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GEOLOGICAL REPORT
HAMAM OF DURRES

ATELIER 4
ARCHITECTURE • ENGINEERING • CONSULTING

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1. INTRODUCTION

The Medieval Hammam building is a cultural monument Category I, declared by decision of the Ministry of Education and Culture dated 10.06.1973, No. 1886. This building is located in Durres, Administrative Unit Municipality of Durres, Neighborhood 1, Rruga Tregtare, with geographical coordinates 41 ° 18'38.38 "N and 19 ° 26'50.51" E.

1.1 PURPOSE OF THE STUDY

The destination of this study is to determine the physical-mechanical characteristics of soils and rocks that meet in the area where "Hammam" is located. The data obtained from the works will serve the designers to anticipate reinforcement and restoration interventions.

1.2 OBJECTIVE OF WORKS

The report briefly examines the following issues which are supported by the geological works according to the program approved by the client.
1. All previous geological works performed by other local authors have been studied, which have been performed for other purposes but have cognitive values. All published and unpublished studies for the area in question have been reviewed.
2. The old geological works that have been done for the promenade "TAULANTIA" in the city of Durres have been studied. Geological and geomorphological maps of the area where the reinforcement and restoration interventions will be performed.
3. Various works have been carried out, but combined with existing works which are very important to understand the geological phenomena that have occurred in the development of the geological history of this area.
4. Of particular importance are the laboratory tests of field samples.
For the performance of this study, the previous works performed for the area in question have been used, such as:
a) Engineering geological and geotechnical study conducted by the company Geology Geodesy for the city of Durres Tirana. 1950 -1990.
b) Geological engineering and geotechnical study for the promenade "TAULANTIA" in Durres year 1999-2010.

2. GEOMORPHOLOGY

In this chapter we will discuss the description of the area where the object is located; modern and early relief forms, geological conditions of the formation of this relief. The description of the geological and geodynamic phenomena of the area will be made.

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2.1 LOCATION OF THE AREA IN THE STUDY AND DESCRIPTION OF THE RELIEF

This building is located in Durres, Administrative Unit Municipality of Durres, Neighborhood 1, Rruga Tregtare, with geographical coordinates 41 ° 18'38.38 "N and 19 ° 26'50.51" E.

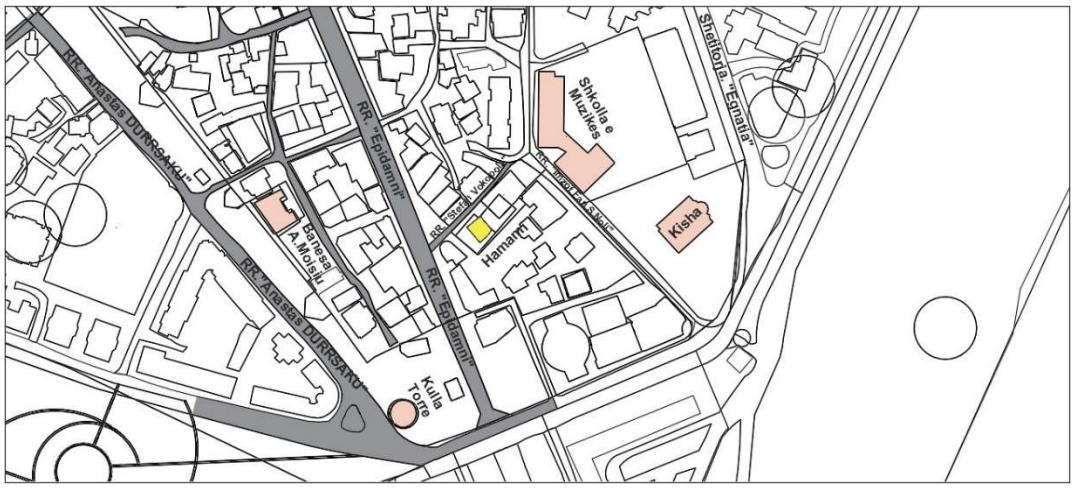

Figure 1. Map of the layout of the Hammam of Durres

The area where the building is located has a slightly sloping relief and represents the sea terrace of Durres which consists of marine and Neogene deposits. The deposits have a thickness over 5.00-10.00 m. Neogene deposits have a thickness of 100-250 m.

2.2 PHYSICAL-GEOLOGICAL AND GEODYNAMIC PROCESS

In the study of geological phenomena of this area we are based on existing studies and new information we have received from the current study. Based on these data we are describing the geological phenomena that are present in the geological formations that meet in this area.
The most obvious geological and geodynamic phenomena observed in this area are:

1. The phenomenon of weathering and alteration
2. The phenomenon of erosion
3. The phenomenon of consolidation of marine deposits

These phenomena can be explained briefly below:
1. The phenomenon of weathering is evident in the root formations consisting of clays and siltstones. These rocks are new deposits and with poor clayey cementation, those under the action of atmospheric agents are transformed from soft rocks into soils. This phenomenon is more common in the hilly part of the area.
2. The phenomenon of erosion is visible at the bottom and on both sides of the Black River valley. Surface water currents that accumulate during the period of massive rainfall erode the

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permeable part of the root formation and transport the material to the lowest points of the relief. The Black River in this segment has a steep slope and has great power to erode the slope and its two banks. From the field observations it has been concluded that the main causes that have brought the damage to the bridge is the phenomenon of erosion.

3. The phenomenon of consolidation of marine deposits: These deposits consist of layers of sand and clay with content of organic matter. The sand layers are slightly to moderately consolidated and under the action of the load these layers consolidate for a short time. Clay layers consolidate under the action of loads for a relatively long time. The presence of organic matter complicates and prolongs the consolidation time because organic matter decomposes over time, during decomposition it changes its volume and brings immediate reductions which negatively affect the stability of objects placed on these layers.

3. GEOLOGICAL AND HYDROGEOLOGICAL CONSTRUCTION

In this chapter we will address the geological composition of the area using existing works and field work. Based on the collected material, we are elaborating on the geological conditions divided into existing studies and new studies conducted by the study group.

- Existing Studies

In the area of Curilave in Durres, many regional and local studies have been conducted, these studies have been conducted for various facilities related to the stability of the slopes of this area and for the design of the foundations of new multi-storey buildings that have been built in this area.

The marine terrace of the western area of the city of Durres is part of the area of the Western Lowlands of Albania in this area Neogene deposits and Quaternary deposits are present, but in the area where the residential complex will be built the following deposits are present:

- Quaternary deposits (Q4 dt)

Marine deposits are represented by small grain gravel to silt, sand, gravel, clay, clay and peat layers. They are slightly consolidated deposits. The sea terrace of Durres represents a flat area on which marine deposits are located.

- Neoplasms of Neogyme (N3)

Neogene deposits consist of gray clay and siltstone with weak to medium cementation, the upper part of these deposits is paved. These deposits come to the surface in the hills of Rrashbull and the mountain of Durres.

- Hydrogeological conditions

From the studies carried out in the area of Currilave in Durres (from the measurements carried out in the drilling for several years in the various works that the authors have done for this area) it results that the level of groundwater in winter and summer is almost the same. The authors of

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this study have used all existing works and new works in them. It turns out that in most of the area the groundwater level is very close to the earth's surface (-2.00 m and in the upper part is -2.50m).

4. FIELD WORKS

To determine the detailed geological and geotechnical conditions of the area where the new facility will be built in cooperation with the investor, a detailed program has been drafted as follows:

4.1 PURPOSE OF FIELD WORKS

The field works are intended to determine insitu characteristics of the geological formations in the area where the construction of the new facility will take place. In the field work phase, samples with disturbed and undisturbed structures were taken to be analyzed in the laboratory. At this stage, the negative physical-geological phenomena that are present in this area have been identified.

4.2 INSPECTION OF FIELD WORKS

All field work such as geological surveys and drilling was carried out under the supervision of engineers and in most cases were inspected by the representative of the customer. The company's engineers have kept all the field records which have been compared with the laboratory data. Based on the corrected data, the field description and laboratory results were compiled into a Geological Report.

4.3 DEPTH PLANNING AND THEIR DETERMINATION

Before starting the field work, a detailed project draft was studied on the basis of which the field works were designed. To assess the geological conditions of the area where the facility is located, for this study three drillings were performed with a depth of 15.00m. This depth is determined because previous works have identified layers with poor physical and mechanical characteristics up to a depth of 15.00m.

Description of equipment used

The drilling in the area of Hamami i Durrës is performed with a drilling equipment which is as follows:

- Autosound mounted on a truck "ZIS" Albanian production mounted in the Republic of Albania
- Field SPT tests were performed in the borehole according to the program designed in collaboration with the customer. The changes are approved by the designers and the customer.

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Parameters of Standard Penetration Test S.P.T:

SPT hammer weight 63.5kg

Weight of drilling rods with 65mm diameter 8 kg / ml

Weight of drilling rods with 42mm diameter 4.0kg / ml

Hammer stroke height 76.40cm

Internal diameter of SPT sampler 34.9mm

The methodology used for the method of drilling in soils and rocks, conducting tests with SPT in the borehole, sampling with broken and unbroken structure is performed according to the methodology described in ASTM and BSI Standard.

Recovering Disturbed and Undisturbed Samples

The drilling method is realized by drilling with a core drilling with diameter φ = 100mm, the length according to the case 2.00-3.00m and the bore hole is protected with casing pipe (metal pipe with diameter φ = 150mm). After finishing a body drilling maneuver, a fencing pipe is inserted, the well is cleaned to the previously drilled depth showing care that the soil structure is not disturbed, then according to the program a test is executed or a sample with undisturbed structure is taken (shellby type). All the time the well is filled to the brim with water.

The way of removing the sample from the body (core drilling) is by pressure with a pump which forms a mixture of air and water. Drilling rods are 1.5-3.00m long and weigh 10kg/m. The length of the drilling maneuvers is performed according to the order of the consulting engineer. The study group paid attention to correctly observe the implementation of the engineer's orders, ensuring that the soil structure is kept intact in all cases when tests would be performed in the well (borehole) or when a sample would be taken with undisturbed structure.

a) Recovering samples.

In geological and geotechnical studies, it is recommended to take several types of samples which serve to identify soil qualities. Which we are expressing with in more detail below.

1. The sample recovered from Standart Penetration Tests (SPT) is regarded as disturbed. As soon as the SPT test is over, split spoon sample is opened and the sample is described, then placed in a plastic bag and wrapped in scotch tape in order to preserve natural moisture. These samples are used to measure humidity and perform identification tests.

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2. Disturbed sample that are marked with "D". The weight of the samples is taken according to the type of soil, the amount in their weight. For these samples, these sampling methods are applied as soon as the sample from drilling comes out, its description is made and it is put in a plastic bag, then it is wrapped with scotch in order to preserve the natural moisture. All samples are stored in wooden crates so as not to be damaged during transport to the laboratory. At the same time during the day, they are stored in cool places so as not to be damaged by the action of sunlight.
3. Bulk disturbed samples according to soil type they are taken in these amounts.
4. For clays, fine sands and silts, samples are recovered with the weight of 3kg
5. For medium sands, samples are recovered weighing 5kg. And these samples as we described above immediately as soon as the sample comes out of the drilling its description is made and then inserted into the plastic bag is made with scotch and then carefully stored in wooden crates.
6. Undisturbed samples are recovered in metal tubes with diameter 100 mm and 80 mm. In order to obtain these samples, metal tubes with a total length of 600mm were prepared at the beginning and the effective length of the sample tube is 550mm. Before taking the sample, the bottom of the drill hole is cleaned and filled to the brim with water. After the end of the drill hole is clean with undisturbed natural soil, the instrument for taking the sample is inserted, which after reaching the bottom it is pushed and the instrument without rotation with the length of the metal tube which is 600 mm and immediately raise the instrument to the surface to take the sample. After the sample comes out, the metal tube is cleaned and then on both sides about 20mm are filled with paraffin and at the end the whole sample is made with scotch. The sampling label (or the address of its sampling) is indicated. In all cases the depth of sampling is measured before and after its execution. These samples are carefully stored in wooden crates so as not to be damaged during the trip to the laboratory.

Groundwater Level Control

Special attention has been paid by the engineers to the measurement of the groundwater level, in the program of the geological study are not foreseen the monitoring of the groundwater level for a long time, for this reason the monitoring of the groundwater has been done for a period from 24 hours to a maximum of 96 hours. The depth of the water level meeting during drilling and the stabilized groundwater level are noted. The groundwater level level is marked on the log of each probe. For a period not shorter than 24 hours.

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5. LABORATORY ANALYSIS

5.1 PURPOSE OF TESTS

According to the program designed in collaboration with the design company, laboratory tests of samples taken in the area where the strengthening and restoration interventions of the "Hammam" will be performed. The tests were performed to determine the physical-mechanical characteristics of the soil and rock types, which were with broken and unbroken structure. These samples were obtained from drilling. The laboratory measuring equipment and instruments valid for these tests are very well preserved, in order to guarantee the correct performance of the test. Each device is checked periodically according to the procedure of the Quality Manual.

5.2 DEFINITION OF SAMPLE STRUCTURE, COLOR AND STRENGTH

A strict procedure was followed for the classification of the tested samples, where each sample was placed a relevant license plate according to which the origin of the sample, location, depth and all other necessary details are fully identified. The samples arrived at the laboratory were stored with the utmost care, at temperature and humidity so that there were no changes in their original characteristics.

Following the requirements of the contractor and the consultant, the following tests were performed in the laboratory:

- Recovering undisturbed samples from metal cylinders by means of a Hydraulic Extruder.
- Determination of Natural Water Content,
- Determination the Consistency Limits,
- Determination of Specific Weight
- Determination of Unit Weight
- Determination of granulometric analysis of BS-series sieves,
- Determination of fine granulometry, which was performed on the material passing the sieve BS - 0.063mm, according to normative BS 1377-2: 1990 9 / 9.5

6. ENGINEERING GEOLOGICAL CONDITIONS OF THE STUDY AREA

Based on the field observations, the lithological composition of the construction site, in-situ tests and the physical-mechanical characteristics of the soils and rocks that are encountered in the studied site, we have sorted out 4 (four) layers, which we are summarizing the properties in particular below:

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LAYER No.1.
It is represented by fills, soils which consist of low plasticity sandy silts and sandy clays, with beige on gray, on some locations are compacted and other parts are slightly compacted. It is located at depths: 0.00 - 2.80m.

LAYER No.2
It is represented by small to medium grain sand with gray to beige color, they are saturated with water, they rarely contain kelp in small quantities, they are slightly to moderately compacted. It is located at depths: 2.80 - 6.30m. Physico-mechanical characteristics for this layer are:

Granulometric composition

Clay fraction (<0.002 mm)	9.80%
Silt fraction (0.002-0.075 mm)	16.70%
Sand fraction (> 0.075 mm)	73.50%
Specific weight	Gs = 2.68 T/m3
Bulk (natural) unit weight	γ = 1.96T/m3
Void's ratio	e= 0.70
Compression modulus	E = 90 kg/cm2
Internal friction angle	Φ = 30o
Cohesion	c = 0.01 kg/cm2
Allowable compressive load	σ = 1.50 kg/cm2

LAYER No.3
It is represented by intensively approved clays and siltstones, low moist, with poor cementation, compacted. It is located at depths: 6.30- 10.50m. Physico-mechanical characteristics for this layer are:

Granulometric composition

Clay fraction <0.002 mm	31.60%
Silt fraction 0.002-0.075 mm	42.80%
Sand fraction> 0.075 mm	25.60%

Plasticity

Liquid limit	w_L = 42.60%
Plastic limit	w_p = 24.20%
Plasticity index	I_p = 18.40%

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Natural water content	w_n = 12.40%
Bulk (natural) unit weight	γ = 2.28 T / m^3
Internal friction angle	ϕ = 28°
Cohesion	c = 0.50 kg/cm^2
Unconfined compressive strength	UCS = 10-25 kg/cm^2
Allowable compressive stress	σ = 3.0-3.50 kg/cm^2

LAYER No.4

It is represented by clays and siltstones, gray to blue in color, are of medium cementation and with few cracks, are strong, compacted. It is located under other layers up to a depth of 30.00m controlled by the study group. From other authors the thickness of this layer is noted as 100-200m deep.

Physico-mechanical characteristics for this layer to be considered:

Bulk (natural) Unit weight	γ = 2.3 T/m^3
Internal friction angle	Φ = 28°
Cohesion	c = 1.2 kg/cm^2
Uniaxial compressive strength	UCS = 30-35 kg/cm^2
Allowable bearing stress	σ = 4.0-4.50 kg/cm^2

7. CONCLUSIONS AND RECOMMENDATIONS

1. Quaternary deposits (Q4 dt) which are represented by low plasticity clays, silts and sands as well as Neogene deposits consisting of clays, sandstones, conglomerates are represented in the study area.
2. The groundwater level should be taken as 2.50 m from the soil surface.
3. Negative physical-geological phenomena in the area of the object to endanger the stability of the object have not been ascertained.