

National Exams May 2012

04-Geol-B3, Site Investigation

3 hours duration

NOTES:

1. If doubt exists as to the interpretation of any question, the candidate is urged to submit with the answer paper, a clear statement of any assumptions made and the rationale for such assumptions.
2. This is an **OPEN BOOK EXAM.**
3. Candidates may use any non-communicating calculator.
4. Questions have equal value. The grade for each question is given. It is suggested that the candidate proportion time based on the allocated value.
5. All questions require an answer in essay format. Clarity and organization of the written answer and any tables, figures or sketches are important.
6. The examination has an overall value of 100 Marks: 4 questions consisting of 25 Marks each.

Marking Scheme

- 1. 25 marks total**
 - (a) 16 marks
 - (b) 9 marks
- 2. 25 marks total**
 - (a) 5 marks
 - (b) 10 marks
 - (c) 10 marks
- 3. 25 marks total**
 - (a) 5 marks
 - (b) 10 marks
 - (c) 5 marks
 - (d) 5 marks
- 4. 25 marks total**
 - (a) 2 marks
 - (b) 2 marks
 - (c) 2 marks
 - (d) 2 marks
 - (e) 2 marks
 - (f) 2 marks
 - (g) 2 marks
 - (h) 2 marks
 - (i) 2 marks
 - (j) 2 marks
 - (k) 2 marks
 - (l) 2 marks
 - (m) 1 mark

Value

25 Marks

Question #1

It is important to realize how site investigation fits in with the civil engineering process from initial conception to completion and beyond. All civil engineering structures interact with 'the ground'. That being said, 'the ground' constitutes and is influenced by a variety of factors. There are multiple disciplines and sub-disciplines (experts) that may contribute in-part to the overall, successful conduct of a site investigation. As such, the geotechnical engineer must have at the very least a basic appreciation of these specializations and to be as versatile as possible in order to effectively interact with these specialists. Within this context:

16 Marks

a. List and describe the contributions of at least 8 relevant specialists at the Engineering level (i.e. not to include technologists) that could be involved in a site investigation; and,

9 Marks

b. Once you have your experts at the table, what is the site investigation design process? i.e. how would you organize your site investigation team in terms of design concepts and the conduct of your site investigation? What are the stages and important/relevant components that your team will focus on?

25 Marks

Question #2

Answer the following questions as fully as possible:

5 Marks

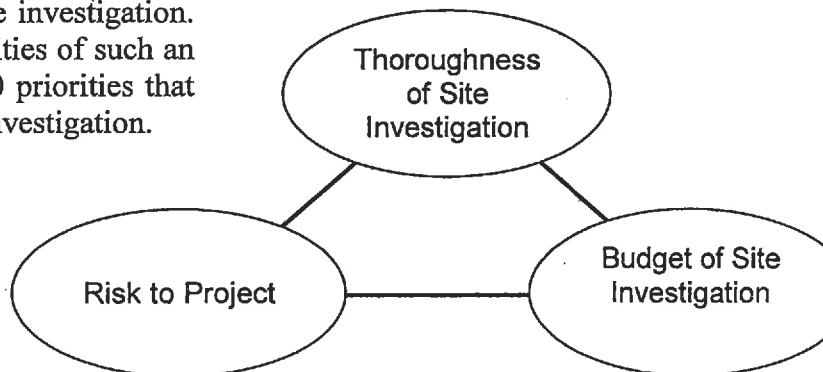
a. For a typical site investigation, what is the percentage of the project's total budget that is usually allocated for site investigation activities?

10 Marks

b. Address the main issues associated with the thoroughness of a site investigation, the budget allocated for the site investigation and the amount of risk to the project. Show how these factors are related and how they influence each other.

10 Marks

c. One never has the amount of resources in order to complete a comprehensive site investigation. As such, what are the main priorities of such an investigation. Create a list of 10 priorities that must be addressed during a site investigation.



25 Marks Question #3

It has been determined that a 10 km subway system extension will be constructed in an urban center (large city) and will be passing under civil infrastructure, populated areas as well as environmentally sensitive regions. As such, make recommendations in terms of how to proceed with a site investigation for the following components:

5 Marks

a. How many boreholes will be required? Justify your answer or cite relevant factors in this determination.

10 Marks

b. How can one determine the zone of influence of the subway tunnels' excavation activities? What factors will influence this zone of influence? How can one determine the extent of this zone of influence using activities associated with the site investigation plan?

5 Marks

c. Are there any differences in the site investigation plan if the material that will be excavated for the subway tunnels is soil or rock? Cite how (or if) this will affect the site investigation plan.

5 Marks

d. Define "accuracy" in terms of the results of your site investigation. How can one determine the extent to which their site investigation is accurate?

25 Marks

Question #4

Describe the significance of the following laboratory or in-situ tests as part of the site investigation. Describe the test/process/instrument/equipment, why/when it is applicable and the knowledge/data obtained from such an item.

All parts of this question are worth 2 Marks unless otherwise noted.

- a. Cone penetrometer test;
- b. Oedometer test;
- c. Usage of Shelby tube;
- d. Vane Test;
- e. Constant Head Test;
- f. Flight Augering;
- g. California Bearing Ratio Test (CBR);
- h. Triaxial testing;
- i. Resistivity (laboratory and in field);
- j. Modified Proctor Test;
- k. Dilatometer test;
- l. Piezometer analysis; and,
- m. Sand cone and rubber-balloon tests/methods (1 Mark).