

REPUBLIC OF RWANDA



RWANDA HOUSING AUTHORITY



BUILDING INSPECTION GUIDELINE

July 2012

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Chapter I. GENERALITIES

I.1 INTRODUCTION

This inspection guide constitutes a reference for inspectors, owners, developers, project managers and building users. It also aims to delineate the extent of inspection services and gives guideline on how to fill out inspection sheet. Finally the guide defines terms related to inspection and inspectors.

I.2 GOALS AND SCOPE OF SERVICES

I.2.1 *Definition of inspection*

Inspection consists of the visual and technical examination of any construction site and the production of a report that outlines the physical state of various components based on the material, technical tests of finished works, prefabricated material specifications and techniques used on the date the inspection is conducted.

I.2.2 *Services and basic obligations of an inspection*

- 1° To inform the client the scope and limitations of the inspection mandate
- 2° To gather information that help to establish the history of the building
- 3° The inspector shall request the documents allowing him or her to get the necessary information on the nature and the condition of the building. For instance deed plans, the construction permit, approved and updated plans, the occupation permit, the land title and any other document depending on the inspection case.
- 4° To examine all documents as specified by the present guide
- 5° To fill out the inspection sheet
- 6° To submit a written inspection report to the owner
- 7° To submit a detailed report of all defects/faults or related to all components of the building. To file all detected fault into the following categories: Major defects, safety risks, other minor faults or defects
- 8° Give a detailed descriptions of building components that were not inspected and provide reasons

9° If possible, propose corrective measures for all detected defects and faults after finding out the reasons for their occurrence

1.2.3 Document to be used

This Inspection is based on the following documents:

- *Rwanda Building control regulation*
- *Rwanda Building Construction Code*
- *Zoning regulations*
- *Building permits*
- *Approved plans*
- *Approved Bill of quantity*
- *Any other official document provided by site manager or owner*

1.2.4 Preparation of site Inspection

The inspector shall prepare the site inspection depending on class of occupancy and stage of construction works. The preparation consists of:

- Check the district copy of the building file
- Check the previous inspection report on the intended building to be inspected
- List items intended to be inspected according to the stage of execution works, the class of occupancy and previous inspection report
- List official documents to be provided by the site manager or owner during the site inspection
- Consult the above mentioned documents on which the inspection will be based on

1.2.5 Competency of the Inspector

For competency and ethical reasons, the inspector shall, while implementing regulations contained in the present guide, carry a badge or a power of attorney letter allowing him or her to carry out his or her duties.

1.2.6 Stages of Inspection

According to construction process, a building project could be divided in the following stages of execution works:

- Stage 1: Before any execution works
 - During site installation
 - And before excavation
- Stage 2: During execution works
- Stage 3: After execution works
 - Before occupation
 - And During occupation

For the effectiveness and performance of the inspection works, all building project shall be inspected at least once during each stage of inspection.

1.2.7 Competency of the Inspector

For competency and ethical reasons, the inspector shall, while implementing regulations contained in the present guide, carry a badge or a power of attorney letter allowing him or her to carry out his or her duties.

Chapter II. GENERAL WORKS

II.1 SITE INSTALLATION

The site layout can be defined as site space allocation for material storage, working areas, units of accommodation, plants/machines positions, general circulation areas, and also access and egress for deliveries and emergency services.

II.1.1 *Site Holding, Boundary Demarcation and Setbacks*

Using distance measuring tools such as wheel-Meter or Laser-Meter and comparing dimensions with those on approved drawings, the inspector shall check:

- If the site and boundary demarcation comply with the approved drawings
- Whether implemented setbacks on site are complying with zoning regulations
- If the demarcation holdings are provided to delineate required work areas.

II.1.2 *Offices, Sanitary, Storages*

Using distance measuring tools such as wheel-Meter or Laser-Meter and comparing dimensions with those on approved drawings, the inspector shall check:

- If setup areas for operation of the site are compliant with approved drawings
- If the functioning of the site have the right machinery in the most advantageous position
- Whether offices, Sanitary, storages and any other working areas are provided and enough to insure good conservation of materials and people's health
- If required working areas are available and not interfering with general site circulation/walkways

Depending on the size and complexity of the construction, and especially on the size of the site, the site layout can be divided into several sections such as:

scaffold storage, aggregate and cement storage and mixers, top soil storage, Materials storage, Timber storage and fabrication, Reinforcement storage and fabrication; Contractor's Offices; Car park ; Tower crane ; Toilets ; Clerk of works' Office ;Dumping areas ; Etc.

II.1.3 *Public Sign Postings/Signage, Site Lighting, Entrance, Exit and Circulation Dispositions*

The inspector shall check:

- If the provided work areas are well marked by using sign postings
- If the location of each required area and unit allow safe and easy circulation within the site
- If the connection between the entrance, exit and internal circulation is well linked, and allow safe and easy circulation of people and machinery
- If used material and techniques comply with Rwandan construction code of standards
- If the lighting and electrical system allow safe environment conditions in terms of lighting and electrical shock
- If the electrification is done using a power saving technology and economic bulbs/lights

II.1.4 *Protection of Public Utilities,*

The inspector shall check:

- If surrounding areas, public infrastructure and public utilities boundaries are respected and protected

II.1.5 *Personal Protective Equipments and Measures*

The inspector shall check if:

- If required safety equipment and tools are provided and used properly,

- If used safety equipment and tools comply with construction code of standards
- If the site insurance cover the totality of workers on the site for all risks

II.1.6 *Rain Water Escape Routes, Dumping Areas (Soil, Metals, Debris...), Noise and Dust Control Measures*

The inspector shall check:

- If the installed drainage system for rainwater is efficient and does not affect the surrounding areas/public infrastructure
- If the dumping areas are appropriate and well managed and if materials are loaded separately and appropriately to avoid risks,
- If the used noise and dust protective/mitigation measures are efficient to protect the surroundings as required. The Sound-Meter can provide readings to be compared to desired intervals

II.2 EARTHWORKS

Earthworks are engineering works created through the moving or processing of quantities of soil or unformed rock. They consist mainly of excavation, leveling, compaction, embankment and trenching works.

II.2.1 *Excavation, leveling and trenching works*

The inspector shall check:

- If the executed works (size and slope) comply with approved drawings using theodolite or any other distance/slope measuring tools
- If the used techniques, material, tools and machinery comply with construction code of standards
- If security measures are provided to avoid accidents
- If used noise and dust protective/mitigation measures are effective to protect the surroundings. The Sound-Meter can provide readings to be compared to desired intervals

II.2.2 *Compaction works*

The inspector shall check:

- If the used techniques, material, tools and machinery comply with construction code of standards,
- If security measures are provided to avoid any accident
- If used noise and dust protective/mitigation measures are efficient to protect the surroundings. The Sound-Meter can provide readings to be compared to desired intervals

II.2.3 *Embankment*

The inspector shall check:

- If the executed works (size and slope) comply with approved drawings using size and distance and slope measuring equipment
- If used materials comply with approved bills of quantities/technical specifications
- If the used techniques, material, tools and machinery comply with construction code of standards
- If security measures are provided to avoid accidents
- If used noise and dust protective/mitigation measures are efficient to protect the surroundings. The Sound-Meter can provide readings to be compared to desired intervals

II.2.4 *Dumping areas*

The inspector shall check if:

- The dumping areas location comply with approved drawings
- The used techniques, material, tools and machinery to load debris comply with construction codes of standards
- The security measures are provided to avoid accidents

- The used dust protective/mitigation measures are effective in protecting the surroundings.
- The dumping areas are appropriate and well managed
- The materials are loaded separately to avoid risks

II.2.5 Transportation

The inspector shall check if:

- The used techniques, tools, methods, and machinery to transport debris and materials comply with construction code of standards
- The transportation of debris and supply of materials avoid getting dirty of the site and surroundings
- The security measures are provided to avoid accidents
- The used dust protective/mitigation measures are efficient to protect the surroundings
- The discharge site is permitted and if debris discharge techniques are not harmful to the surroundings

Chapter III. FOUNDATION WORKS

Foundation works include: foundation walls (or slab), waterproofing, backfill and compaction, and underground plumbing

III.1 FOUNDATION

The inspector shall check if:

- The material used comply with the specification in the approved bills of quantities and code of standards
- The Method/ technology used for onsite fabricated material comply with Rwandan construction code of standards
- The procedures, methods, and techniques used comply with the good workmanship and the Rwandan construction code of standards
- The rebar sizes comply with technical specifications using a Digital Vernier Caliper
- There are no visible and detectable defects such as cracks, humidity...
- The visible cracks are structural/alarming using a concrete scanner

III.2 DAMP-PROOF COURSE

The inspector shall check if:

- The material used comply with the specification in the approved bills of quantities and Rwandan construction code of standards;
- The procedures, methods, and techniques used comply with the good workmanship and the Rwandan construction code of standards;
- No visible and detectable defects/damage on used material.

III.3 SOIL TREATMENT FOR INSECTS

The inspector shall check if:

- The used soil treatment techniques, procedures and methods comply with the Rwandan construction code of standards
- The used Chemicals product comply with Rwandan construction code of standards
- If organic materials and debris in areas to be treated have been removed prior to application of chemicals

III.4 ROUGH PLUMBING

Rough plumbing involves the installation of water, waste, vent and underground piping prior to the walls closed.

The inspector shall check if:

- The executed plumbing lines comply with approved drawings
- The required plumbing lines are completed before structural works
- The used material comply with Rwandan construction code of standards and specification in the approved bills of quantities
- The used techniques comply with Rwandan construction code of standards

Chapter IV. **BUILDING STRUCTURE**

The building structure consists of primary structure which transmits the loads exerted on the cladding to the ground via foundation. It includes mainly columns and beams. The primary structure could be made in steel, reinforced concrete, timber, brickwork or masonry, or a combination of the above.

IV.1 SCAFFOLDINGS AND FORMWORKS

The inspector shall check if:

- The material used for the scaffolding and formworks comply with Rwandan Construction Code of Standards
- The techniques and procedures used for assembling and erecting the scaffold/formworks comply with Rwandan Construction Code of Sif the bolts and nuts of the scaffolding/ formworks are tightened enough using a torque wrench
- The rebar sizes comply with technical specifications using a Vernier Caliper and a meter tape
- The erected scaffold ensure easy and safe circulation on the site
- Protection measures are provided to protect surroundings and pedestrians

IV.2 ELEVATION WORKS

IV.2.1 *General Structural, Columns, Slab, Beams, Stair Cases*

The inspector shall check if:

- The executed structural works comply with approved drawings
- The material used comply with the specification in the approved bills of quantities and Rwandan Construction Code of Standards
- The Method/ technology used for onsite fabricated material comply with Rwandan Construction Code of Standards
- The rebar sizes comply with technical specifications using a Digital

Vernier Caliper and a meter tape for measuring distance between bars

- The bearing capacity of finished concrete members/ structures are beyond minimum admissible strength using a Schmidt Hammer
- There are no visible and detectable defects such as cracks, humidity...
- The elastic properties or strength of casted concrete members are compliant with specification in the bills of quantities using a Digital Schmidt Hammer
- Any visible cracks are not structural/alarming using a concrete scanner
- The visible cracks are not structural using a concrete scanner “GSSI”
- The procedures, methods, and techniques used comply with the code of practice and the Rwandan Construction Code of Standards
- The onsite fabricated materials comply with Rwandan Construction Code of Standards

IV.3 ROOF STRUCTURE

The inspector shall check if:

- The executed structural works/truss comply with approved drawings
- The material used comply with the specification in the approved bills of quantities and Rwandan Construction Code of Standards
- The Method/ technology used for onsite fabricated material comply with Rwandan Construction Code of Standards
- The truss and other members assembled by bolts and nuts are tightened using Torque Wrench
- The dimensions (height, size, slope) of the roof are compliant with approved drawings using height, distance and slope measuring equipment

- The primer coat is thick enough to protect the steel from rust using Elcometer
- The roof structure is grounded with suitable earth resistance values using Digital Earth Resistance Meter
- The onsite fabricated materials comply with Rwandan Construction Code of Standards
- There are no visible and detectable defects such as cracks on the truss bearing members

Chapter V. **FRAMING WORKS**

This stage includes masonry, wood or steel framing. Such as exterior wall and roof sheathing, exterior trim and siding (and/or stucco/brick), windows and exterior doors, stairs and roofing

V.1 WALLS, ROOFS, OPENINGS, SHINGLES, STAIR, DOORS, WINDOWS

The inspector shall check if:

- The executed structural works comply with approved drawings
 - The material used comply with the specification in the approved bills of quantities and Rwandan Construction Code of Standards
 - The Method/ technology used for onsite fabricated material comply with Rwandan Construction Code of Standards
 - The procedures, methods, and techniques used comply with the good workmanship
 - There are no visible and detectable defects such as cracks, humidity...

Chapter VI. OTHER WORKS

VI.1 MECHANICAL, ELECTRICAL, PLUMBING, IT FACILITIES

The inspector shall check if:

- The location of installed facilities comply with approved drawings
 - The fixtures used comply with the specification in the approved bills of quantities Rwandan Construction Code of Standards
 - The procedures, methods, and techniques used for fixtures installation comply with the Rwandan Construction Code of Standards
 - There are no defects detectable in/on the completed/ongoing works
 - If the electrification is done using a power saving technology and economic bulbs/lights
 - The lightening arrester is available and if all the electrical installations are grounded with suitable earth resistance to be checked using Digital Earth Resistance Meter

VI.2 FIRE PROTECTIVE MEASURES

The inspector shall check:

- The location of installed facilities and equipment comply with approved drawings
 - The fixtures and equipment used comply with the specification in the approved bills of quantities and codes of standards
 - The procedures, methods, and techniques used for fixtures and equipment installation comply with Rwandan Construction Code of Standards
 - All required fire protective equipments and measures as per the Rwanda Building Control Regulation and Rwandan Construction Code of Standards
 - There are no visible and detectable defects such as damaged/emptied extinguishers, non operation fire detectors or fire alarms or clogged pipes

- The personnel onsite have skills on firefighting equipment and skills on the usage of First Aid Kit

VI.3 FACILITIES FOR PWDS

The inspector shall check if:

- All required facilities as per the Rwanda Building Control Regulation and other standards or regulations are provided
- The location of installed facilities and equipment comply with approved drawings and Rwanda Construction Code of Standards
- The fixtures and equipment used comply with the specification in the approved bills of quantities and Rwanda Construction Code of Standards
- The procedures, methods, and techniques used to install the facilities comply with the Rwanda Construction Code of Standards
- There are no visible or detectable defects or mistakes

Chapter VII. FINISHES

Finishes includes the interior and exterior finishes which consist of the following items:

1. Wall finishes which consist of plastering, rendering, painting, keying, and any other wall decoration
2. Floor finishes such as carpet, solid wood flooring, laminated wood flooring, tiles, ceramic, natural stone, paver, imprint concrete, interlocking blocks, pebble wash...
3. Ceiling finishes such as wooden panel, gypsum, tray, tiles...

Windows, doors, curtain walls finishes. These consist mainly of fixing and painting.

Others installation:

- *Electrical fixtures and equipments*
- *Plumbing fixtures and equipments*
- *PWD facilities*
- *Signage system*
- *Fire safety fixtures and equipments*
- *IT facilities*
- *HVAC fixtures and equipments*

VII.1 INTERIOR FINISHES

VII.1.1 *Flooring, Ceiling, Doors, Windows, Painting/Wall-paper, Countertops, Curtaining, Toilet facilities*

The inspector shall check:

- The executed finishing works comply with approved drawings;
- The material used comply with the specification in the approved bills of quantities and Rwanda Construction Code of Standards

- The Method/ technology used for onsite fabricated material comply with Rwanda Construction Code of Standards
- The procedures, methods, and techniques used comply with the good workmanship and the Rwanda Construction Code of Standards
- There are no visible and detectable defects such as cracks, humidity...

VII.1.2 Cabinets, Electrical, Mechanical, Hvac and Plumbing Systems, Faucets, Showerheads and Appliances

The inspector shall check if:

- The executed works comply with approved drawings
- The material used comply with the specification in the approved bill of quantity, zoning regulation and codes of standards
- The Method/ technology used for onsite fabricated material comply with Rwandan Construction Code of Standards
- The procedures, methods, and techniques used comply with the good workmanship and the Rwandan Construction Code of Standards
- There are no visible and detectable defects such as non insulated cables, poor cable connections/joints, humidity...
- All the electrical installation is grounded using an Earth Resistance Meter
- Outputs/inputs of electrical services/sockets are compliant to specification and Rwandan Construction Code of Standards. This is done using a Digital Voltmeter

VII.1.3 Lights, sockets and switches

The inspector shall check if:

- The executed works comply with approved drawings;
- The material used comply with the specification in the approved bills of quantities, zoning regulation and Rwanda Construction Code of Standards

- The power saving technology and economic lights are used onsite
- The Method/ technology used for onsite fabricated material comply with Rwanda Construction Code of Standards
- The procedures, methods, and techniques used comply with the good workmanship and the Rwanda Construction Code of Standards
- There are no visible and detectable defects such as non-insulated cables, poor cable connection, humidity...
- The natural/electrical light is sufficient using a Digital Light-meter

VII.2 EXTERIOR FINISHES

VII.2.1 Windows, Doors, Cladding, Roof Covering

The inspector shall check if:

- The executed finishes comply with approved drawings
- The material used comply with the specification in the approved bills of quantities, zoning regulation and codes of standards
- The Method/ technology used for onsite fabricated material comply with Rwanda Construction Code of Standards
- The procedures, methods, and techniques used comply with the good workmanship and the Rwanda Construction Code of Standards
- There are no visible or detectable defects

VII.2.2 Plastering and Painting

The inspector shall check if:

- The executed finishes comply with approved drawings
- The paint coats comply with good workmanship and specification in the bills of quantities using Elcometer

- The material used comply with the specification in the approved bills of quantities, zoning regulation and Rwanda Construction Code of Standards
- The Method/ technology used for onsite fabricated material comply with Rwanda Construction Code of Standards
- The procedures, methods, and techniques used comply with the good workmanship and the Rwanda Construction Code of Standards
- There are no visible or detectable defects

VII.2.3 Fencing

The inspector shall check if:

- The executed finishes comply with approved drawings
- The material used comply with the specification in the approved bill of quantity, zoning regulation and Rwanda Construction Code of Standards
- The Method/ technology used for onsite fabricated material comply with Rwanda Construction Code of Standards
- The procedures, methods, and techniques used comply with the good workmanship and the Rwanda Construction Code of Standards
- There are no visible or detectable defects

Chapter VIII. LANDSCAPING

The landscaping stage includes parking area, green space/ garden, walk way, planted trees, irrigation system (underground or open system), lighting, any other outdoor installation.

VIII.1 PARKING, GARDEN, WALKWAYS, LIGHTING & SPLASH APRONS

The inspector shall check if the landscaping installations comply with:

- Approved landscape plans
- Specifications of approved bills of quantities
- The conformity with RBCR, Rwanda Construction Code of Standards and Zoning Regulation

Chapter IX. **DEMOLITION**

IX.1 SAFETY

The inspector shall check if:

- General safety measures as per chapter X of this document are being applied
- The recommended techniques and materials as per the demolition permit are respected
- The sealing of services and the protection of public utilities have been done before starting demolition

IX.2 USED TECHNIQUES

The inspector shall check if:

- The recommended techniques, tools and machinery as per the demolition permit are respected
- Noise and dust control measures are provided, and if they are compliant with Rwanda Construction Code of Standards

IX.3 CLEARANCE OF THE SITE

The inspector shall check if:

- The used techniques, tools, methods, and machinery to transport debris and materials comply with Rwanda Construction Code of Standards
- The transportation of debris and supply of materials maintains the cleanness of the site and surroundings
- The security measures are provided
- The dust protective/mitigation measures used are efficient in protecting surroundings
- The dumping areas are appropriate and well managed

Chapter X. GENERAL SAFETY

The inspector shall check if:

- Personal safety equipment are provided as prescribed by the Rwanda Construction Code of Standards and used as per the appropriate code of practice/workmanship,

Depending on the size and complexity of the construction to be erected, personal safety equipment may include the following:

- Safety Glasses for eye protection,
 - Helmets at all times within the confines of the construction area where workers are prone to accidents caused by falling materials or tools,
 - Gloves when handling materials and to protect against burns from hot materials,
 - Safety Boots for protection against foot injuries,
 - Appropriate working tools to avoid using hands, fingers, or nails
 - Etc.
- Sanitation facilities are provided for the use of workers according to Rwanda Building Control Regulation,
 - Working areas are free from rubbish and debris,
 - Site First-Aid Kit is provided with a permanent trained persons onsite,
 - Barricades, guard rails or perimeter cables are provided for cranes, trenches or hole over 1.5m deep and danger areas,
 - Trenches and holes over 1.5m deep without barricades or guard rails are properly shored or sloped as prescribed by the Rwandan Construction Codes of Standards,
 - The material used for building scaffold comply with Rwanda Construction Code of Standards

- An evacuation plan is elaborated in case of emergency,
- Fire extinguishers/equipment are provided and located at accessible and appropriate place,
- The site insurance covers the execution period and the total number of workers onsite

Chapter XI. INSPECTION TOOLS

XI.1 Digital Camera



A camera is very useful for building inspectors to photograph/film all interesting items/events/situations during inspection.

XI.2 Tape Measure



For curved or non straight distances, a tape measure is more efficient for building inspectors.

XI.3 Laser Meter



A laser meter is a device which uses a laser beam to determine the distance to an object. The most common form of laser rangefinder operates on the

time of flight principle by sending a laser pulse in a narrow beam towards the object and measuring the time taken by the pulse to be reflected off the target and returned to the sender. Features and Benefits:

- One-person measuring with 1.5 mm accuracy to 100m
- Allows safe measuring to difficult-to-reach or hazardous locations.
- Calculates areas, volumes, room dimensions
- Pythagorean functions.
- Built-in tilt sensor for quick & simple angles up to $\pm 45^\circ$.
- Stake out function for quick define / stake out distances.
- Timer function for increased stability.
- Display is illuminated automatically for dark conditions.
- Multifunctional end piece allows measuring out of corners, slots or from edges.
- The end piece automatically detected helps avoid expensive measuring errors.
- Waterproof to IP54 for use under all conditions.
- System contains a rugged pouch, wrist strap, target plates, and user guide.

Applications:

- Measuring distance, area and volumes
- Checking building square and area
- Measuring for material estimation
- Checking slope and sloped distances

XI.4 Wheel Meter



A surveyor's wheel, also called a clickwheel, odometer, waywiser, trundle wheel, measuring wheel, or perambulator is a device for measuring distance.

Distance Measuring Wheels are excellent tools for measuring long distances in a hurry. They are great for estimating paving jobs, building lot sizes, carpet estimates, grass seed and fertilizer calculations, insurance calculations, fence estimating, utility contracting, and other uses when a large distance measurement is needed quickly. To use, simply reset the counter, place the wheel at the point you want to start measuring, and roll in a straight direction to the stopping point, then read the counter.

XI.5 Sound meters



A digital sound meter makes readings for sound effortless. Compact and with numerous useful features, the digital sound meter includes MAX/MIN, fast/slow time weighting and level range display (Lo, Med, Hi). It is designed to meet the measurement requirements of safety engineers, industrial offices, and sound quality control technicians.

XI.6 Concrete Structure Scan “GSSI”



By the technology of Ground Penetrating Radar (GPR) which is a geophysical method that uses radar pulses to image the subsurface, The GSSI (Concrete Scanner) can give useful information about reinforced concrete made structures. Using a nondestructive method with electromagnetic radiation in the microwaves band (UHF/VHF frequencies) of the radio spectrum, the GSSI can be used in a variety of media, including rock, soil, ice, fresh water, pavements and concrete structures. It can detect objects, changes in material, and voids and cracks. Specifically for concrete structures, GSSI was designed for the following objectives:

- Easy concrete inspection in tight spaces
- Ruggedized plastic casing and wheels for long-lasting performance
- All-in-One handheld GPR system
- Ergonomic handle and controls
- Easy to use operator interface with color display screen
- Survey wheel with encoder
- Guiding laser for locating

XI.7 Digital Schmidt Hammer

A Schmidt hammer, also known as a Swiss hammer or a rebound hammer, is a device to measure the elastic properties or strength of concrete or rock mainly surface hardness and penetration resistance.



Original Schmidt Concrete Test Hammer

The hammer measures the rebound of a spring-loaded mass impacting against the surface of the sample. The test hammer will hit the concrete at a defined energy. Its rebound is dependent on the hardness of the concrete and is measured by the test equipment. By reference to the conversion chart, the rebound value can be used to determine the compressive strength. When conducting the test the hammer should be held at right angles to the surface which in turn should be flat and smooth. The rebound reading will be affected by the orientation of the hammer, when used in a vertical position (on the underside of a suspended slab for example) gravity will increase the rebound distance of the mass and vice versa for a test conducted on a floor slab. The Schmidt hammer is an arbitrary scale ranging from 10 to 100.

The test is also sensitive to other factors:

- Local variation in the sample. To minimize this it is recommended to take a selection of readings and take an average value.
- Water content of the sample, a saturated material will give different results from a dry one.

Prior to testing, the Schmidt hammer should be calibrated using a calibration test anvil supplied by the manufacturer for that purpose. 12 readings should be taken, dropping the highest and lowest, and then take the average of

the ten remaining. Using this method of testing is classed as indirect as it does not give a direct measurement of the strength of the material. It simply gives an indication based on surface properties; it is only suitable for making comparisons between samples.

XI.8 Earth Resistance Meter/Tester



The Digital Earth Resistance Meter (Earth Ground Meter) is a small, compact, battery powered, professional meter. This easy-to-use meter is useful to ensure the “ground” quality and effectiveness of buildings, structures, equipment or electrical systems. A good earth ground is required for new buildings or structures needing to pass required electrical codes. Older buildings can lose a good, effective earth ground connection over time. This can happen after a building or structure has been struck by lightning.

XI.9 Pocket Digital Light Meter



The Pocket Digital Light Meter has a wide range of applications. Small and compact, the digital light meter measures up to 2,000 foot-candle for basic lighting applications, with a 5% basic accuracy. Use this light meter to measure light in numerous environments, the office, factory settings, schools, or in stairwells

and emergency exits, ambient light testing, security areas, parking lots, and many others.

Applications:

- Workplace, clean-room, and computer room light testing
- Compliance with safety regulations
- Ambient testing for light-sensitive archives such as in museums and art galleries
- Schools, library and parking lot light testing

XI.10 Radiation Meter



Radiations emitted from household electric appliances, computer rooms, control-room, high tension line, computer, and TV, can be harmful to occupants. A radiation meter capable of detecting radiations in a given room/place plays an important role in the protection of users/occupants and in the assessment of mitigation measures efficiency.

XI.11 Digital Moisture Meter Inspection Kit

A Digital Moisture Meter Inspection Kit includes everything you need for measuring moisture levels in wood, sheetrock, gypsum, and a variety of other materials with a 0 to 100 relative scale.

Additionally, the kit also includes a hole-punch to ensure minimal damage with penetration. The moisture meter features adjustable, audible set point alerts, and green, yellow and red LEDs provide that allow for easy reading of moisture

Applications:

- Wood
- Concrete
- Exterior Insulated Finish System
- Sheetrock
- Gypsum

XI.12 Elcometer

Elcometers are leaders in coating & concrete inspection equipment rebar & metal detection. They measure coating thickness, climate, porosity & adhesion as well as a wide range of physical test parameters required for the formulation of coatings.

XI.13 Torque Wrench

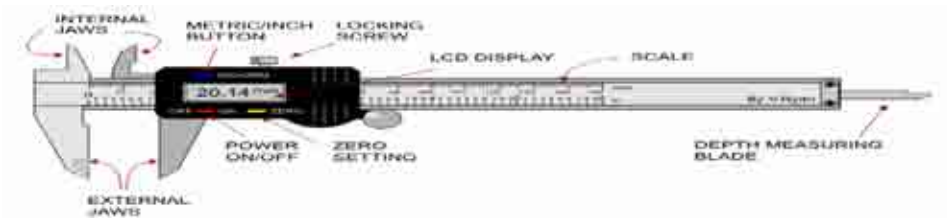
A torque wrench is a tool used to precisely apply a specific torque to a fastener such as a nut or bolt. It was designed to prevent over tightening bolts on water main and steam pipe repairs underground.

A torque wrench is used where the tightness of screws and bolts is crucial. It allows the operator to measure the torque applied to the fastener so it can be matched to the specifications for a particular application. This permits proper tension and loading of all parts.

XI.14 Digital Vernier Caliper

The Digital Caliper is a precision instrument that can be used to measure internal and external distances extremely accurately. The example shown below is a digital caliper as the distances/measurements, are read from a LCD display. The most important parts have been labeled.

Digital calipers are easier to use as the measurement is clearly displayed and also, by pressing the inch/mm button the distance can be read as metric or imperial.



The display is turned on with the on/off button. The digital caliper can then be used to measure small distances. Always go through this procedure when turning on the display for the first time.

The material to be measured is placed between the external jaws and they are carefully brought together. The locking screw is tightened so that the jaws do not move apart. The digital display can then be read. The distance can be read in metric and imperial by pressing the inch/mm button



XI.15 Dust Monitor



The hand-held, data-logging meter for the real-time detection of airborne dusts, fumes and aerosols is very useful during inspection of demolition sites/mines and construction sites. It has a large LCD display and a unique graphical facility, allowing the user to instantly view the dust level and trends to be compared to admissible intervals. It is ideal for walk-through surveys of ambient and indoor workplace environments.

XI.16 Digital Voltmeter

A voltmeter is an instrument used for measuring electrical potential difference between two points in an electric circuit. Analog voltmeters move a pointer across a scale in proportion to the voltage of the circuit; digital voltmeters give a numerical display of voltage by use of an analog to digital converter standards.

