

Term of Reference
GEOLOGY SURVEY
(2750/2751-VIE: PMU-USTH-CS-006)

I. Project Background

1. The University of Science and Technology of Ha Noi Development (New Model University) Project (the Project) is being implemented by the Ministry of Education and Training (MOET) with funds from the Asian Development Bank (ADB) and counterpart fund from the Government of Viet Nam. The objective of the Project is to establish the University of Science and Technology of Hanoi (USTH) to become a leading training and research centre at regional and international standards. The total Project budget is 210 million USD and planned to be implemented from 2012 to 2017.

2. The Project consists of four major outputs:

- **Output A: An Effective Management and Governance System for the University of Science and Technology of Hanoi Developed and Implemented.** This Output aims at setting up effective management and governance systems for the USTH, with capacity building programs for the university leaders and managers that help enhance their understanding on the leadership and management roles which are required for an autonomous and international standard university.
- **Output B: Systems to Promote High Quality and Relevance in Academic Programs at the University of Science and Technology of Ha Noi Developed and Implemented.** This Output aims at establishing a Centre of Excellence for Teaching and Learning, a Quality Assurance Centre, an Academic Management System, a Research Support Centre, an Industry Engagement Centre, and a Centre for Laboratory Management and laboratory equipment.
- **Output C: Physical Facilities at University of Science and Technology of Ha Noi Constructed and Outfitted.** This Output aims at constructing the USTH campus in a site of 65 ha with modern facilities at international universities standards. Due consideration is also taken to assure that the construction complies with construction standards and norms of Vietnam.
- **Output D: Effective Project Management and Implementation.** Ministry of Education and Training sets up a project management unit for the Project at ministerial level (PMU-USTH) and a project management unit for the Project at university level (UIU) with corresponding tasks and responsibilities for implementing the Project. UIU is responsible for implementing Outputs (A) and (B) and relevant activities in Output (D). The PMU-USTH is responsible for implementing Output (C) and relevant activities in Output (D).

3. Contract on Geology Survey of the University of Science and Technology of Ha Noi Development is a category in Component C to ensure providing geotechnical information on the project's area for candidates of the Architectural Design Competition and setting up

detailed Planning of the Project. The Consultant on Primilinary Subsoil Investigation shall be selected pursuant to Consultant's Qualification Selection (CQS).

II. Objectives of the Assignment

1. Geology Survey aims at providing overall information on geological structure, geodynamics, geotechnical conditions, hydrogeology, preliminary investigation the soil properties of the proposed area (65 hectare), which is expected to be support the Architectural Design Competition and preparation the Detailed Planning.

III. Scope of the Assignment

1. Data collection

- Geological map, geotechnical conditions of area;
- Documents of subsoil on the neighboring area.

2. Geophysics Investigation

Geophysics investigation will support to:

- Define the conditions, inclination and stratification of soil layers by horizontal and vertical direction;
- Define the location of karst zones, study its related processing.

The investigation shall be conducted on the whole proposed area (65 hectare). The geophysics explorations shall be in depth of 50m to 70m to ensure reaching weathered rock layers. The points shall be located in 02 perpendicular directions in study area, as well as incorporate with bored holes to evaluate conditions of geotechnical conditions, geodynamics as well as preliminary investigation the soil properties in the area. Interval among the points would be 50m. It is expected that 34 geophysics investigation points shall be conducted.

3. Exploratory Drilling

Geotechnical exploration must ensure to provide overall geological information on study area. Bored holes must reach depth of weathered rock layers, from slightly weathered to the fresh rock layer to reflect the stratification in the study area.

The boring survey shall be conducted in the study area with 03 bored holes (marked from HK1 to HK3) with expected depth of 30m.

The boring works would be completed once satisfying one of following conditions:

- 3m drilling into mass rock (not limestone) with Rock Quality Designation RQD >50%
- Drilling into rock mass with RQD >50% is 5m, if encountering karst the drilling must be conducted via cave's bottom of 5m with RQD > 50%.

In case the drilling reaches expected depth but not matches the above conditions, Consultant must report to Client to engage the proper adjustment.

Standard Penetration Test (SPT) shall be carried out in all bored holes with a 2-metre interval until finishing the holes.

Samples shall be tested according to Vietnam Standards and ASTM.

4. **Define Groundwater Level**

Protect bored holes after drilling. Define groundwater height when its level is stable.

5. **Requirements of Sample Selection**

Undisturbed sample

- To be tested in laboratory, undisturbed samples shall be collected with an interval of 2 meters for 1 sample. The sample would be collected by sample tube with sample's diameter ≥ 90 mm and length ≥ 20 cm.
- Undisturbed samples shall be carefully preserved and fully covered to maintain natural moisture and state of soils before taking into laboratory. All samples shall be protected in cool places and transferred to laboratory as soon as possible.
- After being collected, the samples must be stored in a tin box (or PVC plastic tube) and fully wrapped in paraffin (or tape).
- Samples must be labeled and marked on its upper part. Contents of the label as followed: Name of project, Name of Contract, sample depth, preliminary features of soil, time of sample collection...

Physical Properties of undisturbed soil sample:

No.	Properties	Symbol	Unit
1	Particle size distribution		%
2	Natural moisture content	W_{tn}	%
3	Bulk density	γ_w	g/cm^3
4	Dry density	γ_c	g/cm^3
5	Specific Gravity	Δ	g/cm^3
6	Void ratio	ϵ_o	-
7	Porosity	N	-
8	Degree of saturation	G	%
9	Liquid limit	W_{ch}	%
10	Plastic limit	W_d	%
11	Plasticity index	I_p	%
12	Consistency	B	-
13	Cohesion	C	kG/cm^2
14	Internal friction angle	ϕ	degree
15	Coefficient of compressibility	a_{1-2}	cm^2/kG
16	Conventional bearing capacity	R_o	kG/cm^2
17	Elastic module	E_o	kG/cm^2

Disturbed samples

- Disturbed samples can be collected similar to undisturbed ones or SPT (but must ensure sufficient samples for all kinds of soil)

- Disturbed samples shall be covered with plastic packages (labeled as undisturbed samples). Soil samples must be carefully wrapped in plastic packages to maintain its moisture and state of soil.
- Density (combine with undisturbed samples): 2 meters interval for one disturbed sample.
- Disturbed samples should be collected from granular soil layers and undisturbed samples should be collected from silt and clay stratum.
- Laboratory tests shall be conducted by inspected machines and the laboratory must be licensed by Ministry of Construction to provide following properties:

Physical Properties of Disturbed samples:

No.	Mechanical and physical norms	Symbol	Unit
1	Particle size distribution	P	%
2	Natural moisture	W_{in}	%
3	Specific Gravity	Δ	g/cm^3
4	Liquid limit	W_{ch}	%
5	Plastic limit	W_d	%
6	Plasticity index	I_p	%
7	Consistency	B	-
8	Max void ratio	ϵ_{max}	-
9	Min void ratio	ϵ_{min}	-
10	Dry angle of repose	α_k	degree
11	Saturated angle of repose	α_{ur}	degree
12	Compacted Dry Density	Gk	g/cm^3
13	Uncompacted Dry Density	Gr	g/cm^3

Physical Properties of rock sample:

No.	Mechanical and physical norms	Symbol	Unit
1	Saturated moisture (%)	W	%
2	Saturated density (g/cm^3)	γ	g/cm^3
3	Dry density (g/cm^3)	γ_c	g/cm^3
4	Specific Gravity (g/cm^3)	Δ	g/cm^3
5	Interstice ratio	e	%
6	Interstice degree (%)	N	%
7	Saturation (%)	G	%
8	Dry compressed resistance Streng (kG/cm^2)	R	kG/cm^2
9	Saturation compressed Resistance Streng (kG/cm^2)	R_{bh}	kG/cm^2
10	Softening coefficient		-

Expected Quantities

It is expected that 34 geophysics points shall be conducted.

Bored hole shall be carried out in the zone, with 30m of each hole and total are 90m boring.

No.	Items	Unit	Quantity
1	Geophysics investigation	points	34
2	Rotary drilling and washing by sample tube Depth of bored holes from 0m to 30m	m	90
3	Testing		
	Undisturbed samples testing	sample	28
	Disturbed samples testing	sample	11
	Samples of stone	sample	06
4	Standard Penetration Test SPT		45

IV. Outputs and Data to be Submitted

Consultant for the Survey shall make reports on geo-physic and geology survey (in Vietnamese and English) according to standards, codes and norms and current documents to evaluate the geo-technic conditions , hydrogeology, forecasting the dynamic phenomena that can be disadvantaged for the building, preliminary assess properties of rock and soil stratum in the study area.

A report on geophysics investigation should include following:

- Main text;
- Geophysics investigation plan;
- Geophysics section;
- Results of geophysical investigation.

A report on geotechnical investigation should include following:

- Main text;
- Bored hole plan;
- Bored hole logs;
- Engineering geology cut-side;
- Summary testing results of soil samples (with samples by the soil layers).

V. The Standards

The investigation shall be performed according to related standards of Vietnam or internationally recognized ones, including:

- TCXD 4419: 1987: Construction Survey – Basic principle
- 22 TCN 259 - 2000: Process of exploratory drilling of engineering geology
- TCXD 161-1987: Electricity exploration in construction survey
- TCXD 160 - 1987: Geo-technics survey to design and execute pile foundation
- TCXD 194: 2006: Geo-technics survey for high buildings
- TCXD 45-78: Standards of designing foundation and industrial, civil engineering
- TCVN 309 - 2004: Geodesic in construction

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- TCXD 226 -1999: Method of field experiments - Standard test method penetration test and split - barrel sampling of soil

Experiments in laboratory shall be conducted with following standards:

- TCVN 2683: 1991 Soil for construction. Collection, packing, transport and preservation of soil samples.
- TCVN 4195: 1995 Soil for construction. Method of specific gravity test in laboratory.
- TCVN 4196: 1995 Method of determining the water content and moisture absorption test in laboratory.
- TCVN 4197: 1995 Soil for construction. Method of determination moisture and moisture-retaining test in laboratory.
- TCVN 4198: 1995 Soil for construction. Method of identification grain contents in laboratory.
- - TCVN 4199: 1995 Method of determining shear strength by direct shear test
- TCVN 4200:1995 Method of determining the compressibility in the laboratory.
- TCVN 4202: 1995 Method of determining density in the laboratory.

VI. Submission Time

The contractor shall submit all data in soft and hard copies in 04 weeks since date of issuing Notice to Proceed.

VII. Requirements of Qualifications of Company and Experts

The Survey Company and Team Leader of Geotechnical Investigation must follow requirements on qualifications regulated in article 45, 46 Decree 12/2009/ND-CP. Following these requirements, the company must satisfy requirements on Grade 1 qualifications for Construction Survey Organization, as “*Having at least 20 engineers are adequate to the Survey Task requirements, which include people have qualification of Leader of Investigation Grade 1; having proper equipments adequate to the types of survey and standardized laboratory; have implemented survey task of at least 1 project at Special Grade or Grade I, or 2 projects Grade II*”.

The Leader of Geotechnical Investigation must satisfy requirements on Grade 1 qualifications for Leader of Investigation, as following” *Having professional certificate, have been Investigation Team Leader of at least 1 project at Grade I, or 5 projects Grade II*”.

Other specific requirements as followed:

- Survey Company must be an organization with legal entity; license on business granted in accordance with law and regulations; with at least 10 years of experience in construction survey and completed at least 05 contracts with similar scale and nature in 5 recent years.
- The Company must have standardized laboratory recognized by Ministry of Construction. Equipments for survey includes: equipments for geophysics survey, drilling machine (rotary drilling) and SPT

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- The Leader of Geotechnical Investigation must graduate from majority of geotechnical engineering or related ones, with at least 10 years of experience in geotechnical survey, granted with professional certificate as regulated, director of at least 03 contracts with similar scale. At least 03 Survey engineers, in which 01 geophysics engineer and 02 engineers of engineering geology. Engineers must graduate from geotechnical engineering or related majority, with at least 5 years of experience in geotechnical survey.

VIII. Requirements of Safety at Work and Environmental Sanitation

1. Safety at site

- All people working in the site must be disseminated with regulations on safety of the controlling agency and fully follow all rules at working site.
- All workers must be disseminated with Regulation on safety of survey.
- Only staffs are allowed to enter the working site to avoid damages for individuals and loss of assets.
- On the working site there must be sufficient items serving workers' daily living and personal hygiene such as: dining room, shelter, water closet etc.
- Carefully check equipments and machines before use as regulated in Safety Regulation.
- Drilling: use of drilling must strictly follow current safety regulation for geotechnical drilling.

2. Environmental protection

- Propaganda to every staff and worker on environmental safety and security before conducting survey.
- Continuously and strictly supervise and check safety at work and environmental safety, timely address problems (if any).
- Regularly conduct industrial cleaning. Redundant materials must be placed in regulated area.
- Drilling shall be the main activity of survey; therefore it is necessary to refill the bored holes right after finishing and accepting the work, cleaning the site, not leaving any solid material, plastic and lubricant to avoid destroying soil layers and affecting ecosystem of the zone as well as neighboring areas.
- Fire prevention must be considered a regular task during execution process.
- Requirement of drainage: during execution process, water to wash drilling holes and attracted solution must be supervised to prevent water from overflowing drilling surface, ensuring natural drainage and not causing stagnant and flooding.

IX. Client's Inputs

- Client shall provide free of charge topographic map of scale of 1/2000, location of benchmarks accompanied with coordinates

Client shall contact with the Hoa Lac High Technology Zone Management Authority to inform the local and concerned authorities to facilitate Survey Company in the survey site.