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STUDY ON SOIL INVESTIGATION PRACTISES AMONG LOCAL RESIDENTIAL CONSTRUCTION WORKS

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ABSTRACT

Geotechnical /soil investigation report is essential in order to understand the particulars of the soil beneath to construct a safe building. It gives thorough understanding of the soil and how the soil react when subjected to various conditions. In India there are standards and codes to how to conduct soil investigations but no rule or law on whether it is necessary to generate a soil report. This research aims at bringing light to the current government administrative system of building construction at local level and the level of understanding about soil investigation and its need among a few local contractors. An interview with local authority as well as survey among few contractors were carried out and responses analysed. It was evident that more attention is required in this field and some recommendations like focusing more on awareness about soil investigation as well as need for rules are given.

2. INTRODUCTION

2.1. Geotechnical/ soil investigation

Geotechnical or soil investigation is done as the first step to understand the soil before construction. It is the set of methods used to analyse and understand the site conditions, sub surface profile and get idea about the soil. The soil testing done as part of the geotechnical investigation is a method to analyse the soil condition and decide on the foundation that is required. In the field of buildings, soil investigation and classification is done to evaluate the soil as regards its bearing power to a certain extent (IS 1498, 1970). The various uses of soil investigation include minimizing uncertainties in foundation design, estimating settlement, assessing stability etc.

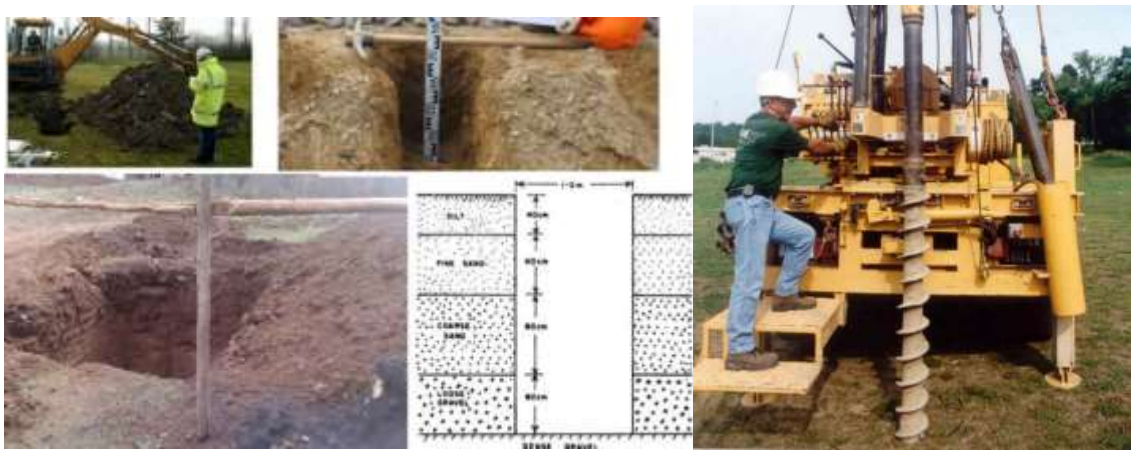
2.2. Methods of soil investigations

Direct methods -Test pits

- Test pits or trenches are an open type or accessible soil exploratory system.
- Soils can be examined in their natural condition.
- Sampling procedures can collect the underlying soils samples and used for finding strength and other engineering properties by relevant laboratory tests.

Semi-direct methods – Boring:

- Making or drilling boreholes into the ground with an outlook to obtaining soil or rock samples from particularised or known depths is known as boring.



(a) (b)

Fig.1 (a) Trial pits, (b) Boring

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2.3. Types of soil samples

Undisturbed sample

- The natural structure and physical properties are intact.
- These samples are used for tests like consolidation test, shear strength test etc.

Disturbed sample

- The natural structure is changed or affected partially or fully during sampling.
- They are used for finding Atterberg limits, grain size analysis, specific gravity etc. (Arora, 2008).

(a) (b)

Fig.2. (a) undisturbed sample, (b) Disturbed sample

2.4. Soil investigation practises in India

At present in India there are no real laws regarding geotechnical investigation before building construction. It is the structural engineer of big multi-storey building projects who decides if the soil needs to be tested when design is carried out according to the IS (Indian Standard) code 1904 and IS 1080. Generally in the case of government constructions, geotechnical investigations are carried out. The soil testing in India is done in accordance with the IS code 2720. It explains the various methods of soil preparation and testing. Usually this kind of soil investigation is carried out when very large structures are erected and there is need for determining the foundation to be used and understand the loading capacity of the soil. But when it comes to small scale construction works the topic of soil investigation is altogether ignored.

Recent incidents of flooding in Kerala have proved and showed us the need for soil investigation and laws related to it. A 2 storey house caved into earth in Nedumkadam due to heavy rains causing flooding and cracks in earth. (Manorama online 2018). Clear understanding of the soil strata gives the engineers design the houses accordingly and the contractors to provide a safe building for use. This study aims to bring attention towards the need for soil testing before construction and give an account of the present scenario about soil testing of the local construction set up and the need for laws and amendments for better and safe construction of buildings.

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Fig.3. House that sunk into earth (Manorama online, 2018)

3. LITERATURE REVIEW

Bereket et al, 2020 discusses site investigation as an essential part of civil engineering and constructions. It is set of methods that helps the engineers to know assess the soil based on its composition and condition and design accordingly. Kyakula M, 2006 in his study on RCC (reinforced cement concrete) structures talks about how and why soil investigation is carried out in order to determine the bearing capacity of soil, settlement rate as well as the position of water table. The knowledge on these factors help decide the type and kind of foundation to be designed for that particular site.Clayton et al, 1995 says that all sites must be investigated if construction is to be safe and economical. In practice, the way in which they are investigated can vary very widely, and the costs and time necessary will also be significantly different. In the Indian standard code IS 1904-1986 (p.6-8), it clearly mentions about the importance of site investigation and the different reasons of doing it stating examples of soil types and what could happen to such soils. A recent study conducted by Nadarajah Ravichandran et al (2021) on numerical analysis of settlement response of shallow footing subjected to heavy rainfall and flood events, they found that the settlement of the foundation were relatively very higher that tolerance levels during the flood and that the depth of soil and presence of pores affected it.

4. RESEARCH METHODOLOGY

4.1. Local Government Authority Interview

The objective was to know whether any laws or rules regarding soil testing or soil investigation were being carried out in the local administrative level. For this an assistant engineer at the panchayath who is responsible for giving out permission for building construction was approached. A series of questions were asked and response noted.

Questionnaire for Local authority

1. Is there any law or government order regarding requirement of soil investigation report for residential construction?
2. Does the local authority accepts soil reports from public before giving permission?
3. How many applications have come with soil reports in last 5 years?
4. Is there any specific situation when the authority asks for soil reports?
5. Is soil report necessary? Why/ Why not?

4.2. Local contractor survey

In the next step a small survey was carried out among the local contractors who are generally doing small scale construction works. In the survey, a set of seven questions were asked with options. The contractors were requested to mark their responses and mention the reason for some of the answers.

Questionnaire for contractors

1. What kind of contract work do you do?
(a) Small scale (residential homes) (b) Large scale (multi-storey buildings)
2. Do you know about soil testing/ geotechnical investigation before construction?
(a) YES (b) NO
3. Do you take soil test reports before construction?
(a) YES (b) NO (c) sometimes-(please specify in what condition)
3. Does your client show concern with soil strength and need for soil testing.

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(a) YES (b) NO (c) sometimes- (please specify in what condition)

4. Do you ever feel concern about the soil condition before construction that it might affect the strength of building?

(a) YES (b) NO (c) sometimes- (please specify in what condition)

5. Do you think there is need for making soil test reports mandatory for construction?

(a) YES (specify reason) (b) NO (specify reason)

5. RESULTS AND ANALYSIS

5.1. Response of the Local Authority

The assistant engineer at the panchayath informed us that the authority has no existing rules to follow regarding soil investigations. She also mentioned if at all anyone brought a soil report they never reject it they do consider it for the permission. It was specified that in the last 5 years there were no cases of soil report submission along with building construction permission application. If the soil was previously found to be very unstable and problems have occurred in the past the panchayath might ask for soil investigation report but it is a very site specific criterion. On the question, whether soil report is necessary, it was stated that in her opinion it depends on site. Additionally it was noted that for government construction works in almost all cases soil investigations are carried out. From the interview with local administrative authority it was clear that, they are aware of such practises but since no real rule exists it is not taken into consideration.

5.2. The Contractors Responses

The survey conducted among few local contractors gave us a perspective from the service providers side on the soil investigation practises. Among the surveyed 5 contractors, 3 of them were small scale (residential buildings) construction contractors while the rest were large scale (multi-storey buildings) contractors. Only 1 of the contractors was unaware of the soil investigation practises but the rest were aware of such a practise and the instances of doing it. It was noted that 3 of them conducted soil investigation before some of their projects but not all of them while the other 2 have never done soil investigation. Most of the contractors responded that in very rare cases only their clients have asked them the need to conduct soil testing before construction. When it comes to their concern about the stability of the soil majority agreed they have felt need for soil analysis in certain projects. To the question on whether soil investigation should be made mandatory some of them were positive about it but others found it time wasting and costly.

The survey gave insight that not all the service providers are aware of the soil conditions or the need for soil investigation. There is a need for these contractors who are primarily in contact with the work and client to understand the need for such investigation practises and make their clients understand about consequences regarding unstable soils.

6. CONCLUSION

Main takeaways are:

- There is no real law or rule regarding soil investigation before construction of any building, and it solely depends on the wishes of clients contractors or engineers.
- There is a general idea among the local people on the soil investigation practise but more awareness is required, especially in these changing times when extreme weather conditions and disasters are calling for more resilient structures
- The construction permission providing system is not that adequate.

Since the survey was very small and localised, broader surveys and researches have to be carried out in order to get more accurate findings. This is a field that needs more attention from both authority as well as researchers.

7. RECOMMENDATION

The key recommendation would be

- Establishment of a set of rules and standards regarding soil conditions for the building construction.
- Committees and teams must be made to analyse the soils for building purpose in general on a local basis.
- Need to spread awareness to the public on the consequences of building houses on unstable soil and the advantages of designing as per soil investigation reports.
- Government could make use of the technologies like GIS in order to predict soil properties to reduce the burden on public and help them effectively construct buildings according soil stability and strata

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