BUREAU OF INDIAN STANDARDS

Draft Indian Standard (WC Draft)
(For comments only)

भू-तकनीकी इंजीनियरिंग सेवाएँ – अपेक्षाएँ

GEOTECHNICAL ENGINEERING SERVICES – REQUIREMENTS

ICS 91.010.01, 91.010.20, 91.010.30, 93.010, 93.020

Preconstruction Services Sectional Committee, SSD 06

FOREWORD

(Formal clause will be added later)

Geotechnical engineering service providers, by assessing ground conditions early in the project planning phase, play a critical role in ensuring the safety, efficiency, and sustainability of civil engineering projects. The service provider provides essential data for informed decision-making and risk management throughout the project lifecycle. The proactive approach ensures the decision on appropriate type of geotechnical engineering and foundation design and thus ensures safety and durability of the structures and geotechnical works. It also minimizes the likelihood of delays, redesigns, and structural and geotechnical failures during construction or during service, which will lead to cost and other serious implications. Geotechnical engineering, which include geotechnical investigations, analysis and design, is an important activity prior to taking up the design of a structure to ensure safety and durability. It is also an important activity to ensure safe execution of construction work.

Therefore, correct delivery of geotechnical engineering services becomes important for public safety and also to enhance confidence and reduce risk on account of errors in the geotechnical investigations, analysis and design.

The intent of this standard is to:

a) overcome the shortcomings of the current practices and terminologies being followed (in the government and private sectors) and suggest those that ought to be adopted and followed as a matter of good and sustainable practices;
b) eliminate subjectivity/arbitrariness and bring transparency, uniformity, and inclusiveness in the qualification requirements and appointment of agencies to provide geotechnical engineering services;
c) remove ambiguities that are evident or implied, by defining and thus clarifying the various associated terms; and
d) elaborate the scope of services, deliverables, and associated responsibilities for the Appointing Authority (AA) (owner/consultant/constructor), Geotechnical Consultant (GC) and Geotechnical Investigation Agencies (GIA) so that all stakeholders can take informed decisions while procuring and/or delivering such services.

This Indian Standard defines the roles and responsibilities of various stakeholders, different models of appointment, the minimum qualification and experience of team members and team leaders of geotechnical consultant and geotechnical investigation agency.

The educational qualification and experience of the team leader of GC and GIA mentioned in this standard are the minimum requirements. However, users of such services may take appropriate decisions to upgrade these qualification requirements, based on the nature, importance and scope of work. The intention of this standard is not to replace the registration and licensing system but to guide and bring uniformity.

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GEOTECHNICAL ENGINEERING SERVICES – REQUIREMENTS

1 SCOPE

1.1 This standard covers the requirements for geotechnical engineering services for all types of civil engineering works. It also includes the role, responsibilities, qualification and experience as well as deliverables expected from all stakeholders.

1.2 This standard covers mainly preconstruction services and also interlinked construction stage services with respect to geotechnical engineering.

2 TERMINOLOGY

For the purpose of this standard, the definitions given in IS 18299:2023 Structural Design and Proof Checking Consultancy Services for Structures – Requirements and the following shall apply.

2.1 Appointing Authority (AA)/Employer — Agency responsible for appointment of Geotechnical Consultant (GC)/Geotechnical Investigation Agency (GIA).

2.2 Consultant — The individual or the organization responsible for providing engineering consultancy/managerial services for a project.

2.3 Foundation — Part of the structure which is in direct contact with and transmits loads to the subsurface stratum.

2.4 Geotechnical Engineering Services — Services such as all stages of geotechnical investigations, testing, analysis, design, drawings, site and laboratory test reports related to the behaviors of engineering structures influenced by characteristics of sub strata, groundwater, other earth materials and natural landforms considering but not limited to stability, serviceability, constructability, durability, sustainability and maintainability to ensure that the structure performs the functions specified over its intended design service life as per applicable standards.

2.5 Geotechnical Engineering — Geotechnical engineering includes aspects of soil mechanics, rock mechanics, geology, groundwater conditions, foundation engineering, geotechnical related construction techniques, as applied to civil engineering structures like buildings, bridges/flyovers, dams, tunnels, road and highways, industrial structures, off-shore structures, special structures, including geotechnical works of earth excavation, ground stability and strengthening and other relevant aspects of earthwork and also forensic geotechnical works.

2.6 Geotechnical Design — Relates to the design of civil engineering structures and geotechnical works for the effects of geotechnical conditions which include subsurface conditions, effects of geotechnical parameters and actions, stability of structures and analysis of soil-structure interaction between the structure and soil conditions.

2.7 Geotechnical Investigation — Collection, examination and evaluation of geotechnical information through site inspection, document search, site sampling and onsite and/or laboratory testing.

2.8 Geotechnical Consultant (GC) — An individual or organization responsible for providing geotechnical engineering services.

2.9 Geotechnical Investigation Agency (GIA) — An individual or organization responsible for geotechnical investigation.

2.10 Geotechnical Investigation Report — It covers the details of site conditions observed including photographs and documents examined, location and detailed data sheet of site samples collected from site of investigation for the purpose of geotechnical studies, data sheet and results of onsite test and laboratory test performed on samples collected from site of investigation with reference to relevant codes, detailed calculation for test results, depth to ground water table and probable seasonal fluctuation.

2.11 Geotechnical Report — Geotechnical report outlines the scope and terms of reference of geotechnical engineering services, summarizes the findings of the geotechnical investigation, presents the analysis, interpretation, conclusions and recommendations for geotechnical design and construction techniques.

2.12 Owner — An individual or organization that owns the project.

2.13 Owner's Representative — An individual or organization nominated/appointed by the owner of the project for planning and execution of the project on its behalf.

NOTE — The term owner shall mean owner/owner's representative.

2.14 Team Leader — The person responsible for overseeing and coordinating the work of the team engaged in geotechnical engineering services or geotechnical investigations and having the authority to sign for and on behalf of the Geotechnical Consultant or Geotechnical Investigation Agency.

2.15 Team Supervisor — The person responsible for performance of geotechnical work at site and/or laboratory with the help of labour, equipment and other resources.

3 REQUIREMENTS FOR SERVICES

When determining the requirements for geotechnical engineering services, the Geotechnical Consultant (GC) and/or Geotechnical Investigation Agency (GIA) shall ensure that the following requirements, but not limited to, are complied with:

a) applicable statutory, regulatory and codal requirements, as mutually agreed with Appointing Authority (AA);
b) adherence to safety provisions during geotechnical investigation;
c) delivery of services as per agreed scope and timelines;

d) providing all relevant geotechnical engineering data as required including recommendation about the type of foundation/geotechnical interventions;

e) recommendation for performance monitoring, if required; and

f) any specific requirements of the Appointing Authority(AA) pertaining to geotechnical engineering services.

4 MODELS OF APPOINTMENT

The contractual model for the appointment of a Geotechnical Consultant (GC) and Geotechnical Investigation Agency (GIA) may vary according to the nature of the project and the project delivery mode. Following models of appointment may be adopted;

4.1 Model 1 — Appointing Authority (AA) appoints GC as well as GIA, independently, refer Fig. 1.

4.2 Model 2 — Appointing Authority (AA) appoints the GC. The GC may also provide the services of GIA, in-house or appoint a GIA, refer Fig. 2.

NOTES

1 The owner/consultant/constructor may also perform the role of GC provided they meet the qualification and experience requirement of GC.

2 Refer flowcharts at Fig. 1 and Fig. 2 for Model 1 and Model 2 respectively.

3 Flowcharts at Fig. 1 and Fig. 2, also illustrate the sequence of activities to be performed under Model 1 and Model 2 respectively.

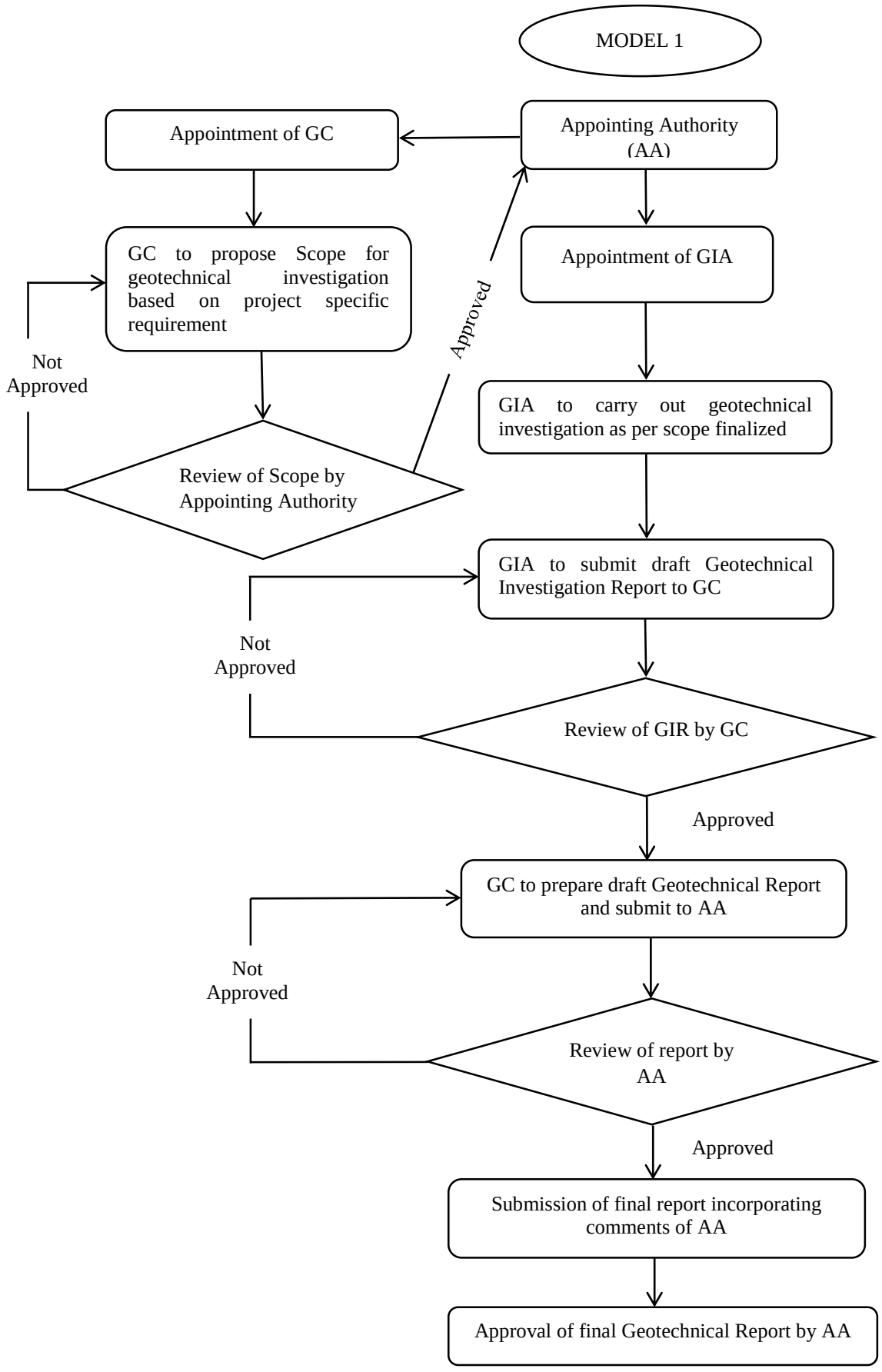

FIG. 1 FLOW CHART FOR MODEL 1 – AA APPOINTS GC AND GIA

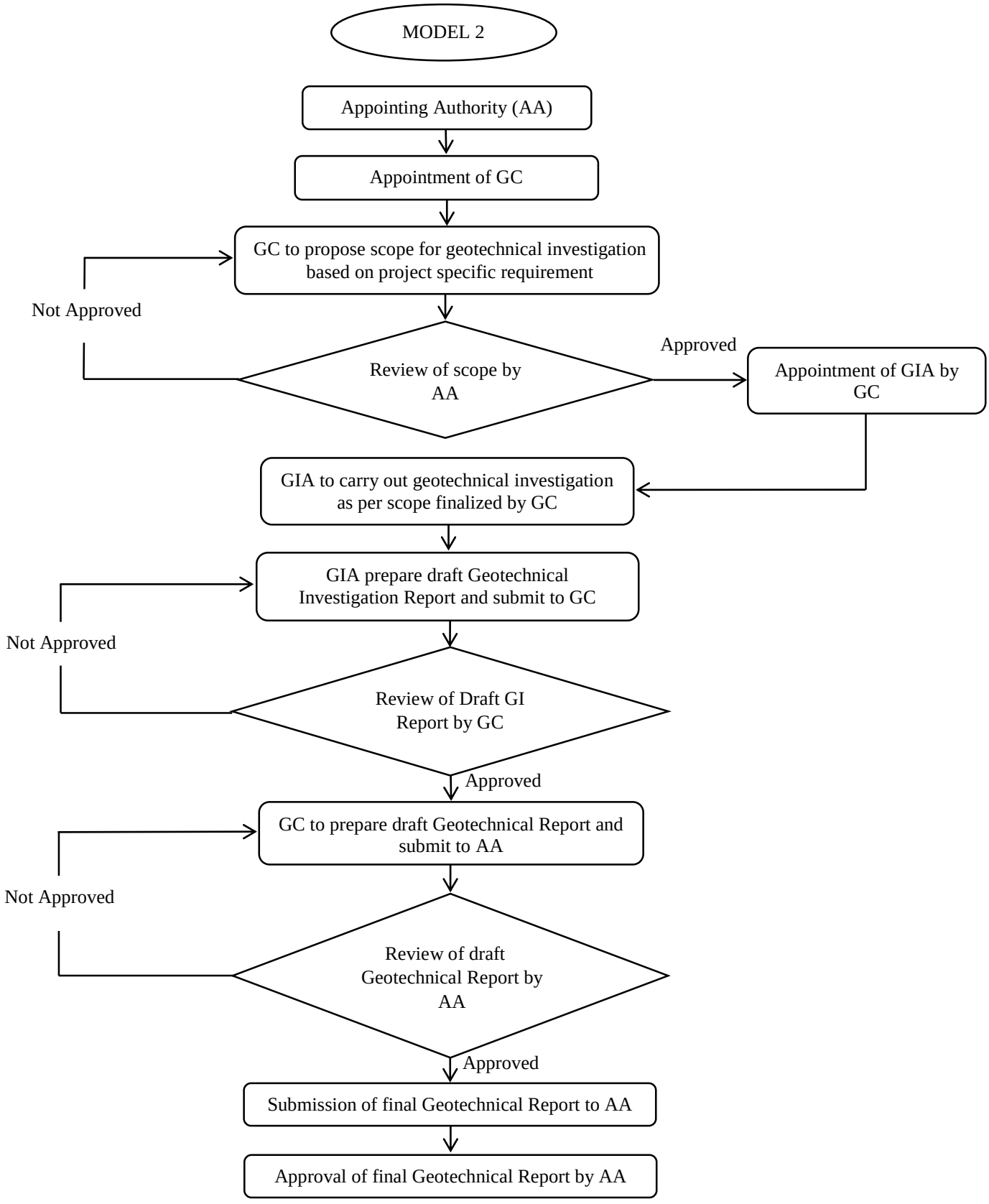

FIG. 2 FLOW CHART FOR MODEL 2 – AA APPOINTS GC ONLY

5 ROLES AND RESPONSIBILITIES

5.1 Appointing Authority (AA)

AA shall:

a) appoint GC and GIA as per Model 1, or GC as per Model 2 of appointment;

b) in case the GC is appointed by the constructor/consultant, the agreement between the owner and the constructor/consultant should stipulate the conditions for the appointment of GC in terms of scope of work. It shall be the responsibility of the constructor/consultant to inform and satisfy the owner about the competence of appointed GC including its qualifications and experience;

c) be primarily responsible and accountable for appointment of GC/GIA having requisite and relevant expertise and experience to provide adequate and reliable geotechnical engineering services;

d) examine documents submitted by the GC and GIA and shall render decisions pertaining thereto. For this purpose, AA may take assistance from others as deemed fit;

e) clearly define the scope of work for GC and GIA including expected deliverables and time schedules;

f) ensure GC/GIA possess the minimum required qualification and experience as specified in **7**;

g) if the AA proposes to provide in-house geotechnical engineering services, then the geotechnical engineering team of the AA shall possess the minimum qualification and experience as specified in **7** and also comply with roles, responsibilities and other provisions for GC/GIA as prescribed in this standard;

h) provide project related information to GC/GIA in a timely manner regarding requirements and parameters of the project, like the design brief, the conceptual drawings, surveyed site plan, proposed materials and methods of construction, the relevant contractual conditions, the functional requirements and constraints, if any, and any special construction loadings;

j) give prompt notice to GC/GIA in case AA becomes aware of any error, fault, omission, or defect in the project or non-conformance with the documentation or plans and specifications; and

k) issue a completion certificate to the GC/GIA in relation to the scope of assigned geotechnical engineering work after successful completion.

NOTE — The design brief should cover all the functional requirements as well as any other special needs of the owner. It should also address the issues related to the site and the situation that the owner wants to cover in design and construction of the project.

5.2 Geotechnical Consultant (GC)

The GC shall:

a) enter into a written explicit agreement with the appointing authority about the scope of work and terms and conditions for performing the assignment;

b) obtain requisite information/reports from the AA such as topographical survey drawings, design brief, functional requirements and constraints and incorporate the same in the geotechnical engineering report;

c) recommend the scope for required geotechnical site investigations and onsite/laboratory testing of geotechnical samples/parameters and shall be responsible for analysis of investigation and testing data, design of geotechnical structures, preparation of geotechnical reports, geotechnical designs and drawings, pile testing data/analysis and/or perform specialized geotechnical assignments as required;

d) ensure that the geotechnical investigation report is truly representative of site conditions;

e) ensure to communicate to the AA about the intention to appoint external GIA, if applicable;

f) ensure that the GIA, when appointed externally, meets the qualification and experience requirements as specified in **7**;

g) in case GC intends to conduct an in-house geotechnical investigation (Model-2), then the GC shall also possess the minimum qualification and the experience and adhere to roles and responsibilities of GIA as specified in **5.3**;

h) ensure completeness and correctness of geotechnical analysis, designs and report in conformity with the scope of services;

j) ensure submission of final report, related to the geotechnical engineering work, to the AA. The analysis and design calculations (consisting of input and output data of the software and manual calculations, if any) shall be presented in a manner that is easily comprehensible and can be checked. Every document shall be page numbered. All documents shall be physically and/or digitally signed with the date and stamped by the team leader of the GC;

k) ensure that all communications between GC and owner/constructor/consultant are well documented;

m) ensure compliance with the observations raised by the AA;

n) maintain confidentiality throughout;

p) declare conflict of interest, if any, prior to accepting the assignment for providing geotechnical engineering services. In case a conflict of interest arises during the progress

of the assignment, it shall be declared by the GC immediately. The GC shall not engage in any activity, or accept any employment, other agreement, interest, or contribution that would reasonably appear to compromise the Geotechnical Consultant's professional judgment with respect to the project;

q) give clarification to the AA on the design, drawings and report provided by the GC during the construction stage;

r) prepare an inspection and maintenance manual related to geotechnical engineering services/design, if desired by the owner; and

s) be entitled to rely on the accuracy and completeness of information furnished by the AA. The GC shall provide prompt written notice to the AA if the GC becomes aware of any errors, omissions, or inconsistencies in such information.

5.3 Geotechnical Investigation Agency (GIA)

The GIA shall:

a) ensure the availability and completeness of the information and directions from GC/AA regarding geotechnical investigations to be carried out;

b) ensure that the approved methodology, equipment, manpower, and process of site investigation are followed as per the prescribed codal provisions, guidelines, and good engineering practices;

c) ensure to conduct onsite/laboratory tests as per prescribed standards of testing. GIA shall preferably conduct laboratory tests in-house. In case of specific requirements, with the approval of AA/GC, GIA may conduct laboratory tests from competent external testing laboratory. The external testing laboratory shall be approved by the AA. However, GIA shall primarily be responsible for correctness and accuracy of laboratory test results even if tests are conducted by an external testing laboratory;

d) ensure completeness and correctness in recording of investigation data and test results in conformity with site conditions;

e) ensure safe handling, transportation and delivery of geotechnical samples;

f) adherence to safety provisions during geotechnical investigation;

g) ensure communications to the AA/GC regarding the execution of geotechnical investigation activities at site and produce evidence of actual execution of geotechnical investigation work at site;

h) ensure compliance with the observations raised by the AA/GC;

j) maintain confidentiality throughout;

k) declare conflict of interest, if any, prior to accepting the assignment for geotechnical

investigation service. In case a conflict of interest arises during the progress of the assignment, it shall be declared by the agency immediately; and

m) give clarification to the AA/GC on geotechnical investigations, as and when demanded.

6 SUPPORT

The GC and GIA should have adequate resources which shall inter alia include competent and skilled technicians, qualified and experienced geotechnical engineers, draftsmen, supervisors, lab technicians and other associated manpower, infrastructure, equipment, and environment for operation of all the processes and other facilities required to perform and complete the work effectively, accurately and within the time-frame mutually agreed with the AA.

7 QUALIFICATION AND EXPERIENCE

The AA shall ensure that the team members of the GC and GIA, as applicable, engaged for the project, have the requisite minimum qualification and relevant experience as given below;

NOTE — The AA may decide the additional qualification and/or experience for GC based on the site conditions, type of structure, health safety, and disaster (such as earthquake, flood and cyclone) vulnerability requirements.

a) Team leader shall have the minimum qualification and experience as given in Table 1.

b) Team supervisor for the field work of geotechnical investigation and geotechnical laboratory testing shall be a competent, qualified person with relevant experience, having degree in Civil Engineering recognized by government as per the requirements of the assignment.

Table 1 Minimum Qualification and Relevant Experience of Team Leader
(*Clause* 7)

Sl No.	Type of Geotechnical Assignment	Team Leader of Geotechnical Engineering Consultant	Team Leader of Geotechnical Investigation Agency
(1)	(2)	(3)	(4)
i)	Geotechnical services for small scale projects viz buildings up to the height of 15 m; Rural roads, low height embankments/ excavations upto 3 m height/depth; Culverts (Span length up to 6 m).	B.E./B.Tech (Civil) with 5years of experience in geotechnical engineering practice with minimum 3 years of experience in geotechnical analysis and designs.	B.E./B.Tech (Civil) with 3years of experience in geotechnical investigations.
ii)	Geotechnical services for medium scale projects viz. Buildings of height more than 15 m and up to 50 m, urban roads, mid height embankments/excavation upto 6m height/depth, minor bridges (bridge length up to 60 m).	B.E./B.Tech (Civil) with 7years of experience in geotechnical engineering practice with minimum 5 years of experience in geotechnical analysis and designs.	B.E./B.Tech (Civil) with 5years of experience in geotechnical investigations.
iii)	Geotechnical services for large scale and specialized projects viz buildings of height more than 50 m, embankments/excavations of height/depth more than 6m, state and national highways and specialized structures such as but not limited to tunnels, major bridges, flyovers, elevated roads, dams, chimneys, industrial, marine/offshore and special structures.	Master's degree with major in geotechnical engineering and 7 years of experience in geotechnical engineering practice out of which minimum 5 years of experience in geotechnical analysis and designs. OR B.E./B.Tech (Civil) with 10 years of experience in geotechnical engineering practice out of which minimum 7 years of experience in geotechnical analysis and designs.	B.E./B.Tech (Civil) with 10 years of experience in geotechnical investigations.

Table 1 *(Concluded)*

Sl No.	Type of Geotechnical Assignment	Team leader of Geotechnical Engineering Consultant	Team Leader of Geotechnical Investigation agency
(1)	(2)	(3)	(4)
iv)	Specialised geotechnical engineering assignments such as but not limited to hill slope stability, erosion and scour controls, ground improvement, shore protection, forensic geotechnical engineering. which are not part of any category of structure stated above.	Master's degree with major in geotechnical engineering and 10 years of experience in geotechnical engineering practice out of which minimum 5 years of experience in similar specialized geotechnical assignment. OR B.E./B.Tech (Civil) with 15 years of experience in geotechnical engineering practice out of which minimum 7 years of experience in similar specialized geotechnical assignment.	B.E./B.Tech (Civil) with 10 years of experience in geotechnical investigations practice.

NOTES

1 For type 1 and 2 of geotechnical assignments specified above under Sl. No. (i) and (ii), in case of Master's Degree in geotechnical engineering, the required minimum experience may be reduced by 1 year and in case of a doctoral degree in area of geotechnical engineering, it may be reduced by 2 years. This note shall not be valid for Sl. No. (iii) and (iv) of Table 1.

2 The team leader of GC/GIA can also be academic faculty member of recognized engineering institutions with relevant qualification and experience as given above.

3 Engineering geologist may be engaged in the team for the projects involving rock formation.

4 The experience of team leader of GC/GIA shall specifically elaborate his/her role and responsibilities in the project with respect to geotechnical engineering assignments.

5 Relevant experience shall mean experience in similar type of projects as per the assignment.