Soil Mapping of Newtown Area in West Bengal

Joyanta Maity, Kaustav Chatterjee, Mainak Mukherjee, Amar prit Singh Arora

***Abstract*— Due to urbanization over the world, all the important cities particularly in recently developed or developing countries are subjected to increase suitable public accommodation and transportation facilities. To cope with such rising demand from increasing population, high rises buildings of increasing heights have been adopted in all big cities in world. Newtown is being cover up over the he barren marshy land on the eastern boarder of city of Kolkata. Massive development is being made over a small time period and over an area where there is hardly any construction till date. Further this sub-soil condition is not at all known quantitatively. However within the recent few years large numbers of structures and facilities have already been constructed for which detail soil-explorations have been made. However in these new cities for construction of buildings with less than two-storied soil exploration is not compulsory but more than two-storied for any commercial or industrial projects soil exploration is mandatory.**

To help proper construction for builders of less than two-storied and permit data for others for planning and estimating the budgets of proposed project soil mapping of this area will be highly beneficial. With this view, the soil mapping of this Newtown has been undertaken in this project.

***Index Terms*— Sub-soil condition, Soil mapping, Urbanization, soil exploration.**

I. INTRODUCTION

Newtown is being cover up over the he barren marshy land on the eastern boarder of city of Kolkata. Massive development is being made over a small time period and over an area where there is hardly any construction till date. Further this sub-soil condition is not at all known quantitatively. However within the recent few years large numbers of structures and facilities have already been constructed for which detail soil-explorations have been made. However in these new cities for construction of buildings with less than two-storied soil exploration is not compulsory but more than two-storied for any commercial or industrial projects soil exploration is mandatory. Being a plan need township, Newtown has been divided into three divisions, Action Area-I, Action Area-II and Action Area-III. Action Area-I is designed to accommodate the residential and commercial flat, Action Area-II planned for mainly central business, IT Business Park and large complex while Action area-III caters the residential projects including educational, medical, IT complex etc. As a result there is no past detailed record of sub-soil characteristics. Presently detailed soil-explorations are being made for recent construction needs and a most cases deep foundations are being provided.

Furthermore these area without any substantial construction history falls in earthquake zone-IV. Since for the area connectivity to the different part is being provided by high speed transit system through metro, it also becomes imperative to check the safety and to provide safety of built structures and proposed transit system against possible future earthquakes.

II. OBJECTIVES OF STUDY

To help proper construction for builders of less than two-storied and permit data for others for planning and estimating the budgets of proposed project soil mapping of this area will be highly beneficial. With this view, the soil mapping of this Newtown was undertaken in this project.

For making mapping possible soil data from field exploration for different projects in the area was collected from various soil engineering firms. As described in the scope of study attempts have been made to identify the sub-soil characteristics of the Newtown area up to the normal depth 30 to 40 meters in which soil are generally affected due to civil engineering constructions. Soil data was collected from SOILEX, Roy Chand Engineers, PIONEER Group of Company and Technorama (I) Ltd.

To study the existing profiles in the area concerned, whole Newtown area is divided into square grids of 0.250km×0.250km and sectional profiles both along and cross direction through these grids have been developed to study the distribution and existence of different important strata. Engineering properties of those strata have been studied and identified. After delineating the major strata important engineering properties of each stratum summarized and the range of variations have been described. To study the fluctuations of ground water table (GWT) at different locations have been marked and shown.

III. STUDY AREA

Newtown is a neighbourhood of Kolkata, located in North-24Parganas district of the Indian state of West-Bengal, is a fast growing planned satellite city. The area mainly consisted of huge acres of cultivable lands and water bodies, which has been acquired & developed in a planned manner. Newtown being three times the sizes of Salt-lake have been allotted as the second IT Hub of Kolkata. Newtown is located at 22°36′11″ N & 22°33′ 29″ N latitude and between 88°23′43″ E & 88°26′34″ longitude and cover is located on average altitude of 11 meter from mean sea level (MSL). This township covers an area of 28 km^2 and is located in Barasat-sadar subdivision of North-24 Parganas district. The water table below the area generally exists over a shallow depth from the existing ground level and in rainy season it may reach the G.L. in many parts of the area. But due to enormous population pressure it has encroached into the back swamp and marshy land to the east by way of filling up extensive areas, especially in the Salt Lake and Newtown area. Attempts have been made to identify the subsoil characteristics of the Newtown, Rajarhat area, Kolkata up to the normal depth of 20 meter in which soil are generally affected due to average civil engineering construction loading. To do so information over a large number of soil

exploration data conducted by different agencies in the area and as well as reports from several soil engineering firms were collected. Boreholes conducted by those agencies from Borehole 1 to 99.

IV. RESULTS AND DISCUSSIONS

To develop the profiles in the area concerned, whole Newtown area is divided into square grids of 0.25 km × 0.25 km (Fig. 1) and sectional profiles both along and cross direction through these grids have been developed to study the distribution and geometry of different successive strata from ending ground level and engineering properties of these strata have been studied and identified and used.

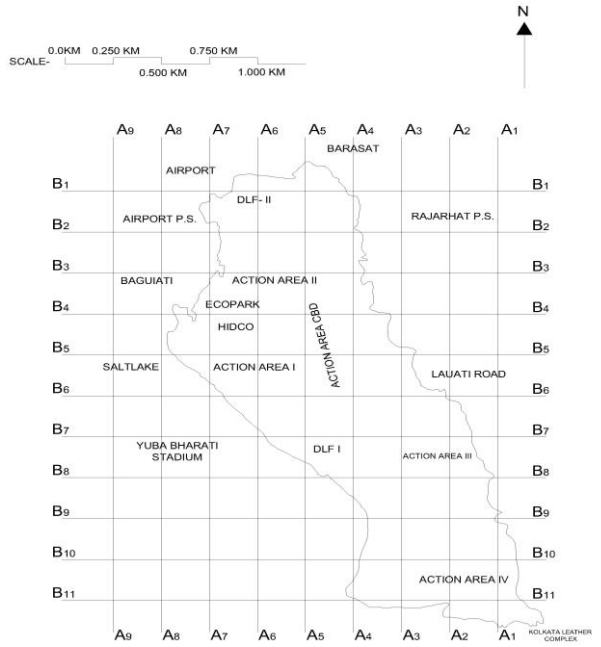

Fig. 1 Grid dimension of Newtown area

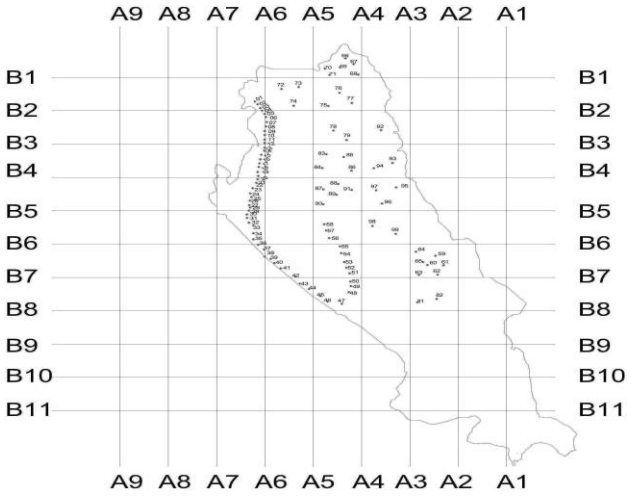

Fig. 2 Location of Bore-hole

Large number of borehole data spread over the above area had been collected from different sources. The general depth of boring were limited to 20 m for which data have been collected are shown in Fig. 2. After delineating the major strata important engineering properties of each stratum are summarized and the range of variations have been described. To study the fluctuations of ground water table at different location, ground water level at different area have been marked and shown in profile developed.

A. Longitudinal Profiles

The longitudinal profiles along N-S direction along different grids over the area shows in figure 1, is plotted from the borehole data collected from different agencies. These profiles are A_1- A_1, A_2- A_2, A_3- A_3, A_4- A_4, A_5- A_5, A_6- A_6 are described separately.

Longitudinal Profile A_1- A_1:-

The longitudinal profile A_1- A_1, Starts from Nababpur and ends at Lauhata. The sub-soil profile along longitudinal profile A_1- A_1, is alluvial clayey deposit, have been classified in four distinct layers. Layers I, II, III and IV (Fig. 3). As per IS these four layers have been classified as CI (Top and bottom), CH and MH.

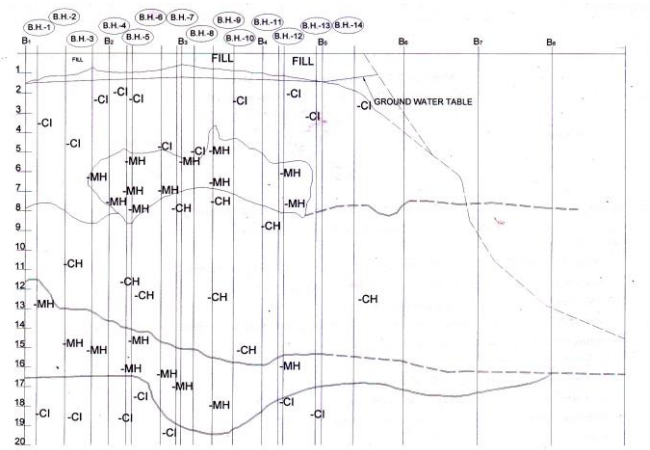

Fig. 3 Sub-soil profile of Newtown area along longitudinal direction (A_1 - A_1)

Longitudinal Profile A_2- A_2:-

The longitudinal profile A_2- A_2, Starts from Lauhata and ends at Jatragachi. The sub-soil profile along longitudinal profile A_2- A_2, is clayey deposit is heterogeneous nature with the depth of exploration the sub-soil have been classified as CI, MH, SM and CL(Fig. 4). But these layers are totally erratic in nature. Such that thickness vary suddenly from place to place.

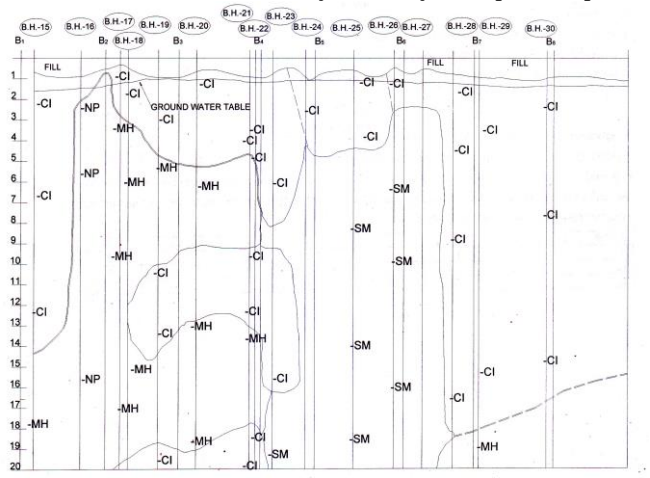

Fig. 4 Sub-soil profile of Newtown area along longitudinal direction (A_2 - A_2)

Longitudinal Profile A_3- A_3:-

The longitudinal profile A_3- A_3, Starts from Jatragachi and end of Narkelbagan. The sub-soil profile along longitudinal profile A_3- A_3, has been classified in the two layers. CI layer have been elusions in two places. Such that MH pockets have been found (Fig. 5).

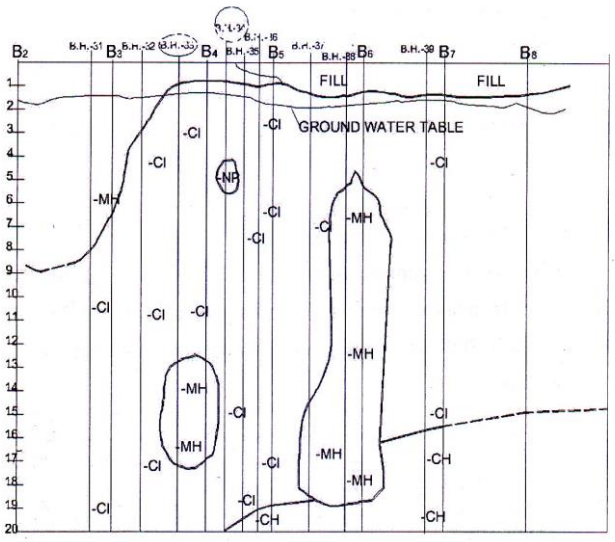

Fig. 5 Sub-soil profile of Newtown area along longitudinal direction (A_3 - A_3)

Longitudinal Profile A_4- A_4:-

The longitudinal profile A_4- A_4, Started from Narkelbagan and ends at the Novatel Hotel building. The sub-soil profile along longitudinal profile A_4- A_4 in N-S direction has been classified in the three layers. Such that CI, CH and MH. Within CI layer there is one MH pockets have been found (Fig. 6).

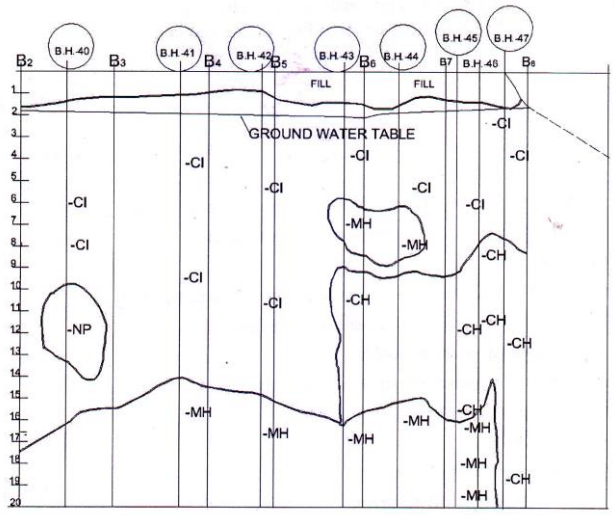

Fig. 6 Sub-soil profile of Newtown area along longitudinal direction (A_4 - A_4)

Longitudinal Profile A_5- A_5:-

The longitudinal profile A_5- A_5, Starts from Novatel Hotel building and ends on the Newtown bus stand. The sub-soil profile along longitudinal profile A_5- A_5, has been classified in the three layers. Such that CI layers exhibits at top and bottom, MH layer found at middle portion. One MH pockets have been found within CH layer (Fig. 7).

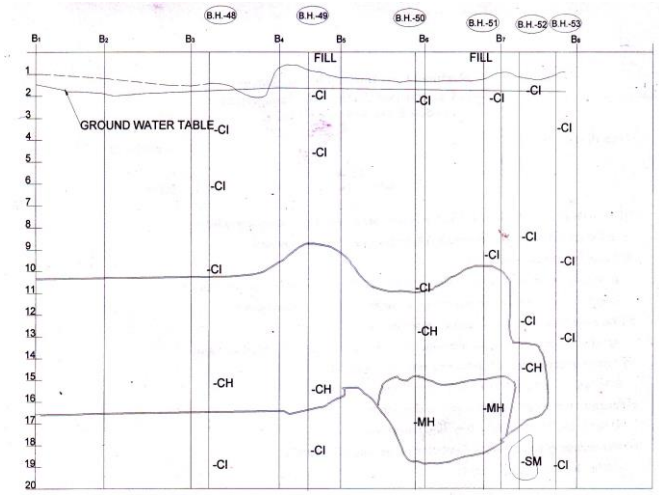

Fig. 7 Sub-soil profile of Newtown area along longitudinal direction (A_5 - A_5)

Longitudinal Profile A_6- A_6:-

The longitudinal profile A_6- A_6, Starts from Newtown bus stand and ends on the DLF-I building. The sub-soil profile along longitudinal profile A_6- A_6, have been classified in the three layers. CI layer at top, MH layer at bottom and at middle position CH layer have been found (Fig. 8).

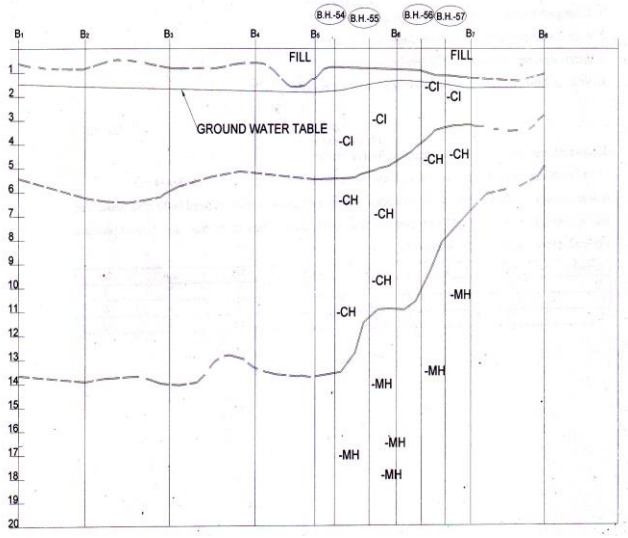

Fig. 8 Sub-soil profile of Newtown area along longitudinal direction (A_6- A_6)

B. Cross-Sectional Profiles:-

Similarly the cross-sectional profiles along E-W direction along different grids over the area are shows in the figure 1. These profile areas B_2 - B_2, B_3 - B_3, B_4 -B_4, B_5 - B_5, B_6 - B_6, B_7- B_7 are described separately below,

Cross sectional Profile B_2 - B_2 :

The cross sectional profile B_2 - B_2, Starts from DLF-II building and ends at Jatragachi. The sub-soil profile along cross-sectional profile B_2 - B_2, has been classified in two layers. The CI layer at the top erratic in nature and below CI layer in the figure 9.

Cross sectional Profile B_3 - B_3:-

The cross sectional profile B_3 - B_3 . Starts from Jatragachi and ends to the Techno India College. The sub-soil profile along longitudinal profile B_3 - B_3, has been classified into two layers. The top layer is CI and bottom layer is MH. Within CI layer two pockets have been found where the soil is silty sand classified in SM in the figure10.

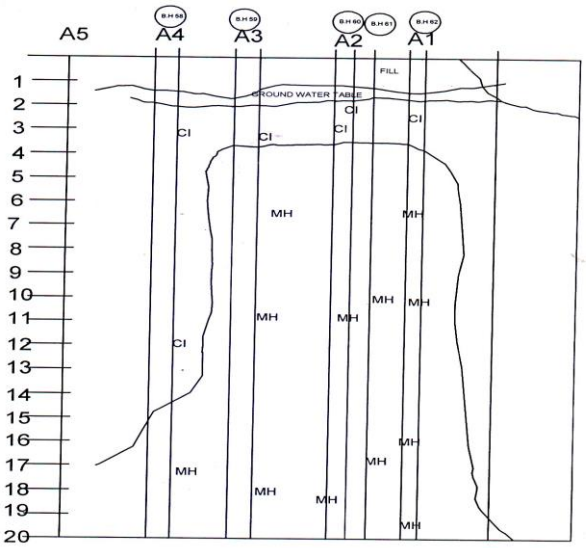

Fig. 9 Sub-soil profile of Newtown area along longitudinal direction (B_2 - B_2)

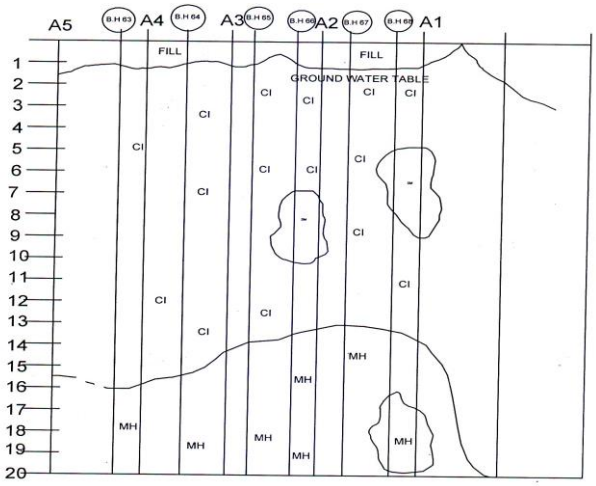

Fig. 10 Sub-soil profile of Newtown area along longitudinal direction (B_3 - B_3)

Cross sectional Profile B_4 -B_4:-

The cross sectional profile B_4 -B_4. Starts from Techno India College and ends at Sahebpur. The sub-soil profile along cross sectional profile B_4 -B_4, has been classified in the three layers. CI layer have been found at top with higher depth, CH layer also found at bottom with smaller depth. MH layer have been found at middle position with erratic in nature which is shows in figure 11.

Cross sectional Profile B_5 - B_5:-

The cross sectional profile B_5 - B_5, Starts from Sahebpur and ends at Newtown park. The sub-soil profile along cross sectional profile B_5 - B_5, has been classified in the two layers. CI layer at top and at the bottom MH layer have been found with in CI layer. One CH pockets and at bottom one sand pocket SM have been formed in the figure 12.

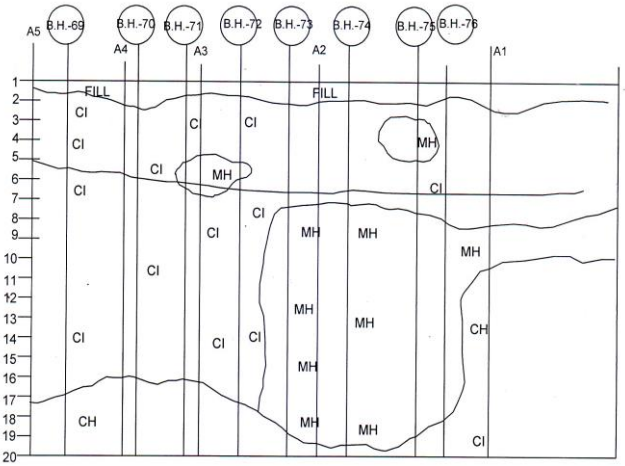

Fig. 11 Sub-soil profile of Newtown area along longitudinal direction (B_4-B_4)

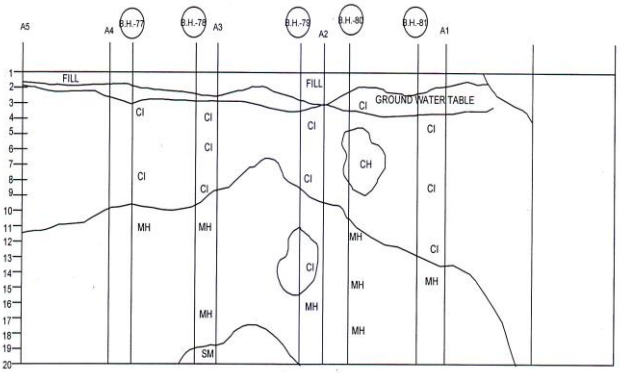

Fig. 12 Sub-soil profile of Newtown area along longitudinal direction (B_5 - B_5)

Cross sectional Profile B_6 - B_6:-

The cross sectional profile B_6 - B_6, Starts from Newtown park and end to Tata Eden Court. The sub-soil profile B_6 - B_6. of alluvial clayey deposit is heterogeneous nature and classified in three layers. The top Cl layer is totally erratic in nature. Such layer thicknesses vary from place to place and at bottom CH layer exhibits. The MH layer have been found between two CI layers which erratic as shown in nature in the figure 13.

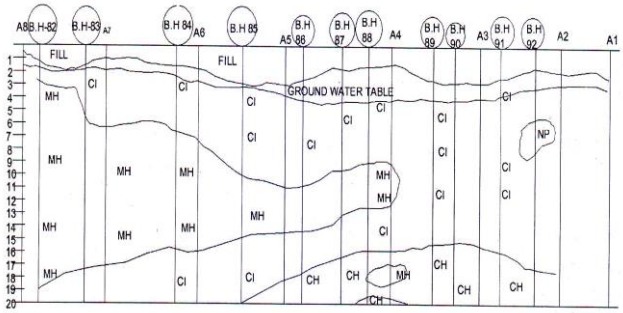

Fig. 13 Sub-soil profile of Newtown area along longitudinal direction (B_6 - B_6)

Cross sectional Profile B_7- B_7 :-

The cross sectional profile B_7- B_7. Starts from Tata Eden Court and ends to the Keppel's Elita Vista. The sub-soil profile along cross sectional profile B_7- B_7 , have been found classified in the three layers. CI layer found at top, SM layer formed at bottom, Between CI and SM layer, CH layer have been

exhibits. Two sand pockets such that SM pockets have been found within CI layers in the figure 14.

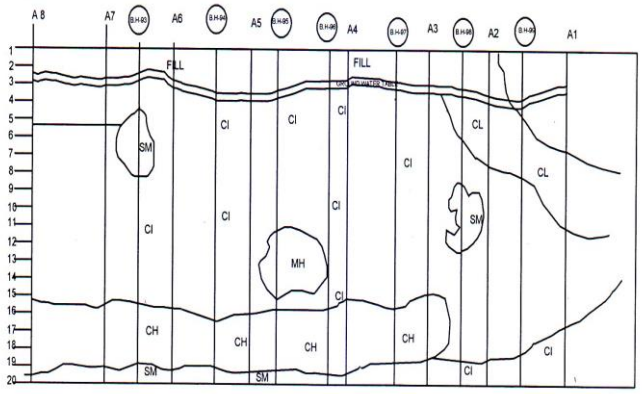

Fig. 14 Sub-soil profile of Newtown area along longitudinal direction (B_7 - B_7)

V. Conclusion

On the basis of the study made for subsoil condition below Newtown area over a depth of 20 Meter for the existing ground level, the following conclusions can be made:

1) Three major soil profiles in N-S direction through western middle and eastern part of the area have been developed. Similarity three major E-W direction soil profiles of the area have been developed for a depth of 20 Meter, through northern, middle and southern part of the area.
2) The developed soil profile indicates large variation in the soil layers particularly the thickness of the layers varies quite arbitrarily indicating typical alluvial deposition.
3) The present work will be useful for Civil engineers, Geotechnical engineers, Planners and even local inhabitant for any future developmental activities in the area concerned. Without conducting costlier and time consuming soil investigation tests, a user can identify the subsurface profile before the start of the work. In fact any specific location, with suitable queries, depth of hard strata, soil profiles, bearing capacity can be obtained, which is found to be close to the actual findings at this location.

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