A BUILDING QUALITY INDEX for HOUSES

'Post' Construction Evaluation
USER MANUAL FOR SCORE SHEETS

Introduction

Post construction evaluation of houses may take place at any time during the five years following completion of a building and is used to evaluate the quality of construction based on the visible state of the building. By implication, it serves to assess the ability of the builder to deliver a quality building.

This document contains a straightforward and practical guide to the specific items in the scoring sheets used in the proposed system of quality assessment. Additional references are provided for the cases where more detail is required. To experienced building inspectors and professionals, many items in this document may appear to be statements of the obvious. Such statements have been included to make the document as self-sufficient as possible and to make it useful to less experienced readers.

Apart from human resource, the implementation of the present system requires a fairly limited amount of basic tools, which includes: a measuring tape, a spirit level, a torch and a ladder. Under certain circumstances a camera, a chipping hammer, a pick and a spade might also be required. Whereas access to the building plans, variation orders and any written specifications may be available to NHBRC inspectors during construction, they may not be available after completion of a house. The post-construction assessment of quality may have to rely on visible details and records or certification required by the NHBRC. In the proposed assessment system, access to NHBRC documentation, as well as any reports by a Competent Person regarding structural work, is taken for granted.

It is not possible to include the information on all unconventional and innovative construction practices used in South Africa for home building in this guide. Therefore, the system concentrates on the traditional construction methods used within the residential market. However, due to its generic nature the proposed assessment system could be adapted and extended to other construction methodologies.

Although both structural and architectural aspects of house construction are considered, in line with the mandate and interests of the NHBRC, the current system is primarily focused at assessing the quality of basic construction aspects, affecting the structural performance and safety of housing units.

The headings and paragraph numbers in this guide correspond to the headings and item numbers used in the score sheets.

Attention is drawn to the nature of the contents of reference [2], which includes the National Building Regulations and the “deemed to satisfy” rules that may be followed in order to meet the requirements of the regulations. It is important to understand that the Regulations (which are mandatory) are given only in terms of the performance required of building components. The regulations can be met through rational design, or by following the “deemed to satisfy” rules, which are not regulations, but simply a set of prescriptive rules that, if followed, would satisfy the requirements of the regulations.

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COMPONENT 1: Foundations

Foundations, together with the conditions of the underlying soil, form the most important components of buildings and houses, affecting their structural performance, integrity and safety of inhabitants. Inappropriate or poor quality foundations combined with poor soil conditions are the most common causes for failures of residential buildings. Inadequate founding conditions could cause differential movement through settlement or heave, leading to cracking of walls, and even collapse of buildings or their parts.

Various types of foundations are used in the residential market and their specific application depends on the design of the building and the type and condition of the soil on the site concerned, as described in Parts 1 and 2 of the NHBRC manual [1]. Identification of soil conditions and designing appropriate foundations should be done by professional persons who also take responsibility for the adequacy of construction of foundations. The NHBRC controls this aspect through the appointment of a Competent Person for specific tasks, i.e.site classification via form EF003; rational design of foundations via Appendix B1 (also B2 & B3) and B.B4 for dolomitic / limestone areas.

The current assessment system does not consider issues pertinent to the design as such, but rather to an appropriate implementation of the design specification.

1.1 Documentation: Soil/fill, design, construction

Rating	Criteria	Score sheet text
1	Documentation properly done and no fault reports on record	Properly done
0	If any documentation or work not done as required	Not properly done

Foundations for single-storey buildings that comply with the limitations set out in the NHBRC manual [1], Part 2 Section 2, for design by rule, will have been inspected during construction and the outcome of such inspection should be on record. In the case of foundations built according to a rational design, there will be further documentation as required by the undertakings of the Competent Person involved. The evaluator should check whether the relevant NHBRC forms, Appendix B1, B2, and B3 or A1 have been lodged with the NHBRC and whether there are any fault reports by the Competent Person.

Do not score if certification is claimed to have been done, but records have not been seen.

The evaluator needs to be aware of the nature of foundation requirements in general, so that if there is no engineer's certification he/she can assess whether a problematic condition might have been overlooked.

There are two general types of soils, namely:
residual (in-situ weathered formations), and
transported soil (weathered material deposited away from the parent rock).

Soils have various bearing capacities but in general the residual soils have higher capacities than transported soils. Both types of soil can exhibit problematic characteristics in relation to building foundations.

Problematic ground conditions such as collapsible or compressible soils, dolomites or expansive clays exist in many areas in South Africa. See 1.2 regarding dolomitic and limestone areas. Groundwater conditions are also important. In some areas the groundwater can contain high levels of chlorides and/or sulphates, which can trigger corrosion of the reinforcement that may be present. Soft water can attack the concrete. Black clays can also cause "bacterial" corrosion. For these reasons, foundations in such environments should be protected by plastic membranes. For conventional strip footings and most foundation types, the base of the excavation should be undisturbed and clear of roots, organic material and other objects.

The foundation should not be placed on loose soils or uncompacted fill. In the case of thick layers of loose sandy soils and soft clays, special foundations should be in place. All the above issues should have been identified and addressed at the design stage by an experienced professional, i.e. prior to any form of construction activities taking place.

Wherever possible, a certificate should be issued by a responsible professional regarding the adequacy of foundations. The evaluator should check if such certification has been done.

1.2 Special measures for dolomitic areas

Rating	Criteria	Score sheet text
1	All procedures and precautions followed according to documents on record and no fault reports on record	Rules followed
0	If any documentation or work not done as required	Rules not followed

Special investigations by a Competent Person are required for dolomitic and limestone areas to assess the risk associated with the site and to liaise with the Council for Geoscience and the NHBRC Technical advisory Group, where necessary. All relevant precautions as set out in the NHBRC manual [1] Part 1 Section 2.8 should be followed.

Special attention must be given to rain water drainage from the building and the site. Water must be effectively drained away from the building and off the site. See also 1.3. where the criteria for a rating of 1 must be met in dolomitic areas.

1.3 Water ponding / surface drainage

Rating	Criteria	Score sheet text
1	If no ponding can occur anywhere around the house	No ponding
0,5	If risk of ponding is small anywhere	Risk small
0	If ponding is likely to occur anywhere	Ponding likely

External foundation walls of buildings should not be subject to accumulation of water against the building. Such situations can negatively affect both loose, sandy soils (erosion and displacement) and clays (heaving and shrinkage) and the associated movement could damage the building, or result in water reaching the brickwork above the DPC. In dolomitic areas, the only acceptable condition will be one meeting the criteria for a rating of 1.

1.4 Proximity of trees

Rating	Criteria	Score sheet text
1	Proximity is acceptable and no distress in house	Proximity acceptable
0	Trees are too close and/or distress in house	Not acceptable

Existing mature trees closer than 3 metres from footings may be detrimentally influenced by excavations and may also have a detrimental effect on the building. New plantings of trees that will have a mature height greater than 8 metres may be accepted no closer than about 1,5 metres from buildings founded on non-problematic soils. In clay soils (class H sites) trees should be located at greater distances from the building, as set out in the NHBRC manual [1] Part 1, section 2.9.

1.5 Depth below ground level

Rating	Criteria	Score sheet text
1	Do not score if the depth of excavation is not visible	Do not score if not visible
0	Foundation visible at finished ground level	Foundation at ground level

This is not normally determined in a post-construction assessment. It may be determined if there is no engineer's certification, or if the top surface of a strip footing is visible at or near the ground surface. The foundation depth refers to the minimum excavation depth into the soil and not to the thickness of the foundation.

Note: The opening-up of foundations should be avoided. It could only be considered upon specific requests of the relevant local authority (project responsible person) due to clear evidence of serious structural damage, which would require further investigation. The location of inspection holes should be selected by the responsible competent person and special attention should be given to the risks of damage to electrical and water services.

The depth of the excavation should comply with dimensions given in the design and relevant working drawings, but should not be less than 400 mm for conventional strip footings. Slab-on-ground systems have the foundation combined with the floor slab and have different requirements: a minimum depth of excavation of 300mm (NHBRC manual [1]).

1.6 Foundation concrete

Rating	Criteria	Score sheet text
1	No readily detectable defects in concrete	Good condition
0,5	Very few minor defects can be detected	Very few defects
0	Several defects can be detected	Poor condition

See note under 1.5. Do not score if foundation concrete is not visible.

In cases of exposed foundations or opening-up of the foundations the following aspects have to be considered:

(a) continuity of foundations (i.e. presence of cracks),

(b) quality of the surface of concrete (i.e. presence of porosity / honeycombing),

(c) tapping and chipping of the surface should not result in any disintegration,

(d) visual assessment of aggregates (their size should fall within 10 and 20 mm, and they should be firmly embedded), and

(e) concrete should be relatively dry and free of chemical discolorations.

1.7 Aggressive soils and fill

Rating	Criteria	Score sheet text
1	Groundwater investigation done by specialists	Evaluation properly done
0	No groundwater investigation done	Evaluation not done

In some areas the groundwater may be deleterious to building materials, for example:

(a) water containing sulphates which could cause expansion of concrete, as in the Northern Cape, or in fills,

(b) water containing sulphuric acid near coal and gold mine dumps,

(c) water containing sulphates or other salts, which may cause mechanical breakdown of materials due to crystallization, and

(d) the water may be soft and leach cement from concrete.

If there had been any doubt about the aggressiveness of the ground water in the soil or fill, expert opinion should have been sought to say whether the water was aggressive or not. If applicable, the assessor should check that the recommendations thus obtained were implemented and check whether there is distress due to aggressive waters.

COMPONENT 2: Floors and Stairs

The quality of floors affects the ease and comfort of human utilisation of spaces within houses.

In residential housing, the ground floor is commonly supported on compacted backfill or hardcore. However, double storey residential units also have suspended floors and stairs, made of reinforced concrete or timber. Because of the grave safety implications of their failure, they require the inputs of registered structural engineers in respect to their design, construction process and supervision. Thus in the case of double-storey buildings, the evaluator must check whether the engineer has issued a completion certificate for the building.

It is not reasonable to expect a quality evaluator to be in a position to assess and question the inputs of professional designers and specifiers, as regards structural integrity or material specifications, therefore the assessment of these building components is limited to the visible aspects.

Several kinds of floors and floor finishes can be present e.g. concrete slab or surface bed with a finish such as granolithic, or screed, wood, tiles or carpets.

The substrate

In most cases the substrate is a concrete slab, which is covered by a finish, so that the substrate is not open for visual inspection. Attention should, however be paid to any manifestations in the finish that could be attributed to the behaviour of the substrate: for example cracks in, or adhesion failure of, the finish, dampness, etc. In wet localities, the floor should be inspected in more detail regarding the possibilities of moisture absorption and penetration. In such localities, the substrate should be laid on a waterproof membrane.

2.1 Specification

Rating	Criteria	Score sheet text
1	Construction followed drawings & specifications	Built to specifications
0	Deviations from specifications noted	Not built to specifications

The specification of materials and the construction procedure for the floor substrate may be on drawings or in a separate document. Where possible, the evaluator should check whether specifications exist and that work has been executed accordingly.

Do not score if certification is claimed to have been done, but records have not been seen.

2.2 Height of floor above ground level

Rating	Criteria	Score sheet text
1	Floor at or higher than minimum specified level	At specified level
0	Floor at lower than minimum required level at any point	Lower than required level

The height of the floor above the external ground level or pavement should be such that flood water cannot enter the house. Normally it is sufficient to have the lowest point of the house at least two 75 mm thick brick courses above the anticipated external ground or pavement level.

2.3 Continuity of the substrate

Rating	Criteria	Score sheet text
1	No cracks visible or signs of distress	No cracks in substrate
0	Cracks, displacement or other signs of distress	Visible cracks or displacement

In the case of concrete or tiled surfaces, the presence of cracks can be easily observed and assessed. For wall-to-wall carpeted floors this is not possible without lifting the carpets. This is not advisable unless for specific reasons (e.g. evidence of significant distress such as differential settlement of the substrate).

A sound floor should not have any visible cracks. Short and localised cracks distributed uniformly across the surface, typically indicate superficial surface cracking, (“plastic shrinkage cracks” formed during initial drying of concrete after casting) which are not of structural importance. (In worst cases this can be assessed with tapping, which should indicate lack of adhesion of upper layers or separation.)

Continuous cracks reflect differential movement in the substrate and, depending on the magnitude, can be critical. The extent of cracks and the amount of settlement or

heaving, deflection, shrinkage or expansion should, if possible, be measured and recorded in the compliance report, which follows the relevant scoring sheet.

2.4 Shrinkage or expansion

Rating	Criteria	Score sheet text
1	No cracks or doming of floor can be detected	No signs of movement
0,5	Less than 10% of floor shows signs of movement	Acceptable
0	More than10% of floor shows signs of movement	Not acceptable

Undue shrinkage of a concrete base during drying or expansion during wetting could lead to cracking of the base and the finish. Also, expansion due to chemical reaction of sulphates in the soil or fill (see Section 1.7) can cause heaving of concrete slabs leading to doming and/or cracking of the substrate and of the finish.

2.5 Appearance of screed or power-floated concrete

Rating	Criteria	Score sheet text
1	No readily detectable defects in concrete	Good condition
0,5	Very few minor defects can be detected	Very few defects
0	Several defects can be detected	Poor condition

In most cases the appearance of concrete can only be investigated for exposed surfaces, which will typically apply only to low-income housing units. In such cases similar comments to those made in Item 1.6 apply.

2.6 Movement joints

Rating	Criteria	Score sheet text
1	Joint required by design, installed to specification and good practice	Meets requirements
0	Joint not specified on drawings, or incorrectly installed	Not acceptable

Movement joints in the substrate (usually concrete) are installed to take up expected movement in the substrate due, for example, to structural effects and variations in moisture content and temperature. They are, however, seldom installed in concrete floor slabs in houses. There should be no joints that are not specified and detailed on drawings or other relevant documents. If they were specified, it should be

ensured that they have been installed in accordance with the specification. Movement joints must extend through the thickness of the substrate and through the floor finish. There should be no difference in floor level across the joint, unless it is located at a step riser. There should be no cracks in the vicinity of the joint and edges should be undamaged.

2.7 Dampness

Rating	Criteria	Score sheet text
1	No moisture or signs of dampness can be seen	No dampness
0	Moist patches, damp spots or signs of dampness	Signs of dampness

Dampness in floors is caused by the upwards migration of moisture from the sub-floor materials in the absence of an under floor damp-proof membrane. It manifests itself in different forms e.g. it may be visible as damp spots on screeds and concrete, usually as darker coloured areas, or it may affect visibly the flooring materials. The presence of dampness can be detected with electronic moisture meters, if necessary, by a gravimetrical method, or by covering the screed or concrete floor with an impermeable plastic membrane of about 0,5metre x 0,5metre for 24 hours and examining the underside for moisture.

The finish

Floor finishes constitute the reference surface of the house for all human activities. The most important aspects of the finishes are their level / evenness (which affect the safe utilisation of space), durability, ability to improve the environment within the house and slipperiness under dry and wet conditions. Slipperiness is beyond the control of the builder. Designers, specifiers and owners should be aware, before specifying or selecting materials, that certain finishes (e.g. ceramic tiles and highly polished hard surfaces) should not be used in areas likely to become wet unless the finishes are designed to be slip resistant.

2.8 Specification

Rating	Criteria	Score sheet text
1	Floor finish to drawings & specifications	Installed to specifications
0	Deviations from specifications noted	Not to specifications

NHBRC requirements and SANS specifications and codes of practice must be followed. Where applicable, manufacturer's instructions must be followed. Specific requirements for different finishes are given under items 2.13 to 2.18.

Do not score if drawings and specifications are not available.

2.9 Levels and evenness

Rating	Criteria	Score sheet text
1	Floor surfaces even throughout and levels to drawings	Well finished and even
0,5	Less than 10% of floor surface uneven	Acceptable
0	More than10% of floor surface uneven, or abrupt level differences or levels not to drawings	Not acceptable

Floors constitute the reference surface of the house for all human activities. Their level and evenness affects the safe utilisation of space and durability, thus there should be no step-like discontinuities in floor level. Floor finishes should be smooth and uniform in texture and appearance.

With the exception of thresholds between the inside and outside of the house, single steps should be avoided.

Where houses are located on natural slopes, and different floor levels are introduced, these should be clearly indicated on drawings.

Unevenness (random irregularities) usually occurs on the screed or concrete surface (e.g. as a result of mechanical trowelling) and is visible under and highlighted by artificial lighting on smooth or polished floor finishes. Grades of evenness should have been specified (SANS 10155 [11]) and should be clearly indicated in the design and on the plans.

2.10 Dull-sounding areas, cracks, adhesion failure, bulging, impact damage

Rating	Criteria	Score sheet text
1	No dull sounding areas, loose tiles or bulging	No defects
0,5	Less than 10% of surface has minor defects	Acceptable
0	More than 10% of surface has defects	Not acceptable

Apart from specialised types of floor, which are not commonly used in housing, the finish should be attached firmly to the slab. Poor adhesion can result in adhesion failure, bulging, cracking and/or impact damage (e.g. of ceramic tiles). Areas of poor adhesion can be detected as a dull (hollow) sound by knocking or tapping on the surface.

2.11 Movement joints

Rating	Criteria	Score sheet text
1	Joints located and finished to drawings, neat and undamaged	Good condition
0	Poor finish, damaged or location not to drawings	Not acceptable

The flooring material should be discontinued over the movement joints and the joint should be finished-off with durable edging and closed off with a cover strip or filled with a suitable joint sealant.

2.12 Dampness

Rating	Criteria	Score sheet text
1	No damp patches or signs of dampness of floor finish	No dampness
0	Damp patches or signs of dampness of finish	Signs of dampness

Dampness is present where floor finishes are affected e.g. where delamination, shrinkage, curling, lifting or discoloration has occurred. In certain cases dampness can be smelled in houses.

2.13 Installation of Carpets

Rating	Criteria	Score sheet text
1	All carpets fitted with no irregularities, according to specifications or established good practice	properly fitted
0,5	Less than 10% of surface area has minor defects	Acceptable
0	More than 10% of surface area has defects	Not acceptable

A variety of carpets are available in roll or in square tile form. Carpets should be laid to provide smooth even floors with no visible irregularities. Joints in carpets should not be visible from a distance of two metres.

2.14 Installation of Ceramic tiles

Rating	Criteria	Score sheet text
1	Entire floor installed according to specifications	Properly laid
0,5	Less than 10% of surface area has minor defects	Acceptable
0	More than 10% of surface area has defects	Not acceptable

Ceramic tiles should comply with the requirements of SANS 1449 [5] and be installed in accordance with SANS 10107 [4]. Salient points are that:

(a) the tiles should have an adequately low moisture expansion to limit the possibility of tiling adhesion failure,

(b) the tiles should not be warped,

(c) the tiles should be strong enough to withstand the effects of traffic,

(d) the concrete on which the tiles are to be laid should be adequately dry before laying to limit the possibility of cracking and/or lifting of tiling due to shrinkage of the concrete,

(e) most of the natural deflection of suspended concrete slabs on which tiles are laid should have taken place before the tiles are laid to limit the possibility of adhesion failure,

(f) the tiles must be bedded in adhesive over their entire underside surface to achieve proper adhesion and to avoid the risk of impact damage, and

(g) joints should be solidly grouted with a durable jointing grout (see Section 2.19).

2.15 Installation of Concrete tiles

Rating	Criteria	Score sheet text
1	Entire floor installed according to specifications	Properly laid
0,5	Less than 10% of surface area has minor defects	Acceptable
0	More than 10% of surface area has defects	Not acceptable

Points (b) to (g) in 2.14 apply equally to concrete (terrazzo) tiles.

2.16 Installation of Natural stone units

Rating	Criteria	Score sheet text
1	Entire floor installed according to specifications	Properly laid
0,5	Less than 10% of surface area has minor defects	Acceptable
0	More than 10% of surface area has defects	Not acceptable

Points (c) to (g) in 2.14 also apply to natural stone floor finishing units.

2.17 Plastic flooring

Rating	Criteria	Score sheet text
1	Entire floor installed to meet all requirements	Properly installed
0,5	Less than 10% of surface area has minor defects	Acceptable
0	More than 10% of surface area has defects	Not acceptable

Plastic flooring should comply with the requirements of SANS 581 [14] and SANS 786 [15] and be installed in accordance with SANS 10070 [16]. The following points are of importance:

(a) the plastic flooring should be mechanically and chemically resistant enough to withstand domestic conditions (e.g. in kitchens) and traffic,

(b) the screeds or concrete on which the tiles are to be laid should ideally be dry (less than 4 % moisture content, determined gravimetrically), smooth and free from protuberances and within the norms of evenness (see SANS 10155 [11]), and

(c) the flooring materials must be solidly bedded in proprietary adhesives over their entire underside surface to achieve proper adhesion and to limit the risk of impact damage. There should be no trapped air or loose edges to tiles or sheets.

Unevenness of highly polished material highlighted by artificial lighting and the reflection of adhesive applications are the main problems encountered with plastic flooring. See the introduction about slipperiness.

2.18 Wood flooring

Rating	Criteria	Score sheet text
1	Entire floor well bedded and even, no warping or shrinkage	Installed correctly
0,5	Less than 10% of surface area has minor defects	Acceptable
0	More than 10% of surface area has defects	Not acceptable

Dense hard woods, providing resistance to wear, are available in block form, in strips, as parquet or laminated flooring. Wooden floors are more sensitive to moisture (dampness) than other finishes. Screeds or concrete floors should be laid on damp proof membranes and should be dry (less than 4 % moisture content) before wood floors are laid. Provision for movement around the perimeter of wooden floors should be provided. After finishing sanding the surface should be even, with no irregularities. Bulging of floors, warping and shrinkage of the units are the common problems experienced with wooden floors.

2.19 Grouting, if applicable

Rating	Criteria	Score sheet text
1	Grouted joints of suitable width and properly filled	Properly grouted
0,5	Very few narrow joints, or poorly filled ones	Acceptable
0	More than 10% of joints are poor	Not acceptable

Ceramic tiles, concrete tiles and natural stone units are either butt jointed or, more frequently laid with a space (joint) between them, which is filled with a grout.

Grouts range from Portland cement-sand mortar through proprietary cement-based grouts to proprietary polymeric ones. Where applicable, for example in the case of ceramic and concrete tiles and natural stone units, all joints should be cleaned and

properly grouted. For proper joint filling, joints should, preferably, be wider than 3 mm. Grouted joints should be satisfactorily finished to a smooth surface. It is important that the grout must be strong, because, in the first place it provides lateral integrity of tiling, and secondly it should not show weathering and/or develop cavities that will collect dirt.

2.20 Appearance, including that of screed and power-floated concrete

Rating	Criteria	Score sheet text
1	Clean, uniform and undamaged non-slippery surface	Clean and uniform
0,5	Less than 10% of surface non uniform or damaged	Acceptable
0	More than 10% of surface non uniform or damaged	Not acceptable

Floors should be clean, uniform in colour and appearance, with no visible damage or stains. The material used for the floors should, preferably, not be slippery as assessed by rubbing one's hand over the dry flooring. (See the introduction about slipperiness).

2.21 Skirting

Rating	Criteria	Score sheet text
1	No readily detectable irregularities or gaps	No irregularities
0,5	Less than 10% of skirting with irregularities or gaps	Acceptable
0	More than 10% of skirting with irregularities or gaps	Unacceptable

The junction (corner) between the floors and walls should be fitted with a cover strip (skirting). This is usually a timber, fibreboard or plastic fixture attached to the wall. Tiled floors often have a tile skirting. The role of the skirting is to protect the bottom portion of the wall against dirt and accidental impact due to internal traffic and cleaning equipment. It may also play an aesthetic role.

The skirting should adhere to the walls, with no visible undulations or gaps between wall and floor or along the length of the skirting. Certain materials are sensitive to humidity and temperature changes and this usually manifests itself in shrinkage openings at the corners or at joints.

Suspended floors and stairs

2.22 Certification/specification

Rating	Criteria	Score sheet text
1	Construction to specification and certified	Properly done
0	Either construction or certification not done	Not properly done

The design, specification and supervision of construction of suspended floors and stairs are the responsibility of the engineer and would normally be certified by him/her. The evaluator should check that such certification has been done and that the work appears to have been properly executed.

Do not score if certification is claimed to have been done, but records have not been seen.

2.23 Suspended concrete floor-slabs

Rating	Criteria	Score sheet text
1	No detectable sag, no cracks, or only hairline cracks in any slab in the house	No detectable sag / cracks
0,5	Sag is less than 1/500 of span and cracks are less than 0,3 mm wide and not all slabs in house show these signs	Acceptable condition
0	If sag is more than 1/300 of span, or cracks wider than 0,3 mm in any slab in house	Unacceptable condition

All reinforced concrete slabs deflect under their own weight and superimposed loads, but this deflection is usually countered by casting the slab with an upward camber, so that it has a flat, horizontal soffit under load.

When there has been no allowance, or insufficient camber, the deflection can be noticeable. If there are no cracks in excess of about 0,3 mm in the soffit, the slab would be structurally acceptable, but could still show an increase in sag over a few years.

The cracks referred to above are structural cracks that would typically be near mid-span on the soffit and be fairly straight lines parallel to the supports.

2.24 Suspended timber floors – (structure)

Rating	Criteria	Score sheet text
1	No detectable sag and construction is according to design and meets NHBRC requirements	Properly Constructed
0	Construction is not according to design / NHBRC requirements, or sag is more than 1/300 of span	Not acceptable

The size and spacing of floor-joists and the specification of floor-boards are to be provided by the structural engineer. Constructional details should be as set out in the NHBRC manual [1], Part 2, Section 8 and Part 3 Sections 10.5.2 to 10.5.4.

2.25 Sub-floor ventilation of timber ground floors

Rating	Criteria	Score sheet text
1	Constructed to meet all ventilation requirements	All requirements met
0,5	Ventilation marginally not to specification	Minor shortfalls
0	Clear height less than 450 mm in many places, and/or very few, small ventilation openings	Not to specification

Construction should comply with the NHBRC manual [1] section 10.5.1 of part 3. The key requirements are provision of a space with a height of 450 mm or more below the floor-joists and openings in walls that ensure free cross-ventilation of the under-floor space.

2.26 Geometry of stairs

Rating	Criteria	Score sheet text
1	All risers are the same and do not exceed 200mm in height Regular treads have a constant width, not less than 250mm No more than three consecutive steps are winders The staircase is 750mm or more in width	Complies with spec
0	If risers and treads are uneven and minimum width is not met	Does not comply

The stairs should be uniform in layout and height. All finished levels should comply with the drawings and should meet the requirements of SANS 10400 and 10401 [2].

These are:

(a) the width of any stair between the enclosing wall(s) and balustrade must not be less than 750 mm,

(b) any tread should not be less than 250 mm wide,

(c) the height of a riser should not be more than 200 mm, and

(d) no more than 3 winders may be used at any one point.

2.27 Balustrade design

Rating	Criteria	Score sheet text
1	Minimum requirements are met	Complies with requirements
0	Minimum requirements are not met	Does not comply

Balustrades must be robust in construction and comply with the requirements SANS 10400 and 10401 [2]. A minimum requirement is that a hand rail must be 1 metre above the stairs, with a rail midway between the hand rail and the stairs.

2.28 Lighting of staircases

Rating	Criteria	Score sheet text
1	Artificial and/or natural lighting is provided	Complies with requirements
0	Artificial and/or natural lighting is not provided	Does not comply

Natural and/or artificial lighting must be provided to all staircases.

Tenancy separation floors

Suspended floors that serve to separate dwelling units that are directly above and below each other must resist the spread of fire between the dwelling units and must provide appropriate acoustic attenuation.

2.29 Specification

Rating	Criteria	Score sheet text
1	Floor meets all requirements of the regulations	Built to specification
0	Floor does not meet all requirements	Not to specification

It is the designer's responsibility to ensure that the requirements for design and construction of separation floors are met. SANS 10400 and 10401 [2] Section T applies. The relevant details should be on the drawings or be specified in a separate document. Where possible, the evaluator should check that construction has been executed according to the drawings and specifications.

Do not score if drawings and specifications are not available.

2.30 Extent of separating floor

Rating	Criteria	Score sheet text
1	Floor covers the entire plan area of dwellings and there are no openings through the floor	Complete
0	Floor does not extend adequately, or has opening(s)	Incomplete

The floor must extend over the full plan area of the dwelling units above and below it and must not have any openings that could link the air spaces of the units.

Basement floors

Basements have to function as an entity, but for the purposes of assessment, the floors and walls have been covered as separate items. See also 3.31 to 3.33.
Before work is started on any basement, a thorough site investigation should be carried out, also a water analysis for aggressive substances such as sulphates.

2.31 Specification

Rating	Criteria	Score sheet text
1	Basement is built to design and meets all specifications	Built to specification
0	Construction is not to design, or does not meet all specifications	Not to specification

It is the responsibility of the designer to specify the details of construction of basement floors including waterproofing and sub-floor drainage. These details should be on drawings or in a separate document. Where possible, the evaluator should check that construction has been according to the specifications. SANS 10021 [10] applies.

Do not score if drawings and specifications are not available.

2.32 Waterproofing

Rating	Criteria	Score sheet text
1	No damp patches or signs of dampness	No signs of dampness
0	Water, damp patches or signs of dampness seen	Dampness noticeable

Normally waterproofing is achieved by “tanking”, i. e., by enveloping the floor and the walls in a continuous waterproof membrane. The presence or absence of moisture or the effects of dampness on the wall and floor surfaces can be used to assess the efficiency of the waterproofing of a basement.

All basements should be properly ventilated to prevent condensation and to keep the humidity down.

2.33 Drainage

Rating	Criteria	Score sheet text
1	Outlets visible and functioning	Outlets good
0	No visible outlets, even remote from basement, or outlets above basement floor level	No effective outlets

In most instances, it may be required to install a drainage system around the basement, below floor level, to drain away ground and surface water, in order to avoid the buildup of hydrostatic pressure under the floor (and behind walls) and to enhance its waterproofness. Where specifications are available and the drain or part of it is visible, it could be assessed whether it has been built according to specification and whether it ought to be functional.

COMPONENT 3: Walls

Traditionally walls were built with burnt clay bricks but in recent years various other types of unit and systems have been employed. The latter refers to the various types of blocks (concrete, hollow, earth etc.) or other materials and systems (gypsum boards, cast in-situ, dry-stack or pre-cast). In view of the large variety of these systems and their requirements, it is impossible to cover all of them in this guide and the accompanying score sheets, which in principle concentrate on traditional materials (clay bricks, concrete bricks and blocks) and associated technologies and systems. However, some of the issues and principles included in the current assessment system are applicable to other construction methods like, for example, those needed for complying with minimum geometrical requirements or tying-down roof structures.

The construction of masonry walling and the use of masonry units are dealt with in SANS 10249 [6] and SANS 10145 [7]. Burnt clay bricks are specified in SANS 227 [8] and concrete masonry units in SANS 1215 [9]. These documents can be consulted in connection with the quality and proper use of the materials.

Prior to an inspection the occupants should be questioned regarding any recent renovations or painting. (These may hide the evidence of problems.)

External walls

3.1 Specification

Rating	Criteria	Score sheet text
1	Built strictly according to plan and any variation orders	Built to plan
0,5	A few minor deviations from plan and variation orders	Minor deviations
0	Several minor deviations and/or a major deviation	Major deviations

The construction of walls for domestic buildings is usually not specified, except in respect of the units to be used, thickness and type of wall (for example solid or cavity wall) and joint details. Walls should, nevertheless, be evaluated in terms of available plans and/or specifications.

Do not score this item if plans are not available.

3.2 Waterproofing

Rating	Criteria	Score sheet text
1	No wet or damp patches or signs of dampness, or dark streaks on interior surface of walls	No dampness
0	Water, damp patches or signs of dampness seen	Dampness noticeable

Moisture on the interior of walls can have serious adverse effects on the occupants and the building. Dampness affects the health and possessions of the occupants and can introduce undesirable cracking (due to expansion), degradation of bricks, rusting, loss of adhesion of floor and wall finishes, as well as a decrease in thermal performance of walls.

Walls should, therefore, be properly waterproofed, in accordance with SANS 10021 [10], against moisture penetration due to:

(a) rising damp from the ground, because of an incorrectly installed damp-proof course (DPC); see item 3.9 Moisture for more detail,

(b) penetration at window reveals because window frames were not properly fitted to walls, or because of absence or poor installation of a DPC,

(c) penetration via protrusions such as ledges and decorative elements,

(d) parapet walls not having correctly installed damp-proof course (DPC) and/or because they were not provided with proper coping, and

(e) direct rain penetration through mortar joints, which, in the case of face-brick walls, is mostly where the vertical joints were not properly filled, a very common defect. In some cases, penetration is through the units themselves.

It is important to record whether the external walls are single leaf solid, double leaf solid, cavity or plastered. In certain regions such as the Cape Peninsula it is commonly demanded that cavity walls are used externally. See item 3.1.
Water reaching the interior wall surfaces from roof leaks is dealt with under roofs.

3.3 Face bricks and blocks

Rating	Criteria	Score sheet text
1	Good quality, dense bricks or blocks, free of cracks	Good quality
0,5	Less than 10% of wall surfaces show minor defects	Acceptable
0	Several minor deviations and/or a major deviation	Not acceptable

Visual check should be performed on exposed bricks. Aspects to observe are:

(a) degree of burning of clay bricks: They should be well baked and hard; normally a ringing sound is obtained when two well-baked bricks are knocked against one other,

(b) clay bricks should be free from undue amounts of efflorescing salts on the surface,

(c) all units, burnt clay bricks and concrete masonry units should be strong, without undue cracking or signs of weathering, and

(d) face bricks should have uniform dimensions SANS 227[8].

3.4 Bedding mortar and vertical joint filling

Rating	Criteria	Score sheet text
1	Hard mortar, properly filled joints, no cracks in mortar	Good joints
0,5	Less than 10% of wall surfaces show minor defects	Acceptable
0	More than 10% of wall surfaces show minor defects, or any major defect present	Not acceptable

The mortar provides the bond between the bricks and by doing so provides integrity of the wall. Because of its function there are five important properties of the mortar to be noted, namely:

(a) adhesion to the bricks so that the required bond strength in brickwork is obtained,

(b) strength (bearing capacity). The condition of the mortar could be assessed with a simple test of scraping with a sharp metal object (if exposed). Good

quality mortar should develop a white scratch-mark, whereas a poor one would tend to disintegrate,

(c) water tightness (especially in the case of face brick walls and limited roof overhangs),

(d) The absence or presence of undue cracking. Joints should not be unduly cracked, and

(e) Proper joint filling and pointing of joints in face brickwork.

3.5 Thickness

Rating	Criteria	Score sheet text
1	Wall thicknesses according to plan, or variation order	Built to norms
0	Thickness is not according to plan, or variation order	Not to norms

The thickness of external walls is of importance in regard to load carrying capacity and rain penetration. In the winter rainfall regions it is essential that external walls are cavity walls. The necessary details should be on the drawings. The assessor should check that the overall wall thickness is consistent with the drawings. Typically, in winter rainfall areas, the overall wall thickness will be about 270 mm; in other areas it will be about 220 mm.

3.6 Movement joints (if required according to design)

Rating	Criteria	Score sheet text
1	Joints located, formed and sealed according to drawings	Meets requirements
0	Not located, and/or formed and/or sealed to drawings	Not acceptable

The role of the movement joints is to articulate the structure of the house into smaller units, with provision for independent movement. It is the designer's responsibility to decide whether joints are required and where they should be located. Movement joints are usually designed and implemented for houses built on problematic soils, and also in the case of elaborate layouts, which may promote differential settlements, or where very long walls are required, when thermal dimensional changes can be large.

Movement joints must extend through the full thickness of the wall. Joints should be neatly filled with a sealant or covered with a protective strip. The sides of joints should be clean and free of cement /plaster. The plaster on interior surfaces should not be taken across joints, there should be a well formed 'Vee' groove, or a filled joint or cover strip. No cracks should develop adjacent to a joint. The width of movement joints must be appropriate for the type of sealant used. Many sealant products require the joint width to be twice the depth of sealant to prevent adhesion failure with the masonry, thus effective sealed joints are typically about 20 mm wide.

3.7 Plaster

Rating	Criteria	Score sheet text
1	Good adhesion everywhere; less than 5% of wall surfaces show hairline cracking	Good plaster
0,5	Good adhesion everywhere; less than 15% of wall surfaces show hairline cracking	Acceptable
0	More than 15% of plastered surfaces show either poor adhesion, or hairline cracking	Not acceptable

Plastering of masonry walls provides a finish and additional strength to the walls. For external surfaces it also improves the resistance to rain penetration.

Plastered surfaces should not exhibit an undue degree of hairline cracking and/or soft spots. The quality (strength of plaster) can be assessed with a 'scraping' test described in Item 3.4. Typically the condition of plaster at corners and areas around openings /door and window frames is a good indication of plaster quality. Poor adhesion to walls (often due to dust or dirt on the masonry units) can be identified with random 'tapping' tests. BOUTEK's recommendation is that dull-sounding patches need not be removed and replastered if they are smaller than 300mm across, but that the sum total area of all dull-sounding patches, even if these were smaller than 300 mm across, should not exceed 10% of the total plastered wall area of the house as a whole.

3.8 Structural Cracks

Rating	Criteria	Score sheet text
1	No visible cracks present	No cracks
0,5	Cracks are very fine, or are only around the ends of pre-cast lintels	Fine cracks only
0	More than two cracks exceed 0,3 mm in width	Cracks exceed 0,3mm

Cracks with a structural cause or having a structural significance can usually be distinguished from cracks caused by plaster shrinkage through their distinctive patterns. Plaster shrinkage cracks are usually fine, irregular, relatively short cracks with no preferred orientation, often referred to as crazing. Structural cracks and those due to unidirectional material dimensional changes, are continuous over substantial distances. For example, they may extend over half to full height of a wall and have a definite orientation, e.g. roughly vertical or horizontal or diagonal, often reflecting the mortar joint pattern.

Cracking can be readily detected in painted plastered surfaces, but is difficult to detect in unplastered brickwork. Thus interior surfaces should be inspected for cracks if the external finish is face-brick.

Cracks do not have to be very wide to signify important structural impairment. Thus damage classifications based on ease of repair criteria can be misleading. In general, structural cracks greater than about 0,5 mm indicate an unacceptable condition that requires professional assessment.

Brickwork over openings (windows, doors, etc.) in external walls usually has a structural function and should not show cracks exceeding about 0,3mm in width. Fine cracks in the mid-span region in the soffit only are usually not structurally significant (high score), but cracks that extend partway up the sides of beams indicate that some deflection has occurred (medium score). Structural cracks within the span near or at the supports could indicate a more serious deficiency (low score). Cracks around the ends of pre-cast lintels are generally due to differences in drying shrinkage and thermal and moisture movement of the bricks and the concrete lintel and are not important if limited to the lintel end region.

3.9 Moisture

Rating	Criteria	Score sheet text
1	No damp patches or signs of dampness	No dampness
0	Damp patches or signs of dampness seen	Dampness noticeable

Moisture in walls often occurs through rising damp from the ground because of the absence or improper installation of damp-proof course material, or because it is bridged by the plaster finish. It manifests itself as discolouring, blistering or flaking of paint finishes. See also 3.2 Waterproofing.

3.10 General appearance

Rating	Criteria	Score sheet text
1	All even surfaces of uniform intended colour and texture	Good
0,5	Less than 10% of surfaces show small defects	Reasonable
0	More than 10% of surfaces show defects	Bad

Wall surfaces should, in general, be even and regular. Acceptable deviations from this would include decorative plaster finishes e.g. Spanish plaster. Any 3 metre straight edge should not show hollowing or bulging in excess of 6 mm both vertically and horizontally. See SANS 10155 [11].

Walls should be uniform in colour, with no visible damage, blemishes or stains. Where walls are painted, it should have good adhesion to the base, and be free of bubbles, flaking and peeling in any form. The surface should be consistent in thickness, texture and appearance.

Internal walls

3.11 Specification

Rating	Criteria	Score sheet text
1	Built strictly according to plan and any variation orders	Built to plan
0,5	A few minor deviations from plan and variation orders	Minor deviations
0	Several minor deviations and/or a major deviation	Major deviations

The specification of materials and the construction procedure for internal walls may be on drawings or in a separate document. Where possible, the evaluator should check whether specifications exist and that work has been executed accordingly. Internal walls are not necessarily built of the same materials as the external walls, they may be built of different masonry units, or be constructed in Dry-walling.

Do not score this item if plans are not available.

3.12 Moisture

Rating	Criteria	Score sheet text
1	No damp patches or signs of dampness	No dampness
0	Damp patches or signs of dampness seen	Dampness noticeable

Because internal walls are not exposed to the weather, the only dampness to which they could be exposed is condensed moisture and/or rising damp (because of the absence of or to defective damp-proof course or because the damp-proof course is bridged by plaster.) Rising damp manifests itself as damp spots, or blistering of paint, along the bottom part of a wall. Dampness due to rising damp could be rated in terms of the area of the patches to the total wall area of the house as a whole.

Condensed moisture normally occurs on surfaces as free water and is often the result of poor ventilation.

Internal walls should be protected from rising damp from the ground. Problems can develop as a result of the absence or improper installation of damp-proof courses or because the DPC is bridged by plaster.

3.13 Thickness

Rating	Criteria	Score sheet text
1	Built according to plan and any variation orders; uniform thickness	Built to norms
0	Not built to plans or specified thicknesses, or thickness irregular	Not to norms

Internal walls may be built of brick or block masonry or be dry-wall partitions. The thickness should be as specified on the drawings. Typically, the overall thickness of plastered masonry walls is about 140 mm and dry-walling about 100 mm thick.

3.14 Connection of walls

Rating	Criteria	Score sheet text
1	No cracks in corners at any internal/external (cross-wall) wall junctions	No cross-wall junction cracks
0	Cracks in corners at cross-wall junctions	Cracks at cross-wall junctions

It is important that all the external and internal walls are effectively bonded during brick-laying. In the case of Drywalling connections, the manufacturers details need to be adhered to. Effective connections ensure the structural integrity and lateral stability of the entire building. External walls without bonded cross walls may not have adequate lateral stability. (References [1] and [2] set out acceptable requirements).

Walls with inadequate or no connections may show a vertical crack in the corner junction, and under certain circumstances can also lose their stability. (Single brick or block walls are especially vulnerable in this respect.)

3.15 Movement joints (if required by design)

Rating	Criteria	Score sheet text
1	Joints located, formed and sealed according to drawings	Meets requirements
0	Not located, and/or formed and/or sealed to drawings	Not acceptable

Movement joints must extend through the full thickness of the wall. Joints should be neatly filled with a sealant or covered with a protective strip. The plaster should not be taken across joints; there should be a well formed ‘Vee’ groove, or a filled joint or cover strip. No cracks should develop adjacent to a joint. The width of movement joints must be appropriate for the type of sealant used. Many sealant products require the joint width to be twice the depth of sealant to prevent adhesion failure with the masonry, thus effective sealed joints are typically about 20 mm wide.

3.16 Grouting

Rating	Criteria	Score sheet text
1	All joints completely filled and smoothed off	Good joints
0,5	Less than 5% of joints defective	Acceptable
0	More than 5% of joints defective	Not acceptable

Ceramic and natural stone tiles are commonly used to tile walls, particularly in bathrooms, kitchens and laundries. The joints between tiles are usually grouted for aesthetic reasons and, more importantly, to limit moisture penetration through the tiling into the wall behind.

Grouts range from cement, through cement-sand mortar to proprietary cement-based and polymeric grouts. All joints should be properly cleaned and grouted. For proper joint filling, joints should, preferably, be wider than 3 mm. Grouted joints should be satisfactorily finished to a smooth surface. It is important that the grout must be strong because, in the first place it provides integrity to tiling. Secondly it should not weather, crack or cavitate, otherwise water would penetrate the joints and they would collect dirt and become unsightly and unhygenic.

3.17 Vertical and horizontal alignment, geometry of corners

Rating	Criteria	Score sheet text
1	All corners visually good; those tested are within tolerances	Within tolerances
0,5	Less than 10% of corners outside tolerances	Acceptable
0	More than 10% of corners outside tolerances	Not acceptable

The vertical and horizontal alignment is of secondary structural importance but, to a large extent, it determines the final geometry of walls and corners, and the aesthetics of the finished surfaces. Small overall deviations from vertical and horizontal alignment can be hidden or rectified by corrective plastering but this becomes difficult for larger discrepancies.

The allowable tolerances as specified in reference [11] are:

vertical : ±10 mm over a distance of 8 courses of bricks,
horizontal : ± 20 mm for distances between 5 and 10 metres.
Planeness : Deviation under a 3-m straightedge should not exceed 6 mm.

Corners must ideally be rectangular otherwise the floor-finish and other installations become problematic.

3.18 Plaster

Rating	Criteria	Score sheet text
1	Good adhesion everywhere; less than 5% of wall surfaces show hairline cracking	Good plaster
0,5	Good adhesion everywhere; less than 15% of wall surfaces show hairline cracking	Acceptable
0	More than 15% of plastered surfaces show either poor adhesion, or hairline cracking	Not acceptable

Plastered surfaces should not exhibit an undue degree of hairline cracking and/or soft spots. The quality (strength of plaster) can be assessed with a 'scraping' test described in Item 3.4. Typically the condition of plaster at corners and areas around openings /door and window frames is a good indication of plaster quality. Poor adhesion to walls (often due to dust or dirt on the masonry units) can be identified with random 'tapping' tests.

See also items 3.4 and 3.7 under external walls

3.19 Skimcoat

Rating	Criteria	Score sheet text
1	Good adhesion everywhere and no hairline cracks	No hairline cracks. No dull sounding areas
0,5	Good adhesion everywhere; less than 10% of wall surfaces show hairline cracking	Acceptable
0	More than 10% of skimcoated surfaces show either poor adhesion or hairline cracking	Not acceptable

Gypsum-based skimcoats are often applied to internal walls to achieve a very smooth finish. The adhesion of such skimcoats to the plaster behind it must be good. Adhesion failure between plaster and skimcoat may lead to large portions of the skimcoat becoming loose and flaking off with the paint applied to it, often soon after the paint has been applied. The adhesion of painted skimcoats can be tested by

rubbing a steel tool, like a steel rod, over the surface. Adhesion failure could be rated as for plaster (see Section 3.7).

3.20 Cracks

Rating	Criteria	Score sheet text
1	No cracks in load-bearing walls, few hairline cracks in non-load-bearing walls	No serious cracks
0,5	Some cracks in non-load-bearing walls exceed 0,5 mm	Few fine cracks
0	Cracks in load-bearing walls, or more than a few cracks in non-load-bearing walls	Unacceptable cracking

The cracks of concern correspond to structural cracks as described in 3.8

Internal walls that do not have to support a first-floor structure are usually built in single-leaf brick masonry, but may also be of block-work or some other system such as drywalling. Cracking in these walls may be due to material shrinkage, settlement of under-floor fill or foundation movement and may not have serious structural consequences if crack-widths do not exceed about 1,0 mm.

Cracks over openings in non-load-bearing walls would have safety implications if there were a risk of portion of the masonry falling out.

Cracks in load-bearing internal walls could have serious structural consequences and should be referred to the designer or other responsible competent person.

3.21 General appearance

Rating	Criteria	Score sheet text
1	All even surfaces of uniform intended colour and texture	Good
0,5	Less than 10% of surfaces show small defects	Reasonable
0	More than 10% of surfaces show defects	Bad

Wall surfaces should, in general, be even and regular. Acceptable deviations from this would include decorative plaster finishes e.g. Spanish plaster. Any 3 m straight edge should not show hollowing or bulging in excess of 6 mm both vertically and horizontally. See reference [11], SANS 10155.

Walls should be uniform in colour, with no visible damage, blemishes or stains. Where walls are painted, it should have good adhesion to the base, and be free of bubbles, flaking and peeling in any form. The surface should be consistent in thickness, texture and appearance.

Openings

This section refers to openings in internal and external walls and deals with aspects relating to door and window frames. The matter of cracks in walling over openings has been dealt with under sections 3.8 and 3.20.

3.22 Specification

Rating	Criteria	Score sheet text
1	Location and size of openings as on drawings	Built to drawings/specs
0	Location or size not as on drawings	Not to drawings/specs

Construction specifications and design of large openings in walls is the responsibility of the structural designer. The position of openings, specification of materials and the construction procedure may be on drawings or in a separate document. Where possible, the evaluator should check whether specifications exist and that work has been executed accordingly. Internal walls are not necessarily built of the same materials as the external walls.

Do not score if plans and specifications are not available.

3.23 Fixing of door and window frames

Rating	Criteria	Score sheet text
1	All door and window frames firm and well sealed	No loose frames, no gaps
0	Loose door or window frames or gaps between frame and wall	Some loose frames or gaps

This item refers mainly to openings in external walls. Door frames, including security doors, and window frames should be firmly anchored to the walls with no gaps in between them. External door and window frames should be sealed against the walls to prevent ingress of water. The adequacy of the fixing of the frames can be

assessed by firmly opening and closing the door or window to make sure the frame is not loose.

3.24 Geometry of door and window frames

Rating	Criteria	Score sheet text
1	All door and window frames true and square	Good
0,5	Less than 10% of frames have some defect	Reasonable
0	More than 10% of frames have some defect	Bad

All frames should be fitted according to the drawings. There should be no gaps between the moveable components and frames in the closed position. The intended shape of door and window frames (with some exceptions) should not be distorted and be installed into the walls with correct vertical and horizontal alignment.

3.25 Ease of operation of doors and windows

Rating	Criteria	Score sheet text
1	Handles and catches function smoothly; free movement opening and closing	All function well
0,5	Less than 10% of items do not function smoothly	Acceptable
0	More than 10% of items do not function smoothly	Not acceptable

The opening and closing should be easy without force. This is in respect to the fit within the frames, operation of the hinges, door handles and locks.

3.26 Ironmongery

Rating	Criteria	Score sheet text
1	Fittings are sturdy, well finished and as specified	As specified
0,5	Good fittings but not as specified (in unimportant locations)	Acceptable
0	Poor fittings or not as specified in prominent locations	Not acceptable

Doors and windows are to be fitted with appropriate ironmongery so that they can be opened, closed and locked properly. Window stays should be provided to secure them in an open position. Door stays are sometimes provided at entrances and exits.

3.27 Glazing

Rating	Criteria	Score sheet text
1	All panes well fitted, no defective surrounds	No defects
0	Poor fitting, chipped glass or defective surrounds	Some defects

The glass panes should be of appropriate thickness according to reference 12 and set in frames using suitable compression gaskets, beads, adhesive strips or sealants (typically general purpose putty). This ensures the resistance to rain penetration and prevents cracking of glass due to vibrations. In the case of metal frames, metal-to-glass contact should be avoided; otherwise panes may crack due to thermal effects.

The surface of the glass should be free of scratches, marks, dirt, cracks and chips.

3.28 Sills and thresholds

Rating	Criteria	Score sheet text
1	All sills and thresholds well fitted to full width of opening	Correctly installed
0,5	All thresholds good, less than 10% of sills defective	Reasonable
0	Defective threshold or more than 10% of sills defective	Poorly installed

All windows are to be provided with sills to prevent the ingress of rainwater into and through the wall. The sill should project beyond the line of the wall so that the flow of water is discharged away from the wall.

Proper thresholds are to be provided to all external doors with a weather bar/strip provided to prevent driving rain from flowing inside the room. This strip is usually brass or aluminium.

3.29 Moisture

Rating	Criteria	Score sheet text
1	Weather seals good, no signs of water penetration	Weathertight
0	Poor fit detectable or signs of water penetration	Poor fit

Doors and windows in external walls may suffer from rain penetration through their surrounds or through poorly fitting movable components and/or moisture may condense on panes in poorly ventilated areas.

3.30 Paintwork

Rating	Criteria	Score sheet text
1	Good uniform appearance, no visible defects	No visible defects
0,5	Less than 10% of surfaces of poor appearance or defects show	Acceptable
0	More than 10% of surfaces of poor appearance or defects show	Not acceptable

Most of the materials used for frames of windows and doors require a coating of paint or other protective treatment, apart from the aesthetic role they play. (The application of protective coatings to aluminum, PVC or concrete frames is usually not necessary, except for aesthetic reasons.) The paintwork should be uniform in texture and appearance. There should be no visible defects e.g. blistering, peeling-off, flaking, stains, cracks or other damage. Paint systems should be specified by the designers, specifiers or owners and are usually required to comply with SANS specifications.

Basement walls

Basements have to function as an entity, but for the purposes of assessment, the floors and walls have been covered as separate items. See also 2.31 to 2.33.

3.31 Specification

Rating	Criteria	Score sheet text
1	Construction is according to specifications in all respects	Built to specifications
0	Construction does not meet all specifications	Not to specifications

It is the responsibility of the designer to specify the details of construction of basement walls including waterproofing (tanking) and drainage of the soil behind the walls. These details should be on drawings or in a separate document. Where possible, the evaluator should check that construction has been executed according to the specifications. SANS 10021 [10] Waterproofing of Buildings usually applies.

Do not score if drawings and specifications are not available. Quality of construction is usually evident in terms of the next two items.

3.32 Dampness

Rating	Criteria	Score sheet text
1	No damp patches or signs of dampness	No signs of dampness
0	Water, damp patches or signs of dampness seen	Dampness noticeable

Normally waterproofing is achieved by “tanking”, i. e., by enveloping the floor and the walls in a continuous waterproof membrane. The presence or absence of moisture or the effects of dampness on the wall and floor surfaces can be used to assess the efficiency of the waterproofing of a basement.

All basements should be properly ventilated to prevent condensation and to keep the humidity down.

3.33 Drainage

Rating	Criteria	Score sheet text
1	Outlets visible and functioning	Outlets good
0	No visible outlets, even remote from basement, or outlets above basement floor level	No effective outlets

In all cases drainage behind basement walls must be provided, in order to avoid the buildup of hydrostatic pressure behind walls and to enhance their waterproofness. The drainage system or part of it may be visible; it should be assessed whether it ought to function adequately.

Tenancy and usage separating walls

Party walls that are common to two attached dwelling units and separating walls between garage spaces and living spaces in a house, are required to prevent fire spreading between the adjacent spaces (i.e. from one dwelling unit, or roof space, to the other.) Such walls are also required to provide appropriate acoustic attenuation.

3.34 Specification

Rating	Criteria	Score sheet text
1	Built according to specifications in all respects	Built to specifications
0	Not according to specifications in all respects	Not to specifications

The design and construction details of separating walls must follow the 'deemed to satisfy' rules in reference 2, Section TT, or be detailed by a Competent Person. These details should be on the drawings or be specified in a separate document. Where possible, the assessor should check that construction has been executed according to the drawings and specifications.

Do not score if drawings and specifications are not available.

3.35 Fire resistance

Rating	Criteria	Score sheet text
1	Meets all requirements of regulations	Meets requirements
0	Does not meet all requirements of regulations	Does not meet requirements

In conventional brickwork, dividing walls have to be nominally 220 mm thick and are accepted as effective fire-walls when built up to the underside of the roof cover material. The construction of the separating-wall in the roof space need not necessarily be the same as that of the dividing wall up to ceiling level, but it must have the required fire rating.

3.36 Extent of separating elements

Rating	Criteria	Score sheet text
1	Separating wall to full extent required and no openings	Complete
0	Incomplete, or openings present	Incomplete

Separating walls should extend over the full width and height of the dwelling cross-section. But separating elements in the roof space may be built of different materials to the wall below, provided there are no openings whatsoever, that might link the air spaces of the abutting dwelling units. The separating elements must have the appropriate fire resistance, as specified. If there is a door between the adjacent spaces in a dwelling unit it must have the required fire resistance. Some local authorities may require that such doors be fitted with automatic closure devices.

COMPONENT 4: Roofs

The main role of the roof is to provide protection against the elements - rain, hail, wind, dust and radiation from the sun. A secondary function that may be served is action as an insulating closure over the house.

The purpose of the quality evaluation is to assess the potential of the roof to serve these functions well in the long term.

In houses with ceilings, the presence of wall-plates and roof-ties cannot be ascertained from within the house, nor can the roof structure, underlays or insulation be seen. These items would normally be assessed by a limited inspection of the roof space, carried out from the available trapdoors in the ceilings. A detailed examination within the roof space may need to be done if distortions in the geometry of the roof are evident, or if there are signs of uplift of light-weight roofs.

4.1 NHBRC or designer's specification

Rating	Criteria	Score sheet text
1	NHBRC and SANS specifications are met	Built to specification
0	Relevant specifications not met in respect of any detail	Not to specification

The roofing material should comply with the relevant SANS specification and be installed in accordance with SANS codes of practice and the manufacturer's specifications.

A number of specific requirements for the roof structure and the roof slopes for various cover materials are set out in reference 1, Part 2, Sections 4 and 5. Roof structures should meet these requirements.

Completion certificates required by local authorities may need to deal specifically with the roof construction. The evaluator should check whether such certification was required and has been made.

4.2 Wall-plates

Rating	Criteria	Score sheet text
1	Wall plate in position to full extent as judged by direct observation or other means	Wall plates in place
0	Wall plate missing or not sufficiently continuous or undersized	Incorrect or missing

The wall-plate is a timber bearer, placed on top of the wall, which provides a base on which the roof structure should rest. It ensures a relatively uniform distribution of loads over the walls and a common reference level for the roof structure. The wall plate should be continuous and is frequently 38 x 114 or 50 x 75 in cross section.

4.3 Roof ties

Rating	Criteria	Score sheet text
1	All ties in correct position with no slack (decision based on fair sample)	Ties in place
0,5	One or two ties incorrectly installed	Acceptable
0	More than a few ties incorrectly installed	Not acceptable

The role of the roof-ties is to anchor the roof trusses to the walls, to minimise the risk of potential uplift of the roof. To fulfill this role, the ties should be well anchored in the wall (not visible in completed building) and all slack taken up when fixed to the roof structure. Adequate anchorage of light-weight roofs (e.g. sheet metal cover) is very important; it is of less significance for heavy roofs (e.g. concrete tile cover). It is particularly important for low-pitched sheeted roofs where high uplift forces can be generated under storm wind gusts.

Generally, two types of tie are used in the construction industry:
a pair of 4 mm galvanized wires; or galvanized straps, 30mm wide and 1.2 mm thick. Wires should be taken up on each side of the rafter, twisted together and nailed down on top of the rafter. Straps should be taken up over the top of the rafter, bent down and nailed on both sides.

Ties should be located in the wall to match the truss positions. If not located close to a truss/rafter the effectiveness of a tie will be considerably reduced.
Misalignments greater than 100 mm should not occur.

It may not be possible to check that all trusses are tied down correctly. In such cases, it is accepted that a good sample of trusses/rafters that can be readily seen, will suffice to make a decision regarding an appropriate score.

Further information on roof-ties is included in references [1] and [3].

4.4 Trusses/rafters

Rating	Criteria	Score sheet text
1	No defects can be seen in trusses or rafters	No defects visible
0,5	One or two defects can be seen	Acceptable
0	More than a few defects can be seen	Not acceptable

Roof trusses and rafters for housing are usually made from timber, but other materials such as steel could be used. This guide only addresses timber roof structures.

Timber roof trusses can either be prefabricated in a factory or assembled on site. Truss manufacturers have, in general, produced high quality nail-plated trusses. Site-assembled trusses are more often a problem (both in design and assembly) and should be made according to the guidelines in NHBRC manual [1], Part 2, Section 4. The timber should be of good quality, with SANS markings and of appropriate structural grading, dry, free from cracks, large knots and irregularities in cross section. Assembly should meet the requirements of SANS 10400 [2], section LL. Trusses assembled on site and with bolted lapped joints are suitable for spans up to about 6 metres.

Factory-made nail-plated trusses, with butt joints can be used for any roof span up to about 11 metres.

The trusses should be spaced uniformly, in accordance with the drawings or specifications. Their alignment (especially vertical) is of utmost importance as it determines their ability to carry the loads to which they will be subjected.

Buckling of roof trusses is unacceptable as this may result in a substantial decrease in load bearing capacity (and even partial pull out of the nail-plates). If the roof structure is severely distorted (possible if bracing is absent), truss joints and other connections should be inspected. See item 4.5.

4.5 Bracing

Rating	Criteria	Score sheet text
1	All specified bracing in place	All bracing in place
0	All bracing not in place	Not in place

The lateral stability and strength of roof structures must be ensured by means of bracing according to the designer's specifications. Overall diagonal bracing is usually fixed to the under side of the rafters extending from eaves level (at gable ends) to the ridge. Bracing girders may be used as an alternative; these are usually fitted between adjacent trusses. Temporary bracing to stabilise trusses during erection must not be confused with the permanent bracing required for structural stability under load.

Sheet covered roofs without ceilings should have runners nailed to the tops of the tie-beams (at right angles to the trusses, i.e. parallel to the eaves) to prevent buckling of the ties when there are uplift forces acting on the roof.

4.6 Purlins or battens

Rating	Criteria	Score sheet text
1	All purlins and/or battens appear to be in order	All in order
0,5	A few battens are questionable; purlins all in order	Acceptable
0	One or more purlins questionable, or more than a few battens questionable	Not acceptable

Purlins of the appropriate cross-sectional dimensions should be nailed at the required spacing for carrying the roofing cover, as specified by the designer or roof material manufacturer.

The fixings of battens and purlins cannot normally be seen in completed roofs and cannot be checked, but the timber quality can be assessed to some extent. There should be no knots at the edges of the timber and there should be no joins between trusses/ rafters.

4.7 Treatment of timber

Rating	Criteria	Score sheet text
1	Confirmation of treatment is available	All timber treated
0	Confirmation of treatment not provided	Not treated to specs

In several areas e.g. coastal and winter rainfall areas, it is a legal obligation to use treated timber (in accordance with SANS 10005 [17] and SANS 1288 [18]) in buildings. Certificates to prove this are required. All exterior components of timber should be treated additionally on site with a recognised preservative or painted with a specified paint system.

4.8 Roof cover

Rating	Criteria	Score sheet text
1	Slope appropriate to cover material; no damaged elements	Construction appropriate
0	Slope not appropriate to cover material or visible damage	Inappropriate detail

This item and the next one: Waterproofing, are closely linked, because the appropriate slopes and other details are interdependent.

Roof covers could roughly be divided into the following categories, each of which requires its own design and installation rules:

(a) heavy covers such as concrete and baked clay tiles, slates and thatch,

(b) light, sheet-metal cover such as galvanized steel of different profiles and fibre-reinforced cement profiled sheets, and

(c) flat concrete roofs, covered with a waterproof membrane.

The following aspects need to be taken into account:

(a) the slope of the roof should be as specified for the particular cover material and be in accordance with accepted practice for that particular cover. See reference 1, Part 2, Section 5,

(b) materials of good quality without damage should be used. Where relevant, they must meet the requirements of SANS specifications. Materials should be used in accordance with accepted practice and in accordance with manufacturer's instructions,

(c) attention is drawn to the use of substandard sheeting products, which seldom provide an acceptable, durable cover,

(d) thatched roofs should be provided with a satisfactory, functional fire-protection system, and

(e) where applicable, a guarantee should be obtained for the prolonged satisfactory performance of the roof.

4.9 Waterproofing

Rating	Criteria	Score sheet text
1	Roof surface in good condition; no sign of leaks; no risk of ponding; no raised roof screws	No leaks
0	Some signs of leaks or ponding or loose waterproofing membranes or roof screws lifting	Leaks

The recommendations of SANS 10021 [10] must be met regarding waterproofing of a roof, with due attention to the following:

(a) the slope of the roof should be as specified and be in accordance with accepted practice for the particular cover under consideration. See reference 1, Part 2, Section 5,

(b) in the case of sheet-metal roofs, the slope should be such that water does not pond on it, even after creep deflection of the structure has taken place,

(c) the roof overhang should be such that water is shed away from the walls if the roof is designed not to have gutters and downpipes. It is particularly important that adequate overhang is used over gable walls to protect them against rain penetration, and

(d) Flat concrete roofs should be strictly built in accordance with engineering design and waterproofed in accordance with manufacturer's instructions (which should be in accordance with the recommendations of SANS 10021 [10]).

4.10 Gutters and downpipes

Rating	Criteria	Score sheet text
1	Good condition, correct falls; no poor joints	All correctly installed
0,5	All joints good, but one gutter fall or downpipe discharge point incorrect	Acceptable
0	Poor condition or poor joints and more than one fall or discharge point incorrect	Not acceptable

Gutters and downpipes should be appropriately installed. The fall of gutters should be such that water does not pond in them. The bottom of downpipes should discharge water away from the wall.

4.11 Beam filling

Rating	Criteria	Score sheet text
1	Filling closes all gaps, maintains wall appearance and no cracks	Good
0,5	Less than 10% of beam filling is defective	Reasonable
0	More than 10% of beam filling is defective	Bad

Beam filling should be provided to close the gap in the wall between trusses or beams. The beam filling should not be laid on top of the wall plate, as this will result in a horizontal crack developing. The finish of the beam filling should be the same as and continuous with the wall on which it is built.

4.12 Barge and fascia boards

Rating	Criteria	Score sheet text
1	Uniform alignment and appearance, in good condition; no sign of rusting screws	Good
0	Poor condition, irregular alignment or signs of rusting screws	Bad

Barge and fascia boards are common in many houses. They are usually made from timber or fibre-reinforced cement boards. Barge boards can take the form of molded tiles that match the tiles of the roof.

The boards should be fixed with brass screws to batten or rafter ends to avoid corrosion. The boards must be finished with appropriate paint applications.

Barge and fascia boards must be straight and vertical.

4.13 Roof lights

Rating	Criteria	Score sheet text
1	Nearly fitted and waterproofed, no signs of water penetration	Good
0	Waterproofing not in good condition and/or signs of water penetration	Bad

Roof lights are installed through penetrations in the roof cover of houses. These penetrations should be waterproofed so that leakages do not occur in or around the roof lights or on the ceilings adjacent to the roof lights.

4.14 Brandering and ceilings

Rating	Criteria	Score sheet text
1	Ceiling of uniform appearance, brandering correctly spaced, nails and/or screw heads well masked	Uniform installation
0,5	Less than 10% of ceiling area shows defects	Acceptable
0	More than 10% of ceiling area shows defects	Not acceptable

Brandering for plasterboard or fibreboard ceilings should be spaced at approximately 300 mm to prevent sagging of the ceiling board between them. It is important that they should be properly levelled, as their geometry will determine the final aesthetics of the ceilings.

The ceilings are usually constructed of gypsum plaster-board or fibre-cement sheeting attached to the brandering, although other kinds of board or plastered ceilings are also used. The sheets should be firmly fixed with nails or screws. All nail heads and/or screw heads should be masked with a recognised filler and the filling smoothed before painting.

The joints between adjacent boards should be filled and the filling smoothed off before painting. Otherwise the joints should be covered with a cover strip.

There should be no gaps or cracks between adjacent boards and no bulging, sagging or unintended differences in levels over the ceiling. The surface of the ceilings should be even and smooth. Deviations under a 3 m straight edge should not exceed 6 mm in any direction.

The paint should cover fixings and be consistent in texture, colour and appearance. There should be no bubbles, peeling, flaking, stains, cracks or other imperfections.

Suspended ceilings should be installed in accordance with manufacturer's instructions. The quality of finish should meet the requirements mentioned above.

4.15 Cornices

Rating	Criteria	Score sheet text
1	Uniform appearance, all joints neat, no gaps	Good
0,5	Less than 10% of cornices show defects	Acceptable
0	More than 10% of cornices show defects	Not acceptable

The junction (corner) between ceilings and walls are normally covered with a cornice. This is usually a gypsum-paper or timber fixture attached to the wall. The role of the cornices is to finish off the junction between wall and ceiling and to limit dust from sifting through the junction. It also plays an aesthetic role.

The cornice must be firmly fixed to the walls, with no visible undulations or gaps between cornice and wall or ceiling or at abutting ends of strips of cornice. Particular attention must be paid to the finish between abutting cornice strips at corners.

4.16 Insulation

Rating	Criteria	Score sheet text
1	No defects in sample area	No defects
0,5	One or two defects in sample area	Acceptable
0	Three or more defects in sample area	Not acceptable

A large number of insulation products are available. Whether an under batten membrane or a layer on the ceiling, the main requirement is that it should be installed from edge to edge, without any gaps that are un-insulated. Manufacturer's recommendations should be followed, if provided.

The entire area that is intended to be insulated may not be readily visible, in which case only a sample area around the trapdoor may be amenable to assessment. For this reason and because there are no structural implications, this item carries a small weight in the scoring system.

COMPONENT 5: ELECTRICAL AND PLUMBING

Electrical and plumbing installations are provided for the convenience of the occupants of the house.

These installations are required to be undertaken by specialised and well-trained contractors and there is, in general, a fair adherence to quality standards in the respective industries. Since a thorough assessment of the quality of workmanship within these installations would require specialised knowledge, which the evaluator does not have, the assessment will only be based on the visual examination of the installation in question. This will allow the basic requirements of the electrical and plumbing installations to be assessed and included as part of the scoring system.

Electricity supply

5.1 Compliance certificate

Rating	Criteria	Score sheet text
1	Municipal electricity provided, thus certification assumed	Certificate available
0	Municipal electricity not yet approved	Certificate not available

Each installation, at the time of its completion, would have been subjected to an inspection by the local authority for approval. A compliance certificate is issued at the time. The availability of this certificate provides adequate proof of the standard of the installation and connection to the municipal electricity grid is usually only permitted by the local authority when a certificate is lodged.

5.2 Distribution board

Rating	Criteria	Score sheet text
1	All essential circuit breakers present, all marked; no exposed wiring	Dist board properly set up
0	Any key feature missing or exposed wiring	Dist board badly set up

Each house should be fitted with an electrical distribution board containing SANS approved circuit breakers. This includes the main breaker (typically 60 amp), an earth leakage unit, and separate breakers for geysers and stove, plus several others

defining specific circuits within the house, for wall plugs and lights. All current breakers must be marked for identification purposes.

No additional connections or loose wiring should be visible .

5.3 Installation

Rating	Criteria	Score sheet text
1	All plugs and lights function, all visible aspects good; no exposed wiring	Correct installation
0	Any malfunction, poor finished aspect or exposed wiring	Incorrect or bad

Electrical wiring (2 insulated wires + a bare earth wire) is commonly installed through pvc conduits that are recessed into the wall. Some may be surface mounted. Other methods, including wiring harnesses are also in use. An armoured main supply cable connects the municipal electricity supply through a meter to the distribution board, from where the conduits and wiring extend to the different rooms of the house. This would comprise separate circuits for lighting and power supply through plugs. Light switches and plug outlets must be installed level. Assessment is in terms of visible aspects and functioning of circuits; all circuits must provide electricity at fittings, chases must be neatly filled and surface cabling must be neat.

5.4 Fittings – indoors and outdoors

Rating	Criteria	Score sheet text
1	All fittings appropriate, securely and neatly fitted	Correct installation
0	Any inappropriate, damaged or defective fitting or badly installed item	Incorrect installation

Electrical fittings (lights, switches and sockets) for household use should be SANS approved. Light fittings and other permanent appliances should be well secured in place making sure that they are level or vertical and earthed as required. Electrical sockets should not be fitted in areas defined as wet, for example bathrooms. Outdoor fittings must be specifically manufactured for outdoor locations and be weatherproof.

5.5 Isolator switches

Rating	Criteria	Score sheet text
1	Isolator switches provided within easy reaching distance	Isolators installed
0	Isolator switches not provided or out of reach	No isolators, or incorrectly installed

Stoves or separate eyelevel ovens and hobs, must be provided with individual isolator switches within easy reach of the appliance. In some municipal areas, geysers have to be provided with their own isolator switches within 1 m of the geyser.

5.6 Functionality

Rating	Criteria	Score sheet text
1	All supply points provide power; earth leakage does not trip	Lights and plugs work
0	Any outlet does not provide power or earth leakage is tripped	Lights and plugs don't work

The electrical installation can very easily be tested to see if it is functioning by turning lights on and plugging in appliances to see if the electricity is connected. The earth leakage unit should not be tripped when any circuit is used (provided no defective appliance is plugged in to that circuit).

PLUMBING INSTALLATION

Plumbing installation can generally be divided into water supply and drainage/sewerage.

Water supply

5.7 Local authority approval

Rating	Criteria	Score sheet text
1	Municipal water available – approval assumed	Approved
0	Water connection not made – assume approval not given	Not approved

The local authority is responsible for providing a metered water connection at the boundary to the property. Approval for the water supply thereafter does not generally

require certification, but installation must be done to the satisfaction of the municipal inspector when the drainage and sewer installation is inspected. See also 5.13.

5.8 Efficiency of supply

Rating	Criteria	Score sheet text
1	Good water pressure available at all taps; geyser overflow pipe projecting outside external wall	Good
0	Poor water pressure at any tap; or geyser overflow pipe not projecting outside external wall	Bad

The installation of the water supply, which has to be undertaken by a competent person, must be neatly installed, and secured with holder bats where visible. Pipe work is normally chased into the walls. Wash hand basins, sinks and toilets are usually supplied with hot and cold water through 12 mm diameter piping while baths and showers are supplied through 18 mm diameter piping. Three types of material are commonly used for pipe work, namely, galvanised iron, copper or polypropylene. Where geysers are provided in houses they should be located in close proximity to the fittings they are supplying and should be fitted with a safety pressure valve and an over-flow valve to discharge the build up of excess water through pressure to the outside of the house. Some water supply installations may be linked to a single stand pipe on the property. In this case the stand pipe must be adequately supported to prevent it being damaged or knocked over.

5.9 Quality and functioning of fittings

Rating	Criteria	Score sheet text
1	All taps firmly mounted, accurately oriented and function well	Good
0	Any tap loose, badly mounted or leaking	Bad

All fittings, including taps, stopcocks and sanitary ware, should be robust of design and secured and fixed in position so that the fittings can be conveniently used as often as required. Fittings must be correctly (level) installed. Fittings should not be cracked or broken, close off fully and glands/spindle seals should not leak.

5.10 Supply connections

Rating	Criteria	Score sheet text
1	Stopcock provided and no leaks in supply line	Correct
0	Stopcock not provided, difficult to operate or leaks evident	Incorrect

The connection between the municipal meter and the house will be underground. A stopcock should be provided and located against the wall where the pipe enters the house. This will allow for the closing of the water supply for the maintenance of the installation (e.g. replacement of tap washers). In some cases the stopcock is less conveniently located below ground level. The stopcock should operate smoothly and close off completely. There must be no leaks in the main water supply pipe to the property.

5.11 Leaks

Rating	Criteria	Score sheet text
1	No signs of leaks anywhere in the building	No leaks
0	Signs of leaking water pipe anywhere	Leaks

The plumbing installation should be checked for telltale signs of leaking. This part of the assessment refers to plumbing within the house.

5.12 Functionality

Rating	Criteria	Score sheet text
1	Water available at all taps	Water flows well
0	Water not available at all taps	No water flow

The water supply installation can easily be tested by turning one or two hot and cold water taps on inside and outside the house to make sure that water is available when municipal supply is on and stopcocks at property boundary and at house are open.

Waste water disposal

5.13 Local authority approval

Rating	Criteria	Score sheet text
1	Municipal water available – implies approval of waste water plumbing by local authority	Approved
0	Municipal water not available not available – implies approval of waste water plumbing not given	Not approved

Each installation, would have been subjected to an inspection and tests by the local authority for approval. An approval certificate would have been issued to provide proof of compliance, before local authority makes water available to the property. See also 5.7.

5.14 Installation

Rating	Criteria	Score sheet text
1	All fittings and pipes correctly mounted, traps and vents provided and no leaks	Correct installation
0	Any item missing or defective or leaks evident	Incorrect installation

Sanitary fittings are usually clustered together. Each fitting must be separately connected to the drainage system with water traps and ventilation pipes in accordance with municipal requirements. Pipe work must have the required fall (15° slope) and be fixed as required to the wall with holderbats. No leaks should be evident. See also 5.15.

5.15 Fittings and fixtures

Rating	Criteria	Score sheet text
1	All fittings securely mounted, leveled and in good condition	Good
0	Any fitting not secure, out of level or damaged	Bad

All plumbing fittings and fixtures (toilets, basins, baths, sinks etc) should be accurately and firmly secured in position (levelled) and should be intact without any sign of damage, cracks or scratches.

5.16 Discharge connections

Rating	Criteria	Score sheet text
1	Waste water pipes and toilet connections in good condition, cleaning/inspection eye covers in place and not evidence of blockages	Correct
0	Any poor quality pipes, signs of blockage or absence of cleaning of cleaning/inspection eyes	Incorrect

The drainage and sewerage system should discharge into the sewerage network, or alternative sanitation system (e.g. septic tank) via a dedicated connection. Most of this pipe work will be underground. Inspection or cleaning eyes should be marked at ground level. No permanent structures should be erected above the pipe or connection. There should be no backing up of waste water in gullies or signs of overflow at inspection eyes or cleaning eyes. See also 5.17.

5.17 Functionality

Rating	Criteria	Score sheet text
1	Water drains freely and rapidly	Correctly functioning
0	Water drains slowly or is blocked	Incorrect

The drainage installation can easily be tested by flushing a toilet or running water into a basin, to make sure that the water flows away quickly and that no blockages occur.

REFERENCES

[1] NHBRC, National Home Builders Registration Council (1999). Home building Manual.

[2] SANS 10400 and 10401. National Building Regulations. Council of the South African Bureau of Standards, Pretoria.

[3] National Building Research Institute (now BOUTEK). A technical guide to good house construction. BOUTEK, CSIR, Pretoria.

[4] SANS 10107. Code of practice for the design and installation of ceramic tiling. Council of the South African Bureau of Standards, Pretoria.

[5] SANS 1449. Standard specification for ceramic wall and floor tiles. Council of the South African Bureau of Standards, Pretoria.

[6] SANS 10249. Code of practice for masonry walls. Council of the South African Bureau of Standards, Pretoria.

[7] SANS 10145. Code of practice for concrete masonry construction. Council of the South African Bureau of Standards, Pretoria.

[8] SANS 227. Standard specification for burnt clay masonry units. Council of the South African Bureau of Standards, Pretoria.

[9] SANS 1215. Standard specification for concrete masonry units. Council of the South African Bureau of Standards, Pretoria.

[10] SANS 10021. Code of practice for the waterproofing of buildings (including damp-proofing and vapour barrier installation). Council of the South African Bureau of Standards, Pretoria.

[11] SANS 10155 - 1980 (1994). Code of practice for accuracy in buildings. Council of the South African Bureau of Standards, Pretoria.

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[13] SANS 10142-1. Code of practice for the wiring of premises Part 1: Low-voltage installations. Council of the South African Bureau of Standards, Pretoria.

[14] SANS 581. Standard specification for semi-flexible vinyl floor tiles. Council of the South African Bureau of Standards, Pretoria.

[15] SANS 786. Standard specification for flexible vinyl flooring. Council of the South African Bureau of Standards, Pretoria.

[16] SANS 10070. Code of practice for the installation of resilient thermoplastic and similar flexible floor covering materials. Council of the South African Bureau of Standards, Pretoria.

[17] SANS 10005. Code of practice for the preservative treatment of timber. Council of the South African Bureau of Standards, Pretoria.

[18] SANS 1288. Standard specification for preservative-treated timber. Council of the South African Bureau of Standards, Pretoria.