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PRELIMINARY GEO-TECHNICAL ASSESSMENT
with subsoil study documentation for the purpose of preparation of competition documentation for development of an architectural concept for the the European Film Center CAMERIMAGE IN TORUŃ

PRINCIPAL: *Europejskie Centrum Filmowe CAMERIMAGE Rynek Nowomiejski 28 87-100 Toruń*

ORDER DATE: *20 January 2021*

SUBJECT OF THE STUDY: *Soil survey for the designed construction area*

CONTENTS OF THE STUDY: *Preliminary determination of geo-technical conditions for the design and construction of building foundations*

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Bydgoszcz, January 2021

CONTENTSSPIS

1. INTRODUCTION

1.1. Basis for the study

- The basis for the study is: Contract no. ECFC.INW.2.2021 with the European Film Center Camerimage in Toruń dated 20 January 2021,
- Regulation of the Minister of Transport, Construction and Maritime Economy of 25 April 2012 on determining geotechnical conditions for the foundation of buildings and non-building structures. (Journal of Laws of 27 April 2012, item 463).

1.2. Scope of the study

The subject of the study is a PRELIMINARY GEO-TECHNICAL ASSESSMENT, including soil survey documentation for the purposes of preparing competition documentation for architectural concept for the European Film Center CAMERIMAGE in Toruń.

The scope of the soil survey is specified in the request for proposal dated 15.01.2021 and answers given by the Principal. The survey shall be treated as preliminary.

This documentation includes a double classification of soil in accordance with PN-EN ISO 14688-1/2 in line with the Eurocode-7 [1,2] and an older code based on Polish standards, including PN-86/B-02480. In the transitional period, this double nomenclature aims to increase the legibility of the study for all participants of the investment process.
The necessity to apply standards based on Eurocode-7 stems from the Regulation [9].

1.3. Materials used in the study

1. PN-EN 1997-1:2008; Eurocode 7 - Geotechnical design – Part 1: General principles.
2. PN-EN 1997-2:2009; Eurocode 7 - Geotechnical design – Part 2: Recognition and testing the foundation soil.
3. PN EN ISO 14688-1-12. Geotechnical surveys. Land designations and classification.
4. PKN-CEN ISO/TS 17892-1 Geotechnical surveys. Laboratory tests of soil.
5. PN-86/B-02480 Building land. Classification, names, symbols and designations.
6. Geografia Regionalna Polski –J. Kondracki, PWN Warsaw 2000.
7. General Geological-Engineering Map of Poland, scale 1:300000.

8. Topographic Map of Poland, scale 1:10000.
9. Regulation of the Minister of Transport, Construction and Maritime Economy of 25 April 2012 on determining geotechnical conditions for the foundation of buildings and non-building structures. (Journal of Laws of 27 April 2012, item 463).
10. A site-elevation map with a spatial concept provided by the Principal.

2. GENERAL DATA

2.1. Location and description of the site

The survey site is situated in a quarter delimited by Al. Św. Jana Pawła II, Czerwona Droga, Aleja Solidarności, Wał Generała Władysława Sikorskiego in Toruń. It is the central part of the city, primarily residential and recreational and usable in character. The planned Investment is situated in the Jordanki Park, which has been gradually converted into a usable area.

The survey site is currently undeveloped, but fenced. The surface of the area is only locally paved with concrete, with numerous mounds of soil. In the old days, a fragment of Prussian fortifications was standing on the site, which was demolished in the interwar period. During World War II, it was the site of a transit camp. In the 1960s, a swimming pool, a stadium and sports pavilions were built on the site. After the 1990s, the area slowly fell into decay, and in 2011, the last sports structures were liquidated. Since then, the area was classified as idle land, and was periodically used for the contractors of the CKK Jordanki building construction for their facilities and as a parking lot.

The surface of the lot is relatively flat, slightly inclined to the South. Local deleveling in the outermost parts of the analyzed lot do not exceed 1.0m. The ordinates of the site in the area of study pits are shaped at 52.89-53.42m above sea level.

In the vicinity of the designed building, the surveyors claimed the presence of extensive underground utilities, including a water supply network, wastewater and rainwater manifolds, electrical networks and communication systems, as well as heating pipelines. However, a site with such rich history is likely to include also non-inventoried underground utilities.

Their detailed locations are presented on the 1:500 site-elevation map supplied by the Principal, appendix 1.

2.2. Characteristics of the facility

The construction of the European Film Center CAMERIMAGE is planned in a quarter delimited by Al. Św. Jana Pawła II, Czerwona Droga, Aleja Solidarności, Wał Generała Władysława Sikorskiego in Toruń.

The official venue of the European Film Center Camerimage is to be a multifunctional facility, capable of housing a large, international festival, as well as single events. Educational and artistic events will be organized in the building. It will also be the venue of congresses and symposiums, world premieres and film reviews, special visual performances using state of the art projection technologies, as well as

variety shows, musicals and theatrical performances, or exhibitions. The building will function all year long and will be available for the residents of Toruń and for guests.

The planned building will have the area of 38,000 m^2, including 18,000 m^2 in usable space.

Due to the preliminary planning phase, no other information concerning the structure of the designed building was provided.

3. SOIL SURVEY

3.1. Scope and method of testing

The program of technical surveys of the soil (quantity, location and depth) has been agreed on with the Principal.

3.1.1. Field work

Field work was performed on January 21, 2021. The works performed included drilling test holes, dynamic probing, sampling for laboratory tests, macroscopic testing of soil, determination of lithology and genesis of substrate soil, and geodetic leveling of test points.
The location of survey pits is presented in appendix 1.

a/ drilling
A total of 9 holes of 110 mm in diameter were executed on the survey site using a rotary, mechanical system (the H16S hydraulic drill) up to a maximum depth of 10.5 m underground. The holes were distributed as necessary for documentation, and as marked in appendix 1 - the site-elevation map. A total of 94.5m of holes were executed in land of the 2nd and 4th category.

b/ pit sampling and macroscopic tests
A total of 12 samples of unconsolidated soil and 4 samples of consolidated soil were collected during the field work. The samples were handed over for detailed testing in the geotechnical laboratory. Sampling category B, class 3 and 4

c/ dynamic probing
Probing was carried out using an automatic dynamic probe, medium (DPM) before the drilling in the place of geotechnical hole o5. A total of 10.0 linear meters of the soil were probed with the DPM probe.

d/ geodetic works
Geodetic works were carried out in connection with the current situation on the site. The elevation coordinates were determined in connection with the adopted working benchmarks and the site-elevation map.

3.1.2. Laboratory tests

The samples collected in the field were macroscopically examined. Selected soil samples were tested in detail in the geotechnical laboratory.

The following designations were established:

- grain size - 7 designations, together with the designation of the filtration coefficient according to USBSC and Hazen,
- natural humidity - 7 unconsolidated soil designations and 2 consolidated soil designations,

- yield point - 2 designations,
- pour point – 1 designation,
- soil type.

Testing was performed according to standard (4).

3.1.3.Studial work

The studial work performed included:

- analysis of test pits, including macroscopic testing and observations of ground water occurrence,
- analysis and summary of laboratory results,
- determination of measurable values of geotechnical parameters on the basis of studies, calculations, standards and references,
- determination of geotechnical conclusions.

3.2. Geographic environment. Geomorphology.

The documented area is situated within the administrative limits of the city of Toruń, in the Kujawsko-Pomorskie Voivodeship. According to the physical and geographic map of Poland, the area is situated in the Toruń Basin (315.35), which is a part of the Toruń-Eberswald Proglacial Stream Valley (315.3).

The analyzed Investment area is situated on a fluvial terrrace of the Vistula stream valley.

In hydrographic terms, the analyzed area is situated within the reception basin of the Vistula River.

3.3. Geological structure

Te geological structure of the substrate was recognized through tests performed at the maximum depth of 10.5m below ground level.
The study pointed to the presence of Quaternary and Neogene (Tertiary) formations in the substrate.
The Quaternary formations are dated to the Holocene and Pleistocene.

Quaternary Q

Holocene Q_h
Represented by uncontrolled embankments, found up to the total depth of 3.8-5.7 m b.g.l. An uncontrolled embankment is composed of medium sand with the addition of organic soil and, locally, of sand with clay with the addition of organic soil. In the area of embankment soil, debris (both concrete and brick), rock and gravel are commonly found. In an area with such rich and abundant history, a higher thickness of uncontrolled embankments can be expected. Below the uncontrolled embankments, in the planned Investment area, the presence of fluvial formations dated to the Pleistocene was reported.

Pleistocene Q_p
Represented by fluvial, unconsolidated soil - medium sand, coarse sand, and, locally, medium sand with the addition of gravel. In deeper parts of the substrate, sand and gravel deposits (sandy-gravel) was noted. These sediments are a form of erosive cobblestone above the roof of virtually impermeable clay sediments. Fluvial sediments are the main genetic complex in the analyzed area.
The primary layer of sandy-gravel sediments is spread on clay sediments dated to the Neogene.

NEOGENE (Tertiary)
Represented by consolidated formations - clays from the Poznań formation, traditionally qualified to Myopliocene (according to the current stratigraphy, these are classified as middle and early Miocene *baden-sarmat* sediments). These are notably expansive grounds, capable of changing their volume under the influence of humidity changes. They are classified as practically impermeable soil. The Neogene clay complex in the test site is composed of clay which may be accompanied by dusty clay and clay with dust, as well as dust.

In places of their presence, loamy sediments attributed to Neogene were not drilled through to the end of the penetration depth, i.e. 10.5m b.g.l.

3.4. Water conditions

During field work, direct observations of ground water were conducted.

A single, unconstrained ground water level was identified, stabilizing at 6.27-6.82m b.g.l., i.e. at ordinates 46.20-46.85m a.s.l. The aquifer is well developed and consists of very permeable middle sand, coarse sand and sand with gravel (sandy-gravel mix) with filtration coefficients of k_{USBSC}=1.1-7.9*10^{-4} m/s.

The current (January 2021) ground water level can be assessed as low in the annual hydrological cycle. The projected groundwater table fluctuations may be ±1,0m and strictly depend on the precipitation and the water level in the Vistula River.

Detailed soil and water conditions are presented in geotechnical sections - appendix 4 and in test hole specifications - appendix 5.

4. GEOTECHNICAL CHARACTERISTICS OF THE SOIL

The soil found in the analyzed area was classified as native mineral soil, both non-consolidated and consolidated. The classification did not include the uncontrolled embankments, which are classified as diverse and low-bearing substrate. The soil units found in the substrate was presented in geotechnical units. Three distinct geotechnical series were identified in terms of their genesis, stratigraphy and lithology, i.e. **series I - medium sand, coarse fluvial sand; series II - fluvial sandy-gravel; series III - Poznań formation clay.**

The geotechnical parameters of the soil were determined on the basis of results of field and laboratory tests. Double classification was applied in soil designations, i.e. effective classification under PN-EN ISO 14688-1/2 and old classification, according to PN-86/B-02480. Material coefficients for geotechnical parameters according to Eurocode-7.

The generalized value of geotechnical parameters for isolated layers is specified in appendix 3.

Geotechnical units

Geotechnical series I.

Formed by medium sand, coarse sand, and, locally, medium sand with the addition of gravel. The primary genetic complex in the analyzed area. This soil is permeable and very permeable, with a filtration coefficient of k_{USBSC}=1.1-7.9*10^{-4}m/s. The soil is even-grained and very difficult to compact. Due to its diversity, this series was divided into two geotechnical layers.

Layer Ia - formed by middle and coarse sand, medium -dense, with a density index of I_D = 45% (I_D = 0.45). They are characterized by average geotechnical properties.

Layer Ib – includes medium, coarse sand and medium sand with the addition of gravel in the compacted state, with a density index of I_D = 66% (I_D = 0.66). They are relatively high-bearing and not easily deformable.

Geotechnical series II.

The series is formed by sand with gravel (sandy -gravel mix) in a very compacted state, with an adopted density index of I_D= 88% (I_D= 0.88). This soil is found in deeper parts of the substrate. It often forms a layer of cobblestone above the roof of virtually impermeable clay sediments. It is high-bearing and not easily deformable.

Geotechnical series III.

It is a limnic-marine layer, composed on Neogene (Myopliocene) clay of the Poznań formation characterized by low plasticity, with a characteristic value of plasticity of I_L = 0.03 (I_C = 0.97). The roof of this layer is morphologically enriched. Poznań clays are expansive soil, capable of undergoing significant volumetric fluctuations as a result of humidity changes. Their roof part is protected from humidity changes and

development of swelling-contraction processes. They are characterized by reduced shear strength. Mirrored surfaces are likely to occur.

The geotechnical category was determined on the basis of Regulation of the Minister of Transport, Construction and Maritime Economy of 25 April 2012 on determining geotechnical conditions for the foundation of buildings and non-building structures. (Journal of Laws of 27 April 2012, item 463).

Based on the geotechnical surveying results obtained, and taking into account the characteristics of the structure, the 2nd geotechnical category is hereby proposed.

A detailed description of the soil forming the substrate for the analyzed building is presented in appendix 3, and the geological structure together with water and soil conditions are presented in appendix 4 - Geotechnical sections, and in appendix 5 - test hole specifications.

5. CONCLUSIONS AND RECOMMENDATIONS

Following field and laboratory tests of the analyzed substrate for the construction of the European Film Center CAMERIMAGE is planned in a quarter delimited by Al. Św. Jana Pawła II, Czerwona Droga, Aleja Solidarności, Wał Generała Władysława Sikorskiego in Toruń, it should be stated that:

- The substrate should be treated as generically heterogeneous,
- Embankments should be treated as low-bearing substrate, not recommended for the direct foundation of the designed building. In the analyzed area, they are characterized by high thickness, locally exceeding 5.0 meters,
- Below the uncontrolled embankments, there are fluvial sand and gravel sediments classified under series I and II, which is the primary genetic complex in the analyzed area,
- Non-consolidated soil - medium sand, coarse sand and sand with gravel are characterized by diverse, primarily beneficial geotechnical properties,
- Medium and coarse sand classified under series I belongs to the even-grained soil category - and is therefore difficult to compact. Attention should be paid to the possibility of de-compacting of series I even-grained sand as a result of decompression,
- The deeper part of the substrate consists of Neogene sediments - series II clay,
- Poznań formation clays are classified as expansive soil, which is protected from cyclic changes of humidity conditions and swelling-contracting processes,
- The strength and deformation parameters of the clays are diverse and depend not only on the state (as stated in PN-B/81-03020), but also on the current stresses, deformations and the presence of mirroring on their surface.
- In the designed Investment area, ground water occurs in the form of an unconstrained water table found at 6.27-6.82m b.g.l., i.e. at ordinates 46.20-46.85m a.s.l.
- Depending on the adopted foundation depth, the soil conditions may be defined as simple (foundation in a sand level, above the ground water table) or complex (foundation in embankments or in sand below the ground water table),
- Depending on the architectural solutions adopted, the building can be directly founded on:
    - Foundation footing or slabs, applying a casing in the form of a Berliner wall, for instance (1 underground story),
    - On a reinforced concrete slab with a circumferential wall, with sheet piling or slurry wall (2 or 3 underground stories),
- This study is preliminary and shall not serve as the basis for design of any buildings,
- At design stage, the Designer shall conduct a detailed geotechnical study based on a denser network of test holes and more detailed dynamic probing (DPM, DPH) and static probing (CPTU),

- Strength and deformation testing should be carried out for consolidated soil, in order to obtain their correct parametrization (TXCIU, EDO, DS.),
- Depending on the final character and size of the designed building (foundation depth, loads transferred onto the substrate, final foundation method, etc.), it will be possible to classify the soil into the 2nd or 3rd geotechnical category. Therefore, the development of Geological and Engineering Documentation is necessary.

Bydgoszcz, January 2021

LIST OF APPENDICIES

Appendix 1 - Site map with the layout of test pits

Appendix 2 - Explanation of symbols and signs used in sections and specifications

Appendix 3 - Legend to the sections and hole specifications

Appendix 4 - Geotechnical sections

Appendix 5 - Test hole specifications

Appendix 6 - DPM dynamic probing specification

Appendix 7 - Grading analyses

Appendix 8 - A list of laboratory tests of unconsolidated and consolidated soil