CHAPTER 2 - CONTRACTUAL ASPECTS AND GENERAL DUTIES

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2.1 SCOPE

The purpose of this chapter is to give an overview of the contractual relationship between the parties to a contract and other roll players and the duties and responsibilities which flow from this contractual relationship with the emphasis on that applicable to the engineer’s representative and his staff.

2.2 BASIS OF CONTRACT

In law, a contract is a binding legal agreement that is enforceable in a court of law. That is to say, a contract is an exchange of promises for the breach of which the law will provide a remedy.

The “promises” to which the aforesaid definition refers are commonly known as the Conditions of Contract and these are more formally defined to be the terms and conditions that set the rights and obligations of the contracting parties when a contract is awarded or entered into. These include ‘general conditions’ which are common to all types of contracts, as well as any variations, amendments and additions which are peculiar to a specific contract. These are set out in the Contract Data and are also referred to as the particular or special conditions of contract.

In South Africa and for the purposes of a construction contract, four standard forms of contract (conditions of contract) have been approved by the Construction Industry Development Board, viz New Engineering Contract (NEC), JBCC, General Conditions of Contract for Construction Works (GCC) and the FIDIC Conditions of Contract for Construction (FIDIC).

The parties to a construction contract are the employer and the contractor.

The employer, the one for whom the works are to be executed, is defined to be a natural person (human being) or a juristic person (a legal entity through which the law allows a group of natural persons to act as if they were a single person for certain purposes, e.g. a company, a partnership, a municipality, the government, SANRAL, etc.).

The contractor is the natural or juristic person whose offer for the execution of the work has been accepted by the employer.

The engineer is the natural or juristic person who has been appointed by the employer to act as the engineer for the purposes of the contract and to carry out the duties assigned to him in the contract [refer FIDIC clause 3]. Where the engineer is a juristic person a specific individual will be named to fulfil the duties of the engineer.

The engineer on his part will appoint an engineer’s representative (traditionally referred to as the RE) and such additional staff as may be required by the circumstances (collectively referred to as the monitoring staff), to maintain a permanent presence on site and to perform the functions assigned to them by the engineer.

It follows that the monitoring staff should ensure that they have a sound knowledge of contract law and in particular the conditions of contract and should understand the nature of the contractual relationship between the employer and the contractor and the role of the engineer and monitoring staff.
2.3 RELATIONS

2.3.1 General

Joe Love, a renowned speaker and author on the subject of relations, had this to say:

“As we move further into the 21st Century, it may well turn out that the success in the workplace pivots on the ability to tap into something very basic, something as old and entrenched as mankind itself: the need to establish relationships, to connect with someone else. Since our professional connections often are forced by time and circumstance to be our social connections as well, it is important for organizations to facilitate dynamic relationships in the workplace. Workplace relationships are personal, despite efforts to keep the personal and professional realms separate. Many of the same dynamics and difficulties exist for relationships in the workplace as do for those outside the workplace. Successful workplaces are the ones that create an environment that encourages people to create relationships. Quality relationships are what produce quality products and services. At the heart of it all is communication. There must however be a delicate balance between relationships and friendships. For example, managers should know not to become great drinking buddies with the people they supervise. Just as they should also know not to become close friends with the chairman. On the other hand, don’t be aloof. Maintain a positive relationship that doesn’t impose on you, the other person, or the work to be done.”

The monitoring staff will do well to keep the aforesaid in mind when they establish relationships with the various role players as listed below.

2.3.2 With Contractor

(a) The monitoring staff should use a courteous, businesslike and ethical procedure when dealing with the contractor. A good relationship is essential to gain the co-operation of the contractor.

(b) The monitoring staff should be confident that the best interests of both the contractor and the employer are being met under the terms of the contract.

(c) Enforcement of instructions will not be difficult if judgment is fair and impartial and knowledge of the work is thorough. This will have been accomplished by detailed examination and understanding of the plans and specifications. If the monitoring staff knows the plans and specifications thoroughly, the contractor’s personnel will respect the engineer’s representative’s judgment in cases where interpretation becomes necessary. A satisfactory relationship between the employer and the contractor at all levels is an important result of smooth relations between the monitoring staff and the contractor’s staff.

(d) Disputed instructions must always be referred to the engineer, and until a decision is received, the best judgment to the instruction should be applied.

(e) By dealing fairly and by recognizing and commending good work, the monitoring staff can usually secure the friendly cooperation and respect of the workmen, an important asset.

(f) The monitoring staff should ensure that any changes they suggest are for the benefit of the work, and not merely to show the authority of the monitoring staff.

(g) The monitoring staff must avoid “criticizing” the contractor’s organization or discussing mistakes discovered with persons not involved with the contract.

(h) Notwithstanding the above, the monitoring staff should ensure that the work is done in strict conformance with the accepted engineering principles and in accordance with the drawings and contract documents.

(i) An incorrect method or procedure must be corrected the first time it is practiced rather than after it has been in use for some time.
Conditions that may lead to unsatisfactory work should be **anticipated** whenever possible, and in any event should be pointed out (preferably in writing) to the contractor at the earliest opportunity, to avoid waste of materials, labour, and strained relations.

In communicating with the contractor and the contractor’s personnel, it is important that the engineer’s representative take a clear position. It is far better to start on a basis of administering the contract firmly in accordance with the plans and specifications than it is to correct a situation caused by laxity later in the contract’s life.

Instructions should be given only to the authorized representative of the contractor (the contractor’s representative, commonly referred to as the site agent). However, on minor and routine matters, and to an extent agreeable to the contractor's organization, instructions may be given directly to the work persons. However, the monitoring staff should not act as superintendent or perform duties for the contractor, nor interfere with the management of the work by the contractor. All orders or instructions should be confirmed in writing with a copy to the engineer.

The monitoring staff may deal directly with the subcontractors to an extent agreeable to the contractor's organization. The contractor is legally responsible for the performance of the subcontractors. Any correspondence between the engineer and the subcontractor must be submitted through the main contractor.

If any doubt exists about a contractual matter, the engineer’s representative has an obligation to clarify in writing the employers’ position for the contractor.

The monitoring staff is cautioned to accept no personal favours from the contractor.

### 2.3.3 With Services Companies and Government Authorities

Good public relations with internal and external stakeholders will have a beneficial effect in completing a construction project within scope, schedule and budget.

Preconstruction discussions that may affect the contract should have involved all stakeholders. Once the contract has commenced the engineer’s representative should encourage the contractor to make early personal contact and establish a good working relationship with staff of affected services companies (e.g. ESKOM, Telkom, Transnet, and other private companies) and government authorities. Such authorities may include: District Municipalities, Provincial Government regional offices, municipal and provincial traffic authorities, the local police and any other government agency with interest in the project. Early personal contact with staff from these agencies and groups will acquaint them with upcoming construction operations and will enable them to have input and schedule their work or services to the best advantage of all concerned.

The engineer’s representative should involve himself in the aforesaid but without assuming responsibility.

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**BEWARE**

All too often, and with the best intentions, monitoring staff issue suggestions / instructions / advice to site personnel who, whilst carrying out these verbal suggestions, incur the wrath of supervisory foremen etc, who are not aware of the input, and admonish the workman for deviating from instructions. It is human nature to offer help where necessary, but any such help should be confirmed ASAP with the relevant supervisor, preferably in writing.
2.3.4 With Interested and Affected Parties

(a) Start public relations early by identifying those parties who are interested in and affected by the project. This information should be readily available from the Environmental Impact Assessment (EIA) process which preceded the contract. Be certain to note the concerns, objections and requests that were recorded at the time.

(b) It is a good idea to arrange at an early stage of the project a meeting with all interested and affected parties and to repeat such meetings periodically.

(c) The nearby property and/or business owners are the ones most affected by construction operations. By courteously listening to their problem, request, or question and by taking the time to explain or answer, the engineer’s representative can generate faith that the employer is not an impersonal organization running roughshod over the general public or the individual. Sometimes this human approach will reduce unreasonable demands and complaints by such owners.

(d) Construction operations (for example, temporary closures of streets and driveways) and construction noise or temporary construction lighting may have an adverse effect on nearby residents and businesses adjacent to the project. Informing business owners and residents near the project about the reason for, and the duration of, the activity will go a long way toward a higher degree of acceptance and tolerance. Timely notice is important. Also consider rescheduling construction activity around major business or public events.

(e) The fullest possible cooperation of the contractor’s organization should be solicited to achieve good public relations most effectively.

(f) It is important to note that in day to day dealings with affected parties the engineer’s representative should be very careful not to compromise the employer’s position on any matter and not to agree to any request which falls outside the scope of the works or his delegated authority. The engineer’s representative should make the limitations of his authority clear and such requests should be directed to the engineer for his further attention.

(g) If blasting or compaction of roadwork layers are to be undertaken which will induce vibrations, the engineer’s representative in conjunction with the contractor and in the presence of, or with the knowledge of the owner/occupant, should do a survey of all nearby structures and record (by way of photos and measurement) all existing cracks and defects or the absence thereof.

(h) Refer Appendix 2A for guidelines with regard to permissible vibrations. The engineer’s representative should ensure that the design of the blast or the equipment used for compaction will induce vibrations within the stipulated limitations. The placement of instruments (called vibrographs or seismographs) for the monitoring of ground vibration at strategic locations will assist in putting everybody’s mind at rest.
2.3.5 With the General Public

(a) The main differences in public relations toward the property owners and the general public occur in the scope of coverage and the degree of personal contact. When construction information must be conveyed to large numbers of road users (including those who commute regularly over a particular route and those who use the route only occasionally), appropriate signage is paramount. In addition, to publicize the upcoming work consideration should be given to making best use of:

- the press and regional radio broadcasts,
- advertised telephone contact numbers,
- SMS services, and
- variable message signs

(b) Frequent notices and progress reports in the local press are also very common and effective methods of keeping the public informed of changing project conditions.

(c) The engineer’s representative is not authorized to issue press releases unless specifically authorised by the employer. From time to time the engineer’s representative will be required to provide information or prepare a draft statement for the employer to issue press releases. In special cases the employer, through the contract, may prepare and distribute pamphlets to motorists who are delayed as they pass through construction.

2.3.6 With Site Staff

(a) Development and maintenance of good relations between monitoring staff is largely a matter of adequate communication and a clear division of responsibility. Site staff must know precisely what their responsibilities are, and they must be given the authority to handle these responsibilities.

(b) It is recommended strongly that engineer’s representatives hold short staff meetings each week. At these meetings the engineer’s representative should brief staff members on the week’s operations, announce any changes or new assignments of responsibility, and discuss any other pertinent subjects.

(c) Engineer’s representatives should provide personnel with an opportunity to demonstrate their strongest capabilities and highest capacity for responsibility. The engineer’s representative should ensure that staff members have an opportunity to gain experience in the various construction phases.

(d) Assignment rotation, especially amongst the lesser experienced members of the team, is encouraged as long as the effectiveness of the overall operation does not suffer. Similarly, if feasible, assign personnel to operations different from those handled on previous projects. Newly assigned personnel should study the applicable portions of the standard specifications, project specifications, the drawings, this manual, and any other applicable publications of the employer and engineer. An individual should not be required to perform new duties until the engineer’s representative is assured that the person is capable of performing them correctly and effectively.
2.3.7 With the Engineer’s Office

(a) Communication is a two-way responsibility. The engineer’s representative should adequately inform the engineer so that he is not embarrassed by learning about project events from outside sources. Conversely, good management practice requires that the engineer keep his personnel informed of decisions affecting an employee’s area of responsibility. Communication has failed whenever an engineer’s representative first hears about an engineers’ decision from outside sources.

(b) An important aspect of internal relations is the necessity for working with other disciplines within the consultant’s organization. People in other disciplines do their work with information available to them, just as construction teams do. They, too, have problems in their work. When there is a difference of opinion on some part of the project, whether it is about design, traffic handling, or some other feature, the engineer’s representative should approach the other party with an open mind to discuss the problem.

2.3.8 With the Employer

(a) Monitoring staff should always keep in mind that they are representatives of the employer. As such, they are expected to conduct themselves in a manner that will command respect and be a credit to the employer’s organization.

(b) Formal communication between the monitoring staff and the employer will normally be conducted via the engineer. However, monitoring staff should ensure that they clearly understand procedures to be followed when communicating with or making submissions to the employer. This will assist in the timely preparation, the use of the right format and the completeness of information required by the engineer.

(c) Neither the engineer nor the employer appreciates unexpected surprises and it is imperative that the engineer’s representative informs the engineer at the earliest opportunity of any significant event or change in current trends, be it good or bad news. Of major importance are changes in expected expenditure, cash flow and progress. Other matters may include quality issues, potential delays and claims, potential variations, complaints from the public, environmental and safety incidents and accidents.

2.4 GENERAL DUTIES

2.4.1 Introduction

Under the general direction of the engineer, the engineer’s representative and his staff, if any, is responsible for the contract administration and management, and construction engineering of the assigned contract. The duties of the monitoring staff with regard to construction engineering aspects are described in more detail in other chapters of this Manual.

The focus in this Chapter is therefore on those duties of the engineer’s representative and his staff which in overview comprise of:

- Contract administration in accordance with the conditions of contract in so far as authority in this regard has been assigned to the engineer’s representative, and
- Management of the contract under the headings of traffic accommodation, scope of the works, cost, time and quality.
2.4.2 Delegated Authority

The authority of the engineer is derived from the Conditions of Contract. This authority may be amended or limited by way of the Particular Conditions amending the General Conditions. The engineer may delegate some of his authority to the engineer’s representative in accordance with the conditions of the relevant Conditions of Contract [e.g. FIDIC clause 3.2]. The delegated authority of the engineer’s representative should be conveyed to him by way of a letter from the engineer in which his authority and the limit thereof, is spelled out clause by clause. An example is presented in Appendix 2C.

For the sake of sound contract administration a copy of the said letter should be given to the contractor for his information.

It is to be noted that the limitation of the engineer’s representative’s authority, and for that matter also that of the engineer, stems from the need of the employer to manage risk, financial risks in particular, at the appropriate decision making level. It should therefore not be viewed as a reflection on the individual’s ability, but rather as a means of providing protection against excessive liability.

The responsibility of the engineer’s representative to administer the contract in accordance with his delegated authority is immense and consequently he should be very familiar with the interpretation and application of the conditions of contract applicable to his project. Ideally he should have received some training in the principles of contract law.

Of equal importance is the fact that the engineer’s representative has no authority other than that delegated to him and hence all instructions issued must be founded on and given in terms of an applicable clause of the Conditions of Contract.

The Conditions of Contract also serves to protect the rights of the contractor and inter alia entitles him to fair compensation for all work instructed and to claim compensation for damages suffered. The contractor may, but is not obliged, to refuse an instruction which exceeds the authority of the engineer’s representative and therefore the engineer’s representative should be acutely aware of the potential consequences in the event of him exceeding his authority.

The engineer’s representative on his part, may not delegate any of the authority which has been given to him by the engineer, to any of his support staff members. Therefore, should the duties assigned to the support staff members necessitate communication with the contractor in terms of the authority derived from the Conditions of Contract, then such written communication must be channelled through the engineer’s representative.

2.4.3 Project Briefing Meeting

Apart from his contract administrative duties, the primary duty of the engineer’s representative and his staff is to manage the contract in the manner described in this manual. To this end it is important that the monitoring staff acquaint themselves fully with all aspects of the contract and therefore, prior to commencement of the contract, the engineer and his monitoring staff should meet with the project leader and his design team to be briefed on all aspects of the project. Attention should be given inter alia to the following aspects:

(a) The design philosophy adopted with reasons
(b) The scope of the works to be performed
(c) Construction restraints specified
(d) Health and safety considerations and risks
(e) Environmental considerations and management plan
(f) Matters effecting interested and affected parties
(g) Traffic accommodation strategy
(h) Specific construction procedures
(i) Considerations to be considered where procedures are at the discretion of the contractor
(j) Design parameters to be considered for temporary works and other items the design of which will be the contractor’s responsibility.
(k) Project specifications which are out of the ordinary
(l) Special quality approval procedures required
(m) Measurement items. A copy of the measurement calculations for all items in the bill of quantities could be useful.
(n) Items in the bill of quantities which are based on assumptions and may vary substantially depending on actual site conditions.
(o) Items in the bill of quantities which may pose a financial risk to either the contractor or employer due to these rates or sums being substantially lower or higher than the estimated rate or sums.
(p) Requirements for and monitoring of contract participation goals in respect of goals set by the employer.

Prior to the commencement of construction, and in a similar vein, the monitoring staff should review the project with the contractor to:

• ensure that the contractor is familiar with all aspects of the contract,
• become acquainted with the contractor’s plan of action and
• discuss anticipated difficulties.

2.5 TRAFFIC ACCOMMODATION

2.5.1 Introduction

The temporary traffic accommodation arrangements and the traffic-control facilities used must be in accordance with the specifications, the drawings and chapter 13 “Roadworks Signing” of the South African Road Traffic Signs Manual.

2.5.2 Objective

The objective of this section is to provide for worker protection and the safe passage of public traffic through and around construction with as little inconvenience and delay as possible.

2.5.3 Planning

Providing for worker safety and the safe movement of traffic through construction zones starts with planning at the design stage, and a traffic accommodation strategy with detailed traffic arrangement drawings should be included in the contract documentation.
2.5.4 Responsibilities and Procedures

The engineer’s representative has the responsibility and authority for administering the traffic accommodation strategy and arrangement and he should perform the following administrative duties:

(a) Compare the plan for traffic accommodation to the actual conditions found at the site.

(b) Workshop the traffic accommodation strategy with the contractor with emphasis on:

- Permissible activities during peak hours, night time and weekends
- Restrictions on road and or lane closures either short term or longer term
- Pavement standard of temporary deviations and the maintenance thereof
- Confirmation of sign layout for various scenarios
- Quality, appearance and construction of temporary signs and facilities to be used and the maintenance thereof.

(c) It is advisable, jointly with the contractor, to also involve the local traffic authority at this stage by soliciting their comment on the proposed strategies in particular with regard to special operations which will necessitate their assistance (e.g. traffic management during beam launching operations) and law enforcement in general. It is important to note that whilst serious consideration should be given to any comment and recommendations made by the traffic authority, their explicit approval of the traffic accommodation arrangement is not a requirement.

(d) Modifications of the traffic accommodation strategy and arrangement may be considered at this point. Given the specifics of a contractor’s needs, it may be possible to provide improved traffic service over the service originally contemplated. Changes requested by the contractor must provide at least equal traffic service to receive favourable consideration.

(e) Proposals for amendment of the traffic accommodation strategy must be approved by the engineer and if approved, must be covered by a variation order. Such ordered changes must include plans in sufficient detail to define all elements of the proposed changes and deviation design.

(f) Some unpredictable, immediate situations of a minor nature or short duration will arise during the work and will require good judgment to obtain optimum results. In these instances, formally approved plans are not required, but the engineer’s representative should specify what is to be done and record in writing actions taken and orders given.

(g) Consider the contractor’s proposal for the position of traffic safety officer. The complexity of the traffic accommodation strategy will dictate the qualifications and level of responsibility expected from the incumbent.

(h) Workshop the required procedures and responsibilities with the appointed traffic safety officer – refer to the project specifications for further guidance.

(i) To establish a record of the geometry, markings, devices, and signs that existed at any time during the project, maintain in sufficient detail a record of the placement into service, changes, and discontinuance of existing roads and deviations. The form of the record may vary according to the magnitude and complexity of the subject. Dated notations or revisions to plans may be helpful. Dated photographic or video tape records, particularly of points of transition or difficult situations, are very valuable and are required for accident records etc.

(j) If the contractor’s operations interfere with or cause potential safety problems with vehicular or pedestrian traffic, contact the contractor immediately and request correction of the deficiency. If necessary, direct the contractor in writing to act at once to remedy the
unsatisfactory situation. A contractor’s failure to perform is cause to order the cessation of the operations and/or the application of penalties as may be provided for in the specifications.

(k) Arrange jointly with the contractor, an information session with the local traffic authority to explain the various traffic accommodation scenarios that will be implemented and where and when their active assistance will be solicited. Agreement should also be reached regarding law enforcement especially with regard to speeding.

(l) Timely publicity can significantly improve traffic behaviour on a construction project. A motorist who is forewarned of construction conditions will be more tolerant of delay and inconvenience and will probably be more alert and responsive to construction zone control.

2.5.5 Guidelines for Traffic Accommodation Strategy and Arrangements

The engineer’s representative will not normally be required to develop and design traffic accommodation strategies, deviation layouts and sign sequences. However, complaints and abnormally high accident rates may require him to critically evaluate the traffic accommodation arrangement with the view of proposing or making improvements.

2.6 SCOPE MANAGEMENT

2.6.1 General

Scope management is essentially the processes required to ensure that the project includes all the work required, and only the work required, to complete the project successfully. It is primarily concerned with defining and controlling what is or is not included in the project.

For the purpose of this manual the scope of the works is defined in the Description of the Works (Part C3), the Drawings, and the Pricing Schedule (Part C2.2). Further clarification of the scope of the works should stem from the project briefing meeting (refer paragraph 2.4.3).

In general, there are two types of specifications: “end-result/performance based” and “method/prescriptive.” For work governed by end-result specifications, the engineer determines “what” and the contractor decides “how.” Method specifications are more restrictive as to the contractor’s options. Deviations from specified methods require variation orders. Deviations must also provide equal or better results while preserving the contract’s integrity.

Scope management therefore also includes controlling the “how” and adequacy of various procedures that the contractor proposes to follow or is obliged to follow and is discussed in 2.6.4 under the heading of Method Statements. It also includes all temporary works as discussed in 2.6.5.

A variation of the original scope of the works may become necessary for a number of good reasons and may be initiated by the employer, the engineer or the contractor.
2.6.2 **Procedure**

The monitoring staff should perform the following procedures:

(a) Produce a work break down structure for the scope of the works.

(b) The break down structure should be in sufficient detail to facilitate:

- compilation of the contractor’s program for the purpose of monitoring progress
- linking of each item of work to the specifications – refer quality management under paragraph 2.9.
- linking of each item of work to a payment item in the bill of quantities.
- calculation of quantities applicable to the relevant pay item

(c) From an analysis of the above said the following should follow:

- confirmation that all work has been included in the contractor’s program
- confirmation of the logic and sequence of activities in the contractor’s program
- confirmation or correction of all quantities in the bill of quantities in so far as they are not based on assumptions yet to be confirmed.
- confirmation of quantities sensitive to varying or actual site conditions
- identification of quantities and/or pay items which may have been inadvertently omitted and which will thus constitute a variation and / or claim.
- identification of details on the drawings which may be lacking or require clarification

(d) Check bending schedules with emphasis on the following:

- the critical bending dimension of bars which need to fit in between formwork faces, remember to consider the allowable bending tolerance.
- for identical units (e.g. wingwalls, beams, columns etc) check that the quantity of each bar type has been multiplied by the appropriate number of units.

(e) Check steel layout drawings with emphasis on the following:

- the practicality of fixing steel in the positions intended in areas which are congested with a high percentage of steel, e.g. bursting steel underneath bearings and behind stressing heads
- the available space to get concrete and vibrating pokers into areas where heavy bars overlap e.g. in heavily reinforced slender columns.

**TIP**

It is worth the effort to draw out critical areas or sections to a large scale e.g. 1:10, if not to full scale, showing actual steel diameters and bending radii to verify the actual position of bars and the available gaps for inserting concrete vibrating pokers.
2.6.3 Variations

Variations are per definition a deviation from the original intended scope of the work and can be classified as any of the following (for example refer FIDIC clause 13.1):

(a) Changes to the quantities (increase or decrease) of any item of work. [but not on account of the actual measured quantities merely varying from that stated in the bill of quantities on account of inaccurate estimating]

(b) Changes to the quality and other characteristics of any item of work. [e.g. a revision of the desired concrete properties]

(c) Changes to the levels, positions and/or dimensions of any parts of the works. [e.g. revised founding level or revised extent of river bank protection]

(d) Omission of any work [e.g. a “nice to have” which is not necessary for the completion of the works or is no longer required for whatever reason. It is important to note that if work is omitted in order for it to be done by another contractor (e.g. routine maintenance contractor), the act of omission may constitute a breach of contract by the employer]

(e) Any additional work necessary for the permanent works. [typically this would be work which is necessary for the completion of the project but which may have been inadvertently omitted from the drawings or bill of quantities]

(f) Changes to the sequence and timing of the execution of the works. [only on account of the engineer’s instruction or for reasons beyond the control of the contractor]

Monitoring staff should be aware of the following:

(a) Only the engineer may issue a variation order and then only with the explicit approval of the employer – refer for example, procedure for variations in paragraph 12.8 of Part 1 of the SANRAL Works Contracts Manual of Procedures.

(b) The issue of a revised drawing may constitute a variation and thus the necessity for such drawings to be signed by the employer.

(c) Monitoring staff should thoroughly familiarise themselves with notice periods since these may vary for the different forms of contract. [e.g. unlike GCC, FIDIC does not require the contractor to confirm within 14 days that he deems an instruction to be a variation and the monitoring staff may only become aware of the contractor’s contention when notice of a claim is received 28 days later].

When a variation is contemplated the monitoring staff should assist the engineer in the following manner:

(a) Define the scope of the variation

(b) Produce a draft motivation for the required variation

(c) Define the appropriate specification applicable

(d) Define the existing payment items applicable and where necessary, the need for new items

(e) Discuss the above with the contractor to solicit his agreement to the scope, specifications and applicable pay items. Note that if the contractor is not agreeable to any one of the above, the engineer should be informed and will give guidance on the way forward to reach agreement.
(f) Request new rates from the contractor where required. The contractor should be requested to provide the following:

- substantiation of the new rate by providing a breakdown of its labour, plant, equipment, material, overheads and profit components
- the production rates on which the labour and plant rates are based,
- the re-use and wastage factors for materials to be used.
- the de-escalation calculation
- all of the above for a relevant existing rate in the schedule as a basis for comparison.

(g) Clarify any of the above with the contractor and submit their recommendation to the engineer together with all substantiating information. Note that in order to prevent embarrassment; the monitoring staff should not agree any new rate with the contractor without the prior approval of the engineer who needs to seek approval from the employer before such acceptance of a new rate can be given.

It must be recognised that there is often a tendency for the above process to be dragged out ultimately to the frustration of all concerned. Generally no work is permitted without authorisation of the variation order. Consequently the process should be approached in a diligent manner and time limits (e.g. 7 days) should be placed on response times so that the matter can be concluded speedily.

2.6.4 Method Statements

The authority to request method statements from the contractor is derived from the Conditions of Contract, for example clause 4.1 of FIDIC states that “The Contractor shall, whenever required by the Engineer, submit details of the arrangements and methods which the Contractor proposes to adopt for the execution of the Works”. This authority should be delegated to the engineer’s representative – refer paragraph 2.4.2

In exercising his authority to call for method statements the engineer’s representative should apply sound judgment having regard to the proven expertise and competencies of the contractor. The perception must not be created that the contractor’s know-how is in question or that the engineer’s representative himself does not actually know how the work is to be done.

The following guidelines and principles should be adhered to:

(a) The focus of a method statement could be any one or a combination of the following:

- the technical procedures to be followed, i.e. method specification,
- to serve as a vehicle for the submission of designs for temporary works (refer also 2.6.5),
- quality when it is dependent on the choice of materials, workmanship and attention to detail,
- programming of activities when time is of the essence,
- resource allocation and planning,
- efficiency of traffic accommodation arrangements,
- safety of workers, general public and traffic, and

TIP
A method statement outlined on a white board and captured in a photo thereof will more than often serve its purpose.
• environmental considerations and risks.

(b) A method statement is for the benefit of all concerned – not just the contractor.
(c) It creates confidence that the work will be done right the first time.
(d) It promotes proper planning of resources required.
(e) It ensures that quality of the end product, which is method dependent, will be attained.
(f) If done jointly, it will incorporate all the best ideas.
(g) Monitoring staff should participate actively by making suggestions and asking what-if questions. They should take care not to assume any responsibility or liability.
(h) The procedure to be followed and the format in which the method statement is required should not create an unnecessary burden or drown the contractor in paper work.
(i) The ideal forum for discussing, agreeing and capturing method statements is at a technical meeting.
(j) Method statements for work which is of a repetitive nature, should be revisited to incorporate lessons learned.
(k) Adherence to an agreed method statement should be strictly enforced.

2.6.5 Temporary Works

Temporary works are generally defined to mean all work required for or in connection with the construction of the permanent works in accordance with the contract. It therefore includes work such as shoring of excavations, falsework (staging or scaffolding) and formwork (shuttering) for concrete elements.

Although it is a requirement of the contract that the contractor shall be solely responsible for the design, safety and adequacy of all temporary works, the engineer’s representative nevertheless has a duty of care to ensure that the contractor meets his obligations, not only with regard to the quality and dimensional tolerances of the permanent works, but also with regard to the safety thereof in accordance with the Construction Regulations (refer also paragraph 2.10). It follows that the engineer’s representative should ensure that the design, erection and maintenance of the temporary works are being done under the supervision of competent persons in accordance with the contractor’s health and safety plan. He should also review the design and inspect the erection and maintenance thereof for obvious omissions and short comings.

Also of importance is the need to ensure that the contractor has been provided with all the information which he will need to do a proper design and which may not be readily available to him, for example, wind loading on super structures and super imposed traffic loading alongside an excavation. The engineer’s representative is advised to consult with the engineer on these matters.

2.6.6 Changes to Designs

Major design changes are not likely to emanate from the site monitoring staff, but quite often minor design changes stemming from for example, a peculiar site geometry, constructability considerations, unknown services, or detailing errors on the drawings, may result in a desire to amend a design. Such an amendment, if approved, will be the subject of a variation and, as stated in paragraph 2.6.3 above, it requires the explicit approval of the design office, the employer and the engineer.

The process is normally initiated by the engineer’s representative who will compile a motivation (with supporting sketches, photos etc) in the format of what may be referred to as a Field Change Request (FCR). The FCR should then be submitted to the design office via the engineer. If approved it will
result in a variation order issued by the engineer and may also include the issuing of additional or revised drawings.

The above will always apply to all structural concrete elements but not necessarily to non-structural elements. The engineer’s representative should apply sound judgement and if in doubt, consult with the engineer.

2.7 COST MANAGEMENT

2.7.1 General

The purpose of cost management is first and foremost:

- to give effect to the relevant clauses in the conditions of contract which governs measurement and payment to the contractor [e.g. FIDIC clauses 12, 13 and 14], and
- to provide realistic information about expected expenditure and future cash flow.

2.7.2 The Schedule of Quantities

The schedule of quantities should ideally be in electronic format, preferably Excel or similar, to allow additional calculations to be performed as work progresses, refer example Appendix 2B.

Ensure that the schedule has been updated with amendments issued under notices to tenderers. It is a good idea to highlight or lightly shade item descriptions or numbers which have been amended by way of a notice to tenderers for the sake of clarity.

Ensure that the schedule adds up to the tender sum.

To reduce the number of printed sheets in a payment certificate, empty lines should be deleted and item description shortened to two or maximum three lines.

2.7.3 Quantities

The accuracy of quantities in the schedule and the completeness of the pay items provided, should be checked at the earliest opportunity so that if required, corrective action can be taken.

The Conditions of Contract may provide for adjustments in the amounts due to the contractor as a result of variations in measured quantities or additional work instructed exceeding certain limits. For example in the case of GCC the general items may qualify for adjustment [GCC clause 50] but in the case of FIDIC any item in the schedule may qualify for a new payment rate should certain criteria be met [FIDIC clause 12.3(a)]. Monitoring staff will do well to identify those items with the potential to qualify for a rerating and to monitor them carefully with the view of limiting quantity variations where possible or where variations cannot be prevented, to gather records which will assist with the determination of a new rate.

The estimated final quantities should be updated monthly, but in any event as soon as new information which will affect final quantities or sums becomes available. This is especially relevant in the case of provisional and PC sums and items with an element of risk which may contain a certain amount of ‘fat’. In the case of items with an element of risk the estimated quantities should be adjusted gradually as the risk or uncertainty diminishes. The intent is to report gradual changes in the expected final contract expenditure. Sudden and large changes in expected expenditure either up or down are highly undesirable and may reflect negatively on the engineer’s representative – refer also paragraph 2.3.8.
2.7.4  Measurement

The measurement of the works is governed by a relevant clause of the conditions of contract [in the case of FIDIC it is clauses 12.1 and 12.2].

It is important to note that the responsibility for measuring the work lies with the engineer (monitoring staff) and not with the contractor. The contractor has a duty to assist the engineer when measurement is to be done and to provide such particulars as may be required [FIDIC clause 12.1].

It follows that for work which can not readily be measured from the drawings, the monitoring staff should be proactive and measure when it is appropriate to do so and not leave it until the end of the month at which time the work may already have been covered up. Typical examples would be the depth of foundation excavations, the volume of concrete in a foundation plinth, and the like.

Although the electronic age presents many opportunities for measurements to be done using computer technology, the recording and record keeping of measurements remain very much a manual operation with hard copy evidence. The following procedure should be followed:

(a) For every pay item a separate sheet should be prepared on which is recorded the quantity measured for the month and a running total. Refer example in Appendix 2D.
(b) The calculations to substantiate the total measured to date should be filed with every pay item sheet.
(c) The contractor should be given the opportunity to examine the calculations and if he agrees with it, the quantities should be signed off as final.
(d) If the contractor disagrees with the quantities measured, the matter should be referred to the engineer who will either confirm or vary them.
(e) Completion of an interim certificate should not be delayed on account of a disagreement, but a conservative interim quantity should be agreed pending the engineer’s decision.

2.7.5  Budgets and Cash Flow

The employer is dependent on reliable actual and expected expenditure reporting in order to manage its budget and cash flow effectively. Providing such reliable information is thus an important responsibility of the engineer’s representative.

The cash flow for the estimated outstanding expenditure is dependent on the contractor’s program and is therefore usually determined by him. The engineer’s representative should exercise caution when presented with these figures, because apart from the warning in the box alongside, payment is not due when the work has been done, but when it has been accepted. Matters such as non-conformances, waiting periods for test results, and measurement and payment disagreements, may cause actual cash flow to lag that of the program by a month or more. In addition, variation orders, claims and volatility in contract price adjustment and special material prices needs to be taken into consideration. This is especially important towards the end of the financial year when the employer is dependent on reliable information for balancing current year expenditure.

BEWARE

Contractors are notoriously optimistic about anticipated progress and are more likely to overestimate than underestimate cash flow.
The cash flow graph (Fig 2.1) for the full extent of a contract in theory follows an S-shape and is a useful point of departure. The formulas are as follows:

\[
C_{ux} = C \times \left( \sin\left( \frac{M_x}{M} \times 2.215 - 0.751 \right) \times 0.596 + 0.407 \right)
\]

\[
C_{lx} = C \times \left( \sin\left( \frac{M_x}{M} \times 1.288 - 1.402 \right) \times 1.147 + 1.131 \right)
\]

Where:
- \( C \) = Contract value
- \( M \) = Contract period (in months)
- \( M_x \) = Month x
- \( C_{ux} \) = Upper value in month x
- \( C_{lx} \) = Lower value in month x

Note: Calculation of angle to be done in radians

![Figure 2.1: Cash flow graph](image)

Contract price adjustment can contribute significantly to the predicted cash flow and the eventual contract amount, especially in periods of high or rising inflation. Since its value is based on uncertain future events which are beyond the control of all concerned, it is very difficult to predict with any measure of certainty. Nevertheless, the engineer’s representative should make use of the best available information to estimate future contract price adjustments. The following is suggested:

- Keep a running record of historic (say last two years) contract price adjustment factors
- Using the statistical functions of Excel (e.g. TREND) to determine a trend line for the recent past performance of the CPA factor.
- Apply best judgment regarding the future trend (some insight in macro economic policy is useful)

Note that no two persons will arrive at the same answer but in order to justify significant deviations in predicted cash flow from actual cash flow stemming solely or partly from contract price adjustment, the engineer’s representative must be able to show that he has applied his mind to the problem. Refer to Appendix 2E for an example with further explanatory notes.
Variations and claims will also have a significant impact on the final contract amount and provision for these needs to be made as soon as reasonable certainty exists that a variation will be required or a claim may be successful.

2.7.6 Reporting

The manner in which expenditure to date and future cash flows are to be reported is prescribed by the employer and entails the use of a set of standard forms for payment certificates, appendices to minutes of site meetings and the like. Details in this regard are not included in this manual.

2.8 TIME MANAGEMENT

2.8.1 General

Contract time management includes the processes required to ensure timely completion of the project. The time allowed for completion is stipulated in the contract and failure by the contractor to complete in time will result in the stipulated penalties being levied.

The development and maintenance of a contract time schedule, commonly referred to as ‘the program’, is an essential part of time management and monitoring staff should familiarize themselves with the processes and various tools and techniques which can be used.

2.8.2 Contract Time Schedule

The major processes in developing the contract time schedule are:

- Activity definition – identifying the specific activities that must be performed to execute the work, also referred to as a work breakdown structure.
- Activity sequencing – identifying the interactivity dependencies.
- Activity duration estimating – estimating the number of work periods (normally working days) that will be needed to complete individual activities.
- Schedule control – controlling changes to the contract schedule.

The development of the contract time schedule (contract programme) is the responsibility of the contractor (refer e.g. FIDIC clause 8.3). Depending on the complexity of the project the above processes can become very involved but most contractors follow a relatively simplistic approach.

The monitoring staff should refer to other literature for a detailed description of the theory of programme scheduling. For the purposes of the manual the following brief summary is given:

(a) Activity definition involves identifying and documenting the specific activities that must be performed to produce the deliverables identified in the work breakdown structure and will include constraints that limit the contractor’s options.

(b) Activity sequencing involves identifying and documenting logical interactivity relationships. Activities must be sequenced accurately to support later development of a realistic and achievable schedule.
The sequences of activities are determined by dependencies which could be:

- Mandatory – those that are inherent in the nature of the work, e.g. it is impossible to erect the superstructure until after the foundations have been built, or
- Discretionary – those that involve a choice and may e.g. be dependent on the traffic accommodation strategy or the employer’s preference as stipulated in the project specifications.

A typical tool and technique for activity sequencing is the precedence diagramming method (PDM). This is a method of constructing a project network diagram that uses boxes to represent the activities and connects them with arrows that show the dependencies as shown in Fig. 2.2.

![Figure 2.2:](image)

(c) Activity duration estimating is the process of taking information on project scope and resources and then developing durations for input to schedules. It can be made a complicated exercise but is generally determined from the available resources (e.g. number of carpenter teams) and historic records of production achieved on previous projects for similar work.

(d) Schedule development means the determination of start and finish dates for project activities. This can be done manually but is best done using suitable computer software e.g. Microsoft Project.

The output of the schedule is usually in the form of a bar chart, also called a Gantt chart, as shown in Fig. 2.3.

![Figure 2.3: Example of a Gantt chart](image)

There are many acceptable ways to display project information on a bar chart depending on the intended purpose. Computer software such as Microsoft Project is very powerful in the hands of a knowledgeable and experienced user.

For smaller and short term duration projects a computer programme such as Excel can also be used, but it has serious limitations when programme amendments and updating becomes necessary.
2.8.3 Approving or Verifying the Programme

It should be noted that some conditions of contract (e.g. GCC) requires the engineer to approve the programme while others, such as FIDIC, merely require the engineer to verify that it complies with the contract.

Monitoring staff should consider the following when presented with the programme:

(a) Presentation of programme

- Should be in electronic format with hard copy
- Provide details of hours per day and days per week on which programme is based.
- Provide details of production rates and resources used for major activities.
- Provide details of constraints such as activities with ‘Start No Earlier Than’ or ‘Finish No Later Than’ dates or activities which can only be done at night or on weekends for example
- The critical path should be clearly identified.

(b) Completeness of activity list

Compare the programme activities with the work breakdown structure compiled as described under paragraph 2.6.2. Minor items are often overlooked and these ‘forgotten’ items of work can be time consuming and pose a restraint on completion especially towards the end of the project when the contractor may be pressed for time.

(c) Logic of programme

The logic of the activity sequence should be thoroughly checked. Pay special attention to:

- Illogical links.
- Overlap (lag) of concurrent activities.
- Time allowed for mix design approval.
- Time allowed for critical information.
- Time allowed for curing and strength development of concrete.

- Allowance for float – the ownership of float is always a debatable issue and the contractor is best advised not to show any initial float, especially on his critical path.
- Time allowed for inclement weather under the contract. Contractors have different ways of accounting for these in their programmes. The most appropriate method is to include additional time in the durations of the more weather sensitive activities on the critical path.

TIP

The network diagram view in Microsoft Project is very useful for checking the logic of the program.
2.8.4 Updating

The original approved programme is only valid for as long as all goes according to plan, which is seldom the case. Consequently the programme needs to be updated with actual start and completion dates as the work progresses. This may have the effect that the anticipated completion date and/or critical path will change. Updating a programme manually is a laborious task which will eventually be neglected, hence the insistence that the contractor should use a purpose made computer program such as Microsoft Project.

Although the programme and its maintenance is fundamentally the responsibility of the contractor, it is good practice for the monitoring staff to run a duplicate programme for the sake of comparison and control.

Reviewing of the programme should be done at least monthly and the programme should be updated whenever a delay event occurs (refer paragraph 2.8.5 below).

If for whatever reason, the logic or sequence of activities becomes outdated and the programme no longer represents reality, the contractor may request or the engineer’s representative may instruct that the programme be revised to reflect the fundamental changes. It is important to note that the programme should be updated to the agreed date of the change to establish a base date for the revised programme. It follows that the revised programme should only consider outstanding items of work.

2.8.5 Delays and Float

Delay events may be attributed to a cause brought about by the contractor himself e.g. a plant breakdown (non-excusable delay or contractor’s delay) or the employer e.g. late information (excusable delay, employer’s delay, relevant event or compensation event) or by circumstances beyond the control of both parties e.g. weather, war, etc (may be excusable depending on the terms of the contract).

The meaning of the word ‘delay’ is not always clearly defined and what may be a delay in terms of one form of contract may not be in another. It is generally accepted that a ‘delay to completion’ can be defined as a delay which causes the works to continue beyond the contractual completion date, or contractually extended completion date. The essential cause of the delay is a delay or extension of the duration of one or more critical activities.

A non-excusable delay (i.e. a delay event within the control of the contractor) is a contractor’s risk for which he has to make provision in the duration of activities. This provision of time for possible delays is commonly called ‘float’ in the programme. It is common practice to ‘hide’ the available float in the original programme i.e. the end date of the last activity is equal to the contract completion date. As the work progresses and assuming that the work is completed in a shorter time than planned, the updated programme will show an earlier expected completion date and thus ‘contract float’ will develop between this date and the contractual completion date.

Non-excusable delays which may cause the projected completion date to exceed the contractual completion date, do not entitle the contractor to any claim for extension of time and he has to accelerate at own cost to make up the lost time.

Excusable delays on the other hand may entitle the contractor to an extension of time depending on inter alia the availability of ‘contract float’ and the never ending arguments regarding ownership thereof. A discussion of the circumstances which will entitle the contractor to an extension of time and the quantification thereof is beyond the scope of this manual. What is however very important, is the fact that the assessment of delay claims has become very dependent on the proper management and updating of the construction programme.
The monitoring staff must therefore ensure that:

- The current programme is relevant and is regularly updated.
- As soon as an excusable delay event occurs the programme should be updated up to the day of the start of the event and a copy thereof saved for future reference.
- Similarly, when the delay event is over a copy of the updated programme should be saved.
- The monitoring staff may not always realise that an excusable delay event has occurred and the value of comprehensive site diaries (refer paragraph 2.12.2) will prove their worth when programmes have to be updated retrospectively to a date somewhere in the past.

### 2.8.6 Reporting

The contractor will be required to report on progress and programme at each site meeting. The format and content of these reports is dependent on the needs of the employer and engineer and guidance is to be obtained from them in this regard.

For proper day to day planning the monitoring staff have different needs and the engineer’s representative is advised to insist on the following:

- A revised programme submitted weekly and representing a 2-week window of the main programme and refined to show the planned daily activities.
- A revised programme submitted monthly showing milestone events (information required, method statements to be submitted, etc) for the next two months.

### 2.9 QUALITY MANAGEMENT

#### 2.9.1 General

Quality management includes the processes required to ensure that the project will satisfy the needs for which it was intended (fit for purpose). It includes all activities that determine the quality policy, objectives and responsibilities and implements them by means such as quality planning, quality assurance, quality control and quality improvement.

In the subsequent chapters the quality aspects of the various project components are dealt with in detail. In this chapter the processes and principles applicable are therefore only described in overview. The monitoring staff should note that these principles apply as much to their own activities as it would apply to that of the contractor.

#### 2.9.2 Quality Plan

At site level the quality plan is in essence a framework of all deliverables and identifies which quality standards are relevant and determines how to satisfy them. There are various approaches that can be followed but a good starting point would be the schedule of quantities. In order to qualify for payment under any item the contractor must meet certain requirements. A spreadsheet can therefore be produced showing the following:

(a) A list of all payment items with short description

(b) Reference to the applicable project specification clause, drawing, standard specification and other sources of knowledge (manuals) etc.

(c) The scope of the deliverable – what is included and what is excluded
(d) Method of evaluation – visual inspection, laboratory test, measurement with instruments, documentation or records to be produced, etc
(e) Frequency and time of assessment - e.g. for reinforcement at start of steel fixing and again 3 hours before casting of concrete.
(f) Number of tests or samples required - e.g. number of cubes
(g) Party or person responsible - distinguish between process and acceptance control.
(h) Method of communicating request for assessment – e.g. site note, request-for-approval book
(i) Method of and responsibility for reporting and record keeping
(j) Procedure for communicating (non)-approval and findings

The aforesaid implies that the engineer’s representative should have at his disposal not only the applicable standard specifications (e.g. COLTO), but also relevant SANS specifications, TMH manuals etc.

The quality plan should be workshopped with the contractor to obtain his input (especially on process control) and buy-in on the procedures to be adhered to. The intent must be to ensure a clear understanding by all concerned of what is required so as to eliminate misunderstandings and surprises.

2.9.3 Quality Assurance

Quality assurance is all the planned and systematic activities implemented within the quality system to provide confidence that the project will satisfy the relevant quality standards and should be performed throughout the duration of the contract.

Typically the quality assurance activities will include:

- Visual inspections preferably with reference to a check list
- Collection of samples and conduction of tests and measurements both on site and in the laboratory.
- Produce and agree content of method statements
- Check and verify correctness and completeness of construction information and details for both temporary and permanent works
- Audits on procedures and testing methods

The extent and detail of quality assurance procedures required is dependent on the nature, size and complexity of a project. Typically and with reference to the quality plan as described above, procedures for the following actions should be implemented:

- Identification of all elements of work subject to quality evaluation – (schedule and work breakdown structure).
- Identification of applicable quality standard required – (project specifications)
- Identification of method of evaluation – (visual, laboratory tests etc)
- Identification of tools and equipment required for the methods of evaluation – (checklists, forms, computer programmes, laboratory equipment etc)

<table>
<thead>
<tr>
<th>TIP</th>
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<tr>
<td>To keep track of each element of work, it should be given a unique number starting with the entry number in the Request for Approval book.</td>
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Contractual Aspects and General Duties
• Initiation of approval process and paper trail of progress – (‘request for approval’ book, to evaluation results, to payment, and to as-built information)
• Recording of work approved and control to ensure all work is covered – (diagrams or bar graphs with colouring, dates and unique element number).

2.9.4 Quality Control

Quality control involves monitoring specific project results to determine if they comply with relevant quality standards, and identifying ways to eliminate causes of unsatisfactory results. Project results include both product results, the works of the contractor, and contract administration results, such as cost (cash flow) and time-schedule performance.

Put in another way, quality control is about maintaining the required quality standard and taking corrective action whenever a deviation becomes evident. Useful tools in this regard would be graphs of the moving average and trend lines of results obtained.

The monitoring staff should have a working knowledge of statistical quality control, especially sampling and probability, to help evaluate quality control outputs. Among other subjects, the team may find it useful to know the difference between:

• Prevention (keeping errors out of the process) and inspection (keeping errors out of the end product)
• Attribute sampling (the result conforms, or it does not) and variables sampling (the result is rated on a continuous scale that measures the degree of conformity – the partial payment case)
• Special causes (unusual events) and random causes (normal process variations)
• Tolerances (the result is acceptable if it falls within the range specified by the tolerance) and control limits (the process is in control if the result falls within the control limits)

The monitoring staff must be careful not to confuse quality with grade. Grade is a category or rank given to entities having the same functional use but different technical characteristics. Low quality is always a problem; low grade may not be. For example, a formed concrete surface may be of high quality (hard durable and sound concrete surface) and low grade (as-stripped surface finish), or of low quality (powdery, blow holes or honeycombing) and high grade (high quality formwork panels for intended class F3 finish).

2.9.5 Laboratory

Access to a suitably equipped and accredited laboratory is essential and unless a commercial laboratory which meets the set standards, are available nearby, it is standard practice to establish a laboratory on site. The staffing and equipment is always subject to the approval of the employer.

The standard specifications (e.g. COLTO) makes a distinction between process control testing and acceptance control testing. The former refers to those quality control procedures which the contractor should exercise in order to satisfy himself and the engineer that the work being done meet or will meet the requirements of the specifications, whilst the latter refers to the testing done by the engineer on completion of the work to verify the acceptability of the work in accordance with the required standards specified. Process control and acceptance control therefore often implies duplication of the same test for example, the making of concrete cubes. Consequently it has become common practice for the engineer and contractor to have a combined laboratory under the control of the engineer, which will conduct both the process and acceptance control testing without duplication of results. As part of his process control responsibility the contractor is required to make a contribution towards the
establishment and running of the laboratory. The monetary value of the contribution and the ways in which it can be made, will be specified in the project document.

2.9.6 Non-conformance

A non-conformance should be formally registered using the appropriate form when work does not meet the required standard. However, monitoring staff should be aware that many contractors will rectify their mistakes without being prompted and dislike non-conformance reports which have been issued in an over eagerly manner. Normal practice is to issue such a report only when the contractor has submitted a request for approval and the work still does not meet the requirement, or in cases where the required corrective action is non-standard (e.g. epoxy repair) or may require a concession, reduced payment, or additional or varied work.

A non-conformance which cannot be corrected to its original intended standard, must be reported to the employer before a decision is taken on corrective action. Substandard work which is to remain in place must be authorised by the employer.

2.10 HEALTH AND SAFETY

2.10.1 General

Health and safety on site is governed by the Occupational Health and Safety Act No 85 of 1993 and the regulations made in terms of this act, the most notable of which is the Construction Regulations, 2003.

There are a number of other regulations which may also be relevant to the project regarding matters such as environment for workplaces, explosives, general safety, general administration, hazardous chemicals, noise, electrical machinery etc.

The act and associated regulations in essence are intended to focus on minimising the incidence of accidents and exposure to hazards in the workplace. Its focus therefore should be about preservation of life and not on the negative consequences of accidents in the workplace, the root cause of which is poor management.

In overview the Construction Regulations ensure that:

- Hazards or potential hazards to a healthy working environment are identified.
- These hazards are removed or reduced.
- Employees are trained to work safely in potential hazardous conditions

2.10.2 Responsibilities

The Construction Regulations ensure that not only the contractor but also the employer has a responsibility to provide a safe and healthy working environment for all employees. The Regulations also place a responsibility on the designer, irrespective of his involvement in the construction phase of the project, to ensure the safety of his design.

TIP
The engineer’s representative should insist on a proper health & safety report to be tabled at each site meeting which demonstrates pro-active rather than re-active actions taken.
As the appointed agent of the employer, the engineer and by implication the monitoring staff, must ensure that the employer’s responsibilities in terms of clause 4 of the Regulations are complied with. This responsibility commences at the design stage with the preparation of a health and safety specification. Once construction commences, the engineer’s representative will, depending on his delegated authority, have the responsibility to:

- Ensure that the contractor is supplied with the necessary information to compile his health and safety plan.
- Recommend approval of and ensure that the contractor’s health and safety plan is implemented and maintained.
- Recommend that the contractor be stopped from executing work which is not in accordance with the approved health and safety plan or poses a threat to the health and safety of persons.
- Manage changes to the health and safety plan of the contractor.
- Ensure that the contractor exercises a similar duty and responsibility towards his appointed sub-contractors.

In order to perform their duties to the required professional standard the monitoring staff should have a working knowledge of the Act and in particular the Construction Regulations. The employer may choose to appoint or permit the engineer to appoint an independent safety consultant to conduct periodic audits as a check on the regular audits conducted on site. The services of such a consultant will greatly ease the burden on the engineer’s representative especially with regard to the many administrative requirements of the Regulations.

### 2.10.3 Health and Safety Plan

The contractor’s health and safety plan should be based on the following principles:

- A proper risk assessment of the construction work.
- Pro-active identification of potential hazards and unsafe working conditions.
- Informing and/or training of employees in hazards and risk areas.
- Provision of a safe working environment and safety equipment.
- Ensuring the safety of his sub-contractors through their safety plans.
- Monitoring the health and safety on the construction works on a regular basis.
- Use of competent safety officers.

Monitoring staff should take note of the following:

(a) Most contractors will have a generic health and safety plan which will be amended to suite the current contract. This cut and paste exercise, if not done properly, results in ‘nonsense’ being included in the plan.

(b) The most important part of the plan is the project specific risk assessments. These must be properly done and should describe in sufficient detail:

- the nature of the risk identified and its potential consequences
- the possible alternatives available to mitigate the risk
- the procedures and measures decided upon
• the details of how these procedures and measures will be implemented - the way in which employees are to be informed, instructed, trained, and equipped.

• the control procedures to be put in place to enforce adherence.

(c) The health and safety plan must cover all the temporary works of the contractor.

(d) It is not possible to eliminate all risks but it must be shown that the contractor has applied his mind to the problem and has made a conscious decision as to how best to mitigate the risk.

(e) Risks not previously contemplated will be identified from time to time and these need to be dealt with as stated above in a speedy manner and incorporated in the health and safety plan.

(f) The health and safety plan may turn out to be nothing more than lip service because old habits tend to prevail. Health and safety consciousness requires a change in culture which must be driven by management in a disciplined manner. The engineer’s representative should not hesitate to use the powers at his disposal (penalty clauses) to encourage such discipline.

(g) The weak link in the management chain is often the appointed ‘competent employee’ who must supervise the safety aspects of a particular aspect of the works. These persons often lack the necessary competence. The same may apply to the ‘safety officer’ who may be appointed on bigger projects.

(h) To be effective the health and safety plan must be managed in a pro-active manner. The engineer’s representative should not allow the contractor to become merely reliant on prompts from the monitoring staff and audit reports before action is taken to rectify unsafe situations.

2.11 ENVIRONMENTAL MANAGEMENT PLAN

2.11.1 General

The purpose of the environmental management plan is to ensure that impacts associated with the construction phase of the project are kept to a minimum. In this regard, the environmental management plan sets environmental targets for the contractor and any nominated or selected subcontractors, and reasonable standards against which the contractor’s performance can be measured during construction.

The environmental management plan is an output of the environmental impact assessment process and will have been approved by the relevant national or provincial department (as applicable to the employer) responsible for environmental affairs acting in accordance with the National Environmental Management Act, 107 of 1998 (NEMA). Such approval is currently called the ‘Environmental Authorisation’. Previously it was called the ‘Record of Decision’. On certain contracts an environmental authorisation may not be required and the employer’s generic environmental authorisation will then apply.

Other authorities who may also be involved are amongst others:

Department of Water Affairs: who may have to issue a Water Licence for activities such as:

• Impeding or diverting the flow of water in a watercourse; and

• Altering the bed, banks, course or characteristics of a watercourse
Provincial Heritage Authority: with regard to for example:

- alteration or demolition of any structure or part of a structure which is older than 60 years
- archaeological materials or objects
- any grave or burial ground older than 60 years

Department of Mineral Resources: with regard to borrow pits and rock quarries
Department of Agriculture: with regard to the use of agricultural land.

Any requirement from such other authorities will have been incorporated into or attached to the environmental management plan.

The environmental management plan is part of the contract documents and is thus a binding agreement between the contractor and the employer.

2.11.2 Responsibilities

2.11.2.1 Employer

The employer is ultimately responsible for the implementation of the environmental management plan and the financial cost of all environmental control measures. The employer must ensure that any person acting on their behalf complies with the conditions/specifications contained in the environmental management plan.

2.11.2.2 Engineer

The engineer as the appointed agent of the employer must assume the responsibility to act on behalf of the employer on all environmental matters and should address any site problems pertaining to the environment at the request of the engineer’s representative and/or the environmental control officer.

2.11.2.3 Contractor

The Contractor shall have the following responsibilities:

(a) To implement all provisions of the environmental management plan. If the contractor encounters difficulties with specifications, he must discuss alternative approaches with the engineer’s representative and/or the environmental control officer prior to proceeding.

(b) To ensure that all staff are familiar with the environmental management plan.

(c) To monitor and verify that the environmental impacts are kept to a minimum.

(d) To make personnel aware of environmental problems and ensure they show adequate consideration of the environmental aspects of the project.

(e) To prepare the required method statements.

(f) To report any incidents of non-compliance with the environmental management plan to the engineer’s representative and the environmental control officer.

(g) To rehabilitate any sensitive environments damaged due to the contractor’s negligence. This shall be done in accordance with the engineer’s representative’s and environmental control officer’s specifications.

(h) On certain contracts the contractor is obliged to appoint a designated environmental officer who must assume responsibility for the obligations specified in the environmental management plan.
Failure to comply with the environmental management plan may result in fines and reported non-compliance may result in the suspension of work by the engineer.

2.11.2.4 Engineer’s Representative

The engineer’s representative should have delegated authority to act as the employer’s on-site implementing agent and has the responsibility to ensure that their responsibilities are executed in compliance with the environmental management plan. Any on-site decisions regarding environmental management are ultimately the responsibility of the engineer’s representative. The engineer’s representative shall assist the environmental control officer where necessary and shall have the following responsibilities in terms of the implementation of the environmental management plan:

(a) Reviewing and approving the contractor’s method statements with input from the environmental control officer where necessary.
(b) Monitoring and verifying that the environmental management plan and method statements are adhered to at all times and taking action if specifications are not followed.
(c) Keeping a photographic record of construction activities on site.
(d) Assisting the contractor in finding environmentally responsible solutions to problems with input from the environmental control officer where necessary.
(e) Ordering the removal of person(s) and/or equipment not complying with the environmental management plan specifications.
(f) Issuing fines for transgressions of site rules and penalties for contravention of the environmental management plan.
(g) Delaying any construction activity if he/she believes the integrity of the environment has been or is likely to be seriously jeopardised.
(h) Providing input into the environmental control officer's ongoing internal review of the environmental management plan.
(i) The engineer’s representative shall communicate environmental issues to the environmental control officer.

2.11.2.5 Environmental Control Officer

The environmental control officer is usually a professional environmental consultant who was involved in the environmental impact assessment process and the drafting of the environmental management plan. His/her duties shall include, inter alia, the following (refer also to the environmental specifications in the document):

(a) Ensuring the necessary environmental authorisations and permits, if any, have been obtained.
(b) Advising the contractor and/or the engineer’s representative on environmental issues within defined construction areas.
(c) Reviewing method statements.
(d) Undertaking regular site visits to ensure compliance with the environmental management plan and verifying that environmental impacts are kept to a minimum throughout the contract.
(e) Completing environmental checklists during site visits.
(f) Keeping a photographic record of progress on site from an environmental perspective.
(g) Assisting the contractor and/or the engineer’s representative in finding environmentally acceptable solutions to construction problems.

(h) Recommending additional environmental protection measures should this be necessary.

(i) Keeping a register of complaints and recording and dealing with any community issues or comments.

(j) Giving a report back on the environmental issues at site meetings.

(k) Ensuring that the environmental affairs authority is informed of work progress on site.

(l) Reporting any incidents that may have caused damage to the environment or breaches of the environmental management plan to the environmental affairs authority.

(m) Preparing an environmental audit report at the conclusion of the construction phase.

The environmental control officer shall communicate directly with the engineer’s representative. Should problems arise on site that cannot be resolved between the environmental control officer and the engineer’s representative, the environmental control officer shall take the matter up with the engineer and/or the employer. If the employer does not respond the environmental control officer shall take the matter up with the environmental affairs authority.

2.12 GENERAL SITE ADMINISTRATION

2.12.1 Wayleaves

Generally a wayleave agreement is the formal written consent between two parties giving rights to install, inspect, maintain, alter or repair equipment or apparatus located alongside, across, over or under private or public land, which in this case would be the road reserve. Typical examples would be services such as power and telecommunication lines or cables, and water and sewage pipes.

A wayleave becomes relevant when an existing service is likely to be affected by the contract works.

The rights and obligations of the service owners are contained in the wayleave agreement but may also be subject to rights protected in accordance with current legislation. Consequently the obligations of the relevant parties and their respective responsibilities and contribution towards any costs, can be a complicated matter which should be resolved at the design stage. The engineer’s representative can expect to be given full details of how each service is to be dealt with and should ensure that copies of all of the wayleaves are obtained from the employer. No payments should be made to service authorities without the approval of the employer.

In the event of a hitherto unknown services being found located within the road reserve and for which no wayleave can be produced by the service owner, the engineer’s representative must advice the service owner to immediately apply for a wayleave and the employer must be notified and supplied with all the details.

2.12.1.1 Private Service Owners

In the case of services belonging to adjacent landowners the respective owners are normally required to protect or relocate their service at own cost in part or in full depending on the project specifications. The monitoring staff should ensure that the contractor:

- Gives early notice of his intentions
- Provides the service owner with reasonable assistance
- Does not cause interruption of the service without approval of the service owner.
2.12.1.2 Statutory Service Authorities

In the case of statutory service authorities the contractor may be required to apply for a ‘wayleave’ from these authorities in which would be stipulated matters such as:

(a) Where work is to be done by the service owner himself;

- the relevant time frame required.
- payment arrangements

(b) Where work is to be done by the contractor;

- the applicable specifications and arrangement for supervision by the service owner
- limitations with regard to type of equipment permissible over or below the service
- clearance limitations with regard to sensitive underground cables (vibrations) and high voltage overhead cables
- deposits’ payable.

The duty of the monitoring staff is to ensure compliance with all of these stipulations.

2.12.2 Diaries

Diaries on a construction site are in essence a record of daily events and the importance of keeping complete and truthful diaries cannot be over emphasised.

The extent to which records of events are compiled will depend on the size and complexity of a contract, but whenever possible the following types of diaries (in order of importance) should be kept:

2.12.2.1 Contract Diary

This is an official daily record of events which are normally recorded on standard forms by the contractor. It should reflect at least the following information:

- For each major activity a brief description of work done with the plant and labour resources involved
- Major plant not available on the day
- Major materials received
- The weather conditions in the morning and afternoon
- Delays and frustrations experienced
- Written instructions received
- Accidents and incidents.

The contract diary should be completed daily and signed by both the site agent and the engineer’s representative as a true record. Separate copies should be kept by the contractor, the engineer’s representative and the engineer.
2.12.2.2 **Progress Diary**

This is a diary jointly compiled by the monitoring staff of actual progress with emphasis on:

- the starting date of activities,
- percentage progress or production achieved,
- delays or disruption experienced, and
- the completion date of activities.

The main purpose of this diary is to:

- periodically update the contract programme with actual progress to date
- determine the impact of delays on the critical path activities
- determine normal versus disrupted production rates
- reconstruct the sequence of past events should such a need arise
- evaluate delay and disruption claims.

An Excel spreadsheet is a useful tool for the purpose of this diary due to its flexibility and ease of distribution to other parties.

2.12.2.3 **Engineer’s Representative’s Diary**

This is a hand written diary kept by the engineer’s representative in which the major events of the day are briefly recorded. A bound hard cover A4 book should be used for this purpose. The entries in the book should be continues with no gaps. At the end of the day a line is drawn across the page and the entries for the next day follows immediately thereafter.

The condensed way in which this diary should be kept renders it ‘tamper proof’ and consequently in a court of law it will carry more weight as a source of reliable evidence. As such it also provides reliable support for other forms of diaries which may be more susceptible to manipulation.

2.12.2.4 **Personal Diaries**

Each member of the monitoring staff should also keep a personal and private diary. A standard commercial diary book is suitable for this purpose. Apart from the normal entries such as appointments, it should also be used to record more private thoughts such as:

- Critical observations made
- Comment on interpersonal relations
- Good ideas to be implemented
- Successes and failures – lessons learned.

Whilst the purpose of this diary is primarily for the benefit of the individual concerned, the issues that may develop on a site are often not only about the cold facts but are influenced by human nature and the personalities involved and hence the observations recorded over time may help to complete the picture and assist with a better understanding of the problem.
2.12.3 Photographs

Photographic records have become an essential part of the site records due to benefits such as low cost, speed, ease with which the information it portrays can be communicated, and flexibility with regard to filing and storage, to name only a few.

In the case of an accident involving a 3rd party e.g. a traffic accident, it is recommended that the monitoring staff:

• Take a series of photos from various angles which records the road condition and all signs and road markings existing at the time.
• Ensure that the photos adequately cover the general surroundings.
• Ensure that the photos are date and time stamped.
• Submit a set to the employer as soon as possible for safe keeping and as proof of the originality thereof.

2.12.4 Written Communications

2.12.4.1 Site Correspondence Book

The traditional site correspondence book consists of a triplicate pen carbon book with a line drawn down the middle of the page – the contractor uses the one half and the engineer’s representative the other half. The purpose of the book is to record in writing all interaction of a contractual nature between the site agent and the engineer’s representative, be it information, a request, a reply, a proposal, a notification etc. All entries by one party should be acknowledged by the other party.

2.12.4.2 Site Instructions

The authority to issue an instruction is to be found in the Conditions of Contract and the authority of the engineer’s representative in this regard is dependent on the extent to which the engineer’s authority has been delegated to him (refer paragraph 2.4.2).

Per definition an instruction will have a clause in the Conditions of Contract as its basis and therefore all instructions will have contractual implications one way or another. The engineer’s representative must be very careful not to unintentionally write something in the site correspondence book which can be interpreted as an instruction, the consequences of which may only come to light at a later stage.

Consequently it is good practice to separate instructions from other correspondence and the use of a dedicated, more formal, instruction book is recommended. A proper instruction should consist of the following:

• Short title
• Reference to the clause in the Conditions of Contract from which the instruction derives its authority
• Body text of the instruction setting out clearly the circumstances, specifications, drawings etc which may be applicable

TIP
A short PowerPoint photo presentation of key events during the preceding month makes for an interesting progress report at site meetings.

IMPORTANT
The phrase 'as soon as possible' should never be used in any written communication. A party to a contract cannot be held liable for delays if no time was fixed for performance.
• The applicable payment items if any, or method of valuation if applicable. It is important that an instruction should not be silent regarding payment and if the engineer’s representative believes that no payment will be due he should clearly state so

• Due date for performance.

The instruction when it is delivered to the contractor, should be signed and dated by him. The contractor may not agree with the view of the engineer’s representative on payment but by having acknowledged the engineer’s representative’s view on the matter he is obliged to react within a reasonable time in accordance with the provisions of the Conditions of Contract. In this manner payment issues can be resolved more speedily and without surprises.

2.12.4.3 E-mail

Communication by way of electronic media has become common place and will also have its use on site. Its advantages are numerous such as speed, disregard for office hours and location, and ability to be copied to any number of recipients, to name a few.

It also has some disadvantages the most important of which is that the time (and date) of delivery of the message and proof of receipt is beyond the control of the sender. For urgent matters there is thus no substitute for a hard copy written instruction placed directly into the hands of the site agent.

The recommended practice is that a paper copy of all e-mail messages to the contractor should be attached to an entry in the site correspondence or site instruction book and filed in the normal manner.

2.12.5 Meetings and Minutes

The primary purpose of meetings, be they formal or informal, is to exchange information and ideas and to make decisions. These discussions and decisions should be recorded to become part of the site records.

Formal meetings should be minuted and for some a standard agenda and format for the minutes are usually prescribed by the employer.

Informal meetings will normally not be minuted and the monitoring staff should make notes of these, usually in their personal diary.

2.12.6 Claims and Risk Management

A discussion of claims is beyond the scope of this manual. All contracts include a certain amount of risk and understanding the risks to which each party is exposed, will go a long way towards minimizing the extent of claims. Monitoring staff do not like claims because they may originate as a result of errors or omissions on the part of the consultant, the employer or contractor. However, the engineer and for that matter, the monitoring staff, have a duty to administer the contract within the terms thereof in a fair and unbiased manner. Their integrity in this regard should never be in doubt.

The main responsibility of the monitoring staff is to advise the engineer about the facts and circumstances relating to a claim as completely and truthfully as is possible. The quality of site records as discussed above, will largely dictate success in this regard.
2.12.7 Materials on Site

The contract normally provides for the contractor to receive payment for materials produced or delivered to the site for incorporation in the permanent works provided that certain conditions are met. The most fundamental conditions are:

- **Satisfactory evidence of ownership.** This can be problematic since contractors often have credit facilities with suppliers allowing them to delay payment. A letter of cession may be offered by the supplier but some consider this to be not worth the paper it is written on. Depending on the specific terms of the contract an indemnity in a form acceptable to the employer against any claim to or in respect of such materials may be a permissible alternative. Also worth considering if acceptable to the employer, is a surety from a financial institution. If in doubt guidance should be sought from the engineer.

- **Satisfactory substantiation of the value of the materials.** This should be based on invoices. However, the monitoring staff must ensure that the valuation is consistent with the rates to which the materials apply and that sufficient money remains in the item for the work to be done with the materials (in the event of the contractor being sequestrated or liquidated and others having to complete the work).

Other conditions to be considered are:

- The quality of the materials must appear to be acceptable as determined from inspection or tests.
- The material must be properly stored and protected against loss, damage or deterioration.

In the case of materials stored off-site e.g. precast units or structural steel elements, similar conditions will apply with the addition that the materials should be stored separate from that of other customers and must be clearly identifiable. The written permission of the employer should be obtained in all such cases.

2.13 CLOSURE

The activities and procedures described under this heading relates to all the information which needs to be collated as a record of what was actually constructed.

2.13.1 Record Drawings (traditionally referred to as “as-builts”)

The final version issued of each drawing forms the basis of the record drawings. These are to be marked-up (in red) with all alterations to the drawing as actually constructed. The purpose of these records is inter alia to:

- obtain an accurate record in case it becomes necessary to analyse or assess the behaviour or structural integrity of the structure at a future date
- assist with the planning and design of possible future alterations (e.g. widening) of the structure
- determine the causes of rehabilitation measures that may become necessary in future.

It follows that the records should accurately reflect that which is visually not obvious, easily determinable or measurable. On the other hand insignificant alterations (e.g. a single reinforcing bar replaced with two overlapping bars) or dimensional deviations from normal tolerances need not be
recorded. The monitoring staff should bear in mind that the provision of the record drawings is a very important matter and they have to ensure that all information provided is accurate. They therefore have to use sound engineering judgement and consult with the engineer if in doubt.

One aspect which is always of vital importance to record accurately for structures is the founding depth and founding conditions.

2.13.2 As-built Material Records

Standard forms (available in Excel format) are to be used for recording as-built material data. The engineer’s representative should obtain these from the engineer who will advise what records are to be kept for the particular project.

Monitoring staff should record this information continually as the work progresses.

2.13.3 Correspondence and Photos

Hard copies of all correspondence should be filed throughout the contract period according to a predetermined filing structure which usually corresponds with that being used in Head Office. A similar structure should be used for electronic correspondence and these must now be transferred to a CD or DVD for storage with the files.

Photos, of which there may be thousands, are normally stored in date order or subject order and should also be transferred to CD or DVD.

2.13.4 Construction Report

A construction report is normally required with content and structure as prescribed by the employer. It is highly recommended that the engineer’s representative, with input from other monitoring staff, writes this report in stages as aspects of the works are completed.

2.13.5 Guarantees

Where the contract calls for guarantees to be provided for specific items, these should be obtained before the works are certified to be complete.

2.13.6 Clearance Certificates

In all instances where land or property owners have been affected by the works (e.g. new boundary fence, service relocated or land temporarily occupied) a letter should be obtained from the owner stating that he/she has inspected the affected property and is satisfied with the condition in which it has been handed over. To expedite the process the engineer’s representative should write the letters and present them to the owners for their signature. Remember to make a copy available to the owner for his records.
INDEX TO APPENDICES

2A - LIMITS FOR BLASTING VIBRATIONS
2B - SCHEDULE OF QUANTITIES
2C - DELEGATION OF POWERS
2D - QUANTITY MEASUREMENT
2E - ESCALATION TREND
<table>
<thead>
<tr>
<th>Particle velocity V mm/s</th>
<th>Damage</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5</td>
<td>Threshold of human perception unlikely to cause damage of any type</td>
</tr>
<tr>
<td>5.0</td>
<td>Limit for blasting adjacent to historical monuments</td>
</tr>
<tr>
<td>25.0</td>
<td>Limit for blasting near private dwellings in order to reduce disturbance to residents to a minimum</td>
</tr>
<tr>
<td>48.5</td>
<td>Limit for blasting adjacent to residential structures on good foundations</td>
</tr>
<tr>
<td>84.0</td>
<td>Limit for property owned by concern doing the blasting</td>
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<tr>
<td>119.0</td>
<td>Recommended level for blasting adjacent to sturdy reinforced concrete structures</td>
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<td>305.0</td>
<td>Rock falls in unlined tunnels</td>
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<td>635.0</td>
<td>Onset of cracking of rock</td>
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<tr>
<td>2540.0</td>
<td>Breakage of rock</td>
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These limits refer to the resultant peak particle velocity of the ground adjacent to the building and not to the vibration of any part of the building.
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<th>Item</th>
<th>Description</th>
<th>Unit</th>
<th>Quantity</th>
<th>Rate</th>
<th>Amount</th>
<th>Scheduled Amount</th>
<th>Estimated Final</th>
<th>Var Est vs Sched</th>
<th>Estimated Outstanding</th>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Billed</td>
<td>Previous</td>
<td>Month</td>
<td>To Date</td>
<td>Quant</td>
<td>Amount</td>
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<tr>
<td>15.01</td>
<td>Accommodating traffic and maintaining temporary deviations</td>
<td>km</td>
<td>7</td>
<td>7.30</td>
<td>0.00</td>
<td>7.30</td>
<td>19 300.00</td>
<td>140 890.00</td>
<td>135 100.00</td>
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<td>Earthworks for temporary deviations</td>
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<td>1.00</td>
<td>1.00</td>
<td>2.00</td>
<td>6 000.00</td>
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<td>Temporary traffic control facilities:</td>
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<td></td>
<td>(a) Flagmen</td>
<td>Man-day</td>
<td>3 000</td>
<td>1 890</td>
<td>109</td>
<td>1 999</td>
<td>70.00</td>
<td>139 930.00</td>
<td>210 000.00</td>
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<td>(b) Portable STOP and GO-RY signs</td>
<td>mm dia</td>
<td>No</td>
<td>6</td>
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<td>1.00</td>
<td>3.00</td>
<td>550.00</td>
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<td>(h) Delineators (TW401 and TW402) 800 mm x 250 mm overall size:</td>
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<td>(i) Single sided, reversible</td>
<td>No</td>
<td>300</td>
<td>223.00</td>
<td>71.00</td>
<td>294.00</td>
<td>80.00</td>
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<td></td>
<td>(ii) Double sided</td>
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<td>500</td>
<td>467.00</td>
<td>38.00</td>
<td>505.00</td>
<td>95.00</td>
<td>47 975.00</td>
<td>47 500.00</td>
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<td></td>
<td>(j) Traffic cones, 750 mm high</td>
<td>No</td>
<td>50</td>
<td>8.00</td>
<td>0.00</td>
<td>8.00</td>
<td>110.00</td>
<td>880.00</td>
<td>5 500.00</td>
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<tr>
<td></td>
<td>(n) Other traffic control measures ordered by the engineer:</td>
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<tr>
<td></td>
<td>(i) Provision of other signs or facilities</td>
<td>Prov sum</td>
<td>10 000</td>
<td>894.33</td>
<td>894.33</td>
<td>1.00</td>
<td>894.33</td>
<td>10 000.00</td>
<td>5 000.00</td>
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<td>(ii) Contractor's handling charges and profit on subitem 15.03(e)(ii)</td>
<td>%</td>
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<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>10 000.00</td>
<td>0.00</td>
<td>(10 000.00)</td>
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<td>Relocation of traffic-control facilities</td>
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<td>1.00</td>
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<td>1.00</td>
<td>5 000.00</td>
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<td>11 800.00</td>
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<td>15.09</td>
<td>Maintenance of the bituminous surface and pavement of temporary deviations</td>
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<td>(a) Repair of surfacing failure</td>
<td>m²</td>
<td>50</td>
<td>419.18</td>
<td>0.00</td>
<td>419.18</td>
<td>100.00</td>
<td>41 918.00</td>
<td>5 000.00</td>
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<td>(b) Repair of base failure</td>
<td>m³</td>
<td>8</td>
<td>14.50</td>
<td>0.00</td>
<td>14.50</td>
<td>1 500.00</td>
<td>21 750.00</td>
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<td>(c) Repair of potholes and edge breaks using e.g. Roadmix (cold coarse mix)</td>
<td>kg</td>
<td>100</td>
<td>939.00</td>
<td>0.00</td>
<td>939.00</td>
<td>20.00</td>
<td>18 780.00</td>
<td>2 000.00</td>
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<td>TOTAL CARRIED FORWARD TO SUMMARY</td>
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<td></td>
<td>466 987.33</td>
<td>478 400.00</td>
<td>689 673.00</td>
<td>211 273.00</td>
<td>222 685.67</td>
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PART 2. DELEGATION OF POWERS TO THE RESIDENT ENGINEER WITH REFERENCE TO THE FIDIC GENERAL CONDITIONS OF CONTRACT

SECTION A

The Resident Engineer may:

1. Furnish the Contractor with drawings, specifications and instructions necessary for the proper and adequate execution of the Works Subclauses 1.8 and 3.3
2. Ensure that the Contractor pays all fees and gives all notices as necessary Subclause 1.13(b)
3. Give further possession of Site from time to time to enable the Contractor to proceed with the Works in accordance with his approved programme Subclause 2.1
4. Require the Contractor to allow appropriate opportunities for carrying out work to other contractors and other persons Subclause 4.6
5. Furnish the Contractor with reference points, lines and levels. Check any setting out done by the Contractor and require the Contractor to rectify errors Subclause 4.7
6. Require the Contractor to provide necessary signs or directions along access routes Subclause 4.15(b)
7. Ensure that the Contractor has adequate equipment on Site and order, or consent to, the removal of major items Subclause 4.17
8. Ensure that the Contractor complies with the provisions and requirements regarding the use of land Subclause 4.23
9. Issue instructions to the Contractor concerning the action to be taken regarding fossils, etc. found on site. Subclause 4.24
10. Permit work outside normal working hours in terms of subclause 6.5(c) but not otherwise Subclause 6.5(c)
11. Ensure that the Contractor complies with the provisions of subclauses 6.6 and 6.7 in respect of his employees’ welfare, health and safety and that the necessary records are maintained. Call for reports as and when required Subclauses 6.6 & 6.7
12. Require the Contractor to remove from Site any of his employees except the Contractor’s Representative Subclause 6.9
13. Carry out all the duties of the Engineer as prescribed in clause 7: Plant, Materials and Workmanship, with the exception that the Resident Engineer may not employ other persons to carry out remedial work in terms of subclause 7.6 Clause 7
14. Require the Contractor to submit programmes and particulars and refer same to the Engineer for his approval Subclause 8.3

Appendix continues on next page…
15. Suspend progress of all or part of the Works for any of the following reasons:
   (a) for the proper execution of the works,
   (b) by reason of weather conditions on the site
   (c) by reason of some default or breach of the contract on the part of the Contractor
   (d) for the safety of the works or any part thereof, or
   (e) for the safety of the public,

but not otherwise Subclause 8.8

16. Require the Contractor to clear the site on completion Subclauses 4.23 & 11.11

17. Measure the Works and require the Contractor to give such assistance and particulars as necessary Subclauses 12.1 &12.3

18. Order expenditure in connection with Provisional and Prime Cost Sums and require the Contractor to produce quotations, invoices, vouchers, accounts and receipts Subclause 13.5

19. Require the Contractor to make good his failure to carry out any of his obligations under the contract Subclause 15.1

20. Ensure that the Contractor indemnifies the Employer in respect of death, injury damage and loss in terms of subclause 17.1 Subclause 17.1

21. Require the Contractor to make good and repair loss or damage to the Works, Goods, or Contractor’s Documents Subclause 17.2

22. Require the Contractor to submit acceptable invoices in respect of Special Materials CONTRACT PRICE ADJUSTMENT SCHEDULE — item 4(1)

SECTION B

With regard to the following matters the Resident Engineer shall have no power of decision but shall receive any submissions from the Contractor (where applicable) and refer the matters to the Engineer.

The Resident Engineer shall, therefore, have no powers to:

1. Explain or adjust any ambiguities or discrepancies in the Contract Documents Subclause 1.5

2. Permit the Contractor to assign the Contract or part thereof Subclause 1.7

3. Require the Contractor to disclose Confidential information Subclause 1.12

4. Agree or determine any matters in terms of subclause 3.5 Subclause 3.5

5. Approve Contractors designs and details or authorize deviations there from Subclause 4.1

6. Approve or withdraw approval of the Contractor’s representative Subclause 4.3

7. Grant permission to the Contractor to sublet any part of the Works or to appoint and hire a subcontractor Subclause 4.4

8. Instruct the Contractor to assign the benefit of a subcontractor’s obligations in terms of Subclause 4.5 Subclause 4.5

Appendix continues on next page…
9. Make any decision regarding unforeseeable physical conditions  
   Subclause 4.12
10. Approve or reject the Contractor’s programme or revised programmes  
    Subclause 8.3
11. Grant extension of time  
    Subclause 8.4
12. Notify the Contractor regarding the rate of progress  
    Subclause 8.6
13. Grant permission to the Contractor to expedite progress  
    Subclause 8.6
14. Suspend the progress of all or part of the Works for any reason other than those described in item 15 of SECTION A of PART 2 of this document  
    Subclause 8.8
15. Permit Works that have been suspended for more than 84 days, to proceed  
    Subclause 8.11
16. Issue a Taking Over Certificate  
    Subclause 10.1
17. Issue a Performance Certificate  
    Subclause 11.9
18. Agree to, or determine, new rates or prices  
    Subclause 12.3
19. Order any Variation or approve a Contractor’s proposal for a variation  
    Subclause 13.3
20. Certify payments to the Contractor  
    Subclause 14.6
21. Grant extension of time for submission of a claim  
    Subclause 20.1
22. Issue a ruling on a Contractor’s claim  
    Subclause 20.1
## Summary of Measurement

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Prepared by:  
Page of
Using the contract price adjustment formula the graph below shows the adjustment factor $F$ (x 100) for the period Jan-04 to Dec-09 with Apr-07 as the base month in this particular case.

\[
F = \left(1 - x\right) \left(a \cdot \frac{L_t}{L_o} + b \cdot \frac{P_t}{P_o} + c \cdot \frac{M_t}{M_o} + d \cdot \frac{F}{F_o} - 1\right)
\]

Trend line 2 for the period Jan-06 to Jan-08 yields an average monthly escalation of 0.626% (7.5% per annum) resulting in a price increase of 5.6% in Jan-08 compared with the base month. However, thereafter escalation increased rapidly to reach a peak of 24.4% in Aug-08 before a new downward trend (no 3) was established.

Between Jan-08 and Jun-08 the average increase was an inconceivable 3.1% per month. Referring to the table below it can be seen that in Apr-08 the actual escalation factor was already double that of the estimated escalation factor based on trend 2. This illustrates the dilemma often faced by the estimator. Should he adjust the estimated monthly escalation for future expenditure using this new trend? How long will it last and what happens thereafter?

In the example shown in the table below, the estimated escalation factor for May-08 was corrected by making it equal to the actual factor for that month and thereafter applying the monthly increase derived from Trend 2 as before. As it happened the actual escalation trend turned negative after Aug-08 which eventually resulted in a reduced total escalation compared to what was predicted in May-08.
Table showing an example of escalation prediction.

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Avg Esc per mnth: 0.62660000

7.52 per annum