KWAZULU-NATAL

DEPARTMENT OF HEALTH

STANDARD PREAMBLES TO ALL TRADES

REV 3 – JANUARY 2009

Compiled by:
Department of Health
Infrastructure Development
Engineering Services
Private Bag X9051
PIETERMARITZBURG
3201

INDEX

TABLES

NOTE:

Only those clauses or portions of clauses in the following preambles, which refer to items in the Bills of Quantities, shall be considered as applying to the performance of this Contract.

2.

1. ALTERATIONS

SITE VISIT: — Tenderers are advised to visit the site prior to tendering and satisfy themselves as to the nature and extent of the work to be done, also to examine the condition of all existing buildings as no claim will be entertained on the grounds of ignorance of the conditions under which the work was to be executed.

MATERIALS FROM THE ALTERATIONS: — unless otherwise stated, will become the property of the Contractor and all these materials, together with all rubbish and debris must be carried away and the site left clean and unencumbered.

Items described as "removed" shall mean removed from the site.

Credit for the value of materials from the alterations is to be allowed for on the Summary/ Final Summary page.

Items described as to be re-used or to be handed over to the Administration are to be dismantled where necessary and stacked on site where directed, and the Contractor will be responsible for their removal and storage until required, and shall make good all items missing, damaged or broken at his own expense.

Unless otherwise described, no materials from the alterations shall be re-used in any new work without the written approval of the Department.

Prior to the removal of any timbers from the site, these are to be inspected by Government Entomologists. If any of these timbers are infested by wood destroying agencies, these timbers are to be disposed of in the manner prescribed by the Government Entomologist.

In taking down and removing existing work, particular care must be taken to avoid any structural or other damage to the remaining portions of the buildings.

ASBESTOS REGULATIONS 2001:

In terms of Asbestos Regulations 2001, no individual person, contractor or agent shall remove, demolish or strip any building containing asbestos or products containing asbestos (including asbestos roof sheeting, ceilings, guttering and down pipes) unless the work is performed by a **"Registered Contractor", registered with the Department of Labour**. All asbestos work shall be carried out under the supervision of an "Approved Inspection Authority".

It is a requirement that before any work involving asbestos removal is carried out, the following procedure and documentation is followed: -

1. Prior to the commencement of any demolition work, written notification shall be given to the Assistant Manager (Inspection and Enforcement), Durban Labour Centre, Masonic Grove, Durban, stating the name, address and details of the person(s) removing or stripping the asbestos. The notification shall include the date, time and place where the proposed work is to be carried out. (Regulation 3).

2. The name and details of the Approved Inspection Authority that is to supervise and confirm that the work is being carried out according to the specific requirements of the Asbestos Regulations 2001 (as amended), including the approved "written work procedure" document. This document shall be submitted and signed at least 14 days prior to commencement of demolition work by the Approved Inspection Authority. (Regulation 21).

3. The production of valid accreditation certification of training for all employees involved in the asbestos removal work.

4. On completion of the asbestos related work a “Clearance Certificate” which includes the asbestos disposal certificate shall be forwarded to the Department by the Approved Inspection Authority.

In terms of the above regulations, it is an offence to carry out any asbestos work as defined in the above regulations without the necessary approval / requirements being met.

Individual persons or contractors found to contravene these regulations will be issued with a **PROHIBITION NOTICE** which in effect will stop all work on site and the offenders will then be liable for prosecution.

Any employer found guilty under the Asbestos Regulations 2001 may be liable to a fine and or imprisonment not exceeding 12 months.

NOTICE OF DISCONNECTIONS: — The Contractor is to give ample notice to the Department and Local Authorities regarding any disconnections necessary prior to the removal or interruption of electrical or telephone cables, water supply and sanitary services, etc.

DUST: — The Contractor is to allow in his rates for taking all precautions necessary to prevent any nuisance from dust whilst carrying out the works.

SHORING: — Rates for shoring are to include for the use and waste of all props, needles, wedges, braces, nails and screws, etc. required and for all cutting, notching, framing and fitting, maintaining in position for the required periods and removing at completion. All shoring is to be executed in a manner approved by the Department.

MATCHING EXISTING WORK: — The terms “make good” or “making good” to existing work as described in the items shall mean making good with materials to match, all joined to existing.

FORMING NEW OPENINGS, ETC. IN EXISTING WALLS: — Rates for items of forming new or altering existing openings are, unless otherwise stated, to include for the following: -

a) Breaking out for and inserting adequate lintels over the new openings (except where stated in the items as being below an existing beam, slab or lintel), to the approval of the Department. The lintels are to be of in-situ concrete Class C, or of pre-cast pre-stressed concrete or of brickwork in 1:3 cement mortar, with a minimum bearing of 230mm at each end and suitably reinforced, and rates are to include for all necessary formwork, turning pieces, etc. and for wedging and pinning up to existing brickwork over in 1:3 cement mortar.
b) All shoring and propping required.
c) Facing up jambs in new brickwork in cement mortar properly bonded to existing,
d) Building up the portions of the openings stated in the items in new brickwork in cement mortar properly bonded to existing.
e) Formwork for concrete sills and thresholds where required.
f) Making good only to the finishes as stated in the items. (Note: — The making good of paint finishes has been measured separately).
g) Forming rounded angles, throats on external plastered soffits, mitres, etc. where required in all new plaster, render and granolithic finishes.

The supply, building in, fixing, etc. of all windows, doors, frames, etc. to the newly formed openings and the removal of all existing windows, doors, frames, etc. from openings to be altered, have been elsewhere measured.

2. EARTHWORKS

SITE CLEARANCE: —The item given in the Bills of Quantities for site clearance shall be deemed to include the removal from the site, or burning if permitted by the Local Authority, of shrubs and trees with trunks under 200mm girth measured at 1m above ground level,

hedges, bushes, other vegetation, rubbish and debris.
Holes left by roots are to be backfilled with earth and rammed.

EXCAVATIONS: — Rates for excavations are to include for forming and trimming to the correct levels, falls, slopes, curves, etc. for trimming sides, stepping, levelling and ramming bottoms, staging and disposing of the excavated material as described in the items. Rates for excavations to reduce levels over site are also to include for forming and trimming banks to the required batter. The Contractor is to allow in his rates for the bulking of excavated material.

The term "excavate", unless otherwise stated, shall mean excavate in "soft excavation" as defined below and for the purpose of classifying excavations the following will apply: —

a) **Soft excavation**: — shall be excavation in material that can be efficiently removed by a back-acting excavator of flywheel power approximately 0, 10 kW per millimetre of tined-bucket width without the assistance of pneumatic tools such as paving breakers, or that can be efficiently loaded without prior ripping or stockpiling by a rubber tired front-end loader of approximately 15t mass and a flywheel power of approximately 100 kW.

b) **Intermediate excavation**: — shall be excavation in material that requires a back-acting excavator of flywheel power exceeding 0,10kW per millimetre of tined-bucket width and the assistance of pneumatic tools prior to removal by equipment equivalent to that specified in (a) above.

c) **Hard rock excavation**: — shall be excavation in material that cannot be efficiently removed without blasting or without wedging and splitting prior to removal.

d) **Class A Boulder excavation**: — shall be excavation in material containing more than 40% by volume of boulders of size between 0.03m³ and 20m³ in a matrix of softer material or smaller boulders.
***Note**: —* Excavation of solid boulders or lumps of size exceeding 20m³ will be classed as hard rock excavation. (2) Excavation of fissured or fractured rock will not be classed as boulder excavation but as hard rock or intermediate excavation according to the nature of the material.

e) **Class B Boulder excavation:** — shall be excavation of boulders only in a material containing 40% or less by volume of boulders of size between 0.03m³ and 20m³ in a matrix of softer material or smaller boulders.
***Note**: —* Those boulders requiring individual drilling and blasting in order to be loaded by a back-acting excavator as specified in (a) above, or by a track type front-end loader, will each be separately measured as Class B boulder excavation.
The excavation of the rest of the material will be classed as soft or intermediate excavation according to the nature of the material.

Method of Classifying: —The Contractor may use any method he chooses to excavate any class of material but his chosen method of excavation shall not determine the classification of the excavation. The Department will decide on the classification of the materials. The classification will be based on inspection of the material to be excavated and the criteria given in (a) to (e) above, as applicable. The decision of the Department shall be, subject to the relevant provisions of the contract, final and binding.

Should the Contractor consider that the excavation is other than "soft excavation" he must notify the Department immediately in order that an inspection be made and a decision arrived at by the Department as to the category of such excavation. Should the Contractor fail to give such notification, the excavation shall be deemed to be "soft excavation" and shall be measured and valued accordingly.

Blasting will only be permitted with the written authority of the Department, if and when permission is granted, it is to be executed only by persons holding the necessary Government Blasting Certificate and subject to all regulations imposed by the Department and/or Local Authority. In addition, the Contractor is to indemnify the Provincial Administration against all claims in respect of damage to persons and property resulting from such blasting operations.

Before commencing any excavations, the Contractor must satisfy himself as to the accuracy of any levels indicated on the drawings, as no claim will be entertained at a later date for any alleged inaccuracy in such levels.

Excavation shall be carried down to such depths as are necessary to obtain firm foundations, but before proceeding to greater depths than are shown on the drawings, the Department's approval must be obtained.

The Contractor will be responsible if he excavates wider or deeper than shown or required. If the excavations are deeper than shown or required such extra excavations are to be filled in with mass concrete at the Contractor's expense. If the excavations are wider than shown or required, any form-wait or mass concrete filling required to the side of the concrete foundations is to be executed at the Contractor's expense and to the approval of the Department.

Depths of excavations as approved shall be checked and recorded by the a Departmental Official and the Contractor's Foreman before any concrete is laid or the excavations are otherwise covered or filled in.

Notwithstanding such approval, any excavations which become waterlogged or otherwise spoilt after approval, shall be cleaned out and reformed, at the Contractor's expense and to the satisfaction of the Department, before any concrete, etc. is laid.

WATER: — The Contractor shall keep all excavations free from water or mud by pumping, baling or otherwise.

WORKING SPACE: — The Contractor is to allow against the items of "excavate to provide working space" for excavating beyond the extent of the net excavations measured to provide the necessary working space for the carrying out of such work as is described in the items. Rates are to include, in addition to the extra excavation, for any additional risk of collapse so incurred and for filling back and compacting the excavated material.

No separate item for working space is provided or will be considered where the face of the measured excavation is 750mm or more away from the finished face of the structure. Separate items for working space for the building of brick foundation walls on ordinary concrete wall footings will not be considered.

In the case of column base and pile cap excavations, where the dimensions between the column face and the excavation face is less than 500mm, working space has been measured for the width of the column face from the commencing level of excavation to the top of the column base or pile cap only where the top of the column base or pile cap exceeds 1.5m below the commencing level of excavation.

RISK OF COLLAPSE: — The Contractor shall maintain all excavated faces affecting the safety of the works and workmen. He must either provide all necessary temporary planking, strutting or shoring to all vertical excavated faces or carry the risk of collapse of these faces with all its implications. He must assume full responsibility in this connection and must allow in his rates accordingly. In addition, all excavated faces exceeding 1.5m deep are to be maintained in accordance with Government Regulations.

Quantities reflect the total superficial areas of the vertical excavated faces and will be subject to variation only in so far as these areas may vary, notwithstanding whether any temporary supports are used or not.

FILLING, ETC.: — All backfilling and filling under floors and paving must be of selected material from the excavations, unless otherwise stated, returned and compacted in layers as later described and with the top surface dressed to the correct levels and grades, all to the approval of the Department. Under no circumstances will the Contractor be allowed to use clay, peat or other unsuitable material for filling.

Rates for all items of filling with material from the excavations are to include haulage not exceeding 100m from the perimeter of the excavations.

Any filling supplied by the Contractor is to be of suitable material approved by the Department.

COMPACTION OF FILLING ETC.: — All filling and backfilling is to be done in layers not exceeding 200mm thick before compaction, with the layers level to ensure uniform compaction. Each layer is to be thoroughly compacted over the whole of the area to a dry density not less than 90% of Mod. A.A.S.H.O. density. The surface of each compacted layer shall be uniform and tightly bonded. Care is to be taken that no damage is done to foundation walls, drains and other services.

The densities of compaction referred to are to be determined by tests carried out in accordance with A.S.T.M. Designation D 1557-58 and at an optimum moisture content of not more or less than 5% of the required Mod. A.A.S.H.O. The Contractor shall be responsible for having sufficient tests taken of the density of the compacted filling to ensure that the required compaction is being attained to the satisfaction of the Department. These tests are to be undertaken by an independent testing authority nominated by the Contractor to the approval of the Department. The costs of all tests in this connection shall be borne by the Contractor and shall be allowed for in his rates.

PROTECTION AGAINST SUBTERRANEAN WOOD-DESTROYING TERMITES: — Where protection against termites is to be provided: —

a) Remove vegetable matter
All dead roots and other vegetable matter likely to encourage termites must be removed from the ground under, against the building and from all filling material.

b) Treating the ground
The ground under surface beds, and below suspended wood floors, must be treated by the application of Soil Insecticides of Chlordane or Aldrin types complying with SANS Specifications 1165 and 1164 respectively, mixed with water and applied at the rate of not less than *5* litres of solution per square metre uniformly over the whole surface. The concentration of the solution must be strictly in accordance with the manufacturer's instructions and to the approval of the Department.

The Department reserves the right to take samples of the diluted solution, at any time, in order to test the concentration of the chemicals used.

Where the ground to be treated is of earth filling, the upper 50mm layer of filling must be levelled by raking, but must not be rammed until after the solution has been applied, and where of natural ground, it must be loosened to a depth of not less than 50mm and similarly levelled, in order to enable the solution to penetrate into the soil. After the solution has been applied and allowed to penetrate the surface, the soil must be well rammed and consolidated.

Before applying the solution to the ground under the floors, splay back earth for a depth and width of 75mm from the internal faces of walls enclosing the floors, against internal walls, sleeper piers, etc. and thoroughly saturate with the solution. After the solution has soaked into the earth, the splayed grooves must be filled with earth and consolidated.

The treated layer of soil under suspended wood floors must be protected with a 75mm thick layer of approved clean gravel, finished to an even surface.

The treated layer of soil under concrete surface beds must be protected with a 25mm thick layer of well-consolidated approved grit prior to laying the waterproofing membrane.

Great care must be taken when laying concrete surface beds, protective layers, etc. in order to avoid rupturing the treated layer of soil. Should the treated layer be ruptured at any

point it must be made good and the area affected re-treated with the soil insecticide.

Contractors are advised that:

a. Special precautions must be taken to protect the workmen whilst using the soil insecticide.
b. The treatment of filling or ground under floors shall be done as soon as practicable, so that treatment may dry out before the floors are laid.
c. The treatment of the ground must be carried out under the supervision of the Department.
d. The soil insecticide to be delivered to the site in sealed drums clearly labelled or stamped with the name of the product.
e. In addition to the foregoing the application of the soil insecticide to be carried out in accordance with SANS Code of Practice 0124 — the application of Certain Soil Insecticides for the Protection of Buildings.
f. The protective layers of gravel or grit have been measured separately.

RE-USE OF EXCAVATED MATERIAL: — Material of any kind that may be discovered on the site during the excavation shall remain the property of the Administration. Such material may, if approved, be used for aggregate. Material so used shall be valued and the value deducted from the Contract Sum.

DEMOLITIONS: — The Contractor is referred to the preambles for "Alterations" insofar as they apply and the following: —

The demolition of existing buildings is to be done in a practical and safe manner, under the continuous supervision of a competent Foreman. Rates for the demolition of existing buildings are to include for breaking up and removing all external screen walls, steps and ramps, surface water channels, rainwater sumps, gulleys, etc. and grubbing up and removing all foundation walls and footings, disconnecting and removing all services to a point not less than 1m beyond the perimeter of the buildings, plugging off ends of all remaining pipes, and for filling in all holes with clean earth and ramming up to ground level. All movable fittings and furniture, fire extinguishers and electrical and other equipment in the buildings to be demolished are to remain the property of and will be removed by the Administration prior to the commencement of the demolition.

Before commencing the demolitions, the Contractor shall comply with any Local Authority regulations in force in respect of rodent extermination, etc. and he shall obtain the required Clearance Certificate. Items to cover the cost of obtaining the certificate and the fumigation, etc. of the buildings to be demolished have been provided elsewhere in the Bills of Quantities, and the fumigation is to be carried out by a firm specialising in this type of work. The fumigation of the buildings to be demolished shall only be carried out if called for by the Local Authorities and if not required the value of the relevant items in the Bills of Quantities will be deducted from the Contract Sum.

After handing over the site to the Contractor, the risk of any loss or damage to the buildings to be demolished and the materials therein, caused by theft, vandalism, etc. shall be the responsibility of the Contractor and he shall take such precautions as he deems necessary against such loss or damage.

GRASS PLANTING AND TURFING: — Is to be "Cape Kweek" or "Umgeni" grass scientifically known as *Cynodon dactylon* or other local fine grass approved by the Department. In areas where fine grass does not grow readily, Kikuyu grass *Pennisetum clandestinum* may be substituted. The areas must be identified and the approval of the Department obtained before Kikuyu grass is to be planted.

Grass Planting To Level Areas: — The areas to receive grass are to be weeded and raked free of stones and other superfluous matter and all depressions left by the earthworks plant are to be filled in with approved topsoil. The planting of grass is to be carried out in continuous root planting in rows 200mm apart. The method of planting called "sprigging" may be used as an alternative.

Immediately after completion of each strip or square, the area thus grassed is to be thoroughly watered and lightly rolled. Any drifting or piling up of the top soil due to wind or any other cause must be prevented as far as possible and should such piling up of soil against newly planted grass occur the soil must immediately be raked level and lightly rolled.

Turfing: — Banks are to be carefully trimmed to an even surface and weeded and raked free of stones, etc. and all depressions filled in with approved topsoil as before described. Turfing of banks is to be carried out with 25mm thick maximum 500mm x 1000mm weed-free grass sods, of grass as before described, and as approved by the Department. The grass sods are to be set in position in horizontal rows to broken bond and closely fitted together and tamped flat with a timber pummel, a maximum of two sods in every square metre of area covered being staked to the bank to maintain position, with and including one sharpened wood or bamboo skewer 250mm long and with all cavities between sods filled in with approved top soil and the whole area lightly top soil dressed on completion.

Established Lawn: — The use of established lawn in pieces size approximately 500mm x 1000mm x 25mm thick in lieu of grass sods on banks will be permitted provided that the established lawn is supplied and laid by a firm experienced in this type of work and to the approval of the Department. The fitting, tamping, staking and top dressing must all be as described for turfing, except that one piece per square metre is required to be staked as described.

Fertilizer: — An approved fertilizer of the following types— Type 2:3:2 for grass planted levelled areas and Type 3:2:1 for turfed or established lawn covered banks is to be supplied and applied by the Contractor at the rate of 400 kg per hectare. In the case of grass planted levelled areas the fertilizer is to be applied either before or after grass planting and in the case of turfed or established lawn covered banks the fertilizer is to be applied after the sods or pieces have been laid.

The fertilizer above described is to in addition to any fertilizer which may have been specified to be applied during either the operation of scarifying and grading the area to be grassed or the re-spreading of top soil.

A sample of the existing topsoil or the topsoil to be re-spread is to be sent to an approved fertilizer manufacturer for testing and advice on the acid or alkaline content of the soil. The cost of this test is to be borne by the Contractor if this is not provided free by the fertilizer manufacturer.

The requisite quantities of limestone ammonium nitrate for acidic soil or ammonium sulphate for alkaline soil as determined by the soil test will be supplied to the Contractor by the Department and the cost thereof is to be included in a Provisional Sum elsewhere in the Bills of Quantities. The application of this treatment is to be undertaken by the Contractor and his rates for grassing, etc. must include for same.

Weed killer: — “Weed Master or Turf Master” or other approved weed killer is to be applied to the entire grassed or turfed areas at a rate of 4 litres mixed with 200 litres of water per hectare, this being equivalent to 40-45 millilitres mixed with 5 litres of water per fifty square metres. The solution is to be sprayed on with a suitable spraying apparatus to achieve an even distribution. Six to eight weeks later, the operation is to be repeated. The application of weed killer is not to take place during wet weather. Weather conditions should be such as to allow a minimum of two hours or absorption before the likelihood of rain.

Watering and Rolling: — The entire turfed area is to be kept clear of weeds, lightly rolled and thoroughly watered throughout the period of the Contract and or at least three months from the time of acceptance of the grounds or until the grassing or turfing is well established if that is sooner, all to the satisfaction of the Department.

In the absence of rain, the initial watering of grassed or turfed areas is to be carried out as follows: —

Grass planted levelled areas: - at least twice a week.
Established lawn areas: - at least once a week.
Turfed areas: - at least once a day for the first ten to fourteen days, thereafter at least once a week.

The Contractor must allow in his rates for providing and removing at completion all necessary temporary water piping complete with fittings, sprinklers, hoses, etc. as required for the proper watering of the grassed or turfed areas of the plateaux and banks.

Cutting of Grass: — The Contractor must commence mowing as soon as possible once turfed areas have become established and undertake regular mowing at approximately one-week intervals up to the date of final delivery, except that, during the maintenance period, the mowing of the plateaux will be undertaken by the Institution.

Note: — All stages of grass planting and turfing are to be supervised on a full time basis by a competent person with the necessary experience and knowledge.

It shall be the responsibility of the Contractor to advise the Department when the following operations are to be carried out in order that his representative may be present: —

a) the application of fertilizer
b) the application of weed killer.

Should the Contractor fail to do so, the Department shall have the right to instruct the Contractor to repeat the operation at his own expense.

3. CONCRETE, FORMWORK AND REINFORCEMENT

GENERAL: — This specification applies to concrete work formed into its final shape and position in-situ.

All concrete and formwork shall be carried out in accordance with SANS Specification 1200 G — Concrete (Structural) (a copy of which the Contractor will be required to keep on the site so that it can be referred to at all times during the Contract), with the following amplifications and amendments: —

INTERPRETATIONS: — Clauses 2.1 and 2.2 of SANS Specification 1200G refer. This preamble, together with any other supplementary preambles appearing in these Bills of Quantities shall be deemed to be the project specification and are the “Portion 2” referred to in Clause 2.2.

DEFINITIONS: — Clause 2.3 of SANS Specification 1200 G refers. All references to the Engineer shall be deemed to mean the Department.

MATERIALS
Cement: —unless otherwise specified, shall be one or more of the following and shall, in each case, comply with the requirements of the relevant standard specification: —
Portland cement and rapid-hardening cement to SANS 471 Specification
Portland blast-furnace cement to SANS Specification 626.
Portland cement 15 to SANS Specification 831.
Nevertheless, no cement other than ordinary Portland cement shall be used without the approval of the Department. Cement containing more than 15% blast-furnace slag will not be permitted in columns or in members less than 50mm thick.

In addition (for the abovementioned items) where Ordinary Portland cement is used, blast-furnace slag (from separate containers) **must not** be added in any proportion whatsoever.

No mixing of two different types of cement in the same batch will be allowed, and unless otherwise approved by the Department, the same brand and type shall be used in all exposed concrete.

Lumpy cement, broken sacks and sweepings shall not be used.

Cement supplied in sacks shall be used in the order in which it was delivered and shall not be kept in storage for longer than six (6) weeks without the approval of the Department.

Water: — Shall be clean and free from injurious amounts of acids, alkalis, sugar, organic matter and other substances that could impair the strength or durability of the concrete. If so required by the Department, the suitability of the water shall be proved by tests carried out by an approved laboratory.

Aggregates: — Unless otherwise specified both the coarse aggregate (stone) and the fine aggregate (sand) shall comply with the requirements of SANS Specification 1083. The Contractor is to prove compliance by means of either a certificate from the supplier or by grading analysis tests.

Admixtures: — i.e. materials other than cement, aggregate and water shall not be used in the concrete mix without the approval of the Department. The onus for proof of satisfaction to the Department for any admixture proposed shall be with Contractor.

Reinforcement: — for concrete shall be as specified and shall, in each case, comply with one of the following: —

a) Type A hot rolled mild steel bars of plain round cross section to SANS Specification 920
b) Type C Class 2 hot rolled high yield stress Grade 1 deformed bars to SANS Specification 920
c) Type D Grade 1 cold worked deformed bars to SANS Specification 920.
d) Welded steel fabric to SANS Specification 1024 manufactured from plain hard-drawn mild steel wire.

A sample reinforcing rod, approximately 600mm long, may be taken from each consignment of rods of similar diameter, for testing. If any sample is found unsatisfactory the whole consignment of rods from which the sample was taken will be rejected.

No substitution of the bars specified shall be made without the prior approval of the Department.

REINFORCEMENT

Bending: — Reinforcing bars shall be cut and bent according to the dimensions shown on the working drawings and in accordance with SANS Specification 82.

Except as allowed for below, all bars shall be bent cold and bending shall be done slowly, a steady even pressure being used without jerk or impact.

If approved by the Department, hot bending of bars of diameter at least 32mm shall be permitted, provided that the bars do not depend for their strength on cold working. When hot bending is approved, the bars shall be heated slowly to a cherry red heat (not above 840 Cº) and after bending shall be allowed to cool slowly in air. Quenching with water shall not be permitted.

Fixing: — All steel reinforcement, at the time of placing of the concrete, must be free from loose rust, scale, oil and other agents which will reduce the bond between the steel and the concrete or initiate corrosion of the reinforcement. Reinforcement exposed to sea spray shall be washed down, and the formwork drained, just prior to concreting.

Reinforcement shall be positioned as shown on the working drawings or as directed by the Department and maintained in those positions within the tolerances given in the Specification for Tolerances. It shall be secured against displacement by tying at intersections with 1.6 or 1.25mm diameter annealed wire or by the use of suitable clips or, if permitted by the Department, by welding in accordance with SANS 1856. Welding will not

be permitted on cold worked bars. Reinforcement shall be supported in its correct position by hangers, saddles or cover blocks and aligned by chairs and spacers all of approved design and material. Where such hangers, saddles, chairs or spacers are of steel, they will be detailed on the drawings or in bending schedules.

Cover: —The minimum cover of concrete over reinforcement, excluding any applied finish, shall be as shown on the working drawings, or as directed by the Department.

Cover shall be maintained by using cover blocks, which shall be made of small aggregate concrete, not mortar, using the same cement and aggregate type and ratio as the parent concrete. Alternatively, cover blocks may be of the plastic type provided that sufficient number are used to prevent their collapse, that they are of a colour compatible with that of concrete and that the prior approval of the Department is given. Metal cover blocks shall not be used.

If the concrete face has a Class F2 smooth finish or some other special finish as is described elsewhere, hemispherical or pyramid shaped concrete cover blocks shall be used unless otherwise specifically approved by the Department.

Splicing: — or joining of reinforcing bars shall be made only as and where shown on the working drawings or as otherwise approved. The length of the overlap in a splice shall be not less than that shown on the working drawings or forty-five times the diameter of the bar if not shown.

Protection of Exposed Bars: — If left exposed for future bonding of extensions to the works, reinforcement shall be protected from corrosion as specified by the Department.

Electric Current: — Reinforcement shall not be used as a means for conducting electric current unless there is conformity with the requirements of SANS Code of Practice 03.

Inspection of Reinforcement: — Reinforcement shall be subject to inspection by the Department after the Contractor is satisfied that it has been completely and correctly fixed. The amount of notice given by the Contractor to the Department before concreting commences that reinforcement is ready for his inspection shall be agreed between the Department and the Contractor at the commencement of the Contract.

FORM WORK

Design: — Formwork shall be so designed and constructed by the Contractor that the concrete can be properly placed and compacted and that the required shapes, finishes, positions, levels and dimensions shown on the working drawings are maintained, subject to the tolerances given in the Specification for Tolerances. Unless otherwise directed by the Department, all formwork to beams and slabs shall be evenly cambered, unless otherwise specified or shown on the drawings, to the mid-point of the span of the member at the rate of 2mm per metre of span, all to the approval of the Department and the full cross section of the member shall be maintained after placing of concrete.

The formwork and joints shall be capable of resisting the dead load and pressure of the wet concrete, effect of vibration equipment, wind forces and all other superimposed loads and forces it is necessary for it to carry.

Should it be necessary to support formwork off suspended or ground bearing slabs, the manner of execution of the support shall be agreed with the Department so that overstress of, or damage to, those members is prevented.

In structures having, in whole or part, two or more reinforced concrete floors, props to the approval of the Department shall be provided under the soffits of beams and slabs of any floor which is being used to support the formwork and new concrete of the floor above. These props shall not be removed until the formwork for the new concrete has been struck.

Wedges and clamps shall be used in preference to nails. Joints in forms shall be tight enough to prevent leakage of cement paste.

Finish: — The quality of the finished surface of the concrete shall be as shown on the working drawings or as otherwise specified, and the type of formwork used shall be adequate to provide such finishes.

Ties: — The type of ties used and their position shall be such that the finish required in terms of the clause “Finish” is achieved. Tie rods are preferable to wire ties and the forms shall not be secured to the reinforcement. No corrodible tie rod or wire tie shall be allowed within the depth of concrete cover, and in the case of water-retaining or tanked structures, no removable tie rod or wire shall pass right through the concrete member.

Preparation of Formwork: — Surfaces that are to be in contact with fresh (wet) concrete shall be so treated by coating with a non-staining mineral oil or other approved material, or, in the case of timber forms, by thoroughly wetting surfaces so as to ensure easy release and non-adhesion to formwork during stripping. If any substance other than water is used, every precaution shall be taken to avoid contamination of the reinforcement.

Re-use of Formwork: — Before re-use, all formwork shall be reconditioned, and all form surfaces that are to be in contact with the concrete shall be thoroughly cleaned without unduly damaging the surfaces of the formwork.

Openings: — Where necessary for the proper placing of the concrete, temporary openings for cleaning, inspection or placing purposes shall be provided, taking cognisance of the finishes specified.

Removal of Formwork: — Formwork shall not be removed before the concrete has attained sufficient strength to support its own mass and any loads that may be imposed on it. Except where the Contractor can prove by means of cube tests, at his own expense to the satisfaction of the Department that, because of its strength development characteristics the concrete has attained sufficient strength and that shorter periods are practicable, formwork shall not be removed within shorter periods than those given in Table A. The number of cube tests required shall be equal to the number required for testing at 28 days. Where full design loads are carried, no soffit forms and props may be removed until the full design strength is attained.

In structures having, in whole or part, two or more reinforced concrete floors, props to the approval of the Department shall be provided under the soffits of beams and slabs of any floor which is being used to support the formwork and concrete of the new floor above. These props shall not be removed until the formwork for the new concrete has been struck.

All formwork props shall have been removed from under beams and slabs before the commencement of construction of brickwork thereon, unless otherwise agreed with the Department. Formwork shall be removed carefully so that shock and damage to the concrete are avoided.

TABLE A—REMOVAL OF FORMWORK (MINIMUM TIMES IN DAYS (24 hrs))

1	2	3	4	5	6	7	8	9	10
Type of structural member or formwork	Type of cement used								
	Portland cement and Portland cement 15			Rapid-hardening Portland cement* and rapid-hardening Portland cement 15			Portland blast-furnace cement		
				Weather					
	Hot or normal	Cool	Cold	Hot or normal	Cool	Cold	Hot or normal	Cool	Cold
(a) Beam sides, walls, and unloaded columns.	0,75	+	1,5	0,5	+	1	2	+	4
(b) Slabs with props left underneath	4	+	7	2	+	4	6	+	10
(c) Beam soffits with props left underneath, and ribs of a ribbed floor construction	7	+	12	3	+	5	10	+	17
(d) Slab props including cantilevers	10	+	17	5	+	9	10	+	17
(e) Beam props including cantilevers	14	+	21	7	+	12	14	+	21

* Shorter periods may be used for sections of thickness 300mm or more.
+ In cool weather, stripping times shall be determined by interpolation between the periods specified for normal and cold weather.

CONCRETE QUALITY

General: — Concrete shall comply with the requirements for “Strength Concrete” as specified. The type of aggregate and cement, and their sources of supply, shall not be altered during the currency of the Contract without the prior written agreement of or instruction from the Department.

Strength Concrete: — The Contractor shall be responsible for the design of the concrete mix and for the proportions of its constituent materials, measured as described, necessary to produce concrete that complies with the requirements specified by the Department thus:-

a) For each section of the work, the class of concrete and position on the Works, as shown on the drawings:
b) For each class of concrete:
   i) the minimum compressive strength at 28 days as shown in Table B
   ii) the maximum nominal size of coarse aggregate as shown in Table B

iii) the stump as shown in Table D
iv) the maximum cement/water ratios as shown in Table C.

At the earliest possible stage in the Contract, at least 35 (thirty-five) days before the first concrete is placed, or as otherwise agreed with the Department, the Contractor shall submit samples of the aggregates which he proposes to use on the works to the Department.

The Contractor, under the supervision of the Department, shall prepare trial mixes using these same aggregates, to establish his ability to achieve the strengths specified, and satisfactory workability of the concrete. The Contractor shall provide all necessary equipment for, and carry out tests of moisture content of aggregates at the time of preparation of the trial mixes, tests of the slump of the mixes and at the same time cast not less than six standard cubes from each mix for compression tests.

The target strengths to be achieved under trial mix procedure shall exceed the specified minimum compressive strengths by a factor which is acceptable to the Department.

The Contractor shall also, when required to do so, prove the concrete yield obtained per sack of cement by suitable measurement of batches after placing.

No structural concrete work shall be poured until trial mix procedure has been properly followed and satisfactory 7 (seven) day compression strengths achieved. (Equivalent 28 (twenty-eight) day strength = 4/3 x 7 day strength + 5 MPA).

Thereafter, the materials, preparation of and method of manufacture of subsequent concrete shall conform accurately to those used in the trial mixes. If materials vary in the course of the Contract from the samples first submitted, the Contractor shall, on the instructions of the Department, repeat the trial mix procedure and vary the proportions to attain the specified qualities.

The costs of preparation of trial mixes, with tests associated with them, shall be borne by the Contractor and must be allowed for in the pricing of the concrete.

A valid concrete test result shall be the average obtained from the testing of three test cubes of concrete in accordance with SANS Method 863.

TABLE B—CONCRETE CLASSES: STRENGTH, AGGREGATE SIZE AND COMPACTION

Class	Minimum 28 day cube compressive strength (MPA)	Maximum nominal size of coarse aggregate (mm)	Method of Compaction
50/26 50/19	50	26,5 19,0	Mechanical (see clause "Compaction")
45/26 45/19	45	26,5 19,0	
40/26 40/19	40	26.5 19,0	
35/26 35/19	35	26,5 19,0	
30/37 30/26 30/19 30/13	30	375 26,5 19,0 13,2	
25/37 25/26 25/19 25/13	25	37,5 26,5 19,0 13.2	
20/37 20/26 20/19 20/13	20	37,5 26,5 19,0 13,2	
15/37 15/26 15/19	15	37,5 26,5 19,0	Non-mechanical (See clause "Compaction")
10/37 10/26 10/19	10	37,5 26,5 19,0	

The Contractor shall be deemed to have satisfied himself, before tendering, of his ability to produce concrete of the required quality with available materials conforming to the specification, and mixed in the proportions on which his tendered rates are based. Any subsequent alterations of the mix proportions to meet these requirements shall be at the Contractors expense.

If, in the opinion of the Department, the concrete proportions are likely to lead to excessive segregation, honeycombing, bleeding or shrinkage cracking, he shall have the right to order the Contractor to amend the proportions at the Contractors own cost.

TABLE C — MAXIMUM CEMENT / WATER RATIOS FOR DIFFERENT CONDITIONS OF EXPOSURE

1	2	3	4	5
Type of structure	**Exposure Conditions**			
	Mild	**Moderate**	**Severe**	**Very Severe**
Thin sections; reinforced piles; all sections with less than 25mm cover reinforcement.	*	0.53	0.48	0.40
Moderate sections; retaining walls, piers, beams	*	*	0.53	0.43
Exterior portions of mass concrete	*	*	0.53	0.43
Concrete slabs laid on ground	*	0.53	0.48	*
Concrete protected from the weather, inside buildings, or in ground below frost level	*	*		*

* In these cases the ratio will be based on the strength for the workability desired.

Consistency and Workability: — Slump measurements taken in accordance with SANS Method 862 shall be within the limits given in Table D appropriate to the type of construction, or within such other limits as are laid down by the Department.

The concrete shall be of such workability that it can readily be compacted into the corners of the formwork and around reinforcement without segregation of the materials or excessive “bleeding” of free water at the surface.

TABLE D—SLUMP LIMITS

1	2	3	4	5
Type of construction	Slump, mm			
	Non-mechanical compaction		Mechanical compaction	
	Max.	mm.	Max.	mm.
Paving and pre-cast units	75	50	50	30
Heavy mass construction	75	25	50	20
Reinforcing foundation walls and footings	125	50	80	30
Slabs, beams, columns, and reinforced walls	125	50	80	30
Slabs and industrial floors on ground	125	75	80	50
Plain footings, caissons, and substructure walls	100	25	60	20

Ready-mixed Concrete: — This may be used subject to the approval of the Department. This approval may be withdrawn on 24 (twenty-four) hours notice to the Contractor if at any time if documents do not conform to the requirements of this Specification. Ready-mixed concrete shall also comply with the requirements of SANS Specification 878. Details of the

mix ingredients and tests thereon, the mix designs and relevant tests shall be forwarded to the Department for his approval. Ready-mixed concrete shall be cast within 3 (three) hours of placing all the ingredients in the mixing plant. Ready-mixed concrete shall be subject to the same sampling and testing at the site as that mixed on site and only the results of these tests will be regarded as valid.

TRANSPORTATION AND PLACING

Transportation: — Unless agreed with the Department, concrete shall not be pumped into its final position.

The Contractor must provide suitable runways for the distribution of concrete to the various parts of the structure and these must be solidly constructed in such a manner so as to obviate the possibility of interference with the steel reinforcement.

Placing: — Unless otherwise agreed with the Department, the Contractor shall give the Department at least 24 (twenty-four) hours notice of his intention to place concrete. No concrete shall be placed without the prior approval of the Department and without a representative of the Department being present. Concrete shall be placed within one hour of the time of its discharge from the mixer. Concrete shall not be re-tempered by the addition of water or other material. The forms to be filled shall be clean internally. All excavations and other surfaces of an absorbent nature that are to come into contact with the concrete shall be dampened with water. There shall be no free-water on the surface against which concrete is to be placed. Wherever possible, the concrete shall be deposited directly into its final position to avoid segregation and displacement of reinforcement and other items that are to be embedded. Deposited concrete shall not be so worked (whether by means of vibrators or otherwise) as to cause it to flow laterally in such a way that segregation occurs. Where possible, the concrete shall be brought up in horizontal layers of compacted thickness not exceeding 450mm and heaping shall be avoided.

Where a chute is used to convey the concrete, its slope shall be such as will not cause segregation, and a suitable spout or baffles shall be provided for the discharge of the concrete. Concrete shall not be allowed to fall freely through a height of more than 3 m, unless otherwise approved. Concrete shall not be placed during periods of heavy or prolonged rainfall.

Compaction: — The concrete shall be fully compacted by approved means during and immediately after placing. It shall be thoroughly worked against the formwork and around reinforcement and other embedded fittings without displacing them.

The concrete shall be free of honeycombing and planes of weakness. Successive layers of the same lift shall be thoroughly worked together.

The method of compaction shall be as specified. Mechanical compaction shall be undertaken by means of high frequency immersion vibrators of minimum frequency of 6000 vibrations per minute and a maximum acceleration of 4 g when under load, being capable of visibly affecting concrete over a radius of at least 500mm. Vibrators shall be inserted at about 500mm centres and withdrawn slowly to close the hole formed by the vibrator.

Non-mechanical compaction shall be undertaken by means of spading, rodding or forking.

Over-compaction resulting in segregation, surface laitance or leakage (or any combination of these) shall not be allowed.

Vibrators shall not be allowed to come within 30mm of the face of the formwork in the case of formed finishes, nor within 75mm of the face of the formwork in the case of special finishes.

Construction Joints: — Concreting shall be carried out continuously up to the construction joints shown on the working drawings or as prior approved by the Department, except that

if, because of an emergency (such as a breakdown of the mixing plant or the occurrence of unsuitable weather), concreting has to be interrupted a construction joint shall be formed at the place of stoppage in conformity with the detail shown on the drawings for construction joints generally and in the manner which will least impair the durability, appearance and proper functioning of the concrete. The Department shall approve the method adopted for forming the construction joints, one of the following methods being adopted, as relevant: —

a) Construction joints when concrete is not more than 24h old: —The surface of the concrete shall be brushed with a steel wire brush before new mortar and concrete are placed as specified in (b) below.
b) Construction joints when concrete is more than 24h but not more than 3 days old: — The surface of the concrete shall be sand-blasted or chipped with a light hammer, swept clean, and thoroughly wetted and covered with a 10mm thick layer of mortar composed of cement and sand mixed in the same ratio as the cement and sand in the concrete mixture. This mortar shall be freshly mixed and placed immediately before the new concrete is placed.
c) Construction joints when concrete is more than 3 days old: — The procedure specified in (b) above shall be followed, except that the old surface shall be prepared and kept continuously wet for at least 24h before the mortar and new concrete are placed.
d) Construction joints at tops of columns: — The procedure for brushing or cleaning specified in (a) or (b) above, as applicable, shall be followed before the steel reinforcement of the slab or floor to be cast on the columns is placed in position.

Curing and protection: — Formwork shall be retained in position for the appropriate period given in the clause “Removal of Formwork” and shall be considered as providing adequate curing on those surfaces for that period. Should this curing period still be less than that specified, alternatively, should surfaces not be cured by forms then all such concrete shall immediately be protected from contamination and loss of moisture by one or more of the following methods: —

a) ponding the exposed surfaces by means of water, except where atmospheric temperatures are low, i.e., less than 2°C,
b) covering the concrete with sand, or mats made of a moisture-retaining material, and keeping the covering continuously wet;
c) continuous spraying of the exposed surfaces with water;
d) covering with a waterproof or plastic sheeting firmly anchored at the edges,
e) using a prior approved curing compound applied in accordance with the manufacturer’s instructions, provided that in this case, the presence of the compound is not detrimental to subsequently applied finishes.

Whatever method of curing is adopted, its application shall not cause staining, contamination, or marring of the surface of the concrete.

The curing period shall be at least 5 days for concrete made with Portland cement, at least 2 days for that made with rapid-hardening Portland cement and at least 7 days if Portland blast-furnace cement is used. When atmospheric temperatures are below 5° C these minimum curing periods shall be extended by 72, 36 and 72 hours respectively.

CONSTRUCTION DETAILS

Holes, Chases and Fixing Blocks: — No holes or chases other than those shown on the working drawings or approved by the Department shall be cut or otherwise formed in the concrete. No blocks for the attachment of fixtures shall be embedded in the concrete unless approved by the Department.

Pipes and Conduits: — No pipes or conduits other than those shown on the working drawings shall be embedded in the concrete without the approval of the Department. The clear space between any such pipes and the clear distance between such-a pipe and any reinforcement shall be at least 25mm or the maximum size of the coarse aggregate plus 5mm, whichever is greater. The amount of concrete cover over pipes and fittings shall be at least 25mm.

Honeycombing and Other Defects: — After removal of the forms, if the concrete shows any defect in terms of the Specification for Finishes for that concrete, the Contractor shall, on the instructions of the Department, make good the defect at his own cost, by either removing and replacing the defective concrete, or by patching, all as approved by the Department and to the standard of finish required. No remedial work shall be carried out by the Contractor without the prior approval of the Department.

Building on Concrete Footings: — No structural load shall be imposed on concrete footings until at least three days after depositing the concrete in the case of mass concrete footings and after seven days in the case of reinforced concrete footings, or as may be directed by the Department.

RECORDS: —The Contractor shall maintain written records indicating: —

a) the date on which each section was concreted, the time taken to place the concrete, and the position of that section in the Works and its construction joints;
b) daily weather conditions with temperatures being recorded by maximum and minimum thermometers and
c) the nature of samples and dates on which they were taken. In the case of cubes these shall also state the identification marks, test results and age, minimum strength required and position of parent concrete.

TESTS

Compressive Strength: — During the time in which each class of concrete, having a specified 28 day compressive strength equal to or greater than 20 MPA, is being placed, samples of the concrete shall be taken from the point of deposit at the rate of at least one sample from each 5m³ of concrete placed in columns, and from each 30 m³ or part thereof of concrete placed elsewhere, but in either case, nevertheless at least once a week. A group of at least three 150mm test cubes shall be made from each sample for testing at 28 days age. If the Contractor plans to execute further work which relies on previously completed work for support but for which the results of 28 day tests are not available, he is to prove the strength of that concrete by taking and testing at 7 days age an equal number of test cubes to that which is to be tested at 28 days age, prior to the commencement of the planned further work.

The cost of the necessary extra test cubes and testing will be for the Contractor's account. Each group of test cubes shall be deemed to represent the whole of the concrete from which sample was taken and shall be identifiable with the concrete.

The Contractor shall provide, at his own expense, sufficient moulds to keep pace with the rate of concreting. He shall also perform all tasks in respect of compressive strength testing except the actual crushing.

If ready-mixed concrete is used, site testing as specified herein shall still be undertaken, and only the results of such site testing shall be considered in determining the acceptance or otherwise of the concrete.

Grading Analysis: — If so directed by the Department, a grading analysis shall be made for each 40m³ of fine aggregate to be used and for each *75* m³ of the coarse aggregate to be used. The analysis shall be made by the method given in SANS Specification 1083.

Determination of Consistency: — When the slump test is used to measure the consistency of the concrete mix, it shall be carried out by the method given in SANS Method 862 with samples taken in accordance with SANS Method 861.

Costs of Tests: — to concrete, trial mixes, cement, aggregates, water and reinforcing steel shall be borne by the Contractor. The Contractor shall also bear the costs of any other tests (including load tests), which are required as a result of failure on the part of the Contractor to meet the requirements of the Specification.

An item against which the Contractor may allow for all costs in connection with tests on concrete cubes has been included elsewhere in these Bills of Quantities.

Testing Authority: — The crushing of cubes and testing of other samples except in the case of the clause "Determination of Consistency" shall be undertaken by an independent Authority as approved by the Department. The Contractor shall arrange with the Authority that copies of the results of all tests are sent direct to the Department.

ACCEPTANCE CRITERIA FOR STRENGTH OF CONCRETE: — Should any test result obtained from a set of three test cubes of concrete of a specific grade that have been made and tested as specified show that the strength is more than 3 MPA below the specified strength, the concrete represented by such results shall be deemed to have failed to meet the Specification. Should an examination carried out in terms of the clause "Procedure in the event of failure" satisfy the Department that the structural adequacy and durability of that part of the structure where the concrete concerned has been used, is not impaired, the concrete will be acceptable. The Contractor will however be required to review the mix design and any other factors influencing the quality to ensure that further concrete is acceptable.

Where three or more consecutive valid test results (i.e., results of sets of three test cubes that have been made and tested as specified) become available, the following criteria shall apply: —

a) The average of any three consecutive valid test results obtained on concrete of a specific grade must exceed the specified strength by at least 2 MPA.
b) If the criterion given in (a) above is not met but the average is at least equal to the specified strength, the concrete cast will be acceptable but the Contractor will be required to adjust the mix design and standard of control.
c) Should the average result be less than the specified strength, an examination must be carried out in terms of the clause "Procedure in the event of failure" on that part of the structure in which concrete represented by the result has been used.

Alternatively, should a concreting operation be of such size or the testing be of such frequency that thirty or more valid test results (i.e., results of sets of three test cubes that have been made and tested as specified) become available within three months, the Contractor may choose, subject to the approval of the Department, to have the results assessed statistically. In such a case, the average of all the test results of a specific trade of concrete at *any stage* must exceed the specified strength by at least 1,7 standard deviations, failing which the Contractor will be required to adjust the mix design to ensure compliance with this criterion.

PROCEDURE IN THE EVENT OF FAILURE: — If after the evaluation of the test results in terms of the clause "Acceptance criteria for strength concrete" an examination of the concrete in the structure is necessary, one or more of the following procedures in the sequence given may be adopted at the discretion of the Department, and for the account of the Contractor, to determine the acceptability or otherwise of the concrete in that particular part of the structure: —

a) An assessment of the stress level in the structure concerned in relation to the test result obtained.

b) Non-destructive testing, subject to the availability of similar concrete of proven acceptable quality in comparable members in the same construction as a reference.

c) The testing of drilled cores in accordance with the relevant SANS Standard Methods.

d) Full scale load tests in accordance with Section 6 of SANS Code of Practice 0100: Part II.

Where load tests are, in the opinion of the Department, unsuitable or impracticable, and if an examination carried out in terms of the above does not show the concrete strength

to be acceptable, or if a tested portion of the structure fails to pass the tests, the Contractor shall, on the instructions of the Department, replace or strengthen by approved means: —

a) each portion that failed or contains concrete that failed, as relevant, and
b) any other portion, irrespective of strength, the functional purpose of which is affected by the portion or concrete referred to in (a) above.

NON-STRUCTURAL PRESCRIBED MIX CONCRETE: — Concrete for non-structural purposes shall be "Prescribed mix concrete" produced in accordance with the requirements indicated in the table below, and the Contractor is also referred to the foregoing Preambles insofar as they apply: —

TABLE E – PRESCRIBED MIX CONCRETE FOR NON-STRUCTURAL PURPOSES

Class of Concrete	Estimated minimum compressive strength in MPA at 28 days	Maximum nominal size of coarse aggregate in mm	Proportion of Constituents		
			Cement (Parts)	Fine Aggregate (Parts)	Coarse Aggregate (Parts)
A	1	37,5	1	4	8
B	15	19,0	1	3	5
C	20	19,0	1	2 ½	3 ½

Cement and aggregates shall be mixed by volume and the contents of a 50 kg sack of cement shall be taken to be 0.033 m^3

The cement / water ratios and the maximum and minimum slumps for concrete shall be as previously listed in Tables C and D.

The Department shall have the right to vary the proportions of the constituents in any of the prescribed mixes as necessary to obtain the required compressive strength, optimum density and workability of the concrete. Any variation in the rates of the concrete will only be considered if the proportion of cement to the total volume of aggregate, in each case, is varied from that Specified.

Notwithstanding any requirements previously described, the Department may permit certain items of non-structural concrete in small quantities to be mixed by hand.

Where concrete is mixed by hand, the coarse aggregate shall be spread out on a timber, concrete or metal platform in a flat heap, the sand-then spread evenly over the heap, followed by the cement also spread evenly, and the whole thoroughly mixed by shovelling from the centre to the side to form a ring, then back to the centre and again to the side. Water shall then be poured into the ring and the materials mixed into it and then back into the ring, the remainder of the water then added slowly as materials are mixed into it. Mixing shall continue until the colour is uniform and the consistency the same throughout the pile.

"NO-FINES" CONCRETE: — shall consist of one part of cement to eight parts of 19mm aggregate (1:8— 19mm stone) with a water/cement ratio of approximately 0, 46. This water/cement ratio may be varied slightly to suit conditions on approval by the Department.

The quantity of water used shall be just sufficient to form a smooth grout, which shall completely coat every particle of aggregate, and also to ensure that the grout is just wet enough to form a small fillet at each point of contact between the stones. 'No-fines" concrete mixed with excessive water, which results in a thin grout which drops off the aggregate, will be rejected.

"No-fines" concrete shall be placed in its final position within 20 minutes of mixing and shall be placed in continuous horizontal layers. "No-fines" concrete shall be spade worked sufficiently to ensure that it fills the forms but vibrating, tampering or ramming will not be permitted.

BREEZE CONCRETE: — shall consists of one part cement to eight parts clean dry furnace ashes, the ashes being free from all coal or other foreign matter and graded up to particles which will pass a 26. 5mm ring from a minimum which passes a 4.75mm mesh. The finer materials from the screening to be first mixed with the cement into the mortar and the ashes added afterwards and thoroughly incorporated. The breeze concrete is to be mixed in batches not exceeding 0, 1 in 3 and each batch is to be immediately placed in position. The ashes for breeze concrete are to be obtained in an unscreened state and are to be kept dry so that sufficient fine material will be obtained from the screening to make the mortar.

FINISHES TO IN-SITU CONCRETE

Formed Finishes: — are the concrete surface finishes developed using formwork and whose standard of finish in each class shall be as described.

The Department shall be informed by the Contractor of any defect in terms of this Specification, and no remedial work shall be carried out by the Contractor without the prior approval of the Department. Any defect shall be made good at the Contractor's expense by either removing and replacing the defective concrete, or, in certain instances only, by patching, all as approved by the Department and to the standard of finish required.

Class F1 Ordinary Finish: — Formwork panels shall be of such quality that upon removal, the concrete is true and even, free from fins and recesses greater than 5mm size, honeycombing, large air holes and the like. Bolt holes shall be filled if so required by the Department.

Class F2 Smooth Finish: —This class of finish requires a high standard of concrete work, formwork and technique.

Concrete placed in any one structure to give this finish shall be made from cement and aggregates from the same source, and similarly, the grading of the aggregate shall be kept constant.

Formwork shall be metal or wrot timber in a new condition designed and constructed to suit the particular job in hand and with shutter bolts and joints between panes in a pattern approved by the Department. Joints between panels shall be watertight, but the use of sealing tape, which marks the concrete, shall not be permitted.

Construction joints shall be in the position and of the detail shown upon the working drawings. Should the Contractor wish to incorporate further construction joints or amend the position of those shown to suit his own requirements or technique, this may be allowed provided that all design considerations are met, that the prior approval of the Department is obtained and that any extra costs are borne by the Contractor. In the case of horizontal construction joints, the top edge of the concrete on the Class F2 smooth finish side is to be struck true and level with a trowel.

Special care shall be taken to ensure that forms are clean of all pieces of tying wire, nails and other debris at the time of concreting.

The standard of finish shall be such that, upon removal of the formwork, no further treatment, other than treatment of bolt holes if required shall be found necessary to provide a straight, smooth and uniform finish of good quality and consistent colour and texture, free of all honeycombing and large air holes.

UNFORMED FINISHES: — are those concrete surface finishes developed without the use of formwork -

Class U1 Ordinary Finish: — Immediately after placing, the concrete shall be finished by screeding with the edge of a wooden board of straight and true line and working between guides set accurately to level. No mortar shall be added and noticeable surface

irregularities caused by the displacement of coarse aggregate shall be made good by re-screeding after removing or tamping down the offending aggregate.

Class U2 Wood Float Finish: — The concrete surface shall first be brought to the standard Class U1 ordinary finish and then floated with a wood float. Floating shall be started as soon as the screeded finish is stiffened sufficiently and the bleed water has evaporated or been removed and it shall be the minimum necessary to produce a surface free from screed marks and uniform in texture.

Class U3 Steel Trowel Finish: — The concrete surface shall first be brought to the standard of Class U2 wood float finish with floating being continued until a small amount of mortar without excess water is brought to the surface and then when the floated surface has hardened sufficiently to prevent any more excess fine material from being drawn to the surface, troweling with a steel trowel. Troweling shall be performed with firm pressure such as will flatten the sandy texture of the floated surface and produce a dense uniform surface free from blemishes and trowel marks. Gradual surface irregularities shall not exceed 5mm over any 3m. The sprinkling of sand and/or neat cement on the surface to absorb excess moisture shall not be permitted.

Class U4 Power Float Finish: — The concrete surface shall first be brought to the standard of Class U1 ordinary finish using wooden screeding boards or steel rollers. After evaporation or removal of all bleed water and immediately the concrete is stiff enough to support the machine the surface shall be closed with a mechanical power float and then finished with a mechanical power trowel. The texture of the finished surface shall be either non-slip or polished as shown on the drawings. Irregularities shall be of long wavelength not exceeding a curvature of 2mm in 600mm. Under no circumstances shall sand and/or neat cement be sprinkled over the surface either to absorb excess moisture or to fill surface blemishes or irregularities. Power floats and trowels shall be operated by skilled operators.

TOLERANCES: — Clause 6 of SANS Specification 1200G refers. Unless otherwise agreed by the Department, 'Degree of Accuracy' shall apply to all concrete work and steel reinforcing.

SUPERVISION: — The construction of all concrete work shall, at all times, be under the supervision of a competent person experienced in the production and placing of high-grade concrete. He shall personally supervise all work relating to the concrete construction and pay special regard to: —

a) The quality, testing and mixing of materials.
b) The finish, stability and cleanliness of formwork and excavations.
c) The cleanliness, correct positioning and maintenance in position of steel reinforcement.
d) The transporting, placing, compacting and curing of the concrete. The construction and stripping of formwork.
e) The production of samples, test cubes, slump and other tests.

GENERAL

Measurement and Payment: — The provisions of Clause 8 of SANS Specification 1200G will NOT apply and the system of measurement that is adopted in these Bills of Quantities is the only system of measurement that will be recognised in this Contract.

No deductions have been made for pipes not exceeding 200mm internal diameter, reinforcement, conduits, structural steel, bolts and the like.

Rates for Concrete: — are to include for mixing, handling and depositing (by hoisting or lowering) in the forms. Rates for items of reinforced concrete are to include for thoroughly working and packing around the steel reinforcement. All reinforcement, except where otherwise described, has been measured separately.

Rates for concrete surface beds are to include for laying in suitable size panels not exceeding 20m^2 or as may be directed. The Contractor is to allow in his pricing of the concrete for all construction joints.

Striking off and Curing: — of concrete slabs and surface beds has been measured separately. The rates for all other items of concrete including stairs and landings and concrete bindings, are, except where otherwise described, to include for all necessary striking off of surfaces and curing.

The rates for items of striking off and curing top surfaces of concrete shall, unless otherwise described, apply to level surfaces.

Where exposed sloping surfaces of concrete do not exceed the limits of pitches laid down for the measurement of back shuttering, the striking off and curing of the sloping top surfaces has been measured in the case of concrete slabs and surface beds, and in other-cases provision has been made for dressing the concrete surfaces to splay.

Where items of striking off and curing are described as to falls or ramps this shall include cross-falls, etc.

The rates for striking off and curing of surface beds formed in panels must also include for all necessary temporary formwork in forming the panels.

Rates for Formwork: — are to be for use and waste only (except where described as "permanent") and are to include for fitting together in the required forms, propping, strutting, shoring, wedging, plumbing and fixing to true angles and surfaces, cambering formwork to slabs and beams where required, preparation and treatment of surfaces as necessary to ensure easy release during stripping, reconditioning as necessary before re-use, providing necessary temporary openings for the purpose of cleaning, inspection and placing of concrete, and for all straight cutting, splayed edges, intersections, notching and narrow widths, including waste and properly fitting at intersections, maintaining in position for periods as directed and for striking and removing.

Rates for items of formwork to soffits of slabs and to sides and soffits of beams, lintels and the like are to include for horsing exceeding 1,5m and not exceeding 4,5m high unless otherwise stated in the items.

Rates for formwork to soffits of stairs and landings are to include for all necessary horsing.

Rates for Permanent Formwork: — are to include for leaving in all formwork, props, etc. as permanent formwork shall be regarded as not being recoverable.

Rates for Steel Fabric Reinforcement: — are to include for lapping the reinforcement at all edges, as specified, for all cutting and waste, notching, etc. bending where required, wiring together at laps and for maintaining in position during placing of concrete.

Rates for Steel Bar Reinforcement: — are to include for all cutting, bending, hooked ends, wiring together at passing points, hoisting or lowering to the required levels, fixing in accordance with the detail drawings, cover blocks and maintaining in position during placing of concrete. The mass of mild and high yield stress steel bars shall be based on the values shown in Table EI of SANS Specification 920— Appendix E (with no allowance being made for rolling margin and waste).

The mass of the binding wire required for fastening the reinforcement together is not included in the mass of the reinforcement. Provision for the cost of this wire shall be deemed to have been made by the Contractor in calculating the unit rate for the net mass (i.e. excluding the mass of binding wire) of the reinforcement.

4. BRICKWORK

SAND: — shall comply with the requirements of SANS Specification 1090, washed where necessary and screened through a 2360 micrometer mesh sieve.

CEMENT: — shall be Portland cement of normal setting quality complying with SANS

Specification 471 or Portland cement 15 complying with SANS specification 831. Cement containing more than 15 % blast furnace slag will not be permitted to be used.

LIME: — shall be hydrated lime complying with SANS Specification 523.

WATER: — shall be clean and free from injurious amounts of acids, alkalis, and other organic substances. If so required by the Department, the suitability of the water shall be proved by tests carried out by an approved laboratory.

CEMENT MORTAR: — unless otherwise described, shall be composed of one part by volume of cement to five parts by volume of sand.

COMPO MORTAR: — unless otherwise described, shall be composed of one part by volume of cement, one part by volume of lime to ten parts by volume of sand.

STRENGTH MORTAR: —where required, shall be of the class specified and as defined in Table C-I of SANS Code of Practice 0164—Part I.

MIXING OF MORTAR: — the materials are to be mixed dry on a non-absorbent and close jointed timber or iron platform until the mixture is of uniform colour with water added and the mixture turned over until the ingredients are thoroughly incorporated.

No cement mortar that has once commenced to set will be allowed to be used. Mixing platforms are to be cleaned and old mortar removed before any new batch of mortar is prepared for mixing. No mortar mixing by adding additional materials is permitted after 5 (five) hours.

TESTING OF STRENGTH MORTAR: — During the time brickwork is being laid samples shall be taken of the mortar being used as shall be directed by the Department. A group of three 70mm x 70mm x 70mm test cubes shall be made from each sample for testing at 28 days of age. Each group test cubes shall be deemed to represent the whole of the batch from which the sample was taken and shall be identifiable with the batch.

The testing shall be undertaken by an independent firm or institution nominated by the Contractor to the approval of the Department. An item for the testing of mortar cubes has been provided elsewhere in these Bills of Quantities.

BURNT CLAY COMMON BRICKS: — shall comply with SANS Specification 227 and are to be good quality, sound, hard, well burnt bricks, uniform in size and shape.

A sample load of bricks is to be approved by the Department and all subsequent loads are to be equal thereto.

BRICKS FOR FOUNDATIONS: — are to be as above but extra hard burnt bricks.
Reject facing bricks may be used in lieu of extra hard burnt foundation bricks provided they are equal to a sample to be submitted to and approved by the Department. These bricks are also to be used for septic tank walls.

BRICKWORK: —unless otherwise described is to be in burnt clay common bricks and wherever practicable is to be in stretcher bond with the skins tied together with and including galvanized crimped wire wall ties in accordance with SANS Specification 28. The wire ties are to be of sufficient length to allow each end to be built into brickwork built into every fourth course and spaced at 450mm staggered centres (seven ties per square metre). The bricks are to be well wetted before being laid and the course of bricks laid last is to be well wetted before bedding the next course of bricks upon it. The brickwork is to have all perpends flushed up solid and each course is to be laid on a solid bed of mortar. No false headers are to be used. Whole bricks are to be used except where bats or closers are legitimately required to form bond.

Unless otherwise described one brick walls are taken at a nominal thickness of 230mm.

The joints of all walls to be plastered are to be raked out as the work proceeds to form key for plaster. All walls are to be carried up regularly so that no part is built more than 1,2m higher than the adjoining walls.

Mortar joints generally are not to exceed 10mm thickness unless otherwise indicated on the drawings. If a specific brick scale is indicated on the drawings, either drawn or written, it must be adhered to.

Solid bricks to X-Ray Room walls are to be used. If hollow core bricks are used, these are to be grouted up solid.

HOLLOW WALLS: — are to be formed of two thicknesses of brickwork as specified with cavity between, tied together, unless otherwise specified, with and including A.I.S.I. Type 304 stainless steel wire butterfly type wall ties in accordance with SANS Specification 23, of sufficient length to allow each end to be built into brickwork, built into every fourth course and spaced at 450mm staggered centres (seven ties per square metre). Cavities are to be kept clear of all rubbish, mortar droppings and projecting mortar.

BRICK LININGS TO CONCRETE: — unless otherwise described are to be tied to concrete with and including A.I.S.I. Type 304 stainless steel wire wall ties complying with SANS Specification 28 with one end embedded is to deep into concrete and other end built into the brick joints and spaced not less than seven ties per square metre.

REINFORCED BRICK LINTELS: — unless otherwise detailed are to be constructed in accordance with KZN Public Works Type Drawing.

PRE-CAST AND PRE-STRESSED CONCRETE LINTELS: — where specified, are to be of approved manufacture and the Contractor is to provide the Department with a certificate issued by the manufacturer certifying that the lintels are adequate for the purpose in terms of span, loading and number of courses and construction of brickwork above the lintel. The manufacturer is also to specify the minimum bearing required at each bearing end and the nature and period of temporary propping required. Rates or pre-cast pre-stressed concrete lintels are to include for any cement mortar filling required and for temporary propping in accordance with the manufacturer's instructions.

BAGGING DOWN BRICKWORK: — shall be carried out when the mortar in joints is still soft by rubbing over with wet rough sacking until all joints and crevices are evenly filled, including additional mortar if necessary to obtain an even surface or, when the mortar in joints is set, by rubbing over as described but including cement grout as necessary to fill up the joints and crevices.

CRAMPS: — for timber door frames shall be 1.6mm thick galvanized hoop iron 32mm wide with one end turned up 50mm and twice screwed to stile of frame and built 450mm deep into wall with other end turned up into brick joint and cranked as necessary where built into cavity wall. Cramps shall be built in approximately 330mm from top and bottom of stile and intermediately at not exceeding 825mm.

TIES TO WALL PLATES, RAFTERS, ETC.: — shall be 1.6mm thick galvanized hoop iron 32mm wide and at least 1500mm long with one end turned up and built in not less than ten courses deep into brickwork or embedded in concrete beams or slab and with end left projecting and wrapped around timber rafter and spiked to timber wall plate. Where ties are embedded to concrete beam or slab, they must be wrapped around the bottom steel bar reinforcement of the beam or slab.

WELDED MESH BRICK REINFORCEMENT: — shall be 55mm, 80mm, 155mm or 235mm wide consisting of two 3.55mm main high tensile steel wires at 50mm, 75mm, 150mm or 230mm centres respectively with 2.80mm high tensile-steel cross wires electrically welded at 300mm centres, lapped 150mm at end joints, 75mm at angles and built 110mm into connecting walls. No allowance has been made for laps.

BITUMEN EMULSION WATERPROOFING TO BRICKWORK: — The inner thickness of external superstructure walls whether hollow or solid, behind facing bricks, is to be bagged and painted with two coats of approved bitumen emulsion waterproofing compound.

FACING BRICKS. PAVING BRICKS, QUARRY TILES, ETC.: — Facing bricks shall comply with SANS specification 227. Facing bricks, paving bricks, quarry tiles, terra cotta grille blocks, etc. are to be of the types and colours specified, specially selected, free from blemishes, square on all faces, uniform in size, shape and colour and equal to a sample to be deposited with and approved by the Department.

Special care must be taken to preserve the arrases and faces of facing bricks, paving bricks, quarry tiles, etc. during transit and handling.

FACED BRICKWORK: — Facing bricks shall be sorted to ensure proper mixing of the bricks within the colour range of each type of facing bricks. Sudden changes in the general colour of faced brickwork in any one type of facing brick will not be acceptable. Sand used in mortar for faced brickwork is to be clean washed sand and sand from the same source is to be used throughout to maintain a uniform appearance. Faced brickwork is to be pointed as specified as the work proceeds. Keyed-in joints are to be formed with a round jointing tool and square recessed joints are to be approximately 6mm deep formed with a square jointing tool. All perpends are to be accurately kept. The bond is to be broken, if necessary, in the centre of panels above and below windows, above doors, between openings and in the centre of sides to piers. No broken bond will be allowed at reveals or quoins. All cutting to face bricks is to be done with a carborundum or other approved high-speed brick saw. Faced brickwork is to be protected from injury, mortar splashes, etc. and cleaned down with spirits of salts and scrubbed down with water at completion to the approval of the Department.

PAVING BRICKS AND QUARRY TILES: — unless otherwise described are to be pointed as the work proceeds with 6mm wide keyed-in joints. Paving bricks and quarry tile paving, sills, etc. are to be protected from injury, mortar splashes, etc. and cleaned down with spirits of salts and scrubbed down with water at completion to the approval of the Department.

FIBRE CEMENT SILLS: — are to be of approved manufacture without fixing lugs, even in shape, uniform in colour, free from cracks, twists and other defects, in single length between reveals and of the thickness and colour specified and equal to approved sample.

RATES

Brickwork Generally: — Rates for brickwork are to include for hacking the face, or raking out the joints, of brickwork where necessary to form key for plaster, etc. and for plumbing angles and surfaces, all square cutting, wedging and pinning against columns, beams, slabs, etc. for all waste in cutting and wire ties required in tying skins together as described.

Rates for hollow walls are to include in addition to the above for keeping the cavities clean and free of mortar droppings and for butterfly type wall ties, all as described.

Where items are described as cut and pinned, built in, bedded, wedged and pinned, etc. rates are to include for grouting in or bedding solid with 1:3 cement mortar, unless otherwise stated.

Where window units, etc. are described for building in as composite, rates are to include for assembling of units as required and, unless otherwise described, for tap screwing to coupling mullions or transoms, including holes:

Faced Brickwork, etc.: — Rates for all fair and faced brickwork, brick paving, grille block walls and the like are to include in addition to the foregoing for building or laying to true surfaces and angles, all fair square cutting and fitting and cleaning down to approval at

completion.

Rates for brick sills, copings, steps, margins, thresholds and the like shall include for fair ends and angles unless different bricks or tiles are used or special cutting is required.

Rates for items described as “Extra over ordinary brickwork” are to be for the extra cost of the facing bricks specified over common brickwork built in stretcher bond, and are to include for building in cement mortar consisting of one part cement to five parts clean washed sand and for pointing as described.

Rates for items described as “Labour and Material” are to be for the full cost of the facing bricks specified, and otherwise as above described.

Rates for all cut face brick linings are to include for cutting and bonding at ends.

Quarry Tiles: —Rates are to include for all square cutting and fitting, bedding and jointing in cement mortar consisting of one part cement to three parts clean washed sand, for pointing as described as the work proceeds and cleaning down to approval at completion.

Rates for treads, sills, copings, cappings, skirtings etc. are to include for pointing to exposed edges, ends and projecting soffits.

Air Bricks: — Rates for air bricks and air vent, gratings are to include for forming openings through the walls, for all necessary jack arches and turning pieces, for plastering all round the openings in cement mortar, and where in hollow walls, for building cavity solid all round in addition.

Fibre Cement Sills: — Rates are to include for all square cutting, waste, and fitting and for bedding in an approved epoxy adhesive.

Terra Cotta Grille Blocks: — Rates are to include for all square cutting and waste and fitting, bedding and jointing in cement mortar consisting of one part cement to three parts clean washed sand and for pointing with keyed in joints on both faces and into reveals of openings as the work proceeds.

5. WATERPROOFING

GENERAL: — All measurements are nett — no allowance being made for laps in sheet materials or for waste in cutting.

WORKMANSHIP: — All work is to be carried out to the approval of the Department by skilled and qualified workmen and in accordance with the methods prescribed in SANS Code of Practice 021 for waterproofing of buildings.

All work is to be executed in accordance with the instructions issued by the manufacturer of the material being used. Roof coverings and linings are to be laid to the fails, cross falls, etc. provided in the screeds or other surfaces to which they are to be applied.

Surfaces to be waterproofed are to be dry and cleaned of all dust, chips, etc. immediately prior to the commencement of this work and are to be free of any contaminating substances or projections that may damage the waterproofing materials being used.

POLYETHYLENE SHEETING: — is to comply with SANS Specification 952 and bear the SANS mark. The sheeting is to be laid with a minimum lap of 150mm, unless otherwise specified, at angles and junctions with laps sealed in accordance with the manufacturer’s instructions.

MASTIC ASPHALT ROOFING: — is to conform to SANS Specification 297 and is to be laid hot in two or three layers, as stated, with each layer of minimum 4mm thickness and laid to break joint with the underlying layer by not less than 150mm.

Prior to the commencement of any work, the specialists who lay the mastic asphalt roofing are to satisfy themselves as to the acceptability of the surfaces upon which the mastic asphalt is to be laid, as the said specialists will be held fully responsible therefore.
Mastic asphalt to surfaces not exceeding 10-degree slope is to be laid in two layers on and including one layer of approved reinforced waterproof building paper lapped 75mm at all edges. Rates are to include for all cutting and waste on building paper.

Mastic asphalt to surfaces exceeding 100 and not exceeding 200 slope is to be laid in two layers on surfaces which have been hacked, grooved or scoured to provide an adequate key. Rates are to include for the necessary preparation of the surfaces.

Mastic asphalt to vertical surfaces and surfaces exceeding 20-degree slope is to be laid in three layers on and including any necessary expanded metal lathing securely fixed to the surfaces to prevent creeping. Where vertical surfaces do not exceed 300mm in height the surfaces to receive mastic asphalt may alternatively be prime coated with a latex based bitumen emulsion primer prior to the application of the mastic asphalt.

Anile fillets to all internal angles are to be run in one operation.

Finishing coats of bituminous-based aluminium paint on mastic asphalt roofing have been measured separately.

FLEXIBLE GLASS-FIBRE REINFORCED POLYESTER WATERPROOFING: — shall be of the type specified, or other approved, supplied and laid in-situ by a specialist sub-contractor, all to the approval of the Department and shall carry a written 10 (ten) year guarantee.

The waterproofing applied in-situ shall consist of one layer of three-ply bituminous felt underlay bonded to the substrate and covered with flexible glass-fibre reinforced polyester waterproofing comprising a chopped strand glass-fibre mat having a minimum mass of 450g / m², impregnated with flexible unsaturated polyester resin and finished with two coats of abrasion-resistant flexible unsaturated polyester surface coating which shall not show any sign of the glass-fibre reinforcement. The total mass of the waterproofing (excluding the bituminous felt underlay) shall be not less than 1.8kg / m².

Chopped strand glass-fibre mat reinforcement is to comply with the requirements of SANS Specification 419.

All unsaturated polyester resins are to be suitable for their intended use and comply with SANS Specification 713 and are to be ultra-violet ray stabilised.

All flexible glass-fibre reinforced polyester waterproofing is to be finished to approved opaque colours (excluding red or orange tints), is to be properly cured, and is to be free from porosity, blisters, cracks, surface crazing or other defects which may affect its appearance or its performance, with the surface colours consistent throughout.

Samples of flexible glass-fibre reinforced polyester waterproofing are to be submitted to and approved by the Department and all work executed is to be equal to the approved samples.

EXPANSION JOINT SEALANTS: — Polysulphide sealants, where specified, are to be approved polysulphide sealants complying with SANS Specification 110 Type 2, well compacted into joint.

Rates are to include for priming joints where recommended by the manufacturer of the sealant being used with a suitable and approved primer.

All work is to be executed by the manufacturer of the material, or other specialist firm, all in accordance with the manufacturer's instructions.

RATES: — for all roofing and linings are to include for cleaning and preparing the surfaces to be waterproofed as before described, for protecting from damage and cleaning down, flood-testing if required and handing over in an acceptable and guaranteed watertight condition at completion.
Rates for sheet waterproofing materials are to include for all dressing, bending, narrow widths, angles, intersections, cutting and waste and where applicable for the extra material required for lapping and for sealing laps as described.

Rates for roofing described as laid on "flat" roofs are to include for laying to slopes not exceeding 100mm from the horizontal.

6. ROOF COVERINGS

CONCRETE ROOFING TILES: — shall conform to SANS Specification 542. The tiles are to be of pattern and colour specified and is to be even in thickness, uniform in shape and colour and free from cracks and blemishes. The tiles are to be laid to "straight bond" in accordance with SANS Code of Practice 062 with vertical joints and bottom edges of each course ranging perfectly straight.

Unless otherwise specified each tile in every third course, all tiles in eaves and ridge courses and tiles in every course on each side of hips and valleys shall be secured with copper clout headed nails driven into the battens or with approved non-corrodible tile clips and nails in accordance with the manufacturer's instructions. Where nail holes in tiles have been cut off at hips, valleys, top edges, etc. new holes are to be drilled.

All ridge and hip cappings are to be of the types specified and of colour to match the roofing tiles. The cappings are to be bedded, jointed, pointed and torched up over roofing tiles in 1:3 cement mortar tinted to match the tiles. Where cappings having butt jointed ends are specified, an approved damp proof course conforming to Type C of SANS Specification 952 is to be fixed under, laid over the roofing tiles in accordance with the manufacturer's instructions.

Barge cappings are to be of the types specified and of colour to match the roofing tiles. The barge capping tiles are, unless otherwise specified, to be bedded, jointed, pointed and touched up over roofing tiles in 1:3 cement mortar tinted to match the tiles with every tile drilled and secured with copper clout headed nails to timber barge boards or bearers (elsewhere measured).

Concrete tiles to residential units in non hail area's are permitted.

"**CHROMODEK" ROOFING SHEETS: -** Shall be the secret fixed type, supplied with all fittings in full-length sheets in the profile and colour as specified. Sheets shall be a minimum of .58mm and maximum of .8mm thickness. When .58 thick sheets are used, purlin spacings shall be a maximum of 1.2mtr¢ and maximum 1.5mtr¢ for .8 thickness. Sheets shall leave the factory in the specified colour and any scratches etc., due to handling are to be 'touched up' on site after installation. All fixings, valleys, cappings and securing clips shall be to manufacturers' recommendations and no variations shall be accepted without prior approval from the department.
0,58mm thick roof sheeting for purlins up to 1,2m spacing and 0,8mm thick roof sheeting for purlins exceeding 1,2m – 1,5m spacing.
In area's up to 30Km from the coast, metal roof sheeting to be 0,58mm thick with special corrosion protection as supplied in " Global- Duro" roofing sheets. All other area's to be 0,58mm as "Global-Tech corrosion protection. 0,58mm "Klip Lock 700 " or "Craflock " and 0,8mm " Brownbuilt ". (0,8mm is recommended for high rainfall and snow fall area's due to deeper trough.)

RATES: **—** for roof coverings, are to include for all necessary half tiles at verges and for all square cutting and waste at verges, abutments, and top and bottom edges and to both sides of ridges.

Rates for cappings, etc. are to include for all short lengths, cutting, waste and fitting at intersections.

All measurements are nett. No allowances have been made for overlaps.

CORRUGATED IRON ROOFING, CLADDING AND FITTINGS: — are to be of an approved brand and are to be manufactured from galvanized steel sheets of the thickness specified after galvanising and having a galvanized coating of "Iscor Coating Designation Z275" for inland areas and 'Z600" for coastal areas as specified.

Roofing, etc. shall be lapped one and a half corrugations at sides and 30mm at ends unless otherwise specified. Roofing, etc. shall be fixed to timber purlins, rails etc. with standard galvanized drive screws 65mm long and to steel purlins, etc. with 8mm galvanized hook bolts of the lengths stated.

Each screw or bolt shall be fitted with one lead washer and one bituminous felt washer and shall be spaced not less than one screw or bolt to every alternate corrugation across the width at end laps and ends of sheets and at each intermediate purlin or rail.

Rates for roofing, cladding and fittings are to include for: —
a) Fixing as described.
b) Bedding washers in an approved mastic sealing compound
c) Coating projecting ends of hook bolts and nuts with bitumen after fixing
d) All square notches, square cutting and waste, laps, fitting and drilling. All measurements are nett. No allowance has been made for laps.

FLUTED STEEL ROOFING, CLADDING AND FITTINGS: **—** are to be approved galvanized fluted steel sheets and fittings manufactured from galvanized steel sheets of the thickness specified after galvanising

(a) **Galvanized steel sheets and fittings**: **—** are to be manufactured from galvanized steel having a galvanized coating of "Iscor Coating Designation Z275" for inland areas and of "Z600" for coastal areas as specified with the sheets having a plain galvanized finish and the fittings an embossed galvanized finish.
Roofing, etc. shall be fixed to timber purlins, rails, etc. with standard drive crews of the lengths stated and to steel purlins, rails, etc. with 8mm galvanized hook bolts of the lengths stated. Each fixing screw or bolt shall be fitted with washers as recommended by the manufacturer of the roofing

Vertical cladding shall be fixed with broad flutes externally - unless otherwise described - to timber rails with standard galvanized drive screws 50mm long and to steel rails with 6mm diameter x 25mm long galvanized sheet bolts. Each fixing screw or bolt shall be fitted with washers as recommended by the manufacturer of the cladding including drilling steel rails as necessary.

(b) **Baked enamel finished galvanized steel sheets and fittings**: **—** are to be manufactured from un-passivated galvanized steel having a galvanized coating of "Iscor Coating Designation Z275" and finished where described in the items, with approved factory applied baked enamel finish of colours to be selected by the Department.

Roofing, etc. shall be fixed to timber purlins, rails, etc. with sherardised or stainless steel drive screws of the lengths stated and to steel purlins, rails, etc. with 8mm diameter sherardised or stainless steel hook bolts of the lengths stated. Each fixing screw or bolt shall be fitted with washers as recommended by the manufacturer of the roofing.

Vertical cladding shall be fixed with broad flutes externally, unless otherwise described, to timber rails with sherardised or stainless steel drive screws 50mm long and to steel rails with 6mm diameter x 25mm long sherardised or stainless steel sheet

bolts. Each fixing screw or bolt shall be fitted with washers as recommended by the manufacturer of the cladding including drilling rails as necessary.

(c) **Generally**: **—** where sheet lengths are in excess of 12m these have been measured separately.

Roofing, etc. shall be lapped one flute at sides and 230mm at ends unless otherwise specified. Fixing roofing sheets are to be spaced one every crest along purlins at top and bottom edges of roof slopes and one to every alternate crest along intermediate purlins. Fixings to vertical cladding are to be spaced one to even alternate trough to each rail.

Fittings, unless otherwise specified, are to be lapped a minimum of 150mm and where necessary are to be drilled for and fixed with the fixings securing the roofing and cladding sheets.

Rates for roofing, cladding and fittings are to include for: —

(a) Fixing as described and in accordance with the manufacturer's instructions.
(b) Seam bolting all side laps at not exceeding 450mm centres with 6mm diameter x 25mm long sheet bolts or with 20mm x No. 14 self-tapping screws and each screw or bolt is to be fitted with washers as recommended by the manufacturer of the roofing.
(c) Fixing of fittings where described as fastened to roofing, cladding, etc. with approved pop rivets spaced at not more than 340mm centres.
(d) Sealing side and end laps of sheeting and end laps of fittings with one continuous strip of approved 5mm diameter pre-formed flexible sealant strip.
(e) Coating the exposed heads of fixings and fasteners to baked enamel finished materials and cut edges of sheets and fittings with matching touch-up compound supplied by the manufacturer of the sheeting and in accordance with his instructions.
(f) All square notches, square cutting and waste, laps fitting and drilling. No punched holes will be permitted.
(g) Taking special care at all times to prevent damage to the finished surfaces of the baked enamel finished materials.

All measurements are nett. No allowance has been made for laps.

7. CARPENTRY AND JOINERY

NOMENCLATURE OF TIMBERS: — Timber described as "softwood" is to be South African softwood of the relevant type, grade, etc. as specified.

The names used for imported timbers are those given in Supplement No. 1 to SANS Code of Practice 12 under "Nomenclature of Standard Trade Names of Imported Commercial Timbers used in South Africa" and the Contractor is referred thereto.

TIMBER SIZES: **—** Sawn and wrot timbers are to be of the full sizes stated.

Where "out of" sizes have been shown for wrot timbers on the drawings, an allowance of 4mm for each wrot face off the sizes shown has been made.

Doors, fanlight, sashes, manufactured boarding, plywood, veneers, etc. must be of the full thickness specified.

Where doors, door frames, fanlights and frames; sashes, windows and frames are measured as numbered items, the overall sizes are given to the nearest 10mm.

Tolerances in nominal dimensions for imported timber shall not exceed the following:

a) For nominal dimensions up to 76mm the actual dimension may be 2.5mm under for each 25mm
b) For nominal dimensions 76mm and over the actual dimension may be 1.6mm under for

each 25mm.

STORAGE OF TIMBERS: — Timber delivered to the site is to be property stacked above ground, either on bearers or platforms under cover and protected from inclement weather.

ORDERS: — for timber, are to be placed immediately after the Contract is signed, as the Contractor will be held responsible for any delay in delivery.

PRE-TREATMENT OF TIMBERS: — All permanent timbers installed in the buildings are to be treated against borer, cryptotermes, termites, and all wood destroying agencies with an approved preventative, all in accordance with SANS Code of Practice 05.

Any surface subsequently exposed by cutting or planing must be touched up with the same preservative solution and rates are to include for all preservative required.

The Contractor is to obtain a certificate from the merchants supplying the treated timber, to the effect that the timber has been treated against wood destroying agencies. The Department has the right to remove samples of the treated timber to have tests carried out by the Division of Entomology or any other Authority.

Temporary timber on the site, e.g. shuttering props, etc. must be free from wood destroying agencies. Any timber so affected is to be immediately removed from the site.

Materials which do not comply with the above requirements or are in any way damaged or discoloured by the pre-treatment must be replaced by the Contractor at his own expense, if so directed by the Department.

STRESS GRADING OF SOFTWOOD TIMBER: —The Mechanical Stress Grading of Softwood Timber (Flexural Method) shall be in accordance with SANS Code of Practice 0149.

STRUCTURAL TIMBER: — for carpentry is to be South African softwood in accordance with SANS Specification 563 and, unless otherwise specified, of Stress Grade V4, and branded accordingly. If it is necessary to use sizes that have to be re-sawn, these shall be re-graded and stamped with the respective SANS stress grade mark. Unless this is done, timber which is re-sawn is no longer considered as complying with the specification and shall on no account be used.

BRANDERING / BATTENS: — of cross-sectional size 50 x 50mm and under shall be South African softwood in accordance with SANS Specification 653 and branded accordingly.

JOINERY AND SHELVING: — Softwood for joinery and shelving shall be South African softwood (S. A. Pine) in accordance with SANS Specification 1359 and branded accordingly. All timber for joinery is to be air or kiln-dried to a moisture content of approximately 12 %.
Shelving to linen stores to be timber slatted with wall bands or free standing units as specified.

STRUCTURAL LAMINATED TIMBERS: — are to be of the sizes detailed, wrot on all faces and are to be manufactured by an experienced fabricator to the approval of the Department. Adhesives used must meet the requirements of the current SANS 1204 for external use.

The surface appearance of members shall be Class C (Constructional) or Class S (Selected) as defined in SANS Specification 876 and as stated in the items

FINGER-JOINTED TIMBERS: **—** are to be manufactured in accordance with SANS Code of Practice 096— “The manufacture of finger-jointed structural timber”.

Contractors wishing to use finger-jointed timber must supply a guarantee that the finger jointing complies with the above Code of Practice and that the glue is suitable for the particular member.

JOINTING OF PURLINS, FASCIAS, RAILS, BEAMS, ETC.: —shall, unless otherwise detailed, be as follows: —

Purlins, slating battens, etc. of cross-sectional size 50 x 76mm and under shall be jointed over the rafter. Larger sized purlins may be dealt with in the same way or by using some other suitable, recognised method. All purlins and battens shall be fixed to the supporting rafter by at least one nail skew driven from the direction of the ridge. Where the purlin or batten is fixed at more than 900mm centres, at least two nails shall be used at every fixing point.

Fascias shall be jointed over rafters.

Beams, rails, etc. shall be jointed over a support or at 1/5th span with a recognised joint using bolts, etc.

Roof and floor plates are to be halved at joints, angles and intersections and nailed together.

Floor joists and bearers are to have splayed heading joints nailed together and staggered to occur over bearers and sleeper piers respectively.

Sawn brandering is to be butt-jointed at heading joints and angles and where wrot, is to have splayed heading joints and mitred angles over all point of support.

HARD WOODS: — (Red Meranti and Sapele) are to be best quality, specially selected and well seasoned, free from all sapwood to the approval of the Department and are to be well kiln-dried.

Red Meranti is to be even in grain and colour, selected from “Standard and Better” grade from Malaysia. Sapele is to be *Entaindrophragma cylindrium* of F..A.S. grade.

PREFABRICATED TIMBER ROOF TRUSSES: -

Design: —The design of prefabricated roof trusses, bracing, and secondary members forming part of the total timber roof construction shall be prepared by a professional structural engineer (Truss Systems Engineer) strictly in accordance with SANS Code of Practice 0160 and the superimposed loading, unless otherwise specified, is to be taken as that for inaccessible roofs.

Analysis: — From the configuration and mechanism shown on the tender drawings the Truss System Engineer shall submit, through the Contractor, to the Department detailed calculations and working drawings showing timber sizes, connections, truss dimensions, etc.

This submission must include details of both trusses and bracing as specified below:

a) TRUSSES: The analysis of the truss system is to include diagrams of the trusses with marked up members and nodes showing dimensions, positions of supports and positions and values of applied loads, which, if not specified in the tender documents, must be derived from an approved source of reference which shall be indicated in the analysis. Due account must be taken of any eccentricity particularly at supports.

   The analysis must also indicate allowable stresses, internal axial forces, moments and resulting stresses, as well as timber sizes and grades and detailed plate sizes

(b) BRACING: Bracing must be designed to withstand the forces specified in SANS Code of

Practice 0163 clauses 6 and 7.

If the bracing system incorporates trusses, the additional forces must be shown in the analysis of the trusses.

The drawings must give all the information necessary for the construction of the bracing.

An outline of the bracing system, including temporary bracing must be shown on a working drawing giving clear details of fixings and anchorages into the supporting structure at wall plate level. Interference of bracing with truss members must be taken into account. Moments caused by forces applied between node points of bracing trusses and the axial forces must be given in the bracing calculations, also sizes and fixings of the bracing system.

Submissions: **—** A copy of letter reference TR1 (attached at the end of this document) completed and signed by the Truss System Engineer must be submitted by the Contractor at the same time as the list of Sub-Contractors. Two sets of calculations and drawings with pertinent erection instructions for the whole roof construction as presented by the Truss System Engineer must be submitted to the Department for consideration and permission to proceed.

This in no way absolves the Contractor of his responsibilities.

Any modifications to design or drawings are to be arranged directly between the Truss System Engineer and the Department. It will be the Contractor's responsibility to ensure that information is presented to the Department in good time and no claims will be entertained in respect of any delays resulting from the late approval of drawings, etc.

Any difference in cost between the roof system initially submitted by the Contractor and the finally accepted system to meet the original design requirements will be for the account of the Contractor.

The Truss System Engineer will be required to inspect the roof structure and certify on letter reference TR2 (attached at the end of this document) that the construction is in conformity with his design, and any costs in this respect must be included in rates for the truss system.

If, in the opinion of the Department, further visits are necessary due to errors or omissions on the part of the Contractor or the Truss System Engineer the costs of these inspections will be for the account of the Contractor.

Fabrication and Storage: — Fabrication shall not commence until written permission has been given by the Department. The prefabricated roof trusses shall be manufactured, supplied and delivered to site by an approved manufacturer with all members accurately mitre cut, close butted and rigidly fixed together by approved galvanized metal spike connectors applied simultaneously to both sides of every joint by use of a mechanical press in accordance with SANS Code of Practice 0163.

Permissible deviations in fabrication of trusses are to be as specified in SANS Code of Practice 0155.
The following will not be permitted at joints: —

b) knots, splits or finger joints
c) varying member thicknesses
d) plates not fully pressed into timber
e) gaps between members exceeding 1.5mm average over the width of the mitred members.

Stress grade marks must be clearly visible on all members.

Relevant dimensions must be checked on site before fabrication. Trusses must be stored off the ground and under cover both at the factory and on site.

Erection and Bracing: — Unless otherwise instructed, erection must be carried out as described in "The Erection and Bracing of Timber Roof Trusses" published by the Truss Plate Association of South Africa and the National Timber Research Institute - CSIR.

Where the overall lengths of trusses exceed 13 m, complete braced bays are to be assembled on level ground and lifted into position suspended at maximum 3m intervals from a spreader bar. Alternatively, braced bays may be assembled in position on a minimum of two lines of temporary intermediate supports below node joints. Temporary supports must be removed before roof covering is placed.

The erector must be suitably qualified and must satisfy the Department that he can meet the specification.

Where the roof incorporates a hipped end, the construction is to commence with the hip, otherwise erection is to be commenced with a fully braced bay.

Temporary bracing must be installed as erection proceeds in accordance with the accepted design.

The Contractor must notify the Department in sufficient time in order that an inspection may be made before the roof covering is placed.

The trusses will be subject to the following tolerances: —
a) maximum out of straight — length/400
b) maximum out of vertical at any point—height/200.

Rates: **—** The Contractor is to allow in his rates for the roof trusses for the design, manufacture, supply, hoisting and fixing of the roof trusses and permanent bracing, any necessary temporary bracing, and for the costs of all inspections by the Truss System Engineer.

Purlins or battens for roof coverings have been measured elsewhere. Rates for roof trusses are also to include for the exposed rafters at eaves overhangs to be wrot all round and trimmed and splay cut as required.

INSULATION, WATERPROOFING AND DUST PROOFING MATERIAL FOR ROOFS: — shall be of an approved aluminium foil faced both sides laminated Kraft Paper and synthetic reinforced material fixed in accordance with the manufacturer's instructions, lapped 150mm at all edge, unless otherwise specified.

GYPSUM PLASTERBOARD: **—** is to be in accordance with SANS Specification 266.

GYPSUM COVED CORNICES: — are to be in accordance with SANS Specification 622.

FIBRE CEMENT SHEETS: **—** are to be in accordance with SANS Specification 685.

FIBRE CEMENT CELLULOSE SHEETS: — are to be in accordance with SANS Specification 803.

HARDBOARD: — is to be in accordance with SANS Specification 540. Tempered and un-tempered hardboard is to be conditioned in accordance with the manufacturer's instructions before fixing in position.

VENEERS: — All decorative face veneers are to be selected kiln dried of best quality of the respective timbers, free from knots, cracks, patchwork, sapwood and other defects and bonded under heat and hydraulic pressure with water-resistant synthetic resin adhesive.

Commercial veneers are to be selected rotary cut hardwood veneers and otherwise as

described above.

PLYWOOD: — is to be long grain three or five-ply type manufactured with hardwood veneers with selected face veneers as described, bonded under heat and hydraulic pressure with water-resistant synthetic resin adhesive and sanded to a smooth finish.

CHIPBOARD: — All joinery fixtures shall be manufactured from 18mm Moisture resistant V313 Melamine Faced Chipboard (Particle Board) only with 32mm worktop as specified.

BATTEN BOARDING: — is to be long grain three-ply boarding manufactured with kiln-dried South African Meranti softwood core formed of laminations not exceeding 45mm wide and faced on both sides with selected veneers as described, bonded under heat and hydraulic pressure with water-resistant synthetic resin adhesive and sanded to a smooth finish.

DECORATIVE LAMINATE LININGS: — are to be 1.2mm thick approved general purpose quality high pressure decorative melamine laminate sheeting with satin finish and of selected colours and patterns, and rates are to include for all square cutting and waste and square notching, close cut and mitred external angle intersections where required and for bonding to the timber backings with an approved adhesive in accordance with the manufacturer's instructions.

The linings are to be cut out of single sheets in obviate joints but where joints are unavoidable, the sheets are to be butted to form a tight inconspicuous joint.

NAILS AND SCREWS: **—** Mild steel nails are to be in accordance with SANS Specification 820. Mild steel and brass screws are to be round headed, countersunk, etc. as appropriate and are to be in accordance with SANS Specification 1171. Nails and screws shall be of the size, length and type appropriate to their respective uses.

PLUGS, ETC.: **—** Where items of woodwork are described as "plugged", these may be nailed to timber plugs or slips built into the structure, and where described as "plugged and screwed" these may be screwed to timber or approved patent fixing plugs.

SHOT FIXING: — Where items of woodwork are described as "shot fixed" these are to be fixed with an approved cartridge-assisted tool, and rates are to include for all nails, spikes, blanks, washers, cartridges, accessories, etc.

CARPENTRY: — Timbers are to be the best of their respective kinds, free from sap, shakes, large, loose or dead knots, wavy edges and other defects and thoroughly seasoned. Wrot surfaces are to be finished clean, smooth and free from tool marks.

Timbers shall be in as long lengths as possible.

Rates for sawn and wrot structural timbers are to include for notching, splay and birds mouth cutting, housing, halving, scarfing, cutting timbers to the required lengths, spiking and clinching and or hoisting and fixing timber in position.

CEILINGS: — are to be of the types described, fixed to timber brandering, bearers etc. as described and with panels set out so as to give even width panels not less than half a sheet wide at edges. Brandering shall be spaced at not more than 400mm c/c and fixed at right angles to sheets.

FLUSH PLASTERED CEILINGS: — are to be formed of gypsum plaster board of the thickness stated, generally in 1200mm widths and long lengths, fixed grey side down to timber brandering, bearers, etc. as described, with butted joints between the boards covered with 65mm wide strips of galvanized wire scrim fixed along both edges, including all square notches and square cutting and waste, and the ceiling finished with two coats of approved retarded hemi hydrate gypsum plaster applied in accordance with the manufacturer's instructions to a finished thickness of not less than 6mm, including pressing into scrim over joints and finished to a smooth polished surface.

TRAP DOORS:- 900 x 600 Prefabricated hinged trap door.

SUSPENDED CEILINGS BOARDS: **—** are to be of the types described or as specified – normally 6mm x 600mm x 1200mm embossed fibre cement boards - and inclusive of their component parts must be of sufficient strength to perform the function for which they are to be used, manufactured from best quality materials and conform to the requirements of the Fire Master. The exposed surfaces of all ceiling panels and supporting members are to be uniform in colour and free from surface blemishes.

Hangers are to be galvanized and are to be at maximum 1, 2mtr centres to meet the requirements of the specification, each with one end fixed to the suspension grid main bearers and the other end fitted with suitable galvanized fixing straps to the roof structure. Fixing points must be agreed to by the Department before any power shot fixings are made. Hangers must not be suspended from air-conditioning ducts.
Hangers to be provided at all four corners of recessed light fittings.

Component parts and fixings other than aluminium must be non-corrosive and able to withstand atmospheric pollution. Surfaces of aluminium which are in contact with other materials when fixed, particularly ferrous metals, are to be suitably insulated to prevent electrolytic corrosion.

All work is to be executed by specialists in accordance with the manufacturer's instructions, and to the approval of the Department.

Rates for ceilings are to include for hangers, suspension systems, ceiling panels, for constructing the ceilings in a manner suitable for carrying air conditioning diffusers and light fittings in the positions required, for setting out the ceilings to layouts approved by the Department, for all non-standard size panels, for modifications to standard suspension systems as necessary to work around any air-conditioning ducts or pipes or light fittings, for all necessary square cutting and waste, notching and fitting around projections, columns, etc.

EXPOSED TEE-SYSTEM SUSPENDED CEILINGS: — are to be of the type described with main tees and cross tees spaced at the required centres to suit the sizes of panels used, with the cross tees fitted between and notched to form a flush fit with main tees unless otherwise described. All suspended ceilings to be fitted with shadow line trimming to perimeters.

Main and cross tees shall be holed as necessary and provided with timber wedges or steel clips to prevent ceiling panels from lifting.

CONCEALED TEE-SYSTEM SUSPENDED CEILINGS: — are to be of the type described with main and cross tee section bearers spaced at the required centres and all properly fitted together at intersections.

ALUMINIUM TRIMS TO CEILINGS: — are to be of extruded aluminium of 6063-TF or equivalent quality and temper, of the sections described. Anodised trims are to be of the colour stated.

Rates are to include for all cutting, fitting at intersections, mitres, etc. and rates for items described as fixed with screws are to include for countersunk drilling and fixing with approved countersunk stainless steel screws.

INSULATION MATERIAL FOR CEILINGS: — shall be 75mm thick resin bonded glass wool / mineral wool thermal insulation blanket complying with SANS Specification 1381 of the thickness specified, delivered to the site in unopened rolls in its original factory wrappings over solid gypsum boards or styrene of 25mm thickness as specified glued to suspended ceiling tiles.

DOORS: —

Flush Doors: - Semi-solid and solid laminated flush doors are to be of approved manufacture complying with SANS Specification 545.

The doors are to be finished on both sides with the facing veneers specified and concealed on both stiles unless otherwise specified, with hardwood edge strips and where doors are required to receive a transparent finish, the edge strips are to match the facing veneers.

Doors with rebated meeting stiles are to have edge strips to the meeting stiles not less than 19mm thick.

Each door or leaf of double door, described as hung to swing, is to be fitted with necessary hardwood reinforcing blocks for bottom shoe and top centre of spring hinge.

Unless otherwise specified, all flush doors are to be interior quality, but, where exterior doors are specified, the glue used must comply with Type WBP of SANS 2304.

FRAMED, LEDGED AND BRACED BATTEN DOORS, ETC.: — Doors described as filled in with V-jointed boarding are to be filled in flush on one side with tongued and grooved vertical boarding, V-jointed on one or both sides and of the thickness stated. The boarding is to be in narrow widths, closely cramped up, rebated on outer edge and housed to grooves in stiles and rails and twice brass countersunk screwed at each intersection.

Ledges and braces and inner edges of the abutting stiles and rails are to be chamfered to form a V-joint at junction with the boarding. Braces to fall from lock to hinge side.

ENTRANCES TO SECLUSION WARDS: - Entrances to seclusion ward buildings shall be fitted with remote controlled full height 'Man Trap' Security Cubicles with bell pushes fitted to both entry and exit sides and remote unlocking / release operation enabled from security booth.

Doors to Seclusion Rooms: - Doors to seclusion rooms are to be steel lined solid core units with 100mm x 100mm viewing panel, glazed with 40mm bullet proof glass in a steel frame. Steel lining for doors is to be epoxy laminated to doors and around edges. Internal steel lining to be primed and finished with approved epoxy paint. External face of doors to be finished in veneer as per DOH standard details. Doors to be hung to open inward on special 6mm galvanized steel door frames with lugs pre welded to frame to fit every third course of brickwork. The complete unit is to be hot dip galvanized and built into surrounding 230mm solid brick walls. No welding to be done on site.

NOTE: - Above Anti–Bandit Security doors are solely supplied by "Chubb" and "Bitcon Industries" as a complete unit with all fittings and ironmongery.

DOORS TO X-RAY UNITS

Entrance doors to X-Ray rooms shall be top hung sliding door size 1830 x 2032 x 40mm, complete with heavy duty sliding door track – 'Henderson' or other approved -, 2.2mm lead insert between panels and four door stoppers. Door is to overlap door opening 100mm each side when closed.

JOINERY: — All timbers shall be in as long lengths as possible. Lengths for joinery shall be single where possible and where joints are unavoidable, they shall be made as inconspicuous as possible.

Timber for grounds, firrings, blocks, plugs, etc. shall be sound and free from defects.

All joinery work is to include for work in connecting by mortise and tenon, dovetailing, housing, flush pinning, etc. as may be by required and for all screws, nails and glueing

together and for sinking flush all exposed screws unless otherwise specified.

Wrot surfaces and edges are to be steel scraped and sandpapered before and if necessary, after fixing.

Edges are to be arras rounded unless specified to be angle rounded.

“Arras rounded” denotes that the sharp edges are slightly rounded off and that no mitring is required.

“Angle rounded” denotes rounded from 3mm to 10mm radius and is to include for housed and mitred joints.

Hardwood doors, frames, jamb and soffit linings, etc. are to be treated on all surfaces with one coat of approved sealer before building in, etc. and rates for these items must include for this. Batten doors with tongued and grooved battens are to have the tongues and grooves well sealed before assembling. The sealer used shall be compatible with the finishing coats to be applied.

Horns of door frames are to be checked and splayed back where frames are fixed projecting or flush with surface and built in.

Where doors, fanlights or sashes are described as hung to butts on steel or aluminium frames, rates are to include for supplying necessary steel, brass or stainless steel screws.

Panel work is to be secured to the grounds, etc. with screws concealed behind the mouldings or by sinking the screws and pelleting as directed.

Joinery is to be framed up, but not glued or wedged, immediately the order is given to commence work. Wherever possible, joinery shall not be placed or fabricated in position until the plaster has dried out. Reasonable tolerance shall be provided at all connections between the joinery and building carcass so that any irregularities, settlements or other movements shall be adequately compensated. All joinery shall be accurately scribed to fit the contour of any irregular surface. Should the joints of any joinery open or give, such defective work is to be taken down, refitted and redecorated or replaced by new joinery at the Contractor’s expense.

Only brass screws may be used for hardwood joinery.

The Contractor is to allow for cross-tonguing all solid wood sections unobtainable in single widths.

No joinery is to be primed until it has been inspected and approved by the Department.

All joinery liable to injury must be protected to the satisfaction of the Department. Rates must include for this temporary protection.

Rates for timber frames, mullions, transoms, linings, standards, rails, fascias, cornices, skirtings, beads, picture rails, etc. are to include for mitres, etc.

Rates for all items of timber-are to include for fixing and planting on as may be required with necessary panel pins or nails.

PARTITIONS:

These are to be of an approved system of standard construction, with an average sound rating of not less than 30 decibels taken over the whole face area.

Framing is to be natural finish anodised aluminium comprising posts at 1200mm centres unless otherwise described, with transom rails where specified, fitted between the posts, a

rail against ceiling and an aluminium standard skirting on each side at base, all neatly and securely fixed together.

Provision is to be made at the base of the partitions and in the ceiling rails and posts for electrical wiring, which will be installed under the electrical sub-contract, and the ceiling tails and end posts are to be fitted with continuous removable access plates.

Solid panelling is to be approved solid chip core panels of the thickness specified faced on both sides as described in the items.

Glazed panels are to be glazed as required, complete with all necessary natural finish anodised aluminium glazing beads and vinyl glazing strips.

Louver panels where specified are to be approved natural finish anodised aluminium adjustable louver sets each comprising head and sill weather bars and two jamb strips each fitted with louver brackets with spring loaded clips for and fitted with and including louvers as required and complete with tilt bars and operating lever handles. Where the openings are not the correct size to suit a full number of standard width louver blades, an alternate head weather bar must be provided to suit a fixed louver blade of the required width. The louver sets are to be fitted with the jamb strips positioned horizontally so that the louvers will be fixed vertically.

Partitions are to be in 1200mm modules, unless otherwise specified, except at ends where the odd lengths are to be made up by a narrow width at one end of the partition.

Ends of partitions against walls, window frames, etc. and the top edge of partitions against ceilings are to be fitted on both sides of partition with approved vinyl scribing sections fitted between the structure and the end post or top rail of the partition.

Plain openings are to have aluminium frames similar to door openings neatly fitted into the framing.
Doors are to be solid laminated flush doors complying with SANS Specification 545. The doors are to be finished on both sides with veneer as described in the items and concealed on both stiles with matching hardwood edge strips.

Where doors are described as having observation openings, these openings are to be of the sizes stated, glazed as specified with all edges bedded in approved neoprene gaskets and fixed with 10 x 25mm wrot matching hardwood rebated glazing beads mitred round and bradded to both sides.

Rates for doors are to include for all necessary additional aluminium framing to form door openings, and for hanging the doors on and including one and a half pairs of 102mm satin chrome finish brass hinges to each door.

All locks to doors in demountable partitions are to be supplied with two keys, and are to be controlled by the same master key as the mortise locks used elsewhere in the Contract when specified.

Unless otherwise specified all veneered solid panelling and doors are to be finished as follows: —

Prepare, stop with tinted stopping, apply an approved stain as necessary to achieve uniform colour appearance, and three coats of approved clear matt polyurethane finish including burnishing with steel wool between coats.

Rates for demountable partitions are to include for supplying, assembling, erecting, finishing, glazing and fixing complete between finished surfaces of concrete floors, plastered walls and ceilings, and all in accordance with the manufacturer’s instructions.

DEMOUNTABLE PARTITIONS 50MM (NATURAL ANODISED).

Extruded Aluminium Sections

Supply and fit demountable “Kappa” partition system comprising anodized aluminium U-Channel fitted to suspended ceilings. Vertical split-post (mullion) to be fitted between floor and ceiling U-Channel at 1225mm c/c with angle brackets. Once framing is fixed, fit panels into place and secure with clip-on cover plates.
All aluminium sections may be anodized or powder coated in a variety of colours.

Panels

41mm thick semi solid core panels 2032 x 1200mm. The panels are made up of two outer skins of 3.2mm hardboard cladding. Lower panels to be provided with a 150mm wide solid mid-rail 850mm from the base of the panel to the centre of the mid- rail built in as part of the construction. The panels to be prepared before applying the final finish as specified.

Construction

Right angled corners to be formed with natural anodized aluminium radiused corner post fitted from floor to ceiling. Floor fixing to be angle brackets and ceiling fixing to be hidden block. The ceiling U-Channel butts up against radiused corner post.

Door Frames

Door frames to be natural anodized aluminium pre-fitted with woolpile gaskets, clipped into H-Profile at head and clipped into combination split post and cover plate at styles. The rebate on the door frame caters for standard doors of a thickness between 40mm and 44mm.

Glazing

Glazed panes to be framed with H-Profile fitted horizontally at top and bottom, butted against side of split-post and clip on cover plate combination and fixed with angle brackets. Glazing sections pre-fitted with woolpile gaskets and set into H-profiles and into post / cover plate combinations to form a neat glazing opening. Glazing beads pre-fitted with woolpile gaskets and then clipped into glazing section.

Termination

Openings for louver frames, sliding doors and windows, serving hatches and partition ends are to be lined with the aluminium termination section.

Skirtings

76mm high aluminium skirting to be glued to panels.

DRYWALL PARTITIONS:

Studs

50mm x 33.5mm x 0.5mm thick drywall galvanised steel studs are used. The studs to receive aluminium extrusions clipped onto both sides of the stud. Framing to be securely fixed to walls, floor and ceilings where necessary. Stud connectors to be used to join horizontal studs to vertical studs.

Floor Track

52mm x 25mm x0.6mm galvanised sheet steel track to be used.

Panels

12,7mm thick tapered edged gypsum plasterboard panels used and decorated in situ with panels secured to either side of framework.
Patient care areas to be 12mm Supa Wood panels in framework as specified.

Construction

Internal walls are constructed by fixing drywall studs to floor track @ 600mm c/c. Wall and ceiling junctions are formed by fixing 84mm x 19mm aluminium ceiling and wall channel to wall or ceiling. The floor track is then fixed into this; alternatively, these components may be fixed simultaneously. The studs are then fixed to floor.
The partitions, unless otherwise described are to be 75mm thick and covered both sides with 12,7mm thick tapered edged gypsum board in 1200mm widths to height specified.
The gypsum boards are screwed @ +/- 300mm c/c at all intersections to the floor and head wall tracks and vertical studs.
Using self-drilling, self-tapping, rust proofed countersunk screws, with screw heads and joints between boards and between abutting edges of boards flushed up with an approved jointing material.

Exposed Aluminium Framing
Door frames, glazing termination and ceiling and wall channels to be natural anodised aluminium. 25 x 25 x 1.5 aluminium angle stuck to external corners of partitioning. 80mm high aluminium skirting glued in position.

Glazing
Aluminium glazing section is clipped onto the flanged end of the stud around the glazing perimeter. The glazing section has a recess to accept a rectangular clip-in glazing bead which enables 3mm-8mm thick glass to be received in the system. The glass is retained with various sizes of PVC glazing gasket.

Termination
Openings for louver frames, sliding doors and windows, serving hatches and partition ends are to be lined with the aluminium termination section.

Skirting
The system is designed to accept recessed base, female, 60mm high aluminium skirting.

Sound Insulation
75mm Fibreglass Cavity Bat with a 35g glass tissue or 75mm Isotherm “Acoustisorb’ mineral wool blanket is to be installed between studding before fixing final outer panel.

All work is to be executed by a firm specialising in this type of work and all to the approval of the Department.

8. FLOOR COVERINGS, PLASTIC LININGS, ETC.

FLOOR SHEETING: — are to be of the composition, type, size and thickness specified with colour, pattern, graining, etc, consistent throughout, all to the approval of the Department.

Thermoplastic floor tiles: — are not to be used.

Fully flexible vinyl floor sheeting: — are to comply with SANS Specification 786 and is to be 2.5 mm nominal thickness.

Recessed entrance mats with brass frame at main entrance into a health facility as “Belgotex” Grimbuster or other approved. This to be positioned outside before entering.
In patient care area’s, no perforations to floor covering is to be made. Eg door stops, door barrel bolt floor keeps etc.
Where the specified sizes and/or thicknesses of floor sheeting differ from those in the SANS Specifications, such items of floor sheeting shall comply in all other respects with the relevant SANS Specifications.

SKIRTINGS, STAIR NOSINGS, EDGING STRIPS, ETC.: —are to be of the types and sizes specified and are to be of approved manufacture

CARPET TILES AND SHEETING: — are to be of the types specified and of approved colours and patterns all to approval of the Department.

LAYING: —
Vinyl Floor covering laying procedure and polishing.

Site conditions required before the layer commences an installing of a Resilient Floor covering. Some of these conditions may appear obvious, but they are not always complied with. If any of the following recommendations are ignored, it is likely that a number of problems will arise during or after installation of the flooring.

1. All building materials and equipment, e.g. sand, scaffolding, tools, etc. should be removed. (Do not allow heaps of sand, concrete, etc., to remain on the surface of the sub-floor since moisture transfer to the sub-floor takes place).

2. All resilient flooring materials require a smooth, hard, clean and level surface, not only for appearance but also for achieving a satisfactory adhesive bond and long-term durability. The Specifier and the Main Contractor shall ensure that the sub-floor is acceptable to receive the resilient flooring specified in respect of levelness, smoothness, soundness and cleanness. (The SANS Code of Practice 070/1991 as amended 1993 Section 9.3 details the requirements in this regard).
The flooring contractor shall ensure that the sub-floor is sufficiently dry prior to the installation of the flooring material. The floor should be tested by means of a Hygrometer or a Tramex. (Of the instruments available for determining moisture levels in sub-floors, the most practical and accurate is the hygrometer).

SHEETING
Ensure that the following steps are followed during the installation:

1. Trim off factory leading edge before laying sheeting.
2. Align the sheet in position that there is an opening no bigger than 1mm between adjacent sheets. For the best results, the width of a credit card is an acceptable measure.
3. Apply adhesive according to the manufacturers' specifications.
4. Roll the floor during and after installation with a 68kg roller to maximize the adhesion between the sheeting and the adhesive.
5. Complete the welding 24 hours after the installation. Groove the joins open with a suitable hand or electric groover to a width of not wider than 3mm and not deeper than 1.5mm. Weld the joins with a hot air welding gun with temperature settings of between 4-6 temperature setting and use a speed nozzle that will not burn the material or damage the coating. Use a sharp spatula and guide plate and remove the excess welding in two stages.
6. All vinyl sheeting needs to be stripped and sealed 72 hours after installation. Please ensure you use a good quality product.

2.1 **HYGROMETER**
When a hygrometer is positioned on a sub-floor surface, the reading of the relative humidity of the entrapped air space is obtained.

- A hygrometer reading of less than 70% indicates that the sub-floor is sufficiently dry for flooring to be laid upon it.
- If the hygrometer indicates a final reading of more than 70% when the initial reading of the atmosphere was less than 70% then the sub-floor is unacceptably damp and must be allowed to dry out before any flooring is installed.
- If the hygrometer indicates a final reading of more than 70% when the initial reading of the atmospheric humidity was also greater than 70%, as can occur in coastal areas, then the following applied:

1. If the final reading is significantly higher than the initial reading, then the sub-floor must be considered to be unacceptably damp.
2. If the final reading is similar to, or less than the initial reading, then the moisture content of both the atmosphere and the sub-floor are similar.

2.2 **TRAMEX CONCRETE MOISTURE ENCOUNTER (C.M.E.)**
Any reading on the C.M.E. of 60% or less indicates acceptable moisture content for the installation of any vinyl floor covering.

3. Floor Preparation – New and Existing (old) Screeds
3.1 Use of screed smoothing compounds should be avoided except for making minor repairs, however should a full skim be required, then the most common method in both instances is the use of a smoothing compound e.g. **Pavelite** in combination with **Pavelite Bonding Liquid**, mixed to the correct ratio and consistency. Only recommended products, mixed strictly in accordance with manufacturers instruction should be used. Do not use smoothing compound on power floated finishes. It is recommended that in new structures the screeding should be as specified by "Tal" using "Screedmaster", the pumped method.
A badly undulating floor may require grinding by mechanical means to improve the overall levelness. Although smoothing compounds such as **Pavelite** will improve the sub-floor it will not achieve perfection.
3.2 In cases where old vinyl floor coverings have been uplifted, leaving a bitumen adhesive residue, it is recommended that a strict procedure relating to the "Preparation of Sub Floors with Bitumen Residue", be complied with.
(This method may not constitute good flooring practice, but has proved to be successful on many occasions. No guarantee is however given or implied).

4. **Construction joints (saw cuts) and Expansion Joints**
4.1Construction joints (saw cuts) in the sub-floor should be cleaned out, and the sides of the saw cut be painted with **Pavelite Bonding Liquid** and allowed to dry. The joint should then be filled with a mixture of **Pavelite** and **Pavelite Bonding Liquid**. It is advisable to slightly overfill the joints, which when dry should be rubbed down with a carborundum stone.
4.2 Expansion joints should be filled with a suitable **Sealant** to prevent the ingress of dirt. **It is bad flooring practice to lay flooring over such a joint**. The flooring should stop at the edge of the joint and cover strips placed over the joint itself. Expansion joints and cover strips should be discussed and designed by a structural engineer.

5 Correct setting out is critical, and consideration should be given to the squareness of the area. It is safest to set out from the longest outside wall.
5.1. The recommended notching for a trowel to spread adhesive is a V notch of 1,5 x 1,5 x 1,5mm at 4,00mm centres. Consideration should however be given to the porosity of the sub-floor. Ensure the use of the recommended adhesive with the appropriate flooring. **Do not** spread the adhesive over a larger area than can be covered within the working/open time of the adhesive.
5.2 All installations must be rolled with a 68kg three sectional articulated metal floor roller on completion, within the working time of the adhesive.
5.3 Welding of sheeting is to be done only after 24 hrs after installation.
5.3. a. Trimming
While the welding rod is still warm, trim off most of the top half using a sharp spatula and spatula guide which fits over the welding rod. Carry out the final trimming using the spatula knife only, when the welding rod has cooled.
5.3.b **Glazing**
The trimmed welding rod will tend to soil more rapidly than the sheeting. It is therefore Important to glaze the surface of the trimmed welding rod.

6. After installation the flooring should be adequately protected, preventing damage caused by other trades working on the site.

7. The completed floor should not be washed or polished for a period of 72 hours after the installation in order to allow the adhesive to cure. This period will vary from one adhesive to another.
7.1 The vinyl floor covering must be cleaned with an approved water based floor Stripper, in order to achieve an acceptable standard of cleanliness for sealing. Avoid excessive use of water at all times

7.2 Foreign matter such as paint stains, tar, etc. which may not respond to the process must be removed by other means.
7.3 Three coats of a Water Based Emulsion floor dressing, shall then be applied on completely dry surface in accordance with the manufacturer's instructions, allowing one hour drying time between the first and second application of each dressing coat.

RATES: —for all floor coverings are to include for laying as described, for cleaning down backing surfaces before laying and or all square and raking cutting and waste and fitting, fair cutting at edges where no skirting occurs, protecting from injury, and for cleaning down, etc. as described, at completion.

Rates for all wall linings are to include for laying as described, cleaning down backing surfaces before laying, sizing backing surfaces if necessary to ensure proper adhesion, all square and raking cutting and waste and fitting, fair cutting at exposed edges, bending at angles and for all narrow widths and protecting from injury and cleaning down, etc. as described, at completion. Wall linings in widths not exceeding 300mm to returns, reveals and the like have not been measured separately, but have been included in the area of the general items of wall linings and rates must include or this.

Rates for skirting, stair nosing, edging strips, etc. is to include for fixing as described, cutting to lengths and fitting at intersections, mitres, ends, etc. and for cleaning down at completion.

9. IRONMONGERY

Ironmongery is to be to the approval of the Department and rates are to include for fixing screws of corresponding metal and finish and for oiling and easing as required at completion.

Where catalogue references are given, the articles are to be of the brand specified or other approved.

No two-lever mortise locks are to be used.

Mortise locks, cylinder locks, cupboard locks, etc. are to differ so that no key will pass a second lock, unless otherwise specified. Where mortise locks, cylinders, locks, etc. are specified to be "en-suite" they are to be made "en-suite" in the specified number of "suites". The "suites" are to be controlled by differing sub-master keys with a grand master key controlling all "suites", and no sub-master is to pass any lock of another "suite".

All locks are to be fitted with two keys and the locks are to be stamped with consecutive numbers and the keys to each are to be stamped to correspond with the lock.

Items of ironmongery specified as chrome plated or satin chrome finish are, unless otherwise specified, to be chromium plated or satin chrome finish on solid brass.

Items of ironmongery specified aluminium are to be natural anodised.

Where items of ironmongery are specified as fixed to pressed steel door frames, the Contractor is to ensure that the suppliers of the steel frames prepare the frames for all keeps and do all mortising and drilling required and receive all information necessary regarding ironmongery. Preparation of steel doorframes for ironmongery has been measured elsewhere.

Where tests of ironmongery are described as "plugged and screwed" these are to be screwed to patent fixing plugs of approved manufacture, and this shall include for plugging and screwing to brickwork or concrete.

Key tags are to be 40mm diameter x 3mm thick plaster of approved colour, engraved on face with the required number of letters and numerals finished in an approved colour, and the tag is to be holed for and fitted with a steel split ring and fixed to key.

Engraved plastic door signs and numeral plates are to be of 5mm thick clear plastic with square polished edges all round with an approved coloured background and sans-serif letters and numerals as described in the items, reverse engraved in the plate with splayed sides and flat reading face and finished in an approved contrasting colour. Each sign is to be twice drilled for and fixed to softwood or hardwood, unless otherwise described, with chromium plated round beaded brass screws. Unless otherwise described, the signs are to be 50mm high with 30mm high, engraved letters or numerals and are to allow a minimum margin of 25mm at both ends. All signs are to be equal to sample to be submitted to and approved by the Department.

Pictorial plastic signs are to be of 5mm thick clear plastic of the sizes stated in the items with square polished edges all round and with the silhouette described in the items applied to the back of the plate by means of the silk screen process in an approved colour and the whole back of the plate finished in an approved contrasting colour. Each sign is to be four times drilled and fixed to softwood or hardwood, unless otherwise described, with chromium plated round-headed brass screws. All signs are to be equal to sample to be submitted to and approved by the Department.

10. STRUCTURAL STEEL WORK

GENERALLY: — The fabrication, assembly and erection of structural steelwork is to be executed in accordance with SANS Specification 1200H — Structural Steelwork (a copy of which the Contractor will be required to keep on site so that it can be referred to at all times during the Contract) with the following amplifications and amendments: —

INTERPRETATIONS: — Clauses 2.1 and 2.2 refer. This preamble, together with any other supplementary preambles appearing in these Bills of Quantities shall be deemed the project specification and are the “Portion 2" referred to in Clause 2.2.

DEFINITIONS: — Clause 2.3 of SANS Specification 1200H refers. All references to the Engineer shall be deemed to mean the Department.

SUB-CONTRACTORS: —The Contractor shall either (a) have adequate satisfactory and approved experience in this type of work or (b) employ an approved specialist structural steelwork Sub-Contractor. The Contractor, in the case of (a), or the specialist Sub-Contractor, in the case of (b), shall employ at all stages of the Works both on and off site a competent Supervisor experienced in the work.

MATERIALS: — Unless otherwise shown on the drawings or hereunder, all rolled sections shall be hot rolled mild steel, and all materials shall comply with one of the following: —

a) Weldable Structural Steels to SANS 4360:
b) Hollow sections to SANS 4848 Part 2 and SANS 6323.
c) Cold rolled sections to SANS 2994.
d) Black bolts and nuts to SANS 135.
e) Precision bolts and nuts to SANS 136.
f) High-strength friction-grip bolts and nuts to SANS 1282.
g) Flat and tapered washers to SANS 1149.
h) Electrodes for welding to SANS 455.

SHOP DETAIL DRAWINGS: — The Contractor shall prepare shop detail drawings, in conformity with the details shown on the structural steelwork drawings and to show all information necessary for complete fabrication, assembly, ejection and painting. In the preparation of the shop detail drawings the Contractor is to comply with the requirements of SANS Code of Practice 0162.

The cost of preparing all necessary shop detail drawings and copies thereof is to be allowed for by the Contractor in his rates.

The Contractor shall submit two copies of his shop detail drawings to the Department for approval at least 10 days before fabrication of the member concerned is due to commence. Such approval does not imply that a complete and comprehensive check of the detail drawings has been carried out, and the Contractor shall remain responsible for ensuring that the steelwork is correctly fabricated, assembled, erected and painted.

SUBSTITUTION OF SIZES, ETC.: — No substitution of sizes or joints additional to those shown on the drawings shall be made without the prior approval of the Department. Except in cases of proven non-availability of materials specified, any additional costs involved due to substitution shall be for the Contractor's account.

FIXINGS: — The positions and manner of fixing the hangers for suspended ceiling air-conditioning ducts, pipe installations, etc. to the structural steelwork are to be approved by the Department before work on such installations commences.

FABRICATION, ASSEMBLY AND ERECTION

Welding: — shall be carried out in accordance with SANS Code of Practice 044 and the relevant recommendations of SANS Code of Practice 0162 and SANS 5135, and in any case of conflict, the SANS Codes of Practice shall be deemed as binding.

All welders employed on the Works shall be currently classified at least as grade 2 welders as defined by SANS Code of Practice 044. Should the Department so request, proof of the classification shall be produced.

Unless otherwise specified all welds are to be continuous fillet welds of 6mm leg length or not less than the thinnest plate or section being welded.

Handling, Storage and Erection: — of members is to be undertaken in such a manner to prevent overstress or damage. Should overstress or damage occur, the Department shall be informed and his instructions sought.

Storage shall be arranged such that damage to applied finishes is prevented.

All plant and equipment used in the erection of structural steelwork shall be adequate in every respect. The Contractor shall allow in his rates for all necessary temporary bracing, and for maintaining and finally removing such temporary bracing.

Fixing of Bolts, etc.: — Unless approved by the Department, no pre-drilled fixings for bolts, etc. will be permitted through hollow section members. Any hollow section member that has been drilled or punctured in any way shall be considered condemned and must be replaced to the satisfaction of the Department.

INSPECTION AND TESTING

Facility for Inspection: — The Contractor shall afford to the Department all reasonable access to inspect the steelwork at any stage of its fabrication, and shall give due notice before delivery of steelwork to the site to allow inspection and tests to be conducted if so required by the Department.

Cost of Tests: — The cost of all tests required by the Department shall be borne by the Administration, except that the costs of the following tests shall be borne by the Contractor:-
(a) Testing of welders and equipment
(b) Such tests (including load tests) as may be necessary by failure on the part of the Contractor to meet the requirements of the specification.

Procedure in the Event of Failure: — In the event of a failure of a test, the Contractor shall

either replace the defective item or prove its sufficiency by means of a load test carried out in accordance with Appendix B of Chapter 6 of the South African Standard Building Regulations. If so required by the Department the Contractor shall also demonstrate by means of tests at his own cost that all like members meet the requirements of the Specification.

PRIMING OF STRUCTURAL STEELWORK

General

(a) Painting conditions.
No painting shall be undertaken when one or more of the following conditions exist: —
(i) The atmospheric or steel temperature is below 10^0 C,
(ii) The atmospheric or steel temperature is expected to fall below 7^0 C before the paint is dry,
(iii)The atmospheric or steel temperature is high enough to cause damage to the paint film,
(iv) In fog or mist,
(v)The relative humidity is greater than 90 *%,*
(vi) Surfaces are or will be wet or damp from rain or other causes,
(vii) Surfaces are contaminated by dirt, dust, grease, oil or other matter detrimental to painting,
(viii) Wind will deposit dust onto un-dried surfaces.

(b) Extent of shop painting.
All surfaces shall be primed as described in the shop except: —
(i) Those to be encased in concrete which are to be left as prepared metal; unless otherwise specified
(ii) Contact surfaces of high strength friction-grip bolt connections which are to be left as prepared metal
(iii) Edges or faces yet to be welded which are to be left as prepared metal over sufficient width from the weld to avoid contamination of the weld or damage to the paint by the effect of welding.

(c) Paint identification, storage and preparation.
All paint shall be supplied in unopened original containers showing the manufacturer's name and trademark date of manufacture and the relevant SANS or other specification number.

No paint shall be used past its maximum life span but otherwise oldest paint shall be used first. Containers shall not be opened until required and opened containers shall be used before unopened containers

Before use, paint shall be thoroughly stirred and prepared in accordance with manufacturer's instructions.

(d) Thinning.
No paint shall be thinned except strictly in accordance with manufacturer's instructions.

(e) Dry film thickness.
Where not specifically later stated this shall be in accordance with manufacturer's instructions for spreading rates. A tolerance of approximately 10% of that thickness will be allowed.

(f) Touching-up surfaces.
Surfaces shall be protected against damage, but should this occur, then the paint shall be rubbed down over the damaged and surrounding area to a sound surface and then restored by re-applying the removed coat properly feathered in with the existing.

Upon completion of site connections, these connections shall be stripe painted with the specified primer before any further painting is carried out.

Class P1 Preparation and Priming Coat: — Unless otherwise specified, rates for structural steel-work are to include for Class P1 Preparation and Priming Coat as follows:-

(i) Surfaces are to be cleaned in accordance with SANS Code of Practice 064 to remove all rust, scale, grease, oil, etc. endeavouring to bring the surface to a bright metallic condition, and painted, unless otherwise specified, with one coat of red -oxide zinc chromate primer in accordance with SANS Specification 909 prior to despatch from the works.

(ii) Upon delivery to the site and again after erection any bared or damaged surfaces are to be made good with similar primer.

The Contractor is advised that the finishing coats of paint to be executed after the erection of the structural steelwork have been measured elsewhere.

Class P2 Preparation and Priming Coat: — Where specified, rates for structural steelwork are to include for Class P2 Preparation and Priming Coat as follows: —

(i) Surfaces shall be thoroughly cleaned by sandblasting to Swedish Standard SIS 055900 standard Sa 2½ to give minimum peak to valley profile of 50 micrometer when measured by SANS Draft Test Method No. 772.

(ii) Surfaces shall be blown thoroughly clean with compressed air and within four hours of sandblasting, one coat of “Plascon SN 162 Ironguard-4-Zinc” or other approved primer of minimum dry film thickness of 75 micrometer shall be applied by pressure pot spray system in accordance with the manufacturer’s instructions in the shop.

(iii) Upon delivery to the site and again after erection, any bared or damaged surfaces are to be made good with similar primer.

The Contractor is advised that the finishing coats comprising one intermediate coat and one finishing coat of chlorinated rubber paint to be executed after the erection of the structural steelwork have been measured elsewhere.

Class P3 Preparation and Priming Coat: — Where specified, rates for structural steelwork are to include for Class P3 Preparation and Priming Coat as follows: —

(i) Surfaces shall be thoroughly cleaned by sandblasting to Swedish Standard SIS 055900 standard Sa 2½ to give maximum peak to valley profile of 50 micrometer when measured by SANS Draft Test Method No. 772.

(ii) Surfaces shall be blown thoroughly clean with compressed air and within four hours of sandblasting, one priming coat of “Epidermix 352” or other approved epoxy coal tar of minimum dry film thickness of 75 micrometer shall be applied in the shop.

(iii) Upon delivery to the site and again after erection, any bared or damaged surfaces are to be made good with similar primer.

The Contractor is advised that the finishing coat comprising a further coat of epoxy coal tar to be executed after the erection of the structural steelwork has been measured elsewhere.

MEASUREMENT AND PAYMENT: — The provisions and Clause 8 will **NOT** apply and the system of measurement which is adopted in these Bills of Quantities is the only system of measurement which will be recognised in this Contract.

RATES FOR STRUCTURAL STEELWORK: — Rates for structural steelwork are to include for all necessary cutting to lengths, splay cut ends, shaping, holing, tapping, threading, forging, turning, assembling, welding, and fixing in position.

11. METALWORK

PROPRIETARY MATERIALS: — Where proprietary materials are specified, the materials used are to be of the type, specified or other approved by the Department.

RATES: — for all metalwork, unless otherwise stated, are to include for cutting to length, shaping, turning, threading, forging, fitting, assembling, riveting, welding, welded running joints, filing smooth, also for all screws and holes and hoisting and fixing in position. All screwed work is to have full threads.

WELDING AND BRAZING: — Where items are described as welded or brazed, rates must include neat welding or brazing by experienced workmen using a recognised process and for cleaning and filing or grinding off smooth, all to approval. All welding is to be continuous unless otherwise described.

SCREW FIXINGS: — Where items are described as tap screwed, grub screwed, set screwed, etc. rates must include for the necessary screws, for drilling all components and for tapping the components where necessary to receive such screws.

PIPE MEMBERS: — All galvanized mild steel pipe members are to be “medium” pipes complying with SANS 1387. Diameters of pipes, unless otherwise stated, are normal internal diameters.

PRIMING OF STEELWORK: — All items of fabricated mild steel except where described to be galvanized, are to be cleaned in accordance with SANS Code of Practice 064 to remove all scale, rust, grease, oil, etc. endeavouring to bring the surface to a bright metallic condition, and painted, unless otherwise specified, with one coat of red-oxide zinc chromate primer in accordance with SANS Specification 909 prior to despatch from the works.

GALVANISING OF STEELWORK: — All steel surfaces described to be galvanized are to be thoroughly sand, grit or steel shot blasted to white metal in accordance with SANS Code of Practice 064 and fluxed ready for galvanising, and the completed unit is to be hot dip galvanized after fabrication in accordance with SANS Specification 763 for general applications on the relative thicknesses of metal.

The zinc coating shall be continuous and of even thickness over all surfaces entirely free of bare spots, dull, rough patches, blisters and other imperfections and shall show no signs of peeling. Where site welding has to be done, the welds are to be properly cleaned down and cold galvanized to the approval of the Department.

If requested by the Department, the manufacturer shall carry out tests to prove that the requisite mass / thickness of zinc coating is applied and that it is of uniform thickness. The tests shall be made by attaching a test piece of mild steel, approximately 250 x 25 x 6mm, by means of wire, to an article being galvanized, and subjecting the test piece to the same cleaning, fluxing and galvanising treatment as the article being galvanized, and at completion, the test piece tested by a method approved by the South African Bureau of Standards, the cost of which will be borne by the Contractor.

CHROMIUM PLATING OF STEELWORK: — All items of fabricated mild steel described to be chromium plated are to be properly de-greased, cleaned and polished perfectly smooth before plating and all in accordance with SANS Specification 728. All items are to be first nickel-plated then chromium plated to provide a bright mirror finish and all plating is to be equal to sample to be submitted for the necessary approval by the Department.

PRESSED STEEL DOOR FRAMES: — shall be manufactured from mild steel sheet 1.60mm thick for single rebated frames and 1.20mm thick for double rebated frames. Rebates shall be suitable for 42mm thick doors and fanlights.

The sections are to be accurately bent to form the profiles. Corners are to be mitred and welded and reinforced at back with 1.60mm thick steel angle sections. Transoms for

fanlights are to be let into the jambs and welded. All welds are to be solid and cleaned off flush, leaving a perfect outside finish.

Each frame is to be fitted with one pair of sturdy angle or channel section tie bars at base, welded below the frame, and where required for additional strength, cross struts of the same section are to be welded between and at right angles to the main tie bars. Each frame is also to be fitted with one 'diagonal brace as temporary support, standard 230mm long corrugated adjustable building-in lugs at jambs, three rubber shock absorbers in rebate of lock jambs of frames for single doors and one rubber shock absorber, for each leaf in the rebate of the head or transom of frames for double doors.

All frames are to be primed on all surfaces with an approved red oxide zinc chromate priming coat in accordance with SANS Specification before leaving the manufacturer's works, unless specified to be hot dip galvanized, and rates are to include for touching up where necessary with similar primer after building in.

Where frames are specified to be galvanized they are to be hot dip galvanized after manufacture in accordance with the relevant provisions of SANS Specification 763 for general applications on the relative thicknesses of metal.

Frames, unless otherwise described, are to be fitted with one and a half pairs of 100mm five-knuckle loose pin steel hinges, unless otherwise specified for each door or each leaf of double door and with one pair of 75mm five-knuckle loose pin steel hinges for each fanlight. The three-knuckle leaf of each hinge is to be welded into the frame or transom.

Where frames are described to be fitted with brass butts, the frames are to be checked out and fitted, unless otherwise specified, with one and a half pairs of 100mm double bronze washered brass butts for each door or leaf of double door, unless otherwise described, as one pair of 75mm brass butts for each fanlight, with open leaf of each butt secured to the frame or transom by means of 6mm diameter countersunk headed brass set screws screwed to and including a 3mm thick steel backing plate of suitable size welded to frame or transom and drilled and tapped to receive the set screws.

Where frames are described to be fitted with aluminium hinges the frames are to be checked out for and fitted, unless otherwise specified, with one and a half pairs of 100mm five-knuckle aluminium hinges of 6082 alloy with nylon bushes for each door or leaf of double door, unless otherwise described, and one pair of similar hinges to each fanlight, with the three-knuckle leaf of each hinge secured to the frame or transom by means of 6mm diameter countersunk headed stainless steel set screws screwed to and including a 3mm thick steel backing plate of suitable size welded to frame or transom and drilled and tapped to receive the set screws.

Where frames are to be prepared for the top centres of floor spring hinges, a 6mm thick steel backing plate of suitable size is to be welded into the back of the frame and drilled and tapped to receive the fixing screws of the top centre.

The preparation of frames or all items of ironmongery, other than butts, has been measured separately and the rates against these items are to include for all drilling, mortising, tapping for screws, etc. required for the fixing of keeps, brackets, etc. of the items of ironmongery described. Preparation of frames for locks and latches is to include, in addition to the above, for recessing and fitting the frames with and including standard keeps and adjustable striking plates to suit the types of locks and latches used and with totally enclosed mortar guards 1, 15 metre high above finished floor.

Door and fanlight sizes are given to the nearest 10mm. The building in of frames has been measured separately.

STAINLESS STEEL DOOR FRAMES:- shall be manufactured from grade 304 stainless steel sheet 1.60mm thick for single and double rebated frames to profiles as per detailed drawings. Rebates shall be suitable for 42mm thick doors and fanlights. Stainless steel

frames to be used only in Patient Treatment facilities.

PRESSED STEEL CUPBOARD DOOR FRAMES: — shall be manufactured from 1.20mm thick mild steel sheet standard sections, having rebates for 42mm thick doors, and fitted with transoms and/or mullions where required and with sill section allowing the cupboard doors to be taken down to general floor level with the floor level inside cupboards not less than 12mm above general floor level. The frames are to be 102mm wide overall.

The sections are to be accurately bent to form the profiles. Corners are to be mitred and welded and reinforced at back with 1.60mm thick steel angle sections. Transoms, mullions and sills are to be neatly fitted at intersections and welded. All welds are to be solid and cleaned off flush, leaving a perfect outside finish.

All frames are to be fitted with rubber shock absorbers to the lock jambs of single doors, and to the head, transom and sill of double doors. Each door is to be fitted with standard corrugated adjustable building in lugs at jambs.

All frames are to be primed on all surfaces with an approved red-oxide zinc chromate priming coat in accordance with SANS Specification 909 before leaving the manufacturer's works, unless specified to be hot dip galvanized, and rates are to include for touching up where necessary with similar primer after building in.

Where frames are specified to be galvanized they are to be hot dip galvanized after manufacture in accordance with the relevant provisions of SANS Specification 763 for general applications on the relative thicknesses of metal.

Frames are to be fitted with one pair of 100mm five-knuckle loose pin steel hinges for each lower door or each leaf of lower double door and with one pair of 75mm five-knuckle loose pin steel hinges for each upper door or each leaf of upper double door. The three-knuckle leaf of each hinge is to be welded into the frame or mullion. Frames for single cupboard doors shall be prepared for locks or catches as specified and the frames for double doors are to be prepared for two barrel bolts for the first closing leaf of lower doors and one barrel bolt for the first closing leaf of upper doors.

Overall sizes are given to the nearest 10mm. Building in of the frames has been measured separately.

STEEL WINDOWS AND DOORS: — shall be in accordance with SANS Specification 727 and the frames are to be provided with fixing lugs or are to be holed for screwing as required.

Industrial type windows are to be suitable for glazing from the inside and all other windows from the outside, unless otherwise described.

Side hung and vertically pivot hung sashes shall open to at least 90 degree horizontally pivot hung sashes to at least 80 degree and bottom hung sashes to 30 degree. Unless otherwise stated, hinges for side hung opening out sashes are to be of the projecting type for easy cleaning.

All opening sashes are to have polished brass furniture.

The transoms and mullions of all purpose-made windows and doors are to be equally spaced between the outer frames of the windows and doors to form openings of equal size. Where this is not the case either the width or the height of the opening is stated, unless otherwise stated, the fixed lights and sashes of all purpose-made windows are to be in one square and the sashes and doors are to open out.

Windows and doors, unless otherwise specified, shall be of "one piece" construction. Composite windows and doors are to be supplied complete with all necessary standard coupling transoms or mullions.

Stock and purpose made residential type steel windows and school type windows of residential section shall be constructed of standard 25mm steel sections and of metal not less than 3mm thick.

Stock and purpose made industrial type steel windows shall be constructed with main frames of standard 35mm steel sections and of steel not less than 3mm thick, with sashes of standard 25mm steel sections and of steel not less than 3mm thick.

“Universal” sections, where specified, shall be not less than 33mm wide (measured over one opening section only) and of metal not less than 4mm. thick, and with all sight lines maintained (whether consisting of all fixed lights, all opening sashes, or portions of both) and with all glass in the same plane.

Stock and purpose made steel doors, sidelights and fanlights, shall be constructed with the doors of “Universal” sections as before described and the sidelights and fanlights of standard residential sections as before described. Bottom openings in doors and sidelights shall be fitted with kicking plates of one thickness of 1.60mm mild steel sheet fixed with metal beads. Frames of outward opening doors shall be fitted with bottom sills of door framing section (stepped sills) and of inward opening doors with metal ties welded to frames for embedding in threshold (flush sills)

Top Hung Sashes: — are to open out on a pair of steel hinges having brass pins and washers and fitted with brass peg stay, steel peg and locking bracket.

Outward Opening Side Hung Sashes: — are to open out on a pair of steel projection hinges having brass pins and washers and fitted with brass two-point handle and brass striking plate and brass sliding stay with friction fastener.

Inward Opening Side Hung Sashes: — are to open in on a pair of steel hinges having brass pins and washers and fitted with brass single point handle and steel engaging hook and brass sliding stay with friction fastener.

Bottom Hung Sashes: — are to open in on a pair of steel hinges having brass pins and washers and fitted with steel concealed side arms with brass guides and brass spring catch for long arm or hand operation and steel catch plate.

Horizontally Pivot Hung Sashes: — are to have brass adjustable friction ring centres and fitted with brass spring catch for long arm or hand operation and steel catch plate.

Projected Out Sashes: — are to be balanced on steel concealed side arms, the top of the sash fitted with spring loaded brass shoes to slide in brass guides and fitted at bottom with brass handle and brass striking plate.

Doors: — are to be hung on one and a half pairs per leaf of steel projection hinges with brass pins and washers and fitted with mortise lock set as specified, and each lock is to be provided with two keys.

Brass concealed bolts are to be fitted at top and bottom of meeting edge of first closing leaf of double doors. Sidelights and fanlights are to be hung as described for windows.

Adjustable Louver Sets: — are to be natural anodised aluminium louver sets of approved manufacture consisting of head and sill weather strips complete with neoprene gaskets and two jamb strips each fitted with louver brackets with spring loaded clips for the specified width of glass louver blades complete with tilt bars and operating lever handles. Where openings are not of a height to suit standard width louver blades an alternate head section with static clips must be provided to take a fixed louver blade of the required width. The louver sets are to be screwed to the steel window frame with stainless steel self-tapping screws and all portions of the louver set which come in contact with the window frame are to be insulated with approved pressure sensitive PVC tape to prevent electrolytic corrosion.

Burglar Bars: — are to be standard type burglar bars formed of 20 x 5mm mild steel bars riveted at intersections and riveted at ends to the window frames. The burglar bars to the small-pane type windows are to line through with the glazing bars and windows of the horizontal-pane type or of the no-glazing bar type are to be fitted with burglar bars which are divided as for the small-pane type window.

Fly screens: — are to be standard type fly screens suitable for residential opening-out type steel windows, unless otherwise described, and are to be constructed of stove enamelled pressed steel frames fitted with 0.25mm thick mosquito-proof mesh glass-fibre gauze. The fly screens are to be clipped onto the inner face of the steel window after all painting is completed.

All steel windows and doors are to be primed on all surfaces with an approved red oxide zinc chromate priming coat in accordance with SANS Specification 909 before leaving the manufacturer's works, unless specified to be hot dip galvanized, and rates are to include for touching up where necessary with similar primer after building in.

Where steel windows and doors are specified to be galvanized they are to be hot dip galvanized in accordance with the relevant provisions of SANS Specification 763 for general applications on the relative thicknesses of metal.

Loose metal glazing beads, where specified, are to be of an approved type and size, and are to be fixed with screws set in the correct positions for the type of glazing to be used, and neatly mitred at angles.

Immediately the windows and doors have been delivered on site, they are to be thoroughly overhauled and all necessary adjustments or repairs are to be made before they are fixed in position. A further inspection is to be made after building in and any further servicing required must be carried out in order to leave windows and doors in a satisfactory condition after glazing is completed.

All glass and glazing has been measured elsewhere.

Sizes of windows and doors are given to the nearest 10mm. The building in of windows and doors has been measured separately.

STAINLESS STEEL: — is to be of the thickness and grade specified and unless otherwise stated is to be buffed to an even satin finish to the approval of the Department.

All welding to stainless steel shall be by argon arc process and where filler rods are used these are to have properties not less than those of the parent metal. All welds are to be ground off smooth and uniform and the whole buffed to an even finish all over. Stainless steel is to be cut and bent in such a manner that a minimum of welding is required.

Where bending is required, all external angles are to be arras rounded and all internal angles are to be radiused.

All stainless steel work is to be of the highest quality and executed by specialists in this type of work and to the approval of the Department.

Note that where stainless steel fittings are specified and support work or fixings with bolts, nuts, rivets, etc, are required / specified, these fixings and support work are to be of stainless steel of the same rating / grade as the equipment specified.

ALUMINIUM AND ANODISED ALUMINIUM: — is to be of the brand specified or other approved and of 6063-TF or equivalent quality and temper.

Aluminium bars and sections shall comply with the relevant clauses of SANS 1476, extruded tube and hollow sections with the relevant clauses of SANS 1474, and sheet and

strips with the relevant clauses of SANS 1470. All alloys to be anodised are to be of anodising quality.

Aluminium is to be free from flaws, hammer and die markings or other imperfections.

Anodising of aluminium is to be carried out in accordance with SANS Specification 999 by an approved process. The average anodic film thickness shall be 25 micrometer, and at no point should the anodic film thickness fall below 22 micrometer or be thicker than 30 micrometer.

Prior to anodising, all surfaces are to be de-greased and cleaned, all irregularities removed and flushed off smooth and buffed where necessary.

All anodised aluminium must be coated with a suitable “non-yellowing” methylcrylate lacquer film, approved by the Department, over the entire surface. The lacquer film must be continuous and of a uniform average thickness not less than 10 micrometer. The lacquer thickness must be determined by use of a film meter or other instrument methods as described in ASTM B244-49T. Rates for anodised aluminium must include for this protective coating.

Before the work is put in hand, samples of finish are to be submitted to the Department for approval, and all finished work is to be equal in all respects to the approved samples.

The Contractor shall provide all samples required for testing in accordance with SANS Specification 999. If required, tests on the anodic film are to be carried out at the works of the anodised to verify that the work conforms to SANS Specification 999, the cost of which will be borne by the Contractor.

The surfaces of all aluminium which are jointed to or are in contact with other materials when fixed, particularly ferrous metals, are to be suitably insulated to prevent electrolytic corrosion.

Joints in all aluminium members are to be neatly formed in an approved manner with screw heads, pins, rivets, etc. concealed so that the joints are practically invisible. Screw or bolt jointing is to be kept to a minimum and will be permitted only when welding is impracticable. Unless otherwise described, stainless steel screws or bolts are to be used for jointing and fixing aluminium work. Welded joints are to be formed by argon arc process using SANS 1476/NS6 welding rods and finished off smooth.

Welding is to be executed in such a manner as not to affect the colour of the material or the anodic coating.

Exposed heads of screws, pins, rivets, etc. in coloured anodised aluminium are to be touched up with enamel paint to match the coloured anodised finish.

No deviation may be made from the general requirements or dimensions, but improvements in the general construction and design affecting neatness, strength or durability may be introduced. If any deviation is proposed, the Contractor must submit detailed drawings showing the particular construction and form or section he proposes to use and such drawings, details and samples of fittings, etc. are to be approved by the Department before manufacture is commenced and every facility must be given for the work to be inspected during manufacture.

No work may be fixed in position until it has been inspected and approved. Anodised aluminium work must be erected as near to the end of the Contract period as possible, to minimise the danger of damage or deterioration.

All work is to be suitably protected during building operations and left in a clean and satisfactorily finished condition on completion. In particular, all anodised aluminium work must be protected against damage, and against deterioration or discolouration caused by

mortar droppings, wax, paint, etc. all to the entire satisfaction of the Department. All work so damaged, deteriorated or discoloured must be replaced at the Contractor's expense.

Rates for aluminium work are to include for necessary cutting to lengths, shaping, turning, threading, forging, fitting, assembling, riveting, welding, welded running joints, filing smooth, also for all screws and holes and hoisting and fixing in position. All screwed work is to have full threads.

ANODISED ALUMINIUM WELDED WINDOWS AND DOORS: — are to be of an approved manufacture and design.

Windows and doors are to be fabricated from Medium Universal equal leg sections, unless otherwise specified, measuring 33mm over one opening section and not less than 4mm thick through the flanges and not less than 4.75mm through the web, unless otherwise stated.

The aluminium sections are to be of approved manufacture and of 6063-TF or equivalent quality and temper and are to be anodised after manufacture to the approval of the Department. Welds are to be electrically flash butt resistance welded, properly ground and cleaned off to give a uniform appearances.

Anodising, etc. is to be carried out as before described.

All windows and doors are to be suitable for internal glazing and are to be fitted with approved anodised aluminium glazing beads of the "clip on" type. Drilling for the fixing of glazing beads is to be done to suit the thickness of the glass used.

The frames are to be perfectly flat, square, butt-welded at joints (mechanical joints will not be permitted) and all opening sashes must fit perfectly on all faces and open or close freely without binding at any point. The glazing bars must be continuous with continuous intersections (mitred intersections will not be permitted) with ends scribed and fitted to the frames with shouldered ends passed through and riveted over. The sight lines of the main frame, whether consisting of all fixed lights, all opening sashes or portions of both and the glass plane must be the same throughout each window.
Weathering on sections is to be solid extruded with the sections (screwed or riveted on strips will not be permitted) except weather bars to sills of inward opening sashes which must be welded on and not screwed or riveted except in the approved designs of built-up transoms.

No steel is to be used in the manufacture of the windows unless it is stainless steel of quality to A.I.S.I. Type 316. All fittings, butt hinges, screws, nuts, bolts, etc. are to be of high quality aluminium or other approved non-corrosive material compatible with aluminium and of sufficient strength to perform the functions for which they are used. The handles, sliding stays and peg stays are to have nylon washers, bushes and pressure pads and are to be secured to the frames with screws having riveted ends. Pop rivet fixings will not be permitted.

The transoms and mullions of all purpose-made windows and doors are to be equally spaced between the outer frames to form openings of equal size. Where this is not the case, either the width or the height of the opening is stated. Unless otherwise stated, the fixed lights and sashes of all purpose-made windows and doors are to be in one square and the sashes and doors are to open out.

Frames must be provided with suitable fixing lugs bolted on to frame with aluminium alloy bolts or are to be holed for screwing as required with lugs or holes spaced one near top, one near bottom and not more than 750mm apart intermediately each side of frame. Frames more than 900mm wide are to be provided with similar fixings to top and bottom and not more than 750mm apart.

All composite windows, doors, etc. are to be supplied with suitable and approved coupling mullions or transoms. Rectangular hollow section transoms where specified are to be

25mm x 115mm in section manufactured from 3mm thick aluminium.

The Contractor must submit drawings showing details of sections he proposes to use and these drawings are to be approved by the Department before manufacture is commenced, and when requested, specimen windows and doors complete with all fittings as well as specimen coupling mullions, transoms etc. must be submitted for approval and all windows, doors, etc. supplied must conform to the approved samples.

The manufacturer of the windows and doors must supply a dimensioned set of drawings with the windows and doors, for use on the site, including clearance and strict fixing methods and details.

Windows and doors are to be delivered to the site in suitable protective wrappings or crates and are to be stacked on end and carefully handled at all times to prevent any marking or staining of surfaces.

Immediately the windows and doors have been delivered on the site, they are to be thoroughly overhauled and all necessary adjustments or repairs are to be made before they are fixed in position. A further inspection is to be made after fixing and any further servicing required must be carried out in order to leave the windows and doors in a satisfactory condition and waterproof after glazing is completed.

Side Hung Sashes: — are to open out on a pair of aluminium hinges complete with anti-friction weatherproof bushings fixed pin and nylon washers and fitted with anodised aluminium alloy sliding stay with friction fastener and an approved anodised aluminium two point handle and striking plate.

Bottom Hung Sashes: — are to open in on a pair of aluminium hinges complete with anti-friction weatherproof bushings, fixed pin and nylon washers and fitted with concealed side arms and strong lever action spring catch and keep.

Top Hung Sashes: — are to open out on a pair of aluminium hinges complete with anti-friction weather proof bushings, fixed pin and nylon washers and fitted with anodised aluminium peg stay with cranked locking stay.

Horizontally Pivot Hung Sashes: — are to be hung on a pair of approved weatherproof brass satin-chrome finished friction pivots of the greatest possible diameter permissible and fitted at top with strong lever action spring catch for long arm or hand operation and striking plate, unless otherwise stated.

Vertically Pivot Hung Sashes: — are to be hung on free pivot cups at the head incorporating nylon bearing sleeves and lever pivots at the sill and fitted with one two-point casement handle and striking plate.

Projected Out Sashes: — are to be balanced on approved concealed side arms with stainless steel shoes and channels and fitted at bottom with one approved bow handle with catch incorporated.

Projected In Sashes: — are to be balanced on approved concealed side arms with stainless steel shoes and channels and fitted at top with strong lever action spring catch for long arm or band operation and striking plate:

Doors: — are to be side hung to open out on one and a half pairs of aluminium hinges to each leaf complete with anti-friction weatherproof bushings, fixed pin and nylon washers and fitted with lock set as specified, and each lock is to be provided with two keys. Satin chrome finish flush bolts are to be fitted at top and bottom of meeting edge of first closing leaf of double doors.

Adjustable Louver Sets: — are to be approved anodised aluminium adjustable louver sets consisting of head and all weather strips fitted with neoprene gaskets and two jamb strips

each fitted with louver brackets with spring loaded clips for the specified width of glass louver blades and complete with tilt bars and operating lever handles. Where the openings are not of height to suit standard width louver blades an alternate head section with static clips must be provided to take a fixed louver blade of the required width. The sets-sets are to be tap screwed to the window frame with stainless steel self-tapping screws.

GLAZING TO DOORS / ALUMINIUM GLAZED SCREENS

No glazing permitted to any fitting below Lock Rail (ie 1,2m high.).

Burglar Bars: — are to be standard type burglar bars formed of 20mm x 5mm aluminium bars riveted at intersections and riveted at ends to the window frame with high strength aluminium rivets. The burglar bars to the small pane type window are to line through with the glazing bars, and windows of the horizontal-pane type or of the no-glazing bar type are to be fitted with burglar bars which are divided as for the small pane type window.

All exposed surfaces of anodised aluminium are to be protected by means of an approved fabric backed adhesive tape. The Contractor shall satisfy the Department that the tape he proposes to use can be easily stripped after long exposure to sunlight, and rates are to include or the final stripping of the protective tape and cleaning dawn to approval at completion.

All work is to be protected during building against deterioration or discolouration caused by mortar droppings, wax, paint, etc. and all work so damaged is to be replaced at the Contractor's expense to the approval of the Department.

All glass and glazing has been elsewhere measured. All sashes and openings, unless otherwise stated, are to be single panes without glazing bars.

All windows and doors must be fixed into preformed openings in the structure (the building-in of windows and doors will not be pen fitted) and rates are to include for supplying necessary templates for forming the openings. Fixing in position of windows and doors has been measured separately. Sizes of windows and doors are given to the nearest 10mm.

STRONG ROOM DOORS: — must comply in all respects with SANS Specification 1015 Category 1. Each door is to be provided with two keys and the keys must be forwarded by the supplier under registered cover direct to the Department, and the supplier must clearly indicate the institutions in which the door (or doors) is being installed.

BURGLAR RESISTING SAFES: — must comply in all respects with SANS Specification 751. The safes shall be "Office Safe Category 1" as laid down in SANS Specification 751. Each safe is to be provided internally with one shelf and two lockable drawers.

Where the mass of each safe is 680kg or less, provision must be made for securing it rigidly to prevent unauthorised removal; the means of securing shall be at least equal in effectiveness to that which would be provided by four 12mm bolts. Locks shall be lever locks with a minimum of six levers. Each safe is to be provided with two keys to each lock and the keys for any safe must be forwarded by the supplier under registered cover direct to the Department, and the supplier must clearly indicate the institution in which the safe (or safes) is being installed.

ADJUSTABLE LOUVER GEAR SETS: — are to be approved natural anodised aluminium adjustable sets consisting of head and sill weather strips fitted with neoprene gaskets and two jamb strips and fitted with sets brackets with spring loaded clips for the specified glass sets blades and complete with tilt bars and operating handles. Where the openings are **not** of a height to suit standard width sets blades an alternate head section with static clips must be provided to take a fixed sets blade of the required width.

RATES: — are to include for fixing in accordance with the manufacturers instructions for screwing head and sill weather strips and jamb strips with stainless steel screws to frames (Elsewhere measured) and for oiling and easing at completion.

12. PLASTERING

MIXING
The mixing of the materials is to be done on a hard surface.
Once all materials have been mixed, they are not to be remixed with new materials added after 5 (five) hours.

MATERIALS
Stone Chippings: — are to be approved clean stone chippings of the sizes stated complying with SANS Specification 1083.

River Sand: — for floor finishes and screeds is to be clean, sharp, coarse sand free from all impurities, washed if so directed and complying with SANS Specification 1090.

Plaster Sand: — is to be clean, sharp, free from all impurities, washed if so directed and is to comply with SANS Specification 1090.

Cement: — unless otherwise specified is to be Portland cement of normal setting quality, is to comply with SANS Specification 471, and must be used fresh. Cement containing more than 15% blast furnace slag will not be permitted to be used.

Lime: — is to comply with SANS Specification 523.

Water: — is to be clean, fresh and free from injurious amounts of acids, alkalis and other organic substances.

MEASUREMENT OF CONSTITUENT PARTS OF FLOOR FINISHES, TOPPINGS, SCREEDS AND PLASTER FINISHES: — Cement, sand and stone chippings are to be measured exactly by means of gauge boxes or purpose made wheelbarrows. Part filling or heaping of normal wheelbarrows will not be permitted.

Water is to be accurately measured for each batch, to approval.

Waterproofing compounds, where specified, are to be added to the mixture in the proportions recommended by and in strict accordance with the manufacturer's instructions.

PREPARATION OF SURFACES: — Prior to the application of floor finishes, toppings, screeds, plaster finishes etc. the surfaces of the new or existing concrete, brickwork, etc. are to be thoroughly cleaned, chipped, hacked, sloshed, etc. as necessary to ensure a satisfactory bond. The Contractor will be held entirely responsible for the proper and adequate preparation of the surfaces and any work which results in failure in this regard must be made good at the Contractor's expense to the satisfaction of the Department.

FLOOR SCREEDS, ETC: — Cement screeds are to consist of one part cement and three parts sand, unless otherwise described, and are to be steel towelled, unless otherwise stated, to true smooth and even surfaces, free from tool marks to the satisfaction of the Department to receive the finishes stated in the items. It is recommended that in new structures the screeding should be as specified by "Tal" using "Screedmaster", the pumped method.

GRANOLITHIC FINISH TO CONCRETE FLOORS, ETC: — Float up to within 6mm of finished surface with layers on concrete approximately 10mm thick, composed of one part cement, two and a half parts concrete and three and a half parts granite or other approved hard stone chippings. Form finished surface with one part cement and one part fine granite chippings or other approved hard stone graded up to particle, which will pass a 6mm mesh brought to a smooth surface with a steel trowel. The floating and finishing coats are to be performed in one operation.

The granolithic work is to be carried out by experienced workmen and is to be laid in panels

V-jointed and not and not exceeding 6m^2 in area or as shown on drawings or described in the Bills of Quantities.

Thin strips if wood or other suitable materials are to be laid between panels to break contact.

Where granolith is described to be tinted, the requisite quantity of oxide of iron or other colouring materials is to be mixed with the finishing thickness.

All granolithic floors, etc. are to be covered up and protected from injury and discolouration during the progress of the work.

Rates for granolithic work are to include for cleaning down and for a coat of approved wax polish or stoep reviver well rubbed in at completion.

13. PLASTER

GENERAL

Except where otherwise described, all external plaster is to be finished with a wood float and internal plaster is to be finished with a steel trowel, unless otherwise described, all to true and even surfaces, free from tool marks and other defects to the satisfaction of the Department. No distinction has been made for brick or concrete surfaces.

CEMENT PLASTER

External cement plaster to wall is to consist on one part cement and four parts sand.

External cement plaster to ceilings is to consist of one part cement and three parts sand.

Internal cement plaster to walls is to consist of one part cement and five parts sand.

Internal cement plaster to ceilings is to consist if one part cement and three parts sand.

One coat cement plaster to walls shall not be less than 13mm or more than 16mm in thickness, and one coat cement plaster to ceilings shall not be less than 10mm or more than 13mm in thickness, unless otherwise described.

Where plaster is described as undecorated, the same type of approved sand the same brand of cement is to be used throughout to maintain a uniform colour and texture.

BARIUM PLASTER

Barium plaster shall consist of two coats plaster, the first coat 13mm thick consisting of one part cement and five parts sand, and the second coat 6mm thick consisting of one part cement and five parts Barium Sulphate. (This is to be applied only to X-Ray Room walls where holed bricks have been used).

All surfaces are to be plastered in one operation from ceiling to floor and corner-to-corner; breaks are to be made only in corners or at junctions of walls and ceilings.

CURING, PROTECTION, ETC.: — All floor finishes, paving, plaster finishes and screeds are to be properly cured to approval and all cracks, blisters and other defects which may occur are to be made good and the whole left in a satisfactory-condition at completion.

The finished surfaces are to be properly protected from damage and cleaned down at completion.

RATES: — Rates for floor finishes and screeds are to include for preparation of new or existing surfaces, dressing to falls where required, V-joints where specified, curing, protecting from damage and cleaning down at completion.

Rates for skirtings, risers, etc. are to include for internal angles at junction with floor, treads, etc. to be square or coved to not more than 50mm girth and in addition are to include for mitres, stops, etc. except where given separately in terms of the Standard System of Measuring Builders' Work.

Rates for plaster finishes are to include for preparation of new or existing surfaces, curing, protecting from damage and cleaning down at completion.

Rates for plastering are to include for internal angles to be square or coved to not exceeding 50mm girth.

Rates for rounded angles, fair edges and arrases and the like are to include for mitres, stops, etc. except where given separately in terms of the Standard System of Measuring Builders' Work.

Rates for mouldings, projecting bands, coves, weatherings and the like are to include for dubbing out.

Rates are to include for cutting back against frames and for V-joints cut where concrete abuts brickwork.

Rates generally are to include for all sundry making good and working around pipes, balusters, etc.

GENERALLY

Narrow Widths
Items described as "Extra over for narrow widths" include for all reveals, edges, soffits, treads, risers, etc. not exceeding 500mm wide, narrow widths not exceeding 500mm wide in general surfaces caused by openings or projections, all of which have been included in the areas of horizontal or vertical surfaces. No distinction has been made for finishes of differing thicknesses.

14. TILING

MATERIALS

River Sand: —is to be clean, sharp, coarse sand, free from all impurities, washed if so directed and complying with SANS Specification 1090.

Plaster Sand: — for wall backings is to be clean, sharp, free from impurities, washed if so directed and complying with SANS Specification 1090.

Cement: —unless otherwise specified, is to be Portland cement of normal setting quality complying with SANS Specification 47I and must be used fresh. Cement containing more than 15 % blast furnace slag will not be permitted to be used

Water: —is to be clean, fresh and free from injurious amounts of acids, alkalis and other organic substances.

MEASUREMENT OF CONSTITUENT PARTS OF BACKINGS, ETC.: — Cement and sand are to be measured exactly by means of gauge boxes or purpose made wheelbarrows. Part filling or heaping of normal wheelbarrows will not be permitted:

Water is to be accurately measured for each batch to approval.

Waterproofing compounds, where specified, are to be added to the mixture in the quantities recommended by and in strict accordance with the manufacturers' instructions.

PREPARATION OF SURFACES: — Prior to the application of the backing for tiles, the surfaces of the new or existing concrete, brickwork, etc. are to be thoroughly sloshed, etc. as necessary to ensure a satisfactory bond. The Contractor shall be held responsible for the proper and adequate preparation of the surfaces and any work which results in failure in this regard must be made good at the Contractor's expense to the satisfaction of the Department.

GLAZED CERAMIC WALL TILES AND FITTINGS: — shall comply with SANS Specification 22 of selected grade, free from defects and blemishes and of uniform colour.

Rates are to include for either bedding tiles on and including a solid cement mortar backing consisting of one part cement to three parts sand on brickwork or concrete, or fixed with an approved tile adhesive on and including a coat of cement plaster consisting of one part cement to five parts sand and finished to a surface to receive tiles.

Tiles are to have vertical and horizontal joints continuous with all joints solidly flushed up in neat white cement.

MOSAICS: — Glass or ceramic mosaics are to be of approved South African manufacture of the sizes and colours specified, fixed to paper panels for ease of handling.

Mosaics are to be bedded to a true even surface on and including a solid cement mortar backing consisting of one part cement and three parts sand on brickwork or concrete, or fixed with an approved mosaic adhesive on and including a coat of cement plaster consisting of one part cement to three parts sand finished to a surface to receive mosaics.

After setting, the paper panels are to be removed and all joints are to be solidly flushed up in neat white cement.

Samples of mosaics are to be submitted to the Department for approval before any work is put in hand.

UNGLAZED CERAMIC FLOOR TILES AND FITTINGS: — are to be unglazed acid and alkali resistant tiles and fittings of the types specified in the items, and of approved manufacture, uniform in size, shape and colour, free from cracks, twists and other defects and equal to samples to be deposited with and approved by the Department.

Floor tiles are to be laid with maximum 10mm wide joints continuous in both directions on and including a 15mm thick cement mortar bed consisting of one part cement to three parts sand, unless otherwise specified, to true levels and grades with the joints raked out and grouted up solid and flush pointed with an approved epoxy jointing compound.

Floor tiles are to be set out so as to have no long edges of tiles cut to suit room size.

RATES: — for tiles, mosaics, etc. are to include for all necessary preparation of surfaces, for laying in accordance with the manufacturer's instructions, all square cutting and waste and fitting, protecting from damage and cleaning down at completion.

Rates for tiles are also to include for laying, bedding, jointing and pointing as described and in accordance with SANS Code of Practice 0107 where applicable.

Rates for treads, risers, sills, copings, cappings, skirting etc. are to include for pointing to exposed edges and projecting soffits.

No distinction has been made for brick or concrete surfaces.

TRANSITION TRIMS:-
Aluminium Wide Tile-In Ramp splayed transition trims to be used at junction between ceramic / porcelain tiles and vinyl sheeting.

MOVEMENT JOINTS:-
Aluminium Structural Screed joints bolted to slab to be capable of total movement of minimum of 5mm either way with flexible PVC Hospital Insert.
Movement joints to be in high traffic area's as "Migua" FV35/1500 or "Kirk" ASSJ390H of approved height with hospital insert bolted to slab before screeding.
Metal movement joints in low traffic area's with hospital insert strips..

15. DRAINAGE AND PLUMBING

GENERALLY: —The Standard Preambles for other trades, with reference to Excavations, Concrete, Brickwork and Plastering, and, in particular for the full description intent and meaning of the classification for excavations, are to apply equally to this trade.

LICENSED DRAINLAYERS AND PLUMBERS: — Only licensed drain layers shall be employed on any drainage work and licensed plumbers on plumbing work.

SUBSOIL DRAINS

Unplasticised polyvinyl chloride (UPVC) slotted drainage pipes and fittings: — shall be of approved manufacture jointed in accordance with the manufacturer's instructions.

Pitch-fibre perforated or slotted drainage pipes and fittings: shall comply with SANS Specification 921 and shall be jointed in accordance with the manufacturer's instructions.

Filter fabric: — shall be non-woven, spun bonded, needle punched and continuous polyester fabric, resistant to the effects of alkalis, acids, saline solution and sunlight.

STORMWATER AND SOIL DRAIN PIPES

Reinforced concrete non-pressured pipes: shall comply, with SANS Specification 677 and must be Type SC of the class specified with spigot and socket ends with rubber insertion ring or with ogee joints with approved rubber collars. Pipes must be marked with the manufacturer's name, trade name or registered trade mark, nominal bore, class and type, date of manufacture, the letter "R" denoting reinforced and the SANS mark. Joints shall be made in accordance with SANS Code of Practice 058.

Unplasticised polyvinyl chloride (UPVC) drain and sewer pipes and fittings: — shall comply with SANS Specification 791. Joins shall be made with fittings in accordance with SANS Code of Practice 058.

CONCRETE BEDS AND ENCASEMENT TO DRAIN PIPES: — Where pipes are required to be bedded on concrete, the bed of concrete shall be Class B, a minimum of 500mm wider than the diameter of the pipe, laid to correct falls and levels with recesses formed in same for pipe joints including all necessary formwork and any additional excavation. The barrel of the pipe shall then be bedded on a thin cement mortar (1:3) bed and laid to falls. After jointing, the recesses previously formed shall be filled in with concrete Class B and the haunching or surrounding completed.

Where pipes are fixed vertically they shall be encased in concrete Class B having a minimum thickness of 150mm around the pipe and carried up to ground level and shall include for any necessary formwork.

PIPE LAYING: — All drain and sewer pipes are to be laid to a straight line to even gradients and jointed in accordance with SANS Code of Practice 058 except in the case of polyethylene or unplasticised polyvinyl chloride drain and sewer piping which is to be in accordance with SANS Code of Practice 01 12.

Before laying, each pipe shall be examined to ensure that the bore is clean and free of any foreign matter and shall be tested for soundness by striking with a wooden mallet, and any cracked or damaged pipes shall be rejected. Ends of all pipes must be clean before

jointing. Immediately after jointing a tight fitting wad or scraper shall be drawn several times through the bore of the pipe to ensure that it is left clean and free from obstructions. Whenever work is suspended, the open ends of pipes and junctions must be temporarily plugged to prevent the entrance of rubbish during construction.

GULLEY TRAPS: — Gulley trap assemblies must be of the material specified with "P" or "S" trap, jointed to drain and with hopper head with vertical and side inlets, the head fitted with 190mm diameter cast iron gulley grating complying with SANS Specification 1115 laid loose in socket. The trap, hopper head and vertical pipe shall be set on and encased in concrete Class B having a minimum thickness of 150mm at any one part, carried up 75mm above ground level as kerb, dished down to grating and finished on all exposed surfaces in 1:3 cement plaster with angles rounded, including necessary excavation and formwork.

GREASE TRAPS: — Grease trap assemblies of vitrified clay must consist of outlet junction jointed to trap with side inlet. Access openings of trap and junction shall be fitted with vitrified clay stoppers laid loose in socket of trap and set in bitumen in socket of junction. The trap and junction and vertical pipe shall be set on and encased in concrete Class B having a minimum thickness of 150mm at any one part, carried up 75mm above ground level as kerb, dished down to grating and finished, on all exposed surfaces in 1:3 cement plaster with angles rounded, including necessary excavation and formwork.

RODDING EYES: — Where pipes are carried up in ramps for rodding eyes, the head of the pipe at ground level must be fitted with an **"A.B.C."** cast iron cover and frame, complying with SANS Specification 746, jointed to pipe, the frame rebated for and including cover with raised letters "CE" cast on same, secured to frame with gun-metal screws and with the whole encased in concrete Class B having a minimum thickness of 150mm at any one part, carried up 75mm above ground Level and finished on all exposed surfaces in 1:3 cement plaster with angles rounded, including necessary excavation and formwork,

INSPECTION EYE BLOCKS: — Where inspection eye fittings are provided in pipelines, the position of these inspection eyes must be registered and demarcated with concrete Class C. block size 300 x 300 x 50mm thick finished on all exposed surfaces with 1:3 cement plaster with angles rounded and with sunk letters "I.E." formed in top and set in ground, including necessary excavation and formwork.

SURFACE WATER CHANNELS: —Concrete open surface water channels shall be formed with concrete Class B with segmental channel formed in same to the size and shape specified and finished on exposed surfaces in 1:3 cement plaster, steel towelled to a smooth even surface with all angles rounded, cast in lengths not exceeding 2m and laid to falls, including necessary excavation and formwork.

GRATINGS FOR GULLEYS AND STORMWATER DRAINS AND CAST IRON SURFACE BOXES AND MANHOLE COVERS AND FRAMES: — Cast iron or Polymer gratings for gulleys and storm water drains shall comply with SANS Specification 1115 and SANS 1882:2003 respectively.

Cast iron surface boxes and manhole covers and frames shall comply with SANS Specification 558.

All cast iron gratings, cast iron surface boxes and cast iron manhole covers and frame must be coated with approved preservative solution before leaving the manufacturer's works.

The masses stated are the combined mass of the grating and frame or the combined mass of the cover and frame.

STORM WATER SUMPS, JUNCTION BOXES, MANHOLES, INSPECTION CHAMBERS, CABLE INSPECTION CHAMBERS AND VALVE CHAMBERS: — shall be of the internal size specified and are to be constructed of one brick sides, unless otherwise specified, built in 1:3 cement mortar on a 150mm thick concrete Class C bottom and finished on top with an 85mm thick pre-cast concrete Class C cover slab, reinforced as detailed and bedded in

cement mortar. The cover slab, except to junction boxes, is to have a rebated opening formed in same, suitable for and fitted with a cast iron orating and frame, or cover and frame, of the size and mass specified with the frame bedded in cement mortar. The bottom of the sump, manhole, etc. and the exposed surfaces of the cover slab are to be finished smooth in 1:3 cement plaster with angles rounded. The internal brick surfaces are to be faceḍ with smooth facing bricks and pointed with flush joints.

Inspection chambers and manholes with an invert not exceeding 1m shall have an internal dimension of 470mm x 700mm and those exceeding 1m shall have an internal dimension of 920mm X 920mm. Where the invert of the hole exceeds 1m, a 150mm thick reinforced concrete Class C corbel slab, reinforced as detailed, with opening size 470mm x 700mm formed in same and finished smooth off the formwork, is to be built into the brick sides at a height not exceeding 1, 5 inches above the concrete bottom with the reduced manhole shaft built off the top of the corbel slab. Cast iron step irons spaced at 300mm staggered centres vertically are to be built into one side of all manholes with an invert exceeding 1m.

Where measured in number, rates for all sumps, manholes, etc. are to include for excavating to the depths required, taking precautions against collapse of sides of excavations, staging, ramming, pumping and baling to keep excavations free from water or mud, filling around and ramming and depositing and levelling spoil on site or carted away as directed. Ends of pipes are to be built through the sides of the sumps, manholes, etc. and rates are to include for this.

SOIL DRAIN MANHOLES AND INSPECTION CHAMBERS: —are to be of the internal diameter and inverts specified and are to be constructed of pre-cast reinforced concrete manhole ring sections with walls a minimum of 50mm thick, pre-cast reinforced concrete cover slabs and spacer pieces complying with SANS Specification 677. The joints for the ring sections shall be of the ogee type. The bottom shall be of concrete Class C-cast in-situ.

The placing of the concrete bottom and benching shall be carried out in three stages with the initial stage being the laying of the concrete bottom projecting 100mm beyond the external diameter of the manhole on which is laid the inspection eye pipe, branches, etc. The second stage comprises the laying of concrete within the manhole to the height of the pipes and around the perimeter of the bottom to a height of not less than 25mm above the collar of the pipe at the highest end. This annular base is to be shuttered to provide a horizontal setting for the first ring section which is to be firmly bedded in the wet concrete. The third stage comprises the laying of the benching within the initial ring section and finished in 1:3 cement plaster with all angles rounded. Thereafter, the ring sections of the required standard height are joined together to form the required depth, with all joints primed with “Bituprime” and sealed with “Bitujoint Putty”. A 125mm thick pre-cast reinforced concrete cover slab, rebated on underside to suit ring sections and with opening size 600mm x 600mm formed in same is to be bedded on top of the ring section. The shaft above the cover slab is to be constructed of either pre-cast reinforced concrete spacer units to suit the type of cast iron cover and frame specified, or one brick kerb walls faced internally with smooth facing bricks jointed with flush joints, and finished on top with an 85mm thick pre-cast concrete Class C cover stab, reinforced as detailed and bedded in cement mortar with the exposed surfaces finished smooth in 1:3 cement plaster with all angles rounded. The cover slab is to have a rebated opening formed in same suitable for and fitted with cast iron cover and frame of the size and mass specified, with the frame bedded in cement mortar.

MANHOLE COVERS AND FRAMES:- Cast iron, Concrete or Cultured Polymer covers and frames to be suitable for the area of usage.

SOAK PITS: — shall be of the lengths and widths specified and shall be a minimum of 900mm deep below the invert of the inlet pipe. A perforated pitch-fibre drainpipe, jointed to the inlet pipe and with other end capped, is to be laid level in a 19mm stone packing of a minimum thickness of 15mm below and at sites of pipe and a minimum thickness of 150mm below the top of the pipe. The remainder of the soak pit is to be filled with stone graded

from 50mm to 75mm, to a level of 50mm above the top of the pipe. The stone is to be covered with corrugated asbestos cement sheets extending 150mm beyond the walls of the soak pit all round. The trench shall be backfilled above the sheeting to a minimum depth of 300mm lightly rammed with the final 100mm of backfilling being approved topsoil from the excavations.

SEPTIC TANKS: —shall be of the internal sizes specified and are to be constructed of one brick sides built in 1:3 cement mortar on 150mm thick concrete Class C bottom laid to falls. A half brick baffle wall finished 75mm below underside of concrete cover slab and with opening size 150 x 150mm high formed in wall is to be built in 1:3 cement mortar on the concrete bottom. A 115mm thick reinforced concrete Class C cover slab, reinforced as detailed, is to be cast in-situ on removable formwork and is to have two openings formed in same, each suitable either for and fitted with 600 x 450mm x 38 kg cast iron single seal manhole cover and frame, or for the shaft of the inspection chamber built off the cover slab in one, brick walls in 1:3 cement mortar with smooth face bricks internally, finished on top with 85mm thick pre-cast concrete Class C cover slab, reinforced as detailed and rebated for and fitted with 600 X 450mm X 38-kg cast iron single seal manhole cover and frame. The bottom and sides of the septic tank are to be finished in 1:3 cement plaster, 19mm thick, with an approved waterproofing compound added, with all internal angles coved to 50mm radius. Inlet and outlet chambers attached at either end of the septic tank shall be size 600 x 450mm internally, of the depth required and each shall be constructed of one brick walls built in 1:3 cement mortar on a concrete Class C bottom 150mm thick, or where extended above the top of the septic tank cover, built off the cover and finished on top with 85mm thick pre-cast concrete Class C cover slab, reinforced as detailed and bedded in cement mortar with the exposed surfaces finished smooth in 1:3 cement plaster with angles rounded. The cover slab is to have a rebated opening formed in same suitable for and fitted with a 600 x 450mm x 38 kg cast iron single seal manhole cover and frame. Chambers shall be provided with inspection eye pipes or bends, straight or curved channel sections, benched up to sides of chambers in concrete Class C, finished in 1:3 cement plaster with all angles rounded.

The inlet and outlet of the septic tank shall be formed of cast iron square junction piece with tail-pipe extending 300mm below water level in tank, built in through end walls and jointed to channels in inlet and outlet chambers.

TESTING OF DRAINS, MANHOLES AND INSPECTION CHAMBERS: — All drains, manholes and inspection chambers with the exception of subsoil drains shall be constructed so as to be watertight. No trenches shall be backfilled or pipes encased in concrete until the drains have been tested and approved. Any drains covered by the Contractor prior to testing shall be exposed at the Contractor's expense.

The Contractor shall give at least 24 hours notice of any particular length between manholes ready for testing. The drains shall not be tested until a period of 24 hours, or such other period as may be required, has been allowed for the pipe joints to set. The Contractor shall provide all necessary testing apparatus, expanding plugs, stoppers, water and any other materials and all labour that may be required for carrying out the tests.

The whole of the drainage system shall be tested using one or more of the following tests:-

(a) **Visual test—** Each length of pipe shall be inspected for invert level grade, direction and line. Internal inspection of the bore of the pipes shall be made using mirrors and a powerful source of light. The drains must be free of invert lips and the bases of the pipes must be straight.

(b) **Air test** — All openings in the drain shall be plugged and sealed and all associated traps filled with water and air pumped into the drains until a manometric pressure of 40mm is indicated, after which, without further pumping, the pressure shall not drop below 25mm for a period of at least 30 seconds.
After the entire drainage system has been completed, all plumbing fittings installed and permanently connected up, and traps filled with water, a final air test shall be applied to the whole system.

(c) **Water test**— All openings-in the drain, except the highest one, shall be plugged and sealed and the drain filled with water so that every part of the system is tested under a head of water of not less than 1.5m and not more than 3.5m. After allowing period of 10 minutes for initial absorption, the amount of water it shall be necessary to add to maintain the water level over the next 15 minutes shall not exceed a rate of 25 litres for 100mm diameter pipe and 3,75 litres for 150mm diameter pipe for 100m of drain and an equivalent rate for larger drains. In carrying out the water test, the head of water shall be obtained by providing temporary pipes, fittings, etc. wherever necessary or by such other method as may be approved.

In cases where the maximum head of water, owing to the gradient of the drains, would be exceeded in any section, inspection eyes at suitable intervals may be provided and the drain plugged, in order not to subject the lower portion of the drain to a greater head of water than that required. Drains must be free of air before testing.

(d) **Manhole and Inspection Chamber test** — The inlet and outlet pipe hose shall be plugged and sealed and the inspection chamber filled with water. After allowing the water to stabilise due to absorption, the water level should not fall more than 5mm in *2* hours.

DEFECTS TO BE MADE GOOD: — Should the drain system fail to withstand the above tests, all defects shall be made good and the tests repeated at the Contractor's expense until the whole system is sound and passed to the satisfaction of the Department. In making good, all defective parts shall be cut out and replaced with new. No patching of pipes, joints or connections will be permitted.

SHEET METALWORK: — generally is to be lapped 75mm at ends and 150mm at angles, unless otherwise specified. Rates for sheet metalwork shall include for all labour, cutting and waste, laps, seams, welts, angles, clips, tacks, soldered dots, riveting, soldering, brazing, burning, nailing, dressing and wedging as required. All measurements are net with no allowance being made for laps, seams, welts, angles, clips and tacks or waste in cutting. Where stepped flashings are described as to flat slope, the pitch of the roof to which they apply does not exceed 40 degrees

.

(a) **Galvanized sheet iron**: — shall be of an approved brand of the thickness specified after galvanising and having a galvanized coating of "Iscor Coating Designation Z450". Corroded or otherwise defective sheets shall not be used. All nailing or screwing shall be done with galvanized nails or screws.

(b) **Sheet aluminium**: — shall be of the thickness and quality specified. All nailing shall be done with aluminium alloy nails and all screwing done with stainless steel screws.

(c) **Sheet copper**: — shall be cold rolled sheet of the thickness and temper specified. Sheet copper for covering flat roofs and for valley and gutter linings, flashings, soakers, etc. shall be of dead-soft temper and for eaves gutters, rainwater pipes and other unsupported or semi self-supported work shall be of half-hard temper. All nailing shall be done with copper or copper alloy nails and all screwing done with brass screws.

(d) **Sheet lead**: — shall be best milled sheet lead of the full mass specified and of equal thickness throughout and must comply with SANS Specification 1178.

LININGS TO VALLEYS: — shall be of the material specified, lapped 200mm at ends and dressed up on to purlins or battens at sides of valleys with edges bent back to form open beads.

LININGS TO SECRET GUTTERS: — at back of chimney stacks and wall abutments and at raking intersections of walls and roofs shall be of the material specified, turned 100mm up vertical surfaces and dressed 250mm up roof slope and on to purlin or batten at edge.

SOAKERS: — to slate covered roofs shall be of galvanized sheet iron or sheet copper of 0.6mm thickness, 450mm wide to closed valleys and 250mm wide to raking intersections of roofs with vertical wall and chimney stack abutments and turned 75mm up vertical surfaces. Soakers shall be 75mm longer than the gauge of the slate roofing.

UNDER-FLASHINGS: — to all iron roofs and where specified to slate or tiled roofs shall be 0.6mm thickness galvanized sheet iron. Flashings to asbestos cement roofs shall be asbestos cement preformed units fitted in accordance with the manufacturer's instructions. Where specified, copper flashings shall be formed from sheet of 0.6mm thickness and aluminium flashings shall be formed from 1200-H4 quality sheet of 0.6mm thickness. Lead flashings, where specified, shall be formed from sheet having a mass of 24 kg/in 2.

COVER FLASHINGS: — shall be either galvanized sheet iron, copper or aluminium, as specified, of 0.6mm thickness fitted over under-flashing, stepped where required on rake and with top edge bent and wedged 25mm deep into joint of brickwork or groove formed in concrete face and flush pointed in 1:3 cement mortar.

FLASHINGS AROUND PIPES THROUGH ROOF COVERINGS

(a) Pipes through preformed sheet steel roofing shall be flashed around with 0.6mm galvanized sheet iron apron pop-riveted to top of roofing wit edges cut and dressed to profile of roofing, soldered all round and with conical sheet iron 'u' stand, riveted and soldered at joint and at base to apron. The top of the conical upstand is to be fixed around the pipe with 25mm x 3mm galvanized mild steel strap wrapped around the pipe and fixed with a galvanized steel gutter bolt.

(b) Pipes through fibre cement roofing shall be flashed around with 24 kg/in 2 lead a on dressed into corrugations, bedded in mastic and bolted to roof sheeting with galvanized steel gutter bolts and with conical lead upstand, wiped on at joint with apron, and secured around pipe with copper wire.

(c) Pipes through slate or tile roofing shall be flashed around with 24 kg/in 2 lead apron dressed to profile of slates or tiles with top edge of lead apron dressed over back edge of slate or tile under overlap of slates or tiles. A conical lead upstand, wiped on at joint with apron, is to be secured around the pipe with copper wire.

(d) Pipes through pre-printed or embossed sheet steel or aluminium roofing shall be flashed around with flexible glass-fibre reinforced waterproofing dressed to profile of roofing, pop-riveted around edges to roofing and dressed up and around pipe. The waterproof is to be finished in a colour to match that of the roofing material.

RAINWATER PIPES

GENERALLY:

Full bore outlets for flat roofs are not allowed. Where flat roofs are specified, it is preferred to have a drain along the edges into a common outlet. Where roof cover is of 'Chromodek' sheets, the preferred guttering is of the same material in the same colour in continuous lengths.

(a) **Unplasticised polyvinyl chloride (UPVC) rainwater pipes and accessories** shall comply with SANS Specification 967 and must be fixed clear of the finished wall face on stock pattern brackets in accordance with the manufacturer's instructions.

(b) **Galvanized mild steel rainwater pipes**, shall be medium quality screwed and socketed normalised welded mild steel pipes, galvanized inside and outside, and shall comply with SANS Specification 62.

Fittings for galvanized mild steel pipes shall comply with SANS Specification 509. The screwed joints must be made with lead paint and hemp or approved thread sealing tape. The pipes must be fixed clear of the finished wall face with galvanized cast iron hinged

holderbats built into walls at not exceeding 2m centres in 1:3 cement mortar.

EAVES GUTTERS

a) **Galvanized sheet iron gutters, rainwater heads, etc.** shall be formed from 0.6mm sheet and must have beaded edges with all laps riveted and soldered. Corners must be reinforced with 0.6mm X 50mm wide galvanized sheet iron strips and must be soldered across the inside of the angles.

Gutters must be laid to even falls on approved galvanized mild steel gutter brackets screwed to roof timbers at approximately 1m centres. Half round pattern gutters shall be bolted to each bracket with 6mm galvanized gutter bolt fitted close to the beaded edge. Rectangular pattern gutters shall be fixed at each bracket with galvanized mild steel long-screw with 1mm thick galvanized sheet iron spacer tube.

(b) **Fibre cement gutters and accessories** shall be of approved manufacture, not less than 6mm thick, with spigot and socket joints made in an approved mastic compound in accordance with the manufacturer's instructions. Gutters must be laid to even falls on approved aluminium alloy or stock asbestos cement brackets screwed to roof timbers at the manufacturer's recommended spacings.

(c) **Unplasticised polyvinyl chloride (UPVC) gutters and accessories** shall comply with SANS Specification 11 and must be laid to falls and fixed on brackets in accordance with the manufacturer's instructions.

SANITARY PLUMBING AND FITTINGS, WASTE, VENTILATION AND ANTI-SIPHON PIPES

(a) **Unplasticised polyvinyl chloride (UPVC) pipes and fittings** shall be of approved manufacture marked with the manufacturer's name and trade name, the nominal bore and the South African Bureau of Standards mark and shall comply with SANS Specification 967. Joints shall be made with injection moulded fittings in accordance with the manufacture's instructions and SANS Code of Practice 0112. The pipes must be fixed clear of the finished wall face with aluminium alloy holderbats fitted with plastic cushion strips with the holderbats fixed to plugs in wall.

(b) **Polypropylene pipes and fittings** shall be of approved manufacture and shall have a mechanical form of jointing. Pipes and fittings are to be fixed and jointed in accordance with the manufacturer's instructions.

(c) **Multilayed pipes** shall be of approved manufacture and shall have a mechanical form of jointing. Pipes and fittings are to be fixed and jointed in accordance with the manufacturer's instructions.

SANITARY FITTINGS: — All sanitary ware must comply with SANS 497 Specifications and be fitted with Ball-O-Cock valves in supply lines.

Wash hand basins shall be of white glazed fireclay or vitreous china of the type and size specified. Basins shall have an integral overflow to non patient treatment facilities and be fitted with 32mm chromium plated waste union with flange and grating, rubber plug on chromium plated brass chain and, where required, tap hole stopper cemented in.

WC pans shall be of white glazed fireclay or vitreous china of the type specified with 'S" or "P" trap with straight or side outlet and shall be fitted with single or double flap plastic seat as required, secured to pan with concealed brass holding down bolts. Pans shall be bedded on the concrete floors in 1:3 cement mortars. Pans in seclusion rooms and other public areas to be 'Gypsy' vandal proof – or other approved.

Glazed ceramic urinals of the bowl or stall type shall be of white glazed fireclay or vitreous china. Bowl urinals shall be fitted with 40mm chromium plated waste union, with flange and

domical grating and with spreader with flush pipe connector. Stall urinals shall be fitted with 75mm chromium plated waste union with flange and hinged domed grating and with spreader with flush pipe connector.

Flushing cisterns shall be as specified, either of white porcelain enamelled cast iron, white glazed fireclay, vitreous china or black plastic complying with SANS Specification 821, each with body and cover. Cisterns shall be a maximum of 11 litre capacity and the flushing apparatus shall be of brass, copper or other corrosion resistant metal, PVC or other approved plastic or of an approved ceramic material. All cistern lids must be able to be **screwed** down. Connections for flush pipe, inlet and overflow pipe must be provided in the body. Cisterns shall be fitted with 15mm brass ball valve with copper, PVC or polystyrene ball and with either chromium plated operating lever handle or galvanized steel pull chain and handle. A galvanized, white enamelled or chromium plated steel or copper flush pipe, of the required length, as specified, is to be jointed to the flush pipe connection on the body of the cistern and in the case of WC pans is to be fixed to the inlet of the pan with an approved patent adaptor. From the overflow connection on each cistern a 22mm copper overflow pipe, bent as required, shall be taken through wall to discharge externally, with ends splay cut and projecting 50mm beyond wall face, or where this is not possible, bent to discharge into WC pan.

Baths shall be enamelled cast iron baths of the type and size specified, holed for and fitted with chromium plated brass overflow union with grating, 40mm chromium plated brass waste union with flange and grating, rubber plug on chromium plated brass chain and fitted with adjustable cast iron feet. The fall along bottom of baths from head ends to outlets must be adequate for complete emptying.

Stainless steel sinks and drainers shall be of the types and sizes specified with exposed surfaces buffed to a satin finish and sound deadened on underside by application of an approved sound deadening coating. Splashbacks with tiling keys shall be provided at back and at ends against walls or as specified. Sink bowls are to be pressed out of single sheets with complete drainage to outlets and each bowl is to be fitted with integral built-in overflow with chromium plated brass grating and 40mm recessed waste outlets with chromium plated brass waste union with grating, rubber plug and chromium plated brass chain. Sink bowls, unless otherwise specified, are to be 450 x 355 x 140mm deep. Drainers are to be pressed out of single sheets and are to have pressed flutes to give complete drainage.

(a) For domestic use — Sinks shall comply with SANS Specification 242 and shall be manufactured from A.I.S.I. Type 430 stainless steel 0.8mm thick for units not exceeding 2,4m long and from stainless steel 1.2mm thick for units exceeding 2,4m Long. -

(b) For hospital use and laboratories — Sinks shall be manufactured from A.I.S.1. Type 304 stainless steel 0.9mm thick for units not exceeding 2.4m long and from stainless steel 1.2mm thick for units exceeding 2.4m long.

Stainless steel wash hand basins and wash troughs shall be of the types and sizes specified complying with SANS Specification 906, with exposed surfaces buffed to a satin finish and sound deadened on underside by application of an approved sound deadening coating. Each basin or wash trough in non patient treatment area's are to be fitted with integral built-in overflow with chromium plated brass grating and 40mm recessed waste outlet with chromium plated brass waste union with grating, rubber plug and chromium plated brass chain.

Stainless steel urinals shall be of the types and sizes specified complying with SANS Specification 924 and shall be manufactured from A.I.S.I. Type 304 stainless steel, 1.2mm thick, buffed to a satin finish and sound deadened at back by application of an approved sound deadening coating. The back and sides of urinals are to be made rigid by means of integral pressed ribs or by bowing. Edges at sides and top are to have plaster key. Tread plates are to be ribbed and the front edges are to be stiffened and bent to form key for floor finish. The trough shall be a minimum of 125mm wide and half round in section with all corners radiused and shall fall to ensure complete drainage to 75mm recessed outlet with

chromium plated domed hinged grating and frame.

RATES FOR SANITARY WARE: — shall include for the supply and fixing of the units as specified and for cleaning, washing and leaving in a satisfactory condition on completion.

BELOW GROUND WATER RETICULATION

Unplasticised polyvinyl chloride (UPVC) piping and fittings shall be of approved manufacture complying with SANS Specification 966. Pipes must be of the class specified and must be marked with the manufacturer's name, trade name or registered trademark, nominal diameter, class reference and the SANS mark. Pipes shall be laid and jointed in accordance with the manufacturer's instructions.

High density polyethylene (HDPE) piping shall be of approved manufacture complying with SANS Specification 533 and shall be of the class specified, laid and jointed in accordance with the manufacturer's instructions. Piping must be jointed with compression fittings with compression rings and coupling nuts.

High Density Polyethylene / Polypropylene / Multilayed piping shall be of approved manufacture, complying with SANS Specification 15875-1-2004 & 2/2003 & 1315, laid and jointed in accordance with the manufacturer's instructions.

Copper piping shall be of approved manufacture complying with SANS Specification 460 and shall be of Class 2. Pipes must be jointed with brass compression fittings with compression rings and coupling nuts complying with SANS Specification 1067 Part I Type 'A'. Copper piping must be bent, where required, with an approved bending machine.

ABOVE GROUND WATER SUPPLIES

Colour Coding Cold Water Supply the exposed piping for this non potable (recycled) water shall be colour banded Brilliant Green (B49) / Yellow Band(H10).
The other exposed piping for potable (drinkable) water shall be colour banded Brilliant Green (B49) / Blue Band(F29)

Galvanized mild steel piping for water supplies shall be medium quality screwed and socketed normalised welded mild steel pipe, galvanized inside and outside, and shall comply with SANS Specification 62.

Fittings to galvanized mild steel piping shall be steel pipe fittings complying with SANS Specification 62 or malleable cast iron fittings complying with SANS Specification 509.

Copper piping shall be of approved manufacture, complying with SANS Specification 460 and shall be of Class 2 – fixed and jointed in accordance with the manufacturer's instructions. Class 2 copper piping must be jointed with brass compression fittings with compression rings and coupling nuts complying with SANS Specification 1067 part I Type 'A'.

Polypropylene / Multilayed Piping shall be of approved manufacture, complying with SANS Specification 1315, laid and jointed in accordance with the manufacturer's instructions. This applies to hot and cold water supply within ceiling spaces also.

Stainless steel piping shall be of approved manufacture, complying with SANS Specification 4127 and shall be A.I.S.I. Type 304 L. Fittings to stainless steel piping not exceeding 50mm nominal bore shall be brass compression fittings with compression rings and coupling nuts.

Piping exceeding 50mm nominal bore shall be welded piping with 1.5mm wall thickness, unless otherwise stated, and of A.I.S.I. Type 316 stainless steel. Joints are to comprise approved A.I.S.I. Type 316 stainless steel pressed collars welded to ends of pipes and fittings with loose galvanized mild steel slip-on flanges complete with galvanized mild steel bolts, nuts and washers, and neoprene gaskets. Fittings must be A.I.S.I. Type 316

stainless steel butt weld fittings.

Phosphoric acid based fluxes must be used for all welded joints which are to be argon arc TIG welded using Type 316 filler rods, with the welds treated with suitable pickling compound.

WATER TAPS AND VALVES: — Water taps, stopcocks, ball-o-cocks and wheel valves shall be of approved manufacture complying with SANS Specification 226.

Ball valves with brass valve and copper or plastic ball float shall be of approved manufacture complying with SANS Specification 1056. Plastic floats when supplied, must comply with SANS Specification 1006.

Full Bore Teflon Seated Ball Valve shall be of approved manufacture complying with SANS Specification 664. Valves shall be clockwise closing with non-rising, cap-fitted spindles and flanked connections and of the class specified.

Pressure reducing valves shall be of approved manufacture complying with SANS Specification 198.

FIXING OF WATER PIPES: — Galvanized mild steel water piping shall be fixed, unless otherwise described, to walls or ceilings with galvanized malleable iron holderbats (school board pattern), built into walls in 1:3 cement mortar. Pipes shall be fixed to timber work with galvanized mild steel pipe clips screwed on.

Copper and stainless steel water piping shall be fixed, unless otherwise described, to walls or ceilings with brass holderbats (school board pattern) built into walls in 1:3 cement mortar. Pipes shall be fixed to timber work with brass or copper pipe clips screwed on.

Polypropylene / Multilayed Piping - shall be fixed to walls according to manufacturers recommendations.

CONCRETE THRUST AND ANCHOR BLOCKS: — shall be of the sizes required and provided where directed to anchor the water pipelines against the thrust due to hydrostatic pressure. Concrete blocks shall be cast against the undisturbed face of the excavation. Backfilling behind the thrust face of the block will not be permitted.

TESTING OF WATER MAINS: — The whole of the water reticulation shall be subjected to a hydraulic test pressure 1.5 times the maximum working pressure of the pipeline. Testing of pipelines may only commence after the installation of all anchor blocks, valves and fittings have been completed. Testing shall be carried out between installed sluice valves whenever possible. Where this is not possible the ends of the pipes shall be sealed with end caps properly held in place with temporary props.

The tests shall be carried out on lengths not exceeding 300 metres.

The pipeline shall be filled from the lowest end in order to expel the air at the upper end through special taps or through service connections, stand pipes, etc. When full the line shall be allowed to stand for 24 hours and any further accumulated air shall be expelled. The full test pressure shall then be applied and maintained for one hour, during which time the line will be examined for any leaks, movement at anchors and other defects.

Any defective work is to be taken out and replaced at the Contractor's expense and the whole retested until found satisfactory.

The Contractor shall provide all necessary testing apparatus, temporary end caps, plugs, stoppers, special taps and any other materials that may be required, and all labour for carrying out the tests.

EXCAVATIONS FOR PIPE TRENCHES: — Excavations for pipe trenches, gulley traps, manholes, inspection chambers, valve, chamber, soakpits and septic tanks shall be to the

depth and gradients shown on the drawings using sight rails and boning rods and shall include for taking precautions against collapse of sides of excavations, staging, pumping and baling to keep the excavations free from water or mud and for filling in and ramming.

The bottoms of pipe trenches are to be excavated to even falls. The barrel of the pipe, except where it is laid on a sand or concrete bed, must rest on solid ground and hand-holds of sufficient size must be cut under pipe joints to enable the jointing and filleting to be properly performed. Any excavations taken out deeper than required shall be made up to the correct grade with well rammed earth. In intermediate or hard rock excavation and where a bedding is not specified, the trench bottom must be excavated 100mm deeper than required for the grade and be backfilled with well rammed earth.

The Contractor is to notify the Department when the trenches are ready for inspection and approval. Any work put in hand before approval has been given shall, if so required, be replaced with new at the Contractor's expense.

Notwithstanding such approval of the trench bottoms, any excavations which become waterlogged or otherwise spoilt after approval, shall be cleaned out and reformed at the Contractor's expense and to the satisfaction of the Department before any piping or sand or concrete beds are laid.

Depths of excavations as approved shall be checked and recorded by a Departmental Official and the Contractor before excavations are filled in.

For the purpose of any measurement, whatever size may have been excavated, excavations are taken as follows: — Trenches not exceeding 0.75mm deep shall be taken 0.5m wider than the internal diameter of the pipe. This width shall be increased by 75mm for each successive depth of 0,75m to a maximum of 1m wider than the internal diameter of the pipe.

BACKFILLING: — No trench shall be backfilled until the Department is satisfied that the works therein have been satisfactorily completed, tested and are ready for backfilling.

The backfilling around and 300mm above the pipe is to be of approved selected material, imported if necessary, free from rock or stone, carefully packed, watered and lightly rammed equally on either side of the pipe and then filled in above this level with suitable material from the excavations, watered and compacted in layers not exceeding 300mm thick with the top 300mm consolidated to dry density of not less than 95% MOD. A.A.S.H.O. density. Topsoil from the excavation is to be set aside and used in the final layer of backfilling.
Any disturbance of or damage to the pipes during backfilling must be made good by the contractor at his own expense.

All spoil from the excavations for trenches, etc. shall be deposited and levelled on site or carted away as directed. Any subsidence or depressions below the level of the adjacent ground shall be filled in, as and when necessary, until the end of the maintenance period.

SIZES OF PIPES: The diameters stated for galvanized mild steel piping, cast iron piping, vitrified clay piping and asbestos cement pressure piping (C.I.D.) are the nominal internal diameters. The diameters stated for all other pipes are nominal external diameters.

In the case of piping and fitting which are manufactured in imperial diameters, the size nearest the metric equivalent must be used.

RATES FOR PIPES: — Rates for all pipes, gutters, channels, etc. are to include for couplings in running lengths, joints, short lengths and cutting and fixing as required. Rates for mild -steel pipes shall include for all plain sockets and nipples. Where fittings have reduced ends or branches the fittings are described as "reduced" and the largest end or branch has been stated. The Contractor may use equal fittings with reducers or bushings if he so desires, but no claim for extras in this connection will be entertained.

Rates for pipes fixed to walls, soffits of slabs, roof timbers, etc. are to include for all

brackets, holderbats, pipe clips and approved extended hangers where pipes are required to be laid to falls and for plugging and screwing or for cutting and pinning or building in tails of holderbats.

Rates for piping are to include for cleaning down at completion, and in addition, the rate for stainless steel pining is to include for polishing exposed piping, all to the approval of the Department.

RATES FOR CHASES, HOLES ETC.: — are to include for making good to approval. The term “hole” is to include for sleeves where required through concrete work.

FIRE EXTINGUISHERS: — Where specified, carbon dioxide gas type fire extinguishers shall be 2.26kg type, complying with SANS Specification 889 and fixed in position on wall brackets screwed to and including 20mm thick chamfered and oiled wrot hardwood backboard, size 450mm x 100mm screwed to plugs in wall.

Where specified, dry powder type fire extinguishers shall be of 10 litre capacity, complying with SANS Specification 810 and fixed as before described on backboard size 1000mm x 200mm.

FIRE HOSE REELS: — shall be non-swinging rotary fire hose reels, complying with SANS Specification 543, with solid side discs and 25mm waterway at bracket incorporating rotary pressure joint to hose connection at hub and fitted with 25mm screwed malleable iron ‘Sanders type A’ valve with “S” grade diaphragm, connection for supply pipe with the handwheel clearly marked in red with arrows and the words “OPEN”, “OOP”.

The reel is to be secured to the wall with and including three steel anchor bolts and fitted with 30m length of 20mm internal diameter best quality reinforced red rubber non-kinkable hose with one end fixed to wheel hub connection and the other end fitted with 20mm chromium plated gunmetal adjustable “Centorium” type nozzle with hose threaded through and including chromium plated hose guide, designed to permit the hose to run out in any direction and the nozzle supported on and including chromium plated bracket fixed to wall.

For ease of removal, a union shall be installed between the valve and the reel.

FIRE HYDRANTS: — shall be of the wheel valve pattern with instantaneous coupling outlets, size 63.5mm or 70mm as stated on the drawings. Hydrants fixed in a horizontal position shall have oblique angle outlets and those fixed in a vertical or inclined position shall have right angle outlets. The materials used in the manufacture of the hydrants shall be as laid down for the manufacture of couplings, branch pipes, etc. in SANS Specification 1128, and the various requirements of instantaneous couplings and dimensions for 70mm outlets shall comply with the requirements for Morris instantaneous pattern couplings.
The valve spindle shall have a minimum diameter of 22mm with swivelling clack at one end fitted with first quality dexine or other approved washer, bedded on to a raised seat not less than 6mm wide, and the other end shall be machined to form a square shank of 15mm minimum thickness and a length corresponding with the thickness of the boss of the handwheel, the portion protruding from the boss shall be threaded and fitted with a washer and nut to hold the handwheel firmly in place. Valve inlet shall be male screwed 80mm Whitworth pipe thread, and outlet shall be fitted with approved India-rubber coupling gasket. The internal diameter of the valve body shall be not less than 95mm in the case of 63.5mm outlets or 100mm in the case of 70mm outlets.

The valve hand wheel shall have an overall diameter of 165mm and the rim shall be of oval cross-section and shall have the words “OPEN” and “OOP” together with direction arrows embossed on the face.

All hexagonal faces shall be machined and all exposed surfaces of the valve and the wheel periphery shall be buffed and polished. Parts of the wheel not polished shall be painted two coats bright red high gloss paint.

The completed hydrant valve shall be guaranteed hydraulically tested by the manufacture to a pressure of 35 bar and shall be badged or stamped accordingly with the manufacturer’s

name or symbol and the words “TESTED 35 bar”.

16. GLAZING

MATERIALS: — Glass shall conform to the requirements of the relevant current British Standards Specification for the respective materials.

Clear glass shall be float quality glass.

Silvered glass mirror to comply with SANS Specification 1236 Class A.

Toughened safety glass 15 to be “Armourplated” float quality safety glass of the thickness specified and as manufactured by Armourplate Safety Glass (Pty) Ltd. or other approved, and glazed to sashes, etc. in strict accordance with the manufacturer’s instructions.

All toughened safety glass is to have the manufacturer’s name or motif sand-blasted in one corner of each pane

Laminated safety glass is to be float quality normal strength glass, unless otherwise stated, and of the type specified and as manufactured by Shatterprufe Safety Glass Co. (Pty) Ltd., or other approved, and glazed to sashes, etc. in strict accordance with the manufacturer’s instructions.

All laminated safety Glass is to have the manufacturer’s name or motif sand-blasted in one corner of each pane.

All glass is to be free from imperfections and is to be left in a thoroughly clean condition on completion.

No glazing is permitted in Patient Treatment area’s below 1 (one) meter.

GLAZING: — The glazing and fixing of glass in buildings shall be in accordance with SANS Code of practice 0317.

Glass panes shall have adequate glazing clearance between edges of glass and the rebates.

Putty for glazing shall comply with SANS Specification 680 type 1 for glazing in wood and type 2 for glazing in steel. Putty for glazing in natural finished wood shall be tinted to match the colour of the wood. Putty to be mixed with a hardener to allow for painting within +/- 3 days. Putty for glazing in aluminium windows shall be tinted to match the aluminium or anodised aluminium where required.
All rebates, other than those in natural finished hardwoods, are to be primed before glazing. Glass fixed with glazing beads shall be well bedded in back putty in the rebates.

Putty shall be carefully trimmed and cleaned off with front putty worked to within 3mm of the sight lines.

RATES: — Rates for glass generally shall include for preparing the rebates, etc. all putty, sprigs, clips, etc. as required and all cutting.

Rates for toughened and laminated glass shall include in addition for all necessary spacing and setting blocks in accordance with the manufacturer’s requirements.

17. PAINTING

MATERIALS: — Proprietary materials where specified are to be of the brand specified or other approved by the Department.

All primers, emulsion paints, enamels, stains, varnishes, etc. are to comply with the relevant SANS Specification.

Paints, etc. shall be suitable for application on the surfaces to which they are being applied and those used externally shall be of exterior quality or suitable for exterior use.

For any particular work the priming coat and subsequent coats of paint are to be executed with paints from the same manufacturer and in accordance with that manufacturer's instructions.

The materials are to be brought to the site in unopened containers and no adulteration will be permitted, except thinners of a quantity and quality directed by the manufacturer.

The Department shall at all times be permitted to take samples for testing purposes from open containers of any brand of paint being used on the work.

All materials, if and when required by the Department, will be subject to tests by the South African Bureau of Standards, and the cost of such tests, should the material under test not meet the requirements of this specification, shall be borne by the Contractor. Fillers and stoppings are to be suitable for use with the material being filled or stopped and to the approval of the Department.

PREPARATORY WORK: — All new and existing surfaces are to be thoroughly dry and are to be cleaned of all dust, dirt, grease, oil, rust, scale, efflorescence, fungus, loose or flaking material, etc. rubbed down, stopped, filled, knotted and sanded smooth as required in accordance with the paint manufacturer's recommendations and to the approval of the Department prior to the application of paint, etc.

Ceilings are to have nail heads, including those to cornices and cover strips, primed and stopped up as necessary and rubbed down smooth.

Asbestos cement shall be primed with an approved alkali resistant primer before the application of subsequent coats which are not, in themselves, alkali resistant.

Iron, steel and other ferrous metals shall be cleaned in accordance with SANS Code of Practice 064 to remove rust, scale, grease, oil, etc. and the surface brought to a bright metallic condition.

Galvanized iron and zinc shall be cleaned in accordance with SANS Code of Practice 062 to remove the manufacturer's temporary protective coating, white rust, etc.

Other non-ferrous metals shall be thoroughly cleaned to remove all milling oils, temporary protective coatings, etc. and the surface abraded with fine water-paper and white spirit.

Woodwork to be painted shall have all knots and resinous areas treated with an approved knotting, the surface shall then be primed and all holes, etc. stopped and rubbed down smooth,

Woodwork to be oiled, stained, varnished, etc. shall be free of all stains, pencil marks and other surface discolorations and all holes, etc. stopped with tinted stopping and rubbed down smooth.

In preparing existing glazed sashes and sash doors, all loose putty is to be removed, the rebates primed and glass re-sprigged and re-puttied as necessary before the painting is commenced.

Previously distempered or lime washed surfaces to receive any other type of paint, are to have the existing distemper or lime wash completely removed by scraping or wire brushing and the surf aces treated with an approved bonding liquid.

Where existing paint film are in good condition any flaking or bared patches are to be properly feathered into the surrounding paint and spot primed as necessary.

Where existing paint films are in poor condition and require to be removed completely, they are to be removed by means of wire brushing, paint remover, burning off, or other approved method. Paint removers shall be free of wax and caustic substances and shall preferably be of water rinseable type. When burning off paint from wood, care must be taken to avoid charring the wood.

The final state of preparatory work to existing decorated surfaces shall in all cases produce in the finished decorated surfaces a condition similar to new work.

The Contractor will be held responsible for the proper and adequate preparation of the surfaces and any work which fails to meet the manufacturer's recommendations must be made good at the Contractor's expense to the satisfaction of the Department.

APPLICATION OF PAINTS, ETC.: — Painting may be carried out by brush, roller or spray as recommended by the manufacturer and to the approval of the Department. All paints, etc. are to be applied in strict accordance with the manufacturer's instructions. Each coat of paint is to be adequately and permanently keyed onto the previous coat or surface and shall be evenly distributed and continuous and shall dry to a smooth film, free from sags, runs or other imperfections. Each coat of paint is to be of a colour distinctive from previous or succeeding coats.

All painting must be done in accordance with a colour scheme which will be provided by the Department, and rates for painting etc. are to include for all cutting in of contrasting colours and masking as required. No distinction has been made where more than one colour of the same material is required on the walls or ceiling of the same room.

Samples of colours for the final coats are to be prepared in all cases to the approval of the Department and all work must be finished to the approved colours.

Backs of wood door and similar frames an the surfaces of other new or prefixed joinery in contact with brickwork, etc. and built in as the work proceeds, shall be primed or sealed before building in to prevent moisture seeping into the wood from the mortar bedding.

Tongued and grooved and rebated edges of boards in batten doors and other such like inaccessible parts of new joinery shall, before assembly, be primed, or where the joinery is to receive a finish other than paint, be given one coat of such other finishing material.

All new external structural timbers shall be primed before the timbers are fixed in position and shall include all surfaces such as backs of fascias and barge boards.

RATES: — Rates for painting, etc. are to include for all preparatory work, and where spraying is employed, are to include or adequately masking all surrounding areas.

Where diameters of pipes are stated these are the nominal internal diameters, and rates for painting pipes are to include for painting the holderbats, hangers, clips, etc. supporting the pipes.

Rates are to include for providing all necessary dust sheets, covers, etc. taking all necessary precautions to prevent marking the surfaces of joinery, walls, floors, glass, electrical fittings, etc. All surfaces disfigured or otherwise damaged shall be completely renovated or replaced as necessary to the approval of the Department at the Contractor's own expense.

18. ROADWORK

The Contractor is referred to the preambles for "Earthworks" with particular reference to the full description, intent and meaning of the classification for excavations and the preambles for "Concrete, Formwork and Reinforcement"

The construction of the roads is to be carried out by an approved Specialist Sub-Contractor in accordance with the following specifications and all to the approval of the Department.

SUB-GRADE: — All materials placed in the sub-grade layer which is defined as being the 150mm thick layer immediately below the sub-base or the base course (where no sub-base is specified), shall conform to the following specification: —

(a) Minimum C.B.R. at 93% Mod. A.A.S.H.O. density = 10 %

(b) Maximum C.B.R. Swell = 1.5 %

(c) Maximum Plasticity Index if:
more than 30% passes the 2mm sieve = 12
less than 30% passes the 2mm sieve = 16

The sub-grade layer in cut areas shall be treated in place either to achieve a uniform standard of compaction or to break up undesirable formations of hard rock.

In the case of materials other than hard rock, treatment in place shall consist of scarifying or otherwise loosening to a depth of 150mm and re-compacting to a density of 93 % Mod. A.A.S.H.O. where directed, with the material stabilised in place before compacting.

In hard rock, treatment in place shall consist of thoroughly loosening to a depth of 450mm by rip in or blasting and then sized by rolling or knapping until the maximum dimension of any spall shall be not more than 300mm.

Compaction of the rock in the sub-grade shall be achieved by spreading and sorting by bulldozer to a reasonable uniform thickness with sufficient fine material added to fill the voids and bind the surface.

Compaction shall be achieved by means of a vibratory roller until the Department is satisfied that the mass is sufficiently dense, to provide a stable sub-grade layer.

Density tests shall be carried out at the minimum rate of one test per every 500m^2 of sub-grade area or not more than 50m apart but not less than four tests for smaller areas and shall assess the full layer thickness. The costs of such control tests shall be included in the Contractor's rate for sub-grade treatment. The Department may; at its discretion, arrange for independent check tests to be performed, but the costs of the tests in this instance will be borne by the Administration.

Processing of the material will be measured under the relevant items. An approved total weed killer shall be applied during the formation of the sub-grade. The rate of application shall be in accordance with the manufacturer's specification.

Rates shall include for the supply, delivery, spreading and stabilisation with lime, if required, and compacting and shaping to correct lines and levels.

The lime and method of mixing and watering shall be as described in the specification for stabilisation.

SUB-BASE: — All material placed in the sub-base layer, which is defined as being that layer of 150mm thickness immediately below the base course layer, shall conform to the following specification: —

	Unstabilised	Stabilised
Minimum C.B.R. at 95 % Mod. A.A.S.H.O. density	70%	50%
Minimum C.B.R. Swell	0, 5%	0, 5%

Maximum Plasticity Index	10	10
Minimum Liquid Limit	35%	35%
Maximum size of aggregate	63mm	63mm
Material passing the No. 75 micrometer sieve shall not exceed	25 %	
Minimum relative compaction in place	95 % Mod. A.A.S.H.O.	

Combined coarse and fine sand density fractions shall exceed 35 % of the soil mortar

Unless otherwise specified, the responsibility for obtaining material that conforms to the above specification rests with the Contractor who will be required to perform his own tests to prove compliance, and to submit samples to the Department before the material is delivered on site. Further control tests will be required by the Department during the placing and compaction of the material, the locations of which will be selected at random.

Should the Contractor wish to use material from the site excavations, he shall first obtain the approval of the Department. His rates shall in this case include for the selection and stockpiling.

Density tests shall be carried out at the minimum rate as specified for the sub-grade layer.

The layer shall be finished off to present a uniform texture and tightly bonded surface.

Rates shall include for the supply, delivery, spreading and stabilisation with lime, if required, and compacting and shaping to correct lines and levels.

The lime and method of mixing and watering shall be as described in the specification for stabilisation.

The finished surface shall be within 20mm of the design level. The finished width shall not be less than the design width. The average of five thickness tests at the rate of one test for every 200m^2 of surface shall not be less than 150mm and at any point not less than 130mm.

The surface finish when measured under a 3m straight edge shall have no slacks or bumps greater than 5mm.

The cost of the density control tests shall be included in the Contractor's rate for sub-base construction. The Department, at his discretion, may arrange for independent check tests to be conducted, and the costs in these instances will be borne by the Administration.

STABILISATION: — The stabilisation agent shall be slaked lime of the calcium type conforming to the requirements of SANS Specification 824.

The rate of application shall conform to the design rate and all materials to be stabilised shall be approved by the Department before processing.

The material shall be spread in a uniformly thick loose layer over the full area and thoroughly dried by scarifying or blading with a grader to ensure exposure to the air of all particles and to ensure thorough mixing to obtain a uniform grading of the material.
When the material has been approved as being ready for stabilising it shall be lightly rolled to facilitate the spreading of the lime. The lime shall be evenly applied to the surface, preferably by mechanical spreader, at the specified rate and thoroughly mixed by rotavator or disc harrow until a uniform integrated mixture of uniform colour is obtained over the full depth of the layer.

Before mixing is commenced, the Contractor shall satisfy the Department that the lime has been applied at the specified rate.

Immediately after the lime has been mixed in, water shall be added in small increments by suitable watering equipment and mixed into the layer until the required water content has been obtained which shall not exceed the Mod. A.A.S.H.O. optimum plus 2%:

The efficiency of the spreading and mixing shall be measured by Lime Determination Test according to A.S.T.M.D. Test Number 3155/1973 or the California Test Method No. 338-B July 1996. Only where the result from every 15 tests at locations selected by the Department indicate that more than 90 % of the layer has a time content exceeding 60 % of the nominal lime content will the work be accepted, provided that the coefficient of variation shall not be greater than 25%.

The test positions shall be spaced at one for every 100m^2 of surface area, but shall not be spaced, greater than 20m apart

BASE COURSE: — When the sub-grade has been prepared and approved, the base course, consisting of one of the following, shall be formed to the compacted thickness specified.

Crusher Run Base Course
Crusher-run base course shall be fresh dolerite, hard blue tillite, quartzite, fresh granite, fresh basalt or other stone which meets the following specifications.

TABLE F: CRUSHER RUN BASE COURSE: STONE SPECIFICATIONS

Sieve Size	% Passing
37.5mm	100
26.5mm	82 - 95
19.1mm	70 - 85
13.2mm	58 - 75
4.75mm	34 - 55
Sieve Size	**% Passing**
2.00mm	22 - 40
0.425mm	10 - 25
0.075mm	5 - 12

Minimum C.B.R. @ 98% Mod. A.A.S.H.O. density	80%
Maximum C.B.R. Swell	0, 5 %
Maximum Liquid Limit	25
Maximum Plasticity Index	4
Maximum Linear Shrinkage	2
Minimum Sand Equivalent Value	30
Maximum Flakiness Index	35

The soundness of the aggregate shall be such that after 5 cycles using Magnesium

Sulphate it shall not show a loss of more than 15% by weight.
The maximum Aggregate Crushing Value should not exceed 30.
The moisture content used for field compaction shall not exceed the Mod. A.A.S.H.O. optimum plus 2 %.

Natural Ground Base Course

Natural ground base course shall be approved stone which meets either of the following specifications.
Natural Gravel (Unstabilised)

Minimum C.B.R. at 98% Mod. A.A.S.H.O.	80 %
Minimum C.B.R. Swell	0.5 %
Group Index value	0
Maximum Plasticity Index	4
Maximum Liquid Limit	35
Maximum Linear Shrinkage	2
Minimum Sand Equivalent Value	30
Maximum size of particle	53mm

Material passing No. 75 micrometer sieve shall not exceed 25 %

The combined coarse sand and coarse/fine sand fraction shall not exceed 35 % of the soil mortar

Natural Gravel (Stabilised with Lime)
Lime must comply with SANS Specification 824 Minimum C. B .R.

at 98% Mod. A.A.S.H.O. density,	160	140	120
provided that the minimum C.B.R. before stabilising, at 95 % Mod. A.A.S.H.O. density	30	45	60
Maximum C.B.R. S well			0, 5%
Maximum Plasticity Index	4		
Maximum particle size	2/3 layer thickness		
Maximum percentage passing No. 75 micrometer sieve	25		
Grading Modules	1, 5		

The responsibility for obtaining suitable base course material complying with the above rests with the Contractor, unless otherwise specified, and the provisions for sub-base material in regard to tests, etc. to prove compliance with the specification shall apply to the base course.

During construction, the base course shall be evenly distributed over the sub-grade. The stone shall then be rolled with a 4 to 5 tonne roller or equal unless otherwise instructed. After a few passes of the roller the surface shall be checked for shape camber and levels and all depressions filled in. Rolling and trimming shall continue until the surface is true to required levels and falls.

Minimum density in place after compaction shall be 98% Mod. A.A.S.H.O. density.

CHIP AND SPRAY SURFACING
Binders
One of the following may be used: —
M.C. 3000 Bitumen to SANS Specification 308 (150/200 Pen.)
M.C. 800 Bitumen to SANS Specification 308 (150/200 Pen.)

RTH 45 / 50 Tar to SANS Specification 748 Spray-grade 60% emulsion where approved or specified by the Department. If emulsion is used then the specified application rates shall be increased to give the required net bitumen content.

Cover Aggregate

All Cover aggregate used in the surface treatment shall be washed 13.2mm nominal sized crusher stone in accordance with SANS Specification 647.

Aggregate Crushing Value shall not exceed 15.

Binder shall be applied after the prime coat has dried completely and all tackiness has vanished.

The binder is to be applied by means of a distributor at a rate of 1.1 litre/m2 followed immediately afterwards by the spreading of a cover aggregate of 13.2mm stone at the rate of 125m^2 / m^3. The aggregate is to be spread by means of an approved chip spreader; band spreading will only be permitted in those areas inaccessible to the spreader. The aggregate is to be rolled immediately with two passes of a pneumatic tyred roller. When the binder has set the surface shall be drag-broomed twice in each direction and then rolled again with four passes of the roller during the heat of the day or until the aggregate is firmly keyed into a tight surface.

DOUBLE SEAL COAT WITH BLACK TOP SURFACING: — The prime and first seal coat shall be applied as previously specified.

After the first seal coat has been drag-broomed and rolled as previously described, the binder shall be applied to the surface at a rate of 0.8 litre/in 2 followed immediately by the spreading of 6.7mm stone chips at the rate of 150m^2/m^3. This stone aggregate shall then be drag-broomed and rolled as previously described.

A seal spray having a net bitumen content of 0.7 litre/in^2 shall then be applied to the surface when this coat has dried completely, and shall be rolled to firmly bed any loose aggregate.

If the surface is to be opened early to traffic, it shall be covered very lightly with sand or crusher dust distributed evenly with a hessian drag and back rolled with wet wheels before opening to traffic.

SLURRY SEAL SURFACING: — The aggregate for slurry seal shall conform to the following grading: —

Sieve Size (mm)	Percentage Passing
4, 75	100
2, 36	90—100
1, 18	65—95
0, 600	42—72
0, 300	23—48
0,150	10—27
0, 075	5—12

Slurry sand shall be crusher sand with a minimum sand equivalent of 35.

Binder — Stable grade emulsion (60%)
Anionic to SANS Specification 309
Cationic to SANS Specification 548

Consistency of the slurry shall consist of 90% crusher sand, cement filler not less than 1% and net binder content of not less than 9% by weight. Water to be added as required. As a guide, approximately 300 litres of emulsion and 160 litres of water are required per cubic metre of slurry.

The slurry shall be machine mixed and wherever possible applied by means of a spreader box. The rate of application shall be 170m^2/m^3. The slurry shall be of a creamy, homogeneous mixture, free of lumps, and if the mixture shows signs of breaking before application to the surface it shall be discarded.

After the first seal has been approved by the Department, but before the application of the slurry, a fog spray comprising of a solution of 1 part emulsion to 3 parts water shall be applied at a rate of 0.8 litre/m^2 to cover the aggregate. The application of the slurry may commence when the fog spray has been applied to assist with the spread of the slurry and to smooth out squeegee marks the slurry shall, immediately after being applied and before it has broken, be smoothed by a damp hessian drag either attached to the spreader box or pulled over by hand.

After the slurry has set it shall be covered by two passes of a pneumatic-tyred roller during the heat of the day.

The permissible variation in the application of the slurry shall not vary from the specified rate by more than 10%.

PREMIX TARMACADAM SURFACING

Prime Coat
When the base course is complete and dry it shall be cleaned of all loose material and be given a prime coat of one of the following primers: —
M.C. cut-back bitumen.
Tar Primer R.T.H. 3/P.
Emulsion Primer (60%).

The rate of application of the primer shall be within the range 0.65—1.0 litre/m^2, the actual rate to be determined by test and observation on site. Where emulsion primer is used, the application rate shall be increased to give the required nett bitumen content.

Hand spraying shall be used only in those areas inaccessible to mechanical distributors. Before spraying is commenced, the surface shall be lightly watered to settle dust.

Single Coat Premix Tarmacadam
When the prime coat has dried the single coat premix wearing course, of the compacted thickness specified, shall be constructed.

The wearing course shall be Type A (Hot Mix), unless otherwise specified or approved by the Department, and shall conform to the following specification: —

TABLE G: SINGLE COAT PRE-MIX WEARING COURSE: SPECIFICATIONS

	Screen Size mm	A Hot Mix	B Hot Mix	C (Kerbs)

Aggregate Grading Per Cent Passing	26.5 19.0 13.2 9.5 6.7 4.75 2.36 1.18 0.6 0.3 0.15 0.075	100 100 80 - 100 70 - 90 - 50 - 70 35 - 50 27 - 40 19 - 30 13 - 23 8 - 16 4 - 10	- - 100 80 - 95 60 - 75 45 - 60 28 - 42 18 - 30 7 - 20 2 - 10 0 - 5 0 - 4	- - - 100 90 - 100 65 - 75 52 - 62 50 - 60 45 - 55 30 - 40 9 - 19 4 - 8
Grade Binder		60 / 70	Emulsion	60 / 70
Nominal Nett Binder Content		5.5 % +/- 0.38	4.75 % +/- 0.3	5.5 % +/- 0.3

Penetration grades to comply with SANS Specification 307.

Cut-back bitumen to comply with SANS Specification 308.

Maximum heating temperature of bitumen 170^0C.

Delivery temperature at the paver for hot mixes 130—160ºC.

For every 500m^2 of area paved the Contractor shall produce an extraction test result from a sample taken during laying operations showing grading and bitumen content of the premix carpet. The test as specified or any further tests to prove compliance with the specification shall be at the Contractor's expense.

In order that the stone and binder shall be properly mixed, this operation must be carried out in a pug-mill mixer or by hand with shovels and wheelbarrows or on metal plates, in which case the binder must be added in the correct proportions in small quantities. Mixing shall continue until the aggregate is uniformly coated with the binder. Bituminous surfacing shall not be carried out in rainy weather nor when atmospheric shade temperature is below 10^0C. Immediately after mixing, the surfacing materials must be spread and rolled on the same day. Spreading shall be done evenly over the base to ensure a consolidated thickness as specified and shall be performed by means of a mechanical spreader or by a drag spreader, or by hand, using rakes and screeds.

Where hand spreading is used, the premix must not be dumped on the base, but taken from the boards on barrows by shovel and then evenly distributed over the base. Hand raking must be reduced to a minimum to avoid segregation of aggregate. Rolling shall commence as soon as the binder has set sufficiently and, unless otherwise instructed, this shall be done with a 4 to 5 tonne roller or equal.

Places inaccessible to a roller may be compacted by means of 12kg tampers. The surface shall be rolled true to line and level without slacks or irregularities.

After three days the rolling shall be repeated during the hottest part of the day and a light application of fines may be added during the final rolling.

Premix Tarmacadam Kerb
Premix kerbs are to be Type C as specified above and constructed to give the following compacted size: —

Width at top	125mm
Width at base	230mm

Height	150mm

PRE-CAST CONCRETE PAVING BLOCKS: — shall be of the type, class and thickness specified, of approved colour and shall comply with SANS Specification 1058. Paving blocks which fail to meet these requirements must immediately be removed from the site and replaced at the Contractor's expense to the satisfaction of the Department.

Paving blocks shall be one of the following types as specified: —
Type S-A: — allows geometrical interlock between all vertical faces of adjacent blocks,
Type S-B: — allows geometrical interlock between some vertical faces of adjacent blocks.
Type S-C: — allows no geometrical interlock between vertical faces at adjacent blocks.

Paving blocks shall be one of the following classes as specified: —
Class 25: — average compression strength of at least 25 MPa.
Class 35*:* — average compression strength of at least 35 MPa.

Paving blocks are to be laid to approved patterns as specified and in accordance with the relevant clauses (excluding Clause 8) of SANS Specification 1200 MJ on and including a sand bed of the compacted thickness specified. After laying, the paving blocks are to be compacted by means of a vibrating plate compactor with the joints filled in, after compaction, by sweeping in jointing sand.

Sand for bedding shall conform to the following grading: —

Sieve size (mm)	Percentage Passing
9, 52	100
4, 75	95-100
2, 36	80-100
1, 18	50-85
0, 60	25-60
0, 30	10-30
0, 15	5-15
0,075	0-10

Sand for jointing shall pass a 1.18mm sieve and shall contain 10-50% of material that passes a 0,075mm sieve.

Spaces constituting less than 25% of a full block unit and of 25mm minimum dimension at perimeter edges of pavings against kerbs, buildings, inspection chambers, etc. are to be filled with Class B concrete trowelled to a smooth even surface to match paving blocks.

Rates for paving block pavings are to include for all straight cutting and waste, all half blocks at straight edges, filling with concrete as described, fitting, protecting from injury and cleaning down at completion.

KERBS

Generally
The kerbs are to be laid before the base course is commenced to the lines and positions as shown on the drawings. The Contractor is to allow sufficient time for the mortar bedding and joints to set and is to take all necessary precautions to maintain the line of the kerbs especially while rolling the base course and surfacing, as no claims in this connection will be considered.

Rates for kerbs are to include for necessary excavation, well consolidated bottom under kerbs and for filling and ramming to secure the kerbs in position.

Pre-cast Concrete Kerbs
Pre-cast concrete mountable kerbs as SANS Fig8 are to be of concrete Class 20 (20 MPa) and of the sizes described in the items, cast generally in 1m lengths, and finished smooth off the mould on top edge and both sides, with angles rounded, and rates are to include for all necessary formwork and moulds. The kerbs are to be bedded on and including a mat of

1:3 cement mortar, and the abutting ends of the kerbs are to be fully jointed in a similar mortar and pointed with a keyed-in joint on top edge and exposed sides.

Brick on edge kerbs
Brick on edge kerbs are to be of extra hard burnt bricks of the colour specified. The kerbs are to project 10mm above the finished tarmacadam level and are to be bedded on a mat of 1:4 cement mortar, and the abutting ends of bricks are to be fully jointed in a similar mortar and pointed with a keyed-in joint on top and exposed sides.

19. FENCING AND GATES

GENERALLY*:* — The Department shall be responsible for the initial location and exposure of all necessary boundary beacons and their indication to the Contractor at the site handover. The Contractor shall be responsible for subsequently ensuring that these beacons remain undisturbed and that the fencing is correctly aligned between boundary beacons. Should, during setting out of the further boundary beacons be uncovered or located and reasonable doubt arise regarding the correct alignment of fencing, then the Contractor shall be responsible for immediately notifying the Department, in writing, of such doubt, in order that the setting out may be checked and rectified, if necessary.

All bushes, trees, old fencing, rocks, debris, long grass and other obstructions shall be removed from the fencing line to produce a clear even strip 500mm wide on either side.

Trees, rocks or other items of horticultural or archaeological interest that are not to be removed will be indicated by the Department.

Straining Posts: - shall be erected at ends, corners and intermediately at not exceeding 30m centres with standards or intermediate posts erected between posts at not exceeding 3m centres.
Where fences are erected directly over boundaries, corner beacons shall be preserved by splaying the corner by planting two straining posts, each with one stay, 1 m from the beacon peg.
Security fences (i.e. fences with projecting overhangs if specified) shall be sited 350 mm back from the boundary line so that the end of the overhang is exactly on the boundary line.

SECURITY FENCING:

2.3m High security fencing shall consist of: -

1) Straining and Intermediate Posts (2.9mtr long).
2) Stays (2.6mtr long).
3) Welded mesh fencing (1.8mtr high).
4) Razor wire.
5) Concrete ground beam.
6) Tubular steel gate posts (when specified).

Straining and corner posts shall be 150mm ø x 3mm wall thickness steel tubing, in lengths as specified, with upper end capped and 3mm thick x 300mm x 300mm footplate welded to base. The whole shall be **hot dipped galvanized**. 80mm diameter stays x 3mm wall thickness shall be secured to posts with galvanised bolts. Straining posts to be positioned at maximum 30mtr c/c. Bottom of posts bedded in concrete to be painted with bitumen paint prior to erection. Where holes have to be drilled on site, drilling shall be cold galvanized before corrosion sets in.

Intermediate posts shall be 2.9mtr long x 100mm x 100mm square pre-stressed, precast concrete posts with top end splayed, spaced at maximum 3mtr apart. Stays for posts shall be prestressed reinforced concrete members of 75mm x 75mm x 2.6mtr long, splayed at the top end, with a 10mm ø x 50mm long galvanized steel pin attached to fit into a drilled hole in the upright and bonded to posts with approved epoxy.

Fence shall comprise of galvanized rectangular welded mesh fencing 1,80mtr high x 3.15mm ø x 25mm x 50mm rectangles fixed to 8 gauge or 3.15mm diameter – as

specified - hardened galvanized steel straining wires x 5, spaced vertically at 450mm ¢. Welded mesh shall be secured to straining wires with 2mm ø galvanized tying wire spaced at a maximum of 250mm between ties. Fencing overlap to be a minimum of 150mm.

Straining wires shall be fixed to posts with doubled strands of 2mm ø galvanized tying wire, pulled tight around posts and wound tightly around the straining wires.

Coils of 500mm ø galvanized flat wrap razor wire shall be fixed vertically above the welded mesh to a height of 450mm above the top of the welded mesh. Razor wire shall be supported on and fixed to three strands of galvanized double strand barbed wire. Barbed wire shall be fixed to the posts in the same manner as the straining wires.

Razor wire shall be fixed to the barbed wire at every intersection and laced to the concrete posts with galvanized tying wire.

A 250mm wide x 150mm minimum depth concrete ground beam of 15mpa strength shall be excavated for and cast along the entire length of the fence. Shuttering for the ground beam sides shall be provided as required. Finished level of the ground beam shall be 50mm above final ground level at the highest point, finished in a straight line both vertically and horizontally. 75mm of the welded mesh fencing and the bottom straining wire shall be embedded in this ground beam to secure the lower fence line. The top of the concrete beam shall be shaped to allow water to run off the top of the beam to prevent water collecting and standing on top of the beam.

At any change in direction of the fence line, two 150mm ø x 3mm wall thickness straining posts shall be erected with bottom ends embedded in a common concrete base with each post stayed separately.

Concrete bases for posts shall be Class B (1:3:5-19mm stone) size 400 x 400 x 500mm deep, unless otherwise specified, with tops of bases 100mm below ground level.

When required, gateposts shall be supplied in steel tubing complying with CKS 82, 150mm ø x 5mm wall thickness, in lengths as specified, with upper end capped with 1.6mm thick pressed mild steel domed cap welded on and 3mm thick x 300mm x 300mm footplate welded to base. Gateposts are to be drilled and fitted with mild steel ferrules welded into position to receive 20 mm ø mild steel hinges. Threaded 12 mm ø studs or approved stay collars are to be fixed on to the posts to locate and secure the top ends of stays. The whole shall be hot dipped galvanized. Where holes for the threading and fixing of straining wires are required, holes shall be drilled on site and cold galvanized on completion.
Stays shall have the top end flattened, bent as required, holed 12 mm ø for bolting to post and the whole hot dip galvanized.

Mild steel tubing for gate components shall comply with SANS Specification 657 Part 1. The diameters specified are the nominal external diameter of the tubing.

Straining wire: - shall be as specified, or either Type 1 galvanized wire of 3,15 mm diameter or Type 2 PVC coated galvanised wire with 3, 15 mm diameter core wire PVC coated to an overall diameter of 3,95 mm. Stainless steel straining wire when specified shall be 2,50 mm diameter A.I.S.I. Type 304 stainless steel, strained between posts and tied to same at terminal ends by turning each wire twice around the post and tying off by twisting it a minimum of three turns around the strained wire.

Binding or Tying wire: - shall be as specified, either Type 1 galvanised wire of 2 mm diameter or Type 2 PVC coated galvanised wire with 2 mm diameter core wire PVC coated to an overall diameter of 2, 80 mm.

Galvanized barbed fencing wire: - shall consist of two strands of 1, 60 mm diameter high tensile steel wire twisted together with barbs at 125 mm centres and each row of barbed wire shall be strained between posts and tied to same at ends by turning each wire around the post and tying off by twisting it a minimum of three turns around the strained wire.

Galvanising: - shall comply with SANS Specification 763 and all items of posts, stays, gate

framing, etc., described as galvanised shall be hot dipped galvanised after fabrication with Class A galvanising with all internal and external surfaces fully coated.

GATES: — Generally single gates and double gates shall be of the sizes stated and formed with mild steel tubular framing all round, covered with chain link wire mesh of the type specified laced to framing. Tubular framing to gates shall be mitred and welded at corners and, at all other intersections, the tubular framing shall be scribed and welded together with all welds ground smooth.

Preferred gate hinges are Bullet Type or through pin type hinges.

Where gates are to be hung on precast concrete posts, hinges shall be fixed to and including mild steel clamps, each formed of two 50 x 5 mm mild steel plates 200 mm long, twice holed for and bolted on opposite sides of post with two 10 mm ø x 140 mm galvanized mild steel hex-head bolts and with each plate holed to receive 20 mm ø gate hinge.

Each single gate and one leaf of each double gate shall be fitted with gate latch formed of 25 x 6 mm mild steel bracket, 550 mm girth, twice bent to U-shape with centre section 150 mm high and with ends scribed and welded to tubular stile of gate. A locking bar formed of 25 x 6 mm mild steel plate, 100 mm long, twice holed 13 mm diameter for shackle of padlock and for pad bolt, shall be welded to inside of bracket. The sliding pad bolt shall be formed of 12 mm ø mild steel rod, 220 mm long, with 25 x 6 mm mild steel flat bar 60 mm long welded on at one end and holed 13 mm diameter for shackle of padlock. The stile of the gate and the locking post or locking stile of the double gate shall be holed for and fitted with mild steel ferrule welded in to receive pad bolt. In addition, fittings to each leaf of double gate shall comprise 50 x 6 mm mild steel locking bar, 80 mm long, holed 20 mm ø for shackle of padlock and welded to locking stile of gate and drop bolt formed of 16 mm diameter mild steel rod, 575 mm girth, once bent to L-shape, fitted through and including 20 mm internal diameter mild steel sleeve welded to gate at bottom corner, with 12 mm diameter mild steel peg stay 25 mm long welded on to gate frame.

A concrete gate stop block size 230 x 230 x 230 mm deep with two 20 mm internal diameter mild steel sockets, each 75 mm long, cast into top shall be embedded in the road surface between each pair of double gates in the closed position. A similar gate stop block but with one socket shall be embedded in the road surface to each leaf of double gate in the open position.

Each single or double gate shall be fitted with an approved 51 mm brass padlock with hardened steel shackle and two keys.

Gates for 1, 20 m high fencing

Single gates shall be size 1,00 x 1,20 m high, each hung on hinges as stated above and formed of 32 mm diameter x 2 mm wall thickness mild steel tubular framing all round. Each gate shall be fitted with locking pad bolt with brass padlock.

Double gates shall be in two equal leaves with each leaf size 2.25 x 1, 20 m high, hung on hinges as stated above, formed of 38 mm diameter x 2 mm wall thickness mild steel tubular framing all round with two 38 mm diameter x 2 mm wall thickness mild steel tubular braces welded on between bottom corners and centre of top rail of each leaf. Each pair of double gates shall be fitted with locking pad-bolt, locking bars with brass padlock, drop bolts and concrete gate stop blocks as specified above.

Gates for 1, 50 m high fencing

Single gates shall be size 1, 00 x 1, 50 m high as described for gates for 1, 20 m high fencing but with each stile of gate extended 330 mm above top rail and braced between top rail and top of extension arm with 32 mm diameter x 2 mm wall thickness mild steel diagonal brace welded on and hung on hinges as stated above. Two rows of galvanised barbed wire, spaced 150 mm apart, shall be strained and tied to the extension arms.

Double gates shall be in two equal leaves with each leaf size 2, 25 x 1.50 m high with each hung on hinges as stated above, all as described for double gates for 1, 20 m high fencing but with each stile of each leaf extended 3 mm above top rail and braced between top rail and top of extension arm with 38 mm diameter x 2 mm wall thickness mild steel diagonal brace welded on. A vertical extension arm 330 mm high - formed of 38 mm diameter x 2 mm wall thickness mild steel tube - shall be welded on above centre of top rail. Two rows of galvanised barbed wire, spaced 150 mm apart, shall be strained and tied to extension arms.

Gates for 3, 00 m high fencing
Single gates shall be size 1,00 x 1,50 m high, hung on hinges as stated above and formed of 38 mm diameter x 2 mm wall thickness mild steel tubular framing all round with 38 mm diameter x 2 mm wall thickness mild steel horizontal centre rail. Each gate shall be fitted with locking pad bolt with brass padlock.
Chain link wire mesh fencing shall be carried over and above the top of the gate as previously described for fencing.
Double gates shall be in two equal leaves with each leaf size 2, 25.x 3, 00 m high, each hung each hung on hinges as stated above, and formed of 51 mm diameter x 2 mm wall thickness mild steel tubular framing all round with two 51 mm diameter x 2 mm wall thickness mild steel tubular braces welded on between bottom corners and centre of top rail of each leaf. Each pair of double gates shall be fitted with locking pad bolt, locking bars with brass padlock, drop bolts and gate stop blocks.

Gates for 1, 8 m high security fencing:
Single gates shall be size 1,00 x 1,80 m high, hung on hinges as stated above and formed of 38 mm diameter x 2 mm wall thickness mild steel tubular framing all round with 38 mm diameter x 2 mm wall thickness mild steel horizontal centre rail. Each gate shall be fitted with locking pad bolt with brass padlock.
Single gates shall be hung on mild steel tubular gate posts with cranked overhang when specified and the galvanised barbed wire overhang shall be carried over above the gate as previously described.
Double gates shall be in two equal leaves with each leaf size 2, 25 x 1, 80 m high, each hung on hinges as stated above and formed of 51 mm diameter x 2 mm wall thickness mild steel tubular framing all round with two 51 mm diameter x 2 mm wall thickness mild steel tubular braces welded on between bottom corners and centre of top rail of each leaf. The stiles of each gate shall be extended 450 mm high above the top rail and braced between top rail and top of extension arm with 51 mm diameter x 2 mm wall thickness mild steel diagonal brace welded on. A vertical extension arm 450 mm high formed of 51 mm diameter x 2 mm wall thickness mild steel tube shall be welded on above centre of top rail. Three rows of galvanised barbed wire, spaced 150 mm apart, shall be strained and tied to extension arm. Each pair of double gates shall be fitted with locking pad bolt, locking bars with brass padlock, drop bolts and gate stop blocks.
Double gates shall be hung on posts without cranked overhang but with the posts extended 450 mm high above top of chain link wire mesh fencing to receive continuation of barbed wire and razor wire.

Gates for 2, 40 m high security fencing
Single gates shall be of size 1, 00 x 2, 00 m high, all as described for gates for 1, 80 m high security fencing.
Chain link wire mesh fencing shall be carried over above the top of the gate to an overall height of 2, 40 m with the razor wire carried across between the gateposts.
Double sates shall be in two equal leaves, with each leaf 2, 25 x 2, 40 m high, all as described for double gates in 1, 80 m high security fencing.
Double gates shall be hung on posts without cranked overhang but with the posts extended 450 mm high above top of chain link wire mesh fencing to receive continuation of razor wire.

SUBMISSIONS FOR PREFABRICATED TIMBER ROOF TRUSSES

Letter Ref. TR 1

I / We hereby undertake to be responsible for the design of the total timber roof construction and will satisfy myself / ourselves that the fabrication and erection is in accordance with my / our design.

Project: _____

_____

Part(s):

_____

_____

NAME OF FIRM:

_____

SIGNATURE: _____ QUALIFICATION:

_____

DATE: _____

Letter Ref. TR 2

I / We am/are satisfied that the fabrication and erection of the total roof construction has been completed in conformity with my / our design.

Project: _____

_____

Part(s):

_____

_____

NAME OF FIRM:

_____

SIGNATURE: _____ QUALIFICATION:

_____

DATE: _____

SUPPLEMENTARY PREAMBLES

The following Supplementary Preambles are to be read in conjunction with the "Standard Preambles to all Trades" included here before and are to apply to this Contract.

Where these "Supplementary Preambles" are at variance with the "Standard Preambles to all Trades" referred to above, such variances are to take precedence and are to apply to this Contract.

1. ALTERATIONS

All Notes, Preambles, etc. applicable for the various trades in the Bills of Quantities, will apply equally to the trades in this Bill.
Tenderers are advised to visit the site and satisfy themselves as to the nature and extent of the work to be done, and also to examine the condition of the existing building.

Tenderers are advised that all materials from the pulling down (except where described to be re-used or handed over to the Department) will become the property of the Contractor, and all these materials, together with all rubbish and debris, must be immediately carted away, and the site left clean and unencumbered. Materials, etc. which are described to be handed over to the Department are to be carefully dismantled where necessary, and neatly stacked where directed on site. Items described as removed shall be removed from site.

Credit for the value of the materials from the pulling down may be allowed for on the Final Summary page.

Prior to the removal of any timbers from the site, they are to be inspected by the Government Entomologist as laid down in Section 32 of the Government Forest and Veld Conservation Act of 1941 (Act 13 of 1941) as amended. If any of the timbers are infested with wood destroying agencies, they are to be disposed of in the manner prescribed by the Government Entomologist.

The Contractor is to give ample notice to the Department and Local Authorities regarding any disconnections necessary prior to the removal or interruption of electric light or telephone cables, water and sanitary services, etc.

Tenderers are advised that adjacent sections of this building will be occupied during the building operations, and the Contractor is required to carry out the work with as little noise, dust and disturbance as possible. Undisturbed access is to be given to patients, staff and visitors.

The Contractor is advised to check all dimensions affecting the existing building as he will be held solely responsible for all new work being of the correct size. All sizes stated are approximate and under no circumstances will claims be entertained should actual sizes of existing items on site vary marginally from the sizes stated in this document.

The Contractor will be held solely responsible for any damage to persons, property, and equipment and for the safety of the structure throughout the whole of the Contract, and must make good at his own expense any damage that may occur.

The Contractor must obey the instructions of the Department in carrying out any portion of the work which in his opinion requires expediting, and the Contractor shall give priority to such work as and when directed.

In taking down and removing existing work, the utmost care is to be observed to avoid any structural or other damage to the remaining portions of the building. The Contractor must also protect all work not removed, such as walls, floors, doors, windows or joinery, loose and fixed fittings and electrical equipment, appliances, etc. from damage during the progress on the works and provide all necessary materials in so doing.

Special care is to be taken not to interfere with any electric light, bell, power or telephone wires and fittings that may be encountered on site. New work to the existing electrical, air-conditioning, gas and telephone installations, etc. is included elsewhere in this document.

The Contractor must take the exigencies of the Hospital Service into consideration. Liaison is to be carried out through the offices of the Regional Engineer, with referrals to the Director: Physical Facilities Management for a final decision. No instructions may be received by the Contractor from the Hospital Authorities and all instructions are to be given by the Chief Department in writing before they are put in hand.

2. CONCRETE, FORM WORK AND REINFORCEMENT

Cement is to comply with:

SANS ENV 197 (1 to 2)
SANS ENV 413 (1 to 2)
SANS ENV 196 (1 to 7)
SANS ENV 196 (21)

as applicable, and replaces the following SANS Specifications in the Standard Preambles:

SANS 471 Portland cement (ordinary, rapid hardening and sulphate resisting)
SANS 626 Portland blast furnace cement.
SANS 831 Portland cement 15 (ordinary and rapid hardening)

3. MASONRY

Masonry is to comply with SANS Code of Practice 0249 and 0164 as applicable.

4. ROOF COVERINGS, ETC.

The installation of roof coverings and side claddings is to comply with SANS Code of Practice 0237 as applicable.

5. CARPENTRY AND JOINERY

Note:

All timber must be treated in terms of SANS Code of Practice 05 for GYMNOSPERMAE including all SA Pine species and ANGIOSPERMAE including all Eucalyptus species but excluding laminated timber.

It is now a compulsory requirement to use only treated timber in buildings. The treatment shall comply with SANS 457, 753, 754 or 1288 as relevant.

Reference must also be made to the appropriate Standard Preambles and SANS requirements for items not covered by these joinery preambles, etc. i.e. ironmongery, aluminium, glazing, paintwork, etc.

Where items are described as “plugged and screwed”, they are to include for plugging and screwing to new or existing brickwork or concrete, with heads of screws sunk and pelleted.

Sawn softwood timber: General, Stress Graded, Industrial, Brandering and Battens is to comply with SANS 1783 Parts 1 to 4 as applicable.

All hardwood is to be dark red Meranti, even in grain and colour selected for “Standard and Better” quality, from Malaysia, with a minimum density of 550 kg per cubic metre at moisture content of 12%, and is to comply with SANS 1099 as applicable.

Hardboard is, unless otherwise described; to be 3mm un-tempered hardboard for floor units and 6mm tempered hardboard for wall units.

Melamine faced moisture resistant V313 chipboard can be used when specified.

Materials generally are to comply with the following specifications and requirements as applicable:

TABLE H: CARPENTRY AND JOINERY: SANS SPECIFICATIONS

MATERIAL	SANS SPECIFICATION	GRADE OR CLASS
Softwood structural timber	1783	Parts 1, 2, 3, 4
Softwood engineering timber	1783	Parts 1, 2, 3, 4
Softwood studs for timber frames in building	1783	Parts 1, 2, 3, 4
Softwood brandering and battens	1783	Parts 1, 2, 3, 4
Softwood joinery timber	1783	Parts 1, 2, 3, 4
Softwood flooring boards	629	Flooring Grade
Hardwood joinery timber	1099	Heavy flooring board
Hardwood strip flooring	281	Knotty grade
Wooden ceiling and panelling boards	1039	As specified
Laminated timber (glulam)	1460	As specified
Gypsum, plasterboard	266	As specified
Wood fibreboard	540	As specified
Wood wool panels (cement bonded)	637	As specified
Fibre cement sheets: profiled and flat	685	As specified
Fibre cement boards	803	As specified
Plywood and composite board Particle Board: Highly Moisture resistant exterior and flooring type Interior Type	929 EN 312 EN 312	 Parts 1 to 7
Decorative laminates	SANS ISO 4586 and SANS 1405	High Pressure
Decorative Melamine Faced Boards	1763	
Wooden Doors (flush)	545	
Materials for thermal insulation of buildings	1381	As applicable
Mild steel nails	820	
Metal screws for wood	1171	
Creosote	538	As specified
Timber roof trusses	0243	SANS Code of Practice

6. CEILINGS AND PARTITIONS

Refer to Joinery Fittings regarding specifications and requirements of materials.

7. IRONMONGERY

Materials

i) Locks are to comply with SANS 4 as applicable
ii) Door closers are to comply with SANS 1510 as applicable
iii) Symbolic safety signs are to comply with SANS 1186 as applicable

All ironmongery, unless otherwise described, is fixed to timber.

Sheet steel furniture to comply with SANS 757 as applicable

8. METALWORK

Rates are to include for cutting to lengths, splay cut ends, shaping, holing, tapping, threading, forging, turning, fitting, assembling, welding, filing smooth, preparation, priming coats, hoisting, temporary bracing and fixing in position.

Towel rails are to be tubular Satin Chrome mild steel to diameters - minimum 19mm - and lengths as specified in matched Satin Chrome end pieces. End pieces to be either flat or bracket type - according to requirements, application and specification - plugged and screwed into walls with Chromed Brass screws.

Electro-plating is to comply with SANS ISO 1456 as applicable.

Curtain tracks to be "Forwin" Hospital Curtain Tracks as "Kirton" (Pty) Ltd. - or other approved -, including 15 wheeled runners per metre, hangers, brackets, stopped ends, etc. Hangers are to be suspended from roof timbers or concrete slab over – **not off the ceiling grid**. Allowance is to be made for necessary bends and curving as per plan supplied.
Curtains to be provided as (Chintz fabric (#155CZ) woven with 100% polyester yarn)

SHELVING FOR PHARMACIES: - Shall be epoxy coated steel shelving, either fixed to epoxy coated wall bands or free standing units as specified.

SHELVING FOR CSSD STERILE STORE: - Shall be slatted grade 304 stainless steel wall bands or free standing units as specified.

Aluminium Windows and Doors

NOTE:

Glazed aluminium alloy windows and sliding doors for external use are to comply with SANS 1651 as applicable.

All items must conform to and carry the Certification Seal of the AAAMSA and no items which are not so certified will be accepted on site.

The work is to be cleated and framed.

All visible surfaces are to have a 25 micron anodised finish as specified.

Anodised coatings on aluminium are to comply with SANS 999 as applicable.

Rates are to include for setting up and building in as well as for isolation material between the aluminium surfaces and adjacent surfaces of a differing material.

All visible surfaces are to be covered with a temporary protective tape, later to be removed.

Float glass for glazing is to comply with SANS CKS 55 and SANS 952 as applicable.

Safety and security glazing materials for buildings is to comply with SANS 1263(1) unless otherwise described. All panes are to be marked so as to be visible. Laminated safety glass is to carry a written five year guarantee.

Windows and doors are to be watertight.

Silicon pointing to windows and doors is covered elsewhere.

9. PLASTERING

Rates for new plaster, screeds, etc. to existing surfaces are to include for all preparatory work and forming a key.

Removal of paint and/or varnish as well as the roughening of the existing face brick surfaces both externally and internally to receive new plaster has been measured separately.

Plaster and screeds, etc. in patches is generally of an isolated nature and to existing surfaces. Portion of the work may be in narrow widths.
Where alterations are to be done to the existing structure, the new plaster, etc. has been measured to a point 300mm beyond the line of the alteration on the existing structure.

10. TILING

Ceramic Wall and Floor Tiles are to comply with SANS 1449 as applicable.

11. PLUMBING AND DRAINAGE

Water Supply and Drainage for Buildings is to comply with SANS Code of Practice 0252 as applicable.

Water Supply and Distribution System Components is to comply with SANS 1808 as applicable.

Electrical Water Heater:

Storage Heaters to comply with SANS 151.
Instantaneous Heaters to comply with SANS 1356 and IEC 335 (2-35).

12. GLAZING

Glass is to comply with SANS Specification 952.

Glass for glazing is to comply with SANS Specification CKS 55.

Safety and security materials are to comply with SANS Specification 1263 as specified.

Laminated safety glass is to carry a written five year guarantee.

KWAZULU-NATAL
DEPARTMENT OF HEALTH

INFRASTRUCTURE DEVELOPMENT
ENGINEERING ADVISORY SERVICES

POLICY DOCUMENT

FOR THE

DESIGN OF STRUCTURAL INSTALLATIONS

(TO BE USED STRICTLY AS A DESIGN GUIDE ONLY)

IMPLEMENTATION DATE: JANUARY 2006

Revision No 1 Jan 2007; Revision No. 2 Jan 2008; Revision No. 3 Jan 2009 ; Revision No. 4 Jan 2010; Revision No.5 Jan 2011
Revision No.6 Jan 2012; Revision No.7 Jan 2013

STANDARDS COMMITTEE MEMBERS

Mr. R. Westwood	Chairman	KZN Department of Health
Mr. G. Pike		KZN Department of Health
Mr. S. Pillay		KZN Department of Health
Mr D.Van Wyk		KZN Department of Health
Miss M.De Goede		KZN Public Works
Mr P.Erasmus		KZN Public Works
Mr P.Culligan		KZN Public Works
Mrs.K.Major		KZN Public Works

INDEX

CODES AND SPECIFICATIONS FOR STRUCTURAL INSTALLATIONS

The complete installation must conform to the following:

- Occupational Health and Safety Act and Regulations (85 of 1993)
- National Building Regulations and Government Gazette No 31084 of 30th May 2008 and the S.A.N.S 10400: (Ex. SABS 0400: 1990) Code of Practice for the Application of the National Building Regulations
- Energy Code of Conduct for all Government buildings Rev 3
- The Local Authority Fire and other Regulations
- R158 where applicable
- Wiring Code, South African National Standards, SANS 10142-1
- Bricks manufactured to SANS 227 standards
- All other legislation

THE PROVINCE OF KWAZULU-NATAL DEPARTMENT OF HEALTH'S STANDARD SPECIFICATIONS As IN:

- Standard Preamble to all Trades dated January 2009 Rev 3
- Policy Document for the Design of Electrical Installations
- Policy Document for the Design of Mechanical Installations
- Solar Water Heater (SWH) specification
- Application of Screedmaster.
- Pharmacy Specifications
- Milk Kitchens

THE PROVINCE OF KWAZULU-NATAL DEPARTMENT OF HEALTH'S STANDARD DRAWINGS:

Ablutions for Clinics	Drwg	No 6018H/01-02	July 2001
Ambulance Shelter	Drwg	No 6055H/01	October 2006
Car-Ports Double Bays	Drwg	No 6033H/01	August 2006
Fuel Storage Bund Walling	Drwg	No 12005H	September 2012
Grease Trap	Drwg	No 942-02GT	August 2001
Guard Hut with Ablution	Drwg	No 5038H	August 2005
Helistop – Restricted	Drwg	No 2017H/01_r2	December 2007
Helistop – Un-restricted	Drwg	No 2017H/02	December 2007
Institution Entrance Signs	Drwg	No 6004H-6008H	May 2005
Laboratory	Drwg	No 4036H/01-R4	January 2004
Medical Waste / Domestic Waste	Drwg	No 7027H/01/R1	December 2012
Official Vehicle Lockup Garages	Drwg	No 6019H	June 2002
Paraplegic Toilet	Drwg	No 6036H/01-02	September 2006
Pharmacy	Drwg	No 5046H	October 2005
Pharmacy Service counter windows	Drwg	No 10025H/ 01	December 2010

Plant Room Doors	Drwg	No 3025H/02	August 2003
Standard 3 Bedroom House	Drwg	No 6016H/R3	October 2005
Septic Tank	Drwg	No 6017H	February 2005
Stainless Steel CSSD Shelving	Drwg	No 7048H	October 2007
Stainless Steel Door Frames	Drwg	No 7002H- 01-05	January 2013
Storm water Details	Drwg	No 6000H/01-04	January 2006
Theatre and CSSD (to be redesigned)	Drwg	No 3039H/01-R4	January 2008
Wash Bay	Drwg	No 6037H/01	August 2006
X-Ray Dark Room Format	Drwg	No 8001H/01	January 2008
X-Ray Digital Room Format	Drwg	No 8002H/ 01	January 2008

GENERAL BUILDING REQUIREMENTS

- A Schedule of accommodation must be supplied by Department of Health officials.
- Availability of water, electricity must be ascertained and a full report submitted before any construction commences. Without these basic's the project is not to proceed. Rev 7
- A Geotechnical Investigation of the site must be conducted.
- Before work commences on site, submit a notification to Department of Labour. Construction Risk Assessment, Safety, Health and Environment Plans to be in place before any work commences.
- Use of natural light and ventilation for patient care facilities is to be maximised when designing a health care facility.
- Maximisation of natural light (daylight) can be met by windows opening onto an atrium or courtyard, or a roof light, provided that privacy within the room or space is maintained. In addition, daylight may be borrowed from an adjacent room or corridor by means of glazing the wall in between provided that the adjacent room or corridor is within the same unit and privacy is maintained.
- Sluice rooms and Instrument wash up rooms must be carefully placed in order to ensure optimum infection control measures.
- General Sluice / Dirty Utility Rooms to be provided with Drawing No ……. Rev 7
- Service balconies are to be provided to all high-rise buildings to facilitate cleaning of windows and general maintenance.
- All stainless steel fittings, fixtures and equipment shall be fixed with Grade 304 stainless accessories (ie Bolts, Nuts washers etc). Rev 1
- Plant rooms should be located preferably at ground level for single story buildings or on the same level in multilevel buildings. Rev 1
- All equipment within the plant rooms shall have at least 1 metre clear working space all round. Rev 1
- No provision shall be made for dedicated gantries or crawl beams for the purpose of lifting equipment. Rev 1
- Preference shall be given to South African manufactured products. Rev 1
- Where reference is made to "or other approved" items this shall mean approval prior to tender closer. Rev 1
- Kerbing to road ways within health facilities to be Fig 8 mountable type. Rev2
- Where doors are described as having observation openings, these openings are to be of the sizes stated and glazed with 6mm safety glass. No glazing permitted to any fitting below Lock Rail (ie 1,2m high). Rev 1

- The preferred infill panels below lock rail in aluminium glazed doors and screens are Aluminium ribbed panel as “Sherline” system T29. Rev 2
- All loose equipment, furniture etc to remain the property of Health or as otherwise stated. Items to be listed with their relevant bar codes if available before removal to another location. Rev2
- Provision must be made for a framed, laminated floor plan of the facility showing fire evacuation routes. This must be positioned at all strategic areas. Rev7
- The usage of Grey Water for only toilet and urinal fittings is to be used where ever possible. The painting of the water supply pipes to be as specified in the Standard Pre-ambles for all Trades. Rev2
- 900mm wide concrete aprons around all buildings. Dished channels, 600,300 split may be used in lieu of the apron. Rev4
- No internal planter boxes are to be provided inside a health facility. Rev7
- **Without compromising quality, locally manufactured products are to take preference over imported products with proven new technology.** Rev7
- **Handover procedures**. Rev6
- Practical completion is taken at the end of contractual construction period or when occupation can practical completion.
- As built’s drawings are to be provided at Practical Completion.
- Works completion is taken when all snag items identified at practical completion have been attended to. At this time the maintenance period commences GCC = 12 moths for building including electrical and mechanical. JBCC = 3 months for building and 12 months for electrical and mechanical.
- At completion of maintenance Final Completion is taken.

Operation and Maintenance Manuals

The contractor shall hand over, at the completion of the works one original and two copies of the necessary operating and maintenance requirements for all plant and equipment supplied and installed by him or her as part of the works. Each copy of the operating and maintenance manual shall be separately bound in an acceptable manner, and shall contain the following data where applicable. These documents are to be handed to the Project Leader responsible for the project and the Project Leader will ensure that these documents are handed to a Department of Health Head Office official.

a) Scope of Work

b) Operating Instructions

c) Normal Operation

d) Safety Measures

e) Fault Finding Guide

f) Equipment Information

g) Schedule of Information

h) List of Spares and Agents

i) Design Data

j) As Commissioned Data

k) Maintenance Requirements

l) KZN Department of Health Service Schedules

m) Manufacturers Service Recommendations

n) Manufactures Literature

o) Equipment Brochures

p) Proprietary Drawings, Exploded Views and Wiring Diagrams

q) As Built Drawings

r) Electrical Drawings

s) System Layouts and Schematics

t) Training Certificates Rev 1

As Built Drawings

Complete sets of drawings (two electronic and three hard copies, Electronic drawings in Autocad and other documents in PDF.) of the entire project shall be included in the as built documentation. The set shall be as per "As Built Document Schedule": Rev 4

Complete sets of drawings (two electronic and three hard copies) of the entire project shall be included in the as built documentation, which is required <u>at practical completion</u>.
Original statutory documents are to be provided in a separate folder. **Rev 5**

- Architectural drawings and details.
- Electrical wiring diagrams indicating all cable sizes, current ratings, fuses, control units, site cable reticulation and schematic wiring diagrams applicable to the works.
- Mechanical drawings and schematics showing all equipment, connections to the equipment and service runs installed by the Contractor, and isolating valves, etc.
- Exploded views of all equipment showing each component part adequately identified and numbered.
- The electronic records (on disk) are to be handed to the Department of Health Head Office official at first delivery.

Equipment Schedules

A complete schedule of all plant and equipment forming part of the works shall be included in the manual. The schedule shall include, but shall not be restricted to the following data:

- Equipment type and model
- Equipment identity number/serial number
- Date of manufacture, testing installation and commissioning
- Country of manufacture
- Manufacturers name and contact address
- Any other information required by the Department Rev1

Maintenance Requirements

The manufacturer's recommendation with regard to the routine servicing and maintenance of all equipment shall be included in the manual. This data shall include the recommended service interval and the estimated hours required for each type of service, for each item of equipment, together with a list of agents/contractors authorised to carry out such service/maintenance. Rev 1

Operating Instructions and Training

- A complete description of all operating procedures and safety measures shall be included in the manual. A basic "Fault Finding Guide" shall also be included.
- Training shall be given to staff operating machinery and plant together with maintenance personnel.
- Training certificates must be signed by staff that has received training.
- The table below is to be used by the Project Leader and Principal Agent as a checklist for all as built documents. Rev 1

AS BUILT DOCUMENTATION REQUIREMENTS
ALL DRAWINGS REQUIRED IN AUTOCAD (DWG) FORMAT ON CD

PROJECT =

	AS BUILT DRAWINGS (DESCRIPTION)	REQUIRED		SUPPLIED	
		Yes	No	Yes	No
1	ARCHITECTURAL - PLANS, DETAILS etc				
2	ELECTRICAL - RETICULATIONS, TELEPHONES, NURSE CALL SYSTEMS, ALARMS, BMS AND ELEVATORS etc.				
3	MECHANICAL - AIR CONDITIONING, VENTLATION, GAS LINES, ELEVATORS,(LAYOUTS AND SIZES)				
4	STRUCTURAL, - REINFORCING SCHEDULES				
5	CIVIL (STORMWATER AND SEWER) - EARTHWORKS, SITE SERVICES RETICULATIONS, ROAD MARKINGS etc.				
6	EQUIPMENT SCHEDULE				
7	COMPUTERISED PROGRAMMES - CD's				
	COMPLIANCE CERTIFICATES (DESCRIPTION)				
8	PRESSURE TESTING -				
	1) MEDICAL GAS				
	2) STEAM LINES				
	3) CHILLED WATER				
	4) CONDENSER WATER				
	5) WATER MAINS				
	6) HOT & COLD WATER RETICULATION				
	7) COMPRESSED AIR LINES				
	8) VESSELS UNDER PRESSURE				
	9) SEWER RETICULATION				
	10) PLUMBER				
	11) STABILITY CERTIFICATES				
9	ELECTRICAL - MASTER or INSTALLATION ELECTRICIAN				
10	SOIL POISONING / COMPACTION				
11	LOCAL FIRE DEPARTMENT CLEARANCE				
12	ROOF TRUSSES - TRI &TR2				
13	FIRE DETECTION - SPRINKLER SYSTEMS, FIRE EXTINGUISHER AND HOSE REELS				
14	LIGHTNING AND EARTHING				
15	ELEVATORS COMPREHENSIVE REPORT HOISTS : ANNEXURE 'K'				
16	CONCRETE CRUSHING TEST				
17	GUARANTEE'S (NEW AND UPGRADED EQUIPMENT)				
	MANUALS				
18	OPERATING MANUALS PERTAINING TO ALL NEW EQUIPMENT				
19	POST GUARANTEE MAINTENANCE SCHEDULE				

PSYCHIATRIC WARDS

Low Secure Area's. (lsa)

- Should form part of general wards
- Dual functional is; medically ill patients should be accommodated for as well as mentally ill patients.
- Low secure areas should each be custom designed to fit into existing building plan / infrastructure. New facilities to be custom designed.
- Positioned near Nurses Station or there should be clear lines of sight from nursing area into low secure area.
- Closed circuit monitoring of facility with only nursing and medical staff able to see monitors.
- Windows to be fitted with external louvre control for patient privacy.
- Light switches outside of ward / facility.
- Maximum natural light and ventilation.
- Facilities to be located on a ground floor with access to an external garden area and covered patio. Rev7
- Easy access to ablutions.
- Security gates with standalone access control to selected entrance areas.
- Windows glazed with 6mm polycarbonate reinforced glass with mesh burglar proofing in framework bolted to walls.
- Any fitting within a facility - if unavoidable to eliminate suicide - is to bear a load of not more than 20 Kg's. (e.g Oxygen mask equipment)
- Fire alarm installation.
- Doors to be solid core minimum width of 900mm, lockable from outside with an armourplate glass observation window to view all corners of the room size250mm x 500mm window set +/- 1,5m to centre above finished floor to centre of window. Rev 7
- Welded vinyl floor sheeting with welded skirting except all wet areas.

PSYCHIATRIC FACILITIES

Entrances:-

- Entrances to ward buildings to be fitted with remote controlled full height "Man Trap" security cubicles with bell pushes fitted both entry and exit sides and remote unlocking operation enabled from the security booth.
- Side entrance door to be a minimum of 900mm wide to be provided for wheel chairs or patient beds Rev 4

Ablutions:-

- W/C pans are to be Vandal Proof with integrated seat; fitted with 'prison type' Flush Masters .
- Thermostatically adjustable demand water supply to showers in Psychiatric facilities. Rev 6
- Wash - hand basins are to be stainless steel recessed wall mounted drinking fountain / hand washing fitted with water metering KM2.100 Bibtap type Rev 7
- Showers to be fitted with solid vandal resistant spouts - not shower roses - with single demand type tap for timed discharge of water from mixer within or behind wall – one per shower. Temperature to be pre-set and controlled for all outlets.
- Cubicles to be fitted with heavy duty stainless steel shower curtain rail and 3mm x 230mm wide blue plastic - polycarbonate strips. Rail secured to wall with Allan keys s/s screw. Rev 3

- All plumbing is to be built into walls and plastered over.
- Seclusion rooms to be provided with a basin and toilet as described above.
- Cold water supply with adjustable demand taps to Seclusion Room basins only. Rev 5
- Recess in shower walls tiled for the soap bar. Rev 6

CCTV Cameras, Monitors and Temperature Control:-

- In dedicated psychiatric institutions, all seclusion rooms to be fitted with CCTV cameras linked to monitors in section heads offices / Nurses station and security booth.
- In ordinary institutions, reinforced / toughened glass viewing panels between seclusion room and Nurses station in galvanized steel frame. Rev 7
- Seclusion rooms to be fresh air ventilated. Rev 7
- Camera to be positioned above toilet pan looking into the room towards the entrance. Rev 7

Floors:-

- Welded vinyl sheeting with weld skirting to sheeting?
- Seclusion rooms are to have floor drains cast in-situ. Grade 304 stainless steel drains cast “in situ” with removable traps with grid screwed down. P traps are not suitable due to blockages. Floors to be finished with 2mm epoxy. No skirtings. Rev 6
- Floors to have under floor heating in cold area’s. Rev5

Seclusion Room Doors:-

- Doors to be 900 x 2032 x 40mm Solid Core Anti-Bandit Security Doors Solely supplied by “Chubb” or “Bitcon” Industries” or other approved as a complete unit with all fittings and ironmongery, steel lined 250mm x 500mm viewing panel, glazed with +/- 40mm bullet proof glass in steel frame. Height above floor level +/- 1,5m to centre of viewing window. Rev 7
- Steel lining for doors is to be epoxy laminated to inside of door and around edges. Internal steel lining to be primed and finished with approved epoxy paint. External face of doors to be finished in veneer or hard board as per standard preambles ready for painting. **Doors to be hung to open inward** on special galvanized steel door frames with lugs pre welded to frame to fit every third course of brickwork. The complete frame is to be hot dip galvanized and built into surrounding 230mm solid brick walls. **No welding to be done on site.**
- Hinges to be stainless steel ball type encased in spun casings.
- Frames to seclusion rooms for psychiatric patients are to be 6mm thick galvanized steel, supplied complete with doors as a unit opening inwards. Rev 2
- Robust lockset to the outside. Preferably secured to top, middle and bottom to safeguard against patient abuse.
- Pull handle on outside with no handles on the inside.
- In cases where Anti- Bandit doors are retro fitted in existing buildings, galvanized security door frame (76mm x 38mm x 3mm Rec-Tube with rebates) are bolted in position with solid core door complete with galvanized steel cladding on inside, masonite external finish ready for painting including 250mm x 500mm x +/- 40mm thick clear vision armour plate glass viewing panel. Pull handle on passage face to door and locking device. Rev 7

Seclusion Room and Psychiatric Facilities Windows:-

- All external windows to be galvanized steel frames of maximum width of 150mm sufficiently burglar proofed to prevent entry into or exit from rooms. Restricted opening of not more than 125mm.
- Internal windows / viewing panels to be glazed with 6mm polycarbonate reinforced glass panels (except seclusion rooms viewing panels)
- Burglar proofing to be built into walls externally and galvanised fine mesh welded to galvanised framework internally. Framework to be fitted between reveals of window, hinged at the bottom to allow for cleaning and repairing of glazing. A suitable locking system for the mesh is to be incorporated at the top of the frame.
- Window sills to slope internally.

Seclusion room Ceilings:-

- Minimum ceiling height of 3,5m from finished floor level Rev 6
- Lock up areas and seclusion rooms to be reinforced concrete slab in new installations.
- In seclusion rooms in existing buildings, ceilings and brandering shall be replaced with 6mm Aluminium Epoxy Powder Coated sheets and 75x50 brandering firmly secured to roofing timbers.

Seclusion Room Light Fittings:-

- Fluorescent vandal / flame proof light fittings with electronic ballast, fitted with high impact diffusers.
- Light controls to be positioned outside the room.
- Natural lighting to be used to the maximum.

Seclusion Room Fittings:-

- Tables and seats in dining / rest areas to be built 'in situ' face brick units with 32mm hardwood tops. Tops to be securely bolted down with all bolt holes pellated. Hardwood to be varnished with polyurethane varnish.
- Seclusion room bed to be bricked up platform 500mm high with reinforced concrete slab with rounded edges. Rev 3

BURGLAR RESISTING SAFES

- The safe must comply in all respects with the current edition of S.A.N.S. 751 - "Standard Specification for Burglar Resisting Safes". The type and class of safe shall be "Office Safe, Class I' as laid down in S.A.N.S. 751.
- Where the mass of each safe is 680 kg or less, provision must be made for securing it rigidly to prevent unauthorised removal. The means of securing shall be at least equal in effectiveness to that which would be provided by four 12 mm bolts. Locks shall be lever locks with a minimum of six levers in accordance with S.A.N.S. 751. The supplier shall forward keys for any safe (or safes) by registered post, direct to the Department and the supplier must clearly indicate the institution in which such safe (or safes) is being installed.
- A minimum number of three Hand Gun Safes to be bolted in position inside Guard Huts not in view of the general public. Size 280mm H x 370mm W x 200mm D. Mass 15 Kg with one key-lock. Rev 1

DISABLED PERSONS

- Consideration to be given to all types of disabilities.
- Provision must be made for easy access for disabled persons in accordance with NBR, S.A.N.S 10400 requirements.

- Provision must be made at all times for transporting wheelchair and disabled patients.
- For general purposes the gradient of any ramp should not be steeper than 1 in 15 (4½ º) with a minimum width of 1, 2 m for every 10m in length in compliance with S.A.N.S 10400 regulations. Rev 6
- Camber not to exceed 1:40
- The preferred maximum length of a general-purpose ramp is 10,00m. Where ramps have to be more than 10,00m long for any reason, a rest platform of 1,50m long is to be provided at 10,00m intervals. Rev 4
- A level platform 1,50m long should be provided at the top and bottom of any general-purpose ramp and at changes in direction.
- Ramps must be provided with handrails. The vertical dimension from ramp surface to top of handrail should be 900 mm.
- Ramps used frequently by wheelchair patients should be provided with an intermediate handrail 750 mm above the surface of the ramp. Where two rails are provided the upper rail maybe placed 960 or 990 mm above the surface of the ramp.
- Where ramps are provided specifically for wheelchair patients or patients' trolleys a non-slip lightly stippled surface is preferred to reduce friction and to enable the individual to climb the ramp with the minimum of effort. External ramps should be rendered non-slip by adding carborundum chippings to the granolithic finish. A grooved rubber tile or non-slip 2,5mm vinyl sheet is suitable for internal ramps.
- Special parking areas with mountable kerbs should be provided for wheelchair users with a minimum width of 3,5m and located not more than 50 metres from the entrance if possible Rev 1
- Entrance from roadway into OPD's and Accident Emergency area's where ambulances carry patients, kerb entrance to be full width of entrance area. Rev 6
- No step from one level to another to exceed 5mm. Rev 6
- If hot and cold water is used for the basin, the cold water tap to be closest to WC pan. Rev 7

FIRE PROTECTION AND NOTICES

- National Building Regulations and the SANS 10400:(ex. SABS 0400:1990) Code of Practice for the Application of the National Building Regulations
- The designer must obtain the approval of the Local authority during documentation. Records to be obtained of approvals etc.
- All necessary signage is to be provided and to comply with SANS1186 and SANS 10400.
- Fire extinguishers and fire hose reels must be clearly indicated in buildings by means of 300mm x 300mm signs in accordance with the SANS and OHSA regulations. Signs to be fixed approximately 2, 500mm above floor level and must be visible from all angles.
- Fire extinguisher handles height to be positioned at 1,500mm above floor and shall be installed with a timber backing plate. Rev 1
- It is recommended that fire extinguishers should not exceed 4,5Kg in weight for ease of handling. Rev 2

FLOOR PLANS

Patient treatment areas dimensions of any room or space shall conform to the requirements as stated in R158.
No habitable room shall have a clear floor space of less than 6 square meters.
The following office norms are in compliance with the norms as gazetted on the 2nd September 2005.

Table shows basic office work spaces minimum/maximum assignable office areas. See gazette for added allowances (committee room executive, interview room admin for example).

Executive Management	Hospital CEO Level 13 and above	=	20 - 25m²
Senior Management	Hospital Manager Level 11-12	=	16 - 20m²
Managers, Doctors, Ward Sisters	Level 9-10	=	10 – 16 m²
Administration	Below Level 9	=	6 – 10 m²

Open Plan Offices

Administrative personnel (per staff member)	8 square meters
Typist/data typists or other members (also Administrative) where only a small space is Required	6 square meters

Rev 4

HEIGHTS ABOVE FLOOR LEVEL

- The clear finished floor to ceiling height for health facilities is to be a minimum of 3, 0 meters with Residential units to be clear finished floor to ceiling of 2,6 meters and in accordance with the NBR. Rev 2
- Any additional height specified in these regulations shall be the vertical dimension from the top of the finished floor to the underside of the ceiling.
- The height for Theatres is to be a minimum of 3.5meters. Rev 3
- Height from floor to underside of surface mounted Lamina Flow in Theatres to be a minimum of 3. 0 metres. Rev 2
- No beams shall be below 2,1m from finished floor level. Rev 1
- Shower roses set from unfinished floor level to outlet in wall at minimum of 2,1m. Rev 6

CORRIDORS

- All corridors where patients are being transported shall have a minimum unobstructed width of 2,3m.
- Any fixtures such as bump-rails, cupboards, etc. shall be regarded as wall or part of the wall.
- All other corridor widths to comply with NBR.

SIGNAGE

Must comply with Occupational Health and Safety Act 85 of 1993.

- The signage system must comply with the primary function of directing the visitor / patient to the areas / departments / wards / rooms, which are their normal destinations, and to indicate the exits clearly.
- Institutional signage at entrances to premises to be as per detailed drawing.
- All signage to be provided in English and Zulu. District office to co-ordinate the correct wording before manufacture commences. Rev 7
- All restricted access rooms or areas must be clearly indicated by appropriate signs.
- 40 x 50mm High Perspex numeral or alphabet door number
- 150 x 150mm High Perspex female, male or paraplegic pictogram door sign
- 300 x 62mm High Perspex door sign to be placed on doors not lower than 1,2m and higher than 1,5m.(Room designation) Rev 6
- Double sided Perspex information sign suspended from ceiling grids with brass chains. Minimum of 2,1m above finished floor level.
- Etched aluminium wall mounted information sign or reverse engraved Perspex signs. Size determined on site. Rev 5

- Lettering on 5mm thick reverse cut out Perspex with Arial or other approved screwed to wall or suspended from ceiling. Colour to institutions colour scheme.
- 1,2mm Thick galvanised steel epoxy coated panels with 20mm bent on either side, single sided directional and information signage with self-adhesive vinyl lettering with Arial fixed to No. 2 x 75mm diameter epoxy coated posts.
- Bed number and patient / doctor card holder size 255mm x 255mm formed of removable clear Perspex cover to hold A5 card on 4mm thick back plate and reverse cut out vinyl lettering.
- Embossed removable infill panel lettering with curved aluminium frame plugged and screwed to wall. Signage as "Vista" or other approved. Rev 1
- Key tag holders 35mm diameter x 5mm thick Perspex punched for and including retainer and engraved with designated room number.
- All fire / emergency exit doors shall have illuminated safety exit signs and shall be on emergency power and own battery backup or phosphorescent signs. Rev 3
- All signage to comply with SANS 10400-S:2011 part 4. Rev 7
- Signage to all rooms to be positioned on doors between 1,4m to 1,7m above floor level in compliance with SANS 10400-S:2011 part 4.2.4. Rev 7
- Laminated and framed copies of operating procedures, wiring diagrams, zone diagrams and plant schematics as applicable are to be fixed to the wall in a well illuminated and accessible area.
- Laminated and framed block floor plan copies of institution floor plan showing fire escape routes. Rev 7

KITCHEN REQUIREMENTS

General comment – quantity and type of equipment must be determined based on the number of meals required and the plating procedures

Canopies – Refer to the Kwazulu Natal Department of Health's Standard Mechanical Document

Equipment – Refer to Kwazulu Natal Department of Health's Standard Mechanical Document

- Canopies: These should extend 300 mm beyond front edge of cooking equipment.
- Drainage: Floor drains and discharge pipes under floor to be Grade 304 stainless steel with removable drainage grids and 100 mm diameter trapped outlets to be provided in kitchens adjacent to cooking utensils and equipment of a similar nature.
- Elsewhere 100 mm diameter trapped outlets with approved hopper heads and stainless steel grids to be provided in approved positions for floor washing purposes. Provide trolley storage and wash up areas.
- Sink and basin wastes are to be connected directly to the sewer system via a Grease Trap gulley and are not to discharge into open floor channels.
- Provide suitable Grade 304 stainless steel floor drain complete with slotted stainless steel cover grid.
- Internal screen walls to preparation areas to extend 1, 2 metres overall above floor level, provide half-round coping to these walls.
- One supervisor's office of approximately 3m x 3m is required in each kitchen.
- Splash-backs: Stainless steel splash-backs 150 mm high to be provided to all work tops. Work tops to be positioned 100mm away from wall face.
- Wall finishes to be tiled according to Departmental standard tile specifications. Provide Grade 304 3mm x 76mm x 76mm x 1.2m high stainless steel protection angles to all exposed corners with S/Steel +/- 30mm long fixing countersunk screws. Rev 7
- All kitchen work tops to be cantilevered off walls for ease of cleaning

LAUNDRY FACILITY

- This will be determined by each institutions needs assessment and shall be in compliance with the policy document for the Design of Mechanical / Electrical Installations.
- The designer must consult institutional management with regards to onsite laundry requirements. Rev 3
- Laundry facilities to be discussed with Department of Health Head Office during the planning phase.

MEDICAL WASTE HOLDING AREA

- A well ventilated, bricked constructed holding facility with solid roof and non-slip concrete floor must be provided at all health facilities.
- The room must be vermin proof and be provided with a trapped drainage outlet connected to sewer system including cold water supply standpipe with hose.
- Stainless steel basin in Medical Waste court yard outside door. Electrical waterproof socket outlet at 1,4m above floor level in store for deep freeze.
- Unauthorised person and Hazard warning signage to be provided.
- Lockable vermin proofed gate of minimum width 900mm to be fitted to entrance. Rev 1
- Medical Waste storage area's to be as follows.
    - Regional Hospitals 20 – 36m 2
    - District Hospitals 14 – 24m2
    - Community Health Centres 9 – 15m2
    - Clinics 5 – 15m2 Rev 7

REFUSE HOLDING AREA

- A well ventilated, bricked constructed holding facility with solid roof and non-slip concrete floor must be provided at all residential complex units.
- The room must be vermin proof and be provided with a trapped drainage outlet connected to sewer system including cold water supply standpipe with hose.
- Lockable vermin proofed gate of minimum width 900mm to be fitted to entrance. Rev 1

STORM WATER DRAINAGE

Storm water drainage systems on all new services should be designed to cater for average rainfall in the particular area.

BULK STORES – DIVISION WALLS

Must be compartmentalised for specific commodities.

X-RAY SUITE

Planning of new and alterations to existing facilities to be done in consultation with Radiology Division at Wentworth Hospital (Health Technology Unit HTU). Rev 3

GENERAL FINISHES

WALLS/ BRICKWORK

Foundation brickwork to be hard burnt NFX type. Rev 4

- Super Structure if not face brick to be NFP type. Rev 4
- Face bricks to conform to FBX quality Rev 4
- All brickwork around an X-Ray room to be 220mm solid brick work or plastered with 15mm barium if hollow bricks are used. Rev 5

- All internal surfaces to patient treatment areas to be plastered and painted. No face brick or stippled wall finish permitted due to infection control. Rev 4
- Inside walls must be covered with a smooth finish and must be painted with a durable washable acrylic paint or covered with an approved ceramic tile.
- Where chasing has occurred in plaster, the wall is to be skimmed feathering to existing surface.
- All brickwork to septic tanks to be manhole bond (water bond) method grouted up. No straight joints will be permitted. Rev 5

WALL FINISHES

Vinyl sheet wall cladding material is not permitted.

- In non- patient treatment areas, the wall behind wash hand basins shall be tiled from two courses below the unit to a height of at least 400 mm above unit, (2 rows) and a distance of at least 150 mm on each side of such fitting. No tiles are to be dressed onto a wash basin fitting. Rev 7
- Glazed tiles to be 1st Grade 200mm x 200mm matt white with PVC edge trim where specified. Rev 7
- Shower cubicles, ablutions and Main Kitchens to be tiled to ceiling height.
- Where medical basins are used in place of Hygia basins a 610mm wide x 600mm long x 1,2mm thick stainless steel panel epoxied and stainless steel screws with chromed domed heads screwed to wall with anti-bacterial silicone sealant between surfaces, basin and panel. Panel to be 400mm above basin with elbow action taps protruding through and minimum of 150mm either side. Rev 7
- All universal undercoats are to comply with SANS 681:1997 in all respects.
- All emulsion paints are to comply with the requirements of SANS 1586:1995 Grade 1.
- All eggshell enamels are to comply with the requirements of S.A.N.S 515: of 1972 in all respects.
- All walls in patient treatment areas to be painted with a polyurethane type wash n' wear paint in compliance with SANS specifications. Rev 7
- External paint finishes are to be good quality exterior quality washable paints. Rev 7

SKIRTINGS

- Splayed and coved cement skirting is to be avoided.
- In all patient treatment areas PVC skirting to be hospital type MFE 5 or MC18C welded to floor vinyl sheeting. Rev 2
- 70mmx19mm varnished and stained to uniform colour hardwood timber to Office and Staff accommodation where carpeting is used. Rev 4
- Half ceramic or porcelain tile skirting when tiled surfaces are specified as well as around cupboard basis. Rev 6
- PVC skirting is to be taken around all fixed floor unit plinths and welded to the floor sheeting. Rev 1
- 80mm Aluminium skirting glued to partitioning. Rev4

BUMPER RAILS

- 300x 30mm wall protection bumper rails shall be varnished laminated hard wood (no particle board) secured to walls with brass screws and silicon sealant between wall and rail for the entire length of both bottom and top. Rev 3
- Bumper rail behind all beds in Wards +/- 1,000m long x 600mm wide solid timber where required. (Due to bed heights been adjustable.) Rev 6
- Bumper Rail height from finished floor to centre of bumper rail = 850mm. Rev 1
- 300mm x1,6mm thick Grade 304 stainless steel bumper rails epoxied and screwed to walls with stainless screws +/- 30mm long. Rev 7

CORNER WALL PROTECTION

76 x 76 x 1.6mm thick x 1200mm high grade 304 stainless steel corner protection plates with +/- 30mm long stainless steel countersunk screws or glued with epoxy to all exposed corners and silicon sealant for the entire length all sides. Rev 1

TRANSITION STRIPS

- Aluminium transition sloping Tile-In ramp as “Kirk” or “Vexcolt” at junction between vinyl sheeting and ceramic / porcelain tiles.` Rev 2
- Aluminium transition threshold covers between different floor materials plugged and screwed to floor. Rev 4

FLOORING

- The floors of all rooms and corridors shall be of concrete, finished to a smooth surface ready to receive specified finish.
- All granolithic floor finishes where specified with skirtings are to remain untinted. Grano to be tested by recognized Laboratory. Rev 4
- Recessed inside entrance mats with brass frame at main entrances into a health facility as “Belgotex” “Grimebuster” or other approved. The mat must have a minimum size of 2m in length and be as wide as the entrance. Rev 6
- Structural Movement joints to be as “Migua” FV35/1500 or “Kirk” ASSJ390H with hospital insert bolted to slab before screeding for high traffic areas. Rev 2
- Aluminium movement joints for low traffic areas for vinyl and tiles with hospital insert. Rev 2
- In patient care area’s, no perforations to floor covering is to be made. Eg door stops, door floor keeps etc. Rev 2

FLOOR SCREED

It is recommended that in new structures the screeding should be as specified by “Tal” using “Screedmaster”, the pumped method. Application of “Screedmaster” must be done by a “Tal” approved contractor. Rev 3

FLOOR LAYING PROCEDURES

Floor laying procedures must be in accordance with the Standard Preambles to all trades. Floor laying must only be undertaken by a manufactures approved installer and the floor screeds approved by the flooring manufacturer. Rev 3

The floor substrate must be inspected and confirmed in writing ready for application by the flooring manufacturer.

Floor laying must comply with the floor laying procedures Rev 3

FLOOR COVERINGS

The following floor coverings shall be as specified or other approved and used in the designated areas as specified below. Samples to be pre-approved.
Rev 7

- 920 g/sq m – 980 g/sq m sheet carpet in administration area’s to be corporate colours, Belgotex and Van Dyk colours. Nile Blue / Cirrus for offices and Azure / Cobolt Blue for passages. Rev 7
- All grouting of floor tiles to be finished flush pointed to tile edges. Rev 7

	300 x 300x 8,3 - 8,5 full bodied Porcelain Tiles in compliance with UPEC specifications with joints varying from 3mm -5mm (Colour to be uniform light colour Salt and Pepper range)	**Ceramic Tiles Johnson Granito GN 573 (330mm x 330mm)**	**Homogeneous Fully flexible Vinyl Sheeting 2,5mm thick**	**Polypropylene Sheet Carpet 'Fibre Weight " 920g/m² - 980g/m²**	**300 x 300x 8,3 - 8,5 full bodied Porcelain Slip Resistant tiles with joints varying from 3mm -5mm or Industrial Vinyl Sheeting 3,0mm thick**	**300 x 300x 8,3 - 8,5 full bodied Porcelain Slip Resistant tiles minimum certification rating of R10/R11 with joints varying from 3mm -5mm (Colours to be uniform Salt and Pepper range)**	**Granolithic Finish**	**4mm Epoxy Seamless Slip Resistant or 4mm matt polyurethane floor finish.**
All Patient Treatment Areas			X					
Patient Ablution Areas	X							
Sluice Rooms/Dirty Utility	X							
Store Rooms In Health Institutions			X					
All Staff Facilities in Health institutions (Kitchens & Ablutions)	X							
Main Kitchen	X							
Administrative Office areas			X	X				
Staff Accommodation		X						
Bulk Stores							X	
Laundries	X (Dry area's)					X (Wet area's)		
External corridors and ramps						X		
Internal ramps					X			
Mortuaries								6mm X
Seclusion Rooms								4mm X
Clinic Corridors	X							X
Pharmacy Store and general work area's. (Not offices)								X
Showers if necessary								X

PATIENT TREATMENT SHOWER FLOORS

- 900 x 900mm x 88mm deep Grade 304 stainless steel shower tray. Rev 1
- Where standard size for shower tray cannot be accommodated apply 4mm slip resistant epoxy graded fall to outlet. Rev 6

RESIDENTIAL SHOWER FLOORS

- Minimum of 800 x 800 x 88mm deep Grade 304 stainless steel shower tray Rev 2
- Mosaic floor tiles where standard size for shower tray cannot be accommodated. Rev 6

PARTITIONING -

- **Patient area's if unavoidable –** If 12mm Plaster Board tapered edge dry wall partitioning is to be used, the base is to be sealed with sound insulation under the floor track for infection control with cavity batt insulation. All butt joints on plaster board to be covered with 50mm fibre tape and made good with quick dry skimming compound ready for painting. Rev 7
- Finish to be painted with a good quality acrylic paint. Recommend a fine stipple coat in an office environment in well-lit area's to avoid seeing skimming of junctions. Rev 7
- Insulation in cavities to conform to Class 1 fire index with a minimum of 50mm thick.
- Studding and tracks for partitioning to be galvanized steel and wall thickness to be 76mm finished product. All 90 degree open corners to be finished with 90 degree galvanized wall angle and made good with quick drying skimming compound. Rev 7
- Stainless steel stile Anchors to be used when using "Vitraflex" partitioning in ablution facilities or other approved "Solid Core" material with formica finish and framework. Rev 4

DOOR FRAMES

- All door frames to be 1,6mm thick with mitred top corners, joints seam welded supplied with corner stiffeners in the reveals on the inside. Rev 4
- 1,6mm thick Grade 304 stainless steel frames to all new Health Facilities. eg Hospitals, CHC and clinic's excluding ancillary buildings. Rev 7
- In areas in CHC's and Hospitals where trolleys will be used and entrances to wards, 1,6mm thick door frames to be splayed type with the rebate protecting the door edges. Rev 7
- Rebates in frames to be +/- 45mm where required to accommodate the door thickness and the stainless steel plates and returns. Rev 7
- Residential units doorframes to be mild steel hot dipped galvanised (Architectural finish) 1,6mm thick double rebated conforming to SANS121, SABS and ISO 1461. SANS for galvanizing. Certificate for galvanizing to be requested for control purposes. Rev 7
- Alterations to existing facilities, (not individual blocks) all frames to be 1,6mm thick, have mitred top corners seam welded supplied with corner stiffeners in the reveals on the inside. The profile of the new frame to match the existing frame. Rev 4
- Service ducts, fire hose reel cupboards and electrical cupboard / duct frames can be timber. Rev 3
- Stainless steel hinges for stainless steel frames and brass for all other frames. Rev 4

- Frames to be checked out to accommodate hinges with back plate. Hinges are not to be welded to frames. Rev 4
- Extended broad Butt brass hinges are preferred to Parliament hinges to external outward opening double swing doors.
- All doors to be hung on three hinges with the top two hinges been +/-300mm spaced apart from each other. Rev 4
- Door locksets to be set at 1,2m above floor level. Frame checked out accordingly with chrome adjustable striker plates screwed in position. Rev 4
- Door handle lockset check out in frames for fire escapes and paraplegic entrance doors to be at 1m from finished floor. Rev 7
- Backs of all galvanized and standard oxide primed metal door frames to be painted with bituminous paint. Rev 7

DOORS

- All doors shall be solid core timber. Rev 3
- Plant room doors shall be galvanised mild steel. Rev 3
- Record room doors shall be purpose made. Rev 5
- Double doors with one way swing to have rebated meeting stiles. Rev 3
- In-patient treatment areas where double swing doors are required, the meeting stiles are to be bull nosed wrapped with stainless steel cladding around.
- Use of folding type doors is to be avoided.
- Sliding doors with heavy duty sliding mechanism can be used in areas where space is of a premium. Rev 3
- Access control doors are to be provided in special cases – e.g. Entrances to Neonatal / Specialized Wards and Main Entrances into Hospitals.
- Hollow core doors are not to be used in any circumstances.
- Doors to wards must be a minimum of 1,350 m clear hung in two leaves. (One and a half doors.) One leaf is to be hung so as to screen the patient in the open position.
- All doors to patient treatment areas are to be a minimum clear width of 1,000mm cladded with Grade 304 stainless steel lining to be 1,2mm thick x 1,1m high generally, to entrance face, returning on lock side of door. Rev 7
- All linings, kick and push plates to doors are to be Grade 304, 1,2mm thick stainless steel. Rev 3
- Linings are to be glued to door face with Epoxy Adhesive or screwed with countersunk stainless steel screws +/- 20mm long screwed along the edges at 150mm c/c.
- Push plates to be 350mm long x 150mm wide fixed to both sides of door.
- All fire escape route doors and server room doors to be solid core with a minimum of 2 hour Fire Rating. Rev 3
- Where framed ledged and braced doors are specified, braces to be fitted falling from lockset side down to hinge side. Rev2
- Service duct doors to suit the size of service ducts. Rev 3
- Sliding doors to X-Ray rooms to 2,0m x 2,1m high hung on approved heavy duty hanger with timber pelmet over mechanism. Door to be lead lined and cladded with grade 304 stainless steel x 1,2mm thick cladding around edges, returned on inside to a height of 1,1m from lower edge. Door to overlap opening reveals of 100mm on each side.

- Sliding doors for Theatre doors in District hospitals to be manually operated with Theatre doors in Regional Hospitals Electrically operated. Rev 4
- No glazing is to be installed in any door or curtain walling below lock rail or 1,2m from finished floor level. The use of aluminium panels to be used. Rev 5

GALVANISED STEEL DOORS

All plant room doors to be hot dipped galvanised louvered doors either single or double as per departmental type drawing No 3025H/02 conforming to SANS 121, SABS and ISO 1461 specifications for galvanizing.

DOOR TYPES

Fitted At	Size	Locks, barrel bolts, floor springs & hinges	Handles	Door Stops	Cladding (Grade 304 s/steel)
Main Hospital Entrance	1800 x 2032 x 40 with safety glazing viewing panel or Glazed Aluminium	Dead Lock with escutcheons, flush bolts to one leaf at the top only, 1 pair double action transom closure with shoe strap	2 pairs of pull handles	Floor mounted door holder satin chrome finish.	Kick and push plates if required
Hospital Passages	1800 x 2032 x 40 with safety glazing viewing panel	Dead Lock with escutcheons, flush bolts to one leaf at the top only, 1 pair double action transom closure with shoe strap	Push plates	Floor mounted door holder satin chrome finish.	Kick and push plates
` Main Ward Block :- Entrance	1800 x 2032 x 40 double swing with 300 x 300 with safety glazing viewing panels mounted 1,5m above floor	Dead Lock with escutcheons, flush bolts to one leaf at the top only, 1 pair double action transom closure with shoe strap, 90 degree hold open	Hospital pull handles to 900 leaf	Floor mounted door holder satin chrome finish to one leaf only.	Stainless steel Cladding
Ward Entrance	1350 (900 + 450) x 2032 x 40 with safety glazing viewing panel	3 pairs of butt hinges, flush bolts to the 450mm leaf at the top only,	Hospital pull handles to 900 leaf	Foot operated door holder	Stainless steel Cladding
Ward Kitchen	1350 (900+ 450) x 2032 x 40 with safety glazing viewing panel	3 pairs butt hinges Dead lock and roller bolt latch 200mm flush bolt to top	Hospital pull handles to 900 leaf and push plates	Foot operated door holder	Stainless steel Cladding

		of 450mm leaf only 3 pairs of butt hinges Dead lock and roller bolt latch			
Sluice / Utility Rooms	813 x 2032 x 40	Dead lock and roller bolt latch 1 1/2 pairs of butt hinges	Approved pull handles and push plates	Wall mounted door stop	Stainless steel Cladding Stainless steel Cladding
Patient Ablution Lobby entrance	813 x 2032 x 40	1 1/2 pairs of butt hinges. Push and pull with door closure	Approved pull handles	Wall mounted door stop	
Toilet & Change Room doors	813 x 1960 x 40	1 pair rising butts, stand closed, Indicator bolts	Approved pull handles	Rubber buffer hat and coat hook	
Store, Linen Rooms	813 x 2032 x 40	1½ pairs butt hinges Dead lock and roller bolt latch	Approved pull handles and push plates	Wall mounted stop	
Counselling, Consulting, Rest Rooms, Duty Rooms and Offices	1000 x 2032 x 40 813 x 2032 x 40	1½ pairs butt hinges. Deadlock, push and pull, thumb turn cylinder	Approved pull handles and push plates	Wall mounted stop	Stainless steel Cladding Stainless steel Cladding
Theatre into Passage	1800 x 2032 x 40 sliding with 300 x 300 viewing with safety glazing panels	Non censored Electrically operated with manual over ride switch in Regional	2 pairs of recessed pull handles – Back to back		Stainless steel Cladding all around to 1,1m high

	mounted 1,5m above floor	Hospitals. District hospital manually operated.			
Theatre Suites	1500 x 2032 x 40 double swing	Dead Lock with escutcheons, flush bolts to one leaf at the top only, 1 double action transom closure with shoe strap, 90 degree hold open.	Hospital pull handles	Wall mounted	Stainless steel Cladding all around to 1,1m high
Scrub Room into Theatre	1000 x 2032 x 40 with safety glazing viewing panel	Double action transom closure with shoe strap	No Pull Handles to be fitted. Push plates	Wall mounted	Stainless steel Cladding all round to 1,1m high
Induction and Tray Setting Rooms into Theatre	1500 x 2032 x 40 sliding		Flush pull handles		Stainless steel cladding to 1,1m high
Doctor's Change Rooms	813 x 2032 x40	½ pairs butt hinges. Deadlock, push and pull, thumb turn cylinder	Approved pull handles and push plates door closure	Floor mounted	Stainless steel cladding to 1,1m high
X-Ray Department - Outer door	1800 x 2032 x 40 with 2mm lead sandwiched between. Concealed edges	Heavy duty sliding door gear. Chromed Lockable heavy duty hasp and staple.	Recessed pull handle or other as specified	Rubber buffer in rail	Stainless steel Cladding to 1,1m high
- Inner door	813 x 2032 x 40	1½ pairs of butt hinges Dead lock and roller bolt latch	Approved pull handles and push plates	Wall mounted	Stainless steel cladding to 1,1m high
- Diagnostic Rooms	813 x 2032 x 40	1½ pairs of butt hinges Dead lock and roller	Approved pull handles and push plates	Wall Mounted	

		bolt latch			
Occupational & Physio Therapy	1500 x 2032 x 40 double swing with safety glazing viewing panel	Dead lock and roller bolt latch with a flush of bolt to one leaf. 1 pair transom closure and shoe	Approved pull handles and push plates	90° hold open door closure on inside	Stainless steel cladding to 1,1m high
Casualty & Outpatients	1500 x 2032 x 40 double swing with safety glazing viewing panel	Dead lock and roller bolt latch with a flush of bolt to one leaf. 1 pair transom closure and shoe	Approved pull handles and push plates	90° hold open door closure on inside	Stainless steel cladding to 1,1m high
Pharmacy: - Main entrance Bulk Stores	1000 x 2032 x 40mm solid with burglar proofing. 2.5mtr x 3mtr high Roll – up galvanized steel shutter door with chain operated on inside where wicker gate is provided.	1½ pairs butt hinges, Five lever deadlock. Approved locking device to burglar proofing. Door closer. Approved additional locking device to base of roller shutter door.	Approved pull handles and push plates	Wall mounted	
Dispensary Dispensary serving hatches	1000 x 2032 x 40 Light weight +/- 750mm wide x 900mm Roll-up epoxy powder coated steel shutter door over vertical sliding window.	1½ pairs butt hinges Dead lock with security knob cylinder on inside and roller bolt latch	Approved pull handles and push plates	Wall mounted	

Main Kitchens	1800 x 2032 x 40 double swing with 300 x 300 with safety glazing viewing panels mounted 1,5m above floor	Dead lock and roller bolt latch with a flush bolt to one leaf. 1 pair transom closure and shoe.	2 pairs of pull handles – Back to back	Stand open 90° check on inside	Stainless steel cladding all around to 1,1m high
Residential, Nurses Homes, Doctors on Call and Mothers Lodgers Bedrooms	813 x 2032 x40	1½ pairs of butt hinges Dead lock with knob on inside and roller bolt latch	Approved pull handles	Wall mounted	
En-suite Ward Ablutions	813 x 2032 x40	1½ pairs of butt hinges Dead lock with knob on inside and roller bolt latch. Door closure	Approved pull handles	Wall mounted	
UPS / Data / Telkom server rooms.	900 x 2032 x40	1 1/2 pairs of butt hinges.		Wall mounted	
Fire escapes	900 x 2032 x 40 1800 x 2032 x 40	Opening outwards. Touch bar panic latch for single or double. Door closure for outward opening door.	Push plate.		
Plant Rooms, Electrical Ducts and LV and HV Rooms	Size to suit	1½ pairs of butt hinges Dead lock for HA1 key and roller bolt latch	Approved pull handles	Heavy duty Cabin Hook and eye where required fixed to 100mm x 100mm hard wood varnished	
Paraplegic Toilet door	1000 x 2032 x 40	1½ pairs of butt hinges with facility indicator bolt and roller bolt latch.	Pull handle on external door face and one on internal face 200mm from hinge edge		Stainless steel cladding all around to 1,1m high

Rev 5

GENERAL IRONMONGERY

Refer to the Kwazulu Natal Department of Health Standard Preambles to all Trades. Surface finishes should be restricted to polished chrome or satin chrome on all approved ironmongery for external and internal doors – unless otherwise stated. Where surface mounted door closers are used on doors opening into a corner, a 76 mm nib is to be allowed. (Door closers mounted inside). Mortise type door closers do not require a nib, but should have a minimum 150 mm top rail. Toilet doors must be fitted with indicator bolts.

LOCKS

- Dead Locks to be minimum of three-lever type unless otherwise specified. External doors are to be fitted with 5 lever deadlock. Rev 7
- Main ward block entrance door shall be fitted with deadlock, roller bolt and pull handles. Rev 5
- Internal ward and ablution entrance doors shall not be fitted with locks sets. Roller bolt latch to be used and pull handles. Rev 6
- Plant room and service duct doors at each institution to be keyed alike with type HA1 locks.
- Master Keying is not allowed in any institution.
- Cupboards in common Kitchens that are used by all staff are not to be provided with locks.
- Cupboard Locks: - All locks where used to be solid CP brass barrel type cupboard locks.
- All built in cupboard doors with locks in a Nurse's Home bedroom are to be keyed alike.
- Oval cylinder dead lock as "Union" L-2153-40 and escutcheons with Cranked pull handle as "Union" AL5512-300FL and escutcheons to high traffic entrance and exit doors or other approved. Rev 4
- Mag locks to be set and secured to the inside of a rectangular tube which is to be the full width of door opening. Tube to be bolted to transom or under top of frame and screwed to frame styles. Rev 7

LOCKSET

Preferred ironmongery for office environment in any health facility is:-
Lockset as deadlock, push and pull and roller ball catch.
Deadlock, push and pull, thumb turn cylinder inside including escutchsions and keeps. Rev 7

JOINERY

- Doors, drawer fronts and cupboard carcases to be constructed out of 16mm Melamine faced "V313" moisture resistant particle board (Identifiable by green in colour) with 2mm high impact edging or 16 x 10mm hard wood edging. Rev 7
- "Supa Wood" is only permitted for internal shelving, and not for cupboard construction or in exposed external surfaces in any Health facility.
- No cupboards under sinks. Provide open slatted rails under.
- Worktops in general to be 32mm solid post formed Formica on "V313 (HMR)" (High Moisture Resistant) particle board in non-moisture areas.
- Worktops against sinks can be "Rustenburg" Black granite slab with silicone sealant at all joints or Solid Surfacing worktops as in "Surinno, Corrian or Caesar Stone" in high moisture usage area's adjacent to sinks and Laboratory worktops if stainless steel is not used. Rev 4
- Preferred wardrobe cupboard doors in Nurses' Home bedrooms to be sliding door type.

SHELVING

- Epoxy powder coated sheet metal adjustable shelving free standing units or pine lacquer finished Modular Timber Shelving to be provided in storerooms. Floor standing shelving units are to include a base shelf. Rev 4
- With metal units, corner support post feet to be fitted with PVC covers to protect the floor coverings.
- In linen storage rooms, slatted wooden shelving is to be provided varnished.
- Width of shelving will be determined during documentation to meet the specific storage requirements. (All shelving must be securely braced).
- All shelving in Pharmacy's to be epoxy powder coated sheet metal adjustable free standing units.
- Theatre and CSSD's shelving to be Grade 304, minimum of 1,2mm thick stainless steel with stainless steel connectors, bolts, support framework, screws etc. Rev 5
- Shelving in CSSD Sterile Store to be slatted type bars of grade 304 stainless steel minimum of 1,2mm thick stainless steel. Rev 5
- The use of epoxy metal slotted wall bands and cantilevered brackets to be avoided in all storage area's. Rev 5

WINDOWS AND BURGLAR PROOFING

- Anodised or epoxy powder coating conforming to Class 2, 25 year guarantee, 60-80 µm dry-film thickness and SANS 1796 certified applicator. Window Sample to be provided. Any supplier / manufacturer / subcontractor shall be registered with AAAMSA (Association of Architectural Aluminium Manufacturers of South Africa).
- S.A.N.S approved UPVC windows with galvanized metal core can be specified. Rev 7
- Sills of all staircase windows must be not less than 1 m above floor level or landings, especially in Nurses' homes and public areas.
- Where windows exist that are less than 1m off floors, safety glass must be used in areas below 1,2m high and where there is a possibility of persons falling down staircases at landing level.
- Provision is to be made for external cleaning of windows.
- Suitable secured access to flat roofs.
- In general all ground floor facilities must be burglar proofed. Specification must be approved prior to installation.
- In multi-storey buildings, all windows in patient treatment areas to be burglar proofed or openings of top hung sashes to be fitted with restriction stays with maximum opening of 35 degrees.
- In areas where access can be gained to higher levels via flat roofs or adjoining roofs these windows / doors are to be burglar proofed.
- Vertical Blinds are the preferred covering to windows.
- Retractable PVC mesh Mosquito screens are to be provided to all opening window sections in Malaria risk areas. Rev 3
- All glazing to patient treatment area's to be obscure glass up to +/- 1,5m from inside finished floor level or to nearest glazing bar / transom. Rev 7

SILLS AND FASCIAS

- Wherever practicable, the standard type of dark fibre cement sills unfinished should be installed internally. Discretion must be exercised in the use of Fibre cement coloured sills externally because of their liability to fade.
- Wherever practicable and particularly in damp, humid areas, the use of Fibre cement fascias and bargeboards is recommended.
- Recommended that Fibre cement fascias and bargeboards are not being painted.

- Brick on edge sills must be used in face brick buildings.

CEILINGS

- **Plasterboard Ceilings**

Truss or Rafter suspension

- 7mm Plasterboard where specified internally with 75mm Cove cornice and minimum of 4mm fibre cement board externally and to ablution facilities. All sheeting to be fixed at right angles to 49 x 19 x
- 0.5mm Furring channels at no greater than 400mm centres or 38 x 50mm brandering at no greater than 400mm centres. Fixing of sheeting must be at no greater than 150mm apart. Cover strips to be powder coated metal "H" section..

Concrete suspension

- 7mm Plasterboard where specified internally with 75mm Cove cornice and minimum of 4mm fibre cement board externally and to ablution facilities. All sheeting to be fixed to Fire rated concealed tee grid system consisting of 38 x 40 x 0.35mm Main tees and perpendicular cross tees at 300mm centres. Fixing of sheeting must be at no greater than 150mm apart. Hangers for concealed tee system are to be 25 x 25 x 0.8mm thick galvanised angles, fixed to concrete by means of 6 x 30mm express nails and washers.

Exposed Grid ceilings

Suspended ceilings

- Suspended ceiling panels in all installations are to be 1200 x 600 x6mm Calcium Silicate vinyl finish with 25mm Fire retardant polystyrene insulation backing glued on or 1200 x 600 x 6mm fibre cement vinyl finished, embossed or painted with 25mm high density polystyrene insulation backing glued on.
- Ceilings and support framework are to comply with Part T of the national building regulations with tiles in compliance with Surface Fire Index Test : SANS 10177 Part 3 Class 1 and SANS 428 overall classification Class B/B1/2.
- Hangers for suspended ceilings are to be 19mm wide by 0.5mm thick galvanised strapping, strapped and secured to tie beams by means of 32mm grabber screws or fixed to concrete soffits by means of 6 x 30mm express nails and washers. All tee sections and wall trimmings to be of galvanised metal powder coated to specified colour. Grid Tee system to consist of 38 x 24 x 0.35mm Fire rated Main and Cross tees. Main tee suspended at 1200mm centres and Cross tees to be fitted at 600mm centres, at right angles to main tees. Room perimeter to be finished with 20 x 20 x 20 x 20 x 0.5mm Shadowline Wall Trim fixed to wall by means of wall anchors at 450mm centres.
- Support T sections for light fittings to be secured at diagonal corners of fitting to roofing members or concrete soffits.
- Fittings to ceilings or hospital curtain track hangers are to be secured through suspended ceiling grid system and supported from roof truss tie beams or concrete slab.
- In new theatres, ceilings are to be plastered concrete.
- In the upgrading of existing theatres with plasterboard ceilings, these are to be skimmed with no visible joints or cornice.
- Pharmacy ceilings shall be fitted with burglar proofing in roof space, or concrete slab to new facilities.
- 900 x 600mm prefabricated hinged trap doors in solid ceilings, installed in each fire zone area: I.e. between firewalls.
- Existing buildings to be fitted with an one hour fire brake on top of existing 230mm walls to underside of concrete slab or roof structure, consisting of 65 x 6.5 x 0.5mm Drywall tracks at wall top and roof or slab with 63.5 x 35 x 0.5mm

Drywall studs fixed vertically at 600mm centres with Wafertek screws. Fit 15mm Fire Guard board on both sides by means of 25mm Drywall screws at 230mm centres. Fire wall cavity to be lined internally with Ultimate U Thermo 6 , 50mm mineral fibre insulation board. System in compliance with SANS 10177 part 2-2005, with a minimum 60 minute fire rating. Rev 7

ROOFS

- Timber roof trusses to be supplied with relevant TR1 and TR2 certificates.
- Structural steelwork trusses are to be specifically designed and must also be supplied with relevant Engineers Design drawings and certificates. Rev 1
- Roof pitches for metal roof coverings to be a minimum of 10˚ and for Concrete Roof Tiles a minimum of 17½˚. In snowfall area's additional Design Criteria is required from a certificated Structural Engineer. Rev 1
- Flat roofs are not permitted.
- Simple and economically design principles must be followed for all roof structures.
- All valley's to have a minimum of 50mm wide between roof finish for ease of cleaning. Rev5
- No box gutters are allowed. Rev 4
- Roof lights must be avoided. Rev 4
- Sufficient gang planks and work platforms are to be provided in the roof space. Rev 3

ROOF COVERINGS

- The preferred roofing material is Secret fixing type galvanised sheeting with a "Chromodek" finish of specified colour to upper side.
- 0,58mm thick roof sheeting for purlins up to 1,2m c/c spacing and 0,8mm thick roof sheeting for purlins 1,2m to 1,7m c/c maximum spacing. Rev 1
- 0,53mm thick Zinculume coloured metal secret fix roofing sheets is required within 50 kilometres from the coast. Rev 7
- All other area's to be 0,58mm as "Global-Tech" corrosion protection.
- "Klip Lock 700" or "Craftlock" roof sheeting. Installed as per manufacturer's instructions. Rev 4

INSULATION

- "Sisalation" FR 405 or other approved insulation on 3.2mm galvanized straining wires or straining tape to be laid on truss under all metal roof sheeting and concrete tiles in any health facility.
- In residential units with Rhino board ceilings, "Aerolite" or 100mm "Isotherm" must be used above solid ceilings. (Not suspended type). Rev 5

GUTTERS, DOWNPIPES

- The preferred guttering is continuous extruded Aluminium with "Chromodek" finish with under gutter bracket. Rev 6
- Gutter brackets to be fixed through fibre cement fascia into tilting batten or purlin. If this is not achieved, brackets to be gutter bolted to fascia. Rev 6
- Additional under gutter brackets ± 750mm apart – are to be fitted in snow and hail areas.

PLUMBING

- All ceramic basins to general areas, sinks and wash troughs are to be supplied with overflows. Request for overflows in stainless steel fittings is to be made at time of order, as this is not a standard supply.

- Basins fitted to Wards, Counselling / Consulting Rooms (Patient treatment areas) to be vitreous china Hygia Basins with chrome plated bottle traps as Cobra 340. Height to be 950mm above floor level to rim.
- Flexitraps are not permitted as traps fitted to patient treatment basins. Rev 7

- All Medical basins shall be wall mounted for ease of cleaning floors positioned 950mm above floor finish. Rev7
- When Medical basins are used in lieu of Hygia basins, these are to be Sola 610 type installed to height of 950mm above floor level to rim. Rev7
- Elbow action taps of +/- 180mm long arms from spindle to lever edge in all area's. Rev7

- **Note that elbow action taps must be positioned at 45 degrees from back wall in the shut position and open inwards.** Rev 7

- The preferred type W/C suite to all areas except public ablutions and Paediatric toilets is "Vaal Aquasave" - or other approved.
- In Public ablutions the preferred W/C pans are to be "Marley" Gypsy Vandal Proof type.
- Paediatric ablutions are to have at least one Junior W/C suite and one low level basin and urinal.
- All Patient ablutions with multiple units in excess of three points in any one facility - i.e. W/C pans and wall mounted Urinals - to be provided with Odour extraction system similar to "Toilet Friend" or mechanical designed odour extraction exhaust systems for infection control as in "Hygizone". Rev 6
- External Visitor's toilets and Guard Hut wash hand basins to be fitted with "Pillar adjustable demand" taps KM2.102 type with cold water supply only. All non- medical wash basins to ablution area's, i.e. staff, residential and patient areas taps are to be adjustable "Pillar demand" taps KM2.102 type with hot and cold water supply in residential units only. Rev5

- Shower cubicles to be provided with extraction system for hot water vapour.
- Shower heads to be vandal resistant and of water saving type. Rev 3

- Provide Paraplegic ablution facilities as per National Building Regulations.
- If Flush Valves are used, these are to be "Flushmaster Junior" where there is insufficient water pressure.
- No drop - in sinks are permitted in post formed formica worktops. These are to be sit-on type. All sinks and wash troughs are to be Grade 304, 1,2mm thick stainless steel complete. Counter tops to be made same width as sink unit. Rev5
- Appropriate sized double chamber instant water heater to be positioned over sink bowl not draining board in all Kitchenettes. Rev5
- In seclusion rooms, mortuary receiving areas and laundries, sluice rooms and hospital kitchens grade 304 stainless steel extendable type floor drains with interior removable foul air trap, screw down stainless steel grid is to be provided. Rev 7

- All Floor drains to main hospital kitchen facilities to be manufactured from grade 304 stainless steel with stainless steel under floor piping to an external grease trap. Rev 3

- Water reticulation (hot and cold water) – Must comply with the KwaZulu-Natal Department of Health's Policy Document for Mechanical Installations.
- Hot water temperature for patient and staff areas shall not exceed 60°C **at the point of use**.
- Hot water temperature for paediatric and geriatric wards shall not exceed 40°C **at point of use.** The use of thermostatically controlled mixing valves on the hot water line is recommended near the point of supply. Rev 1

- PVC sleeves in holder bats - not rubber - in particular to hot water piping. Rev 2
- Hot water piping built into walls to be lagged with brown paper for expansion and contraction. Rev 2
- Ablutions and bathrooms where required to be fitted with “Plexicore” type moulded fibreglass baths bedded down securely. Rev 7
- All shower trays to be stainless steel or other as specified. Rev 3
- All residential waste outlets in bathrooms and kitchens to be fitted with a flexi trap. Rev 3
- Where copper water piping is used, this is to be Class 2.
- Only precast / prestressed concrete and brick septic tanks will be permitted. No plastic extruded moulded septic tanks are to be used. Rev 5
- Provide stop cocks for servicing of plumbing fittings where no valves can be provided under ie Hygia Basins, above ceiling level clearly indicated with Red and Blue dots with the wording Valve “ivorene” label. Rev 6
- No service pipes, eg, sewer and water are to pass through any plant room including medical storage area’s. Rev 6
- No dead legs in water reticulation systems are permitted. Rev 7

SEWER / STORMWATER COVERS ETC.

- The use of hinged Ductile iron manhole covers and grates to be used in preference to cast iron. Rev 7

URINALS

Stainless steel for stall urinals in Public Ablutions.

WATER STORAGE

- Water towers and other water storage facilities at health institutions must be provided .
- The use of sectional steel tanks on stands with ladders, cat-walks and safety rails. Tanks must have a storage capacity holding a minimum of 3 day’s water supply including fire usage.
- 72 Hour water storage capacity shall be provided and if storing more than 100kl then the bulk of storage will be at ground level with a maximum of 50kl elevated storage.

WATER SUPPLY PIPES

Refer to KwaZulu-Natal Department of Health’s Preambles to all Trades.

SUNDRY HOSPITAL EQUIPMENT

- Bedpan washer - Sluicing must be provided in all ward Sluice Rooms
- In rural hospitals mechanical water driven sluicing sink shall be provided. Rev 5
- In urban hospitals electrically driven bed pan sluicing machines shall be provided. Rev5

The following items should be included in the building contract in consultation with the relevant hospital procurement section to determine what is presently under contract: -

- Drug cupboards: - 45 (l) stainless steel metal drug cupboard with flat top size 457, 2 (h) x 355, 6 (l) x 228, 6 (w) bolted to wall in Nurses Station. Provide 3 per Nurses Station. Rev 1

- Soap Dispensers: - Elbow action lever type with bottle container for dispensing of the liquid as in the High Scrub grade 304 stainless steel type. Rev 7
- Toilet Roll Dispensers: -Toilet roll dispenser to be theft proof, lockable container with keys and to carry three standard toilet rolls. Used roll to be easily removed from unit below without having to unlock unit. Unit to be manufactured from mild steel and epoxy powder coated - colour white. Unit to be fixed to wall with four screws.
- Mirrors: - Heavy Duty 400 x 500 x 15mm Grade 18/10 stainless steel screwed to wall in public ablutions. Rev 1
- Garbage peddle bin holders: - 20 litre x 1,2mm thick polished stainless steel pedal bin outer unit, 290mm Diameter x 455mm Height with 40mm Skirting and Safety edge. Removable inner bin with stainless Steel handle for easy disposal of contents. Stainless Steel robust pedal mechanism. Polished Stainless Steel Foot pedal with 8mm solid rod for durability. Rev 5
- Towel Dispensers: - Paper towel dispenser to be the reflex type. Rev 2
- Doctor's Lockers: - shall be included in the building contract bolted to wall.
- Bedside Lockers: - Ward layouts should indicate the bedside locker is positioned to the left of the patient. This dictates the positions of the service outlets etc. in the bed head ducting and lighting system.
- "Forwin "hospital curtain tracks supplied with curtains. (Chintz fabric (#155CZ) woven with 100% polyester yarn) to be provided in building contract Rev 5
- Curtains or vertical louver drapes to be provided in building contract. Rev 5
- Electric Hand Drier's are not to be used in any Patient Care facility.
- Lockable epoxy coated metal key cupboards located in suitable areas. Rev 3
- Hand Gun safes to be provided in security guard hut. Three maximum. Rev 3

KWAZULU-NATAL
DEPARTMENT OF HEALTH

INFRASTRUCTURE DEVELOPMENT

ENGINEERING ADVISORY SERVICE

POLICY DOCUMENT FOR THE

DESIGN OF MECHANICAL INSTALLATIONS

(TO BE USED STRICTLY AS DESIGN GUIDE ONLY)

IMPLEMENTATION DATE: JANUARY 2006

Rev. 7 – January 2013

STANDARDS COMMITTEE MEMBERS

Mr. R. Westwood	Chairman	KZN Department of Health
Mr. V. Stevens		KZN Department of Health
Mr. J. Jeney		KZN Public Works
Mr. L. Wilson		KZN Public Works
Mr. P. Mornet		KZN Public Works

I N D E X

CODES AND SPECIFICATIONS FOR MECHANICAL INSTALLATIONS

The complete installation shall conform to the following:

The South African National Standards Wiring Code - SANS 10142-1:2006.

Occupational Health and Safety Act and Regulations (85 of 1993)

SANS 10147:2011 Refrigeration Systems including plants associated with air-conditioning systems. Rev 6

Any special requirements of the electricity supply authorities of the particular area or district

Energy Code of Conduct for all Government Buildings Rev 3

The Local Authority Fire Regulations

ICASA Regulations

National Building Regulations and the SANS 10400 Code of Practice for the Application of the National Building Regulations

R158 where applicable

The Province of KwaZulu-Natal Standard Specifications for:

a) General Electrical Specifications
b) Air-conditioning and Ventilation Installations
c) Standard Policy and Norms for Air-conditioning
d) Fire Fighting Installations and Equipment
e) Hot and cold water for building services
f) Industrial kitchen equipment
g) Industrial laundry equipment
h) Steam boiler installations
i) Steam and Condensate Reticulation Services
j) Refrigeration Services
k) Standby Generators
l) Water Treatment for Mechanical Installations
m) Standard Specification and drawings for Medical Gas and Vacuum Services
n) Standard Specification for Steam Sterilizers
o) Standard Specification for Instrument Washer/Disinfector
p) Operating Theatre Light Specifications (Combination, Main and Satellite)
q) Medical Inspection Light Specification
r) Bedhead Ducting Specification
s) Nurse Call Specifications
t) Uninterrupted power supply (UPS) Specifications
u) Information Communication Technology Infrastructure Specifications Rev 2
v) Particle Count Testing of Operating Theatres Rev 3
w) Standard Specification for Solar Water Heating (SWH) Rev 3

Standard Drawings

Rev1

The standard drawings listed below form part of this policy document and must be read in conjunction with it: -

Electrical

a)	Theatre Layout (E&M) Rev 6	Drawing No.	3039H/02.1E	January 2008
b)	Clinic Delivery Room UPS	Drawing No.	7006H-01E	January 2007
c)	Typical Bed head ducting	Drawing No.	7008H	January 2007
d)	ICU Fixed Ceiling Pendent	Drawing No.	7009H	January 2007
e)	ICU Articulated Ceiling Pendent	Drawing No.	8004H	January 2008

Mechanical

a)	7007H/M	M(X)DR TB Ward
b)	M040101	Key to Symbols
c)	M040102	Typical Operating Theatre Layout
d)	M040103	Typical Layout of Medical Gas and Vacuum Outlet Points at Bed Head
e)	M040104	Vacuum Pipe Take-off Details
f)	M040201	Diagrammatic Layout – Medical Compressed Air Piping and Equipment
g)	M040202	Typical Oxygen and Gas Bank Layout
h)	M040203	Diagrammatic Layout of Vacuum Plant Pipe Work and Equipment
i)	M040204	Typical Nitrous Oxide Gas Bank Arrangement
j)	M040301	Medical Gas and Vacuum Isolating Valve Cabinet
k)	M040302	Theatre Pendant Details
l)	M040303	High Pressure Compressed Air Outlets
m)	M040305	Anaesthetic Scavenging System for Operating Theatres
n)	M040401	Concrete Base for Air Compressors and Vacuum Pumps
o)	M040403	Gas Evaporator Enclosure Details
p)	M040404	Details of Gas Cylinder Connections
q)	M040501	Wiring Diagram for Vacuum and Compressed Air Plants
r)	M040502	Typical Wiring Diagram for Medical Gas and Vacuum Warning Light Panels
s)	M040503	Typical Warning Light Panel Layout
t)	M040504	Alternate Compressor and Vacuum Plant Wiring Detail
u)	M040505	Wiring Diagram for Anaesthetic Mask Exhaust Fan
v)	5062H/M	Cold and Freezer Room Floor & Door Entry Detail Rev 3

Structural

a)	Laboratory	Drawing No.	4036H/01-R4	January 2004
b)	Pharmacy	Drawing No.	5046H	October 2005
c)	Plant Room Doors	Drawing No.	3025H/02	August 2003
d)	Theatre and CSSD	Drawing No.	3039H/01-R1	February 2005
e)	X-Ray Suite	Drawing No.	5031H	February 2006

General Information

Without compromising quality preference is to be given to locally manufactured products. Rev 7

The electrical reticulation system at all health institutions shall comply with the standards and specifications of the Local Supply Authority or Eskom as the case may be. Rev 1

Efficient energy management shall be encouraged with timer load control on non-critical plant, i.e. air-conditioning in general areas, space heating and hot water generating systems and the use of energy efficient lighting equipment. Rev 1

Solar water heating, energy recovery units and heat pumps shall be considered in the design stage for all new facilities and the renovation of existing facilities. Investigation into the quality of electrical and water supply needs to be evaluated. Rev 4

Sequential delayed soft starting shall be installed on all heavy electrical driven equipment, e.g. medical gas plants, lifts, air-handling units.

All equipment is to comply with the National Electricity Regulator (NER) voltage specifications – 10% <230/400 volts > 10%. All major equipment shall be protected by means of voltage window comparators which shall include single phase protection, phase rotation protection and under/over voltage protection, i.e.

a) Air-conditioning plant

b) Boiler plant

c) Hot water generating plant

d) Kitchen equipment

e) Laundry equipment

f) Medical gas plant

g) Refrigeration plant

h) Stand-by electrical generators

i) Sterilization plant

j) Water and sewer plant

k) X-Ray Equipment Distribution Board Rev 2

Services shall be accessible wherever practicable in order to facilitate repair and maintenance work.

All general plant room doors shall be galvanised and as per Drawing Number 3025H/02 and fitted with a standard HA 1 padlock. Standard air conditioning plant room doors shall be as per Drawing Number 8003H/01. Rev 2

Plant rooms shall preferably be located at ground level for single story buildings or on the same level in multilevel buildings. Rev 1

All equipment within the plant rooms shall have at least one metre clear working space all round to facilitate ease of maintenance. Rev 1

The designer shall provide all proposed plant room layout drawings which shall include all major plant and equipment, ducting layout, distribution boards etc. with due diligence given to a minimum of 1 metre access for maintenance purposes.
Rev 7

The responsibility of coordinating the layout of the plant rooms shall be that of the designer. Rev 2

All stainless steel fittings, fixtures and equipment shall be fixed with stainless steel bolts, screws etc. Rev 1

Preference shall be given to South African manufactured products. Rev 1

Where reference is made to “other approved” items this shall mean approval prior to tender closer Rev 1

Where openings are required in concrete slabs and columns approval and a method statement must be obtained from a suitably qualified structural engineer. Rev 3

HANDOVER PROCEDURES AND OPERATION AND MAINTENANCE MANUALS

Handover procedures are to be as follows: - Rev 6

- Practical completion is taken at the end of contractual construction period or when occupation can be taken.
- As builts are to be supplied at Practical Completion.
- Works completion is taken when all snag items identified at practical completion have been attended to.
  At this time the maintenance period commences GCC = 12 moths
  JBCC = 3 months for building and 12 months for electrical and mechanical.
- At completion of maintenance period Final Completion is taken.

The contractor shall hand over, at the completion of the works one original and two copies of the necessary operating and maintenance requirements for all plant and equipment supplied and installed by him or her as part of the works. Each copy of the operating and maintenance manual shall be separately bound in an acceptable manner, and shall contain the following data where applicable. These documents are to be handed to the Project Leader responsible for the project and the Project Leader shall ensure that these documents are handed to a Department of Health Head Office official.

a) Scope of Work

b) Operating Instructions

c) Normal Operation

d) Safety Measures

e) Fault Finding Guide

f) Equipment Information

g) Schedule of Information

h) List of Spares and Agents

i) Design Data

j) As Commissioned Data

k) Maintenance Requirements

l) KZN Department of Health Service Schedules

m) Manufacturers Service Recommendations

n) Manufactures Literature

o) Equipment Brochures

p) Proprietary Drawings, Exploded Views and Wiring Diagrams

q) As Built Drawings

r) Electrical Drawings

s) System Layouts and Schematics

t) Training Certificates

As Built Drawings

Complete sets of drawings (two electronic and three hard copies) of the entire project shall be included in the as built documentation, which is required at practical completion.
Original statutory documents are to be provided in a separate folder. Rev 5
The set shall include:

a) Architectural drawings and details.

b) Electrical wiring diagrams indicating all cable sizes, current ratings, fuses, control units, site cable reticulation and schematic wiring diagrams applicable to the works.

c) Mechanical drawings and schematics showing all equipment, connections to the equipment and service runs installed by the Contractor, and isolating valves, etc.

d) Exploded views of all equipment showing each component part adequately identified and numbered.

e) The electronic records (on disk) are to be handed to the Department of Health Head Office official at practical completion.

f) Laminated and framed copies of operating procedures, wiring diagrams, zone diagrams and plant schematics as applicable are to be fixed to the wall in a well illuminated and accessible area.

Equipment Schedules

A complete schedule of all plant and equipment forming part of the WORKS shall be included in the manual. The schedule shall include, but shall not be restricted to the following data:

a) Equipment type and model

b) Equipment identity number/serial number

c) Date of manufacture, testing installation and commissioning

d) Country of manufacture

e) Manufacturers name and contact address

f) Any other information required by the Department

Maintenance Requirements

The manufacturer's recommendation with regard to the routine servicing and maintenance of all equipment shall be included in the manual. This data shall include the recommended service interval and the estimated hours required for each type of service, for each item of equipment, together with a list of agents/contractors authorised to carry out service/maintenance.

For identified systems, plant and equipment, a proposed maintenance schedule shall be provided by the specialist for a period of thirty six (36) months after final delivery Rev 2

Operating Instructions and Training

A complete description of all operating procedures and safety measures shall be included in the manual. A basic “Fault Finding Guide” shall also be included.
Training shall be given to staff operating machinery and plant together with maintenance personnel.

Training certificates shall be signed by all staff that has received training.

The following table below shall be used by the Project Leader and Principal Agent as a check list for the submission of all “As built” documents. Rev 1

AS BUILT DOCUMENTATION REQUIREMENTS
ALL DRAWINGS REQUIRED IN AUTOCAD (DWG) FORMAT ON CD

PROJECT =

	AS BUILT DRAWINGS (DESCRIPTION)	**REQUIRED**		**SUPPLIED**	
		Yes	No	Yes	No
1	ARCHITECTURAL - PLANS, DETAILS etc				
2	ELECTRICAL - RETICULATIONS, TELEPHONES, NURSE CALL SYSTEMS, ALARMS, BMS AND ELEVATORS etc.				
3	MECHANICAL - AIR CONDITIONING, VENTLATION, GAS LINES, ELEVATORS,(LAYOUTS AND SIZES)				
4	STRUCTURAL, - REINFORCING SCHEDULES				
5	CIVIL (STORMWATER AND SEWER) - EARTHWORKS, SITE SERVICES RETICULATIONS, ROAD MARKINGS etc.				
6	EQUIPMENT SCHEDULE				
7	COMPUTERISED PROGRAMMES - CD's				
	COMPLIANCE CERTIFICATES (DESCRIPTION)				
8	PRESSURE TESTING -				
	1) MEDICAL GAS				
	2) STEAM LINES				
	3) CHILLED WATER				
	4) CONDENSER WATER				
	5) WATER MAINS				
	6) HOT & COLD WATER RETICULATION				
	7) COMPRESSED AIR LINES				
	8) VESSELS UNDER PRESSURE				
	9) SEWER RETICULATION				
	10) PLUMBER				
	11) STABILITY CERTIFICATES				
9	ELECTRICAL - MASTER or INSTALLATION ELECTRICIAN				
10	SOIL POISONING / COMPACTION				
11	LOCAL FIRE DEPARTMENT CLEARANCE				
12	ROOF TRUSSES - TRI &TR2				
13	FIRE DETECTION - SPRINKLER SYSTEMS, FIRE EXTINGUISHER AND HOSE REELS				
14	LIGHTNING AND EARTHING				
15	ELEVATORS COMPREHENSIVE REPORT HOISTS : ANNEXURE 'K'				
16	CONCRETE CRUSHING TEST				
17	GUARANTEE'S (NEW AND UPGRADED EQUIPMENT)				
	MANUALS				
18	OPERATING MANUALS PERTAINING TO ALL NEW EQUIPMENT				
19	POST GUARANTEE MAINTENANCE SCHEDULE				

VENTILATION AND AIR-CONDITIONING

VENTILATION

All rooms shall be ventilated and lit in accordance with and as required by the National Building Regulations, unless otherwise specified. Building to be designed for optimum natural ventilation and lighting.

Artificial Ventilation

The following minimum air changes and fresh air requirements shall apply where artificial ventilation is required and supplied.

Ventilation in Ablutions and Toilets

Ablutions

Single ablution facilities serving private wards or staff do not require extract ventilation, provided there are openable windows.

Extract ventilation shall be provided by either ceiling extract grilles connected to an in- line ducted fan with outside discharge air grilles by means of galvanised mild steel or PVC tubular ducting or Odour extraction systems. Rev 1

Extract grilles may be of the PVC type with adjustable disc valves or white powder coated or anodised aluminium type with adjustable dampers.

Where two or more ablution areas may be ventilated by one extract system such extract fan shall be connected to an isolator within 1.5 metres from the extract fan.

Toilets

All multiple toilets shall be provided with ducted ventilation system.
Single toilet facilities serving private wards or staff do not require extract ventilation, provided there are openable windows.

AIR CONDITIONING

Operating Theatre Air-Conditioning Policy: ISO 14644-1: Class 5 - 8

NOTE:The following policy shall be adopted for all new operating theatres and also wherever possible in theatre upgrading work.

Where separate package air-conditioning condenser units are provided for each theatre then one theatre may be connected to the essential electrical supply provided there is spare capacity on the emergency generating set. Rev 4

Operating Theatre Design Conditions

a) Constant volume systems shall be employed at a positive pressure (15% excess air) with respect to any adjoining rooms.

b) Temperature range shall be 18ºC to 24ºC. Separate temperature controls in each theatre to be provided. No on and off switching of air handling plant to be done from within the theatres.

c) 20% - 30% fresh air .

d) Delivery of the conditioned air shall be by downward movement from the ceiling to four exhaust outlets located at low level on opposite walls/corners.

e) All ductwork beyond the Hepa filter housing shall be in solid ducting to the air terminal. The final connection to the terminal where alignment necessitates a maximum of 300mm of flexible ducting, of the wire mould type, may be employed. At the end of the duct branch a “Lobster Back” (Galvanised sheet metal bend) shall be employed followed by the flexible joint, i.e. of the wire mould ducting type.

f) New operating theatres and where possible, theatre upgrades, shall be provided with mezzanine floors to necessitate ease of access to plant, filter housings and ductwork. Filter housings shall be positioned such to provide easy access to filter media for servicing and visual inspection purposes.

g) No internal air duct insulation is permitted.

h) No humidifiers are to be installed. Rev 5

i) Condensate water discharge shall go to sewer.

TYPES OF AIR-CONDITIONING SYSTEMS

Two types of air-conditioning systems shall be adopted.
The air-handling unit is to be supplied from the emergency electrical supply and the chillers from the normal electrical supply.
No sewer pipes are permitted through an air-handling unit plant room. Rev 6

Dedicated Air-Handling Unit

A detailed name plate shall be included on the air handling units with design air volume, fan speed, cooling / heating capacity, filter data and heating capacity. Rev 5

Each operating theatre shall be air-conditioned by a dedicated air-handling unit, or individual package unit. A separate air-handling unit shall serve other areas in the theatre suite. This is the preferred system.

Blended Fresh Air and Re-circulation Air Type System

a) This system utilises one central air-handling unit with a variable speed drive for a number of operating theatres. 100% outside air is drawn into the A.H.U, filtered and cooled and delivered via sheet metal ducting to constant volume and variable volume boxes within the system.

b) The constant volume boxes shall feed the operating theatres, scrub rooms, pack rooms and foyers.

c) The variable volume boxes feed the change rooms and storerooms.

d) Each theatre constant volume-mixing box shall supply a constant volume of conditioned air to an inline re-circulation fan that also extracts air from each individual theatre. (Note: Prior to the recycled air entry into the mixing box it shall be filtered by means of a primary filter, this is to remove cotton lint from the return air thus protection of the Hepa filters is optimised.)

e) Scrub Rooms, Pack Rooms and Foyers shall utilise the same air supply as the theatres up to the constant volume boxes, but here the constant volume box supplies air to one or more constant volume diffuser, with room air being exhausted by an adjacent independent exhaust system.

f) In the Change Rooms and Store Rooms air shall be exhausted via independent exhaust systems.

OTHER AREAS

Types of Air-Conditioners

Ceiling mounted fan coil units are not permitted at any Health facilities. Rev 5

The following are the preferred types of air-conditioning systems:

Administration Areas	Unitary (individual) systems where possible
Patient treatment areas	Each area shall, where practical, have its own packaged air-cooled condensing unit in its own service area, or plant room on an outside wall and be easily serviceable by being placed in a plant room or outside at ground level.
Wards	Where directed by the Department of Health shall be Unitary (individual) systems where possible.

The units in all areas shall be the reverse cycle (heat pump) type.

Energy Management control of these systems is preferred.

Any other system shall be substantiated and approved.

Air Handling Units

A detailed name plate shall be included on the air handling units with design air volume, fan speed, cooling capacity, filter data and heating capacity. **Rev 5**

Air-handling units shall be provided with electronic variable speed with direct drives to maintain design airflow for all filter conditions.

Air handling units shall have separate electrical distribution boards (Essential and Non-essential). The coils shall be protected by means of ultra violet light with a consistent minimum average of Circa 800 Micro Joule per centimetre squared at any point of the coil facing. Rev 6

Condensate drip trays shall be stainless steel and so installed to prevent the build-up of condensate. Rev 4

All compartment doors on the air handling unit shall be clearly labelled. Rev 2
Primary filters shall be situated at the fresh air intake opening of the air-handling unit.

Secondary filters shall be situated after the supply air fan in a blow through configuration where clean air supplied to the Hepa filters will be optimised.

PVC drop stop eliminators in 304 stainless steel frames shall be employed, if fin spacing is less than 10 fins per inch, after the cooling coils in areas with high humidity levels. This includes all coastal areas for off coil temperatures of 10º and less.
Copper to copper coils shall be employed and the coil supporting frames shall be Grade 304 stainless steel Rev 4

Condensate drains are to be installed in the floor slab and directed to a sewer connection. Rev 5

Filtration

Air filtration shall be as specified in accordance with the Department of Health's "Filtration and Air Flow Requirements for Operating Theatres".

High efficiency particulate air (Hepa) filters shall be utilised and be situated at the supply air terminals/diffusers before the air enters the theatre or as close to the air terminals as possible. These filters shall be accessible from the Service Areas.

Hepa Filters shall be side or top entry fitted to seal in the direction of airflow against a neoprene gasket, and shall be secured by mechanical means to ensure no air bypass.

Primary and secondary filters shall be secured by means of no less than four (4) holding 304 stainless steel clips.

Secondary and Hepa filters housings shall be fitted with Magnahelic manometers marked with the filter's operating parameters.

Validation of Operating Theatres

Each Operating Theatre shall be validated on completion to ensure compliance with Filtration and Air Flow Requirements for Operating Theatres by means of a particle count and air flow measurement. Particle count shall be undertaken prior to Practical Completion and prior to final delivery.

The Particle Count shall conform to I.S.O 14644 – 1 (Clean-room Classification Standard) and the Standard Specification Particle Count Testing of Operating Theatres. Rev 3
Validation Certification shall be displayed at the operating theatre entrance.

Airborne Particulate Cleanliness Classes

CLASS	Number of Particles per Cubic Meter by Micrometer Size					
	0.1 um	0.2 um	0.3 um	0.5 um	1 um	5 um
ISO 5	100,000	23,700	10,200	3,520	832	29
ISO 6	1,000,000	237,000	102,000	35,200	8,320	293
ISO 7				352,000	83,200	2,930
ISO 8				3,520,000	832,000	29,300

The report shall contain the following details:

i) Date & Time of test
ii) Location of test
iii) Number of test points
iv) Particle readings
v) Airflow readings
vi) Test results in a numerical and graphical format
vii) Test Certificate confirming compliance

FILTRATION

Filters for Ducted Air-Conditioning Systems

Refer to KwaZulu-Natal standard specifications.

i) Pleated Primaries
ii) Secondary Pocket Filters (35% – 85%)
iii) High Efficiency Secondary 95%
iv) High Efficiency Particulate Air Filter (HEPA)

FILTRATION AND AIR FLOW REQUIREMENTS FOR OPERATING THEATRE APPLICATIONS

	Theatre	Primary	Secondary	Tertiary	Laminar Flow	Particle Count	Minimum Fresh Air Changes Per Hour	Minimum Total Air Changes Per Hour
	Description	Pleated	Pocket/Bag or Box	Hepa High Volume		Class		
		Efficiency	Efficiency	Efficiency		ISO		
		20%	95%	99,97 – 99.9999%		14644-1		
1	Casualty/Minor Stitch	X	X			8	5	25
2	Maternity/Caesarean	X	X			8	5	25
3	General Surgery	X	X			7	5	25
4	Gynaecology	X	X			7	5	25
5	Ophthalmology	X	X			7	5	25
6	Urology	X	X			7	5	25
7	Endoscopy	X	X			7	5	25
8	Plastic Surgery	X	X	X		6	5	25
9	Bone Surgery/Orthopaedic	X	X	X	X	5	5	25
10	Heart Surgery	X	X	X	X	5	5	25
11	Vascular	X	X	X	X	5	5	25
12	Neuro Surgery	X	X	X	X	5	5	25
13	Transplantations	X	X	X	X	5	5	25

NOTE: It is the Department's policy to provide 70% return air provided the return air originates from the theatre concerned. Ideally each theatre should have its own air-handling unit.
Minimum velocity in general theatres shall be a minimum of 0.2m per second at 1m above floor level and in laminar flow theatres the velocity shall be a minimum of 0.35m per second and a maximum of 0.55m per second at 1m above floor level.

FILTRATION AND AIR FLOW REQUIREMENTS FOR AREAS OTHER THAN OPERATING THEATRES
AIR-CONDITIONING: EXTERNAL DESIGN CONDITION SHALL BE BASED ON 80% OF SUMMER PEAK SEASON
HEATING: EXTERNAL DESIGN CONDITION SHALL BE BASED ON 80% OF WINTER SUMMER PEAK SEASON

	Description	Pleated	Pocket/ Bag/Box	Pocket/ Bag/Box	Pocket/ Bag/Box	Minimum Fresh Air Changes Per Hour	Minimum Total Air Changes Per Hour	Temperature (Humidity)
		Efficiency	Efficiency	Efficiency	Efficiency			ºC
		20%	35%	65%	95%			
1	Administrative Sections	X				2	4	22 – 24
2	Waiting	X				2	6	N/A
3	Auditoriums	X				2	4	22 – 24
4	Autopsy	X		X		2	12	22 – 24
5	Bath Room					2	10	N/A
6	Bedpan Room					2	10	N/A
7	Blood Bank	X				2	4	22 – 24
8	Casualty	X	X			2	6	22 – 24
9	CSSD	X		X		2	4	22 – 24
10	Dark Room	X				2	10	22 – 24
11	Dining rooms/Canteens	X				2	4 - 6	24 – 26
12	General Stores	X				2	4	N/A
13	Laboratories	X		X		2	6	22 – 24
14	Labour/Delivery Room					2	4	22 - 24
15	Laundry - General					2	10	N/A
16	Lecture Halls	X				2	4	24 – 26
17	M.O.P.D	X				2	4	22 – 24

	Description		Pleated	Pocket/ Bag/Box	Pocket/ Bag/Box	Pocket/ Bag/Box	Minimum Fresh Air Changes Per Hour	Minimum Total Air Changes Per Hour	Temperature (Humidity)
18	O.P.D		X				2	4	24 – 26
19	Pharmacy Dispensing		X		X		2	4	22 – 24
20	Pharmacy Store		X	X			2	4	22 – 24
21	Specialist Clinics–E N T		X		X		2	4	24 – 26
22	Sterilizer Equipment						2	10	N/A
23	Toilet Room						2	10	N/A
24	Treatment Room		X				2	6	24 – 26
25	Units	Burns	X		X		2	15	26 – 28 (50 – 60 %)
		HCU / CCU					2	4	22 - 24
		ICU	X		X		2	6	22 – 24
		ICU Neonatal	X		X		2	6	26 – 28
26	Wards	General					2	4	24 - 26
		Isolation					2	6	
		Maternity	X				2	4	
		Medical					2	4	24 – 26
		Paediatric					2	4	
		Psychiatric					2	4	
		Orthopaedic					2	4	
		Surgical					2	4	
		TB					20	20	**No air conditioning** Rev 1
27	X-Ray	General	X		X		2	6	22 – 24
		MRI/CT Scanner							As per manufacturer's requirements

NOTE: Air extraction systems in TB Wards shall be in accordance with Drawing No. 7007H-M Rev1

1) This filtration only applies to areas served by air handling units or package type units and does not apply to individual units.

2) Other specialized areas shall be individually designed in consultation with the Department.

SPACE HEATING

TB WARDS

An open window policy for all TB Wards as an appropriate infection control measure has been adopted. No air-conditioning is permissible. In M(X)DR-TB Wards fresh air shall be mechanically induced at ceiling level in opposite directions from the centre of the room and extracted at low level at a rate of 20 air changes per hour by means of a continuous extract plenum/duct fixed to the external wall to discharge air at above head height. Heating shall be provided for temperatures below 20°C.
No filtration is required to air extract system. Rev 3

In colder climate areas the preferred heating system will be a ducted heating system.

In hot climate areas no heating will be provided, but ceiling fans will be installed where no air-conditioning is provided.

Nurseries and Children's Wards

Where no air-conditioning or central ventilation type systems with electric heating has been provided, the only heaters which will be permitted in nurseries and children's wards, are the fibre cement with steel frame convection panel type heaters which shall be fixed at a level high enough to be completely out of reach of children in cots and far enough away from a cot or crib so as to prevent overheating by radiation, convection or conduction.

Where central ventilation type systems are installed, electric heater banks shall be installed in the air-handling unit to provide the required space heating. In this case no individual electrical space heaters per room/area will be accepted. Space heating will then be controlled on the supply air temperature of between 22ºC - 24ºC, which will control the heater banks. Once the outside ambient temperature reaches a preset level, the heater banks shall be totally switched off and the air-handling unit shall be functioning normally as a ventilation unit supplying unconditioned air.

Other Areas in Health Care Facilities

Where no air-conditioning or central ventilation type systems with electric heating has been provided, the only heaters which will be permitted will be electrical fan heaters or the fibre cement with stainless steel frame convection panel type heaters. This case will only apply where ambient temperatures require the provisioning of space heating.

Where central ventilation type systems are installed, electric heater banks shall be installed in the air-handling unit to provide the required space heating. In this case no individual electrical space heaters per room/area will be accepted. Space heating will then be controlled on the supply air temperature of between 22ºC- 24ºC, which will control the heater banks. Once the outside ambient temperature reaches a preset level, the heater banks shall be totally switched off and the air-handling unit shall be functioning normally as a ventilation unit supplying unconditioned air. This case will only apply where ambient temperatures require the provisioning of space heating.

REFRIGERATION

Cold Rooms and Freezer Rooms

No stacking or close configuration of condenser units shall be permitted. Rev 5

Refer to KwaZulu-Natal Department of Health Standard Specifications for Refrigeration Services

All refrigeration plant shall be connected to the essential electrical supply.

The refrigeration design capacity for mortuaries shall be 150% with multiple units. Rev 4

Temperatures required for freezer room -18°C to -20ºC

Temperature required for kitchen cold room 2°C to 10ºC

Temperature required for mortuary cold room 2°C to 4ºC

Temperature required for forensic mortuary freezer -8°C to -20ºC Rev 1

Minimum ceiling is to be 2800mm. Rev 4

Floors shall be level with **NO** floor drain. Rev 3

MEDICAL GAS

All piped gas installations shall conform to the following:

i) KwaZulu-Natal Department of Health Specification and Drawings for Medical Gas and Vacuum Services

ii) SANS 051 Part III. The handling and storage of medical gases and the installation of medical gas, compressed air and vacuum pipeline systems.

iii) SANS 1409: The outlet sockets and probes for gas and vacuum services.

iv) SANS 10224: Non-flammable medical gas pipeline system.

v) SANS 1453: Copper tubes for medical gas and vacuum systems.

vi) All self generating oxygen plant must comply with ISO 10083 Rev2

vii) SANS 10224: Section 6. A master gas alarm system to be installed in the medical gas plant room. A line pressure monitoring gas alarm panel shall be connected to the medical gas lines after the isolation valve box into theatres, I.C.U.'s and H.C.U.'s. This alarm system shall be connected to the emergency power supply.

viii) Auxiliary alarm signal at telephone switchboard, security or other 24-hour manned location.

ix) Emergency alarm signal in OT, I.C.U and H.C.U. shall be visual and auditory. To indicate low and high mainline pressure.

x) All oxygen and vacuum plant shall have a back-up system.

xi) Isolation valves should be carefully positioned to avoid shutdowns of major sections.

xii) Medical gas installers must be licenced practitioners. Rev 7

These requirements shall comply with the regulations mentioned under each heading unless otherwise specified. An appropriately qualified engineer shall certify all services.

General

Wherever practically possible medical gas pipe work must be installed within the building, via service ducts and ceiling void, and not run on the outside of the building. Rev 7

All medical gas outlet points shall be numbered and labelled. Numbers shall be allocated and available from the Department of Health Head Office.

Special reference to labelling and testing of medical gas systems as detailed in the Standard Specifications are to be adhered to. A minimum of two weeks notice shall be given to the Health Technology Services.

All Service outlet valves shall be labelled with ivorene labels 35mm long x 15mm high x 1,5mm thick. Label colours match the corresponding service outlet points, which are per the standard colour code for piped services. Rev 3

Main isolating valve boxes shall be provided at the entry to each ward block. Rev 4

All medical gases shall be provided by piped systems.

All medical gas outlet points other than vacuum are to be equipped with self isolating valves.

All medical gas plant shall be connected to the essential electrical supply.

Sequential delayed soft starting shall be installed on all heavy electrical driven equipment, e.g. medical gas plants, lifts, air-handling units.

Minimum Number of Outlet Points

	O_2	N_2O	Vac	LPAir	HPAir	Scav	Rev 7
Operating Theatre	3	3	3	3	2	1	Ref Dwg3039H/02.2E
NICU per cot	3		2	3			On bed head trunking
ICU per bed	3		2	3			On Pendant
High Care per bed	2		1	2			On bed head trunking
Delivery Room per bed	1		1	1			On bed head trunking
Delivery Rescus	1		1	1			On bed head trunking
Casualty per bed	1		1	1			On bed head trunking
Medical equipment store (Theatres & ICU's only)	1			1			

All other patient areas: Oxygen and Vacuum to cover 50% of beds.

Operating Pressures

Oxygen -	Line Pressure	400 kPa
Oxygen -	Bulk changes to manifold at around Between the bulk and manifold	800 kPa 1000 kPa
Nitrous Oxide		400 kPa
Medical Air -	High Pressure (power tools)	700 kPa
Medical Air -	Low Pressure (respiratory purposes)	400 kPa
Vacuum		-40 to -60 kPa
Manifold changes left to right bank		300 kPa
Bulk low-level alarm threshold		25% of volume of tank
Cylinder Contents		15,000 kPa

Vacuum

The vacuum installation shall comply with SANS 051 Part iii. Bacteria Filters shall be installed prior to the vacuum reservoir and pumps. Vacuum liquid bottle traps shall be installed to collect any blood/fluids, etc. that may be drawn into the pipeline. One bottle trap per theatre, ICU, ward block and other patient unit, shall be supplied. Bottle traps should ideally be placed in sluice rooms. Care shall be given to the location of the exhaust discharge of vacuum plants taking into account the standard specification and the location of other air intakes.

Medical Air

Medical air (low pressure) for respiratory purposes shall be provided at a fixed pipeline pressure of 400 kPa. Medical air (high pressure) for driving power tools shall be provided at a terminal usage pressure of 700 kPa.

Care shall be given to the location of the air intake taking into account the standard specification and the location of other exhaust discharges.

Scavenging

A separate anaesthetic gas scavenging, a low-pressure suction system, that removes exhaled anaesthetic gases from the patient circuit, shall be provided. Each outlet point shall have its own balancing valve to allow the system to be balanced progressively from the furthest outlet point towards the fan motor. One system can be utilised for 1 or more theatres.
Scavenging system shall be switched from the nurse's station in the theatre complex. Rev 1

LP GAS

LP gas installations in pathology laboratories and other buildings shall comply with SANS 10087-3.

BEDHEAD DUCTING

Rev 1

All bed head ducting shall be supplied from the essential electrical distribution system.

The Electrical Consulting Engineer shall allow in his/her design documentation for the incorporation of medical gas points in the bedhead ducting including all pipe work and connections where applicable, this work shall be done by the bedhead ducting supplier at the factory.

Prior to manufacture of bedhead ducting all drawings shall be approved by both the mechanical and electrical engineers. Rev 3

The final connection to the bedhead ducting from the main medical pipe system shall be done by the medical gas specialist.

All Health Institutions shall be provided with surface mounted bedhead ducting or pendent type (Where applicable) and shall incorporate the following:

General requirements for all wards.

The following items shall be taken into account in the particular specification of the project:

a) All Socket Outlets, Switches and Isolators shall be of the same make and model

b) No Chamfered earth pins shall be permitted

c) All switch toggles shall identify the type of electrical supply, i.e. white – normal, red – essential, blue - UPS

d) Circuits shall be engraved on base 3mm colour coded lettering indicating circuit number and DB

e) All light fittings shall be the prismatic diffused type and shall have electronic ballasts.

f) Lamp colour – cool white.

g) Wiring – every 1m distance (wire wrapping)

h) Supply vertical riser with ceiling trim and connection box 100mm through ceiling.

i) End of units shall be installed with 50mm distance from either side of wall.

j) Medical gas outlet points shall be identified and colour-coded using labels with 3mm lettering.

k) Medical Gas shall be installed by bedhead manufacturer in terms of the KwaZulu-Natal Standard Specifications and Drawings for Medical Gas and Vacuum Services.

l) Heyer/Afrox gas service outlets with shut off / non-return valve are required.

m) Medical Rails – General Wards 500mm in length behind beds, all other wards full length

Specific Requirements for all wards:

General Wards:

a) Each bedhead duct run shall be provided with one earth leakage isolator with the necessary circuit breakers for the respective circuits and shall be clearly and unambiguously labelled. Rev 2

b) All nightlights and main up lights shall be switched per bedhead duct from entrance door.

c) 58-watt Main up light per bed (Switched from entrance door). Rev 2

d) 18-watt Reading light per bed (Switched from bed head duct). Rev 2

e) 5-watt Nightlight per bed (Switched from entrance door). Rev 2

f) Two switched socket outlets per bed on separate circuits with a maximum of eight (8) socket outlets per circuit. Rev 2

g) Medical gas outlet points (Oxygen and Vacuum – 1 set per two beds).

h) 300mm Medical Gabler rail.

i) One nurse / emergency call point per bed.

Ceiling lighting shall be avoided wherever practicable.

The following items shall be taken into account in the particular specification of the project:

a) Installation height of bed head ducting shall be 1500mm to centre of unit. Rev 2

Adult and Paediatric Intensive Care Units (ICU's)

a) Ceiling lights (Two per bed and dimmable fluorescent – Switched from pendent Rev 2

b) Peripheral lighting (Dimmable fluorescent- Switched from nurse station). Rev 2

c) Ceiling mounted Consulting Medical Examination light 12/24 volt – one per bed. Rev 2

d) One articulated pendent per bed and shall incorporate the following: Rev 2

- Eight (8) switched socket outlets (Minimum of 2 circuits per bed with a maximum of eight (8) socket outlets per circuit) – IT earth monitoring system via UPS on Essential supply. Rev 2
- Eight (8) switched socket outlets (Minimum of 2 circuits per bed with a maximum of eight (8) socket outlets per circuit) – IT earth monitoring system on Essential supply. Rev 2
- Medical gas outlet points (3 x Oxygen, 2 x Vacuum and 3 x Low Pressure Air – per pendent. Rev 7
- Two way light switch.

- Four equipment mounting poles – complete with medical rails -Refer to Drawing No 7009H. Rev 2

The following items shall be taken into account in the particular specification of the project:

a) Labelling above switched socket outlets on pendent shall read the following:

- UPS Supply – Patient Life Support Only
- Essential Supply – Patient General Use Only

b) The pendent shall be located at the head and to the left of the bed and shall be at least 1500mm from the back wall.

c) Installation height 1800mm to underneath of pendent measured from final floor level.

Neonatal Intensive Care Units (NICU's)

a) Ceiling lights (One per bed and dimmable fluorescent - Switched from bed head ducting).

b) Passage lights (Dimmable fluorescent - Switched from nurse station).

c) Bed head ducting shall incorporate the following:

- Eight switched socket outlets per bed (Minimum of 2 circuits per bed with a maximum eight (8) socket outlets per circuit) – IT earth monitoring system via UPS on Essential supply.
- Eight switched socket outlets per bed (Minimum of 2 circuits per bed with a maximum of eight (8) socket outlets per circuit) – IT earth monitoring system on Essential supply.
- Medical gas outlet points (3 x Oxygen, 2 x Vacuum and 3 x Low Pressure Air per bed. Rev 7
- Full length Medical Gabler rail.

The following items shall be taken into account in the particular specification of the project:

a) Labelling above switched socket outlets on pendent shall read the following:

a. UPS Supply – Patient Life support only.
b. Essential Supply – Patient General use only

b) Installation height 1000mm to centre of bed head ducting. Rev 2

Casualty/ Trauma Wards

a) **Regional and Tertiary Hospital**

Twelve (12) switched socket outlets per bed - six (6) on UPS and six (6) on Emergency supply. (Minimum of 2 circuits per bed with a maximum of eight (8) socket outlets per circuit).

District Hospital

Eight (8) switched socket outlets per bed on Emergency supply. (Minimum of 2 circuits per bed with a maximum of eight (8) socket outlets per circuit). Rev 4

b) Medical gas outlets (Oxygen, Vacuum and Medical Air Low Pressure -1 set per bed) Rev 4

c) Full length Medical Gabler rail.

d) One nurse / emergency call point per bed.

e) Ceiling mounted medical light - 24 volt 80 watt 30 000 lux @ 1 metre.

General ceiling lighting shall be supplied.

The following items shall be taken into account in the particular specification of the project:

a) Installation height of over bedhead ducting shall be 1900mm from floor level to underneath of unit and at least 1500mm from the back wall. Rev 4

b) The Bedhead Ducting shall be suspended from the ceiling. Rev 4

High Care Wards/Burns Unit:

a) 58-watt Main up light per bed (Switched from entrance door). Rev2

b) 18-watt Reading light per bed (Switched from bed head duct). Rev2

c) 5-watt Nightlight per bed (Switched from entrance door). Rev2

d) Eight switched socket outlets per bed. (Minimum of 2 circuits per bed with a maximum of eight (8) socket outlets per circuit) Rev 3

e) Medical gas outlets (Oxygen, Vacuum and Medical Air Low Pressure 1 set per bed). Rev 4

f) 500mm Medical Gabler rail.

g) One nurse / emergency call point per bed.

Ceiling lighting shall be avoided wherever practicable.

The following items shall be taken into account in the particular specification of the project:

Installation height of bed head ducting shall be 1500mm to centre of unit. Rev 2

Maternity Delivery Rooms

a) Four (4) switched socket outlets per bed – ***one set per bed + set for infant***. (Minimum of 2 circuits per bed with a maximum of eight (8) socket outlets per circuit) Rev 2

b) Medical gas outlet points

Oxygen and Vacuum – ***one set per bed***

Oxygen, vacuum and medical air low pressure - ***one set for infant*** Rev 3

c) Two 500mm Medical Gabler rail.

d) One nurse / emergency call point per bed.

e) Ceiling mounted medical light - 24 volt 80 watt 30 000 lux @ 1 metre.

f) General ceiling lighting shall be supplied.

The following items shall be taken into account in the particular specification of the project:

a) Installation height of bed head ducting shall be 1500mm to centre of unit. Rev 2

Procedure / Stitch Rooms: Rev 4

a) Eight switched socket outlets per bed. (Minimum of 2 circuits per bed with a maximum of eight (8) socket outlets per circuit).

b) Medical gas outlets (Oxygen, Vacuum and Medical Air Low Pressure 1 set per bed).

c) 500mm Medical Gabler rail.

d) Ceiling mounted medical light - 24 volt 80 watt 30 000 lux measured @ 1 metre.

e) General ceiling lighting shall be supplied. One emergency call point per bed.

Installation height of bed head ducting shall be 1500mm from floor level to centre of unit.

Pre-op/Postop in Theatre Suite

a) Two switched socket outlets per bed. (Minimum of 2 circuits per bed with a maximum of eight (8) socket outlets per circuit).

b) Medical gas outlets (Oxygen, Vacuum 1 set per bed).

c) 500mm Medical Gabler rail.

d) Gabler mounted medical light - 24 volt 80 watt 30 000 lux measured @ 1 metre.

e) General ceiling lighting shall be supplied. One emergency call point per bed.

Installation height of bed head ducting shall be 1500mm from floor level to centre of unit.

MEDICAL WASTE

The policy of this Department is to outsource medical waste disposal.

STERILIZATION AND DISINFECTION

Steam Autoclaves

Refer to KwaZulu-Natal Department of Health Standard Specification.

The sterilizer door shall be of the automatic vertical sliding, counter balanced type.
Throughput requirement for autoclaves shall be confirmed for each institution in order to determine sizing, number and cycle requirements. All autoclaves shall be equipped with recording instruments as per standard specs. All autoclaves are to have Electric control valves. The internal chambers of autoclaves shall be manufactured from Grade 304L Stainless Steel, with the exception of Laboratory autoclaves, which shall be Grade 316 Stainless Steel. Care shall be taken during fabrication to ensure that material limits are not exceeded. On completion all chambers are to be pickled and passivated. Rev 5

Each autoclave shall be provided with a loading trolley and internal chamber cradle. Rev 1

For servicing purposes an inter-leading access door shall be provided between the Autoclave plant room and the CSSD department lockable from plant room side. Rev 5

Where possible the condensate collection drain point shall be placed outside the plant room.

Because of the high temperatures of discharge water from autoclaves and other steam-operated equipment, sewer branch lines to the gullies receiving the condensate should be stainless steel/cast iron for at least the first 6 metres.

Gas Sterilizers

Ethylene Oxide Sterilizer: Refer to SANS 10213 and 11135

Instrument Washers

Refer to standard specification.

All C.S.S.D's shall be equipped with an instrument washer.

Bedpan Washers

Bedpan washers to be provided in all ward sluice rooms.

In rural hospitals mechanical water driven sluicing sinks shall be provided.
In urban hospitals electrically driven bed pan sluicing machines shall be provided. Rev 5

HOT WATER SYSTEMS

The preferred system for the provision of hot water in large quantities is Heat Pumps. Rev 5

Consideration shall be given to the installation of approved solar panel water heating systems which shall form part of the Eskom initiative to reduce power consumption. This system shall be incorporated into the design of electrically operated water heating systems at all health institutions. Rev 2

Solar water heaters shall be installed by ESKOM approved installers only. Rev 3

Only thermo-syphon type solar water heating systems shall be installed in systems with a storage capacity of 350 litres or less. Rev 3

Solar water heating, energy recovery units and heat pumps shall be considered in the design stage for all new facilities and the renovation of existing facilities. Investigation into the quality of electrical and water supply needs to be evaluated. Rev 4

As far as is practical, hot water systems are to be decentralised, i.e. point of use.

Hot water supply design figure – 35 litres per patient per day.

Domestic type installations may be supplied from standard, i.e. up to 250 litres, 4kW geysers, but larger systems are to consist of electric in-line heat pumps coupled to storage tank(s). These storage tanks are not to exceed 2,500L capacity per unit. **Rev 5**

Only double chamber instantaneous water heaters are to be installed and no provision shall be made for hot water tap outlet.

For electrical driven systems refer to the Provincial Standard Specification for Hot and Cold Water for Building Services for further details.

For steam driven: Steam and Condensate Reticulation

General

Point of use application shall be the design criteria.

No calorifier storage for patient and staff areas shall not exceed 60^0C.

Hot water temperature for paediatric wards shall not exceed 40^0C at the point of use. The use of thermostatically controlled mixing valves on the hot water line is recommended near the point of consumption. (Group these points together from one mixing valve).

Kitchen and Laundry calorifiers shall not exceed 80°C.

All pressure/temperature gauges shall be marked.

All reticulation piping on hot or cold water services to be of copper class 2 and installed on external walls wherever possible, if installed in walls, only labour bends are permitted.

Drain valves to be situated at the lowest level for both the storage vessel and the inline heater and to be easily accessible and to discharge to drain.
All safety valves shall discharge outside the plant room and in a safe position so as not to cause injury or damage to persons or buildings.

LAUNDRIES

Other than Central Laundries, equipment shall be kept to a standard size at all Health Institutions to suit the application and shall comply with the following sizes for which technical specifications are available. **Rev 1**

a) Sluice Machine (9 to 25kg).

b) Roll Ironer single roll (1.9 to 2.0 metres)

c) Washer Extractor (23 to 34kg)

d) Side Loading Washing Machine (67kg)

e) Electrically heated Tumble Drier (23 to 34kg)

f) Single Garment Press

KITCHENS

Layouts shall be discussed with this Department's Electrical and Mechanical Section. The complete equipment layout, including sinks, worktops, canopies, etc. will be the responsibility of the Electrical and Mechanical Section and the Architect shall be advised at the working drawing stage of the services and plumbing requirements.

Kitchens - clarify type of dishwash system at design stage.

Preferred system is a central island system with extract canopy fed directly from distribution board.

The amount and size of the equipment needs to be verified by calculation to relate to the number of meals served per sitting.

Technical Specifications are available for the following equipment:

a) Steam Heated Boiling Pan
b) Electrically Heated Boiling Pan
c) Electric Range
d) Tilting Frying Pan
e) Convection/Steaming Oven
f) Stainless Steel Worktops
g) Stainless Steel Sinks
h) Extract Canopy

COLOUR CODING FOR PIPED SERVICES

Colours as per the attached table “Colour Coding for piped Services” are to be used.
Note that unless specified otherwise, medical gas piping is to be painted over its entire length.
Relevant SANS 1091 code in brackets.

CONTENTS OF PIPING	COLOUR (CODE)
STEAM	PASTEL GREY (G54)
CONDENSATE	BRILLIANT GREEN (H10) WHITE
HOT DOMESTIC WATER	BRILLIANT GREEN (H10) CRIMSON (A03)
COLD DOMESTIC WATER	BRILLIANT GREEN (H10) CORNFLOWER (F26)
INDUSTRIAL HOT WATER (i.e. Primary Circuit, Central Heating etc.)	BRILLIANT GREEN (H10) GOLDEN YELLOW (B49)
FIRE WATER	SIGNAL RED (A11)
SEWAGE	BLACK
OXYGEN (Medical)	WHITE
NITROUS OXIDE (Medical)	ULTRAMARINE (F09)
VACUUM (Medical)	PRIMROSE (C67)
AIR (Medical) LOW PRESSURE	WHITE / BLACK
AIR (Medical) HIGH PRESSURE	WHITE / SALMON PINK (A40)
SCAVENGING SYSTEM	ORANGE **Rev 1**
LPG	LIGHT STONE (C37)
COMPRESSED AIR (Industrial)	ARCTIC BLUE (F28)
CONDITIONED AIR FLOW	ARCTIC BLUE (F28) WHITE
CONDITIONED AIR RETURN	ARCTIC BLUE (F28) WHITE
VENTILATION AIR FLOW	ARCTIC BLUE (F28) LIGHT STONE (C37)
VENTILATION AIR EXHAUST	ARCTIC BLUE (F28) LIGHT STONE (C37)
CHILLED WATER	BRILLIANT GREEN (H10) PEACOCK BLUE (F08)
CONDENSER WATER	BRILLIANT GREEN (H10) SALMON PINK (A40)
REFRIGERANT	LIGHT GREY (G29)
DIESEL	GOLDEN BROWN (B13) WHITE
TRANSFORMER OIL	GOLDEN BROWN (B13) CRIMSON (A03)
FUEL OIL	GOLDEN BROWN (B13) + LABEL

All piping shall be labelled as per SANS requirements including the direction of flow at maximum 3 metre intervals or at all changes of direction, Tee’s and wall penetrations.

RECOMMENDED NOISE RATINGS INSIDE BUILDINGS

Description Area	Criteria for continuous noise intrusion	
	NR Curve	Approx. dB (A)
Office Buildings:	40	45
General open offices, reception areas	35	40
Design offices	40	45
Drawing offices	30	35
Conference rooms	35	40
Executive offices	45	50
Foyers, public areas	45	50
Typing and machinist rooms, computer rooms		
Hospitals:	35	40
Hospital wards (public)	30	35
Hospital wards (private)	30	35
Intensive care wards, operating theatres	40	45
Laboratories, casualty areas	45	50
Kitchens, sterilising and service areas	40	45
Surgery, dental clinics and consulting areas	45	50
Waiting rooms and reception areas		

KWAZULU-NATAL
DEPARTMENT OF HEALTH

INFRASTRUCTURE DEVELOPMENT

ENGINEERING ADVISORY SERVICE

POLICY DOCUMENT FOR THE

DESIGN OF ELECTRICAL INSTALLATIONS

(TO BE USED STRICTLY AS A DESIGN GUIDE ONLY)

IMPLEMENTATION DATE: JANUARY 2006

Rev. 1 – January 2007
Rev. 2 – January 2008
Rev. 3 – January 2009
Rev. 4 – January 2010
Rev. 5 – January 2011
Rev. 6 – January 2012
Rev. 7 – January 2013

STANDARDS COMMITTEE MEMBERS

Mr. R. Westwood	Chairman	KZN Department of Health
Mr. V. Stevens		KZN Department of Health
Mr. J. Jeney		KZN Public Works
Mr. L. Wilson		KZN Public Works

I N D E X

CODES AND SPECIFICATIONS FOR ELECTRICAL INSTALLATIONS

The complete installation shall conform to the following:

The South African National Standards Wiring Code - SANS 10142-1:2006.

Occupational Health and Safety Act and Regulations (85 of 1993).

Energy Code of Conduct for all Government Buildings **Rev 3**

The Local Authority Fire Regulations.

ICASA Regulations.

National Building Regulations and the SANS 10400: Code of Practice for the Application of the National Building Regulations.

R158 where applicable

The Province of KwaZulu-Natal Standard Specifications for:

a) General Electrical Specifications.

b) Air-conditioning and Ventilation Installations.

c) Standard Policy and Norms for Air-conditioning.

d) Fire Fighting Installations and Equipment.

e) Hot and cold water for building services.

f) Industrial kitchen equipment.

g) Industrial laundry equipment.

h) Steam boiler installations.

i) Steam and Condensate Reticulation Services.

j) Refrigeration Services.

k) Standby Generators.

l) Water Treatment for Mechanical Installations.

m) Standard Specification and drawings for Medical Gas and Vacuum Services.

n) Standard Specification for Steam Sterilizers.

o) Standard Specification for Instrument Washer/Disinfector.

p) Operating Theatre Light Specifications (Combination, Main and Satellite).

q) Medical Inspection Light Specification.

r) Bed head Ducting Specification.

s) Nurse Call Specifications.

t) Uninterrupted power supply (UPS) Specifications.

u) Information Communication Technology Infrastructure Specifications Manual Rev 2

v) Standard Specification for Solar Water Heating (SWH) Rev 3

Standard Drawings **Rev1**

The standard drawings listed below form part of this policy document and must be read in conjunction with it: -

Electrical

a)	Theatre Layout (E&M) Rev 6	Drawing No.	3039H/02.1E	December 2008
b)	Clinic Delivery Room UPS	Drawing No.	7006H-01E-R4	January 2007
c)	Typical Bed head ducting	Drawing No.	7008H	January 2007
d)	ICU Fixed Ceiling Pendent	Drawing No.	7009H	January 2007
e)	ICU Articulated Ceiling Pendent	Drawing No.	8004H	January 2008

Mechanical

a) 7007H/M M(X)DR TB Ward

Structural

a)	Laboratory	Drawing No.	4036H/01-R4	January 2004
b)	Pharmacy	Drawing No.	5046H	October 2005
c)	Plant Room Doors	Drawing No.	3025H/02	August 2003
d)	Theatre and CSSD	Drawing No.	3039H/01-R3	December 2008
e)	X-Ray Suite	Drawing No.	5031H	February 2006

General Information

All information technology Infrastructure must be installed by an approved and accredited State Information Technology Agency (SITA) Contractor in accordance with Department of Health Tele-Medicine and Information Technology unit policy and specification.
Rev 5

The electrical reticulation system at all health institutions shall comply with the standards and specifications of the Local Supply Authority or Eskom as the case may be. Rev 1

The notified maximum demand shall be calculated by the Consulting Electrical Engineer and shall be submitted at report stage.

The Consulting Electrical Engineer shall determine the availability of supply from the relevant supply authority and the information shall be submitted at report stage. **Rev 7**

Specific applicable notified maximum demands shall be applied for from the relevant supply authorities irrespective of transformer capacity.

The Consulting Electrical Engineer shall indicate the anticipated spare capacity available after installation and commissioning. **Rev 7**

All design criteria for distribution of the electrical systems shall conform to the following estimated sizes of supply and shall be confirmed by calculation.

Clinics: Small - 50 kVA

	Medium	-	50 kVA
	Large	-	100 kVA
	Extra Large	-	100 kVA
Community Health Centres:		-	300 to 500 kVA
District Hospitals:		–	1000 kVA
Regional Hospitals:		–	Consult with Department of Health
Tertiary Hospitals:		–	Consult with Department of Health Rev 1

Power Supply shall be as follows:
Normal / Non-essential = from Supply Authority

Emergency / Essential = from Emergency stand-by generating plant
= 72 hour running capacity including day tank and bulk fuel tank. Rev 4

UPS = all UPS are supplied from Essential supply
= 30 minute backup on full load. Rev 4

The electrical reticulation system for Hospitals, Community Health Centres and Clinics shall be separate essential (Generator Supply) and non-essential (Normal Supply). Where the older type Clinic has only a single electrical distribution system then backup power to the maternity section shall be by means of an Uninterrupted Power Supply (UPS). Refer to Drawing No. 7006H-01E. Drop-out contactor systems are not permitted in new designs. Rev 1

All UPS units must have rotary type bypass systems, which must bypass both the input and output of the UPS, remote alarms and be protected by curve 1 circuit breakers. Rev 3

All UPS units shall have a separate battery cabinet. Rev 3

Sequential delayed soft starting shall be installed on all heavy electrical driven equipment, e.g. medical gas plants, lifts, air-handling units.

Efficient energy management shall be encouraged with timer load control on non-critical plant, i.e. air-conditioning in general areas, space heating and hot water generating systems and the use of energy efficient lighting equipment.

Solar water heating, energy recovery units and heat pumps shall be considered in the design stage for all new facilities and the renovation of existing facilities. Investigation into the quality of electrical and water supply needs to be evaluated. Rev 4

Residences shall have load control relays for geyser control.

All equipment shall comply with the National Electricity Regulator (NER) voltage specifications – 230/400 volts ± 10%. All major equipment shall be protected by means of voltage window comparators which shall include single phase protection, phase rotation protection and under/over voltage protection, i.e.

a) Air-conditioning plant

b) Boiler plant

c) Hot water generating plant

d) Kitchen equipment

e) Laundry equipment

f) Medical gas plant

g) Refrigeration plant

h) Stand-by electrical generators

i) Sterilization plant

j) Water and sewer plant

k) X-Ray Equipment Distribution Board Rev 2

Medium Voltage Equipment: Switchgear shall be vacuum technology. **Rev 7**

All electrical transformers shall have copper windings on both primary and secondary sides. Rev 6

Main and major Medium and Low Voltage Panels and associated switchgear and equipment shall be subjected to infrared testing prior to commissioning. Rev 1

Integral earthing mechanism shall be provided on switchgear.

Earth and overload fault relay protection shall be provided and settings shall be confirmed in writing with the Local Supply Authority.

Paper insulated, lead sheath, copper conductor, steel wire armour cable shall be used on all medium voltage reticulations.

No back-up transformers shall be provided.

It is preferable to have two independent supplies from the Local Supply Authority connected through a bus coupler, which shall be under the control of the Local Authority. The two independent supplies shall not form part of the Local Supply Authority's ring system.

Electronic metering shall be provided on all bulk supplies when it is not provided by the Local Supply Authority.

Laminated framed schematic diagrams showing all sub-stations, switchgear and indicating normal open position of ring circuits is to be installed in each sub-station

Services shall to be exposed wherever practicable in order to facilitate repair and maintenance work.

All general plant room doors shall be galvanised and as per Drawing Number 3025H/02 and fitted with a standard HA 1 padlock. Standard air conditioning plant room doors shall be as per Drawing Number 8003H/01. Rev 2

Plant rooms shall preferable be located at ground level for single story buildings or on the same level in multilevel buildings.

Rev 1

All equipment within the plant rooms shall have at least one metre clear working space all round to facilitate ease of maintenance.

Rev 1

The designer shall provide all proposed plant room layout drawings which shall include all major plant and equipment, ducting layout, distribution boards etc. Rev 2

The responsibility of coordinating the layout of the plant rooms shall be that of the designer. Rev 2

Electrical installations shall carry a 12-month guarantee and maintenance period from the date of Works Completion.

Preference shall be given to South African manufactured products. Rev 1

Where reference is made to “other approved” items this shall mean approval prior to tender closure.

Rev 1

Where conduit chasing and openings are required in concrete slabs and columns approval and a method statement must be obtained from a suitably qualified structural engineer. Rev 3

HANDOVER PROCEDURES AND OPERATION AND MAINTENANCE MANUALS

Handover procedures is to be as follows:- Rev 6

- Practical completion is taken at the end of contractual construction period or when occupation can be taken.
- “As built” drawings are to be supplied at Practical Completion.
- Works completion is taken when all snag items identified at practical completion have been attended to.
  At this time the maintenance period commences GCC = 12 moths
  JBCC = 3 months for building and 12 months for electrical and mechanical.
- At completion of maintenance period Final Completion is taken.

The contractor shall hand over, at the completion of the works one original and two copies of the necessary operating and maintenance requirements for all plant and equipment supplied and installed by him or her as part of the works. Each copy of the operating and maintenance manual shall be separately bound in an acceptable manner, and shall contain the following data where applicable. These documents are to be handed to the Project Leader responsible for the project and the Project Leader shall ensure that these documents are handed to a Department of Health Head Office official.

a) Scope of Work

b) Operating Instructions

c) Normal Operation

d) Safety Measures

e) Fault Finding Guide

f) Equipment Information

g) Schedule of Information

h) List of Spares and Agents

i) Design Data

j) As Commissioned Data

k) Maintenance Requirements

l) KZN Department of Health Service Schedules

m) Manufacturers Service Recommendations

n) Manufactures Literature

o) Equipment Brochures

p) Proprietary Drawings, Exploded Views and Wiring Diagrams

q) As Built Drawings

r) Electrical Drawings

s) System Layouts and Schematics

t) Training Certificates

As Built Drawings

Complete sets of drawings (one electronic and three hard copies) of the entire project shall be included in the as built documentation. The set shall include:

a) Architectural drawings and details.

b) Electrical wiring diagrams indicating all cable sizes, current ratings, fuses, control units, site cable reticulation and schematic wiring diagrams applicable to the works.

c) Mechanical drawings and schematics showing all equipment, connections to the equipment and service runs installed by the Contractor, and isolating valves, etc.

d) Exploded views of all equipment showing each component part adequately identified and numbered.

e) The electronic records (on disk) are to be handed to the Department of Health Head Office official at Practical Completion.

f) Laminated and framed copies of operating procedures, wiring diagrams, zone diagrams and plant schematics as applicable are to be fixed to the wall in a well illuminated and accessible area.

Equipment Schedules

A complete schedule of all plant and equipment forming part of the WORKS shall be included in the manual. The schedule shall include, but shall not be restricted to the following data:

a) Equipment type and model

b) Equipment identity number/serial number

c) Date of manufacture, testing installation and commissioning

d) Country of manufacture

e) Manufacturers name and contact address

f) Any other information required by the Department

Maintenance Requirements

The manufacturer's recommendation with regard to the routine servicing and maintenance of all equipment shall be included in the manual. This data shall include the recommended service interval and the estimated hours required for each type of service, for each item of equipment, together with a list of agents/contractors authorised to carry out service/maintenance.

For identified systems, plant and equipment, a proposed maintenance schedule shall be provided by the specialist for a period of thirty six (36) months after final delivery Rev 2

Operating Instructions and Training

A complete description of all operating procedures and safety measures shall be included in the manual. A basic "Fault Finding Guide" shall also be included.
Training shall be given to staff operating machinery and plant together with maintenance personnel.

Training certificates shall be signed by all staff that has received training.

The following table below shall be used by the Project Leader and Principal Agent as a check list for the submission of all “As built” documents. Rev 1

AS BUILT DOCUMENTATION REQUIREMENTS
ALL DRAWINGS REQUIRED IN AUTOCAD (DWG) FORMAT ON CD
PROJECT =

	AS BUILT DRAWINGS (DESCRIPTION)	**REQUIRED**		**SUPPLIED**	
		Yes	No	Yes	No
1	ARCHITECTURAL - PLANS, DETAILS etc				
2	ELECTRICAL - RETICULATIONS, TELEPHONES, NURSE CALL SYSTEMS, ALARMS, BMS AND ELEVATORS etc.				
3	MECHANICAL - AIR CONDITIONING, GAS LINES, (LAYOUTS AND SIZES)				
4	STRUCTURAL, - REINFORCING SCHEDULES				
5	CIVIL (STORMWATER AND SEWER) - EARTHWORKS, SITE SERVICES RETICULATIONS, ROAD MARKINGS etc.				
6	EQUIPMENT SCHEDULE				
7	COMPUTERISED PROGRAMMES - CD's				
	COMPLIANCE CERTIFICATES (DESCRIPTION)				
8	PRESSURE TESTING -				
	1) MEDICAL GAS				
	2) STEAM LINES				
	3) CHILLED WATER				
	4) CONDENSER WATER				
	5) WATER MAINS				
	6) HOT & COLD WATER RETICULATION				
	7) COMPRESSED AIR LINES				
	8) VESSELS UNDER PRESSURE				
	9) SEWER RETICULATION				
	10) PLUMBER				
	11) STABILITY CERTIFICATES				
9	ELECTRICAL - MASTER or INSTALLATION ELECTRICIAN				
10	SOIL POISONING / COMPACTION				
11	LOCAL FIRE DEPARTMENT CLEARANCE				
12	ROOF TRUSSES - TRI &TR2				
13	FIRE DETECTION - SPRINKLER SYSTEMS, FIRE EXTINGUISHER AND HOSE REELS				
14	LIGHTNING AND EARTHING				
15	ELEVATORS COMPREHENSIVE REPORT HOISTS : ANNEXURE 'K'				
16	CONCRETE CRUSHING TEST				
17	GUARANTEE'S (NEW AND UPGRADED EQUIPMENT)				
	MANUALS				
18	OPERATING MANUALS PERTAINING TO ALL NEW EQUIPMENT				
19	POST GUARANTEE 36 MONTH MAINTENANCE SCHEDULE AND PROPOSED PRICING SCHEDULE				

LIGHTING

Interior Lighting

Interior Lighting shall conform to the following SANS Codes: **Rev 7**
SANS 10400 Application of the National Building Regulations – Part O – Lighting & Ventilation
SANS 10114-1 Interior Lighting Part 1: Artificial Lighting for Interiors.
SANS 10142-1 Code of Practice: The Wiring of Premises.
SANS 204: 2008 Energy Efficiency in Buildings.
SANS 475 Energy Ratings

Energy Efficiency Ratings for luminaires shall be equal to or better than a 4 star rating of 2.1<LR>2.2W/$m^2$100 lux. **Rev 7**

The Standard calculation for efficiency is done with a standard room of 100m^2 (10m x10m x 2.75m H) with a room index of 2.5 using standard room reflectance's of 70/50/20 for ceiling/walls/floor to determine the Watts/m^2/100 lux. **Rev 7**

All luminaires shall have full photometric data sheets available and these shall be included in the "As Built" documentation. **Rev 7**

All types of luminaires shall make use of tried and tested technologies. **Rev 7**

All down lighter type luminaires shall be fitted with integrated ballasts / transformers. **Rev 7**

All interior lighting levels shall be verified by means of an appropriately scaled light meter, witnessed and documented by the Consultant. Rev 1

Luminaries for specific projects must ensure uniformity and standardisation in wattage capacity.
All fluorescent luminaries shall have electronic ballasts and incandescent lighting must be confined to x-ray rooms only. Rev 3

Luminaries in suspended ceilings shall be supported from the roof trusses on all four corners. Rev 3

Lighting above bed spaces in ICU's and Neonatal ICU's shall be made dimmable to enhance patient comfort. Rev 1

Tertiary / Regional Hospitals Operating Theatres: Operating room/luminary	Minimum of 2 x OT lights of 160 000 lux each measured at operation table level. Rev 4 400 lux for general lighting. Rev 2
District Hospitals / CHC's – Operating Theatres: Operating room/luminary	Minimum of 115 000 lux at operation table level via OT main light and a minimum of 50 000 lux for the satellite. 400 lux for general lighting.
OT Recovery areas	400 lux for general lighting.
Maternity Delivery / Stitch Room	Minimum of 30 000 lux measured at operation table level. 400 lux for general lighting.
Paediatric and Neonatal ICU's	10 000 lux for local examination luminary 400 lux at whole bed area for observation – dimmable. Rev 4

Adult ICU	30 000 lux for local examination luminary 400 lux at whole bed area for observation – dimmable. Rev 5
Procedure Room Emergency / Casualty Unit / Resuscitation Room	30 000 lux for local examination luminary. 400 lux at whole bed area for observation. Rev 5
High Care and all patient treatment areas	10 000 lux for local examination luminary 400 lux at whole bed area for observation `` Rev 5
General Wards – passageways, patient waiting areas	160 lux at whole bed area for observation
Forensic and Hospital mortuaries	400 lux
Consulting Rooms	10 000 lux for local examination luminary 400 lux at whole bed area for observation Rev 5
General Administration Offices	400 lux
Kitchens Stores	200 lux
Laundries	200 lux
Plant Rooms and Workshops	400 lux
Boiler Houses	Coal and ash handling – 100 lux Boiler rooms – 160 lux
Lifts	Car interior – 160 lux Motor room – 500 lux
Ablution areas	160 lux
Laboratories	400 lux
Radiology	400 lux for patient preparation Dimmable incandescent lighting for patient treatment. Rev 2
Area lighting	50 lux
Pharmacy	400 lux
Lecture rooms	400 lux
Service Ducts and Roof Voids	100 lux

Types of Luminaries **Rev 1**

All patient treatment areas:	Prismatic diffused fluorescent fittings.
Seclusion Wards :	Vandal proof fitting
Consulting Rooms Examination Lights:	12/24 volt 50w with 4000hr Dichroic reflector lamp
General Administration Offices:	Prismatic diffused or Low brightness fluorescent fittings.

Passages:	Prismatic diffused fluorescent fittings.
Walkways:	2PL9 Round Bulkhead or prismatic diffused fluorescent fittings.
Ablutions:	2PL9 Round Bulkhead diffused fluorescent fittings.
Wet areas:	Splash proof IP65 rated 2 x 58w fluorescent fittings.
Plant Rooms:	Splash proof IP65 rated 2 x 58w fluorescent fittings.
Store Rooms:	Prismatic diffused fluorescent fittings.
Chemical Stores:	Flame proof fittings.
Staff houses and Nursing Homes	10% Battery backup fluorescent fittings if not on essential power Rev 4
Illuminated Exit Signs	2 x PL9 lamps with 1HOUR emergency control gear. Rev 2

Refer to the Province of KwaZulu-Natal Standard Specification for General Electrical Installations for further information.

SPACE HEATING

In colder climate areas the preferred heating system shall be a ducted heating system.

In hot climate areas no heating shall be provided, but ceiling fans shall be installed where no air-conditioning is provided.

Nurseries and Children's Wards

Where no air-conditioning or central ventilation type systems with electric heating has been provided, the only heaters which shall be permitted in nurseries and children's wards, are wall-mounted fibre cement stainless steel encased convection panel type heaters rated at 500 watts maximum.

Where central ventilation type systems are installed, electric heater banks shall be installed in the air-handling unit to provide the required space heating. In this case no individual electrical space heaters per room/area shall be accepted. Space heating shall then be controlled on the supply air temperature of between 22ºC - 24ºC, which shall control the heater banks. Once the outside ambient temperature reaches a preset level, the heater banks shall be totally switched off and the air-handling unit shall function normally as a ventilation unit supplying unconditioned air.

Other Areas in Health Care Facilities

Where no air-conditioning or central ventilation type systems with electric heating has been provided, the only heaters which shall be permitted shall be electrical fan heaters or the wall mounted fibre cement stainless steel encased convection panel type heaters rated at 500 watts maximum. This case shall only apply where ambient temperatures require the provisioning of space heating.

Where central ventilation type systems are installed, electric heater banks shall be installed in the air-handling unit to provide the required space heating. In this case no individual electrical space heaters per room/area shall be accepted. Space heating shall then be controlled on the supply air temperature of between 22ºC- 24ºC, which shall control the heater banks. Once the outside ambient temperature reaches a preset level, the heater banks shall be totally switched off and the air-handling unit shall function normally as a ventilation unit supplying unconditioned air. This case shall only apply where ambient temperatures require the provisioning of space heating.

NORMAL (NON-ESSENTIAL) AND EMERGENCY (ESSENTIAL) ELECTRICAL SERVICES

Normal, emergency and UPS, where applicable, electrical power shall be provided via separate distribution boards.

If a kitchen's primary energy source is electricity, certain appliances shall be fed off the emergency power source. These shall be determined for each institution and shall not compromise the generator capacity. **Rev 1**

Where Operating Theatres are served by individual unitary air-conditioning units one unit may be connected to the Essential supply **Rev 4**

Power Supply shall be as follows:
Normal / Non-essential = from Supply Authority
Emergency / Essential = from Emergency stand-by generating plant = 72 hour running capacity including day tank and bulk fuel tank. **Rev 4**
UPS = all UPS are supplied from Essential supply = 30 minute backup on full load. **Rev 4**

LOCATION	NON-ESSENTIAL POWER	ESSENTIAL POWER	UNINTERUPPTED POWER SUPPLY (UPS)
Major / Main Operating Theatres:			
Main and Satellite OT Lights ----------	----------	----------	100%
Earth Monitoring ----------	----------	----------	100%
Socket Outlets ----------	----------	----------	100%
Peripheral Lighting ----------	----------	----------	100%
Exit Signs ----------	----------	----------	100%
Stitch / Delivery / Procedure Room:			
Main and Satellite OT Lights ----------	----------	100%	
Socket Outlets ----------	----------	100%	
Peripheral Lighting ----------	----------	100%	
Exit Signs ----------	----------	100%	
General areas in OT suites:			
Lighting ----------	----------	100%	Minimum of 1 self-maintained light
Socket Outlets ----------	----------	100%	
Casualty / Trauma Department: Regional and Tertiary Hospital		Min. 6 Socket Outlets per bed / 2 circuits per bed	Min. 6 Socket Outlets per bed / 2 circuits per bed Rev 4
Socket Outlets ----------	----------	100%	100%
Lighting including exit signs ----------	----------	100%	Minimum of 1 self-maintained light

LOCATION	NON-ESSENTIAL POWER	ESSENTIAL POWER	UNINTERUPPTED POWER SUPPLY (UPS)
Casualty / Trauma Department: District Hospital and CHC		Min. 8 Socket Outlets per bed / 2 circuits per bed Rev 2	
Socket Outlets ----------	----------	100%	
Lighting including exit signs ----------	----------	100%	Minimum of 1 self-maintained light
ICU's and Neonatal ICU's:		Min. 8 Socket Outlets per bed / 2 circuits per bed Rev 2	Min. 8 Socket Outlets for Life Support per bed / 2 circuits per bed Rev 2
Earth monitoring system ----------	----------	100%	Min. of 1 self-maintained light
Lighting ----------	----------	100% Patient Treatment	
Socket Outlets ----------	100% General Areas		
HCU's/Burns Unit		Min. 4 Socket Outlets per bed	
Lighting ----------	----------	100%	Min. 1 self-maintained light
Socket Outlets ----------	100% General Areas	100% Patient Treatment	
X-Ray Department:			
3 Phase X-Ray units			
Mobile units – Power ----------	100%		
Lighting ----------	----------	100%	
Socket Outlets ----------	100% General Areas	100%	
Wards			
Bed head Trunking ----------	----------	100% Patient Treatment	
Lighting ----------	----------	100%	
Socket Outlets ----------	100% General Areas	100% Patient Treatment	
Boiler House (Steam)		100%	
General Administration Areas			
Lighting ----------		100%	
Socket Outlets ----------	50%	50% **Rev 4**	
Laboratory		100%	
Mortuary			
Lighting ----------		100%	
Socket Outlets ----------	50%	50% **Rev 4**	
Cold Rooms / Freezer Room ----------	----------	100%	

LOCATION	NON-ESSENTIAL POWER	ESSENTIAL POWER	UNINTERUPPTED POWER SUPPLY (UPS)
Pharmacy		100%	
Plant Rooms		100%	
Medical equipment stores Socket outlets ----------	----------	Min 8 Socket Outlets / 2 circuits	
Medical waste stores Socket outlets ----------	----------	100% One socket outlet per store	
Laundries Laundry Equipment ---------- Lighting ---------- Socket outlets ----------	100% ---------- 100%	100%	
Kitchens Kitchen Equipment ---------- Lighting ---------- Socket outlets ----------	70% ---------- 100%	30% 100%	Rev 3
Nurses Homes Kitchen Equipment ---------- Lighting ---------- Socket outlets ----------	100% ---------- 100% 5amp MCB	100%	Rev 3
MECHANICAL EQUIPMENT Unitary Air-conditioning ---------- Air handling units ---------- Chiller plant ---------- Heating and Cooling ---------- Cold Rooms Autoclaves	100% ---------- 100% 100% 75%	 100% 100% 25%	
Alarms: Fire ---------- Medical Gases ---------- Nurse Call ---------- Burglar/Intruder ----------	 ---------- ---------- ---------- ----------	 ---------- 100% 100% 100%	100% (If not on self-contained battery backup) Self-maintained

LOCATION	NON-ESSENTIAL POWER	ESSENTIAL POWER	UNINTERUPPTED POWER SUPPLY (UPS)
Communication Services:			
PABX ----------	----------	----------	100%
Public Address ----------	----------	100%	
IT Server Rooms ----------	----------	100% for AC and Lighting	100% for data switches Rev 3
Access Control / CCTV ----------	----------	100%	Self-maintained
Hot Water Systems	100%		
Hydro-boils	100%		
Lifts	Other Lifts (if more than one)	Minimum 1 lift	
Pumps:			
Generator Fuel ----------	----------	100%	
Water ----------	----------	100%	
Sewage ----------	----------	100%	
Sumps ----------	----------	100%	
Space Heating	100%		
Ventilation		100%	
X-Ray			
Fixed X-Ray Machines ----------	100%		
Lodox X-Ray Machines----------	----------	100% **Rev 4**	
Mobile X-Ray Machines ----------	----------	100%	
X-Ray Viewers ----------	----------	100%	
Street/Area Lighting	----------	100%	

COLOUR CODING

Normal / Non-essential Supply: White
Emergency / Essential Supply: Signal Red **(SANS 1091 Code A11)**
UPS Supply: Blue **(SANS 1091 Code F01)**
All cover plates shall be PVC and white in colour with 3mm engraved lettering indicating distribution board and circuit number.

COLOUR CODING OF LIGHT SWITCHES

POWER SOURCE	COVER PLATE COLOUR	SWITCH COLOUR	LABEL TYPE	CONTENTS ON LABEL	LETTER SIZE
NORMAL	White	White	Black letters on white Ivorene label or Black engraved letters on cover plate. Ivorene label glued with super glue or pop riveted to cover plate.	Distribution Board Number and Circuit number feeding the switch as per example. DBA /L1	3 mm
ESSENTIAL	White	Red	White letters on red Ivorene label or Red engraved letters on cover plate. Ivorene label glued with super glue or pop riveted to cover plate.	Distribution Board Number and Circuit number feeding the switch as per example. DBAE/L1	3 mm
UPS	White	Blue	White letters on blue Ivorene label or Blue engraved letters on cover plate. Ivorene label glued with super glue or pop riveted to cover plate.	Distribution Board Number and Circuit number feeding the switch as per example. DBAU/ L1	3 mm

Note: All light switches fed from a circuit connected to an Earth Fault Monitor Supply shall be equipped with double pole switches.

COLOUR CODING OF SOCKET OUTLETS

POWER SOURCE	COVER PLATE COLOUR	SWITCH COLOUR	LABEL TYPE	CONTENTS ON LABEL	LETTER SIZE	EARTH PIN	FEMALE SOCKET
NORMAL	White	White	Black letters on white Ivorene label or Black engraved letters on cover plate. Ivorene label glued with super glue or pop riveted to cover plate.	Distribution Board Number and Circuit number feeding the socket outlet as per example DBA/ P1/1 Each socket outlet on a circuit shall be labelled.	3 mm	Round	White
ESSENTIAL	White	Red	White letters on red Ivorene label or Red engraved letters on cover plate. Ivorene label glued with super glue or pop riveted to cover plate.	Distribution Board Number and Circuit number feeding the socket outlet as per example DBAE/ P1/1 Each socket outlet on a circuit shall be labelled.	3 mm	Round	White
UPS	White	Blue	White letters on blue Ivorene label or Blue engraved letters on cover plate. Ivorene label glued with super glue or pop riveted to cover plate.	Distribution Board Number and Circuit number feeding the socket outlet as per example DBAU/ P1/1 Each socket outlet on a circuit shall be labelled. Note: All socket outlets on UPS supply to be labelled as follows: LIFE SUPPORT ONLY	3 mm	Round	White
DEDICATED This socket outlet shall be used for computer equipment only and shall not be on earth leakage units.	Red	Red	Black letters on white Ivorene label or Black engraved letters on cover plate. Ivorene label glued with super glue or pop riveted to cover plate.	Distribution Board Number and Circuit number feeding the socket outlet as per example DBA/ PD1/1 Each socket outlet on a circuit shall be labelled.	3 mm	Chamfered	Red

Note: All socket outlet switches fed from a circuit connected to an Earth Fault Monitor Supply shall be equipped with double pole switches.

All socket outlets used for patient care (i.e. Computers used in Pharmacy, Consulting rooms, Treatment rooms etc.) shall be connected to the Essential power supply where installed. **Rev 7**

COLOUR CODING OF ISOLATORS AT EQUIPMENT

POWER SOURCE	COVER PLATE COLOUR	SWITCH COLOUR	LABEL TYPE	CONTENTS ON LABEL	LETTER SIZE	COMMENTS
NORMAL	White	White	Black letters on white Ivorene label or Black Engraved letters on cover plate. Ivorene label glued with super glue or pop riveted to cover plate.	Distribution Board Number and Circuit number feeding the isolator as per example DBA/ S1	3 mm	
ESSENTIAL	White	Red	White letters on red Ivorene label or Red engraved letters on cover plate. Ivorene label glued with super glue or pop riveted to cover plate.	Distribution Board Number and Circuit number feeding the isolator as per example DBAE/ S1	3 mm	Where red switches are not obtainable the illuminated type red switch may be used or a white switch may be used but the switch shall be tagged with a non removable red sticker.
UPS	White	Blue	White letters on blue Ivorene label or Blue Engraved letters on cover plate. Ivorene label glued with super glue or pop riveted to cover plate.	Distribution Board Number and Circuit number feeding the isolator as per example DBAU/ S1	3 mm	Where blue switches are not obtainable the illuminated type blue switch may be used or a white switch may be used but the switch shall be tagged with a non removable blue sticker.

DISTRIBUTION BOARDS, KIOSKS AND LOW TENSION SWITCHBOARDS

All distribution boards, kiosks and low tension switchboards shall be equipped with lightning protection devices. Rev 7

All Essential and UPS distribution boards, kiosks and low tension switchboards shall be equipped with LED indicators connected to the incoming supply and labelled alternative supply. Rev 7

POWER SOURCE	COLOUR OF DISTRIBUTION BOARD, KIOSK, LOW TENSION SWITCHBOARDS	COLOUR OF FACE PLATE	LABEL TYPE	CONTENTS ON EXTERNAL LABEL	CONTENTS OF INTERNAL LABEL ON FACE PLATE	LETTER SIZE	LABELLING OF CABLES
NORMAL	**Distribution Boards in buildings** White or Beige **Outdoor Kiosks, and Low Tension Switchboards** Electric Orange	**Distribution Boards in buildings** White or Beige **Outdoor Kiosks, and Low Tension Switchboards** Electric Orange	Black engraved letters on white Ivorene label. Ivorene label super-glued or pop riveted to face plate or frame.	Distribution Board Number as per example DB A	Distribution Board Number, Indication of Feeder Source, Size of Feeder Cable, Fault Level Rating of Distribution board, Phase rotation direction	Label of Distribution Board : 6 mm Label on Face Plate: 3 mm	All incoming and outgoing cables shall be labelled with Ivorene labels indicating the size of the cable.
ESSENTIAL	**Distribution Boards in buildings** White or Beige **Outdoor Kiosks, and Low Tension Switchboards** Electric Orange	**Distribution Boards in buildings** Red **Outdoor Kiosks, and Low Tension Switchboards** Red	White engraved letters on red Ivorene label. Ivorene label super-glued or pop riveted to face plate or frame.	Distribution Board Number as per example DB AE	Distribution Board Number, Indication of Feeder Source, Size of Feeder Cable, Fault Level Rating of Distribution board, Phase rotation direction	Label of Distribution Board : 6 mm Label on Face Plate: 3 mm	All incoming and outgoing cables shall be labelled with Ivorene labels indicating the size of the cable.
UPS	**Distribution Boards in buildings** White or Beige **Outdoor Kiosks, and Low Tension Switchboards**	**Distribution Boards in buildings** Blue **Outdoor Kiosks,**	White engraved letters on blue Ivorene label. Ivorene label super-glued or pop riveted to face plate or	Distribution Board Number as per example DBAU	Distribution Board Number, Indication of Feeder Source, Size of Feeder Cable, Fault Level Rating of	Label of Distribution Board : 6 mm Label on Face Plate: 3 mm	All incoming and outgoing cables shall be labelled with Ivorene labels indicating the size of the cable.

	Electric Orange	**and Low Tension Switchboards** Blue	frame.		Distribution board, Phase rotation direction		

OPERATING THEATRES

All new and upgrading of operating theatres shall conform to the latest revision of the Main Theatre Typical Layout Drawing. Rev 1 Rev 2

Each operating theatre shall have its own individual suitably sized UPS situated in a separate air conditioned room.

Where separate package air-conditioning condenser units are provided for each theatre then one theatre may be connected to the essential electrical supply provided there is spare capacity on the emergency generating set. Rev 4

Where the mirroring of operating theatres occurs during the design stage, the position of the ceiling mounted pendent shall not alter. It shall remain at the head and to the right of the operating table when viewed from the foot of the table. Rev 1

Theatre and Examination Lighting

Tertiary and Regional Hospital operating theatres shall each be equipped with a combination of 2 x theatre lights with a minimum lighting level of 160 000 lux each. Rev 4

District Hospital operating theatres shall each be equipped with a combination of 2 x theatre lights with a minimum lighting level of 115 000 lux each. Rev 5

Adult ICU / Maternity Theatres / Delivery Rooms shall be equipped with a medical light of 30 000 lux minimum and shall be ceiling mounted at the foot of the bed. Rev 4

Procedure / Stitch Rooms shall be equipped with a ceiling mounted medical light of 30 000 lux minimum. Rev 4

Each bed in a Casualty / Trauma Unit shall be equipped with a ceiling mounted medical light of 30 000 lux minimum. Rev 5

Each Consulting Room shall be equipped with a wall mounted medical light of 10 000 lux minimum. Rev 5

Uninterrupted Power Supplies (UPS)

Each Operating Theatre and ICU shall be equipped with a UPS with a minimum rating of 5 kVA at 230-volts and shall be housed in an air-conditioned environment in close proximity to the Earth Fault Monitoring Sub-Distribution Board. Rev 2

Clinic maternity units operating on a 24 hour basis shall be equipped with a minimum of 5 kVA at 230-volts UPS. Refer to drawing 7006H-O1E Rev 4. Rev 4

All UPS units must have rotary type bypass systems, which must bypass both the input and output of the UPS, remote alarms and be protected by curve 1 circuit breakers. Rev 3

All UPS units shall have a separate battery cabinet. Rev 3

Earth Monitoring Systems

Power supply to switched socket outlets and switches in ICU's, Operating Theatres shall be on an earth monitoring system. Double pole switches on socket outlets and switches shall be used for supply points in these areas. Refer to standard theatre layout drawing.

All Earth Monitoring Systems shall comply with and be certified in terms of SANS 10142-1 Section 7. Rev 1

All circuits shall be enclosed in PVC conduits and there shall be separate circuits for IT and TN-S systems. Rev 1

The colour coding of wiring on the secondary side of the isolating transformer shall be in accordance with SANS 10142-1 Regulation 6.3.3.2 item a.1 and a.3. Rev 1

The Earth Monitoring Distribution Board shall be located as close as possible to the Earth Monitoring distribution system. The remote alarm panel shall be located inside the theatre and in the case of an ICU it shall be located at the Nurse station. Rev 1

BEDHEAD DUCTING Rev 1

All bed head ducting shall be supplied from the essential electrical distribution system.

The Electrical Consulting Engineer shall allow in his/her design documentation for the incorporation of medical gas points in the bedhead ducting including all pipe work and connections where applicable, this work shall be done by the bedhead ducting supplier at the factory.

Prior to manufacture of bedhead ducting all drawings shall be approved by both the mechanical and electrical engineers. Rev 3

The final connection to the bedhead ducting from the main medical pipe system shall be done by the medical gas specialist.

All Health Institutions shall be provided with surface mounted bedhead ducting or pendent type (Where applicable) and shall incorporate the following:

General requirements for all wards.

The following items shall be taken into account in the particular specification of the project:

a) All Socket Outlets, Switches and Isolators shall be of the same make and model

b) No Chamfered earth pins shall be permitted

c) All switch toggles shall identify the type of electrical supply, i.e. white – normal, red – essential, blue - UPS

d) Circuits shall be engraved on base 3mm colour coded lettering indicating circuit number and DB. Rev 4

e) All light fittings shall be the prismatic diffused type and shall have electronic ballasts.

f) Lamp colour – cool white.

g) Wiring – every 1m distance (wire wrapping)

h) Supply vertical riser with ceiling trim and connection box 100mm through ceiling.

i) End of units shall be installed with 50mm distance from either side of wall.

j) Medical gas outlet points shall be identified and colour-coded using labels with 3mm lettering.

k) Medical Gas shall be installed by bedhead manufacturer in terms of the KwaZulu-Natal Standard Specifications and Drawings for Medical Gas and Vacuum Services.

l) Heyer/Afrox gas service outlets with shut off / non-return valve are required.

m) Medical Rails – General Wards 500mm in length behind beds, all other wards full length

Specific Requirements for all wards:

General Wards:

a) Each bedhead duct run shall be provided with one earth leakage isolator with the necessary circuit breakers for the respective circuits and shall be clearly and unambiguously labelled. Rev 2

b) Separate compartments shall be provided for Electrical mains voltage / low voltage and medical gas in both the bed head trunking and vertical risers. Rev 5

c) All nightlights and main up lights shall be switched per bedhead duct from entrance door.

d) 58-watt Main up light per bed (Switched from entrance door). Rev 2

e) 18-watt Reading light per bed (Switched from bed head duct). Rev 2

f) 5-watt Nightlight per bed (Switched from entrance door). Rev 2

g) Two switched socket outlets per bed on separate circuits with a maximum of eight (8) socket outlets per circuit. Rev 2

h) Medical gas outlet points (Oxygen and Vacuum – 1 set per two beds).

i) 300mm Medical Gabler rail.

j) One nurse / emergency call point per bed.

Ceiling lighting shall be avoided wherever practicable.

The following items shall be taken into account in the particular specification of the project:

a) Installation height of bed head ducting shall be 1500mm from floor level to centre of unit. Rev 2

Adult and Paediatric Intensive Care Units (ICU's)

a) Ceiling lights (Two per bed and dimmable fluorescent – Switched from pendent) Rev 5

b) Peripheral lighting (Dimmable fluorescent- Switched from nurse station). Rev 2

c) Ceiling mounted Consulting Medical Examination light 12/24 volt – one per bed. Rev 2

d) One articulated pendent per bed and shall incorporate the following: Rev 2

- Eight (8) switched socket outlets (Minimum of 2 circuits per bed with a maximum of eight (8) socket outlets per circuit) – IT earth monitoring system via UPS on Essential supply. Rev 2
- Eight (8) switched socket outlets (Minimum of 2 circuits per bed with a maximum of eight (8) socket outlets per circuit) – IT earth monitoring system on Essential supply. Rev 2
- Medical gas outlet points (3 x Oxygen, 2 x Vacuum and 3 x Low Pressure Air per pendent. **Rev 7**
- Two way light switch.
- Four equipment mounting poles – complete with medical rails -Refer to Drawing No 7009H. Rev 2

The following items shall be taken into account in the particular specification of the project:

a) Labelling above switched socket outlets on pendent shall read the following:

- UPS Supply – Patient Life Support Only
- Essential Supply – Patient General Use Only

b) The pendent shall be located at the head and to the left of the bed and shall be at least 1500mm from the back wall.

c) Installation height 1800mm to underneath of pendent measured from final floor level.

Neonatal Intensive Care Units (NICU's)

a) Ceiling lights (One per bed and dimmable fluorescent - Switched from bed head ducting).

b) Passage lights (Dimmable fluorescent - Switched from nurse station).

c) Bed head ducting shall incorporate the following:

- Eight switched socket outlets per bed (Minimum of 2 circuits per bed with a maximum eight (8) socket outlets per circuit) – IT earth monitoring system via UPS on Essential supply.
- Eight switched socket outlets per bed (Minimum of 2 circuits per bed with a maximum of eight (8) socket outlets per circuit) – IT earth monitoring system on Essential supply.
- Medical gas outlet points (3 x Oxygen, 2 x Vacuum and 3 x Low Pressure Air per bed with full length Medical Gabler rail. **Rev 7**

The following items shall be taken into account in the particular specification of the project:

a) Labelling above switched socket outlets on pendent shall read the following:

- UPS Supply – Patient Life support only.
- Essential Supply – Patient General use only

b) Installation height 1000mm above floor level to centre of bed head ducting. Rev 2

Casualty/ Trauma Wards

a) **Regional and Tertiary Hospital**

Twelve (12) switched socket outlets per bed - six (6) on UPS and six (6) on Emergency supply. (Minimum of 2 circuits per bed with a maximum of eight (8) socket outlets per circuit).

District Hospital and CHC's

Eight (8) switched socket outlets per bed on Emergency supply. (Minimum of 2 circuits per bed with a maximum of eight (8) socket outlets per circuit). Rev 4

b) Medical gas outlets (Oxygen, Vacuum and Medical Air Low Pressure -1 set per bed) Rev 4
c) Full length Medical Gabler rail.
d) One nurse / emergency call point per bed.
e) Ceiling mounted medical light - 24 volt 80 watt 50 000 lux @ 1 metre.

General ceiling lighting shall be supplied.

The following items shall be taken into account in the particular specification of the project:

a) Installation height of over bedhead ducting shall be 1900mm from floor level to underneath of unit and at least 1500mm from the back wall. Rev 4
b) The Bedhead Ducting shall be suspended from the ceiling. Rev 4

<u>High Care WardS / Burns Unit</u>:

a) 58-watt Main up light per bed (Switched from entrance door). Rev2
b) 18-watt Reading light per bed (Switched from bed head duct). Rev2
c) 5-watt Nightlight per bed (Switched from entrance door). Rev2
d) Eight switched socket outlets per bed. (Minimum of 2 circuits per bed with a maximum of eight (8) socket outlets per circuit) Rev 3
e) Medical gas outlets (Oxygen, Vacuum and Medical Air Low Pressure-1 set per bed). Rev 4
f) 300mm Medical Gabler rail.
g) One nurse / emergency call point per bed.

Ceiling lighting shall be avoided wherever practicable.

The following items shall be taken into account in the particular specification of the project:

a) Installation height of bed head ducting shall be 1500mm from floor level to centre of unit. Rev 2

<u>Maternity Delivery Rooms</u>

a) Four (4) switched socket outlets per bed – ***one set per bed + set for infant***. (Minimum of 2 circuits per bed with a maximum of eight (8) socket outlets per circuit) Rev 2
b) Medical gas outlet points :-
Oxygen and Vacuum – ***one set per bed***

Oxygen, vacuum and medical air low pressure - ***one set for infant)*** Rev 3

c) Two 500mm Medical Gabler Rail.

d) One nurse / emergency call point per bed.

e) Ceiling mounted medical light - 24 volt 80 watt 50 000 lux measured at 1 metre. General ceiling lighting shall be supplied.

The following items shall be taken into account in the particular specification of the project:

a) Installation height of bed head ducting shall be 1500mm from floor level to centre of unit. Rev 2

Procedure / Stitch Rooms: Rev 4

a) Eight switched socket outlets per bed. (Minimum of 2 circuits per bed with a maximum of eight (8) socket outlets per circuit)

b) Medical gas outlets (Oxygen, Vacuum and Medical Air Low Pressure - 1 set per bed).

c) 500mm Medical Gabler rail.

d) Ceiling mounted medical light - 24 volt 80 watt 50 000 lux measured at 1 metre.

d) General ceiling lighting shall be supplied.

e) One emergency call point per bed.

The following items shall be taken into account in the particular specification of the project:

Installation height of bed head ducting shall be 1500mm from floor level to centre of unit.

Preop / Postop in Theatre Suite

a) Two switched socket outlets per bed. (Minimum of 2 circuits per bed with a maximum of eight (8) socket outlets per circuit).

b) Medical gas outlets (Oxygen, Vacuum 1 set per bed).

c) Gabler mounted medical light - 24 volt 80 watt 30 000 lux measured @ 1 metre.

d) General ceiling lighting shall be supplied. One emergency call point per bed.

e) Installation height of bed head ducting shall be 1500mm from floor level to centre of unit.

HOT WATER SYSTEMS

The preferred system for the provision of hot water in large quantities is Heat Pumps. Rev 5

Consideration shall be given to the installation of approved solar panel water heating systems which shall form part of the Eskom initiative to reduce power consumption. This system shall be incorporated into the design of electrically operated water heating systems at all health institutions. Rev 2

Solar water heaters shall be installed by ESKOM approved installers only. Rev 3

Only thermo-syphon type solar water heating systems shall be installed in systems with a storage capacity of 350 litres or less. Rev 3

Energy recovery units and heat pumps shall be considered in the design stage for all new facilities and the renovation of existing facilities. Investigation into the quality of electrical and water supply needs to be evaluated. Rev 4

As far as is practical, hot water systems are to be decentralised, i.e. point of use.

Hot water supply design figure – 35 litres per patient per day.

Domestic type installations may be supplied from standard, i.e. up to 250 litres, 4kW geysers, but larger systems are to consist of electric in-line heat pumps coupled to storage tank(s). These storage tanks are not to exceed 2,500L capacity per unit. Rev 5

Only double chamber instantaneous water heaters are to be installed and no provision shall be made for hot water tap outlet.

For electrical driven systems refer to the Provincial Standard Specification for Hot and Cold Water for Building Services for further details.

For steam driven: Steam and Condensate Reticulation

General

Point of use application shall be the design criteria.

No calorifier storage for patient and staff areas shall exceed 60^0C.

Hot water temperature for paediatric wards shall not exceed 40^0C at the point of use. The use of thermostatically controlled mixing valves on the hot water line is recommended near the point of consumption. (Group these points together from one mixing valve).

Kitchen and Laundry calorifiers shall not exceed 80°C.

All pressure/temperature gauges shall be marked.

All reticulation piping on hot or cold water services to be of copper class 2 or multi-layered piping and installed on external walls wherever possible, if installed in walls, only labour bends are permitted. Rev 5

Drain valves to be situated at the lowest level for both the storage vessel and the inline heater and to be easily accessible and to discharge to drain.
All safety valves shall discharge outside the plant room and in a safe position so as not to cause injury or damage to persons or buildings.

Where double chamber instantaneous water heaters are installed no provision shall be made for hot water tap outlet at that particular sink.

LAUNDRIES

Other than Central Laundries, equipment shall be kept to a minimum at all other Health Institutions to suit the application and shall not exceed the following sizes of which technical specifications are available. Rev 1

The designer must consult institutional management with regards to onsite laundry requirements. Rev 3

a) Sluice Machine (9 to 25kg).

b) Roll Ironer single roll (1900 to 2000mm)

c) Washer Extractor (23 to 34kg)

d) Side Loading Washing Machine (67kg)

e) Electrically heated Tumble Drier (23 to 34kg)

f) Single Garment Press

KITCHENS

If the kitchen's primary energy source is electricity, certain appliances shall be fed off the emergency power source. These shall be determined for each institution.

Layouts shall be discussed with this Department's Electrical and Mechanical Section. The complete equipment layout, including sinks, worktops, canopies, etc. shall be the responsibility of the Electrical and Mechanical Section and the Architect shall be advised at the working drawing stage of the services and plumbing requirements.

Kitchens - clarify type of dishwasher system at design stage.

Preferred system is a central island system with extract canopy fed directly from distribution board.

The amount and size of the equipment to be installed shall be verified by calculations and shall relate to the number of meals served per sitting. Rev 1

Technical Specifications are available for the following equipment:

a) Steam Heated Boiling Pot

b) Electrically Heated Boiling Pot

c) Electric Range

d) Tilting Frying Pan

e) Convection/Steaming Oven

f) Stainless Steel Worktops

g) Stainless Steel Sinks

h) Extract Canopy

COLOUR CODING FOR PIPED SERVICES

Colours as per the attached table "Colour Coding for piped Services" are to be used.
Note that unless specified otherwise, medical gas piping is to be painted over its entire length.
Relevant SANS 1091 code in brackets.

CONTENTS OF PIPING	COLOUR

	(CODE)
STEAM	PASTEL GREY (G54)
CONDENSATE	BRILLIANT GREEN (H10) WHITE
HOT DOMESTIC WATER	BRILLIANT GREEN (H10) CRIMSON (A03)
COLD DOMESTIC WATER	BRILLIANT GREEN (H10) CORNFLOWER (F26)
INDUSTRIAL HOT WATER (i.e. Primary Circuit, Central Heating etc.)	BRILLIANT GREEN (H10) GOLDEN YELLOW (B49)
FIRE WATER	SIGNAL RED (A11)
SEWAGE	BLACK
OXYGEN (Medical)	WHITE
NITROUS OXIDE (Medical)	ULTRAMARINE (F09)
VACUUM (Medical)	PRIMROSE (C67)
AIR (Medical) LOW PRESSURE	WHITE / BLACK
AIR (Medical) HIGH PRESSURE	WHITE / SALMON PINK (A40)
SCAVENGING SYSTEM	ORANGE Rev 1
LPG	LIGHT STONE (C37)
COMPRESSED AIR (Industrial)	ARCTIC BLUE (F28)
CONDITIONED AIR FLOW	ARCTIC BLUE (F28) WHITE
CONDITIONED AIR RETURN	ARCTIC BLUE (F28) WHITE
VENTILATION AIR FLOW	ARCTIC BLUE (F28) LIGHT STONE (C37)
VENTILATION AIR EXHAUST	ARCTIC BLUE (F28) LIGHT STONE (C37)
CHILLED WATER	BRILLIANT GREEN (H10) PEACOCK BLUE (F08)
CONDENSER WATER	BRILLIANT GREEN (H10) SALMON PINK (A40)
REFRIGERANT	LIGHT GREY (G29)
DIESEL	GOLDEN BROWN (B13) WHITE
TRANSFORMER OIL	GOLDEN BROWN (B13) CRIMSON (A03)
FUEL OIL	GOLDEN BROWN (B13) + LABEL

All piping shall be labelled as per SANS requirements including the direction of flow at maximum 3 metre intervals or at all changes of direction, Tee's and wall penetrations.

RECOMMENDED NOISE RATINGS INSIDE BUILDINGS Rev 1

Description	**Criteria for continuous noise intrusion**	
	NR Curve	**Approx. dB (A)**
Office Buildings: General open offices, reception areas	40	45

Design offices	35	40
Drawing offices	40	45
Conference rooms	30	35
Executive offices	35	40
Foyers, public areas	45	50
Typing and machinist rooms, computer rooms	45	50
Hospitals:		
Hospital wards (public)	35	40
Hospital wards (private)	30	35
Intensive care wards, operating theatres	30	35
Laboratories, casualty areas	40	45
Kitchens, sterilising and service areas	45	50
Surgery, dental clinics and consulting areas	40	45
Waiting rooms and reception areas	45	50

PROTECTION AGAINST LIGHTNING

All specified buildings shall be provided with lightning conductors, which shall be in accordance with SANS 10313:1999 and shall be capable of withstanding the tests laid down herein.

COMMUNICATION SYSTEMS

The following systems shall be provided:

a) Telephone PABX System including cabling and handsets shall be provided.

b) Extensions to existing Telephone PABX Systems shall include cabling and terminations but excludes handsets.

c) P.A. Systems in hospitals and Community Health Centres and other institutions where directed.

d) Fire Detection and Protection to comply with SABS 0400:1990 – Code of Practice for The Application of the National Building Regulations

e) The complete installation for all data and PABX equipment including data switching, cabling, ducting, conduit must be provided by an approved and accredited State Information Technology Agency (SITA) Contractor in accordance with Department of Health Tele-Medicine and Information Technology unit policy and specification Rev 6

f) T.V. Installations ducting, conduit with galvanised draw wire and power point

g) Nurse Call

h) Intercom system where directed

i) Access Control including C.C.T.V. where directed.

j) Intruder Alarm Systems in Pharmacy and other areas where directed

Public Telephones

Provision shall be provided in waiting areas, wards and nurses' homes for public telephone outlets including conduits, cabling and termination points only.

ANNEXURE 13
GEOTECHNICAL REPORT

MUKONA
CONSULTING ENGINEERS

Mukona Consulting Engineers (Pty) Ltd
Postnet Suite 387
Private Bag X121
Halfway House
1685

International Business Gateway
Midridge Office Estate (North)
Midridge Park, New Road,
Midrand, 1685

Telephone: +27 11 443 8293 / 3536
Fax: +27 86 571 2958
Email: info@mukonagroup.com
Website: www.mukonagroup.com

BBBEE: Level 1

PI No. ENGSPS130453 (AON)

REPORT NO. MK25/770/rev.00

INTERPRETIVE GEOTECHNICAL INVESTIGATION REPORT

CONSTRUCTION OF A NEW ONCOLOGY UNIT AT NGWELEZANA HOSPITAL, EMPANGENI, CITY OF UMHLATHUZE LOCAL MUNICIPALITY, KWAZULU-NATAL PROVINCE

00	14 February 2025	L Pfuluwani	D Msiza	TS Phalanndwa	Submitted for Design	SFD
Rev	**Date**	**Compiled by**	**Reviewed by**	**Approved by**	**Description**	**Status**

☒ Professional Engineer (if required): TS Phalanndwa

Title	**:**	***INTERPRETIVE GEOTECHNICAL INVESTIGATION REPORT FOR THE CONSTRUCTION OF A NEW ONCOLOGY UNIT AT NGWELEZANA HOSPITAL IN EMPANGENI, UMHLATHUZE LOCAL MUNICIPALITY, KWAZULU-NATAL PROVINCE.***
Prepared for	**:**	*Mac Engineering Consultants* *Suite 3, Sunnyside Center* *48 Sunnyside Lane* *Pinetown, 3610*
Contact Person	**:**	*James Baloyi* *jamesb@mzansiafrica.co.za*
Prepared by	**:**	*Mukona Consulting Engineers (Pty) Ltd,* *International Business Gateway,* *Midridge Office Estate (North),* *Midridge Park,* *New Road, Midrand, 1685,* *Tel: (011) 443 8293/3536 Fax: 086 571 2958*
Contact Person	**:**	*TS Phalanndwa* *Mobile: 083 785 0284*
Report No.	**:**	*MK25/770/rev.00*
Project team	**:**	*Mr TS Phalanndwa, Pr.Eng. Project Director* *Mr Denzil Oliver, Pr.Sci.Nat Principal Engineering Geologist* *Mr L Pfuluwani, Pr.Sci.Nat. Engineering Geologist* *Mr David Msiza, Snr Civil Engineer*
Coordinates	**:**	*Latitude: 28°46'46.47"S, Longitude: 31°51'54.48"E*
Location	**:**	*Ngwelezana-A, Empangeni, KwaZulu-Natal Province*
Date	**:**	*14 February 2025*

Compiled by:	***Reviewed by:***	***Approved by:***
		
L Pfuluwani Pr.Sci.Nat *Snr Engineering Geologist*	***D Msiza*** *Snr Civil Engineer*	***TS Phalanndwa Pr.Eng.*** *Project Director*

Executive Summary

Mukona Consulting Engineers (Pty) Ltd was appointed by MAC Engineering Consultants to undertake a geotechnical investigation for the proposed construction of a new Oncology Unit at Ngwelezana Hospital within the City of uMhlathuze Local Municipality of KwaZulu-Natal Province.

The geotechnical site investigation commenced on Wednesday the 29th of January 2025 and comprised the excavation of test pits, rotary cored borehole drilling to a maximum depth of 15m depth below current ground level, soil profiling and soil sampling of key horizons.

The proposed development entails the construction of new Oncology Unit four storey building.

The regional geology indicates that the site and surrounding area is underlain by lithologies of the Tugela Group comprising amphibolite belonging to the Mtengu Formation.

The site geology comprises of thin layer of fill material which is underlain by residual soil and bedrock amphibolite.

The general fill was encountered and described as “slightly moist, black to dark grey, mottled dusky red, soft, intact, sandy CLAY”
The residual soil profile was described as “moist, brownish dark orange, soft to firm, intact, sandy silty CLAY” and “slightly moist, greenish yellow mottled white, stained black, firm to stiff, relict structure, silty CLAY”.
The gravelly residual profile was described as “Tightly packed, angular to sub-angular, olive, mottled white, GRAVEL of weathered amphibolite in a minor matrix of moist, yellowish green, sandy silty clay” and “Tightly packed, angular, olive to black, speckled white, GRAVEL of weathered amphibolite in a minor matrix of moist, yellowish green, sandy silty clay”

Groundwater seepage was not encountered in any of the test pits excavated and boreholes drilled. It is anticipated that groundwater will be intersected at the interface between the residual soil and bedrock during periods of heavy rainfall.

Foundations recommendation on this site with its deep weathered profile are CFA and Oscillator Piles. CFA piles are to carry the load inside friction throughout the pile shaft and the Oscillator piles will carry the load by means of a rock socket.

Table of Contents

List of Figures

List of Tables

List of Plates

1 TERMS OF REFERENCE

Mukona Consulting Engineers (Pty) Ltd was appointed by MAC Engineering Consultants to undertake a geotechnical investigation for the construction 0f a new Oncology Unit at Ngwelezana Hospital within the City of uMhlathuze Local Municipality of KwaZulu-Natal Province.

The appointment was based on Mukona's proposal to MAC Engineering Consultants, referenced PP-25-1104, dated 21 January 2025. An appointment letter referenced 6101CS24/Ngwelezana, dated 22 January 2025 was received by Mukona via email.

The scope of the site investigation entailed the excavation of test pits, DPSH probing and rotary core borehole drilling within the footprint of the structure.

Mukona Consulting Engineers mobilised to site on the 28th of January 2025. The geotechnical site investigation commenced on Wednesday the 29th of January 2025 and comprised the excavation of test pits, rotary cored borehole drilling to 15m depth below current ground level, soil profiling and soil sampling of key horizons.

This interpretive geotechnical report presents the results of the fieldwork and available laboratory tests for the BESS and provides foundation recommendations based on available data pending the rest of the laboratory test results.

1.1 Purpose

The primary aim of the geotechnical investigation was to assess the soil and/or rock profile below the site. The investigation was further aimed at evaluating any geotechnical constraints to the proposed development and providing suitable foundation recommendations.

The objectives of the investigation were as follows:

- Provide an overview of the geology of the site;
- Discuss the soil and/or rock profile encountered;
- Present the fieldwork and results of laboratory tests;
- Comment on the suitability of the site for the proposed development;
- Highlight the geotechnical considerations that may have an influence on the proposed development;
- Provide geotechnical related recommendations including allowable bearing capacity to be adopted for design.

1.2 Proposed Development

The proposed development comprises the construction of a new four-storey oncology unit building within the existing Ngwelezana Hospital..

1.3 Available Information

The following published information was used during this investigation:

- The 1: 250 000 scale geological series map, **2830 Dundee**, produced by the Council for Geoscience, Pretoria.
- The 1: 50 000 scale topographical series map, **2831DD Felixton**, produced by the Survey General.
- Seismic hazard map from Kijko et al. (2003) - Probabilistic Peak Ground Acceleration and Spectral Seismic Hazard Maps for South Africa. Report number 2003-0053, Council for Geoscience, Pretoria.
- Google Earth imagery both current and historical.

1.4 Information Supplied

- A survey drawing showing the layout of the Ngwelezana hospital, titled, “Ngwelezana Oncology Empangeni”, drawing number 2024013 revision 1, dated – December 2024, prepared by R Mufamadi and Associates for DGIT Architects.
- A drawing layout of existing underground services, titled, “Site Report of Buried Services and Mapping Survey”, dated – 30 November 2024 prepared by UDS Civils for DGIT Architects

2 SITE DESCRIPTION

2.1 Location

The Ngwelezana Hospital is situated on erf 1241 in Ngwelezana-A. It is located approximately 7km south of Empangeni Central within the City of uMhlathuze Local Municipality of KwaZulu-Natal Province. The Ngwelezana Hospital is bordered by White City Road in the south, Thanduyise Drive in the west and vacant land in the northeast to the north.

The site for the proposed new oncology unit is bordered by existing hospital buildings including surgical ward, highcare unit, chermo mobile unit and renal mobile unit. Access into the site is by foot via existing hospital pathways. Currently, there is no vehicle access into the site. The location of the site is at centre coordinates, Latitude: 28°46'46.47"S and Longitude: 31°51'54.48"E. The location of

the site with respect to the existing Ngwelezana Hospital is shown in **Figure 1** below**.** The locality map is included as **Appendix A.**

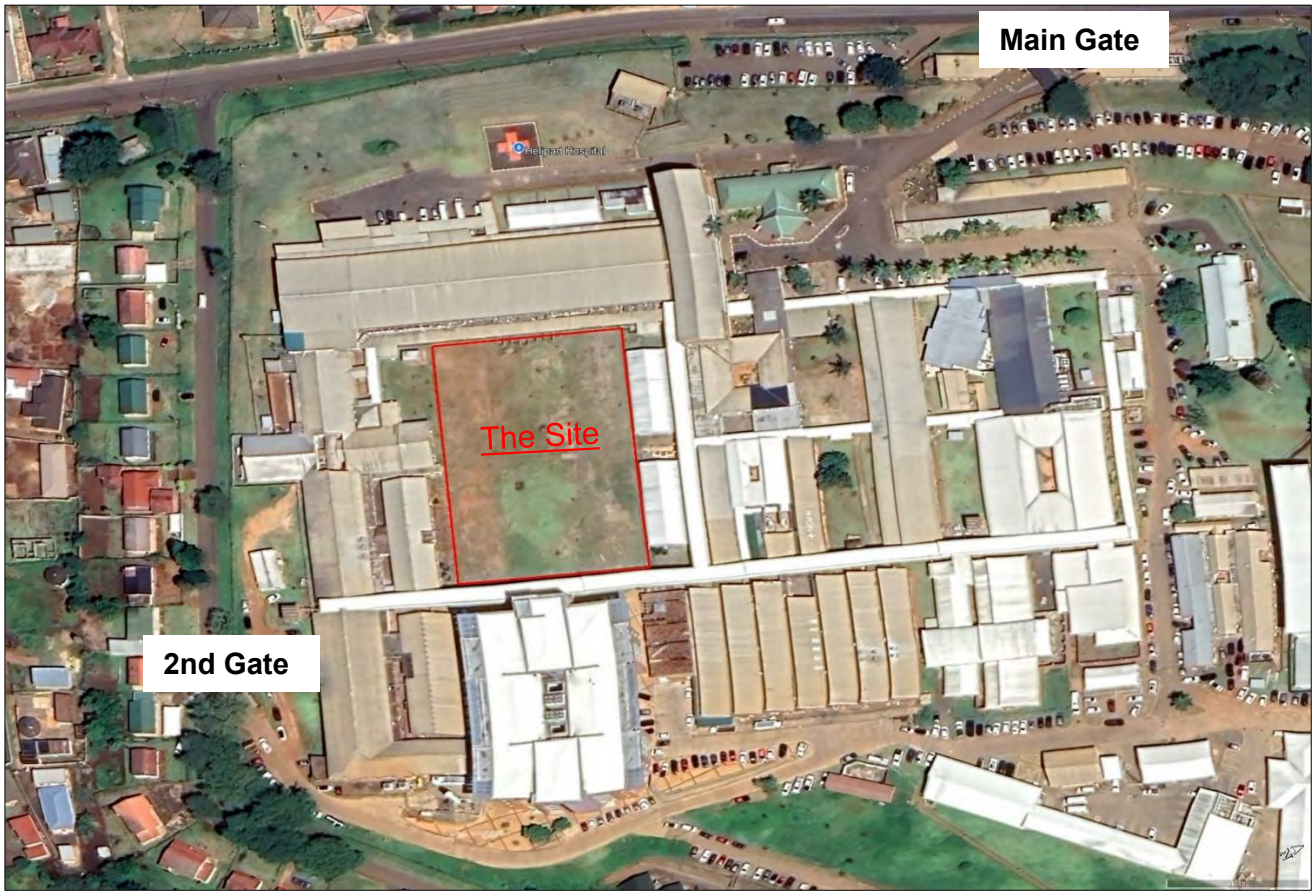


Figure 1: Location of the proposed site for development

2.2 Topography

The site is situated at an elevation of approximately 86m above mean sea level (amsl). The adjacent access roads are situated at elevations ranging between 72m (amsl) in the west, and 77n in the east of the hospital. The Ngwelezana Hospital is situated at the crest of a ridge with elevations reaching 100m (amsl) in the north and 50m (amsl) in the southeast.

Surface runoff, particularly during periods of heavy or prolonged rainfall, is anticipated to be in the form of sheetwash towards the east and south. An extract of the topographical map is included as **Appendix B.**

2.3 Climate

The area experiences warm temperatures for about 6 months of the year from November to April. The average daily maximum temperature remains constant at 30°C during the months of January to February, 27°C to 29°C during the months of November to December and March to April.

The area experiences the coldest period during the month of July with an average daily maximum temperature of 24°C and daily average minimum temperature of 12°C, reaching 8°C in the coldest night.

The site generally receives heavy rainfall from November to February with precipitation ranging between 91mm and 112mm per month during this period. This coincides with the hottest period of the year with maximum daily temperatures of approximately 30°C.

The climatic regime plays a fundamental role in developing the soil profile and rock weathering. Weinert (1980) demonstrated that chemical decomposition is the predominant mode of rock weathering in areas where the climatic "N-value" is less than 5. In areas where the climatic N-value is between 5 and 10, disintegration is the predominant form of weathering, although some chemical decomposition of the primary rock minerals still takes place. Where the climatic N-value is greater than 10, secondary minerals do not develop to an appreciable extent and all weathering takes place by mechanical disintegration of the rock.

The Weinert's climatic N-value for the area is 2. In general, this implies that rocks may be extensively weathered, often to depths of several metres, and decomposition is pronounced. **Figure 2** shows different climatic regions in southern Africa.

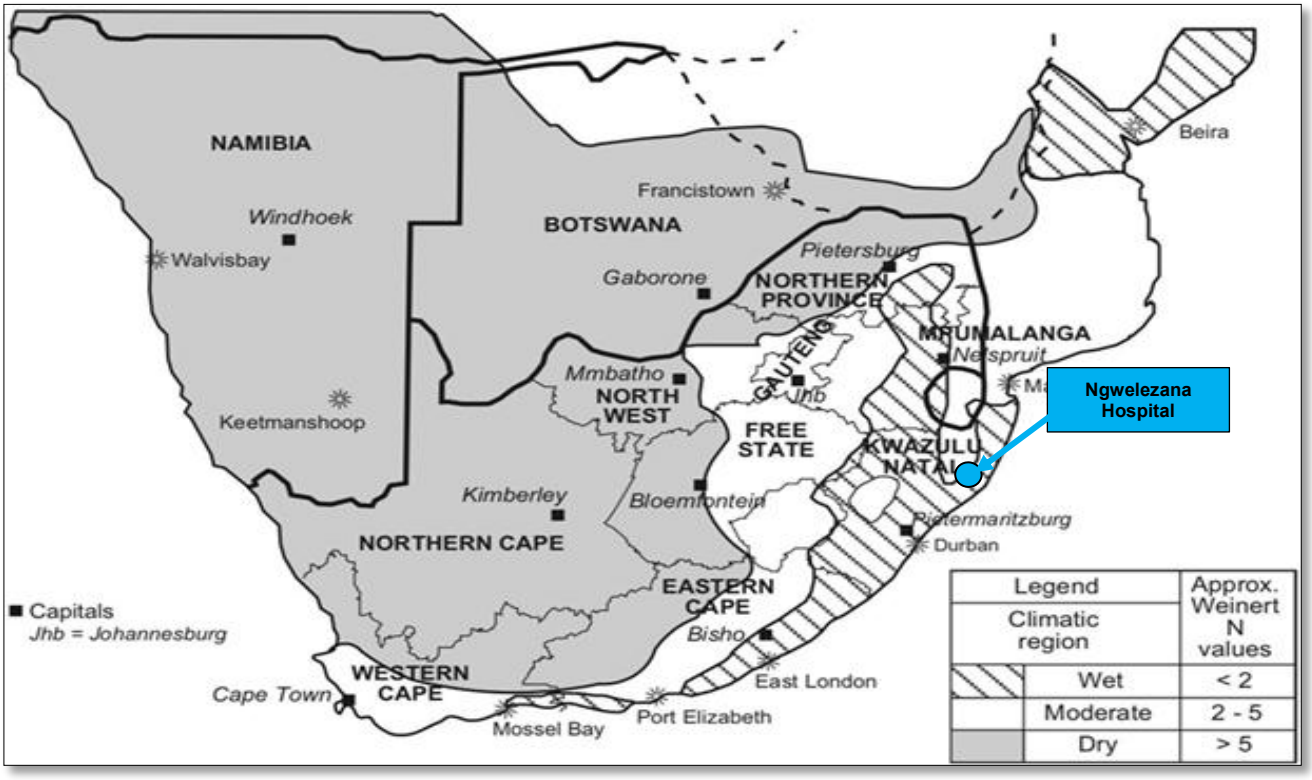


Figure 2: Climatic regions in southern Africa (Adapted from Weinert, 1980)

3 GEOHAZARD

A geohazard is a geological state that has the potential to create severe threat to humans, property and the natural and built environment. Seismic activities, ground subsidence, sinkhole formation, slope failures and volcanic activities are typical examples of geohazards and are discussed in the sections below.

3.1 Seismic Hazard

Seismic activity can be defined by type, frequency and size of earthquakes that happen over a period of time in certain areas. In South Africa, areas of seismic activity are determined from the seismic hazard map shown in **Figure 3** and in accordance with SANS 10160-4 (2011). This map represents peak ground acceleration with a 10% probability of being exceeded in a 50-year period. The classification zones are as follows:

- Regions of natural seismic activity (Zone I),
- Regions of mining-induced and natural seismic activity (Zone II).

Based on the seismic hazard map shown in **Figure 3**, the site does not fall in either Zone I or Zone II.

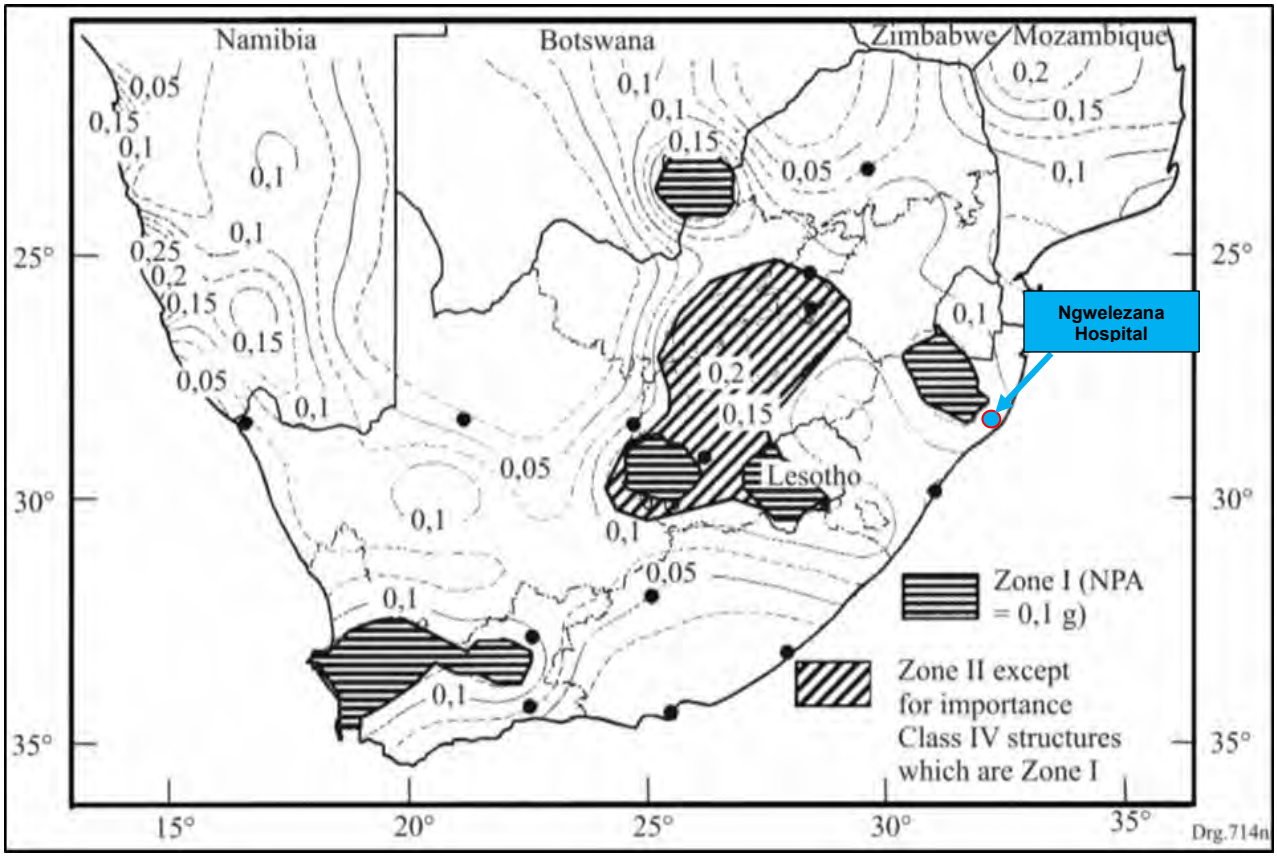


Figure 3: Seismic Hazard Zones of South Africa (SANS 10160-4, 2011)

The seismic hazard map of South Africa produced by Kijko (2003) is shown in **Figure 4**. Both the seismic hazard zones and the seismic hazard map shows that the site is situated in an area where the peak ground acceleration, with a 10% probability of exceedance in a 50-year period, is approximately 0.14g.

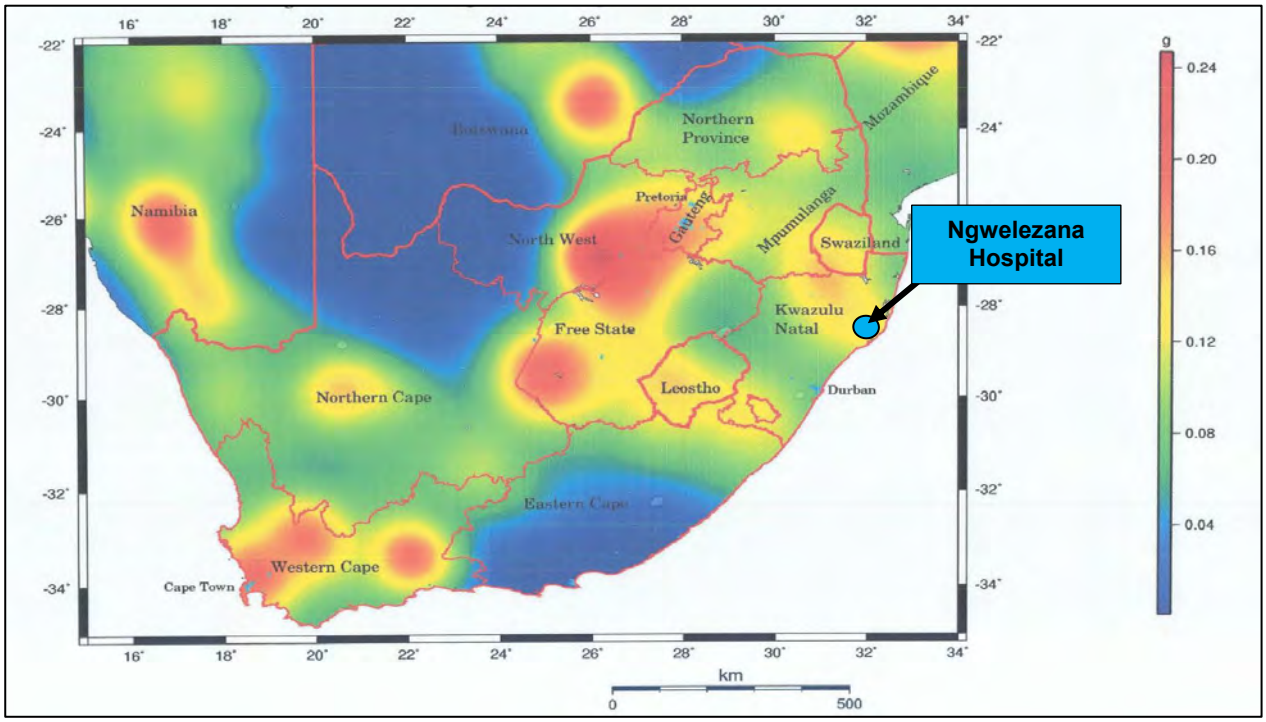


Figure 4: Seismic Hazard Map of South Africa, Kijko et. al. (2003)

3.2 Ground Subsidence

Subsidence occurs in areas with large underground cavities typically resulting from large scale shallow to very shallow mining and from dolomite/limestone dissolution. It may also appear where thick deposits of unconsolidated material exist.

The available geological map and field observations indicate that the site is underlain by the Tugela Group of rocks. The Tugela Group is non-dolomitic and therefore the probability of subsidence and dolines development is remote.

3.3 Sinkhole Formation

Like subsidence, sinkhole formation occurs in areas with large to extremely large underground cavities resulting from poorly designed shallow underground activities. Dissolution of dolomites or limestones over millions of years may lead to cavity formations which later manifest as sinkholes.

The site is not underlain by dolomite and therefore a dolomite stability investigation is not required.

3.4 Landslides and Mudslides

Landslides are caused by disturbances in the natural stability of a slope and are mainly caused by heavy rains or droughts, earthquakes, and volcanic eruptions. Mudslides can develop by rapid water accumulation on the ground, which results in a surge of water-saturated rock, earth and debris (Natural Disasters and Severe Weather, 2018).

The probability of landslides and mudslides occurring within this area cannot be ruled out. This is primarily due to the high relief and relatively high gradient of the area.

3.5 Rockfalls and Rockslides

Rockfalls and rockslides are individual rocks that fall from a steep cliff. Based on the site investigation conducted, the probability of the occurrence of rockfalls and rockslides on the proposed site is remote due to the geology as it comprises deeply completely weathered rocks. No visible outcrops were noted on site.

3.6 Regional Geology

Based on the regional 1:250 000 scale geological map, **2830 Dundee**, the site is underlain by lithologies of the Tugela Group comprising amphibolite belonging to the Mtengu Formation. An extract of the regional geological map is included in **Appendix C**.

4 METHOD OF INVESTIGATION

The geotechnical investigation was performed in accordance with “Site Investigation Code of Practice” developed by SAICE Geotechnical Division (2010), which is the nationally recognised standard for acceptable site investigation practice. A summary of the field investigation methods is provided in **Table 1**. A layout drawing, included as **Appendix D** shows the location of the field tests.

Table 1: Summary of field investigation methods

Activity	Quantities
Excavation of Test Pits	• 2no. test pits
Dynamic Probe Super Heavy	• 5no DPSH
Rotary Core Borehole Drilling	• 2no. boreholes (BH)
Soil laboratory tests	• Foundation Indicator • pH and Conductivity • Basson Index chemical test • Shearbox • Mod/CBR compaction tests • UCS on rock

4.1 Excavation of Test Pits

Test pits were excavated within the footprint of the structure. Test pits were hand excavated to a maximum depth of 1.5m below existing ground level. The test pit coordinates, and final depth of excavation are provided in **Table 2.**

Table 2: Summary of test pit coordinates and final depths

Test Pit. No.	Handheld GPS Coordinates		Final Depth [m]	Comment
	Latitude	Longitude		
TP01	28°46'46.56"S	31°51'55.05"E	1.5	End of hole
TP02	28°46'46.16"S	31°51'53.40"E	1.5	End of hole

The tests pits were profiled by an engineering geologist in accordance with the “Guidelines for Soil and Rock Logging in South Africa, 2nd Impression 2002”, sampled for laboratory tests, whereafter the test pits were loosely backfilled.

Figure 5 shows the location of the test pits:

Figure 5: Location of the test pits

Plate 1: Excavated test pit on site

4.2 Dynamic Probing Super Heavy

The DPSH is typically used to obtain a continuous profile of the consistency (strength) of the subsoils with depth. This test is also useful in determining the stiffness of the in-situ soil required for calculating lateral deformation of deep excavations.

The DPSH is standard practice in South Africa and conforms to the apparatus type and dimensions of the DPSH-B as defined in the British Standard, BS EN ISO 22476-2:2005+A1:2011.

The DPSH is carried out using a 60° cone, 50mm in diameter, fitted onto the bottom of an E size rod and driven into the ground by a 63,5kg hammer falling through 762mm. The number of blows required to drive the cone through each successive 300mm penetration is continuously recorded.

Five (5) DPSH tests were carried out adjacent to test pit positions to determine the consistency of the subsoils.

The coordinates and final depths of the DPSH test results are provided in **Table 3** and the DPSH positions are shown on the layout drawing attached in **Appendix D.**

Table 3: List of DPSH coordinates and final probing depths

DPSH ID	Latitude	Longitude	Final Depth	Comment
DPSH 1	28°46'46.82"S	31°51'55.66"E	5.3	Refusal
DPSH 2	28°46'45.66"S	31°51'54.81"E	9.3	Refusal
DPSH 3	28°46'46.47"S	31°51'54.48"E	4.9	Refusal
DPSH 4	28°46'47.18"S	31°51'54.01"E	7.3	Refusal
DPSH 5	28°46'46.13"S	31°51'53.44"E	9.6	Refusal

Plate 2: Pagani DPSH conducting field tests

4.3 Rotary Cored Boreholes

In order to confirm the subsoil conditions below the bridge, six (6) rotary cored boreholes, designated BH01 to BH06, were drilled at positions determined by ROMH. The boreholes were sited at the bridge abutment and pier positions.

The boreholes were drilled using a NWD4 double tube core barrel, with an inner split tube, which produces 52mm diameter soil and rock samples. Temporary casing was installed, where required, at the discretion of the driller.

The boreholes were logged by an engineering geologist in accordance with the “Guidelines for Soil and Rock Logging in South Africa”, 2nd Impression 2002”.

A layout drawing, included as **Appendix D** shows the location of the boreholes, whereas **Plate 3** shows drilling activities at borehole BH02. The borehole coordinates, and final depths are provided in **Table 4.**

Plate 3: YWE D45 drill rig setting up at borehole BH01

Table 4: List of borehole coordinates and final drill depths

Borehole ID.	Handheld GPS Coordinates		Final Depth (m)
	Latitude	Longitude	
BH01	28°46'46.37"S	31°51'55.50"E	15.2
BH02	28°46'46.07"S	31°51'53.61"E	16.5

5 FIELDWORK RESULTS

5.1 Site Geology

The site stratigraphy as observed within test pits and boreholes are discussed in the sections below.

5.1.1 Test Pit Profiles

Based on the test pits excavated on site, the soil profile comprises of a thin layer of fill material underlain by residual amphibolite.

A summary of the test pit profiles is provided in **Table 5**. The materials encountered in the test pits are presented in **Plate 4**, whereas test pit profiles are included in **Appendix E**.

Table 5: Summary of test pit profiles below the road centreline

Test Pit ID	Depth from Current Ground Level (m)					Water Seepage (mm)	Final Depth (mm)
	Wearing Course	Subbase	Subgrade	Silty CLAY, Alluvial	Clayey GRAVEL, Residual Shale		
TP01	0 – 0.1	0.1 – 0.25	0.25 – 0.5	-	0.5 – 1.1	0.8	1.1
TP02	0 – 0.15	0.1 – 0.4	-	0.4 – 1.5	-	None	1.5

5.1.1.1 General Fill

The general fill was encountered in both test pits TP01 and TP02 from surface to a depth of 0.2m below existing ground level. This material was described as “slightly moist, black to dark grey, mottled dusky red, soft, intact, sandy CLAY”.

5.1.1.2 Residual Amphibolite (soil)

The residual amphibolite was encountered underlying the general fill. This material was encountered in both test pits from a depth of 0.2m to a depth of 1.5m below current ground level.

The residual soil profile was described as “slightly moist, brownish dark orange, soft to firm, intact, sandy silty CLAY” and “slightly moist, greenish yellow mottled white, stained black, soft to firm, relict structure, silty CLAY”.

Plate 4: Typical material encontered from the test pits

5.1.2 Borehole Profiles

Two (2) boreholes were drilled at the footprint of the structure and the geology comprised general fill, residual amphibolite, which is underlain by amphibolite bedrock. A quartz vein was intersected in borehole BH01 underlying the residual amphibolite.

Materials encountered within the boreholes are presented in **Plate 5**. A summary of the borehole profiles is provided in **Table 6.**

Table 6: Summary of borehole and ground profile

Borehole ID	Depth from Current Ground Level (m)							Final Depth (m)
	Fill	Residual Amphibolite		Quartz Vein	Amphibolite Bedrock			
		Silty CLAY	Gravel		Very Soft Rock	Soft Rock	Medium Hard Rock	
BH01	0.0 – 0.5	0.5 – 3.45 4.85 – 5.05	5.05 – 7.85 8.70 – 9.35	3.45 – 4.85	-	7.85 – 8.7 10 – 10.65	9.35 – 10.0 10.65 – 15.12	15.12
BH02	0.0 – 0.2	0.2 – 8.8	11.1 – 12.9	-	8.8 – 11.1	-	12.9 – 16.50	16.50

The borehole drilling indicates deeply weathered profile occur at depths from 0.2m to 9.35m at borehole BH01, and to a depth of 8.8m in borehole BH02. The competent bedrock was encountered at depths of between 10.65m in borehole BH01 and at 12.9m in borehole BH02.

The borehole profiles are included in **Appendix F**, and the borehole photographs are included in **Appendix G.**

5.1.2.1 General Fill

The general fill was encountered in both boreholes from surface to a depth of between 0.2m and 0.5m below existing ground level. This material was described as “slightly moist, dark brown, mottled dusky red, soft, intact, sandy CLAY” or “Tightly packed, subangular, GRAVEL in a matrix of slightly moist, brownish yellow, silty sand”.

5.1.2.2 Residual Amphibolite

The residual amphibolite was encountered underlying the general fill. This material was encountered in both boreholes overlying the bedrock Two distinct profiles were recorded from the boreholes.

Silty Clay.

The silty clay residual soil profile was described as follows;

- Slightly moist, brown to greenish yellow, stained black, firm, ferruginous sandy silty CLAY.
- Slightly moist, brownish red, stained yellow, firm to stiff, relict structure, silty CLAY.
- Moist, brownish yellow, very stiff, relict structure, sandy silty CLAY.

Gravel

The gravelly residual soil profile was described as “Tightly packed, angular to sub-angular, olive, mottled white, GRAVEL of weathered amphibolite in a minor matrix of moist, yellowish green, sandy silty clay” and “Tightly packed, angular, olive to black, speckled white, GRAVEL of weathered amphibolite in a minor matrix of moist, yellowish green, sandy silty clay”.

5.1.2.3 Quartzite Vein

The quartz vein was encountered in borehole BH01 at a depth of 3.45m to 4.85m below current ground level. This material manifested a gravelly material and was described as ” Tightly packed, angular, fine to coarse GRAVEL of quartz, overall consistency is dense”.

Refusal of the TLB occurred on very soft to soft rock gabbro-norite at a depth ranging between 0.5m and 1.8m. At these depths, the bedrock was described as “Greyish creamy white, mottled black, moderately to highly weathered, coarse grained, very soft to soft rock: Gabbro Norite”.

5.1.2.4 Amphibolite Bedrock

Amphibolite bedrock was encountered at a depth of between 7.85m and 8.8m below ground level. The bedrock has three distinct profiles namely very soft rock, soft rock and medium hard weathered bedrock. This material was described as:

Very soft:

Olive to black, speckled white, highly weathered, medium grained, open joints with clayey in-fill, weakly foliated, schistose structure, very soft metamorphic rock:

Soft rock:

Olive to black, speckled white, moderately weathered, medium grained, open joints with clayey in-fill, weakly foliated, schistose structure, soft metamorphic rock

Medium hard rock:

Olive to black, speckled white, slightly weathered, medium grained, closed and open joints (clayey in-fill, stained black in places), weakly foliated, schistose structure, medium hard metamorphic rock

Residual Amphibolite (Silty CLAY) | Bedrock Amphibolite

Plate 5: Typical material encontered from the boreholes

5.2 Dynamic Probe Super Heavy (DPSH) Testing

The results of dynamic probing show that the in-situ soils immediately below ground surface are soft-to-firm from surface (0.0m) to depths of between 6m and 8m from the center of the site to the south. Beyond these depths, stiff to very stiff conditions were encountered with refusal at depths of between 7.5m and 9.3m.

The northern portion of the site shows soft to firm consistencies from surface to a depth of approximately 2m (DPSH 2 & DPSH 3). Beyond this depth, stiff to very stiff conditions were recorded with refusal encountered at depth of between 5.1m and 5.4m belong current ground level.

The inferred SPT-N values derived from the DPSH tests are summarised in **Table 7**. Figure 6 shows the plot of DPSH equivalent SPT N Values versus depth, whereas **Figure 7** shows the estimated bearing capacity.

The DPSH data sheets are included as **Appendix H**.

.Table 7: Summary of DPSH results showing Equivalent SPT-N values

Depth (m)	Equivalent (SPT-N Values)				
	DPSH 1	DPSH 2	DPSH 3	DPSH 4	DPSH 5
0	0	0	0	0	0
0.3	3	3	2	3	5
0.6	3	3	2	5	4
0.9	3	2	4	5	5
1.2	4	2	4	4	5
1.5	5	3	4	6	5
1.8	6	3	6	4	4
2.1	6	3	6	3	3
2.4	8	2	5	3	3
2.7	10	3	6	4	5
3	14	3	8	6	3
3.3	19	3	14	9	3
3.6	17	3	7	3	4
3.9	21	5	10	4	3
4.2	20	4	17	5	2
4.5	16	4	15	4	4
4.8	14	4	30	6	2
5.1	18	4	80	6	3
5.4	80	5	-	6	5
5.7	-	6	-	10	4
6	-	6	-	6	3
6.3	-	6	-	7	4
6.6	-	8	-	6	3
6.9	-	9	-	8	4
7.2	-	10	-	18	6
7.5	-	12	-	80	4
7.8	-	10	-	-	6
8.1	-	13	-	-	9
8.4	-	12	-	-	11
8.7	-	14	-	-	20
9	-	20	-	-	26
9.3	-	30	-	-	80
9.6	-	80	-	-	-
9.9	-	-	-	-	-

LEGEND
Very soft
Soft
Firm
Stiff
Very stiff

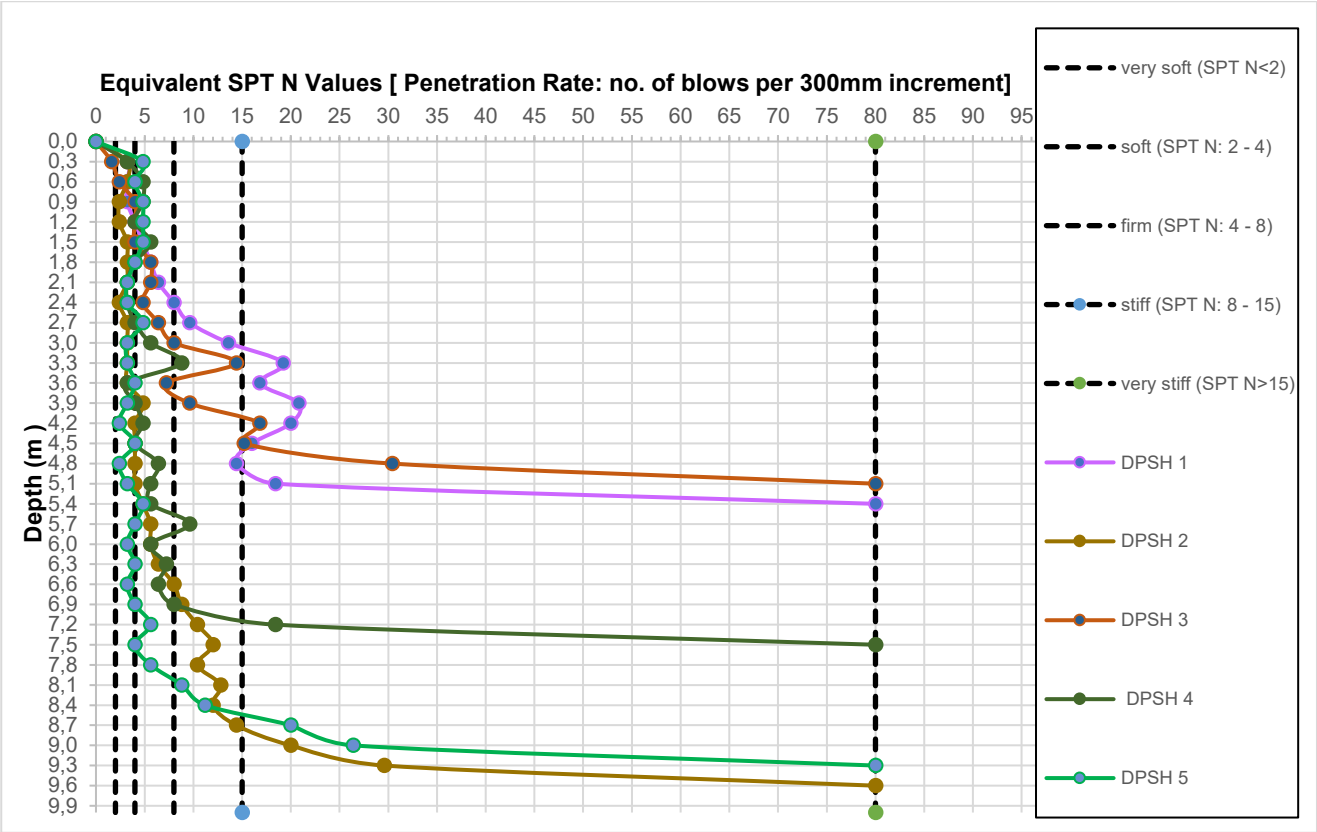


Figure 6: Plot of DPSH Equivalent SPT N Values

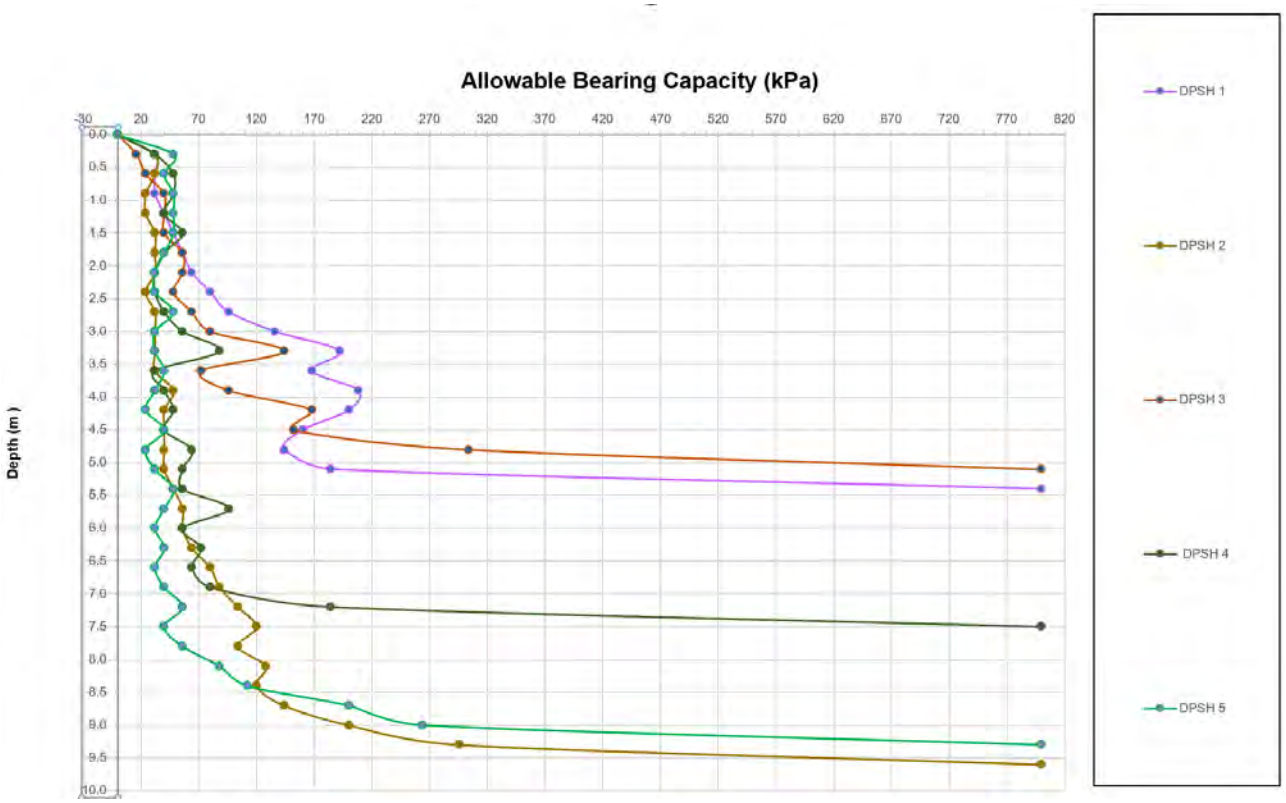


Figure 7: Estimated Allowabl Bearing Capacity Graph

A summary of the geotechnical parameters derived from the DPSH tests are provided in **Table 8**.

Table 8:: Summary of Design Parameters derived from average DPSH test results

Depth (m)	Average SPT N	Cu	α	Ca	Es (MPa)	EABC (kPa)	Ks (ka/mm)
0.3	3	14	1.0	14	5	32	1.28
0.6	4	16	1.0	16	5	35	1.41
0.9	4	17	1.0	17	6	38	1.54
1.2	4	17	1.0	17	6	38	1.54
1.5	4	20	1.0	20	7	45	1.79
1.8	4	20	1.0	20	7	45	1.79
2.1	4	19	1.0	19	6	43	1.73
2.4	4	19	1.0	19	6	43	1.73
2.7	6	25	1.0	25	8	56	2.24
3	7	30	0.9	27	10	67	2.69
3.3	10	44	0.7	31	15	98	3.90
3.6	7	31	0.9	28	10	69	2.75
3.9	8	38	0.8	31	13	85	3.39
4.2	10	43	0.8	35	14	96	3.84
4.5	9	39	0.8	31	13	86	3.46
4.8	12	52	0.7	36	17	115	4.61
5.1	22	100	0.40	40	33	222	8.90
5.4	24	107	0.38	41	36	238	9.52
5.7	6	29	1.00	29	10	64	2.56
6.0	5	22	1.00	22	7	48	1.92
6.3	6	26	1.00	26	9	59	2.35
6.6	6	26	1.00	26	9	59	2.35
6.9	7	31	0.90	28	10	69	2.77
7.2	11	52	0.70	36	17	115	4.59
7.5	32	144	0.29	42	48	320	12.80
7.8	8	36	0.90	32	12	80	3.20
8.1	11	49	0.70	34	16	108	4.32
8.4	12	52	0.70	37	17	116	4.64
8.7	17	77	0.50	39	26	172	6.88
9.0	23	104	0.38	40	35	232	9.28
9.3	55	247	0.22	54	82	548	21.92
9.6	80	360	0.20	72	120	800	32.00

*Cu = Undrained shear strength; **α** = shaft adhesion factor; Ca = pile adhesion factor; Es = Soil Stiffness*

EABC=Estimated Allowable Bearing Capacity; Ks= Subgrade Reaction

5.3 Groundwater

Groundwater seepage was not intersected in any of the test pits excavated. The water seepage intersected during borehole drilling is anticipated to be from leaking services at depth ranges from 0.8m and 1.25m.

It should be noted that the site has several leaking water utility services which can be misinterpreted as ground water. It is anticipated that ground water can be intercepted at the contact between residual clayey material and the weathered bedrock.

5.4 Laboratory Testing

Representative samples retrieved from test pits and boreholes were submitted to Soillab and Rocklab, for the following testing:

- Foundation Indication on soil (Sieve analysis & Atterberg limits)
- Chemical Tests (pH & Conductivity, Basson Index) on soil
- CBR Compaction & Maximum Dry Density
- Shearbox
- Uniaxial Compressive Strength (UCS) on rock

The laboratory testing is underway and will be incorporated into the report when available.

6 RECOMMENDATIONS

6.1 General

The site is generally underlain by a thin layer of general fill, and a thick layer of residual amphibolite and amphibolite bedrock.

The residual amphibolite is generally soft to firm in consistency, becoming stiff to very stiff at greater depth.

The weathering profile of the shale bedrock is variable, with bedrock encountered an average depths of 8m. However, competent bedrock was encountered at depths of between 10.65m and 12.90m below current ground level.

It should be noted that only 2 boreholes were drilled to an average depth of 15m, DPSH data indicates that the depth to weathered bedrock may be variable.

6.2 Foundations

Considering the prevailing geotechnical conditions, **piled foundations** are recommended for the new oncology unit building.

The most suitable pile types on this site with its deep weathered profile are , CFA and Oscillator Piles.

CFA piles are to carry the load inside friction throughout the pile shaft and the **Oscillator piles** will carry the load by means of a rock socket. Safe working loads for typical pile diameters, and depth is provided in **Table 9** and **Table 10**.

Table 9: Summary of CFA pile sizes (purely for guidance purpose)

Pile Type	Maximum Load (kN)	Diameter (mm)	Depth (m)
CFA Piles	750	450	11
CFA Piles	1400	600	13
CPA Piles	2000	750	13
CFA Piles	2900	900	13

Table 10: Summary of Oscillator Piles sizes

Pile Type	Maximum Load (kN)	Diameter (mm)	Depth (m)	Rock Socket (m)
Oscillator Piles	4000	900	11 - 13	3.0
Oscillator Piles	5500	1050	11 - 13	3.5
Oscillator Piles	7000	1200	11 - 13	4.0

6.3 Site Drainage and Stormwater Management

Measures to ensure control of the moisture in and out of the foundation's soils should be made a part of the foundation design. It is essential that a qualified geotechnical engineer be retained to ensure that moisture control and soil stabilisation techniques are assessed and applied appropriately.

Storm water should be collected and piped preferably off site. If this is not feasible, all stormwaters should be led well down slope of all structures and building terraces to discharge in a carefully controlled fashion by means of surface spreaders/headwalls to Engineer’s detail.

6.4 Earthworks

Earthworks should be conducted in accordance with SANS 1200DA. All topsoil should be cleared from the footprint of the proposed development and stockpiled for later site rehabilitation.

6.5 Excavation Classification

Based on DPSH data, it is anticipated that the site would classify as “soft excavation” to a depth of between 5.0m and 9m below ground level, in accordance with SANS 1200D classification.

A geotechnical engineer is to inspect the excavations to ensure sufficient slope stability to prevent collapse of the sidewalls.

During periods of heavy rainfall, the sides of the excavations should be regularly examined, to ensure the safety of personnel and equipment working in them.

6.6 Additional Investigations

Inspections of foundation trenches should be carried out during construction to confirm adequate founding conditions for the structure. This should be considered as part of the construction monitoring by a competent geotechnical engineer.

6.7 Construction Problems

The following general problems are envisaged during construction:

- Safety issues related to deep excavations.
- Dealing with difficult access to site.

6.8 Construction Monitoring

It is recommended that all foundations are inspected by a competent person prior to placing any concrete and regular checks on the quality of compaction should be made.

6.9 General

All test pits were loosely backfilled upon completion of the fieldwork. In order to avoid the possibility of localised settlement occurring below structures due to the consolidation settlement of this loose backfill, it is recommended that each test hole be identified and adequately backfilled in 150mm layers, to at least 95% Mod AASHTO density.

7 CONCLUSIONS

From the above discussion, the following conclusions may be drawn:

i. The site is underlain by general fill, residual amphibolite and amphibolite bedrock.

ii. The residual amphibolite has a thickness ranging between 2.95m and 8.6m.

iii. The weathered bedrock was encountered from depths of approximately 7.85m and 8.8m below existing ground level.

iv. The competent bedrock was encountered from depths of approximately 10.65m and 12.9m below existing ground level.

v. Water seepage was recorded in boreholes at depths of 0.8m and 1.25m. However, it is anticipated that the seepage is from leaking services, as not water seepage was recorded from the test pits.

vi. Foundation recommendations include piled foundation.

8 REFERENCES

[1]. Jennings, J. E. B, Brink, A. B. A Williams, (January 1973) Revised Guide to Soil Profiling for civil Engineering Purposes in Southern Africa. The Civil Engineer in S A, P 3-12.

[2]. SAIGE-AEG-SAICE (Geotech Div.). Guidelines for Soil and Rock Logging in SA

[3]. 1:250 000 scale geological layout map, 2430 Ndundee, produced by the Council for Geoscience, Pretoria; was consulted to determine the regional geology at or near the site.

[4]. Byrne, G., Berry, A.D., (2008). A Guide to Practical Geotechnical Engineering in Southern Africa. Fourth Edition (Revised and Updated).

[5]. Site Investigation Code of Practice, 2nd edition, South African Institution of Civil Engineering – Geotechnical Division (January 2010).

[6]. SANS-10400-H (2012). Edition 3: The application of the national building regulation – Part H: Foundations. ISBN 978-0-626.

[7]. SANS-10160-4 (2011). Part 4: Seismic actions and general requirements for. ISBN 978-0-626-26431-4.

[8]. Guidelines for Soil and Rock Logging in South Africa, 2nd Impression 2001, eds. ABA Brink and RMH Bruin, Proceedings, Geoterminology Workshop organised by AEG, SAICE and SAIEG, 1990.

[9]. Burt G. Look, Taylor & Francis, 2007, Handbook of Geotechnical Investigation and Design Tables

9 APPENDICES

- APPENDIX A: LOCALITY MAP
- APPENDIX B: TOPOGRAPHICAL MAP
- APPENDIX C: GEOLOGICAL MAP
- APPENDIX D: SITE LAYOUT MAP
- APPENDIX E: TEST PIT SOIL PROFILE
- APPENDIX F: BOREHOLE PROFILES
- APPENDIX G: BOREHOLE PHOTOGRAPHS
- APPENDIX H: DPSH FIELD TEST RESULTS

APPENDIX A: LOCALITY MAP

LEGEND

Site

PROJECT LOCATION

CLIENT

MAC ENGINEERING CONSULTANTS

PROJECT

GEOTECHNICAL INVESTIGATION REPORT FOR A NEW ONCOLOGY UNIT AT NGWELEZANA HOSPITAL EMPANGENI, KWAZULU NATAL

TITLE

LOCALITY MAP

AUTHOR: A NOBEBE

DATE: 04/02/2025

DRAWING

MK-25-770

0 0,0425 0,085 0,17 Km

SCALE: 1:5 000

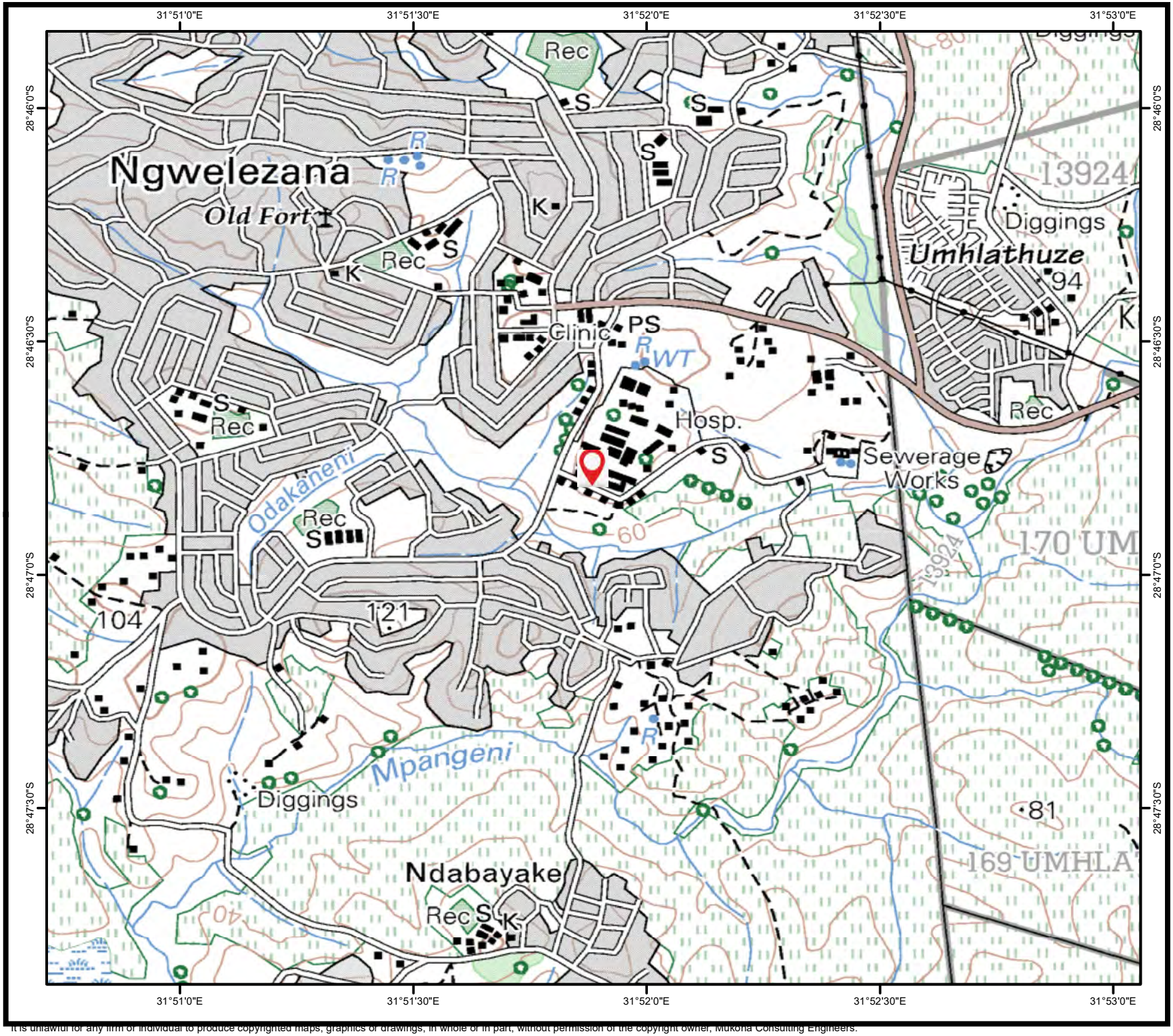
N

Co-ordinate System: GCS WGS1984
Map Source: ESRI Basemap
Project Site Insert: National Geospatial Information

MUKONA

Mukona Consulting Engineers (Pty) Ltd
International Business Gateway, New Road,
Midridge Office Estate (North), Midrand, 1685
Telephone: 0114438293
Mobile: +27 (0) 837850284
Email: sollyp@mukonagroup.com

APPENDIX B: TOPOGRAPHICAL MAP



LEGEND

Site

PROJECT LOCATION

CLIENT

MAC ENGINEERING CONSULTANTS

PROJECT

GEOTECHNICAL INVESTIGATION REPORT FOR A NEW ONCOLOGY UNIT AT NGWELEZANA HOSPITAL EMPANGENI, KWAZULU NATAL

TITLE

TOPOGRAPHICAL LAYOUT MAP
EXTRACT 1:250 000
MAP SERIES: 2831 FELIXTON

AUTHOR: A NOBEBE

DATE: 04/02/2025

DRAWING
MK-25-770

0 0,175 0,35 0,7 Km

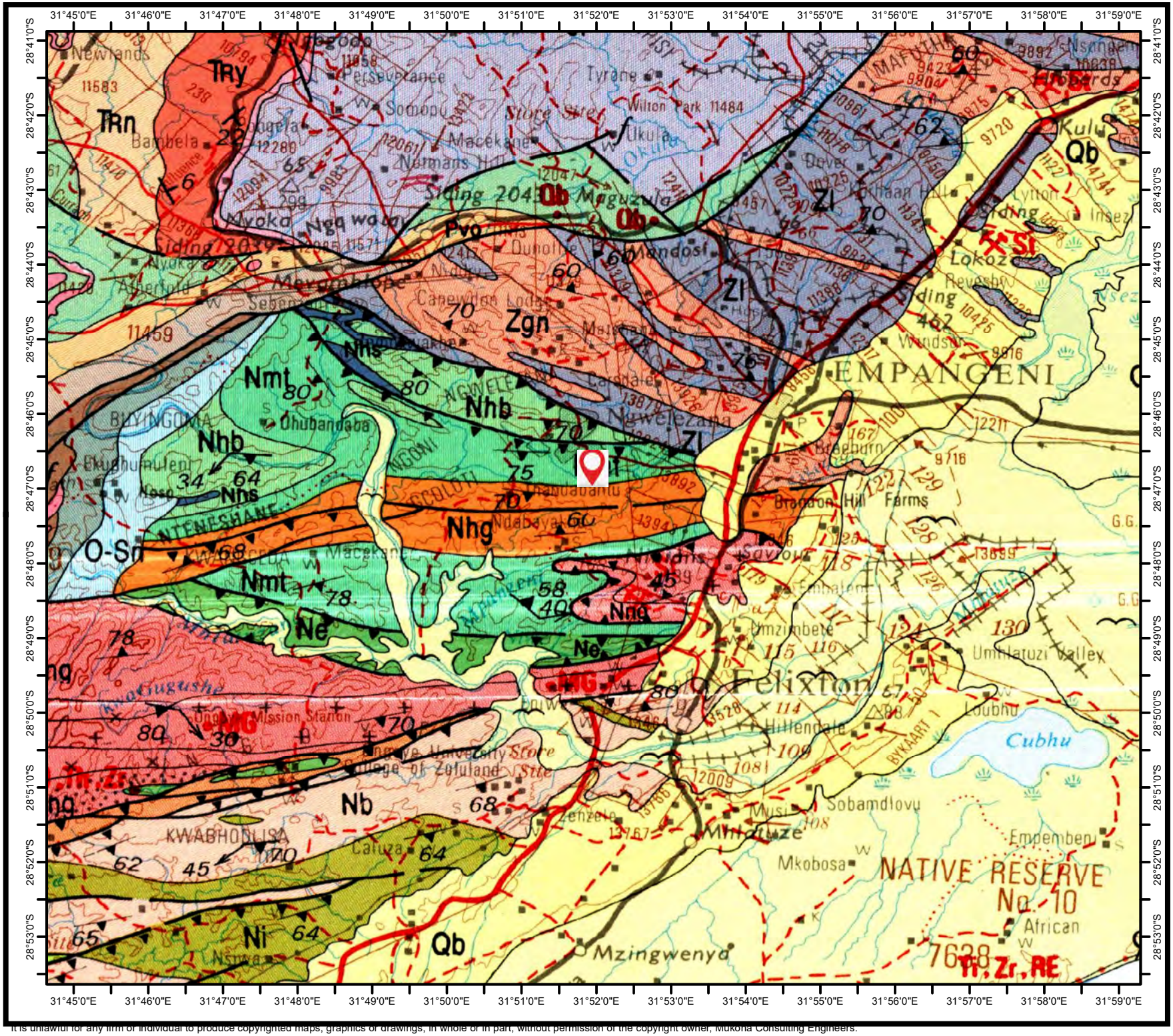
SCALE: 1:20 000

N

Co-ordinate System: GCS WGS1984
Map Source: ESRI Basemap
Project Site Insert: National Geospatial Information

Mukona Consulting Engineers (Pty) Ltd
International Business Gateway, New Road,
Midridge Office Estate (North), Midrand, 1685
Telephone: 0114438293
Mobile: +27 (0) 837850284
Email: sollyp@mukonagroup.com

APPENDIX C: GEOLOGICAL MAP



LEGEND

Site

Nmt Nmt-Amphibolite

PROJECT LOCATION

CLIENT

MAC ENGINEERING CONSULTANTS

PROJECT

GEOTECHNICAL INVESTIGATION REPORT
FOR A NEW ONCOLOGY UNIT AT NGWELEZANA HOSPITAL
EMPANGENI, KWAZULU NATAL

TITLE

GEOLOGICAL LAYOUT MAP
EXTRACT 1:250 000
MAP SERIES: 2830 DUNDEE

AUTHOR: A NOBEBE

DATE: 04/02/2025

DRAWING
MK-25-770

0 1 2 4 Km

SCALE: 1:125 000

N

Co-ordinate System: GCS WGS1984
Map Source: ESRI Basemap
Project Site Insert: National Geospatial Information

MUKONA

Mukona Consulting Engineers (Pty) Ltd
International Business Gateway, New Road,
Midridge Office Estate (North), Midrand, 1685
Telephone: 0114438293
Mobile: +27 (0) 837850284
Email: sollyp@mukonagroup.com

APPENDIX D: SITE LAYOUT MAP

LEGEND

- BOREHOLE (BH)
- DPSH
- Test Pit (TP)

PROJECT LOCATION

CLIENT

MAC ENGINEERING CONSULTANTS

PROJECT

GEOTECHNICAL INVESTIGATION REPORT FOR A NEW ONCOLOGY UNIT AT NGWELEZANA HOSPITAL EMPANGENI, KWAZULU NATAL

TITLE

GEOTECHNICAL LAYOUT MAP

AUTHOR: A NOBEBE

DATE: 04/02/2025

DRAWING

MK-25-770

0 0,0075 0,015 0,03 Km

SCALE: 1:923

N

Co-ordinate System: GCS WGS1984
Map Source: ESRI Basemap
Project Site Insert: National Geospatial Information

Mukona Consulting Engineers (Pty) Ltd
International Business Gateway, New Road,
Midridge Office Estate (North), Midrand, 1685
Telephone: 0114438293
Mobile: +27 (0) 837850284
Email: sollyp@mukonagroup.com

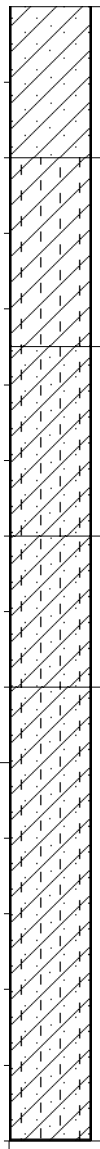
APPENDIX E: TEST PIT SOIL PROFILE

MAC Engineering Consultants
Geotechnical Investigation
New Oncology Unit
Ngwelezana Hospital, Empangeni
City of uMhlathuze Local Municipality
KwaZulu-Natal Province

HOLE No: TP01
Sheet 1 of 1

JOB NUMBER: MK-25-770

Scale 1:10



	0.00	Slightly moist, black to dark grey, firm, sandy CLAY: **FILL**.
	0.20	Slightly moist, brownish dark orange, firm, silty CLAY: **RESIDUAL AMPHIBOLITE**.
	0.45	Moist, yellow mottled white, firm, sandy silty CLAY: **RESIDUAL AMPHIBOLITE**.
FI		
	0.70	Moist, dark reddish orange, stained black, firm, sandy silty CLAY: **RESIDUAL AMPHIBOLITE**.
	0.90	Moist, orangey yellow, speckled greenish white, firm, relict structure, sandy silty CLAY: **RESIDUAL AMPHIBOLITE**.
FI		
	1.50	

NOTES

1) End of hole at 1.5m.
2) No groundwater seepage encountered.
3) Sidewalls stable.
4) Disturbed sample taken for FI at 0.2--0.9m.
5) Disturbed sample taken for FI at 0.9--1.5m.

CONTRACTOR : Casual Labour
MACHINE : Hand Excavations
DRILLED BY : L. Pfuluwani
PROFILED BY : L. Pfuluwani
TYPE SET BY : L. Pfuluwani
SETUP FILE : STANDARD.SET

INCLINATION : Vertical
DIAM : 0.6m
DATE : 30 January 2025
DATE : 30 January 2025
DATE : 10/02/2025 18:20
TEXT : ..zanaSoilProfileslOGS.txt

ELEVATION :
X-COORD : 28´°46’46.56"S
Y-COORD : 31´°51’55.05"E

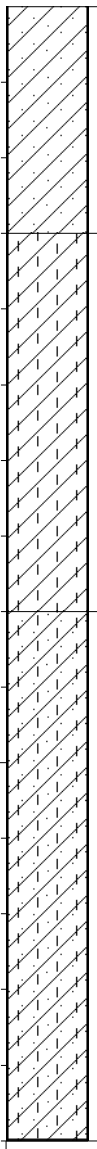
HOLE No: TP01

MAC Engineering Consultants
Geotechnical Investigation
New Oncology Unit
Ngwelezana Hospital, Empangeni
City of uMhlathuze Local Municipality
KwaZulu-Natal Province

HOLE No: TP02
Sheet 1 of 1

JOB NUMBER: MK-25-770

Scale 1:10



0.00 Slightly moist, black to dark grey, soft, sandy CLAY: **FILL**.

0.30 Slightly moist, orangey dark red, stained black, firm, silty CLAY: **RESIDUAL AMPHIBOLITE**.

FI

0.80 Moist, orangey red to yellow, firm, relict structure, sandy silty CLAY: **RESIDUAL AMPHIBOLITE**.

FI

1.50

NOTES

1) End of hole at 1.5m.
2) No groundwater seepage encountered.
3) Sidewalls stable.
4) Disturbed sample taken for FI at 0.3--0.8m.
5) Disturbed sample taken for FI at 0.8--1.5m.

CONTRACTOR : Casual Labour
MACHINE : Hand Excavations
DRILLED BY : L. Pfuluwani
PROFILED BY : L. Pfuluwani

INCLINATION :
DIAM : 0.6m
DATE : 30 January 2025
DATE : 30 January 2025

ELEVATION :
X-COORD : 28´°46’46.16"S
Y-COORD : 31´°51’53.40"E

HOLE No: TP02

TYPE SET BY : L. Pfuluwani
SETUP FILE : STANDARD.SET

DATE : 10/02/2025 18:20
TEXT : ..zanaSoilProfileslOGS.txt

MUKONA
CONSULTING ENGINEERS

MAC Engineering Consultants
Geotechnical Investigation
New Oncology Unit
Ngwelezana Hospital, Empangeni
City of uMhlathuze Local Municipality
KwaZulu-Natal Province

LEGEND
Sheet 1 of 1

JOB NUMBER: MK-25-770

	SANDY	{SA05}
	SILTY	{SA07}
	CLAY	{SA08}
Name ●	DISTURBED SAMPLE	{SA38}

CONTRACTOR :
MACHINE :
DRILLED BY :
PROFILED BY :

INCLINATION :
DIAM :
DATE :
DATE :

ELEVATION :
X-COORD :
Y-COORD :

TYPE SET BY : L. Pfuluwani
SETUP FILE : STANDARD.SET

DATE : 10/02/2025 18:20
TEXT : ..zanaSoilProfilesIOGS.txt

LEGEND
SUMMARY OF SYMBOLS

APPENDIX F: BOREHOLE PROFILES

HOLE No: BH01
Sheet 1 of 2

JOB NUMBER: MK-25-770

ROCK FABRIC
MF -massive
BF -bedded
FF -foliated
CF -cleaved
SF -schistose
GF -gneissose
LF -laminated

GRAIN SIZE
FG -fine grained
MG -medium grain
CG -coarse grain

JOINT SPACING
VCJ-very close spacg
CJ -close spacing
MJ -medium spacing
WJ -wide spacing
VWJ-very wide spacng

JOINT ROUGHNESS
SLJ-slickensided
SJ -smooth
RJ -rough

JOINT SHAPE
CUR-curvilinear
PLA-planar
UND-undulating
STE-stepped
IRR-irregular

ROCK HARDNESS
EHR-extremely hard rock
VHR-very hard rock
HR -hard rock
MHR-medium hard rock
SR -soft rock
VSR-very soft rock

MUKONA
CONSULTING ENGINEERS

MAC Engineering Consultants
Geotechnical Investigation
New Oncology Unit
Ngwelezana Hospital, Empangeni
City of uMhlathuze Local Municipality
KwaZulu-Natal Province

HOLE No: BH01
Sheet 1 of 2

JOB NUMBER: MK-25-770

REDUCED LEVEL	Drilling Method	Depth (m)	Material Recovery (%)	Core Recovery (%)	RQD (%)	Fracture Frequency (%)	DEPTH Scale 1:40
	NXC	0.50	100	0	0	0	
-1	NXC	1.50	65	0	0	0	1
	NWD4	2.00	50	0	0	0	
-2	NWD4	2.60	100	0	0	0	2
-3	NWD4	3.35	100	0	0	0	3
	NWD4	4.85	83	0	0	0	
-4							4
-5	NWD4	6.35	87	0	0	0	5
-6							6
-7	NWD4	7.85	73	0	0	0	7
-8	NWD4	9.35	100	69	26	4	8

Scale 1:40

FI

UCS

0.00	Tightly packed, subangular, GRAVEL in a matrix of slightly moist, brownish yellow, silty sand: **FILL**.
0.50	Slightly moist, brown to greenish yellow, stained black, firm, ferruginous sandy silty CLAY: **RESIDUAL AMPHIBOLITE**.
1.30	Slightly moist, brownish red, stained yellow, firm to stiff, relict structure, silty CLAY: **RESIDUAL AMPHIBOLITE**.
3.45	Tightly packed, angular, fine to coarse GRAVEL of quartz, overall consistency is dense: **QUARTZ VEIN**.
4.85	Moist, brownish yellow, very stiff, relict structure, sandy silty CLAY: **RESIDUAL AMPHIBOLITE**.
5.05	Tightly packed, angular to sub-angular, olive, mottled white, GRAVEL of weathered amphibolite in a minor matrix of moist, yellowish green, sandy silty clay: **RESIDUAL AMPHIBOLITE**.
7.85	Olive to black, speckled white, moderately weathered, medium grained, open joints with clayey in-fill, weakly foliated, schistose structure, soft metamorphic rock: **AMPHIBOLITE**.
8.70	

ROCK FABRIC
MF -massive
BF -bedded
FF -foliated
CF -cleaved
SF -schistose
GF -gneissose
LF -laminated

GRAIN SIZE
FG -fine grained
MG -medium grain
CG -coarse grain

JOINT SPACING
VCJ-very close spacg
CJ -close spacing
MJ -medium spacing
WJ -wide spacing
VWJ-very wide spacng

JOINT ROUGHNESS
SLJ-slickensided
SJ -smooth
RJ -rough

JOINT SHAPE
CUR-curvilinear
PLA-planar
UND-undulating
STE-stepped
IRR-irregular

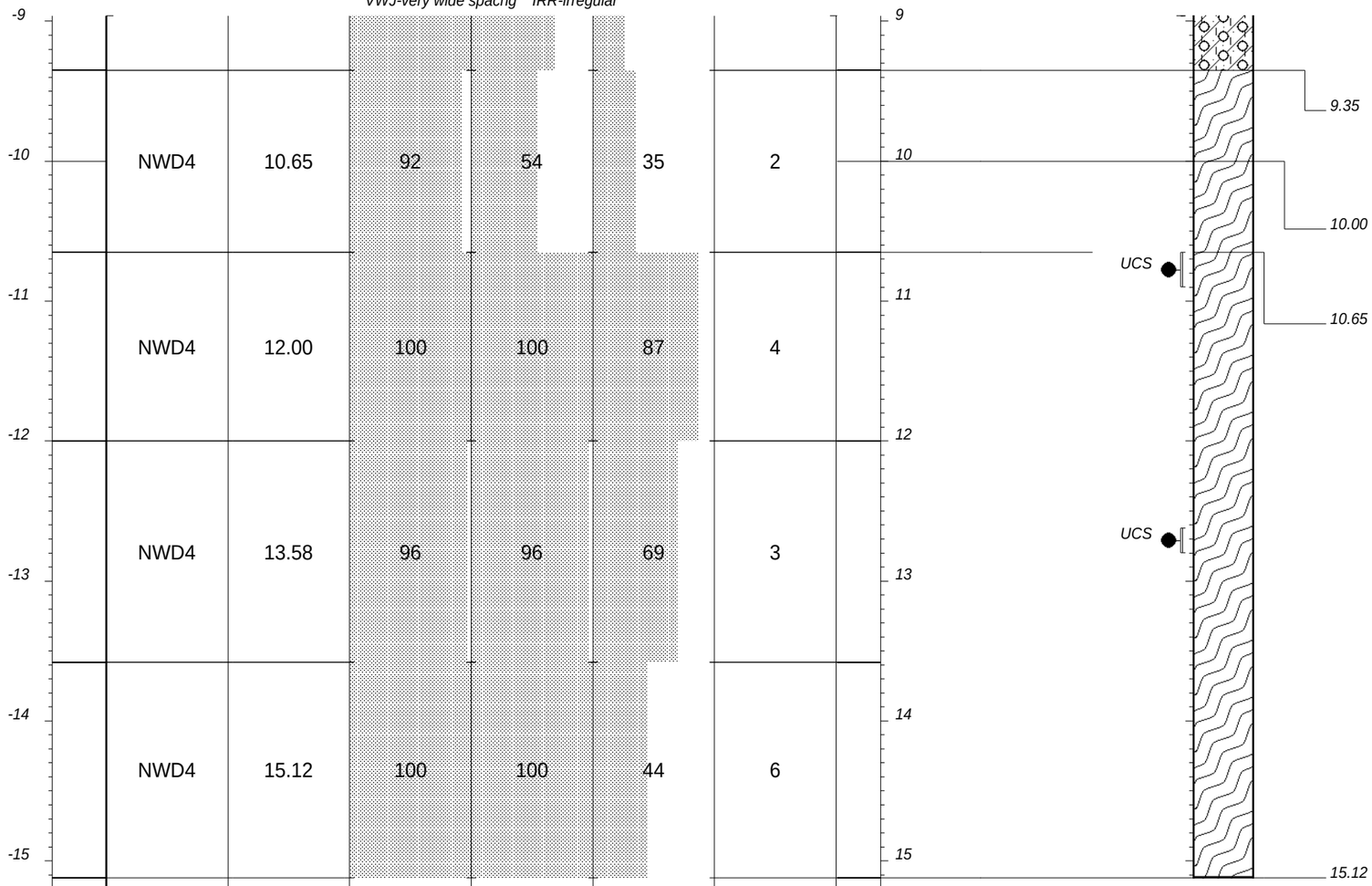
ROCK HARDNESS
EHR-extremely hard rock
VHR-very hard rock
HR -hard rock
MHR-medium hard rock
SR -soft rock
VSR-very soft rock

MUKONA
CONSULTING ENGINEERS

MAC Engineering Consultants
Geotechnical Investigation
New Oncology Unit
Ngwelezana Hospital, Empangeni
City of uMhlathuze Local Municipality
KwaZulu-Natal Province

HOLE No: BH01
Sheet 2 of 2

JOB NUMBER: MK-25-770



Drilling Method	Depth (m)	Material Recovery (%)	Core Recovery (%)	RQD (%)	Fracture Frequency (%)
NWD4	10.65	92	54	35	2
NWD4	12.00	100	100	87	4
NWD4	13.58	96	96	69	3
NWD4	15.12	100	100	44	6

9.35 Tightly packed, angular, olive to black, speckled white, GRAVEL of weathered amphibolite in a minor matrix of moist, yellowish green, sandy silty clay: **RESIDUAL AMPHIBOLITE**.

10.00 Olive to black, speckled white, slightly weathered, medium grained, weakly foliated, open joints with clayey in-fill, schistose structure, medium hard metamorphic rock: **AMPHIBOLITE**.
SA16

10.65 Olive to black, speckled white, stained yellow, highly weathered, medium grained, very highly fractured, open joints with clayey in-fill, weakly foliated, schistose structure, soft metamorphic rock: **AMPHIBOLITE**.

Olive to black, speckled white, slightly weathered, medium grained, closed and open joints (clayey in-fill, stained black in places), weakly foliated, schistose structure, medium hard metamorphic rock: **AMPHIBOLITE**.

15.12

NOTES
1) End of borehole at 15.12m.
2) Drilling medium: EZEE Mix used throughout.
3) Disturbed sample taken for FI at 2.6--3.35m.
4) Rock sample taken for UCS at 7.85--8.20m.
5) Rock sample taken for UCS at 10.65--10.90m.
6) Rock sample taken for UCS at 12.62--12.80m.

REDUCED LEVEL | Drilling Method | Depth (m) | Material Recovery (%) | Core Recovery (%) | RQD (%) | Fracture Frequency (%) | DEPTH Scale 1:40

CONTRACTOR : Mukona Geotechnics
MACHINE : YWE D45
DRILLED BY : L. Siwela
PROFILED BY : Lutendo Pfuluwani

TYPE SET BY : LP
SETUP FILE : STANDARD.SET

INCLINATION : 90´°
DIAM : NWD4
DATE : 31 Jan 2025 - 05 Feb 2025
DATE : 06 February 2025

DATE : 10/02/2025 18:32
TEXT : ..5770BoreholeProfiles.txt

ELEVATION :
X-COORD : 28´°46’46.37"S
Y-COORD : 31´°51’55.50"E

HOLE No: BH01

HOLE No: BH02
Sheet 1 of 1

JOB NUMBER: MK-25-770

ROCK FABRIC
MF -massive
BF -bedded
FF -foliated
CF -cleaved
SF -schistose
GF -gneissose
LF -laminated

GRAIN SIZE
FG -fine grained
MG -medium grain
CG -coarse grain

JOINT SPACING
VCJ-very close spacg
CJ -close spacing
MJ -medium spacing
WJ -wide spacing
VWJ-very wide spacng

JOINT ROUGHNESS
SLJ-slickensided
SJ -smooth
RJ -rough

JOINT SHAPE
CUR-curvilinear
PLA-planar
UND-undulating
STE-stepped
IRR-irregular

ROCK HARDNESS
EHR-extremely hard rock
VHR-very hard rock
HR -hard rock
MHR-medium hard rock
SR -soft rock
VSR-very soft rock

MUKONA
CONSULTING ENGINEERS

MAC Engineering Consultants
Geotechnical Investigation
New Oncology Unit
Ngwelezana Hospital, Empangeni
City of uMhlathuze Local Municipality
KwaZulu-Natal Province

HOLE No: BH02
Sheet 1 of 1

JOB NUMBER: MK-25-770

REDUCED LEVEL	Drilling Method	Depth (m)	Material Recovery (%)	Core Recovery (%)	RQD (%)	Fracture Frequency (%)
	HAND	0.30	100	0	0	0
-1	NXC	1.20	94	0	0	0
	NXC	1.50	80	0	0	0
-2	NWD4	3.00	60	0	0	0
-3	NWD4	3.70	36	0	0	0
-4	NWD4	4.45	87	0	0	0
-5	NWD4	5.95	71	0	0	0
-6	SHELBY	6.50	100	0	0	0
-7	NWD4	7.30	88	0	0	0
-8	NWD4	8.80	84	0	0	0
-9	NWD4	9.80	85	56	36	3
-10	NWD4	11.30	100	85	34	3
-11	NWD4	12.90	100	100	0	9
-12	NWD4	14.45	100	100	40	6
-13	NWD4	15.15	100	100	71	6
-14	NWD4	16.50	100	100	84	4
-15						
-16						

DEPTH Scale 1:100

Scale 1:100

FI

UCS

UCS

UCS

0.00 Moist, black to dark grey, firm, silty sandy CLAY with grass roots: **FILL**.

0.20 Moist, brown to greenish yellow, stained black, firm, ferruginous sandy silty CLAY: **RESIDUAL AMPHIBOLITE**.

0.90 Moist, brownish red, stained yellow, soft to firm, relict structure, silty CLAY: **RESIDUAL AMPHIBOLITE**.

7.50 Moist, olive to black, mottled white, firm to very stiff, relict structure, silty CLAY: **RESIDUAL AMPHIBOLITE**.
Notes
1. Stained reddish brown at the top
2. Scattered gravel size rock fragments towards the bottom.

8.80 Olive to black, speckled white, highly weathered, medium grained, open joints with clayey in-fill, weakly foliated, schistose structure, very soft metamorphic rock: **AMPHIBOLITE**.
Note
1. Completely weathered zone from 11.10m to 12.90m.

12.90 Olive to black, speckled white, stained orange, slightly to moderately weathered, medium grained, closed and open joints (clayey in-fill, stained black in places), weakly foliated, schistose structure, medium hard metamorphic rock: **AMPHIBOLITE**.

16.50

NOTES

1) End of borehole at 16.50m.
2) Drilling medium: EZEE Mix used throughout.
3) Disturbed sample taken for FI at 3.0--4.45m.
4) Rock sample taken for UCS at 10.93--11.40m.
5) Rock sample taken for UCS at 13.18--13.22m.
6) Rock sample taken for UCS at 14.77--14.97m.

CONTRACTOR : Mukona Geotechnics
MACHINE : YWE D45
DRILLED BY : L. Siwela
PROFILED BY : Lutendo Pfuluwani

TYPE SET BY : LP
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : NWD4
DATE : 31 Jan 2025 - 05 Feb 2025
DATE : 06 February 2025

DATE : 10/02/2025 18:32
TEXT : ..5770BoreholeProfiles.txt

ELEVATION :
X-COORD : 28´°46’46.07"S
Y-COORD : 31´°51’53.61"E

HOLE No: BH02

MUKONA
CONSULTING ENGINEERS

MAC Engineering Consultants
Geotechnical Investigation
New Oncology Unit
Ngwelezana Hospital, Empangeni
City of uMhlathuze Local Municipality
KwaZulu-Natal Province

LEGEND
Sheet 1 of 1

JOB NUMBER: MK-25-770

	GRAVEL	{SA02}
	SAND	{SA04}
	SANDY	{SA05}
	SILTY	{SA07}
	CLAY	{SA08}
	METAMORPHIC	{SA16}
	DISTURBED SAMPLE	{SA38}

Name

CONTRACTOR :
MACHINE :
DRILLED BY :
PROFILED BY :

INCLINATION :
DIAM :
DATE :
DATE :

ELEVATION :
X-COORD :
Y-COORD :

LEGEND
SUMMARY OF SYMBOLS

TYPE SET BY : LP
SETUP FILE : STANDARD.SET

DATE : 10/02/2025 18:32
TEXT : ..5770BoreholeProfiles.txt

APPENDIX G: BOREHOLE PHOTOPGRAPHS

BOREHOLE PHOTOGRAPHS

BH01


PROJECT NEW ONCOLOGY UNIT
SITE NGWELEZANA HOSPITAL
DEPTH FROM (M) 8.57 TO 12.00
DATE DRILLED FROM 01/02/25 TO 01/02/25
MUKONA
GEOTECHNICS (PTY) LTD
geotech@mukonagroup.com
(011) 443 3536
CONTACT NO MK-25-770
BORHOLE NO BH 01
CORE BOX NO 3 OF 4
0 100 200 300 400 500
BOREHOLE NO: BH-01
DATE FROM: 01/02/2025 TO
DEPTH 9.35
DEPTH 10.65
DEPTH 12.00
DEPTH FROM: 8.57m TO 12.00m


PROJECT NEW ONCOLOGY UNIT
SITE NGWELEZANA HOSPITAL
DEPTH FROM (M) 12.00 TO 15.12
DATE DRILLED FROM 01/02/25 TO 01/02/25
MUKONA
GEOTECHNICS (PTY) LTD
geotech@mukonagroup.com
(011) 443 3536
CONTACT NO MK-25-770
BORHOLE NO BH 01
CORE BOX NO 4 OF 4
BOREHOLE NO: BH-01
DATE FROM: 01/02/2025 TO 01/02/2025
DEPTH 13.52
DEPTH 15.12
DEPTH FROM: 12.00m TO 15.12m

BH02


PROJECT
NEW ONCOLOGY UNIT
SITE
NGWELEZANA HOSPITAL
DEPTH FROM (M)
0.0
TO
4.65
DATE DRILLED FROM
03/02/25
TO
03/02/25
MUKONA
GEOTECHNICS (PTY) LTD
geotech@mukonagroup.com
(011) 443 3536
CONTACT NO
MK-25-770
BORHOLE NO
BH 02
CORE BOX NO
1
OF
4
BOREHOLE NO : BH-02
DEPTH 0.30
DEPTH 1.20
DEPTH 1.50
DEPTH 3.00
DEPTH 3.78
DEPTH 4.45
DEPTH FROM : 0.00m TO 4.67 m


PROJECT
NEW ONCOLOGY UNIT
SITE
NGWELEZANA HOSPITAL
DEPTH FROM (M)
4.65
TO
9.55
DATE DRILLED FROM
03/02/25
TO
04/02/25
MUKONA
GEOTECHNICS (PTY) LTD
geotech@mukonagroup.com
(011) 443 3536
CONTACT NO
MK-25-770
BORHOLE NO
BH 02
CORE BOX NO
2
OF
4
BOREHOLE NO : BH-02
DEPTH 5.95
SHELBY 3 6.50
DEPTH 7.30
DEPTH 8.80
DEPTH FROM : 4.65m TO 9.55 m


PROJECT NEW ONCOLOGY UNIT
SITE NGWELEZANA HOSPITAL
DEPTH FROM (M) 9.55 TO 13.22
DATE DRILLED FROM 04/02/25 TO 04/02/25
MUKONA
GEOTECHNICS (PTY) LTD
geotech@mukonagroup.com
(011) 443 3536
CONTACT NO MK-25-770
BORHOLE NO BH 02
CORE BOX NO 3 OF 4
BOREHOLE NO: BH-02
DATE FROM: 04/02/2025 TO 04/02/2025
DEPTH 9.80
DEPTH 11.50
DEPTH 12.90
DEPTH FROM: 9.55m TO 13.22m


PROJECT NEW ONCOLOGY UNIT
SITE NGWELEZANA HOSPITAL
DEPTH FROM (M) 13.22 TO 16.50
DATE DRILLED FROM 04/02/25 TO 04/02/25
MUKONA
GEOTECHNICS (PTY) LTD
geotech@mukonagroup.com
(011) 443 3536
CONTACT NO MK-25-770
BORHOLE NO BH 02
CORE BOX NO 4 OF 4
BOREHOLE NO: BH-02
DATE FROM: 04/02/2025 TO 04/02/2025
DEPTH 14.45
DEPTH 15.15
DEPTH 16.50
DEPTH FROM: 13.22m TO 16.50m

APPENDIX H: DPSH FIELD TEST RESULTS

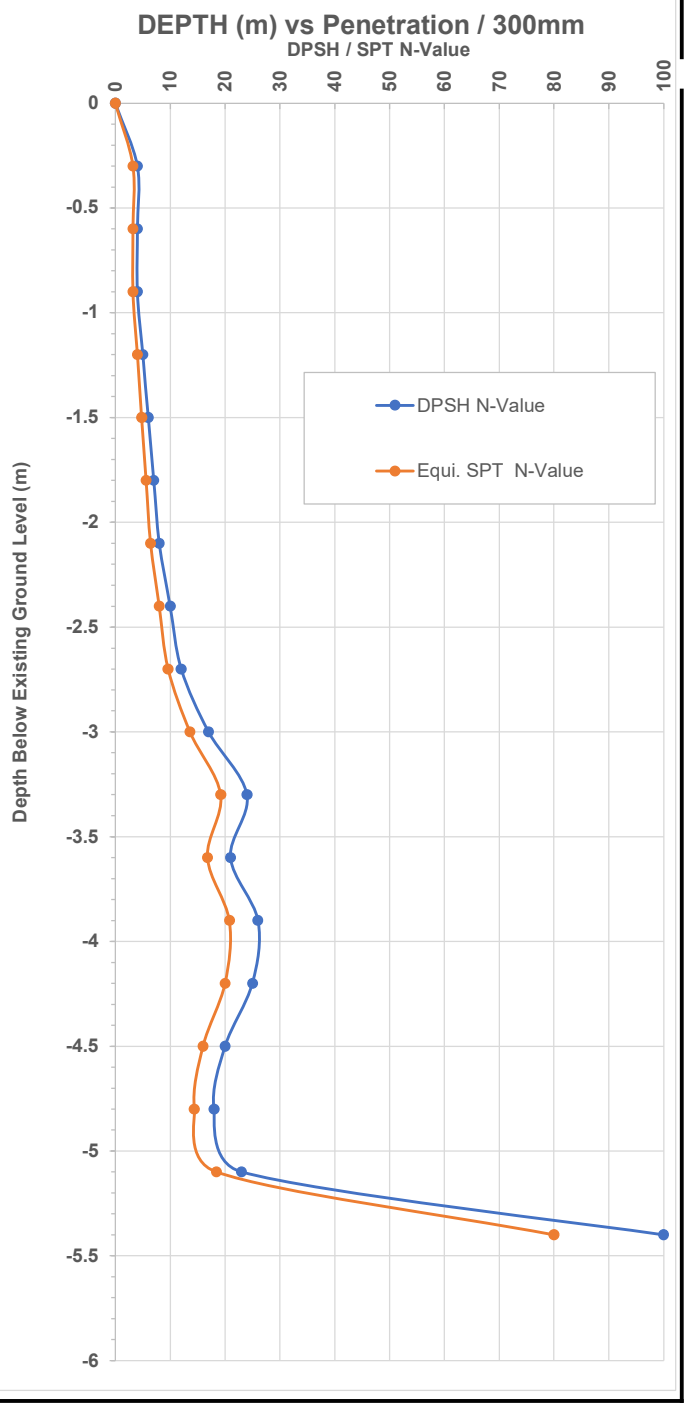
Client	*MAC Engineering Consultants*
Project	*New Oncology Unit, Ngwelezana Hospital, Empangeni*
Date Tested	*31-Jan-25*
Job Ref Number	*MK-25-770*
Operator	*Rabelani*
Final Depth (m)	*5.4m*
Test Number	*DPSH 1*

Coordinates	*X:*	*Y:*
	28°46'46.82"S	*31°51'55.66"E*

MUKONA
GEOTECHNICS (PTY) LTD

DYNAMIC PROBING SUPER HEAVY (DPSH) REPORT

Depth (m)	No. of Blows / 300mm	EQUIVALENT SPT-N VALUE
	DPSH N-Value	Equi. SPT N-Value
0.0	0	0
-0.3	4	3
-0.6	4	3
-0.9	4	3
-1.2	5	4
-1.5	6	5
-1.8	7	6
-2.1	8	6
-2.4	10	8
-2.7	12	10
-3	17	14
-3.3	24	19
-3.6	21	17
-3.9	26	21
-4.2	25	20
-4.5	20	16
-4.8	18	14
-5.1	23	18
-5.4	100	80
-5.7		
-6		
-6.3		
-6.6		
-6.9		
-7.2		
-7.5		
-7.8		
-8.1		
-8.4		
-8.7		
-9		
-9.3		
-9.6		
-9.9		
-10.2		
-10.5		



Remarks

Refusal of DPSH at 2.2m. Bouncing
At refusal, rebound is > 50% penetration depth
Blow count of N = 80 used at refusal
Equivalent SPT N-value = 0.8 x DPSH N-value

SPT-N Consistency Description				
Very Loose	Loose	Medium Dense	Dense	Very Dense
0 - 4	5 - 10	11 - 30	31 - 50	>50

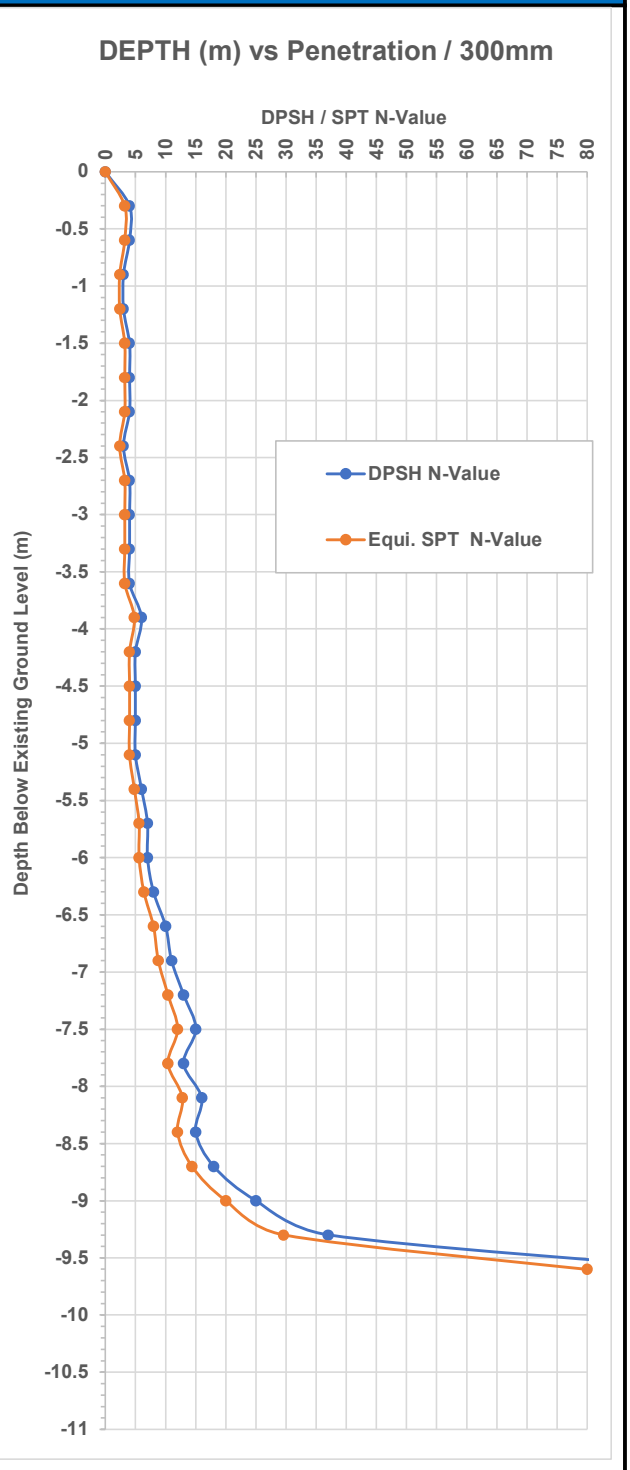
Client	MAC Engineering Consultants
Project	New Oncology Unit, Ngwelezana Hospital, Empangeni
Date Tested	31-Jan-25
Job Ref Number	MK-25-770
Operator	Rabelani
Final Depth (m)	9.6m
Test Number	DPSH 2

Coordinates	X:	Y:
	28°46'45.66"S	31°51'54.81"E

MUKONA GEOTECHNICS (PTY) LTD

DYNAMIC PROBING SUPER HEAVY (DPSH) REPORT

Depth (m)	No. of Blows / 300mm	EQUIVALENT SPT-N VALUE
	DPSH N-Value	Equi. SPT N-Value
0.0	0	0
-0.3	4	3
-0.6	4	3
-0.9	3	2
-1.2	3	2
-1.5	4	3
-1.8	4	3
-2.1	4	3
-2.4	3	2
-2.7	4	3
-3	4	3
-3.3	4	3
-3.6	4	3
-3.9	6	5
-4.2	5	4
-4.5	5	4
-4.8	5	4
-5.1	5	4
-5.4	6	5
-5.7	7	6
-6	7	6
-6.3	8	6
-6.6	10	8
-6.9	11	9
-7.2	13	10
-7.5	15	12
-7.8	13	10
-8.1	16	13
-8.4	15	12
-8.7	18	14
-9	25	20
-9.3	37	30
-9.6	100	80
-9.9		
-10.2		
-10.5		



Remarks

Refusal of DPSH at 0.32m. Bouncing
At refusal, rebound is > 50% penetration depth
Blow count of N = 80 used at refusal
Equivalent SPT N-value = 0.8 x DPSH N-value

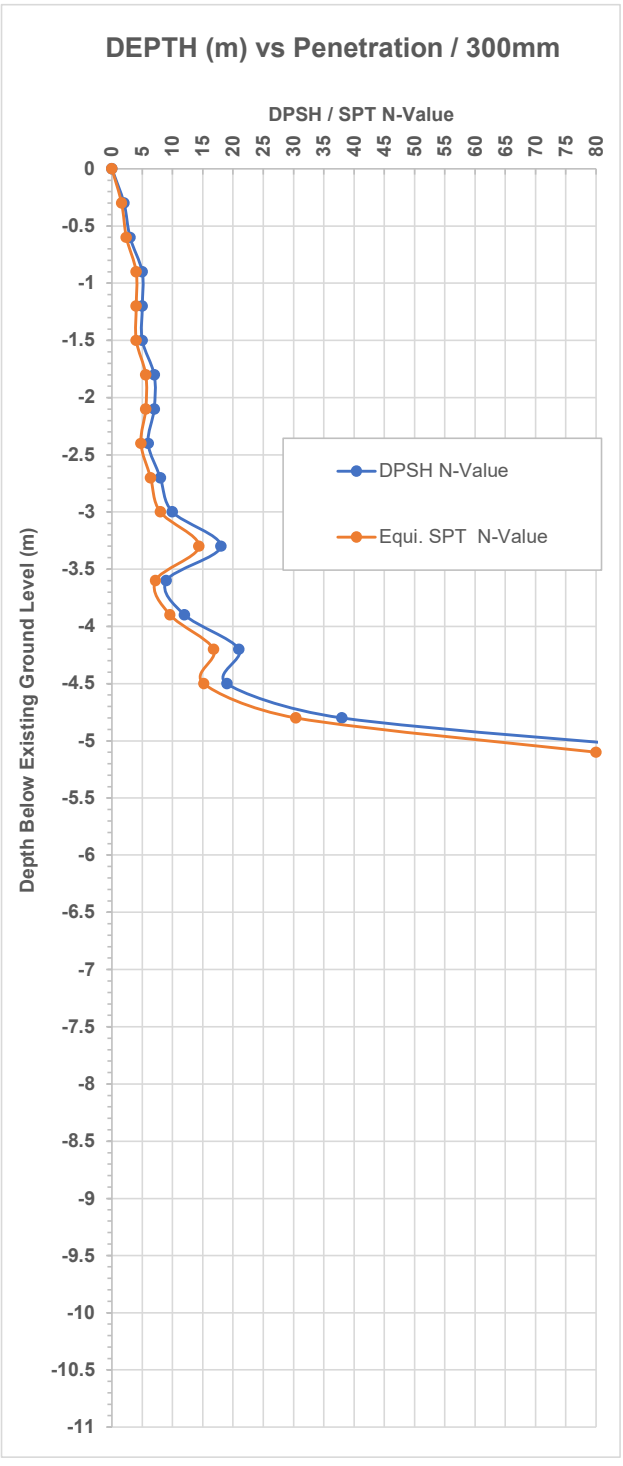
SPT-N Consistency Description				
Very Loose	Loose	Medium Dense	Dense	Very Dense
0 - 4	5 - 10	11 - 30	31 - 50	>50

Client	MAC Engineering Consultants
Project	New Oncology Unit, Ngwelezana Hospital, Empangeni
Date Tested	31-Jan-25
Job Ref Number	MK-25-770
Operator	Rabelani
Final Depth (m)	5.1m
Test Number	DPSH 3

Coordinates	X:	Y:
	28°46'46.47"S	31°51'54.48"E

MUKONA GEOTECHNICS (PTY) LTD

DYNAMIC PROBING SUPER HEAVY (DPSH) REPORT		EQUIVALENT SPT-N VALUE
Depth (m)	No. of Blows / 300mm	
	DPSH N-Value	Equi. SPT N-Value
0.0	0	0
-0.3	2	2
-0.6	3	2
-0.9	5	4
-1.2	5	4
-1.5	5	4
-1.8	7	6
-2.1	7	6
-2.4	6	5
-2.7	8	6
-3	10	8
-3.3	18	14
-3.6	9	7
-3.9	12	10
-4.2	21	17
-4.5	19	15
-4.8	38	30
-5.1	100	80
-5.4		
-5.7		
-6		
-6.3		
-6.6		
-6.9		
-7.2		
-7.5		
-7.8		
-8.1		
-8.4		
-8.7		
-9		
-9.3		
-9.6		
-9.9		
-10.2		
-10.5		



Remarks

Refusal of DPSH at 0.50m. Bouncing
At refusal, rebound is > 50% penetration depth
Blow count of N = 80 used at refusal
Equivalent SPT N-value = 0.8 x DPSH N-value

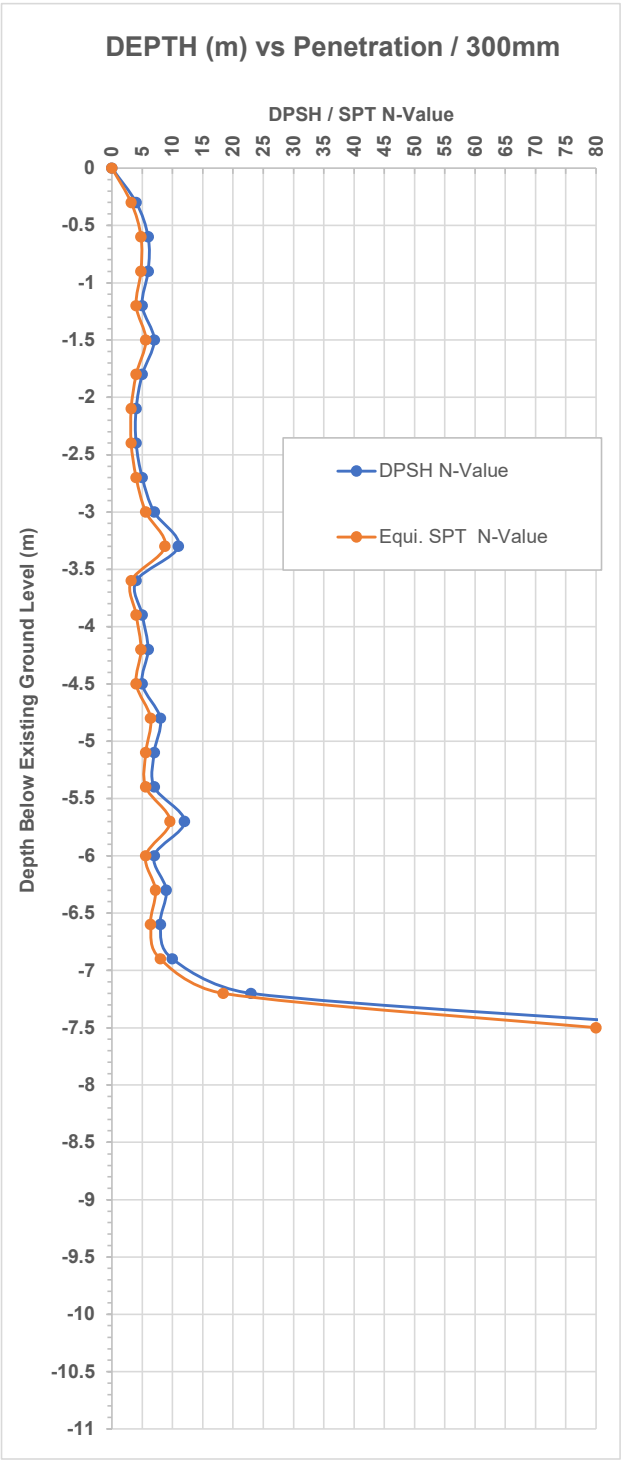
SPT-N Consistency Description				
Very Loose	Loose	Medium Dense	Dense	Very Dense
0 - 4	5 - 10	11 - 30	31 - 50	>50

Client	MAC Engineering Consultants
Project	New Oncology Unit, Ngwelezana Hospital, Empangeni
Date Tested	31-Jan-25
Job Ref Number	MK-25-770
Operator	Rabelani
Final Depth (m)	7.5m
Test Number	DPSH 4

Coordinates	X:	Y:
	28°46'47.18"S	31°51'54.01"E

MUKONA GEOTECHNICS (PTY) LTD

DYNAMIC PROBING SUPER HEAVY (DPSH) REPORT		EQUIVALENT SPT-N VALUE
Depth (m)	No. of Blows / 300mm	
	DPSH N-Value	Equi. SPT N-Value
0.0	0	0
-0.3	4	3
-0.6	6	5
-0.9	6	5
-1.2	5	4
-1.5	7	6
-1.8	5	4
-2.1	4	3
-2.4	4	3
-2.7	5	4
-3	7	6
-3.3	11	9
-3.6	4	3
-3.9	5	4
-4.2	6	5
-4.5	5	4
-4.8	8	6
-5.1	7	6
-5.4	7	6
-5.7	12	10
-6	7	6
-6.3	9	7
-6.6	8	6
-6.9	10	8
-7.2	23	18
-7.5	100	80
-7.8		
-8.1		
-8.4		
-8.7		
-9		
-9.3		
-9.6		
-9.9		
-10.2		
-10.5		



Remarks

4.44444E+11

Refusal of DPSH at 0.50m. Bouncing
At refusal, rebound is > 50% penetration depth
Blow count of N = 80 used at refusal
Equivalent SPT N-value = 0.8 x DPSH N-value

SPT-N Consistency Description				
Very Loose	Loose	Medium Dense	Dense	Very Dense
0 - 4	5 - 10	11 - 30	31 - 50	>50

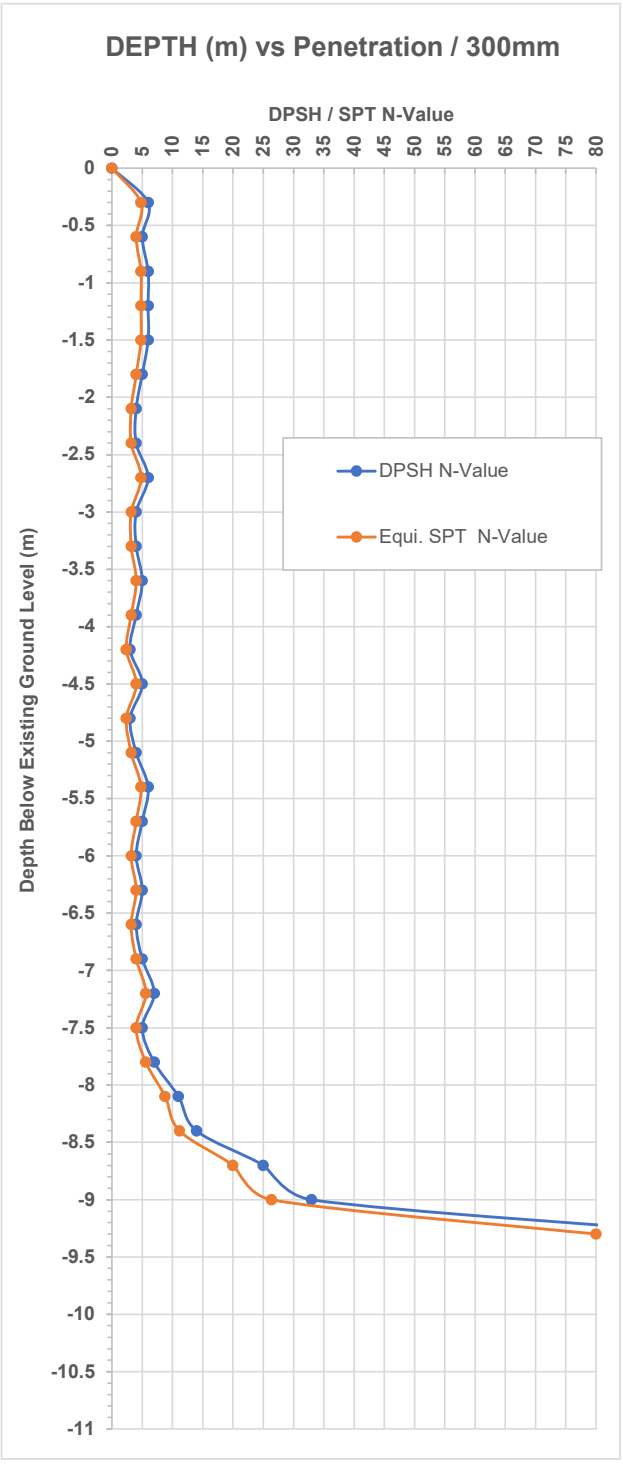
Client	MAC Engineering Consultants
Project	New Oncology Unit, Ngwelezana Hospital, Empangeni
Date Tested	31-Jan-25
Job Ref Number	MK-25-770
Operator	Rabelani
Final Depth (m)	9.3m
Test Number	DPSH 5

Coordinates	X:	Y:
	28°46'46.13"S	31°51'53.44"E

MUKONA GEOTECHNICS (PTY) LTD

DYNAMIC PROBING SUPER HEAVY (DPSH) REPORT

Depth (m)	No. of Blows / 300mm	EQUIVALENT SPT-N VALUE
	DPSH N-Value	Equi. SPT N-Value
0.0	0	0
-0.3	6	5
-0.6	5	4
-0.9	6	5
-1.2	6	5
-1.5	6	5
-1.8	5	4
-2.1	4	3
-2.4	4	3
-2.7	6	5
-3	4	3
-3.3	4	3
-3.6	5	4
-3.9	4	3
-4.2	3	2
-4.5	5	4
-4.8	3	2
-5.1	4	3
-5.4	6	5
-5.7	5	4
-6	4	3
-6.3	5	4
-6.6	4	3
-6.9	5	4
-7.2	7	6
-7.5	5	4
-7.8	7	6
-8.1	11	9
-8.4	14	11
-8.7	25	20
-9	33	26
-9.3	100	80
-9.6		
-9.9		
-10.2		
-10.5		



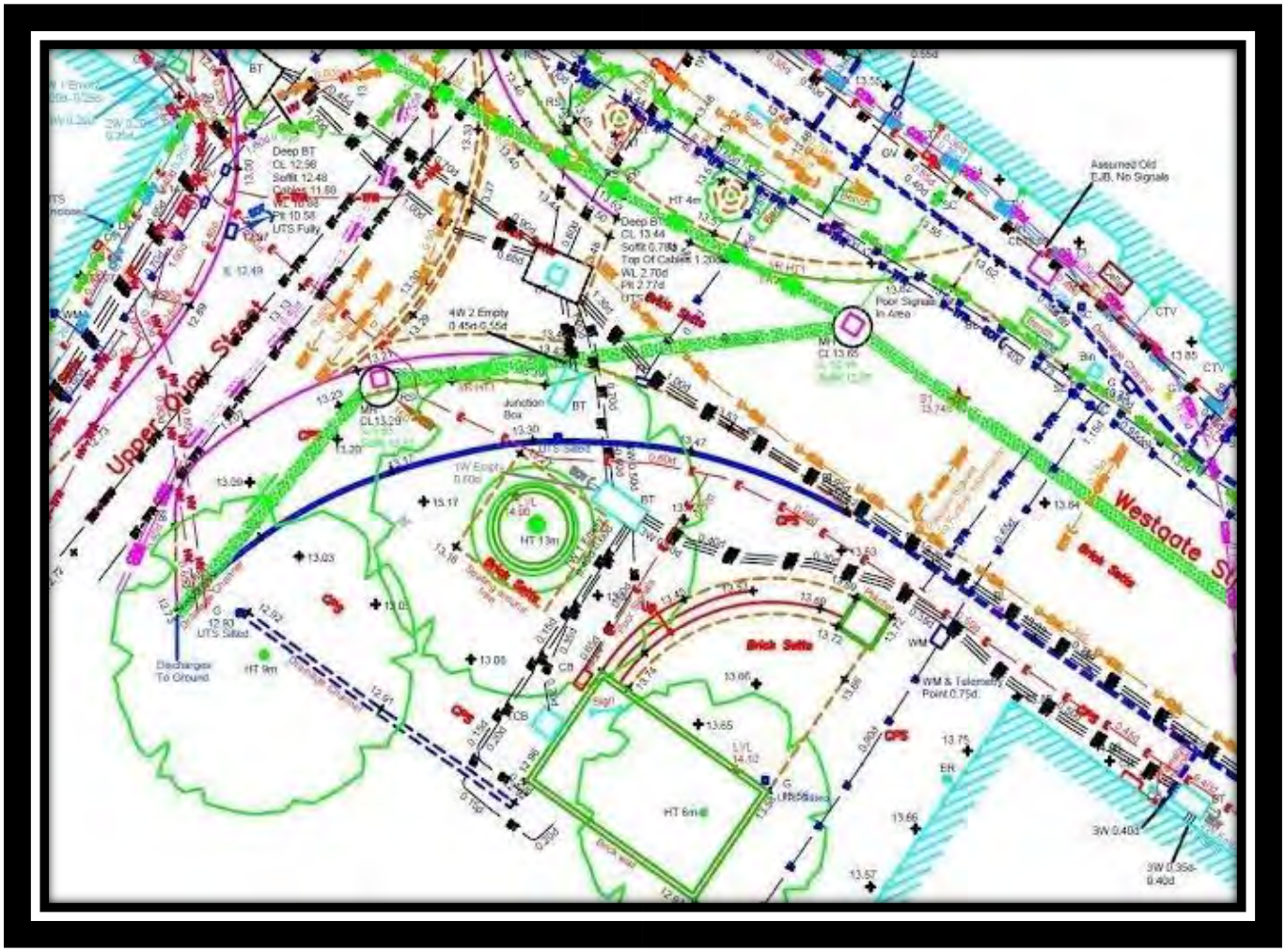
Remarks

Refusal of DPSH at 0.50m. Bouncing
At refusal, rebound is > 50% penetration depth
Blow count of N = 80 used at refusal
Equivalent SPT N-value = 0.8 x DPSH N-value

SPT-N Consistency Description				
Very Loose	Loose	Medium Dense	Dense	Very Dense
0 - 4	5 - 10	11 - 30	31 - 50	>50

ANNEXURE 14
SURVEY REPORTS

Site Report of Buried Services and Mapping Survey



CLIENT: DGIT

SCANNER: Justice Cele

EQUUIPMENT: RD 1100– RD 8100

SCAN DATE: 30November 2024

REPORT DATE: 30 November 2024

SERVICES DETECTION METHODOLGY

Detection of various underground services within the target area is conducted in the following manner

- **Electrical and Telkom cables, steel pipe and other conductive utilities:** A combination of an electromagnetic transmitter and receiver is used, indicating a signal onto utility by means of:
    - Direct Connection at valves, lamps post ect;
    - Clamping inside Telkom Chambers, electrical substations etc. if accessible;
    - Induction scan where no connection points on services are available
- **Storm Water Sewer lines:** This type of services are located by gaining access at points such as manhole kerk inlets etc. A self-containing sonde is propelling down the pipe using a fibre flex rod. The sonde transmits a signal, which enables the operate to locate the exact position and depth of the sonde from above ground by using a receiver.
- **Non-metallic pipes and other non-conductive services:** Non-metallic utilities, such as AC and PVC water mains and Fibre optic cables, are located by means of Ground penetrating radar (GPR). By scanning the servitude with GPR, changes in the ground conductivity are detected. The alignment of several position of this nature usually indicates the existence of non-metallic services. GPR will only be used to locate services that could not be located by means of electromagnetic methods.

Note: Positive Ground Penetrating radar results are dependent on good soil conditions. If soil conditions are not favorable to good results, this will be noted by the contractor in the Survey report.

Utility lines are drawn on the survey report with colour coding unique to each utility type:

Google Erath Map for proposed Location

TYPE OF UTILITY	Colour coding
Electrical cables	E
UNKOWN	UK
Water	W
SEWER	S
Storm Water	SW Drainage
Fiber	F

Please refer to the table for all relevant services detected

Top View image of Proposed area marked in Yellow

Site 1

Site1 Finding

Electrical Cable: Detected cable from the distribution box.
Passes through the laundry yard into the main yard.
Depth: 0.8m.
Stormwater Drain: Main exit from the hospital.
Depth drops from 1.6m to 2.4m.
Sewer Line: Catching from the buildings.
Depth: 1.6m at entry, dropping to 4.4m at exit (sewer main line leaving the hospital).
Electrical Cable: Feeds a light Depth: 0.3m.
Water Line: Supplies the fire hydrant.

Site 2

Site 2 finding

1Sewer Line: Feeding from the building at a depth of 1.2m. Connecting to the sewer main at 3.0m. Exiting the hospital at a depth of 4.3m.

Stormwater Drain: Feeding from the building into the main line. Exiting the hospital at a depth of 4.0m.

Site 3

Site 3 finding

1. High-Voltage Cables:
   Feeding from the mini substation into the building.

- Depth variations:
- 0.2m to 0.6m,
- 0.6m to 0.8m,
- 0.8m to 1.2m,

2.Water Line: Feeding the fire hydrant depth: 0.8m.

3.Sewer Line: Feeding into the sewer mains depth: 1.1m, dropping to 1.7m, and joining the main sewer line referenced in Site 2.

4.Stormwater Drain: Main line at a depth of 0.6m joining to the stormwater main mentioned in Site 1.

Site 4

Site 4 findings

Sewer Line: Originating from the demolished building connecting to the main sewer line at a depth of 0.8m.

Stormwater Lines: Feeding from the demolished building into the main line joining the stormwater main mentioned in Site 1.

3.High-Voltage Cable: Detected across the scanned area feeding from the substation into the distribution box mentioned in Site 1.

4.Electrical Cable: Supplying the demolished building depth: 0.4m, dropping to 0.8m.

5.Water Main: Feeding fire hydrants depth: 0.6m.

Ste 5 findings

Water Lines:

- Fire Hydrant Supply: Entering the building at a depth of 0.9m.
- Building Supply: Water line at a depth of 0.8m.

Sewer Line:

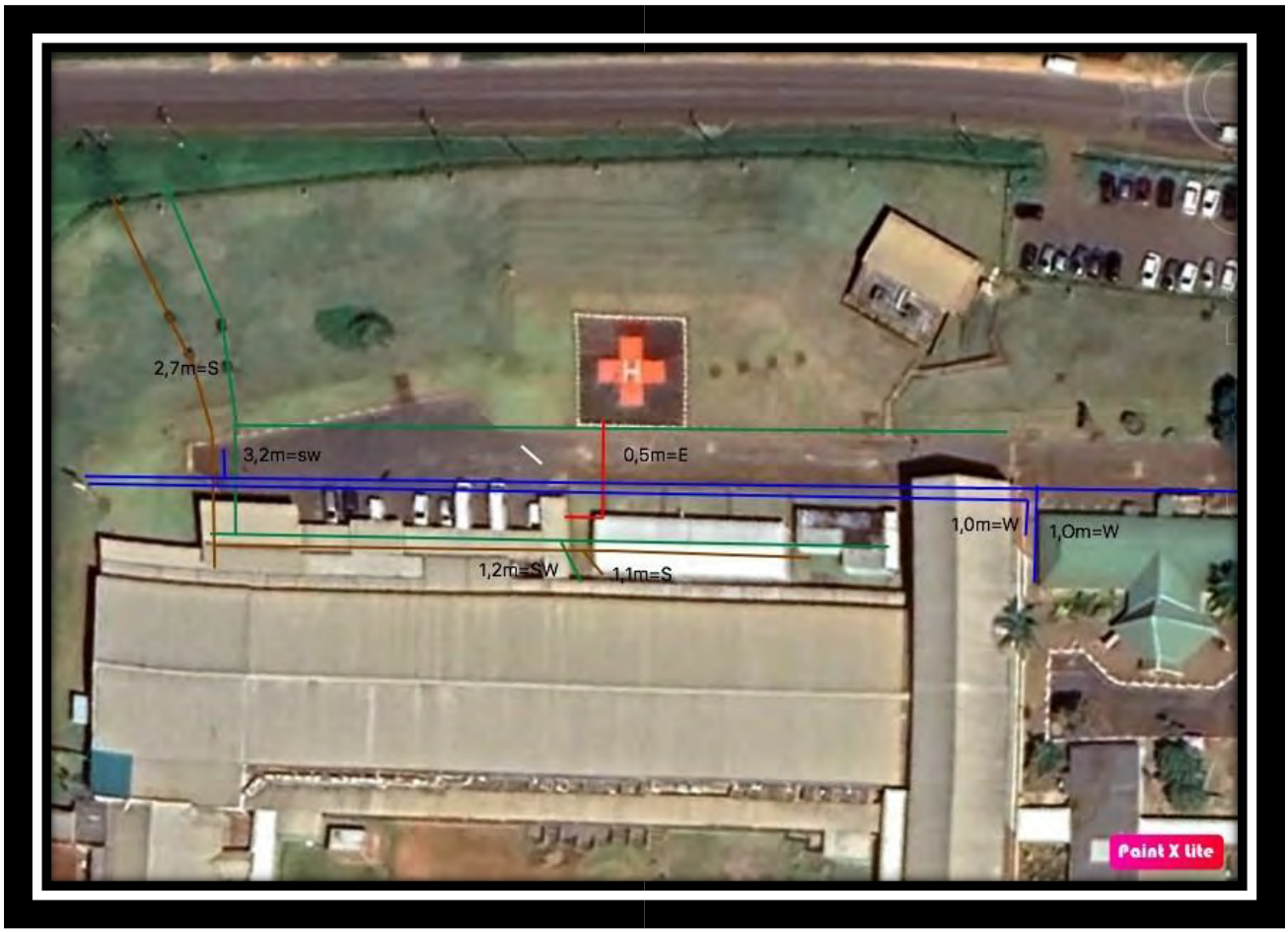
- Feeding from the buildings into the main sewer line mentioned in Site 3 depth: 1.6m.

Stormwater Channel:

- Feeding off the building depth: 0.8m into main line depth 1,2m

Electrical Cables:

- Feeding off the building into the pump station at a depth of 0.5m



Site 6 findings

1. Stormwater Lines:
    - Main Line: Exiting the hospital at a depth of 3.2m.
    - Feeding off the building: Depth of 1.2m.

2. Sewer Lines:
    - Main Line: Exiting the hospital at a depth of 2.7m.
    - Building Feed: Depth of 1.1m.

3. Water Lines:
    - main feed to Hospital Wards: Depth of 1.0m.
    - Fire Hydrant Supply: Depth of 1.0m.

4. Electrical Cable:
    - Detected at a depth of 0.9m.

Ground penetrating Rada findings: Not favorable to good result due soil condition

A0

SCALE 1:750

NOTES:
1. HEIGHTS AND POSITIONS RELATED TO TRIG
2. HEIGHTS ON THE MEAN SEA LEVEL.
3. ONLY VISIBLE SERVICES WERE SURVEYED.

LEGEND

- SEWER DRAIN
- STORM WATER DRAIN
- TREE
- TELEPHONE POLE
- ELECTRIC POLE
- BENCH MARKS
- STAY WIRE
- MANHOLE CABLE
- PALM
- KILOMETER MARKER
- WATER VALVE
- WATER METER
- FIRE HYDRANT

CODE	DESCRIPTION
TP	TELEPHONE POLE
PP	POWER POLE
LP	LIGHT POLE
CC	CONCRETE
TR	TREE
MH	MANHOLE
ET	EDGE TAR
W	WALL
TB	TOP BANK
BB	BOTTOM BANK
ER	EDGE ROAD
F	FENCE
CB	CORNER BUILDING
SPK	SPEAKER
PALM	PALM TREE
CONT	CONTAINER
PV	PAVED / TARRED SURFACE
STPS	STEPS
SGN	SIGN POST

R MUFAMADI AND ASSOCIATES

Topographical Surveys - Engineering Surveys
G.P.S Surveys

Cell : +27 (0)72 327 0585
Email : r.mufamadi@rmsurveys.co.za

12 CHANDLER ROAD
COWIES HILL, 3610

Design:	Date :
Drawn : RMAS	Date : DECEMBER 2024
Traced :	Date :
Checked:	Date :
Approved : RMAS	Date : DECEMBER 2024

Project MANAGER: TAFADZWA

Client :

DGIT ARCHITECTS

Title:

NGWELEZANA ONCOLOGY
EMPANGENI

Scale: 1:750

Project Number: 2024013/DGIT

Drawing Number : 2024013 NGWELEZANA ONCOLOGY

Rev: 1

ANNEXURE 15

ABRIDGED CONCEPT REPORT (WITH DISCIPLINE REPORTS)

KWAZULU-NATAL PROVINCE
HEALTH
REPUBLIC OF SOUTH AFRICA

NGWELEZANA HOSPITAL – NEW ONCOLOGY CENTRE

Abridged Concept Report

Document Control

Version Number	Date	Drafted	Checked	Approved
1	February 2025	LM	AH	BG

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1. EXECUTIVE SUMMARY

This document entails the concept of a New Oncology Centre at Ngwelezana Hospital which services the King Cetshwayo, Zululand and uMkhanyakude districts with a population of 2.7 million.

This project provides for the construction of a new structure that will provide a 128-slice CT scanner, two linear accelerators, one brachytherapy for radiation services, twenty-eight chemotherapy chairs and a 32-bed oncology inpatient ward that will accommodate both females and males. There will also be staff facilities which include offices and meeting rooms.

This report is accompanied by detailed reports which include Architectural, Civil/Structural, Electrical, Environmental, Occupational Health and Safety, Mechanical Engineering, Lifecycle Cost and a Bill of Quantities. These reports explored various options to inform the recommended solutions to fulfil the projects objectives. The detailed information in the reports form the basis for the works and site information that will be used to develop the tender documents for the design and build contractor.

Investigations were conducted to determine the sufficiency of the bulk services, which were all found to be adequate. The site is constrained, and provision has been made for enabling works. This includes the relocation of existing parkhomes and provision of parkhomes to accommodate oncology and renal dialysis services. Access to the courtyard for construction requires modification to the laundry and hospital passage.

2. PURPOSE

The purpose of the Concept Report is to present the development of different design concepts to satisfy the project requirements, as presented in the Initiation Report (Stage 1). Through the comparison of alternatives, it provides opportunity to select a most appropriate conceptual approach.

The ultimate objective of this stage is to determine whether the project is viable to proceed, with respect to available budget, technical solutions, timeframe and other information that may be required.

This document presents the Site Information and Works Information that will be documented as part of the Design and Build tender document for the project.

3. PROJECT DESCRIPTION

The project involves the planning, design and construction of a New Oncology Centre at Ngwelezana Hospital.

The details of the project are as follows:

a) **Project Name:** Ngwelezana Hospital – Construction of a New Oncology Centre

b) **Name of Province:** KwaZulu-Natal

c) **Name of District Municipality:** King Cetshwayo

d) **Name of Local Municipality:** City of uMhlathuze

e) **Name of Town:** Empangeni

f) **Name of Township:** Ngwelezana A

g) **Land Ownership:** City of uMhlathuze

h) **Coordinates of the Proposed Site:** 28.7766307S; 31.8648864E

i) **Estimated Construction Period:** 12 months

j) **Project Type:** Brownfield project

k) **Impact:** Increased life expectancy at birth

l) **Outcomes:** Universal Health Coverage, Improved client experience of care, Reduced morbidity and mortality

m) **Outputs:** Fully commissioned Oncology Centre rendering chemotherapy, radiotherapy and inpatient services with the following:

   i. 28 x Chemotherapy chairs
   ii. 2 x Linear Accelerators
   iii. 1 x Brachytherapy Unit
   iv. 1 x 128 Slice CT Scanner
   v. 32 x inpatient beds

4. SCOPE OF WORKS

The scope of this project involves the construction of an Oncology Centre which provides an inpatient and outpatient service. The centre includes a consulting suite, chemotherapy suite and radiotherapy treatment. It will also provide a 32-bed oncology inpatient ward, administration and staff facilities. The services are summarised below:

Table 1: Summary of Service Requirements

Discipline	Bed Number	Chair Number	Room No.
Consulting rooms			4
Chemotherapy chairs		28	
CT Scanner			1
Radiotherapy teletherapy bunkers			2
Radiotherapy brachytherapy bunkers			1
Oncology Ward	32		
Administrative and staff facilities	46 Staff Members		

As per the approved initiation report the lodger facilities are excluded from the scope. Ethembeni Care Centre at KwaMbonambi is currently used as a step down facility by the Ngwelezana Hospital and has been identified to accommodate ambulant oncology patients that require lodging during treatment.

5. PROJECT MILESTONES

The table below provides a schedule of milestones and deliverables for the project. The project progress has aligned with the Performance Measurement Baseline; however delays have been experienced in finalising the concept report which was updated from 29 November to 13 December 2024.

Table 2: Project Milestones

Milestones	Milestone Dates
Clinical Brief Approved	20-Sep-24
Initiation Report Approved	20-Nov-24
Concept Report Approved	13-Dec-24
ITSC Sitting for all Tenders	13-Dec-24
Advertise Tenders	13-Jan-25
Close Tenders	14-Feb-25

Milestones	Milestone Dates
Award Tenders	14-May-25
Design Development and Documentation Reports	15-Sep-25
Handover - Enabling Works	15-Sep-25
Handover - Works	30-Jun-26
Commissioning	31-Jul-26
Close Out	1-Nov-27

6. ARCHITECTURAL OPTIONS ANALYSIS

Within the chosen site, both the interdepartmental and intradepartmental relationship requirements were explored in order to establish the best layout for the service. The first option was to arrange the centre parallel to the ICU and radiology in a northwest, southeast orientation, the ground floor is shown in the figure below.

Figure 1: Option 1 Layouts

The concept considered the longer length of the courtyard and maintains the existing park homes in their current position. However, it does not take advantage of the area of the courtyard closest to the main entrance to the hospital and pharmacy. The entrance to the centre connects into the hospital between the ICU and theatre, disrupting this passage which should be the quietest patient zone in the hospital. The masterplan for Ngwelezana Hospital includes additional theatres for which reason the courtyard was cleared. By positioning the Oncology Centre close to the theatres, it compromises future development adjacent to the existing theatres. This option finally proposes a basement for the radiotherapy bunkers, this was found to compromise the ability to install and remove the linear accelerators due to the

size of the gantry. A basement also increases reliance on lifts and artificial lighting, which could compromise the safety of occupants in the event of a power disruption.

The layout was then rotated to align with the passage outside the outpatient and emergency department. This provided more successful adjacencies within the workflow of the Oncology Centre. The entrance is along the busiest passage in the hospital, therefore not compromising more controlled areas. Patients can access the centre easily from the main entrance. It also leaves the portion of the courtyard closest to the theatres for their future expansion. The negative result is that the park homes will need to be relocated in order to accommodate the Oncology Centre and a new location for the renal dialysis service must be found. It was also found that intradepartmental relationships were not ideal in the radiotherapy suite where patient privacy was compromised. Chemotherapy services were planned on the second floor, while the oncology ward was on the first floor. This meant that there would be significant movement past the ward to get to the chemotherapy suite. Requirements for the chemotherapy suite were not met, with risk that there will be congestion within the treatment area and that patient experience will not be satisfactory. The linear accelerators have radiation fields that restrict what can be accommodated above them. There was concern about what was proposed on the first floor and that occupancy of these spaces is higher than what is safe. Finally, this option meant that an existing building would need to be altered and ablution block would need to be demolished.

Figure 2: Option 2 Layouts

The final iteration pulled the radiotherapy bunkers outside of the building mass, allowing existing buildings to remain intact. It also allowed the bunkers to be standalone, not affecting any habitable spaces. The radiotherapy treatment areas will be accessed along an L-shaped passage improving the privacy for patients and reducing unauthorised traffic in this zone.

Figure 3: Recommended Ground Floor Plan

The oncology ward was positioned on the second floor improving the privacy gradient in the building. Chemotherapy, on the first floor, has been provided adequate space to provide sufficient space for the patients to have a quality experience of care during the long treatment period.

Figure 4: Recommended First Floor Plan

Figure 5: Recommended Second Floor Plan

Further to the installation of equipment within the building, it is necessary to consider the route that the linear accelerators will take during installation. The recommended concept provides the option for the linear accelerators to be brought in along the main passage, directly into the fire exit closest to the bunkers or across the courtyard during construction.

Service requirements, including the mechanical and electrical, are significant and can be accommodated above the bunkers and at the back of the bunkers, reducing impact of noise on the hospital.

It is recommended that the proposed concept design adequately satisfies the client requirements and that it is taken forward for development.

7. ELECTRICAL INSTALLATION

7.1. Estimated Maximum Load Demand

The estimated electrical loads maximum demand for the proposed development is 262 kVA while the mechanical loads estimated maximum demand is sitting at 331 kVA giving an overall total estimated maximum demand of **593 kVA.**

Table 3: Estimated Electrical Loads

Item	Building Allocation	Electrical Loads (kVA)	Mechanical Loads (kVA)	Total Load (kVA)
1	Ground Floor	204	87	291
2	First Floor	25	5	30
3	Second Floor	34	238	272
Total		262	331	593

7.2. Electrical Power Supplies

Power Supply to the New Oncology Centre shall be as follows:

i. **Normal / Non-essential Power Supply**: Supplied from Supply Authority (Municipality) through the existing 2x 1,25MVA Transformers
ii. **Emergency / Essential Power Supply**: Supplied from Emergency stand-by generating plant (Diesel Generator recommended)
iii. **Uninterruptible Power Supply (UPS)**: All critical medical equipment supplied from Essential supply through UPS

7.3. Normal / Non-essential Power Supply

The hospital currently has two 1.25 MVA transformers (TRF1 and TRF2) with respective loadings of 650kVA and 400kVA. This means that TRF1 is operating at 650kVA (52% capacity), and TRF2 at 400kVA (32% capacity). Each transformer is backed up by an 800kVA generator. The proposed new Oncology Centre, with critical loads including a linear accelerator (LINAC), CT scanner, and brachytherapy can be supplied from the existing transformers by splitting the loads to both transformers. This option utilises the available capacity on both transformers to support the Oncology Centre.

The Department is desirous that solar PV systems are considered as supplementary supply to the two transformers. This option will be further explored during Design Development stage.

7.3.1. Emergency / Essential Power Supply

Currently the Hospital has 2 x 800 KVA generators providing the electrical back up to the whole hospital loads. Generator No.1 has maximum recorded demand of 505kVA (63% loaded) whilst Generator No.2 has a maximum recorded demand of 376kVA (47% loaded). It is evident that these generators' combined capacity is sufficient to cater to the emergency power requirements of the new Oncology Centre but the capacity of a single generator was found inadequate to supply a consolidated load under one circuit breaker. This limitation prevents the Oncology Centre from running all critical loads simultaneously under emergency

conditions and hence the recommendation to install 1x 500kVA back up diesel generator to supply and handle all essential loads of the new Oncology Centre.

7.3.2. Uninterruptible Power Supply (UPS)

Electrical disturbances may affect the reliability of high-tech medical equipment. As medical equipment is often connected to vulnerable patients, such a malfunction may result in fatal consequences. To mitigate this problem careful consideration shall be made in terms of the design of the electrical distribution system as well as selection of electrical distribution equipment.

It is recommended the use of dedicated UPS for each of the main medical equipment that forms part of the Oncology Centre namely, 2 x Linear Accelerators, 1 x Brachytherapy as well as the 1 x Wide Bore CT Scanner. This means that **each** of these critical medical equipment will be supplied from its own dedicated UPS.

8. CIVIL ENGINEERING

A topographical survey has been conducted to obtain the location of the existing services. In addition, on-site investigations have also been conducted to extract the information on the existing and current condition of the services on site. Additional information was also obtained from engagements with the facility management. External investigations that been conducted also include traffic impact studies. Furthermore, investigations on existing services were undertaken including supply capacity. The review of these services is discussed below.

8.1. WATER INFRASTRUCTURE

As stated in the attached Stage 2 report for civil and structural work, Ngwelezana Hospital's water is supplied by the City of uMhlathuze Water Services Authority via a direct connection to the municipality's existing network. The water is then stored in existing reservoirs on site to a total capacity of 1.5 megalitres to serve as the 72 hour watre storage. The supply and storage capacity, water demand and reticulation values were calculated according to the design guidelines set out in the:

a) Guidelines for Human Settlement Planning and Design (Redbook);
b) Department of Public Works: Civil Engineering Manual;
c) The South African Standard Code of Practice for the application of the National Building Regulations, SANS 10400; and
d) South African National Standard: Water supply and drainage for buildings, SANS 10252, was also consulted in the design process.

The current storage capacity and water demand to determine the impact of the New Oncology Centre on the current water network is detailed below.

a) On-site facility storage: 1 mega litre concrete reservoir plus a 500kl elevated concrete reservoir to supply both fire and potable water.
b) Based on the 300 l/bed estimate, the required 72-hour water demand for the 516-bed hospital is 464.4 kl.
c) Based on the 300 l/bed estimate, the required 72-hour potable water demand for the new 34-bed oncology ward is 30.6 kl and the required fire water demand for a minimum of one

hydrant at 1200 l/min for 2 hours (low risk group 1) is 144kl. The total potable and fire water equates to 174.6 kl, which is approximately 11.64% of the entire 1.5 mega litre water supply.

d) The hospital's potable water reticulation network is connected via a 160mmØ feeder main. Where applicable, it may be necessary to reroute portions.
e) An existing 160mmØ uPVC water pipeline is located along the southern boundary of the proposed development.
f) Existing water pressures are adequate subject to confirmation by the Design Engineers during detail design stage.

According to the Redbook, using 300 litres per bed, the AADD (annual average daily water demand) is 10 200 kl and the maximum flow rate/peak domestic water demand is 1.05 l/sec. The future water demand for 548 beds, including the new 32-bed oncology inpatient ward, is 495 kl. The current construction of the orthotics unit requires 5kl potable water storage per day while the fire protection systems are to incorporate fire extinguishers and connections nearby fire hydrants. The hospital's current water storage capacity and supply therefore meets the demand for the hospital, new oncology centre and the new orthotics facility.

According to reports, the Hospital is currently undertaking an exercise to replace all ageing asbestos pipes with uPVC and also to extend the existing network by installing a ring main to optimise operations and maintenance of the system. The current supply to the Hospital is deemed sufficient.

The water reticulation for the Oncology Centre will branch out from the main water reticulation pipe from the hospital's water storage. Separate domestic and fire underground networks of pipes that connect to the water source will be implemented. The existing fire ring main was also upgraded a few years ago to incorporate any additional fire systems that will be incorporated. The pipes are designed to withstand the local environmental conditions and are equipped with appropriate valves and pressure control mechanisms.

A monitoring system that tracks water levels in the On-site storage reservoirs and pressure within the network will be installed to ensure that the Hospital and the Oncology Centre has sufficient and uninterrupted water supply. Regular maintenance schedules will also be developed to inspect the reservoirs, municipality connection, pipes, and any associated components to ensure their proper functioning.

8.2. SEWER INFRASTRUCTURE

As stated in the attached Stage 2 report for civil and structural work, the hospital is currently serviced by a waterborne sewer reticulation network comprising mainly of 160 mm Ø uPVC pipes and Vitrified Clay (VC) pipes, discharging into the municipality's bulk sewer reticulation network and treated at the City of uMhlathuze Waste Water Treatment Works. The sewer reticulation capacity was calculated according to the design guidelines set out in the:

a) Guidelines for Human Settlement Planning and Design (Redbook);
b) Department of Public Works: Civil Engineering Manual;
c) The South African Standard Code of Practice for the application of the National Building Regulations, SANS 10400; and

d) South African National Standard: Water supply and drainage for buildings, SANS 10252, was also consulted in the design process.

The calculated average daily demand for the Oncology Centre is 10.2 kl/day and accommodates a stormwater infiltration of 15%. The peak factor is 3.8 through a 110 mmØ (uPVC class 34) recommended pipe diameter at 70% flow depth.

The pipeline has been designed to ensure that the wastewater gravitates successfully towards the sewer connection point based on the natural topography of the site and the existence of services, and will also accommodate the effluent flows anticipated, including the total dry weather flow (DWF) and peak wet weather flows (PWWF) for the proposed New Oncology Centre.

The total dry weather flow (DWF) and peak wet weather flows (PWWF) for the proposed New Oncology Centre are below:

a) ADWF: 0.975 l/s
b) PWWF: 3.705l/s

8.3. STORM WATER MANAGEMENT

As stated in the attached Stage 2 report for civil and structural work, the storm water system directs the storm water to flow from the respective catchment areas into the nearest downstream kerb/grid inlet, entering the existing 450mmØ storm water pipe network and subsurface drainage systems. The main contributors to peak run-offs are identified as nearby roads, car parks and the roofs of the proposed and existing nearby buildings that also have their own drainage systems. The storm water runoff, catchment areas, channels and drainage were calculated according to the design guidelines set out in the:

a) Guidelines for Human Settlement Planning and Design (Redbook);
b) Department of Public Works: Civil Engineering Manual;
c) The South African Standard Code of Practice for the application of the National Building Regulations, SANS 10400;
d) According to The South African National Roads Agency Limited Design Manual; and
e) All storm water infrastructures will be designed according to the prevailing standards of the Department of Health Kwa Zulu Natal.

The proposed storm water for the New Oncology Centre will comprise of the following:

a) The major and minor flood flows will be defined according to their requirements and the associated drainage systems designed accordingly.
b) The minor storm water drainage system will be a combination of surface drainage and an underground pipe system that will collect storm water from around the proposed buildings.
c) Storm water will be conveyed through a combination of underground pipes and open concrete channels (where applicable)
d) Inlet structures will be selectively placed to collect the storm water flow into the pipe system.
e) The pipe system will direct this flood flow into existing storm water pipes on the southern border of the site before discharging into existing municipality infrastructure.

8.4. ROADS AND PATHWAYS

As stated in the attached Stage 2 report for civil and structural work, there is regional access through the existing hospital entrance located on Thanduyise Drive and the existing hospital walkways to access the Oncology Centre. The impact of an increased number of oncology patients was investigated to determine the impact on the existing traffic patterns and peaks. The access and pathways were designed according to the design guidelines set out in the:

a) Guidelines for Human Settlement Planning and Design (Redbook);
b) Department of Public Works: Civil Engineering Manual;
c) Standards of the uMhlathuze Local Municipality;
d) The South African Standard Code of Practice for the application of the National Building Regulations, SANS 10400; and
e) Rapid Traffic Impact Assessment (RTIA)

Aligned to the findings from the Rapid Traffic Impact Assessment (RTIA) that was conducted in February 2023, the various upgrades to the external and internal road infrastructure and parking areas to improve general access to the Hospital will be implemented through another project in line with Ngwelezana Hospital's master plan.

8.5. EARTHWORKS

As stated in the attached Stage 2 report for civil and structural work, the proposed site is an empty and previously developed site with flat topography, and the ground conditions are characterised by recognised sandy soils based on site assessments. The earthworks and associated systems were designed according to the design guidelines set out in the:

a) Guidelines for Human Settlement Planning and Design (Redbook);
b) Department of Public Works: Civil Engineering Manual;
c) Standard Specifications for Civil Engineering Construction, SANS 1200; and
d) The South African Standard Code of Practice for the application of the National Building Regulations, SANS 10400

The design and construction of the proposed earthworks will ensure that the following is achieved:

a) Adequate and efficient use of available site material.
b) Adequate drainage on site while minimising erosion and damming of water, considering the flat site topography,
c) Ensure safe mobility and use of the facility.

9. STRUCTURAL ENGINEERING

As stated in the attached Stage 2 report for civil and structural work, in-depth information on the existing ground and founding conditions for the foundation and load capacity of the facility can be interpreted from the geotechnical investigations. The preliminary designs have been developed based on site conditions, contour analysis and the utilisation of the survey report, on the rational that the proposed design will be developed using worst-case scenarios, factors

and any conservative considerations. The foundation and structural elements were designed according to the design guidelines set out in the:

a) Guidelines for Human Settlement Planning and Design (Redbook);
b) Department of Public Works: Civil Engineering Manual;
c) Standard Specifications for Civil Engineering Construction, SANS 1200;
d) The South African Standard Code of Practice for the application of the National Building Regulations, SANS 10400; and
e) Basis of structural design and actions for buildings and industrial structures, SANS 10160.

The proposed foundation design, based on the engagements, loads of the structure and size of the structure, has incorporated piling as the best option for the structure. The vertical structural elements have also been designed using 3 vertical structural elements on the various portions of the building as follows:

a) Load bearing brickwork, being the main frame of the structure and primary support,
b) Rectangular concrete columns for double volume areas and high areas to reduce the load and instability of the brickwork.
c) Lift Shafts to provide lateral stability of the entire structure while built on pile foundations.

The horizontal structural elements have also been designed using 3 vertical structural elements on the various portions of the building as follows:

a) Slabs at a minimum of 255 mm based on the various room sizes and uses; thinner slabs may be used for the section that carry low live loads and little equipment
b) Surface beds at a minimum of 150 mm based on the various room sizes and uses; thinner slabs may be used for the section that carry low live loads and little equipment.
c) Staircases at a minimum of 170 mm based on standards spans based on the ultimate and service limit state design approaches (ULS and SLS).
d) Beams at a minimum of 230 mm x 425 mm based on standards spans based on the ultimate and service limit state design approaches (ULS and SLS).

Based on the oncology service provided and the specialist equipment that are required to be utilised in this facility, special consideration has to be made to accommodate the weight, width and vibrations of the equipment that will be installed.

The specifications of the major health technology were considered in the design of the structure. Equipment loading and radiation protection requirements have been incorporated. The bunker construction is proposed to be mass concrete, based on materials and skills commonly available in South Africa.

10. MECHANICAL ENGINEERING

This document was largely informed by the Clinical Brief, benchmarking and stakeholder engagements. The following mechanical services are applicable to the Ngwelezana Hospital Oncology Centre:

a) Wet Services,
b) Medical Gases,
c) Lift,
d) Fire Protection, and
e) Heating, Ventilation and Air Conditioning (HVAC).

10.1. WET SERVICES

The scope of this service involves:

a) Wet services piping throughout the facility. This will supply water to ablutions, kitchens, and various fixtures located throughout the facility.
b) Hot water generation and supply.
c) Design of drainage systems from the buildings to connect externally to civil services.
d) Domestic and fire water pump sizing.

10.1.1. Water Supply

Options on cold water supply was either a new water supply through a new bulk storage tank or connection to existing. The later was chosen based on Civil Engineering report above proving sufficient spare capacity to accommodate the New Oncology Centre. The water supply will connect to the existing water main supply from civil bulk water storage. An isolation valve will be installed at the connection point.

Each building floor will have a clearly marked main isolation valve to ease any maintenance task that must be performed. Each floor in the building will be equipped with pressure regulating valves to ensure no fixtures will be over pressurised.

10.1.2. Hot water Generation and supply

It is required by KZN DOH Mechanical Engineering Design Guide and IUSS that hot water be supplied to the building at 60^0C from the source. In order to achieve this, the following options were considered and evaluated.

Option 1: Electrical geysers
This option involves normal electrical geysers up to 400L shared by nearby zones.

Option 2: Solar PV System
This system is similar in set up and application with the above except that the source of energy is the sun.

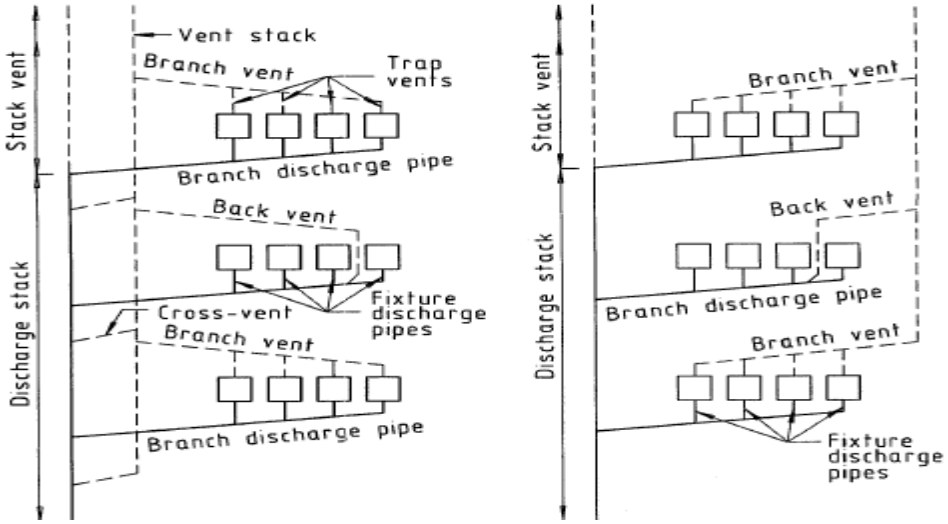
Option 3: Heat Pump with heat accumulator and hot water tanks
In this set up, heat pump is the source of heat utilising ambient air temperature behind a refrigeration principle.

Option 3 is chosen based on energy efficiency and high coefficient of performance. This is further recommended by KZN DOH Mechanical Engineering Design Guide and IUSS.

10.1.3. Drainage

There are not many options available for the drainage system. Below is a working principle and good engineering practice that was adopted.

All ablution stacks will be vented, and all discharge branches will be back vented to ensure no loss of water seals occurs due to pressure differences. Below is a typical layout for the water closet drainage detail, with easy access to all rodding eyes and connection to the vent stack.



10.1.4. Domestic and fire water

Details on domestic water are highlighted above while fire water will follow on later chapters below.

10.2. MEDICAL GASES

Ngwelezana Hospital Oncology Centre will require only oxygen and vacuum based on the services rendered. Oxygen must be piped and supplied through bedhead ducting. Backup oxygen cylinders must be provided. Vacuum must also be connected to bedhead ducting. Vacuum plant must have duty and standby and both be connected to emergency power supply.

Regulations call for the above and as such not many options are available to deliver this requirement. Position and number of points will be as per IUSS Health Facility Guides.

It is important to note that the new Oncology Centre will be connected to the existing oxygen bulk tank.

10.3. LIFT

The lift scope includes:

a) 2 off new lifts in Oncology Centre, Passenger lifts will be provided for vertical circulation of staff, patients and public.
b) The lifts will be suitable to accommodate beds, passenger and will also be capable of housing stretchers.
c) Types of drives, shaft spaces, head room, etc have been coordinated with the architect, electrical engineer and other disciplines as required.
d) All lifts shall comply with the relevant SANS specifications.

A lift is the only option available to deliver vertical circulation of staff, patients and public.

10.4. FIRE PROTECTION

The fire protection scope includes:

a) A basic fire protection system, including fire extinguishers, hose reels and hydrants,
b) Fire signage and adequate fire escape from buildings,
c) Fire detection with a central fire panel,

Building occupancy classification according to SANS 10400-A:2022, the classification of this building is "*E2 Hospital"*. This will inform the requirements described in SANS 10400-T:2024

This will include active and passive fire protection systems. Passive fire protection will involve escape routes, escape stairs, fire signage and emergency fire signage. Active fire protection will involve Fire hose reels, Fire Hydrants, smoke ventilation, and Fire extinguishers. The fire detection and panel (as specified by Electrical Engineer) has been considered. Emergency lighting and fire pumps will be connected to emergency power supply as incorporated by the Electrical Engineer.

10.5. HEATING, VENTILATION AND AIR CONDITIONING (HVAC)

As far as reasonably possible, the building will be designed with openable windows. That can be used if the mechanical ventilation system is out of service even though critical areas will be provided with a backup system. This can also improve air quality during maintenance periods. A mechanical ventilation system will be supplied to general building areas. Mechanical Air Conditioning supplied to selected areas.

10.5.1. HVAC Requirements

Ventilation and fresh air supply requirements are detailed in the main Mechanical PSP report. The report further covers indoor environmental condition requirements. Furthermore,

a) Minimum fresh air requirements were informed by the National Building Regulations, R158 and IUSS Health Facility Guides. Where any apparent conflict between the functional requirements and the "deemed to satisfy" guidance emerged, the rational design route to regulatory compliance was followed.
b) Where odour control is a consideration, a ventilation rate of 10 litres per second per person will be used.

c) Where airborne cross infection is controlled primarily through dilution and natural ventilation, medium and high-risk areas require 60 or 160 litres per second per person respectively.
d) Where airborne cross infection is controlled primarily through dilution and forced ventilation, medium and high-risk areas require 60 or 80 litres per second per person respectively.

10.5.2. Natural Ventilation

The building will be designed as far as possible with openable windows, with a minimum of 5% openable area in relation to floor area. This will allow natural ventilation during periods where mechanical ventilation is out of service, either during load shedding or when maintenance is required. This has been in cooperated by the Architect on the building design.

10.5.3. Mechanical Ventilation

The total area to be air conditioned is approximately 2875m^2 with a resultant cooling load of approximately 475kW. With this magnitude of total capacity, the combination of various systems will be used to provide air conditioning. The various system to be used include,

a) VRF System,
b) Individual DX Splits Units,
c) Full fresh air system

The Department has outlined its position against the use on VRF System and as such this option was rejected upfront.

HVAC services should be energy efficient systems, making use of the latest technology in this regard. The above arrangement of the systems is based on hospital guideline requirements considering the various energy efficient measures.

It is accepted that it is impossible to provide mechanical ventilation for such a huge building requiring 475kW cooling load with only individual DX Splits Units. Hence a combination of this and fresh air supply has been considered.

Option	Combination	Advantages	Disadvantages
OPTION 1	AIR COOLED	Does not require cooling tower. Does not require condenser water pumps. It does not require water reservoir. Easier to maintain compared to Chilled water system.	Is less efficient compared to chilled water.
	DX INVERTER SPLIT TYPE	It is easier to install. DX inverter split type is less expensive. It is much easier and cheaper to maintain.	Compressors are noisy compared to VRF. DX split systems can be less energy efficient. The outdoor unit requires space.
OPTION 2	WATER COOLED	More energy efficient compared to Air cooled system. It requires less footprint.	Challenges on maintenance and expensive to maintain. Expensive installation.

Option	Combination	Advantages	Disadvantages
	VRF SPLIT TYPE	More energy efficient. Operate quietly. It provides consistent comfort supply.	It is not easier to install. It is expensive to install and to maintain the system.

Option 2 was chosen based on ease of maintenance and lower capital costs.

It is important to note that all bunkers will be supplied by the dedicated Duty & standby Air-cooled system complete with common duct supply system. Rooms around bunkers within radiology will be equipped by DX inverter split type system. Condenser units will be grouped in provided plant room.

11. HEALTH TECHNOLOGY SERVICES

The requirements for the commissioning of the major health technology equipment (linear accelerators, brachytherapy unit and CT scanner) were carefully integrated with other disciplines because of their significant requirements during construction and in commissioning and future replacement.

11.1. Radiation emission

Radiation emission of the linear accelerators and brachytherapy unit have been calculated according to the actual specifications of the equipment, in line with SAHPRA regulations. The structure has been designed accordingly. The bunkers have also been located so that spaces with permanent occupancy are not located above them, thus further reducing risk.

11.2. Access for installation

The linear accelerators are delivered to site in components. The gantry is the largest component and requires a clear and even access route. During construction two options were considered to be further developed in the next stage of work. A temporary route can be constructed from the construction access point across the courtyard to the entrance of the radiation therapy unit. The second is from the main entrance to the hospital, along the hospital passage to the entrance of the radiation unit. Should the linear accelerators need to be replaced in the future, the second route described must be used.

11.3. Electrical and Mechanical Services

Separate backup power has been provided for the major equipment in order to prevent damage to the equipment and dedicated UPS's have been allowed for. It has been proposed that the HVAC for the treatment areas is dedicated and is described in the section above to also ensure adequate protection of the high value equipment.