Date: 08/08/2024

To,
Ahmed Akhteruzzaman
Senior Planner & Project Director
Preparation Development Plan for Meherpur Zilla
Room # 507, 4th Floor,
Urban Development Directorate (UDD)
82, Segunbagicha, Dkaka-1000.

Subject: Submission of **Inception Report** for the project of **Engineering Geological and Geophysical Surveys under Preparation of Development Plan for Meherpur Zilla Project.**

Ref No.: 25.45.0000.002.14.038.23.56; Date: 28/02/2024

Dear Sir,

We are herewith submitting 3 copies of **Inception Report** for the project of **"Engineering Geological and Geophysical Surveys under Preparation of Development Plan for Meherpur Zilla Project."** which is going to be conducted in Three (03) Upazilas under Meherpur District.

I hope your honor would be gracious enough to accept the report and oblige thereby.

Thanking you.

Sincerely Yours

Center for Geoservices and Research ★ CGR

Md. Fuad Hasan
Manging Director,
Center for Geoservices and Research.

URBAN DEVELOPMENT DIRECTORATE (UDD)

Ministry of Housing and Public Works

Government of the People's Republic of Bangladesh

Inception Report

On

ENGINEERING GEOLOGICAL AND GEOPHYSICAL SURVEYS UNDER PREPARATION OF DEVELOPMENT PLAN FOR MEHERPUR ZILLA

August 2024

Submitted by

CENTER FOR GEOSERVICES & RESEARCH

IN JOINTVENTURE WITH

CREATIVE SOIL INVESTIGATION

Address: Flat# D1, House # 64/1,
Lake Circus, Kalabagan, Dhaka-1205.

EXECUTIVE SUMMARY

Bangladesh has a long history of natural disasters. The geographical location, land characteristics, multiplicity of rivers and the monsoon climate render Bangladesh highly vulnerable to natural hazards. Land use planning is an impotent component for modern urban development. Prior to land use planning it is essential to access surface and subsurface geological conditions and the relevant geological hazard and risk in and around the site of future urban development. Therefore, rigorous geological and geotechnical site characterization, including a potential risk analysis need to carry out for a risk resilient urban development. From this point of view, Urban Development Directorate (UDD) has initiated to conduct a geological study and seismic hazard assessment for the Meherpur Zilla, which includes three upazilas and announced a project entitled **"Preparation of Development Plan for Meherpur Zila"** to accomplish this goal. "Engineering Geological and Geo-Physical Surveys" is a significant component of this project. Subsurface geology and geotechnical information is considered as essential tools for over time and sustainable urbanization in this geological Study and Seismic Risk Assessment.

To know the subsurface soil condition of the study area, several geophysical and geotechnical surveys will be carried out up to 30 meters depth. To accomplish "Engineering Geological and Geo-Physical Surveys" following investigations should be execute: conducting standard penetration tests (SPTs) and preparation of borehole logs; collection of undisturbed and disturbed soil; conducting Down-hole seismic test, Multi-Channel Analysis of Surface Wave (MASW) and single Microtremor Measurment. Laboratory tests of soil samples such as Grain Size analysis, Natural moisture Content, Atterberg Limits, Direct Shear Test, Unconfined Compression strength, and Triaxial (Uncosolidated Undrain) test need to be performed, which will give more qualitative and quantitative information about the subsurface. Regarding these, 30 numbers SPT boreholes, 11 nos of MASW, 15 nos of single Microtremor and 7 nos of Downhole seismic (PS Logging) will be performed.

Field and laboratory investigations data will be analyzed and result will be integrated with all information in a module which can generate; sub-surface lithological 3D model of different layers, engineering geological map based on AVS30, soil type map, seismic intensity map, peak ground acceleration (PGA) and liquefaction potential zone map etc.

From above engineering geological and geophysical data base would give a clear idea about the geo-hazard status of particular landscape where newly urban developing activities or any

other mega infrastructure project is going on and these mentioned investigation also gives an idea about the vulnerability of existing landscape of a particular area. Based on these results, proper management techniques as well as other necessary adaptation process could be addressed before or after the development activities in the studied area. Finally, from the achieved result from the Engineering Geological and Geo-physical Surveys will be incorporated in the master plan.

Acronyms

ASTM : American Society for Testing and Materials
AVS30 : Average Shear Wave velocity of 30 meter depth
BH: Borehole
MASW : Multi-Channel Analysis of Surface Wave
N value : Standard penetration resistance/Soil resistance or compactness
PGA : Peak Ground Acceleration
PS logging : Primary and Shear wave logging (Down-hole seismic test)
SA/PSA : Spectral Acceleration/ Peak Spectral Acceleration
SPT : Standard Penetration Tests
UDD: Urban Development Directorate
GWL : Ground Water Level

Definitions

MASW: Multi-channel Analysis of Surface Waves (MASW) is non-invasive method of estimating the shear-wave velocity profile.

PS logging (Down-hole seismic test): Downhole Seismic (DS) test is performed on soil and rock sites to measure the in-place shear wave velocity profiles of the soil and rock versus depth.

SPT: The standard penetration test (SPT) is an in-situ penetration test designed to provide information on the geotechnical engineering properties of soil.

Microtremor: Microtremor is a low amplitude (in the order of micrometres) ambient vibration of the ground caused by man-made or atmospheric disturbances.

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1. INTRODUCTION

1.1. Background

Bangladesh has a long history of natural disasters. The geographical location, land characteristics, multiplicity of rivers and the monsoon climate render Bangladesh highly vulnerable to natural hazards. Geological study and seismic hazard assessment is one of the important development module of this project. In this development plan, subsurface geological and geotechnical information consider as an important tool for a modern urban development. Prior to landuse planning it is very essential to access surface and subsurface geological conditions and the relevant geological hazard and risk in and around the site of future urban development, therefore a rigorous geological and geotechnical site characterization, including a potential risk analysis need to carry out for a risk resilient urban development.

In this development plan, subsurface geological and geotechnical information has been considered to determine subsurface soil condition of the project area and evaluating of natural geological hazards such as earthquake, liquefaction and landslide which integrate the consequence into the design of the infrastructure.

In this context, the Urban Development Department (UDD) has prepared a project proposal titled " Engineering Geological and Geo-Physical Studys Under Preparation of Development Plan for Meherpur Zila".

Moreover, Urban Development Directorate (UDD) has initiated a project to prepare Geological Study and Seismic Hazard Assessment. Bangladesh has a long history of natural disasters. The geographical location, land characteristics, multiplicity of rivers and the monsoon climate render Bangladesh highly vulnerable to natural hazards. Seismically, Bangladesh is divided into four zones i.e. highly risk zone (zone VI), risk zone (zone III), moderate risk zone (zone II) and low risk zone (zone I). Meherpur Zila is situated in the zone I (BNBC, 2020). Geological Study and Seismic Hazard Assessment is one of the important study of Preparation of Development Plan. In this perspective, subsurface geological and geotechnical information consider as an important tool for a durable and sustainable urbanization. To achieve this "Engineering Geological and Geo-Physical Surveys" is one of the important module of this project.

1.2. Client: About Urban Development Directorate (UDD)

In the backdrop of rapid urbanization associated with increases in population and economic development in the early sixties. It was keenly felt that a regional and central office had to be created for physical Planning. Accordingly Urban Development Directorate (UDD) was created on the 17th July 1965, under the administrative control of works, Power and irrigation department. The functions of the Urban Development Directorate are following:

a. To advise the Government on matters of policy relating to urbanization, land use and land development.
b. To prepare and co-ordinate regional plans, master plans and detailed layout and site plans for the existing as well as the new urban centers excluding the areas covered by the present town development authorities of Dhaka, Chittagong, Khulna and Rajshahi.
c. To undertake socio-economic research and collection of date for determination of the location and pattern of future urban development.
d. To prepare programs for urban development for execution by the sectoral agencies and secure approval of those from the national Council and assist the agencies in selection of sites for implementation of those programs.
e. To act as a counterpart organization and focal point in the Government for all internationally aided physical planning and human settlement programs in the Country.
f. To organize seminars/workshops for creating better physical planning awareness and to disseminate information through regular publication of the research and planning materials on urbanization and human settlement planning and development.
g. To conduct in-service training of the officers and staff of organizations involved in spatial planning and development.
h. To advise the existing urban development authorities on their operations at their request.

1.3. Location and Accessibility

Meherpur Zilla area is 716.08 sq km, located in between 23°36' and 24°00' North latitudes and in between 88°33' and 88°55' East longitudes.

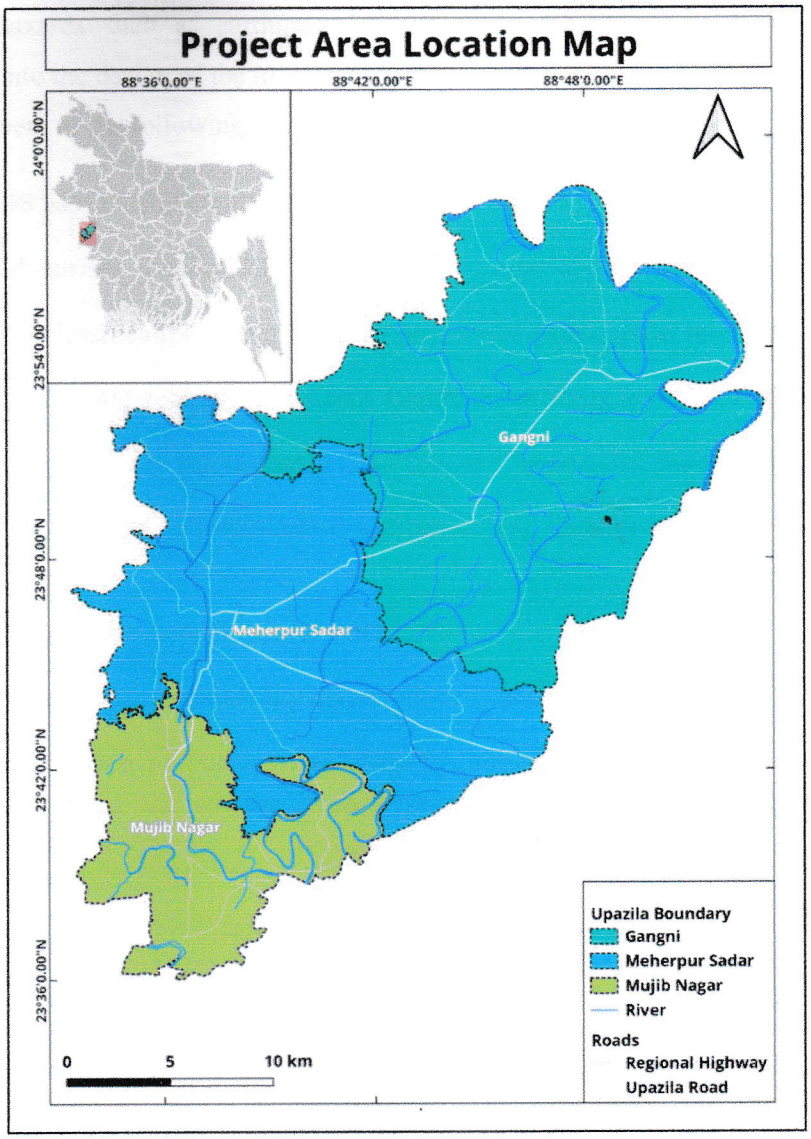

Figure 1.1 Location map of the project area

1.4. Aims And Objectives

In this development plan, subsurface geological and geotechnical information's has been considered to determine subsurface soil condition of the project area and evaluationg of natural geological hazards such as earthquake, liquefaction and landslide which integrate the onsequence into the design of the infrastructures. The main objective will be achieved through accomplishment of the following sub-objectives:

- GIS based Geological/ Geomorphological map of the project area.
- Sub-surface lithological 3D model development and relevant interpretation.
- Soil classification map using geophysical and geotechnical investigations
- Engineering geological map based on Average Shear Wave (AVS30).
- Seismic hazard assessment (PGA/PGV, and SA) map of the project area.
- Foundation layers delineation and developing engineering properties of the sub-soil.
- Landslide vulnerable zones identification.
- Liquefaction susceptibility map construction of the study area.
- Formulation of Policies and plans for mitigation of different types of hazards, minimizing the adverse impacts of climate change and recommend possible adaptation strategies for the region.