/mm should be used in design of floor slabs.

A 100 mm (4 in) crushed stone or washed gravel capillary barrier should underlie floor slabs on grade.

The material should consist of an open graded crushed stone such as AASHTO No. 57 stone. The Contractor should compact the stone in place using suitable compaction equipment. A minimum 10-mil thick impermeable plastic membrane should be placed over the under slab stone layer to serve as a vapor barrier and to prevent infiltration of concrete into the crushed stone during concrete placement. Loose, or high plasticity soils or the existing fill soils observed at floor slab subgrade should be undercut to a minimum depth of 0.6 m or in their entirety, whichever is less. Undercut floor slab subgrades should be backfilled with compacted fill or crushed stone.

The Contractor should compact floor slab subgrades to repair any disturbance that may occur due to construction operations before placing capillary barrier materials. Since floors will be slab-on-grade, footing and utility excavations should be backfilled with compacted fill in accordance with applicable standards.

7.5. Other Geotechnical Design parameters

The following general soil properties may be assumed for the upper existing soils when placed and compacted properly:

- Moist Unit Weight, (kN/m³): 19.7
- Friction Angle (ϕ): 30
- Lateral bearing (kPa): 7.18
- Cohesion Strength C (τ_0) 192 kPa
- Seismic Site Class per Section 1613 of the IBC: C
- Peak Ground Acceleration 0.15g



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7.6. Site Grading and Earthwork

Based on our discussions with the design team of the project, proposed building and site grades associated with the UNDERGROUND & OVERHEAD TRANSMISSION LINE ROUTE will require cuts of up to 1.5 m for the proposed pole foundations and underground utilities. Proposed site grades within the PK 12 Substation will require placement of minimal new compacted fill and minimal cuts.

Recommendations for compacted fill subgrade preparation, compacted fill placement are presented in subsequent sections.

7.7. Compacted Fill

Compacted fill and backfill in building areas should consist of suitable material classifying as SC, SM, SP, SW, GC, GM, GP, GW, or combinations thereof according to ASTM D2487. In addition, fill materials should exhibit Liquid Limit and Plasticity Index values of less than 40 and 15, respectively.

Fill materials should not contain particles larger than 8 cm. Excavated portions of the on-site soils may generally meet these criteria but careful screening and stockpiling will be necessary to separate unsuitable soils from suitable soils.

Compacted fill should be placed in maximum 20 cm thick horizontal, loose lifts. Fill should be compacted to at least 95 percent of the maximum dry density per ASTM D1557 (Modified Proctor).

Soil moisture contents at the time of compaction should be within plus or minus 4 percent of the soils optimum moisture content (e.g. if the optimum moisture content is 16%, allowable moisture range is 12% to 20%). This acceptable range of moisture contents may need to be adjusted in the field depending on results.

Backfill placed in excavations, trenches, and other areas that large compaction equipment cannot access should be placed in maximum 15 cm thick, loose lifts. Backfill should meet the material, placement, and compaction requirements outlined above.

Successful re-use of the excavated, on-site soils and imported soils as compacted fill will depend on the soil type and natural moisture content during placement. Laboratory test results indicate most on site soils encountered are generally little dry of the optimum moisture content.

Soils used for compacted fill placement should be evaluated during construction for conformance with the project specifications and the recommendations included herein. Specifically, evaluation should include soil index, modified Proctor, and CBR tests at the frequencies indicated in the project specification, amongst the other required evaluations.



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7.8. Engineering Services During Construction

Variations in soil conditions will be encountered during construction. To permit correlation between the subsurface exploration data and actual soil conditions, an onsite geotechnical engineer or other qualified individual must provide observations during construction. Construction services should include: observation of foundation bearing materials and shallow foundation construction; evaluation of the suitability of subgrade materials for fill placement; stabilization methods for subgrades, floor slab support, and pavement support; compacted fill and backfill placement and compaction; and consultation on matters related to foundations and earthwork.



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8. LIMITATIONS

We based the analyses and recommendations presented in this report on the information revealed by our exploration. We attempted to provide for normal contingencies, but the possibility remains that unexpected conditions may be encountered during construction.

This report has been prepared to aid in the evaluation of this site and to assist in the design of the project. It is intended for use concerning this specific project. We based our recommendations on information on the site and proposed construction as described in this report. Substantial changes in loads, locations, or grades should be brought to our attention so we can modify our recommendations as needed. We would appreciate an opportunity to review the plans and specifications as they pertain to the recommendations contained in this report, and to submit our comments to you based on this review.

An allowance should be established to account for possible additional costs that may be required to construct earthwork and foundations as recommended in this report. Additional costs may be incurred for a variety of reasons including variation of soil between test locations, excavation of existing fill or soft or loose soils, difficulty in acquiring suitable fill material, moisture conditioning of on-site soils, obstructions, etc.

We have endeavored to complete the services identified herein in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in the same locality and under similar conditions as this project. No other representation, express or implied, is included or intended, and no warranty or guarantee is included or intended in this report, or other instrument of service.

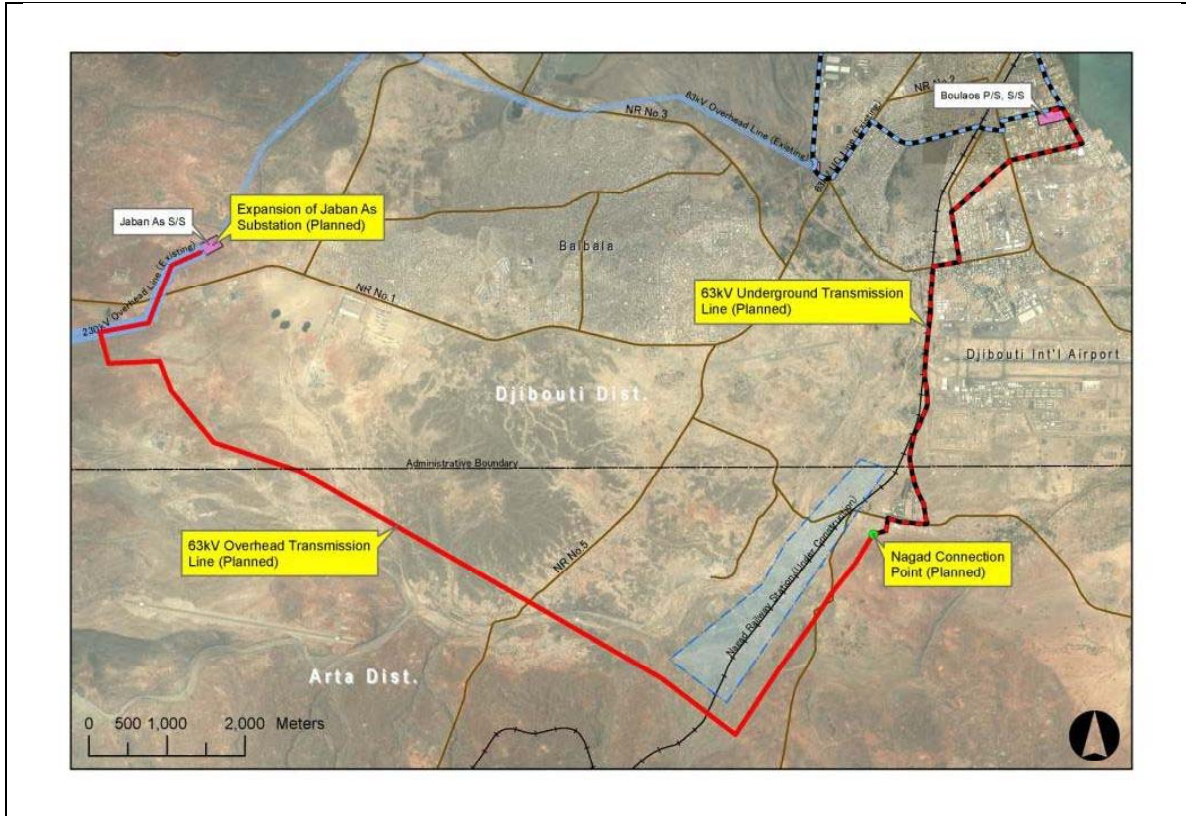


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FIGURES

Figure 1: Site Vicinity Map
Figure 2: Geologic Map

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	<p>Project: IMPROVEMENT OF POWER SUPPLY IN THE REPUBLIC OF DJIBOUTI - PK 12 SUBSTATION & TRANSMISSION LINE ROUTE TO NAGAD</p>	<p>SITE VICINITY MAP</p> <p style="text-align: right;">Figure 1</p>
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Project: **IMPROVEMENT OF POWER SUPPLY IN THE REPUBLIC OF DJIBOUTI - PK 12 SUBSTATION & TRANSMISSION LINE ROUTE TO NAGAD**

GEOLOGIC MAP

Figure 2



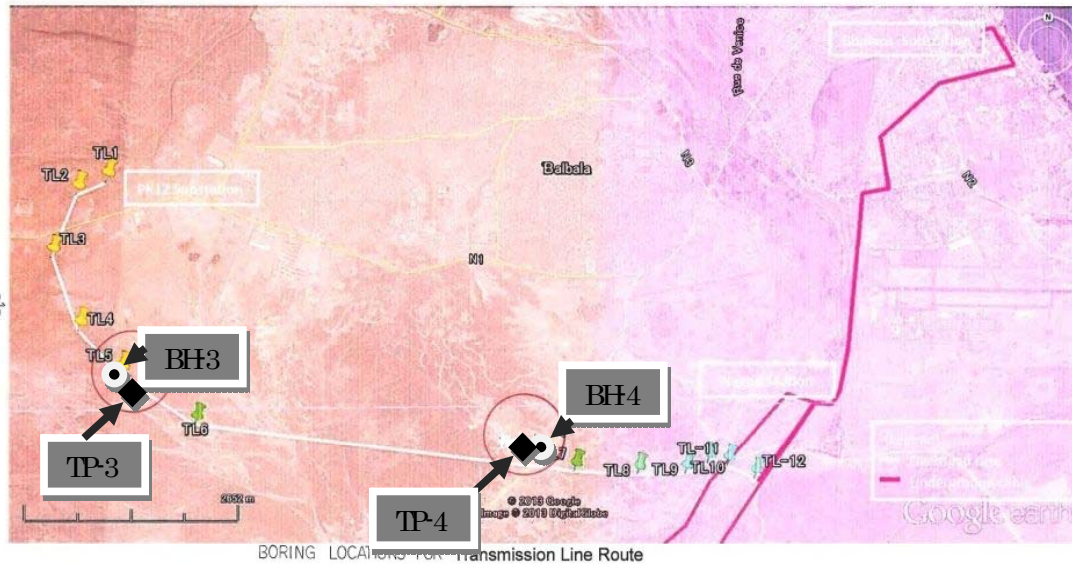
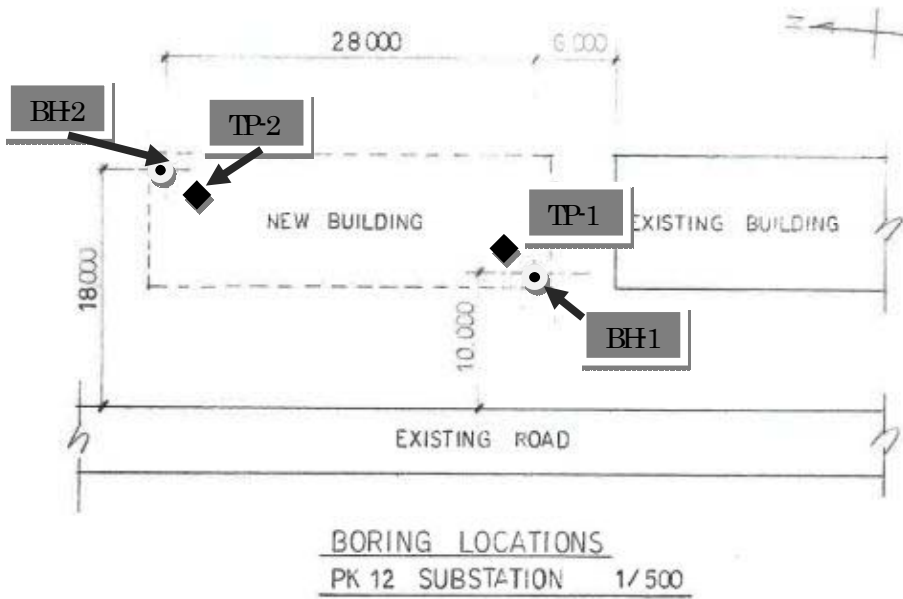
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APPENDIX A

SUBSURFACE EXPLORATION DATA

Figure A1: Boring and Test Pit Location Plan
Subsurface Exploration Procedures
General Notes for Subsurface Exploration Logs
Boring Logs (4 sheets)
Test Pit Logs (4 sheets)

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LEGEND:

TP-1: TEST PIT-1 BH1: BOREHOLE-1

FIGURE A1



GEOTECHNICAL LABORATORY

SUBSURFACE EXPLORATION PROCEDURES

Test Borings – Cased Borings

The borings by Cosmezz were advanced by driving casing (pipe) to the sampling depth. Soil within the casing is cleaned out by chopping or rotary drilling, using wash water to remove cuttings. Samples are obtained using standard methods.

Standard Penetration Test Results

The numbers in the Sampling Data column of the boring logs represent Standard Penetration Test (SPT) results. Each number represents the blows needed to drive a 2-inch O.D., 1 $\frac{3}{8}$ -inch I.D. split-spoon sampler 6 inches, using a 140-pound hammer falling 30 inches. The sampler is typically driven a total of 18 or 24 inches. The first 6 inches are considered a seating interval. The total of the number of blows for the second and third 6-inch intervals is the SPT “N value.” The Standard Penetration Test is conducted according to ASTM D1586.

Soil Classification Criteria

The group symbols on the logs represent the Unified Soil Classification System Group Symbols (ASTM D2487) based on visual observation and limited laboratory testing of the samples. Criteria for visual identification of soil samples are included in this appendix. Some variation can be expected between samples visually classified and samples classified in the laboratory.

Boring and Test Pit Locations

Boring and test pit locations were staked and surveyed by YEC. Boring and test pit locations are shown on Figure A1. Boring and test pit locations were provided by YEC and are indicated on the boring and test pit logs. Locations and elevations should be considered no more accurate than the methods used to determine them.



G E O T E C H N I C A L L A B O R A T O R Y

GENERAL NOTES FOR SUBSURFACE EXPLORATION LOGS

1. Numbers in sampling data column next to Standard Penetration Test (SPT) symbols indicate blows required to drive a 2-inch O.D., 1 $\frac{3}{8}$ -inch I.D. sampling spoon 6 inches using a 140 pound hammer falling 30 inches. The Standard Penetration Test (SPT) N value is the number of blows required to drive the sampler 12 inches, after a 6 inch seating interval. The Standard Penetration Test is performed in general accordance with ASTM D1586.

2. Visual classification of soil is in accordance with terminology set forth in "Identification of Soil." The ASTM D2487 group symbols (e.g., CL) shown in the classification column are based on visual observations.



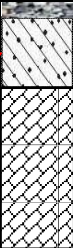
3. Refusal at the surface of rock, boulder, or other obstruction is defined as an SPT resistance of 100 blows for 2 inches or less of penetration.

4. The logs and related information depict subsurface conditions only at the specific locations and at the particular time when drilled or excavated. Soil conditions at other locations may differ from conditions occurring at these locations. Also, the passage of time may result in a change in the subsurface soil and water level conditions at the subsurface exploration location.

5. The stratification lines represent the approximate boundary between soil and rock types as obtained from the subsurface exploration. Some variation may also be expected vertically between samples taken. The soil profile, penetration resistances presented on these logs have been made with reasonable care and accuracy and must be considered only an approximate representation of subsurface conditions to be encountered at the particular location.





6. Key to symbols and abbreviations:



▣ SPT	Standard Penetration Test
5+10+1	Number of blows in each 6-inch increment
☒ S-1	Sample No.,
Rec=24", 100%	Recovery in inches, Percent Recovery
LL	Liquid Limit
MC	Moisture Content (percent)
PL	Plastic Limit
%Passing#200 (0.075 mm)	Percent by weight passing a No. 200 Sieve (0.075 mm)




 GEOTECHNICAL LABORATORY		BORING LOG		Client: YEC, JAPAN	Project Number:			
Project: IMPROVEMENT OF POWER SUPPLY IN DJIBOUTI Location: PK 12 SUBSTATION		Boring No. BH-1		Drilling Contractor: COSMEZZ SARL	Drill Rig Type: CMV MK 600JET (Rotary drilling)			
Logged By: THEOBARD N.		Date	Started: 7-Dec-13 1150H	Bit Type:	Diameter: 101 mm			
Drill Crew: COSMEZZ SARL			Completed: 8-Dec-13 0945H	Hammer Type: MANUAL				
Drilling Operator: JOEMAR T.			Backfilled: 8-Dec-13	Hammer Weight: 63.5 KGS	Hammer Drop: 75 cm			
Drilling Supervisor: THEOBARD NSHIMI.		Groundwater Depth: Not encountered		Elevation: -	Total Depth of Boring: 3.20 m			
Depth (m)	Sample Type	Sample Number	Blow Counts (blows/foot)	Graphic Log	Lithology	Fines (%)	Moisture Content (%)	Additional Test
1.0		SS-1 SPT-1	16-18-50+		Lithology <u>Soil Group Name:</u> modifier, color, moisture, density/consistency, grain size, other descriptors <u>Rock Description:</u> modifier color, hardness/degree of concentration, bedding and joint characteristics, solutions, void conditions.			
					Top layer of crushed gravel material 10/50 mm (0.0 - 0.15m) SILTY SAND (SM) with gravel, very hard, light brown. From 0.5m: More gravelly. (REC=100%)	41.5	8.6	LL=40.3 PI=12.1
					Basalt ROCK (RK) , Moderately hard rock, little fractured from 1.50m to 2.00m. Penetration speed ~7 cm/min	47.0	9.1	LL=39.4 PI=12.3 RQD=65%
5					BOTTOM OF BORING BORING TERMINATED @ 3.20 meters			
10								

COSMEZZ GEOTECHNICAL LAB

Boring Log: Sheet 1 of 1





-  Standard Penetration Split Spoon Sampler (SPT)
-  Bulk/ Bag Sample
-  Shelby Tube
-  CPP Sampler



-  Stabilized Ground water
-  Groundwater At time of Drilling






 GEOTECHNICAL LABORATORY		BORING LOG Boring No. BH-2		Client: YEC, JAPAN	Project Number:			
Project: IMPROVEMENT OF POWER SUPPLY IN DJIBOUTI Location: PK 12 SUBSTATION			Drilling Contractor: COSMEZZ SARL	Drill Rig Type: CMV MK 600JET (Rotary drilling)				
Logged By: THEOBARD N.		Date	Started: 8-Dec-13 1115H	Bit Type:	Diameter: 101 mm			
Drill Crew: COSMEZZ SARL			Completed: 9-Dec-13 0718H	Hammer Type: MANUAL				
Drilling Operator: JOEMAR T.			Backfilled: 9-Dec-13	Hammer Weight: 63.5 KGS	Hammer Drop: 75 cm			
Drilling Supervisor: THEOBARD NSHIMI.		Groundwater Depth: Not encountered		Elevation: -	Total Depth of Boring: 5.36 m			
Depth (m)	Sample Type	Sample Number	Blow Counts (blows/foot)	Graphic Log	Lithology	Fines (%)	Moisture Content (%)	Additional Test
					Lithology <u>Soil Group Name:</u> modifier, color, moisture, density/consistency, grain size, other descriptors <u>Rock Description:</u> modifier color, hardness/degree of concentration, bedding and joint characteristics, solutions, void conditions.			
	☒	SS-1			Top layer of Crushed gravel material 10/50 mm (0.0 - 0.10m) SILTY SAND (SM) with gravel, very hard, light brown.	35.8	7.4	LL=41.6 PI=14.1
5					Basalt ROCK (RK) , Moderately hard rock, fractured. From 0.70 m to 1.4 m: Fractured From 1.4 m to 5.36 m: Continuous rock.			
10					BOTTOM OF BORING BORING TERMINATED @ 5.36 meters			

COSMEZZ GEOTECHNICAL LAB

Boring Log: Sheet 1 of 1





-  Standard Penetration Split Spoon Sampler (SPT)
-  Bulk/ Bag Sample
-  Shelby Tube
-  CPP Sampler



-  Stabilized Ground water
-  Groundwater At time of Drilling













 GEOTECHNICAL LABORATORY		BORING LOG Boring No. BH-3		Client: YEC, JAPAN	Project Number:			
Project: IMPROVEMENT OF POWER SUPPLY IN DJIBOUTI Location: PK 12 TRANSMISSION LINE ROUTE			Drilling Contractor: COSMEZZ SARL	Drill Rig Type: CMV MK 600JET				
Logged By: THEOBARD N.		Date	Started: 15-Dec-13 1535H	Bit Type:	Diameter: 101 mm			
Drill Crew: COSMEZZ SARL			Completed 16-Dec-13 1005H	Hammer Type: MANUAL				
Drilling Operator: JOEMAR T.			Backfilled: 16-Dec-13	Hammer Weight: 63.5 KGS	Hammer Drop: 75 cm			
Drilling Supervisor: THEOBARD NSHIMI.			Groundwater Depth: Not encountered	Elevation: -	Total Depth of Boring: 4.80 m			
Depth (m)	Sample Type	Sample Number	Blow Counts (blows/foot)	Graphic Log	Lithology	Fines (%)	Moisture Content (%)	Additional Test
0.45		SPT-1	10-12-15-21		Lithology Soil Group Name: modifier, color, moisture, density/consistency, grain size, other descriptors Rock Description: modifier color, hardness/degree of concentration, bedding and joint characteristics, solutions, void conditions. Sandy LEAN CLAY (CL) , very stiff, dry, reddish brown. REC=100%	82.6	6.8	LL=37.5 PI=9.7
1.5		SPT-2	28-50+		1.5m to 1.65m: Become gravelly-sandy, and very hard. REC=100% Basalt ROCK (RK) , with cobbles, boulders and some gravel. 2.30m to 3.0m: Big rock. RQD=27%	56.4	15.0	
5					BOTTOM OF BORING BORING TERMINATED @ 4.80 meters			
10								

COSMEZZ GEOTECHNICAL LAB

Boring Log: Sheet 1 of 1

-  Standard Penetration Split Spoon Sampler (SPT)
-  Bulk/ Bag Sample
-  Shelby Tube
-  CPP Sampler

-  Stabilized Ground water
-  Groundwater At time of Drilling

 GEOTECHNICAL LABORATORY		BORING LOG Boring No. BH-4		Client: YEC, JAPAN	Project Number:			
Project: IMPROVEMENT OF POWER SUPPLY IN DJIBOUTI Location: NAGAD - TRANSMISSION LINE			Drilling Contractor: COSMEZZ SARL	Drill Rig Type: CMV MK 600JET (Rotary drilling)				
Logged By: THEOBARD N.		Date	Started: 26-Apr-14 0940H	Bit Type:	Diameter: 101 mm			
Drill Crew: COSMEZZ SARL			Completed 26-Apr-13 1620H	Hammer Type: MANUAL	N= 1274057.0 E= 292291.0			
Drilling Operator: JOEMAR T.			Backfilled: 26-Apr-14	Hammer Weight: 63.5 KGS	Hammer Drop: 75 cm			
Drilling Supervisor: THEOBARD NSHIMI.			Groundwater Depth: Not encountered	Elevation: -	Total Depth of Boring: 4.80 m			
Depth (m)	Sample Type	Sample Number	Blow Counts (blows/foot)	Graphic Log	Lithology	Fines (%)	Moisture Content (%)	Additional Test
0.0		SPT-1	8-50+		Lithology Soil Group Name: modifier, color, moisture, density/consistency, grain size, other descriptors Rock Description: modifier color, hardness/degree of concentration, bedding and joint characteristics, solutions, void conditions.			
2		SS-1			Clayey SAND-GRAVEL (GC) , very dense, dry pinkish. Fractured Basalt rock (RK) , From 0.28 to 0.80 m. Coarse GRAVEL (GW) . From 0.80 to 1.30 m.	NA	NA	REC=28cm Specific Grav=2.60
2.75		SPT-2	20-45-50+		Sandy, LEAN CLAY (CL) , light brown,dry, very stiff.			
3.5		SS-2			Sandy, Cemented SILT (SM) with some gravel, very hard, dry, reddish. From 2.75m to 3.30 m			REC=30cm Specific Grav=2.684
4.0		SPT-3	50+		Clayey, SAND (SC) , with some gravel, very dense, light brown, fine to coarse sand. From 3.30m to 4.0 m	NA	NA	REC=19cm
5					Sandy GRAVEL (GW) , with trace clay, dry, very dense.			
					BASALT BED ROCK			
					BOTTOM OF BORING			
					BORING TERMINATED @ - 4.80 meters			

COSMEZZ GEOTECHNICAL LAB

Boring Log: Sheet 1 of 1

 Standard Penetration Split Spoon Sampler (SPT)

 Bulk/ Bag Sample

 Shelby Tube

 CPP Sampler

 Stabilized Ground water

 Groundwater At time of Drilling



GEOTECHNICAL LABORATORY

"Certified by USACE"

TEST PIT LOG No: TP-1

Project: IMPROVEMENT OF POWER SUPPLY IN THE REPUBLIC OF DJIBOUTI

Location: PK 12 SUBSTATION - DJIBOUTI

Initial Depth : 0,00 m

N=

Date start excav : 31-DEC-2013

Time: 07H25

Final Depth : - 1,05m

E=

Date finish excav : 31-DEC-2013

Time: 08H10

SURFACE ELEVATION :

ELEV=

Weather conditions: SUNNY

DRILLER: COSMEZZ s.a.r.l. LABORATORY




Location: See the location plan

Sheet NO.: 1 of 1

Type of exploration: TEST PIT

EQUIPMENT : EXCAVATOR (HYUNDAI / Rolex 200W-7)

Method of sampler: SELECT SAMPLE

DEPTH, m	SCALE	STRATIGRAPHY	DESCRIPTION OF MATERIAL	SAMPLE	GROUNDWATER LEVEL@ TIME OF BORING	TESTS	REMARKS
0.00			Top layer of Gravel 10/50mm (0.0-0.15m)				
-0.20			Clayey-Silty SAND (SC-SM), with gravel, hard and light brown (FILL MATERIAL)	☒ SS-1 (0.15-0.75m)		See test reports	Sample collected for Proctor, CBR, AL & SA.
-0.40							
-0.60							
-0.80			Cobbles, boulders, and trace clay (Fractured basalt rock): 0.75 - 1.05 m				
-1.00							
-1.20							
-1.40			BOTTOM OF TEST PIT Excavation terminated @ -1.10 meters.				
-1.60							
-1.80							
-2.00							
-2.20							
-2.40							
-2.60							
-2.80							
-3.00							
-3.20							
-3.40							
-3.60							
-3.80							
-4.00							
-4.20							
-4.40							
-4.60							
-4.80							
-5.00							
-5.20							

GROUNDWATER DEPTH at TIME OF EXCAVATION, m: ----

LOGGED By: THEOBARD N.

STABILISED GROUND WATER DEPTH, m: -----



GEOTECHNICAL LABORATORY

"Certified by USACE"

TEST PIT LOG No: TP-2

Project: IMPROVEMENT OF POWER SUPPLY IN THE REPUBLIC OF DJIBOUTI

Location: PK 12 SUBSTATION - DJIBOUTI

Initial Depth : **0,00 m** N=
 Final Depth : **- 1,10m** E=
 SURFACE ELEVATION : ELEV=
 DRILLER: **COSMEZZ s.a.r.l. LABORATORY** Location: **See the location plan**
 Date start excav : **31-DEC-2013** Time: 08H20
 Date finish excav : **31-DEC-2013** Time: 08H42
 Weather conditions: **SUNNY**
 Sheet NO.: 1 of 1

Type of exploration: TEST PIT

EQUIPMENT : **EXCAVATOR (HYUNDAI / Rolex 200W-7)**

Method of sampler: **SELECT SAMPLE**

DEPTH, m	SCALE	STRATIGRAPHY	DESCRIPTION OF MATERIAL	SAMPLE	GROUNDWATER LEVEL@ TIME OF BORING	TESTS	REMARKS
0.00			Top layer of Gravel 10/50mm (0.0-0.15m)				
-0.20			Clayey Silty SAND (SC-SM), with gravel, hard and light brown (FILL MATERIAL)	☒ SS-1 (0.15-0.65m)		See test reports	
-0.40							
-0.60							
-0.80			Cobbles, boulders, fractured basalt rock				Bed rock at 1.10 m
-1.00							
-1.20							
-1.40			BOTTOM OF TEST PIT Excavation terminated @ -1.10 meters.				
-1.60							
-1.80							
-2.00							
-2.20							
-2.40							
-2.60							
-2.80							
-3.00							
-3.20							
-3.40							
-3.60							
-3.80							
-4.00							
-4.20							
-4.40							
-4.60							
-4.80							
-5.00							
-5.20							

GROUNDWATER DEPTH at TIME OF EXCAVATION, m: ----
 STABILISED GROUND WATER DEPTH, m: -----

LOGGED By: **THEOBARD N.**



GEOTECHNICAL LABORATORY

"Certified by USACE"

TEST PIT LOG No: TP-3

Project: IMPROVEMENT OF POWER SUPPLY IN THE REPUBLIC OF DJIBOUTI

Location: PK 12 - OVERHEAD TRANSMISSION LINE

Initial Depth : 0,00 m

N=

Date start excav : 31-DEC-2013

Time: 09H05

Final Depth : - 2,25m

E=

Date finish excav: 31-DEC-2013

Time: 09H40

SURFACE ELEVATION :

ELEV=

Weather conditions: SUNNY

DRILLER: COSMEZZ s.a.r.l. LABORATORY

Location: See the location plan

Sheet No.: 1 of 1

Type of exploration: TEST PIT

EQUIPMENT : EXCAVATOR (HYUNDAI / Rolex 200W-7)

Method of sampler: SELECT SAMPLE

DEPTH, m	SCALE	STRATIGRAPHY	DESCRIPTION OF MATERIAL	SAMPLE	GROUNDWATER LEVEL@ TIME OF BORING	TESTS	REMARKS
0.00			LEAN CLAY (CL) , Reddish brown, loose and dry.	<input checked="" type="checkbox"/> SS-1 (1.0-1.50m)		see test reports	
-0.20							
-0.40							
-0.60							
-0.80							
-1.00							
-1.20							
-1.40							
-1.60							
-1.80							
-2.00		Basalt rock with cobbles, boulders and gravel very hard to excavate.					Very hard to excavate
-2.20							
-2.40							Bed rock at 2.25 m
-2.60			BOTTOM OF TEST PIT Excavation terminated @ -2.25 meters.				
-2.80							
-3.00							
-3.20							
-3.40							
-3.60							
-3.80							
-4.00							
-4.20							
-4.40							
-4.60							
-4.80							
-5.00							
-5.20							

GROUNDWATER DEPTH at TIME OF EXCAVATION, m: ----

LOGGED By: THEOBARD N.

STABILISED GROUND WATER DEPTH, m: -----



GEOTECHNICAL LABORATORY

"Certified by USACE"

TEST PIT LOG No: TP-4

Project: IMPROVEMENT OF POWER SUPPLY IN THE REPUBLIC OF DJIBOUTI

Location: NAGAD - OVERHEAD TRANSMISSION LINE ROUTE

Initial Depth : 0,00 m

N=

Date start excav : 31-DEC-2013

Time: 09H05

Final Depth : - 2,25m

E=

Date finish excav : 31-DEC-2013

Time: 09H40

SURFACE ELEVATION :

ELEV=

Weather conditions: SUNNY

DRILLER: COSMEZZ s.a.r.l. LABORATORY

Location: See the location plan

Sheet No.: 1 of 1

Type of exploration: TEST PIT

EQUIPMENT : EXCAVATOR (HYUNDAI / Rolex 200W-7)

Method of sampler: SELECT SAMPLE

DEPTH, m	SCALE	STRATIGRAPHY	DESCRIPTION OF MATERIAL	SAMPLE	GROUNDWATER LEVEL@ TIME OF BORING	TESTS	REMARKS
0.00			LEAN CLAY (CL) , Reddish brown, loose and dry.	☒ SS-1 (1.0-1.50m)		See test reports	
-0.20							
-0.40							
-0.60							
-0.80							
-1.00							
-1.20							
-1.40							
-1.60							
-1.80							
-2.00		Basalt rock with cobbles, boulders and gravel very hard to excavate.					Very hard to excavate
-2.20							
-2.40							Bed rock at 2.25 m
-2.60							
-2.80							
-3.00							
-3.20							
-3.40							
-3.60							
-3.80							
-4.00							
-4.20							
-4.40							
-4.60							
-4.80							
-5.00							
-5.20							

GROUNDWATER DEPTH at TIME OF EXCAVATION, m: ----

LOGGED By: THEOBARD N.

STABILISED GROUND WATER DEPTH, m: -----



GEOTECHNICAL LABORATORY

APPENDIX B

LABORATORY TEST RESULTS

Summary of Soil Laboratory Tests

Laboratory Test Reports:

- Sieve Analysis
- Atterberg Limits
- Moisture Content
- Proctor Test
- CBR Test
- Specific Gravity

The soil laboratory testing was assigned by us, sample preparation and testing was performed by us. We based on the soil laboratory test results provided by us to develop the recommendations included herein.



GEOTECHNICAL LABORATORY

Certified by U.S. Army Corps of Engineers

GEOTECHNICAL INVESTIGATIONS & TOPOGRAPHICAL SURVEY
Project: IMPROVEMENT OF POWER SUPPLY IN THE REPUBLIC OF DJIBOUTI
Location: PK 12 SUBSTATION, TRANSMISSION LINE AND NAGAD SWITCHING SUBSTATION

Contractor: **COSMEZZ SARL**

Client: **Yec YACHIDO ENGINEERING CO., LTD - JAPAN**

COSMEZZ SARL

Rue de Venise, Salines Ouest

B.P.1831-Djibouti-R.D.D.

Tel. +253 21556142

E-mail: cosmezz@mezzgroup.com

GEOTECHNICAL EXPLORATION

Date: **14-Dec-14**

LABORATORY TEST RESULTS SUMMARY

DATE SAMPLED	SAMPLE / BOREHOLE	SAMPLE DEPTH (m)	LAB SAMPLE NUMBER	SAMPLE TYPE	USCS CLASS.	IN SITU MOISTURE CONTENT (%)	SIEVE ANALYSIS		PROCTOR TEST		SOAKED CBR VALUE (%)	SWELL (%)	ATTERBERG LIMITS			SPECIFIC GRAVITY (g/cm ³)	NATURAL (IN PLACE) DENSITY (g/cm ³)	DRY DENSITY (g/cm ³)	OBSERVATIONS
							% FINES (< 0.075m m)	D max (mm)	MDD (kg/m ³)	OMC (%)			LL	PL	PI				
07-Dec-13	BH-1/SS-1	(0.50 - 0.60m)	SOIL 001/YEC	SS	SM	8.6	41.5	12.5	-	-	-	-	40.3	28.2	12.1	-	-	-	PK-12 SUBSTATION
07-Dec-13	BH-1/SPT-1	(1.00 - 1.45m)	SOIL 002/YEC	SPT	SM	9.1	47.0	19.0	-	-	-	-	39.4	27.1	12.3	-	-	-	PK-12 SUBSTATION
08-Dec-13	BH-2/SS-1	(0.50 - 0.60m)	SOIL 003/YEC	SS	SM	7.4	35.8	37.5	-	-	-	-	41.6	27.5	14.1	-	-	-	OVERHEAD TRANSMISSION LINE
15-Dec-13	BH-3/SPT-1	(0.45 - 1.05m)	SOIL 004/YEC	SPT	CL	6.8	82.6	2.36	-	-	-	-	37.5	27.8	9.7	-	-	-	OVERHEAD TRANSMISSION LINE
15-Dec-13	BH-3/SPT-2	(1.50 - 1.65m)	SOIL 005/YEC	SPT	ML	15.0	56.4	9.50	-	-	-	-	NV	NP	-	-	-	-	OVERHEAD TRANSMISSION LINE
26-Apr-14	BH-4/SPT-1	(0.0-0.30m)	SOIL 006/YEC	SPT	SC-SM	4.2	49.2	19.0					37.0	23.8	13.2				NAGAD TRANSMISSION LINE
26-Apr-14	BH-4/SPT-2	2.75m	SOIL 007/YEC	SPT	MH	15.8	58.0	12.5					55.2	35.7	19.5				NAGAD TRANSMISSION LINE
26-Apr-14	BH-4/SPT-3	4.0 m	SOIL 008/YEC	SPT	SW-SC	5.9	5.9	25					41.4	24.9	16.5				NAGAD TRANSMISSION LINE
31-Dec-13	TP-1/SS-1	0.15-0.75 m	SOIL 009/YEC	SS	SC	9.6	37.7	37.5	13.5	18.2	0.21		38.1	24.4	13.7				PK-12 SUBSTATION
31-Dec-13	TP-2/SS-1	0.15-0.65 m	SOIL 010/YEC	SS	SC	7.9							39.0	25.7	13.3				PK-12 SUBSTATION
31-Dec-13	TP-3/SS-2	0.00-1.50 m	SOIL 011/YEC	SS	MH		80.3	2.36	15.5	4.5	4.28		50.6	27.4	23.2				PK-12 OVERHEAD TRANSMISSION LINE
31-Dec-13	TP-3/SS-1	1.00-1.50 m	SOIL 012/YEC	SS	SW-SC	8.2													PK-12 OVERHEAD TRANSMISSION LINE
31-Dec-13	TP-3/SS-3	1.50-2.25 m	SOIL 013/YEC	SS	SM	7.8	31.2	50.0					43.4	29.6	13.8				PK-12 OVERHEAD TRANSMISSION LINE



GEOTECHNICAL LABORATORY

Certified by U.S. Army Corps of Engineers

GEOTECHNICAL INVESTIGATIONS & TOPOGRAPHICAL SURVEY

Project: **IMPROVEMENT OF POWER SUPPLY IN THE REPUBLIC OF DJIBOUTI**

Location: **PK 12 SUBSTATION, TRANSMISSION LINE AND NAGAD SWITCHING SUBSTATION**

Contractor: **COSMEZZ SARL**

Client: **Yec YACHIDO ENGINEERING CO., LTD - JAPAN**

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E-mail: cosmezz@mezzgroup.com

GEOTECHNICAL EXPLORATION

LABORATORY TEST RESULTS SUMMARY

Date: 14-Dec-14

DATE SAMPLED	SAMPLE / BOREHOLE	SAMPLE DEPTH (m)	LAB SAMPLE NUMBER	SAMPLE TYPE	USCS CLASS.	IN SITU MOISTURE CONTENT (%)	SIEVE ANALYSIS		PROCTOR TEST		SOAKED CBR VALUE (%)	ATTERBERG LIMITS			SPECIFIC GRAVITY (g/cm ³)	NATURAL (IN PLACE) DENSITY (g/cm ³)	DRY DENSITY (g/cm ³)	OBSERVATIONS
							% FINES (< 0.075m m)	D max (mm)	MDD (kg/m ³)	OMC (%)		LL	PL	PI				
11-May-14	TP-4	1.40-2.30 m	SOIL 014/YEC	BAG	MH	15.4	37.9	37.5	1533.0	22.2	6.5	60.3	42.1	18.2				NAGAD OVERHEAD TRANSMISSION LINE
		MINIMUM				4.2	5.9	2.36				37.0	23.8	9.7				
		MAXIMUM				15.8	82.6	50.00				60.3	42.1	23.2				
		AVERAGE				9.4	47.0	22.06				43.7	28.7	15.0				

Remarks: Tests performed in accordance with applicable ASTM test standards.

Reported by :

Theobard N.
Geotech, Lab Mng'r
COSMEZZ SARL



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GEOTECHNICAL INVESTIGATIONS & TOPOGRAPHICAL SURVEY

Project: IMPROVEMENT OF POWER SUPPLY IN THE REPUBLIC OF DJIBOUTI

Location: PK 12 SUBSTATION AND NAGAD SWITCHING SUBSTATION

Client: *Yec* YACHIYO ENGINEERING CO., LTD - JAPAN

Contractor : COSMEZZ SARL

COSMEZZ SARL

Rue de Venise, Salines Ouest

B.P. 1331-Djibouti-R.D.D.

E-mail: cosmezz@mezzgroup.com

NATURAL MOISTURE CONTENT (%) - ASTM D 2216

Date Tested : 18-Dec-13

Sample no : **BH-1/SPT-1**

Date sampled: 7-Dec-13

Sample Description : **Silty SAND (SM)**, with gravel, light brown, very hard

Sampled by : **THEO**

Source : **Borehole#BH-1: PK-12 SUBSTATION**

Tested by : **HOUSSEIN**

Sample Depth : **1,00 - 1,45m**

Designation		<i>unit</i>	1	
N° of container			F	
Weight of wet soil + container	A	grs	948.62	
Weight of Dry soil + container	B	grs	904.79	
Weight of container	C	grs	420.85	
Weight of water	D=A-B	grs	43.83	
Weight of Dry	E=B-C	grs	483.94	
Water content	W=D/E*100	%	9.1	

Remarks :

Reported by :

Theobard N.

Geotech. Lab. Mngr

COSMEZZ SARL



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GEOTECHNICAL INVESTIGATIONS & TOPOGRAPHICAL SURVEY
 Project: IMPROVEMENT OF POWER SUPPLY IN THE REPUBLIC OF DJIBOUTI
 Location: PK 12 SUBSTATION AND NAGAD SWITCHING SUBSTATION - DJIBOUTI
 Client: *Yec* YACHIYO ENGINEERING CO., LTD - JAPAN

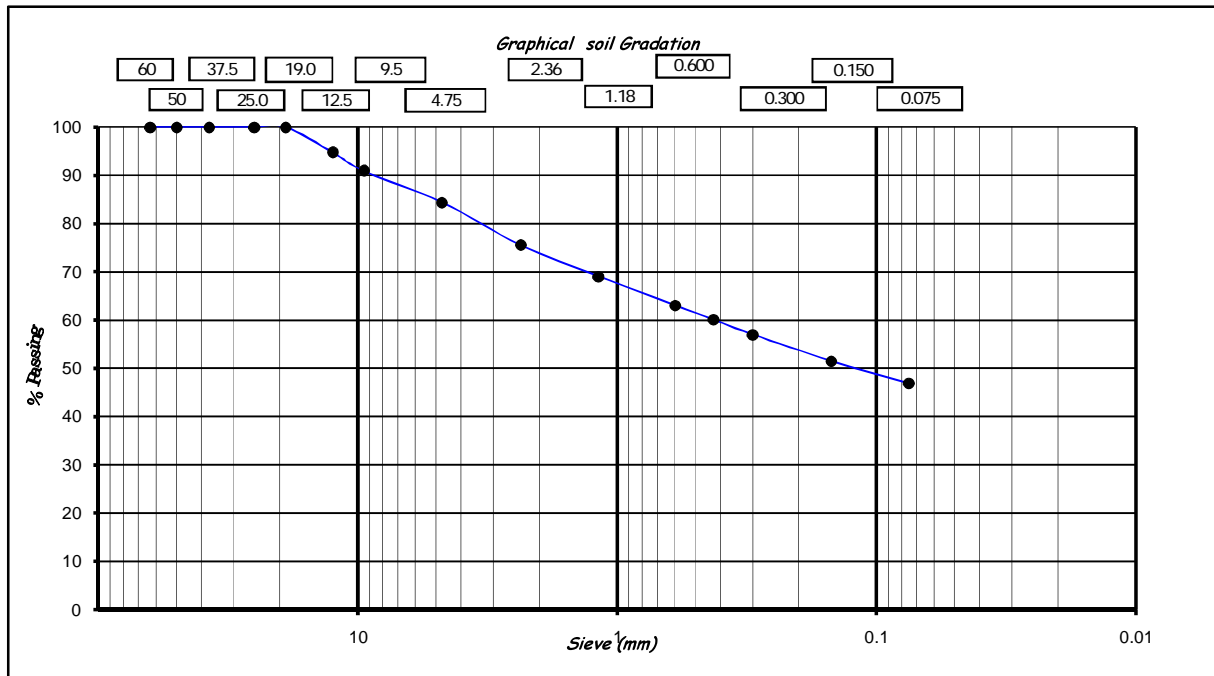
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SIEVE ANALYSIS - ASTM C117/C136

Sample N°: BH-1/SPT-1	Project No.:	Date of Sampling: 07-Dec-13
Sample source: Borehole#BH-1: PK-12 SUBSTATION		Date of Test: 21-Dec-13
Sample Description: Silty SAND (SM), with gravel, light brown, very hard		Station: PK12
Test Method: ASTM C 117 / C136		Sample Depth: 1.00 - 1.45 m
Weight (grs): 483.94		Sampled by: THEO/MOH
Tested by: ABDI		

Sieve Number	Sieve(mm)	Retained (gr)	Cumulative Retained (gr)	Cumulative Retained (%)	Passing (%)
2 1/2	63,0	0	0	0	100.0
2"	50,0	0.0	0.0	0.0	100.0
1 1/2	37,5	0.00	0.0	0.0	100.0
1"	25	0.00	0.0	0.0	100.0
3/4	19	0.00	0.0	0.0	100.0
1/2	12,5	25.50	25.5	5.3	94.7
3/8	9,5	18.38	43.9	9.1	90.9
No.4	4,75	31.56	75.4	15.6	84.4
No.8	2,36	42.56	118.0	24.4	75.6
No.16	1,18	31.63	149.6	30.9	69.1
No.30	0,600	28.84	178.5	36.9	63.1
No.40	0,425	14.42	192.9	39.9	60.1
No.50	0,300	15.11	208.0	43.0	57.0
No.100	0,150	26.36	234.4	48.4	51.6
No.200	0,075	22.34	256.7	53.0	47.0
Can	0				



Remarks : Gravel: 15.6%
Sand: 37.5%
Fines: 47.0%

Submitted By :

Theobard N.

GEOTECH. LAB. MNGR
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GEOTECHNICAL INVESTIGATIONS & TOPOGRAPHICAL SURVEY

Project: IMPROVEMENT OF POWER SUPPLY IN THE REPUBLIC OF DJIBOUTI

Location: PK 12 SUBSTATION AND NAGAD SWITCHING SUBSTATION

Client: **Yec** YACHIYO ENGINEERING CO., LTD - JAPAN

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LIQUID LIMIT, PLASTIC LIMIT, AND PLASTICITY INDEX - ASTM D 4318

Date Tested : **17-Dec-13**

Sample no : **BH-1/SPT-1**

Date sampled : **7-Dec-13**

Sample Description : **Silty SAND (SM)**, with gravel, light brown, very hard

Sample Depth: **1.00 - 1.45 m**

Source : **Borehole#BH-1: PK-12 SUBSTATION**

Tested by: **MANZI**

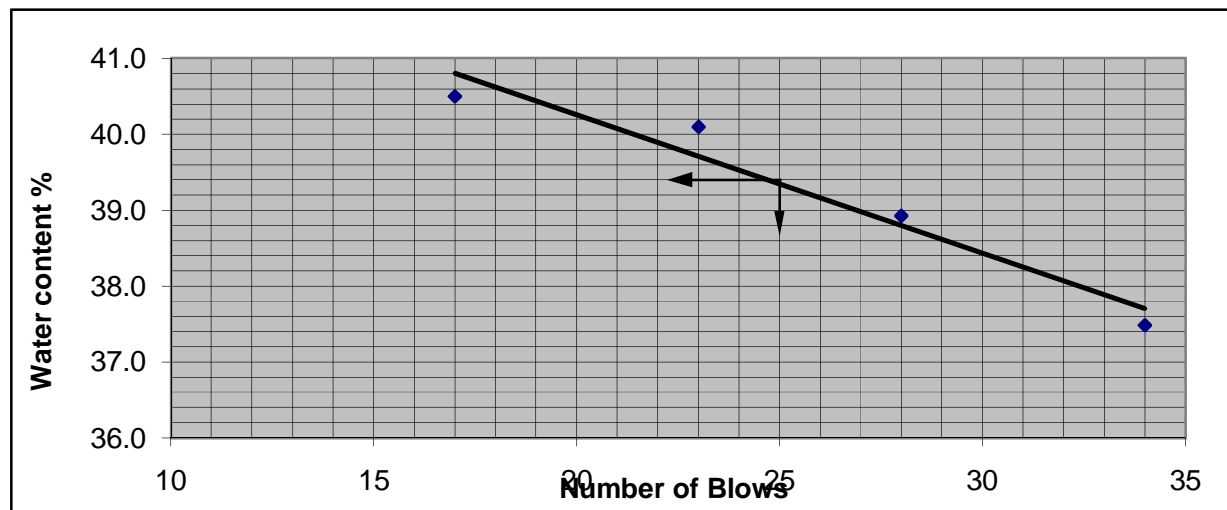
Sampled by: **THEO / MOH**

LL: 39.4

PL: 27.1

PI: 12.3

LIQUID LIMIT (LL)					PLASTIC LIMIT (PL)	
No of Blows	17	23	28	34	Test n°1	Test n°2
N° of container	E	K	D	G	A	Q
Weight of wet soil + container(A)	42.10	46.34	43.00	46.17	40.84	41.24
Weight of Dry soil + container(B)	38.56	42.25	39.31	42.29	38.97	39.32
Weight of container©	29.82	32.05	29.83	31.94	32.02	32.27
Weight of water D=A-B	3.54	4.09	3.69	3.88	1.87	1.92
Weight of Dry soil (E)=(B-C)	8.74	10.2	9.48	10.35	6.95	7.05
Water content (W)=D/E*100	40.5	40.1	38.9	37.5	26.9	27.2
LL @25Blows and Average PL	39.4				27.1	



Remarks: _____

Submitted By _____

Theobard N.

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NATURAL MOISTURE CONTENT (%) - ASTM D 2216

Date Tested : 18-Dec-13

Sample no : BH-1/SS-1

Date sampled: 7-Dec-13

Sample Description : **Silty SAND** (SM), with gravel, light brown, very hard

Sampled by : THEO

Source : **Borehole#BH-1: PK-12 SUBSTATION**

Tested by : HOUSSEIN

Sample Depth : **0.50 - 0.60m**

Designation		<i>unit</i>	1	
N° of container			P	
Weight of wet soil + container	A	grs	903.48	
Weight of Dry soil + container	B	grs	869.25	
Weight of container	C	grs	473.15	
Weight of water	D=A-B	grs	34.23	
Weight of Dry	E=B-C	grs	396.1	
Water content	W=D/E*100	%	8.6	

Remarks :

Submitted by :

Theobard N.

Geotech. Lab. Mngr

COSMEZZ SARL



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GEOTECHNICAL INVESTIGATIONS & TOPOGRAPHICAL SURVEY

Project: IMPROVEMENT OF POWER SUPPLY IN THE REPUBLIC OF DJIBOUTI
Location: PK 12 SUBSTATION AND NAGAD SWITCHING SUBSTATION - DJIBOUTI
Client: Yec YACHIYO ENGINEERING CO., LTD - JAPAN

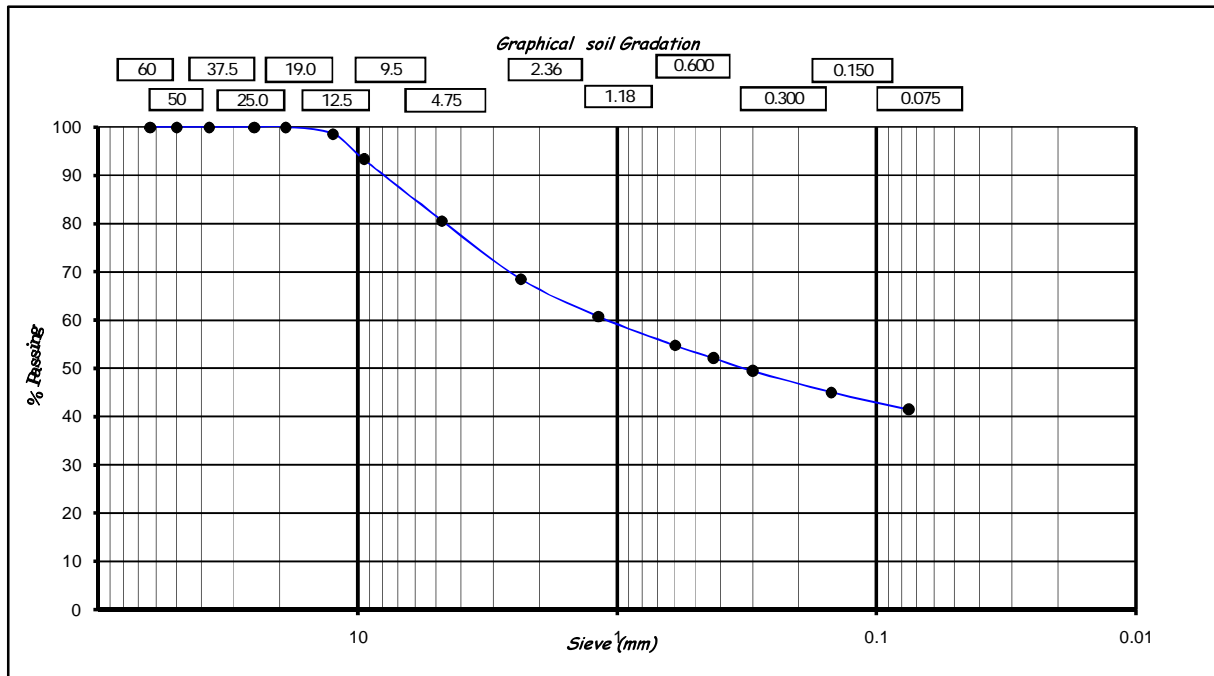
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SIEVE ANALYSIS - ASTM C117/C136

Sample N°: BH-1/SS-1 Project No.: Date of Sampling: 07-Dec-13
Sample source: Borehole #P1: PK-12 SUBSTATION Date of Test: 18-Dec-13
Sample Description: Silty SAND (SM), with gravel, light brown, very hard Station: PK12
Test Method: ASTM C 117 / C136 Sample Depth: 0.50 - 0.60 m
Weight (grs): 396.10 Sampled by: THEO/HOUSSEIN
Tested by: HOUSSEIN

Table with 6 columns: Sieve Number, Sieve(mm), Retained (gr), Cumulative Retained (gr), Cumulative Retained (%), Passing (%). Rows include sieve sizes from 2 1/2 down to Can.



Remarks : Gravel: 19.4%
Sand: 39.2%
Submitted By : Fines: 41.5%

Handwritten signature of Theobard N.

Theobard N.
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GEOTECHNICAL INVESTIGATIONS & TOPOGRAPHICAL SURVEY

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Location: PK 12 SUBSTATION AND NAGAD SWITCHING SUBSTATION

Client: **Yec** YACHIYO ENGINEERING CO., LTD - JAPAN

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LIQUID LIMIT, PLASTIC LIMIT, AND PLASTICITY INDEX - ASTM D 4318

Date Tested : **17-Dec-13**

Sample no : **BH-1/SS-1**

Date sampled : **7-Dec-13**

Sample Description : **Silty SAND (SM)**, with gravel, light brown, very hard

Sample Depth: **0.50 - 0.60 m**

Source : **Borehole#BH-1: PK-12 SUBSTATION**

Tested by: **MANZI**

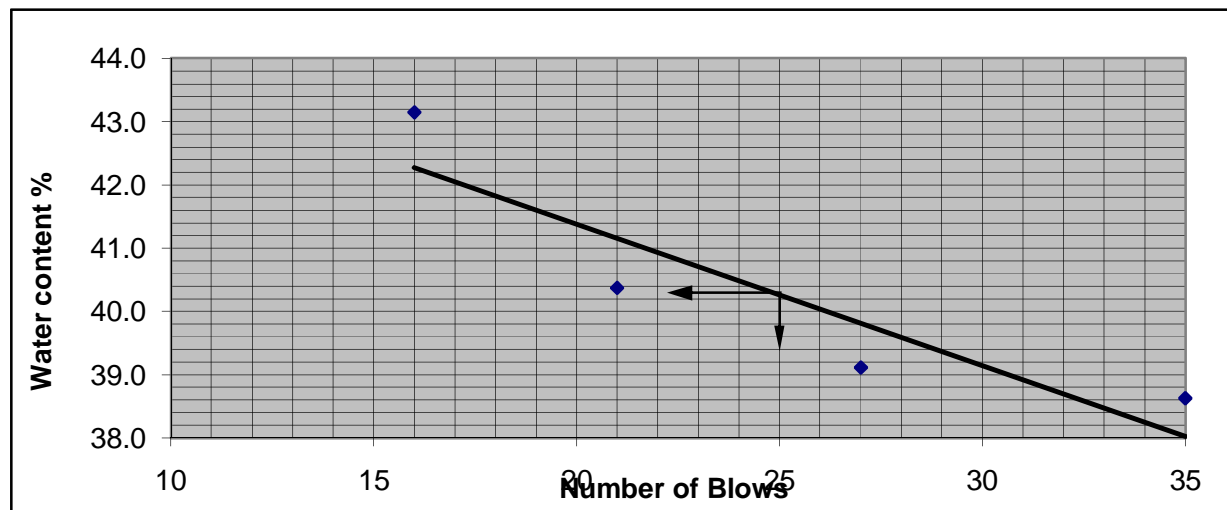
Sampled by: **THEO / MOH**

LL: 40.3

PL: 28.2

PI: 12.1

LIQUID LIMIT (LL)					PLASTIC LIMIT (PL)	
No of Blows	16	21	27	35	Test n°1	Test n°2
N° of container	U	N	R	11	12	13
Weight of wet soil + container(A)	40.43	46.66	45.22	47.61	39.38	40.01
Weight of Dry soil + container(B)	37.88	42.51	41.43	43.26	37.7	38.21
Weight of container©	31.97	32.23	31.74	32.00	31.74	31.81
Weight of water D=A-B	2.55	4.15	3.79	4.35	1.68	1.8
Weight of Dry soil (E)=(B-C)	5.91	10.28	9.69	11.26	5.96	6.4
Water content (W)=D/E*100	43.1	40.4	39.1	38.6	28.2	28.1
LL @25Blows and Average PL	40.3				28.2	



Remarks: _____

Submitted By _____

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GEOTECHNICAL INVESTIGATIONS & TOPOGRAPHICAL SURVEY

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Location: PK 12 SUBSTATION AND NAGAD SWITCHING SUBSTATION

Client: *Yec* YACHIYO ENGINEERING CO., LTD - JAPAN

Contractor : COSMEZZ SARL

COSMEZZ SARL

Rue de Venise, Salines Ouest

B.P. 1331-Djibouti-R.D.D.

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NATURAL MOISTURE CONTENT (%) - ASTM D 2216

Date Tested : 18-Dec-13

Sample no : BH-2/SS-1

Date sampled: 8-Dec-13

Sample Description : *Silty SAND (SM), with gravel, light brown, very hard*

Sampled by : THEO

Source : Borehole#BH-2: PK-12 SUBSTATION

Tested by : HOUSSEIN

Sample Depth : 0.50 - 0.60m

Designation		<i>unit</i>	1	
N° of container			X	
Weight of wet soil + container	A	<i>grs</i>	966.66	
Weight of Dry soil + container	B	<i>grs</i>	932.94	
Weight of container	C	<i>grs</i>	479.83	
Weight of water	D=A-B	<i>grs</i>	33.72	
Weight of Dry	E=B-C	<i>grs</i>	453.11	
Water content	W=D/E*100	%	7.4	

Remarks :

Submitted by :

Theobard N.

Geotech. Lab. Mngr

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Project: IMPROVEMENT OF POWER SUPPLY IN THE REPUBLIC OF DJIBOUTI
Location: PK 12 SUBSTATION AND NAGAD SWITCHING SUBSTATION - DJIBOUTI
Client: Yec YACHIYO ENGINEERING CO., LTD - JAPAN

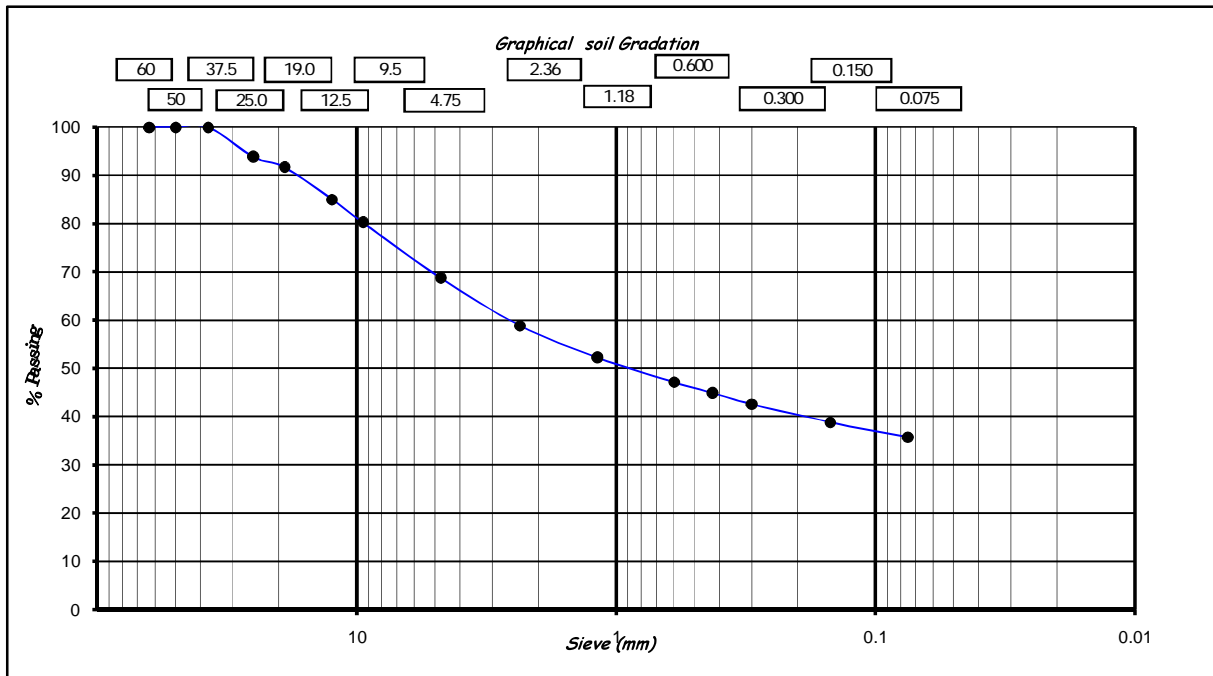
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SIEVE ANALYSIS - ASTM C117/C136

Sample N°: BH-2/SS-1 Project No.: Date of Sampling: 08-Dec-13
Sample source: Borehole#BH-2: PK-12 SUBSTATION Date of Test: 21-Dec-13
Sample Description: Silty SAND (SM), with gravel, light brown, very hard Station: PK12
Test Method: ASTM C 117 / C136 Sample Depth: 0.50 - 0.60 m
Weight (grs): 453.11 Sampled by: THEO/MOH
Tested by: ABDI

Table with 6 columns: Sieve Number, Sieve(mm), Retained (gr), Cumulative Retained (gr), Cumulative Retained (%), Passing (%). Rows include sieve sizes from 2 1/2 to Can.



Remarks : Gravel: 31.3%
Sand: 32.9%
Submitted By : Fines: 35.8%

Handwritten signature of Theobard N.

Theobard N.
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GEOTECHNICAL INVESTIGATIONS & TOPOGRAPHICAL SURVEY

Project: IMPROVEMENT OF POWER SUPPLY IN THE
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LIQUID LIMIT, PLASTIC LIMIT, AND PLASTICITY INDEX - ASTM D 4318

Date Tested : **17-Dec-13**

Sample no : **BH-2/SS-1**

Date sampled : **8-Dec-13**

Sample Description : **Silty SAND (SM)**, with gravel, light brown, very hard

Sample Depth: **0.50 - 0.60 m**

Source : **Borehole#BH-2: PK-12 SUBSTATION**

Tested by: **MANZI**

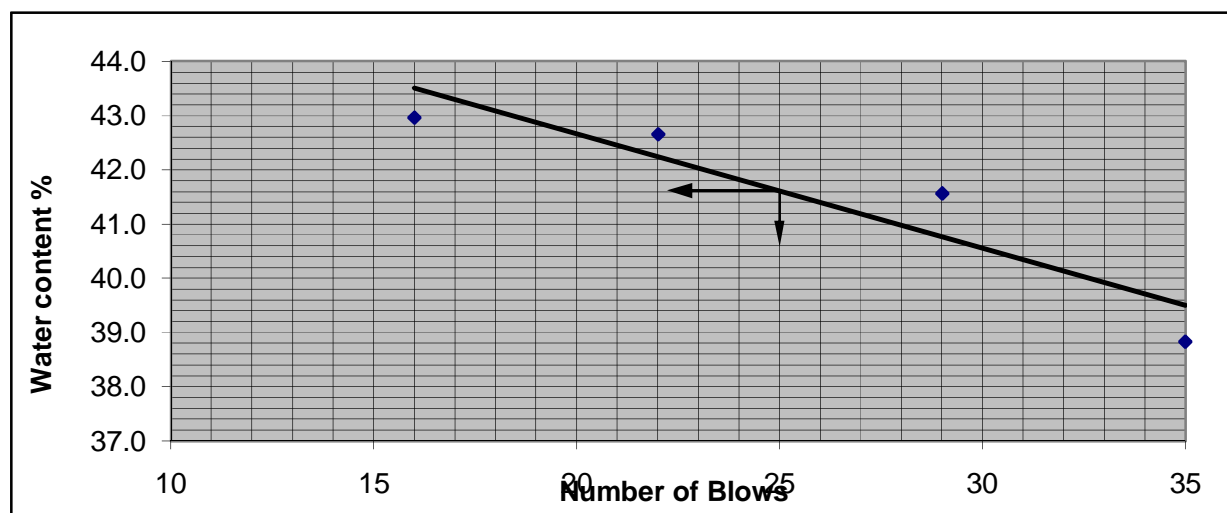
Sampled by: **THEO / MOH**

LL: 41.6

PL: 27.5

PI: 14.1

LIQUID LIMIT (LL)					PLASTIC LIMIT (PL)	
No of Blows	16	22	29	35	Test n°1	Test n°2
N° of container	A1	O	10	Y	W	V
Weight of wet soil + container(A)	41.47	44.34	44.03	48.58	39.15	39.78
Weight of Dry soil + container(B)	38.60	40.62	40.41	43.94	37.59	38.05
Weight of container©	31.92	31.9	31.70	31.99	31.91	31.75
Weight of water D=A-B	2.87	3.72	3.62	4.64	1.56	1.73
Weight of Dry soil (E)=(B-C)	6.68	8.72	8.71	11.95	5.68	6.3
Water content (W)=D/E*100	43.0	42.7	41.6	38.8	27.5	27.5
LL @25Blows and Average PL	41.6				27.5	



Remarks: _____

Submitted By _____

Theobard N.

Theobard N.

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Contractor : COSMEZZ SARL

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Rue de Venise, Salines Ouest

B.P. 1331-Djibouti-R.D.D.

E-mail: cosmezz@mezzgroup.com

NATURAL MOISTURE CONTENT (%) - ASTM D 2216

Date Tested : 18-Dec-13

Sample no : **BH-3/SPT1**

Date sampled: 15-Dec-13

Sample Description : **LEAN CLAY (CL)**, with sand, reddish, Loose and dry

Sampled by : **THEO**

Source : **Borehole#BH-3: PK-12 SUBSTATION**

Tested by : **HOUSSEIN**

Sample Depth : **0,45 - 1,05m**

Designation		<i>unit</i>	1	
N° of container			Z	
Weight of wet soil + container	A	grs	659.63	
Weight of Dry soil + container	B	grs	632	
Weight of container	C	grs	226.02	
Weight of water	D=A-B	grs	27.63	
Weight of Dry	E=B-C	grs	405.98	
Water content	W=D/E*100	%	6.8	

Remarks :

Submitted by :

Theobard N.

Geotech. Lab. Mngr
COSMEZZ SARL



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GEOTECHNICAL INVESTIGATIONS & TOPOGRAPHICAL SURVEY
 Project: IMPROVEMENT OF POWER SUPPLY IN THE REPUBLIC OF DJIBOUTI
 Location: PK 12 SUBSTATION AND TRANSMISSION LINE ROUTE
 Client: *Yec* YACHIYO ENGINEERING CO., LTD - JAPAN

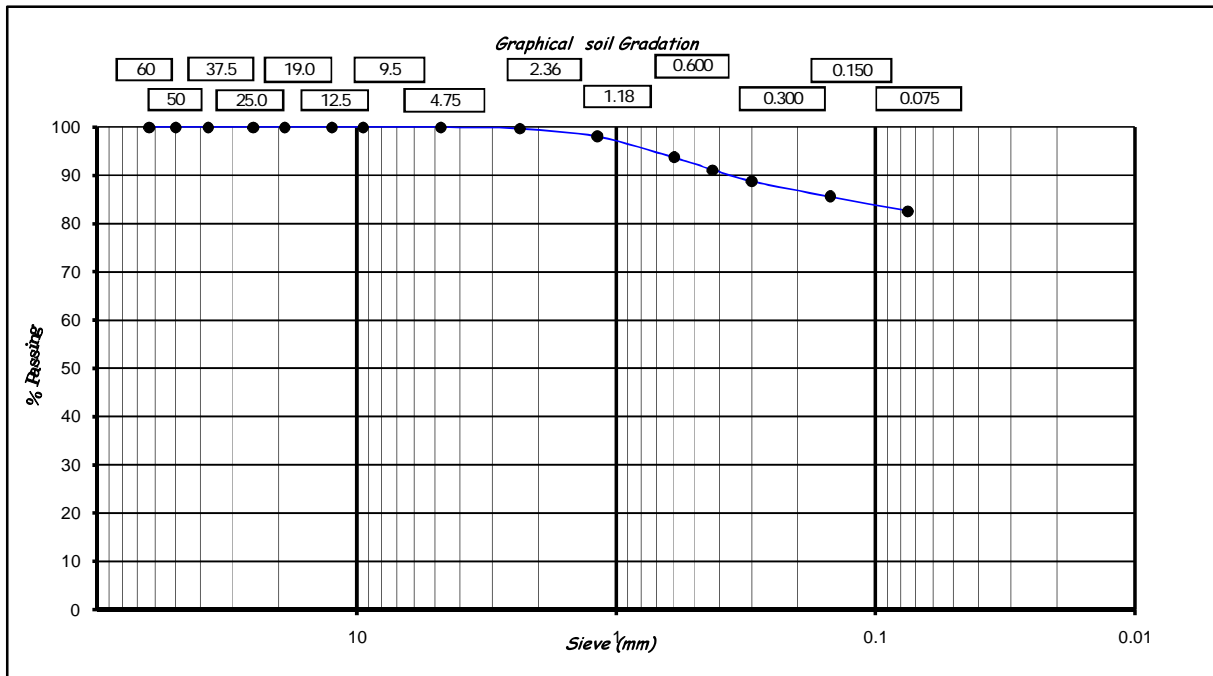
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SIEVE ANALYSIS - ASTM C117/C136

Sample N°: BH-3-SPT1	Project No.:	Date of Sampling: 15-Dec-13
Sample source: Borehole#BH-3: PK-12 TRANSMISSION LINE		Date of Test: 21-Dec-13
Sample Description: LEAN CLAY (CL), with sand, dry, reddish		Station: PK12
Test Method: ASTM C 117 / C136		Sample Depth: 0.45 - 1.05 m
Weight (grs): 405.98		Sampled by: THEO/MOH
Tested by: ABDI		

Sieve Number	Sieve(mm)	Retained (gr)	Cumulative Retained (gr)	Cumulative Retained (%)	Passing (%)
2 1/2	63,0	0	0	0	100.0
2"	50,0	0.0	0.0	0.0	100.0
1 1/2	37,5	0.00	0.0	0.0	100.0
1"	25	0.00	0.0	0.0	100.0
3/4	19	0.00	0.0	0.0	100.0
1/2	12,5	0.00	0.0	0.0	100.0
3/8	9,5	0.00	0.0	0.0	100.0
No.4	4,75	0.00	0.0	0.0	100.0
No.8	2,36	1.17	1.2	0.3	99.7
No.16	1,18	6.80	8.0	2.0	98.0
No.30	0,600	17.54	25.5	6.3	93.7
No.40	0,425	10.52	36.0	8.9	91.1
No.50	0,300	9.42	45.5	11.2	88.8
No.100	0,150	13.07	58.5	14.4	85.6
No.200	0,075	11.99	70.5	17.4	82.6
Can	0				



Remarks : Gravel: 0.0%
Sand: 17.4%
Fines: 82.6%

Submitted By :

Theobard N.

GEOTECH. LAB. MNGR
COSMEZZ SARL



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LIQUID LIMIT, PLASTIC LIMIT, AND PLASTICITY INDEX - ASTM D 4318

Date Tested : **21-Dec-13**

Sample no : **BH-3/SPT1**

Date sampled : **15-Dec-13**

Sample Description : **LEAN CLAY (CL)**, with sand, dry, reddish

Sample Depth: **0.45 - 1.05 m**

Source : **Borehole#BH-3: PK-12 TRANSMISSION LINE**

Tested by: **MANZI**

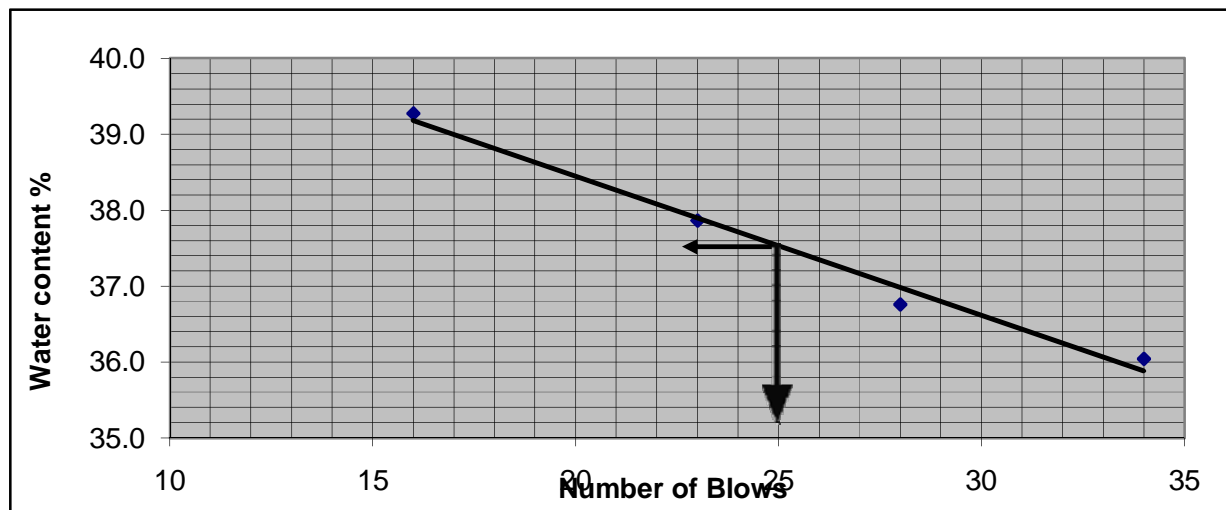
Sampled by: **THEO / MOH**

LL: 37.5

PL: 27.8

PI: 9.7

LIQUID LIMIT (LL)					PLASTIC LIMIT (PL)	
No of Blows	16	23	28	34	Test n°1	Test n°2
N° of container	T	S	X	J	F	N
Weight of wet soil + container(A)	51.51	56.87	55.64	48.61	37.7	40.44
Weight of Dry soil + container(B)	46.02	50.16	49.27	44.22	36.16	38.64
Weight of container©	32.04	32.44	31.94	32.04	30.65	32.14
Weight of water D=A-B	5.49	6.71	6.37	4.39	1.54	1.8
Weight of Dry soil (E)=(B-C)	13.98	17.72	17.33	12.18	5.51	6.5
Water content (W)=D/E*100	39.3	37.9	36.8	36.0	27.9	27.7
LL @25Blows and Average PL	37.5				27.8	



Remarks: _____

Submitted By _____

Theobard N.

GEOTECHNICAL LAB. MNGR

COSMEZZ SARL



Geotechnical Laboratory

Certified by USACE

GEOTECHNICAL INVESTIGATIONS & TOPOGRAPHICAL SURVEY

Project: IMPROVEMENT OF POWER SUPPLY IN THE REPUBLIC OF DJIBOUTI

Location: PK 12 SUBSTATION AND NAGAD SWITCHING SUBSTATION

Client: *Yec* YACHIYO ENGINEERING CO., LTD - JAPAN

Contractor : COSMEZZ SARL

COSMEZZ SARL

Rue de Venise, Salines Ouest

B.P. 1331-Djibouti-R.D.D.

E-mail: cosmezz@mezzgroup.com

NATURAL MOISTURE CONTENT (%) - ASTM D 2216

Date Tested : 18-Dec-13

Sample no : BH-3/SPT2

Date sampled: 15-Dec-13

Sample Description : *Sandy SILT(ML), Brown*

Sampled by : THEO

Source : Borehole#BH-3: PK-12 SUBSTATION

Tested by : HOUSSEIN

Sample Depth : 1,50 - 1,65m

Designation		<i>unit</i>	1	
N° of container			A	
Weight of wet soil + container	A	<i>grs</i>	433.3	
Weight of Dry soil + container	B	<i>grs</i>	406.23	
Weight of container	C	<i>grs</i>	225.48	
Weight of water	D=A-B	<i>grs</i>	27.07	
Weight of Dry	E=B-C	<i>grs</i>	180.75	
Water content	W=D/E*100	%	15.0	

Remarks :

Submitted by :

Theobard N.

Geotech. Lab. Mngr

COSMEZZ SARL



GEOTECHNICAL LABORATORY

Certified by U.S. Army Corps of Engineers

GEOTECHNICAL INVESTIGATIONS & TOPOGRAPHICAL SURVEY

Project: IMPROVEMENT OF POWER SUPPLY IN THE REPUBLIC OF DJIBOUTI
Location: PK 12 SUBSTATION AND NAGAD SWITCHING SUBSTATION - DJIBOUTI
Client: Yec YACHIYO ENGINEERING CO., LTD - JAPAN

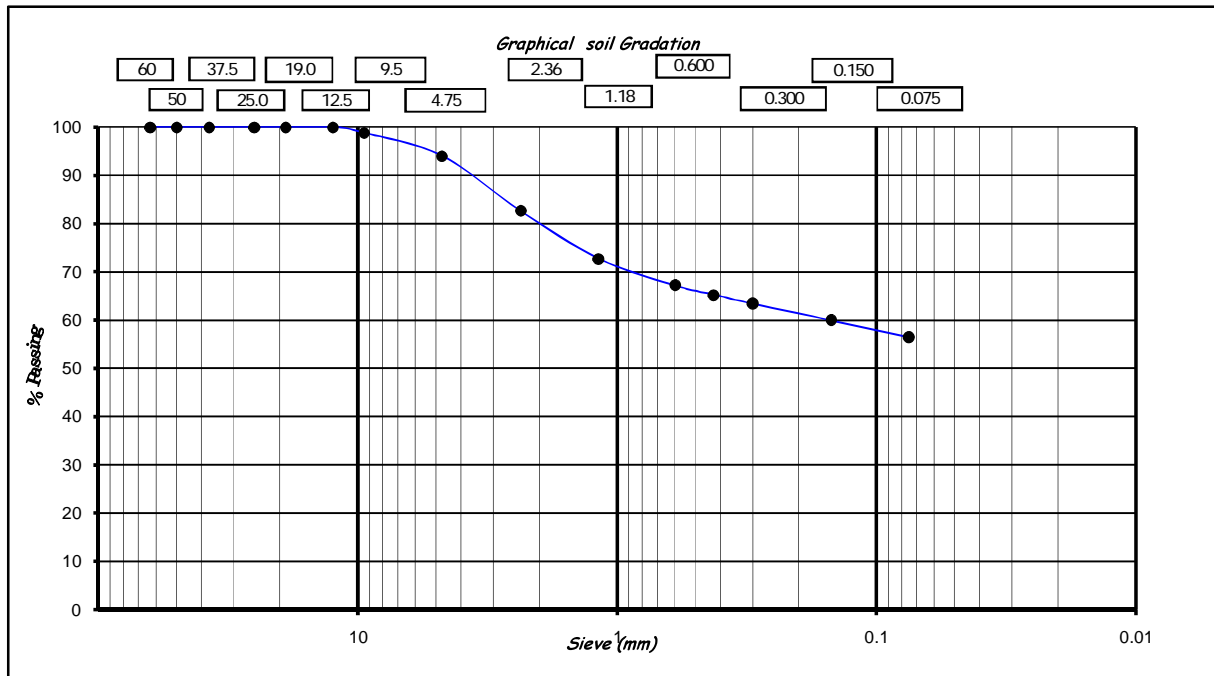
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E-mail: cosmezz@mezzgroup.com

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SIEVE ANALYSIS - ASTM C117/C136

Table with 4 columns: Field Name, Value, Field Name, Value. Includes Sample No., Project No., Date of Sampling, Sample source, Date of Test, Sample Description, Station, Test Method, Sample Depth, Weight (grs), Sampled by, and Tested by.

Table with 6 columns: Sieve Number, Sieve(mm), Retained (gr), Cumulative Retained (gr), Cumulative Retained (%), Passing (%). Lists sieve sizes from 2 1/2 down to Can with corresponding retained and passing percentages.



Remarks : Gravel: 6.0%
Sand: 37.6%
Submitted By : Fines: 56.4%

Handwritten signature of Theobard N.

Theobard N.
GEOTECH. LAB. MNGR
COSMEZZ SARL



Geotechnical Laboratory
Certified by USACE

GEOTECHNICAL INVESTIGATIONS & TOPOGRAPHICAL SURVEY
Project: **IMPROVEMENT OF POWER SUPPLY IN THE REPUBLIC OF DJIBOUTI**
Location: PK 12 SUBSTATION AND NAGAD SWITCHING SUBSTATION
Client: *Yec* YACHIYO ENGINEERING CO, LTD - JAPAN

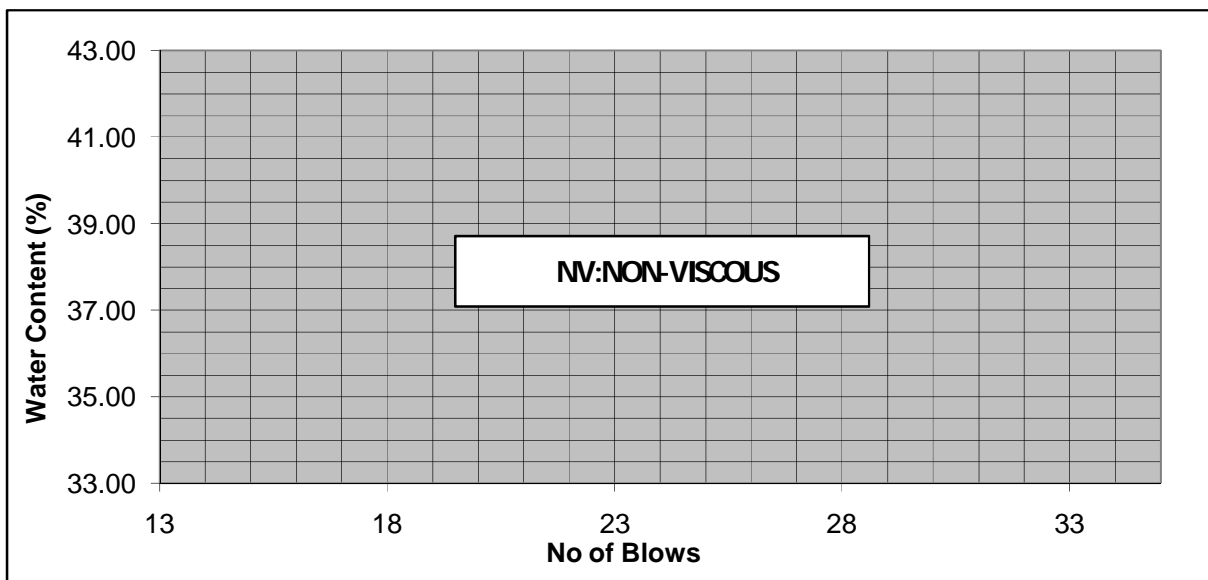
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E-mail: cosmezz@mezzgroup.com

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LIQUID LIMIT, PLASTIC LIMIT, AND PLASTICITY INDEX - ASTM D 4318

Date Tested : **21-Dec-13** Sample no : **BH-3/SPT-2**
Date sampled : **15-Dec-13** Sample Description : **Sandy SILT(ML), Brown**
Sample Depth: **1.50 - 1.65 m** Source : **Borehole#BH-3: PK-12 TRANSMISSION LINE**
Tested by: **HOUSSEIN** Sampled by: **THEO**
LL: 0.0 PL: 0.0 PI: 0.0

LIQUID LIMIT				PLASTIC LIMIT	
No of Blows				Test n°1	Test n°2
N° of container					
Weight of wet soil + container					
Weight of Dry soil + container	NV:NON-VISCOUS			NP:NON-PLASTIC	
Weight of container					
Weight of water					
Weight of Dry					
Water content					
Average					



Remarks: **Nonplastic material**

Submitted By :

Theobard N.
GEOTECHNICAL LAB. MNGR
COSMEZZ SARL



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GEOTECHNICAL INVESTIGATIONS & TOPOGRAPHICAL SURVEY

Project: IMPROVEMENT OF POWER SUPPLY IN THE REPUBLIC OF DJIBOUTI

Location: PK 12 SUBSTATION AND NAGAD SWITCHING SUBSTATION

Client: *Yec* YACHIYO ENGINEERING CO., LTD - JAPAN

Contractor : COSMEZZ SARL

COSMEZZ SARL

Rue de Venise, Salines Ouest

B.P. 1331-Djibouti-R.D.D.

E-mail: cosmezz@mezzgroup.com

NATURAL MOISTURE CONTENT (%) - ASTM D 2216

Date Tested : 27-Apr-14

Sample no : **BH4/SPT1**

Date sampled: 26-Apr-14

Sample Description : **SILTY, CLAYEY SAND (SC-SM)**, with trace of gravel, dry, pinkish

Sampled by : **THEO**

Source : **Borehole#BH4:NAGAD TRASSMISSION LINE**

Tested by : **THEO**

Sample Depth : **0.0 - 0.30m**

Designation		<i>unit</i>	1	
N° of container			X	
Weight of wet soil + container	A	grs	456.88	
Weight of Dry soil + container	B	grs	444.66	
Weight of container	C	grs	150.22	
Weight of water	D=A-B	grs	12.22	
Weight of Dry	E=B-C	grs	294.44	
Water content	W=D/E*100	%	4.2	

Remarks :

Submitted by :

Theobard N.

Geotech. Lab. Mngr

COSMEZZ SARL



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GEOTECHNICAL INVESTIGATIONS & TOPOGRAPHICAL SURVEY

Project: IMPROVEMENT OF POWER SUPPLY IN THE REPUBLIC OF DJIBOUTI
Location: PK 12 SUBSTATION AND NAGAD SWITCHING SUBSTATION - DJIBOUTI
Client: Yec YACHIYO ENGINEERING CO., LTD - JAPAN

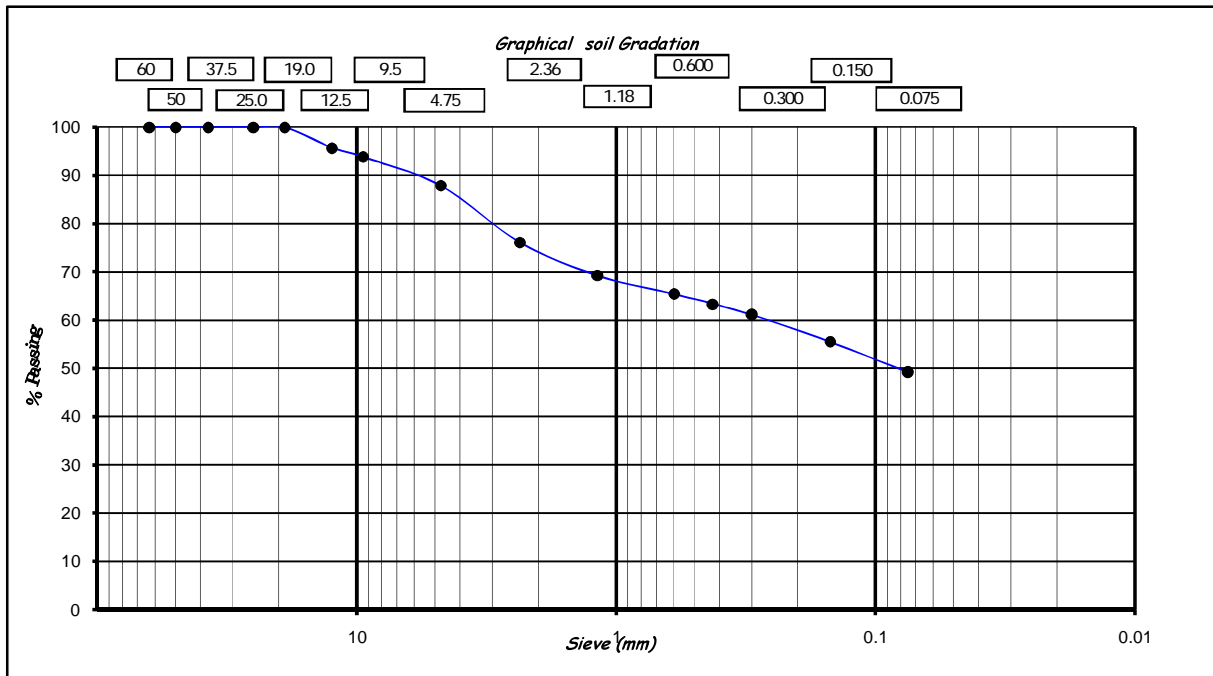
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SIEVE ANALYSIS - ASTM C117/C136

Sample N°: BH4-SPT1 Project No.: Date of Sampling: 26-Apr-14
Sample source: Borehole BH4: NAGAD TRANSMISSION LINE Date of Test: 28-Apr-14
Sample Description: SILTY, CLAYEY SAND (SC-SM), with little gravel, dry, pinkish Station: NAGAD
Test Method: ASTM C 117 / C136 Sample Depth: 0.00 - 0.30 m
Weight (grs): 294.44 Sampled by: THEO
Tested by: SIMANE

Table with 6 columns: Sieve Number, Sieve(mm), Retained (gr), Cumulative Retained (gr), Cumulative Retained (%), Passing (%). Rows include sieve sizes from 2 1/2 down to Can.



Remarks : Gravel: 12.1%
Sand: 38.7%
Submitted By : Fines: 49.2%

Handwritten signature of Theobard N.

Theobard N.
GEOTECH. LAB. MNGR
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Geotechnical Laboratory
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GEOTECHNICAL INVESTIGATIONS & TOPOGRAPHICAL SURVEY

Project: IMPROVEMENT OF POWER SUPPLY IN THE
REPUBLIC OF DJIBOUTI

Location: PK 12 SUBSTATION AND NAGAD SWITCHING SUBSTATION

Client: *Yec* YACHIYO ENGINEERING CO., LTD - JAPAN

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E-mail: cosmezz@mezzgroup.com

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LIQUID LIMIT, PLASTIC LIMIT, AND PLASTICITY INDEX - ASTM D 4318

Date Tested : **29-Apr-14**

Sample no : **BH-4/SPT-1**

Date sampled : **26-Apr-14**

Sample Description : **SILTY, CLAYEY SAND (SC-SM)**, with little gravel, dry, pinkish

Sample Depth: **0.00 - 0.30 m**

Source : **Borehole#BH-4: NAGAD TRANSMISSION LINE**

Tested by: **HOUSSEIN**

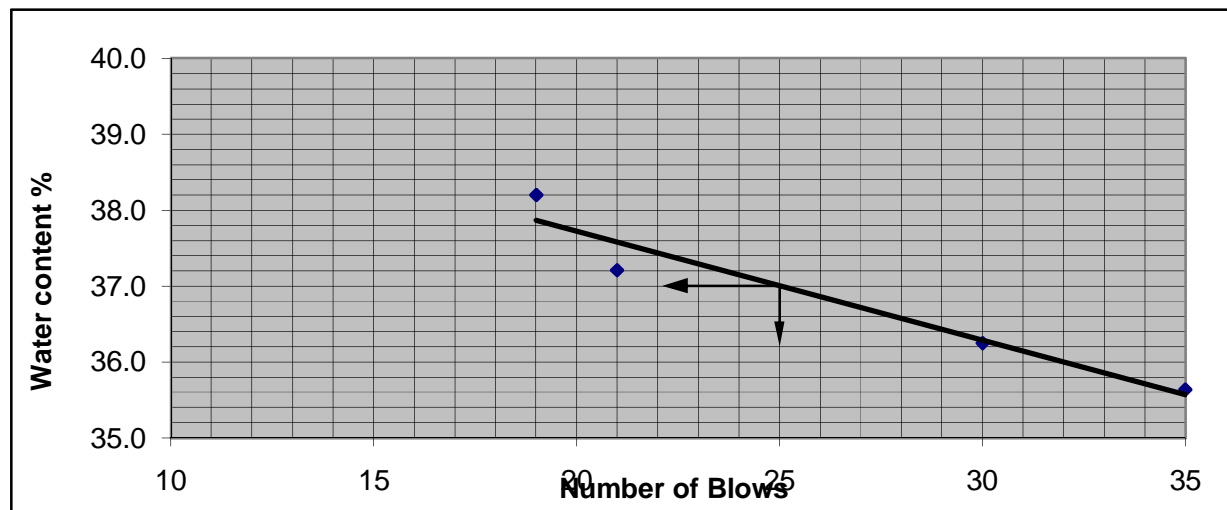
Sampled by: **THEO / MOH**

LL: 37.0

PL: 23.8

PI: 13.2

LIQUID LIMIT (LL)					PLASTIC LIMIT (PL)	
No of Blows	19	21	30	35	Test n°1	Test n°2
N° of container	20	21	22	23	24	25
Weight of wet soil + container(A)	42.91	46.26	41.95	45.42	36.72	38.01
Weight of Dry soil + container(B)	39.85	42.39	39.3	41.91	35.63	37.06
Weight of container©	31.84	31.99	31.99	32.06	30.90	33.18
Weight of water D=A-B	3.06	3.87	2.65	3.51	1.09	0.95
Weight of Dry soil (E)=(B-C)	8.01	10.40	7.31	9.85	4.73	3.88
Water content (W)=D/E*100	38.2	37.2	36.3	35.6	23.0	24.5
LL @25Blows and Average PL	37.0				23.8	



Remarks: _____

Submitted By _____

Theobard N.

Theobard N.

GEOTECHNICAL LAB. MNGR

COSMEZZ SARL



Geotechnical Laboratory

Project : IMPROVEMENT OF POWER SUPPLY IN THE
REPUBLIC OF DJIBOUTI
Location: PK 12 SUBSTATION AND NAGAD SWITCHING
SUBSTATION - DJIBOUTI
Contract #:
Client: Yec YACHIVO ENGINEERING CO. LTD. - JAPAN

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E-mail: cosmezz@mezzgroup.com

SPECIFIC GRAVITY OF SOIL SOLIDS (ASTM D 854) LABORATORY DATA SHEET

DATE TESTED : 25-May-14 TESTED BY : HOUSSEIN D.
DATE SAMPLED : 26-Apr-14 SAMPLED BY : COSMEZZ SARL LAB
SAMPLE NUMBER : SS-1 SAMPLE DEPTH : - 2.0m
SAMPLE SOURCE : BH-4
SAMPLE DESCRIPTION: Sandy LEAN CLAY (CL), light brown, dry, very stiff

Specimen number	1	
Pycnometer bottle number	SM	
M ₀ =Mass of dry soil (grams)	48.28	
M _p =Mass of empty, clean pycnometer (grams)	438.7	
M _{ps} =Mass of empty, clean pycnometer + dry soil (grams)	486.98	
M _b =Mass of pycnometer + dry soil + water (grams)	1174	
M _a =Mass of pycnometer + water (grams)	1144.29	
Specific Gravity of soil solids (G _s) g/cm ³	2.600	
Water temperature (°C)	20.5	
Correction factor (K)	0.9981	
Specific Gravity of soil solids at 20°C (G _{s20})	2.595	

Equation and Calculations:

$$G_s = \frac{M_0}{M_0 + (M_a - M_b)}$$

$$G_{s20} = G_s \cdot K$$

Submitted by :

THEOBARD N.

Geotech. Lab. Mngr

COSMEZZ SARL



Geotechnical Laboratory

Certified by USACE

GEOTECHNICAL INVESTIGATIONS & TOPOGRAPHICAL SURVEY

Project: IMPROVEMENT OF POWER SUPPLY IN THE REPUBLIC OF DJIBOUTI

Location: PK 12 SUBSTATION AND NAGAD SWITCHING SUBSTATION

Client: *Yec* YACHIYO ENGINEERING CO., LTD - JAPAN

Contractor : COSMEZZ SARL

COSMEZZ SARL

Rue de Venise, Salines Ouest

B.P. 1331-Djibouti-R.D.D.

E-mail: cosmezz@mezzgroup.com

NATURAL MOISTURE CONTENT (%) - ASTM D 2216

Date Tested : 27-Apr-14

Sample no : BH-4/SPT-2

Date sampled: 26-Apr-14

Sample Description : Sandy elastic silt (MH), with gravel

Sampled by : THEO

Source : Borehole#BH4:NAGAD

Tested by : THEO

TRASSMISSION LINE

Sample Depth : 2.75 m

Designation		<i>unit</i>	1	
N° of container			z	
Weight of wet soil + container	A	grs	554.47	
Weight of Dry soil + container	B	grs	530.06	
Weight of container	C	grs	375.45	
Weight of water	D=A-B	grs	24.41	
Weight of Dry	E=B-C	grs	154.61	
Water content	W=D/E*100	%	15.8	

Remarks :

Submitted by :

Theobard N.

Geotech. Lab. Mngr

COSMEZZ SARL



GEOTECHNICAL LABORATORY

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GEOTECHNICAL INVESTIGATIONS & TOPOGRAPHICAL SURVEY

Project: IMPROVEMENT OF POWER SUPPLY IN THE REPUBLIC OF DJIBOUTI
Location: PK 12 SUBSTATION AND NAGAD SWITCHING SUBSTATION - DJIBOUTI
Client: Yec YACHIYO ENGINEERING CO., LTD - JAPAN

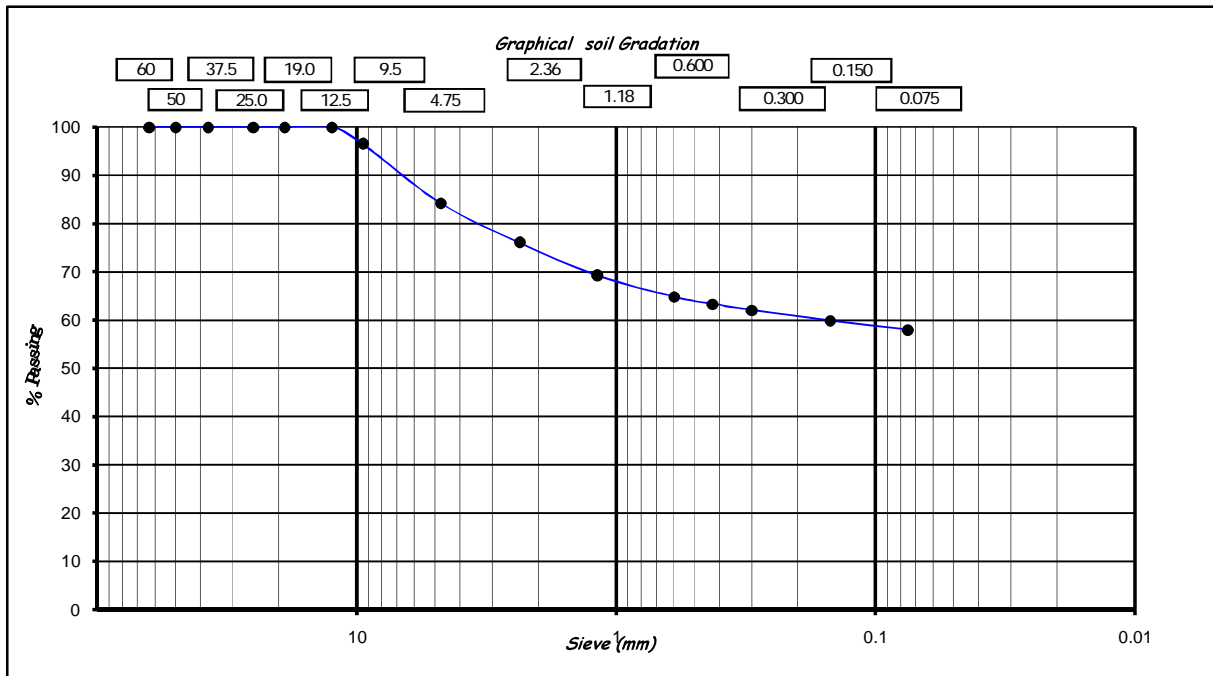
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SIEVE ANALYSIS - ASTM C117/C136

Table with 4 columns: Field Name, Value, Field Name, Value. Includes Sample N°, Project No., Date of Sampling, Sample source, Date of Test, Sample Description, Station, Test Method, Sample Depth, Weight (grs), Sampled by, and Tested by.

Table with 6 columns: Sieve Number, Sieve(mm), Retained (gr), Cumulative Retained (gr), Cumulative Retained (%), Passing (%). Lists sieve sizes from 2 1/2 to Can with corresponding retained and passing percentages.



Remarks : Gravel: 15.8%
Sand: 26.2%
Submitted By : Fines: 58.0%

Handwritten signature of Theobard N.

Theobard N.
GEOTECH. LAB. MNGR
COSMEZZ SARL



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GEOTECHNICAL INVESTIGATIONS & TOPOGRAPHICAL SURVEY

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LIQUID LIMIT, PLASTIC LIMIT, AND PLASTICITY INDEX - ASTM D 4318

Date Tested : **29-Apr-14**

Sample no : **BH-4/SPT-2**

Date sampled : **26-Apr-14**

Sample Description : **Sandy elastic silt (MH)**, with gravel, reddish

Sample Depth: **2.75 m**

Source : **Borehole#BH-4: NAGAD TRANSMISSION LINE**

Tested by: **HOUSSEIN**

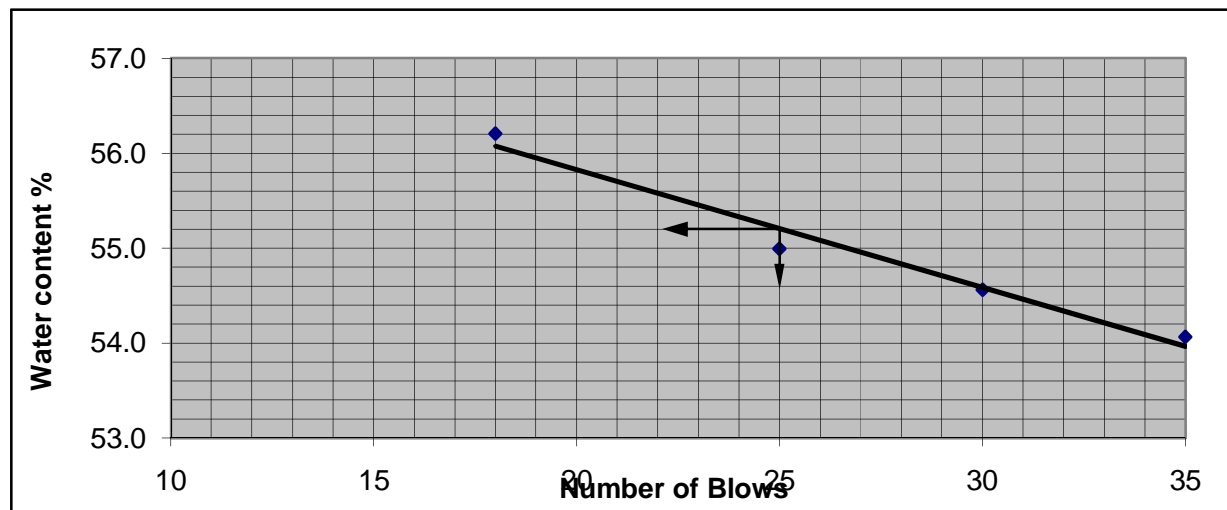
Sampled by: **THEO**

LL: 55.2

PL: 35.7

PI: 19.5

LIQUID LIMIT (LL)					PLASTIC LIMIT (PL)	
No of Blows	18	25	30	35	Test n°1	Test n°2
N° of container	14	15	16	17	18	19
Weight of wet soil + container(A)	40.94	40.98	40.52	42.62	38.32	36.54
Weight of Dry soil + container(B)	37.77	37.73	37.59	38.83	36.67	35.31
Weight of container©	32.13	31.82	32.22	31.82	32.00	31.9
Weight of water D=A-B	3.17	3.25	2.93	3.79	1.65	1.23
Weight of Dry soil (E)=(B-C)	5.64	5.91	5.37	7.01	4.67	3.41
Water content (W)=D/E*100	56.2	55.0	54.6	54.1	35.3	36.1
LL @25Blows and Average PL	55.2				35.7	



Remarks: _____

Submitted By _____

Houssein

Theobard N.

GEOTECHNICAL LAB. MNGR

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GEOTECHNICAL INVESTIGATIONS & TOPOGRAPHICAL SURVEY

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Location: PK 12 SUBSTATION AND NAGAD SWITCHING SUBSTATION

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Contractor : COSMEZZ SARL

COSMEZZ SARL

Rue de Venise, Salines Ouest

B.P. 1331-Djibouti-R.D.D.

E-mail: cosmezz@mezzgroup.com

NATURAL MOISTURE CONTENT (%) - ASTM D 2216

Date Tested : 27-Apr-14

Sample no : **BH-4/SPT-3**

Date sampled: 26-Apr-14

Sample Description : Well-graded Sand (SW-SC), dry, with clay and gravel

Sampled by : THEO

Source : Borehole#BH4:NAGAD
TRASSMISSION LINE

Tested by : THEO

Sample Depth : 4.0 m

Designation		<i>unit</i>	1	
N° of container			w	
Weight of wet soil + container	A	grs	306.92	
Weight of Dry soil + container	B	grs	302.44	
Weight of container	C	grs	226.54	
Weight of water	D=A-B	grs	4.48	
Weight of Dry	E=B-C	grs	75.9	
Water content	W=D/E*100	%	5.9	

Remarks :

Submitted by :

Theobard N.

Geotech. Lab. Mngr

COSMEZZ SARL



Geotechnical Laboratory

Project : IMPROVEMENT OF POWER SUPPLY IN THE
REPUBLIC OF DJIBOUTI
Location: PK 12 SUBSTATION AND NAGAD SWITCHING
SUBSTATION - DJIBOUTI
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Phone: +253 21356142
E-mail: cosmezz@mezzgroup.com

SPECIFIC GRAVITY OF SOIL SOLIDS (ASTM D 854)

LABORATORY DATA SHEET

DATE TESTED : 25-May-14 TESTED BY : HOUSSEIN D.
DATE SAMPLED : 26-Apr-14 SAMPLED BY : COSMEZZ SARL LAB
SAMPLE NUMBER : SS-2 SAMPLE DEPTH : - 3.5m
SAMPLE SOURCE : BH-4
SAMPLE DESCRIPTION: Clayey SAND (SC), with some gravel, very hard, dry, reddish

Specimen number	1	
Pycnometer bottle number	P4	
M ₀ =Mass of dry soil (grams)	51.48	
M _p =Mass of empty, clean pycnometer (grams)	438.74	
M _{ps} =Mass of empty, clean pycnometer + dry soil (grams)	490.22	
M _b =Mass of pycnometer + dry soil + water (grams)	1176.52	
M _a =Mass of pycnometer + water (grams)	1144.22	
Specific Gravity of soil solids (G _s) g/cm ³	2.684	
Water temperature (°C)	22.8	
Correction factor (K)	0.99759	
Specific Gravity of soil solids at 20°C (G _{s20})	2.678	

Equation and Calculations:

$$G_s = \frac{M_0}{M_0 + (M_a - M_b)}$$

$$G_{s20} = G_s \cdot K$$

Submitted by :

THEOBARD N.

Geotech. Lab. Mngr

COSMEZZ SARL



GEOTECHNICAL LABORATORY

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GEOTECHNICAL INVESTIGATIONS & TOPOGRAPHICAL SURVEY

Project: IMPROVEMENT OF POWER SUPPLY IN THE REPUBLIC OF DJIBOUTI
Location: PK 12 SUBSTATION AND NAGAD SWITCHING SUBSTATION - DJIBOUTI
Client: Yec YACHIYO ENGINEERING CO., LTD - JAPAN

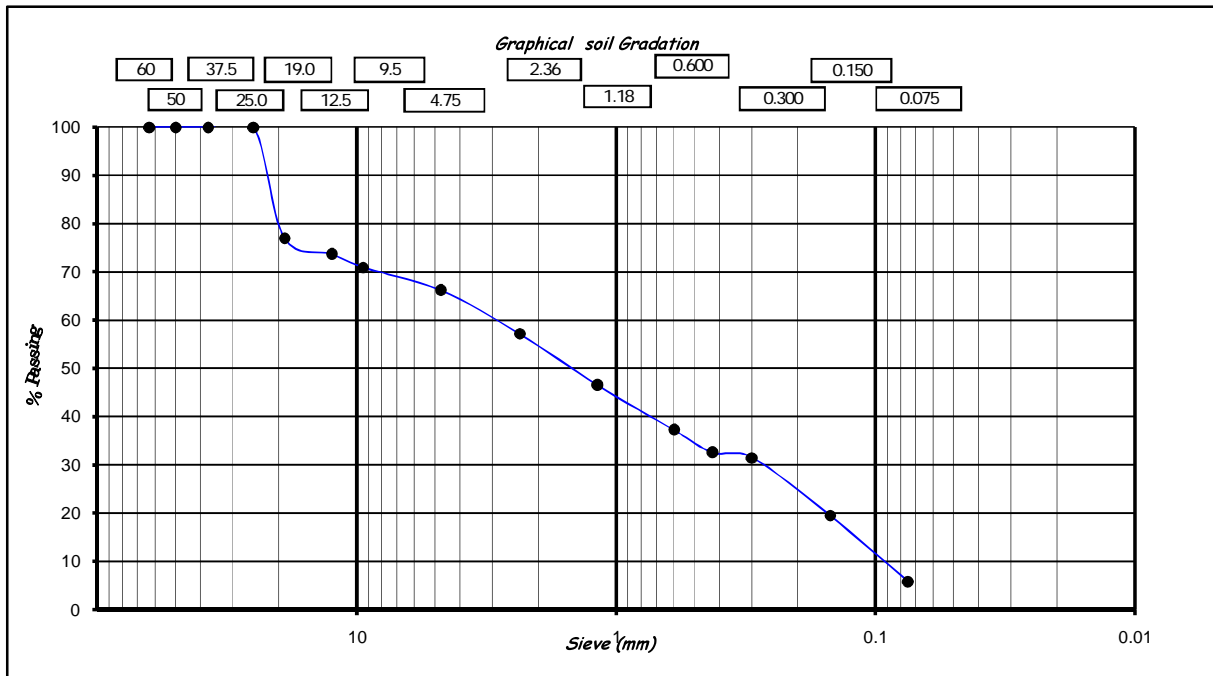
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SIEVE ANALYSIS - ASTM C117/C136

Sample N°: BH-4/SPT-3 Project No.: Date of Sampling: 26-Apr-14
Sample source: Borehole BH-4: NAGAD TRANSMISSION LINE Date of Test: 28-Apr-14
Sample Description: Well-graded Sand (SW-SC), with clay and gravel Station: NAGAD
Test Method: ASTM C 117 / C136 Sample Depth: 4.0 m
Weight (grs): 75.90 Sampled by: THEO
Tested by: HOUSSEIN / SIMANE

Table with 6 columns: Sieve Number, Sieve(mm), Retained (gr), Cumulative Retained (gr), Cumulative Retained (%), Passing (%). Rows include sieve sizes from 2 1/2 down to Can.



Remarks : Gravel: 33.8%
Sand: 60.3%
Submitted By : Fines: 5.9%

Handwritten signature of Theobard N.

Theobard N.
GEOTECH. LAB. MNGR
COSMEZZ SARL



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GEOTECHNICAL INVESTIGATIONS & TOPOGRAPHICAL SURVEY

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COSMEZZ SARL

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LIQUID LIMIT, PLASTIC LIMIT, AND PLASTICITY INDEX - ASTM D 4318

Date Tested : **28-Apr-14**

Sample no : **BH-4/SPT-3**

Date sampled : **26-Apr-14**

Sample Description : **Well-graded Sand (SW-SC)**, with clay and gravel

Sample Depth: **4.0 m**

Source : **Borehole#BH-4: NAGAD TRANSMISSION LINE**

Tested by: **HOUSSEIN**

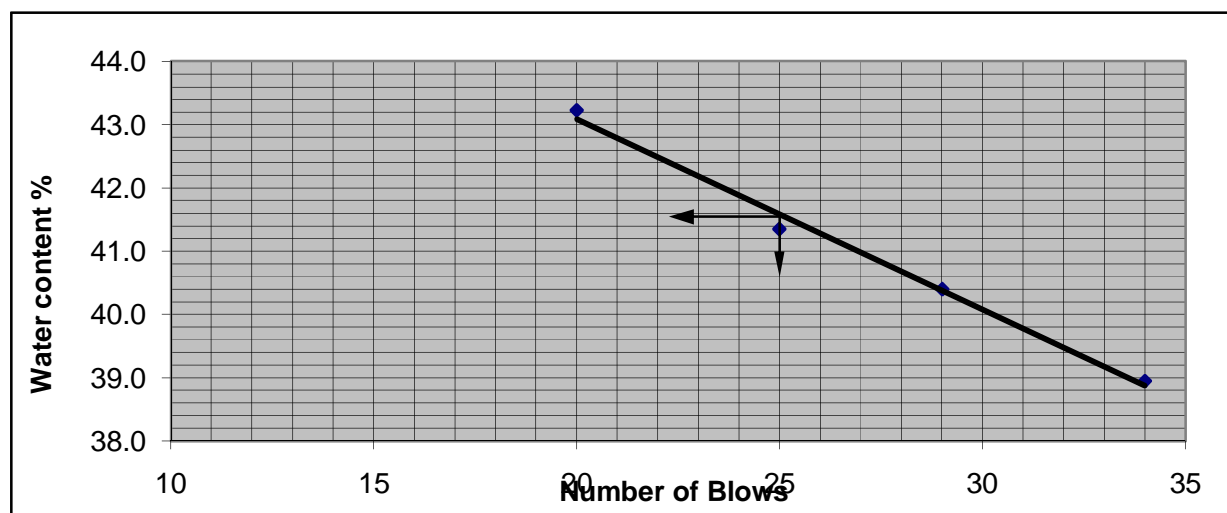
Sampled by: **THEO**

LL: 41.4

PL: 24.9

PI: 16.5

LIQUID LIMIT (LL)					PLASTIC LIMIT (PL)	
No of Blows	20	25	29	34	Test n°1	Test n°2
N° of container	4	b	v	d	a	q
Weight of wet soil + container(A)	34.30	34.74	32.26	33.12	37.9	36.68
Weight of Dry soil + container(B)	33.63	33.88	31.65	32.75	36.79	35.73
Weight of container©	32.08	31.80	30.14	31.8	32.30	31.93
Weight of water D=A-B	0.67	0.86	0.61	0.37	1.11	0.95
Weight of Dry soil (E)=(B-C)	1.55	2.08	1.51	0.95	4.49	3.8
Water content (W)=D/E*100	43.2	41.3	40.4	38.9	24.7	25.0
LL @25Blows and Average PL	41.4				24.9	



Remarks: _____

Submitted By _____

Theobard N.

Theobard N.

GEOTECHNICAL LAB. MNGR

COSMEZZ SARL



GEOTECHNICAL LABORATORY
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GEOTECHNICAL INVESTIGATIONS

Project: **IMPROVEMENT OF POWER SUPPLY IN THE REPUBLIC OF DJIBOUTI**
Location: PK 12 SUBSTATION AND NAGAD - DJIBOUTI

COSMEZZ SARL

Rue de Venise, Salines Ouest
B.P. 1331 - DJIBOUTI - R.D.D.
Phone: +25321356142
E-mail: cosmezz@mezzgroup.com

GEOTECHNICAL EXPLORATION FOR THE EXISTING SOIL

Project No:

Sample n°: **TP-1**

Test Method : **ASTM D 1883; D 1557; D 4318; C 136; C 117**

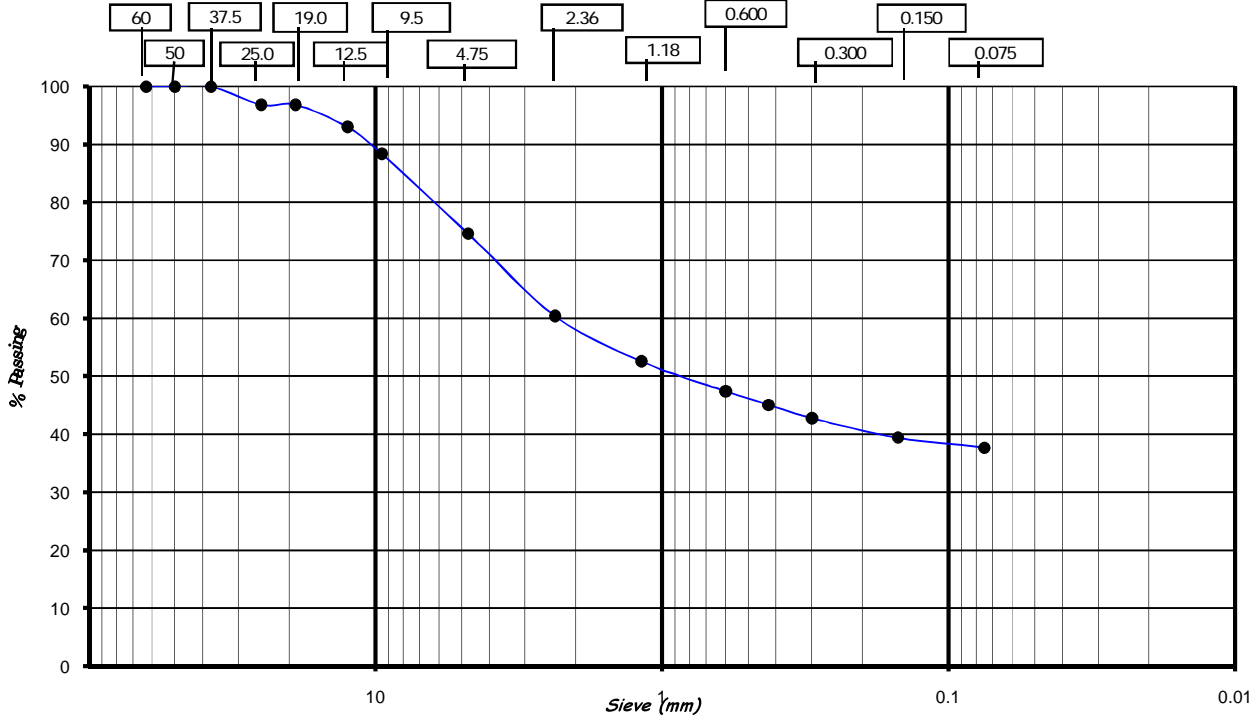
Source : **PK-12 SUBSTATION (TEST PIT #1P1)**

Date Sampled : **31-Dec-13** Sample Depth: **0.15 - 0.75 m**

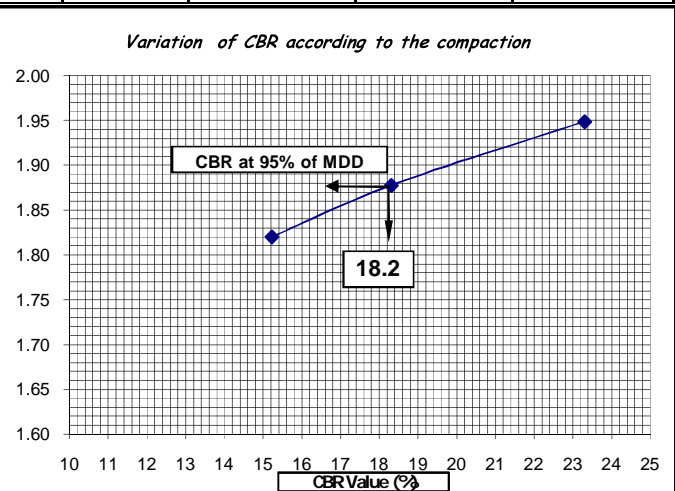
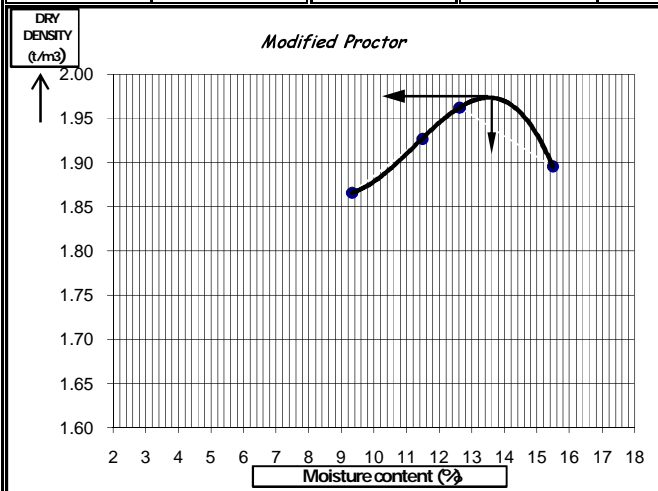
Date Completed Testing : **11-Jan-14**

LL	38.1	CLASSIFICATION		
PI	13.7	H-R-B	U S C S	Clayey SAND (SC) with gravel
%<0,075mm	37.7	A-6	SC	

Graphical soil Gradation



PROCTOR TEST		Natural Moisture content (%)	No of Blows	Compaction	DD (t/m ³)	Soaked CBR	W Soaking	Swell (%)							
MDD(t/m ³) =	1.974								9.6	56 Blows	98.7%	1.949	23.3	4 days	
OMC (%) =	13.5									25 Blows	95.1%	1.878	18.3	4 days	0.21
ρ_{sd} =										10 Blows	92.2%	1.820	15.2	4 days	



Remarks: 1). Soaked CBR Value @95% of MDD for this material equal to 18.2%

Submitted By :

Signature

THEOBARD N.

Geotechnical Lab. Mngr

COSMEZZ SARL



GEOTECHNICAL LABORATORY

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GEOTECHNICAL INVESTIGATIONS & TOPOGRAPHICAL SURVEY

Project: IMPROVEMENT OF POWER SUPPLY IN THE REPUBLIC OF DJIBOUTI

Location: **PK 12 SUBSTATION AND NAGAD SWITCHING SUBSTATION - DJIBOUTI**

Contract #: **N 33191-12-C-0620**

COSMEZZ SARL

Rue de Venise, Saline Ouest - Djibouti

B.P. 1331 - DJIBOUTI - R.D.D

Phone: +253 21356142, E-mail: cosmezz@mezgroup.com

Sample no : **TP-1**

Sample Description : **Clayey SAND (SC) with gravel**

Tested by: **MOHAMED / ABDI**

WATER CONTENT OF COMPACTION

No. Of Blows	56	25	10
BEFORE			
Average			
AFTER			
No. of container	653.27		719.02
W. of Wet soil + Container	605.28		662.65
W. of Dry soil + Container	230.48		233.47
W. Of container	47.99		56.37
W. Of water	374.80		429.18
Water content %	12.8	13.0	13.1

WATER CONTENT AFTER SOAKING (4 days)

No. Of Blows	56	25	10
No. of container	686.36	884.57	643.58
W. of Wet soil + Container	635.38	809.73	593.99
W. of Dry soil + Container	229.13	231.72	233.30
W. Of container	50.98	74.84	49.59
W. Of water	406.25	578.01	360.7
Water content %	12.5	12.9	13.7

SWELL (1/100mm)

Date	Blows	56	25	10
06-Jan-14			0.00	
07-Jan-14			0.19	
08-Jan-14			0.22	
09-Jan-14			0.23	
10-Jan-14			0.24	
Total mm			0.24	
Total %			0.21	

Date Tested: 06-Jan-14

Source : **PK-12 SUBSTATION (TEST PIT # TP-1)**

Project number :

SOAKED C.B.R. TEST - ASTM D 1883

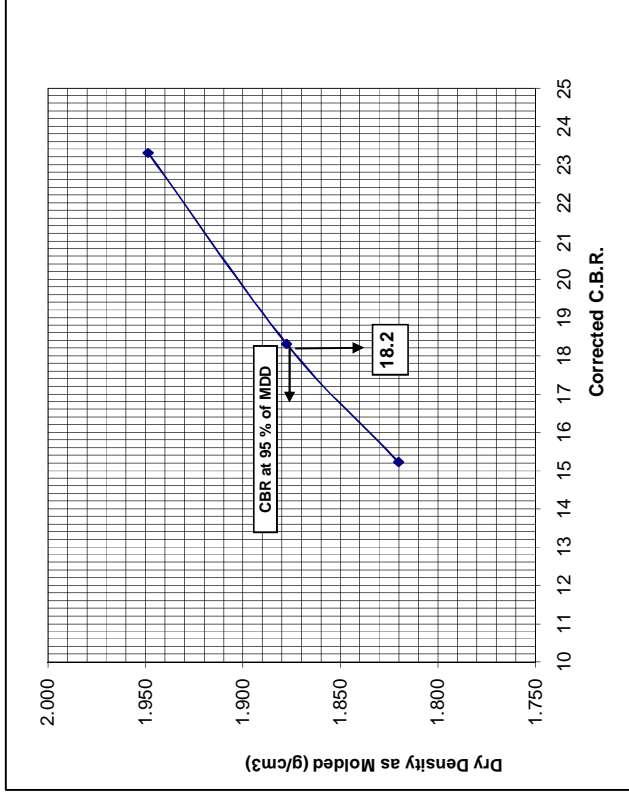
06-Jan-14

Method used for preparation and compaction : **D 1557**

Sample Depth : **0.15 - 0.75 m**

Surcharge weight (kg): **4.5**

No. of Blows	DRY DENSITY			
	56	25	J4	J6
N° of Mold			11240.2	11331.4
W. Of Wet soil + Mold (gram)	11455.8	6745.6	6970.8	4360.6
W. Of Mold (gram)	4860.4	2119.0	2.121	13.0
W. Of Wet soil (gram)	2.201	1.949	1.878	1.820
Volume of Mold (g/cm ³)	13.0	1.974	1.974	1.974
Wet Density (g/cm ³)				
Water content %				
Dry Density (g/cm ³)				
MDD (g/cm ³)				
% of Compaction				
			98.7	95.1
				92.2



No. of Blows	2.54 mm	5.08 mm	CBR@2.5mm
56	23.3	25.6	23.3
25	18.3	19.0	18.3
10	15.2	13.8	15.2

PENETRATION

Date: 10-Jan-14 N° of LOAD RING: **S370-10S-ZI-0001**

Penetr. mm	56 Blows		25 Blows		10 Blows	
	Reading	Stress	Reading	Stress	Reading	Stress
0.00	0.000	0.00	0.000	0.00	0.000	0.00
0.64	0.040	4.59	0.030	3.45	0.020	2.30
1.27	0.080	9.19	0.060	6.89	0.050	5.74
1.91	0.110	12.63	0.090	10.34	0.070	8.04
2.54	0.140	16.08	0.110	12.63	0.085	9.76
3.18	0.170	19.52	0.130	14.93	0.095	10.91
3.81	0.190	21.82	0.150	17.23	0.105	12.06
4.45	0.210	24.12	0.160	18.38	0.110	12.63
5.08	0.230	26.41	0.170	19.52	0.120	13.78
7.62	0.290	33.31	0.220	25.27	0.150	17.23

Submitted By :

Theobard N.

GEOTECHNICAL LAB MNGR

COSMEZZ SARL



GEOTECHNICAL LABORATORY

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GEOTECHNICAL INVESTIGATIONS & TOPOGRAPHICAL SURVEY

Project: **IMPROVEMENT OF POWER SUPPLY IN THE REPUBLIC OF DJIBOUTI**

Location: **PK 12 SUBSTATION AND NAGAD SWITCHING SUBSTATION - DJIBOUTI**

Contract #: **N 33191-12-C-0620**

COSMEZZ SARL

Rue de Venise, Saline Ouest - Djibouti

B.P. 1331 - DJIBOUTI - R.D.D

Phone: +253 21856142, E-mail: cosmezz@mezzgroup.com

Sample no.: **TP-1**

Sample Description: **Clayey SAND (SC) with gravel**

Tested by: **MOHAMED / ABDI**

WATER CONTENT OF COMPACTION

No. Of Blows	56	25	10
N° of container	BEFORE	Average	AFTER
W. of Wet soil + Container	653.27		719.02
W. of Dry soil + Container	605.28		662.65
W. Of container	230.48		233.47
W. Of water	47.99		56.37
W. Of Dry soil	374.80		429.18
Water content %	12.8	13.0	13.1

WATER CONTENT AFTER SOAKING (4 days)

No. Of Blows	56	25	10
N° of container			
W. of Wet soil + Container	686.36	884.57	643.58
W. of Dry soil + Container	635.38	809.73	593.99
W. Of container	229.13	231.72	233.30
W. Of water	50.98	74.84	49.59
W. Of Dry soil	406.25	578.01	360.69
Water content %	12.5	12.9	13.7

SWELL (1/100mm)

Blows	56	25	10
Date			
06-Jan-14		0.00	
07-Jan-14		0.19	
08-Jan-14		0.22	
09-Jan-14		0.23	
10-Jan-14		0.24	
Total mm		0.24	
Total %		0.21	

Date Tested: **06-Jan-14**

Source: **PK-12 SUBSTATION (TEST PIT # TP-1)**

Project number: _____

DRY DENSITY

No. of Blows	56	25	10
N° of Mold	J4	J6	J7
W. Of Wet soil + Mold	11455.8	11240.2	11331.4
W. Of Mold	6795.4	6745.6	6970.8
W. Of Wet soil	4660.4	4494.6	4360.6
Volume of Mold	2117.2	2119.0	2120.8
Wet Density	2.201	2.121	2.056
Water content %	13.0	13.0	13.0
Dry Density	1.949	1.878	1.820
MDD	1.974	1.974	1.974
% of Compaction	98.7	95.1	92.2

PENETRATION

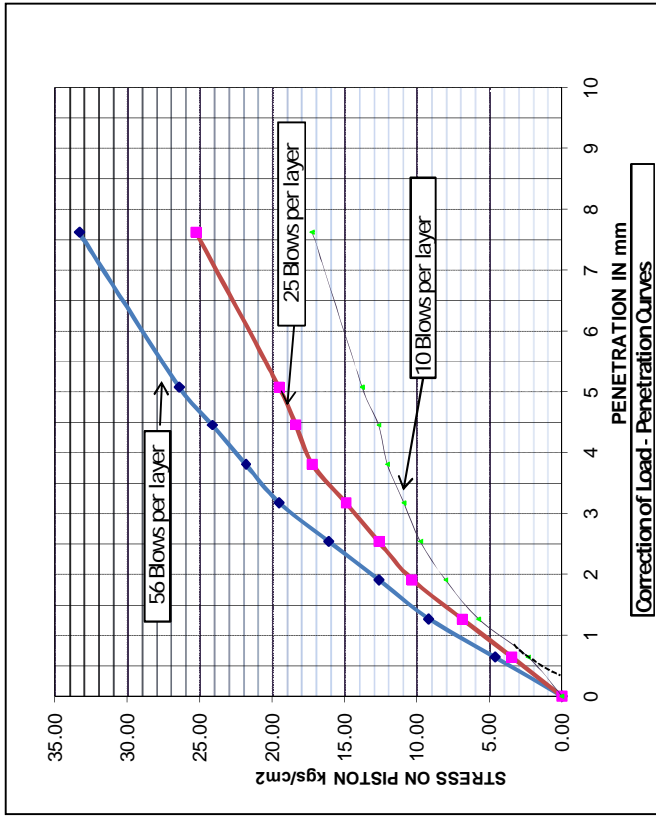
Date: **10-Jan-14** N° of LOAD RING: **S370-10S-ZI-0001**

Penetr. mm	56 Blows		25 Blows		10 Blows	
	Reading	Stress	Reading	Stress	Reading	Stress
0.00	0.000	0.00	0.000	0.00	0.000	0.00
0.64	0.040	4.59	0.030	3.45	0.020	2.30
1.27	0.080	9.19	0.060	6.89	0.050	5.74
1.91	0.110	12.63	0.090	10.34	0.070	8.04
2.54	0.140	16.08	0.110	12.63	0.085	9.76
3.18	0.170	19.52	0.130	14.93	0.095	10.91
3.81	0.190	21.82	0.150	17.23	0.105	12.06
4.45	0.210	24.12	0.160	18.38	0.110	12.63
5.08	0.230	26.41	0.170	19.52	0.120	13.78
7.62	0.290	33.31	0.220	25.27	0.150	17.23

Method used for preparation and compaction: **D 1557**

Sample Depth: **0.15 - 0.75 m**

Surcharge weight (kg): **4.5**



Submitted By :

Signature

Theobard N.

GEOTECHNICAL LAB MNGR

COSMEZZ SARL

1.777 1.875 1.974



GEOTECHNICAL LABORATORY

Certified by U.S. Army Corps of Engineers

Project: IMPROVEMENT OF POWER SUPPLY
IN THE REPUBLIC OF DJIBOUTI
Location: PK 12 SUBSTATION AND NAGAD - DJIBOUTI
Contract #: -----

COSMEZZ SARL
Rue de Venise, Salines Ouest
B.P. 1331 Djibouti - R.D.D.
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COSMEZZ GEOTECHNICAL LABORATORY - B.P. 1331 Rue de Venise - Djibouti, Phone: +253 21356142 - Email: cosmezz@mezzgroup.com

MODIFIED PROCTOR TEST - ASTM D 1557

Method used: C Type of Rammer: Manual % of Retained on 19mm Sieve: 3.1%
Sample Description : Clayey SAND (SC) with gravel Date Sampled : 31-Dec-13
Sample n° : TP-1 Date Tested : 04-Jan-14
Sample Source : PK-12 SUBSTATION Sample Depth : 0.15 - 0.75 m
Tested by : ABDI / HOUSSEIN Sampled By : THEO / MOHAMED

Determination N°	Units	1	2	3	4
% of Water added	%	4	6	8	10

WET DENSITY DETERMINATION

	(grs)	8,896.2	9,125.6	9,256.0	9,211.6
Weight of soil + Mold	(grs)	4,574.4	4,574.4	4,574.4	4,574.4
Weight of Mold	(grs)	4,321.8	4,551.2	4,681.6	4,637.2
Weight of soil	(cm ³)	2,118.7	2,118.7	2,118.7	2,118.7
Volume of Mold	(g/cm ³)	2.040	2.148	2.210	2.189
Wet Density					

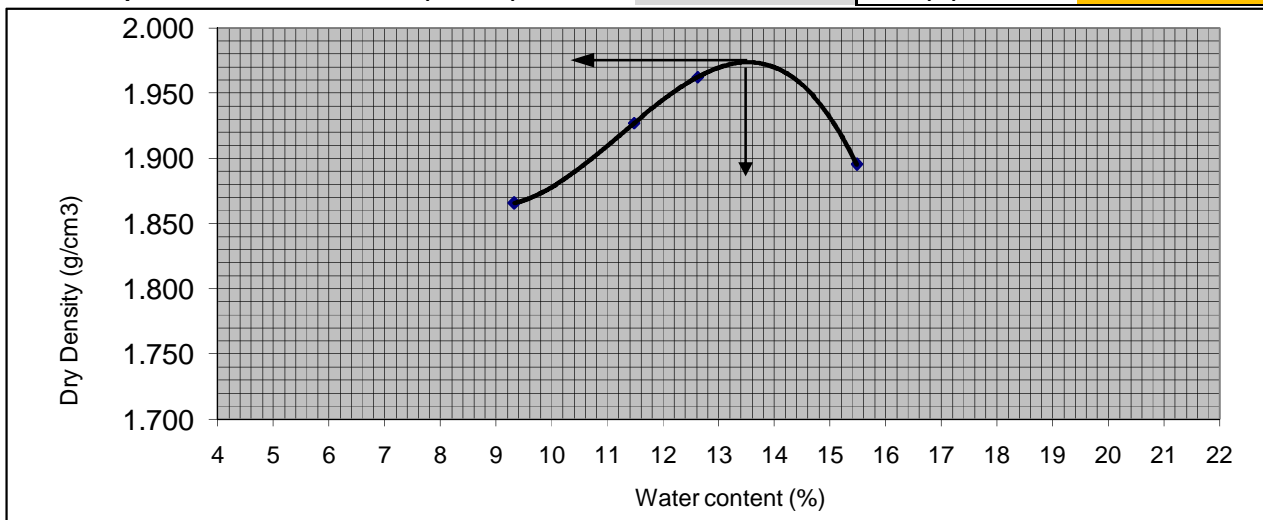
MOISTURE CONTENT DETERMINATION

Weight of Wet soil + Container	(grs)	915.67	897.06	632.82	673.00
Weight of Dry soil + Container	(grs)	878.83	848.01	587.87	614.22
Weight of Water	(grs)	36.84	49.05	44.95	58.78
Weight of container	(grs)	483.79	420.74	231.66	234.53
Weight of Dry soil	(grs)	395.04	427.27	356.21	379.69
Water Content	%	9.3	11.5	12.6	15.5

DRY DENSITY

Dry Density	(g/cm ³)	1.866	1.927	1.962	1.895
-------------	----------------------	-------	-------	-------	-------

Corrected Maximum Dry Density (C-MDD) MDD (g/cm³): 1.974
Corrected Optimum Moisture Content (C-OMC) OMC (%): 13.5



Remarks:

Submitted By :

THEOBARD N.

Geotechnical Lab. Mngr
COSMEZZ SARL



GEOTECHNICAL LABORATORY

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GEOTECHNICAL INVESTIGATIONS & TOPOGRAPHICAL SURVEY

Project: IMPROVEMENT OF POWER SUPPLY IN THE REPUBLIC OF DJIBOUTI
Location: PK 12 SUBSTATION AND NAGAD SWITCHING SUBSTATION - DJIBOUTI
Client: Yec YACHIYO ENGINEERING CO., LTD - JAPAN

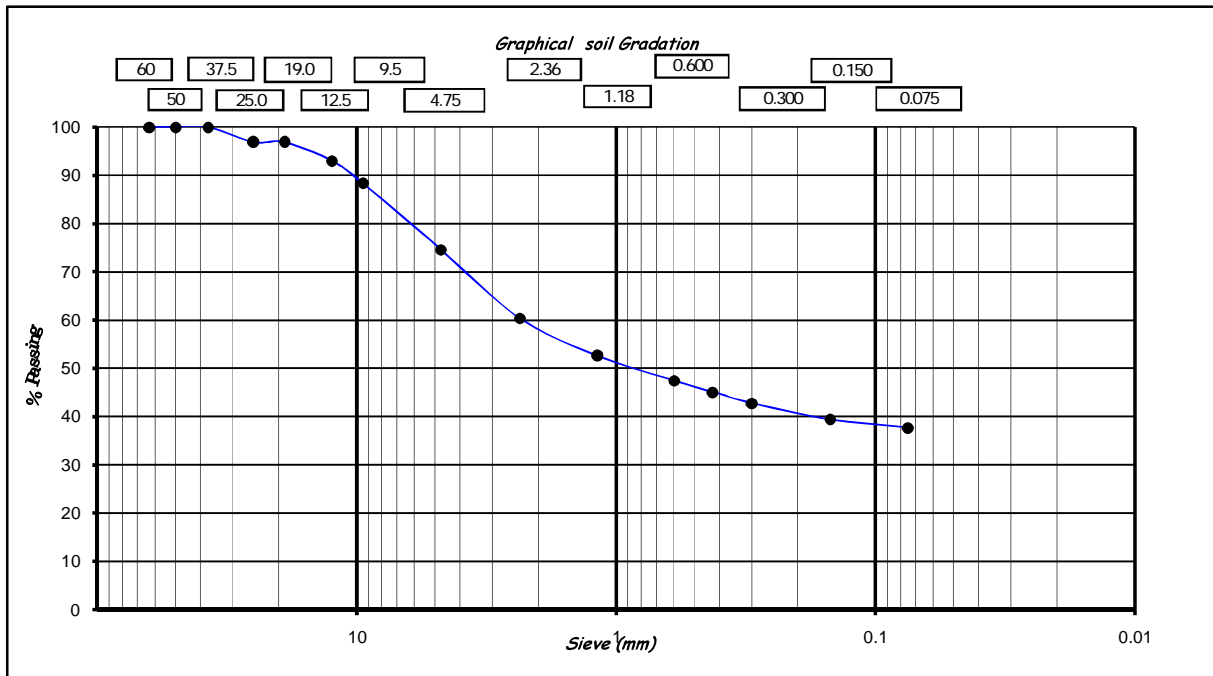
COSMEZZ SARL
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E-mail: cosmezz@mezzgroup.com

COSMEZZ GEOTECHNICAL LABORATORY - B.P. 1331, Rue de Venise - Djibouti, Phone: +253 2 1356 142 - Email: cosmezz@mezzgroup.com

SIEVE ANALYSIS - ASTM C117/C136

Table with 4 columns: Field Name, Value, Field Name, Value. Includes Sample No: TP-1, Project No., Date of Sampling: 31-Dec-13, Sample source: TEST PIT (TP-1): PK-12 SUBSTATION, Date of Test: 1-Jun-14, Sample Description: Clayey SAND (SC) with gravel, Station: PK12, Test Method: ASTM C 117 / C136, Sample Depth: 0.15 - 0.75 m, Weight (grs): 6069.40, Sampled by: THEO/MOH, Tested by: ABDI

Table with 6 columns: Sieve Number, Sieve(mm), Retained (gr), Cumulative Retained (gr), Cumulative Retained (%), Passing (%). Lists sieve sizes from 2 1/2 to Can with corresponding retained and passing percentages.



Remarks : Gravel: 25.4%
Sand: 36.9%
Submitted By : Fines: 37.7%

Handwritten signature of Theobard N.

Theobard N.
GEOTECH. LAB. MNGR
COSMEZZ SARL



Geotechnical Laboratory
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GEOTECHNICAL INVESTIGATIONS & TOPOGRAPHICAL SURVEY

Project: IMPROVEMENT OF POWER SUPPLY IN THE
REPUBLIC OF DJIBOUTI

Location: PK 12 SUBSTATION AND NAGAD SWITCHING SUBSTATION

Client: *Yec* YACHIYO ENGINEERING CO., LTD - JAPAN

COSMEZZ SARL

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E-mail: cosmezz@mezzgroup.com

COSMEZZ GEOTECHNICAL LABORATORY - B.P. 131 Rue de Venise - Djibouti, Phone: +253 2 356 112 - Email: cosmezz@mezzgroup.com

LIQUID LIMIT, PLASTIC LIMIT, AND PLASTICITY INDEX - ASTM D 4318

Date Tested : **6-Jan-14**

Sample no : **TP-1**

Date sampled : **31-Dec-13**

Sample Description : **Clayey SAND (SC)** with gravel

Sample Depth: **0.15 - 0.75 m**

Source : **PK 12 SUBSTATION**

Tested by: **HOUSSEIN D.**

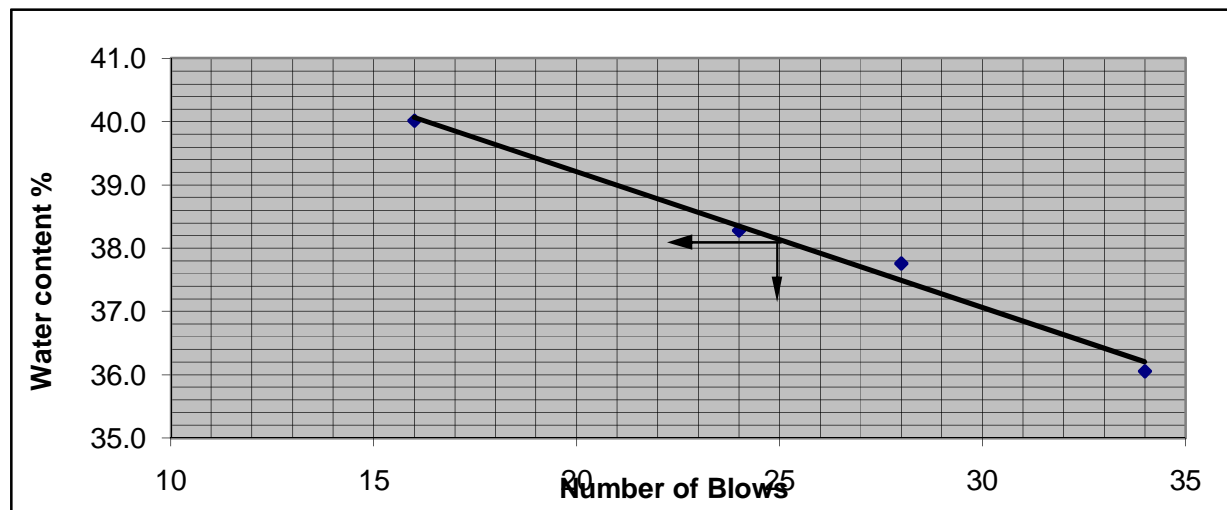
Sampled by: **THEO / MOH**

LL: 38.1

PL: 24.4

PI: 13.7

LIQUID LIMIT (LL)					PLASTIC LIMIT (PL)	
No of Blows	16	24	28	34	Test n°1	Test n°2
N° of container	10	11	13	0	R	W
Weight of wet soil + container(A)	62.07	62.75	65.52	56.54	34.49	36.50
Weight of Dry soil + container(B)	53.4	54.24	56.28	50.01	33.96	35.58
Weight of container©	31.73	32.01	31.81	31.9	31.73	31.91
Weight of water D=A-B	8.67	8.51	9.24	6.53	0.53	0.92
Weight of Dry soil (E)=(B-C)	21.67	22.23	24.47	18.11	2.23	3.67
Water content (W)=D/E*100	40.0	38.3	37.8	36.1	23.8	25.1
LL @25Blows and Average PL	38.1				24.4	



Remarks: _____

Submitted By _____

Theobard N.

Theobard N.

GEOTECHNICAL LAB. MNGR

COSMEZZ SARL



GEOTECHNICAL LABORATORY

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GEOTECHNICAL INVESTIGATIONS & TOPOGRAPHICAL SURVEY

Project: IMPROVEMENT OF POWER SUPPLY IN THE REPUBLIC OF DJIBOUTI

Location: PK 12 SUBSTATION AND NAGAD SWITCHING SUBSTATION

Client: *Yec* YACHIYO ENGINEERING CO., LTD - JAPAN

Contractor : COSMEZZ SARL

COSMEZZ SARL

Rue de Venise, Salines Ouest

B.P. 1331-Djibouti-R.D.D.

E-mail: cosmezz@mezzgroup.com

NATURAL MOISTURE CONTENT (%) - ASTM D 2216

Date Tested : 31-Dec-13

Sample no : TP-2/SS-1

Date sampled: 31-Dec-13

Sample Description : Clayey SAND (SC) with gravel

Source : TEST PIT#TP-2: PK 12

Sampled by : THEO

SUBSTATION

Tested by : THEO

Sample Depth : 0.15 - 0.65 m

Designation		<i>unit</i>	1	
N° of container			T	
Weight of wet soil + container	A	grs	1043.83	
Weight of Dry soil + container	B	grs	983.72	
Weight of container	C	grs	225.5	
Weight of water	D=A-B	grs	60.11	
Weight of Dry	E=B-C	grs	758.22	
Water content	W=D/E*100	%	7.9	

Remarks :

Submitted by :

Theobard N.

Geotech. Lab. Mngr

COSMEZZ SARL



Geotechnical Laboratory
Certified by USACE

GEOTECHNICAL INVESTIGATIONS & TOPOGRAPHICAL SURVEY

Project: IMPROVEMENT OF POWER SUPPLY IN THE
REPUBLIC OF DJIBOUTI

Location: PK 12 SUBSTATION AND NAGAD SWITCHING SUBSTATION

Client: *Yec* YACHIYO ENGINEERING CO., LTD - JAPAN

COSMEZZ SARL

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LIQUID LIMIT, PLASTIC LIMIT, AND PLASTICITY INDEX - ASTM D 4318

Date Tested : **6-Jan-14**

Sample no : **TP-2/SS-1**

Date sampled : **31-Dec-13**

Sample Description : **Clayey SAND (SC)** with gravel

Sample Depth: **0.15 - 0.65 m**

Source : **PK 12 SUBSTATION**

Tested by: **HOUSSEIN D.**

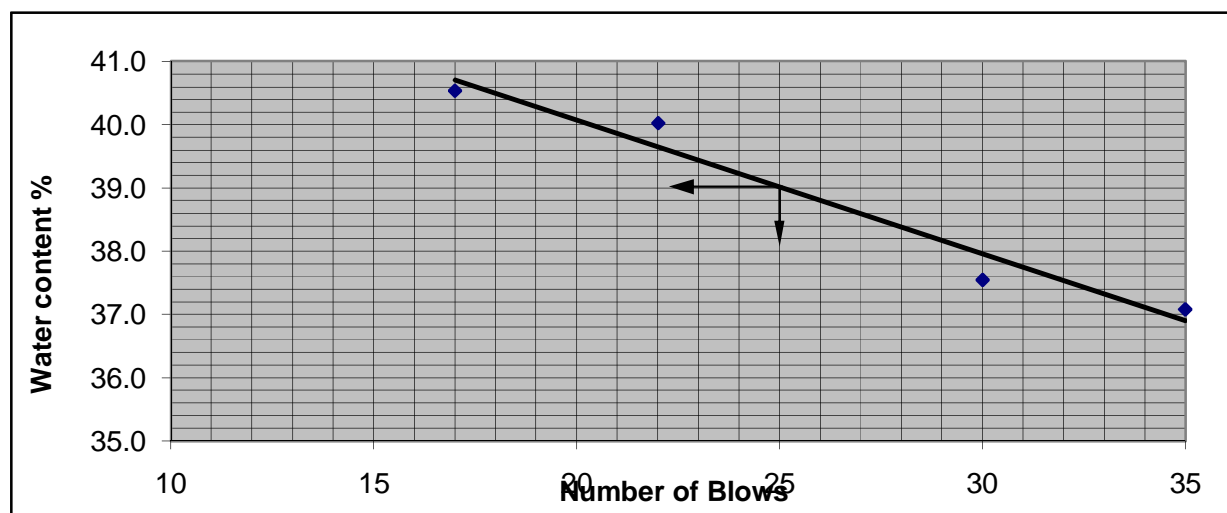
Sampled by: **THEO / MOH**

LL: 39.0

PL: 25.7

PI: 13.3

LIQUID LIMIT (LL)					PLASTIC LIMIT (PL)	
No of Blows	17	22	30	35	Test n°1	Test n°2
N° of container	N	12	T	R	X	Y
Weight of wet soil + container(A)	55.28	52.99	54.54	52.85	36.72	35.24
Weight of Dry soil + container(B)	48.64	46.91	48.39	47.15	35.75	34.56
Weight of container©	32.26	31.72	32.01	31.78	31.9	31.97
Weight of water D=A-B	6.64	6.08	6.15	5.7	0.97	0.68
Weight of Dry soil (E)=(B-C)	16.38	15.19	16.38	15.37	3.85	2.59
Water content (W)=D/E*100	40.5	40.0	37.5	37.1	25.2	26.3
LL @25Blows and Average PL	39.0				25.7	



Remarks: _____

Submitted By _____

Theobard N.

Theobard N.

GEOTECHNICAL LAB. MNGR

COSMEZZ SARL



GEOTECHNICAL LABORATORY
Certified by USACE

GEOTECHNICAL INVESTIGATIONS

Project: **IMPROVEMENT OF POWER SUPPLY IN THE REPUBLIC OF DJIBOUTI**
Location: **PK 12 SUBSTATION AND NAGAD - DJIBOUTI**

COSMEZZ SARL

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B.P. 1331 - DJIBOUTI - R.D.D.
Phone: +25321356142
E-mail: cosmezz@mezzgroup.com

GEOTECHNICAL EXPLORATION FOR THE EXISTING SOIL

Project No:

Sample n°: **TP-3/SS-2**

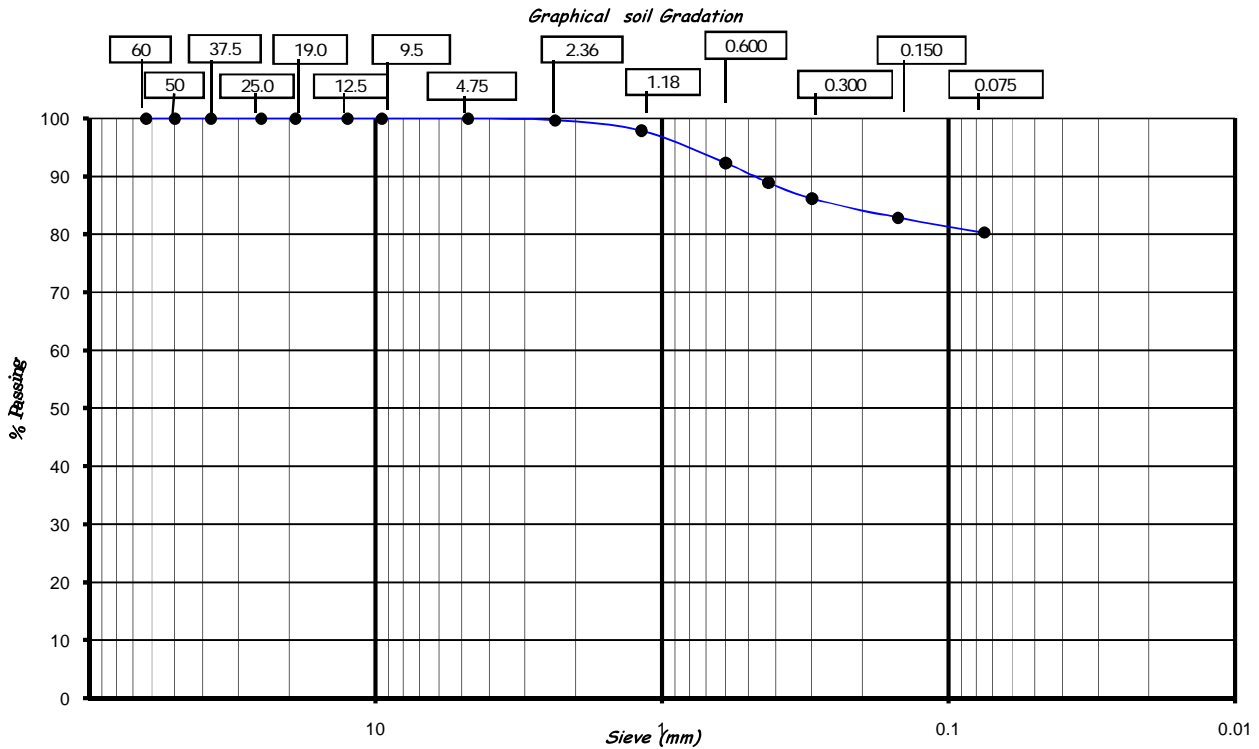
Test Method : **ASTM D 1883; D 1557; D 4318; C 136; C 117**

Source : **PK-12 OVERHEAD TRANSMISSION LINE (TP-3)**

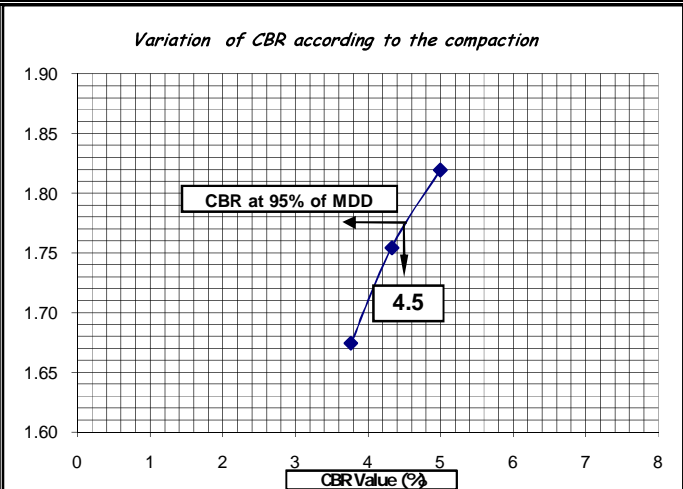
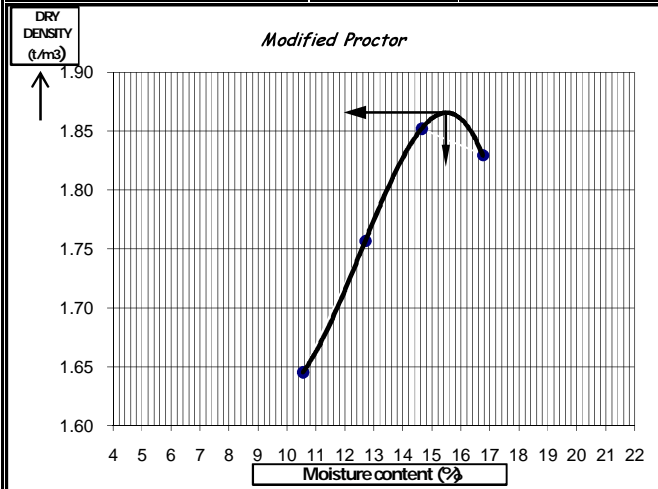
Date Sampled : **31-Dec-13** Sample Depth: **0.00 - 1.50 m**

Date Completed Testing : **11-Jan-14**

LL	50.6	CLASSIFICATION		
PI	23.2	H-R-B	U S C S	Sandy elastic SILT (MH), Reddish-brown
%<0,075mm	80.3	A-7-5	MH	



PROCTOR TEST		Natural Moisture content (%)	No of Blows	Compaction	DD (t/m ³)	Soaked CBR	W Soaking	Swell (%)						
MDD(t/m ³) =	1.867								56 Blows	97.4%	1.819	5.0	4 days	
OMC (%) =	15.5								25 Blows	94.0%	1.755	4.3	4 days	4.28
ρ _{sd} =									10 Blows	89.7%	1.674	3.8	4 days	



Remarks: 1). Soaked CBR Value @95% of MDD for this material equal to **4.5%**

Submitted By :

THEOBARD N.

Geotechnical Lab. Mngr

COSMEZZ SARL



GEOTECHNICAL LABORATORY

"Certified by U.S. Army Corps of Engineers"

GEOTECHNICAL INVESTIGATIONS & TOPOGRAPHICAL SURVEY

Project: IMPROVEMENT OF POWER SUPPLY IN THE REPUBLIC OF DJIBOUTI

Location: PK 12 SUBSTATION AND NAGAD SWITCHING SUBSTATION - DJIBOUTI

Contract #: N 3319-12-C-0620

COSMEZZ SARL

Rue de Venise, Saline Ouest - Djibouti

B.P. 1331 - DJIBOUTI - R.D.D

Phone: +253 21356142, E-mail: cosmezz@mezzgroup.com

Sample no : **TP-3/S-2**

Sample Description : Sandy elastic SILT (MH), Reddish-brown

Tested by: **MOHAMED / ABDI**

WATER CONTENT OF COMPACTION		56	25	10
No. Of Blows	Average	BEFORE	AFTER	AFTER
N° of container		578.73		909.23
W. of Wet soil + Container		530.30		843.32
W. of Dry soil + Container		229.15		420.74
W. Of container		48.43		65.91
W. Of water		301.15		422.58
Water content %		16.1	15.8	15.6

WATER CONTENT AFTER SOAKING (4 days)

No. Of Blows	56	25	10
N° of container			
W. of Wet soil + Container	743.48	664.42	672.95
W. of Dry soil + Container	667.35	594.31	603.44
W. Of container	225.64	226.35	226.10
W. Of water	76.13	70.11	69.51
W. Of Dry soil	441.71	367.96	377.3
Water content %	17.2	19.1	18.4

SWELL (1/100mm)

Date	Blows	56	25	10
06-Jan-14			0.00	
07-Jan-14			4.42	
08-Jan-14			4.81	
09-Jan-14			4.93	
10-Jan-14			4.97	
Total mm			4.97	
Total %			4.28	

Date Tested: 06-Jan-14

Source : PK-12 OVERHEAD TRANSMISSION LINE (TEST PIT # TP-3)

Project number :

SOAKED C.B.R. TEST - ASTM D 1883

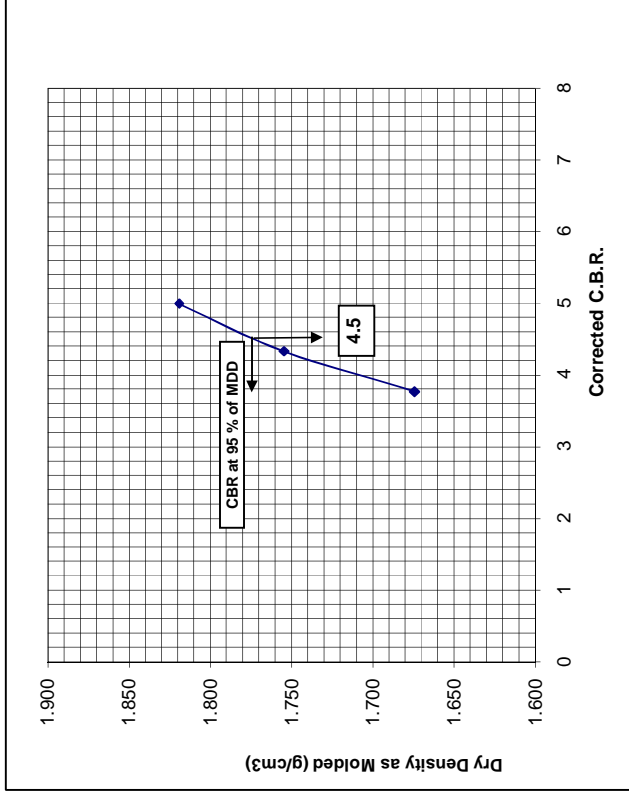
06-Jan-14

Method used for preparation and compaction : D 1557

Sample Depth : 0.0 - 1.50 m

Surcharge weight (kg): **4.5**

		DRY DENSITY				
No. of Blows		56	25	J1	J2	J5
N° of Mold				10755.2	11269.6	10866.8
W. Of Wet soil + Mold	(gram)	6290.8	6961.2	6735.4		
W. Of Mold	(gram)	4464.4	4308.4	4131.4		
W. Of Wet soil	(gram)	2118.4	2119.8	2130.2		
Volume of Mold	(g/cm ³)	2.107	2.032	1.939		
Wet Density	(%)	15.8	15.8	15.8		15.8
Water content %	(g/cm ³)	1.819	1.755	1.674		1.674
Dry Density	(g/cm ³)	1.867	1.867	1.867		1.867
MDD	(%)	97.4	94.0	89.7		
% of Compaction						



No. of Blows	2.54 mm	5.08 mm	CBR@2.5mm
56	5.0	5.6	5.0
25	4.3	5.0	4.3
10	3.8	3.7	3.8

PENETRATION

Date: 10-Jan-14 N° of LOAD RING: S370-10S-ZI-0001

Penetr. mm	56 Blows		25 Blows		10 Blows	
	Reading	Stress	Reading	Stress	Reading	Stress
0.00	0.000	0.00	0.000	0.00	0.000	0.00
0.64	0.010	1.15	0.008	0.92	0.004	0.46
1.27	0.020	2.30	0.016	1.84	0.010	1.15
1.91	0.025	2.87	0.022	2.53	0.014	1.61
2.54	0.030	3.45	0.026	2.99	0.020	2.30
3.18	0.035	4.02	0.030	3.45	0.024	2.76
3.81	0.040	4.59	0.035	4.02	0.027	3.10
4.45	0.045	5.17	0.040	4.59	0.030	3.45
5.08	0.050	5.74	0.045	5.17	0.032	3.68
7.62	0.060	6.89	0.052	5.97	0.040	4.59

Submitted By :

Theobard N.

GEOTECHNICAL LAB MNGR

COSMEZZ SARL

1.680 1.774 1.867



GEOTECHNICAL LABORATORY

"Certified by U.S. Army Corps of Engineers"

GEOTECHNICAL INVESTIGATIONS & TOPOGRAPHICAL SURVEY

Project: IMPROVEMENT OF POWER SUPPLY IN THE REPUBLIC OF DJIBOUTI

Location: **PK 12 SUBSTATION AND NAGAD SWITCHING SUBSTATION - DJIBOUTI**

Contract #: **N 33191-12-C-0620**

COSMEZZ SARL

Rue de Venise, Saline Ouest - Djibouti

B.P. 1331 - DJIBOUTI - R.D.D

Phone: +253 21856142, E-mail: cosmezz@mezzgroup.com

Sample no.: **TP-3/SS-2**

Sample Description: **Sandy elastic SILT (MH), Reddish-brown**

Tested by: **MOHAMED / ABDI**

WATER CONTENT OF COMPACTION			
No. Of Blows	56	25	10
N° of container	BEFORE	Average	AFTER
W. of Wet soil + Container	578.73		909.23
W. of Dry soil + Container	530.30		843.32
W. Of container	229.15		420.74
W. Of water	48.43		65.91
W. Of Dry soil	301.15		422.58
Water content %	16.1	15.8	15.6

WATER CONTENT AFTER SOAKING (4 days)

No. Of Blows	56	25	10
N° of container			
W. of Wet soil + Container	743.48	664.42	672.95
W. of Dry soil + Container	667.35	594.31	603.44
W. Of container	225.64	226.35	226.10
W. Of water	76.13	70.11	69.51
W. Of Dry soil	441.71	367.96	377.34
Water content %	17.2	19.1	18.4

SWELL (1/100mm)

Blows	56	25	10
Date			
06-Jan-14		0.00	
07-Jan-14		4.42	
08-Jan-14		4.81	
09-Jan-14		4.93	
10-Jan-14		4.97	
Total mm		4.97	
Total %		4.28	

Date Tested: **06-Jan-14**

Source: **PK-12 OVERHEAD TRANSMISSION LINE (TEST PIT # TP-3)**

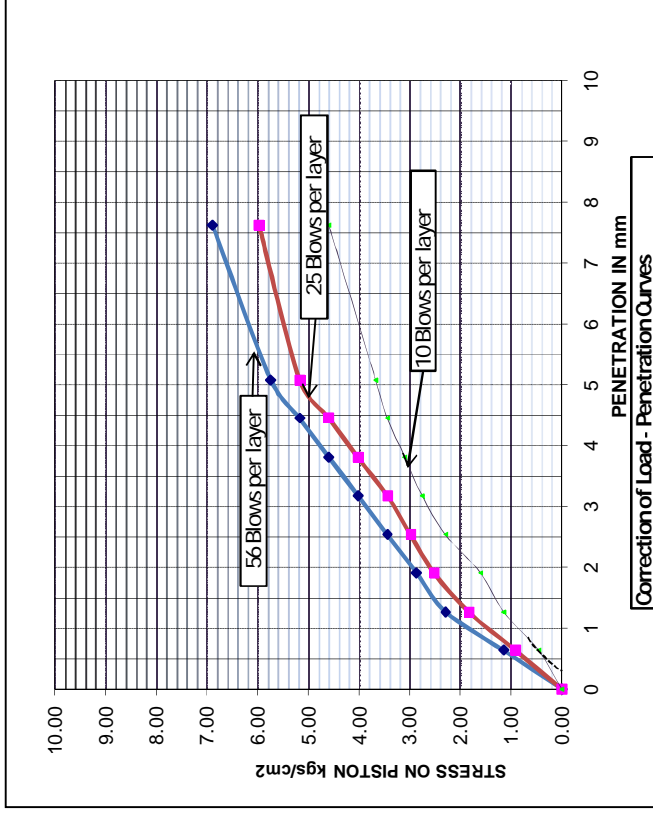
Project number: **4.5**

SOAKED C.B.R. TEST - ASTM D 1883

Method used for preparation and compaction: **D 1557**

Sample Depth: **0.0 - 1.50 m**

Surcharge weight (kg): **4.5**



Correction of Load - Penetration Curves

No. of Blows	2.54 mm	5.08 mm	Max stress
56	3.45	5.74	5.74
25	2.99	5.17	5.17
10	2.60	3.80	3.80

PENETRATION

Date: **10-Jan-14** N° of LOAD RING: **S370-10S-ZI-0001**

Penetr. mm	56 Blows		25 Blows		10 Blows	
	Reading	Stress	Reading	Stress	Reading	Stress
0.00	0.000	0.00	0.000	0.00	0.000	0.00
0.64	0.010	1.15	0.008	0.92	0.004	0.46
1.27	0.020	2.30	0.016	1.84	0.010	1.15
1.91	0.025	2.87	0.022	2.53	0.014	1.61
2.54	0.030	3.45	0.026	2.99	0.020	2.30
3.18	0.035	4.02	0.030	3.45	0.024	2.76
3.81	0.040	4.59	0.035	4.02	0.027	3.10
4.45	0.045	5.17	0.040	4.59	0.030	3.45
5.08	0.050	5.74	0.045	5.17	0.032	3.68
7.62	0.060	6.89	0.052	5.97	0.040	4.59

Submitted By:

Signature

Theobard N.

GEOTECHNICAL LAB MNGR

COSMEZZ SARL

1.680 1.774 1.867



GEOTECHNICAL LABORATORY

Certified by U.S. Army Corps of Engineers

Project: IMPROVEMENT OF POWER SUPPLY
IN THE REPUBLIC OF DJIBOUTI
Location: PK 12 SUBSTATION AND NAGAD - DJIBOUTI
Contract #: -----

COSMEZZ SARL
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COSMEZZ GEOTECHNICAL LABORATORY - B.P. 131 Rue de Venise - Djibouti, Phone: +253 2 1356142 - Email: cosmezz@mezzgroup.com

MODIFIED PROCTOR TEST - ASTM D 1557

Method used: C	Type of Rammer: Manual	% of Retained on 19mm Sieve: ---			
Sample Description : Sandy elastic SILT (MH), Reddish-brown	Date Sampled : 31-Dec-13	Date Tested : 05-Jan-14			
Sample n° : TP-3 / SS-2	Sample Depth : 0.00 - 1.50 m	Sampled By : THEO / MOHAMED			
Sample Source : PK-12 OVERHEAD TRANSMISSION LINE					
Tested by : ABDI / HOUSSEIN					
Determination N°	Units	1	2	3	4
% of Water added	%	4	6	8	10

WET DENSITY DETERMINATION

Weight of soil + Mold	(grs)	8,425.4	8,766.2	9,070.0	9,097.2
Weight of Mold	(grs)	4,571.8	4,571.8	4,571.8	4,571.8
Weight of soil	(grs)	3,853.6	4,194.4	4,498.2	4,525.4
Volume of Mold	(cm ³)	2,118.7	2,118.7	2,118.7	2,118.7
Wet Density	(g/cm ³)	1.819	1.980	2.123	2.136

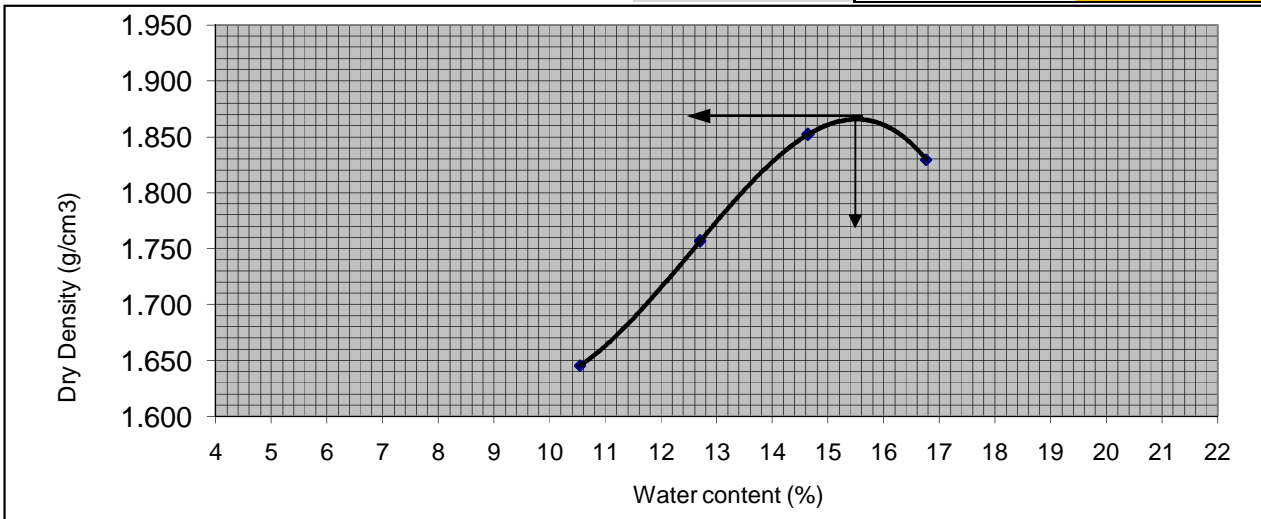
MOISTURE CONTENT DETERMINATION

Weight of Wet soil + Container	(grs)	609.72	563.53	816.13	738.62
Weight of Dry soil + Container	(grs)	573.15	525.87	765.63	666.27
Weight of Water	(grs)	36.57	37.66	50.50	72.35
Weight of container	(grs)	226.35	229.25	420.68	234.55
Weight of Dry soil	(grs)	346.80	296.62	344.95	431.72
Water Content	%	10.5	12.7	14.6	16.8

DRY DENSITY

Dry Density	(g/cm ³)	1.645	1.757	1.852	1.829
-------------	----------------------	-------	-------	-------	-------

Corrected Maximum Dry Density (C-MDD)	MDD (g/cm ³):	1.867
Corrected Optimum Moisture Content (C-OMC)	OMC (%) :	15.5



Remarks:

Submitted By :

THEOBARD N.

Geotechnical Lab. Mngr
COSMEZZ SARL



GEOTECHNICAL LABORATORY

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GEOTECHNICAL INVESTIGATIONS & TOPOGRAPHICAL SURVEY

Project: IMPROVEMENT OF POWER SUPPLY IN THE REPUBLIC OF DJIBOUTI
Location: PK 12 SUBSTATION AND NAGAD SWITCHING SUBSTATION - DJIBOUTI
Client: Yec YACHIYO ENGINEERING CO., LTD - JAPAN

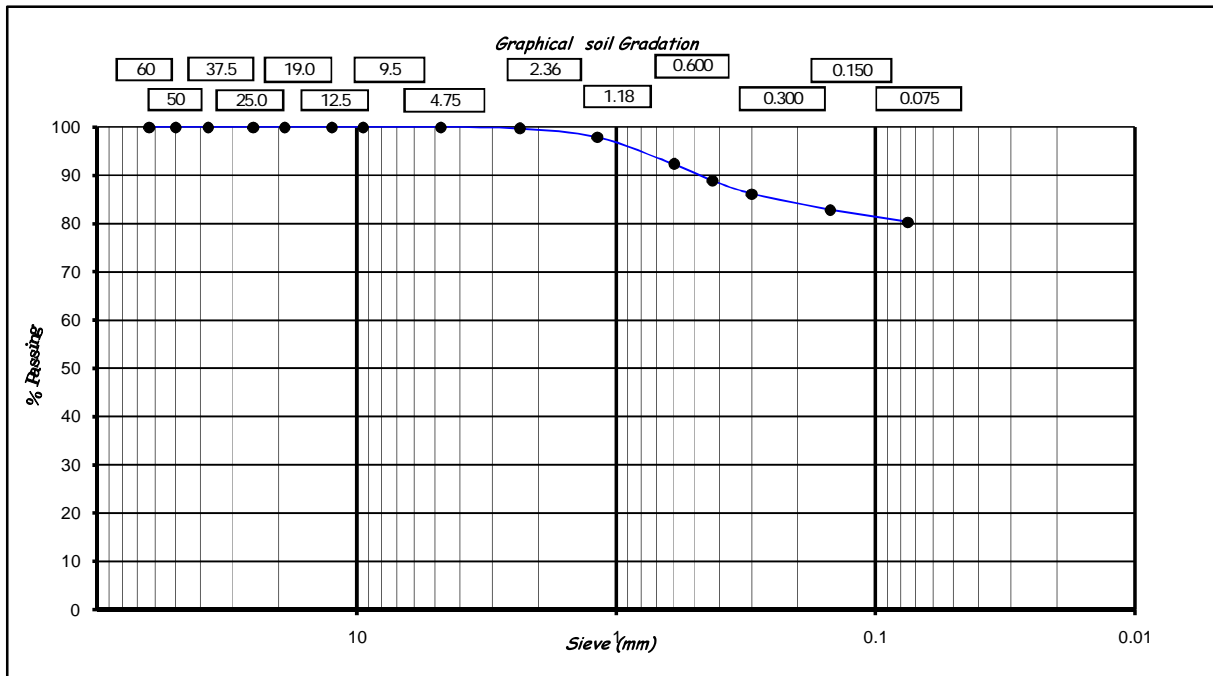
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SIEVE ANALYSIS - ASTM C117/C136

Table with sample details: Sample N°, Project No., Date of Sampling, Sample source, Date of Test, Sample Description, Station, Test Method, Sample Depth, Weight (grs), Sampled by, Tested by.

Table with sieve analysis results: Sieve Number, Sieve(mm), Retained (gr), Cumulative Retained (gr), Cumulative Retained (%), Passing (%).



Remarks : Gravel: 0.0%
Sand: 19.7%
Submitted By : Fines: 80.3%

Handwritten signature of Theobard N.

Theobard N.
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GEOTECHNICAL INVESTIGATIONS & TOPOGRAPHICAL SURVEY

Project: IMPROVEMENT OF POWER SUPPLY IN THE REPUBLIC OF DJIBOUTI

Location: PK 12 SUBSTATION AND NAGAD SWITCHING SUBSTATION

Client: **Yec** YACHIYO ENGINEERING CO., LTD - JAPAN

COSMEZZ SARL

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B.P. 131-Djibouti-R.D.D.

E-mail: cosmezz@mezzgroup.com

COSMEZZ GEOTECHNICAL LABORATORY - B.P. 131 Rue de Venise - Djibouti, Phone: +253 2 356 112 - Email: cosmezz@mezzgroup.com

LIQUID LIMIT, PLASTIC LIMIT, AND PLASTICITY INDEX - ASTM D 4318

Date Tested : **8-Jan-14**

Sample no : **TP-3/SS-2**

Date sampled : **31-Dec-13**

Sample Description : **Sandy elastic SILT (MH), Reddish-brown**

Sample Depth: **0.00 - 1.50 m**

Source : **PK 12 OVERHEAD TRANSMISSION LINE**

Tested by: **HOUSSEIN D.**

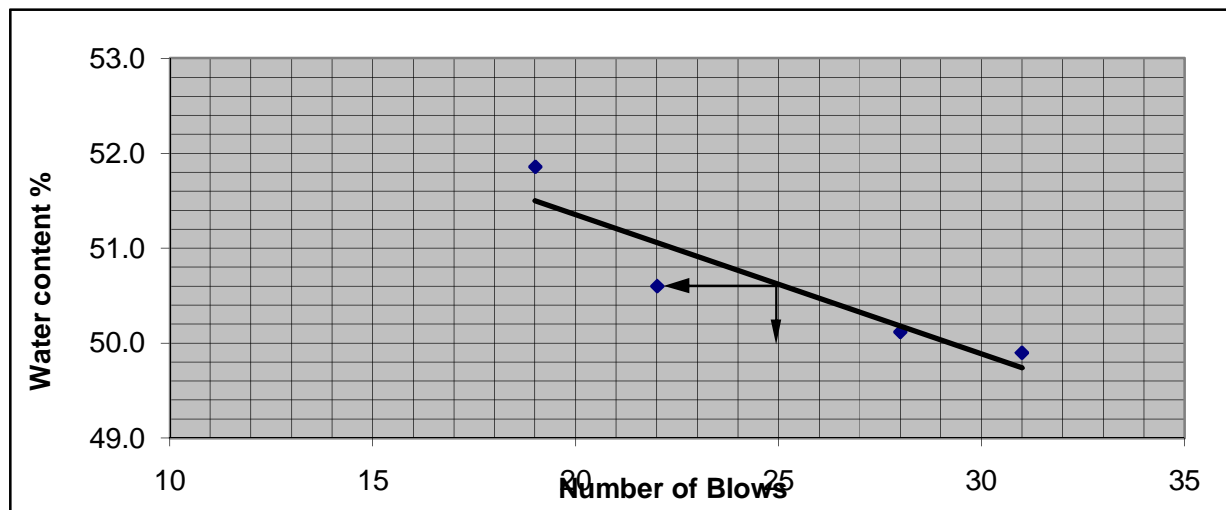
Sampled by: **THEO / MOH**

LL: 50.6

PL: 27.4

PI: 23.2

LIQUID LIMIT (LL)					PLASTIC LIMIT (PL)	
No of Blows	19	22	28	31	Test n°1	Test n°2
N° of container	A1	N	T	U	X	Y
Weight of wet soil + container(A)	47.38	44.77	44.92	46.84	37.06	36.14
Weight of Dry soil + container(B)	42.111	40.56	40.62	41.89	35.94	35.27
Weight of container©	31.95	32.24	32.04	31.97	31.91	32.04
Weight of water D=A-B	5.27	4.21	4.3	4.95	1.12	0.87
Weight of Dry soil (E)=(B-C)	10.161	8.32	8.58	9.92	4.03	3.23
Water content (W)=D/E*100	51.9	50.6	50.1	49.9	27.8	26.9
LL @25Blows and Average PL	50.6				27.4	



Remarks: _____

Submitted By _____

Theobard N.

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GEOTECHNICAL INVESTIGATIONS & TOPOGRAPHICAL SURVEY

Project: IMPROVEMENT OF POWER SUPPLY IN THE REPUBLIC OF DJIBOUTI

Location: PK 12 SUBSTATION AND NAGAD SWITCHING SUBSTATION

Client: *Yec* YACHIYO ENGINEERING CO., LTD - JAPAN

Contractor : COSMEZZ SARL

COSMEZZ SARL

Rue de Venise, Salines Ouest

B.P. 1331-Djibouti-R.D.D.

E-mail: cosmezz@mezzgroup.com

NATURAL MOISTURE CONTENT (%) - ASTM D 2216

Date Tested : 31-Dec-13

Sample no : TP-3/SS-1

Date sampled: 31-Dec-13

Sample Description : Well-graded Sand (SW-SC), dry, with clay and gravel

Sampled by : THEO

Source : TEST PIT#TP-3:PK 12

Tested by : THEO

OVERHEAD TRANSMISSION LINE

Sample Depth : 1.00 - 1.50 m

Designation		<i>unit</i>	1	
N° of container			C	
Weight of wet soil + container	A	<i>grs</i>	960.97	
Weight of Dry soil + container	B	<i>grs</i>	905.31	
Weight of container	C	<i>grs</i>	226.05	
Weight of water	D=A-B	<i>grs</i>	55.66	
Weight of Dry	E=B-C	<i>grs</i>	679.26	
Water content	W=D/E*100	%	8.2	

Remarks :

Submitted by :

Theobard N.

Geotech. Lab. Mngr

COSMEZZ SARL



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GEOTECHNICAL INVESTIGATIONS & TOPOGRAPHICAL SURVEY

Project: IMPROVEMENT OF POWER SUPPLY IN THE REPUBLIC OF DJIBOUTI
Location: PK 12 SUBSTATION AND NAGAD SWITCHING SUBSTATION - DJIBOUTI
Client: Yec YACHIYO ENGINEERING CO., LTD - JAPAN

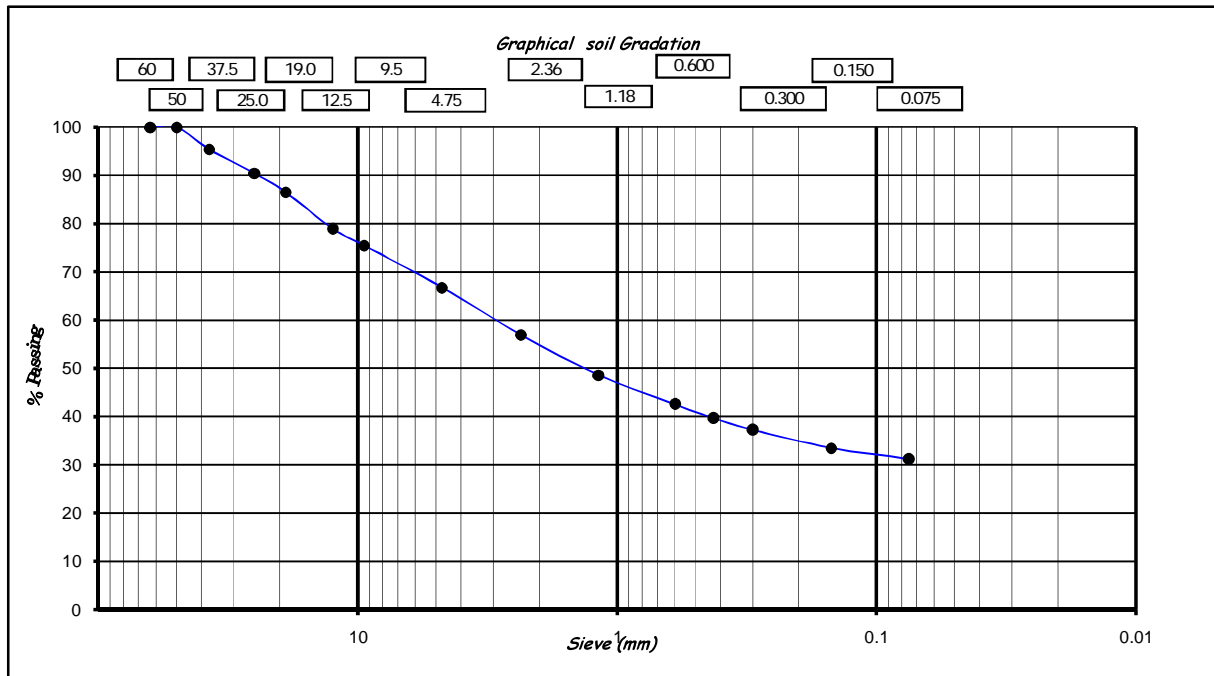
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E-mail: cosmezz@mezzgroup.com

COSMEZZ GEOTECHNICAL LABORATORY - B.P. 1331, Rue de Venise - Djibouti, Phone: +253 2 1356 142 - Email: cosmezz@mezzgroup.com

SIEVE ANALYSIS - ASTM C117/C136

Table with 4 columns: Field Name, Value, Field Name, Value. Includes Sample N°, Project No., Date of Sampling, Sample source, Date of Test, Sample Description, Station, Test Method, Sample Depth, Weight (grs), Sampled by, and Tested by.

Table with 6 columns: Sieve Number, Sieve(mm), Retained (gr), Cumulative Retained (gr), Cumulative Retained (%), Passing (%). Lists sieve sizes from 2 1/2 down to Can with corresponding retained and passing percentages.



Remarks : Gravel: 33.2%
Sand: 35.6%
Submitted By : Fines: 31.2%

Handwritten signature of Theobard N.

Theobard N.
GEOTECH. LAB. MNGR
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GEOTECHNICAL LABORATORY

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GEOTECHNICAL INVESTIGATIONS & TOPOGRAPHICAL SURVEY

Project: IMPROVEMENT OF POWER SUPPLY IN THE REPUBLIC OF DJIBOUTI

Location: PK 12 SUBSTATION AND NAGAD SWITCHING SUBSTATION

Client: **Yec** YACHIYO ENGINEERING CO., LTD - JAPAN

COSMEZZ SARL

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COSMEZZ GEOTECHNICAL LABORATORY - B.P. 131 Rue de Venise - Djibouti, Phone: +253 2 356 112 - Email: cosmezz@mezzgroup.com

LIQUID LIMIT, PLASTIC LIMIT, AND PLASTICITY INDEX - ASTM D 4318

Date Tested : **7-Jan-14**

Sample no : **TP-3/SS-3**

Date sampled : **31-Dec-13**

Sample Description : **Silty SAND (SM) with gravel**

Sample Depth: **1.50 - 2.25 m**

Source : **PK 12 OVERHEAD TRANSMISSION LINE**

Tested by: **HOUSSEIN D.**

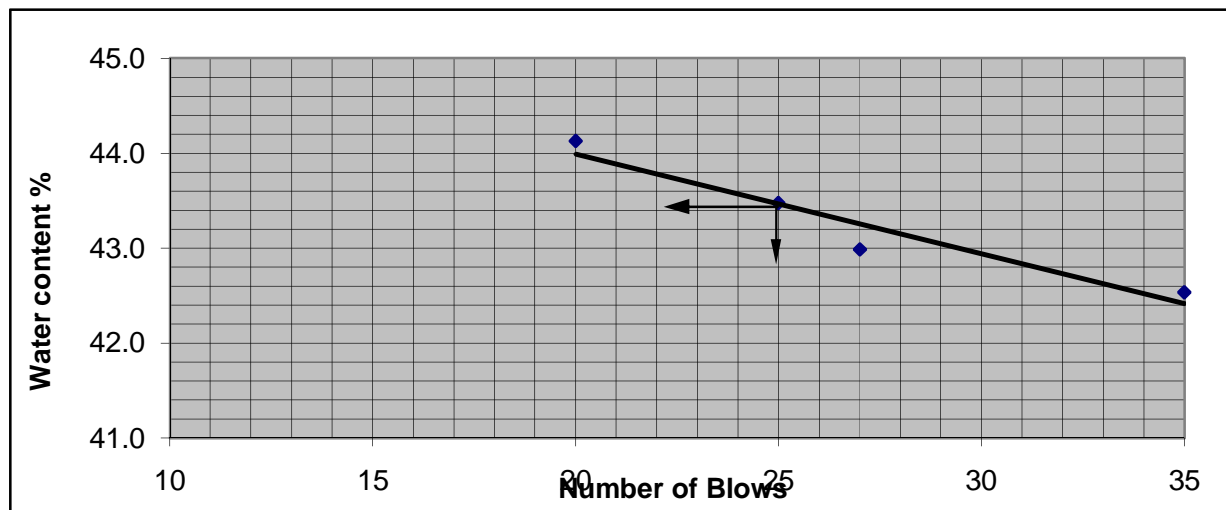
Sampled by: **THEO / MOH**

LL: 43.4

PL: 29.6

PI: 13.8

LIQUID LIMIT (LL)					PLASTIC LIMIT (PL)	
No of Blows	20	25	27	35	Test n°1	Test n°2
N° of container	A	J	G	U	K	Y
Weight of wet soil + container(A)	50.19	54.15	46.24	50.25	36.23	36.01
Weight of Dry soil + container(B)	44.63	47.45	41.95	44.78	35.29	35.07
Weight of container©	32.03	32.04	31.97	31.92	32.03	31.97
Weight of water D=A-B	5.56	6.7	4.29	5.47	0.94	0.94
Weight of Dry soil (E)=(B-C)	12.6	15.41	9.98	12.86	3.26	3.1
Water content (W)=D/E*100	44.1	43.5	43.0	42.5	28.8	30.3
LL @25Blows and Average PL	43.4				29.6	



Remarks: _____

Submitted By _____

Theobard N.

GEOTECHNICAL LAB. MNGR

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GEOTECHNICAL INVESTIGATIONS & TOPOGRAPHICAL SURVEY

Project: IMPROVEMENT OF POWER SUPPLY IN THE REPUBLIC OF DJIBOUTI

Location: PK 12 SUBSTATION AND NAGAD SWITCHING SUBSTATION

Client: *Yec* YACHIYO ENGINEERING CO., LTD - JAPAN

Contractor : COSMEZZ SARL

COSMEZZ SARL

Rue de Venise, Salines Ouest

B.P. 1331-Djibouti-R.D.D.

E-mail: cosmezz@mezzgroup.com

NATURAL MOISTURE CONTENT (%) - ASTM D 2216

Date Tested : 31-Dec-13

Date sampled: 31-Dec-13

Sampled by : THEO

Tested by : THEO

Sample no : TP-3/SS-2

Sample Description : Silty SAND (SM) with gravel

Source : TEST PIT#TP-3:PK 12

OVERHEAD TRASMISSION LINE

Sample Depth : 1.50 - 2.25 m

Designation		<i>unit</i>	1	
N° of container			P	
Weight of wet soil + container	A	<i>grs</i>	1404.08	
Weight of Dry soil + container	B	<i>grs</i>	1318.79	
Weight of container	C	<i>grs</i>	225.6	
Weight of water	D=A-B	<i>grs</i>	85.29	
Weight of Dry	E=B-C	<i>grs</i>	1093.19	
Water content	W=D/E*100	%	7.8	

Remarks :

Submitted by :

Theobard N.

Geotech. Lab. Mngr

COSMEZZ SARL



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GEOTECHNICAL INVESTIGATIONS & TOPOGRAPHICAL SURVEY

Project: IMPROVEMENT OF POWER SUPPLY IN THE REPUBLIC OF DJIBOUTI

Location: PK 12 SUBSTATION AND NAGAD SWITCHING SUBSTATION

Client: *Yec* YACHIYO ENGINEERING CO., LTD - JAPAN

Contractor : COSMEZZ SARL

COSMEZZ SARL

Rue de Venise, Salines Ouest

B.P. 1331-Djibouti-R.D.D.

E-mail: cosmezz@mezzgroup.com

NATURAL MOISTURE CONTENT (%) - ASTM D 2216

Date Tested : 11-May-14

Date sampled: 11-May-14

Sampled by : THEO

Tested by : THEO

Sample no : TP-4

Sample Description : Sandy elastic SILT (MH) with gravel, light brown

Source : TEST PIT#TP-4: NAGAD OVERHEAD TRANSMISSION LINE

Sample Depth : 1.40 - 2.30 m

Designation		<i>unit</i>	1	
N° of container			V	
Weight of wet soil + container	A	grs	942.85	
Weight of Dry soil + container	B	grs	873.11	
Weight of container	C	grs	420.54	
Weight of water	D=A-B	grs	69.74	
Weight of Dry	E=B-C	grs	452.57	
Water content	W=D/E*100	%	15.4	

Remarks :

Submitted by :

Theobard N.

Geotech. Lab. Mngr

COSMEZZ SARL



GEOTECHNICAL LABORATORY
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GEOTECHNICAL INVESTIGATIONS

Project: **IMPROVEMENT OF POWER SUPPLY IN THE REPUBLIC OF DJIBOUTI**
Location: **PK 12 SUBSTATION AND NAGAD - DJIBOUTI**

COSMEZZ SARL

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GEOTECHNICAL EXPLORATION FOR THE EXISTING SOIL

Project No:

Sample n°: **TP-4**

Test Method : **ASTM D 1883; D 1557; D 4318; C 136; C 117**

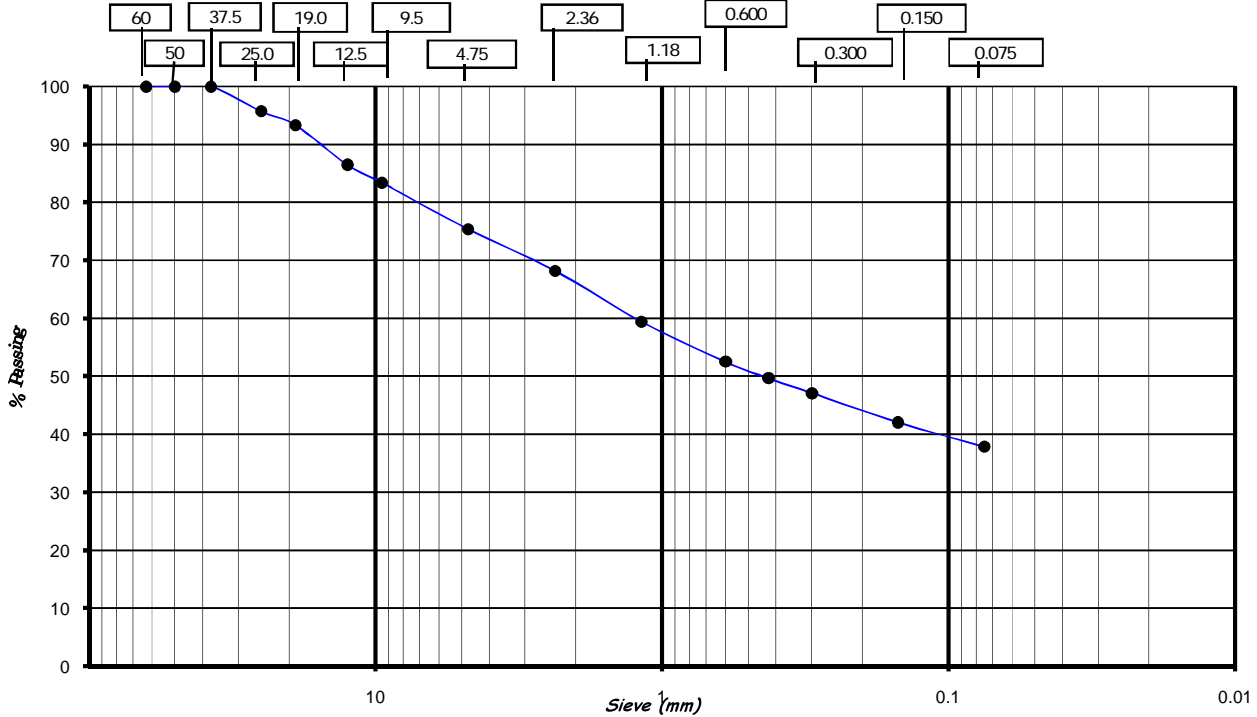
Source : **NAGAD OVERHEAD TRANSMISSION LINE (TP-4)**

Date Sampled : **11-May-14** Sample Depth: **1.40 - 2.30 m**

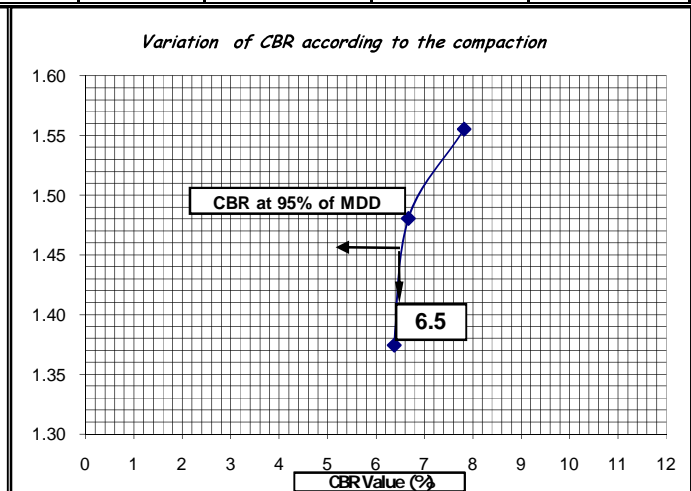
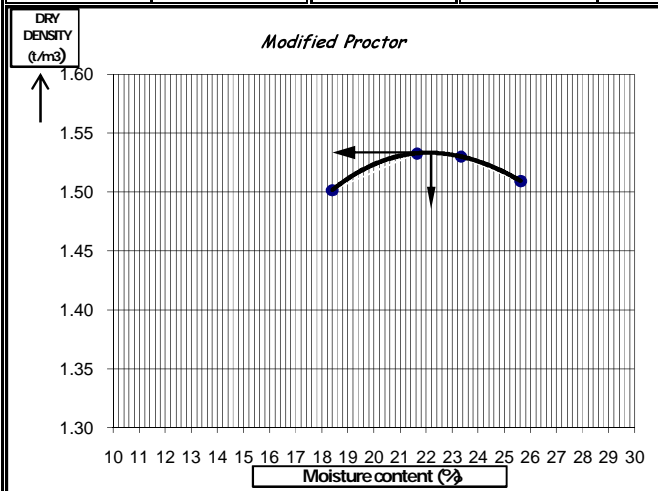
Date Completed Testing : **16-May-14**

LL	60.3	CLASSIFICATION		
PI	18.2	H-R-B	U S C S	Sandy elastic SILT (MH) with gravel, light brown
% < 0,075mm	37.9	A-7-5	MH	

Graphical soil Gradation



PROCTOR TEST		Natural Moisture content (%)	No of Blows	Compaction	DD (t/m ³)	Soaked CBR	W Soaking	Swell (%)
MDD(t/m ³) =	1.533							
OMC (%) =	22.2	25 Blows	96.6%	1.480	6.7	4 days	3.27	
ρ_{sd} =		10 Blows	89.6%	1.374	6.4	4 days		



Remarks: 1). Soaked CBR Value @95% of MDD for this material equal to 6.5%

Reported By :

Signature

THEOBARD N.

Geotechnical Lab. Mngr

COSMEZZ SARL



GEOTECHNICAL LABORATORY

"Certified by U.S. Army Corps of Engineers"

GEOTECHNICAL INVESTIGATIONS & TOPOGRAPHICAL SURVEY

Project: IMPROVEMENT OF POWER SUPPLY IN THE REPUBLIC OF DJIBOUTI

Location: PK 12 SUBSTATION AND MAGAD SWITCHING SUBSTATION - DJIBOUTI

Contract #: N 3319-12-C-0620

COSMEZZ SARL

Rue de Venise, Saline Ouest - Djibouti

B.P. 1331 - DJIBOUTI - R.D.D

Phone: +253 21356142, E-mail: cosmezz@mezgroup.com

Sample no : **TP-4**

Date Tested: 12-May-14

SOAKED C.B.R. TEST - ASTM D 1883

Method used for preparation and compaction : D 1557

Sample Description : Sandy elastic SILT (MH) with gravel, light brown Source : MAGAD OVERHEAD TRANSMISSION LINE (TEST PIT # TP-4)

Sample Depth : 1.4 - 2.30 m

Project number :

Surcharge weight (kg): **4.5**

Tested by: **HOUSSEIN / ABDI**

WATER CONTENT OF COMPACTION		
No. Of Blows	56	10
N° of container	BEFORE	AFTER
W. of Wet soil + Container	804.75	
W. of Dry soil + Container	734.49	
W. Of container	420.38	
W. Of water	70.26	
W. Of Dry soil	314.11	
Water content %	22.4	22.4

DRY DENSITY						
No. of Blows	56	25	J1	J2	J5	10
N° of Mold	J1	J2	J1	J2	J5	J5
W. Of Wet soil + Mold	(gram)	10233.4	10551.0	10298.2	10298.2	10298.2
W. Of Mold	(gram)	6201.8	6711.4	6716.2	6716.2	6716.2
W. Of Wet soil	(gram)	4031.6	3839.6	3582.0	3582.0	3582.0
Volume of Mold	(gram)	2118.4	2119.8	2130.2	2130.2	2130.2
Wet Density	(g/cm ³)	1.903	1.811	1.682	1.682	1.682
Water content %	(%)	22.4	22.4	22.4	22.4	22.4
Dry Density	(g/cm ³)	1.555	1.480	1.374	1.374	1.374
MDD	(g/cm ³)	1.533	1.533	1.533	1.533	1.533
% of Compaction	(%)	101.5	96.6	89.6	89.6	89.6

WATER CONTENT AFTER SOAKING (4 days)

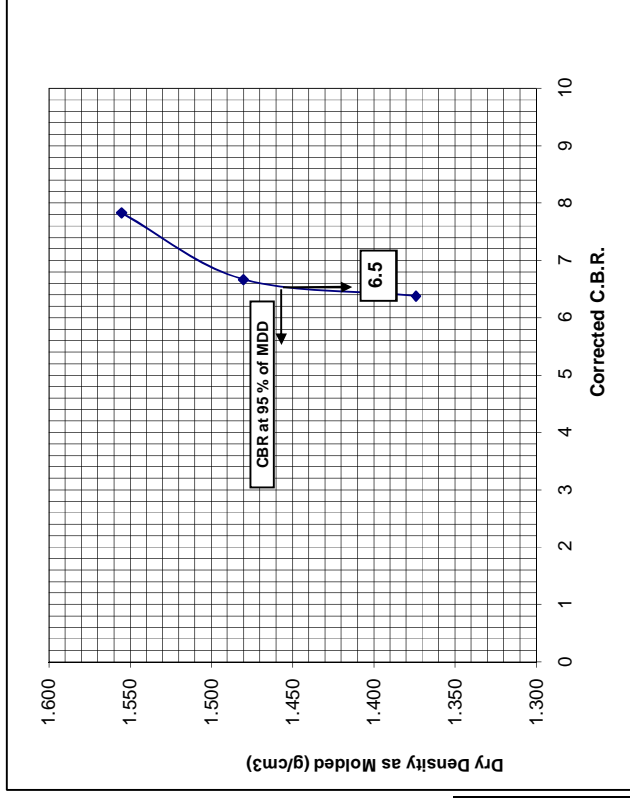
No. Of Blows	56	25	10
N° of container	BEFORE	AFTER	AFTER
W. of Wet soil + Container	804.75	831.20	671.18
W. of Dry soil + Container	685.12	679.63	539.02
W. Of container	233.15	230.22	151.09
W. Of water	119.63	151.57	132.2
W. Of Dry soil	451.97	449.41	387.9
Water content %	26.5	33.7	34.1

SWELL (1/100mm)

Date	Blows	56	25	10
12-May-14	0.00	0.00	0.00	0.00
13-May-14	2.92	3.45	2.5	2.5
14-May-14	3.66	3.71	2.51	2.51
15-May-14	3.79	3.76	2.52	2.52
16-May-14	3.83	3.79	2.53	2.53
Total mm	3.83	3.79	2.53	2.53
Total %	3.30	3.27	2.18	2.18

PENETRATION

Date:	16-May-14						N° of LOAD RING: S370-10S-ZI-0001					
Penetr. mm	56 Blows		25 Blows		10 Blows		Reading	Stress	Reading	Stress	Reading	Stress
	Reading	Stress	Reading	Stress	Reading	Stress						
0.00	0.000	0.00	0.000	0.00	0.000	0.000	0.00	0.000	0.00	0.000	0.00	0.00
0.64	0.005	0.57	0.005	0.57	0.005	0.005	0.57	0.005	0.57	0.005	0.57	0.57
1.27	0.010	1.15	0.010	1.15	0.010	0.010	1.15	0.010	1.15	0.010	1.15	1.15
1.91	0.020	2.30	0.020	2.30	0.015	0.015	1.72	0.020	2.30	0.015	1.72	1.72
2.54	0.035	4.02	0.030	3.45	0.025	0.025	2.87	0.035	4.02	0.025	2.87	2.87
3.18	0.045	5.17	0.040	4.59	0.035	0.035	4.02	0.045	5.17	0.035	4.02	4.02
3.81	0.050	5.74	0.045	5.17	0.040	0.040	4.59	0.050	5.74	0.040	4.59	4.59
4.45	0.055	6.32	0.050	5.74	0.045	0.045	5.17	0.055	6.32	0.045	5.17	5.17
5.08	0.060	6.89	0.055	6.32	0.050	0.050	5.74	0.060	6.89	0.050	5.74	5.74
7.62	0.080	9.19	0.060	6.89	0.055	0.055	6.32	0.080	9.19	0.055	6.32	6.32



No. of Blows	2.54 mm	5.08 mm	CBR@2.5mm
56	7.8	7.3	7.8
25	6.7	6.3	6.7
10	6.4	5.8	6.4

1.380 1.456 1.533

Submitted By :

Theobard N.

Theobard N.
GEOTECHNICAL LAB MNGR
COSMEZZ SARL



GEOTECHNICAL LABORATORY

"Certified by U.S. Army Corps of Engineers"

GEOTECHNICAL INVESTIGATIONS & TOPOGRAPHICAL SURVEY

Project: IMPROVEMENT OF POWER SUPPLY IN THE REPUBLIC OF DJIBOUTI

Location: PK 12 SUBSTATION AND NAGAD SWITCHING SUBSTATION - DJIBOUTI

Contract #: **N 33191-12-C-0620**

COSMEZZ SARL

Rue de Venise, Saline Ouest - Djibouti

B.P. 1331 - DJIBOUTI - R.D.D

Phone: +253 21556142, E-mail: cosmezz@mezzgroup.com

Sample no. : **TP-4**

Sample Description : **Sandy elastic SILT (MH) with gravel, light brown**

Tested by: **HOUSSEIN / ABDI**

WATER CONTENT OF COMPACTION		56	25	10
No. Of Blows				
N° of container	BEFORE	Average	AFTER	
W. of Wet soil + Container	804.75			
W. of Dry soil + Container	734.49			
W. Of container	420.38			
W. Of water	70.26			
W. Of Dry soil	314.11			
Water content %	22.4		22.4	

WATER CONTENT AFTER SOAKING (4 days)

No. Of Blows	56	25	10
N° of container			
W. of Wet soil + Container	804.75	831.20	671.18
W. of Dry soil + Container	685.12	679.63	539.02
W. Of container	233.15	230.22	151.09
W. Of water	119.63	151.57	132.16
W. Of Dry soil	451.97	449.41	387.93
Water content %	26.5	33.7	34.1

SWELL (1/100mm)

Blows	56	25	10
Date			
12-May-14	0.00	0.00	0.00
13-May-14	2.92	3.45	2.5
14-May-14	3.66	3.71	2.51
15-May-14	3.79	3.76	2.52
16-May-14	3.83	3.79	2.53
Total mm	3.83	3.79	2.53
Total %	3.30	3.27	2.18

Date Tested: **12-May-14**

Source : **NAGAD OVERHEAD TRANSMISSION LINE (TEST PIT # TP-4)**

Project number. :

	DRY DENSITY				
	56	25	J2	J5	10
N° of Mold					
W. Of Wet soil + Mold	10233.4	10651.0	10298.2		
W. Of Mold	6201.8	6711.4	6716.2		
W. Of Wet soil	4031.6	3939.6	3582.0		
Volume of Mold	2118.4	2119.8	2130.2		
Wet Density	1.903	1.858	1.682		
Water content %	22.4	22.4	22.4		
Dry Density	1.555	1.519	1.374		
MDD	1.533	1.533	1.533		
% of Compaction	101.5	99.1	89.6		

PENETRATION

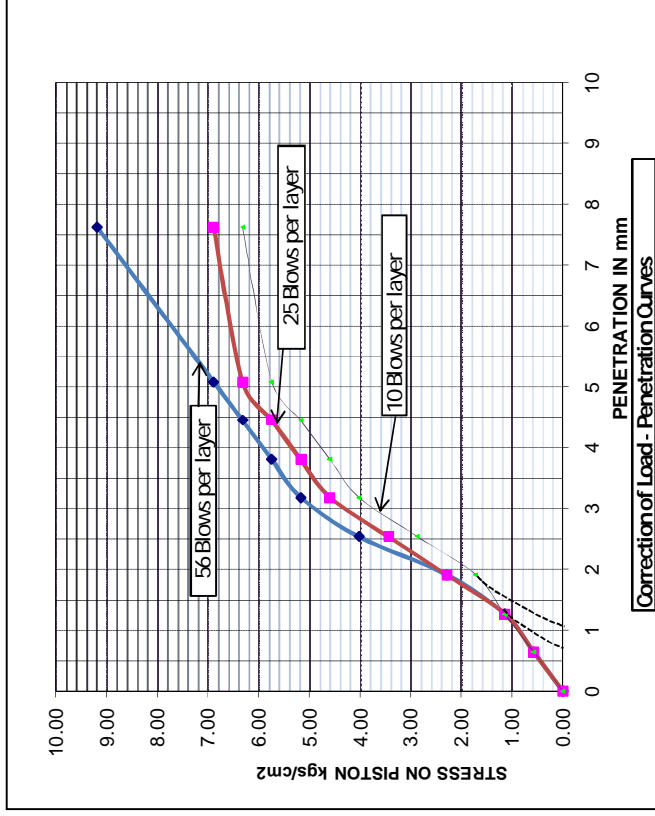
Date: **16-May-14** N° of LOAD RING: **S370-10S-ZI-0001**

Penetr. mm	56 Blows		25 Blows		10 Blows	
	Reading	Stress	Reading	Stress	Reading	Stress
0.00	0.000	0.00	0.000	0.00	0.000	0.00
0.64	0.005	0.57	0.005	0.57	0.005	0.57
1.27	0.010	1.15	0.010	1.15	0.010	1.15
1.91	0.020	2.30	0.020	2.30	0.015	1.72
2.54	0.035	4.02	0.030	3.45	0.025	2.87
3.18	0.045	5.17	0.040	4.59	0.035	4.02
3.81	0.050	5.74	0.045	5.17	0.040	4.59
4.45	0.055	6.32	0.050	5.74	0.045	5.17
5.08	0.060	6.89	0.055	6.32	0.050	5.74
7.62	0.080	9.19	0.060	6.89	0.055	6.32

Method used for preparation and compaction : **D 1557**

Sample Depth : **1.4 - 2.30 m**

Surcharge weight (kg): **4.5**



Correction of Load - Penetration Curves

No. of Blows	2.54 mm	5.08 mm	Max stress
56	5.40	7.50	7.50
25	4.60	6.50	6.50
10	4.40	6.00	6.00

1.380 1.456 1.533

Reported By :

Signature

Theobard N.

GEOTECHNICAL LAB MNGR

COSMEZZ SARL



GEOTECHNICAL LABORATORY

Certified by U.S. Army Corps of Engineers

Project: IMPROVEMENT OF POWER SUPPLY
IN THE REPUBLIC OF DJIBOUTI
Location: PK 12 SUBSTATION AND NAGAD - DJIBOUTI
Contract #: -----

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COSMEZZ GEOTECHNICAL LABORATORY - B.P. 131 Rue de Venise - Djibouti, Phone: +253 2 1356142 - Email: cosmezz@mezzgroup.com

MODIFIED PROCTOR TEST - ASTM D 1557

Method used: C Type of Rammer: Manual % of Retained on 19mm Sieve: ---
Sample Description : Sandy elastic SILT (MH) with gravel, light brown Date Sampled : 11-May-14
Sample n° : TP-4 Date Tested : 11-May-14
Sample Source : NAGAD OVERHEAD TRANSMISSION LINE Sample Depth : 1.40 - 2.30 m
Tested by : ABDI / MERITO Sampled By : THEO

Determination N°	Units	1	2	3	4
% of Water added	%	2	4	6	8

WET DENSITY DETERMINATION

Weight of soil + Mold	(grs)	8,326.2	8,510.0	8,557.8	8,576.2
Weight of Mold	(grs)	4,560.0	4,560.0	4,560.0	4,560.0
Weight of soil	(grs)	3,766.2	3,950.0	3,997.8	4,016.2
Volume of Mold	(cm ³)	2,118.7	2,118.7	2,118.7	2,118.7
Wet Density	(g/cm ³)	1.778	1.864	1.887	1.896

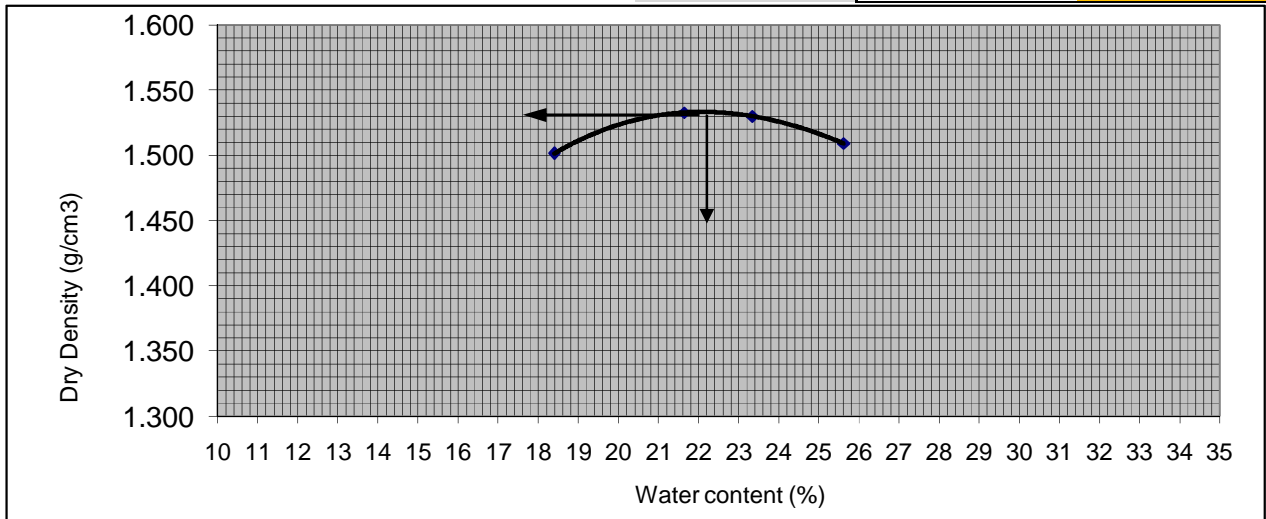
MOISTURE CONTENT DETERMINATION

Weight of Wet soil + Container	(grs)	677.32	611.98	677.39	652.05
Weight of Dry soil + Container	(grs)	608.30	543.84	592.08	565.22
Weight of Water	(grs)	69.02	68.14	85.31	86.83
Weight of container	(grs)	233.08	228.95	226.55	226.25
Weight of Dry soil	(grs)	375.22	314.89	365.53	338.97
Water Content	%	18.4	21.6	23.3	25.6

DRY DENSITY

Dry Density	(g/cm ³)	1.501	1.533	1.530	1.509
-------------	----------------------	-------	-------	-------	-------

Corrected Maximum Dry Density (C-MDD) MDD (g/cm³): 1.533
Corrected Optimum Moisture Content (C-OMC) OMC (%): 22.2



Remarks:

Submitted By :

THEOBARD N.

Geotechnical Lab. Mngr
COSMEZZ SARL



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GEOTECHNICAL INVESTIGATIONS & TOPOGRAPHICAL SURVEY

Project: IMPROVEMENT OF POWER SUPPLY IN THE REPUBLIC OF DJIBOUTI
Location: PK 12 SUBSTATION AND NAGAD SWITCHING SUBSTATION - DJIBOUTI
Client: Yec YACHIYO ENGINEERING CO., LTD - JAPAN

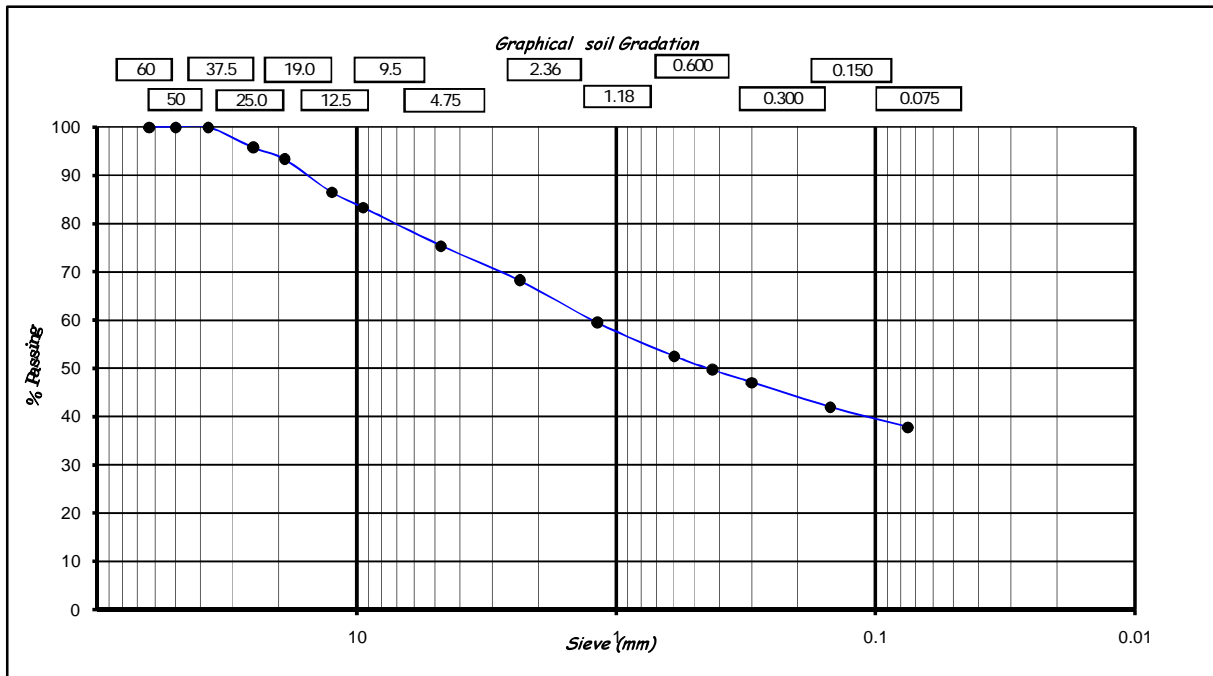
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COSMEZZ GEOTECHNICAL LABORATORY - B.P. 1331, Rue de Venise - Djibouti, Phone: +253 2 1356 142 - Email: cosmezz@mezzgroup.com

SIEVE ANALYSIS - ASTM C117/C136

Sample N°: TP-4 Project No.: Date of Sampling: 11-May-14
Sample source: NAGAD OVERHEAD TRANSMISSION LINE Date of Test: 12-May-14
Sample Description: Sandy elastic SILT (MH) with gravel, light brown Station: NAGAD
Test Method: ASTM C 117 / C136 Sample Depth: 1.40 - 2.30 m
Weight (grs): 3169.80 Sampled by: THEO/MOH
Tested by: ABDI

Table with 6 columns: Sieve Number, Sieve(mm), Retained (gr), Cumulative Retained (gr), Cumulative Retained (%), Passing (%). Rows include sieve sizes from 2 1/2 down to Can.



Remarks : Gravel: 24.6%
Sand: 37.5%
Submitted By : Fines: 37.9%

Handwritten signature of Theobard N.

Theobard N.
GEOTECH. LAB. MNGR
COSMEZZ SARL



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GEOTECHNICAL INVESTIGATIONS & TOPOGRAPHICAL SURVEY

Project: IMPROVEMENT OF POWER SUPPLY IN THE REPUBLIC OF DJIBOUTI

Location: PK 12 SUBSTATION AND NAGAD SWITCHING SUBSTATION

Client: **Yec** YACHIYO ENGINEERING CO., LTD - JAPAN

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COSMEZZ GEOTECHNICAL LABORATORY - B.P. 131 Rue de Venise - Djibouti, Phone: +253 2 356 112 - Email: cosmezz@mezzgroup.com

LIQUID LIMIT, PLASTIC LIMIT, AND PLASTICITY INDEX - ASTM D 4318

Date Tested : **13-May-14**

Sample no : **TP-4**

Date sampled : **11-May-14**

Sample Description : **Sandy elastic SILT (MH) with gravel, light brown**

Sample Depth: **1.40 - 2.30 m**

Source : **NAGAD/OVERHEAD TRANSMISSION LINE**

Tested by: **HOUSSEIN D.**

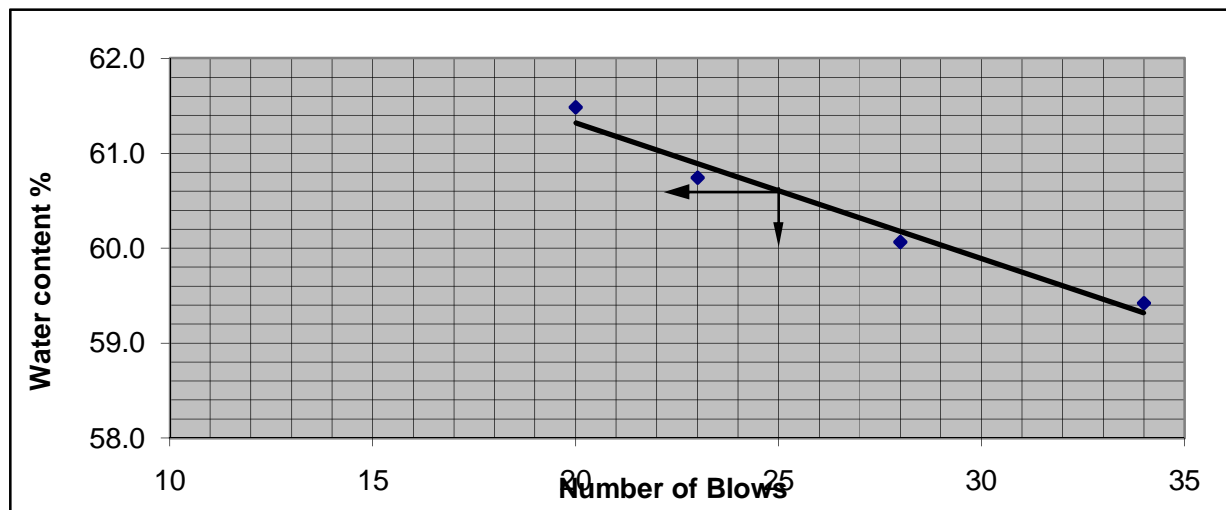
Sampled by: **THEO / MOH**

LL: 60.3

PL: 42.1

PI: 18.2

LIQUID LIMIT (LL)					PLASTIC LIMIT (PL)	
No of Blows	20	23	28	34	Test n°1	Test n°2
N° of container	16	17	18	19	15	20
Weight of wet soil + container(A)	43.00	42.21	42.27	41.08	36.56	36.55
Weight of Dry soil + container(B)	38.85	38.28	38.42	37.20	35.16	35.18
Weight of container©	32.1	31.81	32.01	30.67	31.83	31.93
Weight of water D=A-B	4.15	3.93	3.85	3.88	1.4	1.37
Weight of Dry soil (E)=(B-C)	6.75	6.47	6.41	6.53	3.33	3.25
Water content (W)=D/E*100	61.5	60.7	60.1	59.4	42.0	42.2
LL @25Blows and Average PL	60.3				42.1	



Remarks: _____

Submitted By _____

Theobard N.

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GEOTECHNICAL LABORATORY

APPENDIX C

CALCULATIONS FOR BEARING CAPACITY OF FOUNDATION

As requested by YEC, we have done calculations for Bearing Capacity of Shallow Foundations at three levels based on the general soil design parameters obtained during soil investigations of this Project.



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GEOTECHNICAL INVESTIGATIONS

Project: IMPROVEMENT OF POWER SUPPLY IN THE REPUBLIC OF DJIBOUTI

Location: PK 12 SUBSTATION AND NAGAD SWITCHING SUBSTATION

Client: Yec YACHIYO ENGINEERING CO., LTD - JAPAN

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BEARING CAPACITY CALCULATION OF SHALLOW FOUNDATIONS TERZAGHI & VESIC Bearing Capacity Equations

BEARING CAPACITY OF SHALLOW FOUNDATIONS

Terzaghi and Vesic Methods

Date: January 18, 2015
Identification: Foundation Level=1.0 m

Table with columns: Input, Results, Terzaghi, Vesic. Includes sections for Units of Measurement, Foundation Information, Soil Information, and Factor of Safety (FS).

Table of unit conversions and computations including Terzaghi Computations and Vesic Computation.

TERZAGHI: Q ult= 1.3 c Nc + γ D Nq + 0.4 γ B Ny
VESIC: Q ult= c Nc sc dc + σzD' Nq sq dq + 0.5 γ B Ny sy dy

- Where: Q ult: Ultimate bearing capacity
c: Soil Cohesion
Gamma (γ): Soil Bulk unit weight (KN/m³)
B: Width of foundation (m)
FS: Factor of Safety
Nc, Nq, Nγ: Terzaghi's Bearing capacity Factors
sc, sy, sq: VESIC's shape factors
dc, dq, dy: VESIC's depth factors
q a: Allowable Bearing Capacity
σzD': Vertical Effective Stress at Depth D Below Ground Surface
(phi) φ: Friction Angle for Soil Beneath Foundation

Computed by:

Handwritten signature

THEOBARD NSHIMIYUMUREMYI
Geotechnical Lab Chief
COSMEZZ Sarl

BEARING CAPACITY OF SHALLOW FOUNDATIONS

Terzaghi and Vesic Methods

Date December 13, 2014

Identification Foundation Level=1.0 m

Input

Units of Measurement

SI SI or E

Foundation Information

Shape SQ SQ, CI, CO, or RE

B = 1.5 m

L = 1.5 m

D = 1 m

Soil Information

c = 20 kPa

phi = 30 deg

gamma = 19.7 kN/m³

Dw = m

Factor of Safety

F = 3

Results

Terzaghi

Vesic

Bearing Capacity

q ult = 1,308 kPa

1,672 kPa

q a = 436 kPa

557 kPa

Allowable Column Load

P = 981 kN

1,254 kN

Calculated by: THEOBARD/ COSMEZZ Srl

NOTE: To be applied at PK 12 SUBSTATION area

BEARING CAPACITY OF SHALLOW FOUNDATIONS

Terzaghi and Vesic Methods

Date December 13, 2014

Identification Foundation Level=1.5 m

Input

Units of Measurement

SI SI or E

Foundation Information

Shape SQ SQ, CI, CO, or RE

B = 1.5 m

L = 1.5 m

D = 1.5 m

Soil Information

c = 300 kPa

phi = 30 deg

gamma = 26.5 kN/m³

Dw = m

Factor of Safety

F = 3

Results

Terzaghi

Vesic

Bearing Capacity

q ult = 15,257 kPa

21,492 kPa

q a = 5,086 kPa

7,164 kPa

Allowable Column Load

P = 11,443 kN

16,119 kN

Calculated by: THEOBARD/ COSMEZZ Srl

NOTE: To be applied at PK 12 SUBSTATION area

BEARING CAPACITY OF SHALLOW FOUNDATIONS

Terzaghi and Vesic Methods

Date December 13, 2014

Identification Foundation Level=2.0 m

Input

Units of Measurement

SI SI or E

Foundation Information

Shape SQ SQ, CI, CO, or RE

B = 1.5 m

L = 1.5 m

D = 2 m

Soil Information

c = 300 kPa

phi = 30 deg

gamma = 26.5 kN/m³

Dw = m

Factor of Safety

F = 3

Results

Terzaghi

Vesic

Bearing Capacity

q ult = 15,445 kPa

21,361 kPa

q a = 5,148 kPa

7,120 kPa

Allowable Column Load

P = 11,584 kN

16,021 kN

Calculated by: THEOBARD/ COSMEZZ Srl

NOTE: To be applied at PK 12 SUBSTATION area

BEARING CAPACITY OF SHALLOW FOUNDATIONS

Terzaghi and Vesic Methods

Date December 13, 2014

Identification Foundation Level=1.0 m

Input

Units of Measurement

SI SI or E

Foundation Information

Shape SQ SQ, CI, CO, or RE

B = 1.5 m

L = 1.5 m

D = 1 m

Soil Information

c = 0 kPa

phi = 33 deg

gamma = 21 kN/m³

Dw = m

Factor of Safety

F = 3

Results

Terzaghi

Vesic

Bearing Capacity

q ult = 585 kPa

746 kPa

q a = 195 kPa

249 kPa

Allowable Column Load

P = 438 kN

559 kN

Calculated by: THEOBARD/ COSMEZZ Srl

NOTE: To be applied at TRANSMISSION area

BEARING CAPACITY OF SHALLOW FOUNDATIONS

Terzaghi and Vesic Methods

Date December 13, 2014

Identification Foundation Level=1.5 m

Input

Units of Measurement

SI SI or E

Foundation Information

Shape SQ SQ, CI, CO, or RE

B = 1.5 m

L = 1.5 m

D = 1.5 m

Soil Information

c = 10 kPa

phi = 20 deg

gamma = 19 kN/m³

Dw = m

Factor of Safety

F = 3

Results

Terzaghi

Vesic

Bearing Capacity

q ult = 357 kPa

478 kPa

q a = 119 kPa

159 kPa

Allowable Column Load

P = 268 kN

358 kN

Calculated by: THEOBARD/ COSMEZZ Srl

NOTE: To be applied at TRANSMISSION area

BEARING CAPACITY OF SHALLOW FOUNDATIONS

Terzaghi and Vesic Methods

Date December 13, 2014

Identification Foundation Level=2.0 m

Input

Units of Measurement

SI SI or E

Foundation Information

Shape SQ SQ, CI, CO, or RE

B = 1.5 m

L = 1.5 m

D = 2 m

Soil Information

c = 10 kPa

phi = 20 deg

gamma = 19 kN/m³

Dw = m

Factor of Safety

F = 3

Results

Terzaghi

Vesic

Bearing Capacity

q ult = 391 kPa

521 kPa

q a = 130 kPa

174 kPa

Allowable Column Load

P = 293 kN

391 kN

Calculated by: THEOBARD/ COSMEZZ Srl

NOTE: To be applied at TRANSMISSION area

COSMEZZ Costruzioni Mezzedimi S.a.r.l.
R.C. 9165/B/Sarl Djibouti ■ N.I.F. 2000107
a Mezz Group Company
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cosmezz@mezzgroup.com

GEOTECHNICAL LABORATORY

APPENDIX D

PHOTOS LOG

Geotechnical Engineering Report - Soil investigations

Client: **YEC – YACHIYO ENGINEERING CO.,LTD of JAPAN**

Project: **IMPROVEMENT OF POWER SUPPLY IN THE REPUBLIC OF DJIBOUTI**

December 13, 2014

Contractor: **COSMEZZ SARL**

GEOTECHNICAL LABORATORY



PHOTOGRAPH1:

Photo taken: 07-Dec-2013

Location: PK 12 SUBSTATION
 BH1

Comments:

Cosmezz drilling rig (CMV MK 600JET) performing washed rotary drilling



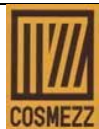
PHOTOGRAPH2:

Photo taken: 07-Dec-2013

Location: PK 12 SUBSTATION
 BH1

Comments:

Cosmezz Split Spoon Sampler



GEOTECHNICAL LAB

**Project: IMPROVEMENT OF
 POWER SUPPLY IN THE
 REPUBLIC OF DJIBOUTI - PK
 12 SUBSTATION &
 TRANSMISSION LINE ROUTE
 TO NAGAD**

PHOTOS LOG



GEOTECHNICAL LABORATORY



PHOTOGRAPH 3:

Photo taken: 07-Dec-2013

Location: PK 12 SUBSTATION
 BH2

Comments:

Existing site conditions during soil investigations



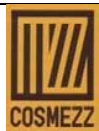
PHOTOGRAPH 4:

Photo taken: 07-Dec-2013

Location: PK 12 SUBSTATION
 BH1

Comments:

Core samples from BH-1



GEOTECHNICAL LAB

**Project: IMPROVEMENT OF
 POWER SUPPLY IN THE
 REPUBLIC OF DJIBOUTI - PK
 12 SUBSTATION &
 TRANSMISSION LINE ROUTE
 TO NAGAD**

PHOTOS LOG

GEOTECHNICAL LABORATORY



PHOTOGRAPH5:

Photo taken: 15-Dec-2013

Location: **TRANSMISSIONLINE ROUTE
BH3**

Comments:

Existing site conditions during soil investigations at Transmission Line Route near PK 12 Plants.



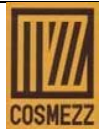
PHOTOGRAPH6:

Photo taken: 15-Dec-2013

Location: **TRANSMISSIONLINE ROUTE
BH3**

Comments:

COSMEZZ Rotary Drilling Rig during soil exploration at BH-3.



GEOTECHNICAL LAB

**Project: IMPROVEMENT OF
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TRANSMISSION LINE ROUTE
TO NAGAD**

PHOTOS LOG

GEOTECHNICAL LABORATORY



PHOTOGRAPH7:

Photo taken: 16-Dec-2014

Location: **TRANSMISSIONLINE ROUTE
BH3**

Comments:

Core samples from BH-3.



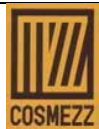
PHOTOGRAPH8:

Photo taken: 15-Dec-2014

Location: **TRANSMISSIONLINE ROUTE
BH3**

Comments:

Looking in the south-east of BH-3.



GEOTECHNICAL LAB

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TO NAGAD**

PHOTOS LOG

GEOTECHNICAL LABORATORY



PHOTOGRAPH9:

Photo taken: 26-April-2014

Location: TRANSMISSIONLINE ROUTE
 BH4

Comments:

COSMEZZ Rotary Drilling Rig during soil exploration at NAGAD.



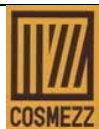
PHOTOGRAPH10:

Photo taken: 26-April-2014

Location: TRANSMISSIONLINE ROUTE
 BH4

Comments:

Core samples from BH-4 at Nagad.



GEOTECHNICAL LAB

Project: IMPROVEMENT OF
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 TO NAGAD

PHOTOS LOG

GEO TECHNICAL LABORATORY



PHOTOGRAPH 11:

Photo taken: 31-Dec-2013

Location: PK 12 SUBSTATION
 TP-2 (Test Pit-2)

Comments:

During Test Pit excavation at PK 12 Substation.



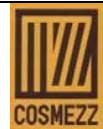
PHOTOGRAPH 12:

Photo taken: 31-Dec-2013

Location: PK 12 SUBSTATION
 TP-2

Comments:

Test Pit-2.



COSMEZZ GEOTECHNICAL LAB

**Project: IMPROVEMENT OF
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 TO NAGAD**

PHOTOS LOG



GEO TECHNICAL LABORATORY



PHOTOGRAPH 13:

Photo taken: 31-Dec-2013

Location: **TRANSMISSION LINE ROUTE
 TP-3 (Test Pit-3)**

Comments:

After test pit excavation of TP-3 near PK 12
 Plants (COLAS Plants and NAEL).



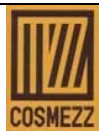
PHOTOGRAPH 14:

Photo taken: 11-May-2014

Location: **TRANSMISSION LINE (NAGAD)
 TP-4**

Comments:

Test Pit-4.



GEOTECHNICAL LAB

**Project: IMPROVEMENT OF
 POWER SUPPLY IN THE
 REPUBLIC OF DJIBOUTI - PK
 12 SUBSTATION &
 TRANSMISSION LINE ROUTE
 TO NAGAD**

PHOTOS LOG

A-8 概略設計図

単線結線図

図面番号	図面名称
DWG No. SS-E-01	ジャバナス変電所 単線結線図
DWG No. SS-E-02	ブラオス発電所 63 kV 変電所 単線結線図

概略配置図

図面番号	図面名称
DWG No. SS-L-01	ジャバナス変電所 全体配置図
DWG No. SS-L-02	ジャバナス変電所 63 kV 開閉装置建屋配置図
DWG No. SS-L-03	ジャバナス変電所 コントロール建屋内配置図
DWG No. SS-L-04	ブラオス発電所 63 kV 変電所 建屋内配置図
DWG No. SS-L-05	ブラオス発電所 63 kV 変電所 リレー室配置図

送電線鉄塔図

図面番号	図面名称
DWG No. T-01	送電線鉄塔 Type A (二回線)
DWG No. T-02	送電線鉄塔 Type B, C (二回線)
DWG No. T-03	送電線鉄塔 Type R (二回線)
DWG No. T-04	送電線鉄塔 Type ZZ (二回線)
DWG No. T-05	送電線鉄塔 Type A (一回線)
DWG No. T-06	送電線鉄塔 Type B, C (一回線)
DWG No. T-07	送電線鉄塔 Type R (一回線)
DWG No. T-08	送電線鉄塔 Type ZZ (一回線)

架台図

図面番号	図面名称
DWG No. P-01	架台 Type A
DWG No. P-02	架台 Type B
DWG No. P-03	架台 Type C
DWG No. P-04	架台 Type D
DWG No. P-05	架台 Type E
DWG No. P-06	架台 Type F
DWG No. P-07	架台 Type G
DWG No. P-08	架台 Type H
DWG No. P-09	架台 Type I
DWG No. P-10	架台 Type J

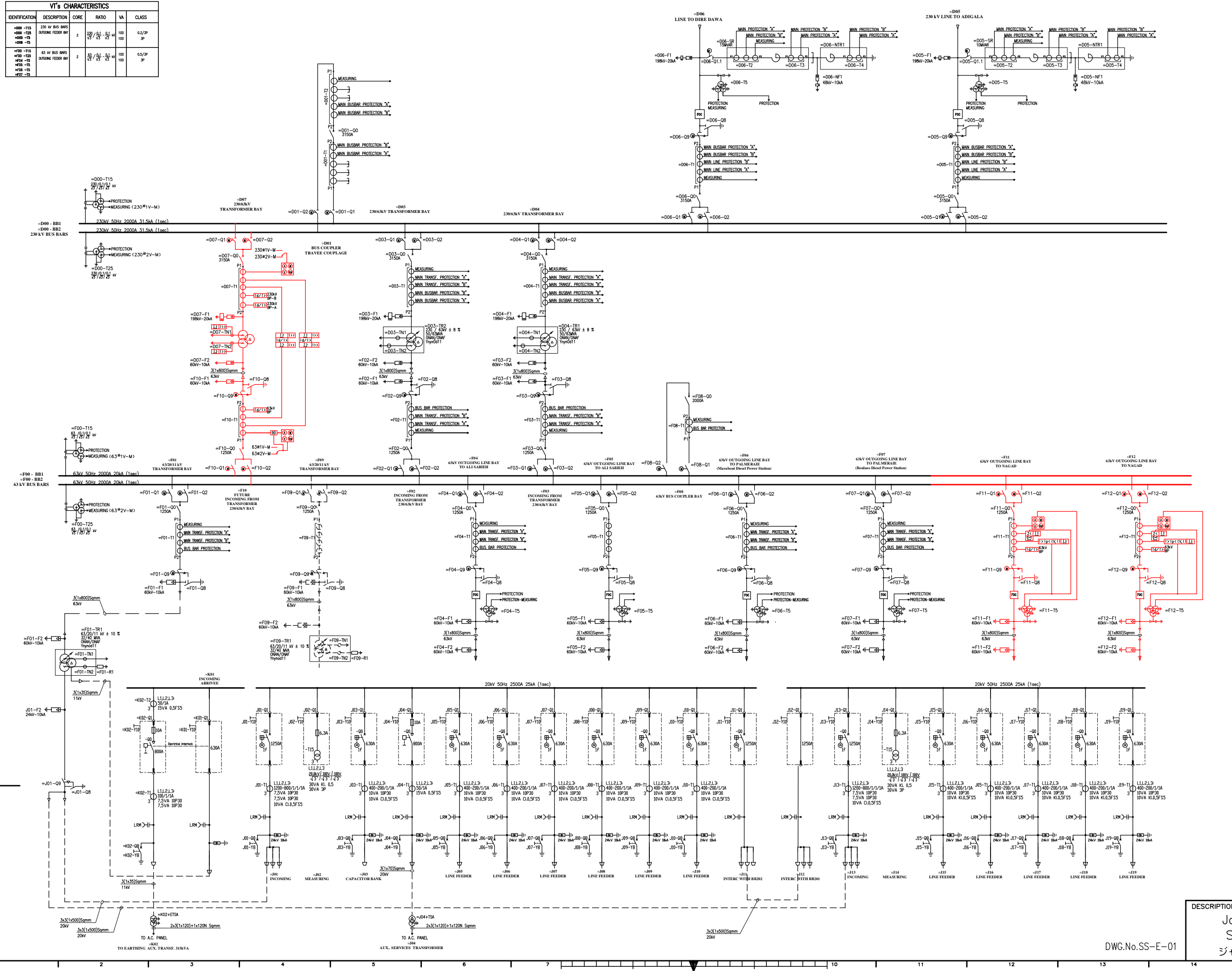
建築図

図面番号	図面名称
DWG No. AR	ジャバナス変電所 機材基礎図

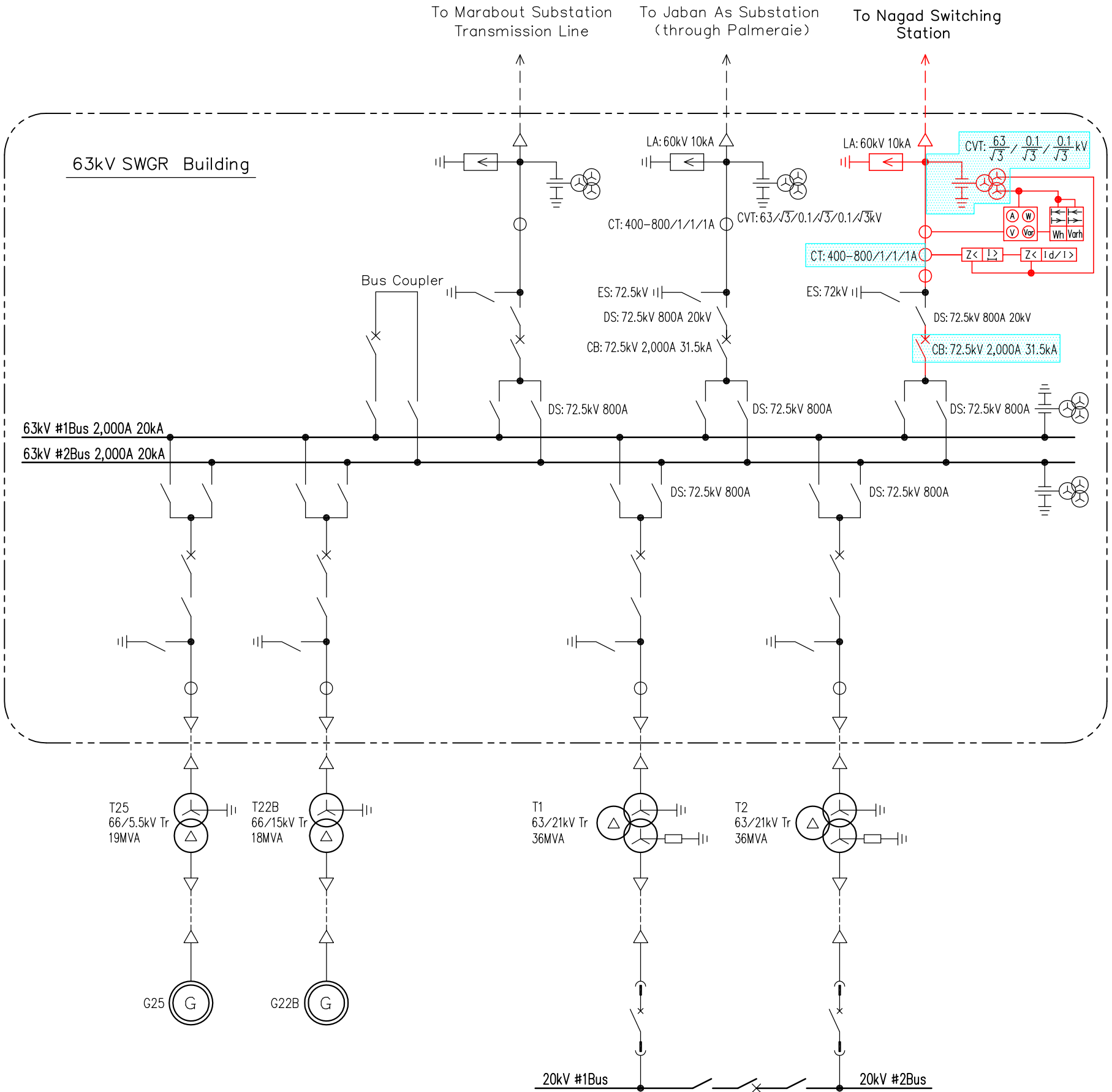
VT's CHARACTERISTICS					
IDENTIFICATION	DESCRIPTION	CORE	RATIO	VA	CLASS
=D00-T15	230 W BUS BARS	2	$\frac{230}{\sqrt{3}} / \frac{0.1}{\sqrt{3}}$	100	0.2/3P
=D00-T25	OUTGOING FEEDER BAY	2	$\frac{230}{\sqrt{3}} / \frac{0.1}{\sqrt{3}}$	100	3P
=D00-T5	230 V				
=F00-T15	63 W BUS BARS	2	$\frac{63}{\sqrt{3}} / \frac{0.1}{\sqrt{3}}$	100	0.2/3P
=F00-T25	OUTGOING FEEDER BAY	2	$\frac{63}{\sqrt{3}} / \frac{0.1}{\sqrt{3}}$	100	3P
=F00-T5	63 V				
=F01-T15	63 W BUS BARS	2	$\frac{63}{\sqrt{3}} / \frac{0.1}{\sqrt{3}}$	100	0.2/3P
=F01-T25	OUTGOING FEEDER BAY	2	$\frac{63}{\sqrt{3}} / \frac{0.1}{\sqrt{3}}$	100	3P
=F01-T5	63 V				

CT's CHARACTERISTICS					
IDENTIFICATION	DESCRIPTION	CORE	RATIO	VA	CLASS
=D01-T1	BUS COUPLER	5	$\frac{230-400}{\sqrt{3}} / \frac{1}{\sqrt{3}}$	30	0.2
=D01-T2	BUS COUPLER	5	$\frac{230-400}{\sqrt{3}} / \frac{1}{\sqrt{3}}$	30	10P30
=D03-T1	OIL LINES	5	$\frac{230-400}{\sqrt{3}} / \frac{1}{\sqrt{3}}$	30	10P30
=D04-T1	OIL LINES AND TRANSFORMER BAYS	5	$\frac{230-400}{\sqrt{3}} / \frac{1}{\sqrt{3}}$	30	10P30
=D05-T1	OIL LINES AND TRANSFORMER BAYS	5	$\frac{230-400}{\sqrt{3}} / \frac{1}{\sqrt{3}}$	30	10P30
=D06-T1	OIL LINES AND TRANSFORMER BAYS	5	$\frac{230-400}{\sqrt{3}} / \frac{1}{\sqrt{3}}$	30	10P30
=D07-T1	TRANSFORMER FEEDER BAY	1	100/VA	15	10P20
=D08-T1	TRANSFORMER FEEDER BAY	1	100/VA	15	10P20
=D09-T1	TRANSFORMER FEEDER BAY	1	100/VA	15	10P20
=D09-T2	OIL LINES	3	100/VA	10	1
=D09-T3	OIL LINES	2	$\frac{200-400}{\sqrt{3}} / \frac{1}{\sqrt{3}}$	15	10P20
=D09-T4	OIL LINES	2	$\frac{200-400}{\sqrt{3}} / \frac{1}{\sqrt{3}}$	15	10P20
=D09-T5	OIL LINES	2	$\frac{200-400}{\sqrt{3}} / \frac{1}{\sqrt{3}}$	15	10P20
=F01-T1	ALI SABEH 48KV BAYS	4	$\frac{480-800}{\sqrt{3}} / \frac{1}{\sqrt{3}}$	40	10P30
=F02-T1	ALI SABEH 48KV BAYS	4	$\frac{480-800}{\sqrt{3}} / \frac{1}{\sqrt{3}}$	40	10P30
=F02-T2	ALI SABEH 48KV BAYS	4	$\frac{480-800}{\sqrt{3}} / \frac{1}{\sqrt{3}}$	40	10P30
=F02-T3	ALI SABEH 48KV BAYS	4	$\frac{480-800}{\sqrt{3}} / \frac{1}{\sqrt{3}}$	40	10P30
=F02-T4	ALI SABEH 48KV BAYS	4	$\frac{480-800}{\sqrt{3}} / \frac{1}{\sqrt{3}}$	40	10P30
=F02-T5	ALI SABEH 48KV BAYS	4	$\frac{480-800}{\sqrt{3}} / \frac{1}{\sqrt{3}}$	40	10P30
=F02-T6	ALI SABEH 48KV BAYS	4	$\frac{480-800}{\sqrt{3}} / \frac{1}{\sqrt{3}}$	40	10P30
=F02-T7	ALI SABEH 48KV BAYS	4	$\frac{480-800}{\sqrt{3}} / \frac{1}{\sqrt{3}}$	40	10P30
=F02-T8	ALI SABEH 48KV BAYS	4	$\frac{480-800}{\sqrt{3}} / \frac{1}{\sqrt{3}}$	40	10P30
=F02-T9	ALI SABEH 48KV BAYS	4	$\frac{480-800}{\sqrt{3}} / \frac{1}{\sqrt{3}}$	40	10P30
=F02-T10	ALI SABEH 48KV BAYS	4	$\frac{480-800}{\sqrt{3}} / \frac{1}{\sqrt{3}}$	40	10P30

MAIN EQUIPMENT CHARACTERISTICS		
IDENTIFICATION	DESCRIPTION	PERFORMANCE
=D03-T1	POWER TRANSFORMER	330kV/220kV/110kV 50/60MVA ONAN ONAF 1150000VA
=D04-T1	POWER TRANSFORMER	330kV/220kV/110kV 50/60MVA ONAN ONAF 1150000VA
=D05-T1	POWER TRANSFORMER	330kV/220kV/110kV 50/60MVA ONAN ONAF 1150000VA
=D06-T1	POWER TRANSFORMER	330kV/220kV/110kV 50/60MVA ONAN ONAF 1150000VA
=D07-T1	POWER TRANSFORMER	330kV/220kV/110kV 50/60MVA ONAN ONAF 1150000VA
=D08-T1	POWER TRANSFORMER	330kV/220kV/110kV 50/60MVA ONAN ONAF 1150000VA
=D09-T1	POWER TRANSFORMER	330kV/220kV/110kV 50/60MVA ONAN ONAF 1150000VA
=D10-T1	POWER TRANSFORMER	330kV/220kV/110kV 50/60MVA ONAN ONAF 1150000VA
=D11-T1	POWER TRANSFORMER	330kV/220kV/110kV 50/60MVA ONAN ONAF 1150000VA
=D12-T1	POWER TRANSFORMER	330kV/220kV/110kV 50/60MVA ONAN ONAF 1150000VA
=D13-T1	POWER TRANSFORMER	330kV/220kV/110kV 50/60MVA ONAN ONAF 1150000VA
=D14-T1	POWER TRANSFORMER	330kV/220kV/110kV 50/60MVA ONAN ONAF 1150000VA
=D15-T1	POWER TRANSFORMER	330kV/220kV/110kV 50/60MVA ONAN ONAF 1150000VA
=D16-T1	POWER TRANSFORMER	330kV/220kV/110kV 50/60MVA ONAN ONAF 1150000VA
=D17-T1	POWER TRANSFORMER	330kV/220kV/110kV 50/60MVA ONAN ONAF 1150000VA
=D18-T1	POWER TRANSFORMER	330kV/220kV/110kV 50/60MVA ONAN ONAF 1150000VA
=D19-T1	POWER TRANSFORMER	330kV/220kV/110kV 50/60MVA ONAN ONAF 1150000VA
=D20-T1	POWER TRANSFORMER	330kV/220kV/110kV 50/60MVA ONAN ONAF 1150000VA
=D21-T1	POWER TRANSFORMER	330kV/220kV/110kV 50/60MVA ONAN ONAF 1150000VA
=D22-T1	POWER TRANSFORMER	330kV/220kV/110kV 50/60MVA ONAN ONAF 1150000VA
=D23-T1	POWER TRANSFORMER	330kV/220kV/110kV 50/60MVA ONAN ONAF 1150000VA
=D24-T1	POWER TRANSFORMER	330kV/220kV/110kV 50/60MVA ONAN ONAF 1150000VA
=D25-T1	POWER TRANSFORMER	330kV/220kV/110kV 50/60MVA ONAN ONAF 1150000VA



DESCRIPTION
 Jaban As Substation
 Single Line Diagram
 ジャバナス 変電所 単線結線図
 DWG.No.SS-E-01



Note;

1. The equipment marked with shall be replaced with new ones

CB: 72.5kV, 2000A, 31.5kA

CVT: 63/√3/0.1/√3/0.1/√3kV, 400-800/1/1/1A

Bus bars for new equipment connections: Al 80mm×5mm or greater
 新設備と接続する母線材: アルミニウム製 80mm×5mm厚以上

 印付の設備は新品と取り替えを実施する。

Regend

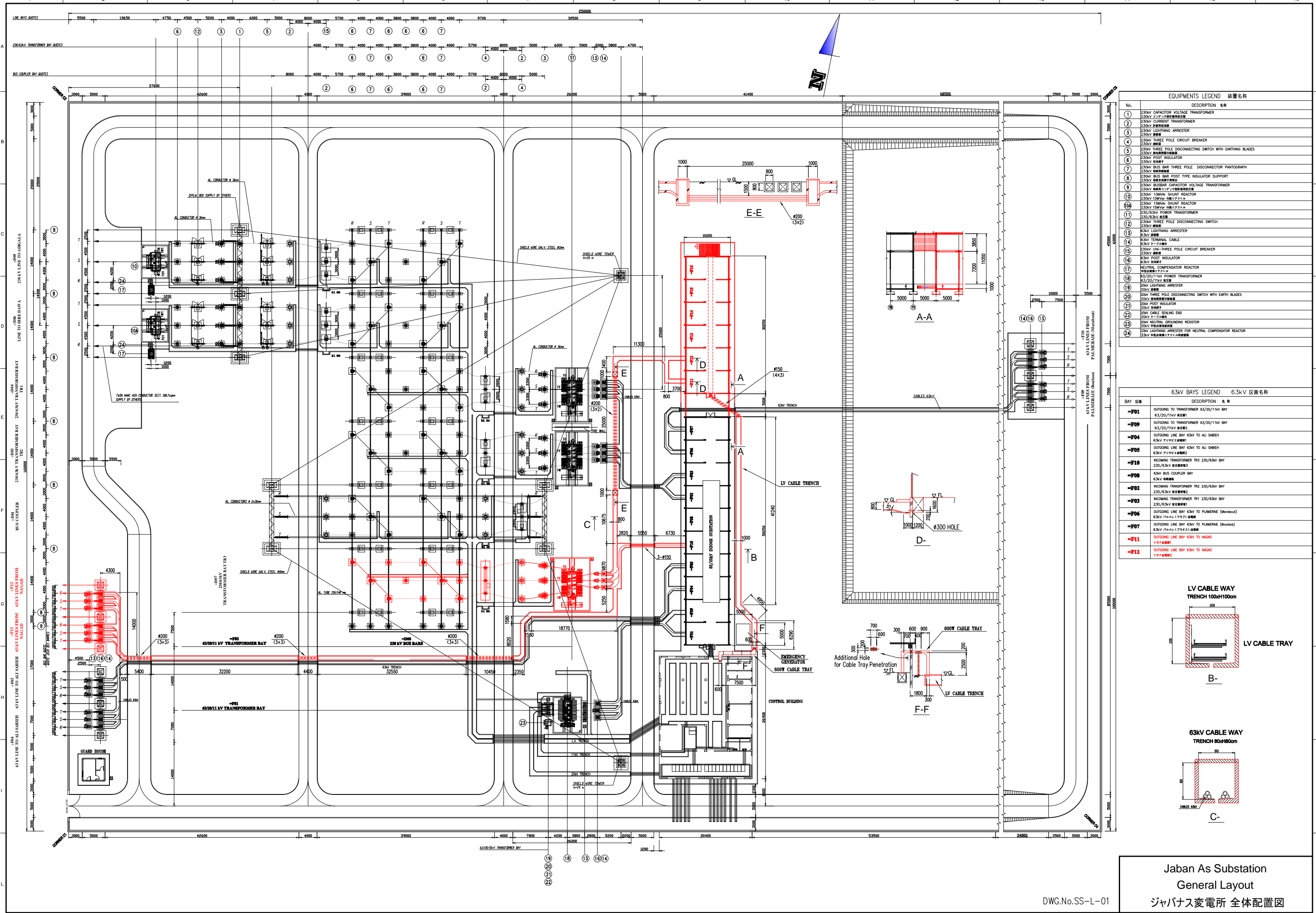
凡例

- Scope of works:
- 今回所掌範囲:
- Existing:
- 既設
- Transmission Line
- 送電線
 - Over head Line:
 - 架空線:
 - Under ground cable:
 - 地中埋設ケーブル:
- Building inside:
- 建屋内設置:

Boulaos 63kV Substation
 Single Line Diagram

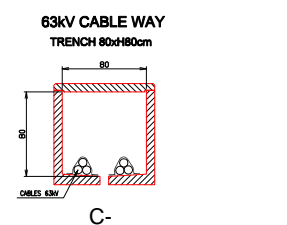
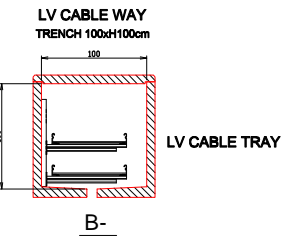
DWG.No.SS-E-02

ブラオス発電所 63kV 変電所 単線結線図

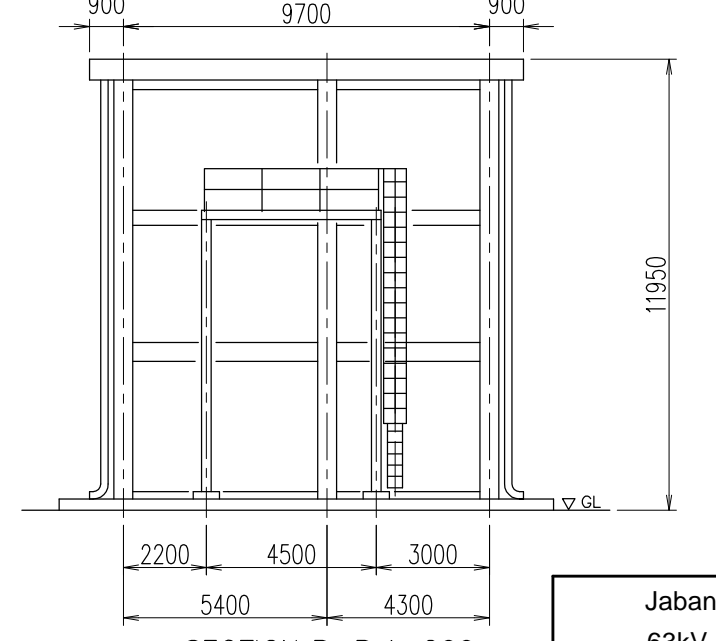
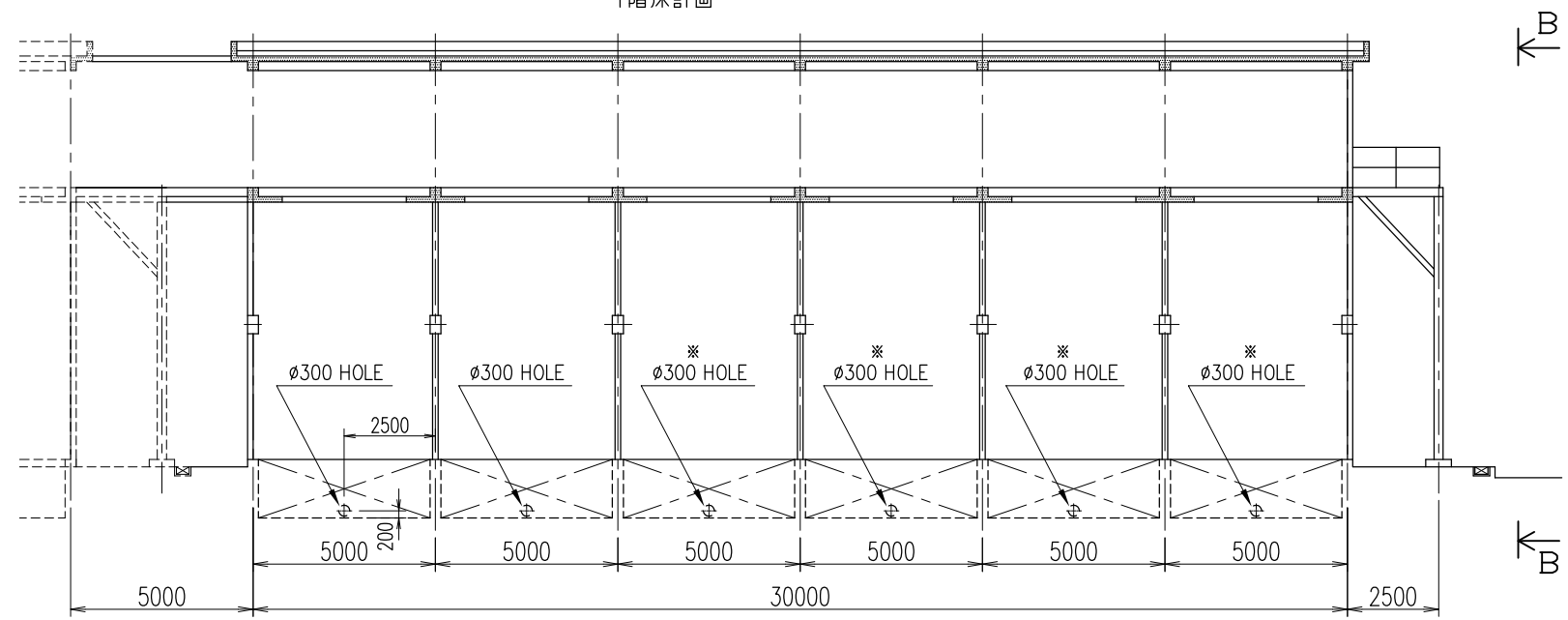
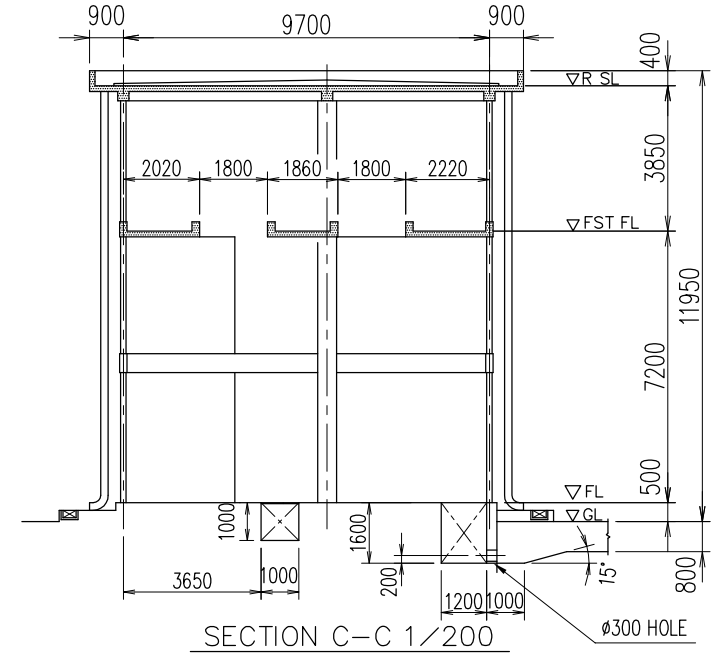
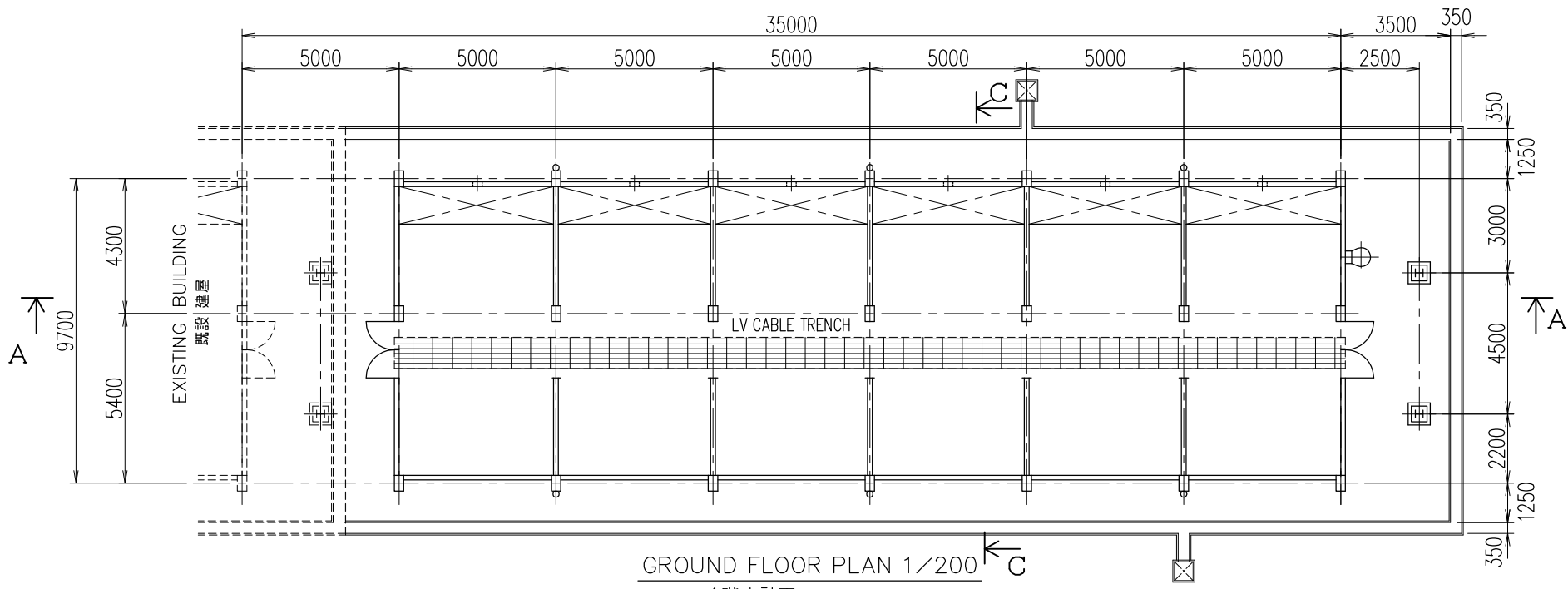
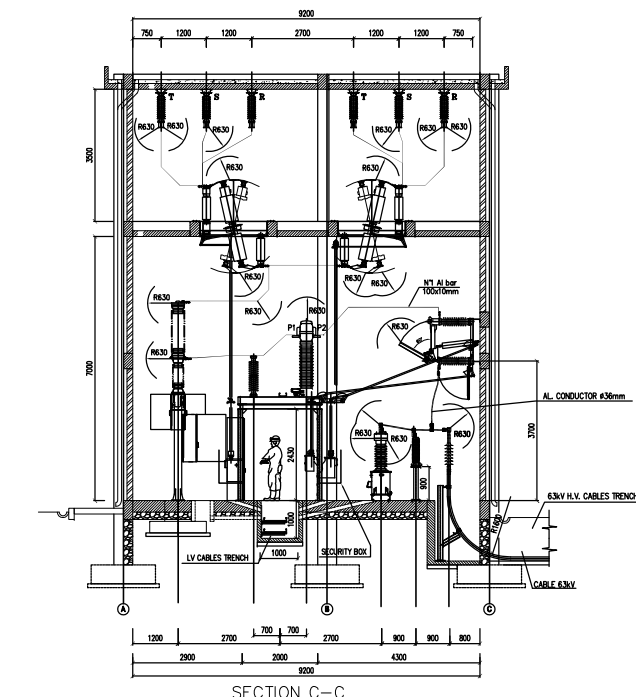
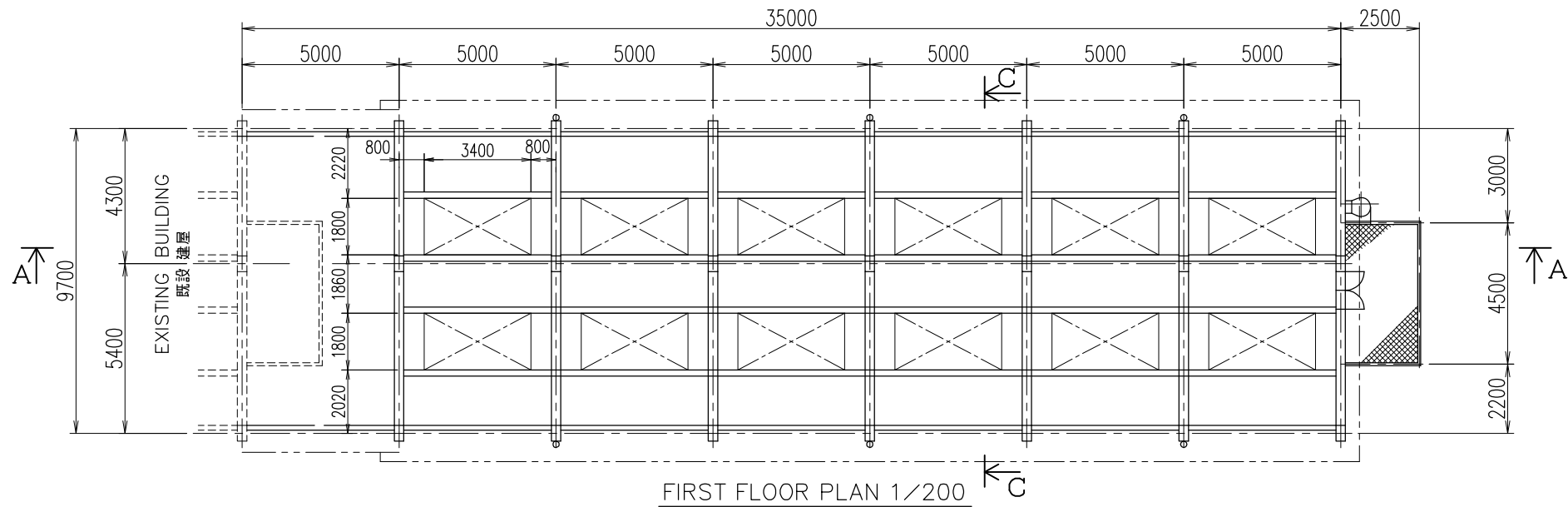


EQUIPMENTS LEGEND 装置名称	
No.	DESCRIPTION 名称
1	230kV CAPACITOR VOLTAGE TRANSFORMER 230kV コンデンサ電圧変換器
2	230kV CURRENT TRANSFORMER 230kV 電流変換器
3	230kV LIGHTNING ARRESTER 230kV 避雷器
4	230kV THREE POLE CIRCUIT BREAKER 230kV 三極遮断器
5	230kV THREE POLE DISCONNECTING SWITCH WITH EARTHING BLADES 230kV 三極接地刀開閉器
6	230kV POST INSULATOR 230kV 支柱絶縁子
7	230kV BUS BAR THREE POLE DISCONNECTOR PANTOGRAPH 230kV 三極支柱絶縁子
8	230kV BUS BAR POST TYPE INSULATOR SUPPORT 230kV 支柱絶縁子支柱
9	230kV BUSBAR CAPACITOR VOLTAGE TRANSFORMER 230kV 支柱コンデンサ電圧変換器
10	230kV 10MVA SHUNT REACTOR 230kV 10MVA 遮りリアクタ
11	230kV 15MVA SHUNT REACTOR 230kV 15MVA 遮りリアクタ
12	230/63kV POWER TRANSFORMER 230/63kV 変圧器
13	230kV THREE POLE DISCONNECTING SWITCH 230kV 三極開閉器
14	63kV LIGHTNING ARRESTER 63kV 避雷器
15	63kV TERMINAL CABLE 63kV 終端ケーブル
16	230kV POST INSULATOR 230kV 支柱絶縁子
17	NEUTRAL COMPENSATOR REACTOR 63/20/11kV 中性点補償リアクタ
18	63/20/11kV POWER TRANSFORMER 63/20/11kV 変圧器
19	20kV LIGHTNING ARRESTER 20kV 避雷器
20	230kV THREE POLE DISCONNECTING SWITCH WITH EARTH BLADES 230kV 三極接地刀開閉器
21	20kV POST INSULATOR 20kV 支柱絶縁子
22	20kV CABLE SEALING END 20kV ケーブルシール端
23	20kV NEUTRAL GROUNDING RESISTOR 20kV 中性点接地抵抗器
24	15kV LIGHTNING ARRESTER FOR NEUTRAL COMPENSATOR REACTOR 15kV 中性点補償リアクタ用避雷器

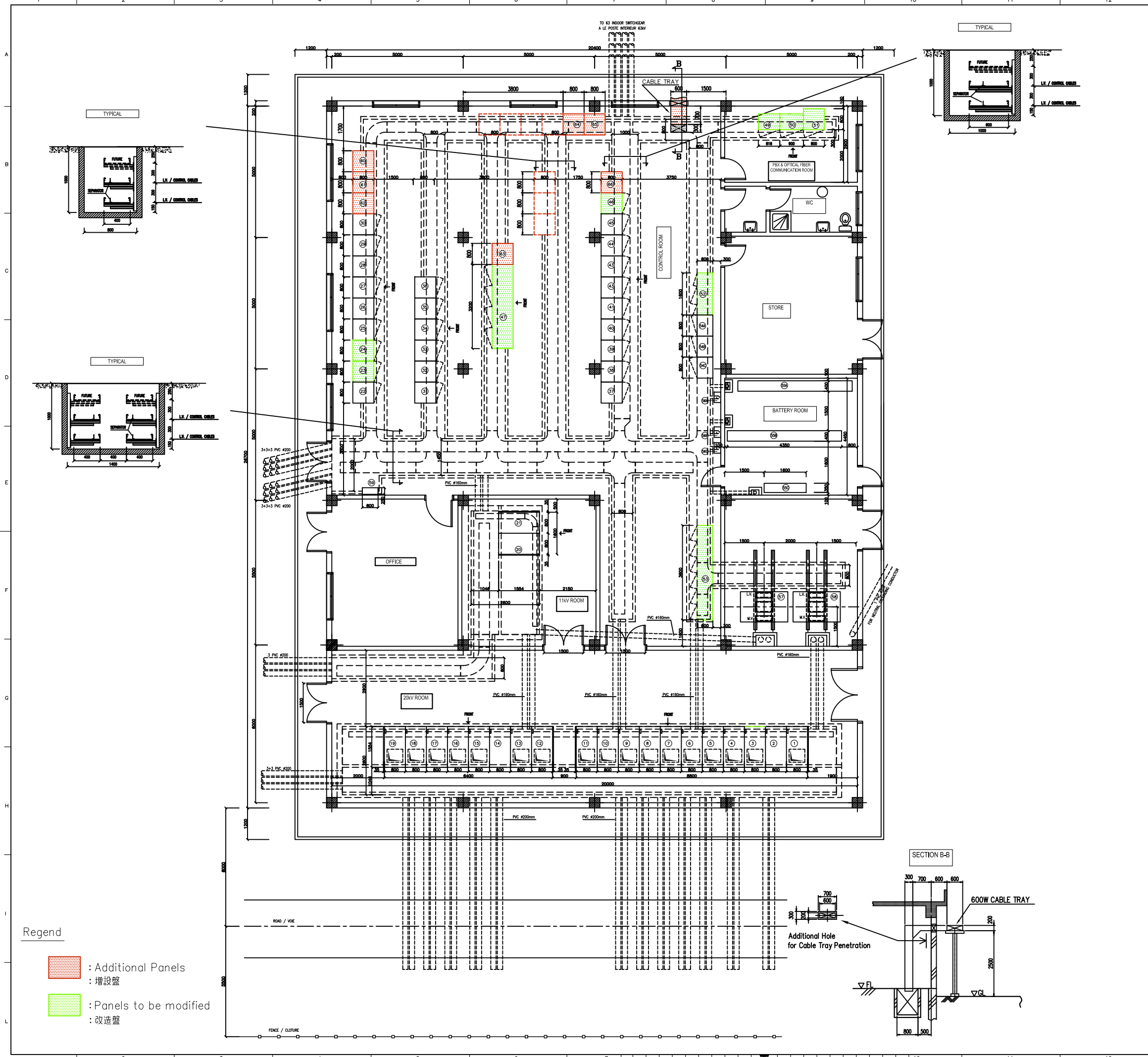
63kV BAYS LEGEND 63kV 区画名称	
BAY 区画	DESCRIPTION 名称
-F01	OUTGOING TO TRANSFORMER 63/20/11kV 区画1 63/20/11kV 区画1
-F09	OUTGOING TO TRANSFORMER 63/20/11kV 区画9 63/20/11kV 区画9
-F04	OUTGOING LINE BAY 63kV TO ALL SABEH 63kV アウトライニング区画2
-F05	OUTGOING LINE BAY 63kV TO ALL SABEH 63kV アウトライニング区画2
-F10	INCOMING TRANSFORMER TR3 230/63kV BAY 230/63kV 変圧器区画3
-F08	63kV BUS COUPLER BAY 63kV 母線結合区画
-F02	INCOMING TRANSFORMER TR2 230/63kV BAY 230/63kV 変圧器区画2
-F03	INCOMING TRANSFORMER TR1 230/63kV BAY 230/63kV 変圧器区画1
-F06	OUTGOING LINE BAY 63kV TO FLAMERAE (Marabout) 63kV アウトライニング区画2
-F07	OUTGOING LINE BAY 63kV TO FLAMERAE (Boulou) 63kV アウトライニング区画2
-F11	OUTGOING LINE BAY 63kV TO NAGAO アウトライニング区画2
-F12	OUTGOING LINE BAY 63kV TO NAGAO アウトライニング区画2



Jaban As Substation
General Layout
ジャバナス変電所 全体配置図

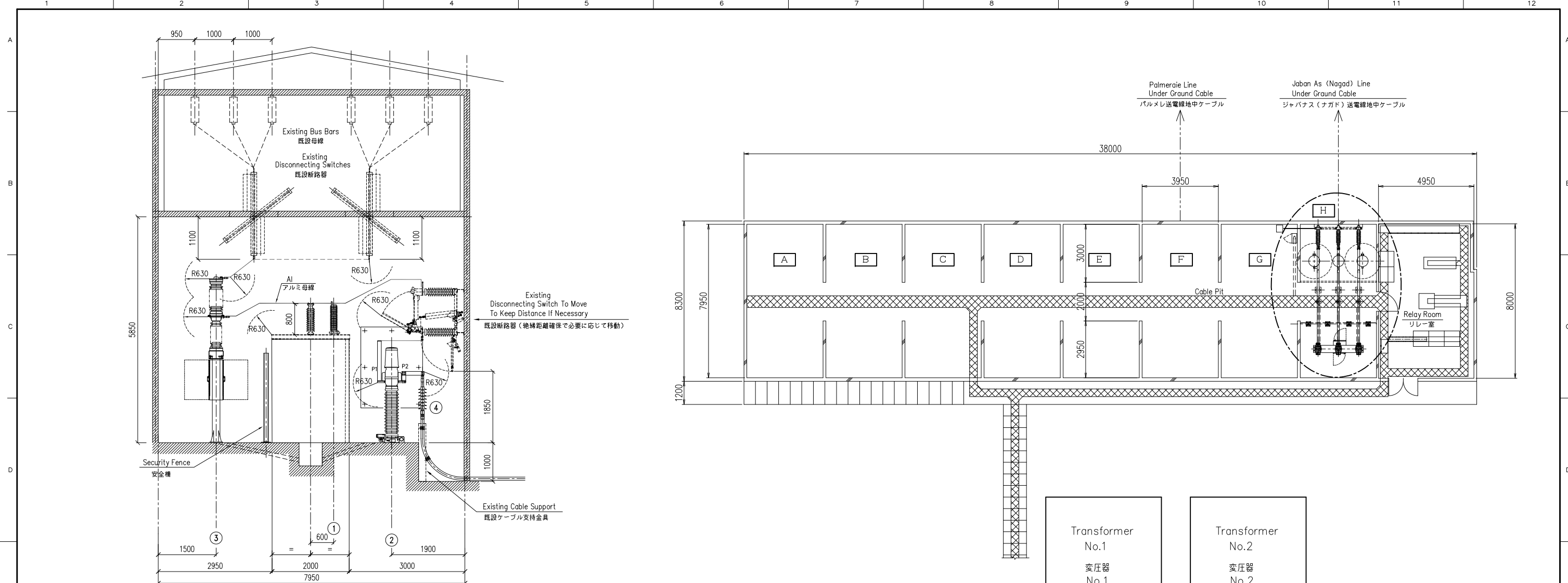


*: Back up material to be filled in for future use
 *: 将来用の穴はバックアップ材充填

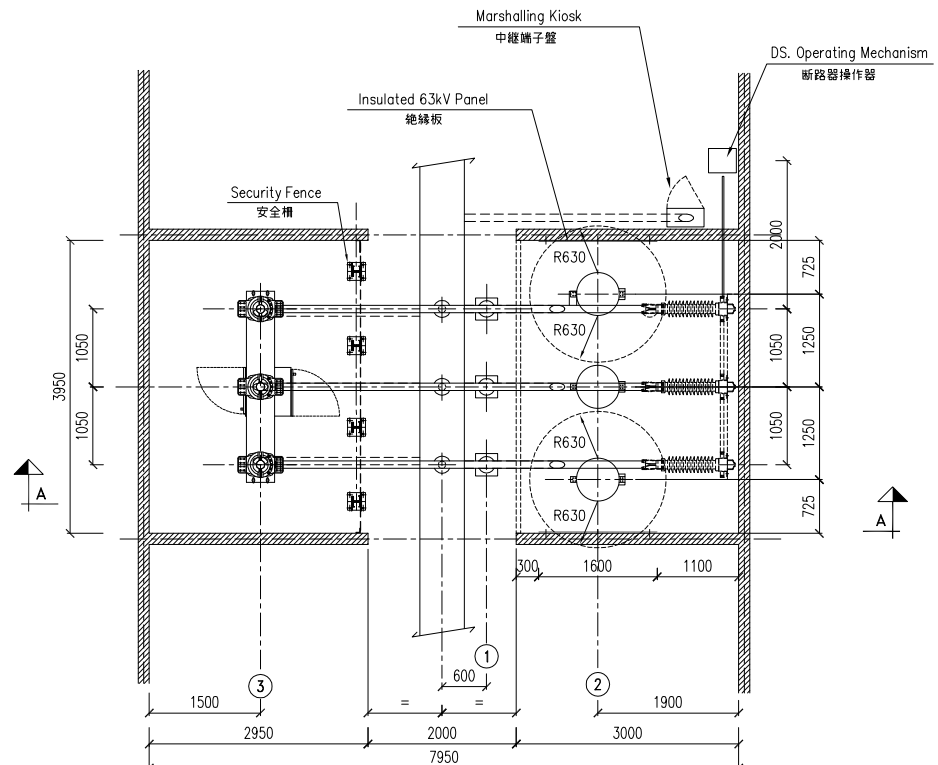


- Regend
- : Additional Panels
: 増設盤
 - : Panels to be modified
: 改造盤

POS.	EQUIPMXNT NAME / 装置名称	DESCRIPTION	
1	20kV AIS 201 / =J01	INCOMING CUBICLE 受電用キュービクル	
2	20kV AIS 201 / =J02	MEASURE CUBICLE 計測用キュービクル	
3	20kV AIS 201 / =J03	CAPACITOR BANK CUBICLE コンデンサバンク用キュービクル	
4	20kV AIS 201 / =J04	AUX. TRANSFORMER CUBICLE 補助トランス用キュービクル	
5	20kV AIS 201 / =J05	LINE FEEDER CUBICLE フィーダ用キュービクル	
6	20kV AIS 201 / =J06	LINE FEEDER CUBICLE フィーダ用キュービクル	
7	20kV AIS 201 / =J07	LINE FEEDER CUBICLE フィーダ用キュービクル	
8	20kV AIS 201 / =J08	LINE FEEDER CUBICLE フィーダ用キュービクル	
9	20kV AIS 201 / =J09	LINE FEEDER CUBICLE フィーダ用キュービクル	
10	20kV AIS 201 / =J10	LINE FEEDER CUBICLE フィーダ用キュービクル	
11	20kV AIS 201 / =J11	INTERCONNECTION WITH BUS BAR 202 CUBICLE 202母線接続用キュービクル	
12	20kV AIS 202 / =J12	INTERCONNECTION WITH BUS BAR 201 CUBICLE 201母線接続用キュービクル	
13	20kV AIS 202 / =J13	INCOMING CUBICLE 受電用キュービクル	
14	20kV AIS 201 / =J14	MEASURE CUBICLE 計測用キュービクル	
15	20kV AIS 202 / =J15	LINE FEEDER CUBICLE フィーダ用キュービクル	
16	20kV AIS 202 / =J16	LINE FEEDER CUBICLE フィーダ用キュービクル	
17	20kV AIS 202 / =J17	LINE FEEDER CUBICLE フィーダ用キュービクル	
18	20kV AIS 202 / =J18	LINE FEEDER CUBICLE フィーダ用キュービクル	
19	20kV AIS 202 / =J19	LINE FEEDER CUBICLE フィーダ用キュービクル	
20	11kV AIS / =K01	AUX. TRANSFORMER CUBICLE 補助トランス用キュービクル	
21	11kV AIS / =K02	INCOMING CUBICLE 受電用キュービクル	
22	230kV CONTROL PANEL / =D01+W1	230kV BUS COUPLER 230kV 母線接続制御盤	
23	230kV PROTECTION PANEL / =D00+R1	230kV BUS BARS 230kV 母線保護盤1	J-21
24	230kV PROTECTION PANEL / =D00+R2	230kV BUS BARS 230kV 母線保護盤2	J-21
25	230kV CONTROL PANEL / =D03+W1 & =F02+W1	230/63kV TRANSFORMER BAY 230/63kV 変圧器制御盤	
26	230kV PROTECTION PANEL / =D03+R1 & =F02+R1	230/63kV TRANSFORMER BAY 230/63kV 変圧器保護盤1	
27	230kV PROTECTION PANEL / =D03+R2	230/63kV TRANSFORMER BAY 230/63kV 変圧器保護盤2	
28	230kV CONTROL PANEL / =D04+W1 & =F03+W1	230/63kV TRANSFORMER BAY 230/63kV 変圧器制御盤	
29	230kV PROTECTION PANEL / =D04+R1 & =F03+R1	230/63kV TRANSFORMER BAY 230/63kV 変圧器保護盤1	
30	230kV PROTECTION PANEL / =D04+R2	230/63kV TRANSFORMER BAY 230/63kV 変圧器保護盤2	
31	230kV CONTROL PANEL / =D06+W1	230kV INCOMING LINE FROM DIRE DAWA 230kV デレタフ線制御盤	
32	230kV PROTECTION PANEL / =D06+R1	230kV INCOMING LINE FROM DIRE DAWA 230kV デレタフ線保護盤1	
33	230kV PROTECTION PANEL / =D06+R2	230kV INCOMING LINE FROM DIRE DAWA 230kV デレタフ線保護盤2	
34	230kV CONTROL PANEL / =D05+W1	230kV INCOMING LINE FROM ADIGALA 230kV デレタフ線制御盤	
35	230kV PROTECTION PANEL / =D05+R1	230kV INCOMING LINE FROM ADIGALA 230kV デレタフ線保護盤1	
36	230kV PROTECTION PANEL / =D05+R2	230kV INCOMING LINE FROM ADIGALA 230kV デレタフ線保護盤2	
37	63kV CONTROL PANEL / =F01+W1	OUTGOING TRANSFORMER 63/20/11kV BAY 63/20kV 変圧器制御盤	
38	63kV PROTECTION PANEL / =F01+R1	OUTGOING TRANSFORMER 63/20/11kV BAY 63/20kV 変圧器保護盤1	
39	63kV PROTECTION PANEL / =F01+R2	OUTGOING TRANSFORMER 63/20/11kV BAY 63/20kV 変圧器保護盤2	
40	63kV CONTROL PANEL / =F04+W1	63kV OUTGOING LINE BAY TO ALI SABIEH & =F08+W1 63kV アリサビエ線・母線接続制御盤	
41	63kV PROTECTION PANEL / =F04+R1	63kV OUTGOING LINE BAY TO ALI SABIEH & =F08+R1 63kV アリサビエ線・母線保護盤1	
42	63kV PROTECTION PANEL / =F04+R2	63kV OUTGOING LINE BAY TO ALI SABIEH & =F08+R2 63kV アリサビエ線・母線保護盤2	
43	63kV CONTROL PANEL / =F05+W1	63kV OUTGOING LINE BAY TO ALI SABIEH 63kV アリサビエ線・母線接続制御盤	
44	63kV PROTECTION PANEL / =F05+R1	63kV OUTGOING LINE BAY TO ALI SABIEH 63kV アリサビエ線・母線保護盤1	
45	63kV PROTECTION PANEL / =F05+R2	63kV OUTGOING LINE BAY TO ALI SABIEH 63kV アリサビエ線・母線保護盤2	
46	63kV PROTECTION PANEL / =F00+R1	63kV BUS BARS 230/63kV 変電所モザイク制御盤	J-22
47	230/63kV SUBSTATION MOSAIC CONTROL PANEL 230/63kV 変電所モザイク制御盤		J-17
48			
49	RACK-1 SDH/PDH EQUIPMENT (COMMUNICATION PANEL) 通信装置 (ラック1)		J-25
50	RACK-2 PABX (DIGITAL TELEPHONE EXCHANGE) デジタル電話交換装置 (ラック2)		J-25
51	SCADA PANEL / =D00+SC SCADAサーバ盤		J-18
52	DC PANEL +BUA / +BUB 直流分電盤		J-23
53	AC PANEL +BT 交流分電盤		J-24
54A	BATTERY CHARGER (FOR 125V BATTERY) +BTIA 充電器 (DC125V蓄電池)		
54B	BATTERY CHARGER (FOR 125V BATTERY) +BTIB 充電器 (DC125V蓄電池)		
54C	BATTERY CHARGER (FOR 48V BATTERY) +BTIC 充電器 (DC48V蓄電池)		
54D	BATTERY CHARGER (FOR 48V BATTERY) +BTID 充電器 (DC48V蓄電池)		
55A	BATTERY 125V +BTA 蓄電池 125V		
55B	BATTERY 125V +BTB 蓄電池 125V		
55C	BATTERY 48V +BTC 蓄電池 48V		
55D	BATTERY 48V +BTD 蓄電池 48V		
56A	FUSE BOX (FOR 125V BATTERY +BUA) ヒューズ箱 (DC125V蓄電池)		
56B	FUSE BOX (FOR 125V BATTERY +BUB) ヒューズ箱 (DC125V蓄電池)		
56C	FUSE BOX (FOR 48V BATTERY +BUC) ヒューズ箱 (DC48V蓄電池)		
56D	FUSE BOX (FOR 48V BATTERY +BUD) ヒューズ箱 (DC48V蓄電池)		
57	11/0.4/0.23kV - 315kVA AUX. TRANSFORMER (DRY TYPE) 11/0.4/0.23kV 315kVA 乾式補助トランス		
58	20/0.4/0.23kV - 315kVA AUX. TRANSFORMER (DRY TYPE) 20/0.4/0.23kV 315kVA 乾式補助トランス		
59	LIGHTING DISTRIBUTION PANEL LP-CB 照明分電盤		
60	230/63kV TRANSFORMER PROTECTION PANEL 230/63kV 変圧器保護盤2		J-19
61	230/63kV TRANSFORMER PROTECTION PANEL 230/63kV 変圧器保護盤1		J-19
62	230kV CONTROL PANEL 230/63kV TRANSFORMER BAY 230/63kV 変圧器制御盤		J-16
63	63kV MOSAIC CONTROL PANEL 63kV モザイク制御盤		(J-17)
64	63kV CONTROL PANEL 63kV OUTGOING LINE BAYS TO NAGADO 63kV ナガド線制御盤		J-16
65	63kV PROTECTION PANEL 63kV OUTGOING LINE BAYS TO NAGADO 63kV ナガド線保護盤		J-20
66	63kV PROTECTION PANEL 63kV BUS BARS 63kV 母線保護盤2		(J-22)



SECTION A-A



LAYOUT PLAN

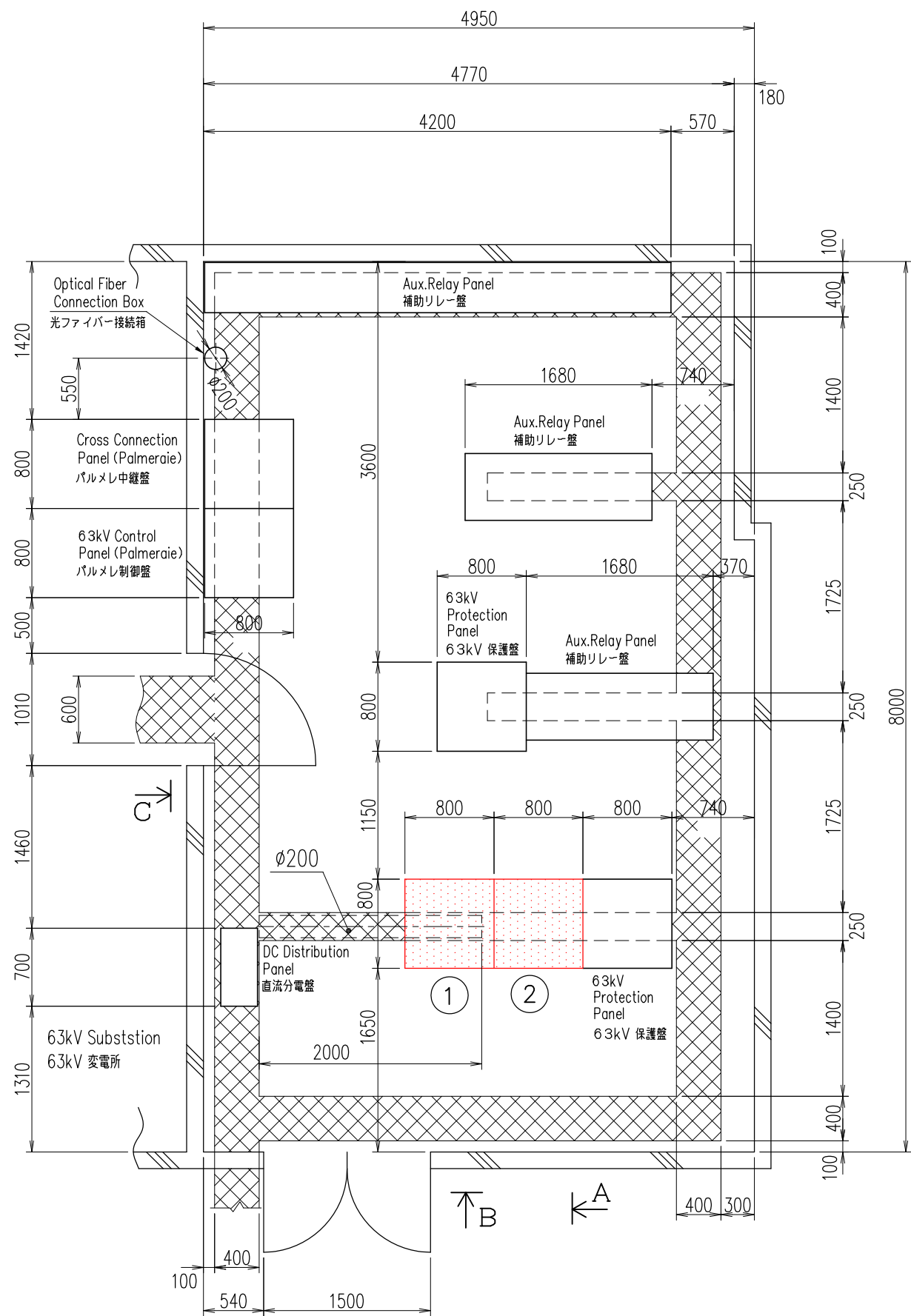
No.	DESCRIPTION / 名称
①	63kV Lightning Arrester 63kV 避雷器
②	63kV Measure Combined Transformer 63kV 計器用変流変圧器
③	63kV Three Pole Circuit Breaker 63kV 遮断器
④	63kV Cable Sealing End 63kV ケーブル端末

No.	DESCRIPTION / 名称
A	No.25 Generator Bay No.25 発電機区画
B	No.22 Generator Bay No.22 発電機区画
C	Bus Conpler Bay 母線連絡区画
D	Marabout Line Bay マラブ送電線区画
E	Spare 予備
F	Palmerie Line Bay パルメレ送電線区画
G	Spare 予備
H	Jaban As (Nagad) ジャバナス(ナガド)

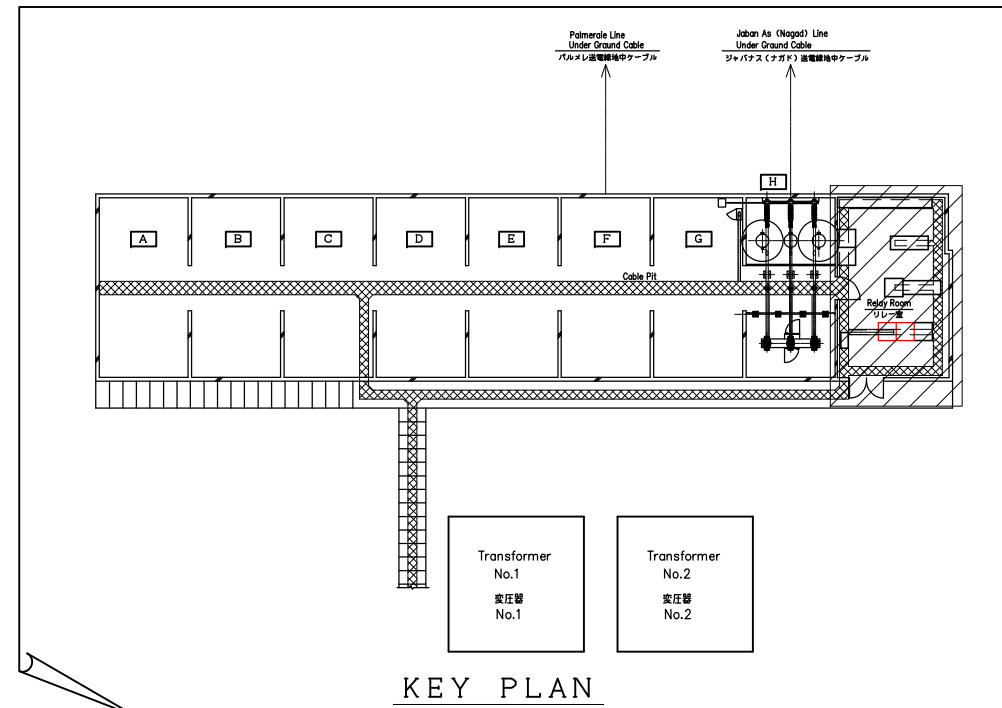
Boulaos Power Station 63kV Substation Building Layout

DWG.No.SS-L-04

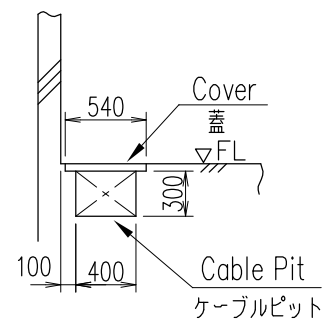
ブラス発電所 63kV 変電所 建屋内配置図



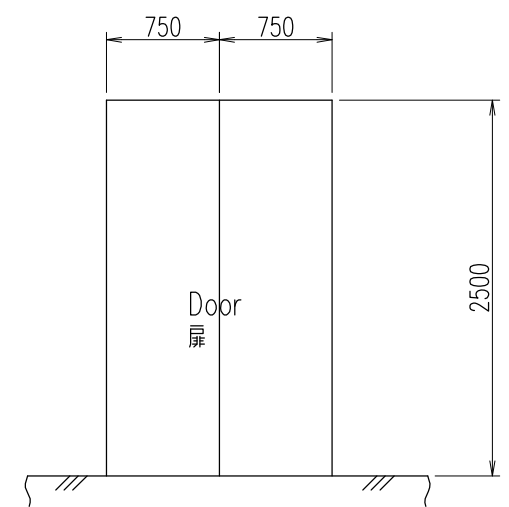
Ceiling Hight: 2990mm
天井高さ



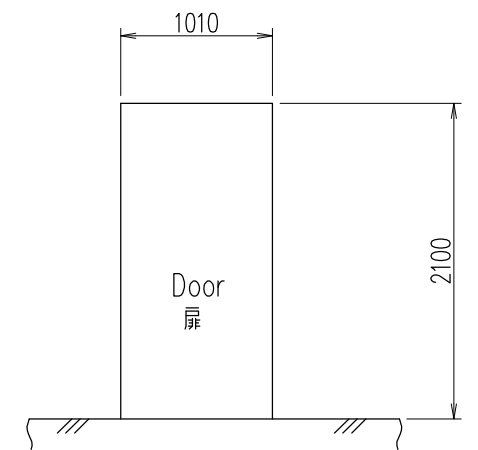
PANEL NAME 盤名称	
①	63kV Control Panel 63kV 制御盤 63kV Outgoing Line Bay To Nagad 63kV ナガド向送電線区画
②	63kV Protection Panel 63kV 保護盤 63kV Outgoing Line Bay To Nagad 63kV ナガド向送電線区画



SECTION A- 1/50

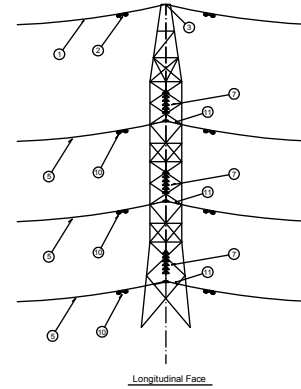
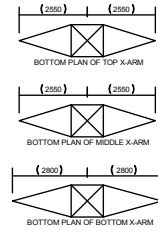
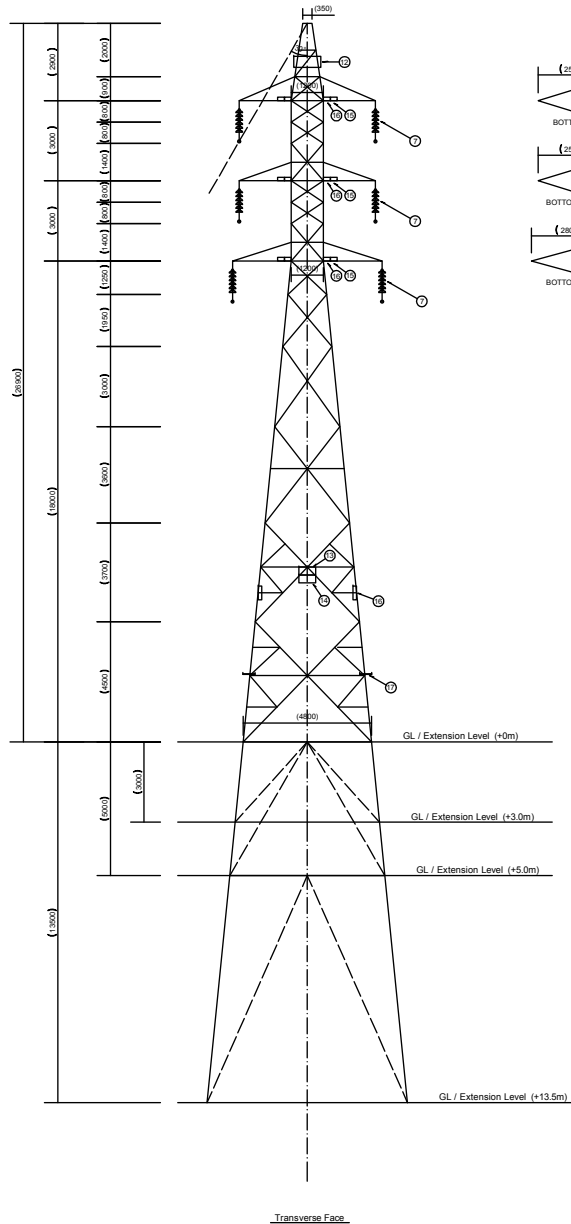


SECTION B- 1/50



SECTION C- 1/50

Tower Type A

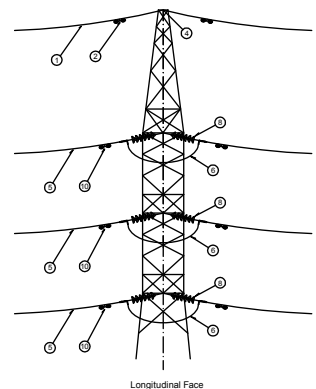
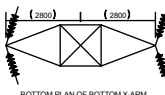
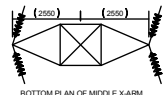
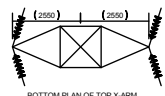
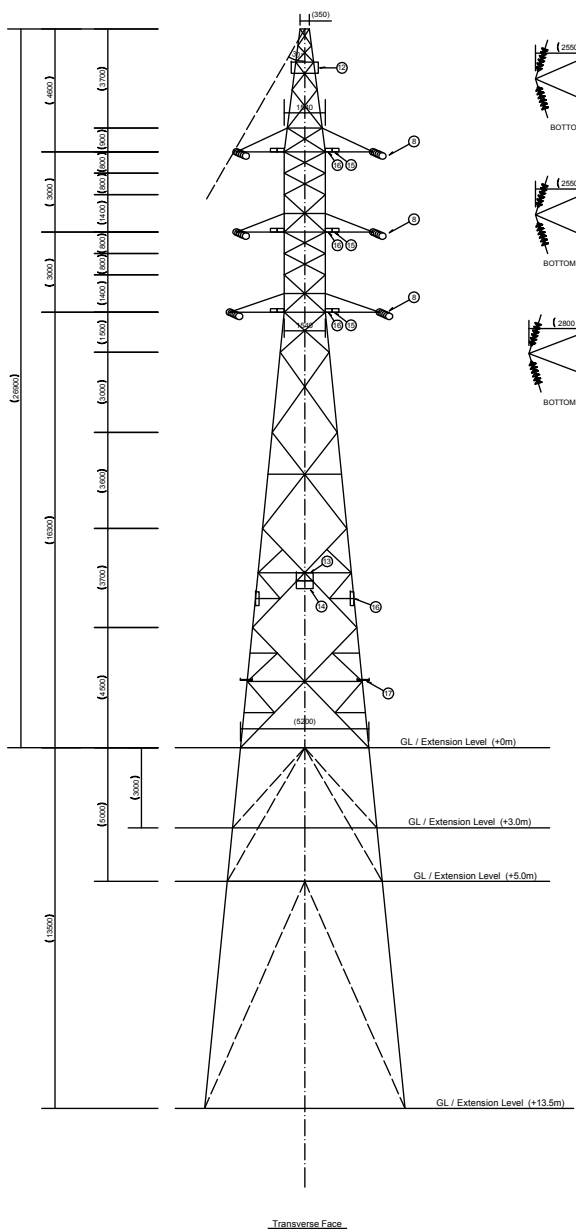


General Design Condition / Criteria	
Voltage	63kV
Circuit	2 oct.
Standard Ruling Span	350m
Horizontal Angle	0° - 5°
Vertical Angle	$\Sigma \tan \alpha = \pm 0.1$
Wind Load	241kg/sq.m
Insulator	
Type	Ball Socket 250 / Fog
Number	6pcs / set
Weight	Approx. 100kg / set
Wind Load	102kg/sq.m
Conductor	
Type	ASTER366
Unit Weight	1.050kg/m
Overall Diameter	24.85mm
Max. Working Tension	46.0kN
Wind Load	68kg/sq.m
Grounding Wire	
Type	OPGW100 or equivalent
Number of Fibers	48 optical fibers
Unit Weight	0.555kg/m
Overall Diameter	14.50mm
Max. Working Tension	29.8kN
Wind Load	74kg/sq.m
Reference	
Seismic Load	0.15G
Horizontal Seismic Coef.	0.15G

No.	Equipment	Description	Q'ty
①		架空地線 光ファイバ(複合架空地線)	1 lot
②		Grounding Wire (OPGW)	1 lot
③		光ファイバ(複合架空地線)振動抑制装置	1 lot
④		Damper for OPGW	1 set
⑤		光ファイバ(複合架空地線)用懸垂保持装置	1 set
⑥		Suspension Set for OPGW	0 set
⑦		光ファイバ(複合架空地線)用耐張引張装置	0 set
⑧		Tension Set for OPGW	1 lot
⑨		電力線(保アス)金具(耐)	0 pcs
⑩		Conductor (AAAC ASTER)	6 sets
⑪		ジャンパー線	0 set
⑫		Jumper	0 set
⑬		懸垂端子装置, クランプ	6 sets
⑭		Suspension Insulator Set, Clamp	0 set
⑮		耐張端子装置, クランプ	0 set
⑯		Tension Insulator Set, Clamp	0 set
⑰		ジャンパー端子	1 lot
⑱		Jumper Support Insulator	1 lot
⑳		電力線振動抑制装置	1 lot
㉑		Damper for Conductor	6 set
㉒		アーマーロッド	1 set
㉓		Armor Rod	1 set
㉔		絶縁器用支持物番号札	1 set
㉕		Aerial Plate	1 set
㉖		支持物番号札	1 set
㉗		Number Plate	1 set
㉘		危険警告札	1 set
㉙		Danger Plate	6 sets
㉚		相番号札	8 sets
㉛		Phase Plate	8 sets
㉜		回路番号札	1 lot
㉝		Circuit Plate	1 lot
㉞		昇降防止装置	1 lot
㉟		Anti-Climbing Guard	

THE PROJECT FOR IMPROVEMENT OF POWER SUPPLY IN THE REPUBLIC OF DJIBOUTI				SCALE
				1:200
Title				DWG. No.
Transmission Line Tower : Type A				T-01
DATE	DESIGNED	CHECKED	APPROVED	REVISION
	*****	*****	*****	
YACHIYO ENGINEERING CO., LTD. TOKYO, JAPAN				

Tower Type B, C

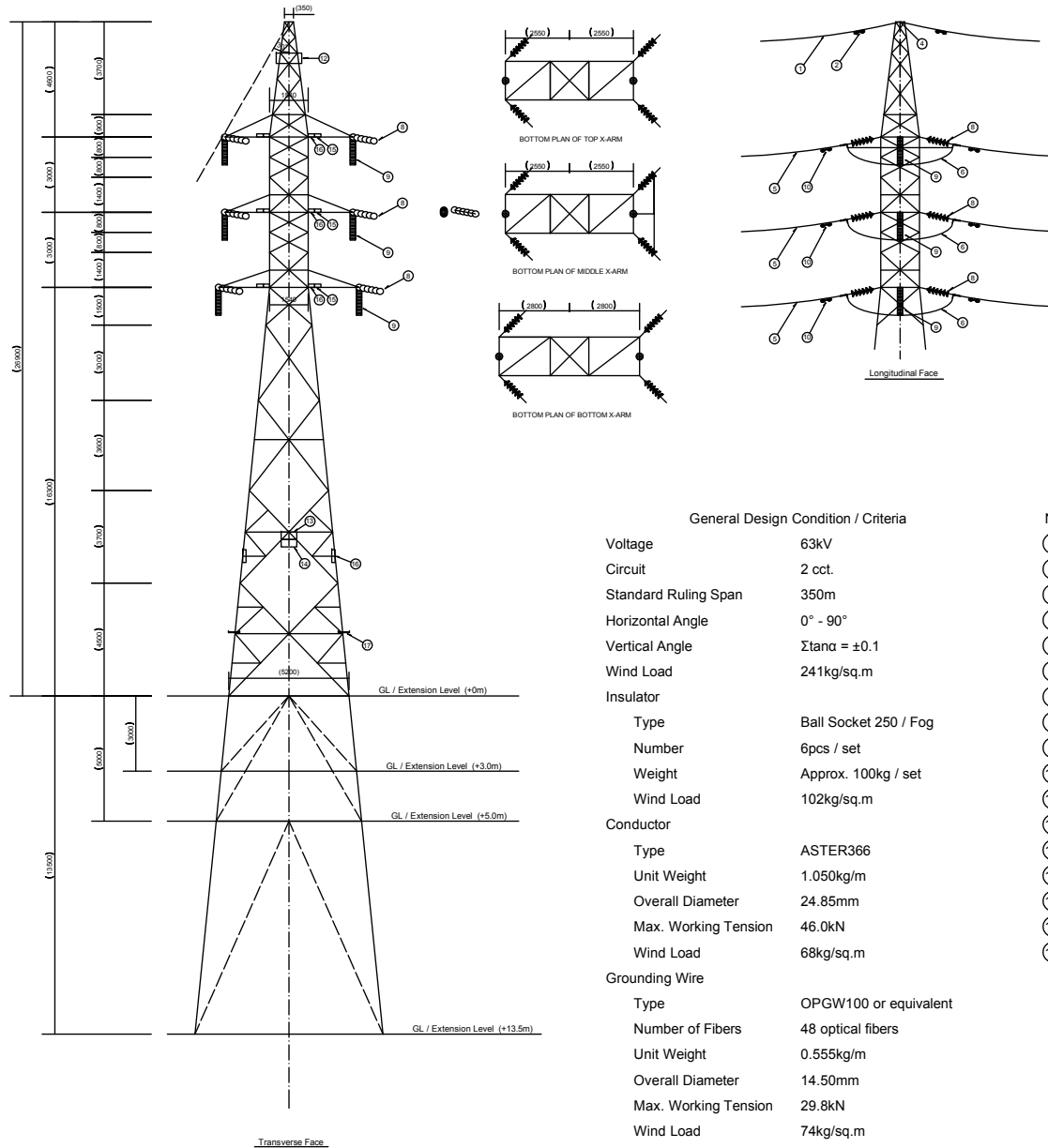


General Design Condition / Criteria	
Voltage	63kV
Circuit	2 cct.
Standard Ruling Span	350m
Horizontal Angle	0° - 35°
Vertical Angle	$\Sigma \tan \alpha = \pm 0.1$
Wind Load	241kg/sq.m
Insulator	
Type	Ball Socket 250 / Fog
Number	6pcs / set
Weight	Approx. 100kg / set
Wind Load	102kg/sq.m
Conductor	
Type	ASTER366
Unit Weight	1.050kg/m
Overall Diameter	24.85mm
Max. Working Tension	46.0kN
Wind Load	68kg/sq.m
Grounding Wire	
Type	OPGW100 or equivalent
Number of Fibers	48 optical fibers
Unit Weight	0.555kg/m
Overall Diameter	14.50mm
Max. Working Tension	29.8kN
Wind Load	74kg/sq.m
Reference	
Seismic Load	0.15G
Horizontal Seismic Coef.	0.15G

No.	Equipment	Description	Q'ty
①		架空地線(光ファイバ)複合架空地線	1 lot
②		Grounding Wire (OPGW)	1 lot
③		光ファイバ複合架空地線振動抑制ダンパ装置	1 lot
④		Damper for OPGW	1 lot
⑤		光ファイバ複合架空地線用懸垂保持装置	0 set
⑥		Suspension Set for OPGW	0 set
⑦		光ファイバ複合架空地線用引張調整装置	1 set
⑧		Tension Set for OPGW	1 set
⑨		電力線(全力及合金)導線	1 lot
⑩		Conductor (AAAC ASTER)	1 lot
⑪		ジャンパー線	6 pcs
⑫		Jumper	6 pcs
⑬		懸垂端子装置, クランプ	0 set
⑭		Suspension Insulator Set, Clamp	0 set
⑮		引張端子装置, クランプ	12 sets
⑯		Tension Insulator Set, Clamp	12 sets
⑰		支持端子	0 set
⑱		Jumper Support Insulator	0 set
⑲		電力線振動抑制ダンパ装置	1 lot
⑳		Damper for Conductor	1 lot
㉑		アーマーロッド	0 set
㉒		Armor Rod	0 set
㉓		絶縁器別用支持物番号札	1 set
㉔		Aerial Plate	1 set
㉕		支持物番号札	1 set
㉖		Number Plate	1 set
㉗		危険警告札	1 set
㉘		Danger Plate	1 set
㉙		相番号札	6 sets
㉚		Phase Plate	6 sets
㉛		回路番号札	8 sets
㉜		Circuit Plate	8 sets
㉝		昇降防止装置	1 lot
㉞		Anti-Climbing Guard	1 lot

THE PROJECT FOR IMPROVEMENT OF POWER SUPPLY IN THE REPUBLIC OF DJIBOUTI				SCALE	
				1:200	
Title Transmission Line Tower : Type B, C				DWG. No.	
				T-02	
DATE	DESIGNED	CHECKED	APPROVED	REVISION	
	*****	*****	*****		
YEO YACHIYO ENGINEERING CO., LTD. TOKYO, JAPAN					

Tower Type R

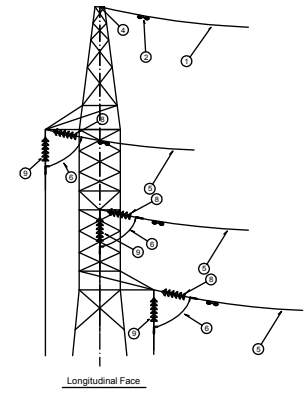
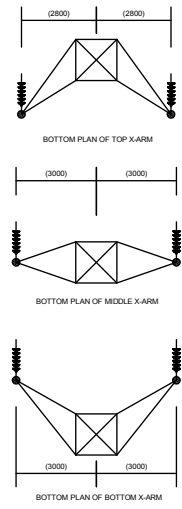
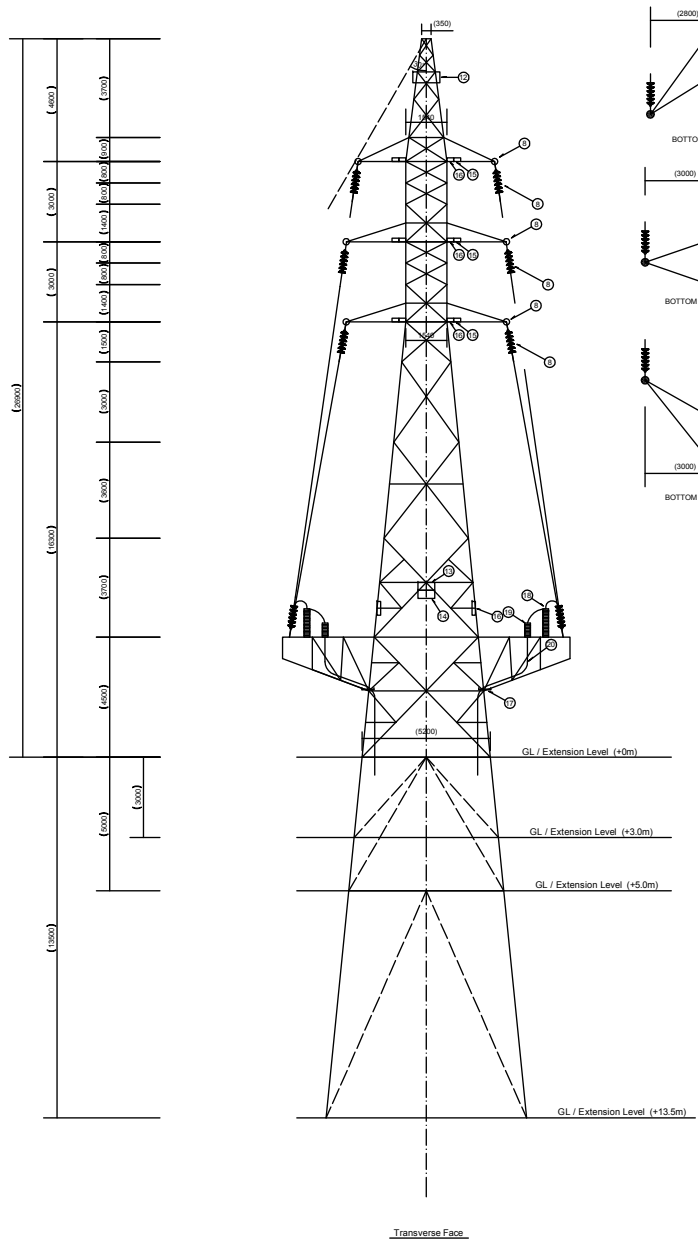


General Design Condition / Criteria	
Voltage	63kV
Circuit	2 cct.
Standard Ruling Span	350m
Horizontal Angle	0° - 90°
Vertical Angle	$\Sigma \tan \alpha = \pm 0.1$
Wind Load	241kg/sq.m
Insulator	
Type	Ball Socket 250 / Fog
Number	6pcs / set
Weight	Approx. 100kg / set
Wind Load	102kg/sq.m
Conductor	
Type	ASTER366
Unit Weight	1.050kg/m
Overall Diameter	24.85mm
Max. Working Tension	46.0kN
Wind Load	68kg/sq.m
Grounding Wire	
Type	OPGW100 or equivalent
Number of Fibers	48 optical fibers
Unit Weight	0.555kg/m
Overall Diameter	14.50mm
Max. Working Tension	29.8kN
Wind Load	74kg/sq.m
Grounding Wire	
Type	OPGW100 or equivalent
Number of Fibers	48 optical fibers
Reference	
Seismic Load	0.15G
Horizontal Seismic Coef.	0.15G

No.	Equipment	Description	Q'ty
①		架空地線(光ファイバ複合架空地線) Grounding Wire (OPGW)	1 lot
②		光ファイバ複合架空地線振動抑制ダンパ装置 Damper for OPGW	1 lot
③		光ファイバ複合架空地線用懸垂保持装置 Suspension Set for OPGW	0 set
④		光ファイバ複合架空地線用張力調整装置 Tension Set for OPGW	1 set
⑤		電力線(金アルミ合金より線) Conductor (AAAC ASTER)	1 lot
⑥		ジャンパー線 Jumper	6 pcs
⑦		懸垂端子装置、クランプ Suspension Insulator Set, Clamp	0 set
⑧		張力端子装置、クランプ Tension Insulator Set, Clamp	12 sets
⑨		支持端子 Jumper Support Insulator	6 sets
⑩		電力線振動抑制ダンパ装置 Damper for Conductor	1 lot
⑪		アーマーロッド Armor Rod	0 set
⑫		架空線別用支持物番号札 Aerial Plate	1 set
⑬		支持物番号札 Number Plate	1 set
⑭		危険警告札 Danger Plate	1 set
⑮		相番号札 Phase Plate	6 sets
⑯		回線識別札 Circuit Plate	8 sets
⑰		昇塔防止装置 Anti-Climbing Guard	1 lot

THE PROJECT FOR IMPROVEMENT OF POWER SUPPLY IN THE REPUBLIC OF DJIBOUTI					SCALE
Transmission Line Tower : Type R					1:200
					DWG. No. T-03
DATE	DESIGNED	CHECKED	APPROVED	REVISION	
	*****	*****	*****		
YEO YACHIYO ENGINEERING CO., LTD. TOKYO, JAPAN					

Tower Type ZZ

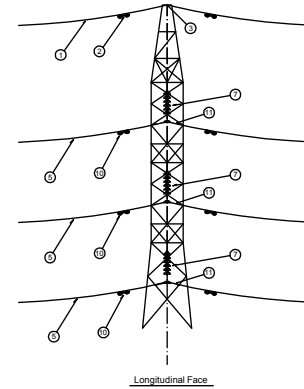
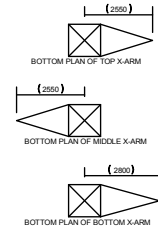
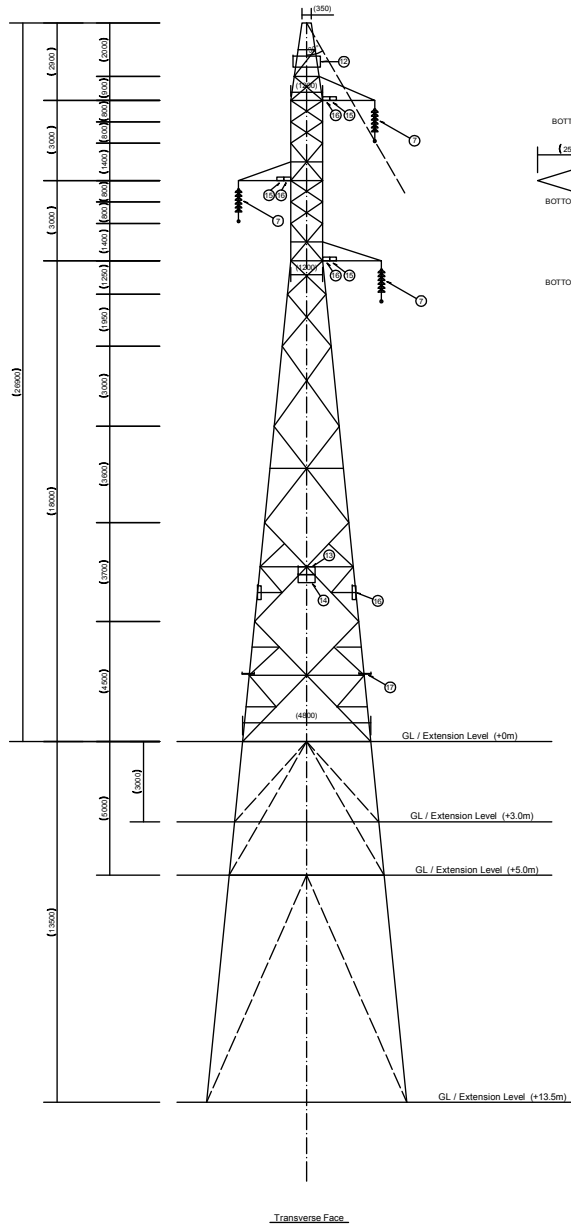


General Design Condition / Criteria	
Voltage	63KV
Circuit	2 cct.
Standard Ruling Span	350m
Horizontal Angle	0° - 5°
Vertical Angle	$\Sigma \tan \alpha = \pm 0.1$
Wind Load	241kg/sq.m
Insulator	
Type	Ball Socket 250 / Fog
Number	6pcs / set
Weight	Approx. 100kg / set
Wind Load	102kg/sq.m
Conductor	
Type	ASTER366
Unit Weight	1.050kg/m
Overall Diameter	24.85mm
Max. Working Tension	46.0kN
Wind Load	68kg/sq.m
Grounding Wire	
Type	OPGW100 or equivalent
Number of Fibers	48 optical fibers
Unit Weight	0.555kg/m
Overall Diameter	14.50mm
Max. Working Tension	29.8kN
Wind Load	74kg/sq.m
Reference	
Seismic Load	0.15G
Horizontal Seismic Coef.	0.15G

No.	Equipment	Description	Q'ty
①		架空地線(光ファイバ) (複合架空地線) Grounding Wire (OPGW)	1 lot
②		光ファイバ(複合架空地線) 抑制ダンパ(装置) Damper for OPGW	1 lot
③		光ファイバ(複合架空地線) 用 懸吊保持装置 Suspension Set for OPGW	0 set
④		光ファイバ(複合架空地線) 用 緊張引継装置 Tension Set for OPGW	1 set
⑤		電力線(金アルミ合金より線) Conductor (AAAC ASTER)	1 lot
⑥		ジャンパー線 Jumper	6 pcs
⑦		懸吊端子装置、クランプ Suspension Insulator Set, Clamp	0 set
⑧		緊張端子装置、クランプ Tension Insulator Set, Clamp	18 sets
⑨		支持端子 Jumper Support Insulator	0 set
⑩		電力線振動抑制ダンパ(装置) Damper for Conductor	1 lot
⑪		アーモロッド Armor Rod	0 set
⑫		航空識別用支持物番号札 Aerial Plate	1 set
⑬		支持物番号札 Number Plate	1 set
⑭		危険警告札 Danger Plate	1 set
⑮		相表示札 Phase Plate	6 sets
⑯		回路識別札 Circuit Plate	8 sets
⑰		昇降防止装置 Anti-Climbing Guard	1 lot
⑱		避雷器 Lightning Arrester with Terminal	6 sets
⑳		ケーブル接続ヘッド Cable Head with Terminal	6 sets
		地中線ケーブル Underground Cable	-

THE PROJECT FOR IMPROVEMENT OF POWER SUPPLY IN THE REPUBLIC OF DJIBOUTI				SCALE	
				1:200	
Title Transmission Line Tower : Type ZZ (with Arresters and Cableheads)				DWG. No.	
				T-04	
DATE	DESIGNED	CHECKED	APPROVED	REVISION	
	*****	*****	*****		
YEO YACHIYO ENGINEERING CO., LTD. TOKYO, JAPAN					

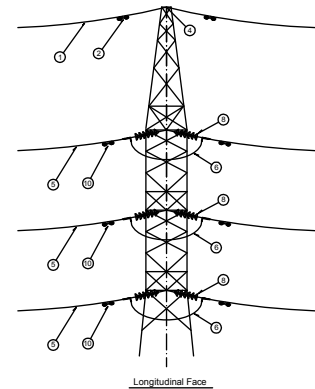
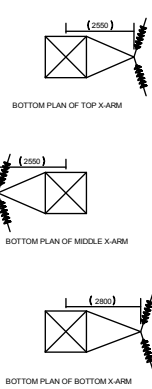
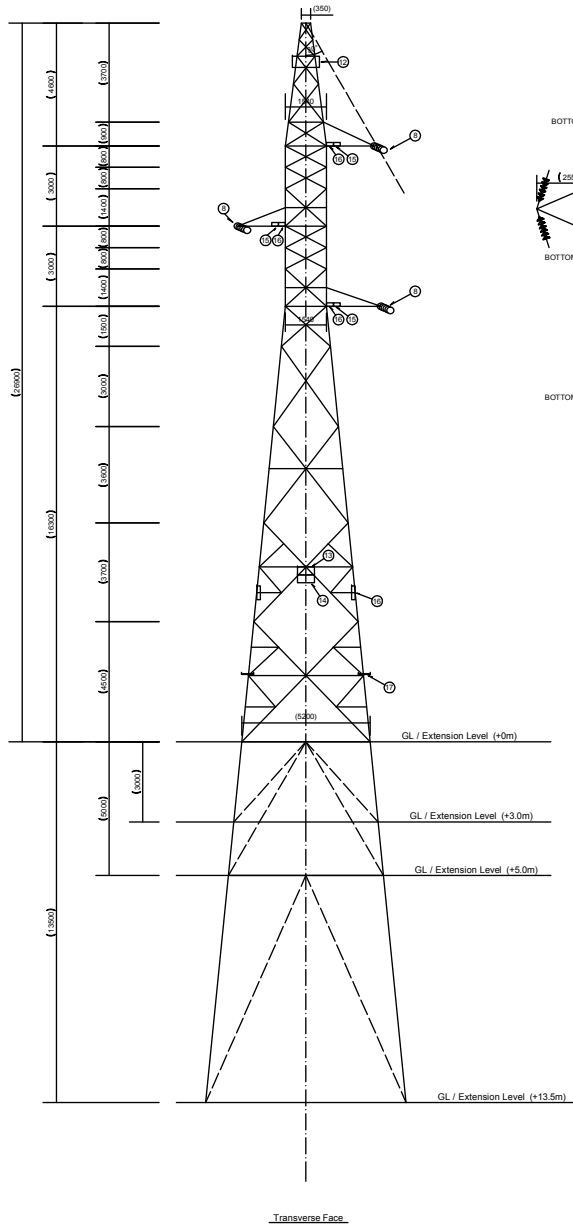
Tower Type A
(Single Circuit)



General Design Condition / Criteria		No.	Equipment	Description	Q'ty
Voltage	63kV	①		架空地線(光ファイバ/複合架空地線)	
Circuit	1 cct.	②		Grounding Wire (OPGW)	1 lot
Standard Ruling Span	350m	③		光ファイバ/複合架空地線振動抑制ダンパ設置	1 lot
Horizontal Angle	0° - 5°	④		Damper for OPGW	
Vertical Angle	$\Sigma \tan \alpha = \pm 0.1$	⑤		光ファイバ/複合架空地線用絶縁保持装置	1 set
Wind Load	241kg/sq.m	⑥		Suspension Set for OPGW	1 set
Insulator		⑦		光ファイバ/複合架空地線用耐張引線装置	0 set
Type	Ball Socket 250 / Fog	⑧		Tension Set for OPGW	0 set
Number	6pcs / set	⑨		電力線(全アルミ合金が線)	1 lot
Weight	Approx. 100kg / set	⑩		Conductor (AAAC ASTER)	1 lot
Wind Load	102kg/sq.m	⑪		ジャンパー線	0 pcs
Conductor		⑫		Jumper	
Type	ASTER366	⑬		懸垂子装置, クランプ	3 sets
Unit Weight	1.050kg/m	⑭		Suspension Insulator Set, Clamp	
Overall Diameter	24.85mm	⑮		耐張子装置, クランプ	0 set
Max. Working Tension	46.0kN	⑯		Tension Insulator Set, Clamp	
Wind Load	68kg/sq.m	⑰		支持子	0 set
Grounding Wire				Jumper Support Insulator	
Type	OPGW100 or equivalent			電力線振動抑制ダンパ設置	1 lot
Number of Fibers	48 optical fibers			Damper for Conductor	
Unit Weight	0.555kg/m			アーモアロッド	3 set
Overall Diameter	14.50mm			Armor Rod	
Max. Working Tension	29.8kN			航空機別用支持物番号札	1 set
Wind Load	74kg/sq.m			Aerial Plate	
Reference				支持物番号札	1 set
Seismic Load	0.15G			Number Plate	
Horizontal Seismic Coef.	0.15G			危険警告札	1 set
				Danger Plate	
				相表示札	3 sets
				Phase Plate	
				回線識別札	0 set
				Circuit Plate	
				昇塔禁止装置	1 lot
				Anti-Climbing Guard	

THE PROJECT FOR IMPROVEMENT OF POWER SUPPLY IN THE REPUBLIC OF DJIBOUTI				SCALE	
				1:200	
Title Transmission Line Tower : Type A (Single circuit)				DWG. No.	
				T-05	
DATE	DESIGNED	CHECKED	APPROVED	REVISION	
	*****	*****	*****		
YEO YACHIYO ENGINEERING CO., LTD. TOKYO, JAPAN					

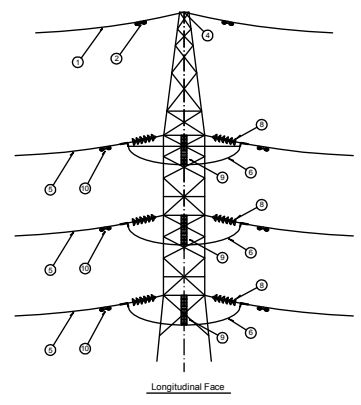
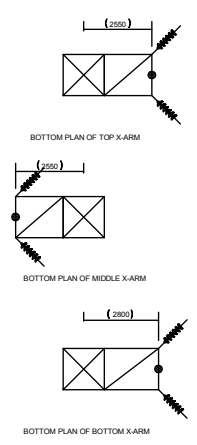
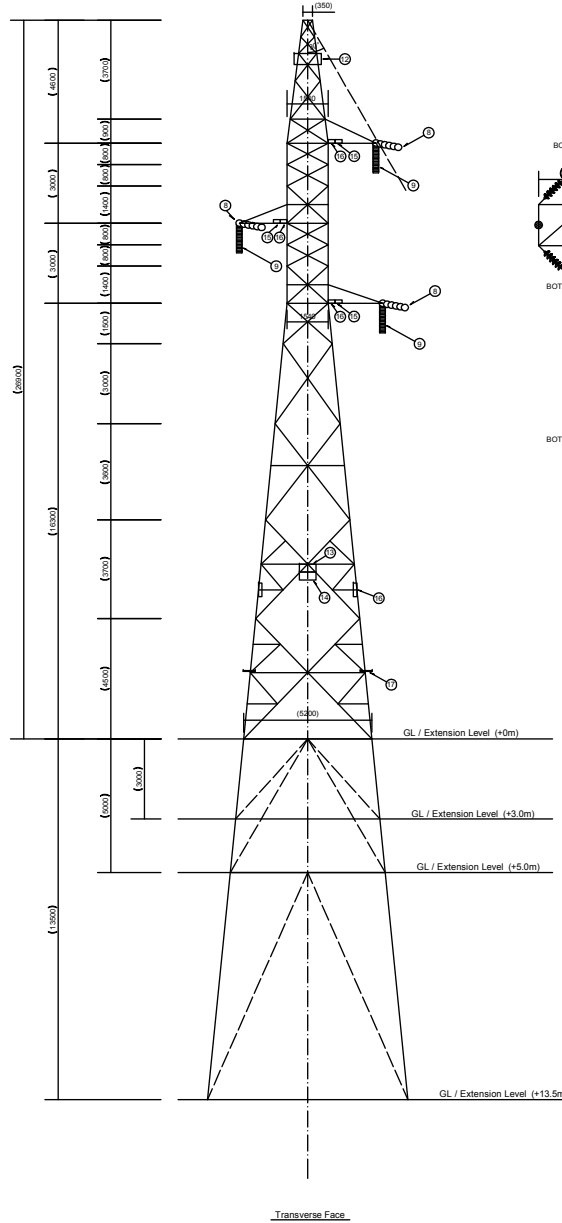
Tower Type B, C
(Single Circuit)



General Design Condition / Criteria		No.	Equipment	Description	Q'ty
Voltage	63kV	①		架空地線(光ファイバ複合架空地線)	
Circuit	1 cct.	②		Grounding Wire (OPGW)	1 lot
Standard Ruling Span	350m	③		光ファイバ複合架空地線振動抑制ダンパ装置	1 lot
Horizontal Angle	0° - 35°	④		Damper for OPGW	
Vertical Angle	$\Sigma \tan \alpha = \pm 0.1$	⑤		光ファイバ複合架空地線用懸垂保持装置	0 set
Wind Load	241kg/sq.m	⑥		Suspension Set for OPGW	1 set
Insulator		⑦		電力線(全アルミ合金)架線	1 lot
Type	Ball Socket 250 / Fog	⑧		Conductor (AAAC ASTER)	
Number	6pcs / set	⑨		ジャンパー線	3 pcs
Weight	Approx. 100kg / set	⑩		Jumper	
Wind Load	102kg/sq.m	⑪		懸垂端子装置 クランプ	0 set
Conductor		⑫		Suspension Insulator Set, Clamp	0 set
Type	ASTER366	⑬		新張端子装置 クランプ	6 sets
Unit Weight	1.050kg/m	⑭		Tension Insulator Set, Clamp	
Overall Diameter	24.85mm	⑮		支持棒子	0 set
Max. Working Tension	46.0kN	⑯		Jumper Support Insulator	
Wind Load	68kg/sq.m	⑰		電力線振動抑制ダンパ装置	1 lot
Grounding Wire				Damper for Conductor	
Type	OPGW100 or equivalent			アーマーロッド	0 set
Number of Fibers	48 optical fibers			Armor Rod	
Unit Weight	0.555kg/m			航空機別用支持物番号札	1 set
Overall Diameter	14.50mm			Aerial Plate	
Max. Working Tension	29.8kN			支持物番号札	1 set
Wind Load	74kg/sq.m			Number Plate	
Reference				危険警告札	1 set
Seismic Load	0.15G			Danger Plate	
Horizontal Seismic Coef.	0.15G			相線番号札	3 sets
				Phase Plate	
				回線識別札	0 set
				Circuit Plate	
				昇降防止装置	1 lot
				Anti-Climbing Guard	

THE PROJECT FOR IMPROVEMENT OF POWER SUPPLY IN THE REPUBLIC OF DJIBOUTI				SCALE
				1:200
Title				DWG. No.
Transmission Line Tower : Type B, C (Single circuit)				T-06
DATE	DESIGNED	CHECKED	APPROVED	REVISION
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YACHIYO ENGINEERING CO., LTD. TOKYO, JAPAN				

Tower Type R
(Single Circuit)



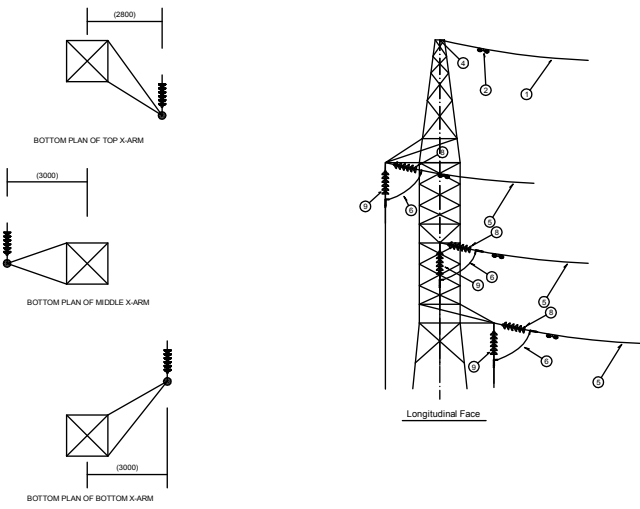
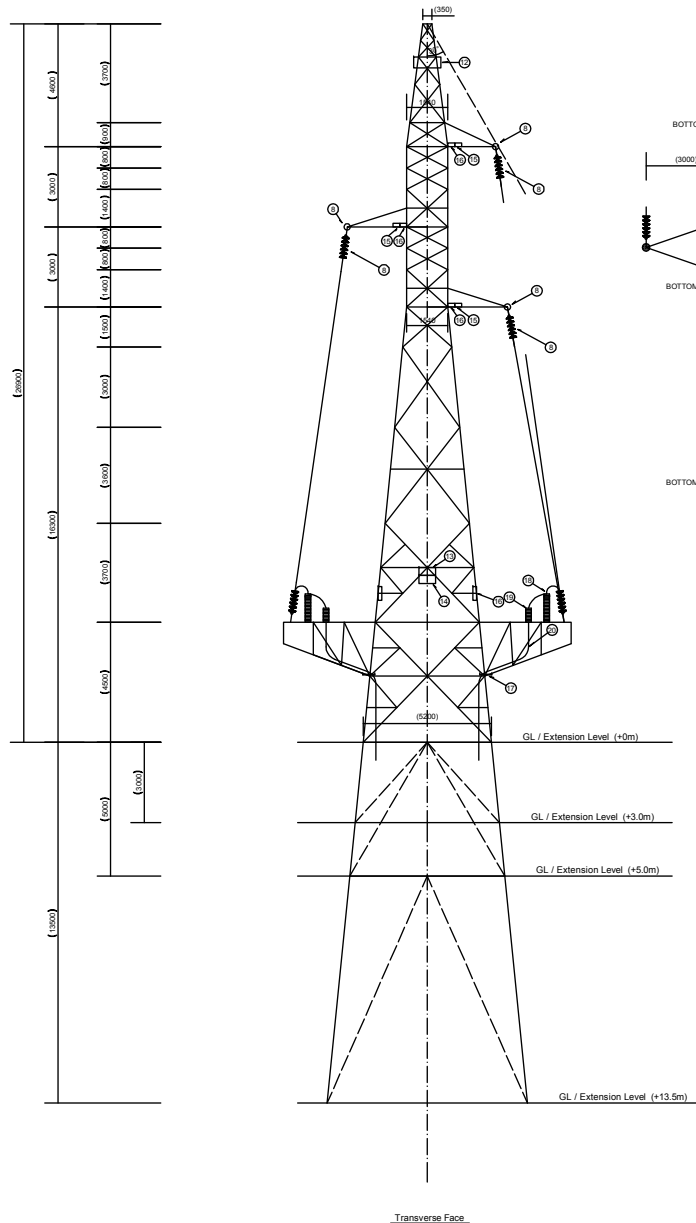
General Design Condition / Criteria

Voltage	63kV
Circuit	1 cct.
Standard Ruling Span	350m
Horizontal Angle	0° - 90°
Vertical Angle	$\Sigma \tan \alpha = \pm 0.1$
Wind Load	241kg/sq.m
Insulator	
Type	Ball Socket 250 / Fog
Number	6pcs / set
Weight	Approx. 100kg / set
Wind Load	102kg/sq.m
Conductor	
Type	ASTER366
Unit Weight	1.050kg/m
Overall Diameter	24.85mm
Max. Working Tension	46.0kN
Wind Load	68kg/sq.m
Grounding Wire	
Type	OPGW100 or equivalent
Number of Fibers	48 optical fibers
Unit Weight	0.555kg/m
Overall Diameter	14.50mm
Max. Working Tension	29.8kN
Wind Load	74kg/sq.m
Reference	
Seismic Load	0.15G
Horizontal Seismic Coef.	0.15G

No.	Equipment	Description	Q'ty
①		架空地線(光ファイバ/複合架空地線)	1 lot
②		Grounding Wire (OPGW)	1 lot
③		光ファイバ複合架空地線振動抑制ダンパ装置	1 lot
④		Damper for OPGW	1 lot
⑤		光ファイバ複合架空地線用懸垂支持装置	0 set
⑥		Suspension Set for OPGW	0 set
⑦		光ファイバ複合架空地線用引張器装置	1 set
⑧		Tension Set for OPGW	1 set
⑨		電力線(全アルミ合金)導線	1 lot
⑩		Conductor (AAAC ASTER)	1 lot
⑪		ジャンパー線	3 pcs
⑫		Jumper	3 pcs
⑬		懸垂端子装置, クランプ	0 set
⑭		Suspension Insulator Set, Clamp	0 set
⑮		耐張端子装置, クランプ	6 sets
⑯		Tension Insulator Set, Clamp	6 sets
⑰		支持端子	3 sets
⑱		Jumper Support Insulator	3 sets
⑲		電力線振動抑制ダンパ装置	1 lot
⑳		Damper for Conductor	1 lot
㉑		アーマーロッド	0 set
㉒		Armor Rod	0 set
㉓		航空機識別用支持物番号札	1 set
㉔		Aerial Plate	1 set
㉕		支持物番号札	1 set
㉖		Number Plate	1 set
㉗		危険警告札	1 set
㉘		Danger Plate	1 set
㉙		相表示札	3 sets
㉚		Phase Plate	3 sets
㉛		回線識別札	0 set
㉜		Circuit Plate	0 set
㉝		昇降防止装置	1 lot
㉞		Anti-Climbing Guard	1 lot

THE PROJECT FOR IMPROVEMENT OF POWER SUPPLY IN THE REPUBLIC OF DJIBOUTI				SCALE	
				1:200	
Title Transmission Line Tower : Type R (Single circuit)				DWG. No.	
				T-07	
DATE	DESIGNED	CHECKED	APPROVED	REVISION	
	*****	*****	*****		
YEO YACHIYO ENGINEERING CO., LTD. TOKYO, JAPAN					

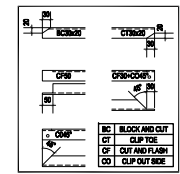
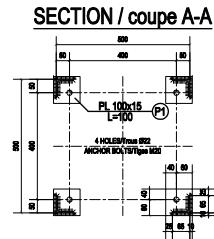
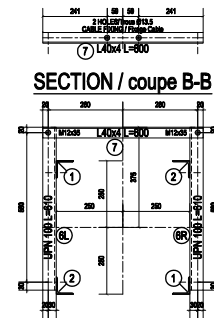
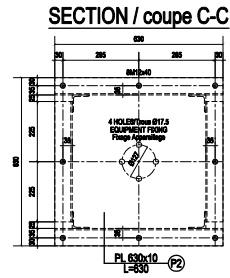
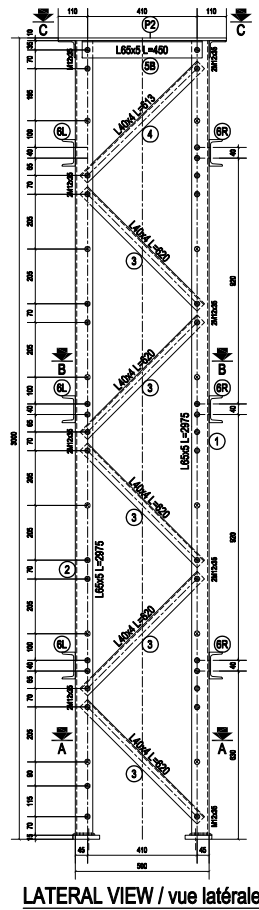
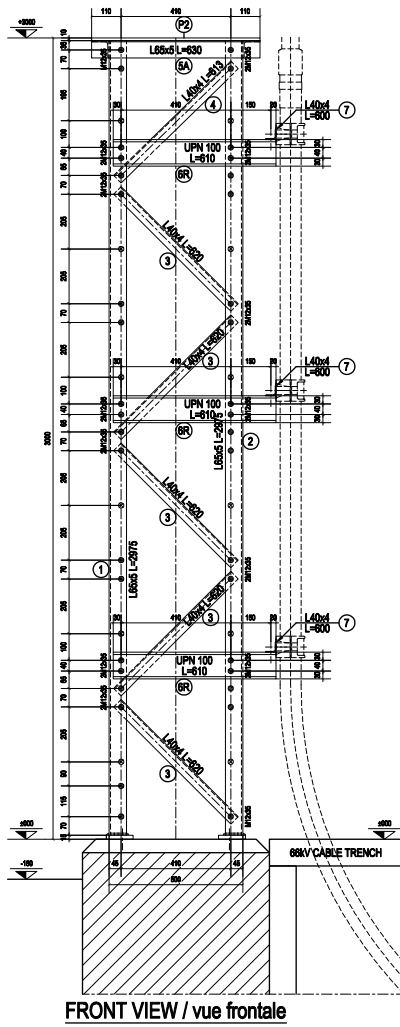
Tower Type ZZ
(Single Circuit)



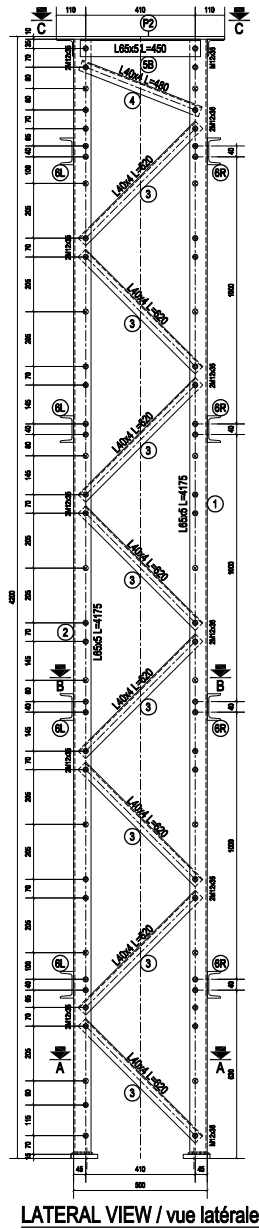
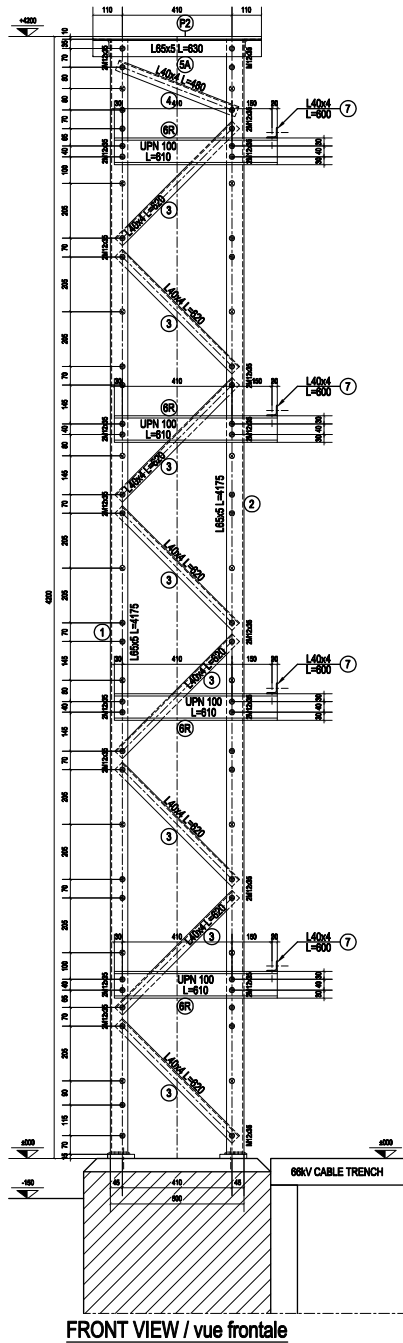
General Design Condition / Criteria	
Voltage	63kV
Circuit	2 cct.
Standard Ruling Span	350m
Horizontal Angle	0° - 5°
Vertical Angle	$\Sigma \tan \alpha = \pm 0.1$
Wind Load	241kg/sq.m
Insulator	
Type	Ball Socket 250 / Fog
Number	6pcs / set
Weight	Approx. 100kg / set
Wind Load	102kg/sq.m
Conductor	
Type	ASTER366
Unit Weight	1.050kg/m
Overall Diameter	24.85mm
Max. Working Tension	46.0kN
Wind Load	68kg/sq.m
Grounding Wire	
Type	OPGW100 or equivalent
Number of Fibers	48 optical fibers
Unit Weight	0.555kg/m
Overall Diameter	14.50mm
Max. Working Tension	29.8kN
Wind Load	74kg/sq.m
Reference	
Seismic Load	0.15G
Horizontal Seismic Coef.	0.15G

No.	Equipment	Description	Q'ty
①		架空地線(光ファイバ)複合架設地線	
②		Grounding Wire (OPGW)	1 lot
③		光ファイバ複合架設地線振動抑制シールド装置	1 lot
④		Damper for OPGW	1 lot
⑤		光ファイバ複合架設地線用懸垂保持装置	0 set
⑥		Suspension Set for OPGW	0 set
⑦		光ファイバ複合架設地線用前張引張装置	1 set
⑧		Tension Set for OPGW	1 set
⑨		電力線(全アルミ合金)が線	1 lot
⑩		Conductor (AAAC ASTER)	1 lot
⑪		ジャンパー線	3 pcs
⑫		Jumper	3 pcs
⑬		懸垂端子装置, クランプ	0 set
⑭		Suspension Insulator Set, Clamp	0 set
⑮		前張端子装置, クランプ	9 sets
⑯		Tension Insulator Set, Clamp	9 sets
⑰		ジャンパー支持用絶縁子	0 set
⑱		Jumper Support Insulator	0 set
⑲		電力線振動抑制シールド装置	1 lot
⑳		Damper for Conductor	1 lot
㉑		アーマードロッド	0 set
㉒		Armor Rod	0 set
㉓		軌道用支持物番号札	1 set
㉔		Aerial Plate	1 set
㉕		支持物番号札	1 set
㉖		Number Plate	1 set
㉗		危険警告札	1 set
㉘		Danger Plate	1 set
㉙		相表示札	3 sets
㉚		Phase Plate	3 sets
㉛		回線番号札	0 set
㉜		Circuit Plate	0 set
㉝		昇塔防止装置	1 lot
㉞		Anti-Climbing Guard	1 lot
㉟		避雷器	3 sets
㊱		Lightning Arrester with Terminal	3 sets
㊲		ケーブルヘッド	3 sets
㊳		Cable Head with Terminal	3 sets
㊴		地下ケーブル	-
㊵		Underground Cable	-

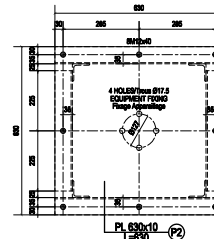
THE PROJECT FOR IMPROVEMENT OF POWER SUPPLY IN THE REPUBLIC OF DJIBOUTI				SCALE 1:200	
Title Transmission Line Tower : Type ZZ (with Arresters and Cable heads) (Single circuit)				DWG. No. T-08	
DATE	DESIGNED	CHECKED	APPROVED	REVISION	
	*****	*****	*****		
YACHIYO ENGINEERING CO., LTD. TOKYO, JAPAN					



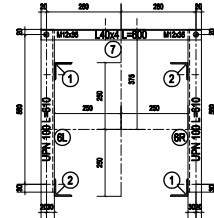
THE PROJECT FOR IMPROVEMENT OF POWER SUPPLY IN THE REPUBLIC OF DJIBOUTI				SCALE	
				1:20	
Title STEEL STRUCTURE 66kV CABLE SEALING END (LINE BAY) TYPE A				DWG. No.	
				P-01	
DATE	DESIGNED	CHECKED	APPROVED	REVISION	
	*****	*****	*****		
YACHIYO ENGINEERING CO., LTD. TOKYO, JAPAN					



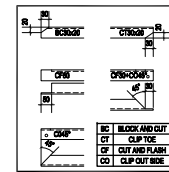
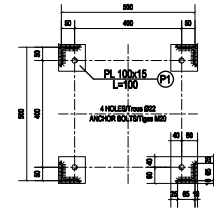
SECTION / coupe C-C



SECTION / coupe B-B



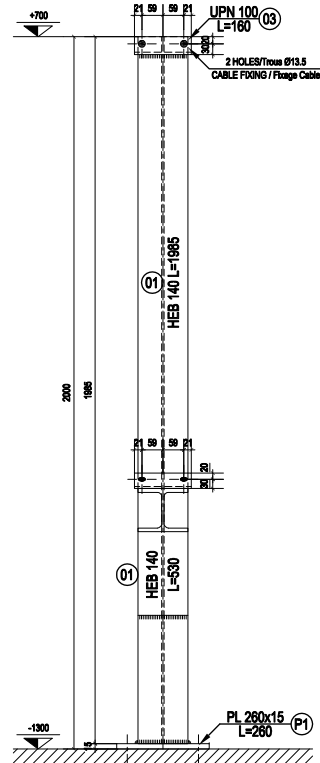
SECTION / coupe A-A



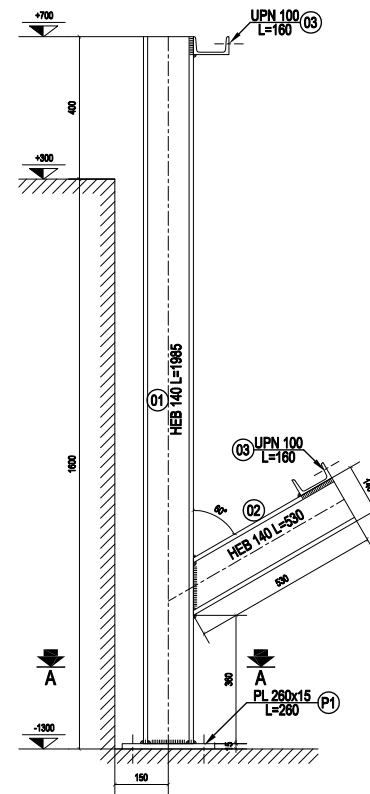
THE PROJECT FOR IMPROVEMENT OF POWER SUPPLY IN THE REPUBLIC OF DJIBOUTI				SCALE	
				1:20	
Title STEEL STRUCTURE 66KV CABLE SEALING END (TRANSFORMER BAY) TYPE B				DWG. No.	
				P-02	
DATE	DESIGNED	CHECKED	APPROVED	REVISION	
	*****	*****	*****		
YACHIYO ENGINEERING CO., LTD. TOKYO, JAPAN					

boite de extrémité CABLE SEALING END

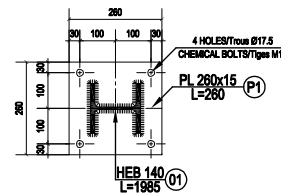
FRONT VIEW / vue frontale



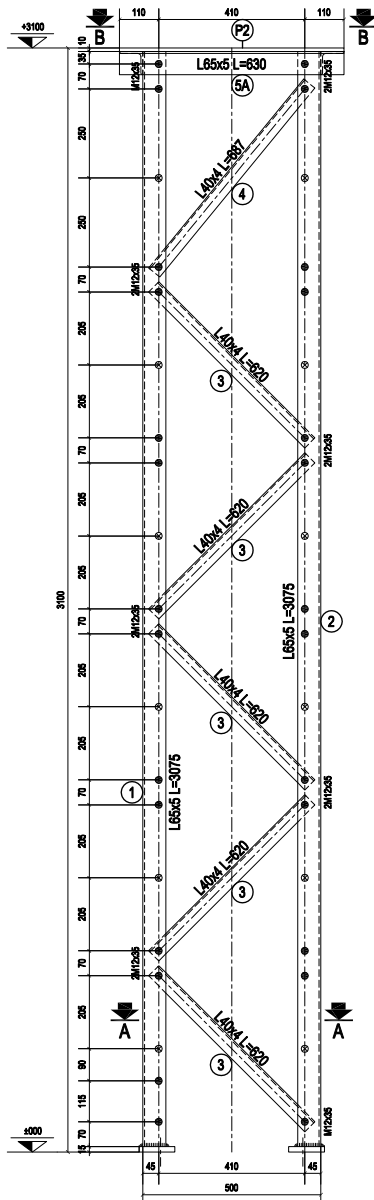
LATERAL VIEW / vue latérale



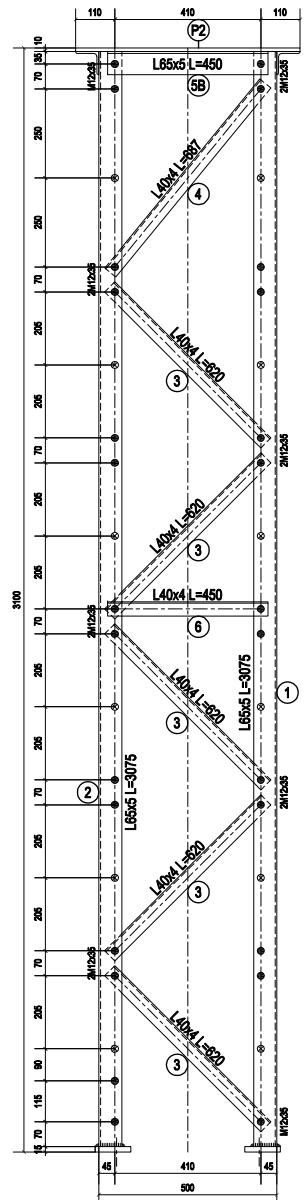
SECTION / coupe A-A



THE PROJECT FOR IMPROVEMENT OF POWER SUPPLY IN THE REPUBLIC OF DJIBOUTI				SCALE 1:15	
Title STEEL STRUCTURE 66kV CABLE SEALING END (INDOOR) TYPE C				DWG. No. P-03	
DATE	DESIGNED	CHECKED	APPROVED	REVISION	
	*****	*****	*****		
YACHIYO ENGINEERING CO., LTD. TOKYO, JAPAN					

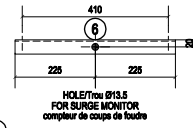
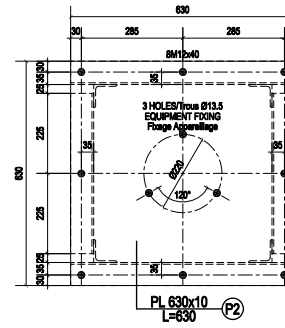


LATERAL VIEW / vue latérale

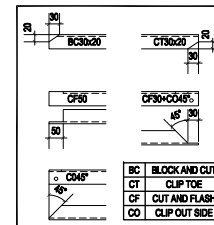
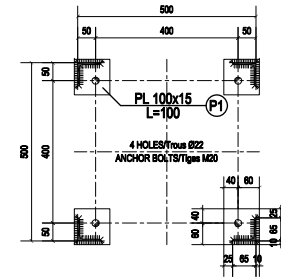


FRONT VIEW / vue frontale

SECTION / coupe B-B



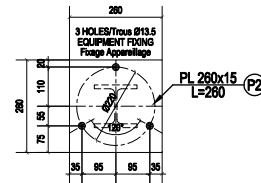
SECTION / coupe A-A



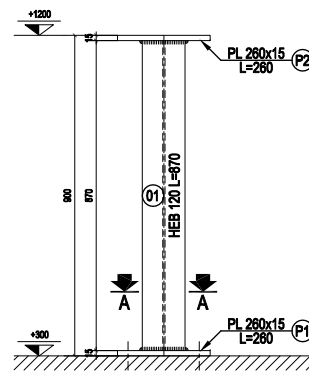
THE PROJECT FOR IMPROVEMENT OF POWER SUPPLY IN THE REPUBLIC OF DJIBOUTI				SCALE	
				1:15	
Title STEEL STRUCTURE 66kV SURGE ARRESTER (LINE BAY) TYPE D				DWG. No.	
				P-04	
DATE	DESIGNED	CHECKED	APPROVED	REVISION	
	*****	*****	*****		
YACHIYO ENGINEERING CO., LTD. TOKYO, JAPAN					

parafoudre niveau +300 SURGE ARRESTER AT +300

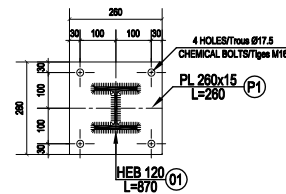
TOP VIEW / vue en plan




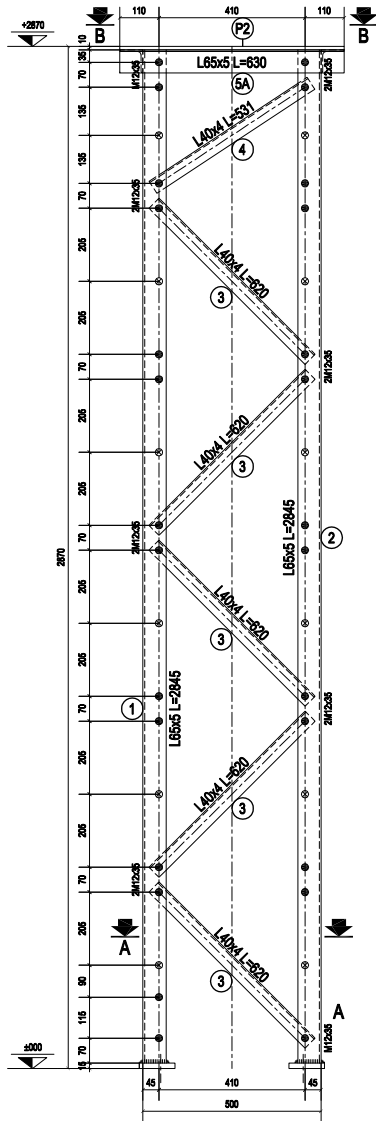
FRONT VIEW / vue frontale



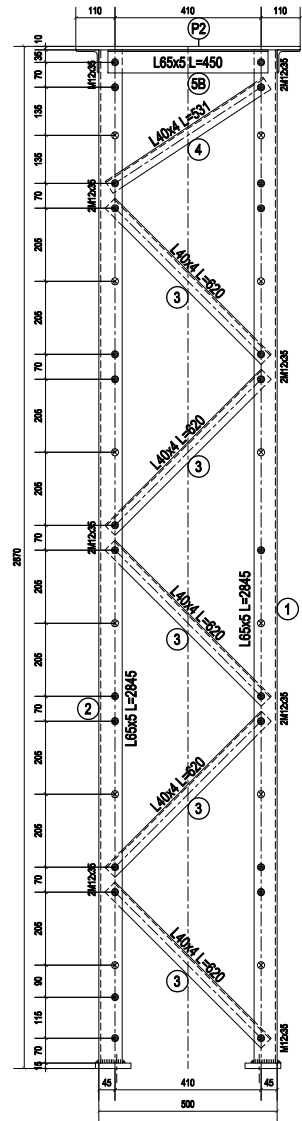
SECTION / coupe A-A



THE PROJECT FOR IMPROVEMENT OF POWER SUPPLY IN THE REPUBLIC OF DJIBOUTI				SCALE	
				1:15	
Title STEEL STRUCTURE 66kV SURGE ARRESTER AT+300 (INDOOR) TYPE E				DWG. No.	
				P-05	
DATE	DESIGNED	CHECKED	APPROVED	REVISION	
	*****	*****	*****		
 YACHIYO ENGINEERING CO., LTD. TOKYO, JAPAN					

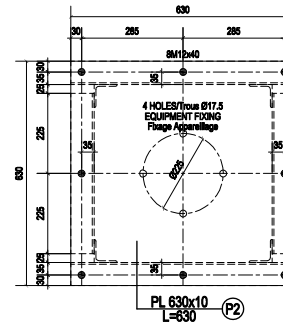


FRONT VIEW / vue frontale

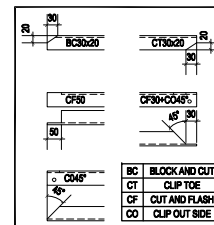
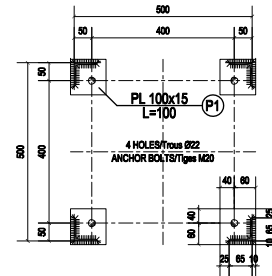


LATERAL VIEW / vue latérale

SECTION / coupe B-B

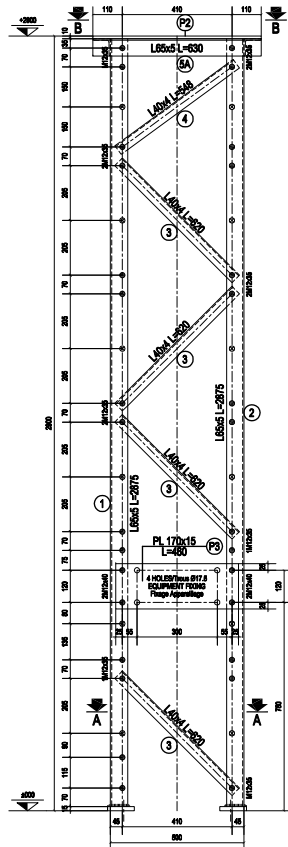


SECTION / coupe A-A

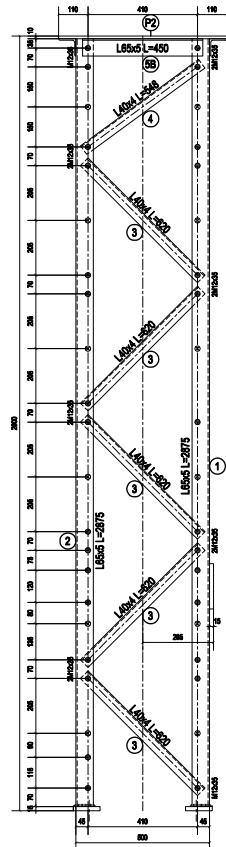


THE PROJECT FOR IMPROVEMENT OF POWER SUPPLY IN THE REPUBLIC OF DJIBOUTI				SCALE	
				1:15	
Title STEEL STRUCTURE 230kV POST INSULATOR TYPE F				DWG. No.	
				P-06	
DATE	DESIGNED	CHECKED	APPROVED	REVISION	
	*****	*****	*****		
YACHIYO ENGINEERING CO., LTD. TOKYO, JAPAN					

CENTRAL POLE / pôle central

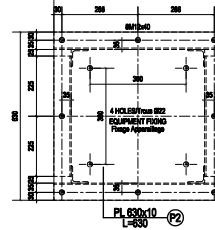


FRONT VIEW / vue frontale

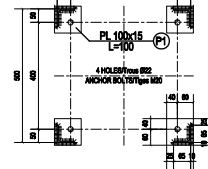


LATERAL VIEW / vue latérale

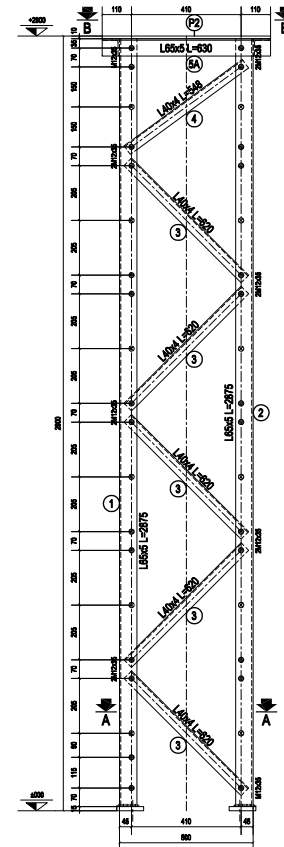
SECTION / coupe B-B



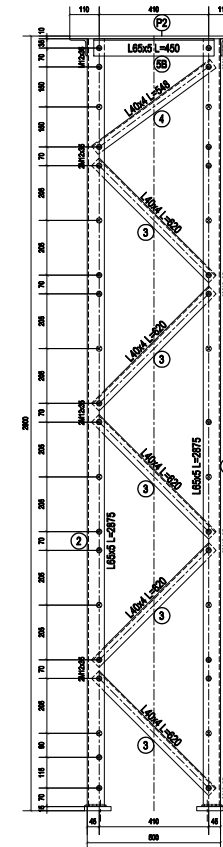
SECTION / coupe A-A




LATERAL POLES / pôles laterals

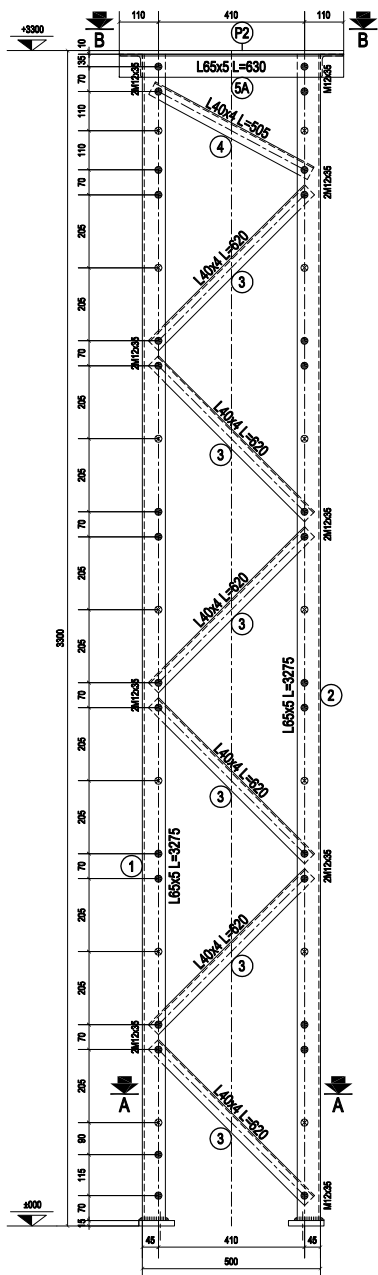


FRONT VIEW / vue frontale

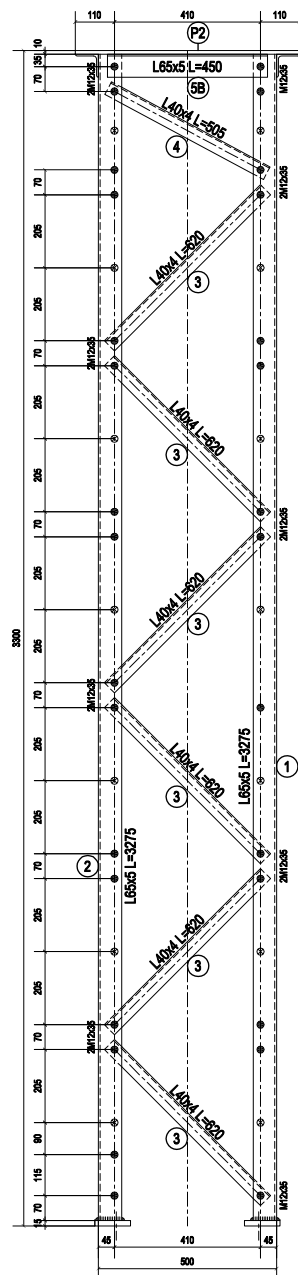


LATERAL VIEW / vue latérale

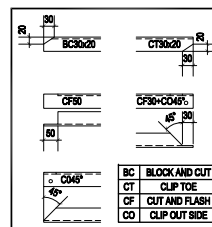
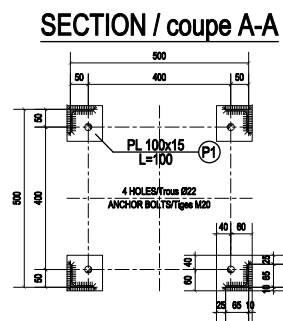
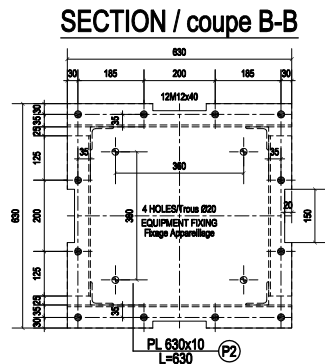
THE PROJECT FOR IMPROVEMENT OF POWER SUPPLY IN THE REPUBLIC OF DJIBOUTI				SCALE	
				1:20	
Title STEEL STRUCTURE 230kV DISCONNECTOR TYPE G				DWG. No.	
				P-07	
DATE	DESIGNED	CHECKED	APPROVED	REVISION	
	*****	*****	*****		
 YACHIYO ENGINEERING CO., LTD. TOKYO, JAPAN					



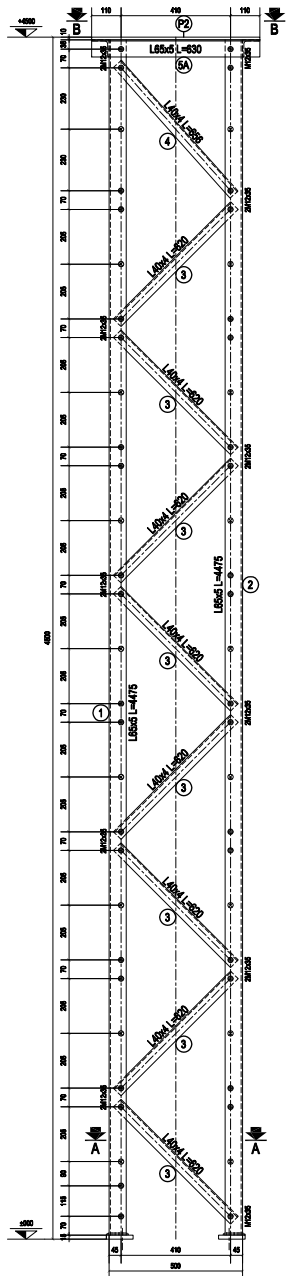
FRONT VIEW / vue frontale



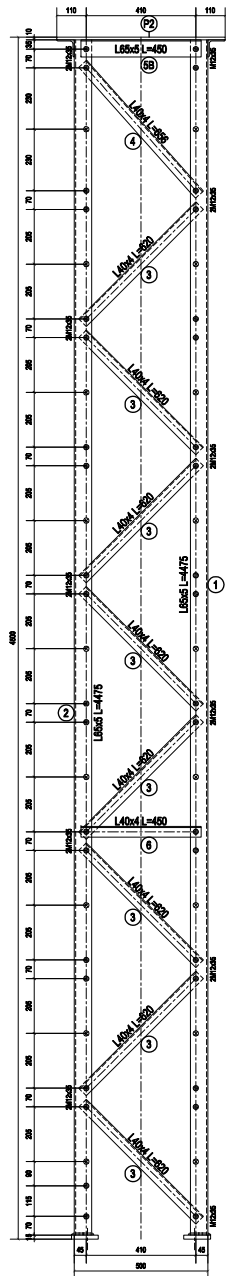
LATERAL VIEW / vue latérale



THE PROJECT FOR IMPROVEMENT OF POWER SUPPLY IN THE REPUBLIC OF DJIBOUTI				SCALE	
				1:15	
Title STEEL STRUCTURE 230kV CURRENT TRANSFORMER TYPE H				DWG. No.	
				P-08	
DATE	DESIGNED	CHECKED	APPROVED	REVISION	
	*****	*****	*****		
yec YACHIYO ENGINEERING CO., LTD. TOKYO, JAPAN					

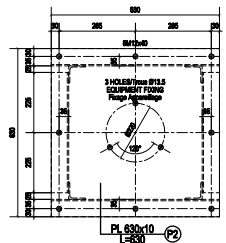


FRONT VIEW / vue frontale

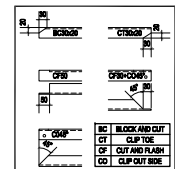
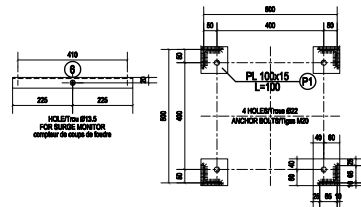


LATERAL VIEW / vue latérale

SECTION / coupe B-B



SECTION / coupe A-A



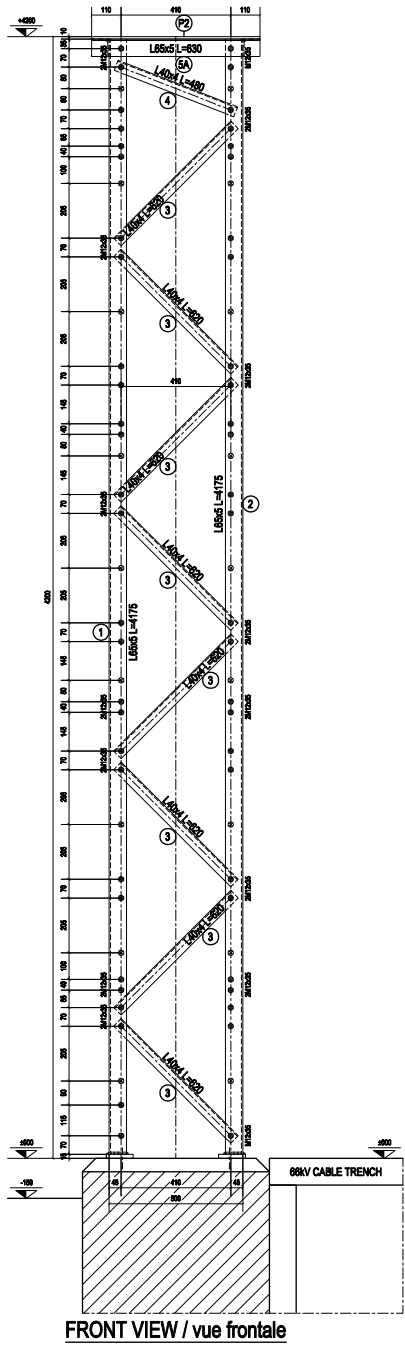
REFERENCE DRAWING - List des dessins	
Description	N.
GENERAL LAYOUT OF CIVIL WORKS Plan Génie Civil	00700-K-C001
SETTING TEMPLATE AND ANCHOR BOLTS Tiges d'ancrages	00700-K-M004
NOTES	
1)- ALL DIMENSIONS ARE IN CENTIMETERS, EXCEPT WHERE INDICATED Toutes les mesures sont en centimètres sauf où indiqué	
2)- ANCHOR BOLTS, PLATES AND SHAPE S 275 JR (Eurocode 3) Tiges d'ancrages, plates et profilés S 275 JR (Eurocode 3)	
3)- SCREWS 6.8 - NUTS 6 Vis 6.8 - Ecrous 6	
4)- DOUBLE HOT-DIP GALVANIZING SHAPES AND PLATES Plats et profilés: double galvanisation à chaude	
5)- MINIMUM BEAD WELD THICKNESS = 0.7 SMALLEST THICKNESS TO JOINT Soudures avec cône de cordon égal à la 0.7 de l'épaisseur minimal à jointe	
6)- ALL STEEL ANGLES ARE DRILLED IN THE MIDDLE OF THE FLANGE EXCEPT WHERE INDICATED Axe de troussage des cornières égal à la moitié des ailes sauf où indiqué	
7)- HOLES / trous Ø17.5 - Bolts / boulons M20 HOLES / trous Ø22 - Bolts / boulons M20 HOLES / trous Ø13.5 - Bolts / boulons M16 - EDGE DIST. / pince 25mm HOLES / trous Ø10	

FOR/pour CONSTRUCTION

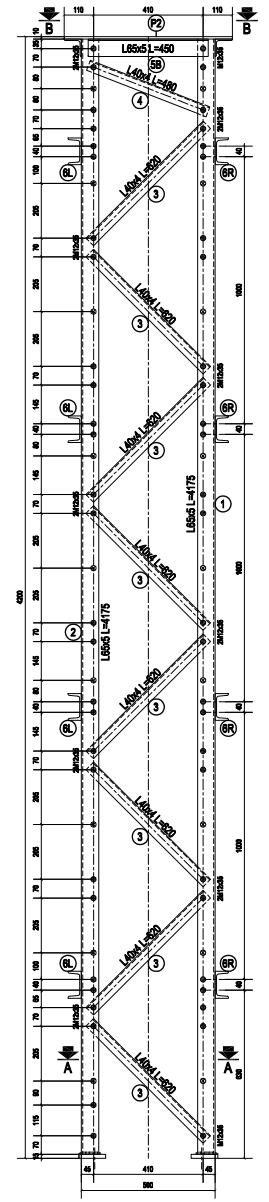
Dimension	Qty.	Type	Mat.	UM	N	Length	Unit Weight	TOTAL	
L60x5	1	Equal Angles	Alloy equal	S275JR	EN 10086	2	4475	4.97	44.5
L60x5	2	Equal Angles	Alloy equal	S275JR	EN 10086	2	4475	4.97	44.5
L60x4	3	Equal Angles	Alloy equal	S275JR	EN 10086	3	620	2.42	48.6
L60x4	4	Equal Angles	Alloy equal	S275JR	EN 10086	4	656	2.42	6.4
L60x5	5A	Equal Angles	Alloy equal	S275JR	EN 10086	2	630	4.97	6.3
L60x5	5B	Equal Angles	Alloy equal	S275JR	EN 10086	2	450	4.97	4.5
L60x4	6	Equal Angles	Alloy equal	S275JR	EN 10086	1	450	2.42	1.1
PLATE	P1	Plate	Flat	S275JR	EN 10025	4	100 100 15	7850	4.7
PLATE	P2	Plate	Flat	S275JR	EN 10025	1	630 630 10	7850	31.2
M12x40		Screws	Vis	A8	EN 190 4016	8		0.13	0.4
M12x35		Screws	Vis	A8	EN 190 4016	81		0.06	4.2
M12		Nuts	Ecrous	A8	EN 190 4016	92		0.02	2.1
R13		Washers	rondelles		EN 190 7081164			0.01	1.3
LN M12		Lock Nuts	Blois Ecrous			92			0.0
TOTAL								199.8	
TOTAL W/ HOT-DIP GALVANIZING / Total avec Galvanisation à chaude (+6%)								211.6	

TOTAL SUPPORTS = 6
MARK: K-SA1

THE PROJECT FOR IMPROVEMENT OF POWER SUPPLY IN THE REPUBLIC OF DJIBOUTI				SCALE	
Title STEEL STRUCTURE 230kV SURGE ARRESTER TYPE I				1:20	
				DWG. No. P-09	
DATE	DESIGNED	CHECKED	APPROVED	REVISION	
	*****	*****	*****		
YACHIYO ENGINEERING CO., LTD. TOKYO, JAPAN					

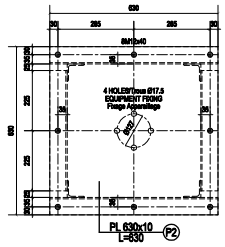


FRONT VIEW / vue frontale

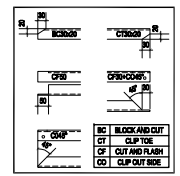
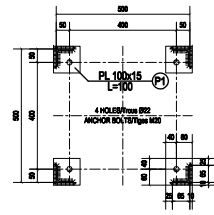


LATERAL VIEW / vue latérale

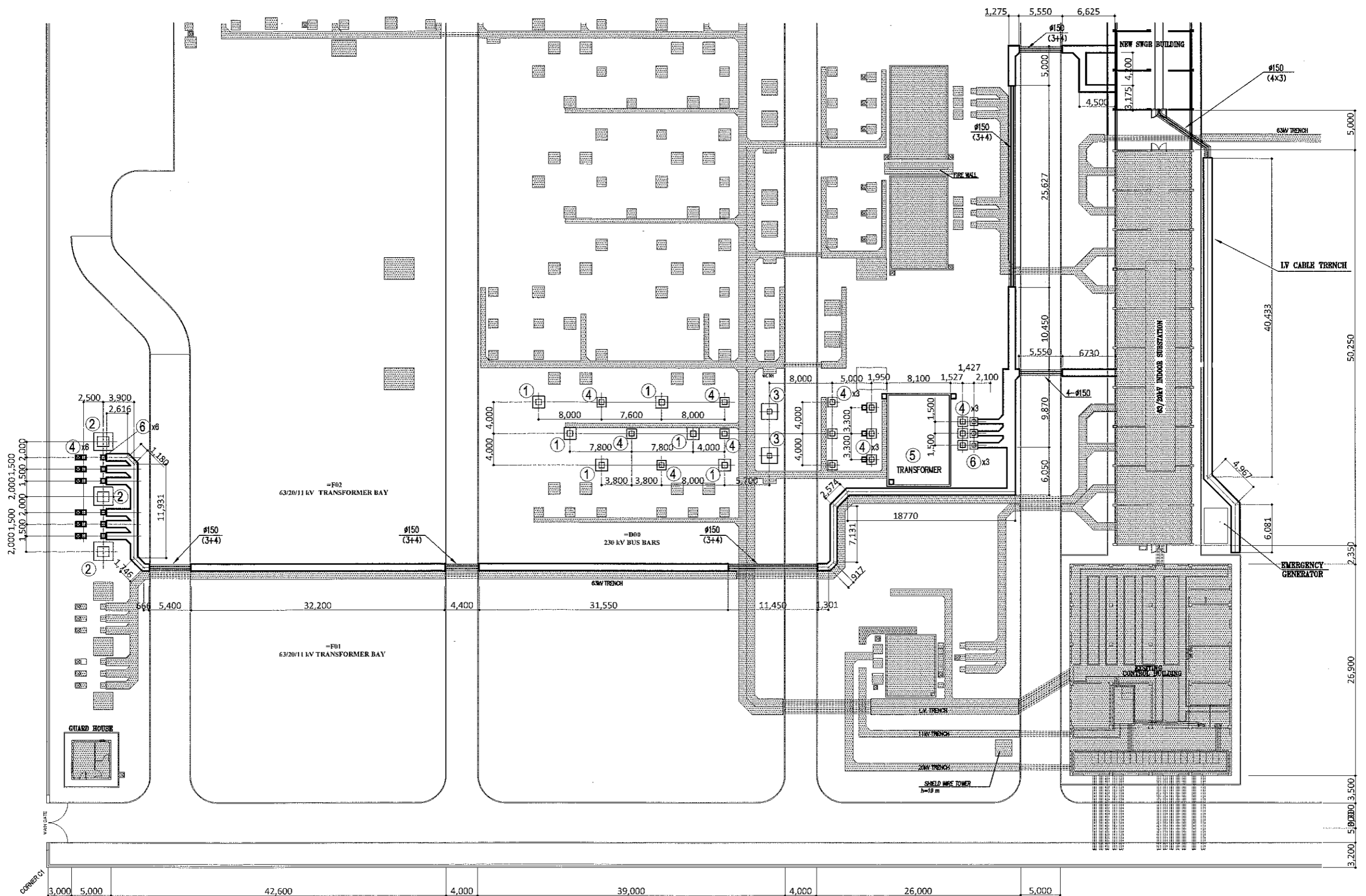
SECTION / coupe B-B



SECTION / coupe A-A



THE PROJECT FOR IMPROVEMENT OF POWER SUPPLY IN THE REPUBLIC OF DJIBOUTI				SCALE	
				1:20	
Title STEEL STRUCTURE 66kV ARRESTER (TRANSFORMER BAY) TYPE J				DWG. No.	
				P-10	
DATE	DESIGNED	CHECKED	APPROVED	REVISION	
	*****	*****	*****		
YACHIYO ENGINEERING CO., LTD. TOKYO, JAPAN					



NOTES

EXISTING EQUIPMENTS FOUNDATION OR BUILDING OR CABLE TRENCH

THE PROJECT FOR IMPROVEMENT OF POWER SUPPLY IN THE REPUBLIC OF DJIBOUTI				SCALE
				1:500
Title JABAN'AS SUBSTATION SWGR BUILDING CABLE TRENCH AND EQUIPMENT FOUNDATION PLAN				DWG. No.
DATE	DESIGNED	CHECKED	APPROVED	REVISION
YACHIYO ENGINEERING CO., LTD.				