

Geotechnical engineers and the Construction Regulations

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INTRODUCTION

In 1993, the Machinery and Occupational Safety Act was replaced by the Occupational Health and Safety Act (Act 85 of 1993). Initially, the new act retained many of the Regulations of the old Act including, among others, the General Safety Regulations, the Driven Machinery Regulations and the General Administrative Regulations, all of which have particular relevance to the construction industry.

Over the years, it was realised that it would be beneficial to consolidate all the regulations pertaining to the construction industry. This resulted in the publication of the Construction Regulations in July 2003. In addition to grouping the regulations that apply to various construction plant and activities (excavation, demolition, scaffolding, cranes etc), the Construction Regulations clearly define the role and responsibilities of the parties involved in construction work. Considerable emphasis is placed on formalising health and safety systems with the introduction of risk assessments and health and safety plans.

Included in the definition of construction work to which the regulations apply, is the making of an excavation, moving of earth, piling or any similar type of work. It is therefore clear that geotechnical engineers engaged in site investigation activities involving test pits or large diameter auger holes are undertaking construction work and, as such, must comply with the Construction Regulations.

The geotechnical profession fully supports the principles embodied in the legislation. Safety of personnel involved in geotechnical investigations is of paramount importance. It is therefore essential that the profession is aware of the requirements of the legislation.

Day (1996) provided guidance for geotechnical engineers engaged in site investigation activities under the old regulations. The purpose of this paper is to extend this guidance to cover the Construction Regulations with particular emphasis on the additional requirements which have now come into force.

CURRENT PRACTICE

Vast areas of South Africa are underlain by partially saturated, often lightly cemented, transported or residual soils which possess sufficient cohesion to ensure stability of

the sidewalls of most open excavations. In many areas, the water table is at considerable depth below ground level. It is therefore not surprising that the many geotechnical investigations in South Africa make use of test pits or large diameter auger holes for in situ inspection and sampling of the soil profile. Even where rotary core drilling is used, it is often complemented by test pits or large diameter auger holes to gain first hand information on the excavatability of the material and/or factors which could influence the installation of piles and other geotechnical construction activities.

Where a backactor is used, test pits are generally excavated to refusal of the machine or to a maximum depth of approximately 3 m to 5 m. Although machines are available that can dig to depths of 6m or more, it is often preferable to use a large diameter auger to form test holes deeper than about 5 m. Access to test pits is obtained using a ladder, generally placed at one end of the trench. Profiling and sampling of the test pit seldom takes longer than twenty minutes, whereafter the hole is back-filled. In situ testing (such as plate load testing) may require the hole to remain open for a longer period of time.

Where a large-diameter auger rig is used, 750 mm diameter test holes are drilled, usually using a flight auger. Even the light auger rigs are able to drill to depths of 15 m in soils and the larger rigs, which can reach depths of 36 m or more, are capable of penetrating soft rock material. The profiler, wearing suitable protective clothing and a safety harness, enters the hole by means of a boatswain's chair suspended from a tripod winch.

Owing to their circular shape, auger holes are intrinsically more stable than backactor test pits, particularly where the pits are long and deep.

In most cases, the profiler is an experienced geotechnical engineer or engineering geologist who is capable of assessing the safety of the test pit or auger hole. There is, however, no formal method of assessment and usually no record is kept of any inspection.

Profiling activities are governed by a Code of Practice issued by the Geotechnical Division of the South African Institution of Civil Engineers (SAICE 1980). The current version of the document, published in 1980, pertains only to circular shafts such as large diameter auger holes. A revised

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draft drawn up in September 1990 was extended to include the profiling of test pits. This unpublished draft is again being revised by the Geotechnical Division with due cognisance being taken of changes in safety legislation. This document is essential in establishing standards of good practice in the industry and its final publication is eagerly awaited.

No official records are available of injuries or fatalities that have occurred in test pits or auger holes during geotechnical investigations or inspections. However, in 1996, the author obtained reports of five injuries and one fatality in auger holes during the past thirty to forty years with six injuries and two fatalities occurring in test pits. A further fatality has occurred in a test pit in the intervening period. Note that these figures pertain only to soil profiling and inspection of pile holes and not to pipe laying, piling or other construction activities.

BASIC REQUIREMENTS OF THE ACT

The crux of the Occupational Health and Safety Act is contained in a single sentence in §8(1): 'Every employer shall provide and maintain as is reasonably practicable, a working environment that is safe and without risk to the health of his employees.' In many respects, much of the remainder of the Act merely provides guidance and lays down mechanisms by which this obligation is to be discharged and monitored. The main duties of the employer towards his employees are set out in §8 of the Act and his duties towards the public in §9. The general duties of employees at work are given in §14.

In assessing reasonable practicability, the Act requires an assessment to be made of the severity of the risk, the means of mitigation and the costs of removing the risk in relation to the benefits derived therefrom.

CONSTRUCTION REGULATIONS

The Construction Regulations (2003) comprise a set of regulations pertaining specifically to the construction industry. Although the issue of the regulations has resulted in the repeal of a number of older regulations, it does not alter the basic requirements of the Act in any way. In short, the employer remains primarily responsible for ensuring the safety of employees at work. The major changes brought about by the Construction Regulations are the introduction of a formal framework for health and safety on construction sites and the spelling out of the duties of the major role players.

One of the 'old' regulations which has been repealed by the Construction Regulations is the often misinterpreted General Safety Regulation 13(2). This

regulation stipulated that no employer shall 'require or permit any person to, and no person shall, work under unsupported overhanging material or in an excavation which is more than 1,5 m deep and which has not been adequately shored or braced if there is a danger of the overhanging material or the sides of the excavation collapsing'. The current regulations contain no reference to a 'safe' excavation depth (previously taken as 1,5 m) and the requirements of the Construction Regulations apply to excavations of any depth.

Role of the geotechnical engineer

In contrast to the Act, which deals mainly with the duties of employers and employees, the Construction Regulations define the duties of, among others, the client, the agent, the principal contractor, the contractor, the designer, the construction supervisor and the competent person. Essentially, the agent is a person appointed by the client to assume many of the duties of the client. The principal contractor is obliged to fulfil all the duties of the contractor with the added responsibility of acting as client to his sub-contractors. The competent person and construction supervisor are generally employees of the contractor charged with certain duties. The designer may be an independent consultant or an employee of either the client or the contractor.

In the course of a typical geotechnical investigation, a geotechnical engineer will employ sub-contractors for plant hire, rotary core drilling, geophysical testing, etc. In addition, he or his personnel will carry out work on site including profiling, testing, etc. In this context, the geotechnical engineer assumes the roles of principal contractor and contractor under the regulations.

Should the geotechnical engineer be appointed to design any aspect of the works, such as lateral support or foundations, he or she would assume the duties of the designer.

In the sections which follow, the general duties of the key role players of relevance to the geotechnical engineer's investigation and design functions are explored. Reference is made only to those duties which impinge directly on the activities of the geotechnical engineer and not to general obligations. This is followed by an examination of specific requirements pertaining to such activities.

General duties

Client

The client's duties are spelt out in Regulation 4. The client is, inter alia, required to prepare a health and safety specification for the construction work and make this available to the principal contractor. The client must ensure that the principal contractor makes sufficient allowance in tenders for the cost of health and safety measures during the

construction process. The client is obliged to provide the principal contractor with any information which might affect the health and safety of persons performing construction work. The principal contractor must be appointed by the client in writing.

Contractor

The duties of the contractor are spelt out in Regulation 5. A contractor is required to provide and demonstrate to the principal contractor or client as the case may be, a suitable and sufficiently documented health and safety plan based on the health and safety specification provided. Contractors are also required to ensure that a health and safety file including all the documents required in terms of the Act (see later section on documentation) is kept on site and is available for inspection on request.

Clause 6 of the regulations requires the contractor to appoint a full-time competent person in writing to supervise the construction work. If the project size or degree of risk warrants it, the contractor is also required to appoint a full-time or part-time safety officer.

Principal contractor

The principal contractor (Regulation 5) finds himself in the unenviable position of having to fulfil all the duties of the client (save the preparation of a health and safety specification) and the duties of a contractor. He has the added duty of ensuring cooperation between all contractors to enable each to comply with the provisions of the regulations. The principal contractor must also keep a list of all contractors on site that are accountable to him together with copies of the agreements between these parties and the type of work being done.

Designer

The duties of the designer are spelt out in Regulation 9, the regulation dealing with structures. In R9(2) the designer is required to inform the client about any aspect of the design that might affect the pricing of the construction work and inform the contractor, once appointed, in writing of any known anticipated dangers or hazards relating to the construction work, providing him with all relevant information required for the safe execution of the work. The designer is also required to provide the contractor with a geotechnical report, the loading the structure is designed to withstand and information on the methods and sequence of construction. During execution of the work, the designer is required to carry out inspections at appropriate times to ensure compliance with the design, to stop any construction work which is not in accordance with the design and to issue a completion certificate to the contractor for the completed structure prior to commissioning.

Specific requirements relevant to geotechnical recommendations

A number of specific requirements are laid down in various places in the regulations. The most important of these applicable to geotechnical investigations and design are set out below.

Regulation 3 requires that the contractor must notify the provincial director in the Department of Labour of any construction work involving excavations deeper than 1 m if the duration of the work exceeds 30 days or will involve more than 300 person days of construction work.

Regulation 6 spells out the requirements for supervision of construction work. In terms of R6(1) the contractor is required to appoint a full-time construction supervisor. Where the size of the project warrants it, sub-regulation R6(6) requires the contractor to appoint a full time or part time construction safety officer. Both appointments are to be in writing.

Regulation 7 deals with risk assessments and safety inductions. The contractor is required to carry out a risk assessment to identify, evaluate and analyse the risks prior to commencement of any construction work. He is then required to produce a safety plan to mitigate, reduce or control the identified risks, a monitoring plan and a review plan, all of which form part of the risk assessment. The risk assessment is to be kept on site and available for inspection. All employees and sub-contractors are to be informed, instructed and trained regarding any risks associated with the work. No person may enter the site without undergoing health and safety induction training. Every employee must be in possession of proof of such induction training and is required to carry this proof on site at all times.

Regulation 11 deals with excavations and is possibly the most pertinent of the regulations for geotechnical investigations. The contractor is required to:

- Appoint a competent person in writing to supervise all excavations R11(1)
- As far as is reasonably practicable, evaluate the stability of ground before excavation work commences R11(2)
- Take reasonable steps to prevent any person from being buried or trapped by a fall of ground R11(3)(a) and must not require or permit any person to work in an excavation which has not been adequately shored or braced R11(3)(b). Shoring or bracing is not required where the sidewalls have been battered to the angle of repose or where the excavation is in stable material. In either event, permission must be given in writing by the competent person for work in such excavations R11(3)(b)(ii)(a). Where there is uncertainty as to the stability of the excavation, the decision of a professional engineer or professional technologist is required and

shall be noted in writing, signed by both the professional engineer / technologist and the competent person R11(3)(b)(ii)(b)

- Prevent surcharging of the sidewalls of the excavation by excavated material, plant or equipment R11(3)(d)
- Provide a convenient and safe means of access (and egress) no further than 6 m from where persons are working in an excavation R11(3)(f)
- Ascertain the position of all services as far as is reasonably practicable prior to commencement of excavation R11(3)(g)
- Cause every excavation to be inspected daily, after an unexpected fall of ground or after rain and the results of such an inspection to be recorded in a register kept on site R11(3)(h). Although the regulation does not specifically require the excavation to be inspected immediately on completion and prior to entry of works, such an inspection is implied by Regulation 11(3)(b)(ii)(a)
- Barricade all excavations accessible to the public and provide warning lights at night R11(3)(i)
- Position warning signs adjacent to any excavation in which people are working R11(3)(l)

Regulation 11(3)(j) requires compliance with the precautionary measures stipulated for working in confined spaces given in Regulation 5 of the General Safety Regulations. This regulation requires the air in any confined space to be tested and evaluated by a competent person who shall certify that the confined space is and will remain safe for the duration of the work before any person may enter therein. If this cannot be done, the confined space must be purged and ventilated or breathing apparatus must be provided. The application of this regulation to excavations places a particularly onerous burden on the geotechnical engineer.

Regulation 16 deals with boatswain's chairs. This regulation requires the chair to be securely suspended and to be constructed in such a manner as to prevent the occupant from falling out R16(1). The chair should be inspected and performance tested at the time of erection and should be visually inspected on a daily basis prior to use R16(2).

Regulation 21 deals with construction vehicles and mobile plant. The most applicable requirement of this regulation is that no one is permitted to ride on any construction vehicle other than in a safe place provided for that purpose R21(2)(a).

Documentation

The Construction Regulations requires the preparation of a number of documents which have not generally been produced in the past. The most important of these are dealt with below.

In terms of R4(1)(a), the client is required to prepare a health and safety specification for the construction work and to issue this specification to contractors at the time of tender. This specification should contain all requirements pertaining to the construction work necessary to ensure the health and safety of persons. The client is also required to provide the contractor with any information which might affect the health and safety of persons at work R4(1)(b).

In terms of R5(1) and (4), all contractors are required to produce a health and safety plan based on the health and safety specification provided by the client. According to the definitions in Regulation 1, this is a documented plan which addresses identified hazards and includes safe working procedures to mitigate, reduce or control such hazards. The health and safety plans produced by all contractors are required to be kept on site and made available for inspection on request.

Regulation 7 spells out the requirements for conducting the risk assessments that form part of the health and safety plan referred to above. The risk assessments are required to identify the risks and hazards on site, analyse and evaluate these risks, identify measures to mitigate, reduce or control the risks, prepare a monitoring plan to ensure compliance and a review plan to ensure the assessment remains current.

Regulation 8(2) requires a separate risk assessment for any work carried out from an elevated position involving the use of fall protection equipment. This regulation would, presumably, apply to persons working in auger holes.

The regulations require a number of appointments to be made. These include the appointment of the principal contractor by the client R4(1)(c), the appointment of the contractor by the principal contractor R5(3)(b), the appointment of a fulltime construction supervisor (6)(1), the appointment of a construction safety officer R6(6), the appointment of a competent person to undertake the risk assessment R7(1) and the appointment of a competent person to supervise excavation work R11(1).

Similarly, a number of records need to be kept. These include a record of health and safety induction training R7(9)(a), a record of permission to enter an excavation R11(3)(b)(ii)(a), a register of excavation inspections R11(3)(h) and a record of the testing of the air in a confined space (including excavations) in accordance with General Safety Regulation R5(1). Although it is not specifically required that written records be kept of inspection of boatswain's chairs (Regulation 16) and fall protection equipment (Regulation 8), it would be wise to keep such records as proof of fulfilment of inspection requirements.

The regulations require that all the above documentation be kept on site in a health and safety file and be made available for inspection on request R5(7). In addition, the health and safety file should contain an up to date list of all contractors on site, the agreements between the parties and a statement of the type of work being done R5(9). Where any permanent work is being undertaken, the health and safety file should include a record of all drawings, designs, materials used and other similar information concerned with the completed structure R5(8) and should be handed to the client at the conclusion of the project.

PRACTICAL SUGGESTIONS FOR SITE INVESTIGATIONS

As indicated in the introductory paragraphs, all site investigations involving any form of excavation classify as construction work, irrespective of how small they may be. Thus, the regulations apply even to an investigation of (for example) a single storey house involving one or two hand dug test pits. The challenge facing geotechnical engineers is to assemble a set of standard procedures, documentation and equipment which results in compliance with the requirements of the Act and the regulations in the simplest possible way. These procedures can then be supplemented as required for larger investigations. Suggestions in this regard are given below.

It is suggested that all geotechnical engineers engaged in site investigation activities should, in addition to their standard conditions of employment, be appointed as competent persons responsible for the supervision of excavation work R11(1), granting permission for persons to work in an excavation R11(3)(b)(ii)(a) and as a construction supervisor R6(1). He or she should also be required to become conversant with and comply with the requirements of the Occupational Health and Safety Act, specifically those requirements pertaining to their activities. Each employee should be issued with the latest available documentation pertaining to the safety of men in trial holes and should have ready access to a copy of the Occupational Health and Safety Act and its regulations.

Prior to being sent out to a site, all new employees should receive training and instruction. In the case of geotechnical engineers, it is particularly important that employees are taught to recognise signs of instability in the sidewalls of excavations. These include the appearance of surface cracks, slickensided joint planes in clay, fissured clays and silts below the water table, loose boulders in the sidewall and granular soils with just enough cohesion for temporary 'stability' of the sidewalls. The best way to impart such instruction is for the new employee to accompany an experienced

geotechnical engineer or engineering geologist to various sites and to receive practical instruction in the field. Safety is a culture which is taught by example.

All employees required to undertake fieldwork should be provided with the necessary personal protective equipment. Hard hat, safety boots, reflective vest, eye protection and ear plugs are regarded as the minimum requirements. Other items such as gloves, flameproof overalls, respirators, gum boots and spats should be issued as required for specific sites. Note that it is the employer's responsibility to provide such equipment §8(2)(d) at no charge to the employee §23 and to replace this equipment when necessary. A register should be kept of all equipment issued and the employee should sign for receipt.

The employer should provide each site investigation team with the equipment necessary for the safe conduct of work in the field. It is often convenient for all the required items to be packed into a small trunk or similar container. In addition to normal profiling equipment (geological pick, tape, sample bags, bag ties, labels and sample bottles), the standard equipment should also include a roll of barrier tape, a sandwich board type warning sign 'Persons working in excavation', a first aid kit and a copy of the Act and regulations (available in booklet form). When working in test pits, a ladder of suitable length should be provided and the employer should make available a vehicle suitable for transporting this equipment to site. All too often, employees do not take a ladder to site even when profiling deep test pits as a result of their preference to use their own transportation or the lack of availability of suitable vehicles for transporting the necessary equipment. When auger holes are involved, either the drilling company or the employer should provide a suitably designed boatswain's chair, a winch, a full body harness and a safety rope. A battery-powered fluorescent light, which can be fixed to the inside of the boatswain's chair, can significantly improve visibility in the hole making it easier to spot unstable sidewall conditions.

A standardised set of documents should be prepared which are applicable to a typical geotechnical investigation site. As a minimum, these documents should include a company health and safety commitment, a list of emergency telephone numbers, written appointments of competent persons, a risk assessment for the typical activities (test pitting, auger hole profiling, rotary core drilling, etc), a health and safety plan, a sign-off sheet for inspection of test pits (which may include an initial section for inspection of equipment such as winches, boatswain's chair, ladders, etc) and standard site safety rules. All these documents should be contained in a health and safety file

which should be taken to site on any geotechnical investigation. An example of a risk assessment for common investigation activities is given in Appendix A with a set of typical site safety rules in Appendix B. On environmentally sensitive sites, it would be prudent to include clauses for environmental protection in both the risk assessment and the health and safety plan.

All sub-contractors (plant suppliers, drilling companies, testing institutions, etc) should be appointed in writing and should be provided with a copy of the client's health and safety specification, the site safety rules and the health and safety plan at the time of appointment. It is important to note that, in appointing a sub-contractor, the geotechnical engineer assumes the role of the principal contractor in terms of the construction regulations and the role of employer in terms of the Act. On larger investigation contracts, a written agreement may be drawn up between the employer and the sub-contractor (who for the purposes of the Act is a mandatory) in terms of Section 37(2) of the Act in which the mandatory acknowledges that he is an employer in his own right with duties and obligations under the Act and agrees to ensure that all work is performed and machinery and plant used in accordance with the provisions of the Act. It may also be desirable to ensure that the sub-contractor appoints a construction safety officer and a safety representative from his own ranks to take charge of the safety aspects of the work undertaken by the sub-contractor.

At the start of every investigation, even a single day's test pitting activity, all personnel on site should be called together for an on-site safety induction. This should include a review of the site safety rules and of any particular aspects of the health and safety plan which pertain to the activities of the individuals present or to the site concerned. Each person on site should be required to sign an attendance register and should receive proof of induction. A simple set of self adhesive labels onto which the site name and date can be inserted will suffice. The label can then be stuck onto the person's clothing or hard hat in fulfilment of R7(9)(b).

During execution of the work, no breach of safety rules should be tolerated no matter at what level this breach occurs. All too often, the very people responsible for ensuring safety on site flagrantly disregard the rules that they themselves have expounded to their fellow workers.

It is recommended that a senior representative of the company, if not the chief executive officer, should from time to time visit the site of investigations being carried out by his employees to assess the level of safety compliance. In terms of the Act, employers have the responsibility not only to equip, inform and train their employees,

they also have the responsibility to enforce compliance with health and safety requirements §8(2)(h).

PROBLEM AREAS

Regulation 11(3)(j) requires that all the precautionary measures stipulated for confined spaces in the general safety regulations are complied with when entering any excavation. General Safety Regulation 5(1) requires the air in the confined space (ie the excavation) to be tested. While this is a sensible precaution for deep auger holes in any contaminated or industrial environment, it is regarded as unnecessarily onerous in the case of shallow excavations into natural ground in open areas. The SAICE Geotechnical Division has, through the South African Association of Consulting Engineers, requested that the regulations be amended to require such testing be carried out only where necessary.

The second problem arises from the requirement of R16(2) which requires the

contractor carry out a performance test on the boatswain's chair after erection. This is impractical for a site investigation using large-diameter auger holes where the winch and chair may be moved and re-erected several times per day. Resolution of this problem requires further investigation by the industry.

CONCLUSIONS

The Construction Regulations make it clear that geotechnical investigations fall within the definition of construction work and that health and safety is paramount on any construction site.

The Occupational Health and Safety Act and Construction Regulations in particular impose onerous requirements on geotechnical engineers engaged in site investigation activities. At first reading, it may appear that it is not possible to comply with the many and varied requirements of the Act. However, with forethought and planning, systems and procedures can be implemented

to ensure substantial compliance with the Act without significant disruption to the investigation. It should also be recognised that the regulations oblige the client to ensure that adequate provision for health and safety is made in tenders received from contractors for the execution of construction work meaning that geotechnical engineers will be paid for the cost of such compliance. There can therefore be no excuse for geotechnical engineers not to conform with the requirements of the regulations when engaged in investigation activities.

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APPENDIX A TYPICAL RISK ASSESSMENT

Item	Task	Potential hazard	Preventative measures	Risk rating*
1	Site establishment and vehicular movement on site	(a) Vehicle accident (b) Damage to property (c) Damage to environment	(i) Observe all road traffic rules (ii) Wear safety belts (iii) Drivers are to be in possession of valid driver's licences for the category of vehicle driven (iv) Drivers are to be instructed about any special precautions for the specific vehicle driven (hydraulic lift, winches, etc) (v) Vehicles are to make use of existing roads where possible (vi) Where no roads are available, the shortest route from the existing road is to be selected. The same route is to be used for access and egress from the site (vii) Existing vegetation is not to be disturbed or damaged unless unavoidable for the execution of the work (viii) Limit speed as appropriate for site conditions or as specified by road signs	(a) Reasonable (b) Tolerable (c) Reasonable
2	Excavation of test pits	(a) Being hit by boom of excavator (b) Falling into pit (c) Collapse of pit sidewalls	(i) No persons are permitted to stand within reach of the boom. (ii) Eye contact is to be established with operator and excavation activities to cease before approaching test pit (iii) Access to area around pit limited to essential personnel (iv) Excavated spoil is to be placed at least 1 m from the edge of the pit to permit access for inspection and to minimise surcharge loading effects. In potentially unstable soils, the clear distance from the edge of the pit is to be increased to be equal to the height of the vertical face of the excavation closest to the spoil heap	(a) Reasonable (b) Tolerable (c) Tolerable
3	Profiling and sampling	(a) Collapse of hole during profiling/sampling (b) Objects falling into hole from surface (c) Profiler being interred in hole	(i) The test pit is to be inspected by a competent person (excavations) and, if safe, permission is to be granted in writing to enter the hole (ii) Only one person shall enter the test pit at a time. (iii) The supervisor is to be present during the sampling operation (iv) All loose material is to be cleared from the lip of the excavation or barred down from sidewalls (v) 'Person in hole' warning signs are to be posted on top of the spoil heap	(a) Reasonable (b) Tolerable (c) Reasonable
4	General	(a) Personal injury (b) Ingesting harmful liquids (c) Injury when using tools (d) Fire	(i) Use appropriate personal protective equipment (PPE) (ii) Report unsafe working conditions to the safety representative or supervisor (iii) Use and maintain/protect all safety equipment (iv) Carry out on-site safety inductions (v) Adhere to all warning signs (vi) Label all fluid containers as appropriate (vii) Clearly identify all hazardous liquids, drinking water, etc (viii) Ensure all tools are in good condition (ix) Use the correct tool for the job (x) No smoking permitted in vicinity of flammable substances.	(a) Tolerable (b) Reasonable (c) Reasonable (d) Tolerable

* Tolerable: Monitor and manage risk
Reasonable: Reduce risk as low as reasonable practicable by precautionary measures
Unreasonable: Reduce risk by introduction of control measures
Intolerable: Eliminate or reduce risk by immediate intervention

APPENDIX B TYPICAL SITE SAFETY RULES

All work on this project shall be carried out in accordance with the Occupational Health and Safety Act (Act 85 of 1993) as amended. In addition to any requirements of the Act, the following rules shall apply.

- Safety boots and hard hats are to be worn at all times when on site
- Gloves, ear and eye protection are to be worn as appropriate
- All personnel must attend a safety induction course at commencement of work on site
- No person may enter any excavation without the excavation having been inspected by the competent person (excavations)
- All excavations, including drilling sumps are to be backfilled as soon as practical

after work in such excavations has been completed

- All speed limits and traffic restrictions are to be obeyed. On the site itself, the speed limit is 35 km/h
- All road traffic rules are to be obeyed including the wearing of safety belts by all occupants
- No person may ride in the back of a bakkie or truck unless seated entirely within the vehicle
- No alcohol or drugs will be permitted on site. Anyone under the influence of alcohol or other substances will be removed from the site
- Smoking is only permitted in the designated areas of the site. No smoking is

permitted in the vicinity of any fuel or gas storage containers or during refuelling of plant and vehicles

- All tools, equipment, lifting apparatus, etc are to be inspected at the start of each shift. Any damaged/unsafe items shall be replaced
- Only the correct tool is to be used for the job
- All containers are to be labelled to indicate contents (drinking water, diesel, lube oil, etc)
- All warning signs are to be obeyed
- Any unsafe conditions/equipment are to be reported to safety officer or safety representative without delay